CLIMATE CHANGE MEANS LIFESTYLE CHANGE

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January 26, 2020

Contents

Introduction

We are not doing enough

This book consists mainly of chapters and articles that I have previously published, although a considerable amount of new material has been added. The book deals with the world's failure to adequately address the existential danger of catastrophic climate change.

Greta Thunberg's speeches at Davos, 2020

Below is a full transcript of Greta's initial speech, delivered during a session called Forging a Sustainable Path towards a Common Future:

I will speak later today so I just want to take this opportunity to once again remind everyone of our current situation.

In Chapter Two, on page 108 in the SR 1.5 IPCC report that came out in 2018, it says that if we are to have a 67 percent chance of limiting the global average temperature rise to below 1.5 degrees Celsius, we had on January 1st, 2018, about 420 gigatons of CO2 left to emit in that budget.

And, of course, that number is much lower today, as we emit, about 42 gigatons of CO2 every year, including in land use. With today's emissions levels, that remaining budget is gone within less than eight years. These numbers aren't anyone's opinions or political views. This is the current best available science. Though many scientists suggest these figures are too moderate, these are the ones that have been accepted through the IPCC.

And please note that these figures are global and therefore do not say anything about the aspects of equity, which is absolutely necessary to make the Paris Agreement work on a global scale. And that means that richer countries need to get down to zero emissions much faster and then help poorer countries do the same so that people in less fortunate parts of the world can raise their living standards.

These numbers also don't include most feedback loops, non-linear tipping points nor additional warming hidden by toxic air pollution. Most models, however, assume that future generations

will, however, somehow be able to suck hundreds of billions of tons of CO2 out of the air with technologies that do not exist today in the scale required - and perhaps never will.

The approximate 67 percent chance is the one with the highest odds given by the IPCC. And now we have less than 340 gigatons of CO2 left to emit in that budget to share fairly.

And why is it so important to stay below 1.5 degrees Celsius? Because even at 1 degree people are dying from climate change because that is what the united science calls for, to avoid destabilizing the climate so that we have the best possible chance to avoid setting off irreversible chain reactions.

Every fraction of a degree matters.

Since last summer, I've been repeating these numbers over and over again in almost every speech. But honestly, I don't think I have once seen any media outlets or person in power communicate this and what it means. I know you don't want to report about this. I know you don't want to talk about this, but I assure you I will continue to repeat these numbers until you do.

In a later session, Greta gave a longer speech. Here is the transcript:

One year ago I came to Davos and told you that our house is on fire. I said I wanted you to panic. I've been warned that telling people to panic about the climate crisis is a very dangerous thing to do. But don't worry. It's fine. Trust me, I've done this before and I assure you it doesn't lead to anything.

And for the record, when we children tell you to panic, we're not telling you to go on like before.

We're not telling you to rely on technologies that don't even exist today at scale and that science says perhaps never will. We are not telling you to keep talking about reaching net-zero emissions or carbon neutrality by cheating and fiddling around with numbers.

We are not telling you to offset your emissions by just paying someone else to plant trees in places like Africa while at the same time forests like the Amazon are being slaughtered at an infinitely higher rate.

Planting trees is good, of course, but it's nowhere near enough of what needs to be done, and it cannot replace real mitigation or

rewilding nature.

Let's be clear. We don't need a low-carbon economy. We don't need to lower emissions. Our emissions have to stop to stay if we are to have a chance to stay below the 1.5 degrees target. And until we have the technologies that at scale can put our emissions to minus then we must forget about net zero we need real zero.

Because distant net zero emission targets will mean absolutely nothing if we just continue to ignore the carbon dioxide budget which applies for today, not distant future dates. If high emissions continue like now even for a few years, that remaining budget will soon be completely used up.

The fact that the U.S.A. is leaving the Paris accord seems to outrage and worry everyone, and it should.

But the fact that we're all about to fail the commitments you signed up for in the Paris Agreement doesn't seem to bother the people in power even the least.

Any plan or policy of yours that doesn't include radical emission cuts at the source starting today is completely insufficient for meeting the 1.5-degree or well-below-2-degrees commitments of the Paris Agreement.

And again - this is not about right or left. We couldn't care less about your party politics.

From a sustainability perspective, the right, the left, as well as the center, have all failed. No political ideology or economic structure has been able to tackle the climate and environmental emergency and create a cohesive and sustainable world. Because that world, in case you haven't noticed, is currently on fire.

You say children shouldn't worry. You say: "Just leave this to us. We will fix this, we promise we won't let you down. Don't be so pessimistic."

And then - nothing. Silence. Or something worse than silence. Empty words and promises which give the impression that sufficient action is being taken.

All the solutions are obviously not available within today's societies. Nor do we have the time to wait for new technological solutions to become available to start drastically reducing our emissions.

So, of course, the transition isn't going to be easy. It will be

hard. And unless we start facing this now together, with all cards on the table, we won't be able to solve this in time.

In the days running up to the 50th anniversary of the World Economic Forum, I joined a group of climate activists who are demanding that you, the world's most powerful and influential business and political leaders, begin to take the action needed.

We demand that at this year's World Economic Forum participants from all companies, banks, institutions and governments:

Immediately halt all investments in fossil fuel exploration and extraction.

Immediately end all fossil fuel subsidies.

And immediately and completely divest from fossil fuels.

We don't want these things done by 2050, 2030 or even 2021, we want this done now.

It may seem like we're asking for a lot. And you will of course say that we are nave. But this is just the very minimum amount of effort that is needed to start the rapid sustainable transition.

So either you do this or you're going to have to explain to your children why you are giving up on the 1.5-degree target.

Giving up without even trying.

Well I'm here to tell you that unlike you, my generation will not give up without a fight.

The facts are clear, but they're still too uncomfortable for you to address.

You just leave it because you think it's too depressing and people will give up. But people will not give up. You're the ones who are giving up.

Last week I met with coal miners in Poland who lost their jobs because their mine was closed. And even they had not given up. On the contrary, they seem to understand the fact that we need to change more than you do.

I wonder, what will you tell your children was the reason to fail and leave them facing the climate chaos you knowingly brought upon them? The 1.5-degree target? That it seemed so bad for the economy that we decided to resign the idea of securing future living conditions without even trying?

Our house is still on fire. Your inaction is fuelling the flames by the hour. We are still telling you to panic, and to act as if you

loved your children above all else.

The world is on fire!

"Our house is on fire!", says Greta Thunberg, and she is right. The year 2019 saw a rise in wildfires across the globe. Bush fires in Australia are threatening Sydney and have caused the Australian government to declare a state of emergency. But Australia's politicians continue the policies that have made their nation a climate change criminal, exporting vast quantities of coal and beef. The Deputy Prime Minister Michael McCormack said, of the fire victems: They don't need the ravings of some pure enlightened and woke capital city greenies at this time when they are trying to save their homes. In other words, let's not talk about climate change.

In the Arctic, wildfires raged, producing plumes of smoke the size of the European continent. In the Amazon, fires were deliberately set by greedy mining interests and beef farmers, illegally, but condoned by the government of Jair Bolsinaro, the "Trump of the Tropics". In Indonesia, plumes of smoke from burning forests darkened the skys over many nearby countries. Again, the deliberately set fires were illegal, but they were condoned by corrupt politicians, receiving money from the hugely profitable palm oil business.

Extraction of fossil fuels must stop!

A United Nations report released Wednesday , 20 November, 2019, warned that worldwide projections for fossil fuel production over the next decade indicate that the international community is on track to fail to rein in planet-heating emissions and prevent climate catastrophe.[1]

"The Production Gap" is an 80 page report produced by a collaboration between the UN Environmental Programme and a number of academic institutions. It examines the discrepancy between countries' planned fossil fuel production and global production levels consistent with limiting warming to 1.5 degrees C or 2 degrees C, and concludes that the necessary policy changes are currently not being made.

The famous economist, Lord Nicholas Stern, has stated that "This important report shows that governments' projected and planned levels of coal,

[1] http://productiongap.org/wp-content/uploads/2019/11/Production-Gap-Report-2019.pdf

oil, and gas production are dangerously out of step with the goals of the Paris agreement on climate change. It illustrates the many ways in which governments subsidize and otherwise support the expansion of such production. Instead, governments should implement policies that ensure existing production peaks soon and then falls very rapidly."

In an article published in Common Dreams on Wednesday, November 20, 2019, Hoda Baraka, the Chief Communications Officer for 350.org wrote:

The disconnect between Paris temperature goals and countries' plans and policies for coal, oil, and gas production is massive, worrying and unacceptable...

The 'production gap' is a term used to refer to the difference between a countries' planned levels of fossil fuel production, and what is needed to achieve international climate goals. This is the first time a UN report has looked directly and specifically at fossil fuel production as a key driver of climate breakdown. It shows that countries are planning to produce fossil fuels far in excess of the levels needed to fulfil their climate pledges under the Paris Agreement, which themselves are far from adequate. This over investment in coal, oil, and gas supply locks in fossil fuel infrastructure that will make emissions reductions harder to achieve.

The science is clear, to stay below 1.5 degrees we must stop the expansion of the fossil fuel industry immediately. That means that not a single new mine can be dug, not another pipeline built, not one more emitting powerplant fired up. And we have to get to work transitioning to sustainable renewable energy powered energy systems.

Across the globe resistance to fossil fuels is rising, the climate strikes have shown the world that we are prepared to take action. Going forward our job is to keep up a steady drumbeat of actions, strikes and protests that gets louder and louder throughout 2020. Governments need to follow through, to act at the source of the flames that are engulfing our planet and phase out coal, oil, and gas production.

COP25 was sabotaged by greed

At the COP25 in Madrid, delegations from the United States, Australia, Brazil and Saudi Arabia worked actively to prevent meaningful progress, and they prevented it. In the words of Alden Meyer, director of strategy for the Union of Concerned Scientists, "I've been attending these climate negotiations since they first started in 1991, but never have I seen the almost total disconnect we've seen here at COP25 in Madrid between what the science requires and the people of the world demand, and what the climate negotiations are delivering in terms of meaningful action".

We need a new economic system

Economists are not used to thinking of the long-term future. We can see this in their attitude to economic growth, a concept which mainstream economists support with almost-religious fervor. But the unlimited growth of anything physical on a physically finite planet is a logical impossibility. To avoid this logic, mainstream economists, with self-imposed shortsightedness, willfully limit their view of the future to a few decades. However, the climate crisis is a long-term multi- generational issue. Young people throughout the world are rightly protesting that their long-term future is being blighted by today's greed.

A few far-sighted economists outside the mainstream, for example Herman Daly, have made extensive studies of Steady-State Economics. Logic tells us that this must become the economics of the future, replacing the growth-worshiping and greed-sanctioning economics of today.

New global ethics to match our technology

Humans are capable of tribalistic inter-group atrocities such as genocides and wars, but they also have a genius for cooperation. Cultural evolution implies inter-group exchange of ideas and techniques. It is a cooperative enterprise in which all humans participate. It is cultural evolution that has given our special dominance. But cultural evolution depends on overwriting destructive tribalism with the principles of law, ethics and politeness. The success of human cultural evolution demonstrates that this is possible. Ethics can overwrite tribalism!

The whole is greater than the sum of its parts. Human society is a

superorganism, far greater than any individual in history or in the present. The human superorganism has a supermind, a collective consciousness far greater than the consciousness of individuals. Each individual contributes a stone to the cairn of civilization, but our astonishing understanding of the universe is a collective achievement.

Science derives its great power from the concentration of enormous resources on a tiny fragment of reality. It would make no sense to proceed in this way if knowledge were not permanent and if information were not shared globally. But scientists of all nations pool their knowledge at international conferences and through international publications. Scientists stand on each other's shoulders. Their shared knowledge is far greater than the fragments that each contributes.

Other aspects of culture are also cooperative and global. For example, Japanese woodblock printers influenced the French Impressionists. The nonviolent tradition of Shelly, Thoreau, Tolstoy, Gandhi, Martin Luther King and Nelson Mandela is international. Culture is cooperative. It is not competitive. Global cultural cooperation can lead us to a sustainable and peaceful society. Our almost miraculous modern communications media, if properly used, can give us a stable, prosperous and cooperative future society.

Chapter 1

REFUGEES FROM CLIMATE CHANGE

1.1 A UN ruling on climate refugees

Here is an excerpt from an article entitled *UN Landmark Case for People Displaced By Climate Change*, published by Amnesty International on Monday, January 20, 2020:

In a ground-breaking asylum case, a UN human rights body has ruled that governments must take into account the human rights violations caused by the climate crisis when considering deportation of asylum seekers, said Amnesty International today.

"The decision sets a global precedent," said Kate Schuetze, Pacific Researcher at Amnesty International. "It says a state will be in breach of its human rights obligations if it returns someone to a country where - due to the climate crisis - their life is at risk, or in danger of cruel, inhuman or degrading treatment."

1.2 Climate change as genocide

Climate change does not affect all parts of the world equally. The harshest effects of the extreme weather that we are already experiencing are disproportionately felt by the poorest people of the world.

In March, 2017. the Security Council was informed [1] that 20 million people in four countries, Nigeria, Somalia, South Sudan and Yemen, were in danger of dying unless provided with immediate help. The cost of the necessary aid was estimated to be $4.4 billion. The developed world's response has been a shrug of indifference. By the midsummer. 2017 only a tenth of the amount needed had been raised.

[1] by Stephen O'Brian, UN Under Secretary General for Humanitarian Affairs

Figure 1.1: **A starving child in Somalia.**

Conflicts and famine are interlinked. The struggle for food produces conflicts; and famine is often used as an instrument of war. Food aid, when available, is often deliberately blocked or destroyed by warring factions. Boko Haram in Nigeria, al-Shabaab in Somalia, assorted militias and the government in South Sudan, and Saudi-backed forces in Yemen all interfered with the delivery of aid supplies.

In the future, the effects of rising temperatures and reduced rainfall will disproportionately affect poor farmers of Africa, the Middle East, South Asia, and Latin America. If the more affluent parts of the world continue to produce greenhouse gasses in a business-as-usual scenario, and if they continue to ignore calls for help from starving people, these actions will amount to genocide.

1.3 The United Nations High Commission on Refugees

In an article on *Climate Change and Disasters* the United Nations High Commission on Refugees makes the following statement:

"The Earth's climate is changing at a rate that has exceeded most scientific forecasts. Some families and communities have already started to suffer from disasters and the consequences of climate change, forced to leave their homes in search of a new beginning.

"For UNHCR, the consequences of climate change are enormous. Scarce natural resources such as drinking water are likely to become even more limited. Many crops and some livestock are unlikely to survive in certain locations if conditions become too hot

and dry, or too cold and wet. Food security, already a concern, will become even more challenging.

"People try to adapt to this situation, but for many this will mean a conscious move to another place to survive. Such moves, or the effects of climate change on natural resources, may spark conflict with other communities, as an increasing number of people compete for a decreasing amount of resources.

"Since 2009, an estimated one person every second has been displaced by a disaster, with an average of 22.5 million people displaced by climate- or weather-related events since 2008 (IDMC 2015). Disasters and slow onsets, such as droughts in Somalia in 2011 and 2012, floods in Pakistan between 2010 and 2012, and the earthquake in Nepal in 2015, can leave huge numbers of people traumatized without shelter, clean water and basic supplies."

1.4 Populations displaced by sea level rise

In a recent article[2] discussed the long-term effects of sea level rise and the massive refugee crisis that it might create. By 2060, about 1.4 billion people could be climate change refugees, according to the paper, and that number could reach 2 billion by 2100.

The lead author, Prof. Emeritus Charles Geisler of Cornell University says: "The colliding forces of human fertility, submerging coastal zones, residential retreat, and impediments to inland resettlement is a huge problem. We offer preliminary estimates of the lands unlikely to support new waves of climate refugees due to the residues of war, exhausted natural resources, declining net primary productivity, desertification, urban sprawl, land concentration, 'paving the planet' with roads and greenhouse gas storage zones offsetting permafrost melt."

We should notice that Prof. Geisler's estimate of 2 billion climate refugees by 2100 includes all causes, not merely sea level rise. However, the number of refugees from sea level rise alone will be very large, since all the world's coastal cities, and many river deltas will be at risk.

1.5 Populations displaced by drought and famine

Climate change could produce a refugee crisis that is "unprecedented in human history", Barack Obama has warned as he stressed global warming was the most pressing issue of the age.

Speaking at an international food conference in Milan, the former US President said rising temperatures were already making it more difficult to grow crops and rising food prices were "leading to political instability".

If world leaders put aside "parochial interests" and took action to reduce greenhouse gas emissions by enough to restrict the rise to one or two degrees Celsius, then humanity

[2]Geisler C. et al,, *Impediments to inland resettlement under conditions of accelerated sea level rise* , Land Use Policy, Vol **55**, July 2017, Pages 322-330

would probably be able to cope.

Failing to do this, Mr Obama warned, increased the risk of "catastrophic" effects in the future, "not only real threats to food security, but also increases in conflict as a consequence of scarcity and greater refugee and migration patterns".

"If you think about monsoon patterns in the Indian subcontinent, maybe half a billion people rely on traditional rain patterns in those areas,"

1.6 Populations displaced by rising temperatures

A new study published in Nature: Climate Change has warned that up to 75% of the world's population could face deadly heat waves by 2100 unless greenhouse gas emissions are rapidly controlled.[3]. The following is an excerpt from the article:

"Here we conducted a global analysis of documented lethal heat events to identify the climatic conditions associated with human death and then quantified the current and projected occurrence of such deadly climatic conditions worldwide. We reviewed papers published between 1980 and 2014, and found 783 cases of excess human mortality associated with heat from 164 cities in 36 countries.

"Based on the climatic conditions of those lethal heat events, we identified a global threshold beyond which daily mean surface air temperature and relative humidity become deadly. Around 30% of the world's population is currently exposed to climatic conditions exceeding this deadly threshold for at least 20 days a year.

"By 2100, this percentage is projected to increase to 48% under a scenario with drastic reductions of greenhouse gas emissions and 74% under a scenario of growing emissions. An increasing threat to human life from excess heat now seems almost inevitable, but will be greatly aggravated if greenhouse gases are not considerably reduced." [4]

[3]Mora, C. et al., *Global risk of deadly heat*, Nature: Climate Change, 19 June 2017

[4]See also https://phys.org/news/2017-08-deadly-south-asia-century.html and https://cleantechnica.com/2017/09/28/extreme-heatwaves-like-recent-lucifer-heatwave-become-normal-europe-2050s/

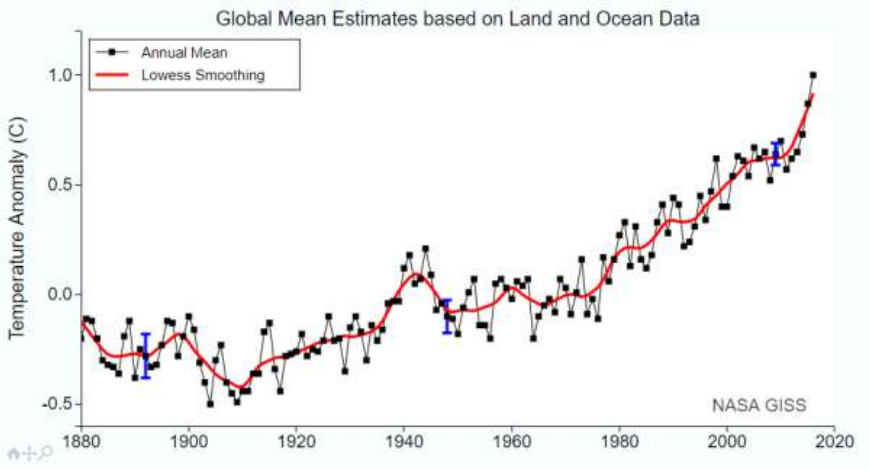

Figure 1.2: **This figure shows an alarming upward turn in the average global temperature**

1.7 Populations displaced by war

A recent article in *The Guardian*[5] discusses the relationship between climate change and war, Here are some excerpts from the article:

"Climate change is set to cause a refugee crisis of 'unimaginable scale', according to senior military figures, who warn that global warming is the greatest security threat of the 21st century and that mass migration will become the 'new normal'.

"The generals said the impacts of climate change were already factors in the conflicts driving a current crisis of migration into Europe, having been linked to the Arab Spring, the war in Syria and the Boko Haram terrorist insurgency.

"Military leaders have long warned that global warming could multiply and accelerate security threats around the world by provoking conflicts and migration. They are now warning that immediate action is required.

"'Climate change is the greatest security threat of the 21st century,' said Maj Gen Muniruzzaman.

"Muniruzzaman, chairman of the Global Military Advisory Council on climate change and a former military adviser to the president of Bangladesh. He said one meter of sea level rise will flood 20% of his nation. 'We're going to see refugee problems on an unimaginable scale, potentially above 30 million people.'

"Previously, Bangladesh's finance minister, Abul Maal Abdul Muhith, called on Britain and other wealthy countries to accept millions of displaced people.

"Brig Gen Stephen Cheney, a member of the US Department of State's foreign affairs policy board and CEO of the American Security Project, said: 'Climate change could lead to a humanitarian crisis of epic proportions. We're already seeing migration of large numbers of people around the world because of food scarcity, water insecurity and extreme

[5]Thursday, 1 December, 2016

weather, and this is set to become the new normal'.

1.8 Political reactions to migration

Brexit

Across the developed world, the reaction to threatened migration of refugees from climate change has been less than generous, to say the least. The recent decision of Britain to leave the European Union was motivated largely by the fear of British workers that EU laws would force their country to accept large numbers of refugees.

Swings to the right in Europe

In Germany, Angela Merkel's generous policies towards refugees have cost her votes, while an openly racist party, the Alternative for Germany (AfD) party, has gained in strength. Frauke Petry, 40, the party's leader, has said border guards might need to turn guns on anyone crossing a frontier illegally. The party's policy platform says "Islam does not belong in Germany" and calls for a ban on the construction of mosques.

In September, 2017, eight people from the neo-Nazi Freital Group were put on trial in Dresden for bomb attacks on homes for asylum applicants. Hundreds of similar assaults occur in Germany every year, but they had never before been tried as terrorism in a federal court.

In the German election, which took place on Sunday, October 1, 2017, Angela Merkel won a fourth term as Chancellor, but her party won only 33% of the votes, a percentage much reduced from the 41% won in the election of 2013. Angela Merkel was paying a high price for her refugee-friendly policies.

Meanwhile the far right anti-immigration AfD party made a historic breakthrough, winning 13.5% of the vote, thus becoming the first overtly nationalist party to sit in the Bundestag in 60 years. The Greens have already complained that "Nazis have returned to parliament". In fact, members of the AfD party have begun to say that Germans should stop being ashamed of their country's Nazi past.

In France, the National Front is a nationalist party that uses populist rhetoric to promote its anti-immigration and anti-European Union positions. The party favors protectionist economic policies and would clamp down on government benefits for immigrants.

Similarly, in the Netherlands, the anti-European Union, anti-Islam Party for Freedom has called for closing all Islamic schools and recording the ethnicity of all Dutch citizens. In early November, the party was leading in polls ahead of next year's parliamentary elections.

Other far-right anti-immigrant parties in Europe include Golden Dawn (Greece), Jobbic (Hungary), Sweden Democrats (Sweden), Freedom Party (Austria), and People's Party

- Our Slovakia (Slovakia). All of these parties have gained in strength because of the widespread fear of immigration.

Populism in the United States

The election of Donald Trump, who ran for President in 2016 on an openly racist and anti-immigrant platform, can also be seen as the result of fear of immigration, especially on the part of industrial workers.

1.9 A more humane response to the refugee crisis

In the long-term future, climate change will make the refugee crisis much more severe. Heat and drought will make large regions of the world uninhabitable, and will threaten many populations with famine. The severity of the refugee crisis will depend on how quickly we reduce greenhouse gas emissions.

While making many parts of the world uninhabitable, long-term climate change will make other regions more suitable for human habitation and agriculture. For example, farming will become more possible in Siberia, Greenland, the Canadian Arctic, Alaska and Patagonia. A humane response to the refugee crisis could include the generous opening of these regions to refuges.

The global population of humans is currently increasing by almost a billion people every decade. Global population must be stabilized, and in the long run, gradually reduced. Money currently wasted (or worse than wasted) on armaments could be used instead to promote universal primary health care, and with it, universal access to the knowledge and materials needed for family planning.

Finally, reduced consumption of meat, particularly beef, would shorten the food chain thus make more food available for famine relief.

Suggestions for further reading

1. P. Dasgupta, *Population, Resources and Poverty*, Ambio, **21**, 95-101, (1992).
2. L.R. Brown, *Who Will Feed China?*, W.W. Norton, New York, (1995).
3. L.R. Brown, et al., *Saving the Planet. How to Shape and Environmentally Sustainable Global Economy*, W.W. Norton, New York, (1991).
4. L.R. Brown, *Postmodern Malthus: Are There Too Many of Us to Survive?*, The Washington Post, July 18, (1993).
5. L.R. Brown and H. Kane, *Full House. Reassessing the Earth's Population Carrying Capacity*, W.W. Norton, New York, (1991).
6. L.R. Brown, *Seeds of Change*, Praeger Publishers, New York, (1970).
7. L.R. Brown, *The Worldwide Loss of Cropland*, Worldwatch Paper 24, Worldwatch Institute, Washington, D.C., (1978).

8. L.R. Brown, and J.L. Jacobson, *Our Demographically Divided World*, Worldwatch Paper 74, Worldwatch Institute, Washington D.C., (1986).
9. L.R. Brown, and J.L. Jacobson, *The Future of Urbanization: Facing the Ecological and Economic Constraints*, Worldwatch Paper 77, Worldwatch Institute, Washington D.C., (1987).
10. L.R. Brown, and others, *State of the World*, W.W. Norton, New York, (published annually).
11. H. Brown, *The Human Future Revisited. The World Predicament and Possible Solutions*, W.W. Norton, New York, (1978).
12. H. Hanson, N.E. Borlaug and N.E. Anderson, *Wheat in the Third World*, Westview Press, Boulder, Colorado, (1982).
13. A. Dil, ed., *Norman Borlaug and World Hunger*, Bookservice International, San Diego/Islamabad/Lahore, (1997).
14. N.E. Borlaug, *The Green Revolution Revisitied and the Road Ahead*, Norwegian Nobel Institute, Oslo, Norway, (2000).
15. N.E. Borlaug, *Ending World Hunger. The Promise of Biotechnology and the Threat of Antiscience Zealotry*, Plant Physiology, **124**, 487-490, (2000).
16. M. Giampietro and D. Pimental, *The Tightening Conflict: Population, Energy Use and the Ecology of Agriculture*, in *Negative Population Forum*, L. Grant ed., Negative Population Growth, Inc., Teaneck, N.J., (1993).
17. H.W. Kendall and D. Pimental, *Constraints on the Expansion of the Global Food Supply*, Ambio, **23**, 198-2005, (1994).
18. D. Pimental et al., *Natural Resources and Optimum Human Population*, Population and Environment, **15**, 347-369, (1994).
19. D. Pimental et al., *Environmental and Economic Costs of Soil Erosion and Conservation Benefits*, Science, **267**, 1117-1123, (1995).
20. D. Pimental et al., *Natural Resources and Optimum Human Population*, Population and Environment, **15**, 347-369, (1994).
21. D. Pimental and M. Pimental, *Food Energy and Society*, University Press of Colorado, Niwot, Colorado, (1996).
22. D. Pimental et al., *Environmental and Economic Costs of Soil Erosion and Conservation Benefits*, Science, **267**, 1117-1123, (1995).
23. RS and NAS, *The Royal Society and the National Academy of Sciences on Population Growth and Sustainability*, Population and Development Review, **18**, 375-378, (1992).
24. A.M. Altieri, *Agroecology: The Science of Sustainable Agriculture*, Westview Press, Boulder, Colorado, (1995).
25. G. Conway, *The Doubly Green Revolution*, Cornell University Press, (1997).
26. J. Dreze and A. Sen, *Hunger and Public Action*, Oxford University Press, (1991).
27. G. Bridger, and M. de Soissons, *Famine in Retreat?*, Dent, London, (1970).
28. W. Brandt, *World Armament and World Hunger: A Call for Action*, Victor Gollanz Ltd., London, (1982).
29. A.K.M.A. Chowdhury and L.C. Chen, *The Dynamics of Contemporary Famine*, Ford Foundation, Dacca, Pakistan, (1977)

30. J. Shepard, *The Politics of Starvation*, Carnegie Endowment for International Peace, Washington D.C., (1975).
31. M.E. Clark, *Ariadne's Thread: The Search for New Modes of Thinking*, St. Martin's Press, New York, (1989).
32. J.-C. Chesnais, *The Demographic Transition*, Oxford, (1992).
33. C.M. Cipola, *The Economic History of World Population*, Penguin Books Ltd., (1974).
34. E. Draper, *Birth Control in the Modern World*, Penguin Books, Ltd., (1972).
35. Draper Fund Report No. 15, *Towards Smaller Families: The Crucial Role of the Private Sector*, Population Crisis Committee, 1120 Nineteenth Street, N.W., Washington D.C. 20036, (1986).
36. E. Eckholm, *Losing Ground: Environmental Stress and World Food Prospects*, W.W. Norton, New York, (1975).
37. E. Havemann, *Birth Control*, Time-Life Books, (1967).
38. J. Jacobsen, *Promoting Population Stabilization: Incentives for Small Families*, Worldwatch Paper 54, Worldwatch Institute, Washington D.C., (1983).
39. N. Keyfitz, *Applied Mathematical Demography*, Wiley, New York, (1977).
40. W. Latz (ed.), *Future Demographic Trends*, Academic Press, New York, (1979).
41. World Bank, *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*, Washington D.C., (1986).
42. J.E. Cohen, *How Many People Can the Earth Support?*, W.W. Norton, New York, (1995).
43. J. Amos, *Climate Food Crisis to Deepen*, BBC News (5 September, 2005).
44. J. Vidal and T. Ratford, *One in Six Countries Facing Food Shortage*, The Guardian, (30 June, 2005).
45. J. Mann, *Biting the Environment that Feeds Us*, The Washington Post, July 29, 1994.
46. G.R. Lucas, Jr., and T.W. Ogletree, (editors), *Lifeboat Ethics. The Moral Dilemmas of World Hunger*, Harper and Row, New York.
47. J.L. Jacobson, *Gender Bias: Roadblock to Sustainable Development*, Worldwatch Paper 110, Worldwatch Institute, Washington D.C., (1992).
48. J. Gever, R. Kaufmann, D. Skole and C. Vorosmarty, *Beyond Oil: The Threat to Food and Fuel in the Coming Decades*, Ballinger, Cambridge MA, (1986).
49. M. ul Haq, *The Poverty Curtain: Choices for the Third World*, Columbia University Pres, New York, (1976).
50. H. Le Bras, *La Planète au Village*, Datar, Paris, (1993).
51. E. Mayr, *Population, Species and Evolution*, Harvard University Press, Cambridge, (1970).
52. Patz, J. A., Campbell-Lendrum, D., Holloway, T. and Foley, J. A. *Impact of regional climate change on human health.* Nature **438**, 310-317 (2005).
53. Basu, R. and Samet, J. M. *Relation between elevated ambient temperature and mortality: a review of the epidemiologic evidence.* Epidemiol. Rev. **24**, 190-202 (2002).
54. Kovats, R. S. and Hajat, S. *Heat stress and public health: a critical review.* Annu. Rev. Publ. Health **29**, 41-55 (2008).

55. Leon, L. R. *Pathophysiology of Heat Stroke* **Vol. 7** (Colloquium Series on Integrated Systems Physiology: From Molecule to Function to Disease, Morgan Claypool Life Sciences, 2015).
56. Ostro, B. D., Roth, L. A., Green, R. S. and Basu, R. *Estimating the mortality effect of the July 2006 Californi a heat wave*. Environ. Res. **109**, 614-619 (2009).
57. Glas er, J. et al. *Climate change and the emergent epidemic of CKD from heat stress in rural communities: the case for heat stress nephropathy*. Clin. J. Am. Soc. Nephrol. **11**, 1472-1483 (2016).
58. Robine, J.-M. et al. *Death toll exceeded 70,000 in Europe during the summer of 2003*. C. R. Biol. **331**, 171-178 (2008).
59. Sillmann, J. and Roeckner, E. *Indices for extreme events in proje ctions of anthropogenic climate change*. Climatic Change **86**, 83-104 (2008).
60. Meeh l, G. A. and Teb aldi, C. *More intense, more frequent, and longer lasting heat waves in the 21st century*. Science **305**, 994-997 (2004).
61. Orlowsky, B. and Seneviratne, S. *Global changes in extreme events: regional and seasonal dimension*. Climatic Change **110**, 669-696 (2012).
62. Tebaldi, C., Hayhoe, K., Arblaster, J. M. and Meehl, G. A. *Going to the extremes*. Climatic Change **79**, 185-211 (2006).
63. Tebaldi, C. and Wehner, M. F. *Benefits of mitigation for future heat extremes under RCP4.5 compared to RCP8.5*. Climatic Change http://dx.doi.org/10.1007/s10584-016-1605-5 (2016).
64. Sterl, A. et al. *When can we expect extremely high sur face temperatures?* Geophys. Res. Lett. **35**, L14703 (2008).
65. Huang, C. et al. *Projecting future heat-related mortality under climate change scenarios: a systematic review*. Environ. Health Persp. **119**, 1681-1690 (2011).
66. Guo, Y. et al. *Global variation in the effects of ambient temperature on mortality: a systematic evaluation*. J. Epidemiol. **25**, 781-789 (2014).
67. Luber, G. snd McGeehin, M. *Climate change and extreme heat events*. Am. J. Prev. Med. **35**, 429-435 (2008).-
68. Bouchama, A. and Knochel, J. P. *Heat stroke*. New. Engl. J. Med. **346**, 1978-1988 (2002).
69. Bobb, J. F., Peng, R. D., Bell, M. L. and Dominici, F. *Heat-related mortality and adaptation to heat in the United States*. Environ. Health Persp. **122**, 811-816 (2014).
70. Gasparrini, A. et al. *Temporal vari ation in heat-mortality associations: a multicountry study*. Environ. Health Persp. **123**, 1200-1207 (2015).
71. Lowe, D., Ebi, K. L. and Forsberg, B. *Heatwave early warning systems and adaptation advice to reduce human health consequences of he atwaves*. Int. J. Environ. Res. Public Health **8**, 4623-4648 (2011).
72. Hanna, E. G. and Tait, P. W. *Limitations to thermoregulation and acclimatization challenge human adaptation to global warming*. Int. J. Environ. Res. Publ. Health. **12**, 8034-8074 (2015).
73. Sherwood, S. C. and Huber, M. *An adaptability limit to climate change due to heat stress*. Proc. Natl Acad. Sci. USA **107**, 9552-9555 (201

74. Whitman, S. et al. *Mortality in Chicago attributed to the July 1995 heat wave*. Am. J. Public Health **87**, 1515-1518 (1997).
75. Dousset, B. et al. *Satellite monitoring of summer he at waves in the Paris metropolitan area*. Int. J. Climatol. **31**, 313-323 (2011).
76. Shaposhnikov, D. et al. *Mortality related to air pollution with the Moscow he at wave and wildfire of 2010*. Epidemiology **25**, 359-364 (2014).
77. Barnett, A. G., Tong, S. and Clements, A. *What measure of temperature is the best predic tor of mortality?* Environ. Res. **110**, 604-611 (2010).
78. Willett, K. M. and Sherwood, S. *Exceedance of heat index thresholds for 15 regions under a warming climate using the wet-bulb globe temperature*. Int. J. Climatol. **32**, 161-177 (2012).
79. Argüeso, D., Di Luca, A., Perkins-Kirkpatrick, S. and Evans, J. P. *Seasonal mean temperature changes control future heatwaves*. Geophys. Res. Lett. **43**, 7653-7660 (2016).
80. Jones, B. and O'Neill, B. *Spatially explicit global population scenarios consistent with t he Shared Socioeconomic Pathways*. Environ. Res. Lett. **11**, 084003 (2016).
81. Diffenbaugh, N. S. and Field, C. B. *Changes in ecological ly critical terrestrial climate conditions*. Science **341**, 486-492 (2013).
82. Mitchell, D. et al. *Attributing human mortality during extreme heat waves to anthropogenic climate change*. Environ. Res. Lett. **11**, 074006 (2016).

Chapter 2

EXTRACTION OF FOSSIL FUELS MUST STOP

2.1 Blood for oil

There is a close relationship between petroleum and war. James A. Paul, Executive Director of the Global Policy Forum, has described this relationship very clearly in the following words:

"Modern warfare particularly depends on oil, because virtually all weapons systems rely on oil-based fuel - tanks, trucks, armored vehicles, self-propelled artillery pieces, airplanes, and naval ships. For this reason, the governments and general staffs of powerful nations seek to ensure a steady supply of oil during wartime, to fuel oil-hungry military forces in far-flung operational theaters."

"Just as governments like the US and UK need oil companies to secure fuel for their global war-making capacity, so the oil companies need their governments to secure control over global oilfields and transportation routes. It is no accident, then, that the world 's largest oil companies are located in the world 's most powerful countries."

"Almost all of the world 's oil-producing countries have suffered abusive, corrupt and undemocratic governments and an absence of durable development. Indonesia, Saudi Arabia, Libya, Iraq, Iran, Angola, Colombia, Venezuela, Kuwait, Mexico, Algeria - these and many other oil producers have a sad record, which includes dictatorships installed from abroad, bloody coups engineered by foreign intelligence services, militarization of government and intolerant right-wing nationalism."

The resource curse

The way in which the industrialized countries maintain their control over less developed nations can be illustrated by the "resource curse", i.e. the fact that resource-rich developing countries are no better off economically than those that lack resources, but are cursed with corrupt and undemocratic governments. This is because foreign corporations extracting

local resources under unfair agreements exist in a symbiotic relationship with corrupt local officials.

One might think that taxation of foreign resource-extracting firms would provide developing countries with large incomes. However, there is at present no international law governing multinational tax arrangements. These are usually agreed to on a bilateral basis, and the industrialized countries have stronger bargaining powers in arranging the bilateral agreements.

2.2 Attacks on Iran, past and present

The assassination of General Qasem Soleimani

On Friday, 3 January, 2020, progressives in the United States and all peace-loving people throughout the world were horrified to learn that Donald Tromp had added to his long list of crimes and imbicilities by ordering the assassination of General Qasem Soleimani, who is a hero in his own country, Iran. The murder, which was carried out by means of a drone strike on Friday, immediately and drastically increased the probability of a new large-scale war in the Middle East and elsewhere. Against this background, I would like to review the history of oil-motivated attacks on Iran.

The desire to control Iran's oil

Iran has an ancient and beautiful civilization, which dates back to 5,000 BC, when the city of Susa was founded. Some of the earliest writing that we know of, dating from from approximately 3,000 BC, was used by the Elamite civilization near to Susa. Today's Iranians are highly intelligent and cultured, and famous for their hospitality, generosity and kindness to strangers. Over the centuries, Iranians have made many contributions to science, art and literature, and for hundreds of years they have not attacked any of their neighbors. Nevertheless, for the last century, they have been the victims of foreign attacks and interventions, most of which have been closely related to Iran's oil and gas resources. The first of these took place in the period 1921-1925, when a British-sponsored coup overthrew the Qajar dynasty and replaced it by Reza Shah.

Reza Shah (1878-1944) started his career as Reza Khan, an army officer. Because of his high intelligence he quickly rose to become commander of the Tabriz Brigade of the Persian Cossacks. In 1921, General Edmond Ironside, who commanded a British force of 6,000 men fighting against the Bolsheviks in northern Persia, masterminded a coup (financed by Britain) in which Reza Khan lead 15,000 Cossacks towards the capital. He overthrew the government, and became minister of war. The British government backed this coup because it believed that a strong leader was needed in Iran to resist the Bolsheviks. In 1923, Reza Khan overthrew the Qajar Dynasty, and in 1925 he was crowned as Reza Shah, adopting the name Pahlavi.

Reza Shah believed that he had a mission to modernize Iran, in much the same way

that Kamil Ata Turk had modernized Turkey. During his 16 years of rule in Iran, many roads were built, the Trans-Iranian Railway was constructed, many Iranians were sent to study in the West, the University of Tehran was opened, and the first steps towards industrialization were taken. However, Reza Shahs methods were sometimes very harsh.

In 1941, while Germany invaded Russia, Iran remained neutral, perhaps leaning a little towards the side of Germany. However, Reza Shah was sufficiently critical of Hitler to offer safety in Iran to refugees from the Nazis. Fearing that the Germans would gain control of the Abadan oil fields, and wishing to use the Trans-Iranian Railway to bring supplies to Russia, Britain invaded Iran from the south on August 25, 1941. Simultaneously, a Russian force invaded the country from the north. Reza Shah appealed to Roosevelt for help, citing Iran's neutrality, but to no avail. On September 17, 1941, he was forced into exile, and replaced by his son, Crown Prince Mohammed Reza Pahlavi. Both Britain and Russia promised to withdraw from Iran as soon as the war was over. During the remainder of World War II, although the new Shah was nominally the ruler of Iran, the country was governed by the allied occupation forces.

Reza Shah, had a strong sense of mission, and felt that it was his duty to modernize Iran. He passed on this sense of mission to his son, the young Shah Mohammed Reza Pahlavi . The painful problem of poverty was everywhere apparent, and both Reza Shah and his son saw modernization of Iran as the only way to end poverty.

In 1951, Mohammad Mosaddegh became Prime Minister of Iran through democratic elections. He was from a highly-placed family and could trace his ancestry back to the shahs of the Qajar dynasty. Among the many reforms made by Mosaddegh was the nationalization of the Anglo-Iranian Oil Company's possessions in Iran. Because of this, the AIOC (which later became British Petroleum), persuaded the British government to sponsor a secret coup that would overthrow Mosaddegh. The British asked US President Eisenhower and the CIA to join M16 in carrying out the coup claiming that Mosaddegh represented a communist threat (a ludicrous argument, considering Mosaddegh's aristocratic background). Eisenhower agreed to help Britain in carrying out the coup, and it took place in 1953. The Shah thus obtained complete power over Iran.

The goal of modernizing Iran and ending poverty was adopted as an almost-sacred mission by the young Shah, Mohammed Reza Pahlavi, and it was the motive behind his White Revolution in 1963, when much of the land belonging to the feudal landowners and the crown was distributed to landless villagers. However, the White Revolution angered both the traditional landowning class and the clergy, and it created fierce opposition. In dealing with this opposition, the Shahs methods were very harsh, just as his fathers had been. Because of alienation produced by his harsh methods, and because of the growing power of his opponents, Shah Mohammed Reza Pahlavi was overthrown in the Iranian Revolution of 1979. The revolution of 1979 was to some extent caused by the British-American coup of 1953.

One can also say that the westernization, at which both Shah Reza and his son aimed, produced an anti-western reaction among the conservative elements of Iranian society. Iran was "falling between two stools", on the one hand western culture and on the other hand the country's traditional culture. It seemed to be halfway between, belonging to neither.

Finally in 1979 the Islamic clergy triumphed and Iran chose tradition. Meanwhile, in 1963, the US had secretly backed a military coup in Iraq that brought Saddam Hussein's Ba'ath Party to power. In 1979, when the western-backed Shah of Iran was overthrown, the United States regarded the fundamentalist Shiite regime that replaced him as a threat to supplies of oil from Saudi Arabia. Washington saw Saddam's Iraq as a bulwark against the Shiite government of Iran that was thought to be threatening oil supplies from pro-American states such as Kuwait and Saudi Arabia.

In 1980, encouraged to do so by the fact that Iran had lost its US backing, Saddam Hussein's government attacked Iran. This was the start of an extremely bloody and destructive war that lasted for eight years, inflicting almost a million casualties on the two nations. Iraq used both mustard gas and the nerve gases Tabun and Sarin against Iran, in violation of the Geneva Protocol. Both the United States and Britain helped Saddam Hussein's government to obtain chemical weapons.

The present attacks on Iran by Israel and the United States, both actual and threatened, have some similarity to the war against Iraq, which was launched by the United States in 2003. In 2003, the attack was nominally motivated by the threat that nuclear weapons would be developed, but the real motive had more to do with a desire to control and exploit the petroleum resources of Iraq, and with Israel's extreme nervousness at having a powerful and somewhat hostile neighbor. Similarly, hegemony over the huge oil and gas reserves of Iran can be seen as one the main reasons why the United States is presently demonizing Iran, and this is combined with Israel's almost paranoid fear of a large and powerful Iran. Looking back on the "successful" 1953 coup against Mosaddegh, Israel and the United States perhaps feel that sanctions, threats, murders and other pressures can cause a regime change that will bring a more compliant government to power in Iran - a government that will accept US hegemony. But aggressive rhetoric, threats and provocations can escalate into full-scale war.

I do not wish to say that Iran's present government is without serious faults. However, any use of violence against Iran would be both insane and criminal. Why insane? Because the present economy of the US and the world cannot support another large-scale conflict; because the Middle East is already a deeply troubled region; and because it is impossible to predict the extent of a war which, if once started, might develop into World War III, given the fact that Iran is closely allied with both Russia and China. Why criminal? Because such violence would violate both the UN Charter and the Nuremberg Principles. There is no hope at all for the future unless we work for a peaceful world, governed by international law, rather than a fearful world, where brutal power holds sway.

An attack on Iran could escalate

We recently passed the 100th anniversary World War I, and we should remember that this colossal disaster escalated uncontrollably from what was intended to be a minor conflict. There is a danger that an attack on Iran would escalate into a large-scale war in the Middle East, entirely destabilizing a region that is already deep in problems.

The unstable government of Pakistan might be overthrown, and the revolutionary Pak-

istani government might enter the war on the side of Iran, thus introducing nuclear weapons into the conflict. Russia and China, firm allies of Iran, might also be drawn into a general war in the Middle East.

In the dangerous situation that could potentially result from an attack on Iran, there is a risk that nuclear weapons would be used, either intentionally, or by accident or miscalculation. Recent research has shown that besides making large areas of the world uninhabitable through long-lasting radioactive contamination, a nuclear war would damage global agriculture to such a extent that a global famine of previously unknown proportions would result.

Thus, nuclear war is the ultimate ecological catastrophe. It could destroy human civilization and much of the biosphere. To risk such a war would be an unforgivable offense against the lives and future of all the peoples of the world, US citizens included.

2.3 The agony of Iraq

There is a close relationship between petroleum and war. James A. Paul, Executive Director of the Global Policy Forum, has described this relationship very clearly in the following words:

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"Just as governments like the US and UK need oil companies to secure fuel for their global war-making capacity, so the oil companies need their governments to secure control over global oilfields and transportation routes. It is no accident, then, that the world's largest oil companies are located in the world's most powerful countries."

"Almost all of the world's oil-producing countries have suffered abusive, corrupt and undemocratic governments and an absence of durable development. Indonesia, Saudi Arabia, Libya, Iraq, Iran, Angola, Colombia, Venezuela, Kuwait, Mexico, Algeria - these and many other oil producers have a sad record, which includes dictatorships installed from abroad,bloody coups engineered by foreign intelligence services, militarization of government and intolerant right-wing nationalism."

Iraq, in particular, has been the scene of a number of wars motivated by the West's thirst for oil. During World War I, 1914-1918, the British captured the area (then known as Mesopotamia) from the Ottoman Empire after four years of bloody fighting. Although Lord Curzon (a member of the British War Cabinet who became Foreign Minister immediately after the war) denied that the British conquest of Mesopotamia was motivated by oil, there is ample evidence that British policy was indeed motivated by a desire for control of the region's petroleum. For example, Curzon's Cabinet colleague Sir Maurice Hankey stated in a private letter that oil was "a first-class war aim". Furthermore, British forces continued to fight after the signing of the Murdos Armistice.

In this way, they seized Mosul, the capital of a major oil-producing region, thus frustrating the plans of the French, who had been promised the area earlier in the secret Sykes-Picot Agreement. Lord Curzon was well aware of the military importance of oil, and following the end of the First World War he remarked: "The Allied cause has floated to victory on a wave of oil".

The Sykes-Picot Agreement essentially took away from the Arabs the autonomy that they had been promised if they fought on the side of the Allies against the Turks. Today this secret double-cross continues to be a great source of bitterness. [1]

During the period between 1918 and 1930, fierce Iraqi resistance to the occupation was crushed by the British, who used poison gas, airplanes, incendiary bombs, and mobile armored cars, together with forces drawn from the Indian Army. Winston Churchill, who was Colonial Secretary at the time, regarded the conflict in Iraq as an important test of modern military-colonial methods.

An article in The Guardian explains that "Churchill was particularly keen on chemical weapons, suggesting that they be used 'against recalcitrant Arabs as an experiment... I am strongly in favour of using poison gas against uncivilized tribes...'" [2]

In 1932, Britain granted nominal independence to Iraq, but kept large military forces in the country and maintained control of it through indirect methods. In 1941, however, it seemed likely that Germany might try to capture the Iraqi oilfields, and therefore the British again seized direct political power in Iraq by means of military force. It was not only Germany that Britain feared, but also US attempts to gain access to Iraqi oil.

The British fear of US interest in Iraqi oil was soon confirmed by events. In 1963 the US secretly backed a military coup in Iraq that brought Saddam Hussein's Ba'ath Party to power. In 1979 the western-backed Shah of Iran was overthrown, and the United States regarded the fundamentalist Shi'ite regime that replaced him as a threat to supplies of oil from Saudi Arabia.

Washington saw Saddam's Iraq as a bulwark against the militant Shi'ite extremism of Iran that was threatening oil supplies from pro-American states such as Kuwait and Saudi Arabia.

In 1980, encouraged to do so by the fact that Iran had lost its US backing, Saddam Hussein's government attacked Iran. This was the start of an extremely bloody and destructive war that lasted for eight years, inflicting almost a million casualties on the two nations. Iraq used both mustard gas and the nerve gases Tabun and Sarin against Iran, in violation of the Geneva Protocol.

Both the United States and Britain helped Saddam Hussein's government to obtain chemical weapons. A chemical plant, called Falluja 2, was built by Britain in 1985, and this plant was used to produce mustard gas and nerve gas. Also, according to the Rigel Report to the US Senate, May 25, (1994), the Reagan Administration turned a blind eye to the export of chemical weapon precursors to Iraq, as well as anthrax and plague cultures

[1] https://www.khanacademy.org/humanities/history/euro
-hist/middle-east-20th-century/v/
sykes-picot-agreement-and-the-balfour-declaration

[2] http://www.theguardian.com/world/2003/apr/19/iraq.arts

that could be used as the basis for biological weapons. According to the Riegel Report, "records available from the supplier for the period 1985 until the present show that during this time, pathogenic (meaning disease producing) and toxigenic (meaning poisonous), and other biological research materials were exported to Iraq perusant to application and licensing by the US Department of Commerce."

In 1984, Donald Rumsfeld, Reagan's newly appointed Middle East Envoy, visited Saddam Hussein to assure him of America's continuing friendship, despite Iraqi use of poison gas. When (in 1988) Hussein went so far as to use poison gas against civilian citizens of his own country in the Kurdish village of Halabja, the United States worked to prevent international condemnation of the act. Indeed US support for Saddam was so unconditional that he obtained the false impression that he had a free hand to do whatever he liked in the region.

On July 25, 1990, US Ambassador April Glaspie met with Saddam Hussein to discuss oil prices and how to improve US-Iraq relations. According to the transcript of the meeting, Ms Galspie assured Saddam that the US "had no opinion on the Arab-Arab conflicts, like your border disagreement with Kuwait." She then left on vacation. Mistaking this conversation for a green light, Saddam invaded Kuwait eight days later.

By invading Kuwait, Hussein severely worried western oil companies and governments, since Saudi Arabia might be next in line. As George Bush senior said in 1990, at the time of the Gulf War, "Our jobs, our way of life, our own freedom and the freedom of friendly countries around the world would all suffer if control of the world's great oil reserves fell into the hands of Saddam Hussein."

On August 6, 1990, the UN Security Council imposed comprehensive economic sanctions against Iraq with the aim of forcing Iraq to withdraw from Kuwait. Meanwhile, US Secretary of State James A. Baker III used arm-twisting methods in the Security Council to line up votes for UN military action against Iraq. In Baker's own words, he undertook the process of "cajoling, extracting, threatening and occasionally buying votes".

On November 29, 1990, the Council passed Resolution 678, authorizing the use of "all necessary means" (by implication also military means) to force Iraq to withdraw from Kuwait. There was nothing at all wrong with this, since the Security Council had been set up by the UN Charter to prevent states from invading their neighbors. However, one can ask whether the response to Saddam Hussein's invasion of Kuwait would have been so wholehearted if oil had not been involved.

There is much that can be criticized in the way that the Gulf War of 1990-1991 was carried out. Besides military targets, the US and its allies bombed electrical generation facilities with the aim of creating postwar leverage over Iraq. The electrical generating plants would have to be rebuilt with the help of foreign technical assistance, and this help could be traded for postwar compliance. In the meantime, hospitals and water-purification plants were without electricity. Also, during the Gulf War, a large number of projectiles made of depleted uranium were fired by allied planes and tanks. The result was a sharp increase in cancer in Iraq.

Finally, both Shi'ites and Kurds were encouraged by the Allies to rebel against Saddam Hussein's government, but were later abandoned by the allies and slaughtered by Saddam.

The most terrible misuse of power, however, was the US and UK insistence the sanctions against Iraq should remain in place after the end of the Gulf War. These two countries used their veto power in the Security Council to prevent the removal of the sanctions. Their motive seems to have been the hope that the economic and psychological impact would provoke the Iraqi people to revolt against Saddam. However that brutal dictator remained firmly in place, supported by universal fear of his police and by massive propaganda. The effect of the sanctions was to produce more than half a million deaths of children under five years of age, as is documented by UNICEF data. The total number of deaths that the sanctions produced among Iraqi civilians probably exceeded a million, if older children and adults are included.[3]

Ramsey Clark, who studied the effects of the sanctions in Iraq from 1991 onwards, wrote to the Security Council that most of the deaths "are from the effects of malnutrition including marasmas and kwashiorkor, wasting or emaciation which has reached twelve per cent of all children, stunted growth which affects twenty-eight per cent, diarrhea, dehydration from bad water or food, which is ordinarily easily controlled and cured, common communicable diseases preventable by vaccinations, and epidemics from deteriorating sanitary conditions. There are no deaths crueler than these. They are suffering slowly, helplessly, without simple remedial medication, without simple sedation to relieve pain, without mercy."

In discussing Iraq, we mentioned oil as a motivation for western interest. Similar considerations hold also for Afghanistan. US-controlled oil companies have long had plans for an oil pipeline from Turkmenistan, passing through Afghanistan to the Arabian Sea, as well as plans for a natural gas pipeline from Turkmenistan through Afghanistan to Pakistan.

The September 11 terrorist attacks resulted in a spontaneous worldwide outpouring of sympathy for the United States, and within the US, patriotic support of President George W. Bush at a time of national crisis. Bush's response to the attacks seems to have been to inquire from his advisors whether he was now free to invade Iraq. According to former counterterrorism chief, Richard Clarke, Bush was "obsessed" with Iraq as his principal target after 9/11.

The British Prime Minister, Tony Blair, was a guest at a private White House dinner nine days after the terrorist attacks on New York and Washington. Sir Christopher Meyer, former UK Ambassador to Washington, was also present at the dinner. According to Meyer, Blair said to Bush that they must not get distracted from their main goal - dealing with the Taliban and al-Quaeda in Afghanistan, and Bush replied: "I agree with you Tony. We must deal with this first. But when we have dealt with Afghanistan, we must come back to Iraq." Faced with the prospect of wars in both Iraq and Afghanistan, Blair did not protest, according to Meyer.

During the summer of 2002, Bush and Blair discussed Iraq by telephone. A senior

[3] https://www.transcend.org/tms/2014/09/usauk-committed-genocide-against-iraq-people/ http://www.informationclearinghouse.info/article37511.htm

official from Vice-President Dick Cheney's office who read the transcript of the call is quoted by the magazine Vanity Fair as saying: "The way it read was that come what may, Saddam was going to go; they said that they were going forward, they were going to take out the regime, and they were doing the right thing. Blair did not need any convincing. There was no 'Come on, Tony, we've got to get you on board'. I remember reading it and then thinking, 'OK, now I know what we're going to be doing for the next year.'" On June 1, 2002, Bush announced a new US policy which not only totally violated all precedents in American foreign policy but also undermined the United Nations Charter and international law6 . Speaking at the graduation ceremony of the US Military Academy at West Point he asserted that the United States had the right to initiate a preemptive war against any country that might in the future become a danger to the United States. "If we wait for threats to fully materialize", he said, "we will have waited too long." He indicated that 60 countries might fall into this category, roughly a third of the nations of the world.

The assertion that the United States, or any other country, has the right to initiate preemptive wars specifically violates Chapter 1, Articles 2.3 and 2.4, of the United Nations Charter. These require that "All members shall settle their disputes by peaceful means in such a manner that international peace, security and justice are not endangered", and that "All members shall refrain in their international relations from the threat or use of force against the territorial integrity of any state, or in any other manner inconsistent with the purposes of the United Nations." The UN Charter allows a nation that is actually under attack to defend itself, but only until the Security Council has had time to act.

Bush's principle of preemptive war was promptly condemned by the Catholic Church. Senior Vatican officials pointed to the Catholic teaching that "preventive" war is unjustifiable, and Archbishop Renato Martino, prefect of the Vatican Council for Justice and Peace, stated firmly that "unilateralism is not acceptable".

However, in the United States, the shocking content of Bush's West Point address was not fully debated. The speech was delivered only a few months after the 9/11 terrorist attacks, and the US supported whatever exceptional measures its President thought might be necessary for the sake of national security. American citizens, worried by the phenomenon of terrorism, did not fully appreciate that the principle of preemptive war could justify almost any aggression, and that in the long run, if practiced by all countries, it would undermine the security of the United States as well as that of the entire world.

During the spring of 2003, our television and newspapers presented us with the spectacle of an attack by two technologically superior powers on a much less industrialized nation, a nation with an ancient and beautiful culture. The ensuing war was one-sided. Missiles guided by laser beams and signals from space satellites were more than a match for less sophisticated weapons. Speeches were made to justify the attack. It was said to be needed because of weapons of mass destruction (some countries are allowed to have them, others not). It was said to be necessary to get rid of a cruel dictator (whom the attacking powers had previously supported and armed). But the suspicion remained that the attack was resource-motivated. It was about oil, or at least largely about oil. The war on Iraq was also designed to destroy a feared enemy of Israel.

The Nobel Peace Prize winner, Maidread Corrigan Maguire estimates that US and UK

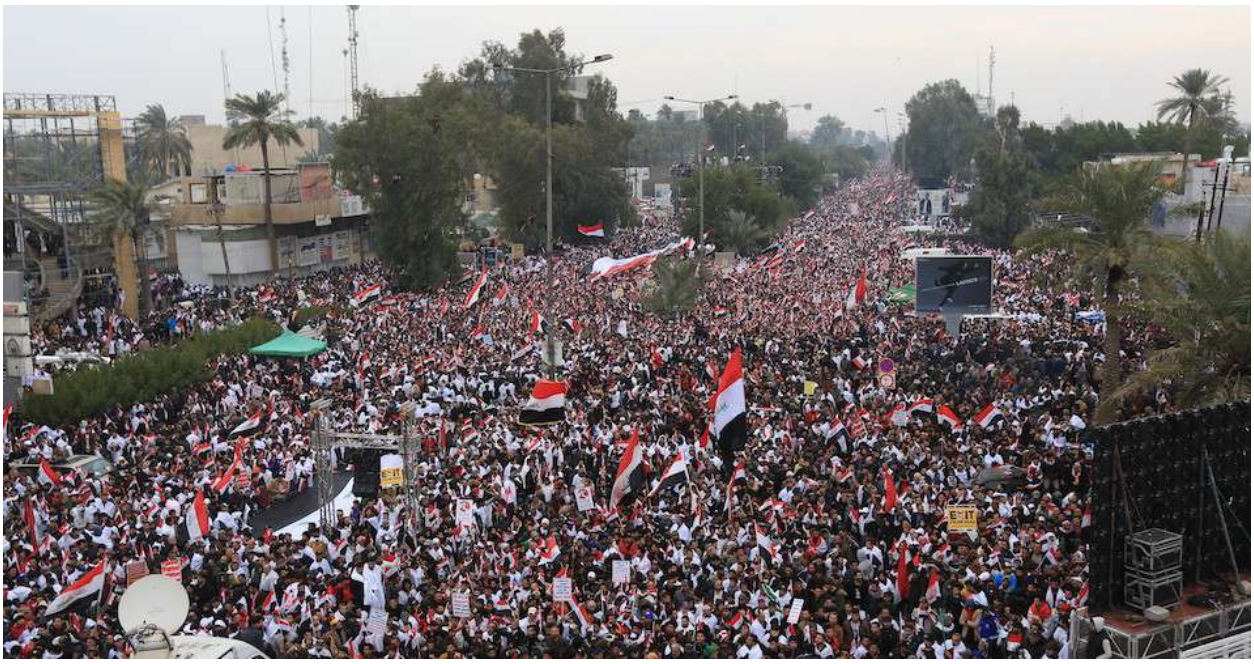

Figure 2.1: **Over 200,000 Iraqis gathering at Jadariya, a neighborhood in the Baghdad city center at a rally against the presence of U.S. troops in the country, in Baghdad, Iraq on January 24, 2020. Demonstrators rejected foreign influence in their country's affairs.**

actions between 1990 and 2012 killed 3.3 million people, including 750,000 children.

Venezuela also targeted because of oil

An article entitled *U.S.-backed coup in Venezuela moves into "final phase" April 30, 2019 12:04 PM CST By C.J. Atkins*[4] stated that

In an all-or-nothing gamble, the Trump administration's man in Caracas, opposition leader Juan Guaidó, has opened what he's calling the "final phase" of the effort to overthrow the elected government of Venezuela.

Pipeline wars

It is disturbing to see how little effect the the earth's present critical climate emergency has on the behaviour of politicians and the mass media. Recent data show that the earth is heating much faster than expected, and that this is most pronounced in the Arctic and Antarctic regions. An extremely dangerous methane hydrate feedback loop could be initiated by melting permafrost and by the warming Arctic seas. This feedback loop could

[4]https://www.peoplesworld.org/article/u-s-backed-coup-in-venezuela-moves-into-final-phase/

Figure 2.2: **A view of oil refineries from the Galveston Channel in Texas (Photo: Roy Luck/flick/CC)**

lead to uncontrollable and catastrophic climate change. But although the use of fossil fuels must stop within one or two decades if a planetary disaster is to be avoided, pipline wars continue as usual.[5]

[5]http://www.commondreams.org/news/2016/03/14/nasa-drops-major-bomb-march-toward-ever-warmer-planet
http://www.theguardian.com/environment/2016/mar/15/record-breaking-temperatures-have-robbed-the-arctic-of-its-winter

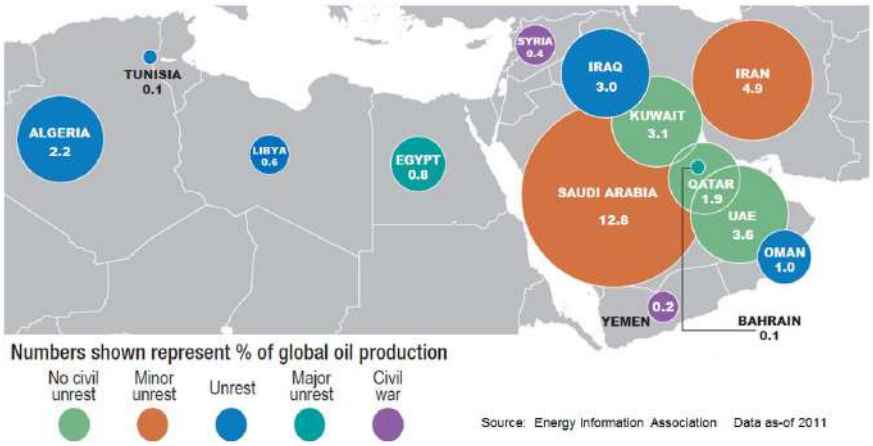

Figure 2.3: **A map showing the major oil-producing countries of the Middle East and North Africa. The percent of global oil production is indicated. Many of the countries shown have some deghree of civil unrest or civil war.**

Figure 2.4: **Burning of coal in China has contributed to rapid industrial growth, but besides being a major factor in the threat of catastrophic climate change, it has produced hundreds of thousands of deaths each year through air pollution (an estimated 366,000 in 2013).**

Figure 2.5: **Protests against the Keystone XL and Dakota Access piplines which, if completed, would carry oil from the Canadian oil sands to refineries in Texas.**

2.4 The Middle East

According to current estimates, 81.5% of the world's proven crude oil reserves are located in OPEC Member Countries, with the bulk of OPEC oil reserves in the Middle East, amounting to 65.5% of the OPEC total.

2.5 China

China's large reserves of coal lie near to the surface, and are thus very easily accessible. Mining of coal has driven the country's rapid industrial growth, but it has also produced a severe public health problem because of air pollution.

In April, 2017, China's rate of economic growth was 6.9%[6]. This rate of growth, if continued, would mean that China's economy would double every ten years. and increase by a factor of 1024 every century. Obviously this is impossible. Never-ending economic growth on a finite planet is a logical absurdity. China's high economic growth rate, is driven by its use of coal, and this must quickly stop if ecological disaster is to be avoided.

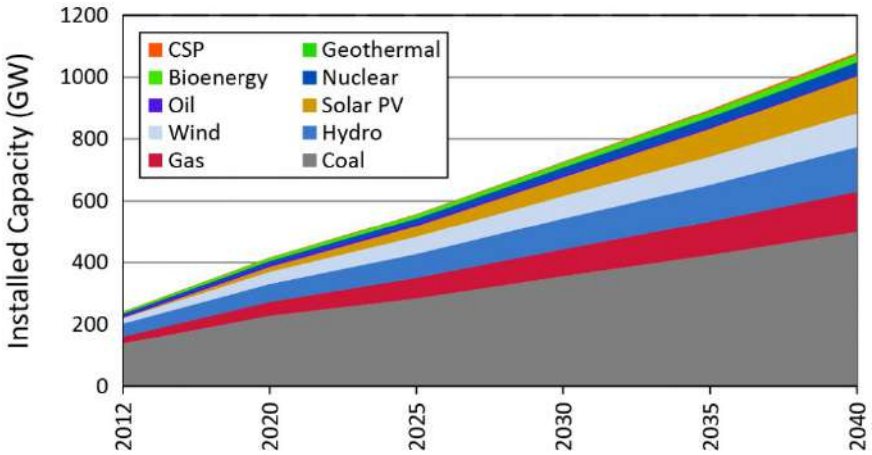

Figure 2.6: **India's installed and future energy mix, as visualized by the World Coal Association**

2.6 India

The MIT Technology Review recently published an important article entitled *India's Energy Crisis*[7].

The article makes alarming reading in view of the world's urgent need to make a very rapid transition from fossil fuels to 100% renewable energy. We must make this change quickly in order to avoid a tipping point beyond which catastrophic climate change will be unavoidable.

The MIT article states that "Since he took power in May, 2014, Prime Minister Narendra Modi has made universal access to electricity a key part of his administration's ambitions. At the same time, he has pledged to help lead international efforts to limit climate change. Among other plans, he has promised to increase India's total power generating capacity to 175 gigawatts, including 100 gigawatts of solar, by 2022. (That's about the total power generation of Germany.)"

However India plans to expand its industrial economy, and to do this, it is planning to very much increase its domestic production and use of coal. The MIT article continues, pointing out that

However India plans to expand its industrial economy, and to do this, it is planning to very much increase its domestic production and use of coal. The MIT article continues, pointing out that "Such growth would easily swamp efforts elsewhere in the world to curtail carbon emissions, dooming any chance to head off the dire effects of global climate change. (Overall, the world will need to reduce its current annual emissions of 40 billion tons by 40 to 70 percent between now and 2050.) By 2050, India will have roughly 20 percent of the world's population. If those people rely heavily on fossil fuels such as coal to expand the economy and raise their living standards to the level people in the rich world have enjoyed

[6]https://tradingeconomics.com/china/gdp-growth-annual

[7]http://www.technologyreview.com/featuredstory/542091/indias-energy-crisis/

for the last 50 years, the result will be a climate catastrophe regardless of anything the United States or even China does to decrease its emissions. Reversing these trends will require radical transformations in two main areas: how India produces electricity, and how it distributes it."

The Indian Minister of Power, Piyush Goyal, is an enthusiastic supporter of renewable energy expansion, but he also supports, with equal enthusiasm, the large-scale expansion of domestic coal production in India.

Meanwhile, the consequences of global warming are being felt by the people of India. For example, last May, a heat wave killed over 1,400 people and melted asphalt streets.[8]

Have India's economic planners really thought about the long-term future? Have they considered the fact that drastic climate change could make India completely uninhabitable?

2.7 Russia

According to Wikipedia, "The petroleum industry in Russia is one of the largest in the world. Russia has the largest reserves, and is the largest exporter, of natural gas. It has the second largest coal reserves, the eighth largest oil reserves, and is one of the largest producer of oil. It is the third largest energy user."

One of the difficulties of reducing Russia's fossil fuel production is that the Russian economy depends so heavily on its oil and gas industries. Many European countries also depend on natural gas from Russia for winter heating of homes and workplaces.

[8]https://www.rt.com/news/262641-india-heat-wave-killed/

Figure 2.7: **Protesters at the 2017 G20 meeting in Hamburg Germany.**

Figure 2.8: **Oil production on the shelf in the Russian Arctic.**

2.8 North America

Canadian oil sands

Canada's oil-sands deposits contain an amount of carbon comparable to the world's total reserves of conventional oil. Oil is currently being extracted by methods that release four times as much carbon into the atmosphere as is contained in the refined oil from the deposits. Nevertheless, the government of Canada wholeheartedly supports extraction of oil from the tar sands.

The position of the Canadian government has been strongly criticized by leading climate scientist Professor James Hansen. A recent article in *The Guardian*[9], reported him as saying; "To leave our children with a manageable situation, we need to leave the unconventional fuel in the ground. Canada's ministers are acting as salesmen for those people who will gain from the profits of that industry. But I don't think they are looking after the rights and wellbeing of the population as a whole.

"The thing we are facing overall is that the fossil fuel industry has so much money that they are buying off governments. Our democracies are seriously handicapped by the money that is driving decisions in Washington and other capitals."

Fracking in the United States

According to the US Department of Energy (DOE), in 2013 at least two million oil and gas wells in the US have been hydraulically fractured, and that of new wells being drilled, up to 95% are hydraulically fractured. The output from these wells makes up 43% of the oil production and 67% of the natural gas production in the United States.

Because of earthquakes and poisoning of water supplies caused by fracking, this practice has been banned by several states in the US, and nine countries or regions in Europe: France, Bulgaria, Roumania, Germany, The Czech Republic, Luxembourg, Northern Ireland, Spain and Switzerland,

[9]https://www.theguardian.com/environment/2013/may/19/tar-sands-exploitation-climate-scientist

Figure 2.9: **Get rich quick at the oil sands.**

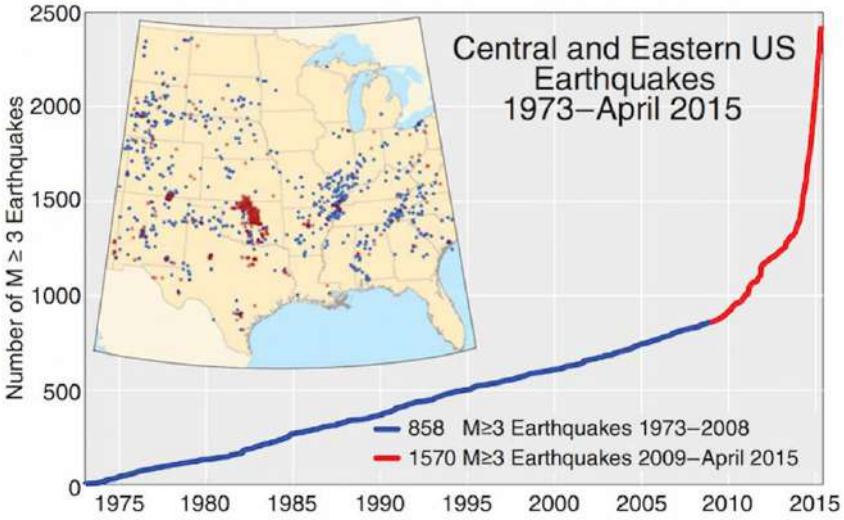

Figure 2.10: **The sharply increased number of earthquakes in the United States has been linked to fracking. The use of fracking has also caused poisoning of water supplies.**

2.9 Latin America

Venezuela's Belt of Tar

The Orinoco River Basin in Venezuela contains the world's largest deposit of extra-heavy oil and tar. The amount of carbon contained in this deposit is comparable to the carbon content of all the world's known reserves of conventional oil, and also larger than the carbon contained in Canada's oil sands.

The Belt of Tar follows the line of the Orinoco river. It is approximately 600 kilometers (370 mi) from east to west, and 70 kilometers (43 mi) from north to south, with an area about 55,314 square kilometers (21,357 sq mi). The Orinoco deposit is estimated to contain 1.2 trillion barrels of extra-heavy oil.

The government of Venezuela has no plans for halting extraction from the Belt of Tar. On the contrary, detailed plans have been made for expanded exploitation of the deposit[10].

Extraction of oil in Brazil

According to a recent article in *The Guardian*[11] "The discovery of tens of billions of barrels of oil in fields far off the coast of Rio de Janeiro was billed as one of the biggest finds of this century when it was announced in 2006.

"Many hoped it would deliver a bonanza for education and health and make Brazil one of world's major economies.

"But with the country's biggest energy company, Petrobras, mired in debt and scandal, the low price of oil and the dangers of a second Deepwater Horizon, the viability of this massive undertaking has never been under more scrutiny."

The Brazilian offshore deposits are called "presalt oil", since they lie under a thick layer of salt deposits.

According to the article in *The Guardian*, "Suggestions by climate campaigners that this reservoir of fossil fuel is a 'carbon bomb' that should be left in the ground, are dismissed as hypocrisy."

The article quotes the geologist who discovered the off-shore fields as saying "The big countries of the world today developed without any concern for the environment. The base of US development was the oil in the Gulf of Mexico. The base of the UK's industrial revolution was coal. How can they now say we can't use our own pre-salt?"

[10] https://en.wikipedia.org/wiki/PDVSA

[11] https://www.theguardian.com/environment/ng-interactive/2015/jun/25/brazils-gamble-on-deep-water-oil-guanabara-bay

Figure 2.11: **Venezuela's Belt of Tar under the Orinoco River Basin is the world's largest deposit of extra-heavy oil and tar.**

2.10 The European Union

Coal in Germany and Poland

In 2016, Germany produced 176,100,000 tonnes of coal while Poland produced 131,100,000 tonnes. In the past, Poland experienced severe ecological effects from acid rain due to the burning of coal. Polish forests were destroyed by the effects of acid rain, and the facades of statues and buildings in Krakow and elsewhere were dissolved by the acid. Today the situation is improving, but the two countries are still heavily dependant on coal.

North Sea oil

According to Wikipedia, "The British and Norwegian sections hold most of the remainder of the large oil reserves. It is estimated that the Norwegian section alone contains 54% of the sea's oil reserves and 45% of its gas reserves- More than half of the North Sea oil reserves have been extracted, according to official sources in both Norway and the UK. For Norway, the Norwegian Petroleum Directorate [28] gives a figure of 4,601 million cubic meters of oil (corresponding to 29 billion barrels) for the Norwegian North Sea alone (excluding smaller reserves in Norwegian Sea and Barents Sea) of which 2,778 million cubic meters (60%) has already been produced prior to January 2007. UK sources give a range of estimates of reserves, but even using the most optimistic 'maximum' estimate of ultimate recovery, 76% had been recovered at end 2010.[citation needed] Note the UK figure includes fields which are not in the North Sea (onshore, West of Shetland).

2.11 Major producers of fossil fuels

The top 20 oil-producing nations in 2016

Wikipedia's article entitles *List of countries by oil production* gives information shown in the table below. In the table. which is based on data from the International Energy Agency, production is measured in barrels of oil per day

1	Russia	10,551,497
2	Saudi Arabia	10,460,710
3	United States	8,875,817
4	Iraq	4,451,516
5	Iran	3,990,956
6	China	3,980,650
7	Canada	3,662,694
8	United Arab Emirates	3,106,077
9	Kuwait	2,923,825
10	Brazil	2,515,459
11	Venezuela	2,276,967
12	Mexico	2,186,877
13	Nigeria	1,999,885
14	Angola	1,769,615
15	Norway	1,647,975
16	Kazakhstan	1,595,199
17	Qatar	1,522,902
18	Algeria	1,348,361
19	Oman	1,006,841
20	United Kingdom	939,760

The top 10 coal producing nations in 2016

Wikipedia gives a similar list of coal producing nations. Only the top 10 are shown here, since these countries completely dominate global coal production. In the table, production is measured in millions of tonnes per year.

1	China	3411.0
2	India	692.4
3	United States	660.6
4	Australia	492.8
5	Indonesia	434.0
6	Russia	385.4
7	South Africa	251.3
8	Germany	176.1
9	Poland	131.1
10	Kazakhstan	102.4
	World	7,460.4

The world production of coal is falling. In 2014 it was 8,164.9 tonnes, in 2015, 7,861.1 tonnes, and in 2016 7,460.4 tonnes. Nevertheless, global production of coal remains worryingly high. If catastrophic climate change is to be avoided, it must stop altogether within one or two decades. At the moment the world is still producing roughly 1 tonne of coal per capita each year.

List of countries by natural gas production

Here is a similar table for natural gas. Production is measured in m^3 per year. The final column indicates the date of the data.

1	United States	728,200,000,000	2014
2	Russia	578,700,000,000	2014
3	Iran	438,000,000,000	2017
4	Canada	143,100,000,000	2012
5	Qatar	133,200,000,000	2011
6	Norway	114,700,000,000	2012
7	China	107,200,000,000	2012
8	Saudi Arabia	103,200,000,000	2012
9	Algeria	82,760,000,000	2011
10	Netherlands	80,780,000,000	2012
	World	4,359,000,000,000	2010

2.12 Fossil fuel extraction must stop!

"Leave the oil in the soil! Leave the coal in the hole! Leave the gas under the grass!" That was message of protesters at the 2017 G20 meeting. But from the facts shown in this chapter, we can see that on the whole, fossil fuels are not being left in the ground, where they have to remain if an ecological disaster is to be avoided. On the contrary, the extraction of coal, oil and gas continues almost as though the climate emergency did not exist. Most politicians, with their eyes focused on the present, seem blind to future dangers. They think primarily about the jobs and living standards of their constituents, and about the next election. Meanwhile, the future of human civilization is neglected and remains in peril.[12]

The fact that historically, the highly industrialized nations were primarily responsible for atmospheric CO_2 increases does not excuse the developing countries from their responsibility for saving the future. Today China's coal, India's coal, Venezuela's tar sands and Brazil's pre-salt oil are among the greatest threats, and in these countries as elsewhere, extraction must stop.

We have to wake up! Business as usual cannot continue!

The Production Gap

Here are some quotations from the Executive Summary of the 80-page United Nations report, *The Production Gap*[13]:

[12] See https://www.theguardian.com/commentisfree/2017/sep/18/enough-tiptoeing-around-lets-make-this-clear-coal-kills-people

[13] http://productiongap.org/wp-content/uploads/2019/11/Production-Gap-Report-2019.pdf

Governments are planning to produce about 50% more fossil fuels by 2030 than would be consistent with a 2 degree C pathway and 120% more than would be consistent with a 1.5 degree C pathway...

- **This production gap is largest for coal. By 2030, countries plan to produce 150% (5.2 billion tonnes) more coal than would be consistent with a 2 degrees C pathway, and 280% (6.4 billion tonnes) more than would be consistent with a 1.5 degree C pathway.**

- **Oil and gas are also on track to exceed carbon budgets, as countries continue to invest in fossil fuel infrastructure that 'locks in" oil and gas use. The effects of this lock-in widen the production gap over time, until countries are producing 43% (36 million barrels per day) more oil and 47% (1,800 billion cubic meters) more gas by 2040 than would be consistent with a 2 degree C pathway.**

This global production gap is even larger than the already-significant global emissions gap, due to minimal policy attention on curbing fossil fuel production.

Suggestions for further reading

1. P.B. Smith, J.D. Schilling and A.P. Haines, *Introduction and Summary*, in *Draft Report of the Pugwash Study Group: The World at the Crossroads*, Berlin, (1992).
2. World Resources Institute, *World Resources*, Oxford University Press, New York, (published annually).
3. J.R. Craig, D.J. Vaughan and B.J. Skinner, *Resources of the Earth: Origin, Use and Environmental Impact, Third Edition*, Prentice Hall, (2001).
4. W. Youngquist, *Geodestinies: The Inevitable Control of Earth Resources Over Nations and Individuals*, National Book Company, Portland Oregon, (1997).
5. M. Tanzer, *The Race for Resources. Continuing Struggles Over Minerals and Fuels*, Monthly Review Press, New York, (1980).
6. C.B. Reed, *Fuels, Minerals and Human Survival*, Ann Arbor Science Publishers Inc., Ann Arbor Michigan, (1975).
7. A.A. Bartlett, *Forgotten Fundamentals of the Energy Crisis*, American Journal of Physics, **46**, 876-888, (1978).
8. N. Gall, *We are Living Off Our Capital*, Forbes, September, (1986).
9. E.J. Hobsbawn, *The Age of Empire, 1875-1914*, Vintage Books, (1989).
10. L. James, *The Rise and Fall of the British Empire*, St Martin's Press, (1997).
11. N. Ferguson, *Empire: The Rise and Demise of the British World Order and the Lessons for Global Power*, Basic Books, (2003).
12. S. Schama, *The Fate of Empire, 1776-2000*, Miramax, (2002).
13. A.P. Thorton, *The Imperial Idea and Its Enemies: A Study in British Power*, Palgrave Macmillan, (1985).

14. H. Mejcher, *Imperial Quest for Oil: Iraq, 1910-1928*, Ithaca Books, London, (1976).
15. P. Sluglett, *Britain in Iraq, 1914-1932*, Ithaca Press, London, (1976).
16. D.E. Omissi, *British Air Power and Colonial Control in Iraq, 1920-1925*, Manchester University Press, Manchester, (1990).
17. V.G. Kiernan, *Colonial Empires and Armies, 1815-1960*, Sutton, Stroud, (1998).
18. R. Solh, *Britain's 2 Wars With Iraq*, Ithaca Press, Reading, (1996).
19. D. Hiro, *The Longest War: The Iran-Iraq Military Conflict*, Routledge, New York, (1991).
20. T.E. Lawrence, *A Report on Mesopotamia by T.E. Lawrence*, Sunday Times, August 22, (1920).
21. D. Fromkin, *A Peace to End All Peace: The Fall of the Ottoman Empire and the Creation of the Modern Middle East*, Owl Books, (2001).
22. T. Rajamoorthy, *Deceit and Duplicity: Some Reflections on Western Intervention in Iraq*, Third World Resurgence, March-April, (2003).
23. P. Knightley and C. Simpson, *The Secret Lives of Lawrence of Arabia*, Nelson, London, (1969).
24. G. Lenczowski, *The Middle East in World Affairs*, Cornell University Press, (1962).
25. John A. Hobson, *Imperialism; A Study*, (1902).
26. P. Cain and T. Hopkins, *British Imperialism, 1688-200*, Longman, (2000).
27. N. Ferguson, *Empire: The Rise and Demise of the British World Order and the Lessons for Global Power*, Basic Books, (2003).
28. G. Kolko, *Another Century of War*, New Press, (2002).
29. G. Kolko, *Confronting the Third World: United States Foreign Policy, 1945-1980*, Pantheon Books, (1988).
30. M.T. Klare, *Resource Wars: The New Landscape of Global Conflict*, Owl Books reprint edition, New York, (2002).
31. Y. Nakash, *The Shi'is of Iraq*, Princeton University Press, (1994).
32. D. Fromkin, *A Peace to End All Peace: The Fall of the Ottoman Empire and the Creation of the Modern Middle East*, Owl Books, (2001).
33. S.K. Aburish, *Saddam Hussein: The Politics of Revenge*, Bloomsbury, London, (2001).
34. M. Muffti, *Sovereign Creations: Pan-Arabism and Political Order in Syria and Iraq*, Cornell University Press, (1996).
35. C. Clover, *Lessons of the 1920 Revolt Lost on Bremer*, Financial Times, November 17, (2003).
36. J. Kifner, *Britain Tried First. Iraq Was No Picnic Then*, New York Times, July 20, (2003).
37. J. Feffer, B. Egrenreich and M.T. Klare, *Power Trip: US Unilateralism and Global Strategy After September 11*, Seven Stories Press, (2003).
38. J.D. Rockefeller, *Random Reminiscences of Men and Events*, Doubleday, New York, (1909).
39. M.B. Stoff, *Oil, War and American Security: The Search for a National Policy on Oil, 1941-1947*, Yale University Press, New Haven, (1980).

40. W.D. Muscable, *George F. Kennan and the Making of American Foreign Policy*, Princeton University Press, Princeton, (1992).
41. J. Stork, *Middle East Oil and the Energy Crisis*, Monthly Review, New York, (1976).
42. F. Benn, *Oil Diplomacy in the Twentieth Century*, St. Martin's Press, New York, (1986).
43. R. Sale, *Saddam Key in Early CIA Plot*, United Press International, April 10, (2003).
44. K. Roosevelt, *Countercoup: The Struggle for the Control of Iran*, McGraw-Hill, New York, (1979).
45. J. Fitchett and D. Ignatius, *Lengthy Elf Inquiry Nears Explosive Finish*, International Herald Tribune, February 1, (2002).
46. M.T. Klare, *Resource Wars: The New Landscape of Global Conflict*, Owl Books reprint edition, New York, (2002).
47. M. Klare, *Bush-Cheney Energy Strategy: Procuring the Rest of the World's Oil*, Foreign Policy in Focus, (Interhemispheric Resource Center/Institute for Policy Studies/SEEN), Washington DC and Silver City NM, January, (2004).
48. M. Klare, *Endless Military Superiority*, The Nation magazine, July 15, (2002).
49. M.T. Klare, *Geopolitics Reborn: The Global Struggle Over Oil and Gas Pipelines*, Current History, December issue, 428-33, (2004).
50. P. Grose, *Allen Dulles: The Life of a Gentleman Spy*, Houghton Mifflin, Boston, (1994).
51. S. Warren, *Exxon's Profit Surged in 4th Quarter*, Wall Street Journal, February 12, (2004).
52. R. Suskind, *The Price of Loyalty: George W. Bush, the White House and the Education of Paul O'Neill*, Simon and Schuster, New York, (2004).
53. D. Morgan and D.B. Ottaway, *In Iraqi War Scenario, Oil is Key Issue as U.S. Drillers Eye Huge petroleum Pool*, Washington Post, September 15, (2002).
54. D. Rose, *Bush and Blair Made Secret Pact for Iraqi War*, The Observer, April 4, (2004).
55. E. Vulliamy, P. Webster and N.P. Walsh, *Scramble to Carve Up Iraqi Oil Reserves Lies Behind US Diplomacy*, The Observer, October 6, (2002).
56. Y. Ibrahim, *Bush's Iraq Adventure is Bound to Backfire*, International Herald Tribune, November 1, (2002).
57. P. Beaumont and F. Islam, *Carve-Up of Oil Riches Begins*, The Observer, November 3, (2002).
58. M. Dobbs, *US Had Key Role in Iraq Buildup*, Washington Post, December 30, (2002).
59. R. Sale, *Saddam Key in Early CIA Plot*, United Press International, April 10, (2003).
60. R. Morris, *A Tyrant Forty Years in the Making*, New York Times, March 14, (2003).
61. H. Batatu, *The Old Social Classes and the Revolutionary Movements of Iraq*, Princeton University Press, (1978).
62. D.W. Riegel, Jr., and A.M. D'Amato, *US Chemical and Biological Warfare-Related Dual Use Exports to Iraq and their Possible Impact on the Health Consequences of the Persian Gulf War*, Report to US Senate ("The Riegel Report"), May 25, (1994).

63. P.E. Tyler, *Officers Say US Aided Iraq in War Despite Use of Gas*, New York Times, August 18, (2002).
64. D. Priest, *Rumsfeld Visited Baghdad in 1984 to Reassure Iraqis, Documents Show*, Washington Post, December 19, (2003).
65. S. Zunes, *Saddam's Arrest Raises Troubling Questions*, Foreign Policy in Focus, http://www.globalpolicy.org/, December (2003).
66. D. Leigh and J. Hooper, *Britain's Dirty Secret*, Guardi an, March 6, (2003).
67. J. Battle, (Ed.), *Shaking Hands With Saddam Hussein: The US Tilts Towards Iraq, 1980-1984*, National Security Archive Electronic Briefing Book No. 82, February 25, (2003).
68. J.R. Hiltermann, *America Didn't Seem to Mind Poison Gas*, International Herald Tribune, January 17, (2003).
69. D. Hiro, *Iraq and Poison Gas*, Nation, August 28, (2002).
70. T. Weiner, *Iraq Uses Techniques in Spying Against its Former Tutor, the US*, Philadelphia Inquirer, February 5, (1991).
71. S. Hussein and A. Glaspie, *Excerpts From Iraqi Document on Meeting with US Envoy*, The New York Times, International, September 23, (1990).
72. D. Omissi, *Baghdad and British Bombers*, Guardian, January 19, (1991).
73. D. Vernet, *Postmodern Imperialism*, Le Monde, April 24, (2003).
74. J. Buchan, *Miss Bell's Lines in the Sand*, Guardian, March 12, (2003).
75. C. Tripp, *Iraq: The Imperial Precedent*, Le Monde Diplomatique, January, (2003).
76. G.H.W. Bush and B. Scowcroft, *Why We Didn't Remove Saddam*, Time, 2 March, (1998).
77. J.A. Baker III, *The Politics of Diplomacy: Revolution, War and Peace, 1989-1992*, G.P. Putnam's Sons, New York, (1995).
78. H. Thomas, *Preventive War Sets Serious Precedent*, Seattle Post Intelligencer, March 20, (2003).
79. R.J. Barnet, *Intervention and Revolution: The United States in the Third World*, World Publishing, (1968).
80. T. Bodenheimer and R. Gould, *Rollback: Right-wing Power in U.S. Foreign Policy*, South End Press, (1989).
81. G. Guma, *Uneasy Empire: Repression, Globalization, and What We Can Do*, Toward Freedom, (2003).
82. W. Blum, *A Brief History of U.S. Interventions: 1945 to the Present*, Z magazine, June, (1999).
83. W. Blum, *Killing Hope: U.S. Military and CIA Intervention Since World War II*
84. J.M. Cypher, *The Iron Triangle: The New Military Buildup*, Dollars and Sense magazine, January/February, (2002).
85. L. Meyer, *The Power of One*, (World Press Review), Reforma, Mexico City, August 5, (1999).
86. W. Hartung, F. Berrigan and M. Ciarrocca, *Operation Endless Deployment: The War With Iraq Is Part of a Larger Plan for Global Military Dominance*, The Nation magazine, October 21, (2002).

87. I. Ramonet, *Servile States*, Le Monde diplomatique, Fromkin Paris, October (2002), World Press Review, December, (2002).
88. J.K. Galbraith, *The Unbearable Costs of Empire*, American Prospect magazine, November, (2002).
89. G. Monbiot, *The Logic of Empire*, The Guardian, August 6, (2002), World Press Review, October, (2002).
90. W.R. Pitt, *The Greatest Sedition is Silence*, Pluto Press, (2003).
91. J. Wilson, *Republic or Empire?*, The Nation magazine, March 3, (2003).
92. W.B. Gallie, *Understanding War: Points of Conflict*, Routledge, London, (1991).
93. R. Falk and S.S. Kim, eds., *The War System: An Interdisciplinary Approach*, Westview, Boulder, CO, (1980).
94. J.D. Clarkson and T.C. Cochran, eds., *War as a Social Institution*, Colombia University Press, New York, (1941).
95. S. Melman, *The Permanent War Economy*, Simon and Schuster, (1974). Morgan
96. H. Mejcher, *Imperial Quest for Oil: Iraq, 1910-1928*, Ithaca Books, London, (1976).
97. D. Hiro, *The Longest War: The Iran-Iraq Military Conflict*, Routledge, New York, (1991).
98. M. Klare, *Bush-Cheney Energy Strategy: Procuring the Rest of the World's Oil*, Foreign Policy in Focus, (Interhemispheric Resource Center/Institute for Policy Studies/SEEN), Washington DC and Silver City NM, January, (2004).
99. J. Fitchett and D. Ignatius, *Lengthy Elf Inquiry Nears Explosive Finish*, International Herald Tribune, February 1, (2002).
100. T. Rajamoorthy, *Deceit and Duplicity: Some Reflections on Western Intervention in Iraq*, Third World Resurgence, March-April, (2003).
101. P. Knightley and C. Simpson, *The Secret Lives of Lawrence of Arabia*, Nelson, London, (1969).
102. G. Lenczowski, *The Middle East in World Affairs*, Cornell University Press, (1962).
103. D. Rose, *Bush and Blair Made Secret Pact for Iraq War*, Observer, April 4, (2004).
104. B. Gellman, *Allied Air War Struck Broadly in Iraq; Officials Acknowledge Strategy Went Beyond Purely Military Targets*, Washington Post, June 23, (1991).
105. M. Fletcher and M. Theodoulou, *Baker Says Sanctions Must Stay as Long as Saddam Holds Power*, Times, May 23, (1991).
106. J. Pienaar and L. Doyle, *UK Maintains Tough Line on Sanctions Against Iraq*, Independent, May 11, (1991).
107. B. Blum (translator), *Ex-National Security Chief Brzezinski Admits: Afghan Islamism Was Made in Washington*, Nouvel Observateur, January 15, (1998).
108. G. Vidal, *Dreaming War: Blood for Oil and the Bush-Cheney Junta*, Thunder's Mouth Press, (2002).
109. H. Thomas, *Preventive War Sets Serious Precedent*, Seattle Post-Intelligencer, March 20, (2003).
110. C. Johnson, *The Sorrows of Empire: Militarism, Secrecy, and the End of the Republic*, Henry Hold and Company, New York, (2004).

111. C. Johnson, *Blowback: The Costs and Consequences of American Empire*, Henry Hold and Company, New York, (2000).
112. M. Parenti, *Against Empire: The Brutal Realities of U.S. Global Domination*, City Lights Books, 261 Columbus Avenue, San Francisco, CA94133, (1995).
113. E. Ahmad, *Confronting Empire*, South End Press, (2000).
114. W. Greider, *Fortress America*, Public Affairs Press, (1998).
115. J. Pilger, *Hidden Agendas*, The New Press, (1998).
116. S.R. Shalom, *Imperial Alibis*, South End Press, (1993).
117. C. Boggs (editor), *Masters of War: Militarism and Blowback in the Era of American Empire*, Routledge, (2003).
118. J. Pilger, *The New Rulers of the World*, Verso, (2992).
119. G. Vidal, *Perpetual War for Perpetual Peace: How We Got To Be So Hated*, Thunder's Mouth Press, (2002).
120. W. Blum, *Rogue State: A Guide to the World's Only Superpower*, Common Courage Press, (2000).
121. M. Parenti, *The Sword and the Dollar*, St. Martin's Press, 175 Fifth Avenue, New York, NY 10010, (1989).
122. T. Bodenheimer and R. Gould, *Rollback: Right-wing Power in U.S. Foreign Policy*, South End Press, (1989).
123. G. Guma, *Uneasy Empire: Repression, Globalization, and What We Can Do*, Toward Freedom, (2003).
124. W. Blum, *A Brief History of U.S. Interventions: 1945 to the Present*, Z magazine, June, (1999).
125. W. Blum, *Killing Hope: U.S. Military and CIA Intervention Since World War II*
126. J.M. Cypher, *The Iron Triangle: The New Military Buildup*, Dollars and Sense magazine, January/February, (2002).
127. L. Meyer, *The Power of One*, (World Press Review), Reforma, Mexico City, August 5, (1999).
128. C. Johnson, *Time to Bring the Troops Home*, The Nation magazine, May 14, (2001).
129. W. Hartung, F. Berrigan and M. Ciarrocca, *Operation Endless Deployment: The War With Iraq Is Part of a Larger Plan for Global Military Dominance*, The Nation magazine, October 21, (2002).
130. C. Johnson, *The Sorrows of Empire: Militarism, Secrecy, and the End of the Republic*, Henry Hold and Company, New York, (2004).
131. C. Johnson, *Blowback: The Costs and Consequences of American Empire*, Henry Hold and Company, New York, (2000).
132. I. Ramonet, *Servile States*, Le Monde diplomatique, Paris, October (2002), World Press Review, December, (2002).
133. J.K. Galbraith, *The Unbearable Costs of Empire*, American Prospect magazine, November, (2002).
134. G. Monbiot, *The Logic of Empire*, The Guardian, August 6, (2002), World Press Review, October, (2002).
135. W.R. Pitt and S. Ritter, *War on Iraq*, Context Books

136. W.R. Pitt, *The Greatest Sedition is Silence*, Pluto Press, (2003).
137. J. Wilson, *Republic or Empire?*, The Nation magazine, March 3, (2003).
138. R. Dreyfuss, *Just the Beginning: Is Iraq the Opening Salvo in a War to Remake the World?*, The American Prospect magazine, April, (2003).
139. D. Moberg, *The Road From Baghdad: The Bush Team Has Big Plans For the 21st Century. Can the Rest of the World Stop Them?*, These Times magazine, May, (2003).
140. J.M. Blair, *The Control of Oil*, Random House, New York, (1976).
141. R.S. Foot, S.N. MacFarlane and M. Mastanduno, *US Hegemony and International Organizations: The United States and Multilateral Institutions*, Oxford University Press, (2003).
142. P. Bennis and N. Chomsky, *Before and After: US Foreign Policy and the September 11th Crisis*, Olive Branch Press, (2002).
143. J. Garrison, *America as Empire: Global Leader or Rouge Power?*, Berrett-Koehler Publishers, (2004).
144. A.J. Bacevich, *American Empire: The Realities and Consequences of US Diplomacy*, Harvard University Press, (2002).
145. D.R. Francis, *Hidden Defense Costs Add Up to Double Trouble*, Christian Science Monator, February 23, (2004).
146. A. Sampson, *The Seven Sisters: The Great Oil Companies of the World and How They Were Made*, Hodder and Staughton, London, (1988).
147. D. Yergin, *The Prize*, Simon and Schuster, New York, (1991).
148. E. Abrahamian, *Iran Between Two Revolutions*, Princeton University Press, Princeton, (1982).

Chapter 3

MONEY DRIVES THE MANIA OF GROWTH

3.1 Madmen and economists

"Anyone who believes in indefinite growth in anything physical, on a physically finite planet, is either mad or an economist". Kenneth E. Boulding (1910-1993)

Why are economists addicted to growth?

Economists (with a few notable exceptions) have long behaved as though growth were synonymous with economic health. If the gross national product of a country increases steadily by 4 percent per year, most economists express approval and say that the economy is healthy. If the economy could be made to grow still faster (they maintain), it would be still more healthy. If the growth rate should fall, economic illness would be diagnosed. However, it is obvious that on a finite Earth, neither population growth nor economic growth can continue indefinitely.

But why do economists cling almost religiously to the idea of growth? In general, growth brings profits to speculators. For example, purchase of land on the outskirts of a growing city will be rewarded as the land increases in value.; and when the economy grows, stocks rise in value. '

Today, as economic growth falters, the defects and injustices of our banking system have come sharply into focus, and light has also been thrown onto the much-too-cozy relationship between banking and government. The collapse of banks during the subprime mortgage crisis of 2008 and their subsequent bailout by means of the taxpayer's money can give us an insight into both phenomena - the faults of our banking system and its infiltration into the halls of government. The same can be said of the present national debt crisis in the Euro zone and elsewhere.

3.2 Fractional reserve banking

One feature of banking that cries out for reform is "fractional reserve banking", i.e. the practice whereby private banks keep only a tiny fraction of the money entrusted to them by their depositors, and lend out all the remaining amount. By doing so, the banks are in effect coining their own money and putting it into circulation, a prerogative that ought to be reserved for governments. Under the system of fractional reserve banking, profits from any expansion of the money supply go to private banks rather than being used by the government to provide social services. This is basically fraudulent and unjust; the banks are in effect issuing their own counterfeit money.

When the economy contracts instead of expanding, the effect of fractional reserve banking is still worse. In that case the depositors ask the banks for their money, which it is their right to do. But the banks do not have the money - they have lent it out, and thus they fail. However, the bankers have insured themselves against this eventuality by buying the votes of government officials. Thus the banks are bailed out and the taxpayers are left with the bill, as in the recent example in which the US Federal Reserve secretly gave 7.7 trillion of the taxpayers' dollars to bail out various banks.

Inside Job

The Academy-Award-Winning documentary film **Inside Job**[1] tells the shocking story of the corruption of the financial sector that led to the 2008 subprime mortgage crisis and bank

[1] https://www.theguardian.com/film/2011/feb/17/inside-job-review
https://topdocumentaryfilms.com/inside-job/

bailout. The film can be seen online free of charge, and is well worth viewing. Of particular interest are discussions of the history of bank deregulation, governmental collusion, and the destabilizing effects of the enormous derivative market.

3.3 Information-driven population growth

Today we are able to estimate the population of the world at various periods in history, and we can also make estimates of global population in prehistoric times. Looking at the data, we can see that the global population of humans has not followed an exponential curve as a function of time, but has instead followed a hyperbolic trajectory.

At the time of Christ, the population of the world is believed to have been approximately 220 million. By 1500, the earth contained 450 million people, and by 1750, the global population exceeded 700 million. As the industrial and scientific revolution has accelerated, global population has responded by increasing at a break-neck speed: In 1930, the population of the world reached two billion; in 1958 three billion; in 1974 four billion; in 1988 five billion, and in 1999, six billion. Today, we have reached 7.6 billion, and roughly a billion people are being added to the world's population every twelve years.

As the physicist Murry Gell-Mann has pointed out, a simple mathematical curve which closely approximates the global population of humans over a period of several thousand years is a hyperbola of the form P = 190,000,000,000/(2025-t). Here P represents the global population of humans and t is the year.

How are we to explain the fact that the population curve is not an exponential? We can turn to Malthus for an answer: According to his model, population does not increase exponentially, except under special circumstances, when the food supply is so ample that the increase of population is entirely unchecked.

Malthus gives us a model of culturally-driven population growth. He tells us that population increase tends to press against the limits of the food supply, and since these limits are culturally determined, population density is also culturally-determined. Hunter-gatherer societies need large tracts of land for their support; and in such societies, the population density is necessarily low. Pastoral methods of food production can support populations of a higher density. Finally, extremely high densities of population can be supported by modern agriculture. Thus, Gell-Mann's hyperbolic curve, should be seen as describing the rapidly-accelerating growth of human culture, this being understood to include methods of food production.

If we look at the curve, P=C/(2025-t), it is obvious that human culture has reached a period of crisis. The curve predicts that the world's population will rise to infinity in the year 2025, which of course is impossible. Somehow the actual trajectory of global population as a function of time must deviate from the hyperbolic curve, and in fact, the trajectory has already begun to fall away from the hyperbola.

Because of the great amount of human suffering which may be involved, and the potentially catastrophic damage to the earth's environment, the question of how the actual trajectory of human population will come to deviate from the hyperbola is a matter of

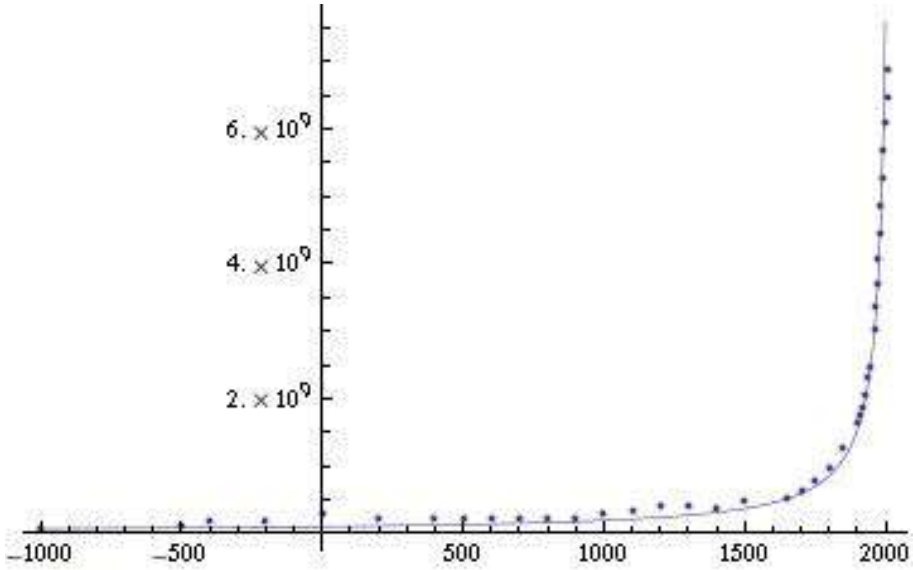

Figure 3.1: **The simple mathematical curve that fits best to human population data over the last 3,000 years is not an exponential increase, but rather a hyperbola of the form P=C/(2025-t). Here P represents population, C=190,000,000,000 and t is the year. The curve goes to infinity at t=2025 (only a few years away), which is of course impossible. Global population has already started to fall away from the hyperbolic trajectory. Will it level off, or will it crash disastrously? Because of the enormous amount of human suffering that would be involved in a population crash, the question has great importance.**

enormous importance. Will population overshoot the sustainable limit, and crash? Or will it gradually approach a maximum? In the case of the second alternative, will the checks which slow population growth be later marriage and family planning? Or will the grim Malthusian forces - famine, disease and war - act to hold the number of humans within the carrying capacity of their environment?

We can anticipate that as the earth's human population approaches 10 billion, severe famines will occur in many developing countries. The beginnings of this tragedy can already be seen. It is estimated that roughly 30,000 children now die every day from starvation, or from a combination of disease and malnutrition.

Beyond the fossil fuel era

An analysis of the global ratio of population to cropland shows that we have probably already exceeded the sustainable limit of population through our dependence on petroleum: Between 1950 and 1982, the use of cheap synthetic fertilizers increased by a factor of 8. Much of our present agricultural output depends on their use, but their production is expensive in terms of energy. Furthermore, petroleum-derived synthetic fibers have reduced the amount of cropland needed for growing natural fibers, and petroleum-driven tractors have replaced draft animals which required cropland for pasturage.

Also, petroleum fuels have replaced fuelwood and other fuels derived for biomass. The reverse transition, from fossil fuels back to renewable energy sources, will require a considerable diversion of land from food production to energy production. For example, 1.1 hectares are needed to grow the sugarcane required for each alcohol-driven Brazilian automobile. This figure may be compared with the steadily falling average area of cropland available to each person in the world: .24 hectares in 1950, .16 hectares in 1982.

Thus there is a danger that just as global population reaches the unprecedented level of 10 billion or more, the agricultural base for supporting it may suddenly collapse. Ecological catastrophe, possibly compounded by war and other disorders, could produce famine and death on a scale unprecedented in history - a disaster of unimaginable proportions, involving billions rather than millions of people.

What would Malthus say today?

What would Malthus tell us if he were alive today? Certainly he would say that we have reached a period of human history where it is vital to stabilize the world's population if catastrophic environmental degradation and famine are to be avoided. He would applaud efforts to reduce suffering by eliminating poverty, widespread disease, and war; but he would point out that, since it is necessary to stop the rapid increase of human numbers, it follows that whenever the positive checks to population growth are removed, it is absolutely necessary to replace them by preventive checks. Malthus' point of view became more broad in the successive editions of his Essay; and if he were alive today, he would probably agree that family planning is the most humane of the preventive checks.

Eliminating poverty and war

In most of the societies which Malthus described, a clear causal link can be seen, not only between population pressure and poverty, but also between population pressure and war. As one reads his Essay, it becomes clear why both these terrible sources of human anguish saturate so much of history, and why efforts to eradicate them have so often met with failure: The only possible way to eliminate poverty and war is to reduce the pressure of population by preventive checks, since the increased food supply produced by occasional cultural advances can give only very temporary relief.

Today, the links between population pressure, poverty, and war are even more pronounced than they were in the past, because the growth of human population has brought us to the absolute limits imposed by ecological constraints. Furthermore, the development of nuclear weapons has made war prohibitively dangerous.

How many people can the earth support in comfort?

The resources of the earth and the techniques of modern science can support a global population of moderate size in comfort and security; but the optimum size is undoubtedly smaller than the world's present population. Given a sufficiently small global population, renewable sources of energy can be found to replace disappearing fossil fuels. Technology may also be able to find renewable substitutes for many disappearing mineral resources for a global population of a moderate size. What technology cannot do, however, is to give a global population of 10 billion people the standard of living which the industrialized countries enjoy today.

3.4 Entropy and economics

We urgently need to shift quickly from fossil fuels to renewable energy if we are to avoid a tipping point after which human efforts to avoid catastrophic climate change will be futile because feedback loops will have taken over. The dangerous methane hydrate feedback loop is discussed in an excellent short video made by Thom Hartmann and the Leonardo DiCaprio Foundation.[2]

Celebrated author and activist Naomi Klein has emphasized the link between need for economic reform and our urgent duty to address climate change.[3]

Rebel economist Prof. Tim Jackson discusses the ways in which our present economic system has failed us, and the specific reforms that are needed. In one of his publications, he says: "The myth of growth has failed us. It has failed the two billion people who still live on 2 dollars a day. It has failed the fragile ecological systems on which we depend for

[2] https://www.youtube.com/watch?v=sRGVTK-AAvw
http://lasthours.org/

[3] http://thischangeseverything.org/naomi-klein/
http://www.theguardian.com/profile/naomiklein

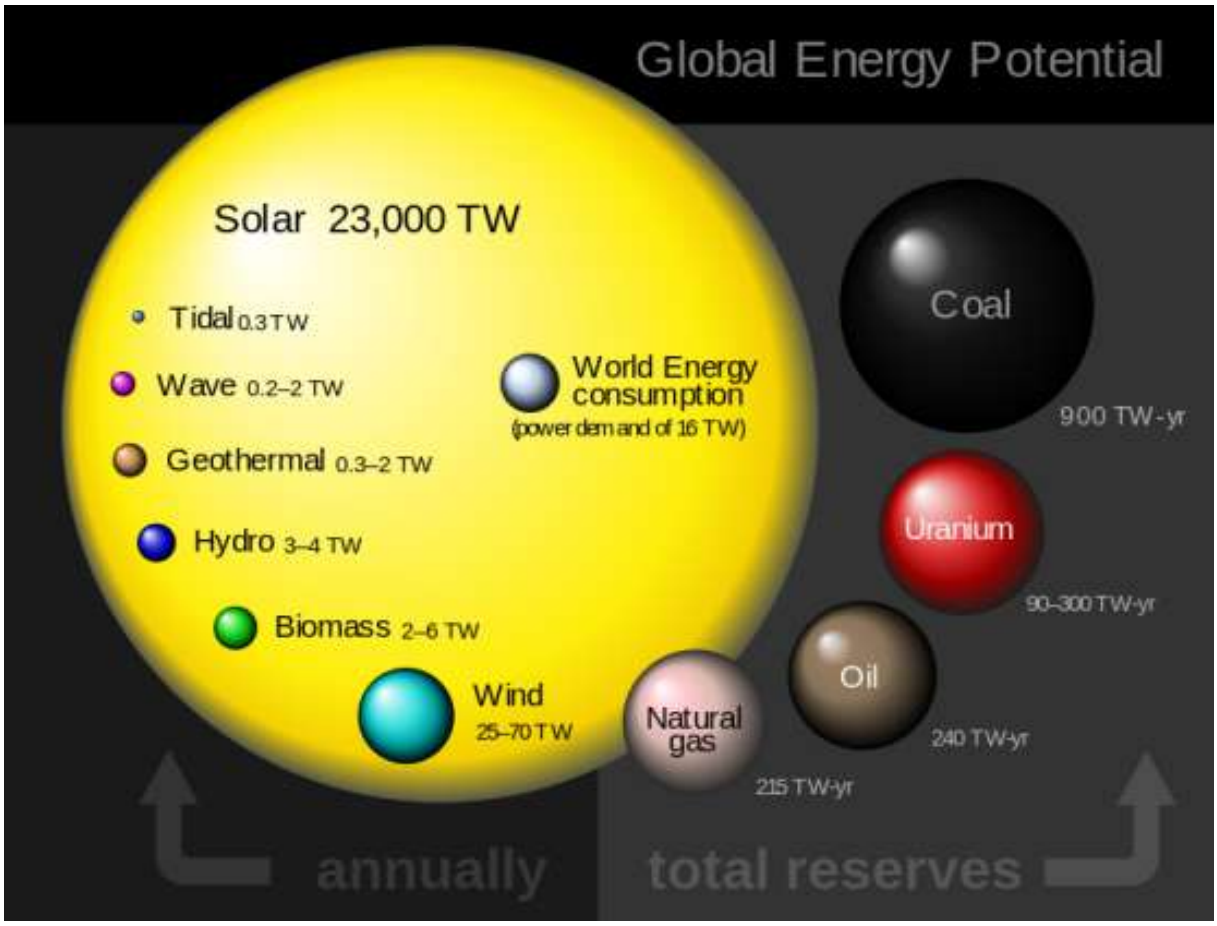

Figure 3.2: **Global energy potential. Comparison of renewable and conventional planetary energy reserves and sources. While renewables display their power potential in terawatts (TW) with the corresponding annual amount of energy, conventional sources display their total recoverable energy reserves in terawatt-years (TW-yr). Author: Rfassbind, Wikimedia Commons**

survival. It has failed, spectacularly, in its own terms, to provide economic stability and secure people's livelihood." [4]

What is entropy?

Entropy is a quantity, originally defined in statistical mechanics and thermodynamics. It is a measure of the statistical probability of any state of a system: The greater the entropy, the greater the probability. The second law of thermodynamics asserts that entropy of the universe always increases with time. In other words, the universe as a whole is constantly moving towards states of greater and greater probability.

For any closed system, the same is true. Such systems move in time towards states of greater and greater probability. However, the earth, with its biosphere, is not a closed system. The earth constantly receives an enormous stream of light from the sun. The radiation which we receive from the sun brings us energy that can be used to perform work, and in physics this is called "free energy". Because of this flood of incoming sunlight, plants, animals and humans are able to create structures which from a statistical point of view are highly unlikely.

The disorder and statistical probability of the universe is constantly increasing, but because the earth is not a closed system, we are able to create local order, and complex, statistically improbable structures, like the works of Shakespeare, the Mona Lisa and the Internet. The human economy is driven by the free energy which we receive as income from the sun. Money is, in fact, a symbol for free energy, and free energy might be thought of as "negative entropy". There is also a link between free energy and information.[5]

Human society as a superorganism, with the global economy as its digestive system

A completely isolated human being would find it as difficult to survive for a long period of time as would an isolated ant or bee or termite. Therefore it seems correct to regard human society as a superorganism. In the case of humans, the analog of the social insects' nest is the enormous and complex material structure of civilization. It is, in fact, what we call the human economy. It consists of functioning factories, farms, homes, transportation links, water supplies, electrical networks, computer networks and much more.

Almost all of the activities of modern humans take place through the medium of these external "exosomatic" parts of our social superorganism. The terms "exosomatic" and "endosomatic" were coined by the American scientist Alfred Lotka (1880-1949). A lobster's claw is endosomatic; it is part of the lobster's body. The hammer used by a human is exosomatic, like a detachable claw. Lotka spoke of "exosomatic evolution", including in

[4] http://www.theguardian.com/sustainable-business/rio-20-tim-jackson-leaders-green-economy?newsfeed=true
http://www.theguardian.com/sustainable-business/consumerism-sustainability-short-termism

[5] http://www.amazon.com/Information-Theory-And-Evolution-Edition/dp/9814401234

this term not only cultural evolution but also the building up of the material structures of civilization.

The economy associated with the human superorganism "eats" resources and free energy. It uses these inputs to produce local order, and finally excretes them as heat and waste. The process is closely analogous to food passing through the alimentary canal of an individual organism. The free energy and resources that are the inputs of our economy drive it just as food drives the processes of our body, but in both cases, waste products are finally excreted in a degraded form.

Almost all of the free energy that drives the human economy came originally from the sun's radiation, the exceptions being geothermal energy which originates in the decay of radioactive substances inside the earth, and tidal energy, which has its origin in the slowing of the motions of the earth-moon system. However, since the start of the Industrial Revolution, our economy has been using the solar energy stored in of fossil fuels. These fossil fuels were formed over a period of several hundred million years. We are using them during a few hundred years, i.e., at a rate approximately a million times the rate at which they were formed.

The present rate of consumption of fossil fuels is more than 14 terawatts and, if used at the present rate, fossil fuels would last less than a century. However, because of the very serious threats posed by climate change, human society would be well advised to stop the consumption of coal, oil and natural gas within the next two decades.

The rate of growth of of new renewable energy sources is increasing rapidly. These sources include small hydro, modern biomass, solar, wind, geothermal, wave and tidal energy. There is an urgent need for governments to set high taxes on fossil fuel consumption and to shift subsidies from the petroleum and nuclear industries to renewables. These changes in economic policy are needed to make the prices of renewables more competitive.

The shock to the global economy that will be caused by the end of the fossil fuel era will be compounded by the scarcity of other non-renewable resources, such as metals. While it is true (as neoclassical economists emphasize) that "matter and energy can neither be created nor destroyed", free energy can be degraded into heat, and concentrated deposits of minerals can be dispersed. Both the degradation of free energy into heat and the dispersal of minerals involve increases of entropy.

Frederick Soddy

One of the first people to call attention to the relationship between entropy and economics was the English radiochemist Frederick Soddy (1877-1956). Soddy won the Nobel Prize for Chemistry in 1921 for his work with Ernest Rutherford demonstrating the transmutation of elements in radioactive decay processes. His concern for social problems then led him to a critical study of the assumptions of classical economics. Soddy believed that there is a close connection between free energy and wealth, but only a very tenuous connection between wealth and money.

Soddy was extremely critical of the system of "fractional reserve banking" whereby private banks keep only a small fraction of the money that is entrusted to them by their

depositors and lend out the remaining amount. He pointed out that this system means that the money supply is controlled by the private banks rather than by the government, and also that profits made from any expansion of the money supply go to private corporations instead of being used to provide social services. Fractional reserve banking exists today, not only in England but also in many other countries. Soddy's criticisms of this practice cast light on the subprime mortgage crisis of 2008 and the debt crisis of 2011.

As Soddy pointed out, real wealth is subject to the second law of thermodynamics. As entropy increases, real wealth decays. Soddy contrasted this with the behavior of debt at compound interest, which increases exponentially without any limit, and he remarked:

"You cannot permanently pit an absurd human convention, such as the spontaneous increment of debt [compound interest] against the natural law of the spontaneous decrement of wealth [entropy]". Thus, in Soddy's view, it is a fiction to maintain that being owed a large amount of money is a form of real wealth.

Frederick Soddy's book, "Wealth, virtual wealth and debt: The solution of the economic paradox", published in 1926 by Allen and Unwin, was received by the professional economists of the time as the quixotic work of an outsider. Today, however, Soddy's common-sense economic analysis is increasingly valued for the light that it throws on the problems of our fractional reserve banking system, which becomes more and more vulnerable to failure as economic growth falters.[6]

Currency reform, and nationalization of banks

Frederick Soddy was writing at a time when England's currency was leaving the gold standard, and in order to replace this basis for the currency, he proposed an index system. Soddy's index was to be based on a standard shopping basket containing household items, such as bread, milk, potatoes and so on. If the price of the items in the basket rose, more currency would be issued by the nationalized central bank. If the price fell, currency would be withdrawn.

Nationalization of banks was proposed by Soddy as a means of avoiding the evils of the fractional reserve banking system. Today we see a revival of the idea of nationalized banks, or local user-owned cooperative banks. The Grameen Bank, founded by Prof. Muhammad Yunus, pioneered the idea of socially-motivated banks for the benefit poor people who would ordinarily be unable to obtain loans. The bank and its founder won a Nobel Peace Prize in 2006.[7]

[6] www.fadedpage.com/link.php?file=20140873-a5.pdf
http://human-wrongs-watch.net/2015/07/08/debt-slavery/

[7] http://www.grameen-info.org/history/
http://www.ibtimes.com/greece-drawing-contingency-plans-nationalize-banks-bring-parallel-currency-report-1868830
http://www.quora.com/Why-were-banks-nationalized-in-India
http://www.bloomberg.com/news/articles/2015-01-28/greek-bank-investors-hammered-as-3-day-slump-wipes-12-billion
http://www.armstrongeconomics.com/archives/30531
https://en.wikipedia.org/wiki/Nationalization

Nicholas Georgescu-Roegen

The incorporation of the idea of entropy into economic thought also owes much to the mathematician and economist Nicholas Georgescu-Roegen (1906-1994), the son a Romanian army officer. Georgescu-Roegen's talents were soon recognized by the Romanian school system, and he was given an outstanding education in mathematics, which later contributed to his success and originality as an economist.

Between 1927 and 1930 the young Georgescu studied at the Institute de Statistique in Paris, where he completed an award-winning thesis: "On the problem of finding out the cyclical components of phenomena". He then worked in England with Karl Pearson from 1930 to 1932, and during this period his work attracted the attention of a group of economists who were working on a project called the Harvard Economic Barometer. He received a Rockefeller Fellowship to join this group, but when he arrived at Harvard, he found that the project had been disbanded.

In desperation, Georgescu-Roegen asked the economist Joseph Schumpeter for an appointment to his group. Schumpeter's group was in fact a remarkably active and interesting one, which included the future Nobel laureate Wassely Leontief; and there followed a period of intense intellectual activity during which Georgescu-Roegen became an economist.

Despite offers of a permanent position at Harvard, Georgescu-Roegen returned to his native Romania in the late 1930's and early 1940's in order to help his country. He served as a member of the Central Committee of the Romanian National Peasant Party. His experiences at this time led to his insight that economic activity involves entropy. He was also helped to this insight by Borel's monograph on Statistical Mechanics, which he had read during his Paris period.

Georgescu-Roegen later wrote: "The idea that the economic process is not a mechanical analogue, but an entropic, unidirectional transformation began to turn over in my mind long ago, as I witnessed the oil wells of the Plosti field of both World Wars' fame becoming dry one by one, and as I grew aware of the Romanian peasants' struggle against the deterioration of their farming soil by continuous use and by rains as well. However it was the new representation of a process that enabled me to crystallize my thoughts in describing the economic process as the entropic transformation of valuable natural resources (low entropy) into valueless waste (high entropy)."

After making many technical contributions to economic theory, Georgescu-Roegen returned to this insight in his important 1971 book, "The Entropy Law and the Economic Process" (Harvard University Press), where he outlines his concept of bioeconomics. In a later book, "Energy and Economic Myths" (Pergamon Press, New York, 1976), he offered the following recommendations for moving towards a bioeconomic society:

1. The complete prohibition of weapons production, thereby releasing productive forces for more constructive purposes;

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http://www.theguardian.com/world/2015/jul/23/beppe-grillo-calls-for-nationalisation-of-italian-banks-and-exit-from-euro
http://dissidentvoice.org/2015/07/whats-wrong-with-our-monetary-system-and-how-to-fix-it/

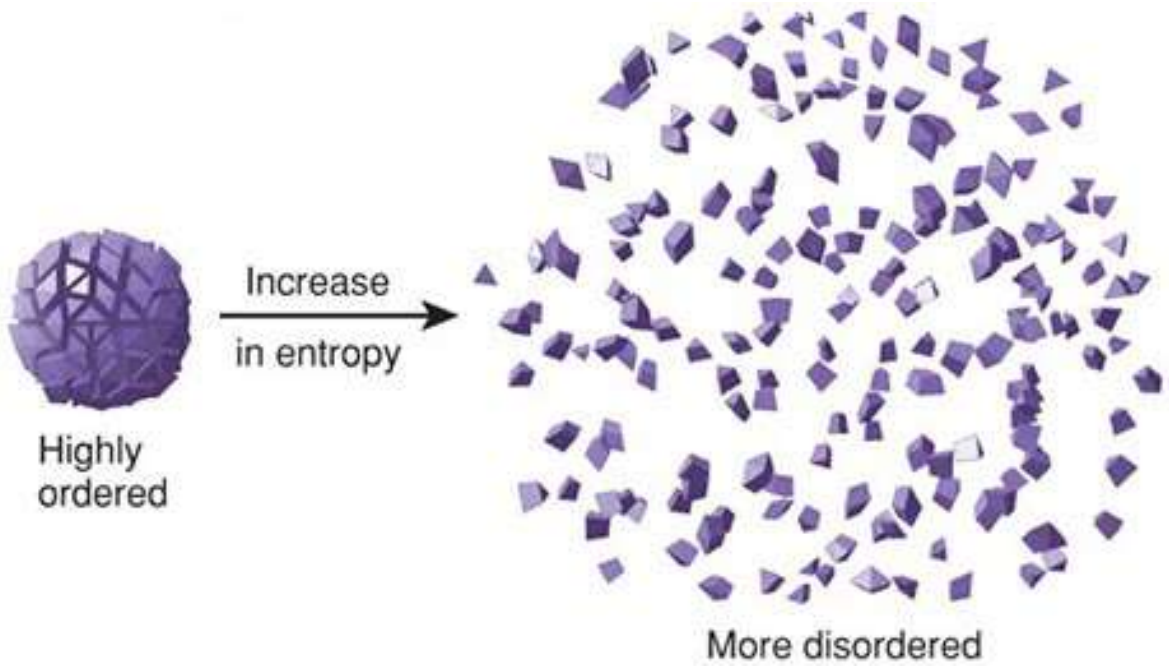

Figure 3.3: **According to the second law of thermodynamics, the entropy of the universe constantly increases. Increase of entropy corresponds to increase of disorder, and also to increase of statistical probability. Living organisms on the earth are able to achieve a high degree of order and highly improbable structures because the earth is not a closed system. It constantly receives free energy (i.e. energy capable of doing work) from the sun, and this free energy can be thought of as carrying thermodynamic information, or "negative entropy". Source: flowchainsensel.wordpress.co,**

Figure 3.4: **Wind, solar, and biomass are three emerging renewable sources of energy. Wind turbines in a rapeseed field in Sandesneben, Germany. Author: Jürgen from Sandesneben, Germany, Wikimedia Commons**

2. Immediate aid to underdeveloped countries;
3. Gradual decrease in population to a level that could be maintained only by organic agriculture;
4. Avoidance, and strict regulation if necessary, of wasteful energy use;
5. Abandon our attachment to "extravagant gadgetry";
6. "Get rid of fashion";
7. Make goods more durable and repairable; and
8. Cure ourselves of workaholic habits by re-balancing the time spent on work and leisure, a shift that will become incumbent as the effects of the other changes make themselves felt.

Georgescu-Roegen did not believe that his idealistic recommendations would be adopted, and he feared that human society is headed for a crash.

Limits to Growth: A steady-state economy

Nicholas Georgescu-Roegen's influence continues to be felt today, not only through his own books and papers but also through those of his students, the distinguished economists Herman E. Daly and Kozo Mayumi, who for many years have been advocating a steady-state economy. As they point out in their books and papers, it is becoming increasingly apparent that unlimited economic growth on a finite planet is a logical impossibility. However, it is important to distinguish between knowledge, wisdom and culture, which can and should

continue to grow, and growth in the sense of an increase in the volume of material goods produced. It is growth in the latter sense that is reaching its limits.

Daly describes our current situation as follows: "The most important change in recent times has been the growth of one subsystem of the Earth, namely the economy, relative to the total system, the ecosphere. This huge shift from an 'empty' to a 'full' world is truly 'something new under the sun'... The closer the economy approaches the scale of the whole Earth, the more it will have to conform to the physical behavior mode of the Earth... The remaining natural world is no longer able to provide the sources and sinks for the metabolic throughput necessary to sustain the existing oversized economy, much less a growing one. Economists have focused too much on the economy's circulatory system and have neglected to study its digestive tract."[8]

In the future, the only way that we can avoid economic collapse is to build a steady-state economy. There exists much literature on how this can be achieved, and these writings ought to become a part of the education of all economists and politicians.

3.5 The global food crisis

Optimum population in the long-term future

What is the optimum population of the world? It is certainly not the maximum number that can be squeezed onto the globe by eradicating every species of plant and animal that cannot be eaten. The optimum global population is one that can be supported in comfort, equality and dignity, and with respect for the environment.

In 1848 (when there were just over one billion people in the world), John Stuart Mill described the optimal global population in the following words: "The density of population necessary to enable mankind to obtain, in the greatest degree, all the advantages of cooperation and social intercourse, has, in the most populous countries, been attained. A population may be too crowded, although all be amply supplied with food and raiment."

"... Nor is there much satisfaction in contemplating the world with nothing left to the spontaneous activity of nature; with every rood of land brought into cultivation, which is capable of growing food for human beings; every flowery waste or natural pasture plowed up, all quadrupeds or birds which are not domesticated for man's use exterminated as his rivals for food, every hedgerow or superfluous tree rooted out, and scarcely a place left where a wild shrub or flower could grow without being eradicated as a weed in the name of improved agriculture. If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not better or happier

[8] http://dalynews.org/learn/blog/
http://steadystate.org/category/herman-daly/
https://www.youtube.com/watch?v=EN5esbvAt-w
https://www.youtube.com/watch?v=wlR-VsXtM4Y
http://www.imf.org/external/pubs/ft/survey/so/2015/car031315a.htm

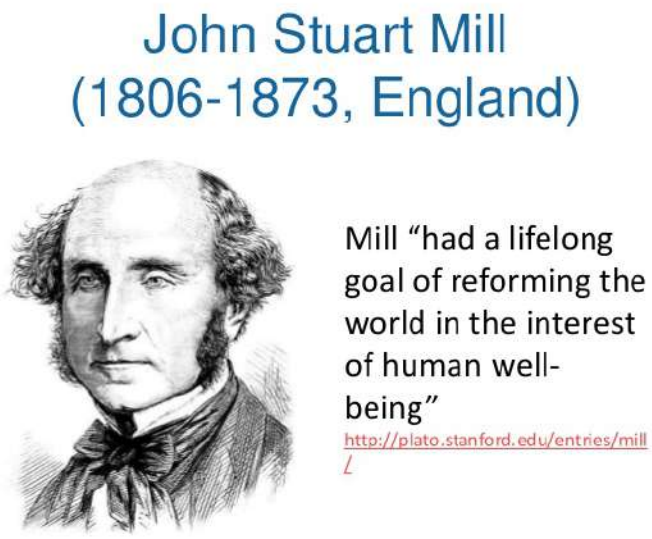

Figure 3.5: **Mill wrote: "I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compels them to it." Source: www.slideshare.net**

population, I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compels them to it." (From John Stuart Mill, "Principles of Political Economy, With Some of Their Applications to Social Philosophy", 1848.)

Has the number of humans in the world already exceeded the earth's sustainable limits? Will the global population of humans crash catastrophically after having exceeded the carrying capacity of the environment? There is certainly a danger that this will happen - a danger that the 21st century will bring very large scale famines to vulnerable parts of the world, because modern energy-intensive agriculture will be dealt a severe blow by the end of the fossil fuel era, and because climate change will reduce the world'-s agricultural output.

When the major glaciers in the Himalayas have melted, they will no longer be able to give India and China summer water supplies; rising oceans will drown much agricultural land; and aridity will reduce the output of many regions that now produce much of the world'-s grain. Falling water tables in overdrawn aquifers, and loss of topsoil will add to the problem. We should be aware of the threat of a serious global food crisis in the 21st century if we are to have a chance of avoiding it.

The term *ecological footprint* was introduced by William Rees and Mathis Wackernagel in the early 1990's to compare demands on the environment with the earth's capacity to regenerate. In 2015, humanity used environmental resources at such a rate that it would take 1.6 earths to renew them. In other words, we have already exceeded the earth's carrying capacity. Since eliminating the poverty that characterizes much of the world today will require more resources per capita, rather than less. it seems likely that in the

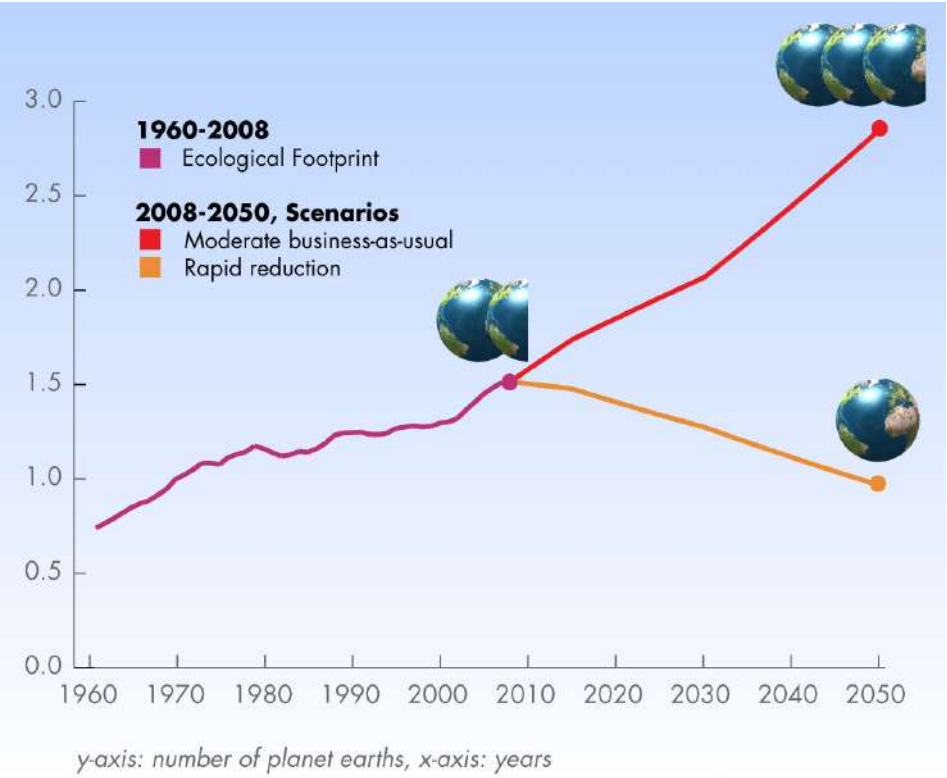

Figure 3.6: **Our present trajectory is completely unsustainable. If we follow it, then by 2050 it would take almost three earths to regenerate our demands on resources. Source: footprintnetwork.org**

era beyond fossil fuels, the optimum global population will be considerably less than the present population of the world.

Limitations on cropland

In 1944 the Norwegian-American plant geneticist Norman Borlaug was sent to Mexico by the Rockefeller Foundation to try to produce new wheat varieties that might increase Mexico's agricultural output. Borlaug'-s dedicated work on this project was spectacularly successful. He remained with the project for 16 years, and his group made 6,000 individual crossings of wheat varieties to produce high-yield disease-resistant strains.

In 1963, Borlaug visited India, bringing with him 100 kg. of seeds from each of his most promising wheat strains. After testing these strains in Asia, he imported 450 tons of the Lerma Rojo and Sonora 64 varieties: 250 tons for Pakistan and 200 for India. By 1968, the success of these varieties was so great that school buildings had to be commandeered to store the output. Borlaug'-s work began to be called a "Green Revolution". In India, the research on high-yield crops was continued and expanded by Prof. M.S. Swaminathan and his co-workers. The work of Green Revolution scientists, such Norman Borlaug and

Figure 3.7: **Norman Borlaug and agronomist George Harrer in 1943. Source: beforeitsnews.com**

M.S. Swaminathan, has been credited with saving the lives of as many as a billion people.

Despite these successes, Borlaug believes that the problem of population growth is still a serious one. "Africa and the former Soviet republics", Borlaug states, "and the Cerrado, are the last frontiers. After they are in use, the world will have no additional sizable blocks of arable land left to put into production, unless you are willing to level whole forests, which you should not do. So, future food-production increases will have to come from higher yields. And though I have no doubt that yields will keep going up, whether they can go up enough to feed the population monster is another matter. Unless progress with agricultural yields remains very strong, the next century will experience human misery that, on a sheer numerical scale, will exceed the worst of everything that has come before."

With regard to the prospect of increasing the area of cropland, a report by the United Nations Food and Agricultural Organization (Provisional Indicative World Plan for Agricultural Development, FAO, Rome, 1970) states that "In Southern Asia,... in some countries of Eastern Asia, in the Near East and North Africa... there is almost no scope for expanding agricultural area... In the drier regions, it will even be necessary to return to permanent pasture the land that is marginal and submarginal for cultivation. In most of Latin America and Africa south of the Sahara, there are still considerable possibilities for expanding cultivated areas; but the costs of development are high, and it will often be more economical to intensify the utilization of areas already settled." Thus there is a possibility of increasing the area of cropland in Africa south of the Sahara and in Latin America, but only at the cost of heavy investment and at the additional cost of destruction of tropical rain forests.

Rather than an increase in the global area of cropland, we may encounter a future loss of cropland through soil erosion, salination, desertification, loss of topsoil, depletion of minerals in topsoil, urbanization and failure of water supplies. In China and in the Southwestern part of the United States, water tables are falling at an alarming rate. The Ogallala aquifer (which supplies water to many of the plains states in the central and southern parts of the United States) has a yearly overdraft of 160%.

In the 1950's, both the U.S.S.R and Turkey attempted to convert arid grasslands into wheat farms. In both cases, the attempts were defeated by drought and wind erosion, just as the wheat farms of Oklahoma were overcome by drought and dust in the 1930's. If irrigation of arid lands is not performed with care, salt may be deposited, so that the land is ruined for agriculture. This type of desertification can be seen, for example, in some parts of Pakistan. Another type of desertification can be seen in the Sahel region of Africa, south of the Sahara. Rapid population growth in the Sahel has led to overgrazing, destruction of trees, and wind erosion, so that the land has become unable to support even its original population.

Especially worrying is a prediction of the International Panel on Climate Change concerning the effect of global warming on the availability of water: According to Model A1 of the IPCC, global warming may, by the 2050's, have reduced by as much as 30% the water available in large areas of world that now a large producers of grain.

Added to the agricultural and environmental problems, are problems of finance and distribution. Famines can occur even when grain is available somewhere in the world, because those who are threatened with starvation may not be able to pay for the grain, or for its transportation. The economic laws of supply and demand are not able to solve this type of problem. One says that there is no "demand" for the food (meaning demand in the economic sense), even though people are in fact starving.[9]

Energy-dependence of modern agriculture

A very serious problem with Green Revolution plant varieties is that they require heavy inputs of pesticides, fertilizers and irrigation. Because of this, the use of high-yield varieties contributes to social inequality, since only rich farmers can afford the necessary inputs. Monocultures, such as the Green Revolution varieties may also prove to be vulnerable to future epidemics of plant diseases, such as the epidemic that caused the Irish Potato Famine in 1845. Even more importantly, pesticides, fertilizers and irrigation all depend on the use of fossil fuels. One must therefore ask whether high agricultural yields can be maintained in the future, when fossil fuels are expected to become prohibitively scarce and expensive.

[9]http://www.independent.co.uk/environment/climate-change/society-will-collapse-by-2040-due-to-catastrophic-food-shortages-says-study-10336406.html
http://www.truth-out.org/news/item/32131-the-new-climate-normal-abrupt-sea-level-rise-and-predictions-of-civilization-collapse
http://www.commondreams.org/views/2015/08/13/dignity-democracy-and-food-interview-frances-moore-lappe

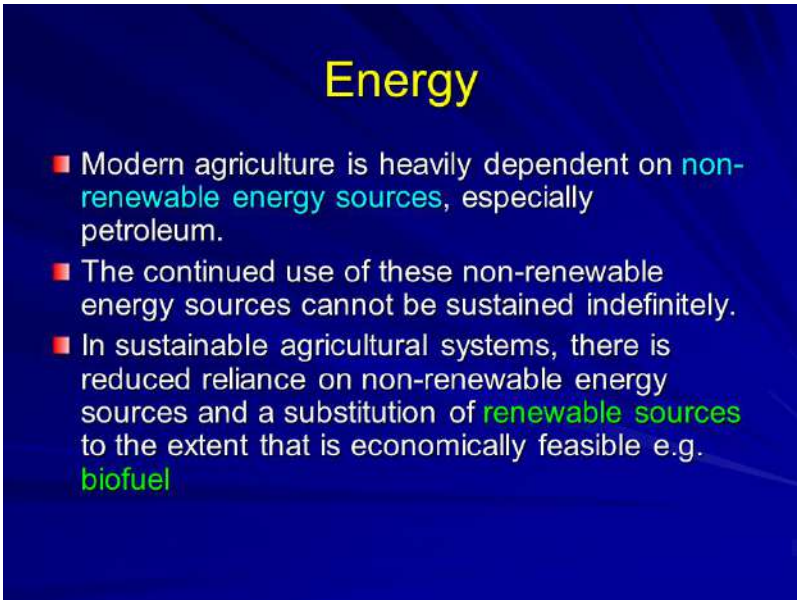

Figure 3.8: **Source: slideplayer.com**

Modern agriculture has become highly dependent on fossil fuels, especially on petroleum and natural gas. This is especially true of production of the high-yield grain varieties introduced in the Green Revolution, since these require especially large inputs of fertilizers, pesticides and irrigation. Today, fertilizers are produced using oil and natural gas, while pesticides are synthesized from petroleum feedstocks, and irrigation is driven by fossil fuel energy. Thus agriculture in the developed countries has become a process where inputs of fossil fuel energy are converted into food calories.

The ratio of the fossil fuel energy inputs to the food calorie outputs depends on how many energy-using elements of food production are included in the accounting. David Pimental and Mario Giampietro of Cornell University estimated in 1994 that U.S. agriculture required 0.7 kcal of fossil fuel energy inputs to produce 1.0 kcal of food energy. However, this figure was based on U.N. statistics that did not include fertilizer feedstocks, pesticide feed-stocks, energy and machinery for drying crops, or electricity, construction and maintenance of farm buildings. A more accurate calculation, including these inputs, gives an input/output ratio of approximately 1.0. Finally, if the energy expended on transportation, packaging and retailing of food is included, Pimental and Giampietro found that the input/output ratio for the U.S. food system was approximately 10, and this figure did not include energy used for cooking.

The Brundtland Report'-s estimate of the global potential for food production assumes "that the area under food production can be around 1.5 billion hectares (3.7 billion acres - close to the present level), and that the average yields could go up to 5 tons of grain equivalent per hectare (as against the present average of 2 tons of grain equivalent)." In other words, the Brundtland Report assumes an increase in yields by a factor of 2.5. This would perhaps be possible if traditional agriculture could everywhere be replaced

by energy-intensive modern agriculture using Green Revolution plant varieties. However, Pimental and Giampietro'-s studies show that modern energy-intensive agricultural techniques cannot be maintained after fossil fuels have been exhausted or after their use has been discontinued to avoid catastrophic climate change.

At the time when the Brundtland Report was written (1987), the global average of 2 tons of grain equivalent per hectare included much higher yields from the sector using modern agricultural methods. Since energy-intensive petroleum-based agriculture cannot be continued in the post-fossil-fuel era, future average crop yields will probably be much less than 2 tons of grain equivalent per hectare.

The 1987 global population was approximately 5 billion. This population was supported by 3 billion tons of grain equivalent per year. After fossil fuels have been exhausted, the total world agricultural output is likely to be considerably less than that, and therefore the population that it will be possible to support sustainably will probably be considerably less than 5 billion, assuming that our average daily per capita use of food calories remains the same, and assuming that the amount of cropland and pasturage remains the same (1.5 billion hectares cropland, 3.0 billion hectares pasturage).

The Brundtland Report points out that "The present (1987) global average consumption of plant energy for food, seed and animal feed amounts to 6,000 calories daily, with a range among countries of 3,000-15,000 calories, depending on the level of meat consumption." Thus there is a certain flexibility in the global population that can survive on a given total agricultural output. If the rich countries were willing to eat less meat, more people could be supported.[10]

Effects of climate change on agriculture

a) The effect of temperature increase

There is a danger that when climate change causes both temperature increases and increased aridity in regions like the US grain belt, yields will be very much lowered. Of the three main grain types (corn, wheat and rice) corn is the most vulnerable to the direct effect of increases in temperature. One reason for this is the mechanism of pollination of corn: A pollen grain lands on one end of a corn-silk strand, and the germ cell must travel the length of the strand in order to fertilize the kernel. At high temperatures, the corn silk becomes dried out and withered, and is unable to fulfill its biological function. Furthermore, heat can cause the pores on the underside of the corn leaf to close, so that photosynthesis stops.

According to a study made by Mohan Wali and coworkers at Ohio State University, the photosynthetic activity of corn increases until the temperature reaches 20°C. It then remains constant until the temperature reaches 35°C, after which it declines. At 40°C and above, photosynthesis stops altogether.

[10] http://www.truth-out.org/news/item/32354-environmentalists-sue-epa-over-dead-zone-in-gulf-of-mexico

Scientists in the Phillipines report that the pollination of rice fails entirely at 40°C, leading to crop failures. Wheat yields are also markedly reduced by temperatures in this range.[11]

b) The effect of decreased rainfall

According to the Stern Report, some of the major grain-producing areas of the world might loose up to 30% of their rainfall by 2050. These regions include much of the United States, Brazil, the Mediterranean region, Eastern Russia and Belarus, the Middle East, Southern Africa and Australia. Of course possibilities for agriculture may simultaneously increase in other regions, but the net effect of climate change on the world'-s food supply is predicted to be markedly negative.

c) Unsustainable use of groundwater

It may seem surprising that fresh water can be regarded as a non-renewable resource. However, groundwater in deep aquifers is often renewed very slowly. Sometimes renewal requires several thousand years. When the rate of withdrawal of groundwater exceeds the rate of renewal, the carrying capacity of the resource has been exceeded, and withdrawal of water becomes analogous to mining a mineral. However, it is more serious than ordinary mining because water is such a necessary support for life.

In many regions of the world today, groundwater is being withdrawn faster than it can be replenished, and important aquifers are being depleted. In China, for example, groundwater levels are falling at an alarming rate. Considerations of water supply in relation to population form the background for China'-s stringent population policy. At a recent lecture, Lester Brown of the Worldwatch Institute was asked by a member of the audience to name the resource for which shortages would most quickly become acute. Most of the audience expected him to name oil, but instead he replied "water".

Lester Brown then cited China's falling water table. He predicted that within decades, China would be unable to feed itself. He said that this would not cause hunger in China itself: Because of the strength of China's economy, the country would be able to purchase grain on the world market. However Chinese purchases of grain would raise the price, and put world grain out of reach of poor countries in Africa. Thus water shortages in China will produce famine in parts of Africa, Brown predicted.

Under many desert areas of the world are deeply buried water tables formed during glacial periods when the climate of these regions was wetter. These regions include the Middle East and large parts of Africa. Water can be withdrawn from such ancient reservoirs by deep wells and pumping, but only for a limited amount of time.

In oil-rich Saudi Arabia, petroenergy is used to drill wells for ancient water and to bring it to the surface. Much of this water is used to irrigate wheat fields, and this is done to such an extent that Saudi Arabia exports wheat. The country is, in effect, exporting its ancient

[11] http://ecowatch.com/2015/08/03/heat-wave-iran/

Figure 3.9: **Lester R. Brown has been a pioneer in the study of the future global food crisis. Source: www.azquotes.com**

heritage of water, a policy that it may, in time, regret. A similarly short-sighted project is Muammar Qaddafi's enormous pipeline, which will bring water from ancient sub-desert reservoirs to coastal cities.

In the United States, the great Ogallala aquifer is being overdrawn. This aquifer is an enormous stratum of water-saturated sand and gravel under-lying parts of northern Texas, Oklahoma, New Mexico, Kansas, Colorado, Nebraska, Wyoming and South Dakota. The average thickness of the aquifer is about 70 meters. The rate of water withdrawal from the aquifer exceeds the rate of recharge by a factor of eight.

Thus we can see that in many regions, the earth'-s present population is living on its inheritance of water, rather than its income. This fact, coupled with rapidly increasing populations and climate change, may contribute to a very serious food crisis partway through the 21st century.

d) Glacial melting and summer water supplies

The summer water supplies of both China and India are threatened by the melting of glaciers. The Gangotri glacier, which is the principle glacier feeding India'-s great Ganges River, is reported to be melting at an accelerating rate, and it could disappear within a few decades. If this happens,the Ganges could become seasonal, flowing only during the monsoon season. Chinese agriculture is also threatened by disappearing Himalayan glaciers, in this case those on the Tibet-Quinghai Plateau. The respected Chinese glaciologist Yao Tandong estimates that the glaciers feeding the Yangtze and Yellow Rivers are disappearing at the rate of 7% per year.[12]

[12]http://www.commondreams.org/news/2015/08/04/global-glaciers-melting-three-times-rate-20th-

Figure 3.10: **Whitechuck Glacier in the North Cascades National Park in 1973. Source: www.nichols.ewdu**

Figure 3.11: **The same glacier in 2006. Source: www.nichols.edu**

The Indus and Mekong Rivers will be similarly affected by the melting of glaciers. Lack of water during the summer season could have a serious impact on the irrigation.

Mature forests contain vast amounts of sequestered carbon, not only in their trees, but also in the carbon-rich soil of the forest floor. When a forest is logged or burned to make way for agriculture, this carbon is released into the atmosphere.

One fifth of the global carbon emissions are at present due to destruction of forests. This amount is greater than the CO_2 emissions for the world'-s transportation systems. An intact forest pumps water back into the atmosphere, increasing inland rainfall and benefiting agriculture. By contrast, deforestation, for example in the Amazonian rainforest, accelerates the flow of water back into the ocean, thus reducing inland rainfall. There is a danger that the Amazonian rainforest may be destroyed to such an extent that the region will become much more dry. If this happens, the forest may become vulnerable to fires produced by lightning strikes. This is one of the feedback loops against which the Stern Report warns: the drying and burning of the Amazonian rainforest may become irreversible, greatly accelerating climate change, if destruction of the forest proceeds beyond a certain point.

e) Erosion of topsoil.

Besides depending on an adequate supply of water, food production also depends on the condition of the thin layer of topsoil that covers the world'-s croplands. This topsoil is being degraded and eroded at an alarming rate: According to the World Resources Institute and the United Nations Environment Programme, "It is estimated that since World War II, 1.2 billion hectares... has suffered at least moderate degradation as a result of human activity. This is a vast area, roughly the size of China and India combined." This area is 27% of the total area currently devoted to agriculture. The report goes on to say that the degradation is greatest in Africa. The risk of topsoil erosion is greatest when marginal land is brought into cultivation, since marginal land is usually on steep hillsides which are vulnerable to water erosion when wild vegetation is removed.

David Pimental and his associates at Cornell University pointed out in 1995 that "Because of erosion-associated loss of productivity and population growth, the per capita food supply has been reduced over the past 10 years and continues to fall. The Food and Agricultural Organization reports that the per capita production of grains which make up 80% of the world'-s food supply, has been declining since 1984...During the past 40 years nearly one-third of the world'-s cropland (1.5 billion hectares) has been abandoned because of soil erosion and degradation. Most of the replacement has come from marginal land made available by removing forests. Agriculture accounts for 80% of the annual deforestation."

Topsoil can also be degraded by the accumulation of salt when irrigation water evaporates. The worldwide area of irrigated land has increased from 8 million hectares in 1800 to more than 100 million hectares today. This land is especially important to the world food supply because it is carefully tended and yields are large in proportion to the area.

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century

To protect this land from salination, it should be irrigated in such a way that evaporation is minimized.

Finally cropland with valuable topsoil is being be lost to urban growth and highway development, a problem that is made more severe by growing populations and by economic growth.

Every year, more than 100,000 square kilometers of rain forest are cleared and burned, an area which corresponds to that of Switzerland and the Netherlands combined. Almost half of the world'-s tropical forests have already been destroyed. Ironically, the land thus cleared often becomes unsuitable for agriculture within a few years. Tropical soils may seem to be fertile when covered with luxuriant vegetation, but they are usually very poor in nutrients because of leeching by heavy rains. The nutrients which remain are contained in the vegetation itself; and when the forest cover is cut and burned, the nutrients are rapidly lost.

Often the remaining soil is rich in aluminum oxide and iron oxide. When such soils are exposed to oxygen and sun-baking, a rock-like substance called Laterite is formed.

Secret land purchases in Africa

According to a report released by the Oakland Institute, in 2009 alone, hedge funds bought or leased nearly 60 million hectares of land in Africa, an area the size of France.

As populations increase, and as water becomes scarce, China, and other countries, such as Saudi Arabia are also buying enormous tracts of agricultural land, not only in Africa, but also in other countries.

These land purchases are very often kept secret from the local populations by corrupt governments.[13]

Some conclusions

There is a danger that just as global population reaches the unprecedented level of 9 billion or more, the agricultural base for supporting it may suddenly collapse. Ecological catastrophe, possibly compounded by war and other disorders, could produce famine and death on a scale unprecedented in history, a disaster of unimaginable proportions, involving billions rather than millions of people.

The resources of the earth and the techniques of modern science can support a global population of moderate size in comfort and security; but the optimum size is undoubtedly smaller than the world's present population. Given a sufficiently small global population, renewable sources of energy can be found to replace disappearing fossil fuels. Technology may also be able to find renewable substitutes for many disappearing mineral resources for a global population of moderate size. What technology cannot do, however, is to give a global population of 9 billion people the standard of living which the industrialized countries enjoy today.

[13] http://www.latimes.com/world/asia/la-fg-china-foreign-farmland-20140329-story.html
http://www.bbc.com/news/world-africa-13688683

3.6 Limits to growth

The Club of Rome

In 1968 Aurelio Peccei, Thorkil Kristensen and others founded the Club of Rome, an organization of economists and scientists devoted to studying the predicament of human society. One of the first acts of the organization was to commission an MIT study of future trends using computer models. The result was a book entitled "Limits to Growth", published in 1972. From the outset the book was controversial, but it became a best-seller. It was translated into many languages and sold 30 million copies. The book made use of an exponential index for resources, i.e. the number of years that a resource would last if used at an exponentially increasing rate.

Today the more accurate Hubbert Peak model is used instead to predict rate of use of a scarce resource as a function of time. Although the specific predictions of resource availability in "Limits to Growth" lacked accuracy, its basic thesis, that unlimited industrial growth on a finite planet is impossible, was indisputably correct. Nevertheless the book was greeted with anger and disbelief by the community of economists, and these emotions still surface when it is mentioned.

Economic activity is usually divided into two categories, 1) production of goods and 2) provision of services. It is the rate of production of goods that will be limited by the carrying capacity of the global environment. Services that have no environmental impact will not be constrained in this way. Thus a smooth transition to a sustainable economy will involve a shift of a large fraction the work force from the production of goods to the provision of services.

In his recent popular book "The Rise of the Creative Class" the economist Richard Florida points out that in a number of prosperous cities, for example Stockholm, a large fraction of the population is already engaged in what might be called creative work, a type of work that uses few resources, and produces few waste products, work which develops knowledge and culture rather than producing material goods. For example, producing computer software requires few resources and results in few waste products. Thus it is an activity with a very small ecological footprint.

Similarly, education, research, music, literature and art are all activities that do not weigh heavily on the carrying capacity of the global environment. Furthermore, cultural activities lead in a natural way to global cooperation and internationalism, since cultural achievements are shared by the people of the entire world. Indeed, the shared human inheritance of culture and knowledge is growing faster than ever before.

Florida sees this as a pattern for the future, and maintains that everyone is capable of creativity. He visualizes the transition to a sustainable future economy as one in which a large fraction of the work force moves from industrial jobs to information-related work. Meanwhile, as Florida acknowledges, industrial workers feel uneasy and threatened by such trends.[14]

[14] http://www.clubofrome.org/?p=326
http://www.donellameadows.org/wp-content/userfiles/Limits-to-Growth-digital-scan-version.pdf

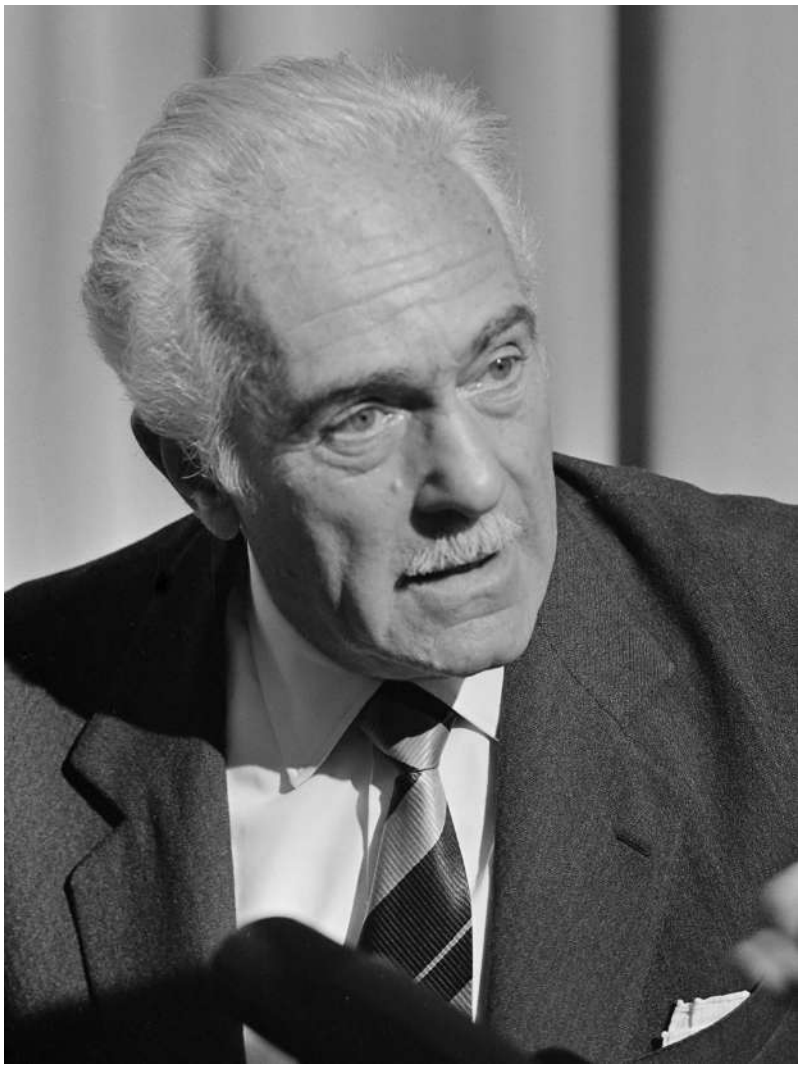

Figure 3.12: **Aurelio Peccei (1908-1984), main founder of the Club of Rome. Concerning our present economic system, he wrote: "The only way we have devised to meet the surging waves of our rampant militarism and consumerism is to draw increasingly on the natural environment and to exploit, indiscriminately, the most accessible mineral and fuel deposits and all living resources we can lay our hands on. Such actions irreversibly impoverish our unique, irreplaceable, world, whose bounty and generosity are not infinite. Even if all the other adverse situations we find ourselves in today were to be alleviated, in itself, our high-handed treatment of Nature can bring about our doom." Photograph by Koen Suyk/Anefo (Nationaal Archif), CC BY-SA 3.0, Wikimedia Commons**

Figure 3.13: **When a forest is destroyed, topsoil is often lost to erosion. Source: United Nations.**

Biological Carrying capacity and Economics

Classical economists pictured the world as largely empty of human activities. According to the empty-world picture of economics, the limiting factors in the production of food and goods are shortages of human capital and labor. The land, forests, fossil fuels, minerals, oceans filled with fish, and other natural resources upon which human labor and capital operate, are assumed to be present in such large quantities that they are not limiting factors. In this picture, there is no naturally-determined upper limit to the total size of the human economy. It can continue to grow as long as new capital is accumulated, as long as new labor is provided by population growth, and as long as new technology replaces labor by automation.

Biology, on the other hand, presents us with a very different picture. Biologists remind us that if any species, including our own, makes demands on its environment which exceed the environment's carrying capacity, the result is a catastrophic collapse both of the environment and of the population which it supports. Only demands which are within the carrying capacity are sustainable. For example, there is a limit to regenerative powers of a forest.

It is possible to continue to cut trees in excess of this limit, but only at the cost of a loss of forest size, and ultimately the collapse and degradation of the forest. Similarly, cattle populations may for some time exceed the carrying capacity of grasslands, but the

http://www.donellameadows.org/archives/a-synopsis-limits-to-growth-the-30-year-update/

ultimate penalty for overgrazing will be degradation or desertification of the land. Thus, in biology, the concept of the carrying capacity of an environment is extremely important; but in economic theory this concept has not yet been given the weight which it deserves.

Exponential growth of human population and economic activity have brought us, in a surprisingly short time, from the empty-world situation to a full-world situation. In today's world, we are pressing against the absolute limits of the earth's carrying capacity, and further growth carries with it the danger of future collapse.

Full-world economics, the economics of the future, will no longer be able to rely on industrial growth to give profits to stockbrokers or to solve problems of unemployment or to alleviate poverty. In the long run, neither the growth of industry nor that of population is sustainable; and we have now reached or exceeded the sustainable limits.

The limiting factors in economics are no longer the supply of capital or human labor or even technology. The limiting factors are the rapidly vanishing supplies of petroleum and metal ores, the forests damaged by acid rain, the diminishing catches from over-fished oceans, and the cropland degraded by erosion or salination, or lost to agriculture under a cover of asphalt.

Neoclassical economists have maintained that it is generally possible to substitute man-made capital for natural resources; but a closer examination shows that there are only very few cases where this is really practical. (See G.E. Tverberg, "Thoughts on why energy use and CO_2 emissions are rising as fast as GDP", www.ourfiniteworld.com, November 30, 2011.)

The size of the human economy is, of course, the product of two factors the total number of humans, and the consumption per capita. If we are to achieve a sustainable global society in the future, a society whose demands are within the carrying capacity of of the global environment, then both these factors must be reduced.

The responsibility for achieving sustainability is thus evenly divided between the North and the South: Where there is excessively high consumption per capita, it must be reduced; and this is primarily the responsibility of the industrialized countries. High birth rates must also be reduced; and this is primarily the responsibility of the developing countries. Both of these somewhat painful changes are necessary for sustainability; but both will be extremely difficult to achieve because of the inertia of institutions, customs and ways of thought which are deeply embedded in society, in both the North and the South.

Population and food supply

Let us look first at the problem of high birth rates: The recent spread of modern medical techniques throughout the world has caused death rates to drop sharply; but since social customs and attitudes are slow to change, birth rates have remained high. As a result, between 1930 and 2011, the population of the world increased with explosive speed from two billion to seven billion.

During the last few decades, the number of food-deficit countries has lengthened; and it now reads almost like a United Nations roster. The food-importing nations are dependent,

Figure 3.14: **Our global food system is broken. Source: Oxfam**

almost exclusively, on a single food-exporting region, the grain belt of North America. In the future, this region may be vulnerable to droughts produced by global warming.

An analysis of the global ratio of population to cropland shows that we probably already have exceeded the sustainable limit of population through our dependence on petroleum: Between 1950 and 1982, the use of cheap petroleum-derived fertilizers increased by a factor of 8, and much of our present agricultural output depends their use. Furthermore, petroleum-derived synthetic fibers have reduced the amount of cropland needed for growing natural fibers, and petroleum-driven tractors have replaced draft animals which required cropland for pasturage. Also, petroleum fuels have replaced fuelwood and other fuels derived for biomass. The reverse transition, from fossil fuels back to renewable energy sources, will require a considerable diversion of land from food production to energy production.

As population increases, the cropland per person will continue to fall, and we will be forced to make still heavier use of fertilizers to increase output per hectare. Also marginal land will be used in agriculture, with the probable result that much land will be degraded through erosion or salination.

Reserves of oil are likely to be exhausted by the middle of this century. Thus there is a danger that just as global population reaches the unprecedented level of 9 billion or more, the agricultural base for supporting it may suddenly collapse. The resulting catastrophe, possibly compounded by war and other disorders, could produce famine and death on a scale unprecedented in history, a disaster of unimaginable proportions, involving billions rather than millions of people. The present tragic famine in Africa is to this possible future disaster what Hiroshima is to the threat of thermonuclear war a tragedy of smaller scale, whose horrors should be sufficient, if we are wise, to make us take steps to avoid the larger catastrophe.

At present a child dies from starvation every six seconds. Five million children die from hunger every year. Over a billion people in today's world are chronically undernourished.

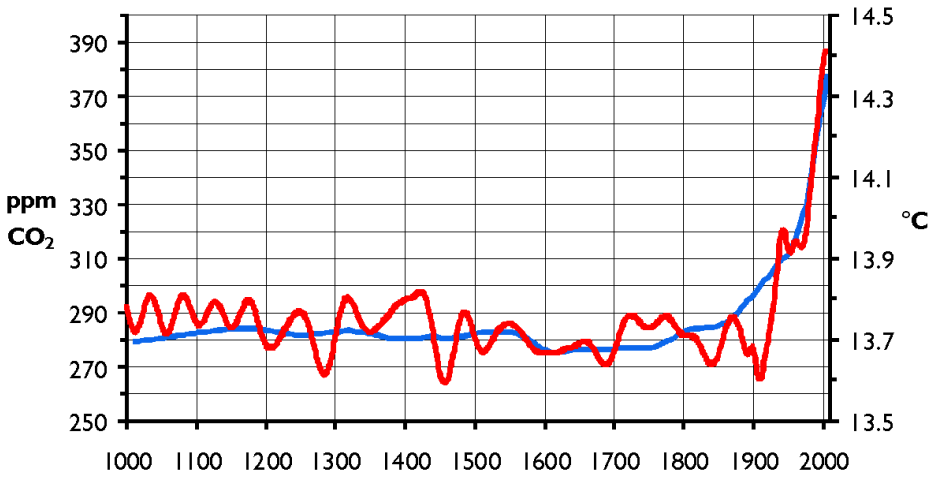

Figure 3.15: **The Hanno graph used by the United Nations Climate Change Compendium 2009. Source: wattsupwiththat.com**

There is a threat that unless prompt and well-informed action is taken by the international community, the tragic loss of life that is already being experienced will increase to unimaginable proportions.

As glaciers melt in the Himalayas, threatening the summer water supplies of India and China; as ocean levels rise, drowning the fertile rice-growing river deltas of Asia; as aridity begins to decrease the harvests of Africa, North America and Europe; as populations grow; as aquifers are overdrawn; as cropland is lost to desertification and urban growth; and as energy prices increase, the billion people who now are undernourished but still survive, might not survive. They might become the victims of a famine whose proportions could exceed anything that the world has previously experienced.

It is vital for the world to stabilize its population, not only because of the threat of a catastrophic future famine, but also because rapid population growth is closely linked with poverty. Today, a large fraction of the world's people live in near-poverty or absolute poverty, lacking safe water, sanitation, elementary education, primary health care and proper nutrition. Governments struggling to solve these problems, and to provide roads, schools, jobs and medical help for all their citizens, find themselves defeated by the rapid doubling times of populations. For example, in Liberia, the rate of population growth is 4% per year, which means that the population of Liberia doubles in size every eighteen years.

Under such circumstances, despite the most ambitious development programs, the infrastructure per capita decreases. Also, since new jobs must be found for the new millions added to the population, the introduction of efficient modern methods in industry and agriculture aggravates the already-serious problem of unemployment.

Education of women and higher status for women are vitally important measures, not only for their own sake, but also because in many countries these social reforms have proved

to be strongly correlated with lower birth rates. Religious leaders who oppose programs for the education of women and for family planning on "ethical" grounds should think carefully about the scope and consequences of the catastrophic global famine which will undoubtedly occur within the next 50 years if population is allowed to increase unchecked.

One of the most important keys to controlling the global population explosion is giving women better education and equal rights. These goals are desirable for the sake of increased human happiness, and for the sake of the uniquely life-oriented point of view which women can give us; but in addition, education and improved status for women have shown themselves to be closely connected with lowered birth rates.

When women lack education and independent careers outside the home, they can be forced into the role of baby-producing machines by men who do not share in the drudgery of cooking, washing and cleaning; but when women have educational, legal, economic, social and political equality with men, experience has shown that they choose to limit their families to a moderate size.

Sir Partha Dasgupta of Cambridge University has pointed out that the changes needed to break the cycle of overpopulation and poverty are all desirable in themselves. Besides education and higher status for women, they include state-provided social security for old people, provision of water supplies near to dwellings, provision of health services to all, abolition of child labor and general economic development.[15]

Social Values and Levels of Consumption

Let us next turn to the problem of reducing the per-capita consumption in the industrialized countries. The whole structure of western society seems designed to push its citizens in the opposite direction, towards ever-increasing levels of consumption. The mass media hold before us continually the ideal of a personal utopia filled with material goods. Every young man in a modern industrial society feels that he is a failure unless he fights his way to the "top"; and in recent years, women too have been drawn into this competition.

Of course not everyone can reach the top; there would not be room for everyone; but society urges all us to try, and we feel a sense of failure if we do not reach the goal. Thus, modern life has become a struggle of all against all for power and possessions.

One of the central problems in reducing consumption is that in our present economic and social theory, consumption has no upper bound; there is no definition of what is enough; there is no concept of a state where all of the real needs of a person have been satisfied. In our growth-oriented present-day economics, it is assumed that, no matter how much a person earns, he or she is always driven by a desire for more.

The phrase "conspicuous consumption" was invented by the Norwegian-American economist Thorstein Veblen (1857-1929) in order to describe the way in which our society uses economic waste as a symbol of social status. In "The Theory of the Leisure Class", first published in 1899, Veblen pointed out that it wrong to believe that human economic behavior is rational, or that it can be understood in terms of classical economic theory.

[15]http://www.poverties.org/famine-in-africa.html

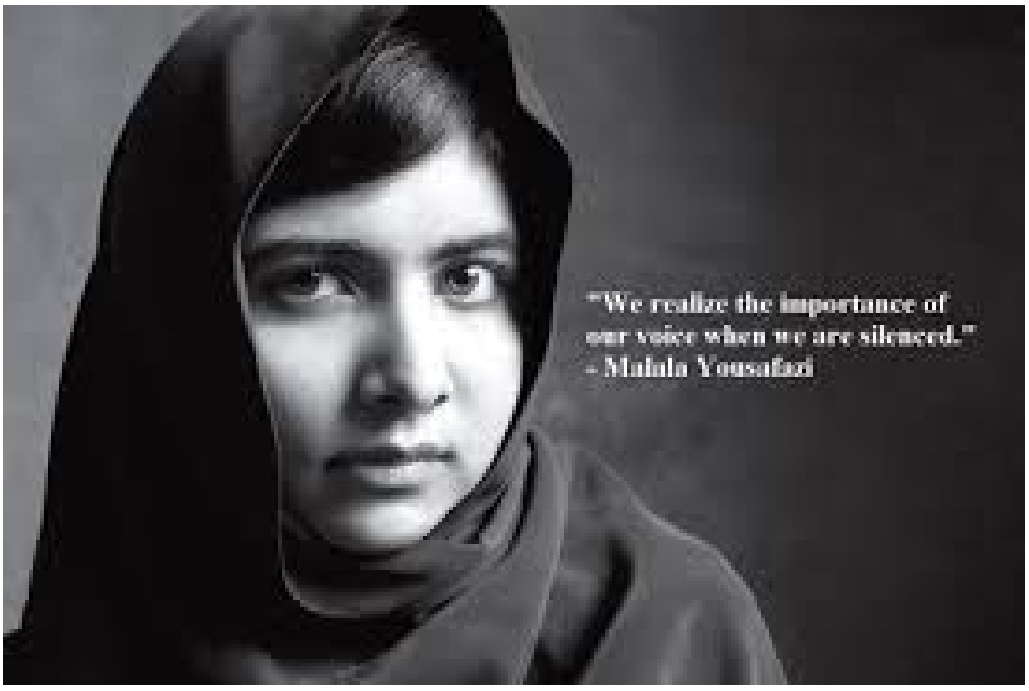

Figure 3.16: **The changes needed to break the cycle of overpopulation and poverty are all desirable in themselves. Besides education and higher status for women, they include state-provided social security for old people, provision of water supplies near to dwellings, provision of health services to all, abolition of child labor, and general economic development. Source: unesco.usmission.gov**

Figure 3.17: **FAO, IFAD and WFP joint project "Mainstreaming food loss reduction initiatives for smallholders in food deficit areas" aims to improve food security and income generation through reduction of food losses in food grains and pulses value chains. Photo: FAO/Alessandra Benedetti**

To understand it, Veblen maintained, one might better make use of insights gained from anthropology, psychology, sociology, and history.

The sensation caused by the publication of Veblen's book, and the fact that his phrase, "conspicuous consumption", has become part of our language, indicate that his theory did not completely miss its mark. In fact, modern advertisers seem to be following Veblen's advice: Realizing that much of the output of our economy will be used for the purpose of establishing the social status of consumers, advertising agencies hire psychologists to appeal to the consumer's longing for a higher social position.

When possessions are used for the purpose of social competition, demand has no natural upper limit; it is then limited only by the size of the human ego, which, as we know, is boundless. This would be all to the good if unlimited economic growth were desirable. But today, when further industrial growth implies future collapse, western society urgently needs to find new values to replace our worship of power, our restless chase after excitement, and our admiration of excessive consumption.

The values which we need, both to protect nature from civilization and to protect civilization from itself, are perhaps not new: Perhaps it would be more correct to say that we need to rediscover ethical values which once were part of human culture, but which were lost during the process of industrialization, when technology allowed us to break traditional environmental constraints.

Our ancestors were hunter-gatherers, living in close contact with nature, and respecting the laws and limitations of nature. There are many hunter-gatherer cultures existing today, from whose values and outlook we could learn much. Unfortunately, instead of learning from them, we often move in with our bulldozers and make it impossible for their way of life to continue. During the past several decades, for example, approximately one tribe of South American forest Indians has died out every year. Of the 6000 human languages now

spoken, it is estimated that half will vanish during the next 50 years.

In some parts of Africa, before cutting down a tree, a man will offer a prayer of apology to the spirit of the tree, explaining why necessity has driven him to such an act. The attitude involved in this ritual is something which industrialized society needs to learn, or relearn. Older cultures have much to teach industrial society because they already have experience with full-world situation which we are fast approaching.

In a traditional culture, where change is extremely slow, population has an opportunity to expand to the limits which the traditional way of life allows, so that it reaches an equilibrium with the environment. For example, in a hunter-gatherer culture, population has expanded to the limits which can be supported without the introduction of agriculture. The density of population is, of course, extremely low, but nevertheless it is pressing against the limits of sustainability. Overhunting or overfishing would endanger the future. Respect for the environment is thus necessary for the survival of such a culture.

Similarly, in a stable, traditional agricultural society which has reached an equilibrium with its environment, population is pressing against the limits of sustainability. In such a culture, one can usually find expressed as a strong ethical principle the rule that the land must not be degraded, but must be left fertile for the use of future generations.

Today, the whole world seems to be adopting values, fashions, and standards of behavior presented in the mass media of western society. The unsustainable, power-worshiping, consumption-oriented values of western society are so strongly propagandized by television, films and advertising, that they overpower and sweep aside the wisdom of older societies. This is unfortunate, since besides showing us unsustainable levels of affluence and economic waste, the western mass media depict values and behavior patterns which are hardly worthy of imitation. We need to reverse this trend. The industrialized countries must learn from the values of older traditional cultures. The wisdom of our ancestors, their respect for nature and their hospitable traditions of sharing, can help us to create a new economic system founded on social and environmental ethics.[16]

Suggestions for further reading

1. Naomi Klein, *This Changes Everything: Capitalism and the Climate*, Simon and Schuster, New York, (2014).
2. Naomi Klein, *The Shock Doctrine: The Rise of Disaster Capitalism*, Knopf Canada, (2007).
3. Noam Chomsky, *Because We Say So*, City Lights Open Media, (2015).
4. Noam Chomsky, *Democracy and Power: The Delhi Lectures*, Open Book Publishers, (2014).
5. Noam Chomsky, *Masters of Mankind: Essays and Lectures, 1969-2013*, Haymarket Books, (2014).

[16]http://www.learndev.org/dl/harmony8.pdf
http://dissidentvoice.org/2015/05/gandhi-as-an-economist/
http://www.encyclopedia.com/doc/1G2-3401804813.html

6. Noam Chomsky, *Nuclear War and Environmental Catastrophe*, Seven Stories Press, New York, (2013).
7. A. Gore, *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It*, Rodale Books, New York, (2006).
8. A. Gore, *Earth in the Balance: Forging a New Common Purpose*, Earthscan, (1992).
9. A.H. Ehrlich and P.R. Ehrlich, *Earth*, Thames and Methuen, (1987).pro Simon and Schuster, (1990).
10. P.R. Ehrlich and A.H. Ehrlich, *Healing the Planet: Strategies for Resolving the Environmental Crisis*, Addison-Wesley, (1991).
11. P.R. Ehrlich and A.H. Ehrlich, *Betrayal of Science and Reason: How Anti-Environmental Rhetoric Threatens our Future*, Island Press, (1998).
12. P.R. Ehrlich and A.H. Ehrlich, *One With Nineveh: Politics, Consumption and the Human Future*, Island Press, (2004).
13. A.H. Ehrlich and U. Lele, *Humankind at the Crossroads: Building a Sustainable Food System*, in *Draft Report of the Pugwash Study Group: The World at the Crossroads*, Berlin, (1992).
14. P.R. Ehrlich, *The Population Bomb*, Sierra/Ballentine, New York, (1972).
15. P.R. Ehrlich, A.H. Ehrlich and J. Holdren, *Human Ecology*, W.H. Freeman, San Francisco, (1972).
16. P.R. Ehrlich, A.H. Ehrlich and J. Holdren, *Ecoscience: Population, Resources, Environment*, W.H. Freeman, San Francisco, (1977)
17. P.R. Ehrlich and A.H. Ehrlich, *Extinction*, Victor Gollancz, London, (1982).
18. D.H. Meadows, D.L. Meadows, J. Randers, and W.W. Behrens III, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*, Universe Books, New York, (1972).
19. D.H. Meadows et al., *Beyond the Limits. Confronting Global Collapse and Envisioning a Sustainable Future*, Chelsea Green Publishing, Post Mills, Vermont, (1992).
20. D.H. Meadows, J. Randers and D.L. Meadows, *Limits to Growth: the 30-Year Update*, Chelsea Green Publishing, White River Jct., VT 05001, (2004).
21. A. Peccei and D. Ikeda, *Before it is Too Late*, Kodansha International, Tokyo, (1984).
22. A. Peccei, *The Human Quality*, Pergamon Press, Oxford, (1977).
23. A. Peccei, *One Hundred Pages for the Future*, Pergamon Press, New York, (1977).
24. V.K. Smith, ed., *Scarcity and Growth Reconsidered*, Johns Hopkins University Press, Baltimore, (1979).
25. R. Costannza, ed., *Ecological Economics: The Science and Management of Sustainability*, Colombia University Press, New York, (1991).
26. M. McCarthy, *China Crisis: Threat to the Global Environment*, The Independent, (19 October, 2005).
27. L.R. Brown, *The Twenty-Ninth Day*, W.W. Norton, New York, (1978).
28. N. Myers, *The Sinking Ark*, Pergamon, New York, (1972).
29. N. Myers, *Conservation of Tropical Moist Forests*, National Academy of Sciences, Washington D.C., (1980).
30. National Academy of Sciences, *Energy and Climate*, NAS, Washington D.C., (1977).

31. W. Ophuls, *Ecology and the Politics of Scarcity*, W.H. Freeman, San Francisco, (1977).
32. E. Eckholm, *Losing Ground: Environmental Stress and World Food Prospects*, W.W. Norton, New York, (1975).
33. E. Eckholm, *The Picture of Health: Environmental Sources of Disease*, New York, (1976).
34. Economic Commission for Europe, *Air Pollution Across Boundaries*, United Nations, New York, (1985).
35. G. Hagman and others, *Prevention is Better Than Cure*, Report on Human Environmental Disasters in the Third World, Swedish Red Cross, Stockholm, Stockholm, (1986).
36. G. Hardin, "The Tragedy of the Commons", *Science*, December 13, (1968).
37. K. Newland, *Infant Mortality and the Health of Societies*, Worldwatch Paper 47, Worldwatch Institute, Washington D.C., (1981).
38. D.W. Orr, *Ecological Literacy*, State University of New York Press, Albany, (1992).
39. E. Pestel, *Beyond the Limits to Growth*, Universe Books, New York, (1989).
40. D.C. Pirages and P.R. Ehrlich, *Ark II: Social Responses to Environmental Imperatives*, W.H. Freeman, San Francisco, (1974).
41. Population Reference Bureau, *World Population Data Sheet*, PRM, 777 Fourteenth Street NW, Washington D.C. 20007, (published annually).
42. R. Pressat, *Population*, Penguin Books Ltd., (1970).
43. M. Rechcigl (ed.), *Man/Food Equation*, Academic Press, New York, (1975).
44. J.C. Ryan, *Life Support: Conserving Biological Diversity*, Worldwatch Paper 108, Worldwatch Institute, Washington D.C., (1992).
45. J. Shepard, *The Politics of Starvation*, Carnegie Endowment for International Peace, Washington D.C., (1975).
46. B. Stokes, *Local Responses to Global Problems: A Key to Meeting Basic Human Needs*, Worldwatch Paper 17, Worldwatch Institute, Washington D.C., (1978).
47. L. Timberlake, *Only One Earth: Living for the Future*, BBC/ Earthscan, London, (1987).
48. UNEP, *Environmental Data Report*, Blackwell, Oxford, (published annually).
49. UNESCO, *International Coordinating Council of Man and the Biosphere*, MAB Report Series No. 58, Paris, (1985).
50. United Nations Fund for Population Activities, *A Bibliography of United Nations Publications on Population*, United Nations, New York, (1977).
51. United Nations Fund for Population Activities, *The State of World Population*, UNPF, 220 East 42nd Street, New York, 10017, (published annually).
52. United Nations Secretariat, *World Population Prospects Beyond the Year 2000*, U.N., New York, (1973).
53. J. van Klinken, *Het Dierde Punte*, Uitgiversmaatschappij J.H. Kok-Kampen, Netherlands (1989).
54. B. Ward and R. Dubos, *Only One Earth*, Penguin Books Ltd., (1973).

55. WHO/UNFPA/UNICEF, *The Reproductive Health of Adolescents: A Strategy for Action*, World Health Organization, Geneva, (1989).
56. E.O. Wilson, *Sociobiology*, Harvard University Press, (1975).
57. E.O. Wilson (ed.), *Biodiversity*, National Academy Press, Washington D.C., (1988).
58. E.O. Wilson, *The Diversity of Life*, Allen Lane, The Penguin Press, London, (1992).
59. G. Woodwell (ed.), *The Earth in Transition: Patterns and Processes of Biotic Impoverishment*, Cambridge University Press, (1990).
60. World Resources Institute (WRI), *Global Biodiversity Strategy*, The World Conservation Union (IUCN), United Nations Environment Programme (UNEP), (1992).
61. World Resources Institute, *World Resources 200-2001: People and Ecosystems: The Fraying Web of Life*, WRI, Washington D.C., (2000).
62. D.W. Pearce and R.K. Turner, *Economics of Natural Resources and the Environment*, Johns Hopkins University Press, Baltimore, (1990).
63. T. Jackson, *Material Concerns: Pollution, Profit and the Quality of Life*, Routledge, (2004).
64. T. Jackson, *Motivating Sustainable Consumption*, Report to the Sustainable Development Research Network, January (2005).
65. T. Jackson, *The Earthscan Reader in Sustainable Consumption*, Earthscan, (2006).
66. J.S. Avery, *Information Theory and Evolution, 2nd Edition*, World Scientific, (2012).
67. A.J. Lotka, *Elements of Mathematical Biology*, Dover, (1956).
68. E.O. Wilson *Sociobiology: The New Synthesis*, Harvard University Press, (1975).
69. E.O. Wilson, *The Superorganism: The Beauty, Elegance, and Strangeness of Insect Societies*, W.W. Norton, (2009).
70. F. Soddy, *Wealth, Virtual Wealth and Debt. The solution of the economic paradox*, George Allen and Unwin, (1926).
71. F. Soddy, *The Role of Money*, George Routledge and Sons, London, (1934)
72. N. Georgescu-Roegen, *Energy and Economic Myths : Institutional and Analytical Economic Essays*, Pergamon Press, (1976).
73. N. Georgescu-Roegen, *The Entropy Law and the Economic Process*, Harvard University Press, (1971).
74. J. Rifkin and T. Howard, *Entropy: A New World View* The Viking Press, New York (1980).
75. P. Bartelmus, *Environment, Growth and Development: The Concepts and Strategies of Sustainability*, Routledge, New York, (1994).
76. H.E. Daly and K.N. Townsend, (editors), *Valuing the Earth. Economics, Ecology, Ethics*, MIT Press, Cambridge, Massachusetts, (1993)
77. C. Flavin, *Slowing Global Warming: A Worldwide Strategy*, Worldwatch Paper 91, Worldwatch Institute, Washington D.C., (1989).
78. S.H. Schneider, *The Genesis Strategy: Climate and Global Survival*, Plenum Press, (1976).
79. WHO/UNFPA/UNICEF, *The Reproductive Health of Adolescents: A Strategy for Action*, World Health Organization, Geneva, (1989).

80. World Commission on Environment and Development, *Our Common Future*, Oxford University Press, (1987).
81. W. Jackson, *Man and the Environment*, W.C. Brown, Dubuque, Iowa, (1971).
82. T. Berry, *The Dream of the Earth*, Sierra Club Books, San Francisco, (1988).
83. T.M. Swanson, ed., *The Economics and Ecology of Biodiversity Decline: The Forces Driving Global Change*, Cambridge University Press, (1995).
84. F.H. Bormann, *Unlimited Growth: Growing, Growing, and Gone?*, BioScience 22: 706-9, (1972).
85. L.G. Brookes, *A Low-Energy Strategy for the United Kingdom*, Atom 269: 73-8, (1979).
86. J. Cherfas, *Skeptics and Visionaries Examine Energy Saving*, Science 251: 154-6, (1991).
87. C.J. Cleveland, *Energy Quality and Energy Surplus in the Extraction of Fossil Fuels in the US*, Ecological Economics 6: 139-62, (1992).
88. C.J. Cleveland, Robert Costanza, Charlie A.S. Hall and Robert Kaufmann, *Energy and the US Economy: A Biophysical Perspective*, Science 225 (4665): 890-7, (1984).
89. P. Cloud, *Entropy, Materials, and Prosperity*, Geologische Rundschau 66: 678-96, (1978).
90. H.E. Daly, *From Empty-World Economics to Full-World Economics: Recognizing a Historical Turning Point in Economic Development*, in R. Goodland, H. E. Daly and S. Serafy (eds) Population, Technology, and Lifestyle, pp. 23-37. Washington, DC: Island Press, (1992).
91. H.E. Daly, *On Nicholas Georgescu-Roegen'-s Contributions to Economics: An Obituary Essay*, Ecological Economics 13: 149-54, (1995).
92. H.E. Daly, *Georgescu-Roegen versus Solow/Stiglitz*, Ecological Economics 22: 267-8, (1997).
93. M. Eigen, *Selforganization of Matter and the Evolution of Biological Macro- molecules*, Naturwissenschaften 58(10): 465-523, (1971).
94. S.O. Funtowicz and Jerry R. Ravetz, *Post Normal Science: A New Science for New Times*, Scientific European 266: 20-2, (1990).
95. N. Georgescu-Roegen, *Fixed Coefficients of Production and the Marginal Productivity Theory*, Review of Economic Studies 3: 40-9, (1935a).
96. N. Georgescu-Roegen, (1935b) *Note on a Proposition of Pareto*, Quarterly Journal of Economics 49: 706-14.
97. N. Georgescu-Roegen, *Marginal Utility of Money and Elasticities of Demand*, Quarterly Journal of Economics 50: 533-9, (1936a).
98. N. Georgescu-Roegen, *The Pure Theory of Consumer'-s Behavior*, Quarterly Journal of Economics 50: 545-93, (1936b).
99. N. Georgescu-Roegen, *Process in Farming versus Process in Manufacturing: A Problem of Balanced Development*, in U. Papi and C. Nunn (eds) Economic Problems of Agriculture in Industrial Societies, pp. 497-528. London: Macmillan, (1969).
100. N. Georgescu-Roegen, *The Entropy Law and the Economic Process*, Cambridge, MA: Harvard University Press, (1971).

101. N. Georgescu-Roegen, *Energy and Economic Myths*, Southern Economic Journal 41: 347-81, (1975).
102. N. Georgescu-Roegen, *Energy and Economic Myths*. New York: Pergamon Press, (1976).
103. N. Georgescu-Roegen, *Inequality, Limits and Growth from a Bioeconomic Viewpoint*, Review of Social Economy 35: 361-75, (1977a).
104. N. Georgescu-Roegen, *The Steady State and Ecological Salvation: A Thermodynamic Analysis*, BioScience 27: 266-70, (1977b).
105. N. Georgescu-Roegen, *Energy Analysis and Economic Valuation*, Southern Economic Journal 45: 1023-58, (1979a).
106. N. Georgescu-Roegen, *Methods in Economic Science*, Journal of Economic Issues 13 (2): 317-28, (1979b).
107. N. Georgescu-Roegen, *Methods in Economic Science: A Rejoinder*, Economic Issues 15: 188-93, (1981).
108. N. Georgescu-Roegen, *The Promethean Condition of Viable Technologies*, Materials and Society 7: 425-35, (1983).
109. Georgescu-Roegen, Nicholas, *Man and Production*, in M. Baranzini and R. Scazzieri (eds) Foundations of Economics: Structures of Inquiry and Economic Theory, pp. 247-80. Oxford: Basil Blackwell, (1986).
110. N. Georgescu-Roegen, *An Emigrant from a Developing Country: Autobiographical Notes-I*, Banca Nationale del Lavoro Quarterly Review 164: 3-31, (1988a).
111. N. Georgescu-Roegen, *The Interplay between Institutional and Material Factors: The Problem and Its Status*, in J.A. Kregel, E. Matzner and A. Roncaglia (eds) Barriers to Employment, pp. 297-326. London: Macmillan, (1988b).
112. N. Georgescu-Roegen, *Production Process and Dynamic Economics*, in M. Baranzini and R. Scazzieri (eds) The Economic Theory of Structure and Change, pp. 198-226. Cambridge: Cambridge University Press, (1990).
113. N. Georgescu-Roegen, *Nicholas Georgescu-Roegen about Himself* , in M. Szenberg (ed.) Eminent Economists: Their Life Philosophies, pp. 128-59. Cambridge: Cambridge University Press, (1992).
114. J. Gever, Robert Kaufmann, David Skole and Charles Vörösmarty, *Beyond Oil: The Threat to Food and Fuel in the Coming Decades*, Niwot, CO: University Press of Colorado, (1991).
115. M. Giampietro, *Sustainability and Technological Development in Agriculture: A Critical Appraisal of Genetic Engineering*, BioScience 44(10): 677-89, (1994).
116. M. Giampietro and Kozo Mayumi, *Another View of Development, Ecological Degradation and North-South Trade*, Review of Social Economy 56: 21-37, (1998).
117. M. Giampietro and Kozo Mayumi, *The Biofuel Delusion: The Fallacy of Large Scale Agro-biofuel Production*, London: Earthscan, (2009).
118. R. Goldschmidt, *Some Aspects of Evolution*, Science 78: 539-47, (1933).
119. S.J. Gould, *The Return to Hopeful Monsters*, Natural History 86: 22-30, (1977).
120. S.J. Gould and Niles Eldredge, *Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered*, Paleobiology 3: 115-51, (1977).

121. J. Gowdy, *The Value of Biodiversity: Markets, Society and Ecosystems*, Land Economics 73(1): 25-41, (1997).
122. J. Gribbin, *The Death of the Sun* New York: Delacorte Press, (1980).
123. C.A.S. Hall, Cutler J. Cleveland and Robert Kaufman, *Energy and Resource Quality* New York: John Wiley and Sons, (1986).
124. S.R. Ichtiaque and Stephen H. Schneider, *Atmospheric Carbon Dioxide and Aerosols: Effects of Large Increases on Global Climate*, Science 173: 138-41, (1971).
125. K. Ito, *Setting Goals and Action Plan for Energy Efficiency Improvement.* Paper presented at the EAS Energy Efficiency and Conservation Conference, Tokyo (19 June), (2007).
126. F. Jevons, *Greenhouse: A Paradox*, Search 21: 171-2, (1990).
127. W.S. Jevons, *The Coal Question* (reprint of 3rd edn, 1906). New York: Augustus M. Kelley, (1965).
128. N. Kawamiya, *Entropii to Kougyoushakai no Sentaku (Entropy and Future Choices for the Industrial Society)*, Tokyo: Kaimei, (1983).
129. J.D. Khazzoom, *Economic Implications of Mandated Efficiency Standards for Household Appliances*, Energy Journal 1: 21-39, (1980).
130. J.D. Khazzoom, *Energy Saving Resulting from the Adoption of More Efficient Appliances*, Energy Journal 8: 85-9, (1987).
131. T.C. Koopmans, *Three Essays on the State of Economic Science*, New York: McGraw-Hill Book Company, (1957).
132. T.S. Kuhn, *The Structure of Scientific Revolutions*, Chicago, IL: The University of Chicago Press, (1962).
133. J. von Liebig, *Letters on Modern Agriculture* (J. Blyth ed.). New York: John Wiley, (1959).
134. A.J. Lotka, *Elements of Mathematical Biology*, New York: Dover Publications, (1956).
135. G. Luft, *Fueling the Dragon: China'-s Race Into the Oil Market.* http://www.iags.org/china.htm, (2007).
136. K. Mayumi, *The Origins of Ecological Economics: The Bioeconomics of Georgescu-Roegen*,London: Routledge, (2001).
137. K. Mayumi, *An Epistemological Critique of the Open Leontief Dynamic Model: Balanced and Sustained Growth, Delays, and Anticipatory Systems Theory*, Structural Change and Economic Dynamics 16: 540-56m (2005).
138. K. Mayumi, Mario Giampietro and John Gowdy, *Georgescu-Roegen/Daly versus Solow/Stiglitz Revisited*, Ecological Economics 27: 115-17. Legacies: Nicholas Georgescu-Roegen 1253, (1998).
139. W.H. Miernyk, *Economic Growth Theory and the Georgescu-Roegen Paradigm*, in K. Mayumi and J. Gowdy (eds) Bioeconomics and Sustainability: Essays in Honour of Nicholas Georgescu-Roegen, pp. 69-81. Cheltenham: Edward Elgar, (1999).
140. Newman, Peter, *Greenhouse, Oil and Cities*, Futures May: 335-48, (1991).
141. D. Pearce, *Substitution and Sustainability: Some Reflections on Georgescu-Roegen*, Ecological Economics 22: 295-7, (1997).

142. D. Pearce, Edward Barbier and Anil Markandya, *Sustainable Development*, Hampshire: Edward Elgar, (1990).
143. J. Polimeni, Kozo Mayumi, Mario Giampietro and Blake Alcott, *The Jevons Paradox and the Myth of Resource Efficiency Improvements*, London: Earthscan, (2008).
144. J.F. Randolph, *Basic Real and Abstract Analysis*, New York: Academic Press, (1968).
145. D. Ricardo, *On the Principles of Political Economy and Taxation*, in P. Sraffa (ed.) The Works and Correspondence of David Ricardo, Vol. 1. Cambridge: Cambridge University Press, (1951).
146. E. Schrödinger, *What is Life? With Mind and Matter and Autobiographical Sketches*, Cambridge: Cambridge University Press, (1967).
147. J.A. Schumpeter, *The Theory of Economic Development*, Cambridge, MA: Harvard Economic Press, (1951).
148. G.T. Seaborg, *The Erehwon Machine: Possibilities for Reconciling Goals by Way of New Technology*, in S.H. Schurr (ed.) Energy, Economic Growth, and the Environment, pp. 125-38. Baltimore, MD: Johns Hopkins University Press, (1972).
149. M.R. Simmons, *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy* New Jersey: John Wiley and Sons, Inc., (2005).
150. B.J. Skinner, *Earth Resource (3rd edn)*, New Jersey: Prentice Hall, (1986).
151. V. Smil, *Global Catastrophes and Trends: The Next Fifty Years* Cambridge, MA: MIT Press, (2008).
152. R. Solow, *Technical Change and the Aggregate Production Function*, Review of Economics and Statistics 39: 312-20, (1957).
153. R. Solow, *The Economics of Resources or the Resources of Economics*, American Economic Review 64: 1-14, (1974).
154. R.E. Ulanowicz, *Growth and Development: Ecosystem Phenomenology* New York: Springer-Verlag, (1986).
155. US Geological Survey, *Commodity Statistics and Information*, (2005).
156. G.K. Zipf, *National Unity and Disunity: The Nation as a Bio-social Organism.* Bloomington, IN: Principia Press, (1941).

Chapter 4

BANKS BEHIND THE FOSSIL FUEL GIANTS

4.1 Banks give fossil fuel giants $1.9 trillion since Paris

Banking on Climate Change 2019 - Fossil Fuel Report Card / : Alison Kirsch et al Rainforest Action Network (RAN) et al.. For the first time, this report adds up lending and underwriting from 33 global banks to the fossil fuel industry as a whole. The findings are stark: these Canadian, Chinese, European, Japanese, and U.S. banks have financed fossil fuels with $1.9 trillion since the Paris Agreement was adopted (2016-2018), with financing on the rise each year. This report finds that fossil fuel financing is dominated by the big U.S. banks, with JPMorgan Chase as the world's top funder of fossil fuels by a wide margin. In other regions, the top bankers of fossil fuels are Royal Bank of Canada in Canada, Barclays in Europe, MUFG in Japan, and Bank of China in China. Here are some quotations from the report:

In October 2018, the Intergovernmental Panel on Climate Change (IPCC) released a sobering report on the devastating impacts our world will face with 1.5^o Celsius of warming - let alone 2^{o}C - while setting out the emissions trajectory the nations of the world need to take if we are to have any shot at keeping to that 1.5^{o}C limit. This 10th edition of the annual fossil fuel finance report card, greatly expanded in scope, reveals the paths banks have taken in the past three years since the Paris Agreement was adopted, and finds that overall bank financing continues to be aligned with climate disaster.

For the first time, this report adds up lending and underwriting from 33 global banks to the fossil fuel industry as a whole. The findings are stark: these Canadian, Chinese, European, Japanese, and U.S. banks have financed fossil fuels with $1.9 trillion since the Paris Agreement was adopted (2016-2018), with financing on the rise each year. This report finds that fossil fuel financing is dominated by the big U.S. banks, with JPMorgan Chase as the

Figure 4.1: **The Fossil Fuel Financial Report Card, 2019.**

world's top funder of fossil fuels by a wide margin. In other regions, the top bankers of fossil fuels are Royal Bank of Canada in Canada, Barclays in Europe, MUFG in Japan, and Bank of China in China.

This report also puts increased scrutiny on the banks' support for 100 top companies that are expanding fossil fuels, given that there is no room for new fossil fuels in the world's carbon budget. And yet banks supported these companies with $600 billion in the last three years. JPMorgan Chase is again on top, by an even wider margin, and North American banks emerge as the biggest bankers of expansion as well.

This report also grades banks' overall future-facing policies regarding fossil fuels, assessing them on restrictions on financing for fossil fuel expansion and commitments to phase out fossil fuel financing on a 1.5^{o}C-aligned trajectory. While some banks have taken important steps, overall major global banks have simply failed to set trajectories adequate for dealing with the climate crisis.


UnionBank
MUFG UnionBank:
STOP BANKROLLING
CLIMATE CHANGE
気候変動に融資しないで
COAL
KILLS
PROTECT
OUR
CLIMATE
WATER
AND
HEALTH
WATER
IS SACRED
NO PIPELINES!
KEEP IT IN THE
GROUND
WATER
LIFE
MNI WICHONI
NO TAR SANDS


NO DAPL
JP Morgan Chase
DON'T FUND
TRANS MOUNTAIN
RAINFOREST
#DEFUND TARSA

Figure 4.2: **Oil is a dirty business in every sense.**

As in past editions, this fossil fuel finance report card also assesses bank policy and practice around financing in certain key fossil fuel subsectors, with league tables and policy grades on:

- **Tar sands oil: RBC, TD, and JPMorgan Chase are the biggest bankers of 30 top tar sands producers, plus four key tar sands pipeline companies. In particular, these banks and their peers support companies working to expand tar sands infrastructure, such as Enbridge and Teck Resources.**
- **Arctic oil and gas: JPMorgan Chase is the world's biggest banker of Arctic oil and gas by far, followed by Deutsche Bank and SMBC Group. Worryingly, financing for this subsector increased from 2017 to 2018.**
- **Ultra-deepwater oil and gas: JPMorgan Chase, Citi, and Bank of America are the top bankers here. Meanwhile, none of the 33 banks have policies to proactively restrict financing for ultra-deepwater extraction.**
- **Fracked oil and gas: For the first time, the report card looks at bank support for top fracked oil and gas producers and transporters - and finds financing is on the rise over the past three years. Wells Fargo and JPMorgan Chase are the biggest bankers of fracking overall - and, in particular, they support key companies active in the Permian Basin, the epicenter of the climate-threatening global surge of oil and gas production.**
- **Liquefied natural gas (LNG): Banks have financed top companies building LNG import and export terminals around the world with $46 billion since the Paris Agreement, led by JPMorgan Chase, Société Générale, and SMBC Group. Banks have an opportunity to avoid further damage by not financing Anadarko's Mozambique LNG project, in particular.**
- **Coal mining: Coal mining finance is dominated by the four major Chinese banks, led by China Construction Bank and Bank of China. Though many European and U.S. banks have policies in place restricting financing for coal mining, total financing has only fallen by three to five percentage points each year.**
- **Coal power: Coal power financing is also led by the Chinese banks - Bank of China and ICBC in particular - with Citi and MUFG as the top non-Chinese bankers of coal power. Policy grades for this subsector show some positive examples of European banks restricting financing for coal power companies.**

The human rights chapter of this report shows that as fossil fuel companies are increasingly held accountable for their contributions to climate change, finance for these companies also poses a growing liability risk for banks. The

fossil fuel industry has been repeatedly linked to human rights abuses, including violations of the rights of Indigenous peoples and at-risk communities, and continues to face an ever-growing onslaught of lawsuits, resistance, delays, and political uncertainty.

The IPCC's 2018 report on the impacts of a 1.5^{o}C increase in global temperature showed clearly the direction the nations of the world need to take, and the emissions trajectory we need to get there. Banks must align with that trajectory by ending financing for expansion, as well as for these particular spotlight fossil fuels - while committing overall to phase out all financing for fossil fuels on a Paris Agreement-compliant timeline.

Figure 4.3: **Liquefied natural gas, transported by ship.**

Figure 4.4: **A large open-pit coal mine.**

Figure 4.5: **Giant trucks in an open-pit coal mine.**

Figure 4.6: **A coal-fired power plant.**

4.2 Fossil fuel industry's disinformation campaign

The Wikipedia article on climate change denial describes it with the following words: "Although scientific opinion on climate change is that human activity is extremely likely to be the primary driver of climate change, the politics of global warming have been affected by climate change denial, hindering efforts to prevent climate change and adapt to the warming climate. Those promoting denial commonly use rhetorical tactics to give the appearance of a scientific controversy where there is none."

It is not surprising that the fossil fuel industry supports, on a vast scale, politicians and mass media that deny the reality of climate change. The amounts of money at stake are vast. If catastrophic climate change is to be avoided, coal, oil and natural gas "assets" worth trillions of dollars must be left in the ground. Giant fossil fuel corporations are desperately attempting to turn these "assets' into cash.

According to a recent article published in "The Daily Kos"[1], companies like Shell and Exxon, knew, as early as the 1970s, how their combustible products were contributing to irreversible warming of the planet, became public knowledge over the last few years.

A series of painstakingly researched articles[2] published in 2015 by the Pulitzer-prize winning Inside Climate News revealed an industry totally aware and informed for decades about the inevitable warming certain to occur as more and more carbon dioxide from the burning of fossil fuels was released into the atmosphere.

The article states that "In fact, the oil industry, and Exxon in particular, had the best climate models available, superior to those relied on by scientific community.[3] And armed with the foreknowledge developed through those models, Exxon and the other oil companies planned and executed an elaborate, cynical long term strategy: to invest hundreds of millions of dollars in a comprehensive propaganda effort designed to raise doubts about the existence and cause of climate change, a phenomenon they well knew was irrefutable, based on their own research. By 2016 the industry's lobbying to discredit the science of climate change had surpassed two billion dollars.

"Meanwhile, as newly discovered documents reported in The Guardian[4] attest, the same companies were preparing projections of what type of world they would be leaving for the rest of humanity. In the 1980s, oil companies like Exxon and Shell carried out internal assessments of the carbon dioxide released by fossil fuels, and forecast the planetary consequences of these emissions. In 1982, for example, Exxon predicted that by about 2060, CO_2 levels would reach around 560 parts per million - double the preindustrial level - and that this would push the planet's average temperatures up by about 2^oC over then-current

[1] ww.dailykos.com/stories/2018/9/23/1797888/-The-Oil-Companies-not-only-knew-fossil-fuels-caused-climate-change-they-knew-how-bad-it-would-get?detail=emaildkre

[2] https://insideclimatenews.org/news/15092015/Exxons-own-research-confirmed-fossil-fuels-role-in-global-warming

[3] https://insideclimatenews.org/news/18092015/exxon-confirmed-global-warming-consensus-in-1982-with-in-house-climate-models

[4] https://www.theguardian.com/environment/climate-consensus-97-per-cent/2018/sep/19/shell-and-exxons-secret-1980s-climate-change-warnings

levels (and even more compared to pre-industrial levels)."[5]

The Fossil Free MIT report, 2014

Here are some excerpts from a report entitled **"The Fossil Fuel Industry's Role in Hindering Climate Change Action: Lobbying and Disinformation Against Science and Scientists"**[6]:

In response to the unprecedented urgency of global climate change, Fossil Free MIT's petition, signed by more than 2,400 MIT members, is calling on MIT to divest its $11 billion endowment from the 200 fossil fuel companies with the world's largest publicly traded carbon reserves.

Fossil Free MIT believes that divestment from the fossil fuel industry presents MIT with a unique opportunity to lead the global effort to combat climate change. We wholeheartedly support our Institute's cutting-edge climate science and renewable energy technology research, as well as MIT's campus sustainability initiatives, and we propose divestment as a highly complementary strategy that will bring MIT's investments in line with the goals of its research and sustainability activities. There are three central reasons why we urge MIT to divest from the fossil fuel industry:

- **The fossil fuel industry's business practice is fundamentally inconsistent with the science of climate change mitigation. A 66% chance of limiting global warming to less than 2^{o}C above pre-industrial temperatures demands that no more than 35% of proven fossil fuel reserves can be burned prior to 2100. Yet in 2012, the fossil fuel industry spent $674 billion developing new reserves.**
- **The fossil fuel industry spends hundreds of millions of dollars lobbying and donating in Washington, D.C. against legislation for climate change action.**
- **Many fossil fuel companies are responsible for funding or orchestrating targeted anti-science disinformation campaigns that confuse the public,**

[5]See also https://truthout.org/articles/self-immolation-as-the-world-burns-an-earth-day-report/
https://countercurrents.org/2018/04/29/the-methane-time-bomb-and-the-future-of-the-biosphere/
https://countercurrents.org/2018/08/07/hothouse-earth-evidence-for-ademise-of-the-planetary-life-support-system/
https://www.independent.co.uk/environment/global-warming-temperature-rise-climate-change-end-century-science-a8095591.html
http://www.lifeworth.com/deepadaptation.pdf
https://www.independent.co.uk/news/business/news/bp-shell-oil-global-warming-5-degree-paris-climate-agreement-fossil-fuels-temperature-rise-a8022511.html

[6]https://www.fossilfreemit.org/wp-content/uploads/2014/08/FossilFreeMIT-Lobbying-Disinformation.pdf

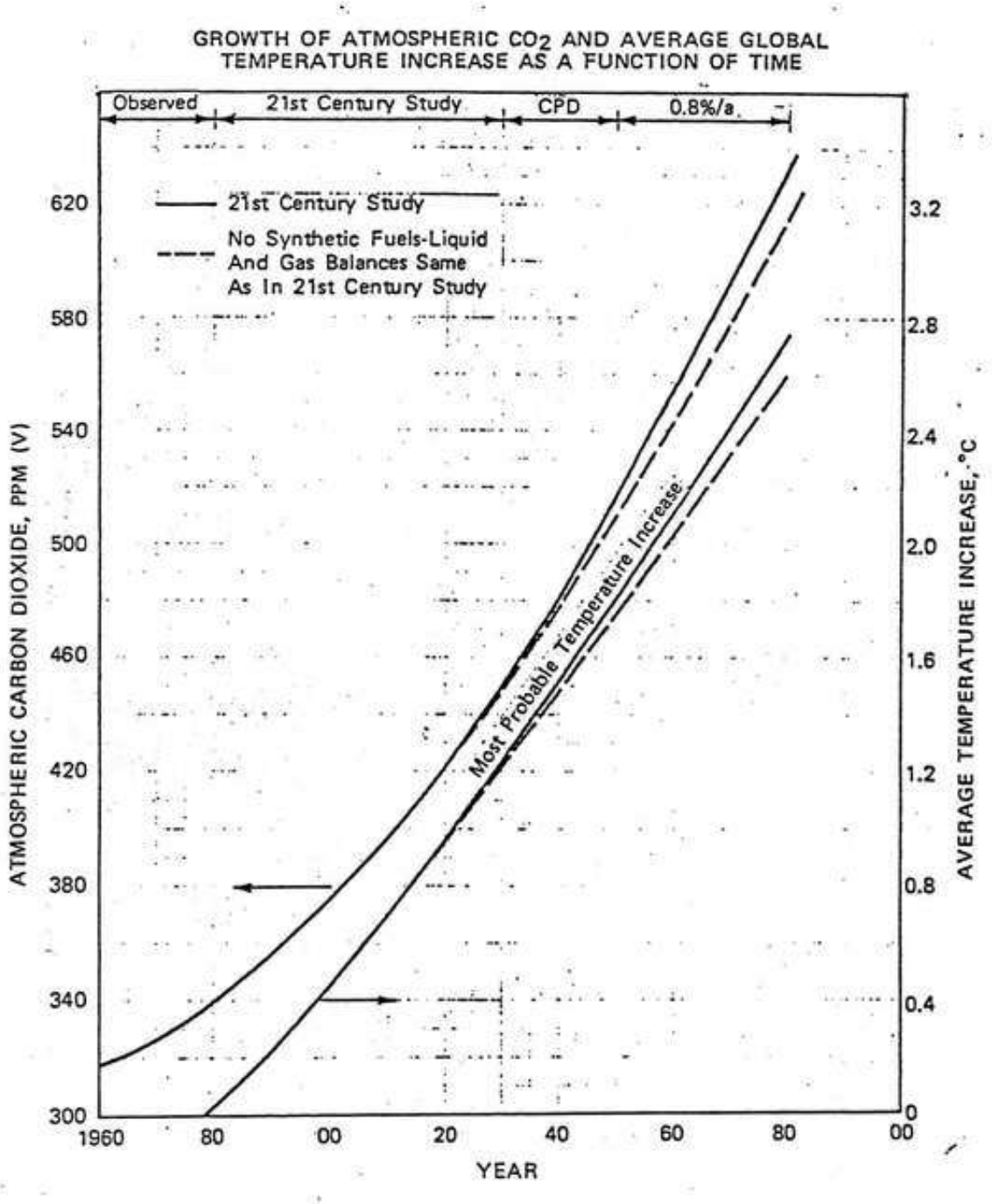

Figure 4.7: **Exxon's 1982 internal projections of the future increase in carbon dioxide levels shows CO_2 percentages increasing to 600 ppm and temperature increases of up to 3°C.**

sabotage science, and slander scientists.

Disinformation from fossil fuel and tobacco industries

Here are some excerpts from a February 19 2019 article by Mat Hope entitled **"Revealed: How the Tobacco and Fossil Fuel Industries Fund Disinformation Campaigns Around the World"**[7]:

Fossil fuel companies have a long history of adopting public relations strategies straight from the tobacco industry's playbook. But a new analysis shows the two industries' relationship goes much deeper - right down to funding the same organizations to do their dirty work.

MIT Associate Professor David Hsu analyzed organizations in DeSmog's disinformation database and the Guardian's tobacco database and found 35 thinktanks based in the US, UK, Australia, and New Zealand that promote both the tobacco and fossil fuel industries' interests.

Of these organizations, DeSmog can reveal that 32 have taken direct donations from the tobacco industry, 29 have taken donations from the fossil fuel industry, and 28 have received money from both. Two key networks, based around the Koch brothers and Atlas Network, are involved in coordinating or funding many of the thinktanks.

[7] https://www.desmogblog.com/2019/02/19/how-tobacco-and-fossil-fuel-companies-fund-disinformation-campaigns-around-world

Figure 4.8: **Smoke destroys human health, regardless of whether it is from cigarettes or coal-fired power plants. Fossil fuel corporations and tobacco companies have exhibited an astonishing degree of cynicism and lack of social responsibility.**

4.3 The divestment movement begins to hurt

In a December 16, 2018 article in The Guardian[8], Bill McKibben wrote:

I remember well the first institution to announce it was divesting from fossil fuel. It was 2012 and I was on the second week of a gruelling tour across the US trying to spark a movement. Our roadshow had been playing to packed houses down the west coast, and we'd crossed the continent to Portland, Maine. As a raucous crowd jammed the biggest theatre in town, a physicist named Stephen Mulkey took the mic. He was at the time president of the tiny Unity College in the state's rural interior, and he announced that over the weekend its trustees had voted to sell their shares in coal, oil and gas companies. "The time is long overdue for all investors to take a hard look at the consequences of supporting an industry that persists in destructive practices," he said.

Six years later, we have marked the 1,000th divestment in what has become by far the largest anti-corporate campaign of its kind. The latest to sell their shares - major French and Australian pension funds, and Brandeis University in Massachusetts - bring the total size of portfolios and endowments in the campaign to just under $8 trillion.

[8]https://www.theguardian.com/commentisfree/2018/dec/16/divestment-fossil-fuel-industry-trillions-dollars-investments-carbon

The list of institutions that have cut their ties with this most destructive of industries encompasses religious institutions large and small (the World Council of Churches, the Unitarians, the Lutherans, the Islamic Society of North America, Japanese Buddhist temples, the diocese of Assisi); philanthropic foundations (even the Rockefeller family, heir to the first great oil fortune, divested its family charities); and colleges and universities from Edinburgh to Sydney to Honolulu are on board, with more joining each week. Forty big Catholic institutions have already divested; now a campaign is urging the Vatican bank itself to follow suit. Ditto with the Nobel Foundation, the world's great art museums, and every other iconic institution that works for a better world.

Thanks to the efforts of groups such as People & Planet (and to the Guardian, which ran an inspiring campaign), half the UK's higher education institutions are on the list. And so are harder-nosed players, from the Norwegian sovereign wealth fund (at a trillion dollars, the largest pool of investment capital on Earth) to European insurance giants such as Axa and Allianz. It has been endorsed by everyone from Leonardo DiCaprio to Barack Obama to Ban Ki-moon (and, crucially, by Desmond Tutu, who helped run the first such campaign a generation ago, when the target was apartheid).

And the momentum just keeps growing: 2018 began with New York City deciding to divest its $189bn pension funds. Soon the London mayor Sadiq Khan was on board, joining the New York mayor Bill de Blasio to persuade the other financial capitals of the planet to sell. By midsummer Ireland became the first nation to divest its public funds. And this month, a cross-party group of 200 MPs and former MPs called on the their pension fund to phase out its substantial investment in fossil fuel giants.

Heavy hitters like that make it clear that the first line of objection to fossil fuel divestment has long since been laid to rest: this is one big action you can take against climate change without big cost. Indeed, early divesters have made out like green-tinged bandits: since the fossil fuel sector has badly underperformed on the market over recent years, moving money into other investments has dramatically increased returns. Pity, for instance, the New York state comptroller Thomas DeNapoli - unlike his New York City counterpart, he refused to divest, and the cost has been about $17,000 per pensioner.

The deeper question, though, is whether divestment is making a dent in the fossil fuel industry. And there the answer is even clearer: this has become the deepest challenge yet to the companies that have kept us on the path to climate destruction.

At first we thought our biggest effect would be to rob fossil fuel companies of their social licence. Since their political lobbying power is above all what prevents governments taking serious action on global warming, that would have been worth the fight. And indeed academic research makes it clear that's happened - one study concluded that "liberal policy ideas (such as a carbon tax), which had previously been marginalised in the US debate, gained increased

attention and legitimacy". That makes sense: most people don't have a coal mine or gas pipeline in their backyard, but everyone has - through their alma mater, their church, their local government - some connection to a large pot of money.

As time went on, though, it became clear that divestment was also squeezing the industry. Peabody, the world's biggest coal company, announced plans for bankruptcy in 2016; on the list of reasons for its problems, it counted the divestment movement, which was making it hard to raise capital. Indeed, just a few weeks ago analysts at that radical collective Goldman Sachs said the "divestment movement has been a key driver of the coal sector's 60% de-rating over the past five years"...

4.4 Some hopeful signs of change

According to a 5 April 2019 article in The Guardian[9], "Norway's $1tn oil fund, the world's largest sovereign wealth fund, is to plunge billions of dollars into wind and solar power projects. The decision follows Saudi Arabia's oil fund selling off its last oil and gas assets.

"Other national funds built up from oil profits are also thought to be ramping up their investments in renewables. The moves show that countries that got rich on fossil fuels are diversifying their investments and seeking future profits in the clean energy needed to combat climate change. Analysts say the investments are likely to power faster growth of green energy.

According to IRENA, "Renewable energy now accounts for a third of global power capacity". Here are some excerpts from the Danish government's State of Green newsletter of April 3, 2019:

The decade-long trend of strong growth in renewable energy capacity continued in 2018 with global additions of 171 gigawatts (GW), according to new data released by the International Renewable Energy Agency (IRENA). The annual increase of 7.9 per cent was bolstered by new additions from solar and wind energy, which accounted for 84 per cent of the growth. A third of global power capacity is now based on renewable energy.

IRENA's annual Renewable Capacity Statistics 2019,[10] the most comprehensive, up-to-date and accessible figures on renewable energy capacity indicates growth in all regions of the world, although at varying speeds. While Asia accounted for 61 per cent of total new renewable energy installations and grew installed renewables capacity by 11.4 per cent, growth was fastest in Oceania that witnessed a 17.7 per cent rise in 2018. Africa's 8.4 per cent growth put it

[9]https://www.theguardian.com/environment/2019/apr/05/historic-breakthrough-norways-giant-oil-fund-dives-into-renewables

[10]https://www.irena.org/publications/2019/Mar/Capacity-Statistics-2019

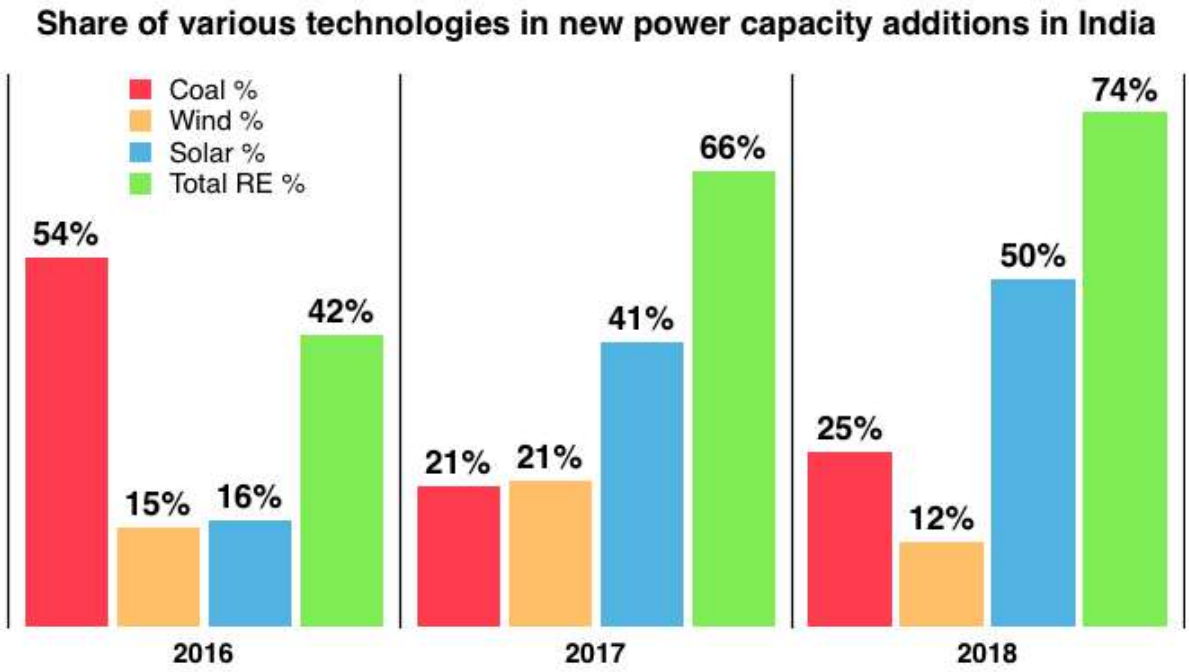

Figure 4.9: **74% of India's new power capacity addition in 2018 was renewable.**

in third place just behind Asia. Nearly two-thirds of all new power generation capacity added in 2018 was from renewables, led by emerging and developing economies.

"Through its compelling business case, renewable energy has established itself as the technology of choice for new power generation capacity," said IRENA Director-General Adnan Z. Amin.

Figure 4.10: **Ukraine in the first quarter of 2019 commissioned 861.1 MW of renewable energy facilities, which is 5.4 times more than in the same period last year.**

Suggestions for further reading

1. Boden, T.A., Marland, G. and Andres, R.J., *Global, Regional, and National Fossil-Fuel CO2 Emissions*, Carbon Dioxide Information Analysis Center, Oak Ridge Laboratory, U.S Department of Energy, Oak Ridge, Tenn., US. (2013).
2. Braconier H., Nicoletti G.and Westmore B., *Policy Challenges for the next 50 years.* OECD Economic Policy Paper. July 2014. No. 9, Paris, (2014).
3. CDM Policy Dialogue, *Climate Change, Carbon Markets and the CDM: A Call to Action*, (2012).
4. Gillenwater, M, and Seres, S,, *The Clean Development Mechanism: A Review of the First International Offset Program. Prepared for the Pew Centre on Global Climate Change*, (2011).
5. McGlade C., Etkins P., *The geographical distribution of fossil fuels unused when limiting global warming to 2°C*, Nature, 8 January 2015, Vol 517, (2015).
6. Meinshausen, M. et al., *Greenhouse gas emission targets for limiting global warming to 2°C*. Nature 458, 1158-1162 (2009).
7. Nordhaus, W., *The Climate Casino: Risk Uncertainty and Economics for a Warming World*, New Haven, CT, Yale University Press, (2013).
8. Victor, David G., *Global Warming Gridlock*, Cambridge, UK: Cambridge University Press, (2011).

Chapter 5

CORPORATIONS CONTROL MEDIA AND GOVERNMENTS

5.1 Benefits of equality

The Industrial Revolution opened up an enormous gap in military strength between the industrialized nations and the rest of the world. Taking advantage of their superior weaponry, Europe, the United States and Japan rapidly carved up the remainder of the world into colonies, which acted as sources of raw materials and food, and as markets for manufactured goods. Between 1800 and 1914, the percentage of the earth under the domination of colonial powers increased to 85 percent, if former colonies are included.

The English economist and Fabian, John Atkinson Hobson (1858-1940), offered a famous explanation of the colonial era in his book "Imperialism: A Study" (1902). According to Hobson, the basic problem that led to colonial expansion was an excessively unequal distribution of incomes in the industrialized countries. The result of this unequal distribution was that neither the rich nor the poor could buy back the total output of their society. The incomes of the poor were insufficient, and rich were too few in number. The rich had finite needs, and tended to reinvest their money. As Hobson pointed out, reinvestment in new factories only made the situation worse by increasing output.

Hobson had been sent as a reporter by the Manchester Guardian to cover the Second Boer War. His experiences had convinced him that colonial wars have an economic motive. Such wars are fought, he believed, to facilitate investment of the excess money of the rich in African or Asian plantations and mines, and to make possible the overseas sale of excess manufactured goods. Hobson believed imperialism to be immoral, since it entails suffering both among colonial peoples and among the poor of the industrial nations. The cure that he recommended was a more equal distribution of incomes in the manufacturing countries.

Interestingly, TED Talks (ideas worth spreading) was recently under fire from many progressive groups for censoring a short talk by the adventure capitalist, Nick Hanauer, entitled "Income Inequality". In this talk, Hanauer said exactly the same thing as John Hobson, but he applies the ideas, not to colonialism, but to current unemployment in the

Figure 5.1: **World wealth levels in 2004. Countries with per capita wealth greater than 100,000 USD are shown in red, while those with per capita wealth less than 5,000 USD are shown in blue.**

United States. Hanauer said that the rich are unable to consume the products of society because they are too few in number. To make an economy work, demand must be increased, and for this to happen, the distribution of incomes must become much more equal than it is today in the United States.

TED has now posted Hanauer's talk, and the interested reader can find another wonderful TED talk dealing with the same issues from the standpoint of health and social problems. In a splendid lecture entitled "How economic inequality harms societies", Richard Wilkinson demonstrates that there is almost no correlation between gross national product and a number of indicators of the quality of life, such as physical health, mental health, drug abuse, education, imprisonment, obesity, social mobility, trust, violence, teenage pregnancies and child well-being. On the other hand he offers comprehensive statistical evidence that these indicators are strongly correlated with the degree of inequality within countries, the outcomes being uniformly much better in nations where income is more equally distributed.

Warren Buffet famously remarked, "There's class warfare, all right. But it's my class, the rich class, that's making war, and we're winning." However, the evidence presented by Hobson, Hanauer and Wilkinson shows conclusively that no one wins in a society where inequality is too great, and everyone wins when incomes are more evenly distributed.

Figure 5.2: **In many countries, children live by scavaging from garbage dumps.**

Figure 5.3: **Even in rich countries, many millions of people live in poverty,**

5.2 Extreme inequality today

Here are some quotations from a report by the Global Inequality organization: [1]

Inequality has been on the rise across the globe for several decades. Some countries have reduced the numbers of people living in extreme poverty. But economic gaps have continued to grow as the very richest amass unprecedented levels of wealth. Among industrial nations, the United States is by far the most top-heavy, with much greater shares of national wealth and income going to the richest 1 percent than any other country.

The world's richest 1 percent, those with more than $1 million, own 45 percent of the world's wealth. Adults with less than $10,000 in wealth make up 64 percent of the world's population but hold less than 2 percent of global wealth. The world's wealthiest individuals, those owning over $100,000 in assets, total less than 10 percent of the global population but own 84 percent of global wealth. Credit Suisse defines "wealth" as the value of a household's financial assets plus real assets (principally housing), minus their debts.

"Ultra high net worth individuals" - the wealth management industry's term for people worth more than $30 million - hold an astoundingly disproportionate share of global wealth. These wealth owners hold 11.3 percent of total global wealth, yet represent only a tiny fraction (0.003%) of the world population.

The world's 10 richest billionaires, according to Forbes, own $745 billion in combined wealth, a sum greater than the total goods and services most nations produce on an annual basis. The globe is home to 2,208 billionaires, according to the 2018 Forbes ranking.

Those with extreme wealth have often accumulated their fortunes on the backs of people around the world who work for poor wages and under dangerous conditions. According to Oxfam, the wealth divide between the global billionaires and the bottom half of humanity is steadily growing. Between 2009 and 2017, the number of billionaires it took to equal the wealth of the world's poorest 50 percent fell from 380 to 42...

The United States has more wealth than any other nation. But America's top-heavy distribution of wealth leaves typical American adults with far less wealth than their counterparts in other industrial nations.

5.3 Oligarchy replaces democracy in many countries

The jaws of power

"Every government degenerates when trusted to the rulers of the people alone. The people themselves, therefore, are its only safe depositories." Thomas Jeffer-

[1] https://inequality.org/facts/global-inequality/

son, (1743-1826)

"The jaws of power are always open to devour, and her arm is always stretched out, if possible, to destroy the freedom of thinking, speaking, and writing."
John Adams, (1735-1826)

According to the Nuremberg Principles, the citizens of a country have a responsibility for the crimes that their governments commit. But to prevent these crimes, the people need to have some knowledge of what is going on. Indeed, democracy cannot function at all without this knowledge.

What are we to think when governments make every effort to keep their actions secret from their own citizens? We can only conclude that although they may call themselves democracies, such governments are in fact oligarchies or dictatorships.

At the end of World War I, it was realized that secret treaties had been responsible for its outbreak, and an effort was made to ensure that diplomacy would be more open in the future. Needless to say, these efforts did not succeed, and diplomacy has remained a realm of secrecy.

Many governments have agencies for performing undercover operations (usually very dirty ones). We can think, for example of the KGB, the CIA, M5, or Mossad. How can countries that have such agencies claim to be democracies, when the voters have no knowledge of or influence over the acts that are committed by the secret agencies of their governments?

Nuclear weapons were developed in secret. It is doubtful whether the people of the United States would have approved of the development of such antihuman weapons, or their use against an already-defeated Japan, if they had known that these things were going to happen. The true motive for the nuclear bombings was also kept secret. In the words of General Groves, speaking confidentially to colleagues at Los Alamos, the real motive was "to control the Soviet Union".

The true circumstances surrounding the start of the Vietnam war would never have been known if Daniel Ellsberg had not leaked the Pentagon Papers. Ellsberg thought that once the American public realized that their country's entry into the war was based on a lie, the war would end. It did not end immediately, but undoubtedly Ellsberg's action contributed to the end of the war.

We do not know what will happen to Julian Assange. If his captors send him to the US, and if he is executed there for the crime of publishing leaked documents (a crime that he shares with the New York Times), he will not be the first martyr to the truth. The ageing Galileo was threatened with torture and forced to recant his heresy - that the earth moves around the sun. Galileo spent the remainder of his days in house arrest. Gordiano Bruno was less lucky. He was burned at the stake for maintaining that the universe is larger than it was then believed to be. If Julian Assange becomes a martyr to the truth like Galileo or Bruno, his name will be honored by generations in the future, and the shame of his captors will be remembered too.

The deep state

Can a government, many of whose operations are secret, be a democracy? Obviously this is impossible. The recent attempts of the United States to arrest whistleblower Edward Snowden call attention to the glaring contradiction between secrecy and democracy.

In a democracy, the power of judging and controlling governmental policy is supposed to be in the hands of the people. It is completely clear that if the people do not know what their government is doing, then they cannot judge or control governmental policy, and democracy has been abolished. There has always been a glaring contradiction between democracy and secret branches of the government, such as the CIA, which conducts its assassinations and its dirty wars in South America without any public knowledge or control.

The gross, wholesale electronic spying on citizens revealed by Snowden seems to be specifically aimed at eliminating democracy. It is aimed at instilling universal fear and conformity, fear of blackmail and fear of being out of step, so that the public will not dare to oppose whatever the government does, no matter how criminal or unconstitutional.

Henry Kissinger famously remarked: "The illegal we do at once. The unconstitutional takes a little longer". Well, Henry, that may have been true in your time, but today the unconstitutional does not take long at all.

The Magna Carta is trashed. No one dares to speak up. Habeas Corpus is trashed. No one dares to speak up. The United Nations Charter is trashed. No one dares to speak up. The Universal Declaration of Human Rights is trashed. No one dares to speak up. The Fourth Amendment to the US Constitution is trashed. No one dares to speak up. The President claims the right to kill both US and foreign citizens, at his own whim. No one dares to speak up.

But perhaps this is unjust. Perhaps some people would dare to protest, except that they cannot get their protests published in the mainstream media. We must remember that the media are owned by the same corporate oligarchs who own the government.

George Orwell, you should be living today! We need your voice today! After Snowden's revelations, the sale of Orwell's "1984" soared. It is now on the bestseller list. Sadly, Orwell's dystopian prophesy has proved to be accurate in every detail.

What is the excuse for for the massive spying reported by Snowden, spying not only on US citizens but also on the citizens of other countries throughout the world? "We want to protect you from terrorism.", the government answers. But terrorism is not a real threat, it is an invented one. It was invented by the military-industrial complex because, at the end of the Cold War, this enormous money-making conglomerate lacked enemies.

Globally, the number of people killed by terrorism is vanishingly small compared to the number of children who die from starvation every year. It is even vanishingly small compared with the number of people who are killed in automobile accidents. It is certainly small compared with the number of people killed in wars aimed at gaining western hegemony over oil-rich regions of the world.

But in Shelley's words, "We are many; they are few!" The people who want democracy greatly outnumber those who profit from maintaining a government based on secrecy and fear. Let us "rise like lions after slumbers, in unvanquishable numbers". Let us abolish

governmental secrecy and reclaim our democracy.

5.4 Media in the service of powerholders

Throughout history, art was commissioned by rulers to communicate, and exaggerate, their power, glory, absolute rightness etc, to the populace. The pyramids gave visual support to the power of the Pharaoh; portraits of rulers are a traditional form of propaganda supporting monarchies; and palaces were built as symbols of power.

Modern powerholders are also aware of the importance of propaganda. Thus the media are a battleground where reformers struggle for attention, but are defeated with great regularity by the wealth and power of the establishment. This is a tragedy because today there is an urgent need to make public opinion aware of the serious problems facing civilization, and the steps that are needed to solve these problems. The mass media could potentially be a great force for public education, but often their role is not only unhelpful - it is negative.

It is certainly possible to find a few television programs and newspaper articles that present the facts about climate change in a realistic way. For example *The Guardian* gives outstanding climate change coverage. However, the mass media could do very much more. One has to conclude that the media are neglecting their great responsibilities at a time of acute crisis for human civilization and the biosphere. The same can be said of our educational systems at both both the primary and advanced levels. We urgently need much more public education about the severe dangers that we face today.

5.5 Television as a part of our educational system

In the mid-1950's, television became cheap enough so that ordinary people in the industrialized countries could afford to own sets. During the infancy of television, its power was underestimated. The great power of television is due to the fact that it grips two senses simultaneously, both vision and hearing. The viewer becomes an almost-hypnotized captive of the broadcast.

In the 1950's, this enormous power, which can be used both for good and for ill, was not yet fully apparent. Thus insufficient attention was given to the role of television in education, in setting norms, and in establishing values. Television was not seen as an integral part of the total educational system. It is interesting to compare the educational systems of traditional cultures with those of modern industrial societies.

In traditional societies, multigenerational families often live together in the same dwelling. In general, there is a great deal of contact between grandparents and grandchildren, with much transmission of values and norms between generations. Old people are regarded with great respect, since they are considered to be repositories of wisdom, knowledge, and culture.

By contrast, modern societies usually favor nuclear families, consisting of only parents

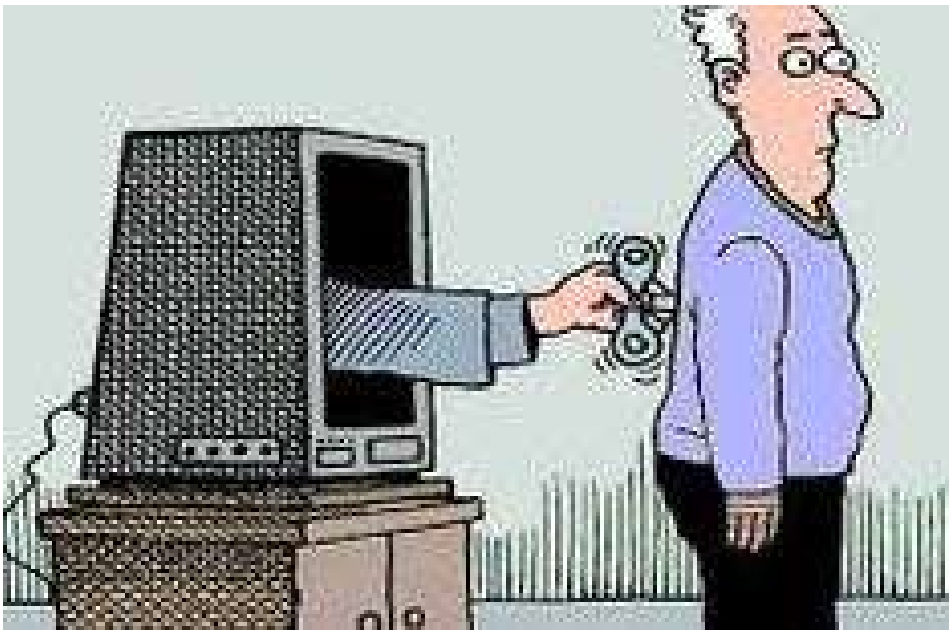

Figure 5.4: **The role of the media.**

Figure 5.5: **Liberty?**

and children. Old people are marginalized. They live by themselves in communities or homes especially for the old. Their cultural education knowledge and norms are not valued because they are "out of date". In fact, during the life of a young person in one of the rapidly-changing industrial societies of the modern world, there is often a period when they rebel against the authority of their parents and are acutely embarrassed by their parents, who are "so old-fashioned that they don't understand anything".

Although the intergenerational transmission of values, norms, and culture is much less important in industrial societies than it is in traditional ones, modern young people of the West and North are by no means at a loss over where to find their values, fashions and role models. With every breath, they inhale the values and norms of the mass media. Totally surrounded by a world of television and film images, they accept this world as their own.

5.6 Neglect of climate change in the mass media

The predicament of humanity today has been called "a race between education and catastrophe": How do the media fulfil this life-or-death responsibility? Do they give us insight? No, they give us pop music. Do they give us an understanding of the sweep of evolution and history? No, they give us sport. Do they give us an understanding of the ecological catastrophes that threaten our planet because of unrestricted growth of population and industries? No, they give us sit-coms and soap operas. Do they give us unbiased news? No, they give us news that has been edited to conform with the interests of powerful lobbys. Do they present us with the urgent need to leave fossil fuels in the ground? No, they do not, because this would offend the powerholders. Do they tell of the danger of passing tipping points after which human efforts to prevent catastrophic climate change will be useless? No, they give us programs about gardening and making food.

A consumer who subscribes to the "package" of broadcasts sold by a cable company can often search through all 95 channels without finding a single program that offers insight into the various problems that are facing the world today. What the viewer finds instead is a mixture of pro-establishment propaganda and entertainment. Meanwhile the neglected global problems are becoming progressively more severe.

In general, the mass media behave as though their role is to prevent the peoples of the world from joining hands and working to change the world and to save it from thermonuclear war, environmental catastrophes and threatened global famine. The television viewer sits slumped in a chair, passive, isolated, disempowered and stupefied. The future of the world hangs in the balance, the fate of children and grandchildren hangs in the balance, but the television viewer feels no impulse to work actively to change the world or to save it. The Roman emperors gave their people bread and circuses to numb them into political inactivity. The modern mass media seem to be playing a similar role.

Figure 5.6: **Network administrators have noticed that programs about climate change often have low viewer ratings. Since they see delivering high viewer ratings to their advertisers as their primary duty, these executives seldom allow programs dealing with the danger of catastrophic climate change. The duty to save the earth from environmental catastrophe is neglected for the sake of money. As Al Gore said, "Instead of having a well-informed electorate, we have a well-amused audience".**

5.7 Climate change denial in mass media

The Wikipedia article on climate change denial describes it with the following words: "Although scientific opinion on climate change is that human activity is extremely likely to be the primary driver of climate change, the politics of global warming have been affected by climate change denial, hindering efforts to prevent climate change and adapt to the warming climate. Those promoting denial commonly use rhetorical tactics to give the appearance of a scientific controversy where there is none."

It is not surprising that the fossil fuel industry supports, on a vast scale, politicians and mass media that deny the reality of climate change. The amounts of money at stake are vast. If catastrophic climate change is to be avoided, coal, oil and natural gas "assets" worth trillions of dollars must be left in the ground. Giant fossil fuel corporations are desperately attempting to turn these "assets' into cash.

Preventing an ecological apocalypse

Here are some excerpts from an article entitled **"Only Rebellion will prevent an ecological apocalypse"** by George Monbiot, which was published on April 15 2019 in The Guardian[2]:

No one is coming to save us. Mass civil disobedience is essential to force a political response.

Had we put as much effort into preventing environmental catastrophe as we've spent on making excuses for inaction, we would have solved it by now. Everywhere I look, I see people engaged in furious attempts to fend off the moral challenge it presents...

As the environmental crisis accelerates, and as protest movements like YouthStrike4Climate and Extinction Rebellion make it harder not to see what we face, people discover more inventive means of shutting their eyes and shedding responsibility. Underlying these excuses is a deep-rooted belief that if we really are in trouble, someone somewhere will come to our rescue: "they" won't let it happen. But there is no they, just us.

The political class, as anyone who has followed its progress over the past three years can surely now see, is chaotic, unwilling and, in isolation, strategically incapable of addressing even short-term crises, let alone a vast existential predicament. Yet a widespread and wilful naivety prevails: the belief that voting is the only political action required to change a system. Unless it is accompanied by the concentrated power of protest - articulating precise de-

[2]https://www.theguardian.com/commentisfree/2019/apr/15/rebellion-prevent-ecological-apocalypse-civil-disobedience

mands and creating space in which new political factions can grow - voting, while essential, remains a blunt and feeble instrument.

The media, with a few exceptions, is actively hostile. Even when broadcasters cover these issues, they carefully avoid any mention of power, talking about environmental collapse as if it is driven by mysterious, passive forces, and proposing microscopic fixes for vast structural problems. The BBC's Blue Planet Live series exemplified this tendency.

Those who govern the nation and shape public discourse cannot be trusted with the preservation of life on Earth. There is no benign authority preserving us from harm. No one is coming to save us. None of us can justifiably avoid the call to come together to save ourselves...

Predatory delay

Here are some excerpts from a May 3 2019 article by Bill Henderson entitled **"Neoliberalism, Solution Aversion, Implicatory Denial and Predatory Delay"**[3]:

Looking back at the history, that it's not really a failure of human beings and human nature that's the problem here. It's a hijacking of our political and economic system by the fossil fuel industry and a small number of like-minded people. It was our bad luck that this idea that markets solve all problems and that government should be left to wither away crested just at the moment when it could do the most damage.

Despite the urgent need to reduce greenhouse gas emissions globally if we are to lower the risks of catastrophic climate change, wealthy industrialized nations persist with a widespread public silence on the issue and fail to address climate change. This is despite there being ever more conclusive evidence of its severity. Why is there an undercurrent of inaction, despite the challenge of climate change being ever more daunting? One element is denial.

George Marshall discovered that there has not been a single proposal, debate or even position paper on limiting fossil fuel production put forward during international climate negotiations. From the very outset fossil fuel production lay outside the frame of the discussions and, as with other forms of socially constructed silence, the social norms among the negotiators and policy specialists kept it that way.

Global climate leadership is being redefined. There is a growing recognition that you cannot be a climate leader if you continue to enable new fossil fuel production, which is inconsistent with climate limits. If no major producers step up to stop the expansion of extraction and begin phasing out existing fields and mines, the Paris goals will become increasingly difficult to achieve.

[3] https://countercurrents.org/2019/05/03/neoliberalism-solution-aversion-implicatory-denial-and-predatory-delay-bill-henderson/

Wealthy fossil fuel producers have a responsibility to lead, and this must include planning for a just and equitable managed decline of existing production.

The (emissions reduction) curve we've been forced onto bends so steeply, that the pace of victory is part of victory itself. Winning slowly is basically the same thing as losing outright. We cannot afford to pursue past strategies, aimed at limited gains towards distant goals. In the face of both triumphant denialism and predatory delay, trying to achieve climate action by doing the same things, the same old ways, means defeat. It guarantees defeat.

A fast, emergency-scale transition to a post-fossil fuel world is absolutely necessary to address climate change. But this is excluded from consideration by policymakers because it is considered to be too disruptive. The orthodoxy is that there is time for an orderly economic transition within the current short-termist political paradigm. Discussion of what would be safe - less warming that we presently experience - is non-existent. And so we have a policy failure of epic proportions. Policymakers, in their magical thinking, imagine a mitigation path of gradual change, to be constructed over many decades in a growing, prosperous world...

5.8 Showing unsustainable lifestyles in mass media

Television and other mass media contribute indirectly to climate change denial by showing unsustainable lifestyles. Television dramas show the ubiquitous use of gasoline-powered automobiles and highways crowded with them. just as though there did not exist an urgent need to transform our transportation systems. Motor racing is shown. A program called "Top Gear" tells viewers about the desirability of various automobiles. In general, cyclists are not shown. In television dramas, the protagonists fly to various parts of the world for their holidays. The need for small local self-sustaining communities is not shown.

Advertisements in the mass media urge us to consume more, to fly, to purchase large houses, and to buy gasoline-driven automobiles, just as though such behavior ought to be the norm. Such norms are leading us towards environmental disaster.

5.9 Alternative media

Luckily, the mass media do not have a complete monopoly on public information. With a little effort, citizens who are concerned about the future can find alternative media. These include a large number if independent on-line news services that are supported by subscriber donations rather than by corporate sponsors. *YouTube* videos also represent an extremely important source of public information.

5.10 Outstanding voices calling for climate action

The Guardian

There are exceptions to the general rule that the mass media downplay or completely ignore the climate emergency. The Guardian is a newspaper with absolutely outstanding coverage of all issues related to climate change. No praise can be strong enough for the courageous environmental editorial policy of this famous old British newspaper.

Al Gore

Albert Arnold Gore Jr. served as the 45th Vice President of the United States from January 1985 to January 1993. He then ran for the office of President, but was defeated by George W. Bush in a controversial election whose outcome was finally decided by the US Supreme Court[4].

Al Gore is the founder and current Chairman of the Alliance for Climate Protection. He was one of the first important political figures to call attention to the problem of steadily increasing CO_2 levels in the atmosphere and the threat of catastrophic climate change. He produced the highly influential documentary film *An Inconvenient Truth*[5]. Because of his important efforts to save the global environment, Al Gore shared the 2007 Nobel Peace Prize with the Intergovernmental Panel on Climate Change.

[4]Many people believe that Al Gore won the election.
[5]https://www.youtube.com/watch?v=I-SV13UQXdk

Al Gore's TED talk: The Case for Optimism on Climate Change

In 2016, Al Gore gave an important talk to a TED audience[6]. in which he pointed out the an economic tipping point has just been passed. Solar energy and wind energy are now cheaper than energy form fossil fuels. This means that economic forces alone can drive a rapid transition to 100% renewable energy. Investors will realize that renewables represent an unparalleled investment opportunity.

Sir David Attenborough

In a 2011 interview in The Guardian, Sir David Attenborough was asked: "What will it take to wake people up about climate change?". He replied "Disaster. It's a terrible thing to say, isn't it? And even disaster doesn't always do it. I mean, goodness me, there have been disasters in North America, with hurricanes, and one thing and another, and floods; and still a lot of people would deny it, and say it's nothing to do with climate change. Well it visibly has to do with climate change!"

Sir David Attenborough's almost unbelievably enormous and impressive opus of television programs about the natural world have helped to raise public awareness of the importance of the natural environment. He also has made a number of television programs specifically related to questions such as saving threatened species, the dangers of exploding global human populations, and the destruction of forests for the sake of palm oil plantations.

Let us return to The Guardian's 2011 interview with Sir David. Had it been made in the autumn of 2017, the interview would certainly have included a discussion of recent hurricanes of unprecedented power and destructiveness, such as Harvey, Irma and Maria, as well as 2017's wildfires and Asian floods. It is possible that such events, which will certainly become more frequent and severe during the next few years, will provide the political will needed to silence climate change denial, to stop fossil fuel extraction, and to promote governmental policies favoring renewable energy.

Although the mass media almost have entirely neglected the link between climate change and recent disastrous hurricanes, floods droughts and wildfires, many individuals and organizations emphasized the cause and effect relationship. For example, UK airline billionaire Sir Richard Branson, whose Caribbean summer residence was destroyed by Hurricane Irma said:

"Look, you can never be 100 percent sure about links, But scientists have said the storms are going to get more and more and more intense and more and more often. We've had four storms within a month, all far greater than that have ever, ever, ever happened in history, Sadly, I think this is the start of things to come. Climate change is real. Ninety-nine percent of scientists know it's real. The whole world knows it's real except for maybe one person in the White House."

May Boeve, executive director of the NGO 350.org, said "With a few exceptions, the major TV networks completely failed to cover the scientifically proven ways that climate

[6]https://www.youtube.com/watch?v=I-SV13UQXdk

change is intensifying extreme weather events like hurricanes Harvey and Irma. That's not just disappointing, it's dangerous. We won't be able to turn this crisis around if our media is asleep at the wheel."

Commenting on the destruction of Puerto Rico by Hurricane Maria, historian Juan Cole wrote: "When you vote for denialist politicians, you are selecting people who make policy. The policy they make will be clueless and will actively endanger the public. Climate change is real. We are causing it by our emissions. If you don't believe that, you are not a responsible steward of our infrastructure and of our lives."

When interviewed by Amy Goodman of *Democracy Now*, musician Stevie Wonder said: "... we should begin to love and value our planet, and anyone who believes that there is no such thing as global warming must be blind or unintelligent."

Another well-known musician, Byoncé, added: "The effects of climate change are playing out around the world every day. Just this past week, we've seen devastation from the monsoon in India...and multiple catastrophic hurricanes. Irma alone has left a trail of death and destruction from the Caribbean to Florida to Southern United States. We have to be prepared for what comes next..."

In her September 2017 publication *Season of Smoke*[7], prizewinning author Naomi Klein wrote:

"We hear about the record-setting amounts of water that Hurricane Harvey dumped on Houston and other Gulf cities and towns, mixing with petrochemicals to pollute and poison on an unfathomable scale. We hear too about the epic floods that have displaced hundreds of thousands of people from Bangladesh to Nigeria (though we don't hear enough). And we are witnessing, yet again, the fearsome force of water and wind as Hurricane Irma, one of the most powerful storms ever recorded, leaves devastation behind in the Caribbean, with Florida now in its sights.

"Yet for large parts of North America, Europe, and Africa, this summer has not been about water at all. In fact it has been about its absence; it's been about land so dry and heat so oppressive that forested mountains exploded into smoke like volcanoes. It's been about fires fierce enough to jump the Columbia River; fast enough to light up the outskirts of Los Angeles like an invading army; and pervasive enough to threaten natural treasures, like the tallest and most ancient sequoia trees and Glacier National Park.

"For millions of people from California to Greenland, Oregon to Portugal, British Columbia to Montana, Siberia to South Africa, the summer of 2017 has been the summer of fire. And more than anything else, it's been the summer of ubiquitous, inescapable smoke.

"For years, climate scientists have warned us that a warming world is an extreme world, in which humanity is buffeted by both brutalizing excesses and stifling absences of the core elements that have kept fragile life in equilibrium for millennia. At the end of the summer of 2017, with major cities submerged in water and others licked by flames, we are currently living through Exhibit A of this extreme world, one in which natural extremes

[7]https://theintercept.com/2017/09/09/in-a-summer-of-wildfires-and-hurricanes-my-son-asks-why-is-everything-going-wrong/

Figure 5.7: **Sir David Attenborough: "Disaster. It's a terrible thing to say, isn't it?"**

come head-to-head with social, racial, and economic ones."

It seems likely that the climate-linked disasters of 2019 and 2020 will be even more severe than those that we have witnessed during 2017 and 2018. But will such disasters be enough to wake us up?

The BBC has recently announced that Sir David Attenborough is currently producing a new series, *Blue Planet II*, which will focus on environmental issues.[8]

"My hope is that the world is coming to its senses ... I'm so old I remember a time when ... we didn't talk about climate change, we talked about animals and species extermination," Sir David told Greenpeace in an interview, "For the first time I'm beginning to think there is actually a groundswell, there is a change in the public view. I feel many more people are concerned and more aware of what the problems are. Young people - people who've got 50 years of their life ahead of them - they are thinking they ought to be doing something about this. That's a huge change."

Climate Change, The Facts

Now Sir David Attenborough has completed a new one-hour BBC program on the danger of catastrophic climate change. Here are some excerpts from an April 18 2019 review of the program by Rebecca Nicholson in The Guardian:

The Facts is a rousing call to arms. It is an alarm clock set at a horrifying volume. The first 40 minutes are given over to what Attenborough calls, without hyperbole, "our greatest threat in thousands of years". Expert af-

[8]http://www.bbcearth.com/blueplanet2/

Figure 5.8: **Speaking at the opening ceremony of COP24, the universally loved and respected naturalist Sir David Attenborough said: "If we don't take action, the collapse of our civilizations and the extinction of much of the natural world is on the horizon."**

ter expert explains the consequences of rising CO2 levels, on the ice caps, on coastal regions, on weather and wildlife and society itself. The most powerful moments are in footage shot not by expert crews who have spent years on location, but on shaky cameras, capturing the very moment at which the reality of our warming planet struck the person holding the phone. In Cairns, Australia, flying foxes are unable to survive the extreme temperatures; rescuers survey the terrible massacre, and we learn that while 350 were saved, 11,000 died. A man and his son talk through their escape from raging wildfires, over the film they took while attempting to drive through a cavern of blazing red trees. These are horror movies playing out in miniature. It is difficult to watch even five minutes of this and remain somehow neutral, or unconvinced.

Yet as I kept on, scribbling down an increasingly grim list of statistics, most of which I knew, vaguely, though compiled like this they finally sound as dreadful as they truly are - 20 of the warmest years on record happened in the last 22 years; Greenland's ice sheet is melting five times faster than it was 25 years ago - I started to wonder about responsibility, and if and where it would be placed. This would be a toothless film, in the end, if it were hamstrung by political neutrality, and if its inevitable "it's not too late" message rested solely on individuals and what relatively little tweaks we might make as consumers. What about corporations? What about governments?

Then, at that exact moment, having played the despair through to its crescendo, the experts served up unvarnished honesty. They lined up to lay out the facts, plain and simple. Fossil fuel companies are the most profitable businesses man has ever known, and they engage in PR offensives, using the same consultants as tobacco companies, and the resulting uncertainty and denial, designed to safeguard profits, has narrowed our window for action. It is unforgivable. I find it hard to believe that anyone, regardless of political affiliation, can watch footage of Trump calling climate change "a hoax ... a money-making industry" and not be left winded by such staggering ignorance or astonishing deceit, though it is, more likely, more bleakly, a catastrophic combination of the two. At least Nigel Lawson only appears here in archive footage, and his argument sounds limp, to put it kindly.

Climate Change: The Facts should not have to change minds, but perhaps it will change them anyway, or at least make this seem as pressing as it needs to be. With the Extinction Rebellion protests across London this week, disrupting day-to-day business, and this, on primetime BBC One, maybe the message will filter through. At the very least, it should incite indignation that more was not done, sooner, and then urgency and a decision to both change and push for change at a much higher level. Because there is, for a brief moment, just possibly, still time.

Greta Thunberg meets Pope Francis

On 19 April 2019, Greta Thunberg met briefly with Pope Francis at the end of his general audience. "Continue, continue!" the Pope told her, "Go on, go ahead!" Greta answered Pope Francis with the words: "Thank you for standing up for the climate, for speaking the truth. It means a lot." Greta's father, Svante Thunberg, expressed his gratitude to the pope: "Thank you so much for what you are doing. It means everything. Everything."

The Pope has made fighting climate change and caring for God's creation a pillar of his papacy. He wrote an entire encyclical about it, blaming a thirst for money for turning the Earth into a wasteland and demanding immediate action to curb global warming.

While in Rome, Greta Thunberg will also address the Italian Parliament and participate in a school strike for action to avoid catastrophic climate change.

In June, 2015, His Holiness Pope Francis I addressed the climate crisis in an encyclical entitled "Laudato Si' "[9]. Here are a few excerpts from this enormously important encyclical, which is addressed not only to the world's 1.2 billion Catholics, but also to concerned people of all faiths. After reviewing the contributions of his predecessors. Pope Francis makes the following points:

23. The climate is a common good, belonging to all and meant for all. At the global level, it is a complex system linked to many of the essential conditions

[9]https://unfccc.int/news/pope-francis-releases-encyclical-on-climate-and-environment

for human life. A very solid scientific consensus indicates that we are presently witnessing a disturbing warming of the climatic system. In recent decades this warming has been accompanied by a constant rise in the sea level and, it would appear, by an increase of extreme weather events, even if a scientifically determinable cause cannot be assigned to each particular phenomenon. Humanity is called to recognize the need for changes of lifestyle, production and consumption, in order to combat this warming or at least the human causes which produce or aggravate it. It is true that there are other factors (such as volcanic activity, variations in the earth's orbit and axis, the solar cycle), yet a number of scientific studies indicate that most global warming in recent decades is due to the great concentration of greenhouse gases (carbon dioxide, methane, nitrogen oxides and others) released mainly as a result of human activity. As these gases build up in the atmosphere, they hamper the escape of heat produced by sunlight at the earth's surface. The problem is aggravated by a model of development based on the intensive use of fossil fuels, which is at the heart of the worldwide energy system. Another determining factor has been an increase in changed uses of the soil, principally deforestation for agricultural purposes.

24. Warming has effects on the carbon cycle. It creates a vicious circle which aggravates the situation even more, affecting the availability of essential resources like drinking water, energy and agricultural production in warmer regions, and leading to the extinction of part of the planet's biodiversity. The melting in the polar ice caps and in high altitude plains can lead to the dangerous release of methane gas, while the decomposition of frozen organic material can further increase the emission of carbon dioxide. Things are made worse by the loss of tropical forests which would otherwise help to mitigate climate change. Carbon dioxide pollution increases the acidification of the oceans and compromises the marine food chain. If present trends continue, this century may well witness extraordinary climate change and an unprecedented destruction of ecosystems, with serious consequences for all of us. A rise in the sea level, for example, can create extremely serious situations, if we consider that a quarter of the world's population lives on the coast or nearby, and that the majority of our megacities are situated in coastal areas.

25. Climate change is a global problem with grave implications: environmental, social, economic, political and for the distribution of goods. It represents one of the principal challenges facing humanity in our day. Its worst impact will probably be felt by developing countries in coming decades. Many of the poor live in areas particularly affected by phenomena related to warming, and their means of subsistence are largely dependent on natural reserves and ecosystemic services such as agriculture, fishing and forestry. They have no other financial activities or resources which can enable them to adapt to climate change or to

Figure 5.9: **Greta Thunberg had the privilege of meeting Pope Francis. Both are outstanding voices for climate action.**

face natural disasters, and their access to social services and protection is very limited. For example, changes in climate, to which animals and plants cannot adapt, lead them to migrate; this in turn affects the livelihood of the poor, who are then forced to leave their homes, with great uncertainty for their future and that of their children. There has been a tragic rise in the number of migrants seeking to flee from the growing poverty caused by environmental degradation. They are not recognized by international conventions as refugees; they bear the loss of the lives they have left behind, without enjoying any legal protection whatsoever. Sadly, there is widespread indifference to such suffering, which is even now taking place throughout our world. Our lack of response to these tragedies involving our brothers and sisters points to the loss of that sense of responsibility for our fellow men and women upon which all civil society is founded.

At a London event arranged by The Guardian, Greta Thunberg was asked whether she believed that a general strike could alert politicians to the urgency of the climate emergency. She replied "yes". Here are some of her other comments:

Figure 5.10: **Of the fossil fuels, all are bad, but coal is the worst.**

Figure 5.11: **Speaking to a crowd of many thousands at Marble Arch, London, on April 21, 2019, Greta Thunberg said: "For way too long the politicians and the people in power have gotten away with not doing anything ... But we will make sure that they will not get away with it any longer, We will never stop fighting, we will never stop fighting for this planet, for ourselves, our futures and for the futures of our children and grandchildren."**

This is not just young people being sick of politicians. It's an existential crisis. It is something that will affect the future of our civilization. It's not just a movement. It's a crisis and we must take action accordingly.

At a later meeting with members of the U.K. Parliament, Greta Thunberg said:

The U.K.'s active current support of new exploitation of fossil fuels, like for example the U.K. shale gas fracking industry, the expansion of its North Sea oil and gas fields, the expansion of airports, as well as the planning permission for a brand new coalmine, is beyond absurd.

This ongoing irresponsible behavior will no doubt be remembered in history as one of the greatest failures of humankind. .

Leonardo DiCaprio

Leonardo DiCaprio has won many awards for his work as an actor, writer and producer in both television and films. These include 50 awards from 167 nominations. DiCaprio has been nominated for six Academy Awards, four British Academy Film Awards and nine Screen Actors Guild Awards, winning one award each from them and three Golden Globe Awards from eleven nominations.

In accepting his Best Actor award at the 2016 Oscars ceremony, DiCaprio said: "Climate change is real, it is happening right now. It is the most urgent threat facing our entire species, and we need to work collectively together and stop procrastinating. We need to support leaders around the world who do not speak for the big polluters, but who speak for all of humanity, for the indigenous people of the world, for the billions and billions of underprivileged people out there who would be most affected by this. For our children's children, and for those people out there whose voices have been drowned out by the politics of greed."

Leonardo DiCaprio has used his great success as an actor in the service of environmental causes. In 1997, following the box office success of *Titanic*, he set up the Leonardo DiCaprio Foundation, which is devoted to environmental causes. He chaired the national Earth Day celebrations in 2000 during which he interviewed US President Bill Clinton, with whom he discussed the actions needed to avoid catastrophic climate change. In 2007 he had a major role in *The 11th Hour*, a documentary about people's relationship to nature and global warming. He also co-produced and co-wrote the film.

DiCaprio's most influential film on climate change is *Before the Flood*[10]. This film, released in 2016, is a 1 hour and 36 minute documentary in which Leonardo DiCaprio travels to many countries to let viewers observe the already visible effects of global warming. He also talks with many of the world's leaders, including Pope Francis I, US Presidents Bill Clinton and Barack Obama, and UN Secretary General Ban Ki-moon.

[10]http://www.get.filmovie.us/play.php?movie=tt5929776t

Figure 5.12: **Leonardo DiCaprio at a press conference in 2000 (Wikipedia).**

Figure 5.13: **Thom Hartmann speaks to the 2010 Chicago Green Festival (Wikipedia).**

Thom Hartmann

Thom Hartmann was born in 1951 in Lansing Michigan. He worked as a disk jockey during his teens, and, after a highly successful business career, he sold his businesses and devoted his energies to writing, humanitarian projects and public education. His influential book, *Last Hours of Ancient Sunlight* was published by Three Rivers Press in 1997 and republished in a revised edition in 2004. In 2013, Hartmann published another extremely important book on the same theme: *The Last Hours of Humanity: Warming the World To Extinction*[11].

Hartmann has hosted a nationally syndicated radio show, The Thom Hartmann Program, since 2003 and a nightly television show, The Big Picture, since 2008.

Concerning Hartmann's radio show, Wikipedia states that "As of March 2016, the show was carried on 80 terrestrial radio stations in 37 states as well as on Sirius and XM satellite radio. A community radio station in Africa, Radio Builsa in Ghana, also broadcasts the show. Various local cable TV networks simulcast the program. In addition to Westwood One, the show is now also offered via Pacifica Audioport to non-profit stations in a non-profit compliant format and is simulcast on Dish Network channel 9415 and DirecTV channel 348 via Free Speech TV. The program is carried on Radio Sputnik in London, England."

"Sen. Bernie Sanders (I-VT) appears every Friday during the first hour of the show titled 'Brunch with Bernie'. Ellen Ratner of the Talk Radio News Service provides Washington commentary daily. Victoria Jones who is the White House correspondent for Talk

[11]https://www.amazon.com/Last-Hours-Humanity-Warming-Extinction/dp/1629213640

Radio News Service appears occasionally as does Dr. Ravi Batra an economics professor at SMU."

Together with Leonardo DiCaprio, Thom Hartman recently produced and narrated an extremely important short film entitled *Last Hours*[12]. This film, draws a parallel between the Permian-Triassic mass extinction, and the danger of a human-induced 6th mass extinction. Various experts who appear in the film confirm that our release of CO_2 into the atmosphere is similar to the greenhouse gasses produced by volcanic eruptions prior to the Permian event. The methane hydrate feedback loop is also discussed. The film should be seen by everyone concerned with the future of human civilization and the biosphere. Concerned citizens should also urgently see Hartman and DiCaprio's short films *Carbon*, *Green World Rising* and *Reforestation*, also available on YouTube .

James Hansen

James Hansen was born in 1941 in Denison, Iowa. He was educated in physics, mathematics and astronomy at the University of Iowa in the space sciences program initiated James Van Allen. He graduated with great distinction. The studies of the atmosphere and temperature of Venus which Hansen made under Van Allen's supervision lead him to become extremely concerned about similar effects in the earth's atmosphere.

From 1962 to 1966, James Hansen participated in the National Aeronautical and Space Administration graduate traineeship and, at the same time, between 1965 and 1966, he was a visiting student at the Institute of Astrophysics at the University of Kyoto and in the Department of Astronomy at the University of Tokyo. Hansen then began work at the Goddard Institute for Space Studies in 1967. He began to work for the Goddard Institute for Space Studies in 1967. Between 1981 and 2913, he was hear of the Goddard Institute of Space Studies in New York, and since 2014, he has been the director of the Program on Climate Science, Awareness and Solutions at Columbia University's Earth Institute.

Hansen continued his work with radiative transfer models, attempting to understand the Venusian atmosphere. Later he applied and refined these models to understand the Earth's atmosphere, in particular, the effects that aerosols and trace gases have on Earth's climate. Hansen's development and use of global climate models has contributed to the further understanding of the Earth's climate. In 2009 his first book, Storms of My Grandchildren, was published.

James Hansen has refined climate change models, focusing on the balance between aerosols and greenhouse gases. He believes that there is a danger that climate change will become much more rapid if the balance shifts towards the greenhouse gases.

Hansen's Congressional testimony leads to broad public awareness of the dangers

In 1988, Prof. Hansen was asked to testify before the US Congress on the danger of uncontrolled climate change. The testimony marked the start of broad public awareness

[12]https://www.youtube.com/watch?v=2bRrg96UtMc

Figure 5.14: **Prof. James Hansen**

of the seriousness of the danger, and it was reported in a front page article by the New York Times. However, Hansen believes that governmental energy policies still favor fossil fuels. Therefore he has participated in public demonstrations and he was even arrested in 2011 together with more than a thousand other activists for protesting outside the White House.

James Hansen's TED talk and book

In 2012 he presented a TED Talk: *Why I Must Speak Out About Climate Change*. This talk is easily available on the Internet, and it should be required viewing for everyone who is concerned with the earth's future.

Hansen's book, *Storms of My Grandchildren: The Truth About The Coming Climate Catastrophe, and Our Last Chance To Save Humanity* was published in New York by Bloomsbury Publishing in 2009.

Suggestions for further reading

1. Abarbanel A, McClusky T (1950) *Is the world getting warmer?* Saturday Evening Post, 1 Jul, p22
2. Bagdikian BH (2004) *The New Media Monopoly.* Boston, MA, USA: Beacon
3. Bennett WL (2002) *News: The Politics of Illusion, 5th edition.* New York, NY, USA: Longman
4. Boykoff MT, Boykoff JM (2004) *Balance as bias: global warming and the US prestige press.* Glob Environ Change **14**: 125-136
5. Boykoff MT, Boykoff JM (2007) *Climate change and journalistic norms: A case study of U.S. mass-media coverage.* Geoforum (in press)
6. Carey JW (1989) *Communication as Culture: Essays on Media and Society.* Boston, MA, USA: Unwin Hyman
7. Carvalho A (2005) *Representing the politics of the greenhouse effect: Discursive strategies in the British media.* Critical Discourse Studies **2**: 1-29
8. CEI (2006) *We Call it Life.* Washington, DC, USA: Competitive Enterprise Institute
9. Cowen RC (1957) *Are men changing the earth's weather?* Christian Science Monitor, 4 Dec, p13
10. Cushman JH (1998) *Industrial group plans to battle climate treaty.* New York Times, 26 Apr, p1
11. Doyle G (2002) *Media Ownership: The Economics and Politics of Convergence and Concentration in the UK and European Media.* London, UK: Sage Publications
12. Dunwoody S, Peters HP (1992) *Mass media coverage of technological and environmental risks: A survey of research in the United States and Germany.* Public Underst Sci **1**: 199-230
13. Entman RM (1993) *Framing: toward clarification of a fractured paradigm.* J Commun **43**: 51-58
14. Fleming JR (1998) *Historical Perspectives on Climate Change.* Oxford, UK: Oxford University Press
15. Gelbspan R (1998) *The Heat Is On.* Cambridge, MA, USA: Perseus Books
16. Grove RH (2003) *Green Imperialism.* Cambridge, UK: Cambridge University Press
17. Leggett J (2001) *The Carbon War.* New York, NY, USA: Routledge
18. McChesney RW (1999) *Rich Media, Poor Democracy: Communication Politics in Dubious Times.* Urbana, IL, USA: University of Illinois Press
19. McComas K, Shanahan J (1999) *Telling stories about global climate change: Measuring the impact of narratives on issue cycles.* Communic Res **26**: 30-57
20. McCright AM (2007) *Dealing with climate change contrarians.* In Moser SC, Dilling L (eds) **Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change,** pp 200-212. Cambridge, UK: Cambridge University Press
21. McCright AM, Dunlap RE (2000) *Challenging global warming as a social problem: An analysis of the conservative movement's counter-claims.* Soc Probl **47**: 499-522
22. McCright AM, Dunlap RE (2003) *Defeating Kyoto: The conservative movement's impact on U.S. climate change policy.* Soc Probl **50**: 348-373

23. Mooney C (2004) *Blinded by science.* Columbia Journalism Review 6(Nov/Dec), www.cjr.org
24. NSF (2004) Science and Engineering Indicators 2004. Washington, DC, USA: National Science Foundation Project for Excellence in Journalism (2006) *The State of the News Media 2006.* Washington, DC, USA:
25. Project for Excellence in Journalism. www.stateofthenewsmedia.org Rajan SR (2006) *Modernizing Nature.* Oxford, UK: Oxford University Press
26. Sandell C, Blakemore B (2006) *ABC News reporting cited as evidence in congressional hearing on global warming.* ABC News, 27 Jul, http://abcnews.go.com
27. Shabecoff P (1988) *Global warming has begun, expert tells senate.* New York Times, 24 Jun, pA1
28. Shrader-Frechette KS (1993) *Burying Uncertainty.* Berkeley, CA, USA: University of California Press
29. Starr P (2004) *The Creation of the Media: Political Origins of Modern Communications.* New York, NY, USA: Basic Books
30. Ungar S (1992) *The rise and (relative) decline of global warming as a social problem.* Sociol **Q 33**: 483-501
31. Weart SR (2003) *The Discovery of Global Warming.* Cambridge, MA, USA: Harvard University Press
32. Weingart P, Engels A, Pansegrau P (2000) *Risks of communication: Discourses on climate change in science, politics, and the mass media.* Public Underst Sci **9**: 261-283
33. Wilkins L (1993) *Between the facts and values: Print media coverage of the greenhouse effect, 1987-1990.* Public Underst Sci **2**: 71-84
34. Wilson KM (1995) *Mass media as sources of global warming knowledge.* Mass Communication Review **22**: 75-89
35. Wilson KM (2000) *Communicating climate change through the media: Predictions, politics, and perceptions of risks.* In Allan S, Adam B, Carter C (eds) **Environmental Risks and the Media,** pp 201-217. New York, NY, USA: Routledge
36. Zehr SC (2000) *Public representations of scientific uncertainty about global climate change.* Public Underst Sci **9**: 85-103
37. O.N. Larsen, ed., *Violence and the Mass Media*, Harper and Row, (1968).
38. R.M.. Liebert et al., *The Early Window: The Effects of Television on Children and Youth*, Pergamon, Elmsford, NY, (1982).
39. G. Noble, *Children in Front of the Small Screen*, Constable, London, (1975).
40. H.J. Schneider, *Das Geschäft mit dem Verbrechen. Massenmedien und Kriminalität*, Kinddler, Munich, (1980).
41. W. Schramm, ed., *Grundfragen der Kommunikationsforschung*, Mu- nich, (1973).
42. J.L. Singer and D.G. Singer, *Television, Imagination and Aggression: A Study of Preschoolers*, Erlbaum, Hillsdale, NY, (1981).
43. O.N. Larsen, ed., *Violence and the Mass Media*, Harper and Row, (1968).
44. H.J. Skornia, *Television and Society*, McGraw-Hill, New York, (1965).

45. D.L. Bridgeman, ed., *The Nature of Prosocial Behavior*, New York, Academic Press, (1983).
46. N. Esenberg, ed., *The Development of Prosocial Behavior*, New York, Academic Press, (1982).
47. W.H. Goodenough, *Cooperation and Change: An Anthropological Approach to Community Development*, New York, Russell Sage Founda- tion, (1963).
48. J.R. Macauley and L. Berkowitz, *Altruism and Helping Behavior*, Aca- demic Press, New York, (1970).
49. P. Mussen and N. Eislen-Berg, *Roots of Caring, Sharing and Helping*, Freeman, San Francisco, (1977).
50. J.P. Rushdon and R.M. Sorentino, eds., *Altruism and Helping Behavior*, Erlbaum, Hillsdale, NJ, (1981).
51. L. Wispé, ed, *Altruism, Sympathy and Helping*, Academic Press, New York, (1978).
52. J.-C. Guedon, *La Planéte Cyber, Internet et Cyberspace*, Gallimard, (1996).
53. J. Segal, *Théorie de l'information: sciences, techniques et société, de la seconde guerre mondaile ' l'aube du XXI siécle*, Thése de Doctorat, Université Lumi're Lyon II, (1998), (http://www.mpiwg-berlin.mpg.de/staff/segal/thesis/)
54. H. von Foerster, editor, *Cybernetics - circular, causal and feed-back mechanisms in biological and social systems.* Transactions of sixth- tenth conferences, Josiah J. Macy Jr. Foundation, New York, (1950- 1954).
55. G. Bateson, *Communication, the Social Matrix of Psychiatry*, Norton, (1951).
56. G. Bateson, *Steps to an Ecology of Mind*, Chandler, San Francisco, (1972).
57. G. Bateson, *Communication et Societé*, Seuil, Paris, (1988).
58. R.M.. Liebert et al., *The Early Window: The Effects of Television on Children and Youth*, Pergamon, Elmsford, NY, (1982).
59. G. Noble, *Children in Front of the Small Screen*, Constable, London, (1975).
60. J.L. Singer and D.G. Singer, *Television, Imagination and Aggression: A Study of Preschoolers*, Erlbaum, Hillsdale, NY, (1981).

Chapter 6

MONEY ENOUGH FOR THE GREEN NEW DEAL?

6.1 Cutting military budgets

The cost of US wars since 2001

According to the National Priorities Project[1], the total cost of US wars between November 11, 2001 and April 8, 2019 has been 4.77 trillion US dollars, or written out in detail $4,773,527,023,293.00. Every hour US taxpayers are paying 32.08 million dollars for the total costs of war. Globally, the world spent 1.9 trillion dollars on military budgets in 2018, according to the Stockholm International Peace Research Institute.

Every war is a war against children

War was always madness, always immoral, always the cause of unspeakable suffering, economic waste and widespread destruction, and always a source of poverty, hate, barbarism and endless cycles of revenge and counter-revenge. It has always been a crime for soldiers to kill people, just as it is a crime for murderers in civil society to kill people. No flag has ever been wide enough to cover up atrocities. Every war is a war against children.

But today, the development of all-destroying modern weapons has put war completely beyond the bounds of sanity and elementary humanity. The danger of a catastrophic nuclear war casts a dark shadow over the future of our species. It also casts a very black shadow over the future of the global environment. The environmental consequences of a massive exchange of nuclear weapons have been treated in a number of studies by meteorologists and other experts from both East and West. Scientists believe that the "nuclear winter" effect could kill a large proportion of the plants, animals and humans on earth.

[1] https://www.nationalpriorities.org/cost-of/war/

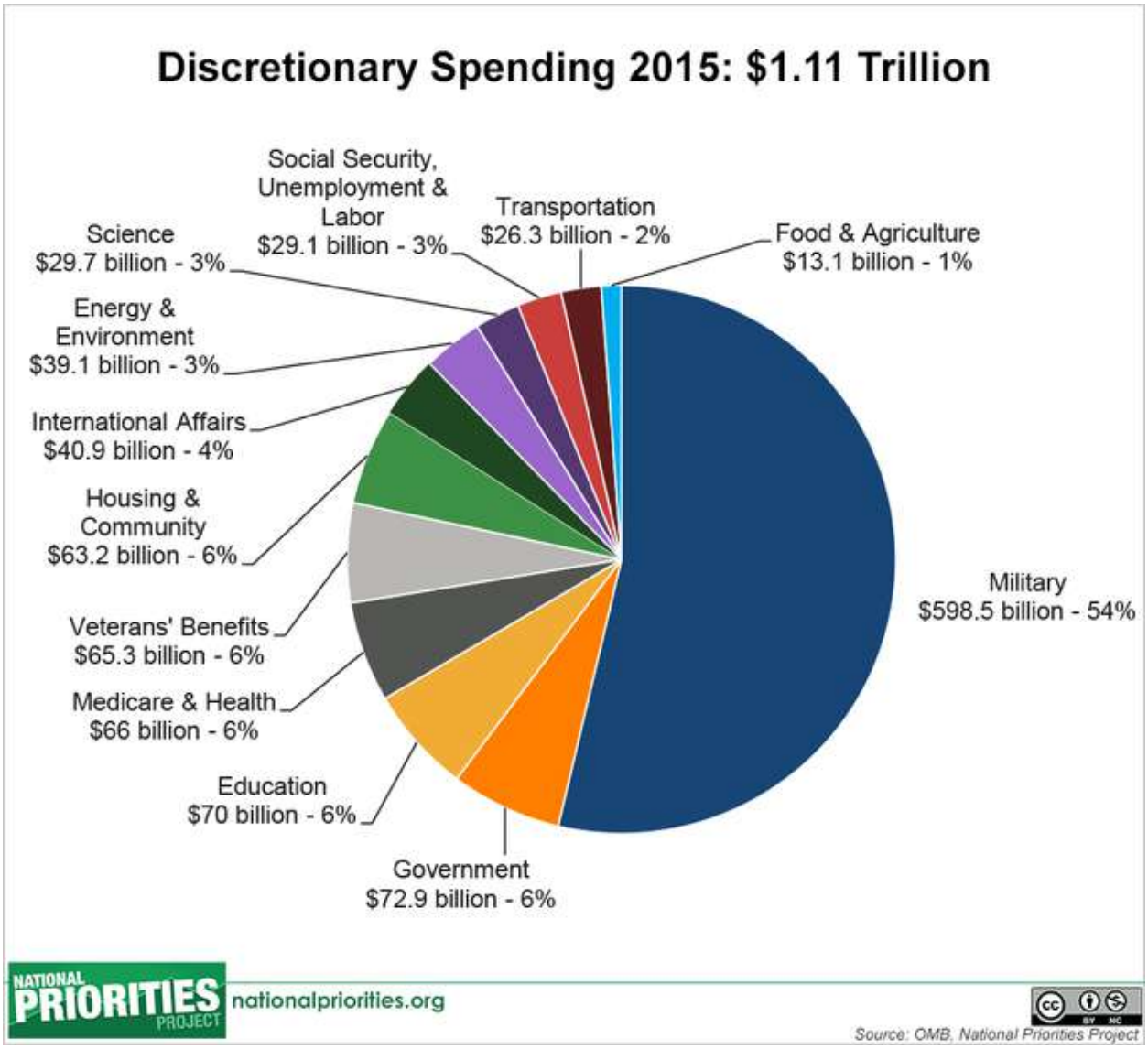

Figure 6.1: **In the fiscal year US 2015, military spending accounted for 54 percent of all federal discretionary spending, a total of $598.5 billion. Military spending includes: all regular activities of the Department of Defense; war spending; nuclear weapons spending; international military assistance; and other Pentagon-related spending.**

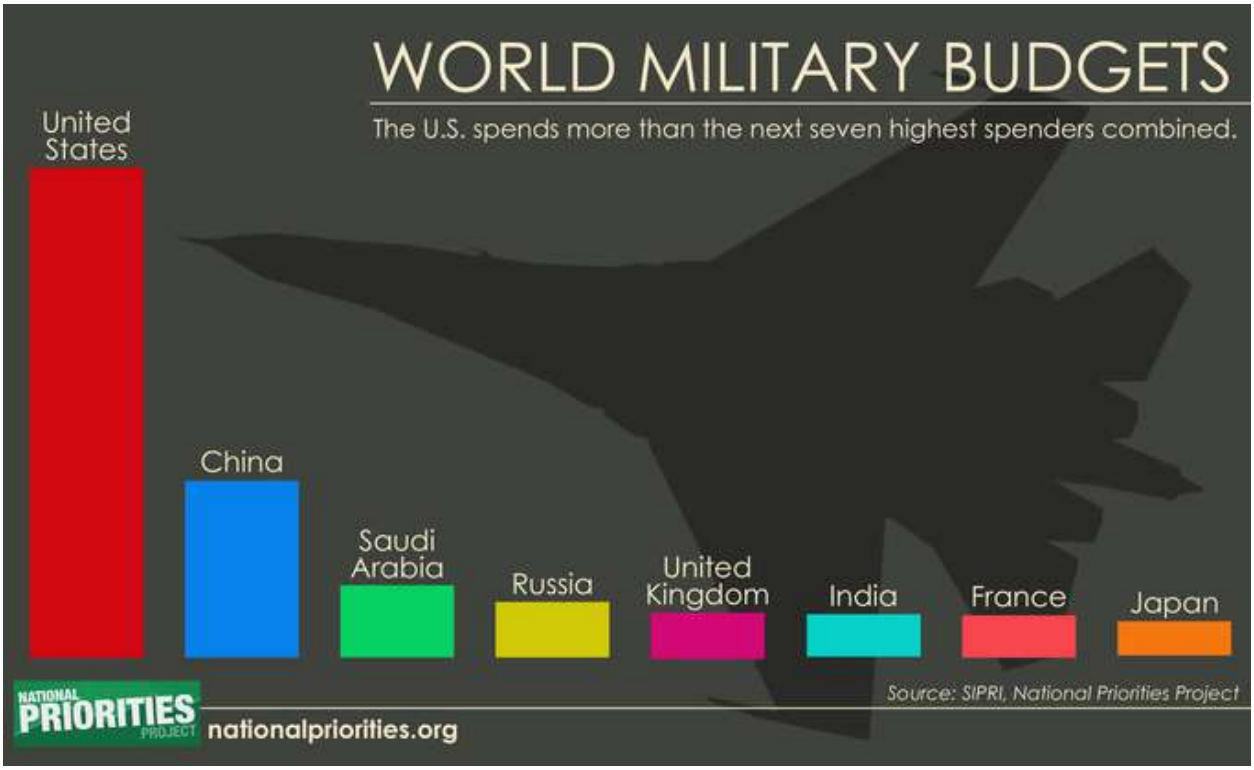

Figure 6.2: **U.S. military spending dwarfs the budget of the #2 country - China. For every dollar China spends on its military, the U.S. spends $2.77. The U.S. outpaces all other nations in military expenditures. World military spending totaled more than $1.6 trillion in 2015. The U.S. accounted for 37 percent of the total. U.S. military expenditures are roughly the size of the next seven largest military budgets around the world, combined.**

Figure 6.3: **An attempt was made to audit Pentagon spending, but the firm entrusted with this task eventually pronounced it impossible because of confusing records and lack of records. Trillions of dollars are unaccounted for.**

Figure 6.4: **No War! No Warming! There are two important connections between war and global warming. Firstly, military organizations run on oil and are are the largest single users of fossil fuels. Secondly, and even more importantly, money saved by slashing military budgets would be more than enough to carry out programs to avoid catastrophic climate change.**

Figure 6.5: **Military-industrial complexes want war. Ordinary people do not want it. According to the Stockholm International Peace Research Institute, global military expenses in 2018 amounted to 1.8 trillion dollars. This almost unimaginable river of money is the basic reason why the terrible suffering and waste of war is inflicted on the world's people.**

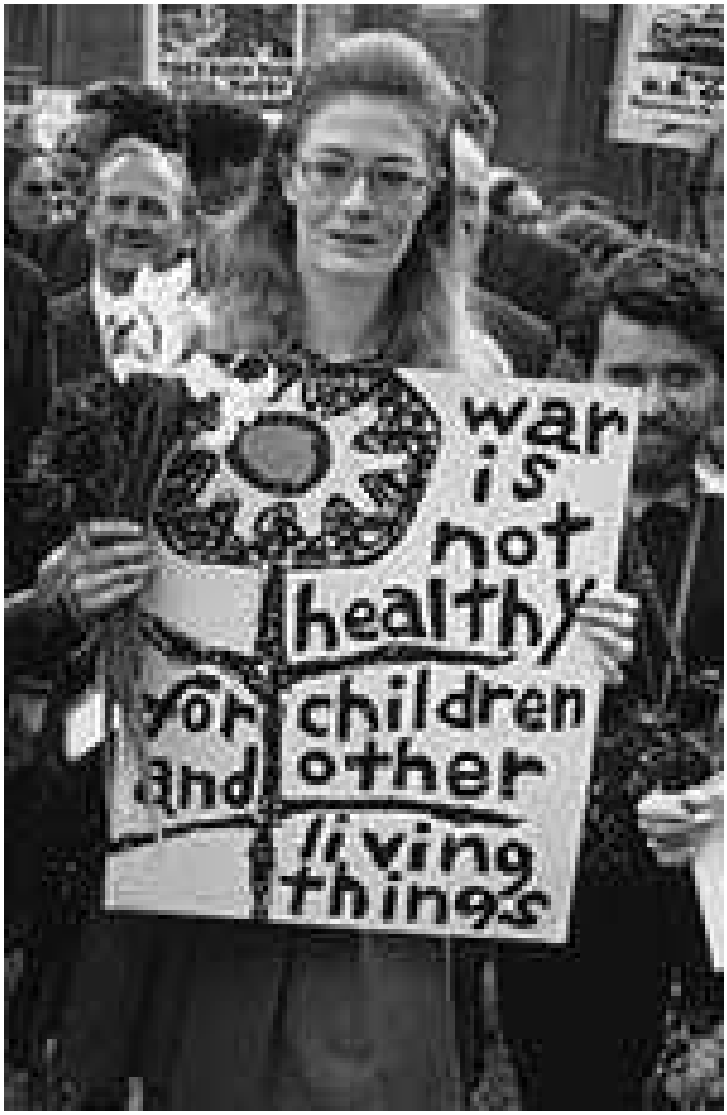

Figure 6.6: **The actress Vanessa Redgrave was part of a 1968 protest against the Vietnam War.**

Figure 6.7: **We must do whatever is necessary to save the future.**

Figure 6.8: **Young protesters from the Sunrise Movement call on leaders to back the Green New Deal.**

6.2 The Extinction Rebellion

In an open letter to governments, reported in The Guardian [2], leaders of the environmental movement said:

In our complex, interdependent global ecosystem, life is dying, with species extinction accelerating. The climate crisis is worsening much faster than previously predicted. Every single day 200 species are becoming extinct. This desperate situation can't continue.

Political leaders worldwide are failing to address the environmental crisis. If global corporate capitalism continues to drive the international economy, global catastrophe is inevitable.

Complacency and inaction in Britain, the US, Australia, Brazil, across Africa and Asia - all illustrate diverse manifestations of political paralysis, abdicating humankind's grave responsibility for planetary stewardship.

International political organizations and national governments must foreground the climate-emergency issue immediately, urgently drawing up comprehensive policies to address it. Conventionally privileged nations must voluntarily fund comprehensive environment-protection policies in impoverished nations, to compensate the latter for foregoing unsustainable economic growth, and paying recompense for the planet-plundering imperialism of materially privileged nations.

With extreme weather already hitting food production, we demand that governments act now to avoid any risk of hunger, with emergency investment in agro-ecological extreme-weather-resistant food production. We also call for an urgent summit on saving the Arctic icecap, to slow weather disruption of our harvests.

We further call on concerned global citizens to rise up and organize against current complacency in their particular contexts, including indigenous people's rights advocacy, decolonization and reparatory justice - so joining the global movement that's now rebelling against extinction (eg Extinction Rebellion in the UK).

We must collectively do whatever's necessary non-violently, to persuade politicians and business leaders to relinquish their complacency and denial. Their "business as usual" is no longer an option. Global citizens will no longer put up with this failure of our planetary duty.

Every one of us, especially in the materially privileged world, must commit to accepting the need to live more lightly, consume far less, and to not only uphold human rights but also our stewardship responsibilities to the planet.

The letter was signed by 100 academics, authors, politicians and campaigners from

[2] https://www.theguardian.com/environment/2018/dec/09/act-now-to-prevent-an-environmental-catastrophe

Figure 6.9: **Young protesters in London demanding action to prevent catastrophic climate change.**

across the world. Among them were Vandana Shiva, Noam Chomsky, Naomi Klein and Bill McKibben.

6.3 The cost of inaction

In a sense, the cost of inaction is incalculably high. At stake is the entire future of human civilization and the biosphere. Our children's future and our grandchildren's future will be lost if we do not take rapid action to avoid catastrophic climate change. Nevertheless, scientists studying two of the most dangerous feedback loops, the albido effect from melting of Arctic sea ice, and the release of methane from melting permafrost, have attempted to put a price tag on the cost of inaction under various scenarios. Their results were recently published in Nature[3], and reported in The National Geographic[4].

The National Geographic article, written by Stephen Leahey and published on April

[3]https://www.nature.com/articles/s41467-019-09863-x

[4]https://www.msn.com/en-us/weather/topstories/a-warming-arctic-could-cost-the-world-trillions-of-dollars/ar-BBWcxsz?li=BBnbcA1

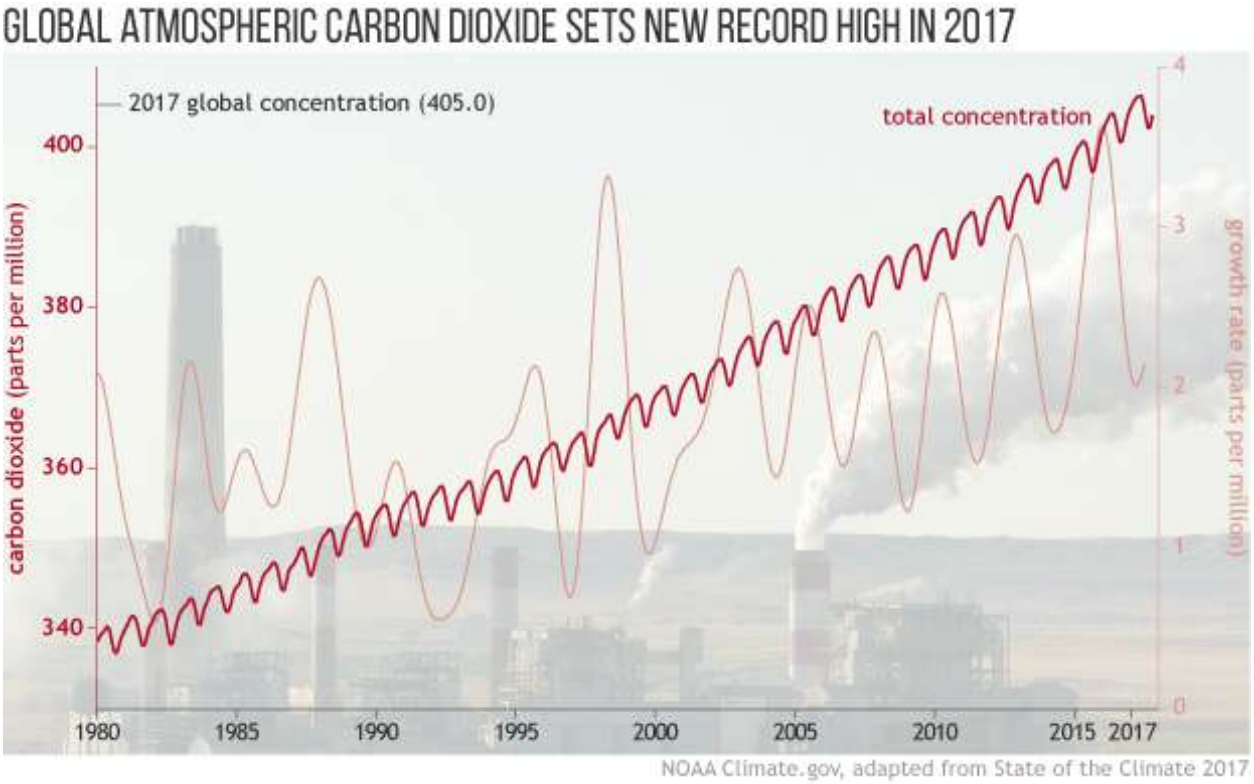

Figure 6.10: **Today the atmospheric concentration of CO_2 is 413 ppm., roughly double the pre-industrial concentration. The last time that it was this high was in the Pliocene Epoch 5.3 to 2.6 million years ago. Sea levels were then 20 meters higher than they are right now, and trees were growing at the South Pole. Unless we quickly lower carbon emissions, most coastal cities and low-lying countries will be lost to rising seas.**

24, 2019, states the following:

Scientists have long warned that climate change is likely to bring expensive impacts, from rising seas to stronger storms. And a new study comes with a hefty price tag.

A warming Arctic is shifting from white to dark as sea ice melts and land-covered snow retreats, and that means it can absorb even more of the sun's heat. Plus, the Arctic's vast permafrost area is thawing, releasing more heat-trapping carbon and methane. These climate-change-driven feedbacks in the Arctic are accelerating warming even faster and may add nearly $70 trillion to the overall costs of climate change - even if the world meets the Paris Agreement climate targets, a new study says.

However, if efforts can be made to keep climate change limited to 2.7 degrees Fahrenheit (1.5C), the extra cost of Arctic warming drops to $25 trillion, new research published in Nature Communications reports. A trillion is a thousand billion. For comparison, the global GDP in 2016 was around $76 trillion.

"Massive changes are underway in the Arctic. Permafrost and loss of sea ice and snow are two known tipping elements in the climate system," said lead author Dmitry Yumashev of the Pentland Centre for Sustainability in Business, Lancaster University in the United Kingdom.

"We wanted to know what Arctic warming could do to the rest of the world," said Yumashev.

Climate "tipping elements" are also known as tipping points or feedbacks, where a change in a natural system triggers further warming. Last year, a study documented ten tipping points and noted that these can act like a row of dominoes, one pushing another system over. Once started, these tipping points are nearly impossible to stop and risk what researchers called a "Hothouse Earth" state - in which the global average temperature is 4 to 5 degrees Celsius higher, with regions like the Arctic averaging 10 degrees C higher than today.

The Arctic is warming at least twice as fast as the global average. Sea ice has been in decline since the 1990s, exposing a million square miles of ocean. As more solar energy is absorbed it creates what's called the surface albedo feedback...

The $25 to $70 trillion cost of Arctic warming adds four to six percent to the total cost of climate change - which is estimated to reach $1,390 trillion by the year 2300 if emissions cuts are not better than the Paris Agreement. However, the costs of the current business-as-usual path could be more than $2,000 trillion.

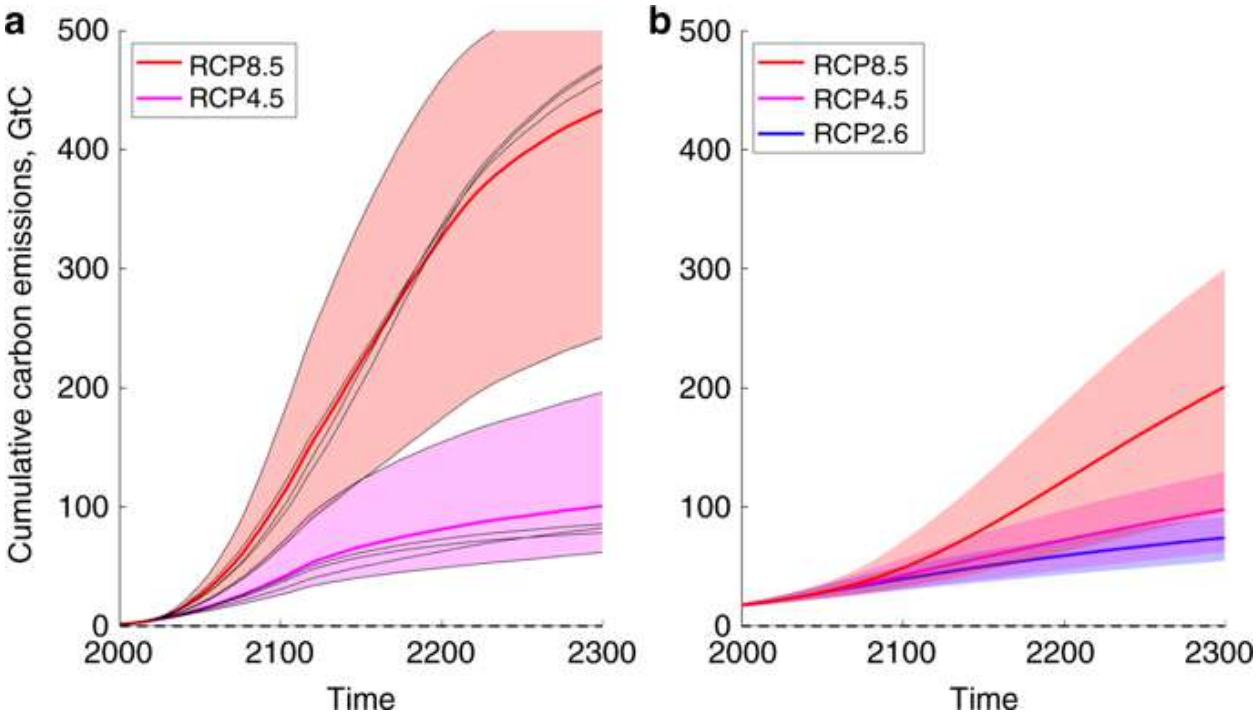

Figure 6.11: **Cumulative carbon emissions in gigatons under various scenarios.**

Global carbon debt increasing by $16 trillion annually

Another estimate of the cost of climate inaction has been made by Dr. Gideon Polya in an article entitled "Inescapable $200-250 Trillion Global Carbon Debt Increasing by $16 Trillion Annually"[5]. Here are some quatationa from the article:

Carbon Debt is simply the damage-related cost of greenhouse gas (GHG) pollution that if not addressed now will inescapably have to be paid by future generations. However GHG emissions continue to rise inexorably and there is no global program to draw down CO2 and other GHGs from the atmosphere. While young people are now vociferously demanding massive climate action, inescapable global Carbon Debt is $200-$250 trillion and increasing by $16 trillion each year.

Unlike Conventional Debt that can be variously expunged by bankruptcy, printing money or default, Carbon Debt is inescapable - thus, for example, national commitments to GHG pollution reduction made to the 2015 Paris Climate Conference amount to a temperature rise of over 3 degrees Centigrade (3C) , and unless huge sea walls are built Netherlands-style , coastal cities of the world housing hundreds of millions of people will be submerged by rising

[5]https://countercurrents.org/2019/04/27/inescapable-200-250-trillion-global-carbon-debt-increasing-by-16-trillion-annually-gideon-polya/

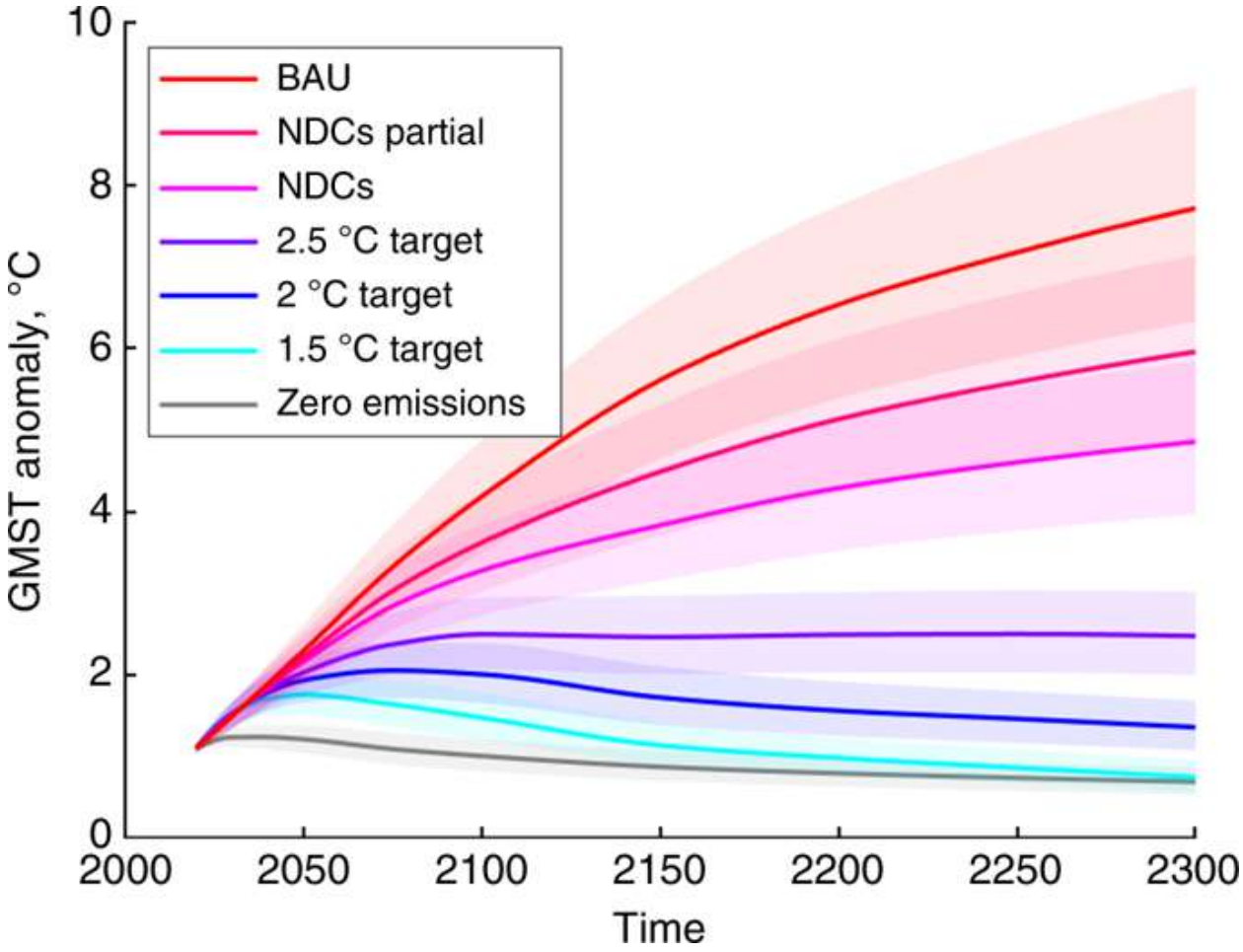

Figure 6.12: **Global mean temperature simulations under the range of climate scenarios considered.**

sea levels (notably in Asia), mega-delta agricultural lands vital for feeding Humanity will be subject to inundation and salinization, and low-lying Island States will cease to exist

While outright, anti-science climate change denialism is politically entrenched in climate criminal Trump America and its climate criminal lackey Australia, most governments around the world are politically committed to effective climate change denialism through climate change inaction. That climate change inaction is most clearly quantitated in terms of Carbon Debt, but the very term has been white-washed out of public perception by US owned or subverted Mainstream media. Thus the Australian ABC (the taxpayer-funded Australian equivalent of the UK BBC) is self-assertedly "progressive" but a Search of the ABC for the term "Climate Debt" reveals zero (0) reportage. A Search of the self-assertedly "ethical" UK BBC for the term "Climate Debt" yields 9 items with none later than 2009, defining the term or quantifying global or national Carbon Debt.

Explanations for this extraordinary mainstream media lying by omission over Carbon Debt can be variously advanced, ranging from entrenched mendacity by US- and corporate- subverted media to cognitive dissonance in the face of a worsening climate emergency. However I am confident in predicting that if governments do not take action on the world's massive Carbon Debt then intergenerational justice action by the utterly betrayed and robbed young people of the world will make the present Extinction Rebellion climate demonstrations in London look like a proverbial Teddy Bear's Picnic. A young people-led Climate Revolution (non-violent one hopes) is coming...

Up to one million species face extinction

According to a recent United Nations report[6]

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report warns of "an imminent rapid acceleration in the global rate of species extinction."

The pace of loss "is already tens to hundreds of times higher than it has been, on average, over the last 10 million years," it notes.

"Half-a-million to a million species are projected to be threatened with extinction, many within decades."

6.4 Social systems in Scandinavia

The Green New Deal can simultaneously address the climate crisis and the problem of excessive economic inequality. In this context, it is interesting to look at the social and

[6]https://news.yahoo.com/one-million-species-risk-extinction-due-humans-draft-131407174.html

economic systems of the Scandinavian countries, Norway, Sweden, Finland, Denmark and Iceland. In these countries the contrast between the rich and poor has been very much reduced. It is almost true to say that poverty has been eliminated in these countries. At the same time, the Scandinavians have strong policies to address the climate emergency. Thus Scandinavian successes are a counter-argument to those who say that the Green New Deal cannot be put into practice.[7]

The Danish system today

In 2017. Denmark ranked 2nd in the world (after Norway) in the World Happiness Report. In a number of other years, Denmark has ranked 1st. In compiling the report, researchers ask people in a given country whether they are happy, and record how many say "yes". Interestingly, in Denmark, women are the most happy of all. It is therefore relevant to look at the Danish social and political system of today, and to examine the reasons why women are so satisfied with it.

Denmark has very high taxes, but in return for these, its citizens receive many social services, such as free health care. If they qualify for university education, the tuition is free, and students are given an allowance for their living expenses. Mothers or alternatively fathers, can take paid leave of up to 52 weeks after the birth of a child. After that, a *vuggestue* (cresch) is always available, so that mothers can return to their jobs. When the child become too old for the cresch, day care centers are always available. For children of school age, after-school clubs are available where children can practice arts and crafts or other activities under supervision until their parents come home from work.

It is illegal in Denmark to fire a woman because she has become pregnant, or to deny her work because the employer fears that she may become pregnant. Thus, Danish women grow up expecting to find jobs outside the home. Danish women are happy to have careers, but it is also a necessity, because with taxes so high that a single income is not enough to give a family the desired standard of living. Husbands are grateful to their wives for helping to support the family. In the case of single mothers, support is given by the state.

The number of births per woman-life reached a low of 1.38 in 1983, but since that time the number has gradually risen gradually and in 2017 the fertility rate was 1.77, still less than the replacement level. The other Scandinavian countries have very similar systems, and they all have high human development indices, as well as a high degree of economic equality. When US Senator Bernie Sanders declared that he is a socialist, he made the statement more precise by saying that he is in favor of the Scandinavian social and political system.

Renewable energy in Denmark

Here are some excerpts from a recent report by the Danish Ministry of Energy, Utilities and Climate:[8]

[7] But, of course, it cannot be put into practice while maintaining an economic oligarchy.

[8] Denmark: Energy and climate pioneer. Status of the green transition

Denmark's success in transforming into a sustainable, green society is widely recognized. Denmark is at the forefront of numerous international initiatives and collaborative endeavors. In 2017, for the second consecutive year in a row, Denmark won the World Energy Council award for the world's best energy system.

Denmark's energy and climate policy was also high lighted in 2017 by the International Energy Agency (IEA), as an international model because the country produces wind turbines, provides record low energy prices and good electricity connections to neighboring countries.

In 2017, Denmark achieved a world record of 43.4% power produced solely by wind turbines.

Denmark can cover the largest share of its electricity production with green power from wind turbines.

Denmark is also a European leader in the export of energy technology, as exports of energy equipment account for a larger share of total exports than in any other EU country.

The government has set ambitious goals that few other countries can match:

- **At least 50% of Denmark's energy needs must be covered by renewable energy by 2030.**
- **Coal must be completely phased out of the power supply by 2030.**
- **Moratorium on all exploration and drilling activities for oil, gas and shale gas on land and inland waters of Denmark.**
- **Denmark must be a low-emission society independent of fossil fuels in 2050.**

Birgitta Jonsdottir (born 1967)

The Icelandic parliamentarian, Birgitta Jonsdottir, has taken an important step towards solving one of the central problems that the world is facing today. The problem is this: How can we regain democratic government when the mainstream media are completely controlled the corporate oligarchy?

If anyone doubts that democratic government has been lost and needs to be regained, let them think of the recent US election, in which a large percentage of the voters stayed home because they were disillusioned with the political process. They knew that whomever they elected, their voices would not be heard.

The voters did not like to be told that they had power, which in fact they did not have. Both major political parties follow the dictates of the corporate oligarchs, rather than the will of the people. No doubt the Democrats in the US Congress are slightly better than

Figure 6.13: **The Icelandic poet, writer, artist, publisher, anti-war activist, and parliamentarian Birgitta Jonsdottir.**

the Republicans, but both parties have essentially been bought by big money from lobbies representing the military-industrial complex, the fossil fuel companies, and Israel.

Contrary to the wishes of the people, social services continue to be cut in favor of obscenely bloated military budgets, perpetual foreign wars, and environment-destroying subsidization of the fossil fuel industry. Despite the will of the people, the US government exposes our beautiful earth to the deadly risks of all-destroying thermonuclear war and out-of-control global warming.

The United States is by no means the only country with an oligarchic non-democratic government. Globally, countries with truly democratic and sane governments are the exception rather than the rule. Therefore the problem is a global one, and let us repeat it: How can we regain democratic government when the mainstream media are completely controlled the corporate oligarchy?

Let us return to Birgitta Jonsdottir. Who is she? Birgitta is a popular and successful young Icelandic poet, writer, artist, publisher and anti-war activist, who had no inkling until quite recently that she was destined to become a politician. Then in 2008, Iceland underwent a financial crisis. It became clear that the crisis was due to corrupt links of politicians with Iceland's financial sector. In 2009, Birgitta ran for the Icelandic Parliament (Althingi, the oldest parliament in the world) as part of the reform movement.

Believing that lack of free information was the main cause of the corruption behind Iceland's 2008 crisis, Birgitta Jonsdottir persuaded her colleagues in the Althingi to pass unanimously a law calling for complete freedom of information in Iceland. She also worked closely with Julian Assange to produce the video "Collateral Murder".[9]

[9]https://en.immi.is/media/documentaries-on-immi/
http://birgitta.isÂ
http://en.immi.is

Figure 6.14: **Senator Bernie Sanders, the popular front-running candidate for the US Presidency in 2020, says that he is a socialist. When asked to explain this in detail, Senator Sanders said that he believes that the United States would benefit from a social system similar to the systems in present-day Scandinavia.**

Under Birgitta Jonsdottir's leadership, Icelandic parliamentarians plan to pass laws which will make make Iceland a safe haven for journalistic freedom. In so doing, they will help to re-establish democratic government throughout the world, a vital step if nuclear and climatic disasters are to be averted.

Figure 6.15: **A day-care center in Sweden. In the Scandinavian countries, most women work, and state-provided day-care centers for pre-school children make this possible.**

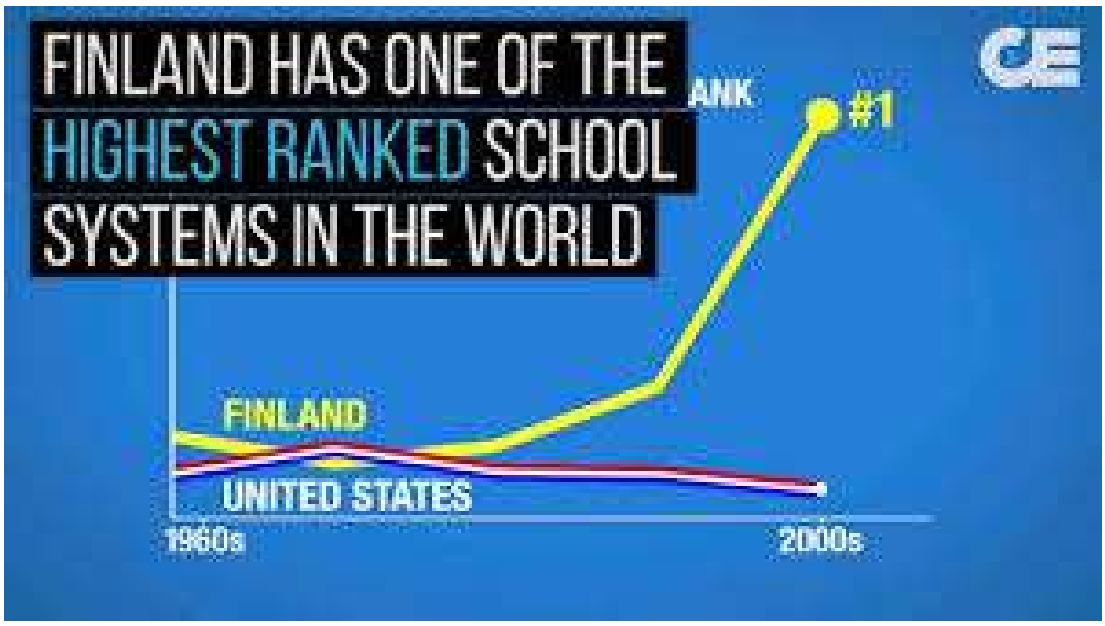

Figure 6.16: **Finland has the best school system in the world. One reason for this is that the teachers are very highly selected and highly paid. Another reason is that the children are given frequent short rest periods, during which they may go outdoors and breath fresh air. They return from these small breaks with improved concentration.**

Figure 6.17: **The long-serving Danish Prime Minister Thorvald Stauning (1873-1942). He was the architect of the Danish social and economic system, which combines a free-market economy with such social benefits as universal free health care, state-provided day-care centers and free higher education. Thanks to Stauning's initiatives, those who qualify for college or university in Denmark are not only given free tuition, but also a stipend to support their living expenses. A high progressive income tax in Denmark pays for these benefits and reduces economic inequality. Stauning forged a coalition that united both labor and employers behind his reforms.**

6.5 Roosevelt saves his nation and the world

Born into a very wealthy Dutch-American family Franklin Delano Roosevelt (1882-1945) attended Groton School, Harvard College and Clolmbia Law School. After practicing law in New York, he was elected to the NY State Senate. During World War I, he served as Assistant Secretary of the Navy. In 1920 he was the Democratic Party's Candidate for US Vice President, but he and James G. Cox were defeated by Warren Harding's ticket.

In 1921, FDR contracted polio and lost the use of his legs. His mother urged him to leave politics and return to the family estate at Hyde Park, but he vigorously resisted this suggestion and struggled to continue despite his handicap. In 1928, Roosevelt was elected Governor of New York. As Governor, he instituted many reforms to combat the economic problems that had followed the 1929 Black Friday stock market crash.

After winning a second term as Governor of New York State in 1930, FDR became the front-running candidate for the US Presidency in i932. In accepting the Democratic Party nomination at the Chicago convention, he said: "I pledge you, I pledge myself to a new deal for the American people... This is more than a political campaign. It is a call to arms."

Here are some excerpts from FDR's First Inaugural Address, Saturday, March 4th, 1933:

I am certain that my fellow Americans expect that on my induction into the Presidency I will address them with a candor and a decision which the present situation of our Nation impels. This is preeminently the time to speak the truth, the whole truth, frankly and boldly. Nor need we shrink from honestly facing conditions in our country today. This great Nation will endure as it has endured, will revive and will prosper. So, first of all, let me assert my firm belief that the only thing we have to fear is fear itself - nameless, unreasoning, unjustified terror which paralyzes needed efforts to convert retreat into advance. In every dark hour of our national life a leadership of frankness and vigor has met with that understanding and support of the people themselves which is essential to victory. I am convinced that you will again give that support to leadership in these critical days.

In such a spirit on my part and on yours we face our common difficulties. They concern, thank God, only material things. Values have shrunken to fantastic levels; taxes have risen; our ability to pay has fallen; government of all kinds is faced by serious curtailment of income; the means of exchange are frozen in the currents of trade; the withered leaves of industrial enterprise lie on every side; farmers find no markets for their produce; the savings of many years in thousands of families are gone.

More important, a host of unemployed citizens face the grim problem of existence, and an equally great number toil with little return. Only a foolish optimist can deny the dark realities of the moment. ..

Recognition of the falsity of material wealth as the standard of success goes

hand in hand with the abandonment of the false belief that public office and high political position are to be valued only by the standards of pride of place and personal profit; and there must be an end to a conduct in banking and in business which too often has given to a sacred trust the likeness of callous and selfish wrongdoing. Small wonder that confidence languishes, for it thrives only on honesty, on honor, on the sacredness of obligations, on faithful protection, on unselfish performance; without them it cannot live.

Restoration calls, however, not for changes in ethics alone. This Nation asks for action, and action now.

Our greatest primary task is to put people to work. This is no unsolvable problem if we face it wisely and courageously. It can be accomplished in part by direct recruiting by the Government itself, treating the task as we would treat the emergency of a war, but at the same time, through this employment, accomplishing greatly needed projects to stimulate and reorganize the use of our natural resources.

Hand in hand with this we must frankly recognize the overbalance of population in our industrial centers and, by engaging on a national scale in a redistribution, endeavor to provide a better use of the land for those best fitted for the land. The task can be helped by definite efforts to raise the values of agricultural products and with this the power to purchase the output of our cities. It can be helped by preventing realistically the tragedy of the growing loss through foreclosure of our small homes and our farms. It can be helped by insistence that the Federal, State, and local governments act forthwith on the demand that their cost be drastically reduced. It can be helped by the unifying of relief activities which today are often scattered, uneconomical, and unequal. It can be helped by national planning for and supervision of all forms of transportation and of communications and other utilities which have a definitely public character. There are many ways in which it can be helped, but it can never be helped merely by talking about it. We must act and act quickly.

Roosevelt's New Deal programs aimed at "the three R's": **relief** of the poor, **reform** of financial institutions, and **recovery** of confidence. New Deal programs aimed at employing people on infrastructure projects that included the following:

- The Civilian Concervation Corps
- The Civil Works Administration
- The Farm Security Administration
- The National Industrial Recovery Act of 1933
- The Social Security Administration
- The Works Progress Administration of 1937 (WPA)

Wikipedia states that **"The WPA financed a variety of projects such as hospitals, schools and roads, and employed more than 8.5 million workers who built 650,000 miles of highways and roads, 125,000 public buildings as well as bridges, reservoirs, irrigation systems, parks, playgrounds and so on."**

Figure 6.18: **Franklin Delano Roosevelt (FDR) in 1933. Wikipedia says of him: "Roosevelt is widely considered to be one of the most important figures in American history, as well as among the most influential figures of the 20th century. Though he has been subject to substantial criticism, he is generally rated by scholars as one of the three greatest U.S. presidents, along with George Washington and Abraham Lincoln."**

Figure 6.19: **Eleanor and Franklin with two of their children in 1908. Eleanor was called Roosevelt even before her marriage. She was the niece of US President Theodore Roosevelt, a distant cousin of Franklin. She is remembered as an outstanding advocate of racial equality, journalistic freedom and human rights.**

Figure 6.20: **A photograph of FDR with his dog Fala and Ruthie Bie, the daughter of caretakers at his Hyde Park estate. Roosevelt was careful never to be seen using his wheelchair in public. Although disabled, he managed to give a public impression of buoyant energy and confidence. One of his slogans, which he used to end the depression, was "The only thing that we have to fear is fear itself!"**

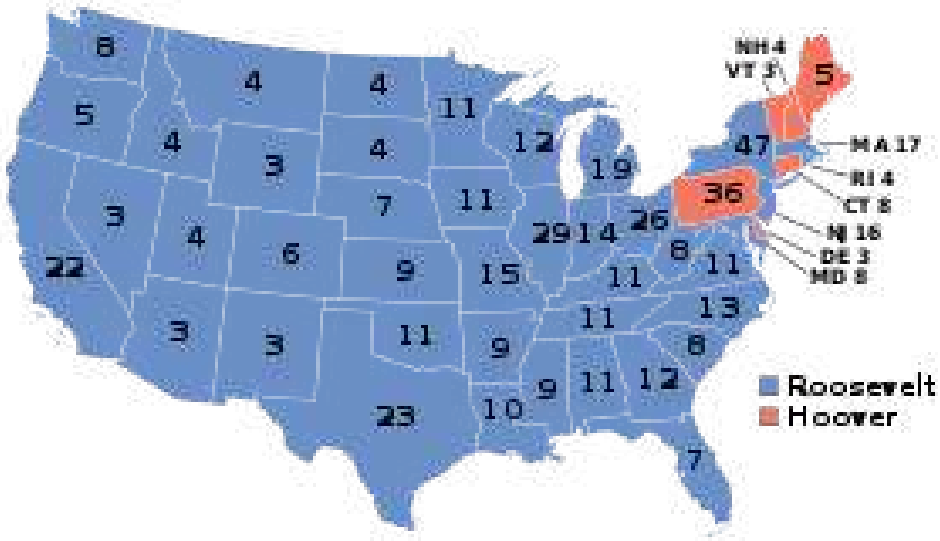

Figure 6.21: **The 1932 electoral vote. Roosevelt also won landslide victorys in 1936, 1940 and 1944. FDR died in office, shortly before the end of World War II. His administration's support for England during the the dark hours of the Battle of Britain had prevented Hitler's forces from invading the UK. In 1945, Eleanor Roosevelt helped to carry through FDR's plans for setting up the United Nations, and she was one of the two main drafters of the Universal Declaration of Human Rights.**

Figure 6.22: **A photo of Eleanor Roosevelt with Charles Malik and their grandchildren. Malik and Eleanor Roosevelt worked together to draft the Universal Declaration of Human Rights.**

Roosevelt's New Deal serves a model for a Green New Deal that can save human civilization and the biosphere from catastrophic climate change, an emergency even more severe than those faced by Roosevelt. We can afford the Green New Deal. What we cannot afford is inaction.

Suggestions for further reading

1. Josh Holder, Niko Commenda and Jonathan Watts, *The three-degree world: the cities that will be drowned by global warming*, Guardian, 3 November (2017).
2. Pacific Islands Development Forum, *Suva Declaration on Climate Change*, 4 September (2015).
3. Credit Suisse, *Global Wealth Report 2018*
4. Oxfam, *Richest 1 percent bagged 82 percent of wealth created last year - poorest half of humanity got nothing* , 22 January (2018)
5. James Hansen, *Climate change in a nutshell: the gathering storm*, Columbia University, 18 December (2018).
6. Output of the technical working group meeting, The Royal Society, London, 6th July, 2009, *The Coral Reef Crisis: scientific justification for critical CO2 threshold levels of less than 350ppm*
7. P. Dasgupta, *Population, Resources and Poverty*, Ambio, **21**, 95-101, (1992).
8. L.R. Brown, *Who Will Feed China?*, W.W. Norton, New York, (1995).
9. L.R. Brown, et al., *Saving the Planet. How to Shape and Environmentally Sustainable Global Economy*, W.W. Norton, New York, (1991).
10. L.R. Brown, *Postmodern Malthus: Are There Too Many of Us to Survive?*, The Washington Post, July 18, (1993).
11. L.R. Brown and H. Kane, *Full House. Reassessing the Earth's Population Carrying Capacity*, W.W. Norton, New York, (1991).
12. L.R. Brown, *Seeds of Change*, Praeger Publishers, New York, (1970).
13. L.R. Brown, *The Worldwide Loss of Cropland*, Worldwatch Paper 24, Worldwatch Institute, Washington, D.C., (1978).
14. L.R. Brown, and J.L. Jacobson, *Our Demographically Divided World*, Worldwatch Paper 74, Worldwatch Institute, Washington D.C., (1986).
15. L.R. Brown, and J.L. Jacobson, *The Future of Urbanization: Facing the Ecological and Economic Constraints*, Worldwatch Paper 77, Worldwatch Institute, Washington D.C., (1987).
16. L.R. Brown, and others, *State of the World*, W.W. Norton, New York, (published annually).
17. H. Brown, *The Human Future Revisited. The World Predicament and Possible Solutions*, W.W. Norton, New York, (1978).
18. H. Hanson, N.E. Borlaug and N.E. Anderson, *Wheat in the Third World*, Westview Press, Boulder, Colorado, (1982).
19. A. Dil, ed., *Norman Borlaug and World Hunger*, Bookservice International, San Diego/Islamabad/Lahore, (1997).

20. N.E. Borlaug, *The Green Revolution Revisitied and the Road Ahead*, Norwegian Nobel Institute, Oslo, Norway, (2000).
21. N.E. Borlaug, *Ending World Hunger. The Promise of Biotechnology and the Threat of Antiscience Zealotry*, Plant Physiology, **124**, 487-490, (2000).
22. M. Giampietro and D. Pimental, *The Tightening Conflict: Population, Energy Use and the Ecology of Agriculture*, in **Negative Population Forum**, L. Grant ed., Negative Population Growth, Inc., Teaneck, N.J., (1993).
23. H.W. Kendall and D. Pimental, *Constraints on the Expansion of the Global Food Supply*, Ambio, **23**, 198-2005, (1994).
24. D. Pimental et al., *Natural Resources and Optimum Human Population*, Population and Environment, **15**, 347-369, (1994).
25. D. Pimental et al., *Environmental and Economic Costs of Soil Erosion and Conservation Benefits*, Science, **267**, 1117-1123, (1995).
26. D. Pimental et al., *Natural Resources and Optimum Human Population*, Population and Environment, **15**, 347-369, (1994).
27. D. Pimental and M. Pimental, *Food Energy and Society*, University Press of Colorado, Niwot, Colorado, (1996).
28. D. Pimental et al., *Environmental and Economic Costs of Soil Erosion and Conservation Benefits*, Science, **267**, 1117-1123, (1995).
29. RS and NAS, *The Royal Society and the National Academy of Sciences on Population Growth and Sustainability*, Population and Development Review, **18**, 375-378, (1992).
30. A.M. Altieri, *Agroecology: The Science of Sustainable Agriculture*, Westview Press, Boulder, Colorado, (1995).
31. G. Conway, *The Doubly Green Revolution*, Cornell University Press, (1997).
32. J. Dreze and A. Sen, *Hunger and Public Action*, Oxford University Press, (1991).
33. G. Bridger, and M. de Soissons, *Famine in Retreat?*, Dent, London, (1970).
34. W. Brandt, *World Armament and World Hunger: A Call for Action*, Victor Gollanz Ltd., London, (1982).
35. A.K.M.A. Chowdhury and L.C. Chen, *The Dynamics of Contemporary Famine*, Ford Foundation, Dacca, Pakistan, (1977)
36. J. Shepard, *The Politics of Starvation*, Carnegie Endowment for International Peace, Washington D.C., (1975).
37. M.E. Clark, *Ariadne's Thread: The Search for New Modes of Thinking*, St. Martin's Press, New York, (1989).
38. J.-C. Chesnais, *The Demographic Transition*, Oxford, (1992).
39. C.M. Cipola, *The Economic History of World Population*, Penguin Books Ltd., (1974).
40. E. Draper, *Birth Control in the Modern World*, Penguin Books, Ltd., (1972).
41. Draper Fund Report No. 15, *Towards Smaller Families: The Crucial Role of the Private Sector*, Population Crisis Committee, 1120 Nineteenth Street, N.W., Washington D.C. 20036, (1986).
42. E. Eckholm, *Losing Ground: Environmental Stress and World Food Prospects*, W.W. Norton, New York, (1975).

43. E. Havemann, *Birth Control*, Time-Life Books, (1967).
44. J. Jacobsen, *Promoting Population Stabilization: Incentives for Small Families*, Worldwatch Paper 54, Worldwatch Institute, Washington D.C., (1983).
45. N. Keyfitz, *Applied Mathematical Demography*, Wiley, New York, (1977).
46. W. Latz (ed.), *Future Demographic Trends*, Academic Press, New York, (1979).
47. World Bank, *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*, Washington D.C., (1986).
48. J.E. Cohen, *How Many People Can the Earth Support?*, W.W. Norton, New York, (1995).
49. J. Amos, *Climate Food Crisis to Deepen*, BBC News (5 September, 2005).
50. J. Vidal and T. Ratford, *One in Six Countries Facing Food Shortage*, The Guardian, (30 June, 2005).
51. J. Mann, *Biting the Environment that Feeds Us*, The Washington Post, July 29, 1994.
52. G.R. Lucas, Jr., and T.W. Ogletree, (editors), *Lifeboat Ethics. The Moral Dilemmas of World Hunger*, Harper and Row, New York.
53. J.L. Jacobson, *Gender Bias: Roadblock to Sustainable Development*, Worldwatch Paper 110, Worldwatch Institute, Washington D.C., (1992).
54. J. Gever, R. Kaufmann, D. Skole and C. Vorosmarty, *Beyond Oil: The Threat to Food and Fuel in the Coming Decades*, Ballinger, Cambridge MA, (1986).
55. M. ul Haq, *The Poverty Curtain: Choices for the Third World*, Columbia University Pres, New York, (1976).
56. H. Le Bras, *La Planète au Village*, Datar, Paris, (1993).
57. E. Mayr, *Population, Species and Evolution*, Harvard University Press, Cambridge, (1970).
58. Patz, J. A., Campbell-Lendrum, D., Holloway, T. and Foley, J. A. *Impact of regional climate change on human health.* Nature **438**, 310-317 (2005).
59. Basu, R. and Samet, J. M. *Relation between elevated ambient temperature and mortality: a review of the epidemiologic evidence.* Epidemiol. Rev. **24**, 190-202 (2002).
60. Kovats, R. S. and Hajat, S. *Heat stress and public health: a critical review.* Annu. Rev. Publ. Health **29**, 41-55 (2008).
61. Leon, L. R. *Pathophysiology of Heat Stroke* **Vol. 7** (Colloquium Series on Integrated Systems Physiology: From Molecule to Function to Disease, Morgan Claypool Life Sciences, 2015).
62. Ostro, B. D., Roth, L. A., Green, R. S. and Basu, R. *Estimating the mortality effect of the July 2006 Californi a heat wave.* Environ. Res. **109**, 614-619 (2009).
63. Glas er, J. et al. *Climate change and the emergent epidemic of CKD from heat stress in rural communities: the case for heat stress nephropathy.* Clin. J. Am. Soc. Nephrol. **11**, 1472-1483 (2016).
64. Robine, J.-M. et al. *Death toll exceeded 70,000 in Europe during the summer of 2003.* C. R. Biol. **331**, 171-178 (2008).
65. Sillmann, J. and Roeckner, E. *Indices for extreme events in proje ctions of anthropogenic climate change.* Climatic Change **86**, 83-104 (2008).

66. Meeh l, G. A. and Teb aldi, C. *More intense, more frequent, and longer lasting heat waves in the 21st century.* Science **305**, 994-997 (2004).
67. Orlowsky, B. and Seneviratne, S. *Global changes in extreme events: regional and seasonal dimension.* Climatic Change **110**, 669-696 (2012).
68. Tebaldi, C., Hayhoe, K., Arblaster, J. M. and Meehl, G. A. *Going to the extremes.* Climatic Change **79**, 185-211 (2006).
69. Tebaldi, C. and Wehner, M. F. *Benefits of mitigation for future heat extremes under RCP4.5 compared to RCP8.5.* Climatic Change http://dx.doi.org/10.1007/s10584-016-1605-5 (2016).
70. Sterl, A. et al. *When can we expect extremely high sur face temperatures?* Geophys. Res. Lett. **35**, L14703 (2008).
71. Huang, C. et al. *Projecting future heat-related mortality under climate change scenarios: a systematic review.* Environ. Health Persp. **119**, 1681-1690 (2011).
72. Guo, Y. et al. *Global variation in the effects of ambient temperature on mortality: a systematic evaluation.* J. Epidemiol. **25**, 781-789 (2014).
73. Luber, G. snd McGeehin, M. *Climate change and extreme heat events.* Am. J. Prev. Med. **35**, 429-435 (2008).-
74. Bouchama, A. and Knochel, J. P. *Heat stroke.* New. Engl. J. Med. **346**, 1978-1988 (2002).
75. Bobb, J. F., Peng, R. D., Bell, M. L. and Dominici, F. *Heat-related mortality and adaptation to heat in the United States.* Environ. Health Persp. **122**, 811-816 (2014).
76. Gasparrini, A. et al. *Temporal vari ation in heat-mortality associations: a multi-country study.* Environ. Health Persp. **123**, 1200-1207 (2015).
77. Lowe, D., Ebi, K. L. and Forsberg, B. *Heatwave early warning systems and adaptation advice to reduce human health consequences of he atwaves.* Int. J. Environ. Res. Public Health **8**, 4623-4648 (2011).
78. Hanna, E. G. and Tait, P. W. *Limitations to thermoregulation and acclimatization challenge human adaptation to global warming.* Int. J. Environ. Res. Publ. Health. **12**, 8034-8074 (2015).
79. Sherwood, S. C. and Huber, M. *An adaptability limit to climate change due to heat stress.* Proc. Natl Acad. Sci. USA **107**, 9552-9555 (201
80. Whitman, S. et al. *Mortality in Chicago attributed to the July 1995 heat wave.* Am. J. Public Health **87**, 1515-1518 (1997).
81. Dousset, B. et al. *Satellite monitoring of summer he at waves in the Paris metropolitan area.* Int. J. Climatol. **31**, 313-323 (2011).
82. Shaposhnikov, D. et al. *Mortality related to air pollution with the Moscow he at wave and wildfire of 2010.* Epidemiology **25**, 359-364 (2014).
83. Barnett, A. G., Tong, S. and Clements, A. *What measure of temperature is the best predic tor of mortality?* Environ. Res. **110**, 604-611 (2010).
84. Willett, K. M. and Sherwood, S. *Exceedance of heat index thresholds for 15 regions under a warming climate using the wet-bulb globe temperature.* Int. J. Climatol. **32**, 161-177 (2012).

85. Argüeso, D., Di Luca, A., Perkins-Kirkpatrick, S. and Evans, J. P. *Seasonal mean temperature changes control future heatwaves*. Geophys. Res. Lett. **43**, 7653-7660 (2016).
86. Jones, B. and O'Neill, B. *Spatially explicit global population scenarios consistent with t he Shared Socioeconomic Pathways*. Environ. Res. Lett. **11**, 084003 (2016).
87. Diffenbaugh, N. S. and Field, C. B. *Changes in ecological ly critical terrestrial climate conditions*. Science **341**, 486-492 (2013).
88. Mitchell, D. et al. *Attributing human mortality during extreme heat waves to anthropogenic climate change*. Environ. Res. Lett. **11**, 074006 (2016).

Chapter 7

MAJOR CRIMES OF DONALD TRUMP

7.1 Impeachment

Impeachment finally under way

The long-delayed impeachment proceedings against Donald Trump are finally starting, but at present the focus is on a relatively minor crime - the Ukraine-Biden scandal. However, Trump has committed (and is still committing) major crimes, and these ought to be in the spotlight. Let us look at a few of them.

Let's look at his major crimes, rather than at minor ones

There is so much wrong with Donald Trump that one hardly knows where to start. He is a bully, braggart, narcicist, racist, mysogenist, habitual liar, and tax evader, in addition to being demonstrably ignorant. He has contempt for both domestic and international law, as well as for the US Constitution. In the words of Michael Moore, he is a "part-time clown and full-time sociopath". However, it is Trump's climate change denial, withdrawal from the Paris agreement, and sponsorship of fossil fuels that pose the greatest threats to the future of humans society and the biosphere. The general support of the Republican Party for the fossil fuel industry is the reason why Prof. Noam Chomsky has called the party "the most dangerous organization in history".

7.2 Donald Trump's climate change denial

Why did Professor Noam Chomsky call the US Republican Party "The most dangerous organization in the history of the world"? In the primary that preceded the 2016 presidential election, every single Republican candidate with a chance of being nominated was a

climate change denier. All received amazingly generous checks from giant fossil fuel organizations. When elected, Donald Trump not only pulled the United States out of the Paris Agreement; he also sabotaged the Environmental Protection Agency to such an extent that the carefully collected facts on climate change that the agency had accumulated had to be secretly saved by scientists to prevent their destruction by the Trump administration. Furthermore, Donald Trump not only subsidizes giant coal corporations. He also has sabotages renewable energy initiatives in the United States.

Here are some quotations from an article by Coral Davenport and Mark Landler, May 27, 2019[1]:

President Trump has rolled back environmental regulations, pulled the United States out of the Paris climate accord, brushed aside dire predictions about the effects of climate change, and turned the term "global warming" into a punch line rather than a prognosis.

Now, after two years spent unraveling the policies of his predecessors, Mr. Trump and his political appointees are launching a new assault.

In the next few months, the White House will complete the rollback of the most significant federal effort to curb greenhouse-gas emissions, initiated during the Obama administration. It will expand its efforts to impose Mr. Trump's hard-line views on other nations, building on his retreat from the Paris accord and his recent refusal to sign a communiqué to protect the rapidly melting Arctic region unless it was stripped of any references to climate change.

And, in what could be Mr. Trump's most consequential action yet, his administration will seek to undermine the very science on which climate change policy rests.

Mr. Trump is less an idealogue than an armchair naysayer about climate change, according to people who know him. He came into office viewing agencies like the Environmental Protection Agency as bastions of what he calls the "deep state," and his contempt for their past work on the issue is an animating factor in trying to force them to abandon key aspects of the methodology they use to try to understand the causes and consequences of a dangerously warming planet.

As a result, parts of the federal government will no longer fulfill what scientists say is one of the most urgent jobs of climate science studies: reporting on the future effects of a rapidly warming planet and presenting a picture of what the earth could look like by the end of the century if the global economy continues to emit heat-trapping carbon dioxide pollution from burning fossil fuels...

The administration's prime target has been the National Climate Assessment, produced by an interagency task force roughly every four years since 2000. Government scientists used computer-generated models in their most

[1]https://www.nytimes.com/2019/05/27/us/politics/trump-climate-science.html

Figure 7.1: **There is so much wrong with Donald Trump that one hardly knows where to start. He is a bully, braggart, narcicist, racist, mysogenist, habitual liar, and tax evader, in addition to being demonstrably ignorant. He has contempt for both domestic and international law, as well as for the US Constitution. In the words of Michael Moore, he is a "part-time clown and full-time sociopath". However, it is Trump's climate change denial, withdrawal from the Paris agreement, and sponsorship of fossil fuels that pose the greatest threats to the future of humans society and the biosphere. The general support of the Republican Party for the fossil fuel industry is the reason why Prof. Noam Chomsky has called the party "the most dangerous organization in history". Burning of coal is responsible for a third of all greenhouse gas emissions.**

recent report to project that if fossil fuel emissions continue unchecked, the earth's atmosphere could warm by as much as eight degrees Fahrenheit by the end of the century. That would lead to drastically higher sea levels, more devastating storms and droughts, crop failures, food losses and severe health consequences.

7.3 Jair Bolsonaro, the Trump of the Tropics

The newly elected President of Brazil, Jair Bolsonaro, has praised Pinochet, expressed support for torturers and called for political opponents to be shot, earning him the label of "the most misogynistic, hateful elected official in the democratic world". Bolsonaro speaks nostalgically about the country's 1964-1985 military dictatorship and has promised to fill his government with current and former military leaders. Here, in his own words, are some of his ideas:

On refugees: "The scum of the earth is showing up in Brazil, as if we didn't have enough problems of our own to sort out." (September 2015)

On gay people: "I would be incapable of loving a homosexual son. I'm not going to be a hypocrite: I'd rather my son died in an accident than showed up with some bloke with a moustache." (June 2011)

On democracy and dictatorship: "You'll never change anything in this country through voting. Nothing. Absolutely nothing. Unfortunately, things will only change when a civil war kicks off and we do the work the [military] regime didn't. Killing some 30,000... Killing them! If a couple of innocents die, that's OK." (May 1999)

On human rights: "I'm in favour of torture." (May 1999)

On women: "I said I wouldn't rape you because you don't deserve it." (December 2014, to politician Maria do Rosário, repeating a comment first made to her in 2003).

Indigenous rights activists fear Bolsonaro's avowed plan to wring riches from the Amazon - whether from expanding agriculture into indigenous lands, building roads and other infrastructure projects, or allowing mining on public lands - will unleash a tide of violence and environmental devastation.

"All indigenous communities are afraid right now," says Felipe Milanez, professor of humanities at the Universidade Federal de Bahia. "There is a risk of brutal, violent attack." Milanez fears that indigenous efforts to patrol and protect their own lands from outsiders, such as the Forest Guardians recently covered in National Geographic magazine, will be banned and persecuted.

Figure 7.2: **Jair Bolsonaro visiting Donald Trump in Washington. Like Trump, he is an utterly despicable person, but (again like Trump) his worst crime is against the future of human civilization and the biosphere. Under Bolsonaro, the vitally important Amazon rainforests are being destroyed, a terrible blow to our efforts to avoid catastrophic ciliate change.**

Figure 7.3: **The indigenous peoples of the Amazon are the guardians of the lungs of Planet Earth. Within hours of taking office on 1 January, 2019, the Trump of the Tropics, aka the new President of Brazil, Jair Bolsonaro, launched an all-out assault against the Amazon rainforest and its indigenous communities, potentially paving the way for large scale deforestation by agricultural, mining and oil companies.**

"His economic project is to destroy the Amazon, to transform the Amazon into commodities for export," Milanez says.

Human rights activists are concerned that a surge in violent land conflicts will accompany an increase in environmentally destructive development in the Amazon. "There is no doubt that devastation will spread in the region," says Diogo Cabral, an attorney with the Sociedade Maranhense de Direitos Humanos. "At the same time, he aims to extinguish policies that protect human rights defenders in Brazil. Under Bolsonaro, human life will have no value."

The indigenous peoples' website Mongabay [2] states that "The potentially resulting wholesale deforestation could be a disaster to indigenous peoples, biodiversity, and even the regional and global climate."

It adds: "Bolsonaro's proposed Amazon policies, if carried out, could ultimately help dash the world's hopes of achieving the global climate goals agreed to in Paris, a failure that could lead to climate chaos."

Leading Brazilian researchers, from the National Institute of Space Research (INPE), have calculated that Bolsonaro's policies could triple deforestation in the Amazon from present levels of 6,900 square kilometers (2,664 square miles) annually, to 25,600 square kilometers (9,884 square miles) per year by 2020.

7.4 The Evangelicals believe that there is no need to act

Here is an excerpt frp, an article by Bernard Daley Zaleha and Andrew Szasz entitled *Why conservative Christians don't believe in climate change*[3]:

American Christians have become increasingly polarized on issues of climate change and environmental regulation. In recent years, mainline Protestant denominations and the Roman Catholic Church have made explicit declarations of support for global climate action. Prominent Southern Baptists and other evangelical Protestants, on the other hand, have issued statements that are strikingly similar to the talking points of secular climate skeptics, and have attempted to stamp out "green" efforts within their own ranks. An analysis of resolutions and campaigns by evangelicals over the past 40 years shows that anti-environmentalism within conservative Christianity stems from fears that "stewardship" of God's creation is drifting toward neo-pagan nature worship, and from apocalyptic beliefs about "end times" that make it pointless to worry about global warming. As the climate crisis deepens, the moral authority of Christian leaders and organizations may play a decisive role in swaying public

[2] https://news.mongabay.com/2019/01/bolsonaro-hands-over-indigenous-land-demarcation-to-agriculture-ministry/?fbclid=IwAR3UG-jneDheuddVEWVcCrcWKk4bnnsdE1uIBMLlnLtS6zGqMmGSPxtgEzM

[3] Bulletin of the Atomic Scientists 2015, Vol. 71(5) 19-30

policy toward (or away from) action to mitigate global warming.

The highly dangerous beliefs of the Evangelicals are in strong contrast to the courageous and enlightened leadership of Pope Francis, who urges us to act resolutely to prevent catastrophic climate change.

There is so much wrong with Donald Trump that one hardly knows where to start. He is a bully, braggart, narcissist, racist, mysogenist, habitual liar, and tax evader, in addition to being demonstrably ignorant. He has contempt for both domestic and international law, as well as for the US Constitution. In the words of Michael Moore, he is a "part-time clown and full-time sociopath". However, it is Trump's climate change denial, withdrawal from the Paris agreement, and sponsorship of fossil fuels that pose the greatest threats to the future of humans society and the biosphere. The general support of the Republican Party for the fossil fuel industry is the reason why Prof. Noam Chomsky has called the party "the most dangerous organization in history". In the remainder of this chapter, some of Trump's other crimes are described.

7.5 Children in cages

Here are some excerpts from the written testimony of Clara Long, Deputy Washington Director (Acting) Senior Researcher, US Program Human Rights Watch. The testimony was submitted to the U.S. House Committee on Oversight and Reform for a hearing on July 19, 2019:

Our in-depth interviews with children revealed that the US Border Patrol is holding many children, including some who are much too young to take care of themselves, in jail-like border facilities for weeks at a time without contact with family members, or regular access to showers, clean clothes, toothbrushes, or proper beds. Many were sick. Many, including children as young as 2 or 3, were separated from adult caretakers without any provisions for their care besides that provided by unrelated older children also being held in detention...

A 7-year-old girl I attempted to interview entered the room silently but burst into tears when we asked whom she traveled with to the US. "My aunt," she said, with a keening cry. She was so upset we decided not to attempt to interview her, a situation that happened several times during our visit. A bracelet on her wrist had the words "US parent" and a phone number written in permanent marker. We called the number on the spot and found out that no one had informed her desperate parents where she was being held. Some of the most emotional moments of our visit came witnessing children speak for the first time with their parents on an attorney's phone.

Trump's treatment of young children is a crime. It is a crime against human rights.

7.6 Threats of war

Donald Trump has frequently threatened foreign countries with war, even nuclear war. For example, regarding the conflict with North Korea, Trump said "Rocket man is on a suicide mission for himself and his regime. If [the US] is forced to defend itself or its allies, we will have no choice but to totally destroy North Korea". Trump has also threatened Iran with war. Such threats are a crime under both the Nuremberg Principles and the United Nations Charter.

7.7 Alt-right

The Associated Press gives the following definition of the alt-right movement:

"The 'alt-right' or 'alternative right' is a name currently embraced by some white supremacists and white nationalists to refer to themselves and their ideology, which emphasizes preserving and protecting the white race in the United States in addition to, or over, other traditional conservative positions such as limited government, low taxes and strict law-and-order. The movement has been described as a mix of racism, white nationalism and populism ... criticizes 'multiculturalism' and more rights for non-whites, women, Jews, Muslims, gays, immigrants and other minorities. Its members reject the American democratic ideal that all should have equality under the law regardless of creed, gender, ethnic origin or race."

Wikipedia states that "The alt-right, an abbreviation of alternative right, is a loosely connected far-right, white supremacist, white nationalist, white separatist, anti-immigration and sometimes antisemitic movement based in the United States. A largely online phenomenon, the alt-right originated in the U.S. during the 2010s although it has since established a presence in various other countries. The term is ill-defined, having been used in different ways by various self-described 'alt-rightists', media commentators, and academics.

"In 2010, the American white nationalist Richard B. Spencer launched The Alternative Right webzine to disseminate his ideas. Spencer's 'alternative right' was influenced by earlier forms of American white nationalism, as well as paleoconservatism, the Dark Enlightenment, and the Nouvelle Droite. Critics charged it with being a rebranding of white supremacism. His term was shortened to "alt-right" and popularised by far-right participants of /pol/, the politics board of web forum 4chan. It came to be associated with other white nationalist websites and groups, including Andrew Anglin's Daily Stormer, Brad Griffin's Occidental Dissent, and Matthew Heimbach's Traditionalist Worker Party...

"The alt-right is a white nationalist, biologically racist movement. Part of its membership supports anti-immigrationist policies to ensure a continued white majority in the United States. Others call for the breakup of the country to form a white separatist ethno-state in North America. Some alt-rightists seek to make white nationalism socially respectable in the U.S., while others - known as the '1488' scene - adopt openly white supremacist and neo-Nazi stances. Some alt-rightists are anti-semitic, promoting a con-

Figure 7.4: **Prominent alt-rightists were instrumental in organizing the "Unite the Right" rally in Charlottesville, Virginia in August 2017. Here, rally participants carry Confederate battle flags, Gadsden flags and a Nazi flag.**

spiracy theory that there is a Jewish plot to bring about white genocide; other alt-rightists view most Jews as members of the white race. The alt-right is anti-feminist, advocates for a more patriarchal society, and intersects with the men's rights movement and other sectors of the online manosphere...

"Membership was overwhelmingly white and male, with academic and anti-fascist observers linking its growth to deteriorating living standards and prospects, anxieties about the place of white masculinity, and anger at increasingly visible left-wing forms of identity politics like the Black Lives Matter movement. Constituent groups using the "alt-right" label have been characterized as hate groups,[2][3] while alt-right material has been a contributing factor in the radicalization of young white men responsible for a range of far-right murders and terrorist attacks in the U.S. since 2014."

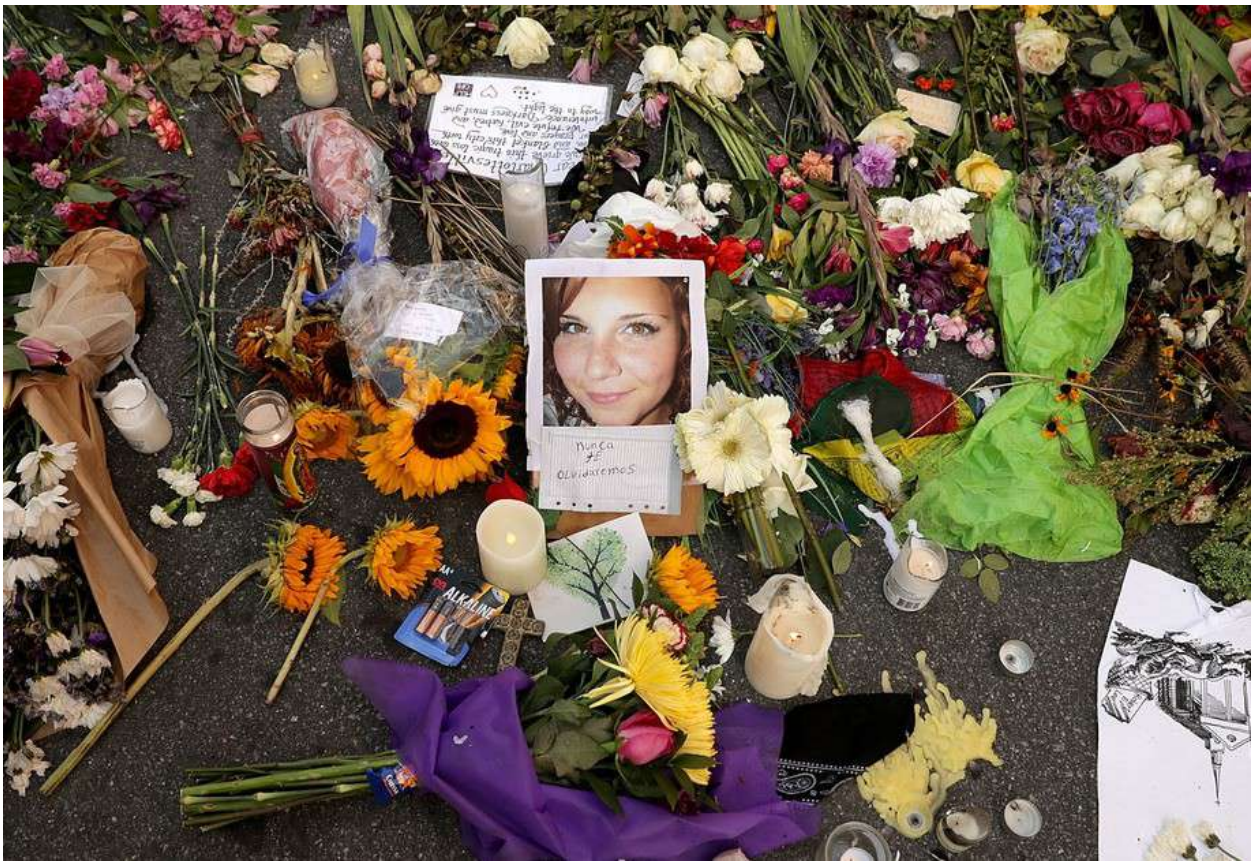

Figure 7.5: **Heather Heyer was murdered in 2017 by a white nationalist rally participant in Charlottesville. Since then, mass shootings in Poway, Gilroy, and El Paso and elsewhere have been each linked to white nationalist beliefs.**

Figure 7.6: **Breitbart News amplified and popularised alt-right ideas under the editorship of "alt-lite" figure Steve Bannon.**

Figure 7.7: **The alt-right largely rallied behind the presidential candidacy of Donald Trump, although he later distanced himself from the movement.**

Figure 7.8: **A participant at the Unite the Right rally giving a Nazi salute in front of counter-protesters.**

Figure 7.9: **The alt-rightist was then punched in an altercation with counter-protesters.**

Figure 7.10: **Protestors at the 2017 Unite the Right rally, which was promoted by the alt-right. One man carries the logo of Vanguard America, and another has a t-shirt praising German Nazi leader Adolf Hitler.**

Figure 7.11: **An attendee at the Unite the Right rally carrying a firearm and wearing a Confederate Battle Flag T-shirt.**

Figure 7.12: **"Trump is Alt-Right with Us." Anti-Trump protesters highlight what they regard as his links to the alt-right and to historical fascism by dressing as Hitler and Mussolini.**

7.8 Proud Boys

Wikipedia states that "The Proud Boys is a far-right neo-fascist organization which admits only men as members and promotes political violence. It is based in the United States and has a presence in Canada, Australia, and the United Kingdom. The group was started in 2016 by Vice Media co-founder and former commentator Gavin McInnes, taking its name from the song 'Proud of Your Boy' from the Disney film Aladdin. Proud Boys emerged as part of the alt-right, but in early 2017, McInnes began distancing himself from the alt-right, saying the alt-right's focus is race while his focus is what he defines as 'Western values'. This re-branding effort intensified after the Unite the Right Rally [4].

"The group sees men - especially white men - and Western culture as under siege; their views have elements of white genocide conspiracy theory. While the group claims it does not support white supremacist views, its members often participate in racist rallies, events, and organizations. The organization glorifies violence, and members engage in violence at events it attends; the Southern Poverty Law Center (SPLC) has called it an 'alt-right fight club'.

"The organization has been described as a hate group by the Southern Poverty Law Center and NPR's The Takeaway, and Spencer, McInnes, and the Proud Boys have been described as hipster racists by Vox and Media Matters for America. McInnes says victim mentality of women and other historically oppressed groups is unhealthy: 'There is an incentive to be a victim. It is cool to be a victim.' He sees white men and Western culture as 'under siege' and described criticism of his ideas as "victim blaming". Their views have elements of white genocide conspiracy theory. The group is part of the 'alt lite' and it is 'overtly Islamophobic'...

"The organization glorifies political violence against leftists, re-enacting political assassinations, wearing shirts that praise Augusto Pinochet's murders of leftists, and participating directly in political violence. McInnes has said 'I want violence, I want punching in the face. I'm disappointed in Trump supporters for not punching enough.' He stated, 'We don't start fights [...] but we will finish them.' Heidi Beirich, the Intelligence Project director for the Southern Poverty Law Center, said that this form of intentional aggression was not common among far-right groups in the past; she said: ' We're going to show up and we're intending to get in fights, that's a new thing.' In August 2018, Twitter shut down the official account for the group, as well as McInnes' account, under its policy prohibiting violent extremist groups; at the time, the group's profile photo was a member punching a counter-protester.

[4] Wikipedia describes this event as follows: "The Unite the Right rally was a white supremacist rally that occurred in Charlottesville, Virginia, from August 11 to 12, 2017. Protesters were members of the far-right and included self-identified members of the alt-right, neo-Confederates, neo-fascists,[13] white nationalists, neo-Nazis, Klansmen, and various right-wing militias. The marchers chanted racist and antisemitic slogans, carried semi-automatic rifles, Nazi and neo-Nazi symbols (such as the swastika, Odal rune, Black Sun, and Iron Cross), the Valknut, Confederate battle flags, Deus Vult crosses, flags and other symbols of various past and present anti-Muslim and antisemitic groups."

Figure 7.13: **Proud Boys founder Gavin McInnes.**

Figure 7.14: **A member of Proud Boys.**

7.9 Evangelicals

Here is an excerpt from a December 31, 2018 article in the New York Times by Katherine Stewart:

The month before the 2018 midterms, a thousand theaters screened "The Trump Prophecy," a film that tells the story of Mark Taylor, a former firefighter who claims that God told him in 2011 that Donald Trump would be elected president.

At a critical moment in the film, just after the actor representing Mr. Taylor collapses in the flashing light of an epiphany, he picks up a Bible and turns to the 45th chapter of the book of Isaiah, which describes the anointment of King Cyrus by God. In the next scene, we hear Mr. Trump being interviewed on "The 700 Club," a popular Christian television show.

As Lance Wallnau, an evangelical author and speaker who appears in the film, once said, "I believe the 45th president is meant to be an Isaiah 45 Cyrus," who will "restore the crumbling walls that separate us from cultural collapse."

Cyrus, in case you've forgotten, was born in the sixth century B.C.E. and became the first emperor of Persia. Isaiah 45 celebrates Cyrus for freeing a population of Jews who were held captive in Babylon. Cyrus is the model for a nonbeliever appointed by God as a vessel for the purposes of the faithful.

The identification of the 45th president with an ancient Middle Eastern potentate isn't a fringe thing. "The Trump Prophecy" was produced with the help of professors and students at Liberty University, whose president, Jerry Falwell Jr., has been instrumental in rallying evangelical support for Mr. Trump. Jeanine Pirro of Fox News has picked up on the meme, as has Ron Dermer, the Israeli ambassador to the United States, among many others.

As the Trump presidency falls under siege on multiple fronts, it has become increasingly clear that the so-called values voters will be among the last to leave the citadel. A lot of attention has been paid to the supposed paradox of evangelicals backing such an imperfect man, but the real problem is that our idea of Christian nationalism hasn't caught up with the reality. We still buy the line that the hard core of the Christian right is just an interest group working to protect its values. But what we don't get is that Mr. Trump's supposedly anti-Christian attributes and anti-democratic attributes are a vital part of his attraction.

Today's Christian nationalists talk a good game about respecting the Constitution and America's founders, but at bottom they sound as if they prefer autocrats to democrats. In fact, what they really want is a king. 'It is God that raises up a king," according to Paula White, a prosperity gospel preacher who has advised Mr. Trump.

Ralph Drollinger, who has led weekly Bible study groups in the White House attended by Vice President Mike Pence and many other cabinet members, likes the word "king" so much that he frequently turns it into a verb. "Get ready

Figure 7.15: **Apparently insanity rules the United States today. The Evangelical Right believes that Trump was sent by God to be King, despite the fact that, according to Glenn Kessler, author of the Washington Post's Fact Checker column, Trump told an average of 15 lies per day in 2018, bringing the total number of documented lies since he took office in January 2017 to 7,645. But neither Trump's lies, nor his racism and mysogeny, nor his cruel authorization of imprisonment of very young children and even babies, are his worst crimes. His most serious offense is a crime against human civilization and the biosphere: his support for coal, his climate change denial, his sabotaging of renewable energy, and his withdrawal from the Paris agreement. These actions. and support for them by Republicans, caused Noam Chomsky to call the Republican Party "the most dangerous organization in history".**

to king in our future lives," he tells his followers. "Christian believers will - soon, I hope - become the consummate, perfect governing authorities!"

The great thing about kings like Cyrus, as far as today's Christian nationalists are concerned, is that they don't have to follow rules. They are the law. This makes them ideal leaders in paranoid times.

Figure 7.16: **An artist's impression of Trump's National Security Advisor John Bolton.**

Figure 7.17: **Stars and stripes.**

Figure 7.18: **Anti-Mexican language used by Trump is very similar to the language used by the El Paso mass murderer. A recent article *Ex-FBI Official, FBI reluctant to probe white supremacists because Trump considers them his base*, quotes Dave Gomez as saying "There's some reluctance among agents to bring forth an investigation that targets what the president perceives as his base."**

Figure 7.19: **Family members mourning the victims of the El Paso murders.**

Figure 7.20: **A woman lights a candle at a makeshift memorial outside Walmart, near the scene of a mass shooting which left 22 people dead, on August 4, 2019, in El Paso, Texas.**

7.10 The El Paso mass murders

On the morning of August 3, 2019, 21-year-old Patrick Wood Crusius, a Republican follower of Donald Trump, walked into a Walmart in El Paso Texas. carrying an AK-47 automatic weapon. He opened fire on the largely Latino customers, killing 22 people and seriously injuring 24 others. In a manifesto, which he published on the Internet just before the murders, he wrote "In general, I support the Christchurch shooter and his manifesto. This attack is a response to the Hispanic invasion of Texas. They are the instigators, not me. I am simply defending my country from cultural and ethnic replacement brought on by an invasion." The language and ideas used by Crucius are similar to those of Donald Trump, who often speaks of a Mexican invasion.

The following day, there was another mass shooting, this time in Dayton, Ohio. Again an automatic attack rifle was used. Nine people were killed.

Between January and February, 2019, President Donald Trump's Facebook page ran about 2,200 ads referring to immigration as an "invasion".

7.11 Right-wing parties in Europe and elsewhere.

Brexit

Across the developed world, the reaction to threatened migration of refugees from climate change has been less than generous, to say the least. The recent decision of Britain to leave the European Union was motivated largely by the fear of British workers that EU laws would force their country to accept large numbers of refugees.

Swings to the right in Europe

In Germany, Angela Merkel's generous policies towards refugees have cost her votes, while an openly racist party, the Alternative for Germany (AfD) party, has gained in strength. Frauke Petry, 40, the party's leader, has said border guards might need to turn guns on anyone crossing a frontier illegally. The party's policy platform says "Islam does not belong in Germany" and calls for a ban on the construction of mosques.

In September, 2017, eight people from the neo-Nazi Freital Group were put on trial in Dresden for bomb attacks on homes for asylum applicants. Hundreds of similar assaults occur in Germany every year, but they had never before been tried as terrorism in a federal court.

In the German election, which took place on Sunday, October 1, 2017, Angela Merkel won a fourth term as Chancellor, but her party won only 33% of the votes, a percentage much reduced from the 41% won in the election of 2013. Angela Merkel was paying a high price for her refugee-friendly policies.

Meanwhile the far right anti-immigration AfD party made a historic breakthrough, winning 13.5% of the vote, thus becoming the first overtly nationalist party to sit in the

Bundestag in 60 years. The Greens have already complained that "Nazis have returned to parliament". In fact, members of the AfD party have begun to say that Germans should stop being ashamed of their country's Nazi past.

In France, the National Front is a nationalist party that uses populist rhetoric to promote its anti-immigration and anti-European Union positions. The party favors protectionist economic policies and would clamp down on government benefits for immigrants.

Similarly, in the Netherlands, the anti-European Union, anti-Islam Party for Freedom has called for closing all Islamic schools and recording the ethnicity of all Dutch citizens. In early November, the party was leading in polls ahead of next year's parliamentary elections.

Other far-right anti-immigrant parties in Europe include Golden Dawn (Greece), Jobbic (Hungary), Sweden Democrats (Sweden), Freedom Party (Austria), and People's Party - Our Slovakia (Slovakia). All of these parties have gained in strength because of the widespread fear of immigration.

Populism in the United States

The election of Donald Trump, who ran for President in 2016 on an openly racist and anti-immigrant platform, can also be seen as the result of fear of immigration, especially on the part of industrial workers.

7.12 Trump copies Hitler's rhetoric

Book review: *When at Times the Mob Is Swayed*

Below are some quotations from an article by Steven Rosenfeld, published by *Common Dreams* on Friday, August 9, 2019. Rosenfeld's article is a review of a book by Bert Neuborne entitled *When at Times the Mob Is Swayed: A Citizen's Guide to Defending Our Republic.*

Neuborne doesn't make this comparison [between Trump and Hitler] lightly. His 55-year career began by challenging the constitutionality of the Vietnam War in the 1960s. He became the ACLU's national legal director in the 1980s under Ronald Reagan. He was founding legal director of the Brennan Center for Justice at New York University Law School in the 1990s. He has been part of more than 200 Supreme Court cases and Holocaust reparation litigation.

"Why does an ignorant, narcissistic buffoon like Trump trigger such anxiety? Why do so many Americans feel it existentially (not just politically) important to resist our forty-fifth president?" he writes. "Partly it's just aesthetics. Trump is such a coarse and appalling man that it's hard to stomach his presence in Abraham Lincoln's house. But that's not enough to explain the

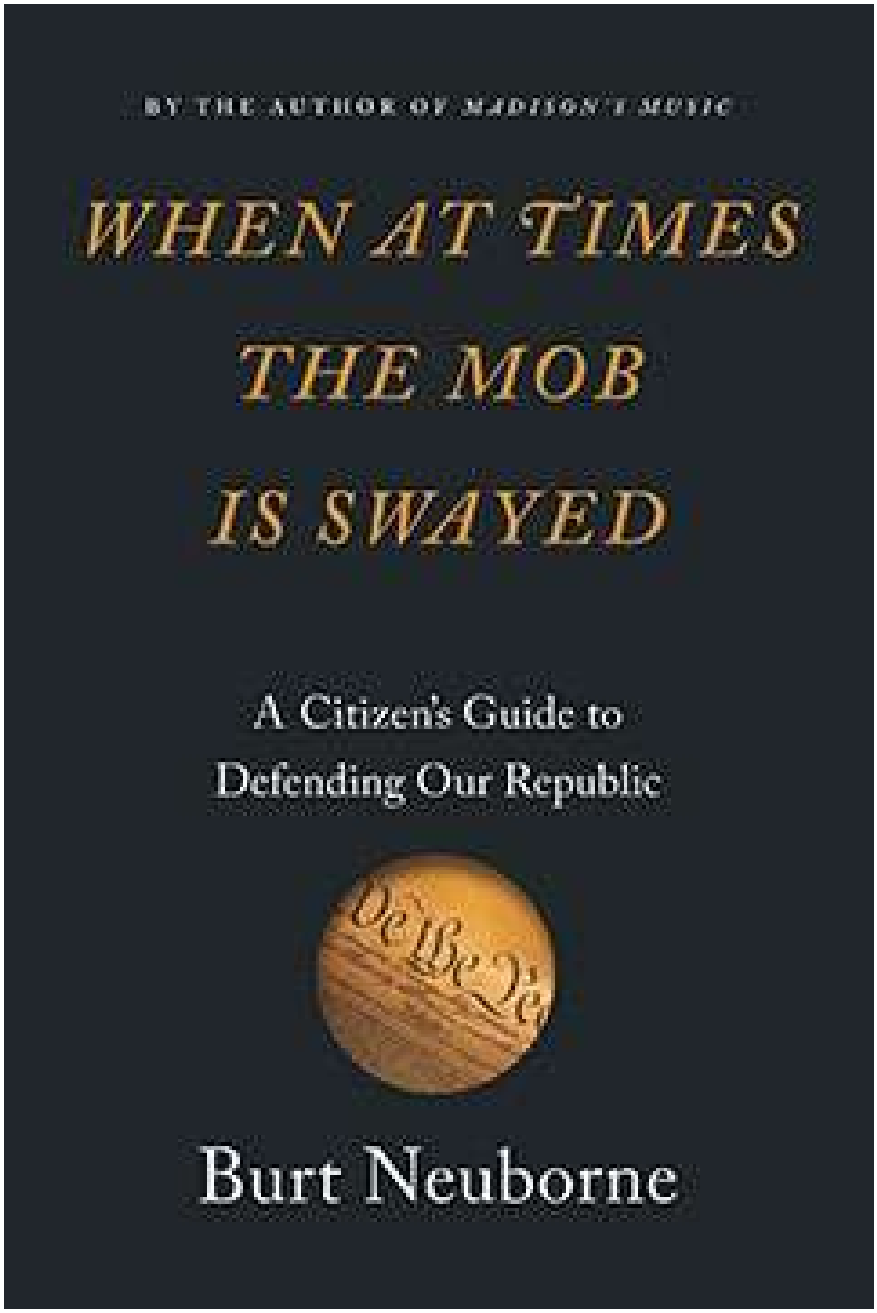

Figure 7.21: **Burt Neuborne's brilliant book on the current crisis of American democracy is a warning that we must take very seriously.**

intensity of my dread. LBJ was coarse. Gerald Ford and George W. Bush were dumb as rocks. Richard Nixon was an anti-Semite. Bill Clinton's mistreatment of women dishonored his office. Ronald Reagan was a dangerous idealogue. I opposed each of them when they appeared to exceed their constitutional powers. But I never felt a sense of existential dread. I never sensed that the very existence of a tolerant democracy was in play."

A younger Trump, according to his first wife's divorce filings, kept and studied a book translating and annotating Adolf Hitler's pre-World War II speeches in a locked bedside cabinet, Neuborne noted. The English edition of My New Order, published in 1941, also had analyses of the speeches' impact on his era's press and politics. "Ugly and appalling as they are, those speeches are masterpieces of demagogic manipulation," Neuborne says.

"Watching Trump work his crowds, though, I see a dangerously manipulative narcissist unleashing the demagogic spells that he learned from studying Hitler's speeches - spells that he cannot control and that are capable of eroding the fabric of American democracy," Neuborne says. "You see, we've seen what these rhetorical techniques can do. Much of Trump's rhetoric - as a candidate and in office - mirrors the strategies, even the language, used by Adolf Hitler in the early 1930s to erode German democracy."

Many Americans may seize or condemn Neuborne's analysis, which has more than 20 major points of comparison. The author repeatedly says his goal is not "equating" the men - as "it trivializes Hitler's obscene crimes to compare them to Trump's often pathetic foibles."

Indeed, the book has a larger frame: whether federal checks and balances - Congress, the Supreme Court, the Electoral College - can contain the havoc that Trump thrives on and the Republican Party at large has embraced. But the Trump-Hitler compilation is a stunning warning, because, as many Holocaust survivors have said, few Germans or Europeans expected what unfolded in the years after Hitler amassed power.

Here's how Neuborne introduces this section. Many recent presidents have been awful, "But then there was Donald Trump, the only president in recent American history to openly despise the twin ideals - individual dignity and fundamental equality - upon which the contemporary United States is built. When you confront the reality of a president like Trump, the state of both sets of brakes - internal [constitutional] and external [public resistance] - become hugely important because Donald Trump's political train runs on the most potent and dangerous fuel of all: a steady diet of fear, greed, loathing, lies, and envy. It's a toxic mixture that has destroyed democracies before, and can do so again.

"Give Trump credit," he continues. "He did his homework well and became the twenty-first-century master of divisive rhetoric. We're used to thinking of Hitler's Third Reich as the incomparably evil tyranny that it undoubtedly was. But Hitler didn't take power by force. He used a set of rhetorical tropes codified

in Trump's bedside reading that persuaded enough Germans to welcome Hitler as a populist leader. The Nazis did not overthrow the Weimar Republic. It fell into their hands as the fruit of Hitler's satanic ability to mesmerize enough Germans to trade their birthright for a pottage of scapegoating, short-term economic gain, xenophobia, and racism. It could happen here."

Twenty points of similarity

Neuborne lists the following points of similarity between early Hitler and Trump:

1. **Neither was elected by a majority. Trump lost the popular vote by 2.9 million votes, receiving votes by 25.3 percent of all eligible American voters. "That's just a little less than the percentage of the German electorate that turned to the Nazi Party in 1932-33," Neuborne writes. "Unlike the low turnouts in the United States, turnout in Weimar Germany averaged just over 80 percent of eligible voters." He continues, "Once installed as a minority chancellor in January 1933, Hitler set about demonizing his political opponents, and no one - not the vaunted, intellectually brilliant German judiciary; not the respected, well-trained German police; not the revered, aristocratic German military; not the widely admired, efficient German government bureaucracy; not the wealthy, immensely powerful leaders of German industry; and not the powerful center-right political leaders of the Reichstag - mounted a serious effort to stop him."**

2. **Both found direct communication channels to their base. By 1936's Olympics, Nazi narratives dominated German cultural and political life. "How on earth did Hitler pull it off? What satanic magic did Trump find in Hitler's speeches?" Neuborne asks. He addresses Hitler's extreme rhetoric soon enough, but notes that Hitler found a direct communication pathway - the Nazi Party gave out radios with only one channel, tuned to Hitler's voice, bypassing Germany's news media. Trump has an online equivalent.**

   "Donald Trump's tweets, often delivered between midnight and dawn, are the twenty-first century's technological embodiment of Hitler's free plastic radios," Neuborne says. "Trump's Twitter account, like Hitler's radios, enables a charismatic leader to establish and maintain a personal, unfiltered line of communication with an adoring political base of about 30-40 percent of the population, many (but not all) of whom are only too willing, even anxious, to swallow Trump's witches' brew of falsehoods, half-truths, personal invective, threats, xenophobia, national security scares, religious bigotry, white racism, exploitation of economic insecurity, and a never ending-search for scapegoats."

3. **Both blame others and divide on racial lines. As Neuborne notes, "Hitler used his single-frequency radios to wax hysterical to his adoring base about his pathological racial and religious fantasies glorifying Aryans and demonizing Jews, blaming Jews (among other racial and religious scapegoats) for German society's ills." That is comparable to "Trump's tweets and public statements, whether dealing with black-led demonstrations against police violence, white-led racist mob violence, threats posed by undocumented aliens, immigration policy generally, protests by black and white professional athletes, college admission policies, hate speech, even response to hurricane damage in Puerto Rico," he says. Again and again, Trump uses "racially tinged messages calculated to divide whites from people of color."**

4. **Both relentlessly demonize opponents. "Hitler's radio harangues demonized his domestic political opponents, calling them parasites, criminals, cockroaches, and various categories of leftist scum," Neuborne notes. "Trump's tweets and speeches similarly demonize his political opponents. Trump talks about the country being 'infested' with dangerous aliens of color. He fantasizes about jailing Hillary Clinton, calls Mexicans rapists, refers to 'shithole countries,' degrades anyone who disagrees with him, and dreams of uprooting thousands of allegedly disloyal bureaucrats in the State Department, the Environmental Protection Agency, the FBI, and the CIA, who he calls 'the deep state' and who, he claims, are sabotaging American greatness."**

5. **They unceasingly attack objective truth. "Both Trump and Hitler maintained a relentless assault on the very idea of objective truth," he continues. "Each began the assault by seeking to delegitimize the mainstream press. Hitler quickly coined the epithet Lügenpresse (literally 'lying press') to denigrate the mainstream press. Trump uses a paraphrase of Hitler's lying press epithet - 'fake news' - cribbed, no doubt, from one of Hitler's speeches. For Trump, the mainstream press is a 'lying press' that publishes 'fake news.'" Hitler attacked his opponents as spreading false information to undermine his positions, Neuborne says, just as Trump has attacked "elites" for disseminating false news, "especially his possible links to the Kremlin."**

6. **They relentlessly attack mainstream media. Trump's assaults on the media echo Hitler's, Neuborne says, noting that he "repeatedly attacks the 'failing New York Times,' leads crowds in chanting 'CNN sucks,' [and] is personally hostile to most reporters." He cites the White House's refusal to fly the flag at half-mast after the murder of five journalists in Annapolis in June 2018, Trump's efforts to punish CNN by blocking a merger of its corporate parent, and trying to revoke federal Postal Service contracts**

held by Amazon, which was founded by Jeff Bezos, who also owns the Washington Post.

7. **Their attacks on truth include science. Neuborne notes, "Both Trump and Hitler intensified their assault on objective truth by deriding scientific experts, especially academics who question Hitler's views on race or Trump's views on climate change, immigration, or economics. For both Trump and Hitler, the goal is (and was) to eviscerate the very idea of objective truth, turning everything into grist for a populist jury subject to manipulation by a master puppeteer. In both Trump's and Hitler's worlds, public opinion ultimately defines what is true and what is false."**

8. **Their lies blur reality - and supporters spread them. "Trump's pathological penchant for repeatedly lying about his behavior can only succeed in a world where his supporters feel free to embrace Trump's 'alternative facts' and treat his hyperbolic exaggerations as the gospel truth," Neuborne says. "Once Hitler had delegitimized the mainstream media by a series of systematic attacks on its integrity, he constructed a fawning alternative mass media designed to reinforce his direct radio messages and enhance his personal power. Trump is following the same path, simultaneously launching bitter attacks on the mainstream press while embracing the so-called alt-right media, co-opting both Sinclair Broadcasting and the Rupert Murdoch-owned Fox Broadcasting Company as, essentially, a Trump Broadcasting Network."**

9. **Both orchestrated mass rallies to show status. "Once Hitler had cemented his personal communications link with his base via free radios and a fawning media and had badly eroded the idea of objective truth, he reinforced his emotional bond with his base by holding a series of carefully orchestrated mass meetings dedicated to cementing his status as a charismatic leader, or Führer," Neuborne writes. "The powerful personal bonds nurtured by Trump's tweets and Fox's fawning are also systematically reinforced by periodic, carefully orchestrated mass rallies (even going so far as to co-opt a Boy Scout Jamboree in 2017), reinforcing Trump's insatiable narcissism and his status as a charismatic leader."**

10. **They embrace extreme nationalism. "Hitler's strident appeals to the base invoked an extreme version of German nationalism, extolling a brilliant German past and promising to restore Germany to its rightful place as a preeminent nation," Neuborne says. "Trump echoes Hitler's jingoistic appeal to ultranationalist fervor, extolling American exceptionalism right down to the slogan 'Make America Great Again,' a paraphrase of Hitler's promise to restore German greatness."**

11. **Both made closing borders a centerpiece. "Hitler all but closed Germany's borders, freezing non-Aryan migration into the country and rendering it impossible for Germans to escape without official permission. Like Hitler, Trump has also made closed borders a centerpiece of his administration," Neuborne continues. "Hitler barred Jews. Trump bars Muslims and seekers of sanctuary from Central America. When the lower courts blocked Trump's Muslim travel ban, he unilaterally issued executive orders replacing it with a thinly disguised substitute that ultimately narrowly won Supreme Court approval under a theory of extreme deference to the president."**

12. **They embraced mass detention and deportations. "Hitler promised to make Germany free from Jews and Slavs. Trump promises to slow, stop, and even reverse the flow of non-white immigrants, substituting Muslims, Africans, Mexicans, and Central Americans of color for Jews and Slavs as scapegoats for the nation's ills. Trump's efforts to cast dragnets to arrest undocumented aliens where they work, live, and worship, followed by mass deportation... echo Hitler's promise to defend Germany's racial identity," he writes, also noting that Trump has "stooped to tearing children from their parents [as Nazis in World War II would do] to punish desperate efforts by migrants to find a better life."**

13. **Both used borders to protect selected industries. "Like Hitler, Trump seeks to use national borders to protect his favored national interests, threatening to ignite protectionist trade wars with Europe, China, and Japan similar to the trade wars that, in earlier incarnations, helped to ignite World War I and World War II," Neuborne writes. "Like Hitler, Trump aggressively uses our nation's political and economic power to favor selected American corporate interests at the expense of foreign competitors and the environment, even at the price of international conflict, massive inefficiency, and irreversible pollution [climate change]."**

14. **They cemented their rule by enriching elites. "Hitler's version of fascism shifted immense power - both political and financial - to the leaders of German industry. In fact, Hitler governed Germany largely through corporate executives," he continues. "Trump has also presided over a massive empowerment - and enrichment - of corporate America. Under Trump, large corporations exercise immense political power while receiving huge economic windfalls and freedom from regulations designed to protect consumers and the labor force. Hitler despised the German labor movement, eventually destroying it and imprisoning its leaders. Trump also detests strong unions, seeking to undermine any effort to interfere with the 'prerogatives of management."**

15. **Both rejected international norms. "Hitler's foreign policy rejected international cooperation in favor of military and economic coercion, culminating in the annexation of the Sudetenland, the phony Hitler-Stalin nonaggression pact, the invasion of Czechoslovakia, and the horrors of global war," Neuborne notes. "Like Hitler, Trump is deeply hostile to multinational cooperation, withdrawing from the Trans-Pacific Partnership, the Paris Agreement on climate change, and the nuclear agreement with Iran, threatening to withdraw from the North American Free Trade Agreement, abandoning our Kurdish allies in Syria..."**

16. **They attack domestic democratic processes. "Hitler attacked the legitimacy of democracy itself, purging the voting rolls, challenging the integrity of the electoral process, and questioning the ability of democratic government to solve Germany's problems," Neuborne notes. "Trump has also attacked the democratic process, declining to agree to be bound by the outcome of the 2016 elections when he thought he might lose, supporting the massive purge of the voting rolls allegedly designed to avoid (nonexistent) fraud, championing measures that make it harder to vote, tolerating - if not fomenting - massive Russian interference in the 2016 presidential election, encouraging mob violence at rallies, darkly hinting at violence if Democrats hold power, and constantly casting doubt on the legitimacy of elections unless he wins."**

17. **Both attack the judiciary and rule of law. "Hitler politicized and eventually destroyed the vaunted German justice system. Trump also seeks to turn the American justice system into his personal playground," Neuborne writes. "Like Hitler, Trump threatens the judicially enforced rule of law, bitterly attacking American judges who rule against him, slyly praising Andrew Jackson for defying the Supreme Court, and abusing the pardon power by pardoning an Arizona sheriff found guilty of criminal contempt of court for disobeying federal court orders to cease violating the Constitution."**

18. **Both glorify the military and demand loyalty oaths. "Like Hitler, Trump glorifies the military, staffing his administration with layers of retired generals (who eventually were fired or resigned), relaxing control over the use of lethal force by the military and the police, and demanding a massive increase in military spending," Neuborne writes. Just as Hitler "imposed an oath of personal loyalty on all German judges" and demanded courts defer to him, "Trump's already gotten enough deference from five Republican [Supreme Court] justices to uphold a largely Muslim travel ban that is the epitome of racial and religious bigotry." Trump has also demanded loyalty oaths. "He fired James Comey, a Republican appointed in 2013 as**

FBI director by President Obama, for refusing to swear an oath of personal loyalty to the president; excoriated and then sacked Jeff Sessions, his handpicked attorney general, for failing to suppress the criminal investigation into... Trump's possible collusion with Russia in influencing the 2016 elections; repeatedly threatened to dismiss Robert Mueller, the special counsel carrying out the investigation; and called again and again for the jailing of Hillary Clinton, his 2016 opponent, leading crowds in chants of 'lock her up.'" A new chant, "send her back," has since emerged at Trump rallies directed at non-white Democratic congresswomen.

19. **They proclaim unchecked power. "Like Hitler, Trump has intensified a disturbing trend that predated his administration of governing unilaterally, largely through executive orders or proclamations," Neuborne says, citing the Muslim travel ban, trade tariffs, unraveling of health and environmental safety nets, ban on transgender military service, and efforts to end President Obama's protection for Dreamers. "Like Hitler, Trump claims the power to overrule Congress and govern all by himself. In 1933, Hitler used the pretext of the Reichstag fire to declare a national emergency and seize the power to govern unilaterally. The German judiciary did nothing to stop him. German democracy never recovered. When Congress refused to give Trump funds for his border wall even after he threw a tantrum and shut down the government, Trump, like Hitler, declared a phony national emergency and claimed the power to ignore Congress," Neuborne continues. "Don't count on the Supreme Court to stop him. Five justices gave the game away on the President's unilateral travel ban. They just might do the same thing on the border wall." It did in late July, ruling that Trump could divert congressionally appropriated funds from the Pentagon budget - undermining constitutional separation of powers.**

20. **Both relegate women to subordinate roles. "Finally," writes Neuborne, "Hitler propounded a misogynistic, stereotypical view of women, valuing them exclusively as wives and mothers while excluding them from full participation in German political and economic life. Trump may be the most openly misogynist figure ever to hold high public office in the United States, crassly treating women as sexual objects, using nondisclosure agreements and violating campaign finance laws to shield his sexual misbehavior from public knowledge, attacking women who come forward to accuse men of abusive behavior, undermining reproductive freedom, and opposing efforts by women to achieve economic equality."**

Suggestions for further reading

1. Geoff Harris. *The Dark Side of Europe: The Extreme Right Today*, Edinburgh University Press; New edition, (1994).

2. Luciano Cheles, Ronnie Ferguson, and Michalina Vaughan. *The Far Right in Western and Eastern Europe*, Longman Publishing Group; 2nd edition, (1995).
3. Herbert Kitschelt. *The Radical Right in Western Europe: A Comparative Analysis*, University of Michigan Press; Reprint edition, (1997).
4. Martin Schain, Aristide Zolberg, and Patrick Hossay, editors. *Shadows Over Europe: The Development and Impact of the Extreme Right in Western Europe*, Palgrave Macmillan; 1st edition, (2002).
5. Robert S. Griffin. *The Fame of a Dead Man's Deeds: An Up-Close Portrait of White Nationalist William Pierce*, Authorhouse, (2001).
6. Jeffrey Kaplan and Tore Bjorgo. *Nation and Race: The Developing Euro-American Racist Subculture*, Northeastern University Press, (1998).
7. Mattias Gardell. *Gods of the Blood: The Pagan Revival and White Separatism*, Duke University Press, (2003)
8. Kathleen Blee. *Inside Organized Racism: Women in the Hate Movement*. Berkeley, California; London: University of California Press, (2002).

Chapter 8

RENEWABLE ENERGY

8.1 The UK declares a climate emergency

Introducing the motion in the House of Commons, Labour leader Jeremy Corbyn said: **"We have no time to waste. We are living in a climate crisis that will spiral dangerously out of control unless we take rapid and dramatic action now. This is no longer about a distant future. We're talking about nothing less than the irreversible destruction of the environment within our lifetimes of members of this house."**

Here are some excerpts from an article by Amy Goodman and Nermeen Shaikh of Democracy now published in Truthout on May 2, 2019.[1]:

On Wednesday, the House of Commons became the first parliament in the world to declare a climate emergency. The resolution came on the heels of the recent Extinction Rebellion mass uprising that shut down Central London last month in a series of direct actions. Activists closed bridges, occupied public landmarks and even superglued themselves to buildings, sidewalks and trains to demand urgent action to combat climate change. Police arrested more than 1,000 protesters. Labour Party Leader Jeremy Corbyn told Parliament, "We are witnessing an unprecedented upsurge of climate activism, with groups like Extinction Rebellion forcing the politicians in this building to listen. For all the dismissive and defensive column inches the processes have provoked, they are a massive and, I believe, very necessary wake-up call. Today we have the opportunity to say, 'We hear you.'" We speak with George Monbiot, British journalist, author and columnist with The Guardian. His recent piece for The Guardian is headlined "Only rebellion will prevent an ecological apocalypse." Monbiot says capitalism "is like a gun pointed at the heart of the planet. It will essentially, necessarily destroy our life-support systems. Among those characteristics is the drive for perpetual economic growth on a finite planet."

[1] https://truthout.org/video/george-monbiot-on-the-uk-climate-emergency/

Spain has also recently declared a climate emergency.

8.2 The 2018 IPCC report

Excerpts from an article summarizing the report

Here are excerpts from an article entitled **UN Experts Warn of 'Climate Catastrophe' by 2040** by Jesica Corbett. The article was published in Common Dreams on Monday, October 8, 2018.[2]:

"The climate crisis is here and already impacting the most vulnerable," notes 350.org's program director. "Staying under 1.5^{o}C is now a matter of political will."

Underscoring the need for "rapid, far-reaching, and unprecedented" changes to life as we know it to combat the global climate crisis, a new report from the Intergovernmental Panel on Climate Change (IPCC) - the United Nations' leading body for climate science - details what the world could look like if the global temperature rises to 1.5^{o}C versus 2^{o}C (2.7^{o}F versus 3.6^{o}F) above pre-industrial levels, and outlines pathways to reducing greenhouse gas emissions in the context of sustainable development and efforts to eradicate poverty.

[2]https://www.commondreams.org/news/2018/10/08/un-experts-warn-climate-catastrophe-2040-without-rapid-and-unprecedented-global

"Climate change represents an urgent and potentially irreversible threat to human societies and the planet," the report reads. "Human-induced warming has already reached about 1^{o}C (1.8^{o}F) above pre-industrial levels at the time of writing of this Special Report... If the current warming rate continues, the world would reach human-induced global warming of 1.5^{o}C around 2040."

Approved by the IPCC in South Korea on Saturday ahead of COP24 in Poland in December, Global Warming of 1.5^{o}C was produced by 91 authors and reviewers from 40 countries. Its release has elicited calls to action from climate campaigners and policymakers the world over.

"This is a climate emergency. The IPCC 1.5 report starkly illustrates the difference between temperature rises of 1.5^{o}C and 2^{o}C - for many around the world this is a matter of life and death," declared Karin Nansen, chair of Friends of the Earth International (FOEI). "It is crucial to keep temperature rise well below 1.5 degrees ... but the evidence presented by the IPCC shows that there is a narrow and shrinking window in which to do so."

The report was requested when the international community came together in December of 2015 for the Paris agreement, which aims to keep global warming within this century "well below" 2^{o}C, with an ultimate target of 1.5^{o}C. President Donald Trump's predecessor supported the accord, but Trump has vowed to withdraw the United States, even as every other nation on the planet has pledged their support for it. In many cases, however, sworn support hasn't led to effective policy.

"It's a fresh reminder, if one was needed, that current emissions reduction pledges are not enough to meet the long-term goals of the Paris agreement. Indeed, they are not enough for any appropriately ambitious temperature target, given what we know about dangerous climate impacts already unfolding even at lower temperature thresholds," Rachel Cleetus, lead economist and climate policy manager for the Union of Concerned Scientists (UCS), wrote ahead of its release.

"The policy implications of the report are obvious: We need to implement a suite of policies to sharply limit carbon emissions and build climate resilience, and we must do all this is in a way that prioritizes equitable outcomes particularly for the world's poor and marginalized communities," Cleetus added.

"We want a just transition to a clean energy system that benefits people not corporations," Nansen emphasized. "Only with a radical transformation of our energy, food and economic systems, embracing environmental, social, gender and economic justice, can we prevent climate catastrophe and temperature rises exceeding 1.5^{o}C."

Today we are faced with multiple interrelated crises, for example the threat of catastrophic climate change or equally catastrophic thermonuclear war, and the threat of widespread famine. These threats to human existence and to the biosphere demand a prompt and rational response; but because of institutional and cultural inertia, we are failing to take the steps that are necessary to avoid disaster.

8.3 Greta Thunberg

Only immediate climate action can save the future

Immediate action to halt the extraction of fossil fuels and greatly reduce the emission of CO_2 and other greenhouse gasses is needed to save the long-term future of human civilization and the biosphere.

At the opening ceremony of United Nations-sponsored climate talks in Katowice, Poland, Sir David Attenborough said "Right now, we are facing a man-made disaster of global scale. Our greatest threat in thousands of years. Climate change. If we don't take action, the collapse of our civilizations and the extinction of much of the natural world is on the horizon. The world's people have spoken. Their message is clear. Time is running out. They want you, the decision-makers, to act now."

Antonio Guterres, UN Secretary-General, said climate change was already "a matter of life and death" for many countries. He added that the world is "nowhere near where it needs to be" on the transition to a low-carbon economy.

Swedish student Greta Thunberg, is a 16-year-old who has launched a climate protest movement in her country. She said, in a short but very clear speech after that of UN leader Antonio Guterres: "Some people say that I should be in school instead. Some people say that I should study to become a climate scientist so that I can 'solve the climate crisis'. But the climate crisis has already been solved. We already have all the facts and solutions."

She added: "Why should I be studying for a future that soon may be no more, when no one is doing anything to save that future? And what is the point of learning facts when the most important facts clearly mean nothing to our society?"

Thunberg continued: "Today we use 100 million barrels of oil every single day. There are no politics to change that. There are no rules to keep that oil in the ground. So we can't save the world by playing by the rules. Because the rules have to be changed."

She concluded by saying that "since our leaders are behaving like children, we will have to take the responsibility they should have taken long ago."

Appearing among billionaires, corporate CEO's and heads of state at the Davos Economic Forum in Switzerland, like a new Joan of Arc, 16-year-old Swedish climate activist Greta Thunberg called on decision-makers to fulfil their responsibilities towards future generations. Here are some excerpts from her speech:

Greta's speech at Davos

Our house is on fire. I am here to say, our house is on fire. According to the IPCC, we are less than 12 years away from not being able to undo our mistakes. In that time, unprecedented changes in all aspects of society need to have taken place, including a reduction of our CO_2 emissions by at least 50%...

Here in Davos - just like everywhere else - everyone is talking about money. It seems money and growth are our only main concerns.

And since the climate crisis has never once been treated as a crisis, people are simply not aware of the full consequences on our everyday life. People are not aware that there is such a thing as a carbon budget, and just how incredibly small that remaining carbon budget is. That needs to change today.

No other current challenge can match the importance of establishing a wide, public awareness and understanding of our rapidly disappearing carbon budget, that should and must become our new global currency and the very heart of our future and present economics.

We are at a time in history where everyone with any insight of the climate crisis that threatens our civilization - and the entire biosphere - must speak out in clear language, no matter how uncomfortable and unprofitable that may be.

We must change almost everything in our current societies. The bigger your carbon footprint, the bigger your moral duty. The bigger your platform, the bigger your responsibility.

Figure 8.1: **Greta Thunberg on the cover of Time Magazine, The Intergovernmental Panel on Climate Change, in their October 2018 report, used strong enough language to wake up at least part of the public: the children whose future is at stake. Here is an excerpt from a speech which 16-year-old Swedish climate activist Greta Thunberg made at the Davos Economic Forum in January, 2019: "Our house is on fire. I am here to say, our house is on fire. According to the IPCC, we are less than 12 years away from not being able to undo our mistakes. In that time, unprecedented changes in all aspects of society need to have taken place, including a reduction of our CO2 emissions by at least 50%..."**

8.4 Worldwide school strike, 15 March, 2019

Over 1.4 million young students across all continents took to the streets on Friday March 15th for the first ever global climate strike. Messages in more than 40 languages were loud and clear: world leaders must act now to address the climate crisis and save our future. The school strike was the largest climate action in history. Nevertheless it went almost unmentioned in the media,

Here are some of the statements by the students explaining why they took part in the strikes:

In India, no one talks about climate change. You don't see it on the news or in the papers or hear about it from government. We want global leaders to declare a climate emergency. If we don't act today, then we will have no tomorrow. - Vidit Baya, 17, Udaipur, India.

We face heartbreaking loss due to increasingly extreme weather events. We urge the Taiwanese government to implement mitigation measures and face up to the vulnerability of indigenous people, halt construction projects in the indigenous traditional realm, and recognize the legal status of Plains Indigenous People, in order to implement environmental protection as a bottom-up approach - Kaisanan Ahuan, Puli City, Taiwan.

We have reached a point in history when we have the technical capacities to solve poverty, malnutrition, inequality and of course global warming. The deciding factors for whether we take advantage of our potential will be our activism, our international unity and our ability to develop the art of making the impossible possible. Whether we succeed or not depends on our political will - Eyal Weintraub, 18, and Bruno Rodriguez, 18, Argentina.

The damage done by multinationals is enormous: the lack of transparency, dubious contracts, the weakening of the soil, the destruction of flora and fauna, the lack of respect for mining codes, the contamination of groundwater. In Mali, the state exercises insufficient control over the practices of the multinationals, and it is us, the citizens, who suffer the consequences. The climate alarm has sounded, and the time has come for us all to realize that there is still time to act locally, in our homes, our villages, our cities - Mone Fousseny, 22, Mali.

8.5 Solar energy

Before the start of the industrial era, human society relied exclusively on renewable energy sources - but can we do so again, with our greatly increased population and greatly

increased demands? Will we ultimately be forced to reduce the global population or our per capita use of energy, or both? Let us now try to examine these questions.

Biomass, wind energy, hydropower and wave power derive their energy indirectly from the sun, but in addition, various methods are available for utilizing the power of sunlight directly. These include photovoltaic panels, solar designs in architecture, solar systems for heating water and cooking, concentrating photovoltaic systems, and solar thermal power plants.

Photovoltaic cells and concentrating photovoltaic systems

Solar power was the fastest-growing source of new energy in 2016, surpassing the net growth of all other energy sources including coal, according to a new report from the International Energy Agency (IEA).

The IEA report found new solar capacity increased by 50 percent in 2016, and IEA executive director Fatih Birol hailed solar's rapid growth. "What we are witnessing is the birth of a new era in solar photovoltaics [PV]. We expect that solar PV capacity growth will be higher than any other renewable technology up to 2022."[3]

The report also shows renewables as a whole accounted for two-thirds of all new energy capacity in 2016. "We see renewables growing by about 1,000 GW (gigawatts) by 2022, which equals about half of the current global capacity in coal power, which took 80 years to build," Birol said in a statement accompanying the report.[4]

Solar photovoltaic cells[5] are thin coated wafers of a semiconducting material (usually silicon). The coatings on the two sides are respectively charge donors and charge acceptors. Cells of this type are capable of trapping solar energy and converting it into direct-current electricity. The electricity generated in this way can be used directly (as it is, for example, in pocket calculators) or it can be fed into a general power grid. Alternatively it can be used to split water into hydrogen and oxygen. The gases can then be compressed and stored, or exported for later use in fuel cells. In the future, we may see solar photovoltaic arrays in sun-rich desert areas producing hydrogen as an export product. As their petroleum reserves become exhausted, the countries of the Middle East and Africa may be able to shift to this new technology and still remain energy exporters.

It is interesting to notice that the primary process of photosynthesis in plants is closely similar to the mechanism by which solar cells separate charges and prevent the back-reaction. We can see why a back-reaction must be prevented if we consider the excitation of a single atom. An absorbed photon lifts an electron from a filled atomic orbital to an empty one, leaving a positively-charged hole in the orbital from which the electron came. However, a back-reaction occurs almost immediately: The excited electron falls back into

[3]https://www.theguardian.com/environment/2017/oct/04/solar-power-renewables-international-energy-agency

[4]https://www.iea.org/newsroom/news/2017/october/solar-pv-grew-faster-than-any-other-fuel-in-2016-opening-a-new-era-for-solar-pow.html

[5]https://www.iea.org/renewables/

the orbital from which it came, and the absorbed energy is re-emitted. One can say that the electron and hole have recombined.

In higher plants, the back reaction is prevented because the photon is absorbed in a membrane which has a sandwich-like structure. Dye molecules (usually chlorophyll molecules) are sandwiched between a layer of charge donor molecules on one side of the membrane, and a layer of charge acceptor molecule on the other side. The electron quickly migrates to the acceptors, which are molecules with low-lying unfilled orbitals. Meanwhile the hole has quickly moved to the opposite side of the membrane. where it combines with an electron from a donor molecule. A donor molecule is a molecule whose highest filled orbital is high in energy. In this process, the back.reaction is prevented. The electron and hole are on opposite sides of the membrane, and they can only recombine after they have driven the metabolism of the plant.

In a photovoltaic solar cell, the mechanism by which the back-reaction is prevented is exactly similar. It too has a sandwich-like structure, with charge donors on one side, charge-acceptors on the other, and photon absorbers in the middle. Here too, the electron and hole quickly migrate to opposite sides. They can only recombine by traveling through the external circuit, which is analogous to a plant's metabolism, and performing useful work.

The cost of manufacturing photovoltaics continues to fall rapidly. In 2017, a homeowner paid approximately $3,360 per kilowatt to have rooftop solar panels installed Usually photovoltaic panels are warranted for a life of 20 years, but they are commonly still operational after 30 years or more. Using the fact that there are 8760 hours in a year, and thus 175200 hours in 20 years, we can calculate that the cost of electricity to a solar-using homeowner today is about 1.92 cents per kilowatt hour. This can be compared with electricity generated from coal, which in 2011 cost 3.23 cents per kilowatt hour, while electricity generated from natural gas cost 4.51 cents per kilowatt hour. We must also remember that photovoltaics are falling rapidly in price, and that the fossil fuel costs do not include externalities, such as their contribution to climate change.

Concentrating photovoltaic systems are able to lower costs still further by combining silicon solar cells with reflectors that concentrate the sun's rays. The most inexpensive type of concentrating reflector consists of a flat piece of aluminum-covered plastic material bent into a curved shape along one of its dimensions, forming a trough-shaped surface. (Something like this shape results when we hold a piece of paper at the top and bottom with our two hands, allowing the center to sag.) The axis of the reflector can be oriented so that it points towards the North Star. A photovoltaic array placed along the focal line will then receive concentrated sunlight throughout the day.

Photovoltaic efficiency is defined as the ratio of the electrical power produced by a cell to the solar power striking its surface. For commercially available cells today, this ratio is between 9% and 14%. If we assume 5 hours of bright sunlight per day, this means that a photo cell in a desert area near to the equator (where 1 kW/m^2 of peak solar power reaches the earth's surface) can produce electrical energy at the average rate of 20-30 W_e/m^2, the average being taken over an entire day and night. The potential power per unit area for photovoltaic systems is far greater than for biomass. However, the mix of

renewable energy sources most suitable for a particular country depends on many factors. We will see below that biomass is a promising future source of energy for Sweden, because of Sweden's low population density and high rainfall. By contrast, despite the high initial investment required, photovoltaics are undoubtedly a more promising future energy source for southerly countries with clear skies.

In comparing photovoltaics with biomass, we should be aware of the difference between electrical energy and energy contained in a the chemical bonds of a primary fuel such as wood or rapeseed oil. If Sweden (for example) were to supply all its energy needs from biomass, part of the biomass would have to be burned to generate electricity. The efficiency of energy conversion in electricity generation from fuel is 20%-35%. Of course, in dual use power plants, part of the left-over heat from electrical power generation can be used to heat homes or greenhouses. However, hydropower, wind power and photovoltaics have an advantage in generating electrical power, since they do so directly and without loss, whereas generation of electricity from biomass involves a loss from the inefficiency of the conversion from fuel energy to electrical energy. Thus a rational renewable energy program for Sweden should involve a mixture of biomass for heating and direct fuel use, with hydropower and wind power for generation of electricity. Perhaps photovoltaics will also play a role in Sweden's future electricity generation, despite the country's northerly location and frequently cloudy skies.

The global market for photovoltaics is expanding at the rate of 30% per year. This development is driven by rising energy prices, subsidies to photovoltaics by governments, and the realization of the risks associated with global warming and consequent international commitments to reduce carbon emissions. The rapidly expanding markets have resulted in lowered photovoltaic production costs, and hence further expansion, still lower costs, etc. - a virtuous feedback loop.

Solar thermal power plants

Solar Parabolic Troughs can be used to heat a fluid, typically oil, in a pipe running along the focal axis. The heated fluid can then be used to generate electrical power. The liquid that is heated in this way need not be oil. In a solar thermal power plant in California, reflectors move in a manner that follows the sun's position and they concentrate solar energy onto a tower, where molten salt is heated to a temperature of 1050 degrees F (566 ^oC). The molten salt stores the heat, so that electricity can be generated even when the sun is not shining. The California plant generates 10 MW_e.

Solar designs in architecture

At present, the average global rate of use of primary energy is roughly 2 kW_t per person. In North America, the rate is 12 kW_t per capita, while in Europe, the figure is 6 kW_t. In Bangladesh, it is only 0.2 kW_t. This wide variation implies that considerable energy savings are possible, through changes in lifestyle, and through energy efficiency.

Figure 8.2: **A rooftop array of photovoltaic cells.**

Figure 8.3: **A solar thermal power plant. Arrays of heliostatic reflectors concentrate the sun's rays onto molten salt in the tower. The plant produces electricity at night because the salt remains hot..**

Figure 8.4: **A solar cooker.**

Figure 8.5: **A rooftop solar thermal array for domestic water heating.**

Important energy savings can be achieved through solar design in architecture. For example, insulation can be improved in walls, and insulating shutters can be closed at night.

In double envelope construction, a weatherproof shell surrounds the inner house. Between the outer shell and the house, sun-heated air circulates. A less extreme example of this principle is the construction of south-facing conservatories. The sun-heated air in the conservatories acts as a thermal buffer, and reduces heat loss from the house.

Solar design aims at making houses cool in the summer and warm in the winter. Awnings can be spread out in the summer to shade windows, and rolled together in the winter to allow sunshine to enter the house. Alternatively, deciduous trees can be planted in front of south-facing windows. During the summer, the leaves of the trees shade the windows, while in the winter, the leaves fall, allowing the sun to enter.

During daylight hours, houses can be illuminated by fiber optic light pipes, connected to a parabolic collector on the roof. The roof can also contain arrays of solar photovoltaic cells and solar water heaters.

Houses can be heated in the winter by heat pumps connected to a deeply buried network of pipes. Heat pumps function in much the same way as refrigerators or air conditioners. When they are used to warm houses in the winter, a volatile liquid such as ammonia is evaporated underground, where the temperature is relatively constant, not changing much between summer and winter. In the evaporation process, heat is absorbed from the ground. The gas is then compressed and re-liquefied within the house, and in this process, it releases the heat that was absorbed underground. Electricity is of course required to drive a heat pump, but far less electrical power is needed to do this than would be required to heat the house directly.

In general, solar design of houses and other buildings requires an initial investment, but over time, the investment is amply repaid through energy savings.

Solar systems for heating water and cooking

Solar heat collectors are are already in common use to supply hot water for families or to heat swimming pools. A common form of the solar heat collector consists of a flat, blackened heat-collecting plate to which tubes containing the fluid to be heated are connected. The plate is insulated from the atmosphere by a layer of air (in some cases a partial vacuum) above which there is a sheet of glass. Water flowing through the tubes is collected in a tank whenever it is hotter than the water already there. In cases where there is a danger of freezing, the heated fluid may contain antifreeze, and it may then exchange heat with water in the collection tank. Systems of this kind can function even in climates as unfavorable as that of Northern Europe, although during winter months they must be supplemented by conventional water-heaters.

In the developing countries, wood is often used for cooking, and the result is sometimes deforestation, soil erosion and desertification. In order to supply an alternative, many designs for solar cooking have been developed. Often the designs are very simple, and

many are both easy and inexpensive to build, the starting materials being aluminum foil and cardboard boxes.

8.6 Wind energy

Wind parks in favorable locations, using modern wind turbines, are able to generate 10 MW_e/km^2 or 10 W_e/m^2. Often wind farms are placed in offshore locations. When they are on land, the area between the turbines can be utilized for other purposes, for example for pasturage. For a country like Denmark, with good wind potential but cloudy skies, wind turbines can be expected to play a more important future role than photovoltaics. Denmark is already a world leader both in manufacturing and in using wind turbines. Today, on windy days, 100% of all electricity used in Denmark is generated by wind power, and the export of wind turbines makes a major contribution to the Danish economy. The use of wind power is currently growing at the rate of 38% per year. In the United States, it is the fastest-growing form of electricity generation.

The location of wind parks is important, since the energy obtainable from wind is proportional to the cube of the wind velocity. We can understand this cubic relationship by remembering that the kinetic energy of a moving object is proportional to the square of its velocity multiplied by the mass. Since the mass of air moving past a wind turbine is proportional to the wind velocity, the result is the cubic relationship just mentioned.

Before the decision is made to locate a wind park in a particular place, the wind velocity is usually carefully measured and recorded over an entire year. For locations on land, mountain passes are often very favorable locations, since wind velocities increase with altitude, and since the wind is concentrated in the passes by the mountain barrier. Other favorable locations include shorelines and offshore locations on sand bars. This is because onshore winds result when warm air rising from land heated by the sun is replaced by cool marine air. Depending on the season, the situation may be reversed at night, and an offshore wind may be produced if the water is warmer than the land.

The cost of wind-generated electrical power is currently lower than the cost of electricity generated by burning fossil fuels.

The "energy payback ratio" of a power installation is defined as the ratio of the energy produced by the installation over its lifetime, divided by the energy required to manufacture, construct, operate and decommission the installation. For wind turbines, this ratio is 17-39, compared with 11 for coal-burning plants. The construction energy of a wind turbine is usually paid back within three months.

Besides the propeller-like design for wind turbines there are also designs where the rotors turn about a vertical shaft. One such design was patented in 1927 by the French aeronautical engineer Georges Jean Marie Darrieus. The blades of a Darrieus wind turbine are airfoils similar to the wings of an aircraft. As the rotor turns in the wind, the stream of air striking the airfoils produces a force similar to the "lift" of an airplane wing. This force pushes the rotor in the direction that it is already moving. The Darrieus design has some advantages over conventional wind turbine design, since the generator can be placed

Figure 8.6: **Rows of wind turbines.**

Figure 8.7: **Vertical axis wind turbines.**

Figure 8.8: **Wind turbines on the Danish island of Samsø The island was the first in the world to achieve 100% renewable energy.**

at the bottom of the vertical shaft, where it may be more easily serviced. Furthermore, the vertical shaft can be lighter than the shaft needed to support a conventional wind turbine.

One problem with wind power is that it comes intermittently, and demand for electrical power does not necessarily come at times when the wind is blowing most strongly. To deal with the problem of intermittency, wind power can be combined with other electrical power sources in a grid. Alternatively, the energy generated can be stored, for example by pumped hydroelectric storage or by using hydrogen technology, as will be discussed below.

Bird lovers complain that birds are sometimes killed by rotor blades. This is true, but the number killed is small. For example, in the United States, about 70,000 birds per year are killed by turbines, but this must be compared with 57 million birds killed by automobiles and 97.5 million killed by collisions with plate glass.

The aesthetic aspects of wind turbines also come into the debate. Perhaps in the future, as wind power becomes more and more a necessity and less a matter of choice, this will be seen as a "luxury argument".

A Danish island reaches 100% renewable energy

The Danish island of Samsø is only 112 square kilometers in size, and its population numbers only 4,300. Nevertheless, it has a unique distinction. Samsø was the first closed land area to declare its intention of relying entirely on renewable energy, and it has now achieved this aim, provided that one stretches the definitions slightly.

In 1997, the Danish Ministry of Environment and Energy decided to sponsor a renewable-energy contest. In order to enter, communities had to submit plans for how they could make a transition from fossil fuels to renewable energy. An engineer (who didn't live

there) thought he knew how Samsø could do this, and together with the island's mayor he submitted a plan which won the contest. As a result, the islanders became interested in renewable energy. They switched from furnaces to heat pumps, and formed cooperatives for the construction of windmill parks in the sea near to the island. By 2005, Samsø was producing, from renewable sources, more energy than it was using. The islanders still had gasoline-driven automobiles, but they exported from their windmill parks an amount of electrical energy that balanced the fossil fuel energy that they imported. This is a story that can give us hope for the future, although a farming community like Samsø cannot serve as a model for the world.

8.7 Hydroelectric power

In 2015, hydroelectric power supplied 16.6% of all electrical power, and 70% of the electrical power generated from renewable energy. In the developed countries, the potential for increasing this percentage is small, because most of the suitable sites for dams are already in use. Mountainous regions of course have the greatest potential for hydroelectric power, and this correlates well with the fact that virtually all of the electricity generated in Norway comes from hydro, while in Iceland and Austria the figures are respectively 83% and 67%. Among the large hydroelectric power stations now in use are the La Grande complex in Canada (16 GW_e) and the Itapú station on the border between Brazil and Paraguay (14 GW_e). The Three Gorges Dam in China produces 18.2 GW_e.

Even in regions where the percentage of hydro in electricity generation is not so high, it plays an important role because hydropower can be used selectively at moments of peak demand. Pumping of water into reservoirs can also be used to store energy.

The creation of lakes behind new dams in developing countries often involves problems, for example relocation of people living on land that will be covered by water, and loss of the land for other purposes[6]. However the energy gain per unit area of lake can be very large - over 100 W_e/m^2. Fish ladders can be used to enable fish to reach their spawning grounds above dams. In addition to generating electrical power, dams often play useful roles in flood control and irrigation.

At present, hydroelectric power is used in energy-intensive industrial processes, such as the production of aluminum. However, as the global energy crisis becomes more severe, we can expect that metals derived from electrolysis, such as aluminum and magnesium, will be very largely replaced by other materials, because the world will no longer be able to afford the energy needed to produce them.

[6]Over a million people were displaced by the construction of the Three Gorges Dam in China, and many sites of cultural value were lost

Table 8.1: Technical potential and utilization of hydropower. (Data from World Energy Council, 2003.)

Region	Technical potential	Annual output	Percent used
Asia	0.5814 TW_e	0.0653 TW_e	11%
S. America	0.3187 TW_e	0.0579 TW_e	18%
Europe	0.3089 TW_e	0.0832 TW_e	27%
Africa	0.2155 TW_e	0.0091 TW_e	4%
N. America	0.1904 TW_e	0.0759 TW_e	40%
Oceania	0.0265 TW_e	0.0046 TW_e	17%
World	1.6414 TW_e	0.2960 TW_e	18%

Figure 8.9: **Hydroelectric power does not suffer from the problem of intermittency, but may sometimes produce undesirable social and ecological impacts.**

8.8 Energy from the ocean

Tidal power

The twice-daily flow of the tides can be harnessed to produce electrical power. Ultimately tidal energy comes from the rotation of the earth and its interaction with the moon's gravitational field. The earth's rotation is very gradually slowing because of tidal friction, and the moon is gradually receding from the earth, but this process will take such an extremely long time that tidal energy can be thought of as renewable.

There are two basic methods for harnessing tidal power. One can build barriers that create level differences between two bodies of water, and derive hydroelectric power from the head of water thus created. Alternatively it is possible to place the blades of turbines in a tidal stream. The blades are then turned by the tidal current in much the same way that the blades of a wind turbine are turned by currents of air.

There are plans for using the second method on an extremely large scale in Cook Strait, near New Zealand. A company founded by David Beach and Chris Bathurst plans to anchor 7,000 turbines to the sea floor of Cook Strait in such a way that they will float 40 meters below the surface. Beach and Bathurst say that in this position, the turbines will be safe from the effects of earthquakes and storms. The tidal flow through Cook Strait is so great that the scheme could supply all of New Zealand's electricity if the project is completed on the scale visualized by its founders.

Choosing the proper location for tidal power stations is important, since the height of tides depends on the configuration of the land. For example, tides of 17 meters occur in the Bay of Fundy, at the upper end of the Gulf of Maine, between New Brunswick and Nova

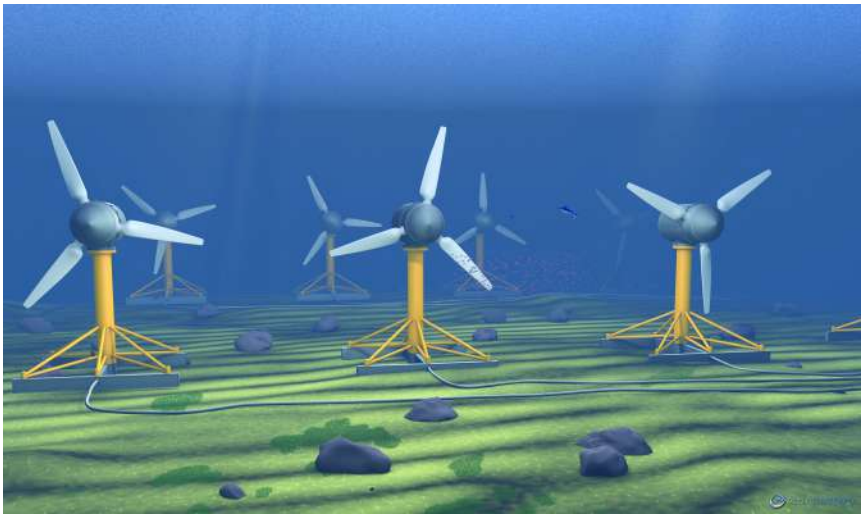

Figure 8.10: **Underwater turbines can make use of the energy of ocean currents.**

Scotia. Here tidal waves are funneled into the bay, creating a resonance that results in the world's greatest level difference between high an low tides. An 18 MW_e dam-type tidal power generation station already exists at Annapolis River, Nova Scotia, and there are proposals to increase the use of tidal power in the Bay of Fundy. Some proposals involve turbines in the tidal stream, similar to those proposed for use in the Cook Strait.

In the future, favorable locations for tidal power may be exploited to their full potentialities, even thought the output of electrical energy exceeds local needs. The excess energy can be stored in the form of hydrogen (see below) and exported to regions deficient in renewable energy resources.

Wave energy

At present, the utilization of wave energy is in an experimental stage. In Portugal, there are plans for a wave farm using the Pelamis Wave Energy Converter. The Pelamis is a long floating tube with two or more rigid sections joined by hinges. The tube is tethered with its axis in the direction of wave propagation. The bending between sections resulting from passing waves is utilized to drive high pressure oil through hydraulic motors coupled to electrical generators. Each wave farm in the Portuguese project is planned to use three Pelamis converters, each capable of producing 750 kW_e. Thus the total output of each wave farm will be 2.25 MW_e.

Another experimental wave energy converter is Salter's Duck, invented in the 1970's by Prof. Stephen Salter of the University of Edinburgh, but still being developed and improved. Like the Pelamis, the Duck is also cylindrical in shape, but the axis of the cylinder is parallel to the wave front, i.e. perpendicular to the direction of wave motion. A floating cam, attached to the cylinder, rises and falls as a wave passes, driving hydraulic motors within the cylinder. Salter's Duck is capable of using as much as 65% of the wave's

Figure 8.11: **The Pelamis wave energy transformer floats on the ocean like a giant sea snake. It consists of several segments which move against each other and build up hydraulic pressure. This in turn drives a turbine. A new Pelamis generation is currently under construction.**

energy.

The energy potentially available from waves is very large, amounting to as much as 100 kilowatts per meter of wave front in the best locations.

Ocean thermal energy conversion

In tropical regions, the temperature of water at the ocean floor is much colder than water at the surface. In ocean thermal energy conversion, cold water is brought to the surface from depths as great as 1 km, and a heat engine is run between deep sea water at a very low temperature and surface water at a much higher temperature.

According to thermodynamics, the maximum efficiency of a heat engine operating between a cold reservoir at the absolute temperature T_C and a hot reservoir at the absolute temperature T_H is given by 1-T_C/T_H. In order to convert temperature on the centigrade scale to absolute temperature (degrees Kelvin) one must add 273 degrees. Thus the maximum efficiency of a heat engine operating between water at the temperature of 25 ^{o}C and water at 5 ^{o}C is 1-(5+273)/(25+273)=0.067 = 6.7%. The efficiency of heat engines is always less than the theoretical maximum because of various losses, such as the loss due to friction. The actual overall efficiencies of existing ocean thermal energy conversion (OTEC) stations are typically 1-3%. On the other hand, the amount of energy potentially available from differences between surface and bottom ocean temperatures is extremely large.

Since 1974, OTEC research has been conducted by the United States at the Natural

Energy Laboratory of Hawaii. The Japanese government also supports OTEC research, and India has established a 1 MW_e OTEC power station floating in the ocean near to Tamil Nadu.

Renewable energy from evaporation

A September 26, 2017 article by Ahmet-Hamdi Cavusoglu et al. in *Nature Communications* points to evaporation as a future source of renewable energy. Here are some excerpts from the article:

"About 50% of the solar energy absorbed at the Earth's surface drives evaporation, fueling the water cycle that affects various renewable energy resources, such as wind and hydropower. Recent advances demonstrate our nascent ability to convert evaporation energy into work, yet there is little understanding about the potential of this resource.

"Here we study the energy available from natural evaporation to predict the potential of this ubiquitous resource. We find that natural evaporation from open water surfaces could provide power densities comparable to current wind and solar technologies while cutting evaporative water losses by nearly half. We estimate up to 325 GW of power is potentially available in the United States. Strikingly, water's large heat capacity is sufficient to control power output by storing excess energy when demand is low, thus reducing intermittency and improving reliability. Our findings motivate the improvement of materials and devices that convert energy from evaporation...

"Recent advances in water responsive materials and devices demonstrate the ability to convert energy from evaporation into work. These materials perform work through a cycle of absorbing and rejecting water via evaporation. These water-responsive materials can be incorporated into evaporation-driven engines that harness energy when placed above a body of evaporating water. With improvements in energy conversion efficiency, such devices could become an avenue to harvest energy via natural evaporation from water reservoirs."

Ozgur Sahin, a biophysicist at Columbia, has developed technology that uses spores from the harmless soil-dwelling bacterium *B. subtilis* to absorb and release water when the relative humidity of the surrounding air changes. At high humidity, the spores take in water and expand, and at low humidity they release water and contract, acting like a muscle.

8.9 Biomass

Biomass is defined as any energy source based on biological materials produced by photosynthesis - for example wood, sugar beets, rapeseed oil, crop wastes, dung, urban organic wastes, processed sewage, etc. Using biomass for energy does not result in the net emission of CO_2, since the CO_2 released by burning the material had previously been absorbed from the atmosphere during photosynthesis. If the biological material had decayed instead of being burned, it would released the same amount of CO_2 as in the burning process.

Figure 8.12: **Rapeseed is grown in several countries, including Denmark and the UK. Experimental Danish buses are already running on rapeseed oil.**

The solar constant has the value 1.4 kilowatts/m^2. It represents the amount of solar energy per unit area[7] that reaches the earth, before the sunlight has entered the atmosphere. Because the atmosphere reflects 6% and absorbs 16%, the peak power at sea level is reduced to 1.0 kW/m^2. Clouds also absorb and reflect sunlight. Average cloud cover reduces the energy of sunlight a further 36%. Also, we must take into account the fact that the sun's rays do not fall perpendicularly onto the earth's surface. The angle that they make with the surface depends on the time of day, the season and the latitude.

In Sweden, which lies at a northerly latitude, the solar energy per unit of horizontal area is less than for countries nearer the equator. Nevertheless, Göran Persson, during his term as Prime Minister of Sweden, announced that his government intends to make the country independent of imported oil by 2020 through a program that includes energy from biomass.

In his thesis, *Biomass in a Sustainable Energy System*, the Swedish researcher Pål Börjesson states that of various crops grown as biomass, the largest energy yields come from short-rotation forests (Salix viminalis, a species of willow) and sugar beet plantations. These have an energy yield of from 160 to 170 GJ$_t$ per hectare-year. (The subscript t means "thermal". Energy in the form of electricity is denoted by the subscript e). One can calculate that this is equivalent to about 0.5 MW$_t$/km^2, or 0.5 W$_t$/m^2. Thus, although 1.0 kW/m^2 of solar energy reaches the earth at noon at the equator, the trees growing in northerly Sweden can harvest a day-and-night and seasonal average of only 0.5 Watts of thermal energy per horizontal square meter[8]. Since Sweden's present primary energy use is approximately 0.04 TW$_t$, it follows that if no other sources of energy were used, a square area of Salix forest 290 kilometers on each side would supply Sweden's present energy needs. This corresponds to an area of 84,000 km^2, about 19% of Sweden's total

[7]The area is assumed to be perpendicular to the sun's rays.

[8]In tropical regions, the rate of biomass production can be more than double this amount.

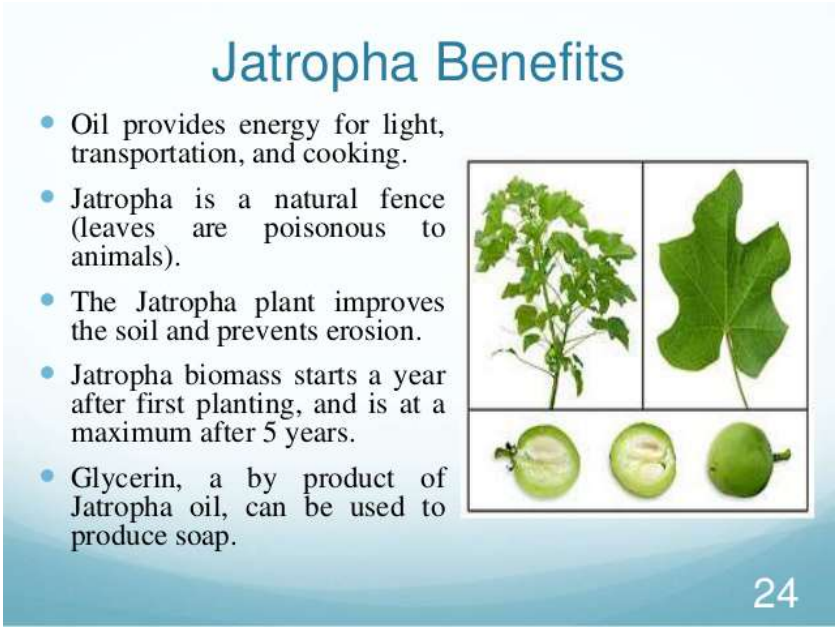

Figure 8.13: **In some countries, Jatropha is a promising source of biomass..**

area[9]. Of course, Sweden's renewable energy program will not rely exclusively on energy crops, but on a mixture of sources, including biomass from municipal and agricultural wastes, hydropower, wind energy and solar energy.

At present, both Sweden and Finland derive about 30% of their electricity from biomass, which is largely in the form of waste from the forestry and paper industries of these two countries.

Despite their northerly location, the countries of Scandinavia have good potentialities for developing biomass as an energy source, since they have small population densities and adequate rainfall. In Denmark, biodiesel oil derived from rapeseed has been used as fuel for experimental buses. Rapeseed fields produce oil at the rate of between 1,000 and 1,300 liters per hectare-crop. The energy yield is 3.2 units of fuel product energy for every unit of fuel energy used to plant the rapeseed, and to harvest and process the oil. After the oil has been pressed from rapeseed, two-thirds of the seed remains as a protein-rich residue which can be fed to cattle.

Miscanthus is a grassy plant found in Asia and Africa. Some forms will also grow in Northern Europe, and it is being considered as an energy crop in the United Kingdom. Miscanthus can produce up to 18 dry tonnes per hectare-year, and it has the great advantage that it can be cultivated using ordinary farm machinery. The woody stems are very suitable for burning, since their water content is low (20-30%).

For some southerly countries, honge oil, derived from the plant *Pongamia pinnata* may prove to be a promising source of biomass energy. Studies conducted by Dr. Udishi

[9]Additional land area would be needed to supply the energy required for planting, harvesting, transportation and utilization of the wood.

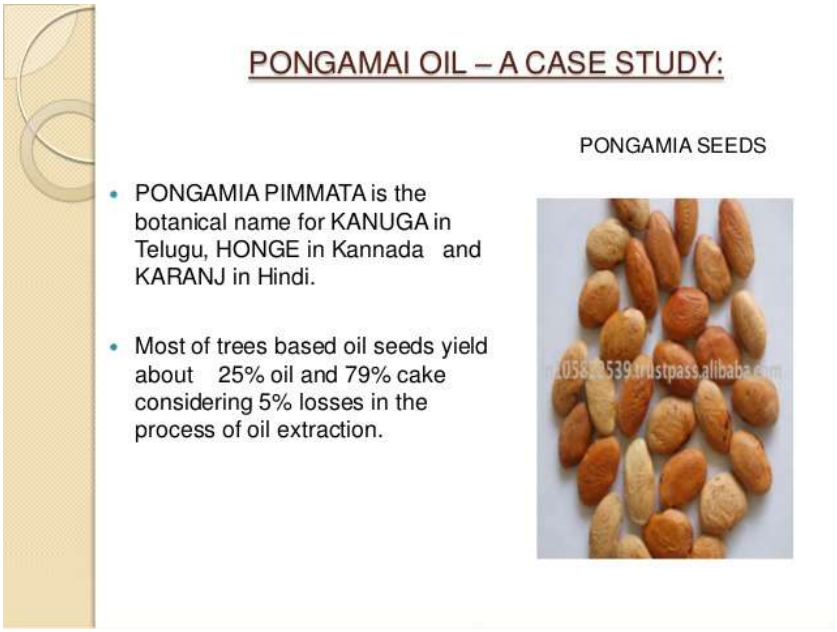

Figure 8.14: **The price of honge oil is quite competitive with other forms of oil.**

Shrinivasa at the Indian Institute of Sciences in Bangalore indicate that honge oil can be produced at the cost of $150 per ton. This price is quite competitive when compared with other potential fuel oils.

Recent studies have also focused on a species of algae that has an oil content of up to 50%. Algae can be grown in desert areas, where cloud cover is minimal. Farm waste and excess CO_2 from factories can be used to speed the growth of the algae.

It is possible that in the future, scientists will be able to create new species of algae that use the sun's energy to generate hydrogen gas. If this proves to be possible, the hydrogen gas may then be used to generate electricity in fuel cells, as will be discussed below in the section on hydrogen technology. Promising research along this line is already in progress at the University of California, Berkeley.

Biogas is defined as the mixture of gases produced by the anaerobic digestion of organic matter. This gas, which is rich in methane (CH_4), is produced in swamps and landfills, and in the treatment of organic wastes from farms and cities. The use of biogas as a fuel is important not only because it is a valuable energy source, but also because methane is a potent greenhouse gas, which should not be allowed to reach the atmosphere. Biogas produced from farm wastes can be used locally on the farm, for cooking and heating, etc. When biogas has been sufficiently cleaned so that it can be distributed in a pipeline, it is known as "renewable natural gas". It may then be distributed in the natural gas grid, or it can be compressed and used in internal combustion engines. Renewable natural gas can also be used in fuel cells, as will be discussed below in the section on Hydrogen Technology.

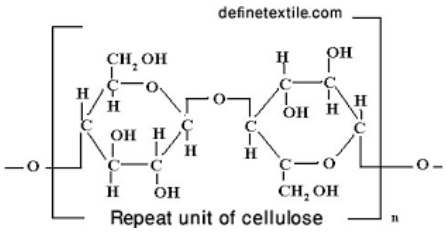

Figure 8.15: **Cellulose is a polysacheride. In other words, it is a long polymer whose subunits are sugars. The links between the sugar subunits in the chain can be broken, for example by the action of enzymes or acids. After this has been done, the resulting sugars can be fermented into alcohols, and these can be used to fuel motor vehicles or aircraft.**

Cellulostic ethanol

The fact that alcohols such as ethanol can be produced from cellulose has long been known.[10] In 1819, the French chemist Henri Braconnot demonstrated that cellulose could be broken down into sugars by treating it with sulfuric acid. The sugars thus produced could then be fermented into alcohols which could be used as liquid fuels.

In 1898, Germany built factories to commercialize this process, and shortly afterwards the same was done in the United States using a slightly different technique. These plants producing cellulostic ethanol operated during World War I, but the plants closed after the end of the war because of the cheapness and easy availability of fossil fuels. The production of cellulostic ethanol was revived during World War II.

During the last two decades, development of enzymatic techniques has supplied a better method of breaking the long cellulose polymer chain into sugars. In fact, it has recently become possible to use microbial enzymes both for this step and for the fermentation step.

In a September 9, 2008 article in the *MIT Technology Review*. Prachi Patal wrote: "New genetically modified bacteria could slash the costs of producing ethanol from cellulostic biomass, such as corn cobs and leaves, switchgrass, and paper pulp. The microbes produce ethanol at higher temperatures than are possible using yeast, which is currently employed to ferment sugar into the biofuel. The higher temperature more than halves the quantity of the costly enzymes needed to split cellulose into the sugars that the microbes can ferment. What's more, while yeast can only ferment glucose, 'this microorganism is good at using all the different sugars in biomass and can use them simultaneously and rapidly,' says Lee Lynd, an engineering professor at Dartmouth College, who led the microbe's development...

"Lynd wants to create microbes that would do it all: efficiently break down the cellulose and hemicellulose, and then ferment all the resulting sugars. Lynd, a cofounder of Mascoma, is working with colleagues at the startup, based in Cambridge, MA, to develop a simple one-step process for making cellulostic ethanol. In the combined process, a mixture of biomass and the microbes would go into a tank, and ethanol would come out."

Cellulostic ethanol has several advantages over alcohol derived from grain;

[10]See the Wikipedia article on *Cellulostic Ethanol*

- Cellulostic ethanol avoids the food-fuel competition.
- The net greenhouse-gas-reducing effect of ethanol derived from grain is questionable.
- Cellulostic ethanol can use cardboard and paper waste as starting substances, thus reducing the quantity of trash in waste dumps.

8.10 Geothermal energy

The ultimate source of geothermal energy is the decay of radioactive nuclei in the interior of the earth. Because of the heat produced by this radioactive decay, the temperature of the earth's core is 4300 ^{o}C. The inner core is composed of solid iron, while the outer core consists of molten iron and sulfur compounds. Above the core is the mantle, which consists of a viscous liquid containing compounds of magnesium, iron, aluminum, silicon and oxygen. The temperature of the mantle gradually decreases from 3700 ^{o}C near the core to 1000 ^{o}C near the crust. The crust of the earth consists of relatively light solid rocks and it varies in thickness from 5 to 70 km.

The outward flow of heat from radioactive decay produces convection currents in the interior of the earth. These convection currents, interacting with the earth's rotation, produce patterns of flow similar to the trade winds of the atmosphere. One result of the currents of molten conducting material in the interior of the earth is the earth's magnetic field. The crust is divided into large sections called "tectonic plates", and the currents of molten material in the interior of the earth also drag the plates into collision with each other. At the boundaries, where the plates collide or split apart, volcanic activity occurs. Volcanic regions near the tectonic plate boundaries are the best sites for collection of geothermal energy.

The entire Pacific Ocean is ringed by regions of volcanic and earthquake activity, the so-called Ring of Fire. This ring extends from Tierra del Fuego at the southernmost tip of South America, northward along the western coasts of both South America and North America to Alaska. The ring then crosses the Pacific at the line formed by the Aleutian Islands, and it reaches the Kamchatka Peninsula in Russia. From there it extends southward along the Kurile Island chain and across Japan to the Philippine Islands, Indonesia and New Zealand. Many of the islands of the Pacific are volcanic in nature. Another important region of volcanic activity extends northward along the Rift Valley of Africa to Turkey, Greece and Italy. In the Central Atlantic region, two tectonic plates are splitting apart, thus producing the volcanic activity of Iceland. All of these regions are very favorable for the collection of geothermal power.

The average rate at which the energy created by radioactive decay in the interior of the earth is transported to the surface is 0.06 W_t/m^2. However, in volcanic regions near the boundaries of tectonic plates, the rate at which the energy is conducted to the surface is much higher - typically 0.3 W_t/m^2. If we insert these figures into the thermal conductivity law

$$q = K_T \frac{\Delta T}{z}$$

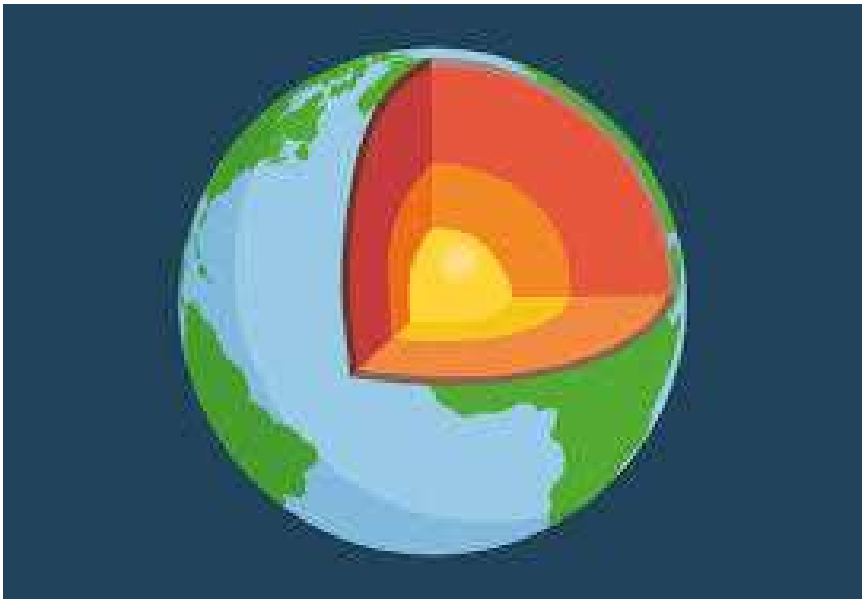

Figure 8.16: **The source of geothermal energy is the radioactive decay of elements deep within the earth.**

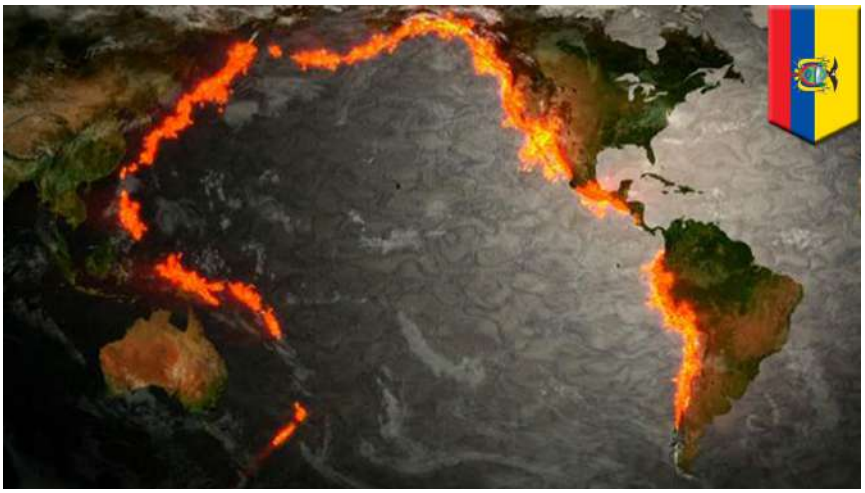

Figure 8.17: **The "ring of fire" is especially favorable for geothermal energy installations. The ring follows the western coasts of South America and North America to Alaska, After crossing the Bering Sea, it runs southward past Japan and Indonesia to New Zealand. Earthquakes and volcanic activity along this ring are produced by the collision of tectonic plates. Another strip-like region very favorable for geothermal installations follows Africa's Rift Valley northward through Turkey and Greece to Italy, while a third pass through Iceland.**

we can obtain an understanding of the types of geothermal resources available throughout the world. In the thermal conductivity equation, q is the power conducted per unit area, while K_T is the thermal conductivity of the material through the energy is passing. For sandstones, limestones and most crystalline rocks, thermal conductivities are in the range 2.5-3.5 $W_t/(m\ ^oC)$. Inserting these values into the thermal conductivity equation, we find that in regions near tectonic plate boundaries we can reach temperatures of 200 ^oC by drilling only 2 kilometers into rocks of the types named above. If the strata at that depth contain water, it will be in the form of highly-compressed steam. Such a geothermal resource is called a *high-enthalpy* resource[11].

In addition to high-enthalpy geothermal resources there are *low-enthalpy* resources in nonvolcanic regions of the world, especially in basins covered by sedimentary rocks. Clays and shales have a low thermal conductivity, typically 1-2 $W_t/(m\ ^oC)$. When we combine these figures with the global average geothermal power transmission, $q = 0.06\ W_t/m^2$, the thermal conduction equation tells us that $\Delta T/z = 0.04\ ^oC/m$. In such a region the geothermal resources may not be suitable for the generation of electrical power, but nevertheless adequate for heating buildings. The Creil district heating scheme north of Paris is an example of a project where geothermal energy from a low enthalpy resource is used for heating buildings.

The total quantity of geothermal electrical power produced in the world today is 8 GW_e, with an additional 16 GW_t used for heating houses and buildings. In the United States alone, 2.7 GW_e are derived from geothermal sources. In some countries, for example Iceland and Canada, geothermal energy is used both for electrical power generation and for heating houses.

There are three methods for obtaining geothermal power in common use today: Deep wells may yield dry steam, which can be used directly to drive turbines. Alternatively water so hot that it boils when brought to the surface may be pumped from deep wells in volcanic regions. The steam is then used to drive turbines. Finally, if the water from geothermal wells is less hot, it may be used in binary plants, where its heat is exchanged with an organic fluid which then boils. In this last method, the organic vapor drives the turbines. In all three methods, water is pumped back into the wells to be reheated. The largest dry steam field in the world is The Geysers, 145 kilometers north of San Francisco, which produces 1,000 MW_e.

There is a fourth method of obtaining geothermal energy, in which water is pumped down from the surface and is heated by hot dry rocks. In order to obtain a sufficiently large area for heat exchange the fissure systems in the rocks must be augmented, for example by pumping water down at high pressures several hundred meters away from the collection well. The European Union has established an experimental station at Soultz-sous-Forets in the Upper Rhine to explore this technique. The experiments performed at Soultz will determine whether the "hot dry rock" method can be made economically viable. If so, it can potentially offer the world a very important source of renewable energy.

[11]Enthalpy $\equiv H \equiv U + PV$ is a thermodynamic quantity that takes into account not only the internal energy U of a gas, but also energy PV that may be obtained by allowing it to expand.

The molten lava of volcanoes also offers a potential source of geothermal energy that may become available in the future, but at present, no technology has been developed that is capable of using it.

8.11 Hydrogen technologies

Electrolysis of water

When water containing a little acid is placed in a container with two electrodes and subjected to an external direct current voltage greater than 1.23 Volts, bubbles of hydrogen gas form at one electrode (the cathode), while bubbles of oxygen gas form at the other electrode (the anode). At the cathode, the half-reaction

$$2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^- \qquad E^0 = -1.23\ Volts$$

takes place, while at the anode, the half-reaction

$$4H^+(aq) + 4e^- \rightarrow 2H_2(g) \qquad E^0 = 0$$

occurs.

Half-reactions differ from ordinary chemical reactions in containing electrons either as reactants or as products. In electrochemical reactions, such as the electrolysis of water, these electrons are either supplied or removed by the external circuit. When the two half-reactions are added together, we obtain the total reaction:

$$2H_2O(l) \rightarrow O_2(g) + 2H_2(g) \qquad E^0 = -1.23\ Volts$$

Notice that $4H^+$ and $4e^-$ cancel out when the two half-reactions are added. The total reaction does not occur spontaneously, but it can be driven by an external potential E, provided that the magnitude of E is greater than 1.23 volts.

When this experiment is performed in the laboratory, platinum is often used for the electrodes, but electrolysis of water can also be performed using electrodes made of graphite.

Electrolysis of water to produce hydrogen gas has been proposed as a method for energy storage in a future renewable energy system. For example, it might be used to store energy generated by photovoltaics in desert areas of the world. Compressed hydrogen gas could then be transported to other regions and used in fuel cells. Electrolysis of water and storage of hydrogen could also be used to solve the problem of intermittency associated with wind energy or solar energy.

Half reactions

Chemical reactions in which one or more electrons are transferred are called *oxidation-reduction reactions*. Any reaction of this type can be used in a fuel cell. As an example,

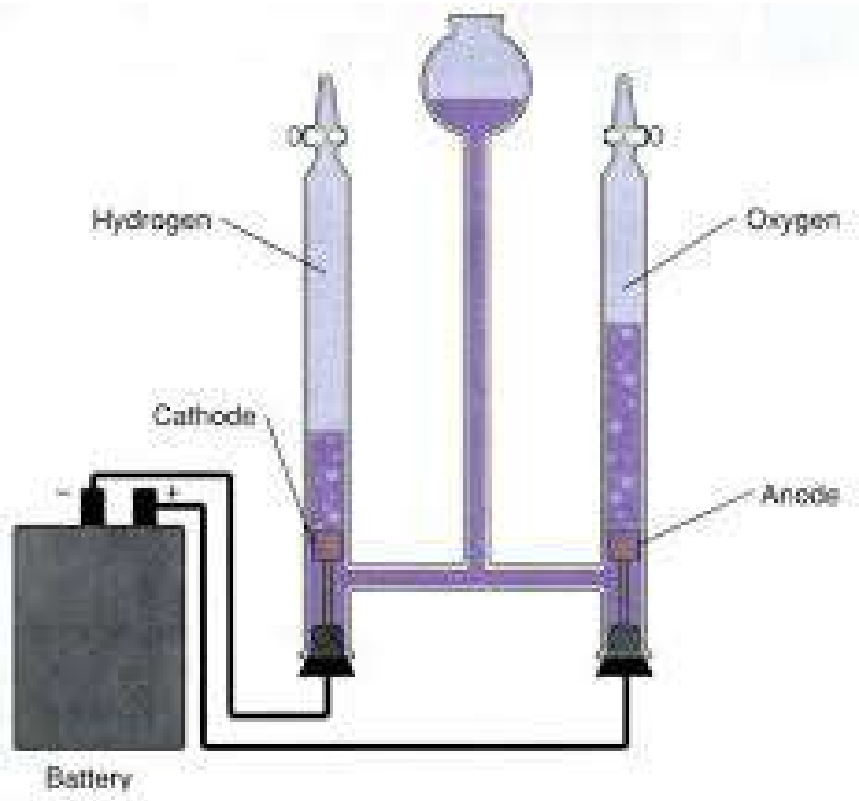

Figure 8.18: **Electrolysis of water.**

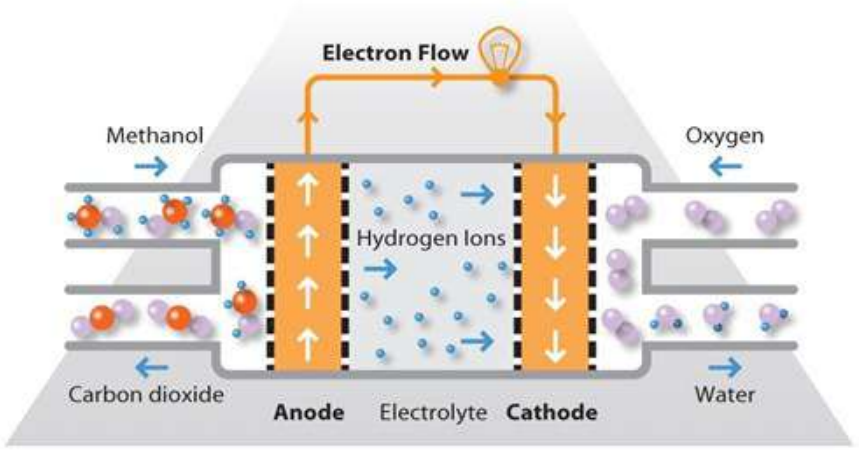

Figure 8.19: **A methanol fuel cell.**

we can consider the oxidation-reduction reaction in which solid lithium metal reacts with fluorine gas;

$$2Li_{(s)} + F_{2(g)} \rightarrow 2LiF_{(s)}$$

This reaction can be split into two half-reactions,

$$Li_{(s)} \rightarrow Li^+ + e^- \qquad E_0 = -3.040\ V$$

and

$$F_{2(g)} \rightarrow 2F^+ + 2e^- \qquad E_0 = 2.87\ V$$

The quantity E_0 which characterizes these half-reactions is called *standard potential* of the half-reaction, and it is measured in Volts. If the oxidation-reduction reaction is used as the basis of a fuel cell, the voltage of the cell is the difference between the two standard potentials. In the lithium fluoride example, it is

$$2.87\ V - (-3.040\ V) = 5.91\ V$$

Here are a few more half-reactions and their standard potentials:

$$\begin{aligned}
K^+ + e^- &\rightarrow K_{(s)} & E_0 &= -2.924\ V \\
Na^+ + e^- &\rightarrow Na_{(s)} & E_0 &= -2.7144\ V \\
2H_2O + 2e^- &\rightarrow H_20 + 2OH^- & E_0 &= -0.828\ V \\
Zn^{2+} + 2e^- &\rightarrow Zn_{(s)} & E_0 &= -0.7621\ V \\
Fe^{2+} + 2e^- &\rightarrow Fe_{(s)} & E_0 &= -0.440\ V \\
Pb^{2+} + 2e^- &\rightarrow Pb_{(s)} & E_0 &= -0.1266\ V \\
2H^+ + 2e^- &\rightarrow H_{2(g)} & E_0 &\equiv 0.0000\ V \\
Cu^{2+} + 2e^- &\rightarrow Cu_{(s)} & E_0 &= +0.3394\ V \\
I_{2(s)} + 2e^- &\rightarrow 2I^- & E_0 &= +0.535\ V \\
Fe^{3+} + e^- &\rightarrow Fe^{2+} & E_0 &= +0.769\ V \\
Br_{2(l)} + 2e^- &\rightarrow 2Br^- & E_0 &= +1.0775\ V \\
O_{2(g)} + 4H^+ + 4e^- &\rightarrow 2H_2O & E_0 &= +1.2288\ V \\
Cl_{2(g)} + 2e^- &\rightarrow 2Cl^- & E_0 &= +1.3601\ V
\end{aligned}$$

Fuel cells are closely related to storage batteries. Essentially, when we recharge a storage battery we are just running a fuel cell backwards, applying an electrical potential which is sufficient to make a chemical reaction run in a direction opposite to the way that it would run spontaneously. When the charged battery is afterwards used to drive a vehicle or to power an electronic device, the reaction runs in the spontaneous direction, but the energy of the reaction, instead of being dissipated as heat, drives electrons through an external circuit and performs useful work.

8.12 Reducing emissions from the cement industry

The cement industry currently account for 7% of all CO_2 emissions, that is to say, three times as much as air travel. If the cement industry were a country, it would be the third largest emitter, after China and the United States. The reason for this enormous and potentially fatal quantity of CO_2 is twofold. Firstly, in the manufacture of Portland cement, the following reaction occurs:

$$C_aCO_3 + \text{heat} \rightarrow CaO + CO_2$$

Thus CO_2 is released in the chemical reaction. Secondly, heat is required to heat the limestone (C_aCO_3) and this heat usually comes from the burning of fossil fuels. However there is hope that new experimental methods may be developed which can reduce or even eliminate the dangerous emissions from the global cement industry.[12]

Here are some excerpts from an article entitled *Why Cement Emissions Matter for Climate Change*[13]:

Some companies have been researching "novel" cements, which do away with the need for Portland clinker altogether. If these could rival the cost and performance of Portland cement, they would offer a way to significantly reduce emissions...

Geopolymer-based cements, for example, have been a focus of research since the 1970s. These do not use calcium carbonate as a key ingredient, harden at room temperature and release only water. Zeobond and banahUK are among firms producing these, with both claiming around 80-90% reduction in emissions compared to Portland cement.

There are also several firms developing "carbon-cured" cements, which absorb CO2, rather than water, as they harden. If this CO2 absorption can be made higher than CO2 released during their production, cements could potentially be used as a carbon sink.

US firm Solidia, for example, claims its concrete emits up to 70% less CO2 than Portland cement, including this sequestering step. The firm is now in a partnership with major cement producer LafargeHolcim.

Similarly, British start-up Novacem - a spin out from Imperial College London - claimed in 2008 that replacing Portland cement with its "carbon negative" product would allow the industry to become a net sink of CO2 emissions. However, the firm failed to raise sufficient funds to continue research and production.

Other firms are using completely different materials to make cement. North Carolina-based startup Biomason, for example, uses bacteria to grow cement bricks which it says are both similarly strong to traditional masonry and carbon-sequestering.

[12] https://www.ecowatch.com/scientists-create-living-concrete-2644831492.html
[13] https://www.carbonbrief.org/qa-why-cement-emissions-matter-for-climate-change

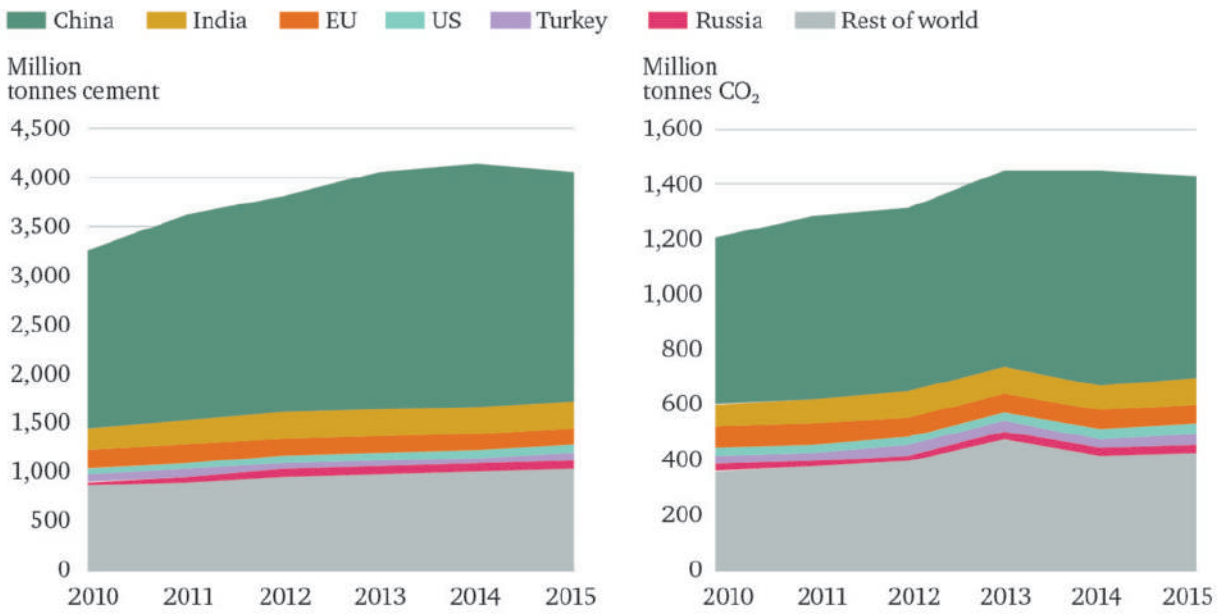

Figure 8.20: **China is the largest producer of cement and the associated CO_2 emissions.**

Figure 8.21: **BioMason uses bacteria to grow cement bricks which it says can sequester carbon. Credit: bioMASON, Inc..**

8.13 Reducing emissions from transportation sectors

We are in love with our automobiles, but it is not certain that they make our lives happier. We love our cars so much that we are willing to die (and kill) for them: Wikipedia states that "It is estimated that motor vehicle collisions caused the death of around 60 million people during the 20th century, around the same number of World War II casualties. Just in 2010 alone, 1.23 million people were killed due to traffic collisions."

Besides being dangerous, automobiles make our cities unpleasant. A pleasant city center is, almost by definition, a car-free one. Today, both tourists and Danish citizens enjoy Copenhagen's bicycle culture and car-free city center[14], and throughout the world, the pleasantness of cities is inversely proportional to the number of automobiles.

Some people visualize the transition from internal combustion engines to electric vehicles as the only change needed to make transportation environmentally friendly; but this ignores the enormous amount of energy, water (148,000 liters), and other resources needed to manufacture private automobiles. A truly sustainable future requites a transition, wherever possible, from private to public transport.

The government of Luxombourg recently announced that it intends to make all public transportation entirely free[15], thus saving on the collection of fares, and eliminating the massive traffic jams that have plagued the country's capital.Luxembourg City, the capital of the small Grand Duchy, suffers from some of the worst traffic congestion in the world. It is home to about 110,000 people, but a further 400,000 commute into the city to work. It will be interesting to follow the progress of this enlightened decision, due to take effect in 2020. Hopefully other countries will follow Luxombourg's example. Luxembourg has increasingly shown a progressive attitude to transport. This summer, the government brought in free transport for every child and young person under the age of 20. Secondary school students can use free shuttles between their institution and their home.

Top Gear is long-running BBC program celebrating the delights of car ownership and motor sport. It is an example of the fact that our mass media actively encourage harmful and unsustainable human behavior. The program appeals to car enthusiasts - people who are passionate about automobiles. How much better it would be if they were passionate about saving human civilization and the biosphere from irreversible feedback loops leading in the long run to catastrophic climate change, mass extinctions, and the collapse of human civilization!

In an article entitled *Why are people so in love with their cars?* [16], Tim Dugan explains why he loves his car:

"This car is bought and paid for by my own hand, it is the first major purchase I ever made as an adult. I worked off the loan and it wholly belongs to me. There is a sense of pride in this. Seeing the fruits of your labor and your saving and scrounging.

[14]https://www.theguardian.com/cities/2016/may/05/story-cities-copenhagen-denmark-modernist-utopia

[15]https://www.theguardian.com/world/2018/dec/05/luxembourg-to-become-first-country-to-make-all-public-transport-free

[16]https://www.quora.com/Why-are-people-so-in-love-with-their-cars

Figure 8.22: **Motor traffic in Manila.**

Figure 8.23: **We love our cars.**

"This car is a tribute to my mother, who has passed away a few years ago. I grew up in a 1981 Camaro, she loved her car like I love mine.

"This car goes FAST. I don't care much for racing but I do love driving fast and boy does her 700rwhp provide that!!

"I have personally seen her at her worst and best. I've had my hands covered in Camaro guts, elbow deep. I've felt the pain of seeing your brand new car with a blown motor out of it sitting in your garage with a hole where the engine is supposed to be and knowing your warranty ain't gonna cover that. These experiences made this vehicle mine through blood, sweat, tears, and vulgar language.

"This car is an extension of my personality. I am loud and noisy when I need to be but I prefer to stay subdued. This machine doesn't need to prove anything. She exudes confidence in herself and her ability to perform at 110% at a moments' notice - but she don't need to prove it, you can look at it, you can hear it and you'll know what's up. Just like her owner. I have nothing to prove - I've made my mark, I believe in myself and let the world make its decision.

"Lastly, this car changed my life. It gave me confidence and pride in myself. It helped me to get in touch with the man I would later grow up to become. It pushed me into a direction in life of working with my hands and being proud of doing well for myself without being stuck in a cubicle. It introduced and brought me into a huge group of amazing people I wouldn't have otherwise known. It gave my future wife a sense of my personality before she even met me. She knew I was a confident self sufficient red blooded American Male without me even saying a word - my Camaro did all the talking for me. She turns heads, she makes kids jump up and down screaming, 'THERE'S THE BAT-MOBILE!' She is a fantastic money sink, a pleasure to drive, and a fine automobile. Never will this vehicle leave my possession and never will it find decay in a junk heap while I walk this earth. It is my friend and compatriot, through thick and thin we have been together, even on the worst days I can hop in this thing and go for a spin and find solace, enjoyment, and testosterone producing speed."

Investment in electric vehicles

On July 5, 2017, the Volvo Car Group made the following announcement: [17]

"Volvo Cars, the premium car maker, has announced that every Volvo it launches from 2019 will have an electric motor, marking the historic end of cars that only have an internal combustion engine (ICE) and placing electrification at the core of its future business.

"The announcement represents one of the most significant moves by any car maker to embrace electrification and highlights how over a century after the invention of the internal combustion engine electrification is paving the way for a new chapter in automotive history.

"'This is about the customer,' said Håkan Samuelsson, president and chief executive.

[17] https://www.media.volvocars.com/global/en-gb/media/pressreleases/210058/volvo-cars-to-go-all-electric

'People increasingly demand electrified cars and we want to respond to our customers' current and future needs. You can now pick and choose whichever electrified Volvo you wish.'

"Volvo Cars will introduce a portfolio of electrified cars across its model range, embracing fully electric cars, plug in hybrid cars and mild hybrid cars.

"It will launch five fully electric cars between 2019 and 2021, three of which will be Volvo models and two of which will be high performance electrified cars from Polestar, Volvo Cars' performance car arm. Full details of these models will be announced at a later date."

The electric vehicle investment opportunity was also illustrated by the 2017 vote of Germany's Bundesrat to ban the manufacture of internal combustion engines after 2030 [18].

The article announcing the vote adds that "It's a strong statement in a nation where the auto industry is one of the largest sectors of the economy; Germany produces more automobiles than any other country in Europe and is the third largest in the world. The resolution passed by the Bundesrat calls on the European Commission (the executive arm of the European Union) to 'evaluate the recent tax and contribution practices of Member States on their effectiveness in promoting zero-emission mobility,' which many are taking to mean an end to the lower levels of tax currently levied on diesel fuel across Europe."

France plans to end the sale of vehicles powered by gasoline and diesel by 2040, environment minister Nicolas Hulot announced recently.

Hulot made the announcement on Thursday, June 13, 2017, in Paris as he launched the country's new Climate Plan to accelerate the transition to clean energy and to meet its targets under the Paris climate agreement.

To ease the transition, Hulot said the French government will offer tax incentives to replace fossil-fuel burning cars with clean alternatives.

Furthermore, the government of India has recently announced its intention to only nave electric vehicles by 2030[19]. This hugely ambitious plan was announced during the 2017 Confederation of Indian Industry Annual Session. Besides the avoidance of climate change, which might make many regions of India uninhabitable, the motive for replacing 28 million combustion engine vehicles by electric ones was the severe air pollution from which India suffers. Severe air pollution also motivates efforts by the government of China to promote the transition to electric vehicles.

The governments of Norway and the Netherlands have taken steps towards banning the internal combustion engine[20]. Both the upper and lower houses of the Netherlands' government voted to ban cars driven by internal combustion engines by 2025, the same year in which Norway plans to sell nothing but zero-emission vehicles.

[18]https://arstechnica.com/cars/2016/10/germanys-bundesrat-votes-to-ban-the-internal-combustion-engine-by-2030/

[19]https://www.greentechmedia.com/articles/read/what-country-will-become-the-first-to-ban-internal-combustion-cars

[20]http://www.prnewswire.com/news-releases/the-dutch-revolution-in-smart-charging-of-electric-vehicles-597268791.html

In a report commissioned by the investment bankers Cowan & Co, managing director and senior research analyst Jeffrey Osborne, predicted that electric vehicles will cost less than gasoline-powered cars by the early- to mid-2020s due to falling battery prices as well as the costs that traditional carmakers will incur as they comply to new fuel-efficiency standards. Osbourne pointed out that a number of major car brands are hopping onto the electric bandwagon to compete in a space carved out by industry disrupter, Tesla.

"We see the competitive tides shifting in 2019 and beyond as European [car makers] roiled by the diesel scandal and loss of share to Tesla in the high margin luxury segment step on the gas and accelerate the pace of EV introductions", he wrote.

Bloomberg New Energy Finance reported similar predictions: "Falling battery costs will mean electric vehicles will also be cheaper to buy in the U.S. and Europe as soon as 2025," the report said. "Batteries currently account for about half the cost of EVs, and their prices will fall by about 77 percent between 2016 and 2030."

In October, 2017, General Motors unveiled plans to roll out 20 new entirely electric car models by 2023, with two of the new EVs coming out in the next 18 months. Meanwhile, Ford announced the creation of "Team Edison," intended to accelerate the company's EV development and partnership work. The name, is "seemingly in direct response to Elon Musk's Tesla, which recently surpassed Ford's market capitalization."

Tesla's Chairman, highly successful inventor and entrepreneur Elon Musk, has made massive investments in factories manufacturing electric vehicles, improved lithium ion storage cells, and photovoltaic panels, as will be discussed in Chapter 2.

Elon Musk and renewable energy technology

Elon Reve Musk was born in 1971 in South Africa. At the age of 10, he developed an interest in computer programming, and by 12 he had invented a computer game which he sold for $500. Just before his 18th birthday, Musk moved to Canada, obtaining citizenship through his Canadian-born mother. After studying for two years at Queens University in Kingston Ontario, Musk moved to the University of Pennsylvania, where where he obtained degrees in both science and economics.

At the age of 24, Elon Musk started Ph.D. studies in applied physics and material science at Stanford University, but he left the program (after 2 days!) to pursue his interests in the Internet-based businesses, renewable energy and outer space. He became a US citizen in 2002. In the meantime, Musk's business ventures and his inventions have made him the 80th wealthiest person in the world. In 2016 he was ranked as 21st on the Forbes list of the world's most powerful people. He has been called the new Thomas Edison.

Luckily, the transition to 100% renewable energy holds a high place in Musk's priorities, and he has applied his genius both as an inventor and as a businessman to achieving this goal. Two of the corporations led by Musk, Tesla and Solar City, are devoted to solving the problem of intermittency through improved storage batteries, replacing petroleum-driven automobiles by attractive and affordable electric cars, and harnessing solar energy.

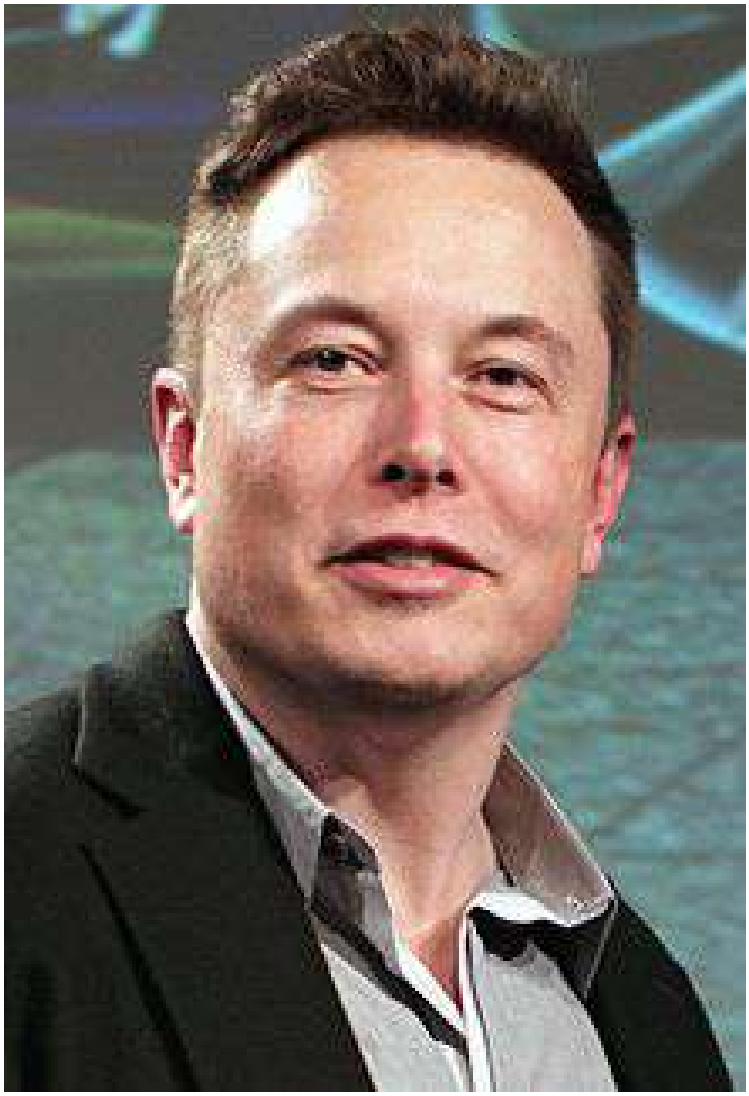

Figure 8.24: **Elon Musk in 2015 (Wikipedia)**

Figure 8.25: **Tesla's Gigafactory 1 in Nevada produces improved lithium ion batteries. Energy for the factory is supplied by solar panels on the roof.**

Figure 8.26: **Gigafactory 2. SolarCity's factory in Buffalo New York produces high-efficiency solar modules. Elon Musk estimates that only 100 gigafactories would be enough to achieve a worldwide transition to 100% renewable energy.**

Figure 8.27: **Tesla was the world's best selling plug-in passenger car manufacturer in 2018.**

Figure 8.28: **Tesla Model 3 production model.**

Figure 8.29: **An electric car currently being produced by General Motors.**

SolarCity leases rooftop solar to customers who pay no upfront costs. In exchange, customers pay for 20 years for power generated by those panels.

Wikipedia states that "In June 2014, SolarCity announced plans to build a new manufacturing facility in Buffalo, New York, in coordination with the SUNY Polytechnic Institute after acquiring Silevo, a maker of high-efficiency solar modules. The initial manufacturing complex will be a 1.2-million-square-foot (110,000 m2) facility that will cost $900 million and employ 1,500 workers in Buffalo and 5,000 statewide."

Speaking at the University of Paris during the recent climate talks, Elon Musk said "The important thing to appreciate is if let's say the only thing we had was solar energy, that that was the only power source, if you just took a small section of Spain, you could power all of Europe. It's a very small amount of area that's actually needed to generate the electricity we need to power civilization, or in the case of the US, a little corner of Nevada or Utah, power the entire United States."

Musk has also predicted that by 2031, solar energy will be the world's largest energy source.

8.14 Renewables are now much cheaper than fossil fuels!

According to an article written by Megan Darby and published in *The Guardian* on 26 January, 2016, "Solar power costs are tumbling so fast the technology is likely to fast outstrip mainstream energy forecasts.

"That is the conclusion of Oxford University researchers, based on a new forecasting model published in Research Policy[21].

"Commercial prices have fallen by 58% since 2012 and by 16

"Since the 1980s, panels to generate electricity from sunshine have got 10% cheaper each year. That is likely to continue, the study said, putting solar on course to meet 20% of global energy needs by 2027.' '

[21] http://www.sciencedirect.com/science/article/pii/S0048733315001699

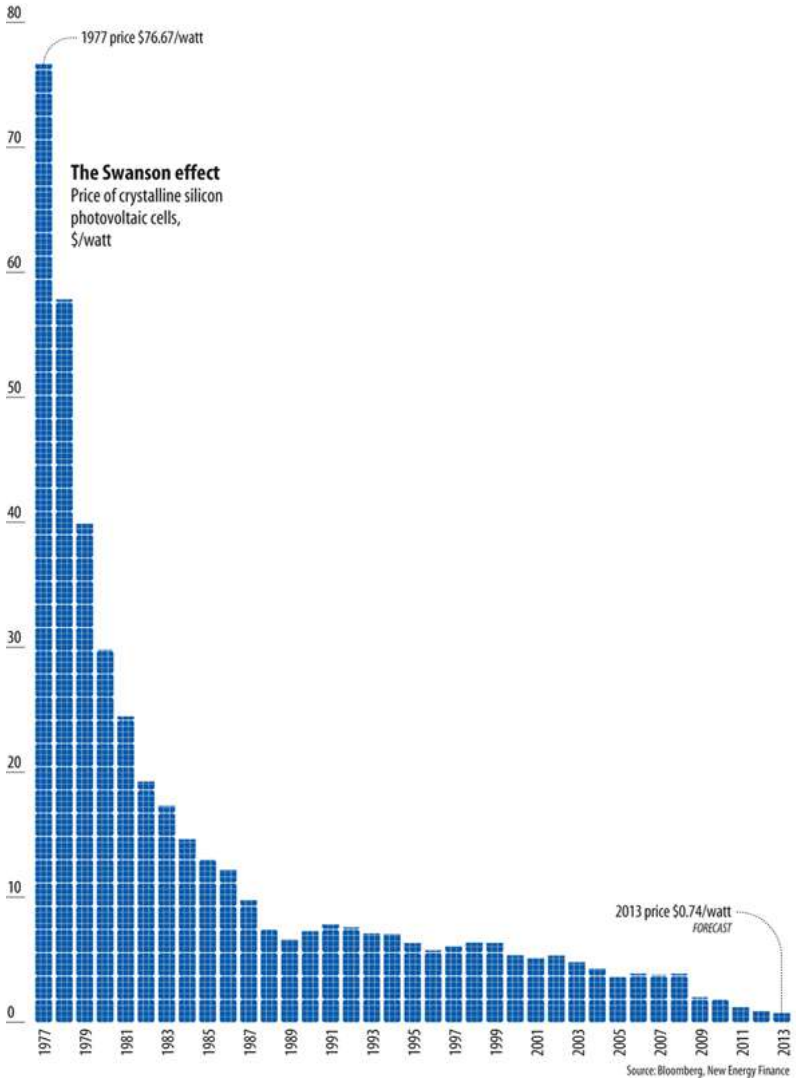

Figure 8.30: **The cost of photovoltaic cell panels is falling rapidly**

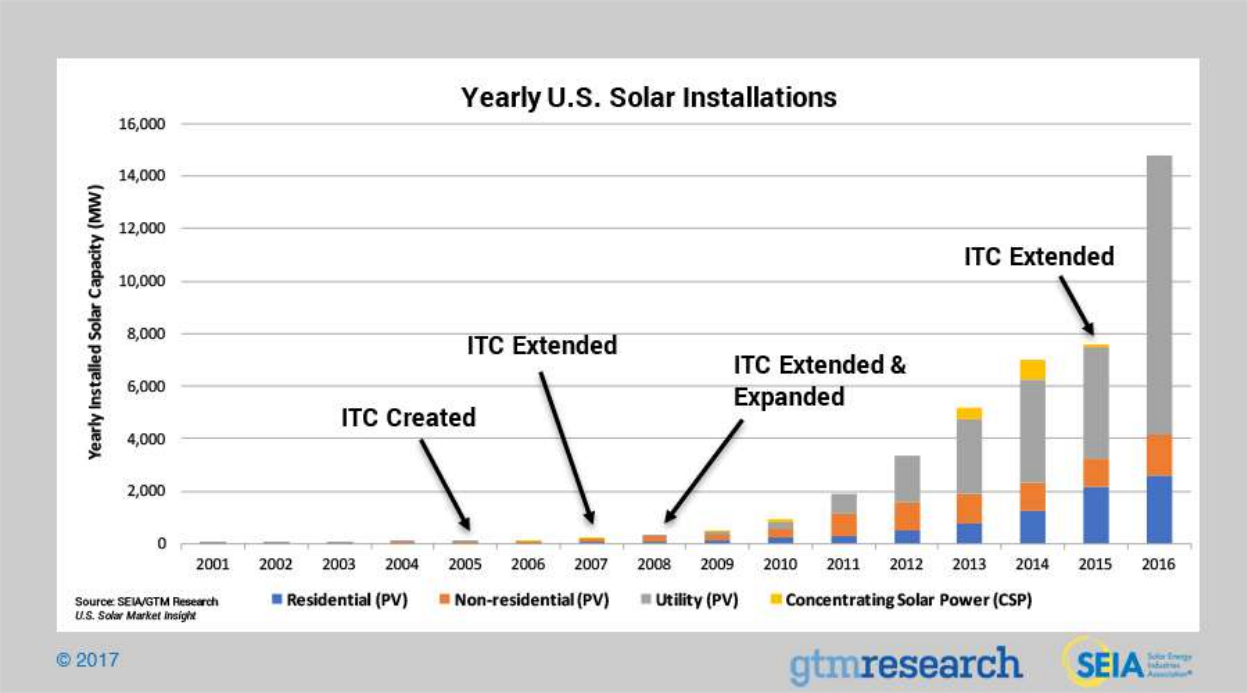

Figure 8.31: **Driven by falling prices, new solar installations in the United States are increasing rapidly. The acronym ITC stands for Solar Investment Tax Credit. Commercial prices have fallen by 58% since 2012 and by 16% in the last year**

8.15 Lester R. Brown

In December 2008, Lester R. Brown called attention to the following facts:

- The renewable energy industry - wind, solar, geothermal - are expanding by over 30 percent yearly;
- There are now, in the U.S., 24,000 megawatts of wind generating capacity online, but there is a staggering 225,000 megawatts of planned wind farms;
- What is needed is a World War II-type mobilization to produce electric-powered cars that will operate at an equivalent gas cost of $1 per gallon (Replacing each SUV with a plug-in hybrid could save $20,000 of oil imports over its lifetime);

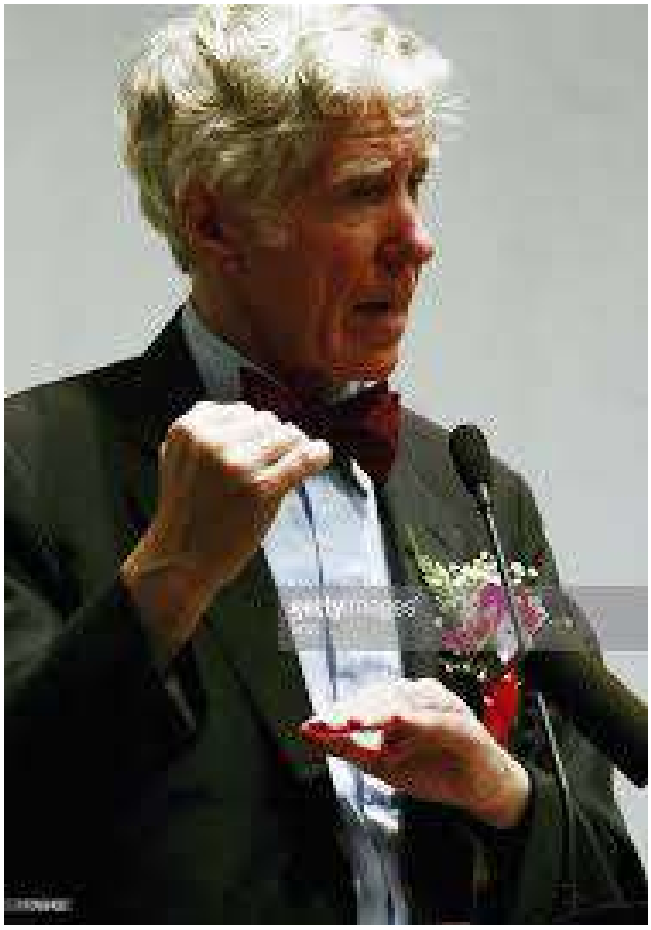

Figure 8.32: **Lester R. Brown, born in 1934, is the author of more than 50 books, and he has been called "...one of the world's most influential thinkers" (Washington Post). He is the founder of the Worldwatch Institute and the Earth Policy Institute. Books produced by Brown and his coworkers at the EPI can be freely downloaded and circulated. The 2015 book *The Great Transition: Shifting From Fossil Fuels to Solar and Wind Energy* can be freely downloaded from the following link: http://www.earth-policy.org/books/tgt**

8.16 We must create a livable future world

We give our children loving care, but it makes no sense to do so unless we do everything in our power to give them a future world in which they can survive. We also have a duty to our grandchildren, and to all future generations.

The amazingly rapid growth of science, technology, agriculture and industry has given the world many benefits, but indefinite growth on a finite planet is a logical impossibility, and we have now reached the point where the human success story has become a threat. Today we are faced with the threat of an environmental megacatastrophe, of which the danger of catastrophic climate change is a part. Human ingenuity also produced nuclear weapons, but the development of international law, governance and ethics has not kept pace, and we face the threat of an all-destroying nuclear war. Finally, because of population growth, the effect of climate change on agriculture, and the end of the fossil fuel era, there is a danger that by the middle of the present century a very large-scale famine could take the lives of as many as a billion people.

We owe it to future generations to take urgent action to prevent these threatened catastrophes. In the present chapter, we will focus on the climate emergency, while the dangers of nuclear war and famine will be discussed in chapters 3 and 5.

A United Nations report released Wednesday , 20 November, 2019, warned that worldwide projections for fossil fuel production over the next decade indicate that the international community is on track to fail to rein in planet-heating emissions and prevent climate catastrophe.

The Production Gap[22] is an 80 page report produced by a collaboration between the UN Environmental Programme and a number of academic institutions. It examines the discrepancy between countries' planned fossil fuel production and global production levels consistent with limiting warming to 1.5^oC or 2^oC, and concludes that the necessary policy changes are currently not being made.

The famous economist Nicholas Stern has stated that "This important report shows that governments' projected and planned levels of coal, oil, and gas production are dangerously out of step with the goals of the Paris agreement on climate change. It illustrates the many ways in which governments subsidize and otherwise support the expansion of such production. Instead, governments should implement policies that ensure existing production peaks soon and then falls very rapidly."

In an article published in *Common Dreams* on Wednesday, November 20, 2019, Hoda Baraka, the Chief Communications Officer for 350.org wrote: "The disconnect between Paris temperature goals and countries' plans and policies for coal, oil, and gas production is massive, worrying and unacceptable...

"The *production gap* is a term used to refer to the difference between a countries' planned levels of fossil fuel production, and what is needed to achieve international climate goals. This is the first time a UN report has looked directly and specifically at fossil fuel production as a key driver of climate breakdown. It shows that countries are planning to

[22]http://productiongap.org/wp-content/uploads/2019/11/Production-Gap-Report-2019.pdf

Figure 8.33: **"Ensuring a livable planet for future generations means getting serious about phasing out coal, oil, and gas," said Christiana Figueres, former executive secretary of the UNFCCC, "Countries such as Costa Rica, Spain, and New Zealand are already showing the way forward, with policies to constrain exploration and extraction and ensure a just transition away from fossil fuels. Others must now follow their lead."**

Figure 8.34: **Today the beautiful city of Venice is flooded. Tomorrow unless urgent climate action is taken, all coastal cities will be under water.**

produce fossil fuels far in excess of the levels needed to fulfil their climate pledges under the Paris Agreement, which themselves are far from adequate. This over investment in coal, oil, and gas supply locks in fossil fuel infrastructure that will make emissions reductions harder to achieve.

"The science is clear, to stay below 1.5 degrees we must stop the expansion of the fossil fuel industry immediately. That means that not a single new mine can be dug, not another pipeline built, not one more emitting powerplant fired up. And we have to get to work transitioning to sustainable renewable energy powered energy systems.

"Across the globe resistance to fossil fuels is rising, the climate strikes have shown the world that we are prepared to take action. Going forward our job is to keep up a steady drumbeat of actions, strikes and protests that gets louder and louder throughout 2020. Governments need to follow through, to act at the source of the flames that are engulfing our planet and phase out coal, oil, and gas production."

Figure 8.35: **On Friday, November 15, 2019, in a speech at the Vatican, Pope Francis railed against corporate crimes and announced consideration of adding "sins against ecology" to the church's official teachings. "The principle of profit maximization, isolated from any other consideration, leads to a model of exclusion which violently attacks those who now suffer its social and economic costs, while future generations are condemned to pay the environmental costs", he said. In his speech, Francis condemned global corporations that are responsible for "countries' over-indebtedness and the plunder of our planet's natural resources." He said that their activities have the "gravity of crimes against humanity," especially when they lead to hunger, poverty and the eradication of indigenous peoples.**

Figure 8.36: **A new report indicates that half of all insects may have been lost since 1970 as a result of the destruction of nature and heavy use of pesticides. The report said 40% of the 1million known species of insect are facing extinction. Unless steps are taken to correct the excessive use of pesticides and loss of habitat, there will be profound consequences for humans and all life on Earth. "We can't be sure, but in terms of numbers, we may have lost 50% or more of our insects since 1970 - it could be much more," said Prof Dave Goulson, at the University of Sussex, UK, who wrote the report for the Wildlife Trusts. Since most crops depend on insect pollination, the insect apocalypse will make it difficult to feed the Earth's growing population unless urgent corrective steps are taken.**

Figure 8.37: **Senator Bernie Sanders and Representative Alexandria Ocasio-Cortez field questions from audience members at the Climate Crisis Summit at Drake University on November 9, 2019, in Des Moines, Iowa. "Faced with the global crisis of climate change, the United States must lead the world in transforming our energy system away from fossil fuel to sustainable energy. The Green New Deal is not just about climate change," Sanders said, "It is an economic plan to create millions of good-paying jobs, strengthen our infrastructure, and invest in our country's frontline and vulnerable communities." The Green New Deal, which is strongly advocated by Sanders and Ocasio-Cortez in the United States, and also currently debated in many other countries, is inspired by the set of programs that Franklin D. Roosevelt used to end the Great Depression. It aims at maintaining full employment by substituting jobs in creating renewable energy infrastructure for jobs lost in the fossil fuel sector.**

Figure 8.38: **The *World Scientists' Warning of a Climate Emergency* was published in Bioscience on 5 November, 2019. The article states that "Scientists have a moral obligation to clearly warn humanity of any catastrophic threat and to 'tell it like it is.' On the basis of this obligation and the graphical indicators presented below, we declare, with more than 11,000 scientist signatories from around the world, clearly and unequivocally that planet Earth is facing a climate emergency...Despite 40 years of global climate negotiations... we have generally conducted business as usual and have largely failed to address this predicament."**

Figure 8.39: **Bush fires in Australia are threatening Sydney and have caused the Australian government to declare a state of emergency. But Australia's politicians continue the policies that have made their nation a climate change criminal, exporting vast quantities of coal and beef. The Deputy Prime Minister Michael McCormack said, of the fire victems: "They don't need the ravings of some pure enlightened and woke capital city greenies at this time when they are trying to save their homes." In other words, let's not talk about climate change. With costs approaching $100 billion, and a billion animals killed, the fires are the costliest natural disaster in Australian history. The link to climate change is obvious to anyone not profiting from the export of coal.**

Figure 8.40: **A Peoples' Climate March in Amsterdam, calling for an ambitious climate policy. The *World Scientists' Warning of a Climate Emergency* called attention to a number of indicators: "The basic scientific data of these changes is presented simply and with great clarity: a 5 percent rise every 10 years in carbon emissions; a 3.65 percent rise of another powerful greenhouse gas, methane, every 10 years; a global surface temperature rise of .183 degrees Celsius every 10 years; a decline of Arctic sea ice at a rate of 11.7 percent every 10 years; significant drops in the ice mass of Greenland, Antarctica and world glaciers; an increase in ocean acidity and temperatures; an increase of 44 percent in the amount of area burned by wildfires in the U.S. every 10 years; and an 88 percent rise in extreme weather events per 10 years."**

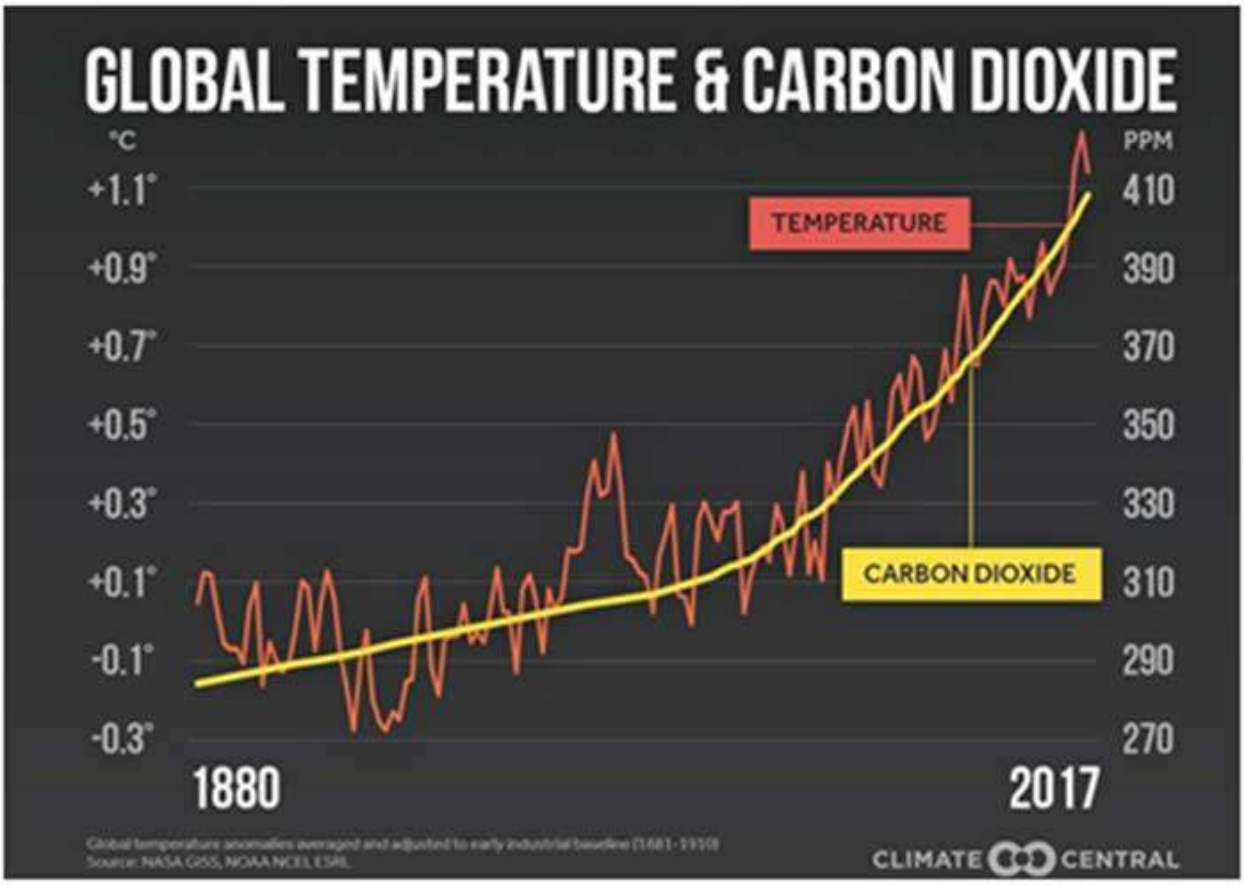

Figure 8.41: **The graphs showing increase in global temperatures and carbon dioxide follow each other closely. In an article published in Countercurrents on November 6, 2019, Dr. Andrew Glickson wrote: "As the concentration of atmospheric CO_2 has risen to 408 ppm and the total greenhouse gas level, including methane and nitrous oxide, combine to near 500 parts per million CO_2-equivalent, the stability threshold of the Greenland and Antarctic ice sheets, currently melting at an accelerated rate, has been exceeded. The consequent expansion of tropics and the shift of climate zones toward the shrinking poles lead to increasingly warm and dry conditions under which fire storms, currently engulfing large parts of South America, California, Alaska, Siberia, Sweden, Spain, Portugal, Greece, Angola, Australia and elsewhere have become a dominant factor in the destruction of terrestrial habitats."**

Figure 8.42: **The Royal Society of the United Kingdom documented ExxonMobil's funding of 39 organizations that promoted "inaccurate and misleading" views of climate science. In an article published by TomDispatch on November 11. 2019, Professor Naomi Oreskes of Harvard University wrote: "Much focus has been put on ExxonMobil's history of disseminating disinformation, partly because of the documented discrepancies between what that company said in public about climate change and what its officials said (and funded) in private. Recently, a trial began in New York City accusing the company of misleading its investors, while Massachusetts is prosecuting ExxonMobil for misleading consumers as well. If only it had just been that one company, but for more than 30 years, the fossil-fuel industry and its allies have denied the truth about anthropogenic global warming. They have systematically misled the American people and so purposely contributed to endless delays in dealing with the issue by, among other things, discounting and disparaging climate science, mispresenting scientific findings, and attempting to discredit climate scientists. These activities are documented in great detail in *How Americans Were Deliberately Misled about Climate Change*, a report I recently co-authored, as well as in my 2010 book and 2014 film, *Merchants of Doubt*."**

Figure 8.43: **A fire burns a tract of the Amazon jungle in Agua Boa, Mato Grosso state, Brazil September 4, 2019. According to a report published by teleSUR on 7 November, 2019, "Deforestation in Brazil's Amazon region increased by 80 percent in September compared to the same month last year, according to a private study released on Wednesday stating that 802 square kilometers of forest was lost in the zone... Environmental and human rights organizations have confirmed that criminal networks are behind the indiscriminate cutting of trees in the region, and that after the illegal lumbering, those deforested zones are burned to make the land suitable for livestock raising and agriculture. In August, fires in the Brazilian Amazon were the worst in a decade, a situation that was denounced worldwide, especially the anti-ecological policies of President Jair Bolsonaro and his poor response to stop the fires."**

Figure 8.44: **In her testimony to the US Congress, Greta Thunberg did not prepare a statement for submission to the record. Instead, she submitted the most recent scientific report, issued by the IPCC three weeks earlier. She said simply, "I am submitting this report as my testimony because I don't want you to listen to me, I want you to listen to the scientists, and I want you to unite behind the science. And then I want you to take real action. Thank you." Here is what the scientists recommend: "Excessive extraction of materials and overexploitation of ecosystems, driven by economic growth, must be quickly curtailed to maintain the long-term sustainability of the biosphere. We need a carbon-free economy that explicitly addresses human dependence on the biosphere and policies that guide economic decisions accordingly. Our goals need to shift from GDP growth and the pursuit of affluence toward sustaining ecosystems and improving human well-being by prioritizing basic needs and reducing inequality."**

Figure 8.45: **Climate activist Greta Thunberg joined thousands of protesters in Lausanne, Switzerland Jan. 17, 2020. The youth activists were planning to attend the Davos summit to demand that "participants from all companies, banks, institutions, and governments immediately halt all investments in fossil fuel exploration and extraction, immediately end all fossil fuel subsidies, and immediately and completely divest from fossil fuels."**

Suggestions for further reading

1. G. Boyle (editor), *Renewable Energy: Power for a Sustainable Future, Second Edition*, Oxford University Press, (2004).
2. G. Boyle, B. Everett and J. Ramage (editors), *Energy Systems and Sustainability*, Oxford University Press, (2003).
3. United Nations Development Programme, *World Energy Assessment*, United Nations, New York, (2002).
4. P. Smith et al., *Meeting Europe's Climate Change Commitments: Quantitative Estimates of the Potential for Carbon Mitigation by Agriculture*, Global Change Biology, **6**, 525-39, (2000).
5. R.E.H. Sims, *The Brilliance of Energy: In Business and in Practice*, James and James, London, (2002).
6. Friends of the Earth, *Energy Without End*, FOE, London, (1991).
7. E.A. Alma and E. Neala, *Energy Viability of Photovoltaic Systems*, Energy Policy, **28**, 999-1010, (2000).
8. Department of Trade and Industry, *Developments of Solar Photovoltaics in Japan*, Global Watch Mission Report, November, (2003).
9. European Photovoltaics Industry Association, *Solar Generation: Solar Electricity for Over 1 Billion People and 2 Million Jobs by 2020*, EPA, published in association with Greenpeace (see www.cleanenergynow.org), (2001).
10. B. Sørensen, *Renewable Energy, Second Edition*, Academic Press, (2000).
11. K. Illum, *A Viable Energy Strategy for the Nordic Countries*, Greenpeace Nordic, (2006).
12. K. Illum, *SESAME: The Sustainable Energy Systems Analysis Model*, Along University Press, Denmark, (1995).
13. G. Sinden, *Wind Power and the UK Wind Resource*, Environmental Change Institute, University of Oxford, (2005).
14. P. Börjesson, *Energy Analysis of Biomass Production and Transportation*, Biomass and Energy, **11**, 305-318, (1996).
15. P. Börjesson, *Emissions of CO2 from Biomass Production and Transportation*, Energy Conversion Management, **37**, 1235-1240, (1995).
16. P. Börjesson and L. Gustav's, *Regional Production and Utilization of Biomass in Sweden*, Energy - The International Journal, **21**, 747-764, (1996).
17. D. Duodena and C. Galvin, *Renewable Energy*, W.W. Norton, New York, (1983).
18. G. Foley, *The Energy Question*, Penguin Books Ltd., (1976).
19. D. Hayes, *The Solar Energy Timetable*, Worldwatch Paper 19, Worldwatch Institute, Washington D.C., (1978).
20. J. Holdren and P. Herrera, *Energy*, Sierra Club Books, New York, (1971).
21. L. Rosen and R.Glasser (eds.), *Climate Change and Energy Policy*, Los Alamos National Laboratory, AIP, New York, (1992).
22. A.B. Lovins, *Soft Energy Paths*, Ballinger, Cambridge, (1977).
23. National Academy of Sciences, *Energy and Climate*, NAS, Washington D.C., (1977).

24. LTI-Research Group, ed., *Long-Term Integration of Renewable Energy Sources into the European Energy System*, Physica Verlag, (1998).
25. P.H. Ableson, *Renewable Liquid Fuels*, Science, **268**, 5213, (1995).
26. W.H. Avery and C. Wu, *Renewable Energy From the Ocean. A Guide to OTEC*, Oxford University Press, (1994).
27. H.M. Browenstein et al., *Biomass Energy Systems and the Environment*, Pergamon Press, New York, (1981).
28. M. Brower, *Cool Energy. Renewable Solutions to Environmental Problems*, MIT Press, Cambridge, Massachusetts, (1994).
29. L.R. Brown, *Food or Fuel: New Competition for the World's Cropland*, Worldwatch Paper 35, Worldwatch Institute,Washington D.C., (1980).
30. C.H. Deutsch, *As Oil Prices Rise, the Hydrogen Car is Looking Better*, New York Times, August 26, (1990).
31. W.L. Driscoll, *Fill 'Er Up with Biomass Derivatives*, Technology Review, August/September, 74-76, (1993).
32. J. Dunkerley et al., *Energy Strategies for Developing Nations*, Resources for the Future, Washington D.C., (1981).
33. C. Flavin and N. Lenssen, *Beyond the Petroleum Age: Designing a Solar Economy*, Worldwatch Paper 100, Worldwatch Institute, Washington D.C., (1990).
34. C. Flavin and N. Lenssen, *The Power Surge. Guide to the Coming Energy Revolution*, W.W. Norton, New York, (1994).
35. J. Gever et al., *Beyond Oil. The Threat to Food and Fuel in the Coming Decades*, Ballinger, Cambridge Massachusetts, (1986).
36. E.A. Hiller and B.A. Stout, *Biomass Energy. A Monograph*, Texas A&M University Press, College Station, Texas, (1985).
37. T.B. Johansson et al., (editors), *Renewable Energy: Sources for Fuels and Electricity*, Island Press, Washington D.C., (1982).
38. D. Knott, *Hydrogen: The Fuel of the Future?*, Oil and Gas Journal, May, 26, (1994).
39. D.K. McDaniels, *The Sun: Our Future Energy Source* Second Edition, Krieger, Malabar Florida, (1994).
40. D. Pimentel, *Renewable Energy: Economic and Environmental Issues*, BioScience, **44**, 536-547, (1994).
41. D. Ross, *Power From the Waves*, Oxford University Press, (1995).
42. S. Sanchez, *Movement is in the Air As Texas Taps the Wind*, USA Today, November, (1995).
43. C.C. Swan, *Suncell. Energy, Economics and Photovoltaics*, Sierra Club Books, San Francisco, (1986).
44. I. Wickelgren, *Sunup at Last for Solar?*, Business Week, July 24, 84,86, (1995).
45. K. Zweibel, *Thin-film Photovoltaic Cells*, American Scientist, **81**, 362-369, (1993).
46. R. Golob and E. Brus, *The Almanac of Renewable Energy. The Complete Guide to Emerging Energy Technologies*, Henry Holt and Company, New York, (1993).
47. N. Yoneda and S. Ito, *Study of Energy Storage for Long Term Using Chemical Reactions*, 3rd International Solar Forum, Hamburg, Germany, June 24-27, (1980).

48. R. Curtis, *Earth Energy in the UK*, in *Proc. International Geothermal Days 'Germany 2001', conference*, Bad Urach, Available in PDF format on www.uni-giessen.de, (2001).
49. R. Harrison, N.D. Mortimer and O.B. Smarason, *Geothermal Heating: A Handbook of Engineering Economics*, Pergamon Press, (1990).
50. G.W. Huttrer, *The Status of World Geothermal Power Generation 1995-2000*, in **WGC 2000**, (2000).
51. International Geothermal Association, *Performance Indicators for Geothermal Power Plant*, IGA News, **45**, July-September, (2001).
52. J.W. Lund and D.H. Freestone, *Worldwide Direct Use of Geothermal Energy 2000*, in **WGC 2000**, (2000).
53. H.C.H. Armstead and J.W. Tester, *Heat Mining*, Chapman and Hall, (1987).
54. T.B. Johansson et al. (editors), *Electricity - Efficient End Use*, Lund University Press, (1989).
55. S. Krohn, *Wind Energy Policy in Denmark, Status 2002*, Danish Windpower Association, (2002), www.windpower.dk.
56. Imperial College London, *Assessment of Technological Options to Address Climate Change*, ICCEPT, (www.iccept.ic.ac.uk), (2002).
57. J. Guldemberg, (editor), *World Energy Assessment: Energy and the Challenge of Sustainability*, United Nations Development Programme, New York, (2000).
58. European Commission, *Green Paper - Towards a European Strategy for the Security of Energy Supply*, COM(2000) final, (2000).
59. P. Dal and H.S. Jensen, *Energy Efficiency in Denmark*, Danish Energy Ministry, (2000).
60. A.C. Baker, *Tidal Power*, Energy Policy, **19**, 792-7, (1991).
61. Department of Energy, *Tidal Power from the Severn Estuary, Volume I*, Energy Paper 46 (The Bondi Report), HMSO, (1987).
62. House of Commons Select Committee on Energy, *Renewable Energy*, Fourth Report Session 1991-1992, HMSO, (1992).
63. American Wind Energy Association, *Global Wind Energy Market Report*, AWEA, (2003).
64. M. Andersen, *Current Status of Wind Farms in the UK*, Renewable Energy Systems, (1992).
65. Border Wind, *Offshore Wind Energy: Building a New Industry for Britain*, Greenpeace, (1998).
66. J. Beurkens and P.H. Jensen, *Economics of Wind Energy, Prospects and Directions*, Renewable Energy World, July-Aug, (2001).
67. British Wind Energy Association, *Best Practice Guidelines for Wind Energy Development*, BWEA, (1994).
68. British Wind Energy Association, *Planning Progress*, BWEA, (2003) (www.britishwindenergy.co.uk).
69. Department of Trade and Industry, *Future Offshore: A Strategic Framework for the Offshore Wind Industry*, DTI, November (2002).

70. European Wind Energy Association, *Time for Action: Wind Energy in Europe*, EWEA, (1991).
71. European Wind Energy Association, *Wind Force 12*, EWEA, (2002).
72. T. Burton et al., *Wind Energy Handbook*, Wiley, (2001).
73. J.F. Manwell et al., *Wind Energy Explained*, Wiley, (2002).
74. G. Boyle (editor), *Renewable Energy: Power for a Sustainable Future, Second Edition*, Oxford University Press, (2004).
75. G. Boyle, B. Everett and J. Ramage (editors), *Energy Systems and Sustainability*, Oxford University Press, (2003).
76. United Nations Development Programme, *World Energy Assessment*, United Nations, New York, (2002).
77. P. Smith et al., *Meeting Europe's Climate Change Commitments: Quantitative Estimates of the Potential for Carbon Mitigation by Agriculture*, Global Change Biology, **6**, 525-39, (2000).
78. R.E.H. Sims, *The Brilliance of Energy: In Business and in Practice*, James and James, London, (2002).
79. Friends of the Earth, *Energy Without End*, FOE, London, (1991).
80. E.A. Alma and E. Neala, *Energy Viability of Photovoltaic Systems*, Energy Policy, **28**, 999-1010, (2000).
81. Department of Trade and Industry, *Developments of Solar Photovoltaics in Japan*, Global Watch Mission Report, November, (2003).
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85. G. Sinden, *Wind Power and the UK Wind Resource*, Environmental Change Institute, University of Oxford, (2005).
86. P. Börjesson, *Energy Analysis of Biomass Production and Transportation*, Biomass and Energy, **11**, 305-318, (1996).
87. P. Börjesson, *Emissions of CO2 from Biomass Production and Transportation*, Energy Conversion Management, **37**, 1235-1240, (1995).
88. P. Börjesson and L. Gustav's, *Regional Production and Utilization of Biomass in Sweden*, Energy - The International Journal, **21**, 747-764, (1996).
89. D. Duodena and C. Galvin, *Renewable Energy*, W.W. Norton, New York, (1983).
90. G. Foley, *The Energy Question*, Penguin Books Ltd., (1976).
91. D. Hayes, *The Solar Energy Timetable*, Worldwatch Paper 19, Worldwatch Institute, Washington D.C., (1978).
92. J. Holdren and P. Herrera, *Energy*, Sierra Club Books, New York, (1971).
93. L. Rosen and R.Glasser (eds.), *Climate Change and Energy Policy*, Los Alamos National Laboratory, AIP, New York, (1992).
94. A.B. Lovins, *Soft Energy Paths*, Ballinger, Cambridge, (1977).
95. National Academy of Sciences, *Energy and Climate*, NAS, Washington D.C., (1977).

96. LTI-Research Group, ed., *Long-Term Integration of Renewable Energy Sources into the European Energy System*, Physica Verlag, (1998).
97. P.H. Ableson, *Renewable Liquid Fuels*, Science, **268**, 5213, (1995).
98. W.H. Avery and C. Wu, *Renewable Energy From the Ocean. A Guide to OTEC*, Oxford University Press, (1994).
99. H.M. Browenstein et al., *Biomass Energy Systems and the Environment*, Pergamon Press, New York, (1981).
100. M. Brower, *Cool Energy. Renewable Solutions to Environmental Problems*, MIT Press, Cambridge, Massachusetts, (1994).
101. L.R. Brown, *Food or Fuel: New Competition for the World's Cropland*, Worldwatch Paper 35, Worldwatch Institute,Washington D.C., (1980).
102. C.H. Deutsch, *As Oil Prices Rise, the Hydrogen Car is Looking Better*, New York Times, August 26, (1990).
103. W.L. Driscoll, *Fill 'Er Up with Biomass Derivatives*, Technology Review, August/September, 74-76, (1993).
104. J. Dunkerley et al., *Energy Strategies for Developing Nations*, Resources for the Future, Washington D.C., (1981).
105. C. Flavin and N. Lenssen, *Beyond the Petroleum Age: Designing a Solar Economy*, Worldwatch Paper 100, Worldwatch Institute, Washington D.C., (1990).
106. C. Flavin and N. Lenssen, *The Power Surge. Guide to the Coming Energy Revolution*, W.W. Norton, New York, (1994).
107. J. Gever et al., *Beyond Oil. The Threat to Food and Fuel in the Coming Decades*, Ballinger, Cambridge Massachusetts, (1986).
108. E.A. Hiller and B.A. Stout, *Biomass Energy. A Monograph*, Texas A&M University Press, College Station, Texas, (1985).
109. T.B. Johansson et al., (editors), *Renewable Energy: Sources for Fuels and Electricity*, Island Press, Washington D.C., (1982).
110. D. Knott, *Hydrogen: The Fuel of the Future?*, Oil and Gas Journal, May, 26, (1994).
111. D.K. McDaniels, *The Sun: Our Future Energy Source* Second Edition, Krieger, Malabar Florida, (1994).
112. D. Pimentel, *Renewable Energy: Economic and Environmental Issues*, BioScience, **44**, 536-547, (1994).
113. D. Ross, *Power From the Waves*, Oxford University Press, (1995).
114. S. Sanchez, *Movement is in the Air As Texas Taps the Wind*, USA Today, November, (1995).
115. C.C. Swan, *Suncell. Energy, Economics and Photovoltaics*, Sierra Club Books, San Francisco, (1986).
116. I. Wickelgren, *Sunup at Last for Solar?*, Business Week, July 24, 84,86, (1995).
117. K. Zweibel, *Thin-film Photovoltaic Cells*, American Scientist, **81**, 362-369, (1993).
118. R. Golob and E. Brus, *The Almanac of Renewable Energy. The Complete Guide to Emerging Energy Technologies*, Henry Holt and Company, New York, (1993).

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