# MONEY, MEDIA AND THE CLIMATE CRISIS

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# INTRODUCTION[1]

## Immediate action is needed to save the future

The central problem which the world faces in its attempts to avoid catastrophic climate change is a contrast of time scales. In order to save human civilization and the biosphere from the most disastrous effects of climate change we need to act immediately, But it is difficult to mobilize public opinion behind urgently needed action because the most severe disasters due to global warming belong to the long-term future.

However, 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%...**

**"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..."**

## Money drives the mania of growth

**"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)

[1]This book makes use of articles and book chapters that I have previously written on subjects related to the urgent need for fundamental change, but a great deal of new material has been added

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.

Undoubtedly even the most growth-mad economists realize that endless growth on a finite planet is a logical impossibility. But with self-imposed myopia, they refuse to look farther than a decade or two into the future. All this has been changed by the climate crisis, since saving the long-term future for our children and grandchildren is today the most urgent of tasks. The long-term future of human civilization and the biosphere must now be given the highest priority. It is an emergency.

## Our entire economic system must be reformed

Old ideas and old economic indicators can no longer serve us. Seen from an ecological perspective, the gross national product of a country does not indicate how well the economy is doing, but almost the reverse. GNP has become a measure of how fast an economy is destroying the environment.

## Lifestyle change but not unhappiness

The urgent actions needed to avoid catastrophic climate change imply lifestyle changes, but we will not necessarily become less happy. Do we really enjoy sitting in traffic jams? We can still be happy when use of private automobiles (except when absolutely necessary) is replaced by bicycles and public transport. We can still be happy without air travel for recreational purposes. We can still be happy with the smaller families which will be needed to stabilize and ultimately reduce global population.

## Climate and social justice addressed simultaneously

The highly successful social an economic systems of the Scandinavian countries, together with their excellent renewable energy policies demonstrate that the climate emergency can be addressed while simultaneously reducing

Figure 1: **Do we really enjoy sitting in traffic jams? The lifestyle changes which are now so urgently needed to address the climate emergency will not necessarily make us less happy. The Green New Deal aims at social justice as well as well as quick climate action. There is much evidence showing that greater economic equality in societies leads to greater happiness.**

economic inequality and providing needed services such as free medical care, social security and free higher education.

## We can afford the Green New Deal

The Green New Deal concept, currently advocated in the United States and many other countries, aims at simultaneously addressing the climate emergency and socio-economic issues. It advocates massive governmental action to create renewable energy infrastructure, simultaneously addressing unemployment through green jobs. Critics say "We can't afford it." They are wrong. What we cannot afford is 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, an 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"[2]. Here is a quotation 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."**

We can easily finance the Green New Deal by making deep cuts in military expenditure, which currently costs the world $1.8 trillion per year, and by raising taxes on the super-rich. Most voters are in favor of greater economic equality and a safe long-term future for their grandchildren. We owe it to future generations and the biosphere to act now!

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

# Contents

# Chapter 1

# THE CLIMATE EMERGENCY

## 1.1 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/


## 1.2 Understatement of existential climate risk

Here are some excerpts from a 44-page report entitled *What Lies Beneath: The Understanding of Existential Climate Risk*, by David Spratt and Ian Dunlop[2]:

**Three decades ago, when serious debate on human-induced climate change began at the global level, a great deal of statesmanship was on display. There was a preparedness to recognize that this was an issue transcending nation states, ideologies and political parties which had to be addressed pro-actively in the long-term interests of humanity as a whole. This was the case even though the existential nature of the risk it posed was far less clear cut than it is today.**

**As global institutions, such as the United Nations Framework Convention on Climate Change (UNFCCC) which was established at the Rio Earth Summit in 1992, were developed to take up this challenge, and the extent of change this would demand of the fossil-fuel-dominated world order became clearer, the forces of resistance began to mobilize. Today, as a consequence, and despite the diplomatic triumph of the 2015 Paris Agreement, the debate around climate change policy has never been more dysfunctional, indeed Orwellian.**

**In his book 1984, George Orwell describes a double-think totalitarian state**

[2]https://www.breakthroughonline.org.au/

where most of the population accepts "the most flagrant violations of reality, because they never fully grasped the enormity of what was demanded of them, and were not sufficiently interested in public events to notice what was happening. By lack of understanding they remained sane."

Orwell could have been writing about climate change and policymaking. International agreements talk of limiting global warming to 1.5-2 degrees Celsius ($^o$C), but in reality they set the world on a path of 3-5$^o$C of warming. Goals are reaffirmed, only to be abandoned. Coal is "clean". Just 1$^o$C of warming is already dangerous, but this cannot be admitted. The planetary future is hostage to myopic national self-interest. Action is delayed on the assumption that as yet unproven technologies will save the day, decades hence. The risks are existential, but it is "alarmist" to say so.

A one-in-two or one-in-three chance of missing a goal is normalized as reasonable. Moral hazard permeates official thinking, in that there is an incentive to ignore the risks in the interests of political expediency.

Climate policymaking for years has been cognitively dissonant, "a flagrant violation of reality". So it is unsurprising that there is a lack of understanding amongst the public and elites of the full measure of the climate challenge. Yet most Australians sense where we are heading: three-quarters of Australians see climate change as catastrophic risk, and half see our way of life ending within the next 100 years.

Politics and policymaking have norms: rules and practices, assumptions and boundaries, that constrain and shape them. In recent years, the previous norms of statesmanship and long-term thinking have disappeared, replaced by an obsession with short-term political and commercial advantage. Climate policymaking is no exception. Since 1992, short-term economic interest has trumped environmental and future human needs.

The world today emits 50% more carbon dioxide ($CO_2$) from the consumption of energy than it did 25 years ago, and the global economy has more than doubled in size. The UNFCCC strives "to enable economic development to proceed in a sustainable manner", but every year humanity's ecological footprint becomes larger and less sustainable. Humanity now requires the biophysical capacity of 1.7 Earths annually as it rapidly chews up natural capital.

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 than 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. The world not imagined is the one that now exists: of looming financial instabil-

ity; of a global crisis of political legitimacy and "fake news"; of a sustainability crisis that extends far beyond climate change to include all the fundamentals of human existence and most significant planetary boundaries (soils, potable water, oceans, the atmosphere, biodiversity, and so on); and of severe global energy-sector dislocation.

In anticipation of the upheaval that climate change would impose upon the global order, the IPCC was established by the United Nations (UN) in 1988, charged with regularly assessing the global consensus on climate science as a basis for policymaking. The IPCC Assessment Reports (AR), produced every five-to-eight years, play a large part in the public framing of the climate narrative: new reports are a global media event.

AR5 was produced in 2013-14, with AR6 due in 2022. The IPCC has done critical, indispensable work of the highest standard in pulling together a periodic consensus of what must be the most exhaustive scientific investigation in world history.

It does not carry out its own research, but reviews and collates peer-reviewed material from across the spectrum of this incredibly complex area, identifying key issues and trends for policymaker consideration. However, the IPCC process suffers from all the dangers of consensus-building in such a wide-ranging and complex arena. For example, IPCC reports, of necessity, do not always contain the latest available information. Consensus-building can lead to "least drama", lowest-common-denominator outcomes, which overlook critical issues. This is particularly the case with the "fat-tails" of probability distributions, that is, the high-impact but lower-probability events where scientific knowledge is more limited.

Vested-interest pressure is acute in all directions; climate denialists accuse the IPCC of alarmism, whereas many climate action proponents consider the IPCC to be far too conservative. To cap it all, the IPCC conclusions are subject to intense political oversight before being released, which historically has had the effect of substantially watering-down sound scientific findings.

These limitations are understandable, and arguably were not of overriding importance in the early period of the IPCC. However, as time has progressed, it is now clear that the risks posed by climate change are far greater than previously anticipated. We have moved out of the twilight period of much talk, but relatively limited climate impacts, into the harsh light of physically-evident existential threats. Climate change is now turning nasty, as we have witnessed recently in the North America, East and South Asia, the Middle East and Europe, with record-breaking heatwaves and wildfires, more intense flooding and more damaging hurricanes.

The distinction between climate science and risk is the critical issue, for the two are not the same. Scientific reticence - a reluctance to spell out the full risk implications of climate science in the absence of perfect information - has become a major problem. Whilst this is understandable, particularly

when scientists are continually criticized by denialists and political apparatchiks for speaking out, it is extremely dangerous given the fat-tail risks of climate change. Waiting for perfect information, as we are continually urged to do by political and economic elites, means it will be too late to act. Time is not on our side. Sensible risk management addresses risk in time to prevent it happening, and that time is now.

Irreversible, adverse climate change on the global scale now occurring is an existential risk to human civilization. Many of the world's top climate scientists - Kevin Anderson, James Hansen, Michael E. Mann, Michael Oppenheimer, Naomi Oreskes, Stefan Rahmstorf, Eric Rignot, Hans Joachim Schellnhuber, Kevin Trenberth and others - who are quoted in this report well understand these implications and are forthright about their findings, where we are heading, and the limitations of IPCC reports.

This report seeks to alert the wider community and business and political leaders to these limitations and urges changes to the IPCC approach, to the wider UNFCCC negotiations, and to national policymaking. It is clear that existing processes will not deliver the transformation to a carbon-negative world in the limited time now available. We urgently require a re-framing of scientific research within an existential risk-management framework. This requires special precautions that go well beyond conventional risk management. Like an iceberg, there is great danger in "what lies beneath".

## Existential Risk to Human Civilization

In 2016, the World Economic Forum survey of the most impactful risks for the years ahead elevated the failure of climate change mitigation and adaptation to the top of the list, ahead of weapons of mass destruction, ranking second, and water crises, ranking third. By 2018, following a year characterized by high-impact hurricanes and extreme temperatures, extreme-weather events were seen as the single most prominent risk. As the survey noted: "We have been pushing our planet to the brink and the damage is becoming increasingly clear."

Climate change is an existential risk to human civilization: that is, an adverse outcome that would either annihilate intelligent life or permanently and drastically curtail its potential.

Temperature rises that are now in prospect, after the Paris Agreement, are in the range of 3-5 $^{o}$C. At present, the Paris Agreement voluntary emission reduction commitments, if implemented, would result in planetary warming of 3.4 $^{o}$C by 2100, without taking into account "long-term" carbon- cycle feedbacks. With a higher climate sensitivity figure of 4.5 $^{o}$C, for example, which would account for such feedbacks, the Paris path would result in around 5 $^{o}$C of warming, according to a MIT study.

A study by Schroeder Investment Management published in June 2017 found - after taking into account indicators across a wide range of the political, finan-

cial, energy and regulatory sectors - the average temperature increase implied for the Paris Agreement across all sectors was 4.1 $^{o}$C.

Yet 3 $^{o}$C of warming already constitutes an existential risk. A 2007 study by two US national security think-tanks concluded that 3 $^{o}$C of warming and a 0.5 meter sea-level rise would likely lead to "outright chaos" and "nuclear war is possible", emphasizing how "massive non-linear events in the global environment give rise to massive nonlinear societal event".

The Global Challenges Foundation (GCF) explains what could happen: "If climate change was to reach 3 $^{o}$C, most of Bangladesh and Florida would drown, while major coastal cities - Shanghai, Lagos, Mumbai - would be swamped, likely creating large flows of climate refugees. Most regions in the world would see a significant drop in food production and increasing numbers of extreme weather events, whether heat waves, floods or storms. This likely scenario for a 3 $^{o}$C rise does not take into account the considerable risk that self-reinforcing feedback loops set in when a certain threshold is reached, leading to an ever increasing rise in temperature. Potential thresholds include the melting of the Arctic permafrost releasing methane into the atmosphere, forest die-back releasing the carbon currently stored in the Amazon and boreal forests, or the melting of polar ice caps that would no longer reflect away light and heat from the sun."

Warming of 4 $^{o}$C or more could reduce the global human population by 80% or 90%, and the World Bank reports "there is no certainty that adaptation to a 4 $^{o}$C world is possible."

Prof. Kevin Anderson says a 4 $^{o}$C future "is incompatible with an organized global community, is likely to be beyond 'adaptation', is devastating to the majority of ecosystems, and has a high probability of not being stable".

This is a commonly-held sentiment amongst climate scientists. A recent study by the European Commission's Joint Research Centre found that if the global temperature rose 4 $^{o}$C, then extreme heatwaves with "apparent temperatures" peaking at over 55 $^{o}$C will begin to regularly affect many densely populated parts of the world, forcing much activity in the modern industrial world to stop. ("Apparent temperatures" refers to the Heat Index, which quantifies the combined effect of heat and humidity to provide people with a means of avoiding dangerous conditions.)

In 2017, one of the first research papers to focus explicitly on existential climate risks proposed that "mitigation goals be set in terms of climate risk category instead of a temperature threshold", and established a "dangerous" risk category of warming greater than 1.5 $^{o}$C, and a "catastrophic" category for warming of 3 $^{o}$C or more. The authors focussed on the impacts on the world's poorest three billion people, on health and heat stress, and the impacts of climate extremes on such people with limited adaptation resources. They found that a 2 $^{o}$C warming "would double the land area subject to deadly heat and expose 48% of the population (to deadly heat). A 4 $^{o}$C warming by 2100

**would subject 47% of the land area and almost 74% of the world population to deadly heat, which could pose existential risks to humans and mammals alike unless massive adaptation measures are implemented."**

**A 2017 survey of global catastrophic risks by the Global Challenges Foundation found that: "In high-end [climate] scenarios, the scale of destruction is beyond our capacity to model, with a high likelihood of human civilization coming to an end."**

**84% of 8000 people in eight countries surveyed for the Foundation considered climate change a "global catastrophic risk".**

**Existential risk may arise from a fast rate of system change, since the capacity to adapt, in both the natural and human worlds, is inversely proportional to the pace of change, amongst other factors. In 2004, researchers reported on the rate of warming as a driver of extinction...**

**At 4 $^o$C of warming "the limits for adaptation for natural systems would largely be exceeded throughout the world".**

**Ecological breakdown of this scale would ensure an existential human crisis. By slow degrees, these existential risks are being recognized. In May 2018, an inquiry by the Australian Senate into national security and global warming recognized "climate change as a current and existential national security risk... defined as 'one that threatens the premature extinction of Earth-originating intelligent life or the permanent and drastic destruction of its potential for desirable future development'".**

**In April 2018, the Intelligence on European Pensions and Institutional Investment think-tank warned business leaders that "climate change is an existential risk whose elimination must become a corporate objective".**

**However the most recent IPCC Assessment Report did not consider the issue. Whilst the term "risk management" appears in the 2014 IPCC Synthesis Report fourteen times, the terms "existential" and "catastrophic" do not appear...**

## 1.3 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.[3]:

**"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**

[3]https://www.commondreams.org/news/2018/10/08/un-experts-warn-climate-catastrophe-2040-without-rapid-and-unprecedented-global

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.

"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°C."**

## Why do we not respond to the crisis?

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.

## 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."

## Institutional inertia

Our collective failure to respond adequately to the current crisis is very largely due to institutional inertia. Our financial system is deeply embedded and resistant to change. Our entire industrial infrastructure is based on fossil fuels; but if the future is to be saved, the use of fossil fuels must stop. International relations are still based based on the concept of absolutely sovereign nation states, even though this concept has become a dangerous anachronism in an era of instantaneous global communication and economic interdependence. Within nations, systems of law and education change very slowly, although present dangers demand rapid revolutions in outlook and lifestyle.

The failure of the recent climate conferences to produce strong final documents can be attributed to the fact that the nations attending the conferences felt themselves to be in competition with each other, when in fact they ought to have cooperated in response to a common danger. The heavy hand of the fossil fuel industry also made itself felt at the conferences.

Until the development of coal-driven steam engines in the 19th century humans lived more or less in harmony with their environment. Then, fossil fuels, representing many millions of years of stored sunlight, were extracted and burned in two centuries, driving a frenzy of growth of population and industry that has lasted until the present. But today, the party is over. Coal, oil and gas are nearly exhausted, and what remains of them must be left in the ground to avoid existential threats to humans and the biosphere. Big coal and oil corporations base the value of their stocks on ownership of the remaining resources that are still buried, and they can be counted on to use every trick, fair or unfair, to turn those resources into money.

In general corporations represent a strong force resisting change. By law, the directors of corporations are obliged to put the profits of stockholders above every other consideration. No room whatever is left for an ecological or social conscience. Increasingly, corporations have taken control of our mass media and our political system. They intervene in such a way as to make themselves richer, and thus to increase their control of the system.

## Polite conversation and cultural inertia

Each day, the conventions of polite conversation contribute to our sense that everything is as it always was. Politeness requires that we do not talk about issues that might be contrary to another person's beliefs. Thus polite conversation is dominated by trivia, entertainment, sports, the weather, gossip, food, and so on, Worries about the the distant future , the danger of nuclear war, the danger of uncontrollable climate change, or the danger of widespread famine seldom appear in conversations at the dinner table, over coffee or at the pub. In conversations between polite people, we obtain the false impression that all is well with the world. But in fact, all is not well. We have to act promptly and adequately to save the future.

The situation is exactly the same in the mass media. The programs and articles are dominated by trivia and entertainment. Serious discussions of the sudden crisis which

civilization now faces are almost entirely absent, because the focus is on popularity and ratings. As Neil Postman remarked, we are entertaining ourselves to death.

## Further growth implies future collapse

We have to face the fact that endless economic growth on a finite planet is a logical impossibility, and that we have reached or passed the the sustainable limits to growth.

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. In the long run, neither the growth of industry not that of population is sustainable; and we have now reached or exceeded the sustainable limits.

The size of the human economy is, of course, the product of two factors: the total number of humans, and the consumption per capita. Let us first consider 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 the competition. Of course, not everyone can reach the top; there would not be room for everyone; but society urges us all to try, and we feel a sense of failure if we do not reach the goal. Thus, modern life has become a competition of all against all for power and possessions.

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 industrial 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.

If you turn on your television set, the vast majority of the programs that you will be offered give no hint at all of the true state of the world or of the dangers which we will face in the future. Part of the reason for this willful blindness is that no one wants to damage consumer confidence. No one wants to bring on a recession. No one wants to shoot Santa Claus.

But sooner or later a severe recession will come, despite our unwillingness to recognize this fact. Perhaps we should prepare for it by reordering the world's economy and infrastructure to achieve long-term sustainability, i.e. steady-state economics, population stabilization, and renewable energy.

## Our responsibility to future generations and to the biosphere

All of the technology needed for the replacement of fossil fuels by renewable energy is already in place. Although renewable sources currently supply only 19 percent of the

world's energy requirements, they are growing rapidly. For example, wind energy is growing at the rate of 30 percent per year. Because of the remarkable properties of exponential growth, this will mean that wind will soon become a major supplier of the world's energy requirements, despite bitter opposition from the fossil fuel industry.

Both wind and solar energy can now compete economically with fossil fuels, and this situation will become even more pronounced if more countries put a tax on carbon emissions, as Finland, the Netherlands, Norway, Costa Rica, the United Kingdom and Ireland already have done. [4]

Much research and thought have also been devoted to the concept of a steady-state economy. The only thing that is lacking is political will. It is up to the people of the world to make their collective will felt. [5]

History has given to our generation an enormous responsibility towards future generations. We must achieve a new kind of economy, a steady-state economy. We must stabilize global population. We must replace fossil fuels by renewable energy. We must abolish nuclear weapons. We must end the institution of war. We must reclaim democracy in our own countries when it has been lost. We must replace nationalism by a just system of international law. We must prevent degradation of the earth's environment. We must act with dedication and fearlessness to save the future of the earth for human civilization and for the plants and animals with which we share the gift of life.

**"And yes, we do need hope. Of course, we do. But the one thing we need more than hope is action. Once we start to act, hope is everywhere. So instead of looking for hope, look for action. Then and only then, hope will come today."**
Greta Thunberg

[4] http://eruditio.worldacademy.org/issue-5/article/urgent-need-renewable-energy
[5] http://steadystate.org/category/herman-daly/

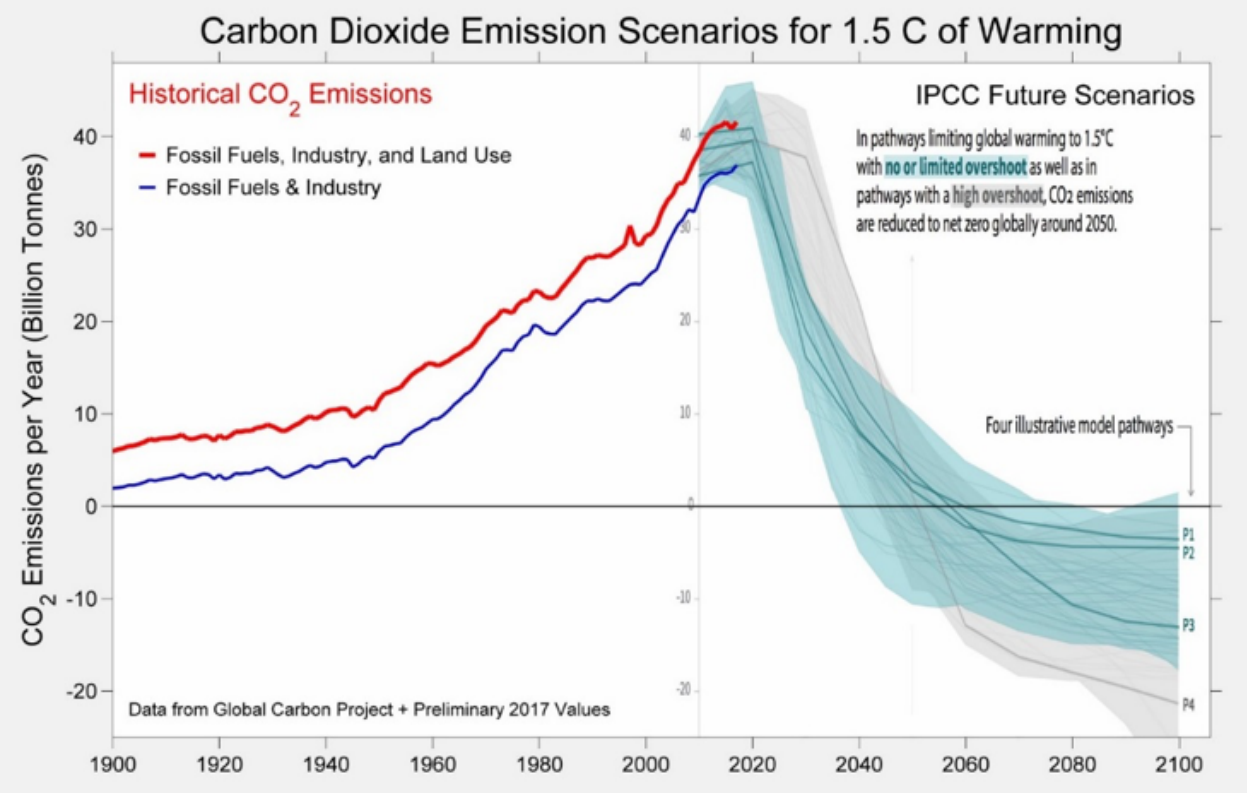


Figure 1.1: **Our carbon budget. If global warming is to be limited to 1.5$^o$C, $CO_2$ emissions must fall extremely rapidly. This means radical and fundamental changes for economies and lifestyles.**

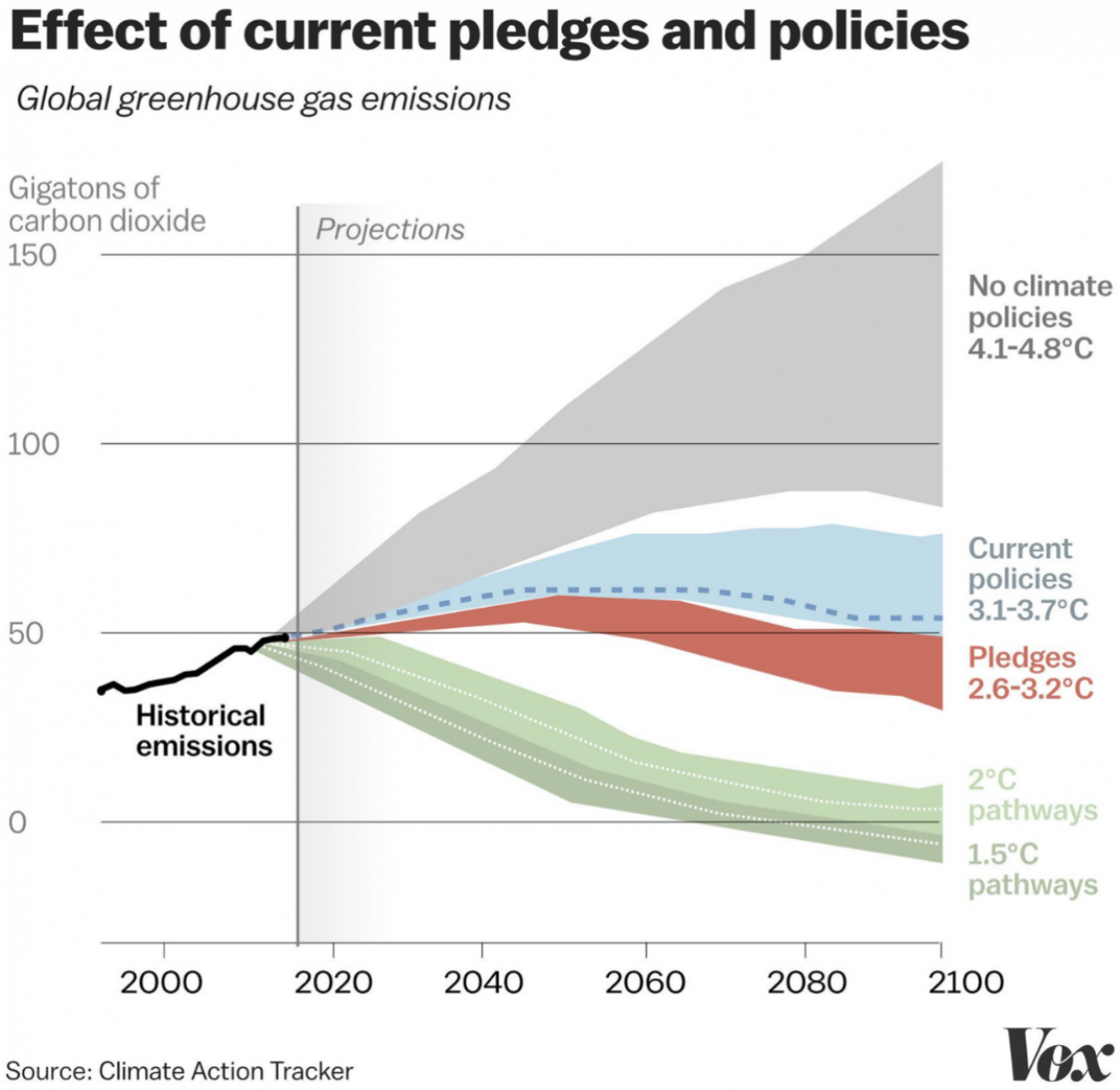


Figure 1.2: **Predicted gigatons of carbon emitted during the present century under various policies. Under current policies, temperatures at the end of the century are predicted to be 3.1-3.7$^o$C higher than normal, which would be disastrous. This implies that quick action must be taken to change current policies.**

## 1.4 Greta Thunberg's speech at Davos, January 2019

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:

**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.**


SKOLSTREJK
FÖR
KLIMATET


Figure 1.3: **Greta Thunberg at the Davos Economic Forum in Switzerland, January 2019. Most of the billionaires and heads of state attending the Davos Forum arrived by private jet. Greta arrived by train.**

## 1.5 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.

[6]

[6]https://www.theguardian.com/environment/2019/apr/03/parents-around-the-world-mobilise-behind-youth-climate-strikes


STOP
BURNING
MY
ANCESTORS
CLIMATE


IT'S
OUR
FUTURE
DECLARATION OF CLIMATE EMERGENGY
#lambethschoolstrike Friday 15TH March 3.00-4.30pm WINDRUSH SQ. BRIXTON


Figure 1.4: **Eve White and her children join climate protesters in Tasmania. According to an article in The Guardian, parents and grandparents around the world are mobilizing in support of the youth climate movement that has swept the globe.**

## Concerns of young protesters are justified

In an article in the journal *Science* dated 12 April, 2019, [7] 20 prominent climate scientists stated that the concerns of student protesters around the world are fully justified. Here are some quotations from the article:

**The world's youth have begun to persistently demonstrate for the protection of the climate and other foundations of human well-being. As scientists and scholars who have recently initiated similar letters of support in our countries, we call for our colleagues across all disciplines and from the entire world to support these young climate protesters. We declare: Their concerns are justified and supported by the best available science. The current measures for protecting the climate and biosphere are deeply inadequate.**

**Nearly every country has signed and ratified the Paris Agreement of 2015, committing under international law to hold global warming well below 2$^o$C above preindustrial levels and to pursue efforts to limit the temperature increase to 1.5$^o$C. The scientific community has clearly concluded that a global warming of 2$^o$C instead of 1.5$^o$C would substantially increase climate-related impacts and the risk of some becoming irreversible. Moreover, given the uneven distribution of most impacts, 2$^o$C of warming would further exacerbate existing global inequalities.**

**It is critical to immediately begin a rapid reduction in $CO_2$ and other greenhouse gas emissions. The degree of climate crisis that humanity will experience in the future will be determined by our cumulative emissions; rapid reduction now will limit the damage. For example, the Intergovernmental Panel on Climate Change (IPCC) has recently assessed that halving $CO_2$ emissions by 2030 (relative to 2010 levels) and globally achieving net-zero $CO_2$2 emissions by 2050 (as well as strong reductions in other greenhouse gases) would allow a 50% chance of staying below 1.5$^o$C of warming. Considering that industrialized countries produced more of and benefited more from previous emissions, they have an ethical responsibility to achieve this transition more quickly than the world as a whole.**

**Many social, technological, and nature-based solutions already exist. The young protesters rightfully demand that these solutions be used to achieve a sustainable society. Without bold and focused action, their future is in critical danger. There is no time to wait until they are in power...**

**The enormous grassroots mobilization of the youth climate movement - including Fridays for Future, School (or Youth) Strike 4 Climate, Youth for (or 4) Climate, and Youth Climate Strike - shows that young people understand the situation. We approve and support their demand for rapid and forceful action. We see it as our social, ethical, and scholarly responsibility to state in no uncertain terms: Only if humanity acts quickly and resolutely can we limit**

[7] https://science.sciencemag.org/content/364/6436/139.2


**global warming, halt the ongoing mass extinction of animal and plant species, and preserve the natural basis for the food supply and well-being of present and future generations. This is what the young people want to achieve. They deserve our respect and full support.**

Figure 1.5: **Greta Thunberg addressing a meeting of the European Parliament in April, 2019. She complained that Brexit was treated as an emergency by the European Union, but climate change, which is a far greater emergency has been almost neglected. The 16-year-old, who is due to meet the Pope on Wednesday, said, "We face an end to civilization as we know it unless permanent changes take place in our society...European elections are coming soon and many like me who are affected most by this crisis, are not allowed to vote. That is why millions of children are taking to the street to draw attention to the climate crisis... It is not too late to act but it will take far-reaching vision and fierce determination... My plea is: Please wake up and do the seemingly impossible."**

## 1.6 The World Meteorological Organization's report

According to a recent United Nations report, extreme weather events displaced 2 million people during 2018. While no single event can be unambiguously attributed to anthropogenic climate change, scientists believe the the increasing frequency of extreme weather events is definitely linked to global warming. The same is true of their increasing severity.

The report states that during 2018, extreme weather events impacted roughly 62 million people, of whom 2 million were displaced from their homes. In the words of the WMO report, "The physical signs and socio-economic impacts of climate change are accelerating, as record greenhouse gas concentrations drive global temperatures towards increasingly dangerous levels."

UN Secretary General Antonio Guterres, speaking at the launching of the WMO report, used the occasion to remind global leaders of the urgency of the climate emergency. Guterres has convened a climate summit meeting scheduled for September 23, 2019, and referring to the meeting, he said: "Don't come with a speech, come with a plan. This is what science says is needed. It is what young people around the globe are rightfully demanding." Two weeks previously, on March 15, one and a half million students from more that 130 countries had skipped school to participate in the largest climate demonstration in history, demanding action to save the future from the threat of catastrophic climate change.

### The tragic floods in Iran, March and April, 2019

The tragic flood disasters in Iran are an example of the socio-economic impact of extreme weather events. Besides causing numerous deaths, the floods also inflicted economic damage amounting to hundreds of millions of dollars. But today's disasters are extremely mild compared with those that lie in the future if we do not take radical action.

## 1.7 Two time scales

Quick change is needed to save the long-term future.

The central problem which the world faces in its attempts to avoid catastrophic climate change is a contrast of time scales. In order to save human civilization and the biosphere from the most catastrophic effects of climate change we need to act immediately, Fossil fuels must be left in the ground. Forests must be saved from destruction by beef or palm oil production.

These vitally necessary actions are opposed by powerful economic interests, by powerful fossil fuel corporations desperate to monetize their underground "assets", and by corrupt politicians receiving money the beef or palm oil industries.

However, although some disastrous effects climate change are already visible, the worst of these calamities lie in the distant future. Therefore it is difficult to mobilize the political will for quick action. We need to act immediately, because of the danger of passing tipping points beyond which climate change will become irreversible despite human efforts to control it.

Tipping points are associated with feedback loops, such as the albedo effect and the methane hydrate feedback loop. The albedo effect is important in connection with whether the sunlight falling on polar seas is reflected or absorbed. While ice remains, most of the sunlight is reflected, but as areas of sea surface become ice-free, more sunlight is absorbed, leading to rising temperatures and further melting of sea ice, and so on, in a loop.

The methane hydrate feedback loop involves vast quantities of the powerful greenhouse gas methane, $CH_4$, frozen in a crystalline form surrounded by water molecules. 10,000 gigatons of methane hydrates are at present locked in Arctic tundra or the continental shelves of the world's oceans. Although oceans warm very slowly because of thermal inertia, the long-term dangers from the initiation of a methane-hydrate feedback loop are very great. There is a danger that a very large-scale anthropogenic extinction event could be initiated unless immediate steps are taken to drastically reduce the release of greenhouse cases.

## 1.8 Scientists have long been aware of the dangers

Scientists have long been aware that $CO_2$ and other greenhouse gases released into the earth's atmosphere through human activities can cause dangerous climate change. László Szombatfalvy's important book. "The Greatest Challenges of Our Time", (Ekerlids, 2010), gives the following history of our knowledge of the link between greenhouse gases and climate change:

"As far back as 100 years ago, Swedish scientists observed that human activities could affect the climate. Arvid Högbom, professor of geology in Stockholm, warned in 1895 that anthracite burning would increase carbon dioxide content in the air. The following year, Svante Arrhenius, professor of physics and Nobel Prize Laureate, estimated that doubling of the content of carbon dioxide in the atmosphere would lead to an increase of the earth's

average temperature by 5-6 degrees C. However, with the low emissions at that time, the process would take several thousand years.

"In 1938, measurements by Guy S. Callendar, an English researcher, confirmed theories that the amount of carbon dioxide in the atmosphere had actually increased since the previous century. His report made little impact since attention at that time was focused on the outbreak of World War II.

"During the 1950s and 1960s, several research reports were published supporting Svante Arrhenius's calculation of carbon dioxide emissions' warming effects. But the time perspective in these reports has been reduced considerably.

"In the 1970s, it was discovered that emissions of several other greenhouse gases from human activities heightened carbon dioxide's effects.

"In 1988, the International Panel on Climate Control, IPCC, was organized. Every fourth or fifth year since 1990, the IPCC has published climate change reports that are increasingly more extensive and ominous.

"In December 1997, the first international agreement to limit emissions of greenhouse gases was signed in Japan. Known as the Kyoto Protocol, the agreement's goal is that industrialized nations reduce emissions of greenhouse gases by 5.2 percent by 2012, compared with 1990 levels. The Protocol has been hitherto ratified by 176 countries, but unfortunately not by the most important country in this matter: USA."

More recently, on December 12, 2015, the Paris Agreement was adopted by consensus by the 196 parties of the United Nations Framework Convention on Climate Change. As of June, 2017, 195 UNFCC members have signed the Agreement, and 153 nations have ratified it.

The Paris Agreement aims at "Holding the increase in the global average temperature to well below $2^oC$ above pre-industrial levels and to pursue efforts to limit the temperature increase to $1.5^oC$ above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change."

The worst effects of catastrophic climate change lie in the distant future, a century or even many centuries from the present; but disaster can only be avoided if quick action is taken. The nations of the world must act immediately to reduce and eventually stop the use of fossil fuels and the destruction of forests. If decisive action is not taken within the next few decades, feedback loops will make human intervention useless. These feedback loops include the albido effect, the methane hydrate feedback loop, and the fact as tropical forests become drier, they become vulnerable to fires ignited by lightning. These fires accelerate the drying, and thus a feed-back loop is formed.

As time passes, and as the disastrous consequences of climate change become more apparent, the political will required for action will increase; but by that time it may be too late. We are rapidly approaching several crucial tipping points.

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.

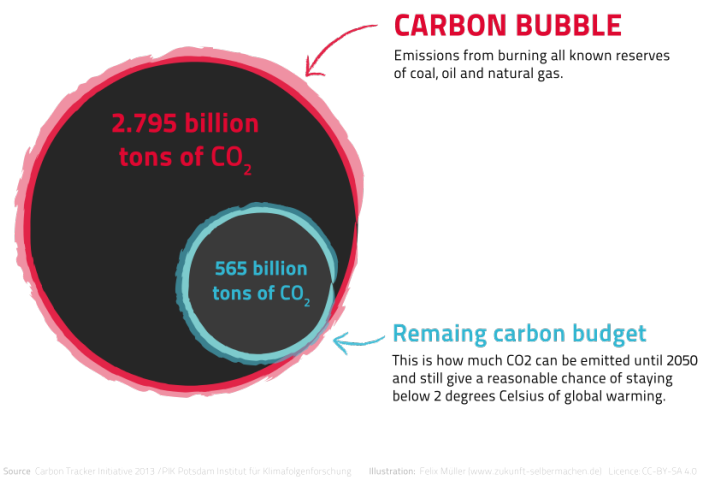


Figure 1.6: **The Carbon Bubble according to data by the Carbon Tracker Initiative 2013. Uploaded by Mueller Felix. [CC BY-SA 3.0], Wikimedia Commons. In order to avoid tipping points that will make human attempts to avoid catastrophic climate change useless, we must leave most of the known fossil fuel reserves in the ground!**

## 1.9 Is 100% renewable energy possible?

### Remaining reserves and rates of use of fossil fuels

If we ask whether the transition to 100% renewable energy is possible, the answer is very simple: It is not only possible; it is inevitable! This is because the supply of fossil fuels is finite, and at the present rate of use they will be exhausted in less than a century. While the transition to 100% renewables is inevitable, the vitally important point to remember is that if we are to avoid disaster, the transition must come quickly.

In this book, we will use kilowatts (kW), megawatts (MW) and terawatts (TW) as the units in which we discuss the rate of use of energy. A megawatt is equal to a thousand kilowatts or a million watts. A terawatt is equal to a thousand megawatts, or a million kilowatts or a billion (1,000,000,000) watts. A citizen of the European Union uses energy at the rate of about 6 kilowatts, while in North America, the rate of energy use is double that amount. The global average rate of energy use is a little over 2 kilowatts. Since there are now 7.5 billion people in the world, our present rate of energy use is roughly 15 terawatts,

The total available energy from fossil fuels can be measured in terawatt.years (TWy). Rough estimates of global coal reserves of coal, oil and natural gas are given by the table shown above.

The per capita energy use is almost constant. Our rapidly growing demand for energy is primarily the result of the world's rapidly growing population of humans. It would

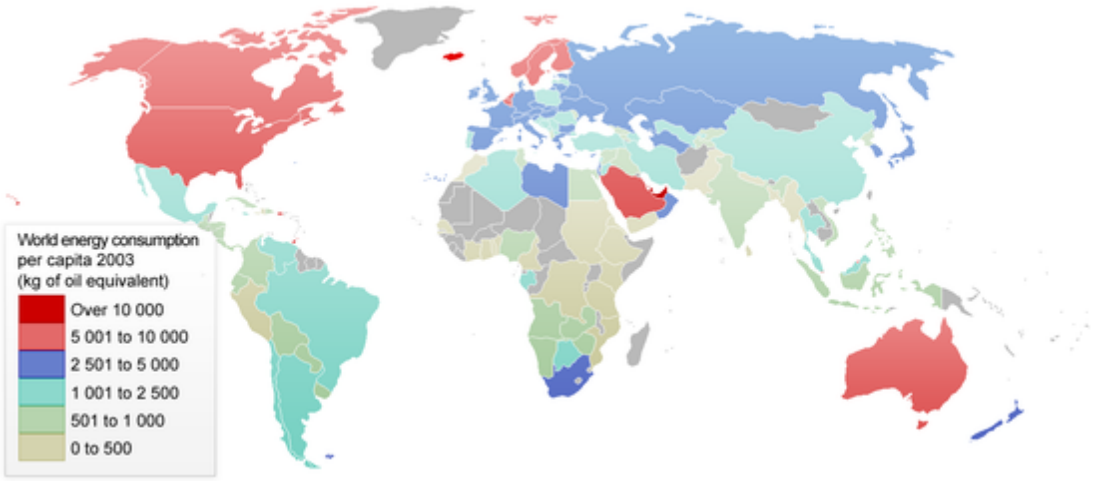


Figure 1.7: **A map of the world showing per capita rates of energy use.**

be wise to stabilize human populations because of the threat of human-caused ecological catastrophes and the danger of an extremely large-scale famine, involving billions of people rather than millions. Such a famine is threatened because growing populations require a growing food supply, climate changes threaten agriculture through droughts, melting glaciers and loss of agricultural land. The end of the fossil fuel era will also mean the end of high-yield petroleum.based agriculture.

## The rate of growth of renewable energy

There is reason for hope that even high energy demands can be met by renewables. The basis of this hope can be found in the extremely high present rate of growth of renewable energy, and in the remarkable properties of exponential growth. According to figures recently released by the Earth Policy Institute, the global installed photovoltaic capacity is currently able to deliver 242,000 megawatts, and it is increasing at the rate of 27.8% per year. Wind energy can now deliver 370,000 megawatts, and it is increasing at the rate of roughly 20% per year.

Because of the astonishing properties of exponential growth, we can calculate that if these growth rates are maintained, renewable energy can give us 24.8 terawatts within only 15 years! This is far more than the world's present use of all forms of energy.

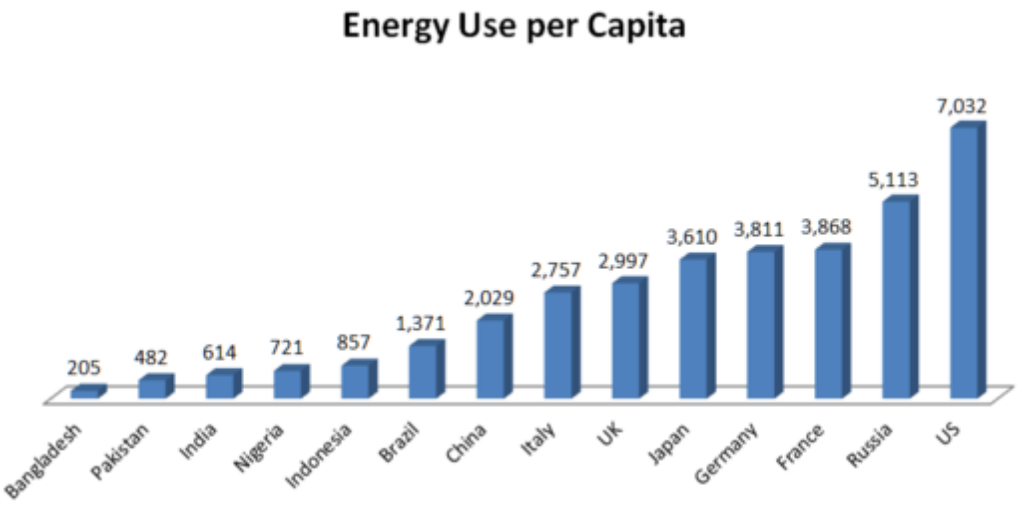


Figure 1.8: **Energy use per capita by country (World Bank data)**

## 1.10 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[8].

"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.' '

### Solar energy

Unlike the burning of fossil fuels, renewables like solar energy do not release pollutants into the atmosphere. In China. public opinion has shifted in favor of renewables because of air pollution in cities.

#### Photovoltaic cells

The price of solar photovoltaic panels has declined 99 percent over the last four decades, from $74 a watt in 1972 to less than 70 cents a watt in 2014.

[8]http://www.sciencedirect.com/science/article/pii/S0048733315001699

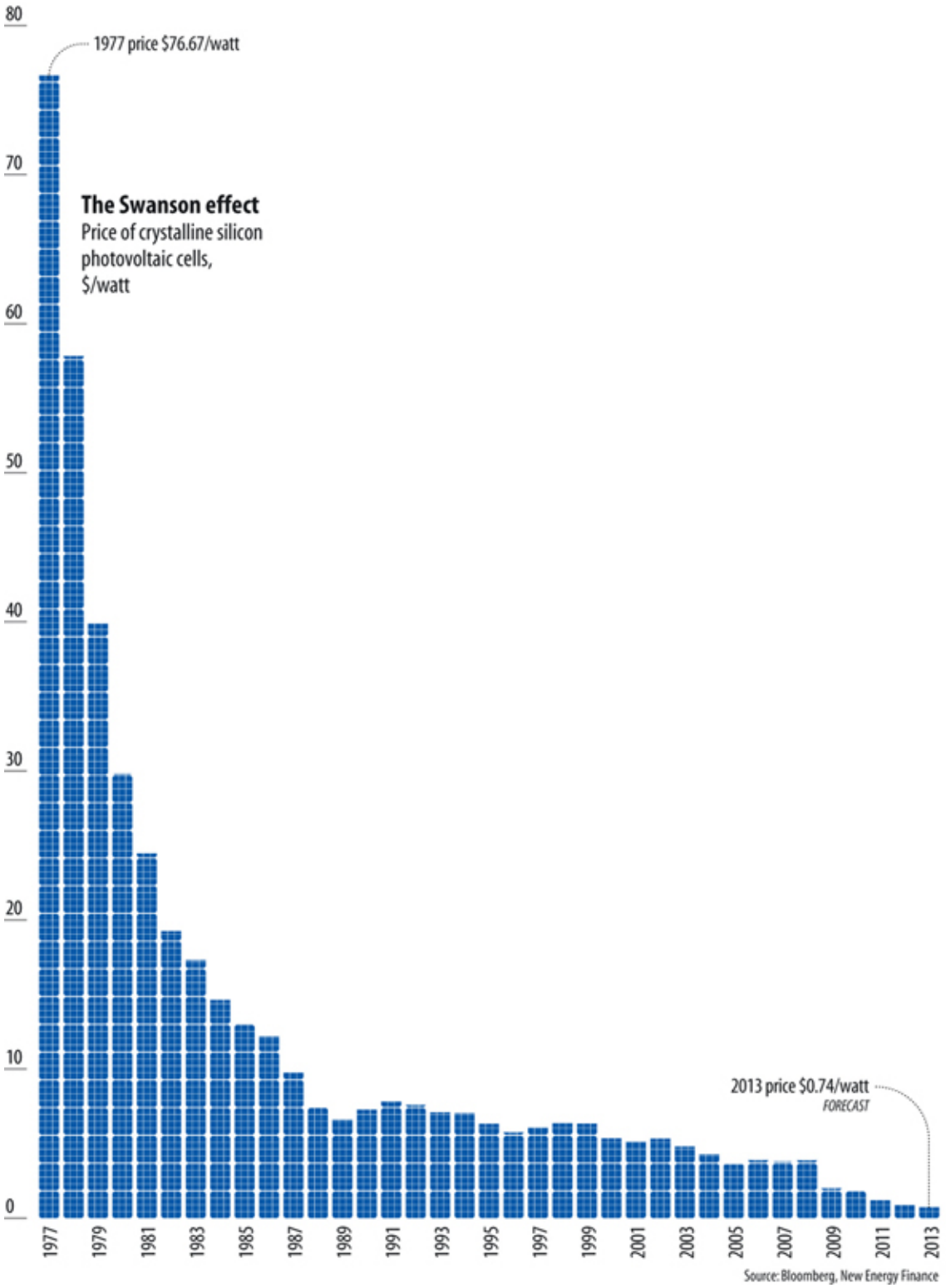


Figure 1.9: **The cost of photovoltaic cell panels is falling rapidly**

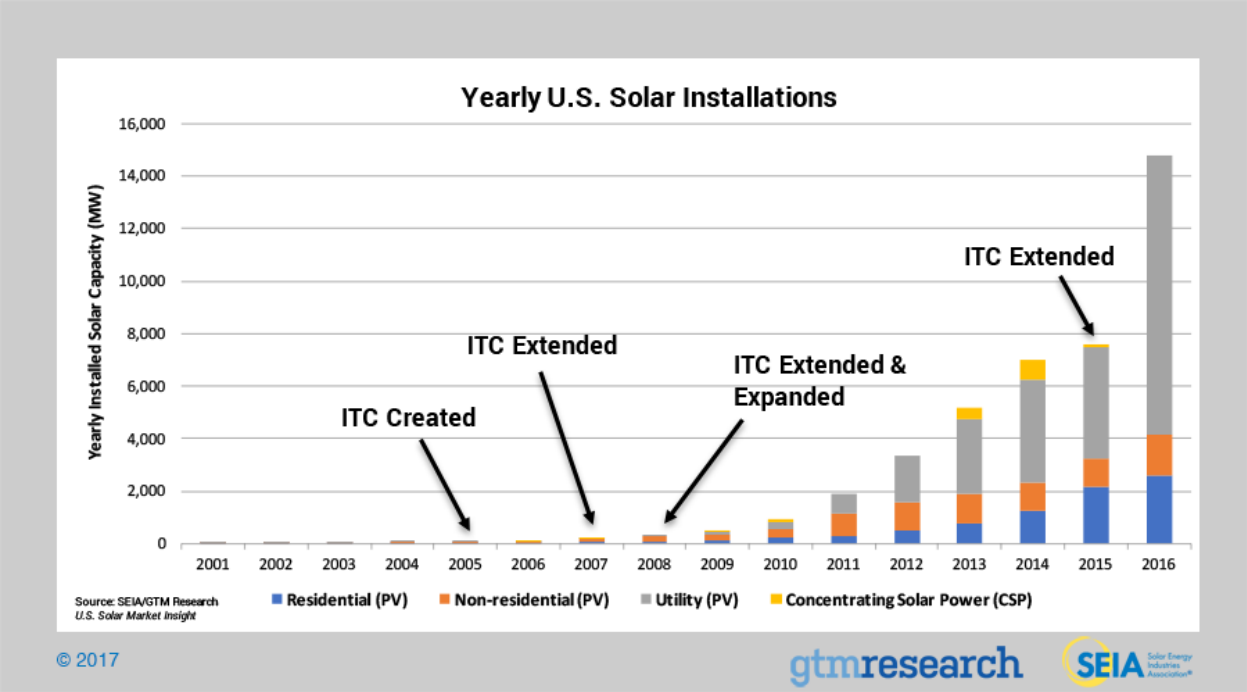


Figure 1.10: **Driven by falling prices, new solar installations in the United States are increasing rapidly. The acronym ITC stands for Solar Investment Tax Credit. Commercial prices have fallen by 58% since 2012 and by 16% in the last year**

Figure 1.11: **Air pollution from the burning of coal has become a serious problem in China. This problem has helped to shift Chinese public opinion away from the burning of coal and towards renewables. China has now become a major manufacturer of photovoltaic cells.**

Between 2009 and 2014, solar panel prices dropped by three fourths, helping global PV installations grow 50 percent per year.

Deutsche Bank notes that as of early 2014, solar PV was already competitive with average residential, commercial or industrial electricity rates in 14 countries, and in California - even without subsidies. By late 2014 there were nearly 600,000 individual PV systems in the United States, almost twice as many as in 2012. This number may well pass 1 million in 2016.

In 2013, just 12 percent of U.S homebuilders offered solar panels as an option for new single-family homes. More than half of them anticipate doing so by 2016. Four of the top five U.S. home construction firms - DR Horton, Lennar Corp, PulteGroup and KB Home - now automatically include solar panels on every new house in certain markets.

In 2007 there were only 8,000 rooftop solar installations in coal-heavy Australia; now there are over a million.

Saudi Arabia has 41,000 megawatts of solar PV operating, under construction and planned - enough to generate up to two thirds of the country's electricity.

For the roughly 1.3 billion people without access to electricity, it is now often cheaper and more efficient simply to install solar panels rooftop-by-rooftop than to build a central power plant and transmission infrastructure.

## Wind energy

Over the past decade, world wind power capacity grew more than 20 percent a year, its increase driven by its many attractive features, by public policies supporting its expansion, and by falling costs.

By the end of 2014, global wind generating capacity totaled 369,000 megawatts, enough to power more than 90 million U.S. homes. Wind currently has a big lead on solar PV, which has enough worldwide capacity to power roughly 30 million U.S. homes.

China is now generating more electricity from wind farms than from nuclear plants, and should have little trouble meeting its official 2020 wind power goal of 200,000 megawatts. For perspective, that would be enough to satisfy the annual electricity needs of Brazil.

In nine U.S. states, wind provides at least 12 percent of electricity. Iowa and South Dakota are each generating more than one quarter of their electricity from wind.

In the Midwestern United States, contracts for wind power are being signed at a price of 2.5 cents per kilowatt-hour (kWh), which compares with the nationwide average grid price of 10-12 cents per kWh.

Although a wind farm can cover many square miles, turbines occupy little land. Coupled with access roads and other permanent features, a wind farm's footprint typically comes to just over 1 percent of the total land area covered by the project.

Wind energy yield per acre is off the charts. For example, a farmer in northern Iowa could plant an acre in corn that would yield enough grain to produce roughly $1,000 worth of fuel-grade ethanol per year, or the farmer could put on that same acre a turbine that generates $300,000 worth of electricity per year. Farmers typically receive $3,000 to $10,000 per turbine each year in royalties. As wind farms spread across the U.S. Great Plains, wind royalties for many ranchers will exceed their earnings from cattle sales.

## The problem of intermittency

Many forms of renewable energy encounter the problem of intermittency. For example, on windy days, Denmark's windmills generate more than enough electricity to meet the needs of the country, but on days when the wind is less strong, the electrical energy generated is insufficient. Denmark solves this problem by selling surplus electrical power to Germany on windy days, and buying power from hydroelectric-rich Norway on less windy days.

The problem of intermittency can alternatively be solved by pumping water to uphill reservoirs when the wind is strong, and letting the stored water drive turbines when the wind is weak. The problem of intermittency can also be solved with lithium ion storage batteries, by splitting water into hydrogen and oxygen, or by using other types of fuel cells.

## Developing countries: No need for grids

When cell phones came into general use, developing countries with no telephone networks were able to use the new technology through satellites, thus jumping over the need for

country-wide telephone lines. Similarly, village solar or wind installations in the developing countries can supply power locally, bypassing the need for a grid.

## 1.11 An economic tipping point

### Renewables are now cheaper than fossil fuels

Solar energy and wind energy have recently become cheaper than fossil fuels. Thus a tipping point has been passed. From now on, despite frantic efforts of giant fossil fuel corporations to prevent it from happening, the transition to 100% renewable energy will be driven by economic forces alone.

### Subsidies to the fossil fuel industry must cease

According to a 2015 study by the International Monetary Fund[9], **"Energy subsidies are projected at US$5.3 trillion in 2015, or 6.5 percent of global GDP, according to a recent IMF study. Most of this arises from countries setting energy taxes below levels that fully reflect the environmental damage associated with energy consumption."** Such governmental subsidies must cease in order to create a level playing field for economic competition between renewables and fossil fuels.

## 1.12 An unprecedented investment opportunity

### Investment in electric vehicles

On July 5, 2017, the Volvo Car Group made the following announcement: [10]

"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. '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.

[9] http://www.imf.org/en/News/Articles/2015/09/28/04/53/sonew070215a

[10] https://www.media.volvocars.com/global/en-gb/media/pressreleases/210058/volvo-cars-to-go-all-electric

"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 [11].

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 have electric vehicles by 2030[12]. 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[13]. 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.

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

[11] https://arstechnica.com/cars/2016/10/germanys-bundesrat-votes-to-ban-the-internal-combustion-engine-by-2030/

[12] https://www.greentechmedia.com/articles/read/what-country-will-become-the-first-to-ban-internal-combustion-cars

[13] http://www.prnewswire.com/news-releases/the-dutch-revolution-in-smart-charging-of-electric-vehicles-597268791.html

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.

## Investment in wind turbine energy

In Denmark, the wind turbine industry contributes substantially to the country's positive balance of payments. According to Wikipedia, "The Danish wind turbine industry is the world's largest. Around 90% of the national output is exported, and Danish companies accounted for 38% of the world turbine market in 2003, when the industry employed some 20,000 people and had a turnover of around 3 billion euro."

Denmark's two largest wind turbine manufacturers are Vestas and Simiens Wind Power. Vestas employs more that 21000 people globally. In February 2016, Vestas got its largest order of 1,000 MW (278 x 3.6 MW) for the Fosen project near Trondheim in Norway. It costs DKK 11 billion, and should deliver 3.4 TWh per year.

In 2015 Siemens Wind had a combined market share of 63% of European offshore wind turbines (nearly 75% in 2009 by capacity and number). In 2011, Siemens Wind Power had 6.3% share of the world wind turbine market, and was the second largest in 2014.

In many countries, including Australia, Canada, Denmark, Germany, India, The Netherlands, United Kingdom, and United States, wind turbine cooperatives have sprung up. In these cooperatives, communities share the costs and profits of wind turbine projects. For example, the Hepburn Wind Project in Victoria, Australia, owns two 2MW wind turbines which produce enough power for 2,300 households.

## Investment in solar energy

Global revenues from solar photovoltaic installations are expected to reach $1.2 trillion between the present and 2024 according to a recent article[14]

[14]https://cleantechnica.com/2016/01/25/global-revenue-solar-pv-installations-expected-reach-1-2-trillion/

Another article[15] states that "The global electric power industry is evolving into a model that offers more diversity, both in terms of generation and in the ownership of generation assets, and solar PV is one technology at the head of this change. Following years of unsustainable pricing and oversupply, demand for solar PV systems has finally caught up, with 2015 expected to be the year when the global solar PV market shifts and starts to compete with other technologies. According to a recent report from Navigant Research, global revenue from solar PV installations is expected to total more than $1.2 trillion from 2015 to 2024."

## 1.13 For creating jobs, renewables beat fossil fuels

Here are some excerpts from a 2016 report issued by the Solar Foundation:

- One out of every 50 new jobs added in the United States in 2016 was created by the solar industry, representing 2 percent of all new jobs.
- Solar jobs in the United States have increased at least 20 percent per year for the past four years, and jobs have nearly tripled since the first Solar Jobs Census was released in 2010.
- Over the next 12 months, employers surveyed expect one out of every 50 new jobs added in the United States in 2016 was created by the solar industry, representing 2 percent of all new jobs.
- In 2016, the five states with the most solar jobs were California, Massachusetts, Texas, Nevada, and Florida.
- The solar industry added $84 billion to the US GDP in 201t to see total solar industry employment increase by 10 percent to 286,335 solar workers.
- The solar industry added $84 billion to the US GDP in 2016.

[15] http://www.navigantresearch.com/newsroom/global-revenue-from-solar-pv-installations-is-expected-to-total-more-than-1-2-trillion-from-2015-to-2024

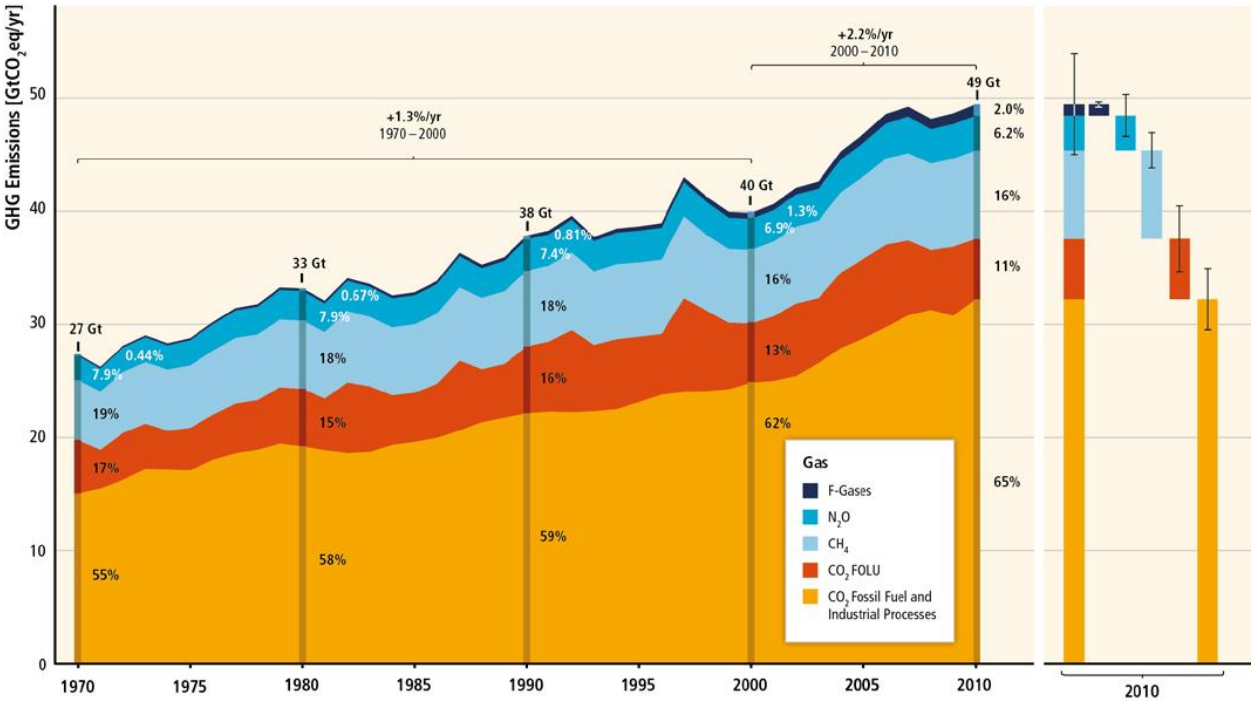


Figure 1.12: **Total Annual Anthropogenic GHG Emissions By Groups of Gases, 1970-2010**

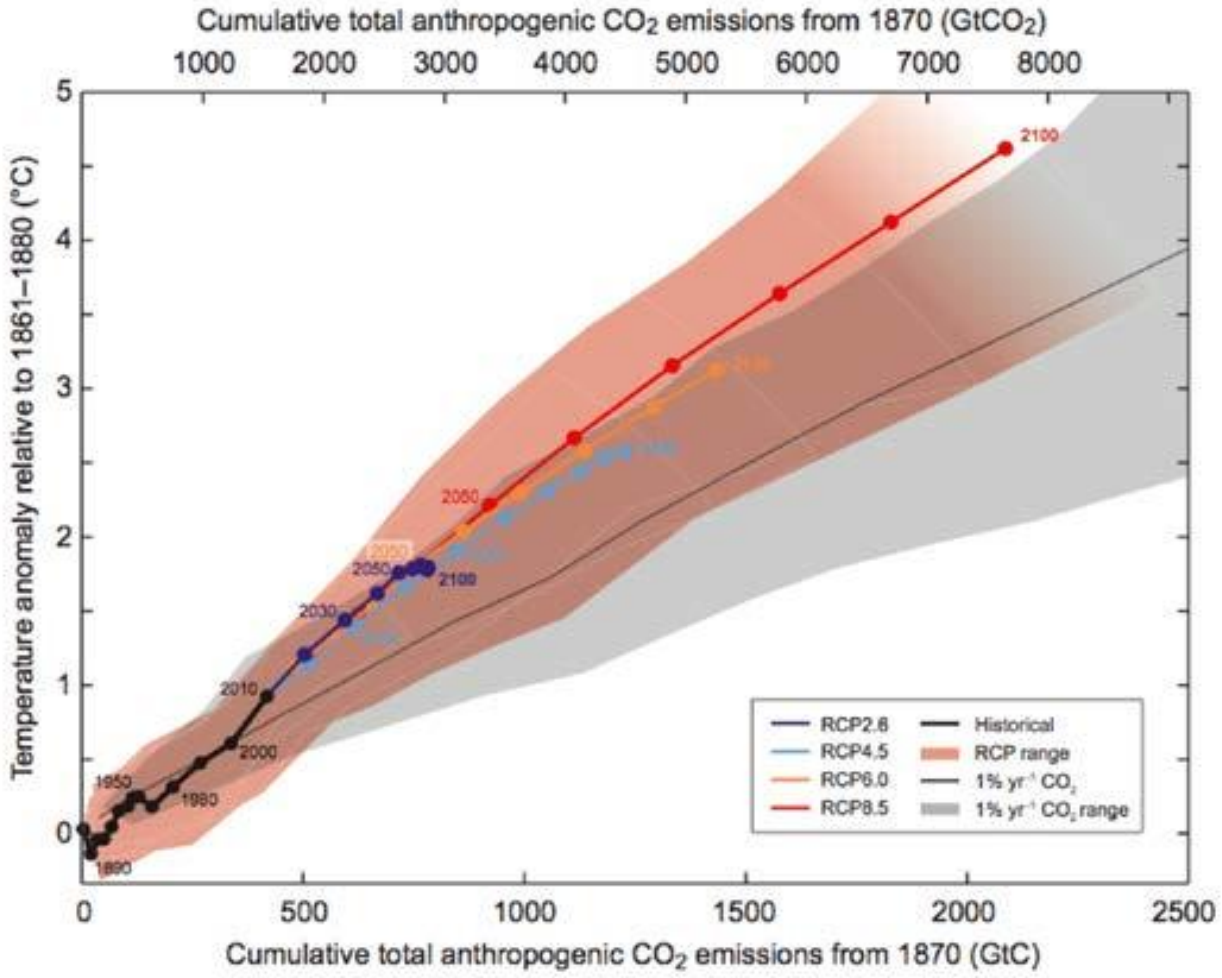


Figure 1.13: **Cumulative $CO_2$ emissions under RCP scenarios**

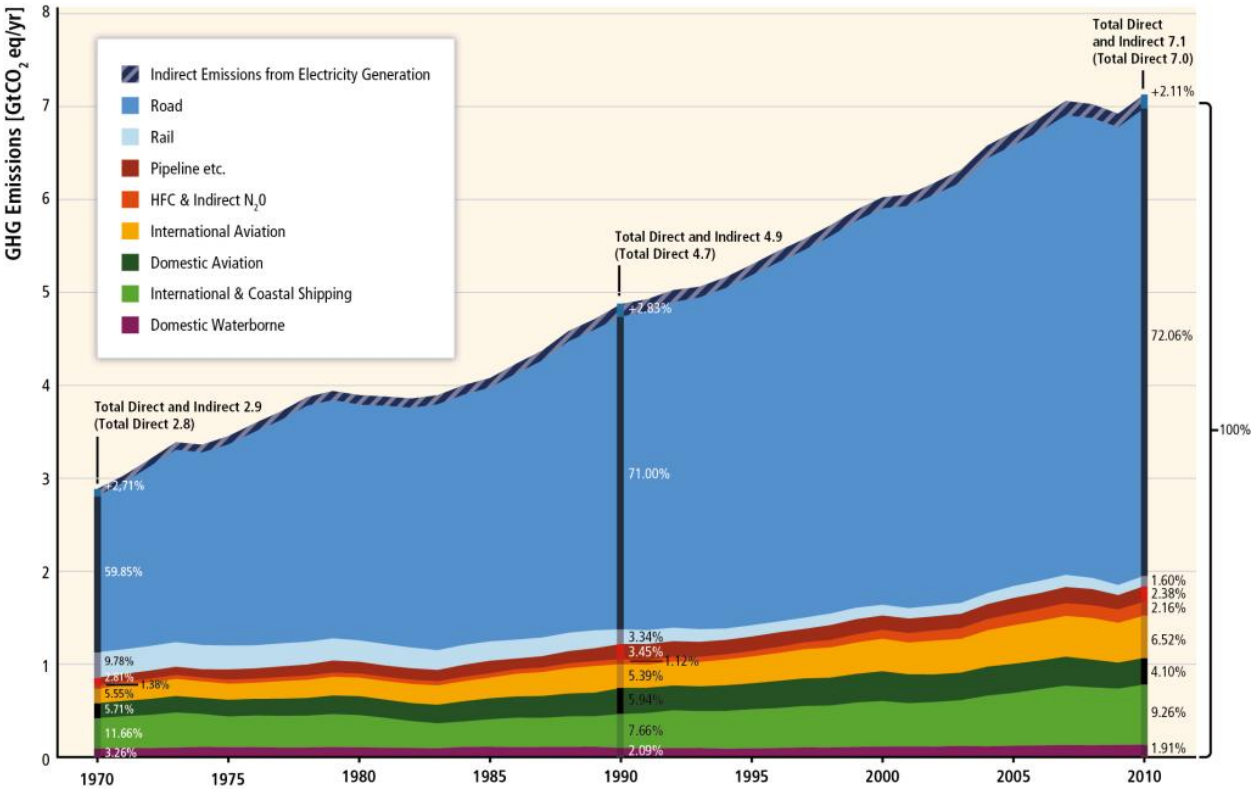


Figure 1.14: **Transport-Related Greenhouse Gas Emissions from 1970 to 2010**


## 1.14 Climate change means lifestyle change

Scientists are unanimous in warning us that unless we very rapidly reduce $CO_2$ emissions, we risk passing a tipping point beyond which we will be powerless to prevent uncontrollable global warming. We risk a human-produced extinction event comparable to the Permian-Triasic thermal maximum, during which 96 percent of marine species and 70 percent of terrestrial vertebrates became extinct.[16]

The excellent videos of Thom Hartmann and his co-workers tell us very clearly a fact of which the scientific community is extremely conscious, but which the mass media refuse to discuss. The fact is this:

Arctic seas are warming very rapidly, and they will soon be free of ice in the summers. The warming of Arctic seas and tundra threatens to release vast quantities of methane into the atmosphere by melting methane hydrates. This in turn threatens to warm the remainder of the world so much that methane hydrates in all offshore deposits will be destabilized. If this happens, the result will be a major extinction event, which will threaten not only human civilization, but also much of the biosphere.[17]

The worrying thing about the threat of an out-of-control methane hydrate feedback loop

[16] https://www.youtube.com/watch?v=k4LL1B3JfnY
https://www.youtube.com/watch?v=vZO2WQ-qK5c

[17] https://www.youtube.com/watch?v=m6pFDu7lLV4
https://www.youtube.com/watch?v=a9PshoYtoxo
https://www.youtube.com/watch?v=c3XpF1MvC8s

is that the quantity of methane hydrates is so vast. There are roughly 10,000 gigatons. of these ice-like crystals on ocean floors, an amount of carbon greater than all of the world's deposits of fossil fuels. Methane hydrates or clathrates are stable at ordinary temperatures, but if oceans warm, they will melt, releasing the potent greenhouse gas methane.

It is not so surprising that our mass media do not give us a correct picture of these grave dangers to the future of our earth. The mainstream media are owned by oligarchic financial interests, including large coal and oil companies, which are desperately anxious cash in on their huge holdings of fossil fuels.

Despite silence and misinformation in the mass media, the general public is becoming, to some extent, aware of the grave dangers posed by out-of-control climate change. However, this does not seem to affect people's behavior. Professor Michael Klare discussed this strange split between awareness and behavior in a recent article:[18]

"Considering all the talk about global warming, peak oil, carbon divestment, and renewable energy", Prof. Klare writes, "you'd think that oil consumption in the United States would be on a downward path. By now, we should certainly be witnessing real progress toward a post-petroleum economy. As it happens, the opposite is occurring. U.S. oil consumption is on an upward trajectory, climbing by 400,000 barrels per day in 2013 alone, and, if current trends persist, it should rise again both this year and next."

"In other words, oil is back. Big time. Signs of its resurgence abound. Despite what you may think, Americans, on average, are driving more miles every day, not fewer, filling ever more fuel tanks with ever more gasoline, and evidently feeling ever less bad about it. The stigma of buying new gas-guzzling SUVs, for instance, seems to have vanished; according to CNN Money, nearly one out of three vehicles sold today is an SUV. As a result of all this, America's demand for oil grew more than China's in 2013, the first time that's happened since 1999."

There is a second reason why the mainstream media conspire to reassure their readers and viewers that it is fine to continue their usual lifestyles: This second reason is the fear of precipitating an economic recession. Such a recession is due to occur soon in the United States because of US overspending on war, using money borrowed from China, and because the petrodollar is threatened by BRICS agreements. However, the short-term profit motive ensures that the slave-like media continue to make us believe that all is well, and that economic growth can continue forever.

Undeniably, an economic recession will be extremely painful, but sooner or later it will certainly occur. On a finite planet, endlessly continued economic growth is a logical impossibility. Furthermore, it is exactly that growth which threatens to produce a 6th mass extinction event.

If we wish to save the long-term future of our beautiful earth for future generations of humans, and for the animals and plants with which we share the earth today, we must not only urgently develop all forms of renewable energy, but also we must quickly change our lifestyles. Renewables, such as wind power and solar cells are producing a rapidly increasing fraction of our energy needs, but this fraction is still very small, only 19 percent

[18] http://www.countercurrents.org/klare040914.htm

Figure 1.15: **We can avoid the frustration of traffic jams by reforming our transportation systems. Saving the future of the biosphere demands lifestyle changes, but perhaps these changes will not really reduce human happiness. We can still be happy when use of private automobiles (except when absolutely necessary) is replaced by bicycles and public transport. We can still be happy without air travel for recreational purposes. We can still be happy with the smaller families which will be needed to stabilize and ultimately reduce global population. Endless growth on a finite planet is a logical impossibility. Seen from an ecological perspective, the gross national product of a country does not indicate how well the economy is doing, but almost the reverse.**

in 2014.

What then must we do? We must develop a new economic system which will aim at long-run sustainability. Within such a system, the problem of unemployment can be addressed by shifting jobs to the task of building renewable energy infrastructure. Secondly, we must recognize that our usual lifestyles cannot be continued. We must limit our consumption to necessities; and we must travel only when absolutely necessary. If we do not make these changes, we will have lost the struggle for the future.

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# Chapter 2

# MONEY DRIVES THE MANIA OF GROWTH

## 2.1 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.

## 2.2 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 documentry 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.

## 2.3 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

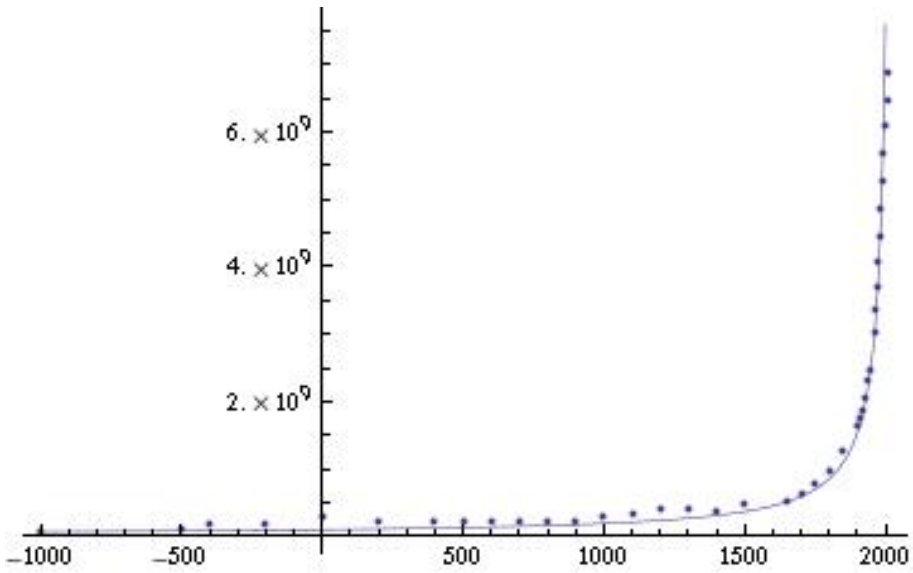


Figure 2.1: **The simple mathematical curve that fits best to human population data over the last 3,000 years is not an exponential increase, but rather a hyperbola of the form P=C/(2025-t). Here P represents population, C=190,000,000,000 and t is the year. The curve goes to infinity at t=2025 (only 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.

## 2.4 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

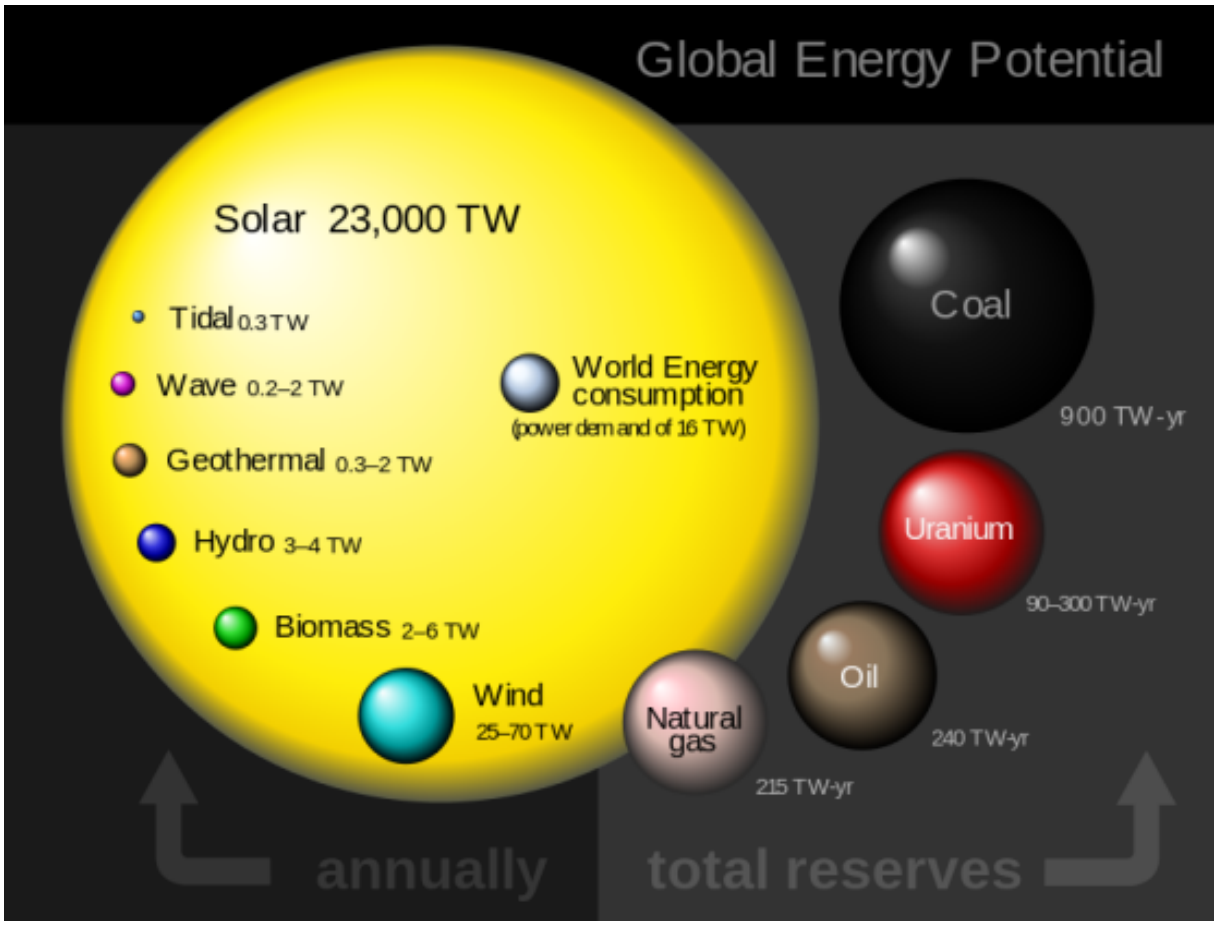


Figure 2.2: **Global energy potential. Comparison of renewable and conventional planetary energy reserves and sources. While renewables display their power potential in terawatts (TW) with the corresponding annual amount of energy, conventional sources display their total recoverable energy reserves 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/

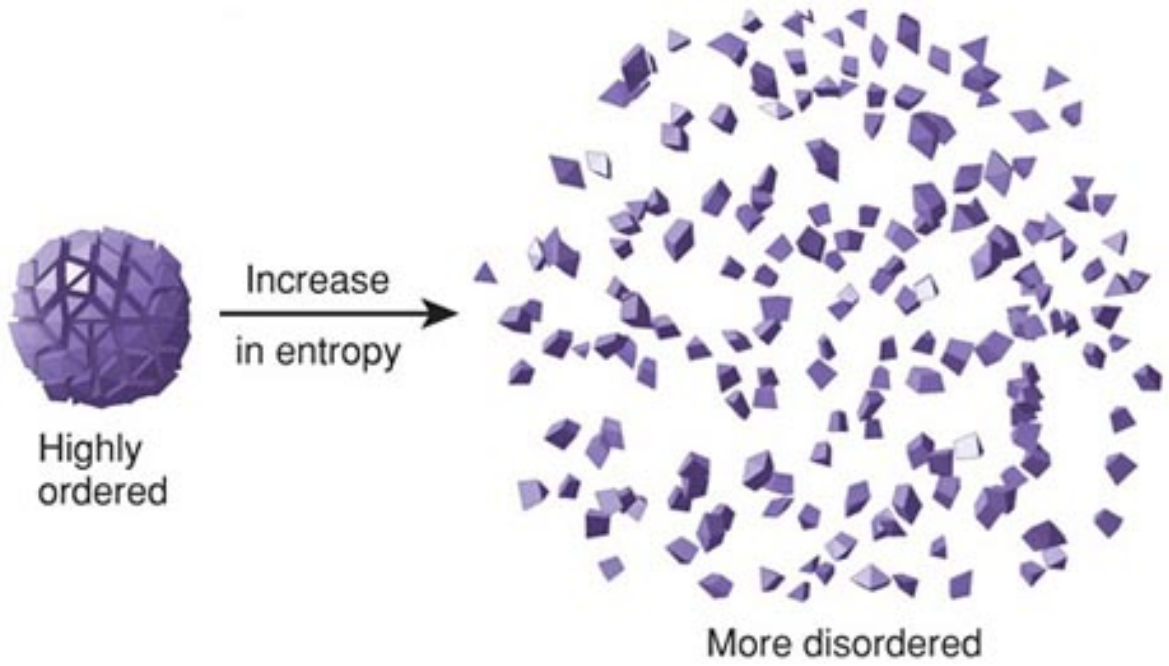


Figure 2.3: **According to the second law of thermodynamics, the entropy of the universe constantly increases. Increase of entropy corresponds to increase of disorder, and also to increase of statistical probability. Living organisms on the earth are able to achieve a high degree of order and highly 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 2.4: **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.

## 2.5 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 2.5: **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

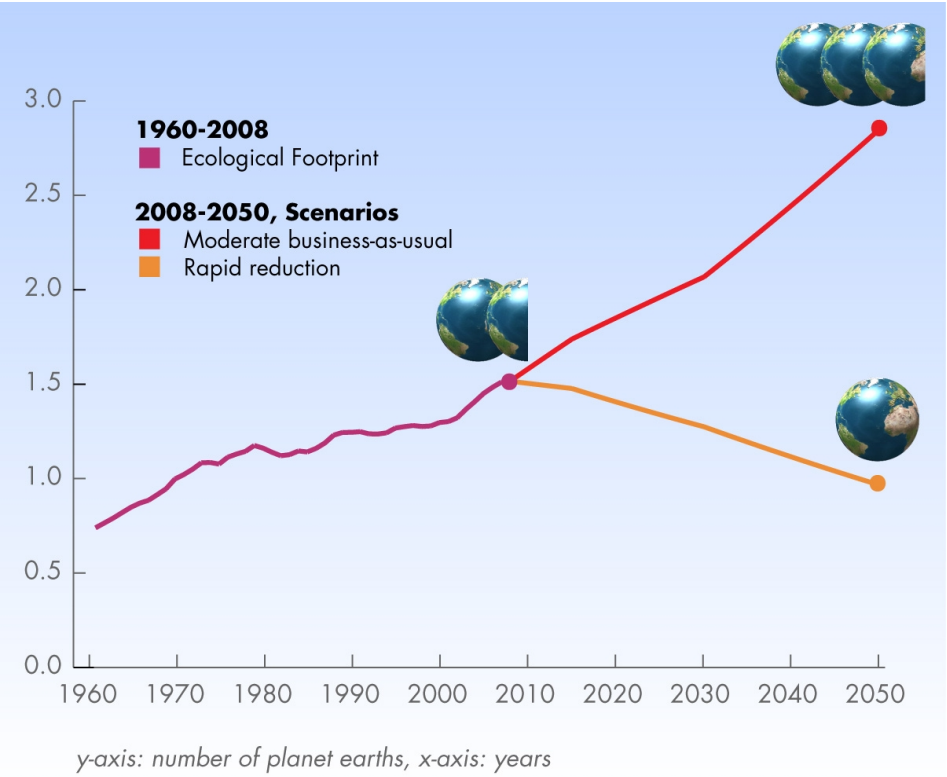


Figure 2.6: **Our present trajectory is completely unsustainable. If we follow it, then by 2050 it would take almost three earths to regenerate our demands on resources. Source: footprintnetwork.org**

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 2.7: **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

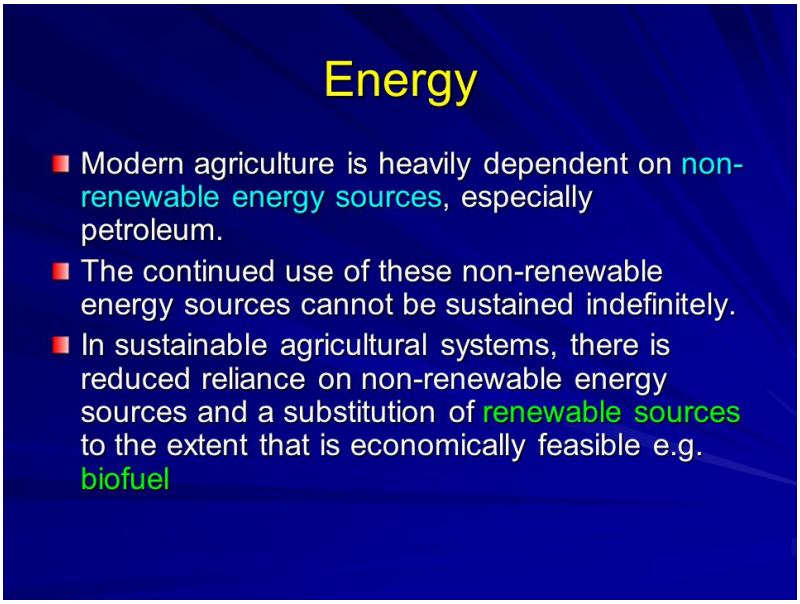


Figure 2.8: **Source: slideplayer.com**

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 2.9: **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 2.10: **Whitechuck Glacier in the North Cascades National Park in 1973. Source: www.nichols.ewdu**

Figure 2.11: **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

## 2.6 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

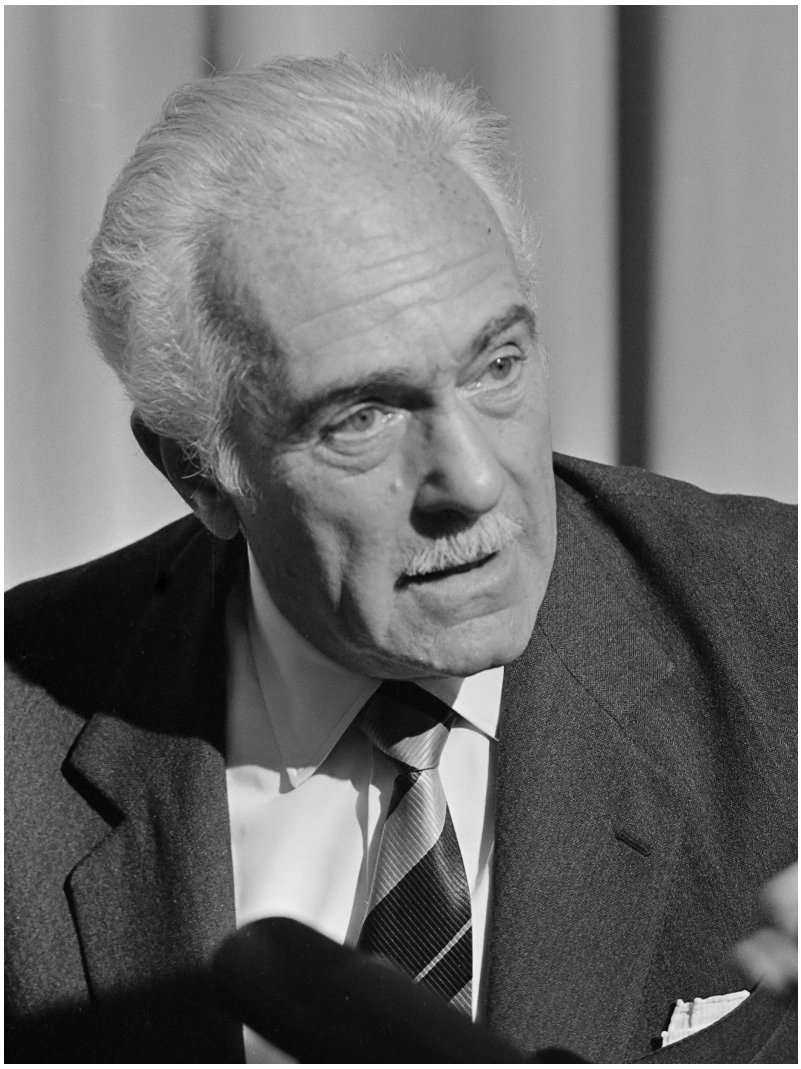

Figure 2.12: **Aurelio Peccei (1908-1984), main founder of the Club of Rome. Concerning our present economic system, he wrote: "The only way we have devised to meet the surging waves of our rampant militarism and consumerism is to draw increasingly on the natural environment and to exploit, indiscriminately, 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 2.13: **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 2.14: **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.

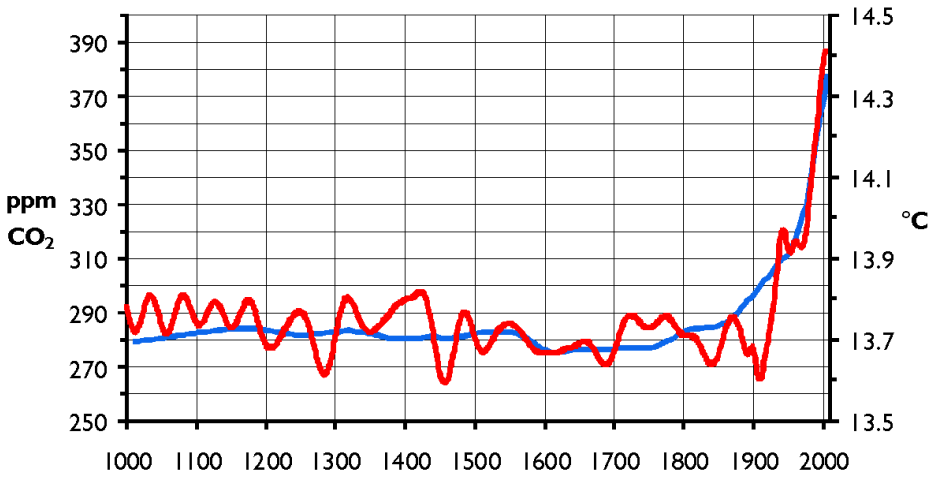


Figure 2.15: **The Hanno graph used by the United Nations Climate Change Compendium 2009. Source: wattsupwiththat.com**

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

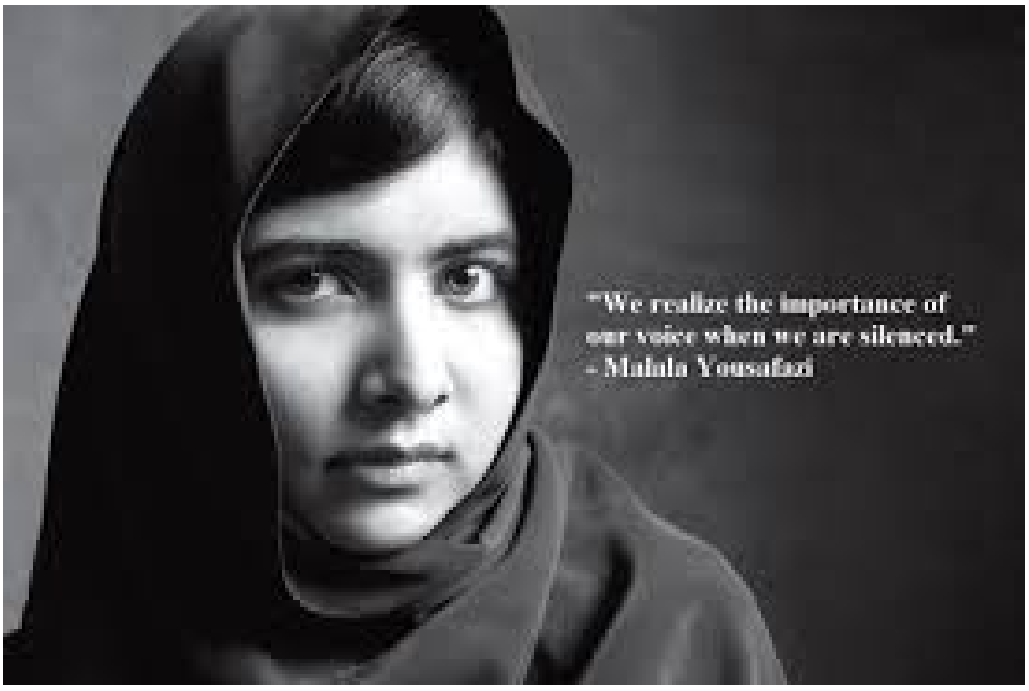


Figure 2.16: **The changes needed to break the cycle of overpopulation and poverty are all desirable in themselves. Besides education and higher status for women, they include state-provided social security for old people, provision of water supplies near to dwellings, provision of health services to all, abolition of child labor, and general economic development. Source: unesco.usmission.gov**

Figure 2.17: **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]

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# Chapter 3

# MONEY BEHIND THE FOSSIL FUEL GIANTS

## 3.1 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 3.1: **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
WATER
IS SACRED
NO PIPELINES!
KEEP IT IN THE
GROUND
PROTECT
OUR
CLIMATE
WATER
AND
HEALTH
WATER
LIFE
MNI WICHONI
NO TAR SANDS
#NoDAPL


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

**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.**

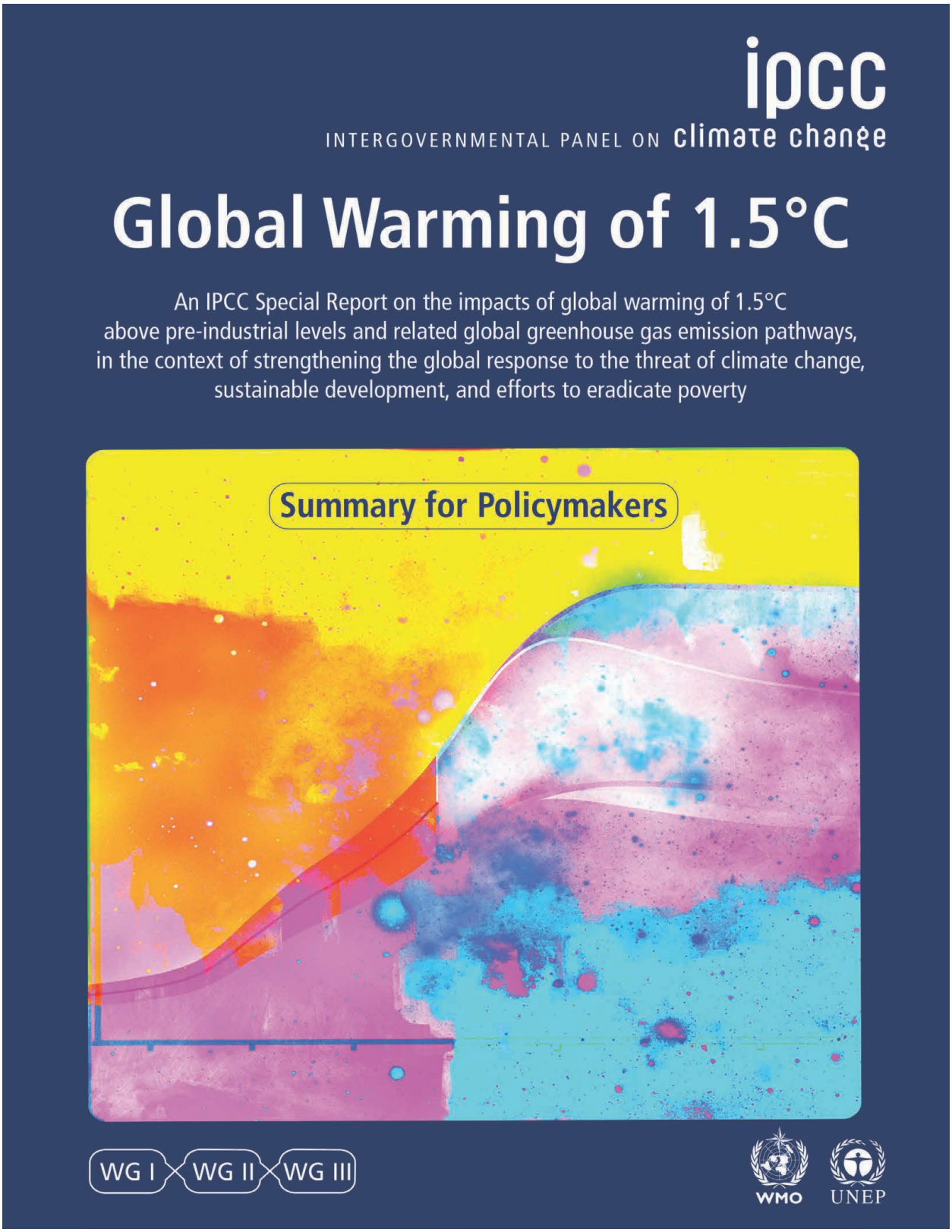
ipcc
INTERGOVERNMENTAL PANEL ON climate change
Global Warming of 1.5°C
An IPCC Special Report on the impacts of global warming of 1.5°C
above pre-industrial levels and related global greenhouse gas emission pathways,
in the context of strengthening the global response to the threat of climate change,
sustainable development, and efforts to eradicate poverty
Summary for Policymakers
WG I
WG II
WG III
WMO
UNEP

Figure 3.2: **Oil is a dirty business in every sense.**

- **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 3.3: **Tar sands in Alberta, Canada.**

Figure 3.4: **Drilling for oil in the Arctic.**


Figure 3.5: **Indigenous protests against Arctic drilling.**


CHASE
CHASE: STOP
PROFITING OFF
DIRTY ENERGY
& RIGHTS ABUSES
JP MorganChase
DON'T FUND
TRANS MOUNTAIN


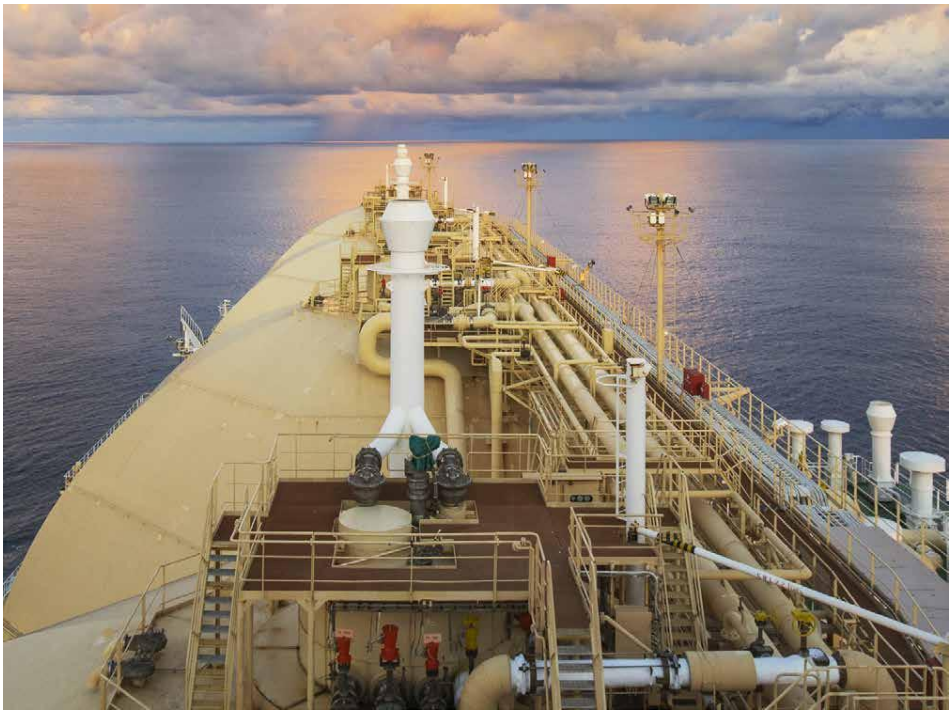

Figure 3.6: **Liquefied natural gas, transported by ship.**

Figure 3.7: **A large open-pit coal mine.**

Figure 3.8: **Giant trucks in an open-pit coal mine.**


Figure 3.9: **A coal-fired power plant.**

## 3.2 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

[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

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 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.**

[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

[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

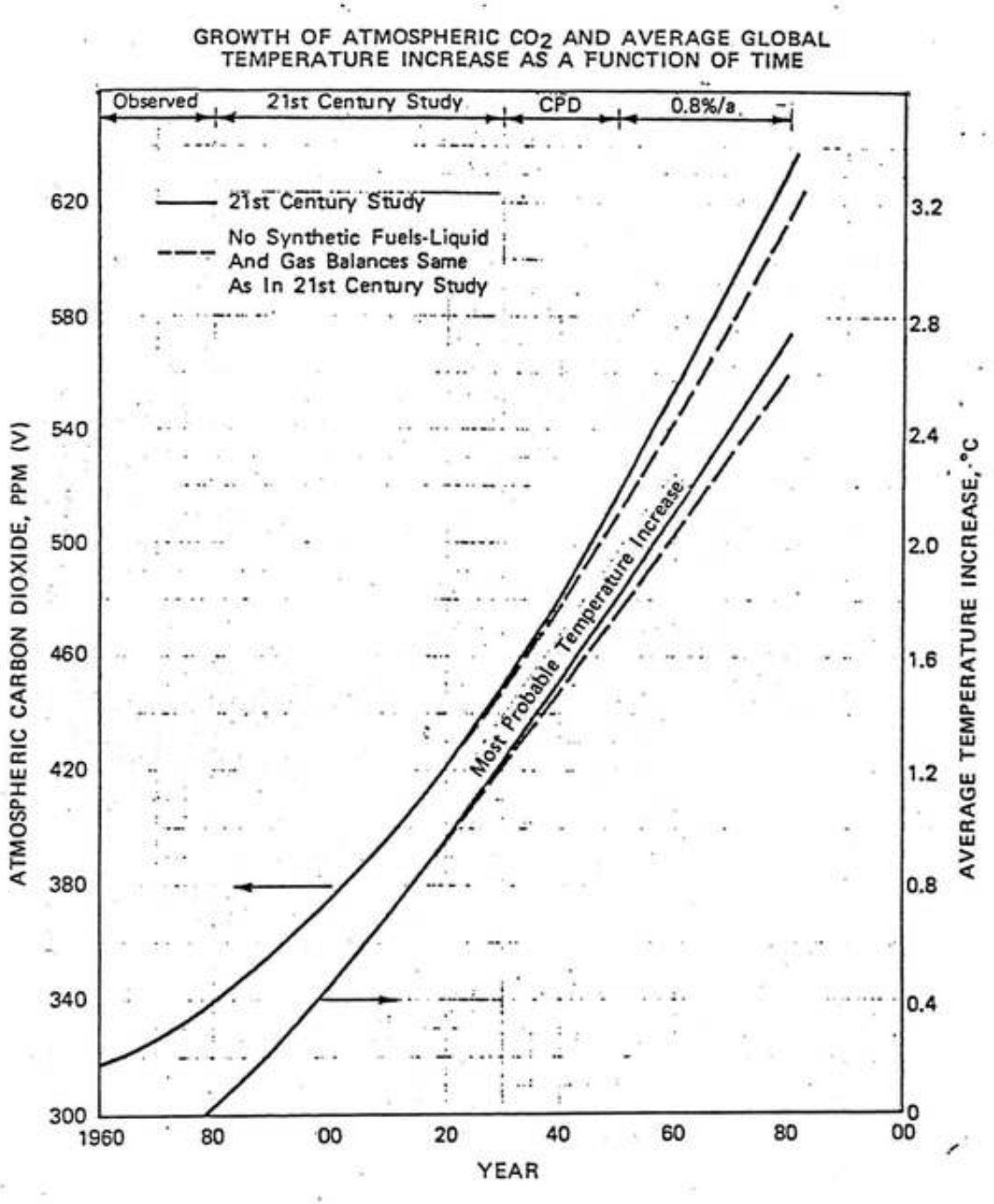


Figure 3.10: **Exxon's 1982 internal projections of the future increase in carbon dioxide levels shows $CO_2$ percentages increasing to 600 ppm and temperature increases of up to 3°C.**

**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, 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**

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

Figure 3.11: **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.**

**around the Koch brothers and Atlas Network, are involved in coordinating or funding many of the thinktanks.**

## 3.3 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**

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

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.

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"...**

## 3.4 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**

[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

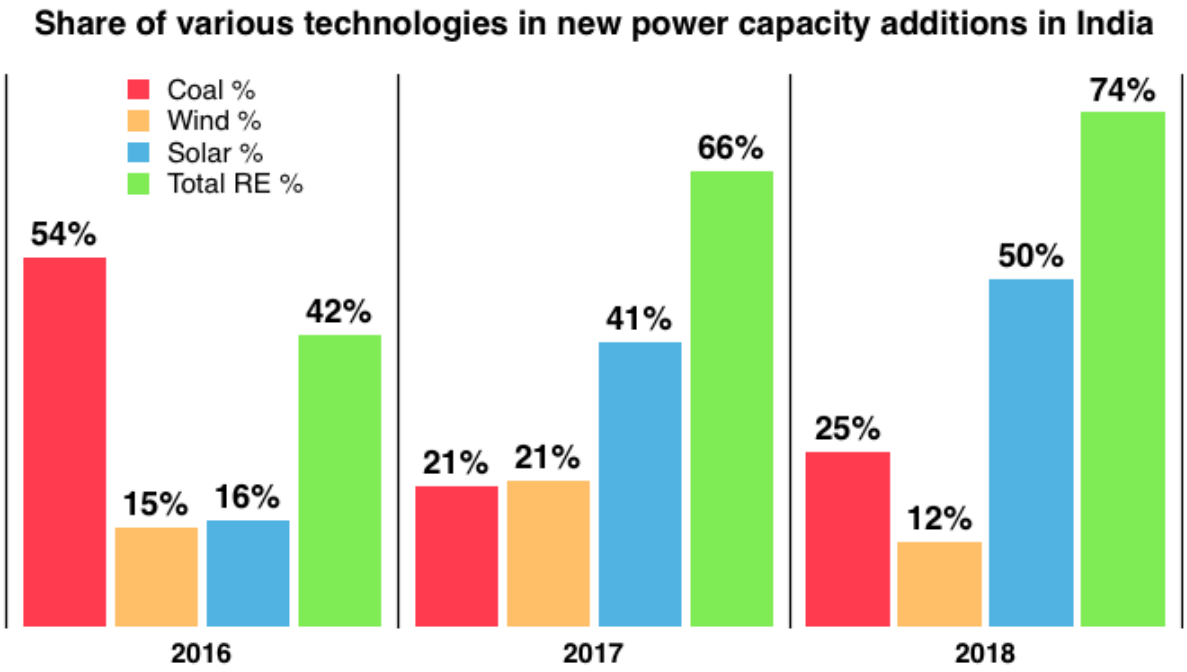


Figure 3.12: **74% of India's new power capacity addition in 2018 was renewable.**

**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 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 3.13: **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


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# Chapter 4

# MONEY CONTROLS MEDIA AND GOVERNMENTS

## 4.1 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

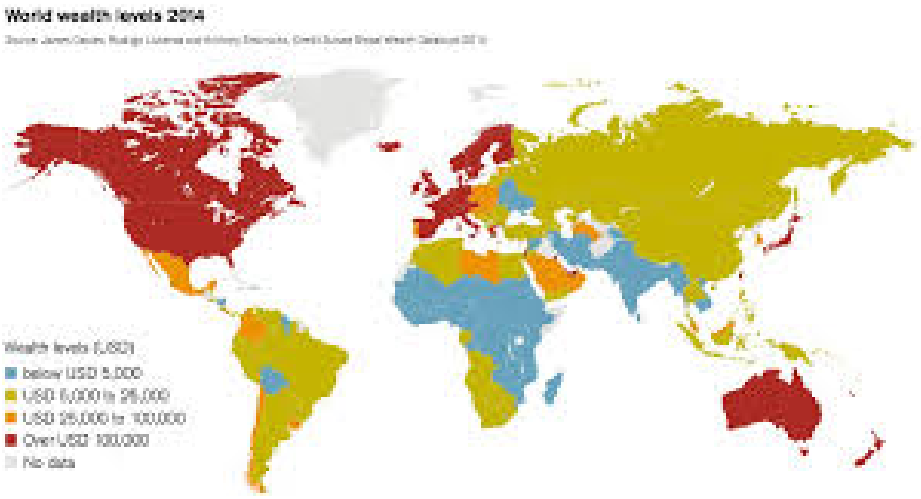


Figure 4.1: **World wealth levels in 2004. Countries with per capita wealth greater than 100,000 USD are shown in red, while those with per capita wealth less than 5,000 USD are shown in blue.**

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


Figure 4.3: **Even in rich countries, many millions of people live in poverty,**

## 4.2 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 glo bal 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.**

## 4.3 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.

## 4.4 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.

## 4.5 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

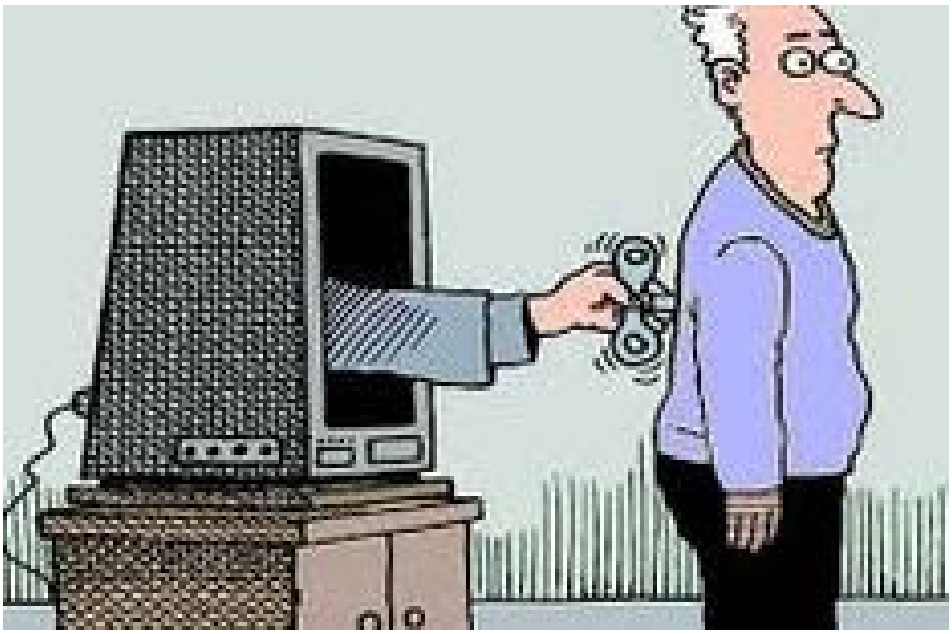

Figure 4.4: **The role of the media.**

Figure 4.5: **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.

## 4.6 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 4.6: **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".**

## 4.7 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...**

## 4.8 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.

## 4.9 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.


## 4.10 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 4.7: **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 4.8: **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 4.9: **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 4.10: **Of the fossil fuels, all are bad, but coal is the worst.**


Figure 4.11: **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 4.12: **Leonardo DiCaprio at a press conference in 2000 (Wikipedia).**


Figure 4.13: **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 Radio

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

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 4.14: **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.

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# Chapter 5

# MONEY ENOUGH FOR THE GREEN NEW DEAL?

## 5.1 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/

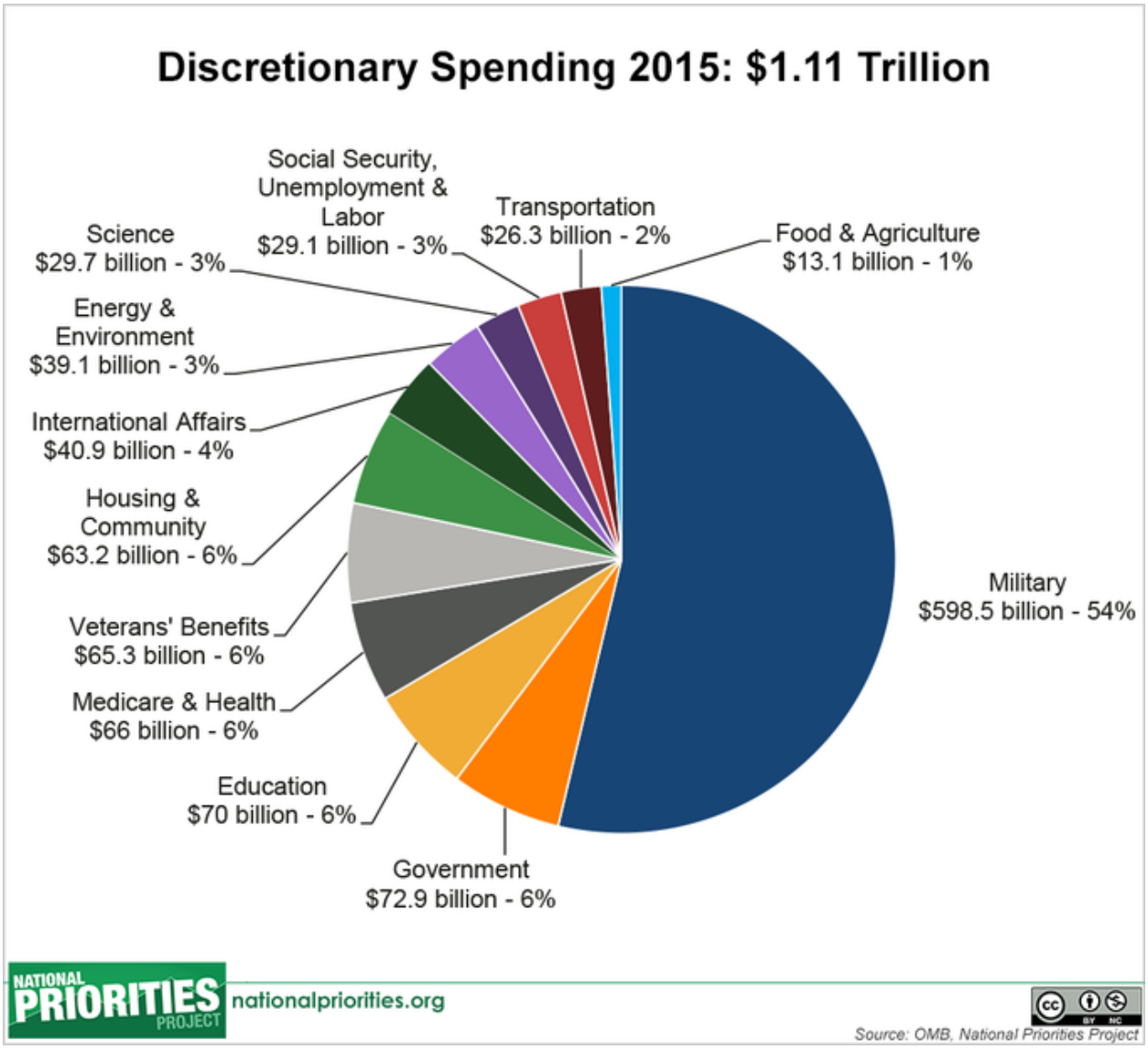


Figure 5.1: **In the fiscal year US 2015, military spending accounted for 54 percent of all federal discretionary spending, a total of $598.5 billion. Military spending includes: all regular activities of the Department of Defense; war spending; nuclear weapons spending; international military assistance; and other Pentagon-related spending.**

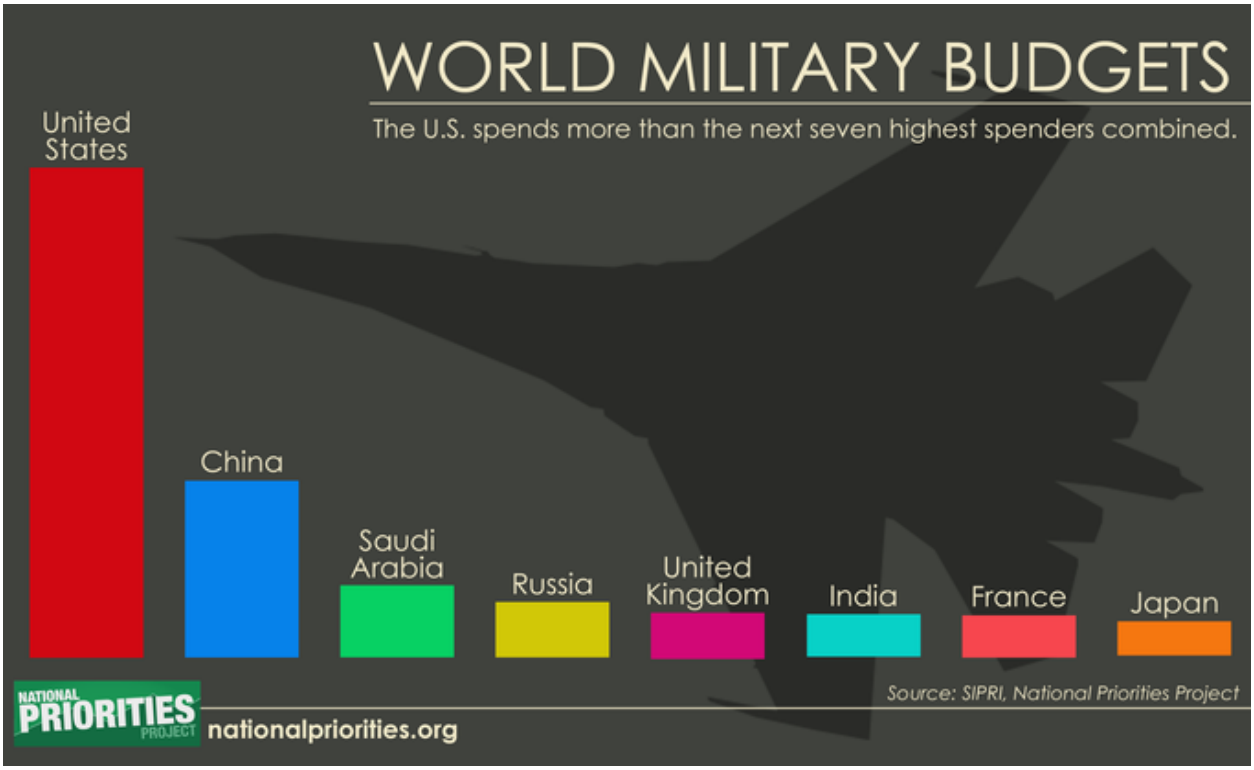


Figure 5.2: **U.S. military spending dwarfs the budget of the #2 country - China. For every dollar China spends on its military, the U.S. spends $2.77. The U.S. outpaces all other nations in military expenditures. World military spending totaled more than $1.6 trillion in 2015. The U.S. accounted for 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 5.3: **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 5.4: **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 5.5: **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.**

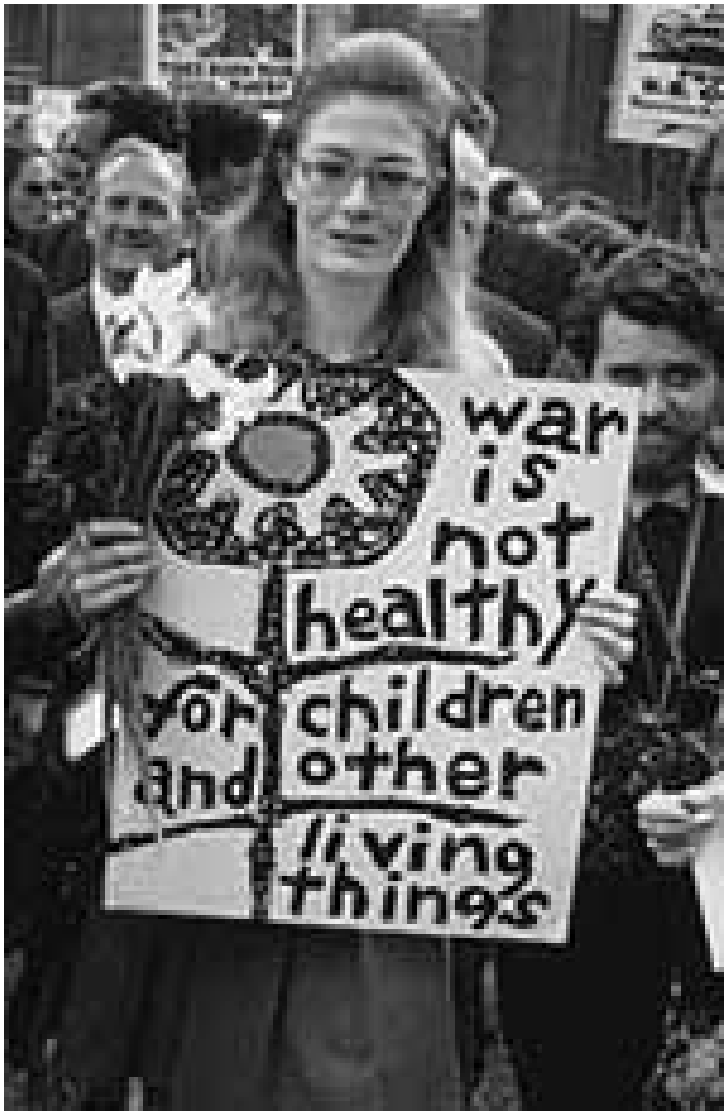


Figure 5.6: **The actress Vanessa Redgrave was part of a 1968 protest against the Vietnam War.**


Figure 5.7: **We must do whatever is necessary to save the future.**


Figure 5.8: **Young protesters from the Sunrise Movement call on leaders to back the Green New Deal.**

## 5.2 The Extinction Rebellion

In an open letter to governments, reported in The Guardian [2], leaders of the environmental mobement 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 5.9: **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.

## 5.3 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 24,

[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

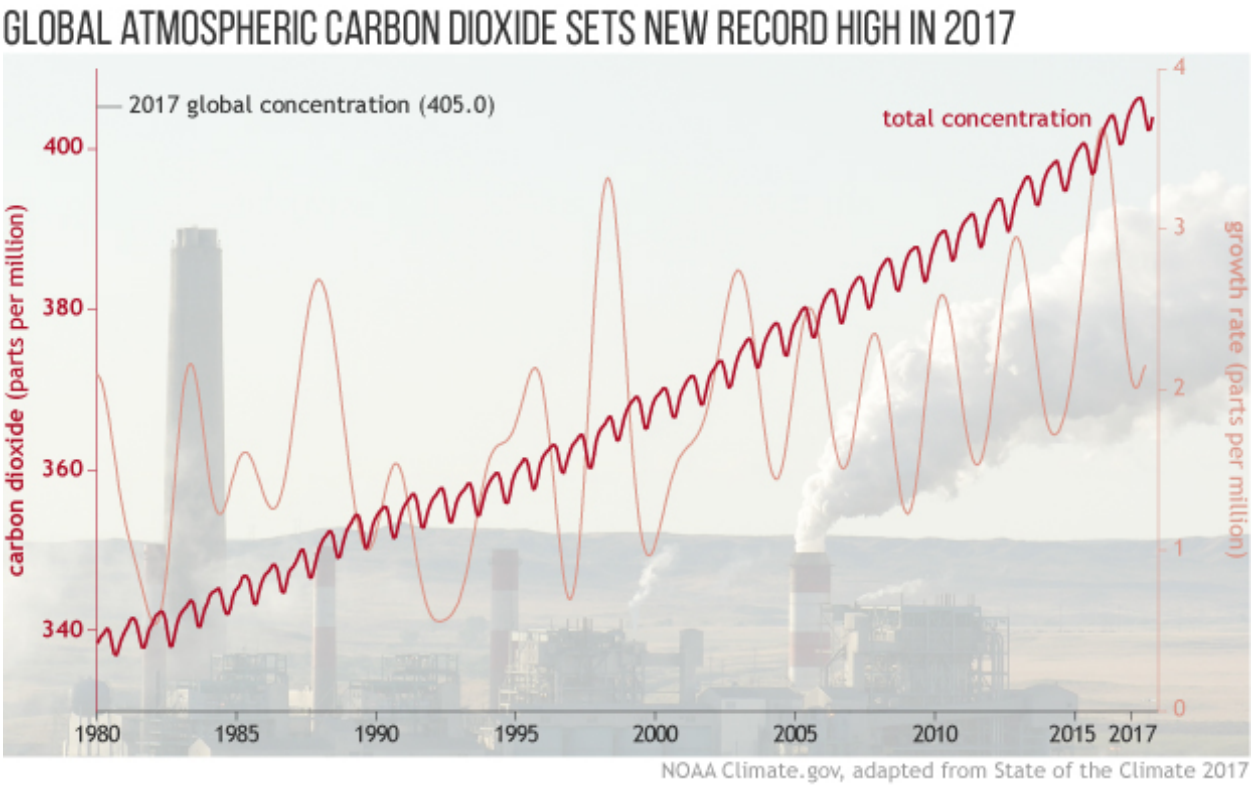


Figure 5.10: **Today the atmospheric concentration of $CO_2$ is 413 ppm., roughly double the pre-industrial concentration. The last time that it was this high was in the Pliocene Epoch 5.3 to 2.6 million years ago. Sea levels were then 20 meters higher than they are right now, and trees were growing at the South Pole. Unless we quickly lower carbon emissions, most coastal cities and low-lying countries will be lost to rising seas.**

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.**

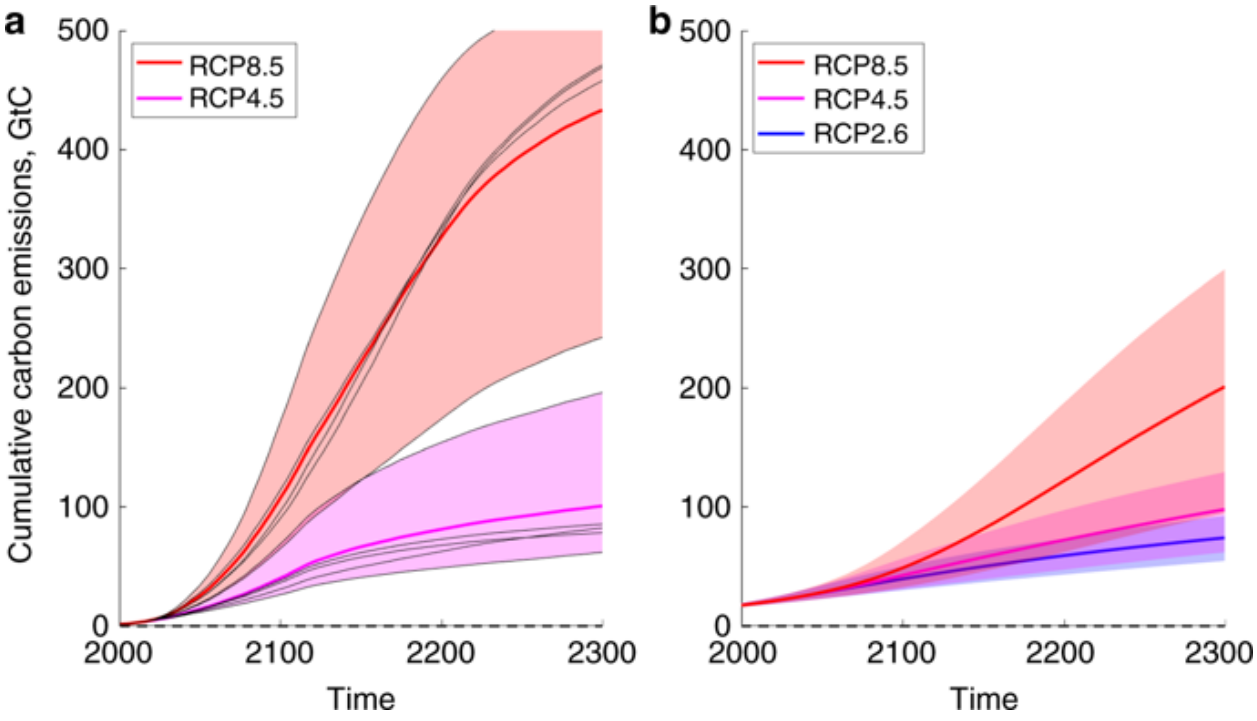


Figure 5.11: **Cumulative carbon emissions in gigatons under various scenarios.**

## 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/

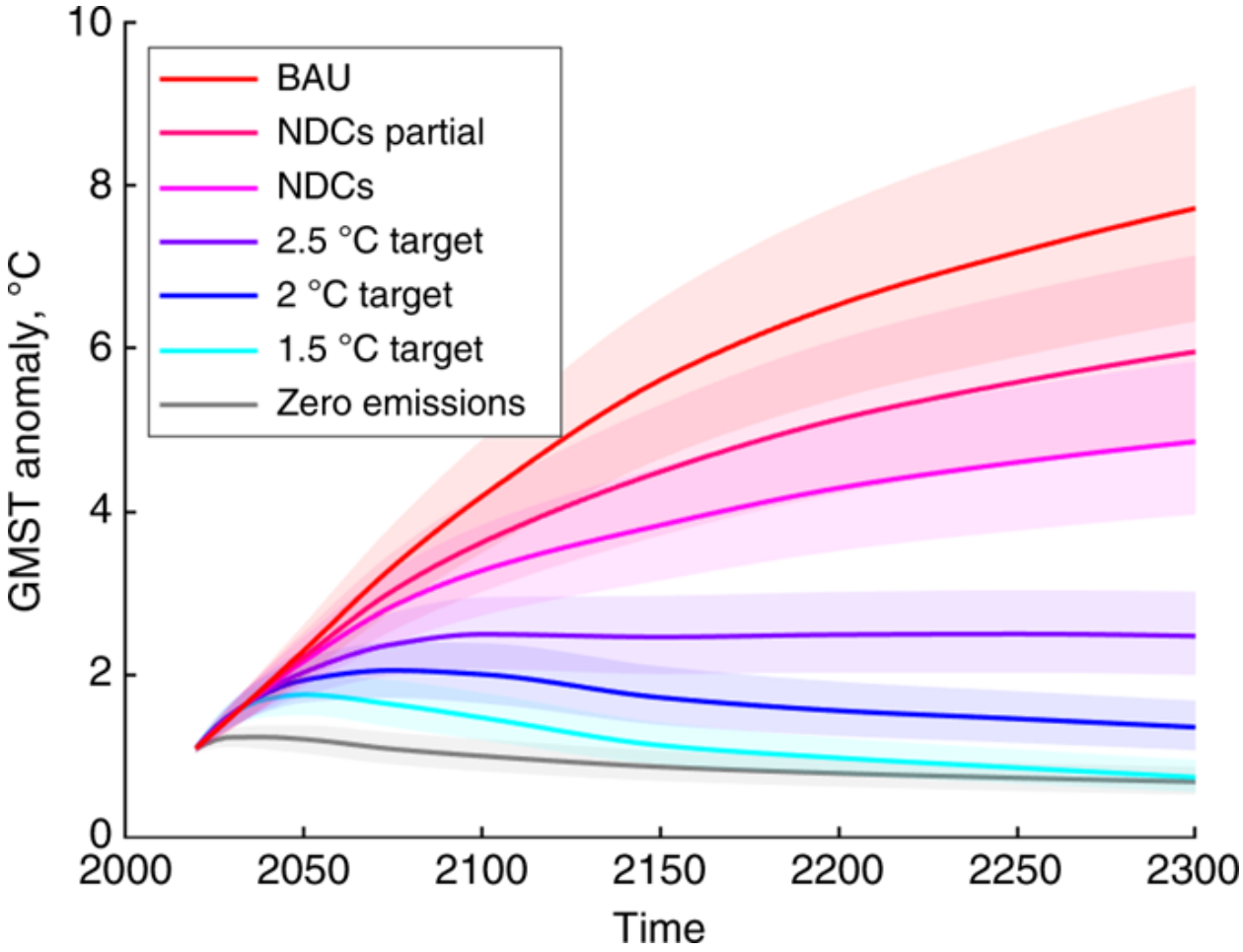


Figure 5.12: **Global mean temperature simulations under the range of climate scenarios considered.**

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

## Refugees from climate change

### 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."

### Populations displaced by sea level rise

In a recent article[7] 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.

[7]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

### 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 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,"

### 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.[8]. 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." [9]

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

[9]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/

### Populations displaced by war

A recent article in *The Guardian*[10] 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 weather, and this is set to become the new normal'.

## 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

[10]Thursday, 1 December, 2016

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.

### 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.

## 5.4 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 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.[11]

### 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

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

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:[12]

**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.**

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

Figure 5.13: **The Icelandic poet, writer, artist, publisher, anti-war activist, and parliamentarian Birgitta Jonsdottir.**

## 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 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?

Figure 5.14: **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.**

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".[13]

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.

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

Figure 5.15: **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.**

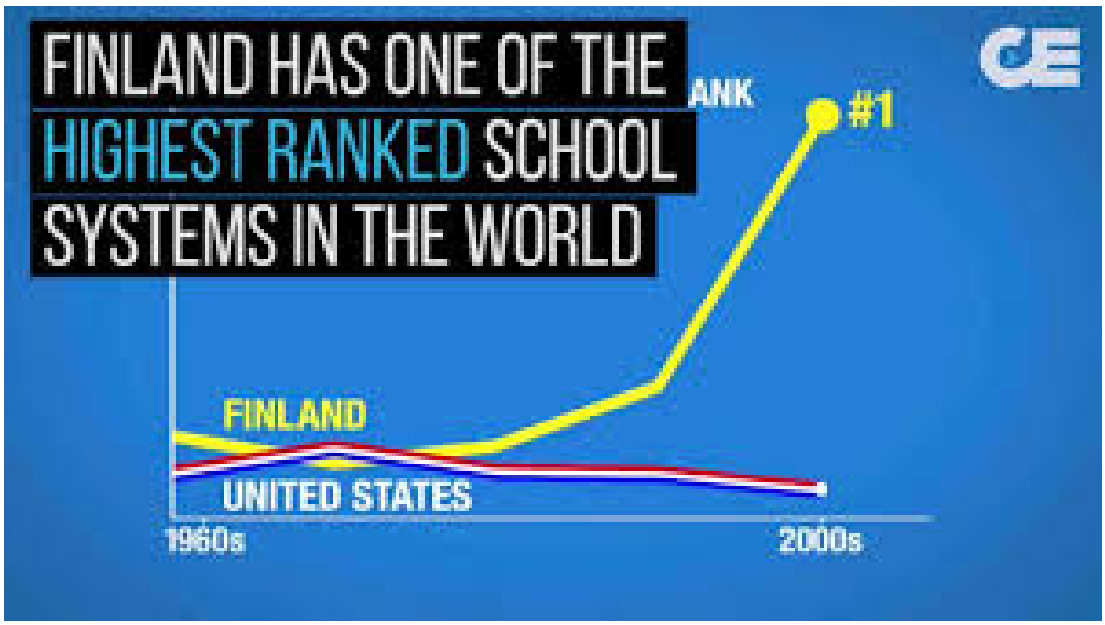


Figure 5.16: **Finland has the best school system in the world. One reason for this is that the teachers are very highly selected and highly paid. Another reason is that the children are given frequent short rest periods, during which they may go outdoors and breath fresh air. They return from these small breaks with improved concentration.**

Figure 5.17: **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.**

## 5.5 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."**

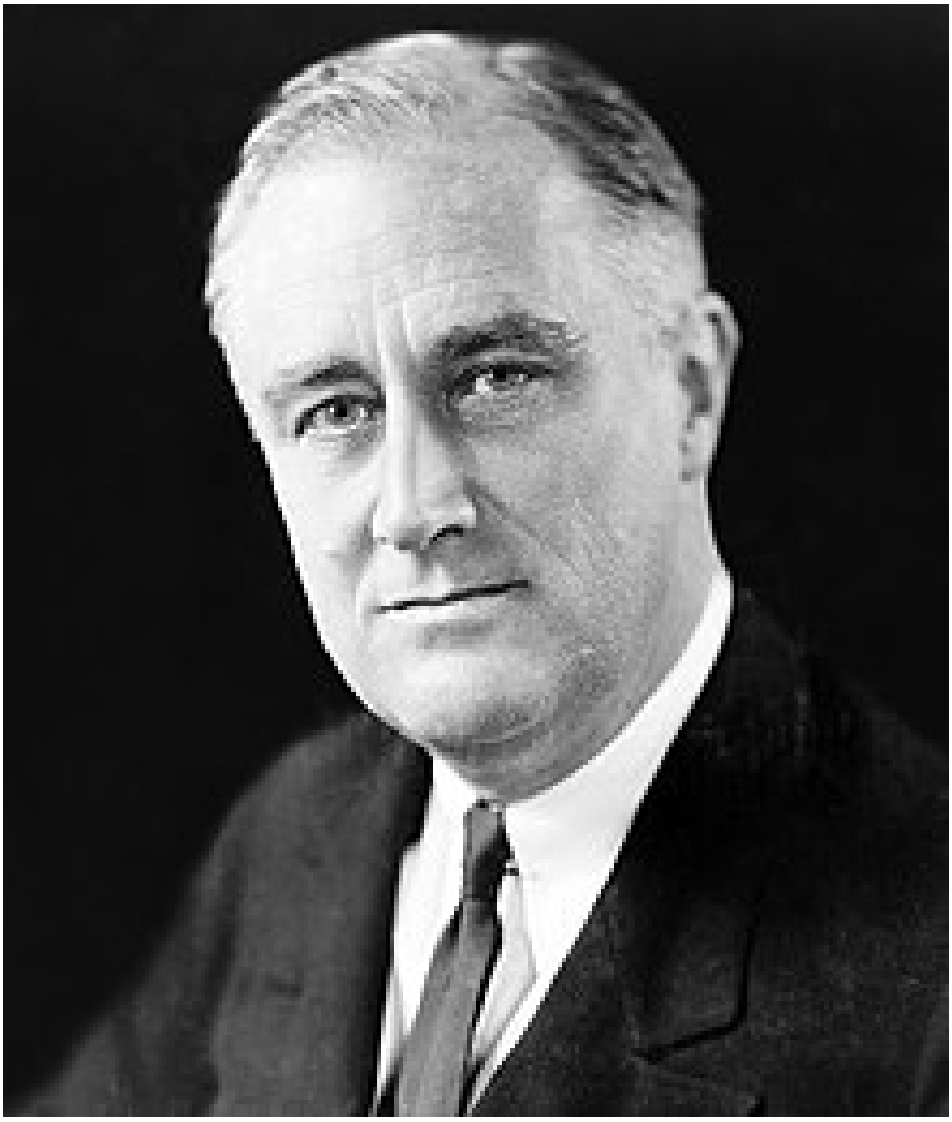

Figure 5.18: **Franklin Delano Roosevelt (FDR) in 1933. Wikipedia says of him: "Roosevelt is widely considered to be one of the most important figures in American history, as well as among the most influential figures of the 20th century. Though he has been subject to substantial criticism, he is generally rated by scholars as one of the three greatest U.S. presidents, along with George Washington and Abraham Lincoln."**

Figure 5.19: **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 5.20: **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!"**

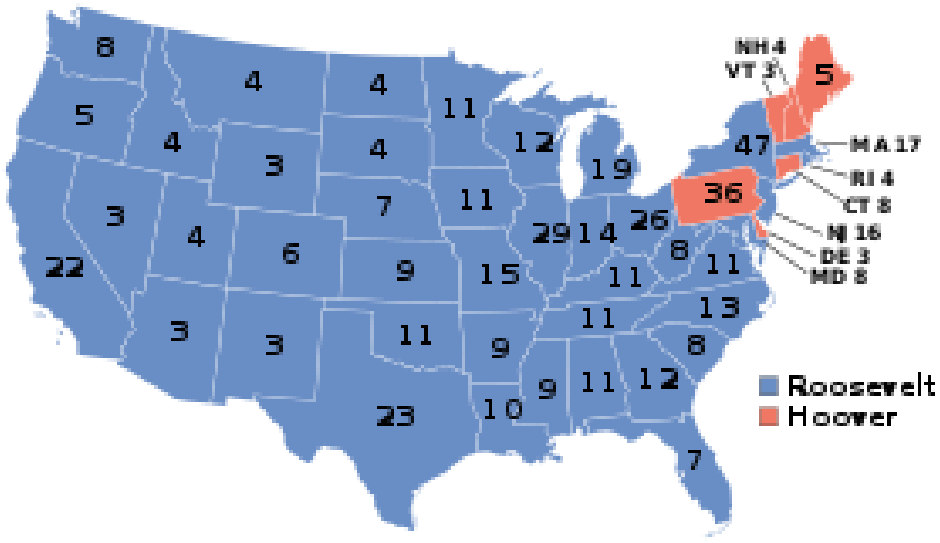


Figure 5.21: **The 1932 electoral vote. Roosevelt also won landslide victorys in 1936, 1940 and 1944. FDR died in office, shortly before the end of World War II. His administration's support for England during the the dark hours of the Battle of Britain had prevented Hitler's forces from invading the 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 5.22: **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.**

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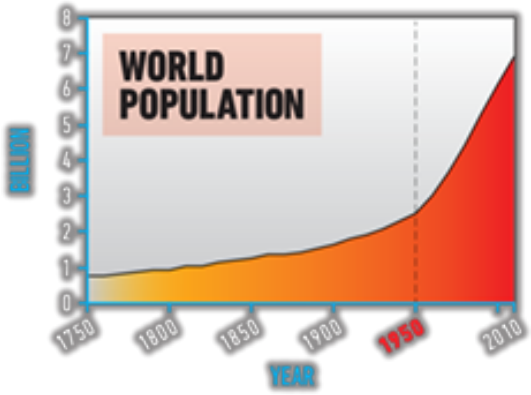
# Appendix A

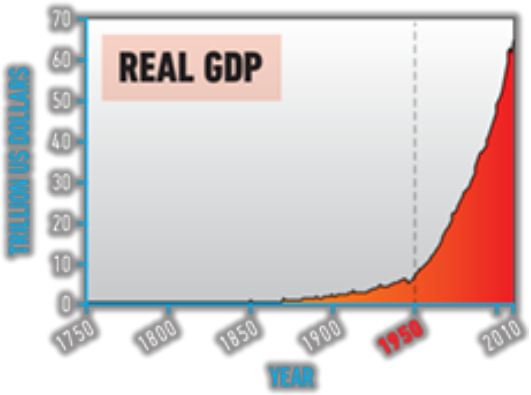
# SOCIO-ECONOMIC TRENDS

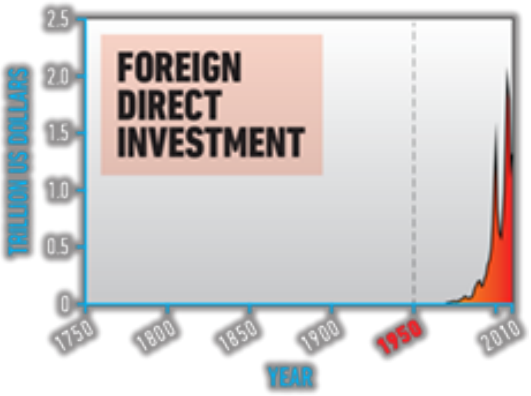
This Appendices A and B make use of graphics taken from the website of Welcome to the Antrhropocene[1], under the heading Great Acceleration. The website includes the following comment:

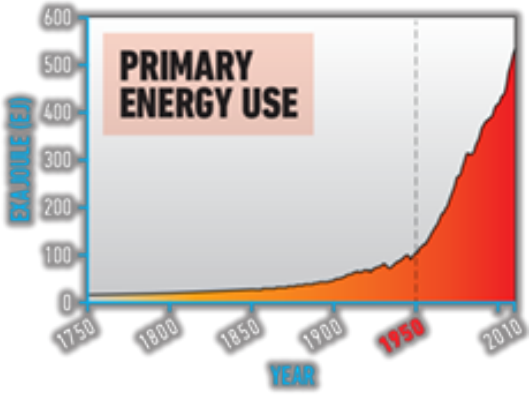
**Human activity, predominantly the global economic system, is now the prime driver of change in the Earth System - the sum of our planet's interacting physical, chemical, biological and human processes. This is the conclusion made visible in a set of 24 global indicators, or a "planetary dashboard", charting the "Great Acceleration" in human activity from the start of the industrial revolution in 1750 to 2010, and the subsequent changes in the Earth System - e.g. greenhouse gas levels, ocean acidification, deforestation and biodiversity deterioration. The post-1950 acceleration of the human imprint on the Earth System, particularly the 12 graphs that show changes in Earth System structure and functioning, have played a central role in the discussion around the formalization of the Anthropocene as the next epoch in Earth history.**

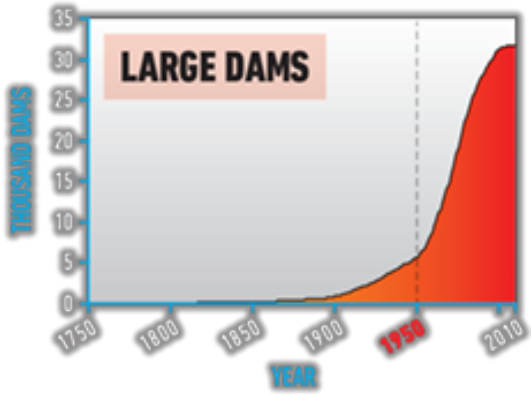
[1] http://www.anthropocene.info/great-acceleration.php

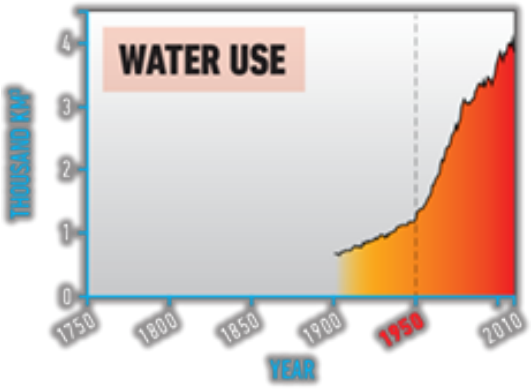


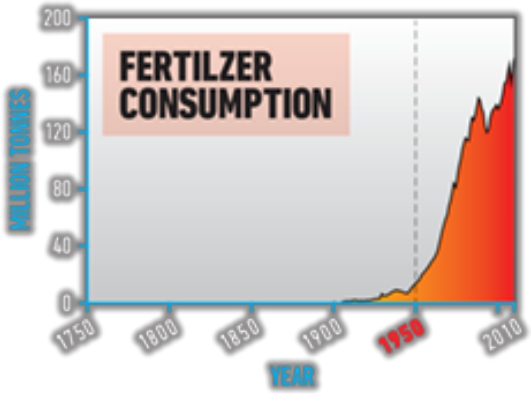

REAL GDP
TRILLION US DOLLARS
70
60
50
40
30
20
10
0
1750
1800
1850
1900
1950
2010
YEAR

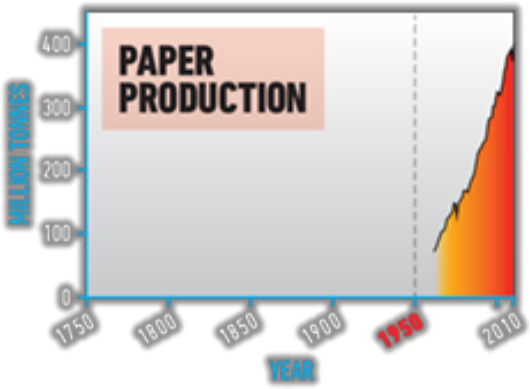

FOREIGN DIRECT INVESTMENT
TRILLION US DOLLARS
2.5
2.0
1.5
1.0
0.5
0
1750
1800
1850
1900
1950
2010
YEAR

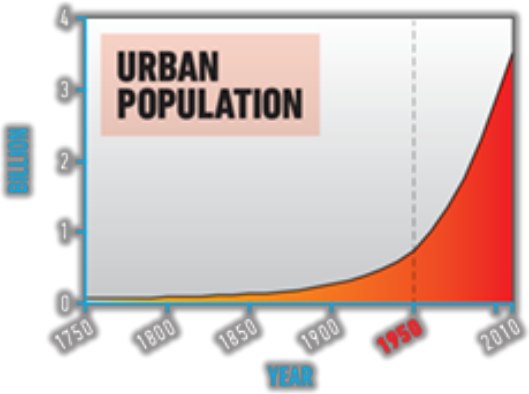

PRIMARY ENERGY USE
EXAJOULE (EJ)
600
500
400
300
200
100
0
1750
1800
1850
1900
1950
2010
YEAR

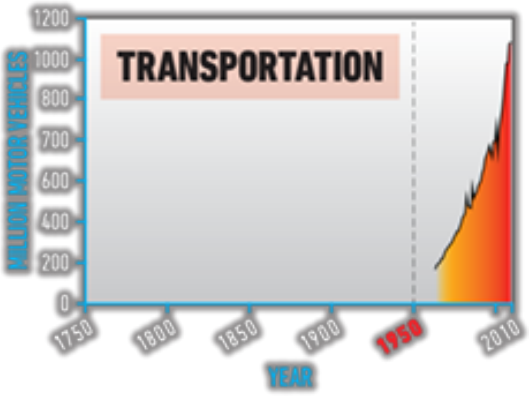

LARGE DAMS
THOUSAND DAMS
35
30
25
20
15
10
5
0
1750
1800
1850
1900
1950
2010
YEAR

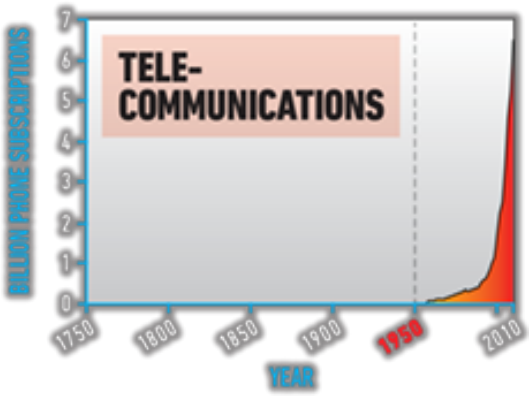

WATER USE
THOUSAND KM³
4
3
2
1
0
1750
1800
1850
1900
1950
2010
YEAR

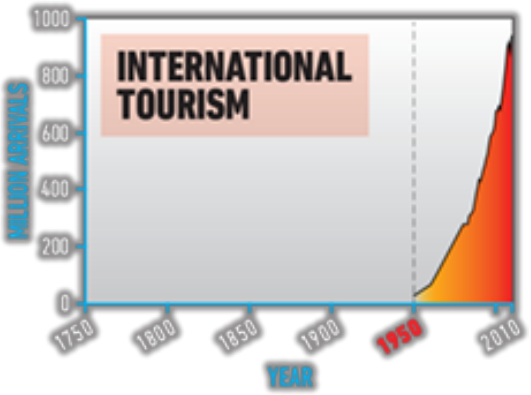

FERTILZER CONSUMPTION
MILLION TONNES
200
160
120
80
40
0
1750
1800
1850
1900
1950
2010
YEAR


PAPER PRODUCTION
MILLION TONNES
400
300
200
100
0
1750
1800
1850
1900
1950
2010
YEAR


URBAN POPULATION
BILLION
4
3
2
1
0
1750
1800
1850
1900
1950
2010
YEAR


TRANSPORTATION
MILLION MOTOR VEHICLES
1200
1000
800
700
600
400
200
0
1750
1800
1850
1900
1950
2010
YEAR


TELE-
COMMUNICATIONS
BILLION PHONE SUBSCRIPTIONS
0
1
2
3
4
5
6
7
1750
1800
1850
1900
1950
2010
YEAR


INTERNATIONAL
TOURISM
MILLION ARRIVALS
0
200
400
600
800
1000
1750
1800
1850
1900
1950
2010
YEAR

## The human footprint is now too large for the earth system

Classical economists like Adam Smith and David Ricardo 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 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 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 that it deserves.

The terminology of economics can be applied to natural resources: For example, a forest can be thought of as natural capital, and the sustainable yield from the forest as interest. Exceeding the biological carrying capacity then corresponds, in economic terms, to spending one's capital.

If it is to be prevented from producing unacceptable contrasts of affluence and misery within a society, the free market advocated by Adam Smith needs the additional restraints of ethical principles, as well as a certain amount of governmental regulation. Furthermore, in the absence of these restraints, it will destroy the natural environment of our planet.

There is much evidence to indicate that the total size of the human economy has exceeded the absolute limits imposed by the carrying capacity of the global environment.

An indication that we have exceeded the absolute limits of environmental carrying capacity can be found in the present rate of loss of biodiversity. Biologists estimate that between 10,000 and 50,000 species are being driven into extinction each year as the earth's rainforests are destroyed.

The burning of fossil fuels and the burning of tropical rain forests have released so much carbon dioxide that the atmospheric concentration of this greenhouse gas has increased from a preindustrial value of 260 ppm to more than 400 ppm. Most scientists agree that unless steps are taken to halt the burning of rain forests and to reduce the use of fossil fuels, the earth's temperature will steadily rise during the coming centuries. This long-term climate change will threaten future agricultural output by changing patterns of rainfall. Furthermore, the total melting of the Arctic and Antarctic icecaps, combined with the

Figure A.1: **The total footprint of the human economy and population is now too large to be supported by the natural world.**

Figure A.2: **A large part of our ecological footprint is due to military activities.**

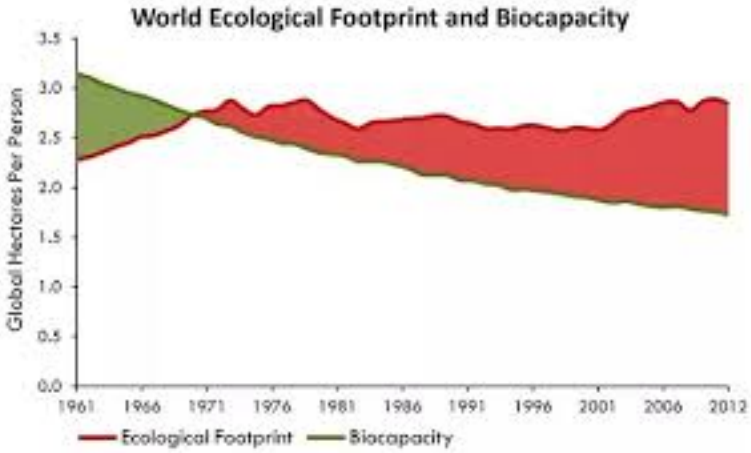



Figure A.3: **Since 1971, the world ecological footprint has exceeded the earth's biocapacity, and the disparity grows each year.**

thermal expansion of the oceans, threatens to produce a sea level rise of more than 12 meters. Although these are slow, long-term effects, we owe it to future generations to take steps now to halt global warming.

Resolute government intervention is needed to bring about the switch from fossil fuels to renewable energy sources, such as biomass, photovoltaics, solar thermal power, wind and wave power, and hydropower. Both subsidies for renewable energy technologies, to help them get started, and taxes on fossil fuels will be needed. Changes in tax structure could also encourage smaller families, encourage resource conservation, and diminish pollution. In general, taxation should be used, not merely to raise money, but, more importantly, to guide the evolution of society towards humane and sustainable goals.

# Appendix B

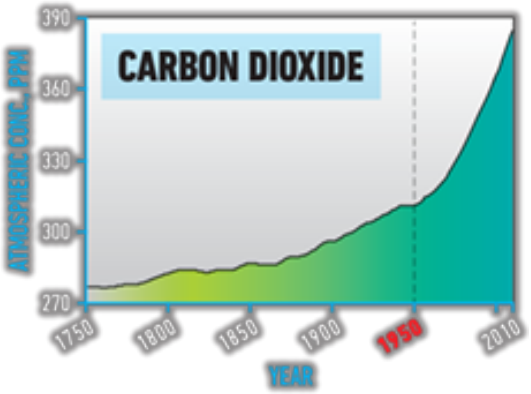
# EARTH SYSTEM TRENDS

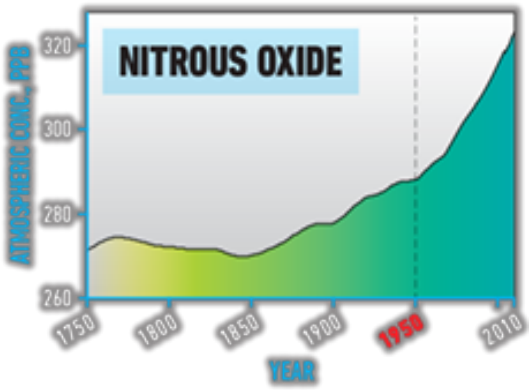
Like Appendix A, this appendix shows graphs from the website of Welcome to the Anthropocene[1], but in this case the graphs show the response of the Earth system to the rapid growth of the human population and economy between the start of the Industrial Revolution in 1750 and 2010. From the graphs it can be seen that the sheer size of the human footprint on the Earth is driving us towards an ecological megacatastrophe.

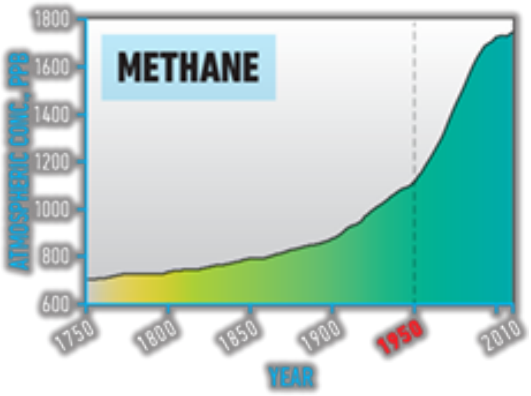
In order to avoid the worst consequences of catastrophic climate change, swift and strong action from governments is needed. All subsidies to fossil fuel corporations must stop, and high taxes must be placed on airline travel and carbon emission. Carbon sinks, such as forests, must be protected, The Green New Deal concept offers a way to construct urgently-needed renewable energy infrastructure while simultaneously creating jobs and social justice. The majority of voters are in favor of ecosocialism.

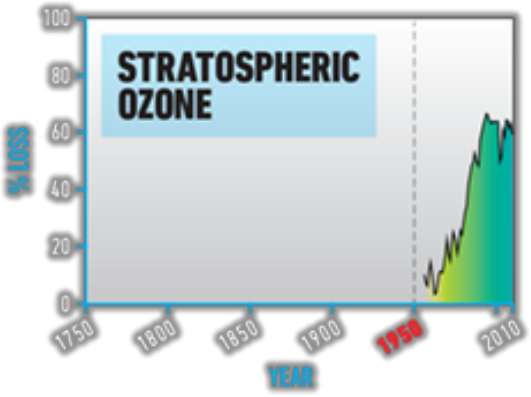
Although some damage is already being caused by extreme weather events, such as increasingly severe hurricanes, floods, droughts and forest fires, the worst consequences of climate change lie in the long-term future. The urgency of our present situation results from the fact that if we do not act immediately, tipping points will be passed beyond which unstoppable feedback loops will begin to operate.

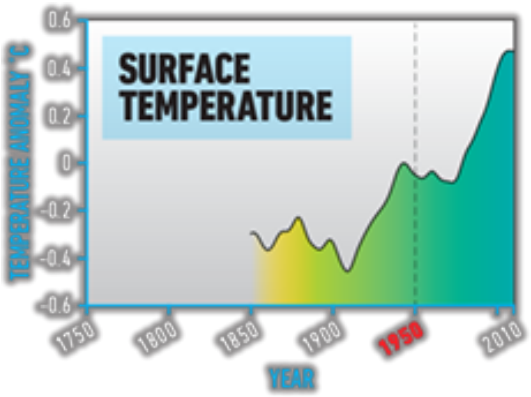
[1] http://www.anthropocene.info/great-acceleration.php

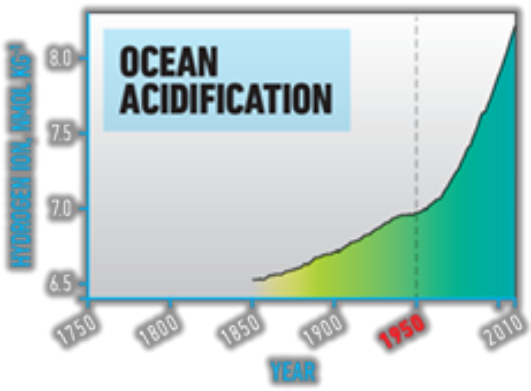


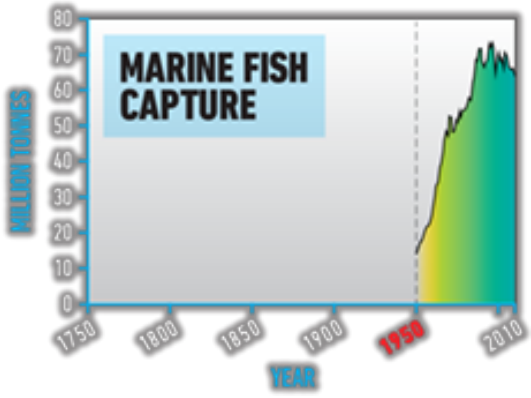

NITROUS OXIDE
ATMOSPHERIC CONC., PPB
320
300
280
260
1750
1800
1850
1900
1950
2010
YEAR

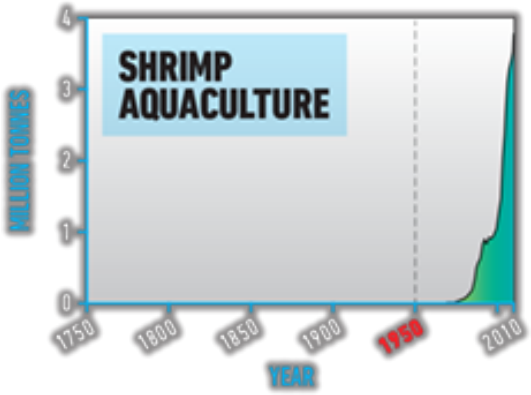

METHANE
ATMOSPHERIC CONC., PPB
1800
1600
1400
1200
1000
800
600
1750
1800
1850
1900
1950
2010
YEAR

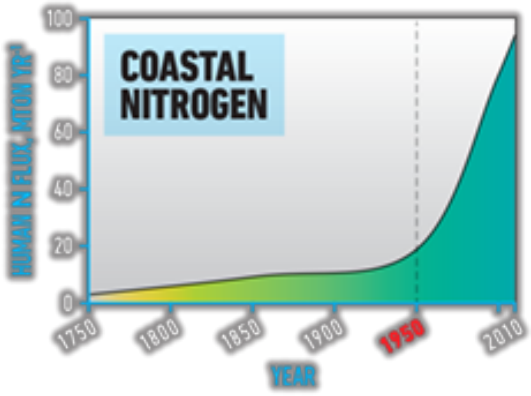

STRATOSPHERIC OZONE
% LOSS
100
80
60
40
20
0
1750
1800
1850
1900
1950
2010
YEAR

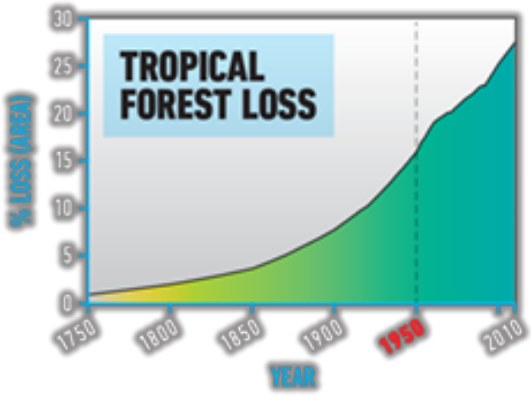

SURFACE TEMPERATURE
°C ANOMALY TEMPERATURE
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
1750
1800
1850
1900
1950
2010
YEAR

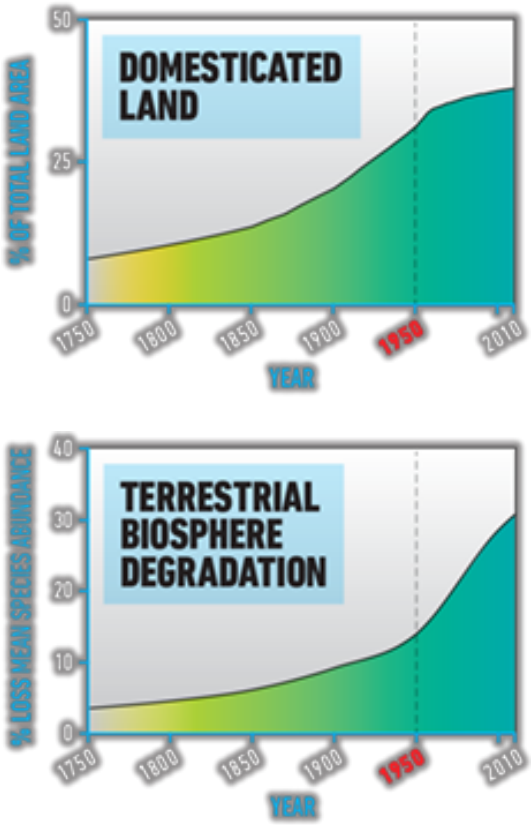

OCEAN ACIDIFICATION
pH UNITS NEGATIVE LOG HYDROGEN ION
8.0
7.5
7.0
6.5
1750
1800
1850
1900
1950
2010
YEAR


MARINE FISH CAPTURE
MILLION TONNES
80
70
60
50
40
30
20
10
0
1750
1800
1850
1900
1950
2010
YEAR


SHRIMP AQUACULTURE
MILLION TONNES
0
1
2
3
4
1750
1800
1850
1900
1950
2010
YEAR


COASTAL NITROGEN
HUMAN N FLUX, MTON YR⁻¹
0
20
40
60
80
100
1750
1800
1850
1900
1950
2010
YEAR


TROPICAL FOREST LOSS
% LOSS (AREA)
0
5
10
15
20
25
30
1750
1800
1850
1900
1950
2010
YEAR




## The World People's Conference on Climate Change and the Rights of Mother Earth

This conference took place in Tiquipaya, just outside the city of Cochabamba, Bolivia, from April 19-22, 2010. The event was attended by around 30,000 people from over 100 countries. It was hosted by the Bolivian government, and the proceedings were transmitted online by the organizations OneClimate and Global Campaign for Climate Action.

One of the outstanding results of the conference was the drafting of a Universal Declaration of the Rights of Mother Earth, modeled on the United Nations' Universal Declaration of Human Rights. Both Declarations might be criticized for being unrealistic,[2] but both have great normative value. They define the goals towards which we ought to be striving.

## Proposed Universal Declaration of the Rights of Mother Earth[3]

### Preamble

*We, the peoples and nations of Earth:*

[2]https://www.transcend.org/tms/2012/12/human-rights-a-letter-to-santa-claus/

[3]https://www.theguardian.com/environment/2011/apr/10/bolivia-enshrines-natural-worlds-rights https://pwccc.wordpress.com

- *considering that we are all part of Mother Earth, an indivisible, living community of interrelated and interdependent beings with a common destiny;*

- *gratefully acknowledging that Mother Earth is the source of life, nourishment and learning and provides everything we need to live well;*

- *recognizing that the capitalist system and all forms of depredation, exploitation, abuse and contamination have caused great destruction, degradation and disruption of Mother Earth, putting life as we know it today at risk through phenomena such as climate change;*

- *convinced that in an interdependent living community it is not possible to recognize the rights of only human beings without causing an imbalance within Mother Earth;*

- *affirming that to guarantee human rights it is necessary to recognize and defend the rights of Mother Earth and all beings in her and that there are existing cultures, practices and laws that do so;*

- *conscious of the urgency of taking decisive, collective action to transform structures and systems that cause climate change and other threats to Mother Earth;*

- *proclaim this Universal Declaration of the Rights of Mother Earth, and call on the General Assembly of the United Nation to adopt it, as a common standard of achievement for all peoples and all nations of the world, and to the end that every individual and institution takes responsibility for promoting through teaching, education, and consciousness raising, respect for the rights recognized in this Declaration and ensure through prompt and progressive measures and mechanisms, national and international, their universal and effective recognition and observance among all peoples and States in the world.*

**Article 1: Mother Earth**

1. *Mother Earth is a living being.*

2. *Mother Earth is a unique, indivisible, self-regulating community of interrelated beings that sustains, contains and reproduces all beings.*

3. *Each being is defined by its relationships as an integral part of Mother Earth.*

4. *The inherent rights of Mother Earth are inalienable in that they arise from the same source as existence.*

5. *Mother Earth and all beings are entitled to all the inherent rights recognized in this Declaration without distinction of any kind, such as may be made between organic and inorganic beings, species, origin, use to human beings, or any other status.*

6. *Just as human beings have human rights, all other beings also have rights which are specific to their species or kind and appropriate for their role and function within the communities within which they exist.*

7. *The rights of each being are limited by the rights of other beings and any conflict between their rights must be resolved in a way that maintains the integrity, balance and health of Mother Earth.*

**Article 2. Inherent Rights of Mother Earth**

1. *Mother Earth and all beings of which she is composed have the following inherent rights:*

   (a) *the right to life and to exist;*

   (b) *the right to be respected;*

   (c) *the right to regenerate its bio-capacity and to continue its vital cycles and processes free from human disruptions;*

   (d) *the right to maintain its identity and integrity as a distinct, self-regulating and interrelated being;*

   (e) *the right to water as a source of life;*

   (f) *the right to clean air;*

   (g) *the right to integral health;*

   (h) *the right to be free from contamination, pollution and toxic or radioactive waste;*

   (i) *the right to not have its genetic structure modified or disrupted in a manner that threatens it integrity or vital and healthy functioning;*

   (j) *the right to full and prompt restoration the violation of the rights recognized in this Declaration caused by human activities;*

2. *Each being has the right to a place and to play its role in Mother Earth for her harmonious functioning.*

3. *Every being has the right to wellbeing and to live free from torture or cruel treatment by human beings.*

**Article 3. Obligations of human beings to Mother Earth**

1. *Every human being is responsible for respecting and living in harmony with Mother Earth.*

2. *Human beings, and all States guarantee peace and eliminate nuclear, chemical and biological weapons;*

Figure B.1: **The earth is our mother.**

*(a) act in accordance with the rights and obligations recognized in this Declaration;*

*(b) recognize and promote the full implementation and enforcement of the rights and obligations recognized in this Declaration;*

*(c) promote and participate in learning, analysis, interpretation and communication about how to live in harmony with Mother Earth in accordance with this Declaration;*

*(d) ensure that the pursuit of human wellbeing contributes to the wellbeing of Mother Earth, now and in the future;*

*(e) establish and apply effective norms and laws for the defense, protection and conservation of the rights of Mother Earth;*

*(f) respect, protect, conserve and where necessary, restore the integrity, of the vital ecological cycles, processes and balances of Mother Earth;*

*(g) guarantee that the damages caused by human violations of the inherent rights recognized in this Declaration are rectified and that those responsible are held accountable for restoring the integrity and health of Mother Earth;*

*(h) empower human beings and institutions to defend the rights of Mother Earth and of all beings;*

*(i) establish precautionary and restrictive measures to prevent human activities from causing species extinction, the destruction of ecosystems or the disruption of ecological cycles;*

*(j) guarantee peace and eliminate nuclear, chemical and biological weapons;*

*(k) promote and support practices of respect for Mother Earth and all beings, in accordance with their own cultures, traditions and customs;*

*(l) promote economic systems that are in harmony with Mother Earth and in accordance with the rights recognized in this Declaration.*

**Article 4: Definitions**

1. *The term "being" includes ecosystems, natural communities, species and all other natural entities which exist as part of Mother Earth.*

2. *Nothing in this Declaration restricts the recognition of other inherent rights of all beings or specified beings.*

Figure B.2: **Love and respect Mother Earth.**


Figure B.3: **We need reverence for all life, and even reverence for inanimate nature. We need respect and love for Mother Earth. She will return our love.**

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