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Radical Realism for Climate Justice

A Civil Society Response to the Challenge of Limiting Global Warming to 1.5°C

Edited by the Heinrich Böll Foundation

Cover picture: Ende Gelände; source: Tim Wagner – flickr.com (CC BY-NC-SA 2.0)

RADICAL REALISM FOR CLIMATE JUSTICE

EDITORIAL

Many people have come to doubt the feasibility of limiting warming to 1.5°C above pre-industrial levels. This is not because of geophysical realities, but because of inability and unwillingness to envision, and deem feasible, a radical shift in the resource-intensive, wasteful and imperial lifestyles of a tiny global elite and of the global middle classes. It is possible to limit global warming to well below 2°C and even to 1.5°C while enhancing wellbeing and prosperity for everyone and conserving biodiversity and ecosystems. However, it is not possible to sustain the profit margins of polluting industries and transnational corporations without crossing planetary boundaries and undermining social equity and human rights.

Climate science is unambiguous: Business as Usual is not an option. There is no more tinkering around the edges. The difference between 1.5° and 2°C global warming is one of life and death for millions of people. At 2°C, heat waves last longer, extreme weather events become more intense and tropical coral reefs stand no chance of recovery. Losses in crop production and freshwater availability intensify over this half-degree of global warming. Beyond 2°C, a «Hothouse Earth» trajectory implies a world of cascading tipping points and feedbacks in the climate system that will be deeply disruptive to societies and ecosystems. Limiting warming to 1.5°C, in contrast, significantly reduces the risks of climate change for the great majority of plant and animal biodiversity. Not least, 1.5°C is our best hope of achieving future environmental and social justice, of limiting the impacts of a global crisis that was born out of historical injustice and highly unequal responsibility.

The legally binding goals enshrined in the Paris Agreement are a lifeline for those already experiencing the effects of climate change. Yet policymakers across the world are failing to embark on a trajectory of change that safeguards human wellbeing, choosing instead to hazard untold suffering and environmental destruction.

The Intergovernmental Panel on Climate Change's 2018 Special Report on Global Warming of 1.5°C is a wake-up call – it's the alarm going off that was set back in Paris in 2015 when the Conference of the Parties commissioned our top climate scientists to tell us the truth. How do we limit global warming to 1.5°C? And how do we do so in a way that achieves climate justice?

Climate change is a catastrophe with many slow onset events and many big and small disasters – but we do not have to watch it unfold as bystanders. Neither do we have to accept large-scale technological quick fixes, so-called geoengineering or climate engineering, that are increasingly being presented as an alternative to runaway climate change and have crept into mainstream climate-economic models. Geoengineering is the perfect excuse to continue Business as Usual and to bet on risky «technofixes» to save the day, but these technologies come with profound risks and potentially devastating and irreversible impacts (ETC Group/Biofuelwatch/Heinrich Böll Foundation, 2017, *The Big Bad Fix*).

We do have a choice – a political one – and there are myriad local, regional and global solutions out there based on the tools and technologies proven to be working and ready to be scaled up. These are real solutions and alternatives that are safe to deploy and that eliminate the purported need to rely on high-risk «technofixes».

Over the past years, the Heinrich Böll Foundation has been working intensively with a wide range of international groups, networks and organizations that in their political work, research and practice have developed radical, social and environmental justice-based agendas for political change.

This publication with eight volumes shows, across a range of sectors, that a world of 1.5°C warming is possible – one in which the solutions to climate change are socially just and ecologically sound, respectful of human rights, Indigenous Peoples' rights and land tenure rights. While reducing greenhouse gas emissions, these solutions also strive to democratize our economies and gear them towards a public-goods approach, aware that a major shift in the way we produce and consume is inevitable if we are serious about limiting global warming.

Each of the eight «chapters» in this publication covers a particular sector, perspective or approach that can boost a justice-based trajectory towards 1.5°C. The perspectives offered here are far from comprehensive, nor do they claim to fit uniformly across local and regional contexts. However, they show that more transformative and just visions of a 1.5°C world than envisioned in mainstream climate policy are possible, and have been spelled out in detail by activists, movements and scholars across the globe.

Those who continue to ignore or disregard this crucial knowledge because they believe it is «too radical», «politically unrealistic», «naïve», or simply «too messy and complex to implement» ignore a very basic truth. To put it in Naomi Klein's words: «We aren't losing earth – but the earth is getting so hot so fast that it is on a trajectory to lose a great many of us.» (The Intercept, August 3, 2018). If the essence of politics is to foster wellbeing and safety in communities, the only possible response is what we would call Radical Realism.

We hope that the experiences and political demands, the stories and recommendations compiled in this publication will be as inspiring to our readers as they are to us.

We are deeply grateful to our partners and allies for their contributions. Naomi Klein writes: «In the nick of time, a new political path to safety is presenting itself. This is no moment to bemoan our lost decades. It's the moment to get the hell on that path.» We are committed to that safe and justice-based pathway forward and invite everyone to build it with us as we go.

Berlin, August 2018

Barbara Unmüßig
Co-President,
Heinrich Böll Foundation

Linda Schneider
Senior Programme Officer International Climate Policy,
Heinrich Böll Foundation

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The publication *Radical Realism for Climate Justice – A Civil Society Response to the Challenge of Limiting Global Warming to 1.5°C* includes the following volumes:

HEINRICH BÖLL STIFTUNG
PUBLICATION SERIES ECOLOGY
VOLUME 44.1

A Managed Decline of Fossil Fuel Production

The Paris Goals Require No New Expansion and a Managed Decline of Fossil Fuel Production

By Oil Change International, compiled by Adam Scott

Edited by the Heinrich Böll Foundation

Note

This contribution draws from works by Oil Change International on the subject of managed decline. Contributing authors include: Greg Muttitt, Hannah McKinnon, Kelly Trout, Adam Scott, David Turnbull, Janet Redman of Oil Change International and Sivan Kartha of Stockholm Environment Institute.

Oil Change International is a research, communication, and advocacy organization focused on exposing the true costs of fossil fuels and facilitating the coming transition towards clean energy.

A Managed Decline of Fossil Fuel Production
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T +49 (0)30 28534-0 **F** +49 (0)30 28534-109 **E** buchversand@boell.de **W** www.boell.de

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INTRODUCTION

The Paris Agreement, now officially in force and ratified by more than 160 nations, sets a global temperature goal of staying well below 2 degrees Celsius above pre-industrial levels while striving to limit the increase to 1.5 degrees Celsius.[1] Signatory nations chose these goals to create a reasonable chance of avoiding the most dangerous impacts of climate change.[2]

Basic climate science shows that – all else equal – total cumulative carbon dioxide emissions (CO2) over time determine how much global warming will occur. There is a set level of total cumulative emissions that can occur for a given temperature limit. This is our «carbon budget.»[3]

In Oil Change International's September 2016 report, The Sky's Limit: Why the Paris Climate Goals Require a Managed Decline of Fossil Fuel Production,[4] we analyzed what a Paris-aligned carbon budget would mean for fossil fuel production globally. We used the carbon budgets, calculated by the Intergovernmental Panel on Climate Change (IPCC),[5] that would give a likely (66 percent) chance of limiting temperature increases below 2 degrees Celsius and a medium (50 percent) chance of limiting temperature increases to below 1.5 degrees Celsius – equivalent to the range of the Paris goals. We compared these budgets to the cumulative CO2 that will be released over time from all coal, gas, and oil projects currently operating or under construction around the world (Figure 1).

The results show that the carbon embedded in already developed fields and mines would fully exhaust and exceed the carbon budgets the world must stay within to achieve the Paris Agreement goals.

1 UNFCCC, «Paris Agreement,» December 2015. http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

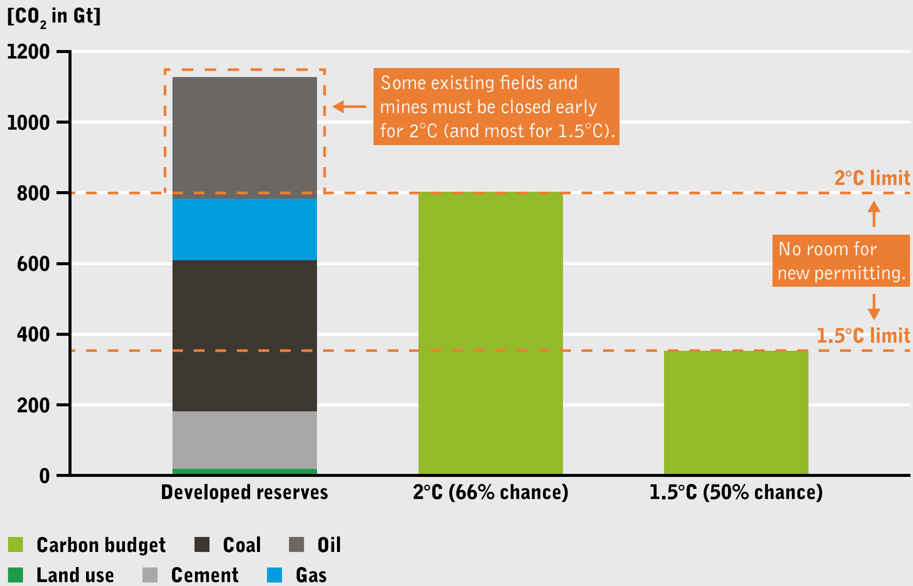
2 UNFCCC, Adoption of the Paris Agreement, p. 2. https://unfccc.int/resource/docs/2015/cop21/eng/L09r01.pdf

3 The carbon budgets approach does not apply to short-lived greenhouse gases such as methane, whose effects are factored into the calculation of carbon budgets in the form of assumptions about their future emissions.

4 Greg Muttitt, «The Sky's Limit: Why the Paris Climate Goals Require A Managed Decline of Fossil Fuel Production,» Oil Change International, September 22, 2016. http://priceofoil.org/2016/09/22/the-skys-limitreport

5 We use IPCC numbers as our principal reference because they represent a broad agreement among the scientific community, informed by and reconciling numerous individual papers.

Figure 1: Carbon Emissions from Developed Fossil Fuel Reserves, Compared to Carbon Budgets



Sources: Rystad Energy, IEA, World Energy Council, IPCC[6]; own chart

Logically, these findings tell us there are three possible futures when it comes to our current climate crisis:

1.) **Managed decline:** We succeed in restricting new fossil fuel supply projects and carefully managing the decline of the fossil industry over time, while planning for a just transition for workers and communities. This path gives us a likely chance of achieving the goals of the Paris Agreement and avoiding the worst impacts of climate change.

2.) **Unmanaged decline:** We allow further fossil fuel development to continue, but eventually manage to limit emissions to within carbon budgets. Meeting the Paris goals would become much harder and would lead to a sudden and dramatic shutdown of fossil fuel production, stranding assets, damaging economies, and harming workers and communities reliant on the energy sector.

3.) **Climate catastrophe:** We fail to restrict emissions. New long-lived fossil fuel infrastructure locks us into a high-carbon future that puts the Paris targets out of reach. Climate change reaches dangerous levels, causing compounding, irreparable harm for people and ecosystems around the world.

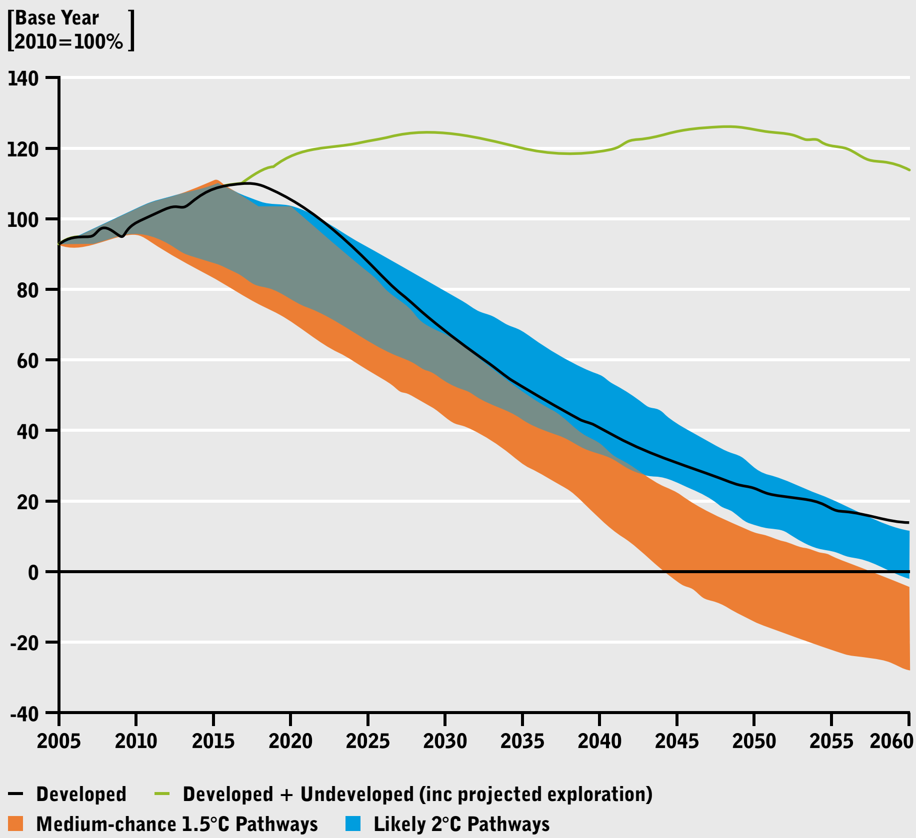
6 For detailed methodology see Muttitt, Sky's Limit, op. cit., Section 2.

Figure 2: Logic Tree of Fossil Fuel Supply vs. Emissions Restrictions

Clearly, the first option is the safest and most efficient path. By stopping new fossil fuel developments and beginning a carefully managed decline of the fossil fuel industry towards an economy powered by clean energy, we have the brightest future.

Managed decline must begin now

Figure 3: Rates of Change* of Global Emissions in a Range of 1.5°C and 2°C Scenarios, and of Emissions from Developed and Undeveloped Global Oil and Gas Fields
*Rates of change are based on 2010 emissions and production levels.



Sources: Rogelj et al.,[7] Rystad Energy UCube,[8] Oil Change International analysis; own chart

7 Joeri Rogelj et al, «Energy system transformations for limiting end-of-century warming to below 1.5°C,» *Nature Climate Change*, Vol. 5, June 2015, p. 520; communication with author

8 Staying within an emissions trajectory consistent with the Paris Agreement goals requires an end to new fossil fuel exploration and development, along with efforts to end some projects faster than natural decline rates would allow.

Meeting climate goals will require a managed phase-out of the entire fossil fuel sector towards global decarbonization in the coming decades.

A study by Joeri Rogelj and colleagues, published in Nature Climate Change, found that to keep warming below 2 degrees Celsius, current global emissions need to be reduced by half by the late 2030s, and reach zero some time around 2065. To aim for 1.5 degrees Celsius, emissions need to be halved by the early 2030s – in fifteen years' time – and reach zero by 2050 (Figure 3). And these estimates rely on unproven negative emissions technology working out – if it does not, those cuts need to be achieved earlier.

But the world is dangerously off course in planning for this imperative. Figure 3 compares the rates of change in global emissions needed for 1.5- and 2-degrees Celsius scenarios (if negative emissions technologies work out) to the projected rates of change in global emissions from future oil and gas production, according to Rystad Energy's projection. As shown by the green line in the graph, current policies and levels of investment would allow the oil and gas industry to expand at a rate that is wholly incompatible with achieving the Paris goals.

Climate leadership requires limiting fossil fuel supply

According to climate policy orthodoxy, emissions are addressed only where they come out of the chimney or tailpipe. This view is no longer supportable.

Until now, efforts to mitigate climate change have been overwhelmingly focused on measures to reduce end-use demand for fossil fuels. Current policies to improve energy efficiency, transition to renewable energy, electrify transportation, and put a price on carbon are among the most commonly used tools applied. These demand-side measures, along with efforts to address non-combustion emissions from sectors such as land use, agriculture, forestry, and industrial sources, form the established doctrine for global climate mitigation. However, increasing evidence shows that without simultaneous action to manage the phase-out of fossil fuel supply, the goals set in the Paris Agreement could be out of reach. If the fossil fuel industry is permitted to continue exploring for and developing new oil, gas and coal infrastructure projects, economic and political forces will lock-in growing emissions for decades to come. Success on climate requires using all available tools at our disposal, requiring action from governments to restrict the supply of fossil fuels as well as their demand.

It is widely recognized that no country is yet doing enough to respond to the global climate crisis. According to Climate Action Tracker, an independent scientific analysis of global climate action, the initial Nationally Determined Contributions (NDCs) currently pledged by countries under the Paris Agreement would add up to an estimated 3.2 degrees Celsius of warming.[9]

While communities on the front lines of the pollution fueled by oil production have long called for more aggressive action to curb extraction, policymakers have only recently begun to consider supply-side measures as part of their policy toolkit. The quantity of oil, gas, and coal used in the world is going to have to decline to near zero over the coming few decades if we are to stay within the Paris climate limits. This will require a comprehensive policy approach. Addressing the production of fossil fuels (i.e. supply) is a critical complement to addressing the end-combustion of fossil fuels (i.e. demand) for the reasons laid out below.

Driven by social movements calling for the managed decline of fossil fuel supply, a small but quickly growing number of jurisdictions have announcing policies to restrict new fossil fuel exploration and/or development on climate grounds. The list

9 http://climateactiontracker.org

of first movers currently includes New Zealand[10], France[11], Costa Rica[12], Belize[13] and Ireland.[14]

Avoid financial lock-in

Given the long-lived nature of fossil fuel projects, approvals and investments made now are locking in decades worth of fossil fuel production and emissions we cannot afford.

As described by Denniss and Green in the journal Climatic Change:

> When production processes require a large, upfront investment in fixed costs, such as the construction of a port, pipeline or coalmine, future production will take place even when the market price of the resultant product is lower than the long-run opportunity cost of production. This is because rational producers will ignore «sunk costs» and continue to produce as long as the market price is sufficient to cover the marginal cost (but not the average cost) of production. This is known as «lock-in.»[15]

Even if initial construction costs are written off, if ongoing revenue generated from a project exceeds the cost of operating it, the project will continue producing. Fossil fuel companies might go bankrupt and investor capital be destroyed, but projects live on. This is a critical reason why new supply-side investments must be stopped. It is significantly easier to stop projects before they start.

Minimize emissions leakage

Leakage refers to the economic phenomenon that, in a global market, the price signals sent by reducing supply or demand in one place will cause some respective increase in production or consumption elsewhere. This happens to a degree on both sides of the supply and demand equation. In neither case is leakage 100 percent. For every

10 Jamie Smyth, «New Zealand to ban future offshore oil and gas exploration,» Financial Times, April 12, 2018. https://www.ft.com/content/d91e9864-3ded-11e8-b7e0-52972418fec4

11 «France bans fracking and oil extraction in all of its territories,» The Guardian, December 20, 2017. https://www.theguardian.com/environment/2017/dec/20/france-bans-fracking-and-oil-extraction-in-all-of-its-territories

12 Corey Kane, «Costa Rica extends ban on petroleum extraction,» The Tico Times, July 28, 2014. http://www.ticotimes.net/2014/07/28/costa-rica-extends-ban-on-petroleum-extraction

13 «Belize Bans Offshore Oil and Gas Exploration,» Maritime Executive, January 9, 2018. https://www.maritime-executive.com/article/belize-bans-offshore-oil-and-gas-exploration#gs.Mux9rfs

14 Kevin O'Sullivan, «Move to ban issuing of fossil fuel exploration licences in Ireland,» Irish Times, February 6, 2018. https://www.irishtimes.com/news/politics/move-to-ban-issuing-of-fossil-fuel-exploration-licences-in-ireland-1.3382681

15 Fergus Green and Richard Denniss, «Cutting with both arms of the scissors: the economic and political case for restrictive supply-side climate policies,» Climatic Change, March 12, 2018. https://doi.org/10.1007/s10584-018-2162-x barrel of oil not produced, and every barrel of oil not consumed, there are emissions reductions.[16]

Pulling at demand and supply levers simultaneously reduces the emissions «leakage» effect on both ends. For instance, if policies aimed at accelerating the global transition to electric vehicles are adopted, the subsequent reduction in oil demand would have some effect in lowering global oil prices, which would in turn induce some increased oil consumption. But, if policies are simultaneously enacted to reduce oil production, that reduced production would in turn raise oil prices slightly, helping to offset the price impact of lowering demand.

The fossil fuel industry continues to wield significant influence over politics around the world. In order to successfully address the global climate crisis, politicians are going to have to begin saying «no» to the sector.

Governments tend to act more strongly to protect existing industries than to stimulate future ones because of the political clout of real jobs held by identifiable people (as opposed to abstract numbers), and because of the lobbying power of dominant industries.

For example, when fossil fuel prices are low, governments often feel political pressure to reduce taxes on fossil fuel production or provide other subsidies to keep companies producing. In the United States, oil, gas, and coal companies spent over $350 million in campaign contributions and lobbying from 2015 to 2016, and received nearly $30 billion in federal subsidies over those same years – which equates to a 8,200 percent return on investment.[17] The Stockholm Environment Institute recently estimated that nearly half of new, yet-to-be developed U.S. oil production through 2050 could depend on subsidies to be economical.[18]

Industry influence and lobbying often has the effect of reducing the ambition of demand-side policies and undercutting industry regulation as well.

A portfolio approach to climate action is urgently needed

A portfolio approach to climate policy is critical: this must include complementary policies to restrict supply and demand for fossil fuels, combined with policies to rapidly incentivize the proliferation of clean energy alternatives.

16 While limiting oil and gas production as a policy tool is still relatively new, there is a growing body of academic literature that supports the conclusion that limiting production leads to decreased global emissions. See: Michael Lazarus, Peter Erickson, and Kevin Tempest, «Supply-side climate policy: the road less taken,» SEI Working Paper No. 2015-13, October 2015. https://www.sei.org/publications/supply-side-climate-policy-the-road-less-taken/; and Green and Denniss, «Cutting with both arms of the scissors,» op. cit., https://doi.org/10.1007/s10584-018-2162-x

17 Janet Redman, «Dirty Energy Dominance: Dependent on Denial – How the U.S. Fossil Fuel Industry Depends on Subsidies and Climate Denial,» Oil Change International, October 2017. http://priceofoil.org/2017/10/03/dirty-energy-dominance-us-subsidies

18 Peter Erickson et. al., «Effect of subsidies to fossil fuel companies on United States crude oil production,» Nature Energy, October 2017, pp. 891–898. https://www.nature.com/articles/s41560-017-0009-8

A recent academic study from the London School of Economics and the Australia Institute lays out four quadrants of climate policy (Table 1), noting that the quadrant of restrictive supply-side policies has been the most underutilized.[19] The study adds to a growing body of academic research that confirms that a portfolio approach – one that includes policies in all quadrants – is not only necessary for climate goals, but also economically efficient. The study suggests that the reason restrictive supply-side policies have been avoided is the political and financial power of the fossil fuel sector.

Table 1: The four quadrants of climate policy

	Supply-side	Demand-side
Restrictive	Restrictive supply-side climate policies (e.g. FF subsidy reduction; FF supply tax; FF production quotas; FF supply ban/moratorium)	Restrictive demand-side climate policies (e.g. carbon tax; carbon cap-and trade; mandatory CO2 emissions standards)
Supportive (of substitutes)	Supportive supply-side climate policies (e.g. direct government provision of low-carbon infrastructure; R&D subsidies; renewable energy feed-in-tariffs)	Supportive demand-side climate policies (e.g. government procurement policies; consumer subsidies for energy-efficient or low-emitting substitutes)
Notes: FF=fossil fuels. Shaded area represents the focus of this article; unshaded areas are those typically analysed in the comparative literature on climate policy instruments.		

Source: Green and Denniss[20]; own chart

The study makes four distinct economic arguments in favor of supply-side restrictions:

1.) **Supply-side policies are easier to administer and enforce:** Rather than accounting for and monitoring countless facilities along the supply chain, policy can be focused on relatively few production points and a small number of companies for which data is already collected for other reporting.
2.) **Supply-side policies backstop weaknesses in demand-side policies:** In the absence of a perfect global carbon market, supply-side policies are necessary to protect from demand-side leakage.
3.) **Supply-side policies avoid carbon lock-in (as discussed above).**
4.) **Supply-side policies address the challenge of the «green paradox»:** In theory, companies respond to the threat of future demand-side restrictions by accelerating growth in production now to maximize profit in the near-term.

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19 Green and Denniss, «Cutting with both arms of the scissors,» op. cit.
20 Ibid.

As David Roberts of Vox helpfully summarizes:

> [N]o one is arguing that RSS [restrictive supply-side] policies are better than demand-side policies, or a substitute for them. The exact economic and political effects of any set of policies will always depend on context-dependent factors; different portfolios will be appropriate for different times and places. But RSS policies are an excellent complement to demand-side policies, with economic and political strengths that help fill in the gaps. They are simple, transparent, easy for the public to grasp, and unmistakable signs of good faith in international climate negotiations.[21]

21 David Roberts, «It's time to think seriously about cutting off the supply of fossil fuels,» Vox, April 2018. https://www.vox.com/energy-and-environment/2018/4/3/17187606/fossil-fuel-supply.

Who should move first?

Our *Sky's Limit* report shows that to achieve the goals enshrined in the Paris Agreement, no new fossil fuel development can be allowed and some resources must be retired early. This raises important questions about which countries and regions should act first and fastest, and what obligations exist for supporting regions with fewer resources to manage the transition.

In a forthcoming paper on supply-side equity from Oil Change International and the Stockholm Environmental Institute, the authors enumerate five key ethical principles by which we might aim to manage these concerns fairly, and that might inform civil society demands for an equitable phase-out of fossil fuel extraction.[22]

Briefly, these five principles are:

- **Curb extraction at a pace consistent with climate protection:** The overall global pace of the managed decline must be consistent with a precautionary interpretation of the Paris objectives of keeping warming well below 2°C, and aiming to keep warming below 1.5°C; this implies sharply curbing future extraction, and developing no new oil and gas fields or coal mines.
- **Ensure a just transition:** This decline must afford fossil-dependent workers and their communities a viable, positive future.
- **Respect human rights and safeguard local environment:** Prioritize for closure any extraction activities that violate human rights, especially of poor, marginalized, ethnic minority and indigenous communities, and local environmental protections.
- **Transition fastest where it is least disruptive:** Phase out extraction fastest in the countries where it is least socially and economically disruptive, particularly in wealthier, less extraction-dependent countries, including the early closure of oil and gas fields and especially of coal mines.
- **Share transition costs fairly:** Ensure that poorer countries whose economies depend on extraction receive support for an effective and just transition.

From this lens, wealthy, diversified jurisdictions with significant fossil fuel industries should move first and fastest in sharply reducing fossil fuel extraction. While all countries will need to undergo a managed decline of their fossil fuel sectors, the poorest

22 Sivan Kartha of the Stockholm Environment Institute and Greg Muttitt of Oil Change International are developing a forthcoming paper on equity considerations in the managed decline of fossil fuel extraction. The paper is expected to be published by Fall of 2018.

nations will need significant support, including their fair share of the global carbon budget to aid in the transition.

A just transition

The need for a just transition, especially in relation to climate change, has been adopted by numerous unions and union confederations worldwide, as well as the International Labour Organization (2015), and in the preamble of the Paris Agreement. It is now widely recognized as a key element of addressing climate change.

The labor movement has developed a set of principles to promote and guide a transition that minimizes the disruption of a rapid shift away from unsustainable practices and that paves a path for decent work going forward, i.e., a just transition.[23]

Key elements of a just transition include:

- Sound investments in low-emission and job-rich sectors and technologies
- Social dialogue and democratic consultation of social partners (trade unions and employers) and other stakeholders (such as communities)
- Research and early assessment of the social and employment impacts of climate policies
- Training and skills development to support the deployment of new technologies and foster industrial change
- Social protection alongside active labor market policies
- Local economic diversification plans that support decent work and provide community stability in the transition.

A key lesson from past transitions is that early planning is a determinant of success.[24] Delay leaves the problem more entrenched and forces a faster and more disruptive rate of change on workers.

Undergoing a transition is not easy for any region, nor for any worker. At the very least, it means disruption, and worse, risks undermining the economic basis of the region, or offering little to workers whose skills, developed over a lifetime, are no longer required. Therefore, successful action to manage the decline of fossil fuel production is indivisible from action to achieve a just transition for fossil-fuel dependent

23 International Labour Office, Governing Body, Outcome of the Tripartite Meeting of Experts on Sustainable Development, Decent Work and Green Jobs, 325th Session, Geneva, October 5–9, 2015. http://www.ilo. org/wcmsp5/groups/public/---ed_norm/---relconf/ documents/meetingdocument/wcms_420286.pdf

24 Oliver Sartor and Andrzej Błachowicz, «End of coal: Failure to see it coming will hurt miners most,» Climate Home, June 25, 2017. http://www.climatechangenews. com/2017/06/25/ just-transition-coal-possible-startsnow; Ben Caldecott, Oliver Sartor & Thomas Spencer, «Lessons from previous Coal Transitions,» High-Level Summary for Policy Makers, Climate Strategies / IDDRI, 2017, pp. 8-10. http://www.iddri.org/ Publications/Lessons-from-previous-coal-tr workers and communities. While the necessary pace of transition is determined by science, the goals of the transition, the vision for the future economy, the strategy for getting there, and the support needed must all be actively developed by and with residents of affected regions and those who work in fossil fuel extractive industries.[25]

25 Ben Caldecott, Oliver Sartor & Thomas Spencer, «Lessons from previous Coal Transitions,» High-Level Summary for Policy Makers, Climate Strategies / IDDRI, 2017, pp. 8-10. http://www.iddri.org/Publications/Lessons-from-previous-coal-transitionsHigh-level-summary-for-decision-makers

CONCLUSION

The global carbon budget is finite and dwindling. As the world moves to curb its addiction to fossil fuels, both consumption and supply are going to decline. Producing countries face an inflection point: do they embrace the inevitable and proactively manage the decline of the sector, or continue on a status quo trajectory? The former offers opportunities for leadership and innovation in defining the course for a post-carbon economy, while the latter threatens workers, communities, and finance that have become dependent on the fossil fuel-based economy.

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Another Energy is Possible

By Sean Sweeney

Edited by the Heinrich Böll Foundation

The author

Sean Sweeney is the director of the International Program on Labor, Climate & Environment at the School of Labor and Urban Studies, City University of New York and coordinator of the Trade Unions for Energy Democracy (TUED).

Trade Unions for Energy Democracy (TUED) is a global network of 65 unions from 24 countries that advocates for democratic control and social ownership of energy resources, infrastructure and options.

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T +49 (0)30 28534-0 **F** +49 (0)30 28534-109 **E** buchversand@boell.de **W** www.boell.de

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INTRODUCTION

If we are to achieve the Paris climate commitments to limit warming to well below 2 degrees Celsius and, if possible, 1.5 degrees Celsius, «revolutionary changes»[1] to the global energy system are going to be necessary, as stated by the IEA. According to a joint 2017 study by the IEA and IRENA, the Paris targets «require an energy transition of exceptional scope, depth and speed. Energy-related CO_2 emissions would need to peak before 2020 and fall by more than 70 % from today's levels by 2050.»[2]

There is no energy revolution

Current energy and emissions trends are not compatible with the Paris targets – not even close. The world is not «moving away from fossil fuels,» as many have claimed and many more believe. The use of oil and gas continues to grow and even coal use is rising again after three years of annual declines. Emissions, therefore, continue to rise. As a proportion of total energy produced and used, renewable energy is growing only incrementally. Investment in renewables has flatlined at the levels reached in 2011 and is far below the annual levels needed to achieve the Paris goals.[3] The IEA's latest report from July 2018 shows how combined investment in renewable energy and energy efficiency fell by 3 % in 2017.[4]

Today, all forms of energy use are growing together: gas, coal, oil, nuclear and renewables (wind, solar, bioenergy, and hydropower). This is because the global demand for energy in general continues to grow at around 2 % annually, and for

1 IEA. (2014, September 29). Webinar launch of the Solar Electricity Roadmaps 2014. [Webinar]. www.iea.org/media/speeches/mvdh/140929_Solar_Roadmaps_Speech.pdf

2 IEA/IRENA. (2017). Perspectives for the Energy Transition: Investment Needs for a Low Carbon Energy System. www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=3828

3 According to the Climate Policy Initiative – a non-profit that advises major institutions and government agencies on energy and land use policies and business practices, with a special focus on finance – reached an alarming conclusion: «The cumulative gap between finance needed and finance delivered is growing, putting globally agreed temperature goals at risk, and increasing the likelihood of costly climate impacts.» See: Climate Policy Initiative, Global Landscape of Climate Finance 2014. www.climatepolicyinitiative.org. For investment needs, see also: www.mission2020.global

4 Vaughan, A. (2018). IEA warns of «worrying trend» as global investment in renewables falls. *The Guardian*. www.theguardian.com/business/2018/jul/17/iea-warns-of-worrying-trend-as-global-investment-in-renewables-falls electricity in particular, at more than 3% annually.[5] This is not what an energy revolution looks like. What is happening today is an energy expansion, and apprehending and reversing this expansion is absolutely essential.

A two-shift solution

But what, then, is the alternative to «business as usual»? The assessment offered focuses mainly on electrical power, which, at 25%, is still the largest single contributor to global greenhouse gas emissions (GHGs).[6]

This assessment highlights the need for two major shifts. The first is a shift in policy towards a «public-goods» approach that can liberate climate and energy policy from the chains of the current investor-focused neoliberal dogma, where «the private sector must lead.» Broadly speaking, emissions reductions benefit everyone, and because most emissions come from how we generate and use energy, both will need to be radically reshaped by pro-public policies.

The second is a shift towards social ownership and management so that energy systems can be restructured and reconfigured to serve social and ecological needs. As long as large energy interests remain in private hands or are formally public entities that – in line with neoliberal directives – have become «marketized» and profit-focused, the energy system will continue to be about selling as much energy as possible in order to make money. These interests – including large renewable energy companies – are content with the current state of energy expansion (a growing global market!). They will resist the kind of transformative energy transition that the situation demands – a transition that can rapidly decarbonize energy supply while simultaneously reducing demand.

5 BP. (n.d.). Electricity: World electricity generation grew by 2.8% in 2017, close to its 10-year average. www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/electricity.html

6 IPCC. (2014). *Climate Change 2014: Mitigation of Climate Change*. www.ipcc.ch/report/ar5/wg3 See also: www.undp.org/content/undp/en/home/sustainable-development-goals/goal-7-affordable-and-clean-energy/targets

Our ambition deficit

The climate justice movement, along with other movements, not only has the capacity to drive home these points and to forcefully articulate the need for the shift in policy and ownership proposed here, but it also will become stronger if it does so. Calling for «greater ambition» and more «political will» from political leaders and governments has become habitual and ritualistic. Equally worrying, such calls imply that these same leaders know what to do but are just not paying sufficient attention. This is plainly false. No amount of political will can alter the fact that perpetual-growth capitalism is incompatible with a science-based approach to climate protection. Instead, it would be more productive to acknowledge the ambition deficit that expresses itself all too frequently in our own politics.

In recent years, the term «energy democracy» has emerged as a means to express both the need and the desire for social ownership and popular democratic control over energy systems. The concept of «energy democracy» itself, however, remains a site of contestation, and its use is often loose and even confusing at times. One narrative that is taking shape in these debates emphasizes a focus on local, community-based or city-level control over renewable sources of power, as well as energy access and management. This approach has many positive features, but it often avoids (or at least neglects) discussing large-scale sector restructuring. The energy democracy movement must grasp the need for system-level transformations that go beyond the reach of «energy sovereignty» or self-determination for this or that community, city, or region. We return to this issue below.

Either way, the two-shift solution proposed here means that neoliberal energy policy must be completely rescinded. This policy began in the early 1980s with the privatization of electricity and the commitment to profit-making as a guiding principle. But rescinding this policy is just the starting point. Our goal is not to return to the past, where energy mainly served the cause of capital accumulation and, for some, reckless consumption. The next energy system must operate within an economic paradigm that is truly needs-based and sustainable.

The prospects for energy transformation, however, will depend on the emergence of a unifying social movement that can offer a comprehensive alternative to the current global political economy and its grotesque features. As part of building this movement, we not only must raise our collective understanding of what needs to be done to dramatically reduce emissions, but we also must address *how* it can be done – and this will compel us to tackle some of the technical obstacles that potentially stand in the way of a new energy future.

The giant green failure

Before more is said about the two-shift approach, it is necessary to be clear about the need for such a change of course. This explanation is needed because many of those active in the climate movement believe that the arc of history (and energy economics) bends towards renewables, and that the era of fossil fuels is all but over. If this were true, it would imply that the current neoliberal approach is working, and therefore what we need is more (albeit much more) of the same.

Importantly, this optimism does not come from the climate movement. Rather, it comes from political elites who are committed to the current «mobilize the private sector» approach. It is a message aimed at investors and not at ordinary people. In the words of Al Gore during COP 21 in Paris in late 2015, «We're still behind on the scoreboard, but the momentum has shifted. We are winning.»[7] Similarly, former UN Secretary General Ban Ki-Moon stated in 2016, «We have entered a new era. The progression to low-emission, climate-resilient growth is inevitable, beneficial, and already under way.»[8] These are not isolated comments. This optimism shamelessly conceals a policy failure of monumental proportions: one that – because it is not fully understood – continues to have a disarming influence on the climate movement and its allies.

To explain this failure and the need for a radical alternative, we need to go back to 2006, when Nicholas Stern (now Lord Stern), former Chief Economist of the World Bank, made headlines when he told the world, «The science tells us that greenhouse gas emissions (GHGs) are an externality; in other words, our [sic] emissions affect the lives of others. When people do not pay for the consequences of their actions, we have market failure. *This is the greatest market failure the world has seen.*»[9] The solutions proposed by Stern in his landmark study, *The Economics of Climate Change* (also known as «The Stern Review»), revolved around two main strategies: first, introduce a global price on carbon and raise it over time and, second, make sure that governments «send signals» in the direction of private corporations and investors. The transition to a green economy needed to be «incentivized.» According to Stern's logic, the transition to a low-carbon economy would be driven by the dynamism, know-how, and financial resources of the private sector or it would not happen at all. With emissions subjected to a price, technological innovation would flourish and investment would shift from carbon-intensive processes to «low-carbon solutions.»

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7 envirobeat. (2015, December 8). Former Vice President Al Gore Fires Up COP21 Delegates. www.youtube.com/watch?v=T90BcrwmoAA

8 United Nations. (2016, January 27). Addressing Summit on Climate Risk, Secretary-General Challenges Investors to Double Clean Energy Investments by 2020. www.un.org/press/en/2016/sgsm17493.doc.htm

9 Nicholas Stern in *New Economist*. (2006, October 30). Climate Change: «the greatest market failure the world has seen». New Economist. http://neweconomist.blogs.com/new_economist/2006/10/stern_review_2.html Royal Economic Society. (2008). Climate Change Ethics and the Economics of the Global Deal. *RES Newsletter*. www.res.org.uk/view/art3Jan08Features.html

More than twelve precious years have passed since the «Stern Review» and the result has been the greatest policy failure the world has ever seen. First, the effort to introduce a global price on carbon has been a disaster. The World Bank's detailed annual assessment of carbon pricing reported that in 2017, just 15 % of global GHGs were subjected to a price.[10] And where a price on carbon exists, in 75 % of cases, the price was at or below $ 10 per ton.[11] This is far too low to have anything but a minor impact on investment decisions. The High-Level Commission on Carbon Prices, a project of the World Bank, reported in May 2017 that in order to be consistent with the «well below 2 degrees Celsius» target, the global carbon price needed to reach «$ 40–$ 80 per ton of CO_2 by 2020 and $ 50–100 per ton by 2030.»[12] For the IEA and IRENA, the carbon price for the power sector will need to be much higher – around $ 150 per ton – in order to close down many currently operating coal and gas power stations («displace existing assets»).[13] The idea of a meaningful global carbon price is a neoliberal fantasy. If we are going to take utopias seriously, they should at least be realistic utopias of our own making and shaped by our principles.

Second, the private sector has failed to deliver the investments needed to drive the transition. Major policy institutions acknowledge that the investment deficit exists. In its *World Energy Investment Outlook* released in 2014, the IEA stated that investment «falls well short of reaching climate stabilization goals, as today's policies and market signals are not strong enough to switch investment to low-carbon sources and energy efficiency at the necessary scale and speed.»[14] Two years later, the IEA calculated that investment in renewables had fallen to $ 286 billion in 2015 and noted that «Globally, energy investment is not yet consistent with the transition to a low-carbon energy system envisaged in the Paris Climate Agreement.»[15] Overall, the annual investment deficit in what the IEA refers to as «clean energy» is estimated to be $ 600 billion annually. Reflecting on these numbers, the Climate Policy Initiative reached an alarming conclusion: «The cumulative gap between finance needed

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10 The most recent World Bank data released in May 2017 estimates that the percentage of emissions covered by a price had reached 15 %. 75 % of these emissions were priced at under $ 10 per ton. World Bank Group. (2017). *Carbon Pricing Watch 2017*. https://openknowledge.worldbank.org/handle/10986/26565

11 World Bank Group. (2017). *State and Trends of Carbon Pricing*. https://openknowledge.worldbank.org/handle/10986/26565

12 Carbon Pricing Leadership Coalition. (2017, May 29). Leading Economists: A Strong Carbon Price Needed to Drive Large-Scale Climate Action. www.carbonpricingleadership.org/news/2017/5/25/leading-economists-a-strong-carbon-price-needed-to-drive-large-scale-climate-action

13 Carbon Pricing Leadership Coalition. (2017, May 29). *Report of the High-Level Commission on Carbon Prices*. www.carbonpricingleadership.org/report-of-the-highlevel-commission-on-carbon-prices

14 IEA. (2014, June 3). World Needs $ 48 Trillion in Investment to Meet Its Energy Needs to 2035. www.iea.org/newsroom/news/2014/june/world-needs-48-trillion-in-investment-to-meet-its-energy-needs-to-2035.html

15 IEA. (2016). *World Energy Investment 2016*. www.iea.org/newsroom/news/2016/september/world-energy-investment-2016.html and finance delivered is growing, putting globally agreed temperature goals at risk, and increasing the likelihood of costly climate impacts.»[16]

The consequences of this «mobilize the private sector» policy failure cannot be exaggerated. Most obviously, the policies pursued have not significantly impeded the rise of emissions. Globally, emissions from fossil fuels rose a staggering 60 % between 1990–2014.[17] Since the year 2000, power sector emissions worldwide alone have increased by more than 45 %.[18] CO_2 emissions from all sources leveled off from 2014 to 2016, but they rose again by 2 % in 2017 and are expected to rise again in 2018.[19] The current annual GHG output is nearly 50 billion metric tons (MT) – a level that far above what is compatible with the Paris target of «well below 2 degrees Celsius.»[20]

If Paris were truly a turning point for humanity as some have irresponsibly claimed, then our task would be different. But it was not. Paris has become a palliative care program, providing political relief at time when emissions are rising faster than ever and ecosystems are steadily shutting down.

Renewable energy: galloping forward at a snail's pace

Meanwhile, the meteoric rise of wind and solar power has become the lynchpin of the «official optimism» of green growth enthusiasts. In 2016, a record-breaking 161 GW in new renewable generating capacity was installed, and more renewable energy came on line than coal and gas.

But the growth of renewables has not significantly impeded the rise in fossil fuel use or emissions.[21] There are three main reasons for this. First, total global power generation capacity is currently at around 6,400 GW, so adding 164 GW of renewable energy (alongside 86 GW of new gas and coal) is, however impressive, no more

16 Climate Policy Initiative. (2014, November). *Global Landscape of Climate Finance 2014*. https://climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2014

17 Global Carbon Project. (2015, December 7). *Global Carbon Budget 2015*. www.globalcarbonproject.org/carbonbudget/archive/2015/GCP_budget_2015_v1.02.pdf

18 IEA/IRENA. (2017, March). *Perspectives for the Energy Transition: Investment Needs for a Low-Carbon Energy System*. www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=3828

19 Hausfather, Z. (2017, November 13). Analysis: Global CO_2 Emissions Set to Rise in 2017 after Three-Year «Plateau». *Carbon Brief*. www.carbonbrief.org/analysis-global-co2-emissions-set-to-rise-2-percent-in-2017-following-three-year-plateau. See also: http://iopscience.iop.org/article/10.1088/1748-9326/aa9662/meta.

20 PBL Netherlands Environmental Assessment Agency. (2017, September 28). *Trends in global CO_2 and total greenhouse gas emissions: Summary of the 2017 report*. www.pbl.nl/en/publications/trends-in-global-co2-and-total-greenhouse-gas-emissions. IPCC. (2015). *IPCC Fifth Assessment Synthesis Report*. www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf Global Carbon Project. (2017, November 13). *Global Carbon Budget 2017*. www.globalcarbonproject.org/carbonbudget/17/presentation.htm

21 Jackson, R. B., et al. (2017, November 13). Warning Signs for Stabilizing Global CO_2 Emissions. *Environmental Research Letters*. http://iopscience.iop.org/article/10.1088/1748-9326/aa9662.

than an incremental improvement. Second, since global energy demand is presently rising at around 2 % per year, *both* fossil fuels *and* renewables are growing. Moreover, both the IEA and the US's Energy Information Administration (EIA) project that world energy demand will increase between 28 % and 30 % by 2040.[22] Third, fossil fuels are also extensively used in transport and industry. In these sectors, the use of fossil fuels is not only rising, but is mostly unchallenged by renewable alternatives (see *A Managed Decline of Fossil Fuel Production* in this publication).

Wind and solar, however, have established a firm foothold in the electricity sector. These so-called «modern renewables» provided a little over 5 % of total electricity generation at the end of 2016.[23] In other parts of the economy, however, renewable energy has made little or no progress. Modern renewables currently produce a little over 1 % of the total energy consumed globally.[24]

In the face of these data, the current policy approach is shockingly out of touch. Policies proposed to drive decarbonization involving incentives, carbon pricing, «certainties» for investors, etc., have been grossly inadequate and will continue to be so. Even a section of the global corporate elite has already admitted as much.[25] The oft-celebrated idea that renewable energy is becoming «competitive» with fossil fuels and hence «market forces are on our side,» is therefore both dangerously off target and politically disarming.

22 IEA. (2017, November 16). *World Energy Outlook 2017*. www.iea.org/bookshop/750-World_Energy_Outlook_2017. EIA. (2017). International Energy Outlook 2017. www.eia.gov/outlooks/ieo

23 IEA. (2017, May 16). *Tracking Clean Energy Progress (TCEP) 2017*. www.iea.org/publications/freepublications/publication/tracking-clean-energy-progress-2017.html. The TCEP examines the progress of a variety of clean energy technologies towards interim 2° C scenario targets in 2025. IEA. (2017). *Energy Technology Perspectives 2017*. www.iea.org/etp2017

24 Reflecting on these trends, BP's head of research Spencer Dale recently stated: «I had no idea that so little progress had been made until I looked at these data[…] because despite the extraordinary growth in renewables in recent years and the huge policy efforts to encourage a shift away from coal into cleaner, lower carbon fuels, there has been almost no improvement in the power sector fuel mix over the past 20 years[…] The share of non-fossil in 2017 is actually a little lower than it was 20 years ago, as the growth of renewables hasn't offset the declining share of nuclear.» BP. (2017). Analysis: Spencer Dale, group chief economist. www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/chief-economist-analysis.html#analysis-carbon-emissions

25 In a 2013 report titled *Too Late for Two Degrees?*. PricewaterhouseCoopers (PwC) noted, «Governments' ambitions to limit warming to 2° C[…] appear highly unrealistic.» PwC report concluded, «businesses, governments and communities across the world need to plan for a warming world – not just 2° C, but 4° C, or even 6° C.» PwC. (2012, November). *Too Late for Two Degrees? Low Carbon Economy Index Report 2012*. www.pwc.com/gx/en/sustainability/publications/low-carbon-economy-index/assets/pwc-low-carbon-economy-index-2012.pdf

The ownership challenge and the IPCC

Today, the need for a radical policy shift is indisputable, but such a shift is not likely to occur without a protracted, movement-driven, all-out political fight for social ownership and democratic management of energy systems. The main arguments for this ownership shift are twofold. First, as we have seen, the «mobilize the private sector» approach has failed because it is tied to the need for profit. Without sufficient profit, investment will not materialize. Second, the energy revolution that is needed to limit warming to «safe» levels will require planning, cooperation, sharing of skills and know-how, and high levels of public participation. The current model is one based on private (or «marketized» public) entities committed to selling *more* energy. This model is not compatible with meeting social and ecological needs.

With social ownership, the cost of developing large-scale renewable power would actually be lower than it typically has been with the current «liberalize, then subsidize» approach. The development of wind and solar power today relies almost completely on government guarantees and incentives (in the form of favorable government-backed financing, power purchase agreements, privileged access to grids, etc.) rather than on revenues from market-driven prices.[26]

Public entities can take advantage of economies of scale and scope, and the removal of profit as well as the costs of competition would also yield positive results. For public entities, capital borrowing costs are lower than they are for private companies by some distance, and the cost of financing is currently the largest single factor in determining the price of renewable energy.[27]

Meanwhile, the need for a shift in how energy is owned and managed has been made, although inadvertently, by the IPCC. Since its *First Assessment Report* in 1990,

26 Sweeney, S. and Treat, J. (2017, November). *TUED Working Paper #10. Preparing a Public Pathway: Confronting the Investment Crisis in Renewable Energy*. http://unionsforenergydemocracy.org/wp-content/uploads/2017/10/TUED-Working-Paper-10.pdf

27 Sweeney, S. and Treat, J. (2017, November). *TUED Working Paper #10. Preparing a Public Pathway: Confronting the Investment Crisis in Renewable Energy*. http://unionsforenergydemocracy.org/wp-content/uploads/2017/10/TUED-Working-Paper-10.pdf the IPCC has developed different options for reducing emissions.[28] In terms of policy, IPCC reports tend to repeat what the major policy institutions such as the World Bank and the IMF are saying about the «leading role of the private sector» and the need for incentives, carbon pricing, «long-term market signals» and «a supportive policy environment.»[29] Perhaps because of this mandatory market speak, climate activists have tended to shrug their shoulders when different decarbonization scenarios are discussed, and many have pointed out that «it's not about carbon; it's about injustice, racism, and colonialism.» As true as these statements are – and they *are* true – implementing solutions at the necessary speed and scale will involve decisions that *must* take technical matters into consideration. While there indeed may be no «techno-fix» to climate change, the overall societal or system-level «social fix» will nevertheless have technical aspects and dimensions, and making the right decisions matters.

But for our purposes, the discussions around the IPCC's various scenarios are valuable because they draw attention to what is, or might become, *technically* possible. For this reason, they can be useful in helping us imagine a radically different and more sustainable energy future. But, as we will see, the IPCC has often acknowledged that, in the eyes of neoliberal policy makers, not all scenarios are equal. The ones that do not fit in with the calculations of investors and private interests are, in policy terms, the neglected stepchildren who are pushed into the corner of the room.

Escaping capture

The majority view inside the IPCC is that renewables will play the leading role in decarbonizing the electrical power sector. Furthermore, over time, a renewables-driven power sector can lead to the electrification and decarbonization of other key energy-intensive sectors, including transport (through electric vehicles and integrated public transport systems), industry, buildings, food and agriculture, and so forth. This, however, will entail a massive expansion of renewable energy use across the entire economy, and the ecological and social implications of such a dramatic scale-up need to be thoroughly investigated.

28 Metz, B., et al., Eds. (2007). *Climate Change 2007: Mitigation of Climate Change. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge University Press. The IPCC's Working Group III Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN) presents an assessment of the scientific, technological, environmental, economic and social aspects of renewable energy sources and their potential role in climate change mitigation. However, the IPCC also has a Clean Coal Group and solicits input from coal, oil and gas experts and specialists. (www.ipcc.ch/report/srren)

29 From the *First Assessment Report*: «The challenge to policymakers is to enhance the market uptake of technological options and behavioural and operational changes as well as to address the broader issues outside the energy sector in order to capture more of the potential that exists.» IPCC. (1992). *Climate Change*: The IPCC 1990 and 1992 Assessments. www.ipcc.ch/publications_and_data/publications_ipcc_90_92_assessments_far.shtml

But in common with the IEA, the IPCC is convinced that 100 % renewable energy *is not possible even for the power sector*, and both nuclear energy and fossil fuels accompanied by carbon capture and sequestration (CCS) are necessary. CCS involves the chemical separation and removal of as much as 90 % of CO_2 from «stack gas» generated by power plants and industrial processes that require the use of coal or gas. CCS is also needed because renewables are not yet capable of supplying certain industries that require intense heat (i.e. steel, cement, pulp and paper, refining and petrochemicals).

Both the IEA and the IPCC have consistently stated that the deployment of CCS is not only essential in order to meet climate targets, but there also needs to be a lot of it.[30] Prior to the Paris Agreement, CCS was being counted on to contribute at least 14 % of «avoided» CO_2 emissions between 2014 and 2050 in order to stay within 2 degrees Celsius of warming.[31] This would require a «capture» rate of around 7 Gigatons (Gt) of CO_2 per year. With the more ambitious targets adopted in Paris, the IEA recently calculated that capture technologies would need to account for as much as 36 % of the projected reductions of cumulative CO_2 emissions between now and 2050.[32] In April 2018, Shell released its Sky Scenario that estimated that achieving «net-zero» emissions by 2070 would mean «some 10,000 large carbon capture and storage facilities.»[33]

According to the IPCC's models, however, the mass deployment of CCS (along with renewables, nuclear, efficiency gains, etc.) will still not be enough to reach climate targets. Additionally, there is a need to deal with the possibility of cumulative emissions exceeding «safe» levels (emissions «overshoot»), in which case the removal of CO_2 from the atmosphere will become a priority at some point.

Based on this assessment, scientists have investigated the potential of CO_2 removal (or CDR) technologies of various kinds. Bioenergy with carbon capture and storage (BECCS) has attracted sustained attention because its advocates say that it promises to remove CO_2 and provide fuel for the generation of energy at the same time. According to the IEA, «BECCS is able to do this because it uses biomass that

30 IEA. (2014, November 20). Five key actions to achieve a low-carbon energy sector. *IEA Newsroom*. www.iea.org/newsroom/news/2014/november/five-key-actions-to-achieve-a-low-carbon-energy-sector.html

31 EIA. (n.d.). Frequently Asked Questions: How much carbon dioxide is produced per kilowatthour when generating electricity with fossil fuels?. www.eia.gov/tools/faqs/faq.php?id=74&t=11. U.S. Department of Energy. (n.d.). Fact Sheet: Clean Coal Technology Ushers in New Era in Energy. www.energy.gov/sites/prod/files/edg/media/CleanCoalTaxCreditFactSheet.pdf

32 IEA. (2017). E*nergy Technology Perspectives 2017*. www.iea.org/etp2017/summary

33 Shell. (n.d.). Sky Scenario. www.shell.com/energy-and-innovation/the-energy-future/scenarios/shell-scenario-sky.html. For a discussion on the challenges of mass deployment of CCS, see Sweeney, S. (2015). *TUED Working Paper #5: The Hard Facts about Coal*. http://unionsforenergydemocracy.org/tued-working-paper-urges-unions-to-re-think-carbon-capture-and-storage has removed atmospheric carbon while it was growing, and then stores the carbon emissions resulting from combustion permanently underground.»[34]

Many in the climate justice movement have argued that CCS merely perpetuates dependence on fossil fuels and should be opposed on this basis. Similarly, research has estimated the enormous potential impact of BECCS, particularly due to the extremely large areas of arable land that would likely be used to generate the biomass feedstock for bioenergy – land that would need to be cultivated to meet rising global food demand. Using vast amounts of arable land in this way would impose an intolerable burden on hundreds of millions of people.[35]

But if the task is to develop an alternative energy vision, there are other parts of the story around CCS and BECCS that are also important. Significantly, the adoption of the Paris targets has increased the clamor for CCS, but its prospects remain extremely grim.[36] According to one observer, «All the major oil and gas companies and some of the coal companies are ‹committed› to CCS as part of the solution. But they are not doing it.»[37] Why is this? According to the IEA's Clean Coal Centre, CCS was being impeded due to «insufficient attention given to establishing an enabling environment» and the lack of «an adequate financing model.»[38] In plainer language, there is no profit to be made from CCS and, in the absence of a high price on CO_2, there is no incentive to bring it to scale. Aside from the cost of the capture technologies, power generated with CCS uses around 20% more coal and gas to generate the same amount of energy (this is called the «energy penalty»), thus adding to the price tag. Another massive problem for both CCS and BECCS is the lack of suitable

34 IEA. (2011). *Combining Bioenergy with CCS: Reporting and Accounting for Negative Emissions under UNFCCC and the Kyoto Protocol*. https://webstore.iea.org/combining-bioenergy-with-ccs

35 National Research Council et al. (2015). *Assessment of Possible Carbon Dioxide Removal and Long-Term Sequestration Systems. Climate Intervention: Carbon Dioxide Removal and Reliable Sequestration*. Washington, DC: The National Academies Press. https://doi.org/10.17226/18805

36 Institution of Chemical Engineers (IChemE). (2018). Carbon capture and storage: Making commercialisation a reality. Retrieved from https://youtu.be/9BPEKI4ohJ8. Comments from Professor Nick Butler: «The only problem is this (CCS) is not being done. All the major oil and gas companies and some of the coal companies are ‹committed› to CCS as part of the solution. But they are not doing it. Governments are not doing it. The EU created a fund in 2009 to produce 9 CCS projects. That money still sits in Brussels not taken up. There is no carbon price to speak of. The costs at the current level are a deterrent.» See also: www.globalccsinstitute.com/projects/large-scale-ccs-projects, and www.bloomberg.com/news/articles/2015-11-06/shell-sees-carbon-price-of-60-to-80-needed-to-justify-ccs

37 Institution of Chemical Engineers (IChemE). (2018). Carbon capture and storage: Making commercialisation a reality. Retrieved from https://youtu.be/9BPEKI4ohJ8. Comments from Professor Nick Butler, «The only problem is this (CCS) is not being done. All the major oil and gas companies and some of the coal companies are ‹committed› to CCS as part of the solution. But they are not doing it. Governments are not doing it, The EU created a fund in 2009 to produce 9 CCS projects. That money still sits in Brussels not taken up. There is no carbon price to speak of. The costs at the current level are a deterrent.»

38 Minchener, A. (2017, January 27). The Urgent Need to Move from CCS Research to Commercial Deployment. *Corner Stone*. http://cornerstonemag.net/the-urgent-need-to-move-from-ccs-research-to-commercial-deployment places to sequester (or, more accurately, dump) the captured carbon.[39] Even if there were enough injection sites available, the costs involved in dumpling billions of tons of carbon would be a major disincentive to investors.

These technical and financial obstacles go a long way towards explaining why CCS is essentially going nowhere. In 2017, there were just 17 large (but not commercial-scale) conventional projects operating globally and only a handful in the pipeline.[40] Many projects have been cancelled. In fact, only 10 of the 169 NDCs submitted by governments to the UNFCCC referred to plans to develop CCS.[41] It is also worth noting that BECCS only becomes plausible if CCS becomes routinely established for stationary sources of emissions such as power stations. This would entail an annual installation rate of around 40 GW by 2030.[42] This is very unlikely to happen. For this reason, activists can see that both CCS and BECCS are unlikely to occur and can now safely turn their attention to thinking about what an alternative energy system might look like and how they can make it a reality.

But the main point here is this: if CCS and BECCS had been good mitigation options, they would still be «orphan technologies» because, as is the case with other mitigation options, their uptake is not contingent on their potential social or ecological value. Rather, their adoption is determined by profit considerations. In early 2016, Achim Steiner, the then UNEP Executive Director, declared that the Paris Agreement

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39 National Research Council et al. (2015). Assessment of Possible Carbon Dioxide Removal and Long-Term Sequestration Systems. *Climate Intervention: Carbon Dioxide Removal and Reliable Sequestration*. Washington, DC: The National Academies Press https://doi.org/10.17226/18805

40 Global CCS Institute. (2017). *The Global Status of CCS 2017*. www.globalccsinstitute.com/sites/www.globalccsinstitute.com/files/uploads/global-status/1-0_4529_CCS_Global_Status_Book_layout-WAW_spreads.pdf See also: Minchener, A. (2017, January 27). op. cit.

41 IEA. (2014). *CCS 2014: What lies in store for CCS?* www.iea.org/publications/insights/insight-publications/ccs-2014---what-lies-in-store-for-ccs.html See also: Jacobs, W. B. Carbon Capture and Sequestration in Freeman, J. and Gerrard, M., eds. (2014) Global Climate Change and US Law. ABA.; and Summary for Policymakers in IPCC. (2005). IPCC Special Report: Carbon Dioxide Capture and Storage: A Special Report of Working Group III of the Intergovernmental Panel on Climate Change. «If CO_2 storage is to be undertaken on the scale necessary to make deep cuts to atmospheric CO_2 emissions, there must be hundreds, and perhaps even thousands, of large-scale geological storage projects under way worldwide.»

42 UCL Institute for Sustainable Resources. (2017). *The Role of CCS in Meeting Climate Policy Targets*. www.ucl.ac.uk/bartlett/sustainable/latest?meta_UclSubject=carbon; IEA. (2016). *Energy and Climate Change: World Energy Outlook Special Report*. www.iea.org/publications/free-publications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf. Summary for Policymakers in IPCC. (2005). *IPCC Special Report: Carbon Dioxide Capture and Storage: A Special Report of Working Group III of the Intergovernmental Panel on Climate Change*. www.ipcc.ch/pdf/special-reports/srccs/srccs_summaryforpolicymakers.pdf According to the World Business Council for Sustainable Development, the earliest deployment for CCS is twenty years away – and the IPCC does not expect CCS to be commercially viable until after 2050. According to the IPCC: «If CO_2 storage is to be undertaken on the scale necessary to make deep cuts to atmospheric CO_2 emissions, there must be hundreds, and perhaps even thousands, of large-scale geological storage projects under way worldwide.»

signified «the triumph of science over politics.»[43] But in terms of the implementation of the targets, the fate of the IPCC's scenarios shows that it is economics – specifically capitalist economics – that defeats science with alarming frequency.

Either way, we are left with the huge challenge of reducing emissions to «safe» levels without the availability of acceptable carbon capture or carbon reduction options. And it is clearly not enough to state without substantiation that more renewable energy is the answer. The decarbonization of energy-intensive industrial processes clearly presents challenges for which, in the absence of CCS, there is as yet no convincing option other than to steadily scale back on the production of carbon-intensive products.

43 UN Environment. (2016, April 18). UNEP Executive Director Achim Steiner's Message on the Paris Agreement. www.youtube.com/watch?v=NcwXZTDa0SM

Establishing – and then fulfilling – the potential of renewable energy

Advocates of a transformative public-goods approach to energy transition must therefore fully investigate the claims made by the IEA and IRENA that renewable energy cannot meet global energy needs on its own – however these needs may be defined.

If one of the goals is to get to a point where renewable energy provides electricity to the 1.3 billion people who currently have none at all (mostly rural dwellers in South Asia and Sub-Saharan Africa) and to also electrify various transport modes as well as domestic cooking and heating, etc., it is very likely that, based on today's technologies, the technical potential of renewables will be pushed to the absolute limits.[44]

The IEA and IPCC's «renewables can't do it all» approach nevertheless has been challenged by Stanford University's renowned scientist Mark Z. Jacobson.[45] He and others have argued that renewable energy can provide almost all of the world's energy needs by 2050 at the latest – without CCS or new nuclear power.[46] Other scientists strongly disagree.[47] A paper challenging Jacobson's claims referred to, among other things, the undeveloped state of storage technologies that will need to be routinely available in order to overcome the problems created by the variable nature

44 IEA/IRENA. (2017, March). *Perspectives for the Energy Transition: Investment Needs for a Low Carbon Energy System*. www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=3828 Importantly, the IPCC has already calculated that that energy efficiency can produce a situation where «energy demand in 2050 would remain around today's level due to extensive energy intensity improvements.»

45 Jacobson, M. Z., et al. (2015). Low-cost solution to the grid reliability problem with 100 % penetration of intermittent wind, water and solar for all purposes. *Proceedings of the National Academy of Sciences*. 112 (49), 15060–15065. www.pnas.org/content/112/49/15060

46 Jacobson M. Z., et al. (2015) 100 % clean and renewable wind, water, and sunlight (WWS) all-sector energy roadmaps for the 50 United States. *Energy & Environmental Science*. 2015 (8), 2093–2117.

47 Clack, C. T. M., et al. (2017). Evaluation of a proposal for reliable low-cost grid power with 100 % wind, water and solar. *Proceedings of the National Academy of Sciences*. www.pnas.org/content/early/2017/06/16/1610381114 Loomis, Ilima. (2018, February 15). Scientific Row over Renewables Lead to Free Speech Legal Fight. *Earth & Space Science News*. https://eos.org/articles/scientific-row-over-renewables-leads-to-free-speech-legal-fight.

of wind and solar power.[48] A recent MIT study focused on the levels of storage that would be needed, should the continental United States reach a point where wind and solar power provides 80 % of the country's electricity. The study's conclusions deserve to be taken seriously. Aside from the enormous costs and the levels of lithium required in the mass production of batteries, the technical challenges posed by the need to store renewable energy at levels that can guarantee reliable energy supply are formidable to say the least.[49]

It is important to try to understand the basis for these contrasting assessments and to examine the data without prejudice. For now, whatever the «true potential» of renewable energy, there is no doubt that the deployment of renewables is globally far lower than it can or should be, in the same way that energy efficiency is also advancing far too slowly. This has been acknowledged by the IPCC.[50] But the IPCC did not offer an explanation as to why renewables were not fulfilling their potential. We know the reason, however: the decision to invest in or to deploy any given energy technology is not driven by the need to meet climate targets, but rather based on an estimate of a likely return on investment. And there is simply not sufficient or sufficiently reliable profit in renewable energy to ensure that the technical potential of these technologies can be reached.

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48 See e.g., IPCC (2011). *Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN)*. www.ipcc.ch/report/srren; Jacobson, M. Z., et al. (2015). Low-cost solution to the grid reliability problem with 100 % penetration of intermittent wind, water and solar for all purposes. *Proceedings of the National Academy of Sciences*. 112 (49), 15060–15065. www.pnas.org/content/112/49/15060 See also http://thesolutionsproject.org/cop21-9-questions-renewable-energy-expert, and www.washingtonpost.com/news/energy-environment/wp/2017/06/19/a-bitter-scientific-debate-just-erupted-over-the-future-of-the-u-s-electric-grid/?utm_term=.ba5a2d6c4b76. For a useful discussion, see Chevallerau, F.-X. (2017, June 27). 100 % Renewables – A Few Remarks about the Jacobson/Clack Controversy. *Resilience*. www.resilience.org/stories/2017-06-27/100-renewables-a-few-remarks-about-the-jacobsonclack-controversy Chevallerau notes, «These kinds of studies may also increase the risk of somehow ‹trivializing› the debate about the energy transition. This debate is or should be, first and foremost, a political debate, and the outcome of the transition will depend, first and foremost, on how we will manage to design, implement, and sustain new economic, social and political balances of power, within and between countries. This, much more than the accuracy of technical roadmaps that we may be able to design today, will determine whether, how and how successfully we will be able to transition to renewables.» See also: Heinberg, R. (2017, July 11). Controversy Explodes over Renewable Energy. *Post Carbon Institute*. www.postcarbon.org/controversy-explodes-over-renewable-energy

49 Temple, J. (2018, July 27). The $2.5 trillion reason we can't rely on batteries to clean up the grid. *MIT Technology Review*. www.technologyreview.com/s/611683/the-25-trillion-reason-we-cant-rely-on-batteries-to-clean-up-the-grid

50 IPCC. (2011). Summary for Policymakers. In *Special Report on Renewable Energy Sources and Climate Change Mitigation*. www.ipcc.ch/report/srren

Planning and cooperation to overcome technical challenges

The prerogatives of profit currently prevent us from dealing with the technical challenges associated with the deployment of large-scale renewable power. We can start by acknowledging that these challenges are real and that they need to be addressed.[51] Perhaps the most pressing question is how to deal with system-level challenges posed by variable renewable energy (VRE) or «source intermittency.» Put simply, the wind does not blow all the time and the sun does not always shine. As the share of power generated by wind and solar grows over time, the need to find ways to store this power and/or to move electrical power quickly and efficiently from one region to another to address this variability becomes extremely urgent. In China and India, the share of VRE is expected to double to over 10 % by 2022. As the IEA notes, without a simultaneous increase in «system flexibility» (grid reinforcement and interconnections, storage, demand-side response, etc.), the effort to decarbonize power generation with renewables will confront serious technical roadblocks.[52] The same challenge exists wherever renewable energy progresses beyond a certain point.

How can we address the challenges posed by variable supply? Private renewable energy interests operate on a «build and sell» approach; system balancing is therefore someone else's problem and someone else's expense. Social ownership deploying a public-goods approach will allow for the broadest possible consultation aimed at finding technological and social solutions to this challenge. As the IPCC itself has noted, cooperation is key: «Effective mitigation will not be achieved if individual agents advance their own interests independently» and cooperation «can play a constructive role in the development, diffusion and transfer of knowledge, and environmentally sound technologies.»[53]

The problems of variable supply will not be solved simply by extending social ownership and democratic control over energy. But it will provide us with the means to mobilize the skills, capital, and public support to confront the challenge head on. For now, it is our political responsibility to acknowledge the challenge and to

51 As wind and solar floods into the system at any given moment, wholesale prices have typically collapsed. This means profits are compromised. When the sun is not shining and wind is not blowing, the grid relies on coal, gas, nuclear and large hydro. That is why governments often pay to keep these supplies available, even though they are not profitable.

52 IEA. (2017). *Renewables 2017*. www.iea.org/publications/renewables2017

53 IPCC. (2014). *Climate Change 2014: Mitigation of Climate Change*. www.ipcc.ch/report/ar5/wg3 explore ways to solve the problem. The forces of climate justice are not currently in a position to implement solutions, but we need to prepare for the day when we may be the only ones able to do so.

Controlling and reducing demand

The problems of decarbonizing energy supply are real, but some of these problems can be either reduced or resolved by enhancing energy efficiency and by controlling and lowering energy demand. The IPCC, the IEA, and others acknowledge that energy efficiency can potentially contribute up to 40 % of the reductions in energy-related emissions required by 2050. The IPCC process has produced the «non-nuclear and non-CCS» scenario, or «nonnucccs,» that would require much more emphasis on reducing energy consumption and increasing the pace of electrification on an economy-wide basis in order to be realized.[54] In this scenario, reaching below 2 degrees will be contingent on energy demand in 2050 remaining «around today's level due to extensive energy intensity improvements. Around half of the improvements could be attributed to renewable energy from heating, cooling, transport and electrification based on cost-effective renewable power.»[55] Such a scenario, the IEA says, is «technically feasible.»

But there is evidence to suggest that both the IPCC and the IEA may have actually underestimated the extent to which energy efficiency could impact the levels of demand. According to the findings of a recent study by a team of scientists led by Arnulf Grubler, it is possible – based on existing and likely technologies – to reduce final energy demand as much as 40 % from today's levels by 2050 without unduly impeding progress towards the UN's Sustainable Development Goals (SDGs).[56]

Of all the mitigation literature available today, Grubler's study proposes the lowest global energy demand scenario yet. The authors claim that their «scenario meets the 1.5° C climate target as well as many sustainable development goals without relying on negative emission technologies.»[57]

The lower energy demand (LED) scenario provides a starting point for a public-goods approach to energy transformation. Importantly, it shifts attention towards demand reduction. This itself will not solve all of the supply-related problems discussed above, but it is fairly obvious that «downsizing the global energy system

54 Akashi, O., et al. (2013). Halving Global GHG Emissions by 2050 without Depending on Nuclear and CCS. Climatic Change. 123 (3–4), 611–622. https://link.springer.com/article/10.1007%2Fs10584-013-0942-x

55 IEA/IRENA. (2017). *Perspectives for the Energy Transition: Investment Needs for a Low Carbon Energy System*. www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=3828

56 Grubler, A., et al. (2018). A low energy demand scenario for meeting the 1.5° C target and sustainable development goals without negative emission technologies. *Nature Energy*. 3, 515–527.

57 Grubler, A., et al. (2018). A low energy demand scenario for meeting the 1.5° C target and sustainable development goals without negative emission technologies. *Nature Energy*. 3, 515–527.

dramatically improves the feasibility of a low-carbon supply-side transformation.»[58] In plainer terms, less demand will require less supply, making it easier to create an energy system based on 100 % renewable sources.

There are, of course, many unanswered questions regarding the LED scenario. But one thing is clear: the current policy framework – which is pro-market and investor-focused – has shown itself to be incapable of delivering the levels of energy efficiency required for the same reasons it has been unable to decarbonize energy supply. As the IEA itself notes, «Future projections reveal that under existing policies, the vast majority of economically viable energy efficiency investments will remain unrealized.»[59] This is a staggering statement given that both the IPCC and the IEA are counting on dramatic improvements in efficiency as a means of reaching climate targets.

The task of controlling and dramatically lowering demand lies at the heart of the fight for climate protection. This will be an enormous challenge regardless of who controls and operates the energy systems. Energy demand has been rising between 2 % and 3 % per year on average for several decades and the global economy is expected to be three times larger in 2050 than it is today.[60] This means that the IPCC and IEA's «flat energy demand» scenario, where energy use in 2050 will be the same as it is today, is completely at odds with the projected increases. And the far more ambitious 40 % demand reduction presented in the LED scenario is, needless to say, even more so. As Grubler's paper notes, «Ultimately, LED's low energy demand outcomes depend on social and institutional changes that reverse the historical trajectory of ever-rising demand.»[61] Indeed, they do.

Today, there is a broad social consensus in many parts of the world to address climate change. This consensus is a mandate for action that can be endorsed at the local level and directed towards the achievement of bold demand-reduction targets. If not tied to a public-goods approach, however, the LED scenario will be left to gather dust. Such an approach – where energy generation and management is configured as a public service – opens the door to the gradual decommodification of electrical power while introducing methods to use electricity more efficiently. «Smart» web-based technologies can assist in this effort, but their deployment and use cannot be dependent on «consumer choice.»

But the kind of investments needed to both decarbonize energy supply while simultaneously driving down energy demand have no place in the neoliberal economic textbooks. We have more than enough evidence to conclude that, if things are left as they are, the capital needed to develop, produce, and deploy massive numbers of heat pumps, fuel cells, the «smart» transformation of physical networks and

58 Grubler, A., et al. (2018). op. cit.

59 IEA. (2014). *Capturing the Multiple Benefits of Energy Efficiency*. www.iea.org/publications/freepublications/publication/Multiple_Benefits_of_Energy_Efficiency.pdf

60 PwC. (2015). *The World in 2050: Will the shift in global economic power continue?*. www.pwc.com/gx/en/issues/the-economy/assets/world-in-2050-february-2015.pdf

61 Grubler, A. et al. (2018). op cit.

control systems and to scale-up storage and load-management options – all of which are proposed in the LED scenario – will simply not materialize, just as they did not materialize for the provision of public health, education, transport, water and sanitation, and other vital services.

A socially-owned energy system pursuing a public-goods approach promises to create a situation where both the mammoth tasks associated with decarbonization of supply and radical demand reduction can be confronted in an integrated and planned way. Democratic and popular participation at all levels of decision making will be essential.

Energy democracy rising

It was mentioned at the outset that, in recent years, the term «energy democracy» has emerged as a means to express both the need and the desire for social ownership and popular democratic control over energy systems. A nascent movement has emerged – one that intersects with local, community-based, or city-level initiatives, trade unions, indigenous groups and some of the more radical NGOs.

In political life, energy democracy efforts are currently more visible around grassroots struggles than it is around large policy options and debates. But given the issues of the required speed and scale of decarbonization discussed above and the need to dramatically reduce demand, the energy democracy movement will need to raise its sights in order to promote system-level transformations that can ensure that the decarbonization of supply and reduction of demand are incorporated into one integrated process. This goes beyond the reach of «energy sovereignty» or self-determination for this or that community, city, or region.

For now, energy democracy advocates are all over the global map – politically as well as geographically.[62] Many hold the view that people organizing locally can become the social force best equipped to transform the energy system. For example, «prosumer» approaches to energy democracy situate individuals or small groups of individuals at the center of a new energy vision. «Prosumers» both produce and consume electricity and therefore have some degree of control over energy choices. By installing solar panels and eventually batteries and micro-grids, «prosumers» (on this line of thinking) are able to disrupt the market dominance of the large energy companies tied to fossil fuels and nuclear power. Some US-based advocates of energy democracy have concluded that large, centralized generation is intrinsically undemocratic, while decentralized generation is – almost by definition – a platform for local democracy and energy self-determination.[63]

Local control has immense potential to shape the way in which energy is managed and used, and many progressive organizations and movements consider local struggles to be the front line of battle for a new and genuinely people-driven energy system.[64] (see *System Change on a Deadline. Organizing Lessons from Canada's*

62 For a range of views in the US context, see Fairchild, D. and Weinrub, A. (Eds). (2017). *Energy Democracy: Voices from the Field*. Washington D.C.: Island Press.

63 Farrell, J. (2011, June). *Democratizing the Electricity System: Vision for a 21st Century Grid*. Washington, D.C.: Institute for Local Self Reliance.

64 Bottger, C. (2018, July 13). This Hurricane Season, Puerto Ricans Are Imagining a Sustainable Future. *The Nation*. www.thenation.com/article/hurricane-season-puerto-ricans-imagining-sustainable-future

Leap Manifesto in this publication). In the immediate aftermath of Hurricane Maria, when Puerto Rico's power grid was knocked out completely, grassroots solar-powered organizations like Casa Puebla distributed solar lamps and bulbs to thousands of the island's residents that were without electricity.[65] The lamps and other much-needed emergency supplies were the result of the Puerto Rican diaspora mobilizing in the face of government foot-dragging. The hurricane claimed the lives of more than 4,600 people, with a number of deaths directly connected to the loss of electrical power as chronically ill people were unable to keep medicines refrigerated or operate respiratory equipment.[66] It is also true, however, that power has been largely restored in Puerto Rico because 52,000 power poles and thousands of miles of cable are in the process of being replaced in, as of this writing, a $4 billion government operation.[67] This underlines the need to see the state as a site of struggle for energy democracy, because it has the capacity to move the kind of financial, technical and human resources needed to drive the energy transition forward.

Some advocates of bottom-up approaches see «cooperative purchasing» or «community choice aggregation» (CCA) as an option. Relatively well-established in California, these programs give consumers the choice of an alternative electricity service provider. CCA programs can then pivot towards renewables and focus on energy conservation.[68] According to advocates of CCA, democratizing energy in this way «can have far-reaching impacts and pave the way for the kind of equitable, regenerative, new economy we need to survive on the planet.»[69] But CCA advocates also acknowledge that capturing the potential of CCA programs «requires mobilizing the community to shape the Community Choice program to provide economic, environmental, and equity benefits to the community.»[70]

Others see cities as future hubs of energy democracy. Germany has been presented as a model where the «remunicipalization» of energy distribution has made

65 Casa Pueblo. (n.d.). http://casapueblo.org/index.php/que-significa-50consol Bottger, C. (2018, July 13). op. cit.

66 Kishore, N., et al. (2018, July 12). Mortality in Puerto Rico after Hurricane Maria. *New England Journal of Medicine*. www.nejm.org/doi/full/10.1056/NEJMsa1803972

67 Cotto, D. (2018, July 16). Puerto Rican Regain Power, but Fear for Long Term. *U.S. News & World Report*. www.usnews.com/news/healthiest-communities/articles/2018-07-16/puerto-ricans-return-to-power-grid-but-fear-for-long-term

68 California passed AB 117, the Community Choice Aggregation law in 2002. This law allows a city, county, or any grouping of cities and counties, to «aggregate» electricity customers in their jurisdictions for the purpose of procuring electricity on their behalf. Under this arrangement, a public agency – the newly formed Community Choice program – decides where electricity will come from, while the incumbent utility delivers the electricity, maintains the electric lines, and bills customers.

69 Weinrub, A. (2016, November 12). Energy Democracy: inside California's Game Changing Plan for Community Owned Power. *Yes! Magazine*. www.yesmagazine.org/new-economy/energy-democracy-inside-californians-game-changing-plan-for-community-owned-power-20151112

70 Weinrub, A. (2017). Democratizing Municipal-Scale Power. In Fairchild, D. and Weinrub, A. (Eds). Fairchild, D. and Weinrub, A. (Eds). (2017). *Energy Democracy: Voices from the Field*. Washington D.C.: Island Press.

great headway in recent years.[71] Between 2007 and mid-2012, over 60 new local public utilities (*Stadtwerke*) were set up and more than 190 concessions for energy distribution networks have returned to public hands.[72] In July 2018, the city of Barcelona established an electricity distributor that will compete in the existing energy market in 2019. The goal of Barcelona Energia is to develop locally-generated renewable energy, advance energy efficiency, and fight energy poverty. The cities of Cádiz and Pamplona are also considering a similar approach.[73] Energy cooperatives have also been established, although many such cooperatives have been operating successfully for many years. In the Philippines, energy democracy advocates envisage a new role for cooperatives in the transition to a more sustainable energy system.[74]

Another approach is to reclaim the power utilities to their public mission so they can drive renewables – sometimes called Utility Owned Generation or UOG. This approach rejects the idea that projects over a certain size have no place in a democratic energy system, especially when small, local-level projects are not guaranteed to escape the reach of private corporations.[75] Globally, a number of unions believe that energy democracy will entail a wholesale reorientation of most existing public companies, a redefining of the political economy of energy around truly sustainable principles, and a new set of priorities. The National Union of Metalworkers of South Africa (NUMSA) and the Canadian Union of Public Employees have talked in terms of reclaiming or resocializing entities that were once privatized or marketized.[76] In Puerto Rico, the power sector union UTIER opposes plans to privatize the public utility (known as PREPA) and has instead called for a transition to public renewable energy led by a radically reformed public company.[77]

In the UK, a national approach to reclaiming energy is taking shape. The opposition Labour Party is currently working with unions and environmental allies to

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71 Krause, M. B. (2013, October 11). Thousands of German Cities and Villages Looking to Buy Back Their Power Grids. *Greentech Media*. www.greentechmedia.com/articles/read/Thousands-of-German-Cities-and-Villages-Looking-to-Buy-Back-Their-Power-Gri#gs.niSGUJc

72 Hall, D., et al. (2012, November). *Re-municipalisation in Europe*. PSIRU. www.psiru.org/reports/re-municipalisation-europe.html

73 Barcelona City Council. (2018, June 30). Barcelona Energia flicks the switch. www.barcelona.cat/infobarcelona/en/barcelona-energia-flicks-the-switch_683855.html

74 Fortaleza, W. (2016, September 24). Unions in Philippines Commit to Defend Power Generation Cooperatives, Drive Public Renewables. *TUED*. http://unionsforenergydemocracy.org/unions-in-philippines-commit-to-defend-power-generation-cooperatives-drive-public-renewables

75 Moynihan, M. (2010, February 4). *Electricity 2.0 Unlocking the Power of the Open Energy Network (OEN)*. Washington, DC: NDN and the New Policy Institute.

76 National Union of Metalworkers of South Africa. (2012, February). Statement from International Conference on Building a Renewable Energy Sector in South Africa, Johannesburg, 4–8 February 2012; *Trade Unions for Energy Democracy*. (2013, April 17); Canadian Union of Public Employees Says Public Ownership of Energy Is Key to Winning the War Against Climate Change. http://energydemocracyinitiative.org.

77 Trade Unions for Energy Democracy. (2018, March 13). UTIER's Proposals on the future of PREPA and the power (and water) sectors in Puerto Rico. *TUED*. http://unionsforenergydemocracy.org/utiers-proposals-on-the-future-of-prepa-and-the-power-and-water-sectors-in-puerto-rico establish as many as 200 public municipal energy companies, should the Party win the next General Election.[78] If successfully implemented, the UK could become the champion of energy democracy across the EU. Brexit has created space for an alternative pro-public approach to energy, but with the EU's energy and climate policy in disarray (marked by missed emissions targets and collapsing levels of renewable energy investment and deployment due to the withdrawal of subsidies), other member states could, over time, challenge the current EU policy and its dogged pursuit of neoliberal objectives.

78 Labour Party. (n.d.). Our Manifesto. https://labour.org.uk/manifesto

CONCLUSION

The challenges posed by the need to limit overall warming to 1.5 degrees or even to «well below 2 degrees» will require an energy revolution and a sustained movement of global proportions that is committed to an integrated and transformative approach to an energy transition. The examples of energy democracy mentioned above provide a glimpse into a different energy future, but they do not – either separately or in sum – provide all of the answers. If the idea of energy democracy is to be at the heart of a *transformative* transition, we must be clear about the political and social objectives we aim to achieve. Such clarity can bring consensus, allowing us a chance to mobilize all of the human and technical potential needed to meet the formidable challenge of achieving a «net-zero» future.

Local initiatives are crucially important, but so are national and even global projects that can move both people and resources behind an inspiring vision of change at the level of political economy. Many of the struggles in today's efforts are erecting a series of community-based and city-level platforms from which to launch a more comprehensive effort to reclaim energy systems in the future.

But while small is often beautiful, large is not always ugly. Rejecting capture and removal technologies makes sense today, but a transformational movement will need to take ownership of the various technical challenges that are being posed by the need for both radical decarbonization and demand reduction. Overcoming these challenges will require a system-level approach to energy, large-scale sector restructuring, and an important role for regional and national governments. Democracy and popular participation must operate at *all* levels.

Another energy is possible, but she is not yet on her way. To advance this, we need a mammoth movement-driven political effort united around an all-out fight for a seismic shift in climate policy towards a public-goods approach. This is inseparably tied to the need for a decisive shift towards democratic control and social ownership of energy at all levels.

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By Mariel Vilella

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The author

Mariel Vilella is Zero Waste Europe's Managing Director. Zero Waste Europe's mission is to empower European communities and change agents to redesign their relationship with resources, to adopt smarter lifestyles and sustainable consumption patterns in line with «circular» resource management.

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INTRODUCTION

Over the last decades, action on climate change has concentrated on the sectors perceived to be contributing the most to the problem: primarily the energy and transport sectors, with special attention to the use of fossil fuels. While these sectors are undoubtedly important, keeping global warming below 1.5 degrees Celsius requires a much deeper and wider look at the way our economy operates, analysing our production and consumption habits in particular and resource management in general.

On the one hand, our linear economy, having led to a global and rapid increase in resource extraction, is as responsible for climate change as any other fossil-energy intensive source of greenhouse gas emissions. Its basic logic consists of extracting primary natural resources, producing an ever increasing amount of products generally designed not to last and involving dubious toxic impacts and environmental standards, transporting them all over the world by energy-intensive means, ensuring quick and compulsive consumption, and finally disposing of them in landfills or incinerators. In this sense, the linear economy is not only driving over-consumption and unsustainable exploitation of natural resources, but it also contributes to an ever increasing spiral of waste production, a highly problematic output in itself.

Waste, the end result of the linear economy – the mix of plastic, paper, food waste, and any random bit one may come across on a daily basis – contributes to climate change at its disposal stage once it is generated and taken away from households to landfills and incinerators. Emissions from organic waste rotting in landfills and from waste burnt in incinerators contribute 6.6 % of total anthropogenic greenhouse gas emissions.[1]

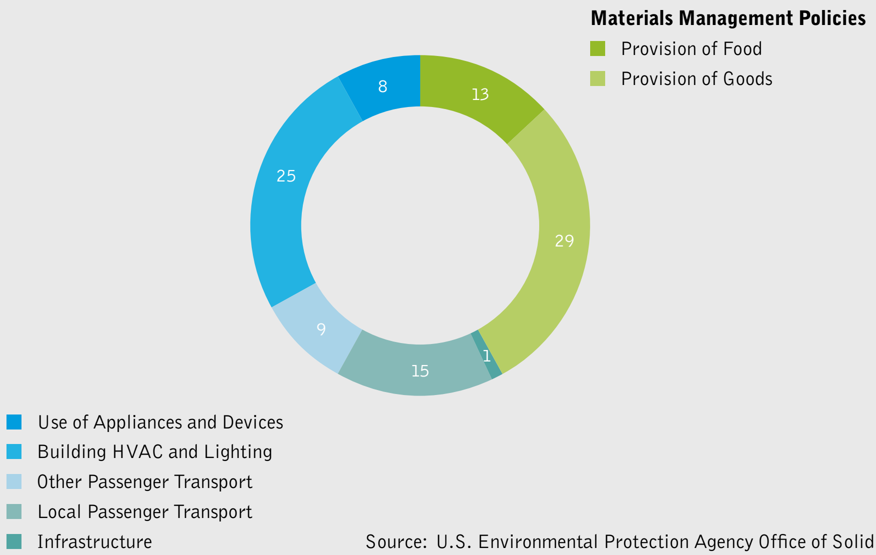
However, waste is not only an issue at the disposal stage. Waste itself is made of natural resources that have been extracted, manufactured, transported, consumed, and eventually disposed of, and all these steps in the linear economy system give rise to a major portion of the global anthropogenic greenhouse gas emissions that are effectively embedded in the products we consume and discard.

Thus, looking at the entire life-cycle of a product, the amount of greenhouse gas (GHG) emissions is large and significant. For example, it has been estimated that

1 Fischedick, M., et al. (2014). Industry. In IPCC, *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. (Edenhofer, O., et al. [Eds.]). Cambridge and New York: Cambridge University Press.

materials management – in other words, the provision of goods and food – was associated with 42 % of U.S. anthropogenic GHG emissions in 2006 (Fig.1).[2]

Figure 1: Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices



Source: U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response; own chart.

Unfortunately, the accounting guidelines set up by the Intergovernmental Panel on Climate Change (IPCC) for national greenhouse gas emissions inventories do not follow a life-cycle approach. For the waste sector, the inventories only require the reporting of emissions produced in landfills and incinerators. This accounting loophole, added to other methodological gaps in the greenhouse gas accounting systems which are explored further below in this chapter, presents a misleading picture of the potential contribution of resource management to climate change. In sum, the potential contribution of waste prevention and management to keeping global warming under 1.5 degrees Celsius could be far greater than the total reported emissions under the «waste» part of the inventory reported to the UNFCCC.

Opposite to the linear economy, the basis of a circular economy is a zero waste society, where everything that we produce and consume can return safely to nature or society. The IPCC already recognizes that programs that reduce, reuse and recycle

2 U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response. (2009). *Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices*. www.epa.gov/sites/production/files/documents/ghg-land-materials-management.pdf

municipal waste are effective and high-impact means of reducing greenhouse gas emissions.[3] But in fact, a zero waste circular economy goes beyond the model of the 3 Rs and proposes a much more comprehensive transformation of our production and consumption patterns to achieve high resource efficiency and move towards zero waste and zero emissions.

Zero waste solutions, alongside climate action in other sectors, can be a game-changer to achieve the global target of a maximum of 1.5 ºC global warming, embracing the principles of conservation of materials, reduction of toxics, equitable distribution, and access to resources.

Moreover, these solutions – including waste reduction, redesign, composting, biogas, producer responsibility, consumption habits transformation, community empowerment, and recycling – could be implemented today, using existing innovations, with immediate results.

In cities and regions around the world, cooperatives of recycling workers, visionary policy-makers, and innovative practitioners are showing that zero waste is a viable strategy. In contrast to the primitive idea of burning waste, zero waste solutions create livelihoods, save money, and protect the environment and public health. These efforts go hand-in-hand with clean production, producer responsibility, and waste minimization programs for dangerous and hard-to-recycle materials. Together, these practical, bottom-up strategies provide some of the most decentralized urban solutions for reducing climate pollution, conserving energy and natural resources. They present enormous opportunities for developing local economies.

3 IPCC. (2014). op. cit.

A systemic game-changer to climate change

A zero waste circular economy has critical climate implications. The bottom line is that zero waste programs ultimately result in less demand for virgin materials whose extraction, transport and processing are major sources of greenhouse gas emissions, and thus they reduce emissions in virtually all industries and economic sectors.

Moreover, the successful implementation of a zero waste circular economy will provide significant other environmental, social and economic benefits, such as resource efficiency, job creation, low-carbon prosperity, a healthy environment, clean production and sustainable consumption.

But to ensure such success, it is necessary to undertake a comprehensive approach. The transition to a zero waste circular economy requires fundamental changes across the entire economy based on the following interdependent pillars: constant reduction of residual waste via waste prevention and maximization of material recovery through separate collection schemes, product and process redesign, flexible waste treatment facilities, reforming renewable energy policies and greenhouse gas accounting methodologies and supporting the development of worker-led schemes – all of which is the operational translation of the overarching principles of the circular economy.

Waste prevention

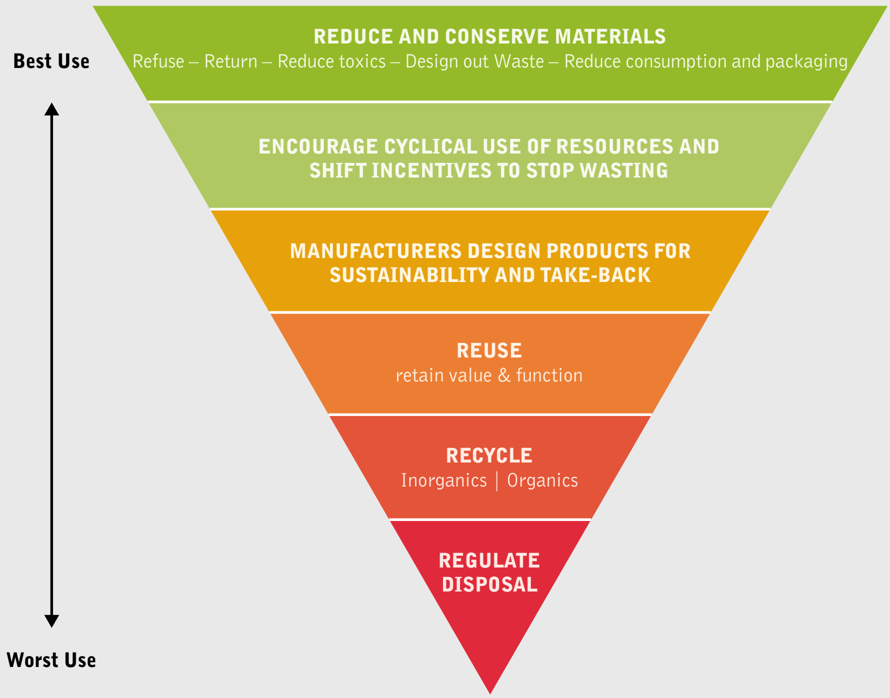
It goes without saying: the best waste is that which is never produced in the first place. Indeed, waste prevention and reduction is the most preferred option in the Waste Hierarchy in terms of sustainability (Fig. 2),[4] and the most effective option for climate change mitigation in resource management.

The effects of the different options are shown in conventional terms (excluding biogenic CO_2 emissions) in Figure 3.[5] As this shows, the main benefits come from waste prevention, while waste disposal, including incineration with energy recovery (known as waste-to-energy incineration), tend to make contributions to climate change emissions rather than helping to reduce emissions overall.

4 Waste Hierarchy. Reprinted from «From the 3Rs to the Zero Waste hierarchy», In *Zero Waste International Alliance*, 2013. https://zerowasteeurope.eu/2013/04/zero-waste-hierarchy

5 Eunomia. (2015). *The Potential Contribution of Waste Management to Climate Change Mitigation*. www.zerowasteeurope.eu/downloads/the-potential-contribution-of-waste-management-to-a-low-carbon-economy

Figure 2: Waste Hierarchy, indicating the order of preference for waste management options based on sustainability.



Source: Adopted by ZWIA board March 2013; own chart.

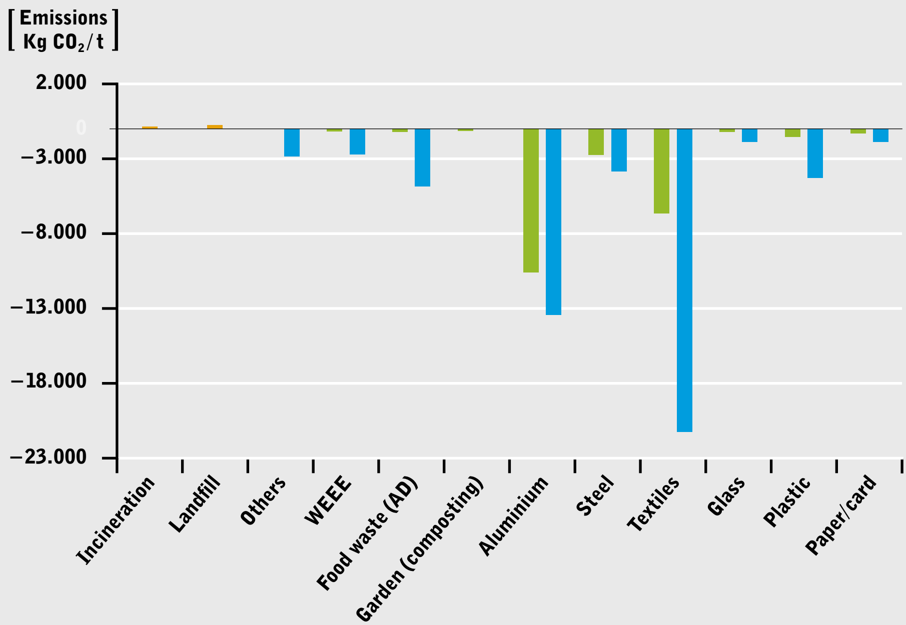
Textiles, aluminium, food waste and plastic are among the top waste streams that can be critical to climate change mitigation, if reduced.[6] In textiles production for example, greenhouse gas emissions totalled 1.2 billion tonnes of CO_2 equivalent in 2015, more than those of all international flights and maritime shipping combined, mainly due to the fast fashion nature of global production and consumption rates of clothing products. If only the average number of times a garment is worn were doubled, GHG emissions would be 44 % lower.[7] A zero waste circular economy for textiles including high rates of clothing utilization, improved recycling, and reduced waste in production would reduce the negative impacts.

Similarly, the benefits from food waste prevention are significant: to the extent that separate collection of food waste can give rise – in both households and businesses – to enhanced awareness of what is thrown away (hence motivating a

6 Eunomia. (2015). op. cit.

7 Ellen MacArthur Foundation. (2017). *A new textiles economy: Redesigning fashion's future*. www.ellenmacarthurfoundation.org/publications/a-new-textiles-economy-redesigning-fashions-future preventive effect), the benefits of such an approach become even greater. Data used to elaborate Figure 3 indicate that every tonne of prevented food waste saves 4.5 tonnes CO_2 eq.

Figure 3: Indicative Climate Change Impacts of Key Waste Management Activities
(exclusive CO_2 from biogenic sources)



Residual waste treatment
Recycling & composting
Avoided production (waste prevention)

Source: Eunomia 2015; own chart.

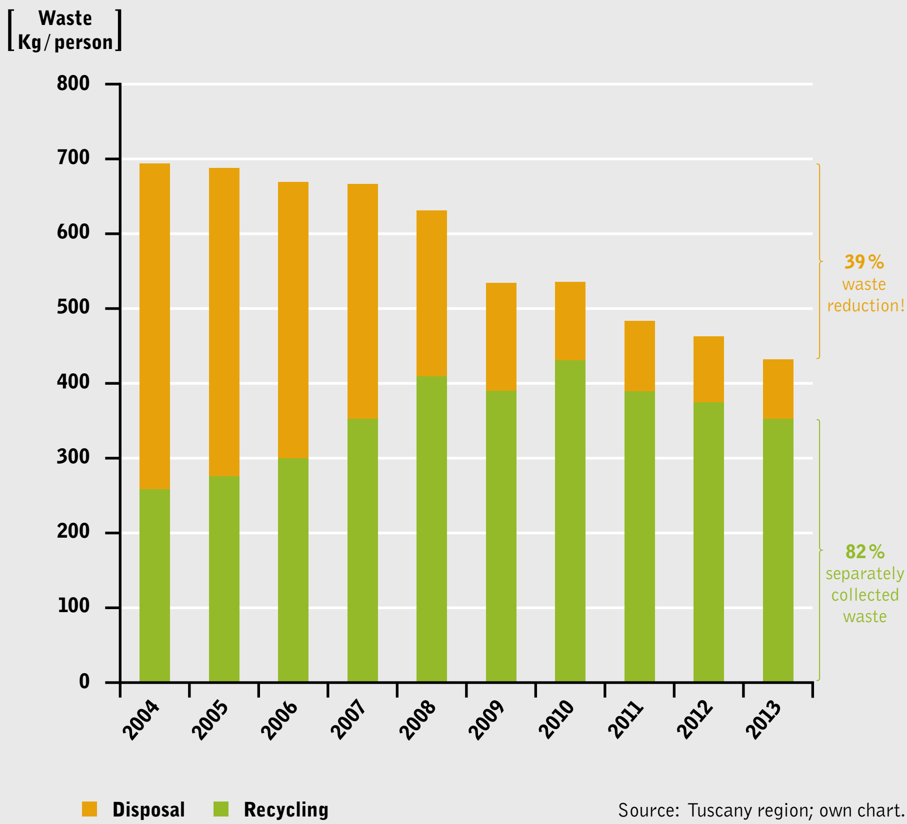
Maximization of material recovery

If prevention is not possible, a zero waste circular economy system ensures that any discards from our consumption are safely and efficiently recovered. In doing so, it ensures a continual reduction in residual waste per capita (the waste that isn't prevented, reused, recycled or composted) and a radical increase in resource efficiency.

Such a system requires separating waste at the source in order to reuse, repair, and recycle inorganic materials, and compost or digest organic materials. The introduction of such a system has proven to be a key element of success in, for example, Capannori (Italy), the first town in Europe to sign up to a Zero Waste Strategy in 2007, committing to sending zero waste to disposal by 2020.

In Capannori, door-to-door collection was introduced in stages across the municipality between 2005 and 2010, starting with small villages, where any mistakes could be identified and corrected early on, then extended to cover the entire municipal area in 2010. By that time, 82 % of municipal waste was separated at source, leaving just 18 % residual waste to go to landfill. Since this went hand in hand with a sharp reduction in waste arisings, the combined effect was an even more marked minimization of residual waste.

Figure 4: Evolution of separate collection and waste generation in Capannori 2004–2013



Source: Tuscany region; own chart.

Separate collection of organics is one critical step within the general waste collection system, as it prevents the greenhouse gas emissions from organics rotting in landfills. This is particularly important in the rapidly developing countries, where municipal solid waste keeps increasing and methane emissions from landfills alone are expected to increase almost 50 % between 1990 and 2020.[8] Methane's short-term, heat-trapping effects are severe; over the next 20 years – the period of time during which effective action on global warming is most crucial – methane's potential to trap heat in the atmosphere is 72 times greater than that of CO_2, on a per tonne basis.[9] Therefore, curbing methane emissions is critical to preventing catastrophic climate change, as methane is second only to CO_2 as a man-made driver of global warming.[10]

Moreover, recovering organic waste contributes to closing the nutrients loop, and it allows vital components such as nitrogen, phosphorus and potassium to return to the soil in the form of compost, effectively capturing carbon and improving crop resilience, along with increasing the water retention capacity of the soil.[11] In turn, the use of compost avoids the use of chemical fertilizers and supports a pesticide-free agriculture, which delivers further greenhouse gas emissions savings, along with job creation and health benefits.

The climate benefit of material recovery maximization can be further illustrated by recent research on the Circular Economy Package, approved by the European Commission: assuming the implementation of 70 % recycling, 30 % food waste reduction, and 80 % recycling of packaging waste, the EU would save 190 million tonnes CO_2-eq/year, which would be the equivalent to the total annual emissions of the Netherlands.[12]

Regarding the implementation and further encouragement of a separate collection system, it is vital to address the economic incentives. Pay As You Throw programs, where households are charged a tariff based on how much residual waste they present for collection to the local authority, are an effective tool in increasing waste separation and recycling, and also encourage waste minimization. In Capannori, the new waste tariff implemented in 2012 through a Pay As You Throw scheme incentivized better separation and prevention, and was later followed by many other municipalities, driving local source separation rates towards 90 %.

8 Bogner, J., et al. (2007). Waste Management. In IPCC, *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. (Metz, B., et al. [Eds.]). Cambridge and New York: Cambridge University Press.

9 Summary for Policymakers. In IPCC. (2007). *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. (Solomon, S., et al. [Eds.]).Cambridge and New York: Cambridge University Press.

10 IPCC. (2001). *Climate Change 2001: The Scientific Basis*. (Houghton, J. T., et al. [Eds]). Cambridge and New York: Cambridge University Press. http://pubman.mpdl.mpg.de/pubman/item/escidoc:995493/component/escidoc:995492/WG1_TAR-FRONT.pdf

11 See several papers on this published by the Marin Carbon Project. www.marincarbonproject.org/science/paper

12 Zero Waste Europe. (2018, May 18). Press Release: European Commission steps forward to cut on single-use plastics – but it's just the beginning. https://zerowasteeurope.eu/2018/05/european-commission-steps-forward-to-cut-on-single-use-plastics-but-its-just-the-beginning

Redesigning and phasing out products

Once optimal separate collection is in place, the residual waste fraction – that which is left over because it is either too toxic to be safely recycled or is made out of non-recyclable materials – becomes evident, and industrial design mistakes and inefficiencies can be studied and corrected. If it cannot be reused, composted, or recycled, it should be redesigned to meet the optimal standards for clean production, repairability, reusability or recyclability, or not produced in the first place.

If products cannot be redesigned, innovative alternatives should be found and obsolete products should be phased out. This is particularly important when it comes to plastic-based products: recycling plastic, on account of inherent technological and organizational constraints, will not be enough to reduce plastic production, consumption, subsequent disposal and dispersal into the environment. This is where product bans can be instrumental. Recent successful campaigns to ban plastic bags, straws, and other single-use products have shown the potential of product bans to reduce waste and greenhouse gas emissions. The European Commission recently announced clear legislative measures in this direction.[13]

Within this pillar, it's important to emphasise clean production. Toxic substances should be avoided at the design stage to allow products and materials to circulate in a closed loop without endangering the quality of materials and the health of citizens, workers and the environment. This requires changing our approach to toxic substances so that in a circular economy, hazardous substances will not hinder the processes of reuse, repair and recycling. Authorizing the inclusion of toxic substances in recycled products seriously threatens the credibility and economic model of the entire recycling industry.[14]

This strategy requires engaging with producers, pushing ambitious policies on Extended Producer Responsibility (EPR) and encouraging change in design systems. For instance, in Norway the deposit and return system for one-way beverage packaging has not only reduced litter and its associated costs and has achieved collection rates above 90 %, it has also affected the design of beverage packaging. Now a limited number of materials are used, all of them recyclable, hence ensuring they will be recycled. In the meantime in France, EPR systems with modulated fees have been used beyond packaging to cover items such as furniture or graphic paper, with a bonus-malus system that incentivizes the use of non-toxic recyclable materials and penalizes the toxic or non-recyclable ones.

Reforming energy and GHG accounting systems

As mentioned in the introductory section, the current climate and energy policies fall short of addressing and fully utilizing the potential of the resource management

13 Zero Waste Europe. (2018). op. cit.

14 Zero Waste Europe. (2017, March). *Policy Briefing: Creating a Toxic Free World: avoiding a collision between the EU and the Circular Economy*. http://zerowasteeurope.eu/wp-content/uploads/edd-free-downloads-cache/ZWE_PolicyBriefing_decaBDE-2.pdf sector. Most importantly, several issues regarding the greenhouse gas emissions accounting methodology are misleading political action.

In the first place, the GHG emissions accounting methodology for IPCC inventories only looks at disposal treatment (incineration, landfill), appearing to be a minor contributor to climate change. Certainly, other stages in the resource management chain, such as extraction and transportation, may be addressed through other sectoral analyses, but compartmented analyses miss the full picture and overlook the contribution of the upper tiers of the Waste Hierarchy, which ultimately prevents proper guidance for waste and climate policies.

This situation is further exacerbated by the national GHG inventories being solely focused on emissions from national production and ignoring national consumption. The consumption-based approach captures direct and lifecycle GHG emissions of goods and services (including those from raw materials, manufacture, distribution, retail and disposal) and allocates GHG emissions to the final consumers of those goods and services, rather than to the original producers of those GHG emissions. In this way, wealthy countries with delocalized production and high consumption levels may appear to be lowering their contribution to climate change in their national emissions reporting, painting a misleading picture of how important it is to address wasteful consumption in order to tackle climate change.

Another key issue to be addressed within the emissions accounting methodologies is the misleading assumption that biogenic emissions resulting from burning organic or biomass waste can be considered zero or carbon-neutral. As Eunomia put it: «It is a mistake to assume that CO_2 from non-fossil sources does not matter [...]the only correct way to process is to account for emissions of all greenhouse gases since they will all have ‹warming potential›, irrespective of their origin».[15]

The assumption that burning organic waste is carbon-neutral has expanded to assume that it's a source of renewable energy, as in the European Union and many other countries which have consequently allowed energy policies to support various forms of waste-to-energy processes, both from the separately collected organics and from the mixed municipal and industrial waste. In the case of renewable energy subsidies for incineration of waste, this has driven the expansion of this polluting and resource-destructive, hence GHG intensive, industry. In the EU, fortunately the revision of the Renewable Energy Directive may, if finally approved, put an end to these subsidies.

Instead of providing economic incentives to burn waste, new methodologies must be developed to account for, and reward, the preservation of energy embedded in products or materials. Premiums for energy from waste incineration distort markets. Therefore they should not be considered unless there is a level playing field with embedded energy conservation, taking into account the reduction of greenhouse gas emissions from prevention, reuse or recycling in all comparisons. There is huge potential in preserving the energy embedded in products and materials and

15 Eunomia. (2015). op. cit.

preventing them from becoming waste; far more than can be generated by burning or landfilling them.

Development of communities and local economies

A successful zero waste circular economy must also be an inclusive and equitable one, giving priority to job creation and respect for workers' rights. Inclusive zero waste systems ensure that resource recovery programs include and respect the community and all social actors involved in resource conservation, especially informal recyclers whose livelihoods depend on discarded materials.

In the Global South, recycling provides a livelihood for approximately 15 million people worldwide – 1 % of the urban population.[16] These are self-employed workers, mostly in the informal economy, who retrieve reusable and recyclable items from the waste stream. They collect, sort, clean, and in some cases, process the recyclables, returning them to industry as an inexpensive and low-carbon raw material.[17]

In doing so, waste pickers can be incredibly efficient recyclers and thus represent a huge opportunity to reduce GHG emissions through increased recycling rates, if given proper recognition and support. In Delhi, the annual GHG emissions savings that the informal sector brings to the city is estimated to be 962,133 T CO_2-eq,[18] which is over 3 times more than other waste projects slated to receive carbon credits in the city.[19]

Today, waste pickers are increasingly organized all over the world. Key victories include the case of Bogotá, where the Constitutional Court has required the local waste management plans to incorporate informal recyclers after a long legal battle.[20] The Goldman Prize awarded in 2013 to Nohra Padilla, one of the Bogotá Recyclers Association leaders, was a major victory in gaining global recognition and visibility. In India, cooperatives of waste pickers in Pune or Mumbai run waste collection and management services for the city with outstanding results.[21]

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16 WIEGO. (2012). *Urban Informal Workers and the Green Economy*. www.wiego.org/sites/wiego.org/files/resources/files/WIEGO_Urban_Informal_Workers_Green_Economy.pdf

17 For more information on waste pickers, see Samson, M. (2009). *Refusing to be Cast Aside: Waste Pickers Organizing Around the World*. Cambridge, USA: Women in Informal Employment: Globalizing and Organizing (WIEGO).

18 Chintan. (2009). *Cooling Agents. An Analysis of Greenhouse Gas Mitigation by the Informal Recycling Sector in India*. www.chintan-india.org/documents/research_and_reports/chintan_report_cooling_agents.pdf

19 Vilella, M. (2012, April). *The European Union's Double Standards on Waste and Climate Policy*. Global Alliance for Incinerator Alternatives. www.no-burn.org/eu-double-standards-on-waste-management-climate-policy

20 Yler, M. (2015). Case Study on Bogotá. In UNEP and ISWA (Eds.). *Global Waste Management Outlook*. www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/E-Learning/Moocs/Solid_Waste/W1/Global_Waste_Outlook_2015.pdf

21 Global Alliance for Incinerator Alternatives. (2012). *On the Road to Zero Waste. Successes and Lessons from Around the World*. www.no-burn.org/on-the-road-to-zero-waste-successes-and-lessons-from-around-the-world-2

In sum, workers who handle waste should therefore be fully integrated into the design, implementation, and monitoring processes, as it is the application of their skills and efforts which ultimately make the system function. Moreover, by prioritizing job creation in a zero waste circular economy, the significant investments necessary for creating incineration infrastructure can instead be redirected to developing re-use centres and networks, recycling infrastructure and clean renewable energy, all of which require more, better quality jobs than incineration and landfilling. In the EU, the job creation prospects related to the full implementation of the existing EU waste legislation is estimated to be up to 400,000 jobs.[22]

Ultimately, zero waste builds on democratic tradition and strong community action to determine the direction of waste management programs. Citizens need to be part of the very design of the plan, and a lengthy initial consultation process can pay off with better design and higher participation rates. Residents must actively participate in the programs by consuming sustainably, minimizing waste, separating discards, and, whenever possible, composting at home. They should also be given the chance to be active in monitoring the implementation of programs in their community.

Phasing out waste incineration and landfills

Open dumps, landfills, and incinerators (including so-called waste-to-energy facilities) are part of a shortsighted and outmoded way of thinking that views waste disposal as cheap because true costs are not taken into account. Waste-to-energy is often described as a good way to extract energy from resources, but in fact it works against the circular economy, producing toxic waste, air pollution and contributing to climate change – all without delivering what it promised. The costs of pollution, resource depletion, climate change, health problems, and human suffering are externalized onto the environment and people, including future generations.

Most importantly, burning waste is far from climate neutral. Incinerators actually emit more CO_2 (per megawatt-hour) than coal-fired, natural-gas-fired or even oil-fired power plants.

Denmark, the poster child of Europe's incineration industry, recently discovered that its incinerators were releasing twice the amount of CO_2 than originally estimated, which led the country to miss its Kyoto Protocol greenhouse gas reduction targets.[23]

In addition, incinerators are the most expensive method to generate energy and to handle waste, while also creating a significant economic burden for host cities.

22 Zero Waste Europe, et al. (2015, May 18). *Walking the Circle: The 4 guiding pillars for a Circular Economy*. https://zerowasteeurope.eu/2015/05/walking-the-circle/#_ftn7

23 Plastic surgery for Copenhagen's recycling policy. (2011, April 15). *Plastics Infomart*. www.plasticsinfomart.com/plastic-surgery-for-copenhagens-recycling-policy

The story of Copenhagen's infamous Amager Bakke incinerator is just an example.[24] There are many cases of municipalities that have ended up in debt because of incinerators, while others are trapped in long-term contracts compelling them to deliver a minimum quantity of waste for 20 to 30 years, to repay investment costs, even creating a situation of incineration overcapacity as is the case in many European countries.[25] On the other side of the Atlantic, the city of Harrisburg in Pennsylvania, due to financial costs of upgrading the city's incinerator in 2011, became the largest US city to declare bankruptcy.

Moreover, burning these valuable materials in order to generate electricity discourages efforts to preserve resources and creates incentives to generate more waste. It is typical for countries that encourage waste burning to have low recycling rates as a result, or high waste production. Data on household waste in Denmark clearly shows this trend, with the regions that have high incineration rates producing the highest amounts of waste per capita.

Ultimately, a zero waste circular economy moves societies away from waste disposal by setting goals and target dates to reduce waste going to landfills, abolishing waste incineration, establishing or raising landfill fees, shifting subsidies away from waste disposal and into discard recovery, and banning disposable products, among other interventions that contribute to ultimately setting a new direction away from waste disposal.

24 Nicastro, C. (2017, November 13). Copenhagen goes all in on incineration, and it's a costly mistake. *Zero Waste Europe*. https://zerowasteeurope.eu/2017/10/copenhagen-goes-all-in-on-incineration-and-its-a-costly-mistake

25 Muznik, S. (2017, October 31). «Deliver or pay», or how waste incineration causes recycling to slow down. *Zero Waste Europe*. https://zerowasteeurope.eu/2017/10/deliver-pay-waste-incineration-causes-recycling-slow

Quantitative analysis for GHG emissions savings

Research undertaken by Eunomia for European countries has suggested that even though much progress has already been made in respect of reducing climate change emissions from waste, «further savings of the order 100–200 million tonnes CO_2 equivalent could be made simply through conventional waste management approaches: conventional waste prevention measures could deliver more substantial reductions, whilst measures designed to achieve a circular economy could further enhance emissions reduction through reuse, repair and remanufacturing.

The level of these savings compares with the reported level of emissions from waste of around 143 million tonnes in 2012 for the EU under the waste chapter of the IPCC GHG inventory. Of this, around 100 million tonnes is related to solid waste management (the majority of the balance being due to waste water treatment). Consequently, it would appear that the potential for emissions reduction from waste prevention and management is likely to be of the order two times the reported level of emissions under the ‹waste› inventory».[26]

New analysis undertaken at a global level suggests that GHG emissions savings in the order of 900 million tonnes CO_2 eq. might be achieved by applying similar conventional waste management approaches to all countries across the globe – namely through increasing the recycling of materials such as paper, plastics and metals, alongside the collection and treatment of organic waste (including food). The basis for this estimate is data from the World Bank on global waste generation for 2025. It is further assumed that a recycling rate of 65 % is achieved by the lower income countries and 70 % by the high-income countries.[27] As with the above estimates for the European countries, further savings would be possible by applying waste prevention measures, as well as additional measures designed to achieve a circular economy (through reuse, repair and remanufacturing).

While data on repair and remanufacturing are relatively limited, the potential contribution from waste prevention activities can be considered in part with reference to the data shown in Figure 3 of this report. This shows that the emissions associated with the production of food that is wasted are around 4 tonnes CO_2 eq. – around 80 times that of organic waste treatment. The World Bank dataset indicates there will be over 950 million tonnes of organic waste in 2025 – much of which will

26 Eunomia. (2015). op. cit.
27 World Bank. (2012). *What a Waste: A Global Review of Solid Waste Management, Final Report*. https://openknowledge.worldbank.org/handle/10986/17388

be food waste. A 10 % reduction in the amount of organic waste produced would therefore result in similar emissions reductions figure to that obtained by improving conventional waste management techniques – in the absence of any other activities such as repair and remanufacturing. A 10 % reduction in each of the waste plastics and waste textiles streams could save another 150 million tonnes CO_2 eq.

The IPCC GHG inventory suggests that global emissions from waste are around 700 million tonnes CO_2 eq., excluding the waste water treatment impacts. However, only emissions from waste disposal – principally those relating to the landfilling of waste, and disposal of waste in incinerators without energy recovery – are recorded under the waste chapter of the inventory. As such, there is considerable further potential on a global scale to reduce emissions from the waste sector by following the approach set out above.

CONCLUSION

As explained in this chapter, a zero waste circular economy can be a game-changer to keep the planet under 1.5°C of global warming, and experience shows that this visionary future is far closer if we look beyond business-as-usual scenarios and similar conservative climate and energy policies. Unfortunately, some mainstream climate policies are effectively outdated and are preventing the greatest greenhouse gas emissions savings we could have in the waste and resource management sector. The zero waste (ZW) circular economy principles are increasingly being implemented around the world, and it is necessary that climate policies are upgraded and aligned with them, instead of applying double standards.

In the Global North, developed countries are shifting away from incineration and embracing zero waste paths. Europe, despite having some of the most advanced waste burning facilities, has taken a first step to phase out incinerators in the context of the EU Action Plan for the Circular Economy. In the US, no new incinerators have been built since 1997 due to resistance from the public, health risks and high costs. Moreover, hundreds of municipalities around Europe have now set zero waste as their new goal, with cities like Parma or Besançon taking the lead and implementing zero waste policies. Other cities, even without adopting a formal ZW commitment, are successfully implementing various elements of a wider zero waste strategy, such as Milan, which is spearheading kerbside collection and separation of food scraps in metropolitan areas. Barcelona, Paris, and Copenhagen have also implemented promising pilot projects in the same direction.

In the Global South, many innovative and visionary cities, with the support of recyclers' cooperatives and civil society, are engaging on a zero waste path too.[28] This is the case in San Fernando in the Philippines with 305,000 inhabitants, which stands out by achieving a 78% diversion rate for waste from landfill while revitalizing the local recycling economy through a cooperative of recyclers. It's important that international climate finance learns from these success stories and prevents investments in the opposite direction.[29]

Ultimately, a zero waste circular economy will require policies to make it legally and economically viable to sell services instead of goods, to sell durable goods that are repairable, reusable and upgradable, to promote shared or leased ownership, and to have deposit and return programmes. In short, resource consumption should be discouraged in comparison with product service, maintenance and repair

28 Global Alliance for Incinerator Alternatives. (2012). op. cit.

29 Vilella, M. (2017). *Climate Finance for the Waste Management Sector – Guidance for Policy-Makers and Project Developers*. Zero Waste Europe. https://zerowasteeurope.eu/downloads/climate-finance-for-the-waste-management-sector operations, which should become cheaper. This would mean taxation shifting from labour to resources, especially virgin resources, as this will help to increase employment and decrease resource use while incentivizing businesses to move towards circular production and consumption patterns.

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By Mladen Domazet

Edited by the Heinrich Böll Foundation

The Author

Dr Mladen Domazet is a philosopher-physicist and Research Director at the Institute for Political Ecology in Zagreb, Croatia. He focusses on degrowth research, its social, cultural and community aspects in the European semi-periphery, and the hegemony of economic growth.

Institute for Political Ecology (IPE) is a research and educational organisation that designs alternative development models and innovative institutional frameworks for a democratic political and economic attainment of justice, equality and ecological stability in contemporary societies.

Degrowth – A Sober Vision of Limiting Warming to 1.5°C
By Mladen Domazet
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T +49 (0)30 28534-0 **F** +49 (0)30 28534-109 **E** buchversand@boell.de **W** www.boell.de

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INTRODUCTION

You and I are not disinterested bystanders in the 6th massive planetary extinction on the only habitable planet we have access to. Modern civilization will not be a self-destructive blip in the history of life on Earth, nor a coldblooded destroyer of the majority of the world's people in an attempt to bring a handful of high-impact lifestyles within the planetary boundaries. We are fed and have food to share, and can be reflective and informed. For these reasons we are able to see how degrowth and limiting global warming to 1.5°C are intrinsically connected. Our fortunate vantage point of thinking through and discussing planetary climate stability provides us with the tools to see beyond the blinding size of global inequalities and abrupt climate destabilization, by reshaping the myths through which we connect ourselves to the world. The myths tell us humanity created the fossil economy for all to thrive and had to end in this global climatic predicament, locked-in now into drastic natural degradation and further destructive struggles over insufficient life supplies.[1]

Beyond the myths lies the century that came about from a global understanding of the role that fossil fuels played in the driving of climate change and the social organization of everyday life's reproduction up to now. In this future people understand that there is excess energy available in the Earth system from the incoming sunshine, even after it is shared with the other living beings and geological processes. Our descendants strive to collectively better understand how that excess energy can be harnessed through technologies that maintain stability and power flourishing of their communities with minimal disruption to the non-human ecosystems already destabilized by global environmental change in 21st century. And they repeatedly renegotiate where to direct the excess energy after their basic needs have been met. Excess energy that they do not treat as a scarce resource, but as a supply of frugal abundance. They know that globalized capitalism and the periodic «catch-up socialist productivism» were not by-products of technological development, but a social organization of production and consumption of things motivated by the cultural imperative to expand the accumulation of profits after sale. And they choose to organize differently.

They work in democratically self-managed productive open collectives and care units when they are not in need of solitary creative autonomous expressions. Collectives are nested in larger collectives that eventually provide the complex goods and services that their society uses and exchanges with others. They read from libraries and study in freely available schools and universities. They change professions

1 Klare, M. T. (2012). *The Race for What's Left*. New York: Metropolitan Books. See also: Welzer, H. (2012). *Climate Wars: why people will be killed in the twenty-first century* (Tr. P. Camiller). London: Polity Press.

throughout lifetime and communicate with like-minded professionals around the world. They extract nourishment from a broad variety of living organisms, but are not at every period able to choose everything any one of them might have a taste for. Most of their food comes from a variety of farming patches no more than 100km away. They largely live in urban cohabitation and travel by ground-based energy efficient public transport. The cyclists among them prize the beauty of their legs at any age. Conviviality, a shared use of abstract and material tools and knowledge, rather than individual striving for domination of the commodified social and natural environment guide their personal choices and development. The material form of their freedom is care for each other and their environment.

They burn next to no fossil fuels, by relocalizing most of production and consumption and deliberating on the material global outreach of their different cultures around the globe. No community knowingly uses material or cultural power to dominate other communities, but communities live very different lives. All are considerate travellers, reflecting collectively on the costs and benefits of their aggregate people and goods movements.

Our descendants at the end of 21st century know they live in the shadow of the Great Thermocene,[2] a rapid capital-driven expansion of the fossil fuel based productive infrastructure and competition for explosive accumulation of the collective surplus of the fossil energy transformation.[3] Their climate and the ecosystems dependent on it will for a thousand years carefully balance the tipping points of catastrophic climate change and ecosystems' collapse induced by the global inflation of structural competition for domination, the pre-degrowth.

In their book and film clubs they will long continue to discuss the pros and cons of being born close to that historic epoch, studying the culture of growth so as to distinguish it from diversification and flourishing at many levels of natural, individual and community existence. They will study how the degrowth transition came about in the nick of time to spare the billions in the Global South the misery of violent and unalterable destruction and to spare a billion in the Global North the spirit-crushing drudgery of «bullshit jobs» within an economic grinder machine moving liberation from scarcity forever just out of reach.[4]

They identify our inaction, our paralysis before the necessary social change, in the cultural lock-in of the myths of technological progress and private bearers of all «capital» necessary for progress (natural, material, intellectual). We face scarcities despite mass overproduction of commodities of all kinds through hearty attachment to private property at every level of life, from simplest of tools to whole ecosystems. These illusory scarcities, socially created chimera for sorting who is «better» among us, keep us feeling short-served and submissive to persistent wage-slavery to gain more access and diminish the pain of scarcity a little. At the same time, 2 billion of our fellow humans are hungry whilst enough food is produced to nourish the whole 7 billion

2 Following Thierry Sallantin, see: Bonneuil, C. and Fressoz, J-B. (2016). *The Shock of the Anthropocene (tr. David Fernbach)*. London: Verso.

3 Morton, T. (2017). *Humankind: solidarity with non-human people*. London: Verso.

4 Graeber, D. (2011). *Debt: The First 5000 Years*. New York: Melville House.

and leave some over for the forthcoming 3 billion more in this century.[5] Hunger is a material scarcity of the first degree and we fear lest it should befall us (again), committing to more work and more throughput to gain a little more capital.[6] Yet many are out of job or in insufficiently paid precarious temporary work placements that offer little security and emancipation, but don't trust those in similar positions to be equally concerned about global unsustainability.

The sober vision of the degrowth future is still obscured by the myth of rational technological transformation necessarily driving the social organization that provides the present day material comforts. Eventually, the myth promises, work and accumulation will eliminate wants for all, along with the waste by fully conserving processing energy and materials. It is purely inadvertently that this social organization and production power (energy and technology) landed us in the climate catastrophe and the greatest inequality between human individuals that the world has ever seen. For the selected few the myth is a reality today, they see no waste and struggle to select wants that will identify them, at the expense of over 7 billion others.

This myth of technology-as-development does not allow us to see the existing low-carbon lifestyle practices as anything but misery in need of more investment and technology to overcome scarcity.

The world of precariously balanced cooler climate and bright degrowth self-aware humanity starts in our world today. It begins when we finally turn away from the paralysing myths:

I) that growth driven mitigation of climate change can finally become just,
II) that current social organization and climate crisis were inadvertently produced by the rational technological improvements of individual lives around the globe,[7] and
III) that new technology within the same social organization will neutralize («sequester and store»; GCCSI, 2015) the causes of climate catastrophe.

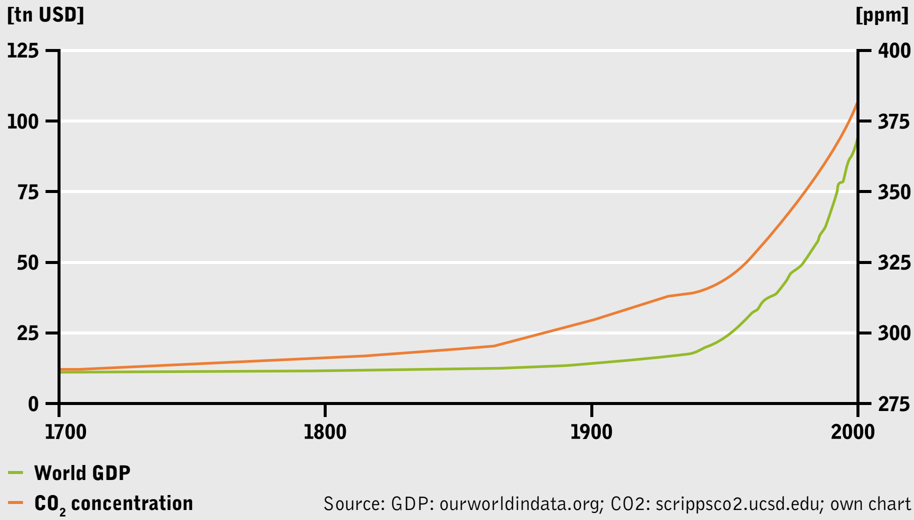
It is a cultural change followed by a material transformation, in the nick of time to avoid crossing the 1.5°C of planetary warming and experimenting with ecological and geological tipping points. This is followed by an honest look at environmental and cultural impacts of our collective practices and infrastructures. Finally, an honest empathy with distant fellow humans, a solidarity across the one and only planet is acknowledged. But first, we realize that distrust of other humans on the same planet, wage-slavery, scarcity of fashionable novelties and disgust at manual farming do not give us flourishing fulfilment. *We've had enough!, we say.*

5 Hickel, J. (2017). *The Divide: a brief guide to global inequality and its solutions*. London: William Heinemann.

6 Lewis, S. L. and Maslin, M. A. (2018). *The Human Planet: how we created the Anthropocene*. London: Penguin.

7 Mokyr, J. (2017). *A Culture of Growth*. Princeton, NJ: Princeton University Press. See also: Bonneuil and Fressoz, 2016, op. cit.

Figure 1: World GDP and CO_2 concentration
Total output of the world economy and ice-core CO_2 concentration from 1700-2015



Source: GDP: ourworldindata.org; CO2: scrippsco2.ucsd.edu; own chart

Growth, as a motive and icon, was supposed to produce greater wealth to be used as an instrument with which to increase the reach and range of human choice, of freedom from drudgery, of flourishing. But historically the link between the dominant growth trend and the flourishing of choices has not been the case for most of the human population, even with the increasing rate of aggregate growth over the last two centuries. When we look around, we see that the benefits of growth have been unequally distributed, to the level of different orders of magnitude (10x, 100x and more) and not just two-fold or three-fold. Colossal inequality of attainment, what I get, paired with equality of ambition, what I know I could have, has frustrated most freedoms materially attained. And the greenhouse gas concentration has risen from the long-term «stable» range of the last 100 centuries to the critical threshold today mostly within one century. What makes the growth focus a desirable aim for the human population living with climate instability, whilst its benefits barely reach them at all? What makes the focus on growth the strategic imperative for those of us who understand climate justice to be inseparable from climate stability eked out through limiting warming to 1.5°C?

We shall initiate and they, the next generation, will maintain the preservation of average global temperature below 1.5°C of warming relative to the preindustrial average, through societies organized differently. They will be using fewer resources and structuring production, consumption, use and reproduction differently. Crucially this will include a reduction in emission of climate change driving greenhouse gases, primarily from energy production, transport and land-use (change).

Whatever emissions pathway, whatever carbon budget we focus on and distribute among people in this century, we must and will reach net zero emissions in less than

40 years, half a lifetime. Degrowth, cultural change and human solidarity are the surefire way to start achieving that vision now.[8]

Recognizing the difference between the contributions to the problem by the poorer countries and their suffering of current climate change costs shows how unjust the growth imperative is in the joint global fight against climate change. Climate Vulnerability Monitor points out that poorer countries contributed around 30% of cumulative carbon emissions, but will suffer around 90% of the economic costs of climate change impacts by 2030.[9] 99% of the human death toll associated with these impacts happens to the poorer people in poorer countries. All this time growth and development are to go on globally. Let's be honest about climate justice.

8 Millar, R. J. et al. (2017). Emission budgets and pathways consistent with limiting warming to 1.5 °C. *Nature Geoscience* 10: 741-747. See also: Peters, G. P. (2018). Beyond carbon budgets. *Nature Geoscience* 11: 378-380.

9 DARA and the Climate Vulnerable Forum [DARA]. (2010). *Climate Vulnerability Monitor 2010 – «The State of the Climate Crisis»*. Fundacion DARA Internacional. See also: Hickel, 2017, op. cit.

Mythbuster I

Perpetual exponential growth will not alleviate climate inequality and historic injustices.

A demand for limiting global warming to 1.5°C is part of a demand for justice, as that warming limit is expected to be the one that keeps the global South habitable. Geographically and infrastructurally it includes the regions most exposed to both the sudden and insidious impacts of climate change – violent storms and landslides on the one hand, and extended drought and sea-level rise on the other. These regions are where the majority of the global population lives, and the population that has on the whole contributed next to nothing to the catastrophic climate change trend.[10] Contemporary commitments from socialized profit to help the people of the global South to adapt to the impacts of climate change are much lower than even the amounts promised by global consensus.[11]

Degrowth in globalized resource and waste circulation is required both materially and culturally to achieve the climate justice of staying below 1.5°C average global warming. Materially, a smaller global metabolism overall, and especially among the overdeveloped social strata in the Global North, is the only way to reduce the greenhouse gas emissions driving climate change.

Historically, only a reduced economic output has produced lasting regional emissions reductions. Within the current global market and with much of the world's people in need of finances to alleviate scarcities, dematerializing economies is achieved by eventually shifting emissions to the South.[12] Without a cultural change of aspirations and emancipation, the growth imperative commits the capital sunk in the technological extraction and processing infrastructure to not only shift, but to overall expand the harmful emissions through a rebound effect.[13] Eventually, some responsibility for

10 den Elzen, M., et al. (2013). Countries' Contribution to Climate Change: Effect of Accounting for All Greenhouse Gasses, Recent Trends, Basic Needs and Technological Progress. *Climatic Change* 121: 397-412.

11 Guimaraes, R., et al. (2009). *Earth System Governance: people, places, and the planet understanding Earth system governance after the financial crisis*. Paper presented at the Amsterdam Conference on the Human Dimensions of Global Environmental Change (HDGEC). Amsterdam. See also: Oxfam. (2018). *Climate Finance Shadow Report 2018: assessing progress towards the USD 100 billion commitment*. Oxford: Oxfam GB.

12 Giljum, S., et al. (2014). Global Patterns of Material Flows and their Socio-Economic and Environmental Implications: A MFA Study on All Countries World-Wide from 1980 to 2009. *Resources* 3: 319-339. See also: Schaffartzik, A., et al. (2014). The global metabolic transition: regional patterns and trends of global material flows, 1950–2010. *Global Environmental Change* 26: 87–97.

13 Giljum et al. (2009). *Overconsumption: our use of the world's natural resources*. SERI, GLOBAL 2000, Friends of the Earth Europe.

contemporary emissions changes hands, but the planetary atmospheric carbon concentration rises just the same – and the 1.5°C warming limit is breached.

The cultural transformation is therefore a crucial component of degrowth, driving the material reduction of extraction, throughput and emissions. First, consider the historical injustice inscribed into the climate change problem globally, where the historic populations of the Global North benefited from 80% of the greenhouse gases since the industrial revolution, despite being only 20% of the historic global population.[14] Without the rich Global North addressing the climate challenge, it is unfair to expect the South to do so. Second, the poorer countries are where most of the climate-restorative practices like subsistence agroecology and agroforestry are already practiced, and their political commitments through mitigation pledges already exceed their fair share of climate stabilization burden.[15] With the South's right to basic human rights aspirations this requires change leadership, in visible transformation not just words, from the globally rich in North and South. Finally, the potential of the developing countries of the South to assist with mitigation can be further increased by satisfying aspirations through redistributing benefits from the North, wherever countries are materially unable to fulfil their fair share of emissions reduction exclusively within their borders because of the large historic «climate debt».[16]

Climate change contains a historic injustice which can be corrected through universal empathy, solidarity and inter-societal coordination, a broad principle of climate justice. Our economies currently force the growth through newly created value which overcompensates the initial investments and pushes up extraction and emissions dumping externalities of growth on the Global South. Climate justice within 1.5°C limit requires fundamentally transforming our economies and understanding the historical path that led to the brink of climate catastrophe. Climate justice means transforming the social metabolism and economic institutions that uphold it, and this in turn requires that broad principles of degrowth inspire the transformation of the world economy. And it means that richer societies materially reduce throughput by redistributing and reusing existing products and services, not offshoring production of new ones. They can learn from degrowth practices in many cultures of the South which have for long been misrepresented as technologically lacking (Buen Vivir, Swaraj, Ubuntu and the like).

Perpetual striving for economic growth under current conditions aggravates the climate breakdown through increased output of greenhouse gas emissions, *simultaneously aggravating the historic injustices in responsibility and impacts of climate change* by focusing benefits of growth extremely disproportionately onto the rich strata of the overdeveloped North. The impossible (see Mythbuster III) decarbonized growth under the same paradigm leaves all the other environmental load shifting in place and the inequalities of benefits and impacts intact. Overcompensating for the injustice by forcing growth under the current economic paradigm in the South is committed to

14 den Elzen, 2013, op. cit.

15 Climate Equity Reference Project [CERP]. (2015). *Fair Shares: A Civil Society Equity Review of INDCS*. http://climateequityreference.org

16 Climate Equity Reference Project, 2015, op. cit.

increasing most of the same environmental burdens that make up the unjust historic legacy of the North, breaching the 1.5°C boundary several times over, whilst leaving most inequality and injustice in suffering the impacts of climate change in place.

Climate justice and climate stability require a global transformation that abandons the growth fetishizing paradigm and redresses the past injustices, so that North and South can face imminent rapid climate change together.

Mythbuster II

Power struggles in society drive technological choices.
Hopes for radical emissions reduction without addressing changes in social organization of production and cultural choices, the emissions reduction coupled with continued economic growth, rely heavily on expectations of technological innovation. This is based on a myth about historical development that led to contemporary climate change: that discovery of productive forces based on energy from fossil fuels drove the rise of late modernity in the West, eventually spreading across the globe. Climate change is supposedly the unexpected side-effect of this striving for progress and emancipation. Historical cultural and social changes concurrent with expansion of fossil-based industrialization are seen as a consequence, not a driver of the spread of technological infrastructure that locks-in the current social organization of production and the associated emissions. Therefore, it is assumed, only further commitment to technological innovation that will secure this organization, but without the carbon emissions, will achieve progress and mitigate catastrophic global climate change.

The myth about how we got to the brink of climate catastrophe, the broadly outlined Anthropocene story, starts with the production revolution, the invention of the steam engine and the shift to coal as the primary energy source at the end of 18th century in Britain. An energy shortage coupled with a culture of growth based on free-thinking technological exploration,[17] supposedly pushed the early industrial capitalists to turn to fossil-powered technologies. The actual historic transition to fossil-fuel driven technology, including extraction, transport, combustion and disposal of residual waste, was different. The fossil fuel and much of the technological know-how had been available for a long time around the world without producing the specific shift in power source, social organization, and scale and means of production. Renewable energy sources, water and wind, were cheap and abundant in late modern British industry. A change in social organization, a novel organization of property and expanding market exchange coupled with increasing power over workers was the dominant influence for the establishment of fossil power infrastructure. Factory workers' struggle for broader economic and political democracy resulted in a reaction from the capital owners to prefer coal over water and wind, introducing the great global Thermocene exponential acceleration in emissions.[18]

Capitalist industrial production, the largest base of global historic emissions and a major source of current emissions, eventually became a system of self-perpetuating

17 Mokyr, 2017, op. cit.
18 Malm, A. (2016). *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming*. London: Verso.

economic growth once coal and steam engine systematically replaced production organized around renewable energies. In the second half of the 20th century, workers' demands for greater involvement returned at the nexus of extraction and transport of the increasing amounts of coal to the urban industrial centres. Strike action disruption of coal-based energy infrastructure forced the owners of capital to turn to oil, a globally extracted energy source beyond the reach of industrial workers' solidarity and subject to greater automation in extraction and production processes.[19] Social organization supporting a perpetually growing capitalist industrial production came to be seen as an organic offspring of a development of productive capacities and technological innovation, the latter two expected as primary drivers of its future modifications. Historic material development resting on access to mass produced commodities fitting all purposes became equated with human flourishing. Along such inverted historical causality it becomes automatic to expect that today new technologies will provide negative emissions and global temperature geoengineering, funded by surpluses produced by economic growth and leaving the material development and social organization of production largely undisturbed.

From a global perspective it is apparent that the spread and normalization of the fossil fuel industrial infrastructure was not driven by technological determinism of the better or more efficient energy source, but by social strategies for displacing workloads and environmental loads to the societies where work and nature afforded greater accumulation through lower costs.[20] Current debates about the role of technology are largely building on the narrow idea that technology is something neutral, merely a means to an end. But technology always transforms non-human-made objects into human-made objects resulting in a greater matter-energy throughput and associated waste and emissions overall,[21] as well as greater dependence of all aspects of our lives on corporate concentrated industrial production. The present organization of social life with production growing continuously as a scarcity-quenching necessity for the majority of the global population cannot avoid soon breaching the 1.5°C warming limit. *Degrowth hinges on a change of perspective,* a liberation from the apparent historical necessity of exponentially expanding carbon emissions from extraction and waste to provide commodities as realization of a good life. Extraction and d*istribution of useful energy is not a technically determined process* led by discoveries of «better» energy sources, *but a socially negotiated historic choice of what defines a good life.*

19 Mitchell, T. (2011). *Carbon Democracy: Political Power in the Age of Oil*. London: Verso.

20 Hornborg, A. (2016). *Global Magic: Technologies of Appropriation from Ancient Rome to Wall Street*. Berlin: Springer. See also: Moore, J. W. (2015). *Capitalism in the Web of Life*. London: Verso.

21 Heikkurinen, P. (2016). Degrowth by means of technology? A treatise for an ethos of releasement. *Journal of Cleaner Production* n.d. https://doi.org/10.1016/j.jclepro.2016.07.070

Mythbuster III

There is no technology that can reduce emissions and leave the economic system as it has been – there is no straightforward engineering solution to the climate crisis.

Without addressing the growth fetish we are left with a false hope of rapid efficiency improvements in current economic activity that would rapidly decouple economic growth from greenhouse gas emissions. Historically, the growing capitalist economy has only achieved partial and slow energy transitions, primarily due to infrastructural lock-ins and associated social conditions. It took 60 years for coal to reach 50% of global energy consumption, another 60 years for oil to reach 40% and almost another 50 years for natural gas to reach 25%.[22] Coal is still the most widely used industrial energy source today. Social conditions that created its utility, corporate concentration and state subsidies secured by fossil industry's lobbying power help to maintain its use. Social organization of production oriented to profit accumulation and the cultural imposition of the growth imperative culturally lock in this carbon-intensive energy base for the next generation. Growth decoupling generating surplus value without emissions is achieved in parts of the North by technological offshoring of environmental loads to the global South.[23]

Techno-optimism promises to keep the global temperature rise below 1.5°C by a profitable shift to renewable energies and use of «negative-emissions» technology to pull the excess carbon out of the atmosphere. «Negative emissions» technologies, largely a hypothetical concept, don't have more than a few realistic-scale demonstration plants, and in most cases only exist only in small-scale demonstration or just as theoretical studies.[24] Even at the concept level, the environmental and social side-effects of their use are left unknown and unaccounted for, whilst the large uncertainty in efficacy of their implementation to drive down the atmospheric CO_2 concentration in time is mired by gross uncertainties. If we are to commit our climate stabilization strategy to these technologies performing the desired task in the future, ignoring the other available options now under the myth of technology driving social productive choices, we would calamitously constrict the range of strategies available in the future when desired technologies don't materialize or bring about too burdensome side-effects.[25]

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22 Smil, V. (2016). *Energy Transitions: Global and National Perspectives, 2nd Edition*. Santa Barbara: ABC-CLIO.

23 Hardt, L. et al. (2018). Untangling the drivers of energy reduction in the UK productive sectors: Efficiency or offshoring?. *Applied Energy* 223: 124-133.

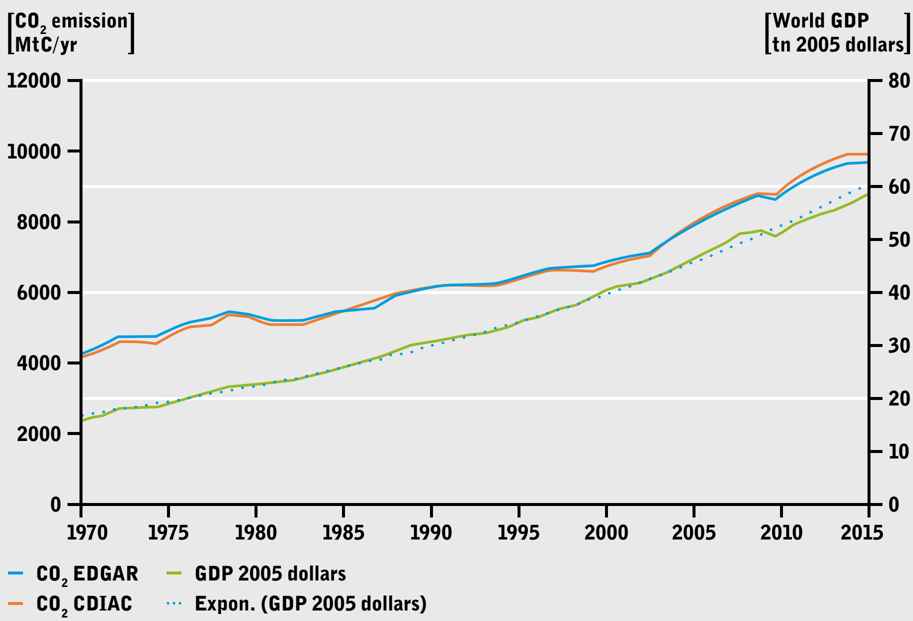
24 Anderson, K. and Peters, G. (2016). The trouble with negative emissions. *Science* 354: 182-183.

25 ETC Group, Biofuelwatch & Heinrich Böll Foundation. (2017). *The Big Bad Fix: The Case Against Climate Geoengineering*. Nairobi/Berlin/Ottawa.

By avoiding culturally and socially hard choices now, we would be materially locking in the technology with unpalatable social and cultural necessities tomorrow, ignoring the lesson of the mythbuster above.

To stay in line with expectations of economic growth, scientific assessments that rely on global scale implementation of «negative emissions» production plants assume that the future costs of global-scale implementation of the associated technologies are lower than present day cultural transformation to move away from production organized around fossil technology. Such accounting privileges immediate growth of surplus today by discounting the projections of expected costs tomorrow. Under global capitalist organization of production these technologies will also have to deliver cumulative return on investment by charging human societies for climate stabilization for thousands of years. In contrast, in our vision, the degrowth society of our descendants will employ all available approaches to extract existing excessive CO_2 in the atmosphere through restoration of stable ecosystems, primarily forests, restorative agricultural practices and enhanced weathering of minerals, not to provide an insurance policy for growth but to direct any social surplus of work and energy to maintenance of ecological stability on a single available planet.

Figure 2: Late industrialism GDP and CO_2 emissions output



Source: Andy Skuce (https://goo.gl/M3aWU4); own chart

The future begins today …

Cap and phase out fossil pollution

The known reserves of fossil fuels are already so large that if they were to be burnt they would blow through the 1.5°C limit several times over.

Growing our economies based on the existing investments into exploration and exploitation of fossil fuels is already incompatible with staying below the dangerous level of climate change.[26] In other words, given our foundation of economic activity in fossil-fuel-driven energy production, economic degrowth is a favourable strategy for limiting global warming below 1.5°C. We know that globally we need to leave the fossil fuels in the ground, the *coal in the hole* and the *oil under the soil*.

The immediately available regulatory and financial instruments to address this target are caps[27] and taxes on emissions, caps on fossil fuel extraction, and the abolishment of subsidies for fossil fuel exploration and extraction (see *A Managed Decline of Fossil Fuel Production* in this publication). Caps should be adopted on the best known order of magnitude estimates of the carbon budgets and emissions pathways[28] distributed on per capita basis, and in a way that reliably commits to almost net zero carbon by 2050. This per capita allocation should be further enhanced so as to account for current infrastructure development and basic services inequalities, and then shared among the respective national populations. National allocations should be shared based on solidarity and justice.[29] Meaningful quantitative accounting of a spectrum of social and environmental costs against economic benefits need to be developed alongside close monitoring of carbon concentrations in the atmosphere.[30]

Current subsidies from governments for research, extraction, transport and exploitation of fossil fuels should be abolished and directed into expanding knowledge, infrastructure and jobs in community-led energy efficiency and renewable energy generation (see *Another Energy is Possible* in this publication).

As energy of the flow and not stock, renewables organize the social control and utilization of energy sources differently and limit the appropriation for fully private use and market trading of energy. So we must revive the knowledge how to organize

26 Mercure, J-F., et al. (2018). Macroeconomic impact of stranded fossil fuel assets. *Nature Climate Change* n.d. https://doi.org/10.1038/s41558-018-0182-1

27 Davey, B. (Ed.) (2012). *Sharing for Survival: Restoring the Climate, the Commons and Society.* Dublin: Feasta.

28 Geden, O. (2016). An actionable target. *Nature Geoscience* 9: 340-342.

29 Cf. Climate Equity Reference Project [CERP], 2015, op. cit.

30 Raworth, K. (2017). *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist.* White River Junction, VT: Chelsea Green Publishing.

production in different communities, from villages, through municipalities of different sizes to whole regions and states, to maintain democratic control over aims and volumes of production. It is no longer a matter of simply stockpiling the fuels or securing ever expanding energy supply through the market. As the technological utilization of renewables, primarily for electricity generation, is closely tied with appropriate materials and infrastructure for extraction and use, further caps on materials extraction and effects on the forests, land and water must be taken into account.

Restorative agroecology and wilderness safehavens

Communities that are long resident in a certain area and dependent on its natural cycles for reproduction and regeneration are best placed to deliberate the balance between extraction and energy generation practices and habitat protection and regeneration.[31] It would be a mistake (as well as physically and technologically impossible) to focus *exclusively* on replacing the current energy demand with the same amount generated from renewables, increasing extraction and habitat destruction in the process. The latter would lead to negative consequences of global warming such as biodiversity loss, destruction of natural carbon sinks and jeopardy to food security, ultimately leading to a much higher rise than 1.5°C.[32]

Using the best available knowledge, combining indigenous experience and scientific modelling, we should seek the available balance between renewable energy generation, and protection of natural carbon sequestration and low-impact peasant agroecology (see *La Via Campesina in Action for Climate Justice* and *Re-Greening the Earth: Protecting the Climate through Ecosystem Restoration* in this publication).

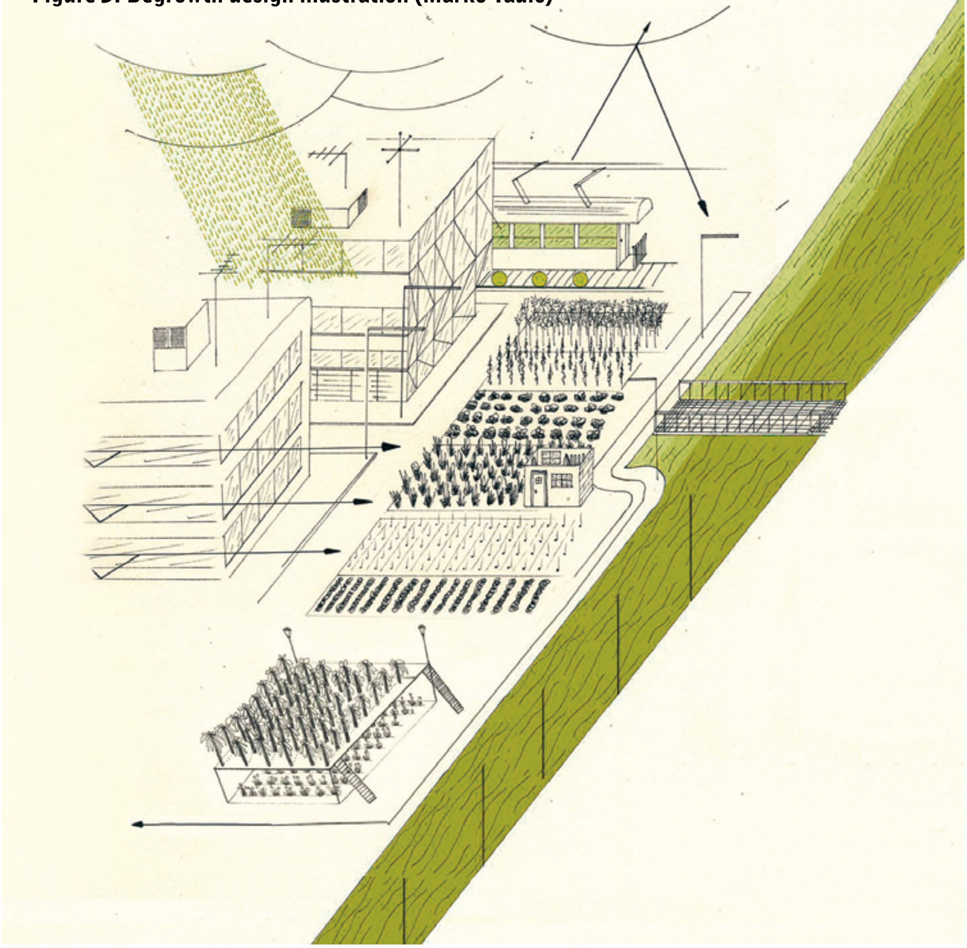
This includes just compensation for such agroecological practices concurrent with the abolishment of public subsidies for intensive industrial fossil-fuel based agriculture, and abolishment of subsidies for land-use change from forests to monoculture carbon bubbles and for intensive marine aquaculture that reduces the biodiversity and carbon storage capacity of the global seas. Peasant agroecology is labour intensive and will be increasingly precarious under climate change in the centuries to come, so greater social recognition and distribution of risks in food production is needed. Food is the most important driver of human health and flourishing in the current and future degrowth worlds, and a just compensation for those who tend for the soils and food supply on behalf of those who play other social roles is an essential ingredient of the degrowth social contract. Market valuation is the least significant form of this compensation, though plays a role, whilst rights-based resource conservation that recognizes indigenous land rights and promotes locals' sovereignty over forests, fields and water, and promotion of farming and fishing practices that preserve food stability and sovereignty should be accentuated.

31 Lews and Maslin, 2018, op. cit.

32 Williamson, P. (2016). Emissions reduction: Scrutinize CO_2 removal methods. *Nature* 530: 153-155.

Perishables such as foodstuffs will be transported over shorter distances, practically abolishing the global market in basic foodstuffs, and rooting different communities in the locally grown staples. To reduce the climate impact of global goods transport, especially of high-impact air cargo, transport of all perishables over long distances should be eventually phased out, along with shifting from airplanes to continental railways and sailships where needed. The car and truck transport between cities and between farm producers and city consumers will also be rapidly phased out and replaced by renewably powered rail transport, which is based on network durability and efficiency rather than high speed. The fossil intensity of the highways infrastructure and of haulage and private car transport is not significantly reduced with a shift to new electric vehicles. Less driving overall is the degrowth way to reduce emissions from transport and long-distance goods distribution. In densely populated zones like the municipal regions and cities, low-hanging fruit of public transport and cycling is already being picked, with healthier lifestyles and less clogged-up cities.

Figure 3: Degrowth design illustration (Marko Tadić)



Production for life, not profit

Economies currently produce commodities under the profit imperative for the states and private owners, mostly externalizing negative impacts of such production to distant people and future generations in order to boost immediate financial profit.

Climate change is the loudest warning sign that the natural endowment of the planet is not limitless, that the (humanly co-created) nature upon which all economic activity is eventually based will run out.

With that awareness human societies should take democratic control over production of commodities needed for the reproduction and stability of societies and the direct them towards achievement of shared social progress goals. Factories, farms, service hubs and cooperatives should be producing output required by human flourishing and wellbeing under the constrictions of available energy and minimum harm to stable habitats. This is where circular economy principles (see *Zero Waste Circular Economy: A Systemic Game-Changer to Climate Change* in this publication) merge with degrowth, as to stay well and flourish humans of the 21st century will need to keep making products not readily found in nature, but will have to throw away and waste almost none of them. Those products that cannot be reused, composted or recycled should be redesigned in order to be produced with lower impact, repairable and reusable – or simply not produced in the first place. Enhancing low-tech repair through education across different communities will contribute to re-use potential, whilst decentralized sharing of products and tools will reduce their overall material footprint. Regulation of advertising and incentivizing production aimed at durability are some of the social instruments for transition to this different organization of production. Our current production practices are drowning the world in greenhouse gas emissions and waste, we must take back control and produce to live rather than live to produce.

The distribution of the social product required for a good life will have to change under these conditions, from the generation of concentrated abstract wealth to provision of the basic material provisions for all. Freshwater and adequate sanitation, electricity and cogeneration heating are life's necessities that we know how to technologically bring about and must shift away from fossil fuels. Providing universal access to education and healthcare is something we know how to do and have to some extent provided in the past; the economies driven by profit generation through growth are preventing us from delivering it even further. Shorter working time will help distribute meaningful employment more broadly, and help distribute the benefits of the economic practices of a non-growing economy to those people currently left with low income and wealth. Most importantly, care work and all those activities that help society regenerate from day to day outside market valuation have to be properly recognized in economic reproduction of societies.

The money required to kickstart this change languishes in tax havens and financial instruments securing future returns through the accountancy of economic growth. Whilst the global South is lacking funds with which to provide healthcare, sanitation education and adaptation to climate change including low-carbon reconstruction, its current economic output is eaten up by debt repayments. To stay below 1.5°C within new arrangements of production and distribution, a new economy will require immediate sizeable financial transfers from North to South, raising people from poverty and providing instruments of emancipation and inclusion in the global society. This is a just repayment of the climate debt. Debt cancelation and abandonment of the debt-based money system (fractional reserve banking) should be the first obvious structural steps of transition to a new kind of economy that does not necessitate all (re) productive work to increase year after year so as to repay the compound interest on the initial capital downpayment.

Abandoning the dominant growth obsession will collapse the over-financialized globalized economy, whilst breaking into catastrophic climate change over 1.5°C global warming will collapse the natural reproduction base of all economies, the complex living planet.

It is in the interest of the haves and have-nots, the elites and the struggling together to avoid the latter collapse. It is fair and democratic to mitigate it by strategically guiding the degrowth of the global economy.

CONCLUSION

People living at the end of this century will embody in their culture, their material infrastructure and the throughput of their societies a worldwide understanding of the role that fossil fuels played in the driving of climate change and the social organization of everyday life in our world. Knowing the injustices and the universal peril that is catastrophic climate change over 1.5°C, they will nurture the degrowth world relative to what we inherited from the last century. The transformation following the sobering vision starts with us today, realizing that myths of self-propelled technological progress are false, that many scarcities are illusory and that injustices are created through mutual distrust. Myths can be abandoned, replaced and improved on to better explain what is happening to us. We hear today and they remember for a long time the call of 15,000 studious women and men warning that humanity is on a collision course with the limits of our planet. «To prevent widespread misery, humanity must practice a more environmentally sustainable alternative to business as usual,» including «reassess[ing]… the role of an economy rooted in growth.»[33] *Degrowth is a sobering vision with which we start the transformation to stay below 1.5°C global warming.*

33 Ripple, W. J., et al., 15,364 scientist signatories from 184 countries. (2017). World Scientists' Warning to Humanity: A Second Notice, *BioScience* 67 (12): 1026–1028. https://doi.org/10.1093/biosci/bix125

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Organizing Lessons from Canada's Leap Manifesto

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T +49 (0)30 28534-0 **F** +49 (0)30 28534-109 **E** buchversand@boell.de **W** www.boell.de

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INTRODUCTION

How do we achieve emissions cuts that are rapid, deep, and just? In other words: how can we use the ideas and tools collected in this report to change the world?

Everyone reading this knows we need to limit global temperature rise to 1.5° Celsius. Climate justice advocates agree on one prerequisite for getting there: massive popular movements, capable of redefining public debate and policy agendas – in short, we need to upend what's considered politically possible.

But that's just the first act. This crisis of unfathomable size and stakes is unfolding on a punishing timeline. Around the world, progressives are grappling with an age-old question that is now infused with existential urgency: how do we get the power we need to win, without being co-opted into the structures we oppose?

Climate action commensurate with the scale of the crisis will require every kind of transformative change at the same time – bottom-up, top-down, and everything in between. To slash emissions quickly, we need governments to confront corporate interests and re-discover an appetite for large-scale economic planning. But if we want this shift to be genuinely democratic and responsive, then we also need durable forms of community control and accountability. How can we advance the transition on multiple fronts at once?

In Canada, we took on the challenge by gathering a diverse coalition to draft the 2015 Leap Manifesto, a 15-point people's plan for a just transition away from fossil fuels. We knew that to win, progressives would need to abandon a defensive stance and craft a vision of the climate-safe pathway we *do* want – not just resist the policies we oppose.

Because if the 99% doesn't set the agenda, the 1% will. Indeed, we know exactly the kind of climate future that global elites are planning for. It is a future dotted with protected enclaves for the few, in the midst of ever-expanding sacrifice zones for the many. Where capital wrings every last dollar out of destructive economies both old and new, and out of the escalating climate chaos they produce. Where technologies of surveillance and social control merge with the desperate dream of engineering the planet itself – all of it backed by militarized governments that repress and warehouse the victims.

There is still time to change course. But in order to build social movements with the power to lead the way, we need a vision of «radical emissions reduction» that is irresistible, vivid and concrete, connected to the issues and struggles that most people deal with every day. To succeed, the energy transition must promise real and continuing improvements to the material conditions faced by the majority of people around the world.

Our experience in Canada offers several lessons about the challenges and potential of this process.

In the essay that follows, we draw on the Leap story to explore how coalition-building can break down traditional «issue» silos, which too often restrict the scope and impact of social justice activism. We consider how these new coalitions can communicate positive, detailed pictures of the world we need, and deploy them to shift the goalposts of what is considered politically possible.

While documents like The Leap Manifesto are necessarily rooted in specific places and histories, they can play a role in climate policy at the local, national, and even international levels. So we conclude with a discussion of how initiatives like The Leap can complement emerging ways of engaging with electoral politics and efforts to scale up local democracy, and help forge a path to power for a radical, justice-based agenda for 1.5°C.

Building the Coalition

In the years leading up to the drafting of The Leap Manifesto in 2015, we watched with admiration as social movements around the world racked up unlikely victories against the fossil fuel industry.

While documenting some of those extraordinary stories in *This Changes Everything*, the documentary film accompanying Naomi Klein's book of that name, we saw a pattern emerge: there was power in organizing across traditional «issue» silos. Whether it was urban doctors and lawyers making common cause with subsistence farmers and fishers to stop a coal plant in southern India, or white-led environmental NGOs learning to follow Indigenous leadership to block oil pipelines in rural North America, we were seeing alliances that had never happened before, transcending lines of class, race, caste, language – and winning.

It seemed to us that these new alliances were a significant new variable in the calculus of resistance, and that they had the potential to take on more than just our energy systems. *This Changes Everything* argued that the climate crisis is a fundamental challenge to free-market orthodoxy and the values of dominance, extraction, and individualism underlying it. Skyrocketing emissions go hand in hand with rising inequality and white supremacy. It all has to be challenged at once – and doing so is a once-in-a-century opportunity to build a better world.

We also sensed a growing dissatisfaction with simply saying «no» to the extractive economy, as vital as those resistance fights have been and will remain to keeping fossil fuels in the ground. In Canada, where our work is centered, organizers were increasingly asking how to articulate a collective «yes» – how to define a new system.

We wanted a shared story about a better future, and the path to get there. We asked ourselves: could our varied movements come together to craft a genuinely collaborative, grassroots vision of the future we want?

In 2015, we had our chance. The story of The Leap Manifesto begins with a movement convening in Toronto in 2015, against the backdrop of the plummeting price of oil. It was a shock – the kind so often used to bypass democracy and ram through corporate-friendly policies, as Naomi Klein documented in her 2007 book *The Shock Doctrine*. But if people could be prepared, remember their history, and tell a different political story, she concluded, shocks could also be harnessed in the interest of the majority.

In Canada, where tens of thousands of oil workers were getting laid off, we believed this was one of those moments. For a decade, a far-right government had doubled down on extracting some of the dirtiest and most energy intensive fossil fuel in the world from the Alberta tar sands. Under Prime Minister Stephen Harper, it seemed that Canada was determined to restructure its entire economy around the extraction and export of this one commodity, to the point where our currency became a petrodollar on world markets. Now, with the industry no longer drunk on $150/barrel oil, we saw an opening to propose a different economic future.

Adding to the political stakes, there was also a federal election coming up in the fall of 2015. None of the major political parties were talking about the climate crisis in any meaningful way. And not one was offering an ambitious, inspiring vision of a new path forward for Canada's economy and energy needs.

We sensed a deep hunger for a completely different way forward for the country, one that could begin to heal wounds going back to Canada's founding – from the theft of First Nations land and the betrayal of treaties, to the profoundly unequal distribution of wealth today.

So in May 2015, we invited progressive leaders from across a range of issues and regions to a two-day meeting in Toronto, titled «From Oil Shock to Energy Shift». There were First Nations leaders and trade unionists representing oil workers; a range of environmentalists, from direct action-minded folks to conventional NGOs; food justice, anti-poverty, and faith organizations; as well as housing, refugee, and immigrant rights activists.

We enlisted two facilitators to lead the gathering: Detroit-based social justice facilitator adrienne maree brown, and Toronto-based labor educator D'Arcy Martin. Their complementary experiences and backgrounds were essential to bringing the group together.

On the first day, we told stories of previous historical moments when diverse social movements had worked together on this land – like the first wave of resistance to the NAFTA «free trade» agreement. We used post-it notes to create a timeline of those moments on the wall, and heard reflections from attendees who had participated in some of those moments of unity.

Later that day, we shifted gears to asking how we could move from defence to defining the agenda in Canada. We had several different breakout sessions that forced activists to get out of their comfort zones and talk about hope, aspiration, and how to bring about the kind of society we want to live in.

For example: what does your free time look like if you're working less? What would it mean to have energy security, with local ownership rooted in communities? How would that make day-to-day life different?

It was fascinating how challenging it felt to imagine life «when we win.» It's easy to imagine dystopia – but the «yes» is a muscle too-rarely used in the course of social justice activism. It was gratifying to see everyone rise to the challenge as the afternoon went on, engaging in deep conversation with people they don't normally work with.

If the theme of the first day was asking how we break down barriers, the second day's question was, what could keep us apart? There is a long history in our society of workers being pitted against environmentalists, and both against Indigenous peoples. Decades of tensions and memories of betrayals surfaced in these discussions. They were blunt, and often painful, but always respectful. We confronted the reality that there are real obstacles separating our movements, and we need to continue working through them together.

On the last day, we stood together in the heart of Toronto's financial district, to announce the group's first collaboration: a March for Jobs, Justice and the Climate, to take place later that summer.

The idea was to test drive the new coalition by working together on a concrete action. We went straight into planning it after the meeting, and ultimately that summer's march made history as one of the most diverse climate actions in Canadian history – led by Indigenous youth, with trade unionists, migrant justice advocates, environmentalists and anti-poverty activists marching together.

We also started work on another outcome from the gathering: The Leap Manifesto itself, which eventually launched with the subtitle: «A Call for a Canada Based on Caring for the Earth and One Another.» With no single author, it is a consensus document through and through. But as a writer, Naomi's role over the three days of the gathering was to take in the full range of conversations and concerns, tease out common threads, and try to come up with a structural frame that spoke to the emerging demands.

Naomi worked to revise a first draft into something both lyrical and narrative-driven, which was then subject to a wide-ranging group process. Coalition members weighed in throughout that summer; the re-writing, horse trading, and negotiating all took place in Track Changes in a Microsoft Word document, battled out in the margins. Some of this recalled the perils of collective writing, but what we remember most is how thoughtful and impressive people's contributions were. On the whole, the collaboration and even the compromises made the document immeasurably better.

By the end of the summer, we had something truly exciting: a final text with 15 demands that all of our many different constituencies agreed on. The demands amounted to 14 powerful «yeses,» and one big «no» – a science-based call for no new investments in fossil fuel infrastructure. As far as the «yeses» go, many are the familiar pillars of climate policy: yes to a rapid transition to 100% renewables, yes to green housing retrofits and affordable public transit, yes to massive public investments in low-carbon infrastructure.

Perhaps more unusually for a climate-focused document, the manifesto opens with a demand to respect the inherent rights and title of Indigenous peoples in Canada, starting by upholding the UN Declaration on the Rights of Indigenous Peoples. And it says that as we assert local, democratic control over our energy systems, Indigenous people and «others on the front lines of polluting industrial activity should be first to receive public support for their own clean energy projects.»

The text also includes calls for a «more localized and ecologically-based agricultural system»; a re-imagined trade system that serves communities rather than corporations; and welcoming refugees and migrants fleeing war and climate impacts, along with «immigration status and full protection for all workers»; a national childcare program; and «a vigorous debate about the introduction of a universal basic annual income.»

There was nothing radically new in the substance of the manifesto. These were all demands that have been made by different social movements for decades. What was new was the particular configuration of the policies, situated in a positive and hopeful frame, and told as a story. More than just a laundry list of political demands, The Leap Manifesto unfolds as a narrative – a concrete picture of a safe and equitable future.

In the weaving of that story, several core themes came into focus:

- *Frontlines first.* The people and communities who have been most harmed by the current system should be first in line to benefit from the alternatives.
- *No worker left behind.* Nobody whose livelihood depends on fossil fuel extraction should be left to fend for themselves in the energy transition. This goes beyond financial assistance and retraining; like other frontline communities who have borne the brunt of pollution, these workers must be in the driver's seat as we design and build a new economy.
- *Care work is climate work.* Installing solar panels and building wind turbines are not the only kinds of green jobs. Education, health care, care of the young and elderly, and the arts are all already low-carbon forms of work – they are also the ones that have been under attack during decades of austerity, and need to be placed at the center of the next economy.
- *Polluter pays.* The money to pay for the great transition is available – this is an era of unprecedented private wealth – but a justice-based response to the climate crisis will require a major redistribution of both wealth and power across global society. Historic emitters like fossil fuel corporations, rich industrialized countries, and the hyper-consuming global 1%, all have climate debts that urgently need to be paid.


the leap manifesto
A call for a Canada based on caring for the Earth and one another
The leap must begin by respecting the inherent rights and title of the original caretakers of this land, starting by fully implementing the United Nations Declaration on the Rights of Indigenous Peoples.
The latest research shows we could get 100% of our electricity from renewable resources within two decades; by 2050 we could have a 100% clean economy. We demand that this shift begin now.
No new infrastructure projects that lock us into increased extraction decades into the future. The new iron law of energy development must be: if you wouldn't want it in your backyard, then it doesn't belong in anyone's backyard.
The time for energy democracy has come: wherever possible, communities should collectively control new clean energy systems. Indigenous Peoples and those on the frontlines of polluting industrial activity should be first to receive public support for their own clean energy projects.
We want a universal program to build and retrofit energy efficient housing, ensuring that the lowest income communities will benefit first.
We want high-speed rail powered by just renewables and affordable public transit to unite every community in this country – in place of more cars, pipelines and exploding trains that endanger and divide us.
We want training and resources for workers in carbon-intensive jobs, ensuring they are fully able to participate in the clean energy economy.
We need to invest in our decaying public infrastructure so that it can withstand increasingly frequent extreme weather events.
We must develop a more localized and ecologically-based agricultural system to reduce reliance on fossil fuels, absorb shocks in the global supply and produce healthier and more affordable food for everyone.
We call for an end to all trade deals that interfere with our attempts to rebuild local economies, regulate corporations and stop damaging extractive projects.
We demand immigration status and full protection for all workers. Canadians can begin to rebalance the scales of climate justice by welcoming refugees and migrants seeking safety and a better life.
We must expand those sectors that are already low-carbon: caregiving, teaching, social work, the arts and public-interest media. A national childcare program is long past due.
Since so much of the labour of caretaking—whether of people or the planet—is currently unpaid and often performed by women, we call for a vigorous debate about the introduction of a universal basic annual income.
We declare that "austerity" is a fossilized form of thinking that has become a threat to life on earth. The money we need to pay for this great transformation is available—we just need the right policies to release it. An end to fossil fuel subsidies. Financial transaction taxes. Increased resource royalties. Higher income taxes on corporations and wealthy people. A progressive carbon tax. Cuts to military spending.
We must work swiftly towards a system in which every vote counts and corporate money is removed from political campaigns.
This transformation is our sacred duty to those this country harmed in the past,
to those suffering needlessly in the present,
and to all who have a right to a bright and safe future.
Now is the time for boldness.
Now is the time to leap.
Source: The Leap

Moving the Goalposts

As we prepared to launch the manifesto, our goal was to move the 15 demands into mainstream debate through the strength and diversity of the coalition that had come together to back them – including not only Indigenous and social justice leaders, but political figures from every party. With the manifesto written, and the drafters ready to go public, we brought one more ingredient to the mix: Canada's artists, celebrities, and public intellectuals.

Many of these public figures had already started to dig deeper into the climate crisis and the need for systemic change. In looking for signatories, we decided to go to this group first, and only then to large organizations that may be more reluctant to sign on to a controversial document.

We were thrilled to garner support from across Canada's arts community, from Donald Sutherland, Ellen Page, and Rachel McAdams, to Leonard Cohen, Neil Young, Feist, and Arcade Fire, as well as some of the country's best-known authors and poets.

Then, when we turned to the big unions, environmental NGOs, and other activist groups, there was already cultural momentum behind the manifesto. Dozens of respected organizations joined as initiating signatories in the weeks before we launched.

The launch was a star-studded event that made headline news across the country. Canada's national «paper of record» printed the Manifesto text in full, and outlets from Entertainment Tonight to the country's public broadcaster covered the press conference. It was clear we were shaking up Canadian political debate – though at that point, we didn't know how deeply.

As quickly as the debate opened up around an alternative vision for our economy and society, the country's elite began a campaign to close it down. «Madness,» exclaimed the *Globe and Mail*'s editorial board. The *National Post* described the Manifesto as «economic suicide»; for the right-wing commentator Rex Murphy, it was a «wild-eyed, ultra greenist, anti-capitalist dogma sheet.» (Rex, you say that like it's a bad thing!)

Brian Mulroney, Canada's neoliberal prime minister during the Reagan-Thatcher era, crept out of retirement to weigh in, telling a business audience that the Leap represented a «new philosophy of economic nihilism that must be resisted and defeated.» Brad Wall and Christy Clark, then the sitting premiers of Saskatchewan and British Columbia, respectively, were equally bombastic; Clark infamously proclaimed that if The Leap were to become law, «hundreds of towns would be wiped off the map tomorrow, and turned into ghost towns.»

It was an incredible, all-out elite aerial bombardment – since 2015 there have literally been hundreds of columns and op-eds attacking The Leap Manifesto and its backers. At times, it was difficult to be on the receiving end. But it also made us proud to be targeted by some of the most regressive and powerful voices in our society – it was proof we were shaking them up.

And in the end, they did us a huge favor. At the peak of the outcry, after weeks of sustained attacks, a prominent research firm did a national poll about The Leap. It found that 52% of Canadians had heard of the manifesto – and a solid majority of voters backing Canada's three progressive parties, ranging from 50% and 59%, endorsed the document's principles. Startlingly, even 20% of Conservative Party supporters agreed with them.

We had set out to change the goalposts of political debate, and ended up in a firestorm. But once we recovered from the attacks, what we discovered is that backlash can be beautiful. The more the country's elites smeared the manifesto, mischaracterizing its intent and spirit, the more Canadians wondered if it might be worth a look, and found that it spoke to them.

Since then, more than 50,000 people have endorsed the document, and well over 200 organizations have joined them. Those numbers are roughly the equivalent of some half a million Americans signing a radical climate justice manifesto in the U.S. – certainly no small feat.

In shaking up the country's political debate, we learned that Canadians are far more eager for transformative change than the governing class would have us believe. And many have already started working furiously to break with politics as usual. In 2015, rank-and-file members of the New Democratic Party, Canada's historically democratic socialist party, shepherded and won a resolution to debate The Leap Manifesto at the local level, with a view to eventually taking it up as party policy (that process is still unfolding).

Corresponding shifts in the national discourse have followed. In the 2015 election, for example, politicians of all major parties felt it necessary to pick a tar sands pipeline project to cheer for. Just a few years later, a government has been elected in British Columbia that campaigned forthrightly against the Kinder Morgan pipeline, and Federal Members of Parliament have been arrested as part of protests against the project. The goalposts are starting to move.

Building Power

When we launched The Leap Manifesto, our intent was to build pressure for a radical climate justice agenda from outside the political sphere. While we were working with a new constellation of demands, we were also following a familiar model of how outside social movements have achieved inside political change in the past.

Since then, we've witnessed (and taken part in) a rapid evolution of the inside/outside dynamic between movements and politicians around the world. By putting movement-inflected, decentralized organizing techniques behind transformative political manifestos, candidates like U.S. presidential contender Bernie Sanders and UK Labour leader Jeremy Corbyn have scored electoral breakthroughs: a fresh formula for change, with re-configured relationships between movements and electoral leaders.

As an example of this phenomenon, consider a game-changing demand made by U.S. activists two years ago:

> «We believe the United States must lead in forging a robust global solution to the climate crisis. We are committed to a national mobilization, and to leading a global effort to mobilize nations to address this threat on a scale not seen since World War II. In the first 100 days of the next administration, the President will convene a summit of the world's best engineers, climate scientists, policy experts, activists, and indigenous communities to chart a course to solve the climate crisis.»

You might think this is an excerpt from the U.S. Leap Manifesto. In fact, it was an official plank in the 2016 Democratic Party platform. The provision was fought for by a group of Bernie Sanders supporters, as they anticipated how to pressure the then-expected future President Clinton to act boldly on climate.

In a joint op-ed recently published in Canada's *Globe and Mail* in 2018, senior Sanders advisor Becky Bond, along with Adam Klug and Emma Rees of Momentum UK, explain why they find The Leap Manifesto inspiring – and in the process, sum up some of the common principles that drove their own pioneering work. On both sides of the Atlantic, a fundamental premise was that young people are fed up, and «ready to work for genuine system change.» So above all, the organizers sought to put those people directly in charge: «Call it bottom-up, peer-to-peer, distributed or decentralized – our approach to politics is to offer voters both inspiration and the tools to lead the organizing themselves.»

And while much has been made of Sanders' and Corbyn's personal popularity, Bond, Klug, and Rees attribute their success as much (or more) to their radical platforms as the candidates themselves. «Both the Labour Party manifesto in 2017, and Mr. Sanders' platform in 2016, rejected incrementalism and put forward system-level demands: Break up the big banks, free education from cradle to grave and an emergency mobilization in response to the climate crisis. Bold ideas such as these inspired tens of thousands to skip work on election day in Britain, knocking on millions of doors to get out the vote.»

Indeed, Sanders not only argued for free public health care for all; he also made the case for investing $1 trillion over 5 years to rebuild America's infrastructure, and put over 13 million people to work. In the UK's last general election, the Labour Party under Jeremy Corbyn called for not only re-nationalizing the railways and the post, but also for a «publicly-owned, locally accountable» green energy system, 60% renewables by 2030, and the creation of a National Investment Bank to help fund the transition.

In the developed countries that must reduce emissions fastest and deepest, we believe it's imperative for climate activists and experts to take advantage of this momentum, and to align themselves with the political movements that are creating a progressive populism for the 21st century. After all, if any rich world politician is going to achieve radical, just emissions cuts in the near future, they will almost surely come to power (and be held accountable) by popular, youth-led movements like the ones that brought Sanders and Corbyn to prominence.

Deeper work is required to make these movements more inclusive and diverse, and to build greater unity on the left of the political spectrum. But the growing impulse to win state power and use it – to redistribute wealth, shift ownership to workers, and transform our economy and society for the better – is one that we simply cannot ignore. Indeed, with each late tick of the climate clock, that social and economic agenda looks more and more like a to-do list to halt catastrophic warming.

And yet, the re-emergence of democratic socialism a la Sanders and Corbyn is not the only exciting political development for those who care about climate justice. We're also living in a golden age for municipal radicalism and local democracy.

In a dizzying range of places around the world – from Barcelona, to the cities of Northern Kurdistan, to Jackson, Mississippi – people are building local institutions to bring progressive power and resources to their own communities. It's a global wave that is as varied as its geographical scope implies, its sites of struggle drawing strength from diverse movements and ideological touchpoints. But what many of these experiments share is a fusion of the practices of direct democracy with the tools of solidarity economics, such as worker-owned co-ops and community land trusts. In some cases, their leaders have already been elected to City Hall.

«Blurring the lines between social movement and local governance, these municipalist experiments [are] demanding socially just and ecological solutions to issues that concern the community as a whole,» notes a 2017 *ROAR Magazine* issue on the trend. «Patiently, through a combination of political education, grassroots mobilization and reform, municipalists seek to place decision-making power back in the hands of citizens.»

As the surest way to guarantee that climate action actually improves people's lives, robust local institutions can serve as a check on the centralized powers that must mandate and guide the societal energy shift. We know that relying on top-down change is inherently risky; as governments change and constantly face regulatory capture, strength and pressure from below is crucial to top-down delivery. Progressive electoral victories can also solidify, institutionalize, and scale up municipal innovations.

Moved by the treaties that formed this country and bind us to share the land "for as long as the sun shines, the grass grows and the rivers flow," we want energy sources that will last for time immemorial and never run out or poison the land.
–The Leap Manifesto

CONCLUSION

If radical emissions reduction is a fundamentally global challenge, can radical cities truly lead the way? This is one of the central questions we're asking on the ground, particularly since we began working as a member of the Leap Los Angeles coalition.

The coalition draws its leadership from environmental justice organizations that have been fighting locally for decades – community-based struggles that are bright lights in the polluted history of L.A. But this particular project emerged from the hope and disaster of the 2016 US election.

When Trump was elected, the notion of a wartime-level climate emergency response was an obvious non-starter at the federal level. But some of the drafters of that language from the 2016 Democratic Party platform decided it was time to shift tactics – and move their efforts from the federal to the municipal stage.

In Los Angeles, that meant connecting with local community leaders and politicians, and launching an audacious effort to make L.A. fossil-free by 2025, and to do so on principles of justice, embedded in a community-led Leap Manifesto process.

That's right: the goal is take the second-largest city in the U.S. to 100% renewables in less than 10 years. As a first step, activists commissioned a rigorous technical roadmap for how L.A. can reach that audacious target, and recruited City Council allies to back policies to enact the plan. To ground the electoral and regulatory project in a framework of climate justice, the drafting of a grassroots L.A. Leap Manifesto is also underway – led by representatives of communities that have long been on the frontlines of struggle against environmental racism.

From a process standpoint, the L.A. project suggests a tantalizing recipe for building power: vision and policy demands from the people; a technical plan in dialogue with them, grounded in the urgency of climate science; municipal politicians ready to move in concert with community leadership; and a common front that is committed to actually making the platform a reality.

Crucially, it's also a local approach that has the seeds of a national strategy built in: L.A. Leap is consciously seeking to create a replicable and scalable model that could roll out in hundreds of U.S. cities in the coming years.

But as this project moves forward with maximum velocity, we do find ourselves grappling with one of the most difficult and time-consuming elements of this work: what does it really mean to put frontline communities at the center?

While we're still learning how to answer that question, we do know that taking direction from the frontlines is both a moral and strategic imperative. If you start in the places where people are facing life and death struggles, you'll find that they're fighting like hell to change our system; the urgency, fierce commitment, and creativity we need to win already exists. But we must go to these movements and follow their lead, not expect them to come to us.

The communities most impacted by the current system, and who have done the most to resist and propose alternatives – Indigenous groups, people of color (especially women), workers, and many more – were at the heart of The Leap Manifesto in Canada, both in terms of the process that led to the document and the content itself. This, more than any other single factor, is what made the document compelling and gave it legitimacy. It's why it rang true for so many readers of so many backgrounds. It's why we were able to use megaphones of privilege to amplify it effectively, and why it stood stronger after relentless establishment attacks.

So as participants in the L.A. project, we've helped to reinforce those principles first and foremost. Some of the fiercest environmental justice fights in the country are unfolding in Los Angeles, including resistance to urban oil drilling concentrated in poor neighborhoods of color. In every aspect of their approach, the coalition is striving to foreground the struggles and aspirations of the city's frontline communities; several are represented on the steering committee, which is launching deep community consultation and mapping initiatives that will feed directly into an L.A. Leap Manifesto.

Los Angeles was built by oil, and has a special responsibility to lead the transition to a better system. The L.A. Leap coalition believes this can only be done holistically: addressing climate alongside homelessness, mass incarceration, skyrocketing inequality (including in the city's health care and transit systems), and much more. Think about what it could mean for the second largest U.S. city to spearhead this kind of integrated approach to just transition.

It won't be easy, and L.A. Leap won't pull everything off. But we believe that the underlying framework – major cities going carbon-free in less than a decade, driven by broad-based coalitions and people's platforms – has real potential. And one of our greatest hopes is that this current project, along with our previous experience in Canada, can provide usable templates for movements around the world to experiment with.

Organizing new coalitions with frontline leaders at the center is unbelievably hard, painstaking work. There will be times when doing the necessary groundwork feels difficult to reconcile with the very compressed timeline we collectively face.

But we believe there is revolutionary potential in being unapologetically ambitious, putting frontlines first, and connecting the dots between the great crises we face, and the holistic solutions already on offer from below.

For those interested in pursuing this model of change, we can only say: be bold, remember that if there's no struggle within your coalition, than it's probably too narrow, and know that you are investing in building people power – the kind that can unleash the urgency, unity and transformation this historic moment requires.

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La Via Campesina in Action for Climate Justice

By La Via Campesina

Edited by the Heinrich Böll Foundation

The authors

La Via Campesina is an international social movement of peasants, small and medium-size farmers, landless people, rural women and youth, Indigenous People, migrants and agricultural workers. It defends peasant agriculture for food sovereignty and promotes social justice and dignity. The movement strongly opposes corporate driven agriculture that destroys social relations and nature.

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Picture above: Peasant agroecology has strong feminist roots and acknowledges women as central agents of agroecological transformation.

Picture below: Through the brigades women, men, young and old work the land collectively. Brigades also include a political dimension. With boots on the ground and tools in hands, brigades become the ideal space for grassroots groups to continue the formación process within a «campesino-a-campesino» (peasant-to-peasant) format.

INTRODUCTION

Industrialized agriculture and the corporate food system are at the center of the climate crisis and cannot be ignored in discussions about pathways to a 1.5 degree Celsius world.[1] The IPCC found in 2014 that agriculture and land-use change are responsible for around one quarter of global greenhouse gas (GHG) emissions.[2] Yet, rather than taking immediate and far-reaching action to make fundamental change, governments and corporations promote carbon markets, geoengineering and technological fixes they say are «triple wins» for sustainability, development and equity.[3]

Carbon trade, genetically modified organisms (GMOs), REDD+[4], climate smart agriculture, and geoengineering are capitalists' attempts to dominate and instrumentalize nature at the service of ever-expanding profits. These market-based «false solutions» are designed to solve the accumulation crisis, not the climate crisis.

As the global peasant movement, La Via Campesina (LVC)[5] is on the frontlines of the climate catastrophe. From our perspective, halting the climate crisis requires systemic change to uproot the primary cause of the crisis – the capitalist system.

This chapter outlines key aspects of system change in agriculture and gives concrete experiences of organized resistance and alternatives that are making change happen. In Part One we define La Via Campesina's perspective on the climate crisis and present evidence to show that, while the industrial food system is one of the

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1 Although the word «agriculture» was not mentioned once in the Paris Agreement, 94 percent of countries address agriculture in their strategies for combating climate change (Confédération Paysanne and CCFD-Terre Solidaire 2016).

2 Smith, P., et al. (2014). Chapter 11: Agriculture, Forestry and Other Land Use (AFOLU). In: *Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5)*. www.ipcc.ch/report/ar5/mindex.shtml

3 Karlsson, L., et al. (2018). «Triple wins» or «triple faults»? Analysing the equity implications of policy discourse on climate-smart agriculture (CSA). *Journal of Peasant Studies*, 45 (1), 150–174.

4 REDD/REDD+ stands for Reducing Emissions from Deforestation and Forest Degradation. Defined in more detail below, REDD/REDD+ is a carbon trading program that has social justice implications for forest dwelling communities.

5 La Via Campesina is an international movement bringing together millions of peasants, small and medium-size farmers, landless people, rural women and youth, Indigenous People, migrants and agricultural workers from around the world. Built on a strong sense of unity and solidarity between these groups, it defends peasant agriculture for food sovereignty as a way to promote social justice and dignity and strongly opposes corporate driven agriculture that destroys social relations and nature (https://viacampesina.org/en/international-peasants-voice).

main drivers of global warming, peasant agroecology and food sovereignty[6] offer huge potentials for reducing emissions – including by keeping fossil fuels underground, adapting to climatic changes and realizing social justice. Peasant agroecology and food sovereignty are social, political, and ecological visions that unite multiple sectors within a single movement to challenge business-as-usual and create systems of shared control over the requirements of life. In Part Two, we highlight four La Via Campesina members' struggles for climate justice: how peasants in France, Indonesia, South and East Africa and Puerto Rico are resisting false solutions and developing pathways to the new system.

6 According to the *Nyéléni Declaration*, «[f]ood sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems. It puts those who produce, distribute and consume food at the heart of food systems and policies rather than the demands of markets and corporations. It defends the interests and inclusion of the next generation. It offers a strategy to resist and dismantle the current corporate trade and food regime, and directions for food, farming, pastoral and fisheries systems determined by local producers» (Nyéléni Declaration, 2007, https://nyeleni.org/spip.php?article290). See also: ECVC. (2018). *Food Sovereignty Now! A guide to Food Sovereignty*. www.eurovia.org/wp-content/uploads/2018/01/FINAL-EN-FoodSov-A5-rev6.pdf

PART ONE

Industrial agribusiness vs. peasant agroecology

To fully understand the climate crisis as it relates to agriculture requires distinguishing between two agri-food systems:

1. industrial agribusiness carried out by a small set of increasingly large corporations seeking to expand private profits (including through the financialization of nature);
2. peasant agroecological farming practiced by peasants and other small-scale food producers, and with support from their urban and rural allies. Together they seek to meet human needs by working with nature.

This analysis is important because it unmasks the power relations shaping the agri-food system. It enables us to more clearly assess which systems will support a just transition away from climate crisis and towards climate justice.

Industrial agribusiness

As a whole, between 44 and 57 percent of all GHG emissions come from the industrial food chain. This includes emissions from deforestation, agriculture, processing, packaging, retail, transportation, refrigeration, and waste (see Figure 1). Each link of this food chain is controlled by a small number of very large and highly integrated global corporations.[7] The decisions they make have a profound influence on local communities and environments, and on the global climate.

One quarter of the transportation worldwide is dedicated to supplying this long-distance commercial food chain.[8] The industrial food chain as a whole promotes the consumption of processed food, instead of fresh local food. This requires the use of energy-intensive processing, packaging and refrigeration in order to longer conserve the products shipped all over the world. A globalized food market runs under the logic of overproduction. This means throwing away «up to half of the food that it produces, in its journey from farms to traders, to food processors,

7 IPES-Food. (2017). *Too Big to Feed: Exploring the Impacts of Mega-Mergers, Consolidation, and Concentration of Power in the Agri-Food Sector*. www.ipes-food.org/images/Reports/Concentration_FullReport.pdf

8 Eurostat. (2011). *From farm to fork – a statistical journey along the EU's food chain*.

to stores and supermarkets.»[9] Furthermore, this system is responsible for expanding the amount of lands used for industrial agriculture worldwide, risking the existence of savannas, wetlands, cerrados, and forests through land-use change. Soy, sugarcane, palm oil, maize, and rapeseed plantations for the industrial production of food commodities are the main culprits of deforestation in the world today.[10]

At the United Nations (UN) climate meetings, industrial agribusiness corporations are using their significant lobbying power to exert influence over climate policy in agriculture.[11] We are not tricked by the corporate discourse. So-called «climate smart agriculture» is «part of a larger process of ‹green› structural adjustment projects required by an economic system and the political elites in distress, because they have exhausted other places for enormous speculative financial investments and now see agriculture and agricultural land as the new frontier.»[12] The Paris Agreement is part of this arrangement. It provides a global framework for the expansion of carbon markets.[13] The Paris Agreement is a «carbon trade agreement» that further commodifies Mother Earth and dispossesses peasants and Indigenous Peoples of their territories.[14]

Carbon markets have serious consequences for peasants and local communities. In a grand gesture of greenwashing, private corporations, governments and other players seek to restore, develop and fund «carbon sinks» in agriculture. Agriculture and healthy soil carbon initiatives are used as a means to compensate for corporations' continued excessive GHG emissions. Meanwhile, peasants, Indigenous Peoples and other rural people live on and use these so-called carbon sinks, which represent their livelihoods. Once the carbon stored in the lands, forests and waters is given market value, agriculture and food security uses by rural communities become secondary. As the profit value of the land increases, land grabbing is more likely.[15]

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9 GRAIN. (2016). *The Great Climate Robbery*. GRAIN/Daraja Press.

10 GRAIN, 2016, loc. cit.

11 Corporate Accountability, ActionAid, ETC Group, APMDD, and Corporate Europe Observatory. (2017). *Polluting Paris: How Big Polluters are undermining global climate policy*. www.corporateaccountability.org/wp-content/uploads/2017/10/PollutingParis_COP23Report_2017.pdf

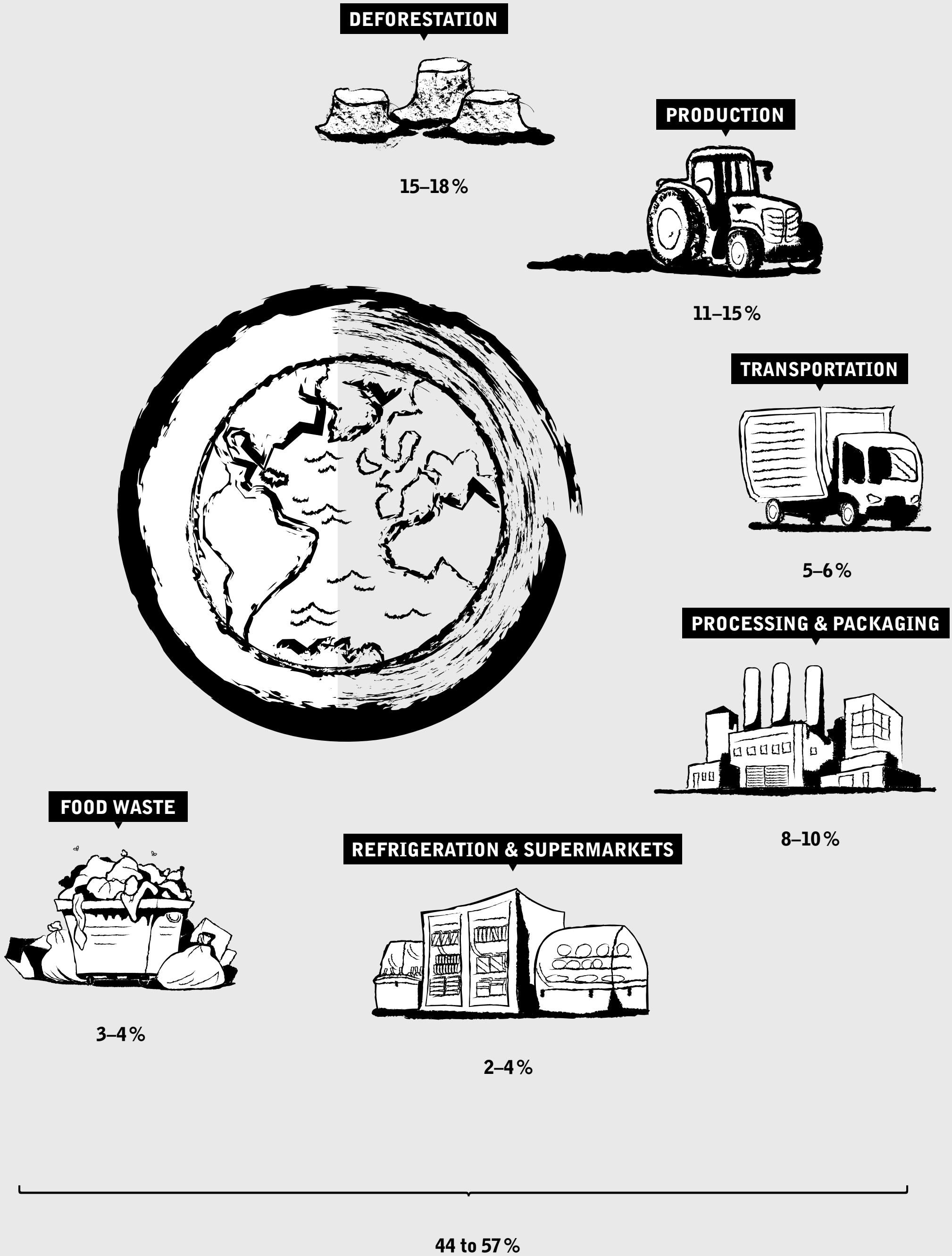
12 LVC. (2014). *Unmasking Climate Smart Agriculture*. https://viacampesina.org/en/un-masking-climate-smart-agriculture

13 Article 6 of the Paris Agreement enables country specific (unique) cap-and-trade markets to be globally integrated, especially by allowing countries to transfer a portion of their agreed-to voluntary GHG reduction commitments (called Nationally Determined Contributions [NDCs]) to another country, opening more policy space for promoting carbon trading and carbon colonialism. See also: IEN-CJA, 2017, in Footnote 14 below.

14 IEN-CJA. (2017). *Carbon Pricing: A Critical Perspective for Community Resistance*, p. 31. Indigenous Environmental Network and Climate Justice Alliance. www.ienearth.org/wp-content/uploads/2017/11/Carbon-Pricing-A-Critical-Perspective-for-Community-Resistance-Online-Version.pdf

15 Confédération Paysanne and CCFD-Terre Solidaire. (2016). *Our Land is Worth More than Carbon*. www.eurovia.org/cop-22-our-land-is-worth-more-than-carbon

Figure 1: Percentage of global GHG emissions coming from the industrial food system



Source: LVC/GRAIN. 2016; own chart.

These agribusiness corporations claim that their power and profits are justified because they will feed the world and solve the climate crisis.[16] However, the industrial food system provides food to only 30 percent of the world's population. It does so while using a massive 75 percent of the agricultural resources.[17] The corporate food chain has contributed to hunger and poverty.[18] In addition, the industrial agribusiness system is particularly harmful for women and youth. Women are the first to suffer from the impacts of land dispossession, climatic changes and disasters.[19] The corporate competition for land and water is producing conditions for massive migration, especially of young people, as well as land grabs, social conflicts and wars.

Solving the climate crisis requires transforming the power relations at the foundation of the capitalist system. Peasant agroecology offers some important starting points for elaborating collective solutions to these serious, life-threatening problems in agriculture.

Peasant agroecology

For generations, peasants and indigenous communities have worked with nature to produce food at very low risk to and in harmony with the Earth. In recent decades, the term agroecology has come to be used by social movements seeking to defend peasants' and small-scale food systems and expand alternatives to agribusiness.[20] At the same time, many multilateral institutions, some national governments, corporations, and some academics and NGOs use the concept of agroecology in different

16 Grant in: Kowitt, B. Can Monsanto Save the Planet? *Fortune Magazine*. http://fortune.com/monsanto-fortune-500-gmo-foods

17 ETC Group. (2017). *Who Will Feed Us?: The Peasant Food Web versus the Industrial Food Chain*. www.etcgroup.org/sites/www.etcgroup.org/files/files/etc-whowillfeedus-english-webshare.pdf

18 Lappé, F.M., et al. (1998). *World Hunger: Twelve Myths*. New York: Grove Press. Second edition, Chapter 5.

19 Shiva, V. (1988). *Staying Alive: Women, Ecology and Development*. London and New Jersey: Zed Books; Neumayer, E., and Plümper, Th. (2007). The gendered nature of natural disasters: the impact of catastrophic events on the gender gap in life expectancy, 1981–2002. *Annals of the Association of American Geographers*, 97 (3), 551–566.

With carbon market projects, women experience a serious decline in their quality of life. Research shows that in Costa Rica where communities lost access to forests due to privatization from carbon trading and debt-for-nature schemes, women from these communities were left without livelihoods and often ended up working in the sex tourist industry to secure a living (Isla, A. [2009]). Who Pays for Kyoto Protocol? Selling Oxygen and Selling Sex in Costa Rica. *Eco-Sufficiency and Global Justice: Women write political ecology*, edited by Ariel Salleh. London and New York: Pluto Press. pp. 209–210). In addition, on the whole, the agribusiness system benefits men by giving them priority access to land, wages, and women's labor. This power imbalance produces the conditions for violence against women. This is why we say that «agribusiness is patriarchal capitalism's rural strategy» (LVC. [2012]). *Stop the violence against women!* https://viacampesina.org/en/wp-content/uploads/sites/2/2012/10/Cartilha-VCSudam%C3%A9rica-ingles-18set12.pdf.

20 Altieri, M., and Rosset, P. (2017). *Agroecology: Science and Politics*. Nova Scotia and Winnipeg: Fernwood, Agrarian Change and Peasant Studies series.

ways, often to promote agribusiness which threatens smallholder producers.[21] Proponents of the agribusiness system argue that peasant agriculture is incapable of feeding the world's growing population, blaming peasants for their own hunger and poverty. However, small-scale farmers, peasants, fisherfolk, indigenous communities, rural workers, women and youth already feed more than 70 percent of the world's population, and they do so using only 25 percent of the agricultural resources.[22]

Moreover, a food system based on food sovereignty, small-scale farming and agroecology can overall reduce carbon emissions by half within a few decades. All of this can be done without commodifying carbon, and, at the same time, can contribute to resolving poverty and hunger.[23] The five necessary steps are outlined in the chart below.

Figure 2: A food system based on food sovereignty, small-scale farming and agroecology

Taking care of the soil		Right policies and incentives to peasant agroecological practices would allow to restore soil organic matter to pre-industrial agriculture levels within 50 years and absorb 24–30 % of all current GHG emissions.
Natural farming, instead of chemicals		Chemicals deplete the soil and pests become immune. Peasants' knowledge and practices improve soil fertility, prevent soil erosion and build organic matter, enhancing the productive potential of the land.
Reducing food miles		Much of the food system's GHG emissions can be eliminated through local markets and fresh food consumption, away from processed and frozen food in the supermarkets. Food is not a commodity to be traded.
Giving land back to the farmers		Monocultures are notorious emitters of GHGs. Small farmers are feeding 80 % of the population in non-industrialized countries, using less than 25 % of farmlands. Land redistribution to small farmers, combined with policies to rebuild soil fertility and promote local markets, can reduce GHG emissions by half within a few decades.
No false solutions		Food and agriculture are main drivers of GHG emissions. Currently governmental solutions such as CSA, GMOs, geo-engineering, biofuels, carbon markets, and REDD+, don't challenge the root causes of climate change. A shift from an industrialized food system to agroecological practices based on food sovereignty is a real solution for the climate crises.

Illustration: Raúl Fernández Aparicio/GRAIN/LVC (In the publication «Food sovereignty: five steps to cool the planet and feed its people»)

21 Pimbert, M. (2016). Agroecology as an Alternative Vision to Conventional Development and Climate-smart Agriculture. *Development*, 58, 2–3, 286–298.

22 ETC Group, 2017, op. cit., pp. 12 and 17.

23 LVC and GRAIN. (2014). *Food Sovereignty: 5 steps to cool the planet and feed its people*. https://viacampesina.org/en/wp-content/uploads/sites/2/2014/12/Food%20and%20climate%20poster%2007.pdf

Food sovereignty is the right of peasants and local communities to control their own food systems. Peasant agroecology is food sovereignty in action. It «is political; it requires us to challenge and transform structures of power in society. [It puts] the control of seeds, biodiversity, land and territories, waters, knowledge, culture and the commons in the hands of the peoples who feed the world.»[24] Peasant agroecology drastically reduces the use of external inputs that must be purchased from agribusinesses. It rejects the use of agrochemicals, artificial hormones, GMOs, synthetic biology and other corporate technologies that undermine people's well-being and food sovereignty. This system also produces for local markets thereby helping communities de-link from global corporate value chains.[25]

In 2015 in Nyéléni, Mali, several allied social movements came together to develop common pillars and principles of agroecology.[26] In April 2018, in Rome, Italy, small-scale food producers and their allies convened again at the FAO's 2nd International Symposium on Agroecology, reaffirming that: «agroecology is a way of life of our peoples, in harmony with the language of Nature. It is a paradigm shift in the social, political, productive and economic relations in our territories, to transform the way we produce and consume food and to restore a socio-cultural reality devastated by industrial food production. Agroecology generates local knowledge, builds social justice, promotes identity and culture and strengthens the economic viability of rural and urban areas.»[27]

Peasant agroecology cools the Earth. It requires less energy than industrial agribusiness.[28] The peasant system also helps keep fossil fuels in the ground by using less fossil fuel-based chemicals[29] and technologies. In addition, research has found that the wealth of biodiversity within agroecological systems makes these systems much more resilient to climate disasters.[30]

Agroecology in the framework of food sovereignty promotes social justice and equity. In particular, peasant agroecology has strong feminist roots. It acknowledges women as central agents of agroecological transformation – on farms and within social movements.[31] The struggle for agroecology affirms all people's shared control

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24 LVC. (2015a). https://viacampesina.org/en/declaration-of-the-international-forum-for-agroecology

25 LVC, 2015a, op. cit.

26 LVC, 2015a, op. cit.

27 Declaration of Small-Scale Food Producers' Organizations and Civil Society Organizations at The 2nd International Symposium On Agroecology Convened by the FAO (2018).

28 ETC Group, 2017, op. cit., 35.

29 For the most part, peasants do not use chemical inputs but, rather, use manure, so-called crop wastes and soil micro-organisms to fix 70–140 million tonnes of nitrogen per year, blocking an equivalent of roughly $90 billion in nitrogen fertilizer sales (ETC Group, 2017, op. cit., 32).

30 Vandermeer, J., et al. (1998). Global change and multi-species agroecosystems: Concepts and issues. *Agriculture, Ecosystems and Environment*, 67, 1–22. Altieri, M.A., et al. (2015). Agroecology and the design of climate change-resilient farming systems. *Agronomy for Sustainable Development*, 35, 869–890.

31 Why Hunger. (2017). *Through Her Eyes: The Struggle for Food Sovereignty*. https://whyhunger.org/wp-content/uploads/2017/12/through-her-eyes-food-soveriegnty-agroecology-sustainabilty-1.pdf over the essentials of life, including land.[32] Agroecology gives women more autonomy and empowers them within their families and communities. The same is also true for youth and elders.[33]

32 LVC, 2015a, op. cit.

33 Research from Cuba finds that higher levels of biodiversity on farms translate into more sharing of wealth and decision-making power among all family members and contribute to a breakdown in men's patriarchal power (Machín Sosa, B., et al. [2010]). *Agroecological Revolution: The Farmer-to-Farmer Movement of the ANAP in Cuba*. Havana, Cuba, and Jakarta, Indonesia: ANAP and La Vía Campesina. https://viacampesina.org/en/wp-content/uploads/sites/2/2013/07/Agroecological-revolution-ENGLISH.pdf.

Source: La Via Campesina


SS DISRUPTS THE CLIMATE
GRICULTURE
HE EARTH
Confédération Paysanne
LA VIA CAMPESINA
EUROPEAN COORDINATION VIA CAMPESINA

PART TWO

Grassroots actions for agroecology and food sovereignty

We now turn to the experiences of La Via Campesina's grassroots peasant organizations and their allies resisting false solutions and building food sovereignty and agroecology within four areas: livestock agriculture, land and forests, social movement political training, and resilience to climate disasters. We present in Part Two further evidence of resistance involving peasant agroecological food production to feed people, build social justice, and contribute to mitigating GHG emissions while adapting to climate change.

Peasant and small-scale livestock farming reduces GHG emissions and conserves the soil

Various reports from the UN Food and Agriculture Organization (FAO), and other sources, cite livestock farming as being responsible for 14.5 % of total global GHG emissions.[34] Together the top 20 meat and dairy corporations emit more GHGs than Germany.[35] Confédération Paysanne,[36] one of La Via Campesina's member organizations in France, has been working to expose the differences between two main livestock farming models: factory farming (rooted in industrial agribusiness) and peasant livestock farming (rooted in peasant agroecology).[37] This distinction is important because it dispels the myth that all livestock farming is harmful for the climate.

Contrasting models

On the one hand, factory farms are highly specialized, work with huge animal populations concentrated in single areas, produce industrial-scale animal waste, and put far too much nitrogen and phosphorus into the environment, while leaving other plots deprived of those elements. Factory farms have high demands on feed production. In order to achieve this large scale, crop growing practices are intensified and

34 FAO. (2006). *Livestock's Long Shadow*.

35 IATP, GRAIN and Heinrich Böll Stiftung. (2017). *Big Meat and Dairy's Supersized Climate Footprint*. www.iatp.org/sites/default/files/2017-11/BOELL_Meat%20Dairys_A4%20factsheet%20Web_V1.pdf.

36 www.confederationpaysanne.fr

37 Peasant livestock farming also includes pastoralists and nomadic communities.

crop rotations are simplified, especially through the application of huge amounts of synthetic fertilizers, high concentrations of manure and other external inputs. The intensive use of resources causes an increase in nitrous oxide and other GHG emissions.[38] Furthermore, the production of animal feed to supply factory farms is in direct competition with the production of food for humans, as well as with the conservation of intrinsically valuable nature reserves. In the Amazon, for instance, land-use change for industrial livestock production has been a major threat. 80 % of all deforested land has been converted to pasture for grazing animals, while the other 20 % has been mainly used to produce animal feed.[39]

Yet animals are an integral part of agroecosystems. Peasant livestock farming involves the conservation of considerable amounts of permanent grasslands, and animal and plant biodiversity. It promotes the integration of crops with livestock. Moreover, worldwide 430 million peasant farmers work with animal traction, which represents a very important energy source for rural populations that avoids the use of fossil fuels.[40] It means that animals provide both draft power to cultivate the land and manure to fertilize the soil. The resources from this system (manure, crop residues, energy) benefit both crop and livestock production, leading to greater farm efficiency, productivity and sustainability.[41] In this model, farmers avoid using synthetic fertilizers which break down the soil and lower its humus content. Animal manure contributes to maintaining humus in the soil, while humus stores CO_2 thus contributing to climate change mitigation. Grasslands represent important means to absorb and store carbon. One of the most detailed studies at the continental scale of Europe on the GHG balance found that European grasslands have extremely significant potential for absorbing large amounts of carbon, sequestering 2–2.7 times the carbon emissions from transport and fertilizer production in the EU. However, net sequestration of GHGs by the land surface (including forest biomass and soil, grasslands, other wooded land and cropland) may even diminish as CH_4 and N_2O emissions increase with further intensification of agriculture and forestry.[42]

In addition, peasant and small-scale livestock farming makes use of grasslands where other crops are not planted or where grasslands are integrated in longer rotation cycles. This offers the advantage of reducing the presence of parasites and restoring soil fertility. Holistic practices of peasant agroecology also embrace polyculture-livestock farming systems that acknowledge the differences between each species and make use of their complementarity, for instance, by feeding pigs or poultry with vegetable and cereal wastes and residues, and producing natural fertilizers.

38 UBA. (2014). *Nitrous oxide and methane*. www.umweltbundesamt.de/en/topics/soil-agriculture/ecological-impact-of-farming/nitrous-oxide-methane

39 Machovina, B., and Feeley, K. J. (2014). Meat consumption as a key impact on tropical nature: A response to Laurance et al. *Trends in Ecology and Evolution*, 29, 430–431.

40 *Journal d'Uniterre, le Journal Paysan Indépendant. Véganisme entre utopie et réalité*. (2018). https://uniterre.ch/fr/thematiques/veganisme-entre-utopie-et-realite

41 Powell, J., et al. (2004). Crop-livestock interactions in the West African drylands. *Agronomy Journal*, 96 (2), 469–483. In: Altieri, M., and Rosset, P., 2017, op. cit., p. 13.

42 Schulze et al. (2009). Importance of methane and nitrous oxide for Europe's terrestrial greenhouse-gas balance. *Nature Geoscience*, 2, 842–850.

Cows have been blamed as major climate destroyers due to the methane (CH_4) generated during their digestion process. Some experts say that the intensification of production would be a solution to this problem. The logic is that each animal would live shorter lives and, consequently, generate less CH_4. However, according to peasants of Confédération Paysanne this is a flawed argument. They point out that gains in productivity per animal generally go together with very negative factors: declines in animal health, simplification of crop production, destruction of grasslands, high use of fossil fuel and other types of energy for machines, transportation and refrigeration, and longer distances between producers and consumers. If all these factors are considered, factory farms have disastrous records when it comes to GHG emissions.[43] Furthermore, their social standards are very low; this includes labor exploitation through poor wages and working conditions, and the appropriation of large amounts of public subsides.[44] Factory farms also have many negative public health impacts including water and air pollution as well as antibiotic resistance.[45]

Finally, consumption is also an important element to take into account. Advertisements by agro-industry urge consumers to buy more and more, contributing to a worldwide increase in meat consumption.[46] However, we urgently need to reduce meat consumption and improve its distribution in accordance with what is simultaneously ecologically, nutritionally and culturally appropriate. Food sovereignty provides the level of local control over food which would also address hunger because social bonds – not market forces – influence who eats, how much, when and the type and quality of the food.

French peasant livestock farmers in action

For all the above reasons Confédération Paysanne has been working for years to strengthen the food sovereignty movement, to train peasants and allies, and to advance public policies – at local, national, European and international levels – which protect small-scale livestock holders and which support a change in the industrial animal farming model. Its advocacy work seeks public support to strengthen grassland and low-external-input systems. Such policies would address many of the challenges of the 21st century.

But Confédération Paysanne's strategies go beyond advocacy work. Civil disobedience actions represent an important pillar in their resistance. Confédération Paysanne defends farmers who refuse to vaccinate or microchip their animals. They organize collective actions like the one to dismantle the milking parlor on a 1,000-cow factory farm.[47]

43 FAO, 2006, op. cit.

44 Confédération Paysanne. (2015). *Animal-rearing: Small-scale solutions to future problems. Supplément à Campagne Solidaires no 312*.

45 GRAIN. (2017). *Grabbing the Bull by the Horns*.

46 Confédération Paysanne, 2015, op. cit.

47 See: https://viacampesina.org/en/france-call-for-support-to-confereration-paysanne and http://en.rfi.fr/economy/20140529-farmers-arrested-protest-1750-cow-factory-farm-protest.

A considerable number of members of Confédération Paysanne have been taken to court for their acts of resistance. Some of them have even lost their public subsidies or the right to sell their products. This resistance comes with great sacrifice. At the same time, it has been essential to the continued survival of peasant farming in France, and to building greater awareness in society that peasant livestock farming has nothing in common with the industrial livestock system. Peasant farming is, rather, part of a broad movement for food sovereignty and climate justice.

Indonesian peasants defending peasant rights through resistance to land grabbing and deforestation

Indonesia has the third largest tropical rainforest on the planet. The rate of deforestation in the country is among the highest in the world. In the early 2000s in Jambi, a resource-rich province in South Sumatra, around 96,000 hectares of land were privatized through REDD+[48] in the name of being an «environmentally friendly» project. Local communities lost their food sovereignty while a corporation received a 100-year lease to access the land.[49] For the local communities REDD+ has meant a grave violation of their peasants' rights. In Mekar Jaya, a province in North Sumatra, the homes and cornfields of over 100 families were destroyed in 2016 by the police to make way for the industrial cultivation of palm oil by two corporations. The peasant communities evicted have been inhabitants and workers of that land for more than six decades.[50] In April 2018 a highway construction project by the regional government led to another massive eviction. This time, 140 peasant families from nine villages in Central Java lost their lands and homes, which caused misery for those families.[51]

Such deforestation and forest degradation must urgently be stopped in order to combat climate change and halt the threats to life of forest-dependent communities who are being confronted with forced eviction. The UN-sanctioned carbon trade program, REDD+, supposedly plays the role of protecting forests thereby reducing

48 LVC. (2017b). *The future is in the hands of young peasants!* https://viacampesina.org/en/future-hands-young-peasants

49 LVC. (2008). *Small farmers victims of forest carbon trading*. https://viacampesina.org/en/small-farmers-victims-of-forest-carbon-trading

50 LVC. (2017a). *Peasants fighting for Justice*.

51 LVC. (2018). *Law on Land Procurement & Highway Construction is resulting in peasant houses and lands being forcefully grabbed: SPI, Indonesia*. https://viacampesina.org/en/law-on-land-procurement-highway-construction-is-resulting-in-peasant-houses-and-lands-being-forcefully-grabbed-spi-indonesia emissions coming from deforestation. In reality, this scheme consolidates corporate control over territory and expands profits.[52]

Indonesian peasants organized under the Indonesian Peasant Union (SPI)[53] have been engaged in a long-term fight against deforestation, land grabbing and the eviction of peasant communities from their territory. They have been organizing land occupations and pressuring the government for the implementation of popular agrarian reform to redistribute land in ways that put the needs of the people first.

As part of this struggle against land grabbing, SPI played a fundamental role in kick starting a global process to develop what has come to be called the «UN Declaration on the Rights of Peasants and Other People Working in Rural Areas». In 2010, as a result of several years of joint work between SPI, other members of La Via Campesina and allies, the Human Rights Council mandated an Advisory Committee to undertake a preliminary study on ways and means to further advance the rights of peasants and other people working in rural areas. In 2012, the results of the study lead to the establishment of an open-ended intergovernmental working group on the subject. As of June 2018, the Declaration is in the final stages of negotiations and is expected to be adopted by the UN General Assembly. Among its key components are measures to guarantee the rights of peasant communities to land, water and other resources, as well as other rights protecting peasants against systematic discrimination and human rights violations.

While corporations and world governments respond to the accelerating crises with business-as-usual, La Via Campesina fights for justice and human rights. SPI's struggle shows us that the defense of the rights of peasants and the protection of healthy ecosystems cannot be disconnected from one another.

Real solutions in LVC's Southern and East Africa Region (SEAf)

African smallholder farmers are especially vulnerable to climate change and, on the whole, African people are among the least responsible for historic emissions.[54] Despite this fact, the Paris Agreement includes no provisions that recognize African

52 REDD+ is a mechanism negotiated under the United Nations Framework Convention on Climate Change (UNFCCC) that allows international donors and private companies to pay countries to keep forests intact, the theory goes, in order to capture carbon and stabilize the climate. This carbon trading mechanism is getting a lot of international support at UN climate meetings. However, such programs negatively impact peasants and Indigenous Peoples because the forests are privatized. REDD is leading to more land grabbing.

53 SPI stands for Serikat Petani Indonesia. It is the member organization of LVC in Indonesia. www.spi.or.id

54 Althor, G., et al. (2015). Global mismatch between greenhouse gas emissions and the burden of climate change. *Nature, Scientific Reports*, 6, 20281.

countries' differing responsibilities for historic GHG emissions.[55] In the face of this injustice, political trainings and peasant-to-peasant exchanges – a core part of La Via Campesina's work – have been helping to build capacity within the Southern and East African (SEAf) region to help smallholders develop their own analysis of the problems and solutions based on their shared experiences and own expertise. At these trainings, farmers tell their stories, define their conditions and shape their priorities. As they exchange with other farmers, they learn best practices and cosmovisions from each other, and strengthen and build solidarity.

At the Juru,[56] peasant agroecology is critical to fighting climate change

During a regional training session in January–February 2018, La Via Campesina delegates from six countries in the region visited smallholder farmers and their families at Juru in Zimbabwe's Goromonzi district, Mashonaland East province.

Climate change is causing droughts in that region. Too much heat and not enough rainfall has meant that maize, the staple crop for the country, is under-producing. Farmers at the Juru Centre address the challenges of low rainfalls with agroecology. They draw on a range of techniques which include mulching, intercropping, mixed cropping, rainwater harvest, the use of terraces, planting fruit trees and agroforestry, and rain pattern recording. The farmers of Juru also grow crops that are known to withstand extreme heat, including ground nuts and beans.[57] Delegates strongly agreed on the importance of saving and using traditional or indigenous seeds that are adapted to local conditions. Their experience shows that food sovereignty and agroecology processes mitigate and adapt to climate change.

Re-defining «Climate Smart Agriculture»

Delegates to the SEAf regional meeting agreed that so-called «Climate Smart Agriculture» is not meant to benefit smallholder farmers. Rather, it is part of the package of false solutions in agriculture that helps big polluters make profits from the climate crisis at the expense of food sovereignty.[58]

55 In the lead-up to the Paris Agreement, the bullying tactics of the governments of the global North undermined the UNFCCC's principle of Common but Differentiated Responsibilities (CBDR). While this principle would have acknowledged African countries' differing responsibilities for historic emissions, this core principle for climate justice was left out of the framework for commitments outlined in the Paris Agreement.

56 The Juru Centre is a member within the national network of the Zimbabwe Smallholder Organic Farmer Forum (ZIMSOFF), which is currently the member organization hosting LVC's general secretariat. www.facebook.com/zimsoff

57 Although maize is an important crop for the culture and lifestyle of the people of Zimbabwe, the government is promoting maize without sufficiently supporting alternatives. Such alternatives will become necessary to secure food sovereignty for the country as climate changes loom on the horizon. Farmers will require government support to make the shift to diversified, agroecological agriculture.

58 LVC and Afrika Kontakt. (2018). *Peasant Agroecology Achieves Climate Justice: A Primer*. https://viacampesina.org/en/wp-content/uploads/sites/2/2018/05/primer_english_print.pdf

The FAO, the Global Alliance for Climate Smart Agriculture (GACSA)[59] and other private sector and government institutions use «climate smart» to refer to any practices that promote the interests that suit their needs. In their understanding, both agroecological farming and producing with GMOs are «climate smart». SEAf members challenge this ambiguity, providing a very clear perspective: «Climate Smart Agriculture» is the massive use of chemicals and fertilizers for agricultural production. «Climate Smart Agriculture» involves the use of high technology and GMOs, and the promotion of biotechnology. «Climate Smart Agriculture» is the opposite of agroecology.

In some parts of the Teso region of Uganda, smallholder farmers reported that the cassava seeds that were distributed by government research institutes under the so-called Climate Smart Agriculture Program did not offer the anticipated solution. They were actually fast rotting and slow growing. In contrast, agroecology contributes to food security and food sovereignty by providing families with enough diversity in food crops hence providing for their needs in times of varying climate. By practicing agroecology, farmers have more food sovereignty compared to having to purchase seeds and inputs from big agribusinesses.[60] According to a farmer representative from the region, «to gain Climate Justice one needs to regain control of seed: select it, manage it, maintain it and improve it using participatory plant breeding methods. This would allow farmers to be able to plant it again and again».

Agroecology, just recovery and mutual support in Puerto Rico after the 2017 hurricanes

In September 2017, the islands of Puerto Rico experienced two back-to-back category five hurricanes: Irma and María. Peasants, farmers, farm workers and working people living in rural and urban areas were particularly vulnerable. Many months after the hurricanes, local communities, particularly in rural areas, are still without access to electricity and other basic services. The death toll directly and indirectly related to the hurricanes continues to rise while the government has yet to address the crumbling infrastructure.[61]

Organización Boricuá de Agricultura Ecológica de Puerto Rico is a 28-year-old organization of farmers, peasants, farm workers, and activists that practices and

59 The GACSA, an initiative promoted by the FAO. Top multinationals Monsanto, DuPont-Pioneer, BASF, McDonalds and Cargill are also members of the GACSA. A total of 60 percent of the private sector membership of the GACSA comes from the fertilizer industry (GRAIN 2015).

60 LVC and Afrika Kontakt, 2018, op. cit.

61 Puerto Rico's Center for Investigative Journalism originally estimated the death toll for the first few months of the storm to be in the thousands. A new study by Harvard researchers confirms at least 4,645 deaths in the first three months. The study also found that, if the pattern continues, thousands more deaths can be attributable to the government's abandonment that continues today. No number can capture those that were lost without knowledge or those that in the emergency had to be buried in the backyard never to be counted. The link to the Harvard study is www.nejm.org/doi/full/10.1056/NEJMsa1803972 promotes agroecology as the essential tool to achieve food sovereignty.[62] After many months of living through these hurricanes and the aftermath of the devastation, Boricuá's members share four reasons why agroecology and food sovereignty are crucial to addressing the climate crisis.

Compared to conventional farming, agroecology has a high degree of resilience to climate change

The storms had a major impact on conventional farmers whose monoculture farms are dependent on external inputs. In nearly every region, the monocultures were leveled during the storms. The labor and financial investment in external inputs were lost. Over time, farmers' debt has increased because there has been no harvest to pay the bills. This loss is compounded by bad government administration that is preventing farmers from accessing insurance payments and other supports. More than nine months after the storms, conventional agriculture had still not recuperated.

The experience of agroecological farmers was somewhat different. They had significant losses. However, just like in Guatemala and Nicaragua after hurricane Mitch in 1998,[63] we see that agroecological farms were more resilient to the storms' powerful winds and rains. We have found that agroecological farms have been able to bounce back, largely because they have relied on a diversified farming system that protected and shared local *jíbaro-campesino*[64] ancient knowledge.[65] Many root vegetables like cassava, yam, taro and sweet potato resisted the storm. With a vast diversity of crops on farms, many members from our network were harvesting food for their families and their communities only days after the hurricanes, while simultaneously planting crops to feed people for the weeks and months to come.

The brigade methodology helps us recover and «scale up» agroecology

Boricuá's years of work on agroecology has created a network of mutual support. We have been able to draw upon this network to recover from disaster capitalism where corporations take advantage of natural disasters to advance their interests.[66] Our main strength is that we have each other: we are organized together as a family within «base groups» across diverse regions in the archipelago of Puerto Rico.

The methodology follows a decentralized, mutual support process called brigades. This methodology has been at the core of Boricuá's work for decades. Through the brigades women, men, young and old work the land collectively. We exchange seeds, we learn from local experiences, host agroecological workshops, stay in touch with each other, and move from region to region to support the network of farmers and agroecological projects. A brigade will collectively complete as much work as it takes the labor of a typical farm to complete in approximately one month.

62 Boricuá is a member organization of La Via Campesina. www.facebook.com/organizacion-boricua

63 See: Holt-Giménez, E. (2008). El huracán Mitch. *Campesino a campesino*. Managua.

64 *Jíbaro* is the Puerto Rican word for peasant, while *campesino* is the Spanish word for it.

65 Some farms had less erosion, thanks to agroforestry and agroecological practices.

66 www.democracynow.org/2018/2/19/five_months_after_maria_san_juan

Brigades also include a political dimension. With boots on the ground and tools in hands, brigades become the ideal space for grassroots groups to continue the formación process within a *campesino-a-campesino* (peasant-to-peasant) format. Participants learn from each other about the political dimensions of agroecology. The brigade is a tool to «scale up» agroecology by encouraging adoption in new areas. This work is all done without the support of formal institutions. When we work together grounded in social justice principles, we not only produce healthy food in harmony with the Earth. We also build community power.

Agroecology is a form of resistance and an alternative to capitalism

We do not rebuild the same system that created the problems in the first place. We are achieving systemic change starting from our own communities and territories. We are going to the root of the problem – the capitalist system which relies on colonialism, racism and patriarchy.[67]

For us, agroecology is a form of resistance – a tool for organizing in opposition to corporate power. Agroecology cannot be defined exclusively in terms of sustainable and healthy food production. When we work together as farmers, farm workers, peasants, and food sovereignty activists, we do it to develop a strong platform to create policy, to influence public opinion, to educate each other, to mobilize against corporations that are putting our lives and livelihoods at risk. We practice agroecology to protect and share *jíbaro-campesino* ancestral knowledge, to make the struggles of rural and urban communities more visible, and to help develop a new generation of farmers. Agroecology has served as a liberating tool that enables us to be independent. We are focused on food because we are farmers but we care about every aspect of life and how it is organized.

International solidarity strengthens our movement

As a part of the global movement of La Via Campesina and other international articulations, we have received support from many of our friends who were there for us after the disaster. This international solidarity was important for us because of our colonial context. International brigades became a tool for decolonization. It is important for us to be a part of an international articulation that builds the global movement because many of the obstacles and problems we experience at the local scale are systemic and global. Fighting this requires global coordinated action. This type of international exchange brings opportunities to learn from strategies of our allies in other places, and enables joint political analysis and strategic planning.

67 Legally, Puerto Rico is a commonwealth of the USA. In this relationship, Puerto Rico has become a colony for transnational agribusinesses including Bayer, Monsanto, Syngenta, DuPont Pioneer, and others carrying out GMO experiments on public farm land, jeopardizing the health of communities and the environment.

CONCLUSION

The industrial agribusiness system is at a critical juncture. Its continued expansion is destroying the conditions of life for present and future generations. The pathways to achieving a 1.5°C world must be radically different than the ones which produced the crisis we are in today. This chapter sought to make clear a crucial reality: while agribusiness is destroying biodiversity, local ecosystems, the global climate, livelihoods and life itself, peasant agroecology is a vital pathway forward as it already feeds the world's people without risking the health of the planet. As the global peasant movement – La Via Campesina – and our allies state: «[R]eal solutions to stop climate change are rooted in peoples' access to and control of land and water and promoting agroecology, nature restoration and water retention landscapes.»[68] The world's peasants have the skills and experiences to build on and expand the power from below that is necessary to make this quantum leap to a new system.

The above four examples of peasant agroecology demonstrate that peasants and their organizations are not waiting for governments and corporations to take the lead. They are already defending and recreating agricultural systems that have for thousands of years nurtured life, not undermined it.

Peasant agroecology requires immediate support in order to reverse the interconnected social and ecological crises. For governments to take seriously real solutions to the climate crises, they must urgently take direction from the masses of people, especially rural peasant communities, pastoralists, small-scale fishers, and Indigenous Peoples, including women and youth who are most impacted by the crisis. As we sought to demonstrate above, peasant-led strategies to mitigate GHG emissions and adapt to climate change are the most holistic approach to reversing the climate crisis and promoting social justice in the agri-food system.

The struggle for a 1.5oC world is also a struggle for human rights.[69] To support peasant agroecological practices and build the political will to achieve food sovereignty, political measures must include the immediate implementation of human rights based processes. Those processes include the Right to Adequate Food, the International Labour Organization (ILO) Convention 169, Free Prior and Informed Consent, the General Recommendation 34 by the Committee on the Elimination of Discrimination against Women, the UN Declaration on the Rights of Indigenous Peoples, the Tenure Guidelines, and the Small-Scale Fisheries Guidelines. Similarly,

68 IPC. (2018). *The IPC Statement from Paarl (Cape Town)*. www.foodsovereignty.org/ipc-statement-cape-town

69 We would like to highlight that in accordance with international law and international human rights law, if human rights are in conflict with economic interests, then human rights must prevail.

quick adoption and implementation of the UN Declaration on the Rights of Peasants and Other People Working in Rural Areas is essential. Because the climate crisis is intrinsically interconnected to the crisis of global inequality, hunger, poverty, migration, dispossession, territorial conflicts, political repression, occupations and wars, broad systemic changes are urgently needed. La Via Campesina and our allies are working in the fields, on the streets and at institutional level to make these changes a reality.

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Re-Greening the Earth

Protecting the Climate through Ecosystem Restoration

By Christoph Thies

Edited by the Heinrich Böll Foundation

The Author

Christoph Thies holds a PhD in Ecological Chemistry from the University of Oldenburg in Germany. He joined Greenpeace Germany in 1988 and is an expert on forest and climate related issues.

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INTRODUCTION

The land sector is part of the climate problem today, but it can become part of the climate solution in the future. Currently, emissions from the land sector—primarily from industrial agriculture and forest and peatland destruction—contribute to global warming and dangerous climate change. As a result, the CO_2 content in the atmosphere continues to increase and is already at levels that, if not decreasing, would likely see global temperature rise exceed 1.5°C above pre-industrial levels. The world's natural ecosystems, however, acts as vital carbon sinks that absorb and sequester CO_2 from the atmosphere, thereby regulating the climate system. The protection and restoration of natural ecosystems, particularly forests, peatlands and coastal ecosystems, can therefore promote CO_2 uptake from the atmosphere and contribute to climate and biodiversity protection.

There is a growing consensus that more CO_2 must be removed from the air. It is estimated that a cumulative amount of 100 to over 1,000 billion tons of CO_2 must be removed within this century, depending on the speed and the extent to which emissions will be cut. If emissions from burning fossil fuels and other greenhouse gas emissions can be reduced quickly enough, the necessary CO_2 uptake can be achieved by protecting and restoring natural sinks, thereby avoiding untested and potentially risky Carbon Dioxide Removal (CDR) technologies.

Land ecosystems and terrestrial carbon

On the earth's surface, there are large reservoirs of carbon, which regulate the global climate and provide the basis for all terrestrial plants and animals. These carbon pools consist mostly of the world's soils and, to a smaller extent, trees and other vegetation. They exist in various natural ecosystems such as forests, peatlands, savannas, steppes, and also extending to areas where the land meets the sea, in mangroves, salt marshes, seagrasses and other coastal ecosystems.

Some 600 million years ago, marine organisms and plants colonizing the formerly barren lands, turned the earth into a large battery. This battery charged itself by converting sunlight into stored energy in forms of organic matter in living vegetation, other living biomass, soils, and fossilized biomass—vast reserves of coal, oil and gas, which started forming underground some 350 million years ago.[1]

After a long period of equilibrium, humans began discharging this battery 12,000 years ago by cultivating crops and herding animals. By burning, logging, grazing, draining, and flooding forests and other natural ecosystems, organic matter in vegetation and soils was depleted more quickly than the battery could recharge. This depletion has accelerated vastly in the last 120 years. About half of the global vegetation biomass has been lost in the last 2,000 years compared to what it would be in a world without human activity.[2] Almost a quarter of this loss occurred in just the last 120 years.[3]

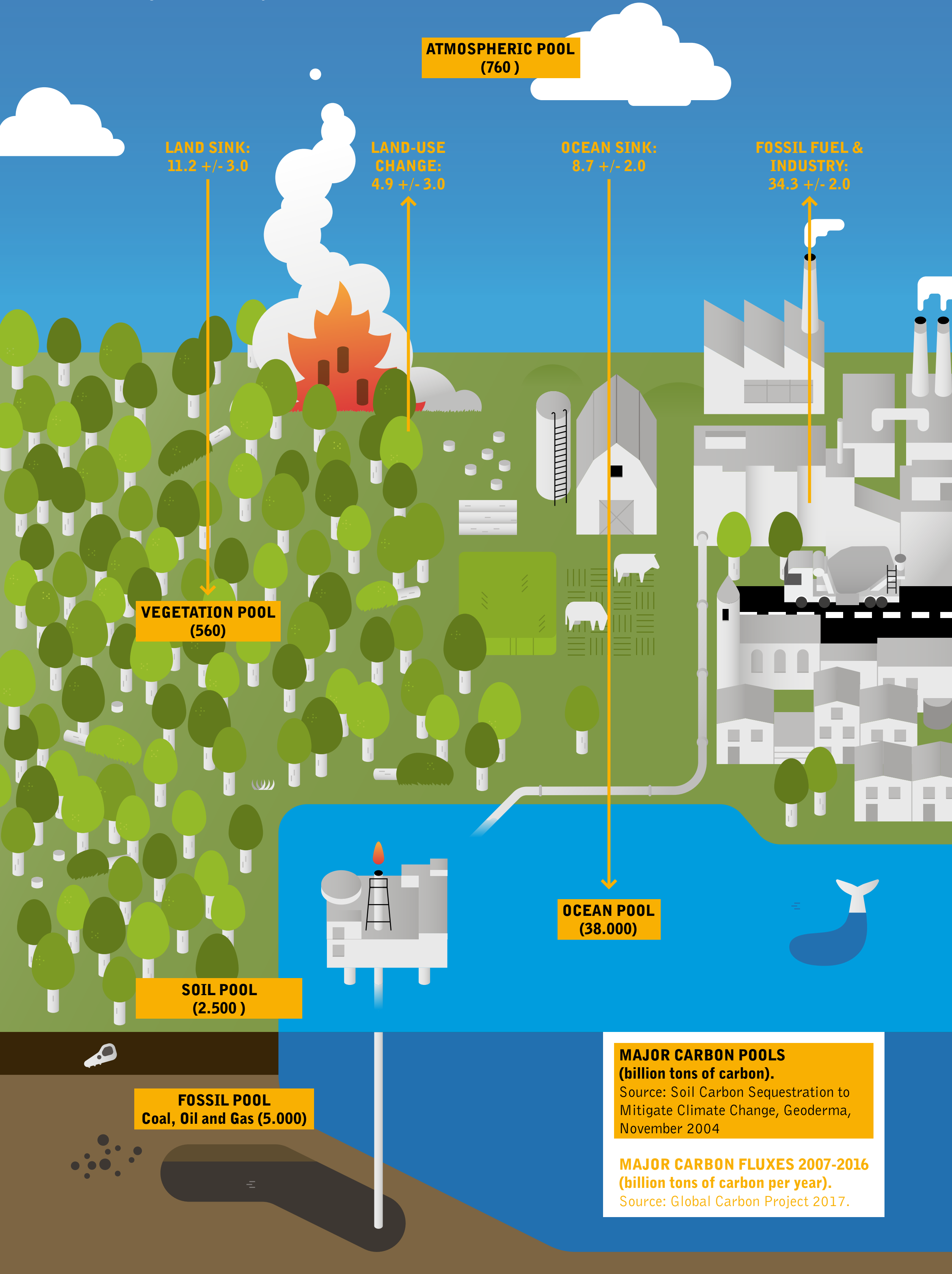
These activities, together with the emissions from depleting soils (particularly in peatlands) and fossil fuel combustion in the last 150 years, led to rapidly increasing amounts of carbon accumulating both in the atmosphere and in the oceans, causing climate change and ocean acidification. Carbon is being depleted from the land and underground and is now in dangerous excess in the oceans and atmosphere. Climate change and ocean acidification are threatening many land and sea species with extinction and massively impacting terrestrial and marine ecosystems (see figure 1).

1 Schramski, J. R., et al. (2015). Human domination of the biosphere: Rapid discharge of the earth-space battery foretells the future of humankind. *Proceedings of the National Academy of Sciences*. 112(31), 9511–9517. http://www.pnas.org/content/112/31/9511

2 Erb, K-H., et al. (2017). Unexpectedly large impact of forest management and grazing on global vegetation biomass. *Nature*. 553, 73-76. https://www.nature.com/articles/nature25138

3 Schramski, J. R., et al. (2015). op. cit.

Figure 1: Carbon Cycle



The difference between fossil and terrestrial carbon pools

Terrestrial carbon regulates the climate differently than coal, oil, and gas, which make up the fossil carbon pool. Fossil carbon is more or less permanently locked up underground and would remain there if we don't dig it up and burn it.

By contrast, terrestrial carbon is in permanent exchange with the atmosphere.

Soils and vegetation are subject to both growth and decomposition. Growth is generated by vegetation absorbing CO_2 from the air with the help of sunlight, storing carbon in the biomass of growing trees and plants, and passing some of it through their roots on to the soils. Vegetation acts as bridge between the atmospheric carbon pool and the (much larger) soil carbon pool.

Decomposition, in contrast, releases CO_2 back into the air and is caused largely by burning forests and other lands, logging trees and subsequent felling damage to other trees and skidding damage to the soil, as well as harvesting plant biomass from other lands. It also is caused by droughts, storms, and heatwaves. If decomposition dominates growth, the ecosystem is in process of destruction; if growth is faster than decomposition, it is in process of restoration.

Burning fossil fuels is an irreversible process moving carbon from the fossil pool to the atmospheric pool. Through the restoration of global vegetation, however, a good part of the lost carbon from the terrestrial carbon pool from past destruction could be restored within decades. In other words, while stopping fossil fuel combustion is the most important task in reducing CO_2 emissions, halting the destruction of and restoring forests and other land ecosystems is key in removing CO_2 from the atmosphere and reversing the trend of rising CO_2 concentrations.

Forests are crucial for CO_2 uptake

To mitigate climate change and protect biodiversity and ecosystems, terrestrial carbon pools must be urgently prevented from losing more of the carbon they have accumulated over centuries and millennia. Restoring at least a small part of the lost vegetation biomass is a fast and environmentally friendly way to combat dangerous climate change by removing large amounts of CO_2 from the air. The majority of global plant biomass is stored in the world's largest plants, the trees of the forests. Forests are the most important natural land carbon sink. Stopping deforestation, allowing forests to recover some of the deforested areas, protecting ancient forests from logging, and allowing managed forests to grow back towards their natural growing stock and native tree composition are the most important natural climate solutions.

The estimated global potential for CO_2 uptake through forest restoration is of the order of 400 billion tons in the 21st century. According to the calculation by Kartha and Dooley, imposing social constraints to ensure food security as well as biophysical constraints would provide a cumulative potential of 370–480 billion tons within the 21st century.[4]

The extent of forest restoration can be impacted by an increased frequency of regional fires, droughts, and heatwaves. Die-back and reduced growth of trees also temporarily reduce the global forest carbon uptake. These risks increase with global warming, so it is crucial for the rate and intensity of climate change to be minimized with fast and deep emission cuts to maintain the significant potential that ecosystem restoration holds over the 21st century.

It is important to highlight that the protection and restoration of forests and other ecosystems accomplish much more than just reduce greenhouse gas concentrations in the atmosphere and increase the CO_2 uptake. Based on ecologically and socially adequate principles (see the restoration principles developed by the Climate, Land, Ambition and Rights Alliance (CLARA) below), restored natural ecosystems protect biodiversity, filter air and water bodies, increase clean water supply, help prevent coastal floods and soil erosion, serve as biodiverse habitats that strengthen livelihoods of Indigenous Peoples and local communities, and enhance climate resilience in droughts, fires, storms, floods, and other extreme weather. In short, they pave the way towards realizing the 2015 Sustainable Development Goals (SDGs).

4 Kartha, S. and Dooley, K. (2018). Land-based negative emissions: risks for climate mitigation and impacts on sustainable development. *International Environmental Agreements: Politics, Law and Economics*. 18(1), 79–88. https://link.springer.com/article/10.1007/s10784-017-9382-9

Forest ecosystem restoration
Forest restoration can provide the backbone for additional CO_2 sequestration in this century. There are two ways to do this:

- Protecting primary forests from logging and allowing other forests to grow and be restored through natural forest management with reduced logging rates and impacts
- Halting deforestation and reforesting lost forests

Protecting and restoring existing forests

For successful forest restoration, logging rates must be limited in many forest regions. Furthermore, measures such as logging bans in primary and other valuable and/or vulnerable forests, drastic reduction of felling, skidding, road-building damage, forest fire prevention and control, and reduction of herbivore overpopulation (e.g. trophy hunting) must be put into place. These combined measures would minimize soil and vegetation damage; enable forest regrowth as well as additional carbon uptake.

Forests and the wood they provide form an important part of the bioeconomy. A crucial sustainability criterion for a bioeconomy with nature protection and natural climate solutions is the balance between what to leave and what to take—in other words, the balance between the share of the growing biomass left to nature for biodiversity and natural CO_2 uptake and the share harvested and used for cutting CO_2 emissions and replacing fossil and other non-renewable resources.

Therefore, a new balance between forests and wood harvest for the benefit of the forest is needed. In a recently published *Forest Vision* for Germany by the Öko-Institut for Greenpeace, Germany's forest growth in the 21st century under different management assumptions could have significant potential for future CO_2 uptake: within this century, over 2 billion tons of additional CO_2 could be absorbed in Germany's 11 million hectares of forest alone.[5]

As Table 1 shows, this forest vision offers decisive advantages compared to a Business as Usual (BAU) scenario in the 90-year modelling period from 2012–2102; annual growth is 7 percent higher, annual CO_2 sequestration by the forest and its harvested wood is 77 percent higher, and annual wood harvest is only 25 percent lower. In the year 2102, the growing stock is 42 percent higher, the growing stock of larger trees (above 60 cm BHD) is 169 percent higher, and the deadwood stock is 18 percent higher.

It cannot be expected that the CO_2 uptake potential everywhere else in the world would be the same as that of Germany. There is an enormous potential, however, as global secondary forest cover is over 200 times larger than Germany's forest area. Even if the global average of additional CO_2 uptake would be only half of that of Germany,

5 Böttcher, H., et al. (2018). *Forest Vision Germany: Description of methodology, assumptions and results*. Öko-Institut e.V. https://www.greenpeace.de/files/publications/20180228-greenpeace-oekoinstitut-forest-vision-methods-results.pdf it would result in some 200 billion tons of additional CO_2 uptake in the world's secondary forests. Restoration of secondary forests offers the single biggest natural CO_2 uptake potential without requiring any additional land.

At the same time, demand for wood is increasing; wood is being promoted to replace aluminum, steel, cement, and fossil fuels, thus contributing to the reduction of fossil fuel emissions. Allowing forests to restore themselves and grow back to their natural capacity with reduced logging would make wood a rare and limited resource.

Table 1: Different scenarios of forest management (study by Ökoinstitut on Germany's forests 2012-2102)

	Unit of measurement	Scenario «base» business as usual	Scenario «forest vision» ecological forest management
Growing stock in forests	Billion m^3 in 2102	5	7.1
Forest growth	m^3 per year and hectare	9.3	9.9
CO_2 uptake in forest vegetation*	Million t CO2 per year 2012–2102	17.2	48.2
Total CO_2 uptake**	Million t CO2 per year 2012–2102	31.9	56.3
Growing stock large trees (>60 cm diameter)	Billion m^3 in 2102	0.6	1.7
Deadwood stock	m^3 per hectare in 2102	22.5	26.2
Annual wood harvest rate	m^3 per year and hectare 2012–2102	6.8	5.1
	Million m^3 per year in 2102	71.8	61.8
Share of forest area excluded from logging	%	4.1	16.6

*stored in stems, branches, leaves, roots
**stored in forest biomass and dead wood, litter, soil and wood products

Reduced wood supply, however, can still imply increased wood use if we make more from less. This can be achieved by using wood in cascades of products. Various long-lived and short-lived products could be created using only otherwise unusable wood residue in product chains for bioenergy. Wasteful use such as burning massive amounts of fresh wood for bioenergy or throw-away paper products must be drastically reduced and largely phased-out.

Wood products cannot absorb CO_2 from the air; they can only store the carbon that the living tree removed from the atmosphere before. The only way that CO_2 can be absorbed from the air with additional benefits for biodiversity is to have more trees and to allow them to grow old and large. Every single tree cut down unnecessarily or too early means less carbon uptake from the atmosphere.

Halting deforestation and reforesting lost forests

Successful reforestation will require significant areas of formerly forested lands. This will be required mostly in tropical regions where forests have been replaced by cropland, pasture, and settlements in the last decades and also in temperate regions where forests have been cleared in the more distant past. Policy incentives must be put in place to ensure that the drivers of deforestation are addressed, including cattle pastures, soy, oil palm, and other crops.

Furthermore, a major effort must be put into involving Indigenous Peoples and other communities of traditional forest and land users. Not only are their full participation and prior informed consent vital, but also their rights and livelihoods must be respected in the decision-making in reforestation.

It is also likely that there will be many other demands for these lands from a growing population, such as to expand croplands. Such demands could pose a challenge in finding former forest lands that have the potential to be reforested, particularly in the tropics.

A global land-use vision would help address competing land-use demands. It could demonstrate how the expansion of agricultural lands can be halted through a diet with less meat, reduced food waste, bioenergy downsized to biomass waste instead of dedicated energy-croplands or fresh wood, soil restoration, and so forth. This must be complemented with mobility and other land-planning concepts that reduce the expansion of built-up land (settlements, roads, and other infrastructure).

Restoration principles

1. **To ensure restoration is good for people it must**
   - **Respect the rights of local and indigenous people.** Many of the most promising areas for forest restoration are under the legal or customary ownership of local forestdependent people. Their right to free, prior and informed consent (FPIC) about what happens to their land must be respected and promoted.
   - **Respond to local needs.** To be resilient and just, restoration strategies must respond to local needs and conditions. When led by local people, forest restoration can provide many everyday benefits like providing food and strengthening local peoples' connection to the forest.
   - **Promote social justice and equality.** Women, the poor and marginalised groups are especially dependent on forests. Restoration activities should therefore promote their rights and benefit their everyday lives.
   - **Promote good governance.** Forest restoration will only be successful if there is good governance of forests that ensures meaningful participation of local communities in decision-making.

2. **To ensure restoration is good for biodiversity it must**
   - **Support ecosystem protection.** Restoration should foster natural forest features such as having a variety of local and endemic species, rather than cultivating monoculture tree plantations which have low biodiversity value.
   - **Promote environmental co-benefits.** Restoration projects should explicitly aim to achieve broader environmental benefits in the local area – such as improved water quality, ecosystem productivity and soil fertility.
   - **Support biodiverse landscapes.** Restoration should reconnect fragmented primary and natural forests, increase natural features of secondary forests (such as decaying wood), increase tree cover in agricultural areas via agroforestry, and balance different land uses. Creating larger biodiverse landscapes – rather than targeting individual areas enhances the resilience of restored areas.

3. **To ensure restoration is good for climate it must**
   - **Promote strong ecosystems.** Biodiverse ecosystems (rather than plantations) are more resilient to environmental changes like increased pests, forest fires and disease. This is particularly important as a warming planet will see an increase in such environmental disasters.
   - **Protect existing carbon stocks.** Primary forests, natural wetlands and grasslands store large amounts of carbon and they should not be compromised.
   - **Increase overall climate ambition.** The remaining carbon budget is so small that increased efforts in all sectors are necessary. There are social and ecological limits to how much climate action can be achieved by forests. Restoration should therefore be additional to emission reductions in other sectors and not used to compensate, or «offset», lowered ambition.

Above principles are from Restoration Statement.
https://fern.org/restorationprinciples.

Paris Climate Agreement and limiting global warming to 1.5°C

The Paris Agreement to avert catastrophic climate change and limit global warming to 1.5 degrees compared to pre-industrial levels poses a significant challenge to governments and societies around the world. However, this goal can still be achieved. We have the options and pathways to stay below 1.5 degrees; what is lacking is the political will in many countries to prioritize and implement them. Current commitments are far from this target, and measures to mitigate climate change must be ramped up significantly. This entails massive emissions cuts and eliminating CO_2 emissions from fossil fuel combustion and greenhouse gas emissions from forest destruction, agriculture, and many other sources.

In addition to fast and more stringent emissions reductions, many of the 1.5°C scenarios developed over the past few years envision large-scale implementation of technologies to remove CO_2 from the atmosphere and bury it underground or in the oceans.[6] According to some scenarios, several hundreds of billions of tons of CO_2 would need to be taken out of the atmosphere; the actual numbers would depend on the speed and extent of emission cuts in the near and medium-term future. These involve technologies called Negative Emission Technologies (NETs) or Carbon Dioxide Removal (CDR) technologies with chemical CO_2 capture and geological storage, which are untested, especially on a large scale, and could cause significant adverse impacts that put both human communities and natural ecosystems at great risk.[7]

There has been growing unease and criticism regarding such unsustainable assumptions about the large-scale implementation of CDR in such scenarios. Some recent climate mitigation modeling, therefore, have explored alternative, more profound, and far-reaching mitigation options that have not been considered in mainstream 1.5°C scenarios and that pave the way for a climate trajectory that depends much less on CDR and avoids temperature overshoot (see *Modelling 1.5°C-Compliant Mitigation Scenarios Without Carbon Dioxide Removal* in this publication).

Similarly, the contributions to this publication also demonstrate that more transformative visions for the 1.5°C goal are both feasible and urgently required. They unlock additional mitigation potential to drastically reduce the amount of CO_2 uptake needed.

Gambling with untested and potentially risky technologies

The widely proposed option for land-based CDR is large-scale afforestation (monoculture plantations of fast-growing exotic trees), either alone or in

6 Minx, J. C., et al. (2018) Negative Emissions–Part 1: Research landscape and synthesis. *Environmental Research Letters*. 13(6). http://iopscience.iop.org/article/10.1088/1748-9326/aabf9b/pdf

7 ETC Group, Biofuelwatch and Heinrich Böll Foundation (2017). *The Big Bad Fix. The Case Against Climate Geoengineering*. Nairobi/Berlin/Ottawa.

combination with another contested technology: bioenergy with carbon capture and storage (BECCS). Typically, in BECCS, plantation wood is combusted in power stations and the arising CO_2 is chemically captured and buried under high pressure in underground geological formations.

Only a few pilot BECCS plants have been in operation so far, removing some 20 million tons of CO_2 per year from the atmosphere, or a negligible 0.5 per mille of current annual CO_2 emissions. There are large uncertainties surrounding the technological, social, and economic feasibility of scaling up BECCS. For one, the significant land requirement for BECCS in many assessments imply serious social and ecological risks: It is estimated that between 380 million hectares (approximately the area of India) and more than the equivalent of all land currently used for crop cultivation would be required for BECCS.[8,9] Monoculture plantations are also more vulnerable to climate change than biodiverse forests as they are susceptible to droughts, excessive heat, and fire.

Land-based CDR technologies, therefore, are a dangerous «quick-fix» to gamble with. We must take timely and adequate action today to avoid risky reliance on them in the future. There are not only fundamental uncertainties regarding their technological feasibility, but BECCS also could have unacceptable social and ecological impacts.

8 Smith P., et al. (2016). Biophysical and economic limits to negative CO_2 emissions. *Nature Climate Change*. 6, 42–50. https://doi.org/10.1038/nclimate2870

9 Burns, W. and Nicholson, S. (2017). Bioenergy and carbon capture with storage (BECCS): the prospects and challenges of an emerging climate policy response. *Journal of Environmental Studies and Sciences*. 7(4), 527–534.

Natural Climate Solutions – window of opportunity

While forest protection and restoration are prominent natural climate measures for removing CO_2 from the atmosphere, other land and coastal ecosystems offer potential as well. A 2017 paper by Griscom and co-authors identifies a range of what they call «Natural Climate Solutions.» According to their study, two-thirds of all natural climate solutions to mitigate climate change lie in forest protection, management, reforestation, and restoration.[10] They found, however, that one-fifth of the total potential lies in grazing-land management and restoration, together with other agricultural measures. Furthermore, 14 percent of all natural climate solutions to mitigate climate change that they identified were in the protection and restoration of peatlands and coastal ecosystems.

Forests and other ecosystems have a significant potential to sequester CO_2 over the course of the 21st century, but this opportunity is limited. Their CO_2 uptake will eventually reach saturation and is regionally reversible when ecosystems degrade, collapse, or become otherwise destroyed. The risk of ecosystem degradation and destruction increases with rising temperatures and unfolding global climate change. Carbon sequestration in natural ecosystems, therefore, must not be (mis)used to offset or compensate fossil fuel and industry emissions, which, in contrast, are irreversible. Forest and ecosystem restoration, therefore, must be undertaken in conjunction with full and rapid decarbonization and restructuring of the energy and industrial sectors (see *A Managed Decline of Fossil Fuel Production, Another Energy is Possible* and *Zero Waste Circular Economy. A Systemic Game-Changer to Climate Change* in this publication).

Drastically ramped-up national mitigation targets, political measures, and economic incentives to speed up and intensify emission reductions in all sectors are crucial in ensuring that the additional CO_2 uptake required in this century stay within the lower range of the estimates (e.g. 100–400 billion tons). If this were the case, it can be achieved by protecting and restoring forests and other natural ecosystems, provided that national targets, measures, and incentives are being developed for the protection and restoration of natural sinks as well.

The current lack of ambitious climate targets pushes the amount of CO_2 uptake required over the course of this century towards the upper end of the estimates (e.g. 400 to over 1000 billion tons of CO_2 cumulatively)—a magnitude of carbon dioxide

10 Griscom, B. W., et al. (2017). Natural Climate Solutions. Proceedings of the National Academy of Sciences. 114 (44), 11645–11650. http://www.pnas.org/content/114/44/11645 removal that is impossible to achieve through Natural Climate Solutions. This would require the deployment of technologies such as BECCS, which are either untested or potentially involve high risks for local people, natural carbon sinks, native biodiversity, water cycles, and soil erosion, thus being incompatible with the sustainable development goals (SDGs). Such largely hypothetical methods of removing CO_2 from the atmosphere are therefore dangerous to bank on as they may prove unfeasible or socially and ecologically unacceptable.

If every sector steps up ambition and does its utmost to rapidly phase out emissions and increase natural CO_2 uptake, the window of opportunity to stay below 1.5°C of global warming can be kept open without putting our natural ecosystems even further at risk. Natural climate solutions have high potentials and provide a robust basis for immediate global action to improve ecosystem protection and restoration. They can provide a remedy not only for climate change, but also for biodiversity, soil and water threats, and help to remain a safe operating space of our planetary boundaries. Humanity and nature depend on intact ecosystems as much as on a stable climate.

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Modelling 1.5° C-Compliant Mitigation Scenarios Without Carbon Dioxide Removal

By Christian Holz

Edited by the Heinrich Böll Foundation

The author

Christian Holz is a postdoctoral researcher at Carleton University in Ottawa and the Senior Research Associate at the Climate Equity Reference Project. His work focuses on the role of equity as enabler of ambitious domestic and international climate change action while protecting the rights of the world's poor.

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INTRODUCTION

In the Paris Agreement, the countries of the world agreed to «pursue efforts to limit temperature increase to 1.5°C above pre-industrial levels».[1] Climate scientists typically interpret this phrase to mean to limit global warming to 1.5°C or less in 2100. They can then develop greenhouse gas (GHG) emissions pathways that can lead to this outcome.[2] The majority of the 1.5°C-compatible emissions pathways in the climate modelling literature[3] rely on removing large amounts of carbon dioxide (CO_2) from the atmosphere. This Carbon Dioxide Removal (or CDR) by large-scale technological means is typically focussed in the second half of the century and is typically modelled as Bioenergy combined with Carbon Capture and Storage (BECCS). BECCS means that CO_2 is removed from the atmosphere through photosynthesis of bioenergy crops, which are then used in bioenergy power plants or converted to liquid fuels, hydrogen or methane for the transport sector, while the associated emissions are partially captured and stored underground. The 1.5°C scenarios analyzed in Rogelj et al. (2015) envision cumulative removals between 450 and 1,000 $GtCO_2$ over the course of the century, with annual removals as high as 20 $GtCO_2$.[4] Contrasting this figure with the current level of annual global emissions from fossil fuels, industry and land use change of about 31 $GtCO_2$ illustrates the scale.[5]

More recently, scholars, policy-makers and civil society have increasingly questioned the feasibility of implementing CDR, especially BECCS, at this large scale, pointing to large land requirements for bioenergy crops, and the associated risks for food and water security or biodiversity, as well as technological feasibility, social

1 UNFCCC. (2015). *Decision 1/CP.21 – Adoption of the Paris Agreement*. Paris: UNFCCC. https://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf

2 IPCC. (2014). *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. (Edenhofer, O., et al., Eds.). Cambridge: Cambridge University Press. http://mitigation2014.org/report/final-draft; See also: Rogelj, J., et al. (2015). Energy System Transformations for Limiting End-Of-Century Warming to Below 1.5°C. *Nature Climate Change*, 5 (6), 519–527. https://doi.org/10.1038/nclimate2572

3 E.g.: IPCC, 2014, op. cit.; Rogelj, J., et al., 2015, op. cit.; Rogelj, J., et al. (2018). Scenarios Towards Limiting Global Mean Temperature Increase Below 1.5°C. *Nature Climate Change*, 8 (4), 325–332. https://doi.org/10.1038/s41558-018-0091-3

4 Rogelj, J., et al., 2015, op. cit.

5 Le Quéré, C., et al. (2018). Global Carbon Budget 2017. National Emissions v1.2. *The Global Carbon Project*. https://doi.org/10.18160/GCP-2017 and political acceptance issues, and storage permanence.[6] In addition to BECCS, other CDR technologies have been proposed, such as biochar, soil carbon management, direct air capture (DAC), or enhanced weathering (EW). Other models include afforestation, where plantations of fast-growing trees are established on land that does not naturally support forest, in order to absorb and store CO_2 in these trees and soil.

Given the risks and uncertainties surrounding CDR, scholars have suggested to follow a precautionary approach, wherein «the mitigation agenda should proceed on the premise that [CDR] will not work at scale.»[7] This is because embarking today on an emissions pathway that assumes successful large-scale deployment of CO_2 removal in the future leads to a breach of the carbon budget if this deployment fails to materialize: Reliance on CDR allows modelled scenarios to follow less stringent emissions pathways in the near term since later removal essentially increases the available net CO_2 emissions budget. In a recent study,[8] we show that restricting CDR to zero requires 2030 benchmark emissions of CO_2 to be at least one third lower than in a scenario with a full complement of CDR options (22.2 vs 32.2 $GtCO_2$). This indicates the importance of increasing mitigation ambition in the very near term if a precautionary approach to CDR is to be followed.

In the following sections, I will first consider in more detail the drawbacks of the different CDR proposals, then discuss recent studies that explore how a 1.5° C-compliant mitigation approach could be structured to follow a somewhat precautionary approach to scenario creation in which BECCS and other technological CDR is not deployed (but other forest-based natural sequestration is occurring). This discussion will outline the conditions under which it is still possible, at least theoretically, to achieve the 1.5° C temperature limitation objective without relying on speculative

6 Anderson, K., & Peters, G. (2016). The Trouble with Negative Emissions. *Science, 354* (6309), 182. https://doi.org/10.1126/science.aah4567; Fuss, S., et al. (2014). Betting on Negative Emissions. *Nature Climate Change*, 4, 850. https://doi.org/10.1038/nclimate2392; Fuss, S., et al. (2016). Research Priorities for Negative Emissions. *Environmental Research Letters*, 11 (11), 115007. https://doi.org/10.1088/1748-9326/11/11/115007; Heck, V., et al. (2018). Biomass-Based Negative Emissions Difficult to Reconcile with Planetary Boundaries. *Nature Climate Change*, 8 (2), 151. https://doi.org/10.1038/s41558-017-0064-y; Kreidenweis, U., et al. (2016). Afforestation to Mitigate Climate Change: Impacts on Food Prices Under Consideration of Albedo Effects. *Environmental Research Letters*, 11 (8), 085001. https://doi.org/10.1088/1748-9326/11/8/085001; Mander, S., et al. (2017). The Role of Bio-Energy with Carbon Capture and Storage in Meeting the Climate Mitigation Challenge: A Whole System Perspective. *Energy Procedia*, 114, 6036–6043. https://doi.org/10.1016/j.egypro.2017.03.1739; Schulze, E.-D., et al. (2012). Large-Scale Bioenergy from Additional Harvest of Forest Biomass Is Neither Sustainable nor Greenhouse Gas Neutral. *GCB Bioenergy*, 4 (6), 611–616. https://doi.org/10.1111/j.1757-1707.2012.01169.x; Smith, L. J., & Torn, M. S. (2013). Ecological Limits to Terrestrial Biological Carbon Dioxide Removal. *Climatic Change*, 118 (1), 89–103. https://doi.org/10.1007/s10584-012-0682-3; Smith, P., et al. (2015). Biophysical and Economic Limits to Negative CO_2 Emissions. *Nature Climate Change*, 6 (1), 42–50. https://doi.org/10.1038/nclimate2870

7 Anderson & Peters, 2016, op. cit., p. 183

8 Holz, C., Siegel, L., et al (2018). Ratcheting Ambition to Limit Warming to 1.5° C – Trade-Offs between Emission Reductions and Carbon Dioxide Removal. *Environmental Research Letters*. https://doi.org/10.1088/1748-9326/aac0c1 and potentially deleterious technology, while also aiming to safeguard the aspirations of people everywhere, including in the Global South, to a decent standard of living. Importantly, the discussion will also touch on potential additional emissions reductions options that have not been addressed in the studies.

Carbon Dioxide Removal and Natural Sequestration

BECCS' large demand for land has been pegged at about 30–160 million hectares (Mha) per $GtCO_2$, depending on the type of bioenergy feedstock used.[9] This means that land in the order of 600–3,200 Mha would be required to achieve the 20 $GtCO_2$ magnitude at the upper end of the range of annual sequestration found in the models. In contrast, current global cropland is approximately 1,500 Mha,[10] suggesting that massive-scale BECCS deployment would be in strong land-use competition with land currently used for food production, thus undermining efforts to increase food security and end hunger, or with land that is currently forest or other natural land, thus undermining protection of biodiversity and efforts to stop deforestation, itself a major contributor to climate change. Further concerns relate to the amount of water, fertilizer and energy that would be required to implement BECCS at large scales: Researchers at the Potsdam Institute for Climate Impact Research have recently investigated whether large-scale BECSS deployment can be accomplished while taking a precautionary approach to important «planetary boundaries» (freshwater use, forest loss, biodiversity, and biogeochemical flows, e.g. fertilizer) and found that only about 0.2 $GtCO_2$ per year can be achieved this way, several orders of magnitude below what is typically assumed in models.[11] Exceeding this amount would push at least one of these planetary boundaries (further) into the uncertainty or high-risk range.

Other proposed CDR technologies share similar concerns. For example, DAC requires large amounts of energy to enable the chemical reactions that remove the CO_2 from the atmosphere plus energy to liquify, transport and store the CO_2 once captured. EW is an approach where rock, for example olivine, is mined, ground and then spread out over large areas to facilitate its weathering which binds CO_2. These steps require large amount of energy, similar in scale to the energy requirement of DAC. The energy required for these approaches is estimated to be as much as 12.5 GJ per ton of CO_2.[12] Considering that generating 12.5 GJ of electricity with coal would emit about 3.5 tons of CO_2 (or 2.9 or 1.6 tons of CO_2 with oil and natural gas,

9 Smith et al., 2015, op. cit.

10 Dooley, K., Christoff, P., & Nicholas, K. A. (2018). Co-Producing Climate Policy and Negative Emissions: Trade-Offs for Sustainable Land-Use. *Global Sustainability*, 1 (e3), 1–10. https://doi.org/10.1017/sus.2018.6

11 Heck et al., 2018, op. cit.

12 Smith et al., 2015, op. cit.

respectively)[13] highlights that these approaches are not a plausible alternative to fossil fuel phase-out. Furthermore, these CDR technologies are very costly with estimates for DAC and EW exceeding US $ 500 per ton of net negative CO_2.[14]

Models also often include sequestration of CO_2 from forests. It is important to distinguish this sequestration from the CDR approaches outlined above, even though models, or literature discussing model results, often do not make this distinction. Broadly speaking, forest-based sequestration can occur through afforestation or through natural sequestration by forests. Because it involves establishment of tree plantations on land that would not otherwise carry forest, afforestation shares many of the issues of the CO_2 removal approaches discussed above: to sequester large amounts to CO_2, it requires large amounts of land (thus competing with food and other land uses), nutrients, and water.

In contrast, where deforestation and forest degradation are halted, forest can be restored or re-established. In that context, natural sequestration of CO_2 by these forest would occur, potentially in the magnitude of several hundred $GtCO_2$ over the course of the 21st century.[15] However, since the carbon thus stored in the biosphere is at risk of being re-emitted to the atmosphere, for example, if pests, forest fires, or human activity were to destroy these forests, it remains risky and thus a violation of the precautionary principle to rely on these processes to occur when articulating near-term mitigation ambition. This is especially true where scenarios delay the rapid phase-out of fossil fuel use, given that existing fossil fuel deposits represent a stable way of storing carbon unlike potentially volatile storage in the biosphere.

Reliance on large-scale CDR allows modelled scenarios to follow less stringent emissions pathways in the near term since later removal essentially increases the available net CO_2 emissions budget – in such pathways, less ambitious near-term climate action bets on removing CO_2 from the atmosphere in the future. In a recent study,[16] we show that restricting CDR to zero requires 2030 benchmark emissions of CO_2 to be at least one third lower than in a scenario with a full complement of CDR options (22.2 vs 32.2 $GtCO_2$). This shows how important it is to increase mitigation ambition in the very near term to allow for a prudent precautionary approach in relation to CDR deployment. In the following sections, I will discuss recent studies that explore how a 1.5° C-compliant mitigation approach could be structured to follow such a precautionary approach where carbon sequestration levels can be met with limited forestry-based approaches alone.

13 Using median values of the survey of life cycle analyses of emissions of different fuel types conducted by the IPCC: 1001 gCO_2/kWh for coal, 840 gCO_2/kWh for oil, and 469 gCO_2/kWh for natural gas (IPCC, 2011).

14 Smith et al., 2015, op. cit.

15 Dooley, K., & Kartha, S. (2018). Land-Based Negative Emissions: Risks for Climate Mitigation, and Impacts on Sustainable Development. *International Environmental Agreements: Politics, Law and Economics*, 18 (Special Issue: Achieving 1.5° C and Climate Justice), 79–98. https://doi.org/10.1007/s10784-017-9382-9

16 Holz, Siegel, et al., 2018, op. cit.

Near-term Ratcheting Success

In the aforementioned study,[17] we investigated different assumptions about CDR availability and by how much, under each of these assumptions, near-term mitigation ambition would have to increase to keep the 1.5°C objective within reach. Notably, even when assuming that a very large amount of CDR, through a variety of approaches, might eventually be forthcoming (net CDR in our «allCDR» scenario totals 883 $GtCO_2$ between 2016 and 2100), the level of ambition expressed in countries' current climate action pledges, or Nationally Determined Contributions (NDCs), is not consistent with the 1.5°C objective. At a minimum, developed countries need to increase their ambition by moving their current NDCs' target date up from 2030 to 2025, even if major CDR is assumed.

Disallowing BECCS and technological CDR approaches and only allowing limited, forestry-only sequestration, necessitates all countries (not just the developed ones) to shift from a trajectory consistent with their NDC to a more ambitious one by 2025 and very stringent reductions afterwards: 5.5% annual reduction for developed and 4.5% for developing countries. In another scenario, where CDR is disallowed completely, this has to increase to 9% and 8.5%, respectively. Note that while the former reduction rates have historical precedents, typically associated with economic crises and turmoil, annual reduction rates of 8.5–9% are historically unprecedented, indicating that a focussed, globally-coordinated effort would have to be undertaken to achieve this trajectory and that mitigation options that have hitherto been neglected would have to receive more attention.

The majority of 1.5°C scenarios in the literature are so-called overshoot scenarios: they result in warming of more than 1.5°C during some years of the 21st century, to return to the 1.5°C level by 2100 the latest. Temperature overshoot carries substantial potential risks and uncertainties, for example, with regard to the irreversible crossing of tipping points, or the permanence of warming impacts: «Impacts that could be wholly or partially irreversible include species extinction, coral reef death, [permafrost melt], and loss of sea or land ice, some of which themselves lead to positive feedbacks or tipping points that current carbon cycle models do not currently take into account.»[18] Due to their assumed ability to remove CO_2 from the atmosphere, and thus bring temperatures back down, scenarios using large amounts of CDR often display longer overshoot periods with higher peak warming than scenarios with less (or no) CDR. In our study, even the «noCDR» scenario led to an overshoot, due to the rapid reduction in air pollution and the associated reduction

17 Holz, Siegel, et al., 2018, op. cit.

18 Dooley & Kartha, 2018, op. cit., p. 82

in cooling.[19] Generating a «noCDR» scenario without overshoot required increasing the stringency of reductions to 12 % and 11 % annual reductions, respectively, and starting with this very ambitious trajectory as early as 2023. If allowing forestry-based sequestration of CO_2, the 8.5–9 % reduction rates mentioned earlier were sufficient (if commencing in 2023) to avoid an overshoot.

19 Air pollutants such as the aerosols sulphur dioxide or nitrogen oxides are often associated with the use of fossil fuels (e.g. co-emitted with CO_2 from coal-fired power plants, vehicle exhausts etc.). Aerosols have a cooling effect, thus offsetting some of the warming caused by the greenhouse gases. When greenhouse gases are mitigated aggressively, aerosol co-emission is also drastically reduced, leading to correspondingly less aerosol cooling (and thus, more warming).

Low Energy Demand and Decent Living

The modelling team Grübler et al.[20] built a global scenario of Low Energy Demand (LED) which explicitly takes the attainment of a decent living standard by all as a modelling criteria. For example, metrics such as floor space with thermal comfort, food demand, mobility, and access to consumer goods converge between Global North and Global South and exceed the decent living standard (DLS) recently put forward as material prerequisites for human wellbeing beyond merely addressing extreme poverty.[21] For example, in the LED scenario, «thermal comfort» converges to 30 m^2 per capita of adequately heated or cooled space, while the DLS suggests 10 m^2 per capita. Grübler et al. also assess the LED scenario in comparison to other 1.5° C scenarios[22] with regard to its benefits in terms of progress toward several of the SDGs, and find significant co-benefits.

The modelling approach follows major trends in energy demand development already observable today (e.g. regarding urbanization, device convergence, the sharing economy etc). As a result of these trends and other substantial increases in energy efficiency across all sectors, the scenario projects very low energy demand in the future, substantially lower than current and reference levels (2050 global energy demand is 41 % lower than in the 2020 reference case), despite population growth and increase in «activity» of end use services, e.g. thermally comfortable floor space, the amount of food consumed per person, or the number of person-kilometers travelled. The energy efficiency increases are achieved by moving beyond a narrow focus on technological efficiency improvements to take into account broader shifts and changes that improve the efficiency of the entire system of energy service delivery. This includes shifts in service provision through granular, decentralised energy systems, shifts to new business models (e.g. to use-based rather than ownership-based business models, or the sharing economy), as well as shifts towards digitalisation (e.g. smart appliances, homes and grids) and economies of scope (e.g. through device convergence, where single devices such as smart phones fulfill the functions of numerous previous-generation devices).[23]

20 Grübler, A., et al. (2018). A Low Energy Demand Scenario for Meeting the 1.5° C Target and Sustainable Development Goals Without Negative Emission Technologies. *Nature Energy*, 3, 515–527. https://doi.org/10.1038/s41560-018-0172-6

21 Rao, N. D., & Min, J. (2017). Decent Living Standards: Material Prerequisites for Human Well-being. *Social Indicators Research*, 1–20. https://doi.org/10.1007/s11205-017-1650-0

22 Rogelj et al., 2018, op. cit.

23 Grübler et al., 2018, op. cit.

Having generated this very low energy demand scenario, the authors model the upstream structural changes arguing that «changes in energy end-use [...] drive supply-side transformation, as has been the case historically,»[24] with the overall shrinking of the global energy system due to lower demand providing the necessary «breathing room» for this supply-side decarbonization. Specifically, fossil fuels and traditional biomass phase down as primary energy sources quickly, BECCS or fossil CCS are not deployed since the low energy demand can comfortably be met without these sources. Notably, the low energy demand also reduces the demand for land for bioenergy crops relative to similar scenarios, which combined with a reduction in pasture land leads to an increase in global forest cover, which in turn results in the natural sequestration of a cumulative 168 Gt CO_2 from the atmosphere through forests during the 21st century.

Certain life-style changes have not been modelled, for example reduction in overall meat consumption, which is assumed to converge globally at levels roughly equivalent to current figures in the Global North, or reduction in aviation, where activity is assumed to roughly double between 2020 and 2050. These examples point toward additional mitigation potential in the scenario that could be unlocked by addressing these drivers.

Overall, the scenario leads to a very ambitious global emissions pathway that achieves the 1.5° C objective without the need for controversial negative emissions technologies and without a temporary overshoot.

24 Grübler et al., 2018, op. cit., p. 516

Alternative Mitigation Approaches

In a recent piece of scenario work, van Vuuren et al.[25] took as a starting point the 1.5°C scenario based on the Shared Socioeconomic Pathway 2 (SSP2)[26] as implemented by the IMAGE model of the Netherlands Environmental Assessment Agency. This implementation, the «default» 1.5°C strategy,[27] shares certain features with other 1.5°C-consistent SSP-based pathways, for example, that a large amount of carbon dioxide is removed through BECCS and other CDR approaches during the 21st century.[28] Van Vuuren et al. then model «alternative» pathways that implement mitigation strategies not typically modelled by integrated assessment models (IAM) such as IMAGE, because estimates of their future cost and performance is more speculative than those of «default» mitigation approaches, limiting their application in models that select measures based on cost optimization.

The alternative measures modelled by van Vuuren et al. individually reduce the degree to which BECCS and other non-forestry CDR are utilized, while implementing all the approaches together completely eliminates them. Notably, however, CO_2 sequestration is still assumed to occur in this case, albeit through natural sequestration where restoration of forests and reforestation takes place on land that is freed up by the reduced need for agricultural land as a result of agricultural intensification, a lower population, and low-meat diets based on cultured, as opposed to farmed, meat. Table 1 below shows the specific alternative scenarios and their descriptions and assumptions. «The rate and level with which the measures are introduced [into the model] are meant to reflect ambitious, but not unrealistic implementation.»[29]

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25 van Vuuren, D. P., et al. (2018). Alternative Pathways to the 1.5°C Target Reduce the Need for Negative Emission Technologies. *Nature Climate Change*, 8 (5), 391–397. https://doi.org/10.1038/s41558-018-0119-8

26 The Shared Socio Economic Pathways (O'Neill et al., 2015) are a relatively new device in the climate modelling community that describe five different story lines (SSP1 – SSP5) of the future development of the global population, macro economy, geopolitical framework and so on, based on which modelling teams then develop specific scenarios with more or less stringent climate policies. SSP2 (Fricko et al., 2017), also known as «Middle of the Road,» involves a story line wherein global political, social and economic trends remain similar to their current situation with development uneven across the globe, relatively weak global governance institutions, medium population growth and continued inequality.

27 Cf. Rogelj et al., 2018, op. cit.

28 The cumulative amount of BECCS in recent 1.5 °C pathways based on the SSPs ranges from 150 to 1,200 Gt CO_2, with substantial variation across models and SSPs. The range of BECCS in SSP2 scenarios (the SSP used in van Vuuren et al. [2018]) is 400–975 Gt CO_2 (Rogelj et al., 2018. op. cit.).

29 van Vuuren et al., 2018, op. cit., p. 1

Table 1: Alternative mitigation approaches modelled

Scenario	Short name	Description & key assumptions
Efficiency	Eff	Rapid application of the best available technologies for energy and material efficiency in all relevant sectors in all regions.
Renewable electricity	RenElec	Higher electrification rates in all end-use sectors, in combination with optimistic assumptions on the integration of variable renewables and on costs of transmission, distribution and storage.
Agricultural intensification	AgInt	High agricultural yields and application of intensified animal husbandry globally.
Low non-CO_2	$LoNCO_2$	Implementation of the best available technologies for reducing non-CO_2 emissions and full adoption of cultured meat in 2050.
Lifestyle change	LiStCh	Consumers change their habits towards a lifestyle that leads to lower GHG emissions. This includes a less meat-intensive diet (conforming to health recommendations), less CO_2-intensive transport modes (following the current modal split in Japan), less intensive use of heating and cooling (change of 1°C in heating and cooling reference levels) and a reduction in the use of several domestic appliances.
Low Population	LowPop	Scenario based on SSP1, projecting low population growth.
All	TOT	The combination of all the options described above.

Source: Van Vuuren et al. (2018).

Equity and Fair Shares

In the lead-up to the Paris climate summit in 2015, a large and diverse global coalition of civil society organizations and social movements released a report (with updates in subsequent years) contrasting countries' NDC pledges with what the groups considered their fair shares of addressing a global 1.5° C-consistent mitigation effort.[30] The analysis calculated these fair shares by taking into account countries' responsibility for contributing to the climate crisis (i.e. their historical emissions) and their capacity to act (i.e. their financial wherewithal), but did so in a way that explicitly protects the world's poor, in whichever country they may live, from an undue burden that would jeopardize their struggle for a life free of poverty.

The report found that, in aggregate, poorer countries were already pledging more than their fair share, while wealthier countries were falling far short of theirs. Importantly, the report concluded that in order to meet the global 1.5° C effort, all countries had to increase their ambition – even poorer countries that had already pledged more than their fair share had to undertake even more mitigation. However, since this additional mitigation would far exceed their fair share, these countries could not fairly be expected to undertake these efforts on their own, instead wealthier countries would have to cooperate (for example, by providing finance, capacity building or technology transfer support) to achieve this additional mitigation, for example by providing financial support to adopt cleaner energy solutions faster and at a larger scale than the country would have been able with its own resources alone.

This highlights that in the context of sharing fairly a stringent mitigation effort, all countries have «dual obligations,» where in addition to stringent unsupported domestic reductions, countries engage in deep international mitigation cooperation, where poorer countries implement mitigation action beyond their own fair share while wealthier countries provide the support necessary to undertake those efforts. Without this large-scale international mitigation cooperation, «1.5° C-compliant mitigation will remain out of reach, impose undue suffering on the world's poorest, or both.»[31]

30 CSO Equity Review. (2015). *Fair Shares: A Civil Society Equity Review of INDCs*. Manila, London, Cape Town, Washington, et al.: CSO Equity Review Coalition. http://civilsocietyreview.org/report; CSO Equity Review. (2017). *Equity and the Ambition Ratchet: Towards a Meaningful 2018 Facilitative Dialogue*. Manila, London, Cape Town, Washington, et al.: CSO Equity Review Coalition. http://civilsocietyreview.org/report2017; Holz, C., Kartha, S., & Athanasiou, T. (2018). Fairly Sharing 1.5 – National Fair Shares of a 1.5° C-compliant Global Mitigation Effort. *International Environmental Agreements: Politics, Law and Economics*, 18 (Special Issue: Achieving 1.5° C and Climate Justice), 117–134. https://doi.org/10.1007/s10784-017-9371-z

31 Holz, Kartha, et al., 2018, op. cit., p. 117

Furthermore, pathways that rely on a large scale of CDR later in the 21st century to reach the 1.5° C objective introduce an element of intergenerational injustice: if today's societies decide to embark on pathways that feature less stringent near-term emissions reductions facilitated by assumptions of large-scale deployment of technologies that have not yet been proven to work at scale and that carry profound environmental, social and economic risks, they essentially force future generations to deploy these technologies despite those risks, or accept much higher warming.

CONCLUSION

Pathways to 1.5° C that do not rely on large-scale deployment of unproven and potentially deleterious technologies, such as BECCS or other CDR approaches, have recently become available in the literature. Such pathways share important features, namely that they require more stringent near-term emissions reductions than in 1.5° C pathways that envision removal of large amounts of CO_2 later. Figure 1 shows the scenarios discussed in this chapter in the context of the 1.5° C and 2° C scenarios from the SSP database and the level of emissions implied by the current NDCs. Compared to most other 1.5° C scenarios, the scenarios by Grübler et al. and van Vuuren et al. display much lower near-term emissions than the «default» scenarios, showing that the mitigation activities are embarked upon earlier and more stringently. Due to their research objective, the Holz, Siegel et al. scenarios were specifically designed to follow the emissions pathway implied by the NDCs as long as possible, to account for inertia of the political system, thus they are not as stringent in the period up to 2025 but then steeply reduce emissions.

Furthermore, it is notable that each of the very ambitious mitigation scenarios discussed here still leaves out additional mitigation options, for example, maintaining a high level of meat consumption, aviation, and population growth in Grübler et al.[32] None of the studies explores the impact that placing limits on GDP growth could have on the feasibility of achieving the 1.5° C temperature limitation objective, despite GDP growth having been identified as a principal driver of emissions growth.[33]

Finally, it is important to distinguish in scenarios between different types of CDR on the one hand and natural sequestration in forests and other natural ecosystems on the other. Activities like BECCS, DAW, or afforestation are only potentially attractive to societies because of their potential (under the right circumstances) to remove carbon dioxide from the atmosphere and they come with considerable risks and/or costs. In making decisions about near-term levels of ambition, societies need to be aware of the trade-offs implied with regard to CDR. Because different CDR types carry different types and levels of risks, it is important to take these into account.

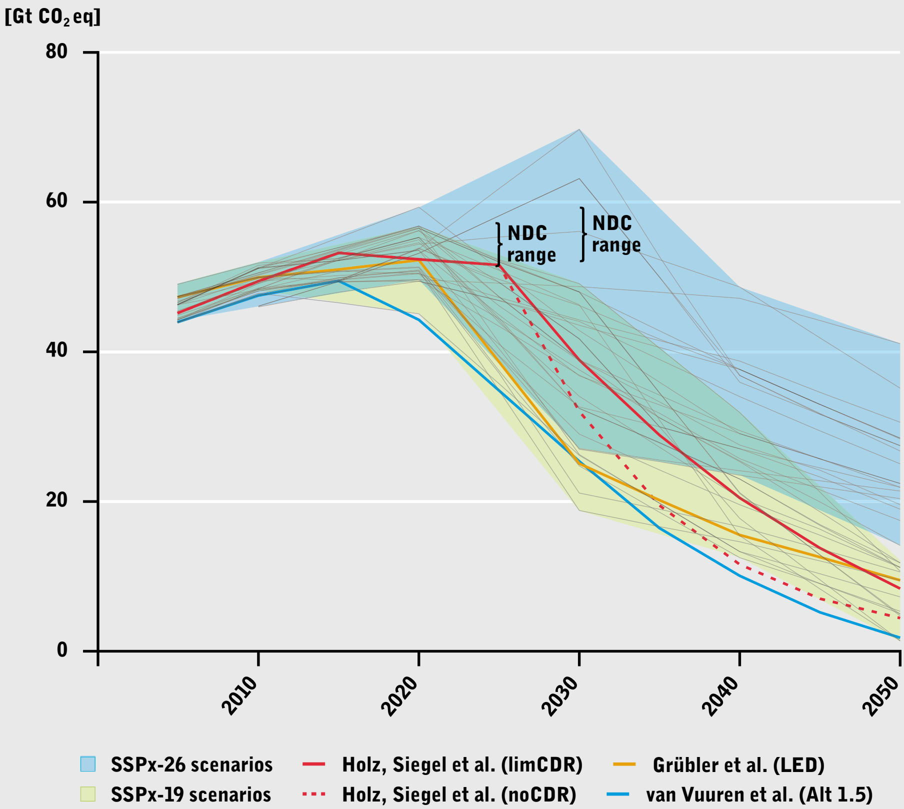
Reforestation and forest ecosystem restoration, on the other hand, can also sequester carbon dioxide, but this feature is a secondary attribute of these activities.

32 Grübler et al., 2018, op. cit.

33 Kuhnhenn, K. (2017a). Climate Mitigation Scenario – Contains Growth and Other Normative Substances. www.degrowth.info/en/2017/07/climate-mitigation-scenario-contains-growth-and-other-normative-substances; Kuhnhenn, K. (2017b). *Wachstumsrücknahme in Klimaschutzszenarien* (p. 18). Leipzig: Konzeptwerk Neue Ökonomie. www.degrowth.info/wp-content/uploads/2017/06/ModWac3.pdf

In the first instance, they are undertaken to enhance the biodiversity and resilience of the forests and to reverse the loss of forest cover and vegetation over the past 200 years. This issue is discussed in much more detail in *Re-Greening the Earth. Protecting the Climate through Ecosystem Restoration* in this publication.

Figure 1: BECCS-free scenarios in context (in Global GHG emissions [Gt CO_2 eq])



The light green, the blue and the mixed shaded areas show the range of the «default» 2°C and 1.5°C scenario implementations in the SSP database, with individual scenarios shown as grey lines.[34] The coloured lines show the BECCS-free scenarios discussed in this chapter; the right braces indicate the range of emissions that would result from the implementation of the mitigation pledges made by countries in their NDCs.[35]

Source: Grübler et al 2018, van Vuuren et al 2018 und Holz, Siegel et al 2018; SSP database, IIASA, 2016, UNFCCC, 2016; own chart.

34 IIASA. (2016). SSP Database. International Institute for Applied Systems Analysis. https://tntcat.iiasa.ac.at/SspDb

35 UNFCCC. (2016). *Aggregate Effect of the Intended Nationally Determined Contributions: An Update. Synthesis Report by the Secretariat*. Bonn: UNFCCC. http://unfccc.int/resource/docs/2016/cop22/eng/02.pdf

An important implication of the scenarios discussed here is that the reductions pledged in countries' NDCs are not consistent with these pathways. Therefore countries have to strengthen their current pledges significantly, for example in the context of the Talanoa dialogue taking place in 2018, or in the context of the requirement to «communicate or update» NDCs by 2020.[36] Strengthening near-term mitigation ambition, including the current mitigation pledges for 2025 and 2030, is paramount to avoid locking future generations into high-risk technological pathways that might never materialize, thereby potentially committing the world to unacceptably high rates of global warming.

36 UNFCCC. 2015, op. cit., Paragraphs 23 & 24

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Limiting global warming to 1.5°C above pre-industrial is feasible, and it is our best hope of achieving environmental and social justice, of containing the impacts of a global crisis born out of historical injustice and unequal responsibility.

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Heinrich-Böll-Stiftung
The Green Political Foundation
Schumannstraße 8, 10117 Berlin, Germany
+49 (0)30 28534 0 info@boell.de www.boell.de