ENERGY TRANSITION OR ENERGY EXPANSION?

TRADE UNIONS FOR ENERGY DEMOCRACY

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Energy Transition or Energy Expansion?
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EXECUTIVE SUMMARY

From politicians to corporate executives, media commentators to environmental campaigners, narratives evoking the "unstoppable" progress of a global transition from fossil fuels to renewable energy have grown increasingly commonplace.

However, in reality, the global shifts in energy production, energy usage and greenhouse gas emissions we urgently need *are not happening*:

- In 2019, over 80% of global primary energy demand came from fossil fuels, with global greenhouse gas emissions at record levels.[1]
- In 2020, wind and solar accounted for just 10% of global electricity generated.[2]
- Despite stories of its decline, coal-fired power generation continues to rise globally. In 2020, global efforts to decommission coal power plants were offset by the new coal plants commissioned in China alone, resulting in an overall increase in the global coal fleet of 12.5 GW.[3]

Recently, some have argued that the Covid-19 pandemic and subsequent contraction in economic activity signal a turning point. Indeed, global energy demand fell by nearly 4% in 2020, while global energy-related CO2 emissions fell by 5.8% — the sharpest annual decline since the second world war.[4]

Despite these short-term shifts, the pandemic has failed to result in any significant long-term changes for the energy sector or associated emissions:

- Global energy-related CO2 emissions are projected to grow by 4.8% in 2021, the second highest annual rise on record.[5]
- Demand for all fossil fuels is set to rise in 2021.[6] A 4.6% increase in global energy demand is forecast for 2021, leaving demand 0.5% higher than 2019 levels.[7]
- By the end of 2020 electricity demand had already returned to a level higher than in December 2019, with global emissions from electricity higher than in 2015.[8]
- By the end of 2020, global coal demand was 3.5% higher than in the same period in 2019.[9] A 4.5% rise in coal demand is forecast for 2021, with coal demand increasing 60% more than all renewables growth combined and undoing 80% of the 2020 decline.[10]
- Oil demand is forecast to rebound by 6% in 2021, the steepest rise since 1976.[11] By 2026, global oil consumption is projected to reach 104.1 million barrels per day (mb/d), an increase of 4.4 mb/d from 2019 levels.[12]

As such, an energy transition with the depth and speed necessary for meeting the 2015 Paris Agreement shows no sign of materializing. Indeed, most of the world's major economies are not on track to reach their Nationally Determined Contributions (NDCs) on emissions reductions.[13]

These facts point to a clear conclusion: the dominant, neoliberal climate policy paradigm, which deploys a "sticks and carrots" approach that attempts to disincentivize fossil fuels through carbon pricing, while promoting low-carbon investment through subsidies and preferential contractual arrangements has been completely ineffective. This policy paradigm positions governments as guardians and guarantors of the profitability of private actors, thus preventing them from addressing social or environmental challenges head-on. The results have been disastrous:

- 15 years after on the establishment of the European Union's flagship Emissions Trading System, the vast majority of global emissions (84%) are still not priced at all, and the share of emissions that are priced high enough to be potentially effective remains well below 1%.[14] The International Monetary Fund (IMF) estimates that the global average carbon price is a mere one-twentieth of the absolute minimum price it considers necessary.[15]
- Although renewables have increased their global share of energy usage, this growth has been outstripped by rising electricity demand. The global electricity system has been expanding at an annual rate of nearly 300 GW per year in recent years, but renewable capacity only grew by 198 GW in 2020, and the rate of increase year-on-year has been slow over the past decade: an average of just 11 GW per year.[16] Worse still, the rate of growth for renewable energy deployment has almost halved in the past five years.[17]

Today the growth of renewables is being impeded by an investment crisis, and investment levels will need to increase dramatically in order to reach climate goals:

- China, responsible for 40% of renewables investment in 2017, reduced its renewables investment by 38% in 2018, with investments falling a further 8% in 2020 to the lowest figure since 2013.[18]
- Investment in new renewable power generation capacity (mainly wind and solar) needs to total USD 22.5-trillion by 2050.[19] That equates to around USD 662-billion each year, every year — roughly double the levels of investment seen in recent years, which have averaged around USD 300-billion.

Furthermore, the current policy does not adequately account for the impact of "variable renewable energy" (VRE):

- There is a risk that power utilities are increasingly unable to keep operating the "baseload" fossil fuel plants still relied upon across much of the world. As such, governments are currently stepping in to subsidize the fossil fuel industry, at the cost of the taxpayer or consumer.
- The technologies required to integrate renewable energy into electricity grids are themselves facing significant obstacles. For example, according to the IEA, under 2% of the global potential for demand-side flexibility is currently realized.[20]

In sum, the current policy is incapable of delivering the energy transition urgently required. It relies on failed "market mechanisms" ("sticks and carrots"); suffers from a massive investment, deficit, and has failed to deal with the technical challenges posed by variable renewable energy.

We need an alternative paradigm. As we have seen with the pandemic, addressing complex global problems in short timescales calls for government planning and coordination. A TUED-PSI-FNME-CGT joint report on *Public Energy Futures* to be released at COP 26 will set out an agenda for democratically controlled public ownership and management of the energy sector. *A truly public approach to energy transition* is necessary for limiting climate change and avoiding the worst climate impacts.

1
INTRODUCTION

We see the energy transition is in full swing, with the highest capacity of renewables financed ever. Meanwhile, the fossil fuel sector has been hit hard by the Covid-19 crisis, with demand for coal- and gas-fired electricity down in many countries, and oil prices slumping.

Nils Stieglitz, President, Frankfurt School of Finance & Management, 2020.[21]

The recent [emissions] trends show that the gap between where we are and where we should be is not decreasing but widening. We are heading in the wrong direction.

International Renewable Energy Agency (IRENA), 2021.[22]

For more than a decade, mainstream policy institutions, analysts and commentators have advanced some version of the claim that the transition to a sustainable, low-carbon future energy system is already underway and accelerating, even “inevitable” or “unstoppable.”

Such a transition has long been recognized as central to the struggle to minimize the risk of dangerous climate change by limiting greenhouse gas (GHG) emissions, nearly three-quarters of which come from energy use.

According to the neoliberal "green growth" vision, the transition to low-carbon energy is being driven by two kinds of policy interventions. The first involves putting a price on CO2 and other greenhouse gases. According to this theory, if emitters had to pay for their emissions (the “polluter pays” principle), then they would either make investments to reduce emissions from existing activities or begin to redirect investment into less carbon-intensive activities. This thinking has informed the development of various carbon pricing mechanisms, such as emissions trading schemes and carbon taxes.

The second kind of intervention is aimed at incentivising private-sector investment in renewable energy, green technologies, and other low-carbon solutions. Incentives include direct subsidies, preferential or concessionary financing and favourable long-term contracts.

This mixture of disincentives and incentives has been described as a "sticks and carrots" approach whereby governments send signals to private investors and energy users.[23] Adopted by almost all of the world’s major economies, these interventions were expected to both "unlock" and redirect private sector investment, to unleash new markets and foster unlimited opportunities for sustainable prosperity.

RISING “AMBITION”, WEAK ACTION

However, it is today quite clear that most of the world’s major economies are not on track to reach their Nationally Determined Contributions (NDCs) on emissions reductions. While a number of governments have adopted “net-zero” emissions targets, these targets, according to the United Nations Environment Programme (UNEP), “highlight the vast discrepancy between the ambitiousness of these goals and the inadequate level of ambition in the NDCs for 2030”.[24]

In other words, the distance between ambition and action has widened considerably. The result, in the terms of the Intergovernmental Panel on Climate Change (IPCC) August 2021 report, is that *climate change is "rapid, widespread and intensifying"*.[25]

The main features of neoliberal climate policy have been dominant for almost 30 years now, during which time emissions from fossil fuel use have continued to rise. Emissions rose 61% between 1990 and 2014 — a period that roughly coincides with the adoption of the UN Framework Convention on Climate Change (UNFCCC) and the late-stage negotiations that led to the Paris Agreement.[26] Global CO2 emissions levelled off from 2014-2016 but then rose again in 2017, by 2%, and an additional 1.7% in 2018.[27] Annual emissions in 2019 remained at record levels, and more than 80% of total primary energy demand came from fossil fuels: oil, gas, and coal.[28] While emissions fell in 2020 when the outbreak of the Covid-19 pandemic brought a major global economic slowdown, recent data indicates that emissions may soon return to 2019's record-breaking levels.[29]

ENERGY TRANSITION OR ENERGY EXPANSION?

The growing gap between ambition and action has been a source of growing anxiety for the scientific community and some political leaders. But this has not led to any serious interrogation of the neoliberal "sticks and carrots" approach.

Proponents of this approach argue that any issues with the pace and depth of the transition highlight only that neoliberal policies are not being pursued aggressively or consistently enough. What they mean by this is: private investors need to be given more incentives; carbon pricing schemes must proliferate and become more robust in their impact on polluters; subsidies for fossil fuels must be removed as quickly as possible; and energy market liberalization and privatization must be pursued more aggressively than ever. Because the need for climate action is so pressing, neoliberal institutions also propose that public money should be used to further "leverage," "unlock" and "de-risk" private investment, so that new markets can be created and new industries may begin to flourish.

This report will show that neoliberal climate and energy policy has failed. The energy transition is not happening. Neoliberal institutions are unwilling to take responsibility for the fact that their broader agenda — trade liberalization, privatization, strengthening the power of private corporations, financial deregulation, etc. — is helping to drive energy use and emissions ever higher. In keeping with IMF and World Bank orthodoxy, the spokespersons of neoliberal policy uncritically endorse endless economic growth and capitalist accumulation. They are quick to emphasize the need to "decouple" growth from rising emissions — something that has demonstrably failed to occur — but have shown little or no willingness to acknowledge that meeting the Paris targets is simply incompatible with the neoliberal "green growth" agenda.

This helps to explain the fact that, in recent decades, what we have witnessed is not an energy transition, but an energy expansion. Despite some changes in the fuel mix in some places and some sectors, overall energy demand has continued to rise even faster than the deployment of new, "clean" energy sources. As a result, nearly all forms of energy have grown alongside each other. Renewable sources have been a significant contributor to that overall growth — particularly in the power sector — but this has not resulted in any significant displacement of fossil-based energy.

GOALS AND STRUCTURE OF THE REPORT

In the pages that follow, we document three specific failures of neoliberal climate and energy policy.

The first failure is "carbon pricing", which has not remotely approached the breadth or levels required in order to be effective.

The second failure is that efforts to "incentivize" private investment to decarbonize energy supply have not produced the levels of investment required.

The third failure is that the neoliberal "energy-for-profit" paradigm has not only failed to drive the transition, but actually stands in the way of it. Here we focus on how the current approach to energy transition has: (1) created a chaotic "energy war" between competing for-profit companies; (2) led to the proliferation of profit guarantees ("subsidies for all"); and (3) neglected some serious technical challenges associated with the "variability" of renewable energy.

Following this introductory first chapter, Chapter 2 looks at the current state of energy and emissions in the context of the Covid-19 pandemic. It shows that, contrary to the claims of some, the pandemic has not fundamentally disrupted longer-term trends of increasing energy use and rising emissions. Chapter 3 takes a wider view of neoliberal energy and climate policy, drawing attention to the specific failures mentioned above, and why these failures occurred. Chapter 4 concludes the report, highlighting the need for an alternative approach to climate and energy policy premised upon public goods and public ownership.

2
COVID-19 AND THE ENERGY SYSTEM

Some commentators have claimed that the Covid-19 pandemic marks a significant turning point for the energy sector. Indeed, the sudden decline in economic activity at the start of the pandemic did usher in a temporary reduction in global energy use and greenhouse gas emissions. However, by December 2020, electricity demand had already returned to a higher figure than in December 2019.

Meanwhile, fossil fuel usage is once again on the rise and overall energy consumption continues to grow at a rate that outpaces renewables investment. As such, despite some initial signs of hope, the pandemic shows no sign of having disrupted business as usual in the long-term.

A PANDEMIC SILVER-LINING?

It is by now widely recognized that the pandemic set in motion a chain of events around the world that led to a record annual fall in global energy use and emissions. According to the latest statistics from the International Energy Agency (IEA), global energy demand fell by nearly 4% in 2020, while global energy-related CO2 emissions fell by 5.8% — the sharpest annual decline since the second world war.[30] According to the International Energy Agency's (IEA's) World Energy Outlook 2020:

> *The Covid-19 pandemic has caused more disruption to the energy sector than any other event in recent history, leaving impacts that will be felt for years to come.*[31]

Consumption fell across all forms of energy — down 5.3% overall. — except for renewables, according to the IEA; meanwhile, global investment in energy fell by a staggering 18%.[32]

The sharp drop in consumption of all fossil fuels during 2020 brought a record annual fall in emissions. Early in the pandemic, an analysis published in *Nature Climate Change* had found that global emissions in early April were down 17% compared to one year earlier, roughly the same as the emissions levels of 2006.[33] According to this study, emissions from road transport fell by 36%, with emissions from the power sector falling by 7.4%, and emissions from industry falling by 19%.

While some of these reductions were temporary, and partially reversed later in the year as restrictions eased, by the end of the year overall global carbon dioxide (CO2) emissions were still expected to be down by 7%— the largest absolute decrease in annual emissions ever recorded, and the largest *relative* decrease since the second world war.[34]

RESUMING BUSINESS AS USUAL

Emissions declines were largest in the richest countries; according to the IEA, averaging declines of almost 10%. Emissions from the so-called "emerging markets" and "developing economies" contracted by 4% from 2019 levels.[35] Emissions were down for all of the world's major emitters: 12% for the United States (US), 11% for the European Union (EU), 9% for India and 1.7% for China.[36]

The unprecedented contraction in energy consumption and the fall in emissions unleashed by the pandemic initially sparked hope of a turning point, away from ever-escalating energy use and emissions. But similar hopes were expressed following the financial crisis and economic crash of 2008-9 — and then quickly dashed as energy use and emissions rapidly returned to pre-crash levels.[37] Indeed, economic chaos caused by the response to one emergency is hardly a strategy for dealing with another. Far from helping catalyse systemic change towards a low-carbon future, the pandemic crisis has thrown the lives of most working people into chaos, and in many instances undermined the capacity of public authorities to respond either to the immediate health crisis, or to the larger ecological crisis lurking behind it. In the words of the IEA Executive Director, Fatih Birol:

> *The economic downturn has temporarily suppressed emissions, but low economic growth is not a low-emissions strategy — it is a strategy that would only serve to further impoverish the world's most vulnerable populations. Only faster structural changes to the way we produce and consume energy can break the emissions trend for good.*[38]

Indeed, the pandemic has had little sustained impact on the prospects of low-carbon energy transition. The IEA projects that global energy-related Co2 emissions will grow by 4.8% in 2021, the largest annual increase since the financial crisis that hit more than a decade ago and the second highest annual rise on record.[39] It also forecasts a 4.6% increase in global energy demand for 2021, a rise higher than the 2019 4% contraction that would leave demand at 0.5% higher than 2019 levels.[40] Demand for all fossil fuels is set to rise in 2021.[41] Electricity demand is also set to rise quicker this year than any point over the past decade — by 4.5%, five times the 2020 contraction.[42] By the end of 2020 global emissions from electricity had already returned to levels higher than in 2015, when the Paris Climate Agreement was adopted. By December 2020, electricity demand had already returned to a level higher than those of December 2019, with India up by 5%, the EU by 2%, Japan by 3%, South Korea by 2%, and the US by 2%.[43]

The disruptions caused by the pandemic have also set back efforts to improve access to electricity, reversing several years of prior progress. For example, the number of people without electricity access in sub-Saharan Africa will likely rise in 2020, according to the IEA's *World Energy Outlook 2020*.[44]

The fact that global energy systems have not been fundamentally altered by the pandemic disruptions and are likely soon to return to something like "business as usual," should draw fresh attention to the overall challenge.

SECTOR-SPECIFIC ANALYSES

This section of the report offers a sector-specific analysis of the impacts of the pandemic on the energy sector.

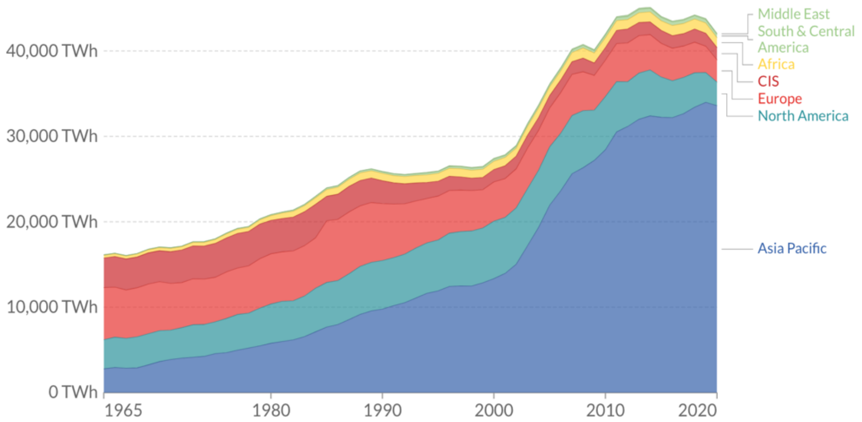
COAL

Global coal consumption fell by 4% in 2020. But most of that decline occurred in the first few months of the year. Coal use by the end of 2020 was 3.5% higher than in the same period in 2019, helping to usher in a return to growing global CO2 emissions.[45]

The IEA forecasts a 4.5% rise in coal demand for 2021, with coal demand increasing 60% more than all renewables growth combined and undoing 80% of the 2020 decline. On this projection, by the end of the year global coal demand would rise to higher than 2019 levels and return to its 2014 peak.[46]

Figure 1: Coal consumption by region

Annual coal consumption, measured in equivalents of terawatt-hours (TWh) per year



Source: BP (2021) *Statistical Review of World Energy*, available at: https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html.

Looking ahead, the IEA projects that growth in demand for coal may "flatten" by 2025 or so. But that still means continuing consumption of roughly 7.4 billion tonnes per year.[47] In rich economies where coal use for power generation has declined, it has mainly been replaced by gas rather than by renewables. Coal and gas have essentially swapped places in the electricity generation mix in the US over the past decade: from 45% for coal and 23% for gas in 2009, to 24% and 38% respectively in 2019.[48] Europe saw a similar reversal, with the respective shares of coal and gas in the EU's power generation mix shifting from 31% for coal and 16% in 2009, to 15% and 22% respectively for 2019.[49]

Coal remains a major fuel for key countries of the South, particularly in Asia (see Figure 1), most importantly China and India. Vietnam and Indonesia have also seen dramatic growth in coal use in recent years: 30% and 20% respectively during 2019 alone.[50]

China is already responsible for roughly one-quarter of annual global GHG emissions, largely due to its vast fleet of coal-fired power stations, which continues to expand rapidly. Indeed, the 38.4 GW of new coal plants commissioned by China in 2020 – equivalent to over one new coal plant per week – offset the year's record global coal power station retirements, resulting in an overall increase in the global coal fleet of 12.5 GW.[51] Chinese power companies submitted proposals for 73.5 GW of new coal-fired power in 2020 — more than five times the 13.9 GW initiated in the rest of the world combined. Also, in 2020, Chinese provincial authorities granted approval to build 36.9 GW of coal power projects — more than triple the capacity approved the year before.[52]

After China, India remains by far the largest user of coal in the Asia, with coal usage growing quickly. The pandemic and lockdowns led to a dramatic fall in India's coal consumption during 2020. But speculation that this fall represents "the beginning of the end of coal in India" seems premature.[53] As with China, India's response to the pandemic is expected to reinforce Prime Minister Modi's reliance on coal to stimulate a pandemic recovery, including over USD 6billion earmarked for coal transport infrastructures.[54] Meanwhile, the output target for India's state-owned coal company — the world's largest miner of coal — was raised 18% for the year, to 710 million tons.[55]

In contrast, several other Asian countries announced cancellations or delays of planned coal power projects during 2020. Indonesia, Bangladesh, the Philippines, and Vietnam cancelled 62.0 GW of planned coal capacity, leaving an estimated 25.2 GW in the pre-construction planning pipeline across these four countries. This amounts to an 80% decline from the 125.5 GW planned there five years earlier.[56] These cancellations have been attributed to a combination of lower demand due to the pandemic, greater difficulty securing financing, and falling costs for wind and solar.

Yet such developments hardly mean that coal's fate in Asia is sealed. As the IEA points out in a December 2020 commentary:

> *India, Pakistan, Bangladesh and Southeast Asian countries currently consume the same amount of electricity annually for a population of 2.4 billion people as the European Union does for a population of 450 million. The task of scaling up those Asian energy systems to meet rising demand without increasing coal consumption is possible, but it also represents a significant challenge.*[57]

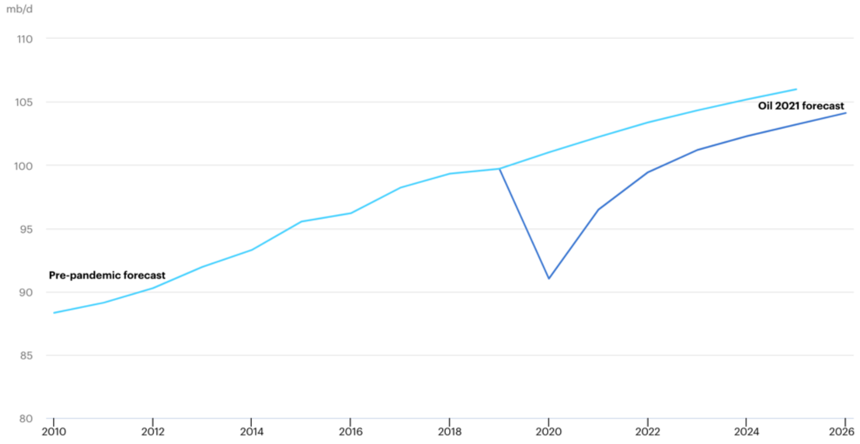
One crucial difference between the OECD and some of the major non-OECD countries like China and India concerns the age of their generation capacity. The declining role of coal in the OECD's power sector is being driven by the fact that many coal-fired power stations are reaching the end of their life. This capacity is being replaced by wind, solar, biomass, and some gas-fired capacity.[58] By contrast, many of the coal-fired power stations in Asia are relatively new, and thus have a long "useful" life ahead of them. While the average age of a coal plant in the US is 39 years,[59] for China this figure is just 14 years.[60]

OIL

Oil consumption saw the sharpest fall among the major fossil fuels during 2020. In the early months of the pandemic, the contraction in oil consumption led some analysts and commentators to suggest that the long-predicted "peak oil demand" may have finally arrived.[61]

The unprecedented collapse in demand has had a clear impact on upstream investment in the sector, which fell by roughly one-third compared to stated plans at the start of the year.[62] Due to the "price war" between Saudi Arabia, Russia and the US, upstream investment had already fallen sharply from the levels of 2012-2013, but prior to the pandemic had shown signs of a recovery.[63]

Figure 2: Oil demand forecast, 2010-2026, pre-pandemic and in Oil 2021



Source: IEA (2021), available at: https://www.iea.org/data-and-statistics/charts/oil-demand-forecast-2010-2026-pre-pandemic-and-in-oil-2021.

However, although the growth in global demand for oil has been impacted by the pandemic, the IEA acknowledges that, in the absence of more radical change, "longer-term drivers of growth will continue to push up oil demand" (see Figure 2).[64] Indeed, oil demand is forecast to rebound by 6% in 2021, faster than any other fossil fuel and the steepest rise since 1976.[65]

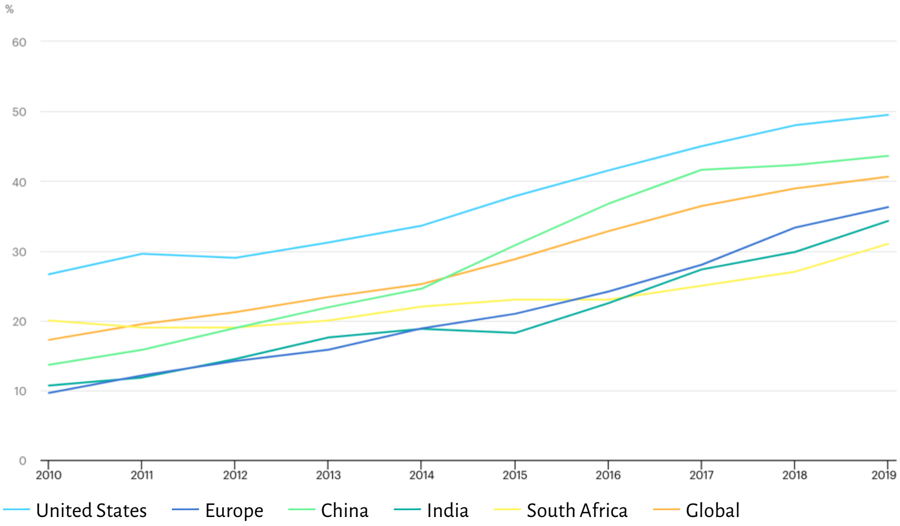
According to OPEC, global demand for oil, "is expected to increase by 4.2 million barrels a day in 2022 to 100.8 million barrels a day, 980,000 barrels a day higher than last month's estimate and exceeding pre-pandemic levels."[66]

The IEA projects that, by 2026, global oil consumption will reach 104.1 million barrels per day (mb/d) — and an increase of 4.4 mb/d from 2019 levels. It writes: "In the absence of major policy changes from governments and more rapid changes in behaviour, global oil demand is set to increase for years to come."[67]

One major source of rising demand for oil is the continuing growth of consumer demand for larger personal vehicles — especially SUVs (see Figure 3). According to an IEA commentary in early 2021, energy-related carbon emissions declined across all sectors in 2020 except for SUVs.[68] In late 2019, the *Financial Times* reported that electric vehicle (EV) sales were being outpaced by SUVs, which at that time accounted for 45 per cent of new car sales in the US, 42 per cent in China, 34 per cent in Europe, and 23 per cent in India — and this share has steadily risen across all major economies for the past decade.[69]

The consequences of this steady growth in SUV sales are hard to overstate. For one thing, the reduction in oil demand from that higher share of EVs in the overall car market — roughly 40,000 barrels of oil per day — was outpaced by the growth in SUV sales within the same time period.[70]

Figure 3: Share of SUVs in total car sales in key markets, 2010-2019



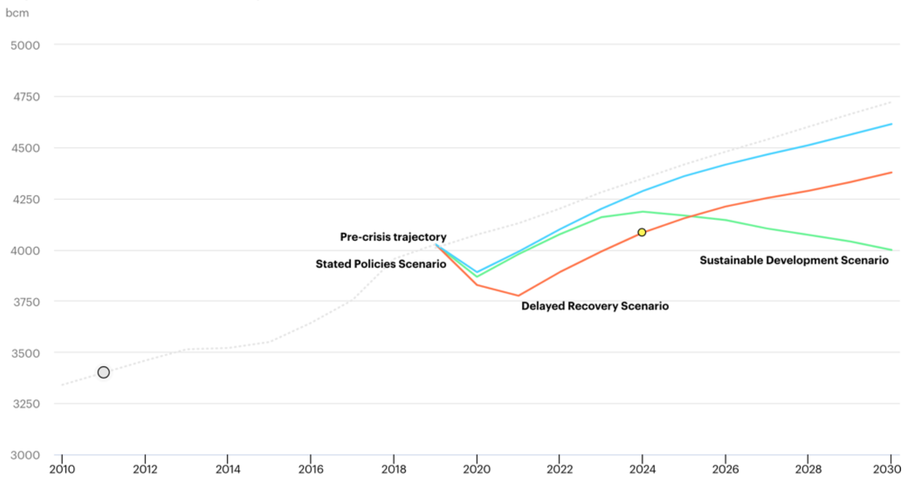
Source: IEA (2021), available at: https://www.iea.org/data-and-statistics/charts/share-of-suvs-in-total-car-sales-in-key-markets-2010-2019.

GAS

Globally, demand for gas has roughly doubled since 1990 and is expected to continue its rapid rise in the years ahead, absent a major shift in policy.[71]

According to the IEA's *Global Energy Review 2020*, published during the very early days of the pandemic (April 2020), mild weather in Europe drove down demand for gas by roughly 2.6% during the first quarter of 2020 compared to one year earlier. Over the same time scale, demand for gas in the US fell by roughly 4.5%, while Japan's LNG imports fell by 3%. Demand in China remained essentially flat but grew in India at nearly 8% compared with one year earlier.[72] By the end of the year, global demand for natural gas had fallen by 3% overall.[73] These disruptions have caused significant uncertainty for gas markets and producers and may result in regional shifts in production and distribution, and even some issues for security of supply.

Figure 4: Global natural gas by scenario, 2010-2030



Source: IEA (2021), available at: https://www.iea.org/data-and-statistics/charts/share-of-suvs-in-total-car-sales-in-key-markets-2010-2019.

But despite even these considerable disruptions, the ongoing rise in overall demand is expected to continue. As the IEA projects on its "Stated Policies

Scenario,"[74] gas will recover quickly, rising by 3.2% in 2021, and then rising steadily to 14% above 2019 levels by 2030, with most of that growth taking place in Asia (see Figure 4).[75]

Gas is often presented as a "bridge fuel" in many decarbonization scenarios and is frequently the preferred fuel to replace coal in power generation. Carbon dioxide (CO2) emissions associated with burning natural gas are lower than those for coal — as are other damaging forms of particulate air pollution. However, even small leaks of methane during its extraction and processing can offset the effects of lower CO2 emissions. A major 2018 study found that methane leakage in the US is 60% higher than previous estimates — enough to erase the greenhouse warming advantage from using methane rather than coal.[76]

RENEWABLES

The year 2020 saw renewables reportedly "defying the odds," compared to the impact the pandemic crisis had on other forms of energy. For 2020, the amount of all new net installed renewable capacity grew by roughly 4% for the year, to reach nearly 200 GW in total.[77] Overall, renewable capacity additions accounted for nearly 90% of the year's total increase in global power generation capacity. Net solar capacity increased by 107GW, wind by 65GW; and hydropower by 18GW.[78] The amount of electricity generated from all renewable sources rose nearly 7% in 2020 compared to the year before. Renewables demand grew 3% in 2020 and the IEA forecast increase renewables demand across electricity, heat, transport and industry for 2021.[79]

According to the IEA, both China and the US saw substantial gains in both wind and utility-scale solar PV during 2020. China alone accounted for nearly half of onshore wind capacity last year (adding around 29 GW) and more than half of global growth in offshore wind (adding 2.6 GW).[80] Meanwhile, the US added 12 GW of onshore wind capacity — nearly a third more than during 2019, despite the Covid-19 lockdowns.

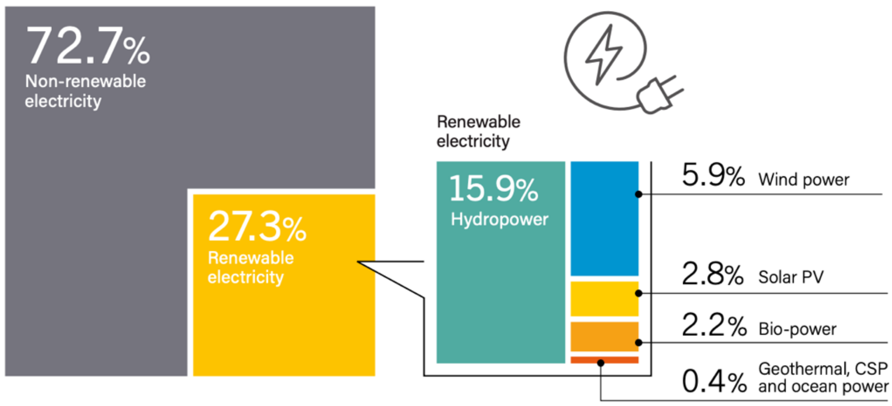
But in both China and the US, the gains made by renewables in 2020 were largely the result of developers "rush[ing] to complete projects before changes in policy take effect"[81] — that is, before key subsidies and tax credits expired. More generally, the growth in renewables seen during 2020 was helped along by existing long-term contracts, guarantees for priority access to the grid, and ongoing completion of projects already in the pipeline.[82]

Similarly, for the current year (2021), the IEA anticipates that Europe and India will "lead a renewables surge," producing a "record expansion" of renewable capacity additions of nearly 10%. But, again, this expected "record expansion" turns out to be largely due to the completion of projects that were delayed during 2020, either by the pandemic or by various contractual or legal issues.[83] In other words, the expected record growth for 2021 includes a significant "catch-up" factor following slowdowns in 2020.

Even beyond 2021, the IEA's assessment reveals that the deployment of renewables in major economies will continue to be tied to subsidies. The IEA notes that accelerating deployment of wind power in the years ahead "will require the enhancement of policy support schemes, more investment in grids, eradication of social acceptance and permitting challenges, faster expansion of corporate PPAs and alleviation of regulatory uncertainties and off-taker risks in emerging markets." As expiration deadlines for existing subsidies or other supports are approached, developers rush to hit key project milestones for eligibility and lock in those supports. Once the supports have expired, deployment stalls.[84]

Crucially, despite the considerable level of policy support provided to date, the growth of renewables has struggled to keep up with rising electricity demand. Prior to the pandemic, annual increases in demand had averaged between 2% and 3%. Thus, although renewables (including large hydroelectric systems) met nearly 28% of global electricity generation in the first quarter of 2020,[85] coal and gas still provided more than 70% of global electricity supply at the end of 2019 (see Figure 5). According to the World Economic Forum, "even after a decade of sustained capital investment and a policy environment conducive to renewable energy sources, renewable energy supply (solar photovoltaic and onshore wind) amounts to only 1.6% of global primary energy supply."[86]

Figure 5: Estimated Renewable Energy Share of Global Electricity Production, End-2019



Source: REN21 (2020) *Renewables 2020 Global Status Report*, available at: https://www.ren21.net/wp-content/uploads/2019/05/gsr_2020_full_report_en.pdf.

Equally concerning, demand for energy beyond the power sector is also growing steadily, especially in the transport sector. This is led by the global south, where a combination of rapid urbanization and inadequate public transport systems is driving demand for private automobiles and other forms of mechanized personal mobility.

SUMMARY

This brief survey of the energy sector after a year of Covid-19 illustrates that, without major changes to the infrastructures on which our economies depend — for mobility, for heating and cooling, for industrial processes, and more — demand for fossil fuel energy will continue at levels that will make the Paris targets impossible to reach. The pandemic has done nothing to alter this. Globally, demand for all forms of energy continues to rise, renewables cannot keep pace, and emissions have risen accordingly.

3
UNPACKING FAILURE: WHERE NEOLIBERAL ENERGY POLICY WENT WRONG

This chapter takes a wider view of neoliberal energy and climate policy, beginning by discussing the two main pillars of this policy paradigms: carbon pricing and renewable investment incentives. Both of these approaches are shown to have decisively failed: carbon pricing schemes have been set by loopholes and the vast majority of global emissions remain priced, while the growth of renewable energy lags significantly behind growing global energy demand. The chapter then moves on to discuss a range of converging challenges that threaten to compound the crisis facing the renewables sector, resulting from the contradictions and limitations of dominant market approaches.

NEOLIBERAL CLIMATE POLICY

Neoliberalism came to dominate economic thought and discourse (and most national economies) following the election of Margaret Thatcher in the UK in 1979 and Ronald Reagan in the US in 1980. Where neoliberalism departs from the "laissez faire" approach of classical liberalism is in its embrace of state-driven interventions aimed at constructing, enforcing and managing markets, in order — among other things — to ensure profitability to major private sector interests.

The United Nations Framework Convention on Climate Change (UNFCCC) was established in 1992 at the height of the "triumph of the market", following the collapse of the former Soviet Union and Eastern Europe. The three "Kyoto mechanisms" proposed to facilitate emissions reductions bear the clear mark of neoliberal thinking: carbon trading alongside two carbon offsetting schemes named the Clean Development Mechanism (CDM) and Joint Implementation (JI).

Mainstream climate policies that have followed echo a core claim of the broader project of neoliberalism: governments are neither competent nor financially capable of tackling societal challenges and should instead be put in service of guaranteeing the profitability of markets for private interests. In relation to decarbonization, this means that governments should aim to unlock private-sector innovation and capital.

This "green growth" vision of decarbonization and the energy transition informs the landmark 2006 *Stern Review on the Economics of Climate Change*, lead-authored for the UK Government by former World Bank economist Nicholas Stern.[87] The Stern Review famously labelled climate change "the greatest market failure ever seen" and insisted both that "stabilisation of greenhouse gas concentration in the atmosphere is feasible and consistent with continued growth," and that the transition to a low-carbon economy would "bring challenges for competitiveness but also opportunities for growth."

In his own terms, Stern adopted a "sticks and carrots" approach to climate policy.[88] This relies on disincentivizing fossil fuels, while incentivizing low-carbon energy technologies. This approach is analysed in further detail below.

STICKS AND CARROTS

CARBON PRICING

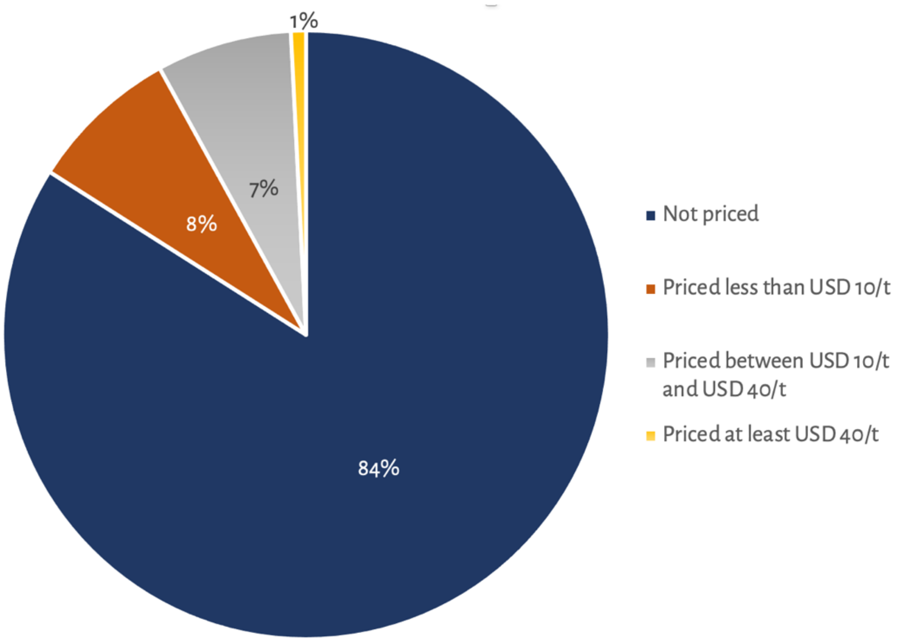
The main "stick" for mainstream policy has been carbon pricing, either through carbon taxes or carbon trading. Carbon trading schemes are based on pollution credits issued by governments and then traded through an exchange. The value of these credits increases over time as the space to pollute created by the credits shrinks relative to emissions.

The flagship example of carbon pricing has been the EU's "Emissions Trading System" (ETS). Launched in 2005, the ETS has been plagued from its inception by serious problems. In its early days, far too many permits were issued, which kept prices low and left companies with no real incentive to curb emissions. Permits were also allocated according to performance "benchmarks", designed by the very companies that were supposed to be regulated and thus very weak. Power companies and energy intensive industries gained billions in windfall profits during the early years of the scheme — profits that mostly turned into shareholder dividends, with little invested in new clean energy infrastructure.[89]

After years of tinkering, the past two years have finally seen the price of carbon on the EU ETS starting to rise.[90] But the EU accounts for roughly 10% of the world GHGs and the EU ETS covers roughly 40% of the EU's economy, or roughly 4% of the world's GHGs. And the current EUR40 per ton price, while still below the desired levels, stands in contrast to what is happening globally.

Although it has been over 15 years since the 2005 launch of the EU ETS, the vast majority of global emissions (84%) are still not priced (see Figure 6) at all, and the share of emissions that are priced high enough to be potentially effective remains well below 1%.

Figure 6: Global Carbon Pricing, 2019



Source: World Bank (2020) *State and Trends of Carbon Pricing 2020*, available at: https://openknowledge.worldbank.org/handle/10986/33809.

Indeed, in 2018, the Global Commission on Economy and Climate acknowledged that carbon prices "are still too low to have meaningful impact". They suggested that a global carbon price of USD 40-USD 80 per ton was needed by 2020, rising to USD 50-USD 100 by 2030.[91] As of November 2020, however, only 9 gigatons of "CO2 equivalent" emissions were covered by any carbon pricing scheme at all — equivalent to just 16 percent of global emissions.[92] Roughly half of covered emissions are priced at less than USD 10/tCO2e — a negligible amount — and less than 5 percent of covered emissions have a price within the range considered effective. The IMF estimates that the global average carbon price is just USD 2/tCO2[93] — a mere one-twentieth of the *absolute minimum price* considered necessary by 2020 in order for the policy to be working.

Large sections of business accept the need for carbon pricing — at least in theory. In practice, however, individual corporations undermine its application by demanding free pollution permits or, in the case of energy-intensive manufacturers, by threatening to close operations and relocate to less "carbon constrained" economies. Otherwise, they do their utmost to politically defeat efforts to introduce a price in the first place.

In early 2015, BP's Chief Economist, Spencer Dale, described how, over the next twenty years, the use of oil and gas would grow 25 percent and, therefore, climate goals could not be reached. Dale suggested that, given this worrying situation, "Policy makers may wish to impose additional policies," principal among them being a "meaningful global price for carbon."[94] Three years later, in 2018, the same corporation spent $12 million dollars in an effort to defeat a ballot initiative in Washington State that would have introduced a relatively modest pollution fee.[95]

INCENTIVIZING RENEWABLES

As the other key element of its "sticks and carrots" approach to driving the transition, mainstream policy has relied on various subsidies and incentives aimed at encouraging investment in "low-carbon" technologies — the "carrots."

Over the past decade, deployment of new renewable generation capacity has been on an upward trajectory (see Figure 7). Net capacity additions for wind and solar have outstripped those for coal and gas. From 2009 to 2019, solar added 638GW of capacity, while wind added 487GW.[96] 2020 saw the addition of another 107GW of net solar capacity and 65GW of wind — roughly 172 GW together.[97] Meanwhile, net coal capacity increased by just 12.5 GW in 2020, while natural gas capacity grew by roughly 40 GW.[98] Since 2009, then, an additional 1297GW of wind and solar capacity have been gained, almost 300GW more than the 1017.5GW of coal and gas added.

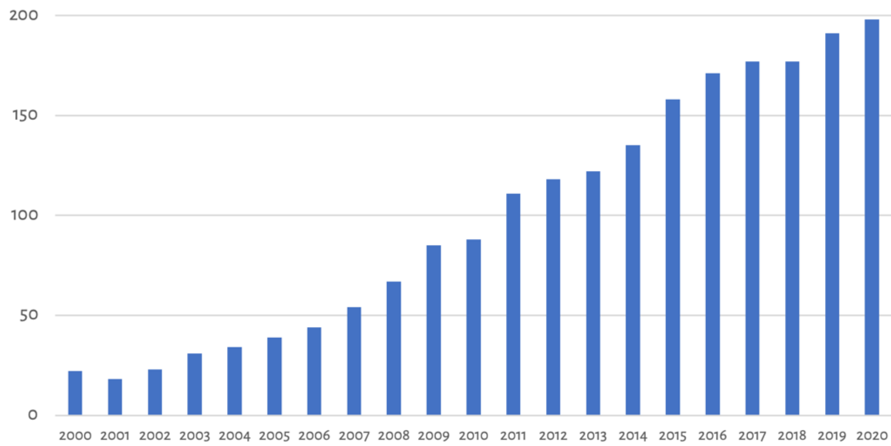
When viewed in isolation, the growth of renewables has been impressive. But growth alone does not mean the current investor-focused policies are succeeding in displacing fossil fuel energy (see Figure 8).

According to the United Nations Environment Programme (UNEP) and Bloomberg New Energy Finance (BNEF):

> *Even though there was a lot of solar and wind capacity installed in the latest decade, its impact on the electricity mix has been gradual, not dramatic.*[99]

And even after roughly two decades of these "gradual" gains, the share of global electrical power generated during the first half of 2020 by wind and solar capacity was just 10%.[100] In 2016, global installed power capacity (from all sources) stood at 6,473 GW and was growing at around 4% annually (roughly 265 GW that year). By 2019, total installed power capacity had risen to 7247 GW.[101] In other words, the overall global power system has been steadily expanding, by nearly 300 GW per year in recent years.

Figure 7: Annual net renewable capacity additions, 2000-2020
GW



Source: Original chart, based on IEA data.

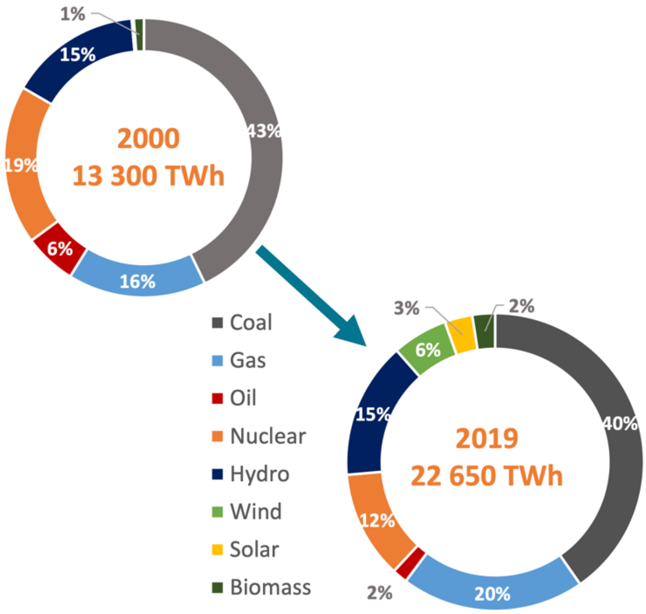
WHY COMPARING "INSTALLED CAPACITY" IS MISLEADING

At first glance, these figures suggest that, although the contribution of wind and solar is growing only slowly, they are winning the race with coal and gas in terms of new capacity additions. When measured in this way, over the last decade renewables were ahead of fossil-based power by a considerable margin (roughly 158 GW). If this trend continues, then the energy transition will, it seems, happen eventually.

But how much electricity is actually generated by the different technologies? Any serious effort to answer this question can only lead to one conclusion: in terms of actual generation, newly installed wind and solar is still trailing behind the power generated by newly installed coal and gas. This is because, over the course of a year, power stations using coal, gas, and nuclear energy generally produce far more electricity per GW of installed capacity than is typically produced by renewable sources. Coal, gas, and nuclear energy are not dependent on the weather. They can generate electricity around the clock, 365 days a year (sometimes referred to as "24/365 power").[102]

In other words, different sources of electrical power have varying "capacity factors." A "capacity factor" is the percentage of nameplate electricity that is expected to be produced over the course of a year (or some other time period) for a specific technology in a specific location. For example, a 5 MW wind turbine situated in a wind corridor off the coast of Denmark might produce at 40% of its "nameplate" capacity. If the wind blew hard and constantly for "24/365" the capacity factor would be close to 100%. But because wind is highly variable, the capacity factor is going to be less than the 100% maximum. The same is true in the case of solar. Solar panels generate no electricity at night, limited electricity on cloudy days, and more on long sunny days in summertime.

Figure 8: G20 Power Mix – 2000 vs 2019



Source: Enerdata (2020). *Global Energy Trends* 2020, available at https://www.enerdata.net/publications/reports-presentations/world-energy-trends.html.

It must be emphasized that capacity factors vary significantly and in general vary much more substantially for renewable technologies than for fossil fuel-based generation. This is because the amounts of wind and solar available for capture and conversion to electricity vary by location, whereas differences in fossil fuel types (for example, due to the thermal quality of different grades of coal) are not linked in the same way to the location of the generation assets.

Globally, the "capacity factor" of solar PV is in the 11-35% range. The capacity factor for wind power is usually 20-40%, although some offshore wind installations in the North Sea have an annual capacity factor above 40% for the newer and larger turbines.[103] However, the capacity factor for a new coal-fired power station can be as high as 80%, although even new coal plants are seldom utilized at this level. The capacity factor for gas-fired power is normally 50-60%, and nuclear at around 80%.

Based on crude averages, 1GW of new coal capacity (assuming a capacity factor of 60%, which is on the low end of the global average for coal-fired power) will out-produce 1GW of wind (with a 30% capacity factor) at a 2:1 ratio over the course of a year. And 1GW of new gas capacity (at a 50% capacity factor) will generate more power than 1GW of new solar (at a 25% capacity factor) by a similar ratio.

Capacity factors for both wind and solar are improving, so the next generation of solar and wind installations could be accompanied by considerably higher capacity factors. But these improvements are likely to be incremental (at current rates of improvement, roughly 1% annually for wind, and 0.5% annually for solar PV).

The point is this: as a general rule, in order to generate comparable amounts of electricity in a given time period, far higher amounts of wind and solar capacity must be installed than might be the case for coal or gas.

THE INVESTMENT DEFICIT IN RENEWABLES

The issue of "capacity factors" also drives home the importance of the shortfall of investment in renewable generation.

Despite the commitment of huge amounts of public money to incentivize private investment, there is growing concern that both renewable energy and decarbonization more broadly are facing a serious and growing investment deficit. According to the IEA's 2019 assessment:

> *There are few signs of the major shift of capital towards efficiency, renewables and innovative technologies that is needed to turn emissions around.... Investment and financing decisions are shaped by policies: today's frameworks are not yet equipped to avoid multiple risks for the future.*[104]

According to IRENA, investment in new renewable power generation capacity (mainly wind and solar) needs to total USD 22.5-trillion by 2050.[105] That equates to around USD 662-billion each year, every year — roughly double the levels of investment seen in recent years, which have averaged around USD 300-billion.

Even more concerning, in their latest report, UNEP-BNEF note that investment commitments for the decade look "modest compared to the $2.7 trillion invested" during the past decade.[106] According to the report, the commitments will add an estimated 826GW of additional non-hydro renewable power capacity — roughly one third less than the 1,213 GW installed in the period 2010-2019.[107]

With overall demand for electricity still expanding, the growth in the share of power being generated from wind and solar is still not sufficient to reduce the volume of fossil fuels being burned. In other words, although the growth of renewables is chipping away at the *share* of fossil fuels in the power generation mix, it is not yet reducing their *quantity* — and even this limited progress looks set to slow in the years ahead.

THE FALLING COSTS FALLACY

Despite the prevalence of claims around the "unstoppable" growth of renewables, the evidence above suggests that investment and deployment are not happening at anything approaching the scale or speed necessary.

However, according to one popular narrative, technological improvements and economies of scale are driving down the costs of wind, solar and storage technologies. For Bloomberg New Energy Finance, the experience of Germany and the United Kingdom suggest that these cost reductions will lead to a series of "tipping points," as wind and solar become cheaper options than various incumbent generation technologies. Might falling costs, then, result in the dramatic spike in renewables investment we need? There are serious grounds to think not, as explained below.

QUESTIONING THE TIPPING POINT

Advocates of the "tipping point" view typically draw on a method of comparing costs among different generation technologies known as the "levelized cost of electricity" (LCOE). LCOE is not a measure of what end users pay for electrical power. Rather, LCOE represents the cost per unit of electricity associated with procuring and operating a power plant, over an assumed lifetime for that plant. In theory, LCOE is supposed to provide a "neutral" or "objective" basis for comparing value for money across all generation technologies.[108]

Box 1: *Europe as a world leader in renewable energy?*

Even in Europe, where "out of market" protections for private renewable power companies have caused significant changes to electricity systems, a serious shift from fossil fuels to renewables has not materialized.

For the EU, the share of fossil fuel generation (lignite, coal, gas and oil) decreased from 53.6% in 2008 to 45.5% in 2018. During the same 11-year period, the share of renewables (including wind, solar, hydro and biomass) increased from 16.6% to 28.5%.[109] The relatively fast growth of renewables in electricity generation helped establish Europe as the world leader in renewable energy.

But as of 2019, wind and solar together still provided just over 17% of the EU28's electrical power.[110] While this was well above world regional averages, Europe's power system is currently still largely dependent on coal, gas and nuclear -- taken together, these sources supply nearly three-quarters of the bloc's electricity.[111] Public hydroelectric systems contribute an additional 12.2% -- such systems are considered "renewable power" but, in most instances, they were built decades ago, and have relatively little scope for expansion.

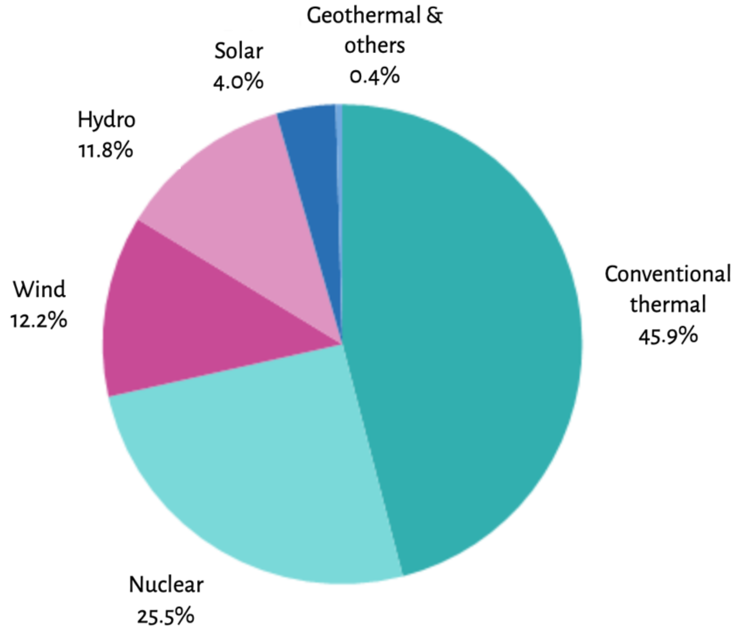
The IEA observed in mid-2020 that the EU was "not yet on track" towards achieving its targeted increase of the renewables share in power generation to 32% (which was at just 18% in 2018), nor of energy efficiency gains of 32.5% by 2030. As the IEA states:

> *Today's 2030 targets will require a significant system transformation, even more so with the announced enhanced targets under the EGD [i.e., the European Green Deal].*[112]

Globally, the average LCOE of power generated by solar photovoltaics (PV) dropped 88% between 2009 and 2019, while the figure for wind fell 69%.[113] Figures such as these are often cited to support the claim that building wind and solar PV capacity is now cheaper than new (and possibly even existing) coal capacity.[114]

There are, however, significant problems with this "tipping point" argument. LCOE ignores crucial differences between electricity and other energy sources. Unlike most other economic goods, electricity cannot simply be "stored" in a warehouse or transported on trucks or ships. Electricity must either be used to do work (to power a refrigerator, a bus or whatever else) or converted into another form of energy (chemical, potential, kinetic, etc.) in the same instant in which it is generated.

Figure 9: Electricity production by source, EU28, 2018 (%)



Source: Eurostat (2018), available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Electricity_production_by_source,_EU-28,_2018_(%25).png.

Because of these physical constraints, it matters exactly when, where and how electricity is generated and supplied to the grid. Whatever other differences there might be among different kinds of electricity sources (including price differences), the "variable renewable energy" (VRE) supplied by a wind or solar farm is not a perfect substitute for the comparatively constant (and controllable) electricity supplied by a coal, gas or nuclear plant (sometimes called "baseload" or "firm" power). The price of electricity generated from variable renewable energy sources fluctuates dramatically in ways that LCOE fails to capture. As such, LCOE makes for a biased and inaccurate unit for comparing the costs of renewables and fossil fuels – the "tipping point" argument ends up exaggerating the declining costs of solar and wind.[115]

PROFITABILITY CRISIS

Typically, the main driver of renewables cost reductions has been the introduction of competitive, auction-based systems, usually following a period of often quite generous public subsidies. But this shift to competition has produced a similar set of outcomes in country after country: a loss of investor interest and stalling growth in deployment.

Endeavours to incentivise renewables in Europe – echoed by similar efforts in other contexts – initially took the form of a system of Feed-in Tariffs (FiTs). FiTs are a guaranteed subsidy, paid to anyone who can install renewable generation capacity and feed power into the grid. This system led to a dramatic rise in deployment of new generation capacity — so dramatic, in fact, that the limits of existing grids to incorporate additional generation capacity were quickly reached.

Governments also faced out-of-control subsidy bills, which either had to be covered out of public budgets or passed along to consumers — with both approaches creating political risks. In order to contain this, FiT systems were progressively replaced by a system of capacity auctions, where successful bidders would typically be awarded 20-year "Power Purchase Agreements" (PPAs). Under this system, renewable energy developers must bid for the new capacity that governments consider necessary.

Box 2: *Variable Renewable Energy (VRE)*

Solar and wind are often described as forms of "variable" renewable energy (VRE). They are variable in that electricity generated from solar and wind is dependent upon the variability of the weather and climate. This stands in contrast to coal, oil and gas, which can be combusted to generate electricity in a way that can be controlled and planned with consistency and are thus able to offer a so-called "baseload" of continuous generation.

The competition of PPA auctions drives down prices. But lower prices lead to lower profit margins, leading investors to lose interest and look elsewhere. As such, rather than opening the door to massive growth in renewables, falling procurement costs may instead lead to a crisis in the entire "renewables for profit" system.

The only way to prevent such a crisis within this auction-based system is for prices to be kept at levels that guarantee satisfactory returns to investors. Yet to do this, governments would need to cover the additional costs of the PPAs in some way — either by passing them along to end-users or covering them out of public funds. Meanwhile, they would have to sustain two myths: that such practices are consistent with "competitive" electricity markets, and that they make the best use of supposedly "scarce" public funds.[116]

However, as we have seen with the phasing out of FiT subsidies, policies can change. And the likelihood of change then becomes an added risk factor for investors. If the additional costs associated with keeping PPAs profitable for private investors were reflected in the costs of the renewable generation assets, they might quickly lose their "least cost option" status.

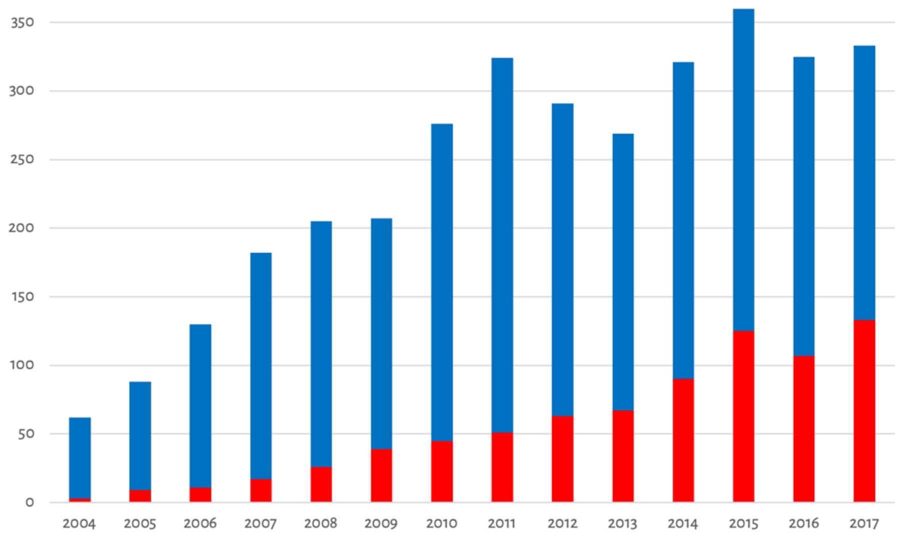
This is a "no win" situation for private renewable energy companies, which lies at the heart of the current global crisis of investment in the power sector caused by neoliberal climate policy.

In response to the falling levels of investment discussed above, some argue that this problem will be mitigated by falling costs. The claim here is that any investment committed today will result in more capacity than would have been the case a number of years ago, when costs were considerably higher.

What these overall figures do not reflect is the massive contribution that China was making in the years before to global financing of clean energy investment.. As of 2017, according to BNEF, China was responsible for 40% of global investment, and if its investment is taken out of the picture, it becomes clear that investment for the "rest of the world" was already falling to worryingly low levels (see Figure 10).

Figure 10: New financial investment in clean energy, 2004-2017

USD billions



Source: Original chart, based on Bloomberg NEF data.

For a period following 2013, China's robust investment in renewable energy obscured the underlying downward slide in investment elsewhere. But eventually, following the lead of Europe and some non-European countries, China took steps to reduce FiT support — and this produced a fall in investment levels just as it had elsewhere. According to UNEP/BNEF, China invested USD 88.5 billion in renewable energy in 2018 and remains the world's leading investor — but this 2018 investment level was down 38% from the previous year as a result of these policy changes. Investment in China fell a further 8% in 2020, to $83.4 billion — its lowest since 2013.[117]

THE UTILITY "DEATH SPIRAL"

Falling prices will not save the renewables sector from the crisis of investment it faces. This crisis is a direct consequence of the "electricity for profit" framework promoted by neoliberal policy. The wave of privatisation, liberalisation, and marketisation of the 1980s and 1990s introduced "investor risk," and now governments are scrambling to "de-risk" investment by using public money.

One of the main obstacles facing the current energy system is the "death spiral" of the incumbent companies or utilities in many parts of the world, especially where energy demand is either flat or falling (such as Europe, the United States, Japan, and South Africa), and, secondly, where renewable energy has made subsidy-enabled gains in market share.

The deployment of renewable energy guarantees returns on investment through the purchase of electricity at an agreed above-market price through long-term PPAs. Armed with a PPA, private developers are in a strong position to negotiate financing arrangements with lenders. Both the developer and the lender will operate on the basis that "satisfactory returns" are contractually locked in and therefore all but guaranteed.

As such, PPAs make it easier for actors beyond incumbent utilities to become active in the energy market, in turn hitting the market share and revenues of the incumbents. In Europe, there has been a precipitous collapse of the European utilities' balance sheets. In 2013 alone, this amounted to a €32 billion decline. In 2018 the net income of the Germany-based energy multinational RWE's fell by a staggering 83%, EDF's by 65%, and E.ON's by 22%.[118]

Another factor that contributes to the "death spiral" of the utilities is the "system costs" that accompany variable renewable energy (VRE). According to the IEA, when VRE penetration ranges from 15% to 25% of annual generation, countries and regions can expect to encounter significant challenges in integrating VRE into the grid."[119] At this point there needs to be an increase in "system flexibility", requiring grid upgrades and significant investment in new technologies such as storage. This means that incumbent companies will incur significant costs, estimated by the IEA at an additional 10-15% above the costs of a unit of installed wind and solar capacity.[119]

However, the "death spiral" facing many utilities does not spell the end of fossil fuels. In the case of Europe, where renewables have grown impressively, wind and solar energy alone cannot meet demand. The record level of renewable power generated by wind and solar Europe-wide on any given day has never exceeded 30.1% (on July 30, 2017). On that record-breaking day, "dispatchable" or "firm" power (including large hydro) provided the remainder: almost 70%. Three weeks later, during the evening of August 25, 2017, wind and solar provided only 5.5% of the region's power, and the remainder, 94.5%, was provided by coal, gas, nuclear and large hydro systems.[120] Put differently, Europe still relies heavily on "baseload" power, and this is likely to continue for a significant number or years. The same is true for other major economies.

However, because coal and gas plants are not operating at full capacity, under the current market design, utilities often struggle to cover operating costs. Meanwhile, they are expected to invest in the upgrades needed to handle rising levels of VRE.[121] Concerned that the "death spiral" dynamics would bankrupt the incumbent companies at a time when the power they generate remains essential, eleven EU Member States began in 2013-2014 to introduce some form of supplementary capacity mechanism into their domestic energy markets. These are "insurance" payments to electricity generators in order to keep their capacity available for those times when it may be needed.[122] Without guaranteed capacity payments, it seemed that there would be no investment in future "baseload" power. The result is a transfer of funds to coal, gas and nuclear interests. In the EU at least, neoliberal policy has degenerated into a "subsidies for all" situation.

Meanwhile, it is not clear how the challenges posed by VRE — challenges that are expected to grow in the coming years — will be resolved. The neoliberal approach to dealing with VRE has been built around three main policy proposals. The first proposal involves providing incentives that can lead to the scaling up of energy storage.[123] The second proposal concerns expanding and upgrading grids. The third proposal is policies that cultivate enhanced demand flexibility, often referred to as "demand-side response" (DSR).[124] There are serious problems with each of these proposals, as explained below.

STORAGE AND EXPANSION OF THE GRID

Battery storage is currently not growing in tandem with renewables.[125] Solar-plus-storage systems have reached high deployment levels in Germany (50% of installations) and Australia (40%).[126] The US-based Solar Industries Research Association (SEIA) notes, "By 2025, more than 25% of all behind-the-meter solar systems will be paired with storage, compared to under 5% in 2019."[127] But only a handful of countries have reached these levels of deployment, and scores of others have deployed little or none at all.[128]

Meanwhile, the lack of "utility scale" storage is also becoming a major problem. California has installed approximately 28.5 GW of solar power. In August 2020, Bloomberg Green noted:

> *There aren't enough batteries installed on California's grid right now.... California's grid operator estimates that as much as 12GW of batteries would eventually be needed to store enough renewable energy to help maintain the balance between supply and demand. That's a huge jump from the more than 500 megawatts worth of batteries operating in the state at the end of last year [2019].*[129]

Large "utility scale" battery storage capacity rose to roughly 23 GW globally in 2020, which is still marginal when viewed in the context of global power systems.[130] The most widely reported such project is a Tesla battery in South Australia, attached to a wind farm, and reportedly capable of delivering 150MW of power.[131] The Danish company Ørsted has built 40MW of storage as part of a 460MW "solar+storage" project in Texas.[132] In New York, the investor-owned utility, Consolidated Edison, intends to partner with a private developer "174 Power Global" to build a 100MW battery in the borough of Queens.[133] But, as with smaller stationary battery systems, the growth in large scale storage is still nowhere near where it needs to be.

Neoliberal policy is also committed to supporting the expansion of transmission extensions and interconnectors in order to deal with VRE while pushing forward with decarbonization. In Europe, where renewable energy has reached 30% of installed capacity, it is widely accepted that electricity will need to travel across regional and national borders connected by a continent-wide grid. This "big grid" approach will connect areas that are sunny and windy to areas where the sun is not shining and/or the wind is not blowing. However, one of the technical challenges facing the "big grid" idea is the need for expanded transmission infrastructures stretching over long distances. The IEA notes that "interconnection among adjacent countries/power systems can make this area very wide indeed."[134] But the aggregated approach will require not just a wider spatial distribution of wind and solar technologies to "smooth out" supply, it would also require far more capacity than the conventional centralized system. For example, a recent study on South Africa estimated that meeting all of the country's energy needs from wind and solar would require a massive increase of generation capacity — roughly 150 GWs will need to replace 40GW of coal-fired capacity.[135]

FLEXIBILITY INVESTMENT CRISIS

Just as there exists a widening "investment deficit" for renewable energy generation, there is an equally serious investment deficit in essential technologies that need to be deployed in order to ensure the flexibility of electricity systems. Private or marketized public companies are simply not prepared to commit capital to the technologies required unless they receive cast-iron guarantees that their investments will produce a return.

A 2009 study conducted by the US Department of Energy concluded that new transmission infrastructure, "could address the general increase seen in grid congestion and support the future integration of renewable resources; however, the relationship between this general economic benefit and the private return to companies paying for new transmission is often insufficient or too uncertain to spur investment."[136]

The same issue pertains to storage. The IEA bemoans the fact that investors do not have a means to achieve "fair remuneration for flexibility services." Therefore, "longer-term storage options are largely not cost-effective at this stage."[137] Indeed, 2019 was, according to the IEA, a "lackluster year" for storage: "Events in 2019 highlighted how fragile growth in these technologies remains, as they continue to depend heavily on policy intervention through direct support or market creation."[138]

Meanwhile, "clean tech" companies have joined ranks with private wind and solar companies in calling for "risk negation."[139] Storage industry groups note how the EU's Clean Energy Package does not provide "investment certainty in the form of long-term contracts for storage services."[140] The European Commission concurs, stating:

> *Above all, the main challenge for energy storage development is economic… Today, development is very slow due to the poor economic/business case and related uncertainties.*[141]

Neoliberal policy is driving a decarbonization agenda anchored in the massive expansion of privately owned renewable energy, but the investor-focused framework means that the technologies needed to make power systems sufficiently flexible are not being deployed fast enough to serve this purpose.[142] There is every possibility, therefore, that the story of solar and wind—where public money was made available to make profitable what would not otherwise be profitable—will be repeated for auxiliary technologies either in the form of lucrative public-private partnerships, concessionary financing, or most likely both.[143] Just as public subsidies brought us variable power, public subsidies will, it seems, be committed to the task of increasing flexibility in order to stabilize power systems. This is what happens when planning is neglected.

DEMAND SIDE RESPONSE

The third and final neoliberal proposal to deal with VRE is known as "demand side response." This has been described as the controlled shifting of load away from the system peak, by commercial and industrial users who have sufficient flexibility to move forward or delay some of their power demand, and would be rewarded by the System Operator for doing so. Households and small businesses can also play a role in shifting demand in this manner.[144]

According to the IEA, digitalized systems (or "smart demand response") could provide 185GW of system flexibility, adding up to savings of USD 270 billion.[145] But there are clear signs that this is not yet happening to the degree that policy makers feel it needs to. As the IEA has noted, only 1% of demand globally, or about 40 GW of capacity, is able to directly respond to shortages or excess supply.[146] Demand response is largely restricted to large industrial consumers that can negotiate deals with energy providers with regard to their consumption patterns. According to the IEA, "Less than 2% of the global potential for demand-side flexibility is currently being utilized."[147]

For IRENA, consumer behaviour will be key, with consumers becoming providers of flexibility through shifting their electricity usage patterns via smart technologies, mediated through financial incentives.[148] However, in OECD countries, residential users normally consume less than a third of total electricity generated, although consumption levels of course fluctuate country by country. The percentage of residential consumption of electricity is often lower in the global south, especially in Asia where industrial and commercial use accounts for the bulk of electricity consumption. According to the US Energy Information Administration (EIA), only a fraction of global electricity consumption can be categorized as "residential", and commercial and industrial electricity use (particularly in non-OECD countries) already account for the majority of electricity consumed.

Serious questions have already been raised about the practical limits of a demand response approach. Will factories, offices and other commercial spaces change their entire mode of operation simply to save money on electricity? In 2018, a group of energy scientists in the US questioned why those proposing a transition to 100% renewable energy "provide no explanation or justification as to how (and why) industrial producers would be able or willing to schedule their production around variable renewable energy output on a daily basis nor do the [they] quantify the resulting economic impacts of doing this."[149]

According to the European Commission's *Energy Roadmap 2050*:

Massive investments are needed in infrastructures.... The public sector might have a role as a facilitator for investment in the energy revolution. The current uncertainty in the market increases the cost of capital for low-carbon investment. The EU needs to move today and start improving the conditions for financing in the energy sector.[150]

This is a thinly veiled way of saying that, in the absence of sufficient investment from the private sector, public money will need to be packaged in a way that private interests can make returns.

Addressing these challenges will require a planned approach in which grid technologies and demand management innovations develop in tandem with the deployment of renewables. The current approach — based on "subsidized renewables" at almost any cost — is to press forward with renewables, without taking into account their impact on the overall system. This is a direct consequence of the irrational obsession with liberalisation, "competitive electricity markets," and independent power producers (IPPs).

SUMMARY

Even for countries that are blessed with large natural endowments of wind and / or sunshine, the challenges of incorporating "variable renewable energy" (VRE) remain. As more renewable energy comes online, the technical complications and financial burdens increase. The LCOE, which shows renewables becoming increasingly competitive, ignores the costs of backing up renewables' supply with reserve capacity and of integrating renewables into the system. As the IEA notes in its *World Energy Outlook 2020*:

Electricity grids could prove to be the weak link in the transformation of the power sector, with implications for the reliability and security of electricity supply. The projected requirement for new transmission and distribution lines worldwide in the [Stated Policies Scenario] is 80% greater over the next decade than the expansion seen over the last ten years. The importance of electricity networks rises even more in faster energy transitions. However, the financial health of many utilities, especially in developing economies, has worsened as a result of the crisis. There is a disparity in many countries between the spending required for smart, digital and flexible electricity networks and the revenues available to grid operators, creating a risk to the adequacy of investment under today's regulatory structures.[151]

Meanwhile, the death spiral of the utilities risks slowing down the transition to a low-carbon system, because any intensification of the "energy war" between incumbent utilities and new, independent power producers can only exacerbate systemic problems, ultimately requiring state intervention. These interventions will inflict additional costs (through "capacity payments") and complexities that can be avoided only if overall power systems are in public hands, so that the transition can proceed in a planned and orderly way.

4
CONCLUSION

Sensantionalist narratives of an unstoppable growth in renewable energy and various "clean" technologies perpetuate the myth that the transition to a low carbon world is well underway, and merely needs to go faster. In reality, greenhouse gas emissions are rising and climate change is intensifying. This is because fossil fuel usage continues to rise. And while the renewable sector is growing, its rate of growth is far outstripped by that of global energy demand.

Although the pandemic marked a temporary shift for the energy sector and associated emissions, no sustained change has materialised. Global energy demand and associated emissions are once again rising and business as usual has been resumed.

After thirty years of neoliberal climate policy, it is safe to conclude that it has failed to even begin to make significant headway. The problem the policy set out to address has gotten larger, not smaller. An effective carbon price has not materialized and its prospects are currently dismal. The "carrots" that were supposed to unlock low-carbon investment has failed to stimulate the growth of renewables at anything like the pace necessary.

Meanwhile, a new crisis in the energy sector is on the horizon as incumbent utility firms hit by "out of market" support for renewables face quickly declining revenues and market share. As a result, public funds are once again being siphoned off into the energy industry in order to ensure the "baseload" fossil fuel power plants we still rely on for reliable power remain viable.

The pursuit of endless growth and capitalist accumulation has resulted in an *energy expansion*, rather than an *energy transition*. Further, the dogmatic defence of market competition and private profit above all else has resulted in an ever-deepening crisis of underinvestment and a series of technical problems that have yet to be solved.

The contradictions of the neoliberal approach are very clearly recognised in a recent IEA report, which stated:

> *The private sector has limited incentive to produce knowledge if firms cannot fully exploit the returns on their investment because that knowledge is easily available to others.*[152]

In other words, the "invisible hand" of the market will never achieve the global energy transition we need, because doing so would threaten the profitability of private actors that have become too big to fail.

The need for a public alternative could not be clearer. A public goods and public ownership approach can hardwire social and environmental goals into climate and energy policy. What's more, it can facilitate the forms of planning and coordination that has for decades been unforthcoming.

Yet shifting power and control from unaccountable private actors to unaccountable state institutions is unlikely to result in the radical change we need. As trade unions and social movements have been arguing for years, an energy transition that works for people and planet must be grounded in the principles of *energy democracy*.

This means forms of *public ownership and management* rooted in genuine popular participation and control.

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ACRONYMS AND ABBREVIATIONS

BNEF	Bloomberg New Energy Finance
CCFI	Centre for Climate, Finance and Investment
CGT	Confédération Générale du Travail [France]
CIS	Commonwealth of Independent States
COP	Conference of the Parties [United Nations Climate Change Convention]
CO_2	Carbon dioxide
CHG	Greenhouse gas
GW	Gigawatt
EIA	United States Energy Information Administration
EU	European Union
FNME	Fédération CGT des Mines et de l'Énergie [France]
FiT	Feed-in tariff
IEA	International Energy Agency
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IPPs	Independent power producers
IRENA	International Renewable Energy Agency
LCOE	Levelized Cost of Energy
LNG	Liquefied natural gas
MW	Megawatt
NDCs	Nationally Determined Contributions
OFGEM	Office of Gas and Electricity Markets [United Kingdom]
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
PPAs	Power purchase agreements
PSI	Public Services International
PV	Photovoltaic energy
SUV	Sport utility vehicle
TNI	Transnational Institute
TUED	Trade Unions for Energy Democracy
TWh	Terawatt-hour
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	United States Dollar
VRE	Variable Renewable Energy