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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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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

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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.

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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.

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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/insightpublications/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/freepublications/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.

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

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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

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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.

ECOLOGY
VOLUME 44.2

Another Energy is Possible

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

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