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As part of Climate Action 100+ Global Investors Driving Business Transition

GLOBAL SECTOR STRATEGIES: INVESTOR INTERVENTIONS TO ACCELERATE NET ZERO ELECTRIC UTILITIES

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ABOUT CLIMATE ACTION 100+ AND THE GLOBAL SECTOR STRATEGIES

Climate Action 100+ is an investor-led engagement initiative that strives to ensure the world's largest corporate greenhouse gas emitters take necessary action on climate change. More than 615 investors, responsible for $60 trillion in assets under management, are engaging 167 focus companies to improve climate governance, curb emissions, align their emissions performance with net zero, and strengthen climate-related financial disclosures.

Climate Action 100+ is delivered by five investor networks (AIGCC, Ceres, IGCC, IIGCC and PRI) working with the initiative's investor signatories. In March 2021, Climate Action 100+ published the first company assessments from its Net-Zero Company Benchmark [1] (hereafter referred to as "the Benchmark"), which evaluates climate performance and corporate transition plans. Acknowledging that corporate net zero strategies will vary significantly by sector, Climate Action 100+ is developing a series of Global Sector Strategies to accelerate sectoral decarbonisation.

This workstream from the Climate Action 100+ initiative, launched officially in August 2021, aims to encourage the transition for specific high emitting sectors by identifying key actions for companies, investors and industries overall. Aligned with the Benchmark, the Global Sector Strategies guide investor engagement by Climate Action 100+ signatories, mapping out what corporates in carbon intensive industries need to do to build out effective transition plans and decarbonise value chains.

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ABOUT THIS REPORT

Global Sector Strategies: Investor interventions to accelerate net zero electric utilities was developed by the Institutional Investors Group on Climate Change (IIGCC) as part of the Global Sector Strategies, a workstream coordinated by the investor networks that coordinate Climate Action 100+.

This report aims to help investors accelerate the transition to net zero in the Electric Utility (power) sector and builds on work by AIGCC [2], Carbon Tracker [3], IEA [4], IIGCC [5], SBTi [6] and TPI [7], [8] amongst others. It sets out what is needed to overcome the challenges posed to the sector by the net zero transition and inform investors on what they should be asking power companies to do and disclose. It identifies:

1. The level and pace of decarbonisation needed in the power sector if the increase in global temperatures is to be restricted to 1.5°C with limited or no overshoot (net zero)
2. The gap between current company ambitions and the required level of decarbonisation
3. The specific challenges that power companies face in closing that gap
4. The sector-specific actions companies should take to overcome these challenges (building on the existing Climate Action 100+ Benchmark indicators [1])
5. How investors can accelerate progress
6. The disclosure and methodological challenges to assessing progress.

This report has been shared with Climate Action 100+ investor signatories and power companies participating in the **Global Sector Strategies** workstream, and their feedback has been incorporated into the final report. It also includes analysis from IEA's NZE by 2050 scenario [4] which brings forward the date by which power sector emissions need to reach net zero in advanced economies from 2040 to 2035. The report will now be used by investors that are engaging with power companies on the Climate Action 100+ focus list, through sector-wide dialogue that encourages collaborative action and as part of individual engagements.

It is important to note that this report represents investors' current understanding on how the power sector should decarbonise. This understanding will evolve over time and will be reflected in future iterations as dialogue with the companies continues.

ACKNOWLEDGEMENTS

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The feedback provided by these individuals does not represent an investment endorsement or recommendation and does not reflect any policies or positions of their firms.

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ROLE OF THE INVESTOR NETWORKS

Each **Global Sector Strategy** is developed by a lead investor network with the most in-depth strategic understanding of the sector, in consultation with the other investor networks that deliver Climate Action 100+.

The lead investor network develops the strategy in consultation with external sector technical experts, signatory investors and focus companies. The supporting investor networks assist by contributing insights to the report and gathering feedback from their members and focus companies.

IIGCC led on the development of the **Global Sector Strategies: Investor interventions to accelerate net zero electric utilities** report. The supporting investor networks – AIGCC, Ceres, IGCC and PRI – have reviewed and endorsed the recommendations outlined in this report.

The report provides sector wide actions that investors can request from focus companies for each regional context. Each investor network will play an important role in taking regionally specific actions to their investors, to inform engagement with focus companies in their regions.

GLOSSARY

Advanced economies: as specified by IEA NZE report [4], advanced economies refer to the OECD regional grouping and Bulgaria, Croatia, Cyprus, Malta and Romania.

BECCS: Bioenergy with Carbon Capture and Storage is a technology-based carbon removal which extracts energy from biomass and captures and stores the carbon released

Bn: Billion (USD$)

CAGR: Compounded Annual Growth Rate

Carbon neutrality: Many corporate and national emissions targets aim to reduce annual net CO_2 emissions to zero, a level where, either by using technology that captures emissions at source (e.g. CCUS) or removes carbon from the atmosphere (DACCS or offsets) any residual gross emissions are balanced by these neutralising actions.

CCS/CCUS: Carbon Capture (Utilisation) and Storage refers to a technology and supporting infrastructure designed to capture carbon emissions from a point source and transport it either to be used in products ("utilisation") or stored underground.

CHP: Combined Heat and Power

CO_2: Carbon dioxide

DACCS: Direct Air Capture with Carbon Capture and Storage refers to a technology and supporting infrastructure designed to capture ("remove") carbon dioxide directly from the atmosphere and compress it to be injected into geological storage.

EV: Electric Vehicle

EU: European Union

GHG: Greenhouse gases

Gt: Gigatons

GWh: Gigawatt-hour

H_2: Hydrogen

kWh: kilowatt-hours

LCOE: Levelised Cost of Electricity

MWh: Megawatt-hour

Mt: Million tonnes

Net Zero: As established in the IPCC report [9], Net Zero refers to climate scenarios consistent with the ambition of limiting the rise in global warming to 1.5°C with limited or no overshoot. These scenarios are characterised by a rapid reduction in emissions over the next decade and annual emissions falling to "net zero" by 2050. Frequently discussed in terms of this 2050 annual emissions target, if the temperature increase is to be restricted to 1.5°C, the emissions pathway is also crucial.

NZE: The IEA's (International Energy Agency) Net Zero Emissions by 2050 scenario and report. See [4]

PPA: Power Purchase Agreement (PPA) is a long-term contract under which a business agrees to purchase electricity directly from a renewable energy generator

Ppts: percentage points

Tr: Trillion USD

TWh: Terawatt-hour

FOREWORD

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Power is arguably the most important sector to decarbonise over the next decade. It accounts for nearly 40% of energy emissions, the most of any sector. Rapid decarbonisation is needed, not just to address these emissions, but to support the transition of other sectors to net zero. However, as the current surge in energy prices highlights, electricity is also key to social and economic development. A net zero power sector should be resilient and able to supply affordable electricity.

The rapid pace of the transition expected in the power sector reflects the increasingly favourable economics of low carbon generation, investor engagement and a more supportive policy environment. Renewables today are the cheapest source of electricity in many circumstances. There is evidence that power utility companies that have already embraced renewables and anticipated policy shifts have often created shareholder value [10]. Moreover, the transition to net zero constitutes an unparalleled opportunity for power companies and investors alike. According to the International Energy Agency's latest Net Zero Report (IEA NZE), from 2030 onwards at least USD 2 trillion of annual investments in generation and infrastructure will be required to achieve net zero and meet rapidly growing demand for electricity.

However, despite this promising landscape and some encouraging developments, most power companies have not been progressing at the pace required to restrict rises in global temperatures to 1.5°C. Based on analysis from the IEA [4], annual emissions from the power sector must reach net zero by 2035 in advanced economies and by 2040 globally. Of the 68 companies assessed by TPI, only one (Ørsted) is currently aligned with this target. To close the gap between many power companies' stated net zero ambitions and delivery requires bold action now. These actions should include an immediate halt to the construction of coal-fired power plants, the phase out of coal in line with the timelines proposed by PPCA and IEA NZE, and the scaling up of investments in clean energy sources and infrastructure. It is also vital to ensure full accountability of boards of directors to ensure that governance, targets and disclosures are provided, in line with the Climate Action 100+ Benchmark, to allow shareholders and stakeholders to track progress.

Reflecting its strategic importance, the power sector is highly regulated, which can restrict some companies' ability to take decisive action. Policymakers therefore have a critical role to play in supporting the sector's net zero transition. Effective public policies are needed to create the appropriate incentives to reduce fossil fuel-based generation and rapidly increase investment in renewable generation, storage and network infrastructure. Clear nation-wide deadlines and incentives are of critical importance as policymakers look to accelerate the phase out of coal.

In this rapidly evolving landscape, companies, investors and policymakers must also deliver a 'Just Transition'. Overall, assistance to companies, workers, communities and suppliers is key to attracting long-term public support and legitimacy for a rapid transition. Moreover, companies and policymakers must develop mechanisms to ensure that the energy transition does not translate into increased 'energy poverty[1]' for consumers.

Investors acknowledge their role in helping power companies navigate this transition. We are working alongside companies, financiers and public bodies to create innovative solutions that can accelerate the retirement of polluting assets, particularly those burning coal. Engagements now need to focus on ensuring the delivery of science-based net zero targets, credible transition plans that support a just transition and adequate disclosures to ensure accountability. Investments in clean power generation and infrastructure need to treble by 2030. However, these actions need to go beyond developed economies. The challenge lies in implementing these in developing economies, where financing and technical assistance may be needed to expand access to affordable energy. Globally coordinated action in the power sector is needed at pace and scale in the next decade in order to reach a net zero economy by 2050. Without transformation in the global power sector, this goal will be out of reach.

[1] Definition of energy poverty: https://ec.europa.eu/energy/eu-buildings-factsheets-topics-tree/energy-poverty_en

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EXECUTIVE SUMMARY

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This report aims to help investors accelerate the transition to net zero in the power sector. Electricity is central to economic activity and daily life. It is a considerable contributor to the overall level of emissions globally and decarbonisation is needed to address these emissions and support other sectors' transition to net zero. This report highlights that:

1. Urgent action is needed to decarbonise the power sector to limit the increase in global temperatures to 1.5°C (net zero). Emissions from electricity generation should reach net zero by 2040 globally and by 2035 in advanced economies [3], with a reduction of more than 50% by 2030.
2. TPI data [7] suggests that only one of the 68 publicly listed power companies it assessed has a decarbonisation plan consistent with a 1.5°C pathway.

However, the challenges posed by achieving net zero in the power sector are not insurmountable:

3. Many power companies already believe reaching net zero annual emissions is achievable. According to TPI [7] at least 22 (32%) of the publicly listed power companies analysed are aiming to reach net zero emissions for their electricity generation businesses by 2050. Clearly more companies need to set net zero targets and existing targets need to be brought forward by 10-15 years, but there is existing ambition in this area. Four companies (CMS, Cons Edison, E.On and RWE) are targeting net zero for their electricity generation businesses by 2040.
4. Policy, economic and technology barriers are falling. Renewables are already the cheapest source of electricity in many circumstances; further cost declines and cost-effective storage will help address the challenges of variability. Support for net zero at a national government level has increased substantially and this is feeding into more favourable power sector policies and regulation.
5. Net zero creates a substantial growth opportunity. There is evidence that power companies focused on renewables have outperformed their peers in creating shareholder value over the last five years [10]. The IEA forecasts electricity demand to grow by over 166% by 2050, resulting in an 11% CAGR in wind and solar generation [4]. Companies focused on renewable generation and other enabling infrastructure are likely to gain share and outperform their peers.

ACTIONS REQUIRED TO MEET NET ZERO

ACTIONS FOR POWER COMPANIES

Reflecting on these considerations, this report proposes actions that power companies should take to align with a 1.5°C scenario (net zero) and the disclosure they should provide to communicate their strategy to investors. These measures are mapped against the Climate Action 100+ Benchmark indicators [1] and shown in full in Exhibit 1. This provides investors with a sector specific guide as to what companies should provide in their transition plans.

To stay within the limited emissions budget required by net zero pathways, power companies should:

1. **Set a company-wide emissions target for annual emissions from electricity generation reaching net zero by 2035 in advanced economies and by 2040 in developing markets** (as consistent with the IEA NZE scenario [4]).
2. **Achieve more than 50% of the decarbonisation of annual emissions from electricity generation (from a 2019 level) by 2030 or sooner.**
3. **Set two additional company-wide emissions targets** in accordance with the approach adopted by SBTi:

- For all sold electricity (typically Scope 1 emissions plus emissions in Scope 3, category 3). Aside from electricity generated, this target also covers any electricity purchased from third parties (including PPAs) and subsequently resold to customers.
- For all sold or distributed energy. In addition to covering electricity sales, this target also covers heat and any downstream emissions from sales of distributed energy, typically natural gas Scope 3, category 11.

4. **Set a clear decarbonisation strategy identifying the main measures they intend to use to deliver their targets and specify the contributions they expect each to make towards those targets.** Decarbonisation strategies will vary by company but should:

- Focus on measures which reduce gross emissions. Consistent with the concept of prioritising emission reductions above offsetting, power companies should focus primarily on minimising the use of fossil fuels and particularly coal.
- Minimise the reliance on CCUS (Carbon Capture Utilisation and Storage). In addition to prioritising reductions in gross emissions, the stubbornly high costs of CCUS in the power sector make it a risky and potentially expensive decarbonisation strategy. Power companies should disclose the expected contribution of CCUS to any targets and conduct and publish a feasibility study setting out its CCUS strategy.
- Not use carbon offsets to reduce generation emissions to net zero. A consistent feature of 1.5°C pathways as set out by the IPCC is the near full decarbonisation of electricity generation. SBTi does not count the contribution of offsets to company emissions targets [11]. Since cost effective sources of low carbon electricity are already available, the finite resources (land and water) required for offsets should be reserved for 'hard to abate' sectors [9].
- Set a date for the phasing out of unabated coal generation. Consistent with the timeline proposed by PPCA [12] and the regional analysis set out by Climate Analytics [13], coal based generation should cease by 2030 for OECD countries, by 2031 for Eastern Europe and Former Soviet Union, 2032 for Latin America, 2034 for Middle East and Africa and 2037 for non-OECD Asia.
- Expect to deploy negative emissions technologies including BECCS (CCUS applied to bioenergy) to be modestly emissions negative beyond 2040 (and 2035 for advanced economies) [4]. This report recognises that the technology needed to deliver negative emissions and the mechanism to finance its use have yet to be determined.
- Disclose both the expected total of low carbon generation (TWh) and the contribution of different technologies (variable renewables: solar, wind; low carbon fuels: biopower, hydrogen; nuclear and others) as applicable.
- Set out how any non-generation energy activities, including sales of third-party electricity, heat and natural gas, will be decarbonised.

5. **Power companies should align their capital investment (capex) plans to a 1.5°C pathway by:**

- Not investing in any new coal generation.
- Committing to ensure that any new natural gas generation will be net zero by 2040 (2035 in advanced economies).
- Disclosing any planned and actual investment in CCUS and committing to deploy CCUS to abate emissions from any residual fossil fuel generation still running beyond 2040 (2035 in advanced economies).
- Disclosing a 5-year capex budget for its own renewable deployment.
- Where relevant, disclosing a 5-year network infrastructure budget.

6. **Identify policy barriers to net zero.** Where policy or regulatory barriers exist to delivering net zero, power companies should publish a board level report identifying these issues and setting out proposals on how they could be removed. Broader policy and lobbying positions should be consistent with these proposals.

7. **Provide a just transition.** Power companies should commit to providing a just transition by setting out, in a board level report, how the company intends to manage the wider societal impact of transitioning to net zero and who will be responsible for implementing its strategy.

INDUSTRY-WIDE ACTIONS

This report recognises that some power companies will be unable to deliver net zero without support from other actors. Listed below are actions that they should take, through appropriate coordination with their peers and other value chain participants, and actions that other parts of the value chain should take, to accelerate the transition.

8. **Power companies should work together via the appropriate national and regional industry bodies to remove common policy barriers to net zero.** Where individual power companies have identified barriers (see Action #6 for power companies), these should be raised with the appropriate industry body. By 2023, this body should publish a joint report identifying the actions that policymakers need to take to overcome these barriers.

9. **Power companies should fund joint R&D projects either with peers or other value chain participants to accelerate the removal of key technological barriers to net zero.** Where individual power companies have been unable to set out how they intend to reach net zero or have highlighted common technology barriers (e.g. CCUS, BECCS or DACCS), they should establish or fund joint R&D projects with their peers and other value chain participants (i.e. technology suppliers, governments, academic institutions) to accelerate their deployment. By 2023, power companies that continue to cite technology barriers to net zero should be able to identify in the appropriate annual report (i.e. annual report for shareholders, sustainability report or equivalent) the substantial contributions they are making to remove these barriers.

10. **Power companies should establish partnerships and collaborations with players in hard-to-decarbonise industrial, transport and buildings sectors to enable their electrification.** Working either directly or via appropriate national and regional industry bodies, power companies should establish partnerships and collaborations with players in hard-to-decarbonise sectors (or their appropriate industry bodies). These partnerships should publish a report by 2023 identifying the potential electricity demand from these sectors and how barriers can be overcome to supply this.

11. **Reduce power demand through collective action.** Collective action, across the value chain and multiple regions, will be required to reduce electricity demand from existing applications. These actions can be broadly categorised into two elements:

- **Improving appliance efficiency.** Manufacturers will need to accelerate improvements in the efficiency of their devices during the next decade according to the IEA [4]. Policymakers globally will need to support this by setting progressively tighter standards. A further study setting out the potential opportunity to reduce demand (and thereby emissions) through enhanced device efficiency will be needed to identify key actions.

- **Behavioural change.** Adapting consumer behaviour either through the use of smart meters/tariffs and education more broadly has the potential to substantially reduce demand in some markets. A further study, benchmarking current best practice, could identify the size of the opportunity and how it can be realised.

ACTIONS FOR INVESTORS

Investors can play a key role by encouraging companies to go faster. Many are seeking to reduce exposure to climate transition risks within their portfolio, to align their investments with net zero or to engage with management to reduce emissions. Others see a significant growth opportunity in funding low carbon infrastructure. Specific actions investors can take to accelerate the transition in the power sector include:

12. **Help to address or remove regulatory and policy barriers.** Investors recognise that the scope for power companies, particularly regulated utilities, to deliver net zero can be constrained by the policy and regulatory environment. By working in coordination with the organisations which coordinate Climate Action 100+ (AIGCC, Ceres, IGCC, IIGCC and PRI), investors can add a powerful voice to calls to address or, where appropriate, remove these regulatory barriers.

13. **Engage with power companies to establish credible net zero transition plans.** The rapid change required by the shift to net zero will require a comprehensive strategic response from power companies. Using this report and the Climate Action 100+ Benchmark as a guide, investors can help companies develop comprehensive transition plans covering metrics including emissions targets, decarbonisation strategy, alignment of capex, just transition planning and disclosure. The credibility of these plans will be assessed by the Climate Action 100+ Benchmark using tools like SBTi and TPI to verify alignment with climate goals. Investors should also request a vote on these transition plans where possible.

14. **Prepare escalation strategies for unresponsive companies.** Set out escalation strategies (e.g. joint investor statement, shareholder resolution, vote on directors) for companies that do not respond to engagement and for those accentuating transition risks by constructing new fossil fuel generation.

15. **Provide fresh equity and debt capital explicitly to accelerate the construction of the infrastructure required.** Additional transmission and distribution networks and low carbon generation infrastructure can be explicitly funded using dedicated transition financing mechanisms (see [14] and [15]).

16. **Scale up clean energy investments in developing countries.** Engage with Multilateral Development Banks (MDBs) and Development Finance Institutions (DFIs) to develop appropriate investment vehicles and to deploy capital to suitable clean energy projects in developing countries.

EXHIBIT 1: PROPOSED ADDITIONAL ACTIONS POWER COMPANIES SHOULD TAKE TO DELIVER NET ZERO

Climate Action 100+ Net-Zero Company Benchmark indicator and description		Proposed supplemental power company actions and disclosure	Rationale
1. Ambition	If the company has set an ambition to achieve net zero GHG emissions by 2050 (or sooner)	A net zero commitment should be comprehensive covering all energy related activities (generation plus any third-party electricity, heat and gas sales) across all divisions, regions and material emissions including Scope 3 (where applicable).	Power companies primarily generate electricity but are also providers of final energy. These broader activities create transition risk and should be decarbonised.
2-4. Targets	If clearly defined short-, medium- and long-term targets to reduce GHG are in place covering all material emission scopes and aligned to a goal of limiting global warming to 1.5°C	Set an emissions target for electricity generation to reach net zero by 2035 or sooner in advanced economies and 2040 (or sooner) in developing markets. Expect electricity generation activities to be emissions negative thereafter (i.e. from 2035 in advanced economies, 2040 elsewhere). The majority (i.e. >50%) of this decarbonisation should be achieved by 2030. With the exception of the short-term target, emissions targets should be set at three levels: i) For “all electricity generated” (typically Scope 1) ii) For all sold electricity (typically Scope 1 emissions plus emissions in Scope 3, category 3). Aside from electricity generated by the reporting company, this target also covers any electricity purchased from third parties (including PPAs) and subsequently resold to customers iii) For downstream emissions from sold or distributed energy (mainly gas), typically Scope 3, category 11. Targets can be set on absolute and/or intensity metrics but companies should indicate how an intensity target translates into absolute emissions and vice versa.	Consistent with 1.5°C pathways with limited or no overshoot, electricity generation must substantially decarbonise well before the rest of the energy sector. Companies should have some flexibility over the pace and timing of decarbonisation. Electricity generation targets can be benchmarked against 1.5°C scenarios. A methodology to benchmark other final energy sales against climate targets has yet to be developed but ultimately these activities will also have to substantially decarbonise. Companies should have flexibility to set targets on either absolute or intensity metrics but showing the impact of intensity on absolute emissions is important. Targets will be externally assessed by TPI and SBTi.
5. Decarbonisation strategy	If a decarbonisation strategy to meet its long-, medium- and short-term GHG reduction targets is in place and if it includes a commitment to ‘green revenues’	Actions a company intends to take to reach net zero and their expected contribution to medium-term and long-term targets should be disclosed. It may not be possible for a company to identify and quantify all actions it intends to take today but it should ensure that the total of all quantified actions accounts for >75% of the medium-term reduction and >50% of the long-term reduction. A company should primarily focus on cutting gross emissions. CCUS is accepted but the contribution should be minimal and disclosed. Offsets do not ‘count’ as emissions reductions for many power sector benchmarks like SBTi and should not be used. Unabated coal should be phased out by 2030 (OECD), 2031 (EE and FSU), 2032 (LATAM) 2034 (MENA) and 2037 Non-OECD AP). The expected contribution of low carbon generation (in TWh) to those targets and generation mix should be disclosed. Any use of PPAs should be specified and “green” fuels should be consistent with the appropriate regional taxonomy.	A credible decarbonisation plan should set out the strategy a company intends to adopt to reach net zero. Electric utilities have a range of options and should be as free as possible to set the most cost-efficient pathway. However, there are certain constraints set by 1.5oC pathways with limited or no overshoot. Reduction in (gross) emissions should be the primary focus and hence the use of CCUS should be minimised. Companies can choose not to invest in renewables and return cash to shareholders (a “wind down” strategy).
6. Capital Allocation Alignment	If a company is working to decarbonise its future capital expenditures and discloses the methodology used to determine the Paris alignment of its future capital expenditures	A company should disclose its forward-looking capex budgets (minimum five years). A company should not invest in new coal generation. A company should not invest in any new natural gas generation that, either for economic or technical reasons, is not capable of being net zero by 2040 (2035 in advanced economies). A company should commit to deploying CCUS to abate emissions from any residual fossil fuel generation still running beyond 2040 (2035 for advanced economies). A company should disclose its 5-year budget for direct investment in renewable capacity. A company with energy distribution infrastructure should set out a 5-year budget and how they intend to upgrade their networks.	An alignment of capex plans with 1.5°C requires companies not to invest in any new fossil fuel generation that cannot achieve net zero by 2040 (2035 in advanced economies). Where fossil fuel generation is expected to run beyond 2040 (2035 in advanced economies) it should be abated. Therefore, the company should set out its plans for investment in CCUS and (ultimately) negative emissions technologies including BECCS.
7. Climate Policy Engagement	If a clear commitment and set of disclosures, clarifying intent to support climate policy, has been developed by the company, together with a demonstration of how direct and indirect lobbying is consistent with this intent	Publish a board level report identifying policy and regulation issues that are impacting the ability to accelerate the transition to net zero and set out proposals on how they could most effectively be removed. Ensure broader policy and lobbying is consistent with these proposals.	Policy or regulation can pose substantial barriers to delivering net zero. Identifying the major issues and setting out proposals on how they could be solved will potentially enable investors to support those positions.
8. Climate Governance	If the company’s board has clear oversight of climate change sufficient capabilities/ competencies to assess and manage the risks, If climate targets are included in the executive remuneration scheme	The link between executive remuneration and climate targets should be prominently disclosed with who it applies to, share of the pay linked to the target and the impact of under/over performance explicitly stated. Companies should eliminate any and/or all components in annual and/or long-term executive compensation plans that incentivise links between fossil fuel power generation capacity growth.	To increase the chances of success, short- and medium-term compensation incentives should be clearly aligned to the strategic objective of transitioning to net zero.
9. Just Transition	If it considers the impacts from transitioning to a lower-carbon business model on its workers and communities	Publish a board level report setting out how the company will address workforce and community needs in the implementation of the company’s transition to net zero. The report should cover energy prices, job losses, job creation, wages, benefits, training and community concerns about energy prices and access to renewable power and the loss of tax and other community revenues.	A detailed just transition policy is needed to ensure the decarbonisation strategy can be delivered and the benefits and costs are shared equitably.
10. TCFD Disclosure	If it has committed to implement the recommendations of the Taskforce on Climate-related Financial Disclosures (TCFD) and employs climate-scenario planning to test its strategic and operational resilience.	Companies should provide emissions, electricity and energy disclosure on a consistent footprint and Scope 3 disclosure where applicable (see Section 5). Companies should disclose the impact of a net zero scenario (through flexing carbon price, fuel and renewable costs and asset lives assumptions amongst other points) on their financial statements (P&L, balance sheet and cashflow).	Improving disclosure will enable investors to understand, track and compare strategies Applying the IEA’s NZE scenario assumptions will enable investors to asset the risk of stranded assets on financials amongst other risks.

SECTION 1: AIMS AND CONTEXT

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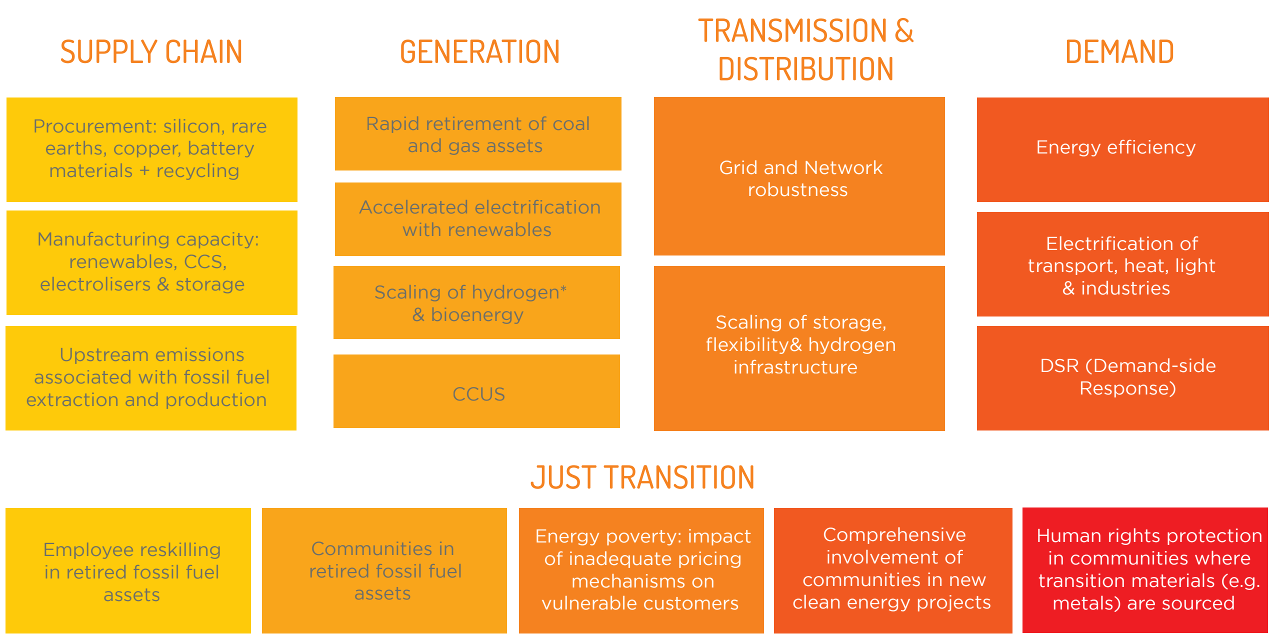
The IPCC's special report on global warming of 1.5°C [9] states that if the rise in global temperature is to be limited to 1.5°C, global emissions must fall by around 45% from 2010 levels by 2030 and to net zero by 2050. According to the UN [16] over 110 countries have now made some form of pledge to reach net zero greenhouse gas emissions by 2050, with the EU recently joining the UK and seven other countries in enshrining this into law. China has pledged to reach carbon neutrality by 2060. Countries representing more than 65% of global emissions and 70% of GDP have currently made net zero commitments.

Given the policy momentum towards net zero, investors in publicly listed companies are increasingly seeking to either minimise their exposure to climate transition risk, align their portfolios to 1.5°C, or reduce company emissions via engagement and stewardship. One investor collaboration focusing on the world's largest emitters is Climate Action 100+, an initiative backed by over 615 investors responsible for a total of $60 trillion in assets under management. This report aims to inform the engagement activities of signatories to Climate Action 100+ (and investors more broadly) by establishing a baseline understanding of what companies in the power sector should do to transition to net zero and how that transition can be both encouraged and tracked.

Electricity is central to any plan to reach net zero. It is a large source of emissions today and decarbonisation is needed, not just to address these emissions, but support the transition of other sectors to net zero. It is also central to economic activity and daily life. The need for a secure supply of low-cost electricity is a strategic imperative for most national governments, a fundamental tool for the economic development of emerging and developing economies [17], and an essential part of most consumers' lifestyles. Actions to decarbonise power, which will include replacing dispatchable fossil fuel generation with variable renewable sources, can therefore have widespread implications.

This report focuses mainly on the potential to reduce the carbon intensity of electricity generation mix, given power companies have the greatest scope to directly influence this. However, it is important to look at decarbonisation of the power sector as part of a system. Reducing demand or enhanced energy efficiency – measures outside the direct control of power companies – can also be highly cost-effective ways to reduce emissions. Actions to decarbonise power generation also have implications for the value chain (see Exhibit 2) and the Just Transition of workers and communities. This report discusses some of these issues in more detail on the section barriers to accelerating power sector decarbonisation, and particularly in barriers g) and h).

Exhibit 2: Actions to decarbonise power have implications for many parts of the electricity value chain



* Not all forms of hydrogen and bioenergy are low carbon. Regional taxonomies are seeking to establish definitions of sustainable low carbon fuels that have minimal impact on other environmental and social metrics

There are some notable limitations to the scope of this report. This report focuses on publicly listed power companies (both regulated electric utilities and independent companies). These do not represent the whole sector and not all of the conclusions reached here may apply to private or government held companies. Nevertheless investors championing solutions with publicly listed utilities should help to establish pathways and accelerate broader momentum to net zero for the entire power sector.

Regulatory and technical challenges are often market specific and vary widely between countries. This report tries to identify and focus on the main barriers to decarbonisation drawing on evidence from the major markets but recognises the challenges faced by individual companies may be unique.

Data availability is heavily skewed to the US and Europe. TPI's analysis of the 70 largest listed electricity utilities by free float equity market capitalisation ($1.3 trillion) captured just c.20% of global generation; 54 (79%) of these companies were based in the US or Europe with only modest coverage of important Asian Pacific markets. There are over 130 additional publicly listed power companies globally and, while most are relatively small, some are very large but, either due to a high level of debt or large majority shareholder, have only a modest equity free float and are therefore not captured by TPI and other studies.

In addition, the analysis in the report largely focuses on electricity generation. Many publicly listed electric utilities also sell other forms of energy including natural gas, heat and electricity supplied by third parties. These activities often burn fossil fuels at some point in the value chain and therefore carry transition risk. This report proposes that these activities should also be assessed, just as the SBTi does today [6] and TPI does for third party energy in oil and gas [18]. However it is not currently possible to directly benchmark these activities using the sectoral decarbonisation approach [19]. This and other methodological issues are discussed in more detail in Section 5: The disclosure and methodological challenges to assessing progress.

SECTION 2: WHAT NET ZERO MEANS FOR THE POWER SECTOR: CHALLENGES AND OPPORTUNITIES

SECTION 2: WHAT NET ZERO MEANS FOR THE POWER SECTOR: CHALLENGES AND OPPORTUNITIES

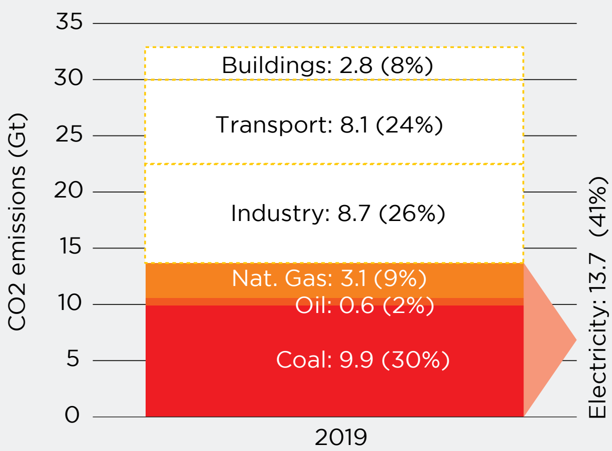
a) What net zero looks like in the power sector?

The electricity sector must play a leading role if the world is to achieve net zero. Emissions released by burning fossil fuels to generate electricity accounted for 13.7 $GtCO_2$ in 2019, 41% of total global energy emissions (Exhibit 3).

The IEA's net zero (NZE scenario) analysis [4], which is consistent with around a 50% chance of restricting the average temperature increase to 1.5°C with limited or no overshoot, suggests that emissions from electricity generation should be essentially decarbonised globally by 2040 and by 2035 in advanced economies. The majority of this decarbonisation (58% from a 2019 base year, a -8% CAGR) needs to take place by 2030 (Exhibit 4). These conclusions are broadly consistent with the interquartile range of IPCC scenarios with limited or no overshoot which suggest electricity generation emissions must fall between c.55-80% from 2019 levels by 2030.

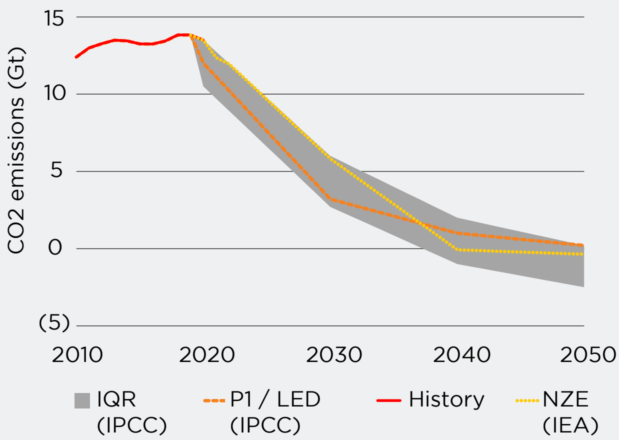
However, the IPCC scenarios also include those that rely on a substantial deployment of Carbon Dioxide Removal (CDR) technologies. Analysis by the SBTi concludes that, given the scope for CDR to scale remains highly uncertain, these do not represent responsible decarbonisation pathways for the sector. It sees the "MESSAGE-GLOBIOM", Low Energy Demand pathway (P1/LED in the IPCC Special Report on 1.5°C, see Exhibit 4), which requires emissions to fall c. 77% by 2030 (a -12% CAGR), as the minimum decarbonisation pathway needed for the sector.

Exhibit 3: Emissions from electricity generation by fuel and vs total energy emissions by sector [20]*



Source: * Based on global CO2 emissions in 2019 from IEA's WEO outlook ([20], pg 345) with emissions per sector allocated according to Figure 4.4 (pg 128). Largely as a result of COVID-19, electricity sector emissions fell to 13.5 GtCO2 in 2020.

Exhibit 4: 1.5°C pathways for emissions from electricity generation SBTi [6], [20]**



Source: ** P1/LED (Low Energy Demand) scenario is a pathway where a combination of reduced demand and rapid decarbonisation of energy supply avoids the use of CCUS (afforestation is the only CDR option considered). SBTi considers this the minimum level of ambition for the sector. IQR = Interquartile Range.

A key feature of the pathways the IEA and SBTi consider consistent with net zero for electricity generation is that emissions are net negative after 2040. Reaching negative emissions implies the use of Carbon Dioxide Removal (CDR) also referred to as Negative Emissions Technologies (NETs). There are two broad categories of NETs: technology based (including BECCS – Bioenergy Carbon Capture and Storage, and DACCS – Direct Air Carbon Capture and Storage) and nature based (including afforestation or reforestation). The overall number of NETs required in the power sector is relatively modest. The IEA's NZE implies -0.1 $GtCO_2$ in 2040 and -0.4 $GtCO_2$ in 2050 and currently the SBTi does not specify that power companies aligning to net zero set negative emissions targets (see [6] pg. 8). TPI is likely to adopt the IEA's NZE scenario as a basis for assessing net zero targets from electricity generation.

Many companies in the power sector do more than just generate electricity, they also sell electricity from third parties, heat and natural gas. These "final energy" activities will also need to reach net zero by 2050 but, as noted previously, it is not currently possible to directly benchmark them using the sectoral decarbonisation approach [19].

b) The challenge: transforming the global generation mix in the next 10 years

Decarbonising at the scale and pace required by these pathways represents a huge challenge. In the IEA's NZE scenario, global low carbon generation grows fivefold from 10 m GWh in 2019 (40% of the total electricity generation) to 54 m GWh in 2040 (96% of the total, see Exhibit 5). The challenge is particularly acute over the next decade. Renewable generation is expected to treble by 2030 (from 7 m GWh in 2019 to 24 m GWh), largely driven by solar and wind but with modest increases in hydro and bioenergy (see [4] and Exhibit 6) and with more nuclear power also required. The deployment of additional hydro, bioenergy and nuclear generation in particular are all potentially controversial due to wider environmental or social impacts. Nevertheless these technologies are considered by this report as potentially compatible with net zero.

While investment in low carbon generation ramps up, fossil fuel-based electricity generation must fall from 17 m GWh to 10 m GWh by 2030, largely driven by coal, while CCUS abated generation must rise to 0.5 m GWh from near zero today.

Exhibit 5: Change in the global electricity generation mix required to deliver net zero in the IEA's NZE [4]

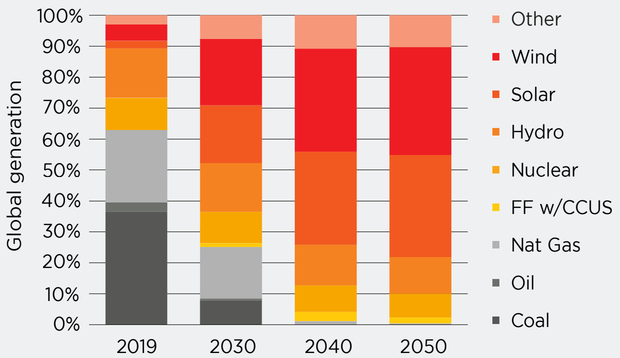
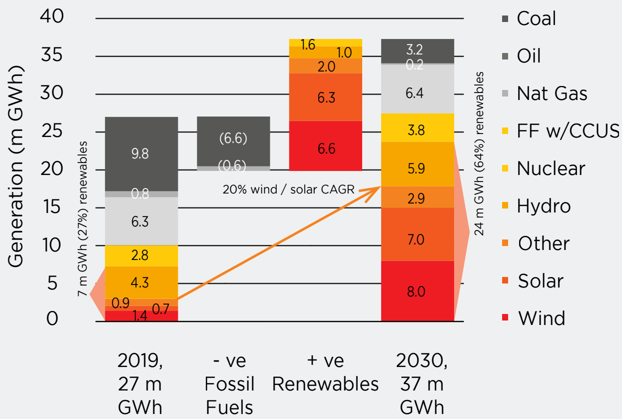


Exhibit 6: Changes in global generation needed by 2030 in the IEA's NZE [4]



The high emission intensity of coal generation (1.01 tCO_2/MWh vs 0.50 tCO_2/MWh for natural gas [20]), makes its rapid reduction crucial. The IEA NZE models total thermal coal generation falling 67% from 2019 levels by 2030 (from 9.8 m GWh to 3.2 m GWh), at the low end of the reductions required by IPCC scenarios with limited to no overshoot (the reductions in these scenarios range from 66% and 81% ([9] pg. 14)). The IEA NZE models all unabated coal generation being completely phased out by 2040.

This analysis is broadly consistent with that of Climate Analytics [13] which derived the median phase out date by region from IPCC scenarios. Based on the assumption that CCUS is unlikely to become a cost-effective retrofit solution in the next decade, it estimates coal fuelled generation must be phased out by 2031 for OECD countries, Eastern Europe and Former Soviet Union, 2032 for Latin America, 2034 for Middle East and Africa and 2037 for Non-OECD Asia (includes China and India). These phase-out dates are derived from least-cost optimisations based on socioeconomic pathways. The Powering Past Coal Alliance (PPCA), a coalition of over 100 members including 34 national governments, is seeking commitments to phase out coal in all OECD countries by 2030 [12].

The pathway for phasing out of natural gas generation is different. Consistent with the median value in the IPCC's 1.5°C scenarios (with limited to no overshoot), the IEA NZE models broadly flat global natural gas generation relative to 2019 levels (6.4 m GWh) in 2030. However, beyond 2030 a rapid decline is required. According to the IEA scenario, global electricity generation from gas falls 79% between 2030 and 2040. By 2040, just 1.3 m GWh of electricity is generated by natural gas, 0.7 m GWh of which is abated using CCUS. This sharp reduction in electricity generated by natural gas, combined with the deployment of CCUS, enables electricity to be essentially decarbonised at a global level by 2040.

However, the IEA's NZE scenario also states that, consistent with the principal of differentiated responsibilities established in the Paris Agreement [21], advanced economies should decarbonise their power sectors by 2035. Therefore phasing out of unabated natural gas-based generation will need to start sooner in these countries and be substantively complete by 2035.

Given average asset lifetimes, the IEA's analysis implies that any investment in new natural gas capacity today should therefore anticipate not only the likely significant fall in demand over the project lifetime, but the cost of adding CCUS, or being converted to run on low carbon alternatives (biogas/green hydrogen) by 2035 in advanced economies. Several power companies interviewed for this report stated their belief that only with substantial financial incentives would these natural gas-CCUS plants become economic.

c) The opportunity: new sources of demand will stimulate growth in wind and solar

In most advanced economies demand for electricity is currently flatlining or falling. However, the accelerated decarbonisation of the whole economy required in a net zero scenario is set to reaccelerate growth in these markets and sustain the steady growth already seen in developing economies (Exhibit 7). Decarbonised electricity will be needed to charge electric vehicles, feed ground/air source heat pumps and make the green hydrogen needed to address multiple other "hard-to-decarbonise" sectors. IPCC 1.5°C scenarios with limited or no overshoot suggest electricity demand will more than double by 2050 [9]. The IEA's NZE implies 166% demand growth from a 2019 basis by 2050, implying a CAGR of 3.3% (up from 2.3% between 2011-2020). Of the incremental 44 m GWh of new electricity demand in the IEA model, 33% is expected to come from hydrogen, 25% from transport and 6% from heat (see Exhibit 8). The grid must decarbonise as soon as possible if the electrification of these sectors is to reduce CO_2 emissions. Wind and solar generation is expected to demonstrate a 11% CAGR between 2019-50 to meet this demand and a 20% CAGR over the next decade.

The precise mix and timing of the incremental demand for electricity created by transport, heating and hydrogen is likely to vary substantially by country and is still uncertain. Modelling of three 1.5°C scenarios in the UK by the National Grid [22] highlights this. Forecast growth in electricity demand between 2019 and 2050 varies from 54% to 125%, primarily due to the range of assumptions applied to green hydrogen (25-88% of 2019 demand by 2050) but residential heat is also a significant driver of additional demand (7-21% of 2019 demand by 2050).

Exhibit 7: Growth in Electricity demand by region and decade in IEA NZE scenario (2010–2050) [4]

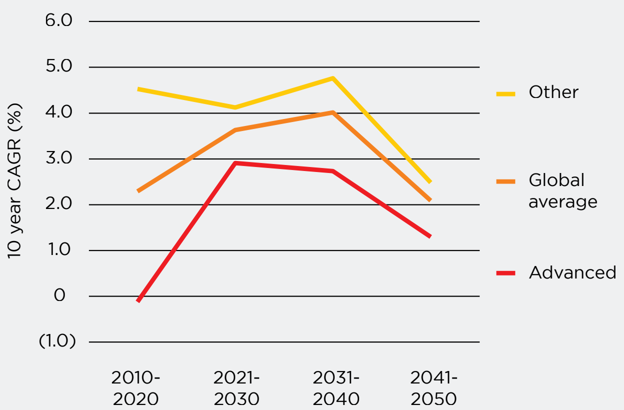
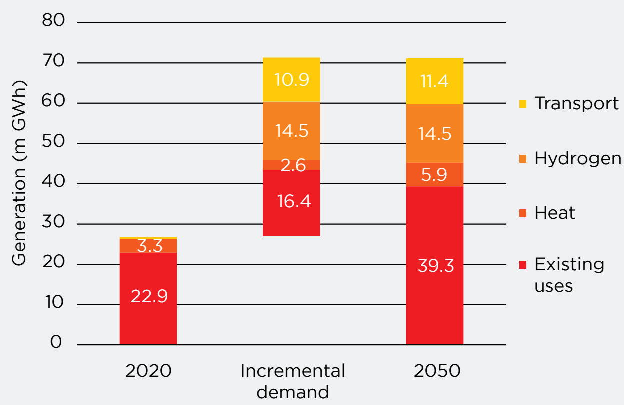


Exhibit 8: Sources of incremental electricity demand in IEA NZE scenario (2020–2050) [4]



SECTION 3:
THE CURRENT STATUS OF POWER SECTOR DECARBONISATION

SECTION 3: THE CURRENT STATUS OF POWER SECTOR DECARBONISATION

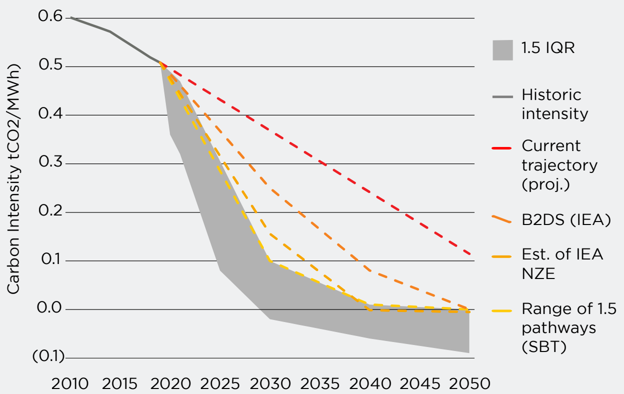
a) Emissions intensity in the power sector is falling

Of the major energy sectors shown in Exhibit 3, arguably power has made the most progress towards decarbonisation. The rising deployment of variable renewable generation (solar and wind) has seen global emission intensity fall 0.09 tCO2/MWh between 2010-19 (from 0.60 tCO2/MWh to 0.51 tCO2/MWh, Exhibit 9). This deployment has been fuelled by a combination of policy support and dramatic reductions in technology costs. As Exhibit 10 highlights, renewables are now cheaper than new fossil fuel generation in many regions on a LCOE basis [23]. In some markets, particularly those with carbon taxes, renewables are already cheaper than the marginal cost of existing fossil fuel generation [3] [24] [23]. Carbon Tracker estimates that the running costs of 77% of existing fossil fuel generation are higher than building new renewable capacity today and this rises to almost 100% by 2026 [25]. Analysis of existing global coal capacity suggests that 39% is currently uncompetitive relative to renewables combined with storage [15].

b) However pronounced regional variations in intensity remain ...

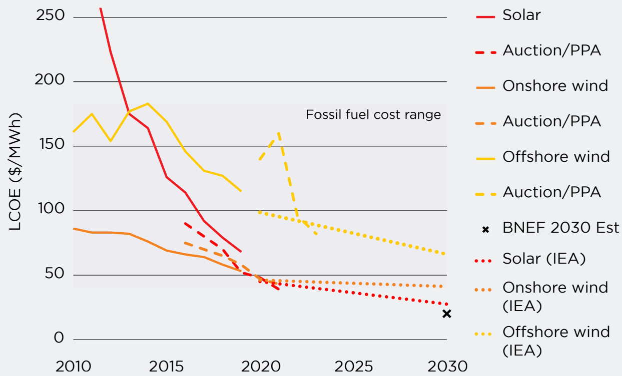
However progress has varied between regions. Exhibit 11 highlights that, while almost all regions have seen emission intensity fall, a wide variation in intensity remains. Largely as a result of the fossil fuel capacity added in recent decades, emission intensities in the Asia Pacific region (specifically China, India and Other Asia Pacific – referred to as "Other AP" in Exhibit 11) are above the global average. As a result of pivoting its energy policy towards coal after the Fukushima nuclear disaster, Japan is the only developed economy to see emission intensity rise. In total, Asia Pacific accounts for 60% of power sector emissions, 75% of thermal coal consumption but just 47% of generation [20]. In Europe, policy support (carbon taxes and renewable subsidies) has helped renewable penetration rise to 37% of generation and deliver emission intensity substantially below the global average (0.30 tCO_2e/MWh vs 0.51 tCO_2e/MWh). In North America, cheap (fracked) natural gas has displaced coal, lowering emission intensity to 0.36 tCO_2e/MWh but renewable penetration (23%) remains behind that of Europe.

Exhibit 9: The emission intensity of the global electricity sector in a 1.5°C scenario*



Source: *Based on SBTI's analysis of pathways consistent with 1.5ºC with limited or no overshoot [6]. The range of (20) scenarios with limited or no overshoot that do not require substantial CDR deployment is shown in grey. B2DS (IEA) = IEA's "Beyond 2 Degrees Scenario". This report has estimated the intensity implied by the IEA's NZE ([20] see pgs 132-4).

Exhibit 10: Solar and wind are now lowest cost generation technology on a LCOE basis**



Source: **Based on global deployments in 2019 according to IRENA [23], LCOE assumptions from the IEA's NZE scenario [4] and BNEF NEO [26].

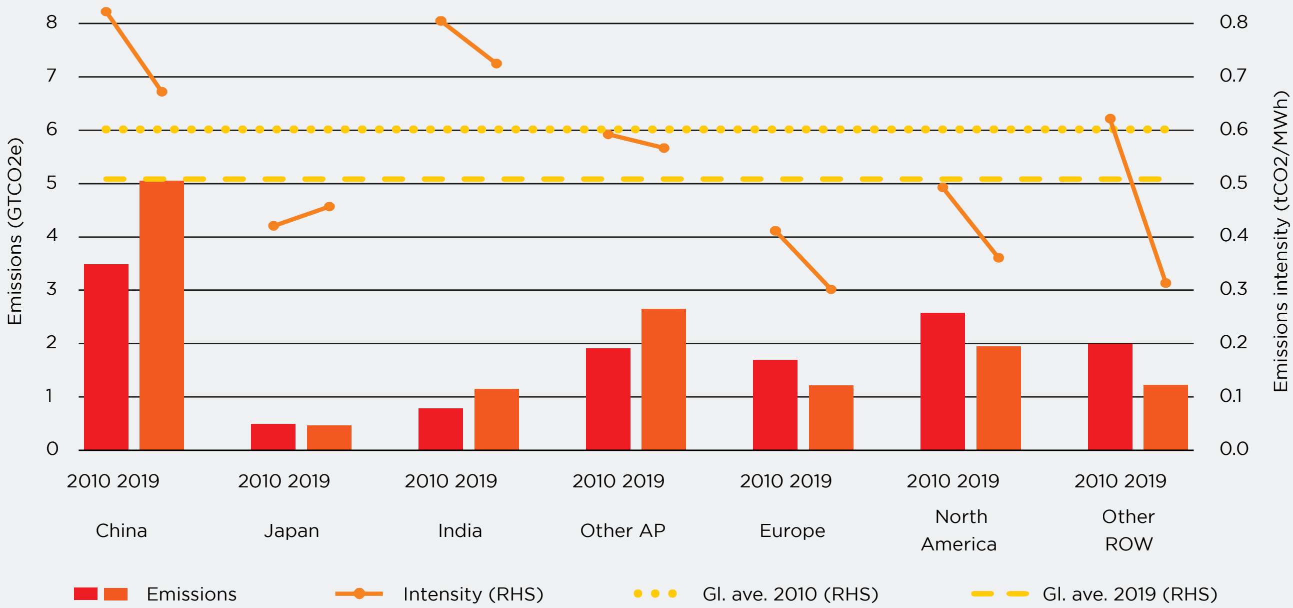
c) … and absolute emissions are not falling

More significantly, falling emissions intensity has yet to be matched by falls in absolute emissions. Between 2010 and 2019 consumption of electricity in the Asia Pacific region increased by 4,500 TWh (82% of the global increase in demand over that period), led by China and India (61% and 11% respectively of the global increase in demand (See Exhibit 11). The additional natural gas and particularly coal capacity added to meet this growth resulted in emissions in this region rising by 2.3 $GtCO_2$ between 2010 and 2019, offsetting declines in the rest of the world. Excluding the Asia Pacific region, emissions in the rest of the world fell by 1.5 $GtCO_2$ (22%) between 2010 and 2019 (a -2.7% CAGR).

d) Decarbonisation at the company level

The pace of decarbonisation can also be assessed at a company level. TPI's report on the global energy sector analysed the carbon intensity of 68 of the largest publicly listed electricity utilities by market capitalisation. Together these firms accounted for $1.3 trillion of market capitalisation, c.20% of global generation and 18% of sector emissions [7]. Of the 59 that provided sufficient data to be assessed, the unweighted average intensity of the electricity generated was 0.48 tCO_2e/MWh, broadly consistent with the global average (Exhibit 12). Their unweighted average rate of decline across the years was 0.02 tCO_2e/MWh per annum. In the US, a study of emissions from the 100 largest electricity utilities (accounting for 77% of total US generation) categorised companies by ownership. Publicly listed US electric utilities had an emission intensity of generation similar to the overall market and both publicly listed and government owned utilities showed similar levels of falling emission intensity (c. 0.015 tCO_2e/MWh per annum) [27].

Exhibit 11: Changes in absolute emissions and intensity in the power sector by region (2010–2019)*



Note: (RHS) corresponds to "Right Hand Side".
Source: Based on data in the IEA's World Energy Outlook 2020 [20]

Of the 68 power companies assessed by TPI, 42 (62% of the total) have set long-term targets to reduce emissions associated with generation*, with 22 (32%) targeting zero emissions by 2050. However as the analysis of the IEA NZE and IPCC scenarios in Section 2 shows, reaching net zero emissions in 2050 is insufficient to align with the emissions budget associated with 1.5°C in the power sector. Emissions from generation need to reach net zero by 2040 globally (and by 2035 for advanced economies) and be emissions negative thereafter. The majority of decarbonisation needs to be achieved by 2030. Of the 68 companies assessed, only Ørsted, with its target to reach zero by 2025, currently has a net zero plan that looks to be compatible with the IEA's NZE scenario. Four companies (6%) – CMS, Cons Edison, E.On and RWE – had targets to reach net zero emissions on electricity generation by 2040.

Benchmarking by WBA confirms the overall poor alignment of the power sector with climate targets [28]. It found only four out of the 50 companies it assessed had emissions reduction targets aligned to the well-below 2-degrees Paris Agreement goal; nearly half (23) had not set any targets beyond 2022. The Climate Action 100+ Benchmark is likely to evaluate company commitments using TPI's sectoral decarbonisation pathway based on the IEA's NZE data as and when it becomes available.

Overall, the analysed company data by TPI is heavily weighted to North America and Europe (accounting for 31 and 15 of the 59 companies the TPI assessed respectively), due to its focus on publicly listed companies. Like the country data, it shows significant regional variation. Looking at final intensity (the emissions intensity implied by the target or, where a target has not been set, the last reported figure) shows that 9 of the 15 assessed companies in Europe (60%) are targeting net zero emissions. In North America 13 of the 31 assessed companies (42%) are targeting net zero emissions. With the exception of Japan's Jera which owns the combined thermal assets of TEPCO and Chubu and recently set a 2050 net zero target, no company outside these regions is targeting net zero (Exhibit 13).

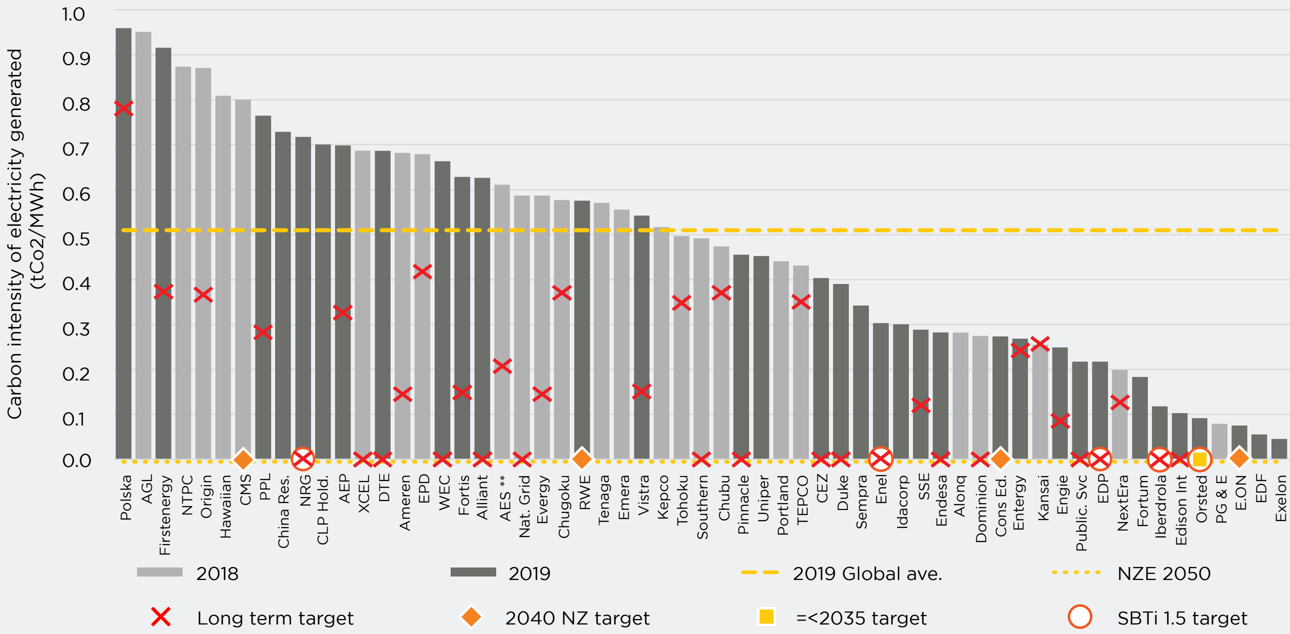
Of the twelve companies with targets aligned with 1.5°C scenarios according to SBTi, eight are in Europe (Agder, EDP (Portugal), Enel, Iberdrola, Ørsted, Siemens Gamesa, Scottish Hydro Electric and Verbund), one in Latin America (EDP - Brazil) two in Asia Pacific (Genesis – New Zealand and Digital Grid Corporation – Japan) and NRG in the US [29].

While not captured by either TPI or SBTi analysis currently, there are recent, encouraging signs that the pace of decarbonisation of China's state-owned utilities is set to accelerate. In 2021, its top five state-owned utilities (CHN Energy, Huaneng, Huadian, Datang and SPIC – accounting for 878GW of generation capacity or 9% of the global total) announced major renewables expansion plans. These plans are designed to lift renewable generation share up to at least 50% by 2025 and bring forward their carbon peaks to the middle of this decade (ahead of China's stated 2030 nationwide intention).

There is also evidence that public power companies transitioning to low carbon are seeing better financial performance and therefore are being rewarded by higher valuations. An analysis of 53 power companies in the US and Europe by BCG, which compared the proportion of profits from renewables against a "Total Shareholder Return" metric, highlighted that those that had invested early in renewable generation had outperformed their peers on a five-year view [10].

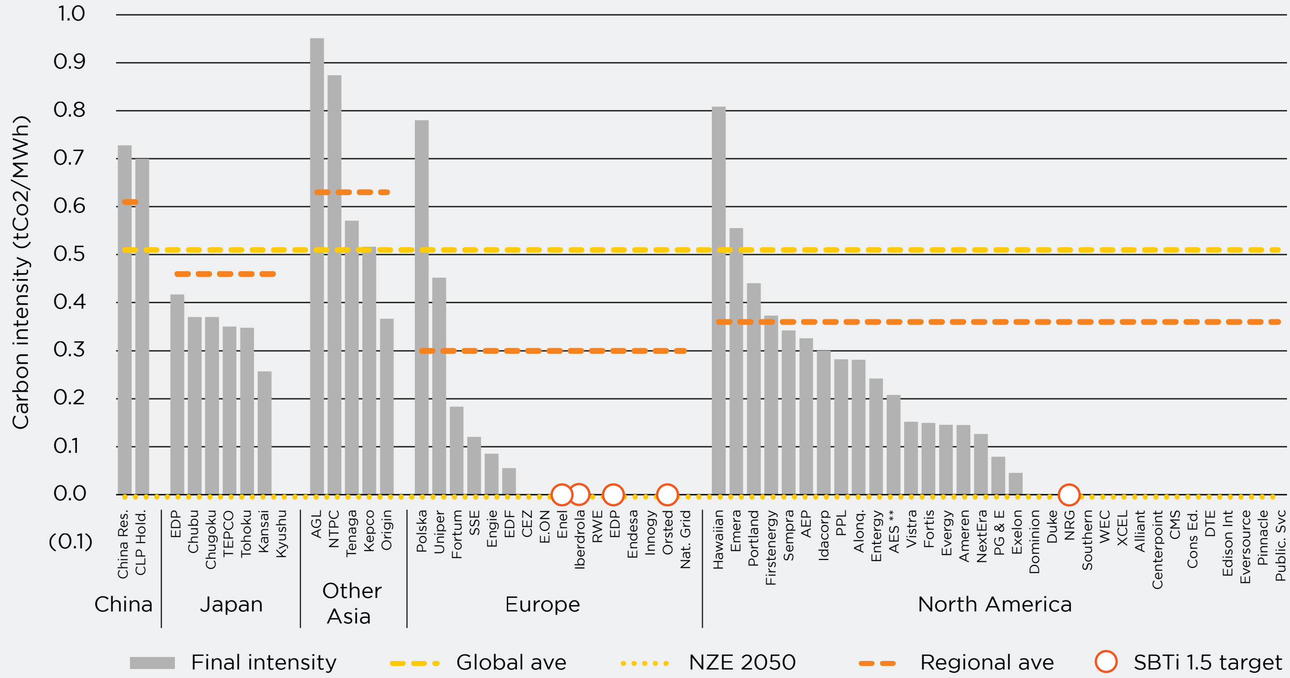
Despite the cost advantage of renewables and evidence of the benefits of transitioning to low carbon on financial performance, 26 companies (38% of companies assessed by TPI) have yet to set emissions targets. Furthermore, most of the companies that have set targets have not explained how they intend to deliver on those goals. A survey of 50 electric utilities by WBA highlighted that the sector was not prepared for the rapid transition required by net zero and that there were clear discrepancies between climate rhetoric and actions [28]. Analysis of the 50 utilities in the US most invested in fossil fuel generation (accounting for 50% of the total fossil fuel generation in the US) found an "enormous gap" between their current practices and the actions they need to take to transition even amongst companies that had set emission targets [30]. The next section reviews the potential barriers that may be preventing these companies decarbonising.

Exhibit 12: Historic and target carbon intensity of publicly listed electricity utilities compared to global average intensity and B2DS scenario based on the TPI*



Source: Based on TPI's analysis of the carbon intensity of the electricity generated (i.e. Scope 1 generation emissions/electricity generated) by the 68 largest electric utilities by freefloat adjusted market capitalisation [7]. Fifty-nine companies are shown here, as those that have either not updated disclosure since 2017 or are otherwise not assessable are excluded. The TPI's calculation of generation intensity implied by IEA's NZE scenario in 2050 is shown for reference. Enel, EDP, Iberdrola, NRG and Ørsted have set targets compatible with 1.5°C according to the SBTi ** This analysis is based on information that is now nearly a year out of date. It will be updated when the TPI releases its latest assessment of the energy sector in H2 2021. AES recently announced a commitment to achieve net zero carbon emissions from electricity sales by 2040 and Japan's Jera (parent company of TEPCO and Chubu) also set a 2050 net zero target however both these targets have yet to be assessed by TPI or validated by SBTi.

Exhibit 13: Final emissions intensity* of publicly listed electricity utilities by region based on the TPI



Source: Based on the same 59 assessed companies shown in Exhibit 12. Final emissions intensity is the intensity implied by the target in the target year or, where a target has not been set, the last historic figure that TPI was able to calculate. ** This analysis is based on information that is now nearly a year out of date. It will be updated when the TPI releases its latest assessment of the energy sector in H2 2021. AES recently announced a commitment to achieve net zero carbon emissions from electricity sales by 2040 and Japan's Jera (parent company of TEPCO and Chubu) also set a 2050 net zero target however both these targets have yet to be assessed by TPI or validated by SBTi.

CASE STUDY: AMERICAN ELECTRIC POWER (AEP)

AEP: The journey of an historically carbon-intensive utility accelerating its decarbonisation ambition

1. **About the company:** American Electric Power Company Inc. (AEP) is a US-listed utility holding company with assets in multiple states. AEP's core businesses include electricity generation, transmission and distribution, with ownership of seven regulated utilities. AEP's other subsidiaries operate in competitive markets, including electricity and gas retailing, wholesale power services and renewable energy development.

2. **Plans for a robust, fast and just transition.** In March 2021, AEP published a climate impact analysis report that includes:

- Disclosure provided on the TCFD framework that covers governance, strategy, risk management, metrics and targets.
- Transition planning and scenario analysis. The company evaluated "Business as Usual" and "Fast Transition" scenarios that reflected uncertainty in modelling input assumptions, including on carbon pricing. However, the AEP did not clearly indicate how those scenarios align with 1.5°C or 2°C thresholds.
- An analysis of the transition risks and opportunities AEP faces.
- A review of decarbonisation technologies.
- A review of how AEP is reflecting "Just Transition" considerations in its operations and strategy.

3. **The decarbonisation journey to date:** AEP is part-way through transitioning from a historical position of very emission-intensive and coal-dependent generation. On an absolute basis, carbon emissions in 2020 were already nearly 74% lower than in 2000. These reductions have been achieved in part by a large decline in generation volumes. On an intensity basis, AEP's generation remains carbon intensive at 0.58 metric tonnes of CO_2 per net MWh compared to the sector mean of 0.43 estimated by TPI analysis.

4. **Setting targets and the need to align the ambition with science-based targets:** AEP's latest targets, announced in February 2021, are Scope 1 emission reductions of 80% by 2030 (from a 2000 base) and net-zero emissions by 2050. While assumptions must be made about projecting volumes, the current absolute 80% by 2030 target implies an intensity for AEP that is likely to be above that of 1.5°C or 2°C intensity benchmarks, despite the company claiming the target is "2°C aligned" in its CDP report. Furthermore, AEP's current net zero goal by 2050 is not yet consistent with the 2035 timeline for advanced economies set by the IEA in its NZE scenario.

"The scenario analysis highlights opportunities for AEP as we transition to a clean energy economy. Tens of billions of dollars in capital investments will be needed for new, clean energy infrastructure. This represents a significant opportunity to reduce carbon emissions, provide stable energy costs, and grow corporate earnings while also helping to insulate customers from variable costs associated with fossil fuels."

5. **The decarbonisation opportunity:** AEP's August 2021 investor presentation elaborates on its scenario analysis describing a total regulated renewables opportunity of 16.6 GW by 2030 across its utility subsidiaries. Further work will be required to include these "projected resource additions" into specific integrated resource plans. AEP's inclusion of carbon pricing in integrated resource plans and executive compensation being partly tied to carbon-free capacity growth will help in formalising these development ambitions.

Sources: AEP's Climate Impact Analysis, AEP EEI ESG/ Sustainability Report, AEP CDP Climate Change Report 2021, AEP Investor Meetings August 2021

SECTION 4: BARRIERS TO ACCELERATING POWER SECTOR DECARBONISATION

SECTION 4: BARRIERS TO ACCELERATING POWER SECTOR DECARBONISATION

A significant acceleration in the pace of decarbonisation is needed in the power sector if the increase in global temperatures is to be restricted to 1.5°C. Absolute emissions are falling in most regions (Europe, North America and the rest of the world) but the pace of the decline needs to accelerate and progress must rapidly spread to the Asia Pacific region and particularly China.

This section focuses on the key (i.e. not all) barriers preventing power companies accelerating their decarbonisation plans. These challenges are not applicable to all companies or strategies, nor are they unsolvable: the fact that four companies have already set net zero targets by 2040 and one by 2025 highlight that they can be overcome. Nevertheless plans to accelerate power sector decarbonisation likely need to acknowledge and address many of these issues.

a) National policy priorities: balancing climate ambitions against energy security and cost

The wide variation in power sector decarbonisation between countries primarily reflects differing policy environments. Electricity supply is a strategic issue for all governments; they must balance the desire to decarbonise against both security of supply and cost considerations. Even where markets have been liberalised, there often remains tight governmental control of prices and supply via regulation or partial state ownership. In developed markets, decommissioning fossil fuel generation before it has reached the end of its useful life often has controversial cost and social implications which governments are keen to avoid (see Barrier h) and will often require regulatory approval. Similarly, replacing this decommissioned fossil fuel generation with renewables has cost and social implications and requires regulatory approval. In some developing markets, governments have opted to prioritise adding generation that uses (historically cheaper) fossil fuels, particularly where these fuels can be sourced domestically, to meet growing demand even at the expense of increased GHG emissions and air pollution.

Europe, and to a lesser extent other markets, have used various policies including subsidies, tax credits and a price on carbon to encourage renewables. But even in Europe policy varies widely between countries, reflecting the different balance of competing interest groups (e.g. existing power companies, domestic natural resources providers, consumers and society). As a result, power sector decarbonisation has been uneven [31]: Poland and Germany still rely on coal for 74% and 28% of their electricity generation respectively. The absence of a broadly supportive policy and regulatory environment makes it difficult for power companies to accelerate the move to net zero.

However globally the policy environment looks to be steadily improving. As a result of better technology and falling costs, countries no longer have to choose between low carbon and low cost electricity when considering new capacity. Concerns about the effects of climate change are also increasing. In January 2021 US President Biden signed an executive order pledging to build a "carbon pollution-free electricity sector by 2035" (the US accounts for 7% of coal consumption). In the last year China, Japan, and South Korea (countries accounting for 49%, 3% and 2% of thermal coal demand respectively) pledged to reach net zero at a national level. The Philippines, Thailand and Indonesia, (c.3% of global thermal coal in total) have also made moves to cut coal consumption [2]. However, these long-term pledges often contradict stated short and mid-term plans. As of June 2021, China, India, Indonesia, Japan and Vietnam still had plans to build more than 600 new coal plants with a combined capacity of over 300GW [32].

Translating these enhanced pledges into action will not be straightforward and many countries are still trying to establish a policy environment favourable to decarbonisation. Nevertheless, the direction of travel in policy seems clear and, whilst obviously making decarbonisation harder, an adverse or uncertain policy environment today should not justify inaction. The growth opportunities and economic advantages of renewable generation are clear and evidenced from a study by BCG [10] which suggests that companies that have anticipated policy shifts to encourage decarbonisation have created the most shareholder value. As such, power companies should anticipate those policies and set their long-term strategies accordingly as regulation increasingly converges with climate science.

b) The variability of renewable solar and wind generation

Much of the proposed decarbonisation of the power sector is expected to be delivered by the massive expansion of solar and wind generation, sources which are inherently variable or intermittent. This increased variability makes consistently balancing demand and supply, at all times of day and throughout the year, much more challenging. Supply shortfalls, particularly if accompanied by demand surges during periods of bad weather for example, can be especially problematic [33], particularly as power plays an ever greater role in the economy. Unlike fossil fuel-based generators, wind and solar cannot be relied upon to provide additional "firm" or "dispatchable" power in these circumstances. The need to provide additional spare capacity as variable renewable penetration rises may push up system costs. However, a core objective of power companies and policymakers is to ensure security of supply at minimal cost.

There are a range of potential solutions to this challenge. Improvements in forecasting coupled with larger offshore wind turbines is making the contribution of renewables easier to predict in general. Overbuilding renewables or diversifying low carbon generation to include additional (firmer) sources such as bioenergy and hydrogen and adding nuclear baseload can help. Residual gas generators, fitted with CCUS, could provide additional generating capacity in an emergency.

Different forms of "flexibility" can also help manage variability. Battery storage, either on the grid, behind the meter (BTM) or via distributed vehicle to grid (V2G) solutions, can manage short-term fluctuations in demand and supply. Mediums such as hydrogen (or hydrogen-based fuels) may help address seasonal imbalances [34]. Demand side response (DSR) mechanisms can help reduce peak demand while ultrahigh-voltage (UHV) interconnectors may help to balance areas of excess demand and areas of excess supply over long distances [35]. China is the global leader in UHV interconnectors with 18 UHV transmission lines with an overall length of 27,570 km [36] and total capacity of 260 GW (roughly five times more UHV transmission capacity than Europe (44GW) and over 80 times more than the US (3GW)) [37].

Given security of supply and cost considerations, power companies and policymakers' reluctance to move quickly is arguably understandable. However rapid change is required to reach net zero and given a wide range of potential solutions, increased variability does not pose an insurmountable challenge [38]. Optimal solutions are likely to vary by location, require combinations of actions and a coordinated system level approach [39]. Some will also require policy and regulation changes, further infrastructure investment and additional technology development.

c) Funding the required increase in capital investment

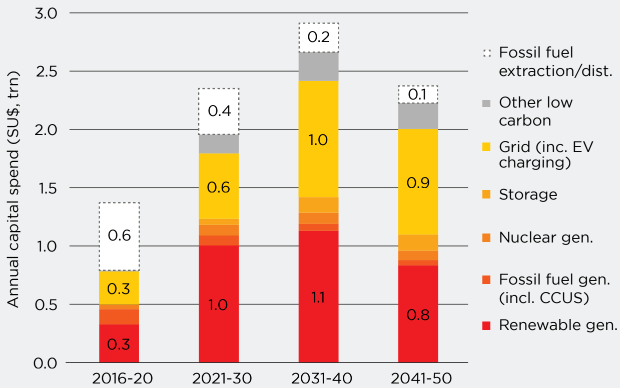
Accelerating the deployment of renewable generation (and thus displacing fossil fuels) requires the current rate of investment to significantly increase. The IEA NZE estimates that to deliver the expansion shown in Exhibit 5, annual installation of solar and wind must average 422 GW and 236 GW respectively every year for the decade from 2021 to 2030. Both figures represent c.4x the average rate of deployment in 2016-20 [4]. While China, Vietnam and India substantially raised renewable deployment in 2020, there is little evidence of the required acceleration elsewhere. The IEA NZE believes this increased rate of deployment requires the average annual investment in renewable generation to more than triple from $0.3 trillion in 2016-20 to average of $1.0 trillion in 2030 (Exhibit 11, [4]). To put this into perspective, the annual investments in renewable electricity generation represent 30% more than the investment level achieved in the best year of oil and gas upstream investment ($0.8 trillion in 2014). The IEA NZE models a fall of 40% and 48% in solar and offshore wind LCOE respectively.

Capital is also needed to adapt and strengthen the existing electricity grid. A growing population, distributed (variable) generation and the additional demand from EVs, heating and hydrogen will require better interconnection and more capacity. The IEA estimates that the current rate of global spending on networks including storage ($0.3 Tr per year between 2016-20) needs to increase to $0.6 Tr (between 2021-2030) in a net zero scenario.

To support the transition to net zero, the IEA believes that the total average annual investment in power infrastructure (new renewable generation plus accompanying battery storage and network capacity) must more than double to nearly $2 trillion between 2021-2030 and grow to $2.5 trillion between (2031-40) ([4], Exhibit 14); this implies a significant increase in energy investment as a proportion of GDP (from 1.1% in 2020 to 1.6% by 2030). In this scenario the impact of this rise on total energy investment is partially offset by reductions in oil and gas investment and this investment may reduce spending on fuel in the long term, resulting in savings for customers and better trade balances for countries that are currently net importers of fossil fuels.

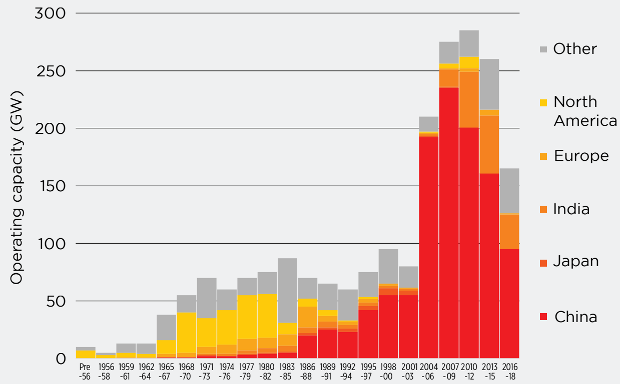
Nevertheless, how these upfront investments are going to be funded is a key issue. Traditional power and distribution companies appear to be struggling to ramp up spending: over the decade 2010-20 global generation investment was flat while network investment declined [40]. Governments, keen to stimulate economic growth post COVID-19, have pledged to increase their investment but generally only play a peripheral role in advanced economies (state backed enterprises accounted for just 10% of total energy investment). Oil and gas companies have spent less than 1% of their capex budgets outside fossil fuel projects thus far [42]. Dedicated energy infrastructure funds are growing rapidly but cuts in the long-term power price assumptions underpinning the valuations of generation assets have raised concerns about returns in some markets [43]. Dedicated transition financing mechanisms such as transition or green bonds are evolving to explicitly fund this infrastructure (see [14] and [15]).

Exhibit 14: Average annual capex required by the power sector vs total energy sector*



Source: *Based on analysis from the IEA [20] [40]. Effectively average annual capex spending on the power sector needs to rise to more than the current combined spending on power and oil and gas.

Exhibit 15: Coal capacity additions by region (pre-1956 to 2018)**



Source: **Much of the current coal capacity was added relatively recently [41].

d) Displacing "locked-in" fossil-fuel generation

Displacing generation from "locked-in" or existing fossil fuel assets is also likely to be a big challenge. A large amount of coal capacity was added in the last 20 years (Exhibit 15). Assuming a standard 40-year lifespan, most of these assets are not due for retirement until after 2040. In cases where renewables can freely compete, the zero marginal cost of wind and solar can typically undercut existing fossil fuel-based generation, resulting in lower utilisation and falling emissions. As utilisation falls, many of these plants become heavily loss-making; this trend will accelerate as renewable costs decrease further. However, in some cases the marginal cash costs of running fossil fuel generation are still lower than renewable LCOE (the cost of adding renewable capacity). Effectively the presence of "locked-in" fossil fuel assets delays the pace of adding low carbon generation [3]. Benchmarking analysis by WBA [28] found that as a result of emissions already 'locked-in', 70% of their 50 companies assessed will exceed their well-below 2-degree carbon budgets between 2019 and 2033.

In addition, generation from fossil fuel plants is often sold on long-term contracts. The power prices set in these contracts, often established many years ago, can be substantially above the current "market" rate but customers cannot exit them without paying compensation. Unwinding these contracts is often a complex process and voluntarily shutting down fossil fuel-based assets which, due to the guaranteed income stream, have a positive net present value, is often against a company's direct interests. An estimated 93% of global coal plants are insulated from competition to some degree from renewables by these long-term contracts and non-competitive tariffs [15]. Some companies, despite recognising the overall need to decarbonise, have opted to fight state imposed closure plans through legal action [44].

Instead of legally imposed closure plans, the RMI [15] proposes two incentive-based mechanisms to accelerate early coal phase out. First, a debt relief mechanism through reverse auction to acquire outstanding debt on coal plants in exchange for closure. Second, a carbon financing mechanism to build renewables capacity through a carbon bonus in which public financiers would offer payments to power utilities for each tonne of verifiable, permanent, and additional emissions abated.

Public-private initiatives to accelerate the closure of coal-fired power plants have also been announced. The Asia Development Bank and other major financial institutions [45] are working on an Asia-focused initiative to partner, acquire and run coal-fired power plants. They believe that their lower cost of capital will enable them to generate similar returns over a shorter period and therefore accelerate their closure. These schemes are however potentially controversial as they can create an incentive for operators to delay shutting down their plants.

Other compensation mechanisms for the early closure of fossil fuel generation are based on switching the contracts to renewable generation. However many of these contracts also specify the provision of "firm" (dispatchable) power or back up capacity, often mandated by regulators and which renewables are less well suited to provide in general. Provision of these ancillary services, particularly back-up capacity, has been used to justify investment in additional natural gas generation. As discussed in barrier b), in the long-term storage or hydrogen may be part of the answer. However, in many situations fossil fuel currently provides these services more cheaply [3].

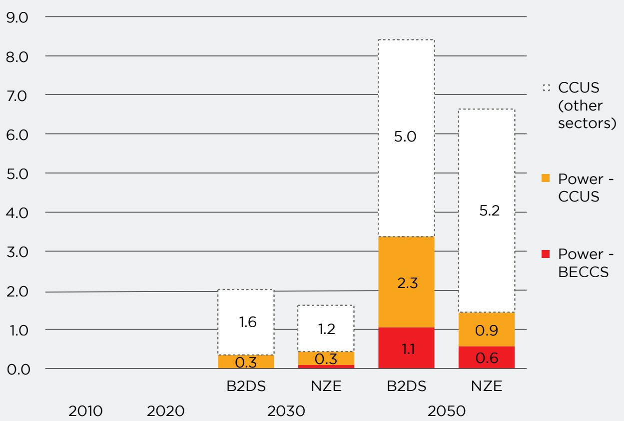
e) The challenges of applying CCS/CCUS in the power sector

Where fossil fuel-based generation remains, either due to its low cost or the need for dispatchable power, emissions will need to be captured by retrofitting CCS/CCUS (Carbon Capture, (Utilisation) and Storage) to reach net zero [46]. The risk of not deploying CCS/CCUS at the appropriate rate is these power plants will need to close earlier, raising the risk of stranded assets. According to a Low CCS/CCUS Case (LCC) modelled by the IEA in its NZE report [4], low CCS/CCUS deployment for existing coal- and gas-fired generation raises the risk of stranded assets to up to USD $90 billion in 2030 and up to USD $400 billion by 2050.

However, CCS/CCUS technology and economics have not made much progress over the last decade ([9] pg. 326). The costs of capturing CO_2 in the power sector are particularly high, ranging from \$60-160/tCO_2 according to the Global CCS Institute [47], with the variation largely driven by CO_2 concentration (coal is generally cheaper per tonne of CO_2) and capture technology (transport and storage costs are important but generally smaller items). Lack of local storage means CCS/CCUS is not a viable solution in all locations and the capture process itself consumes significant amounts of energy (estimated to be 5-16% of generation [48]). As a result, CCS/CCUS can increase LCOE by 45-70% [49]. Not running fossil fuel generation continuously, which would be expected as the penetration of variable renewables rise, further reduces the justification for the investment in CCS/CCUS. Some sites have faced technical challenges [50]. Enel, a European electric utility, recently announced that it did not expect CCS/CCUS to become cost effective and was planning to phase out gas completely to get to its net zero target: *"We already tried CCS in the past and it didn't lead to success. So why do it again?"* [51].

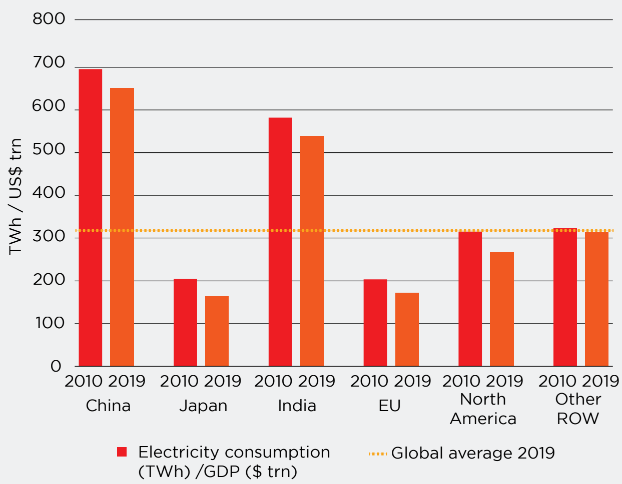
As a result of the limited recent progress of CCS/CCUS in the power sector, the IEA's NZE scenario assumes substantially less emissions captured by CCS/CCUS in power than its previous Below 2 Degrees Scenario (B2DS) (0.9 GtCO_2e annually in 2050 vs 2.3 GtCO_2e, see [4] and [52]). This lower forecast still implies more than a 100-fold increase in power sector emissions captured by CCS/CCUS over the next decade (a 60% CAGR), a substantial acceleration in the current rate of deployment. Significant cost reductions or improvements in technology are needed to deliver this acceleration. Heavy reliance on CCS/CCUS in the power sector is however a risky corporate strategy that threatens the ability of society to decarbonise.

Exhibit 16: CCUS and BECCS need to scale up rapidly and are not on track*



Source: *Based on data from the IEA's NZE [4] and 2017 ETP [52]. Delivery of the total CCUS (power plus other sectors) requires a c.45% CAGR between 2019 and 2030 and a 7% CAGR between 2030 and 2050.

Exhibit 17: Electricity consumption per \$ of GDP is falling but varies significantly by economy**



Source: **Based on World Bank and IEA data

f) How can the power sector deliver negative emissions?

The IEA NZE report is clear that emissions from electricity generation should be (modestly) net negative beyond 2040. However, the prospects for both the technology-based and nature-based NETs needed to deliver negative emissions are unclear at this point. BECCS and DACCS technologies are currently expensive and energy intensive ([53], [54]) and the contributions of nature based approaches lead to uncertain emission reductions and create broader environmental challenges at scale [9]. The financial mechanism to fund the deployment of these technologies or the legal mechanism to enforce it are not yet established and, more fundamentally, some power companies have questioned their obligation to deliver negative emissions.

The use of NETs in the power sector is also constrained by the limited land and water resources needed for nature based solutions. Diverting substantial land and water resources from growing food potentially creates both ethical issues and broader environmental issues ([55], [9]). A consistent feature of 1.5°C pathways modelled by the IPCC is the near full decarbonisation of electricity generation due to availability of already commercial and cost effective clean generation technologies. This implies no reliance on nature based solutions to offset emissions [4] [55]. The use of nature based solutions to offset emissions from other energy sales relevant to the power sector such as natural gas and heat is not as clear.

Given the restriction on the use of offsets and that emissions from electricity generation are expected to be negative beyond 2040, BECCS is expected to play a role in the decarbonisation of the power sector. Burning a feedstock containing carbon drawn from the atmosphere to produce electricity, then capturing and permanently storing the emitted CO_2, effectively removes it from the atmosphere. Like CCS/CCUS, the IEA's recent NZE BECCS assumptions are less ambitious than its previous B2DS scenario. It now assumes just 0.6 $GtCO_2$ by 2050 (see Exhibit 16) and the contribution over the next decade (less than 0.1 $GtCO_2$) is small. Nevertheless, scaling up is likely to be challenging. In addition to the issues posed by high CCS/CCUS costs and the sustainability of feedstock production already mentioned, there are questions about the competitiveness of bioenergy (particularly given falling wind and solar costs).

g) Demand reduction requires coordinated interventions from a range of actors

Across many sectors, reducing demand is often considered to be one of the most (if not the most) cost effective ways to decarbonise. In the power sector, which should benefit from increased demand for electricity as other sectors decarbonise, an absolute reduction in overall demand is unlikely. Nevertheless, efforts to stem the growth in demand, such as shifting behaviour or increasing energy efficiency, can still be effective – accelerating the pace of decarbonisation and decreasing the total investment required. In general, electrical energy consumption is falling per unit of GDP (see Exhibit 17) but the wide variation in electricity consumption intensity between countries with similar (mature) economies highlights the potential for the US in particular to reduce consumption further.

The IEA NZE scenario highlights the primary importance of energy efficiency in delivering net zero [4], modelling a near trebling in the current annual rate of energy productivity improvements in the decade between 2020-30 across the economy. While no specific data is provided on its impact in the power sector, its scenario assumes: *"Minimum energy performance standards and replacement schemes for low-efficiency appliances are introduced or strengthened in the 2020s in all countries. By the mid-2030s, nearly all household appliances sold worldwide are as efficient as the most efficient models available today."*

Some power companies are required by regulation to encourage efficiency while DSR payments can help reduce the need for often emission-intensive peak generation [56]. Nevertheless, the required step change in energy efficiency assumed by the IEA NZE here requires swift action at a global scale. It requires coordinated interventions from a range of players outside the power industry including regulations tightening energy efficiency across a wide range of consumer goods, technological progress from manufacturers and widespread acceptance and adoption amongst end users. In some cases, it may be necessary to change regulations to help customers save energy and enable improving energy efficiency to be properly valued [57].

h) Just Transition: a rapid shift to net zero must be "equitable"

Due to the central role the power sector plays in the economy and the need for it to decarbonise further and faster than others, it is front and centre of the shift to net zero. The scale and speed of change required means its transition is likely to have widespread impacts on employees, local communities, customers and the value chain. Unless these wider social impacts can be managed, with the impact on vulnerable groups mitigated and any benefits seen to be fairly distributed, these groups may seek to oppose the transition, and as a result it might not be possible to deliver the required pace of decarbonisation [58].

The concept of "Just Transition" aims to embed these wider social impact considerations into transition plans to ensure climate action is as equitable and inclusive as possible. It is included in the Paris Agreement [59], ILO [60] and several investor initiatives ([61], [62], [63]) including the Climate Action 100+ Benchmark [1]. Several European and US utilities have included Just Transition into their climate plans and published statements including American Electric Power, EDF, Enel, E.ON, SSE and ZE PAK. A summary of SSE's Just Transition strategy which sets out in detail the principles guiding its approach are highlighted in the case study below [64].

Just Transition issues in the power sector can result from the impact on employees and communities of exiting fossil fuel generation (so called "transitioning out of" issues). Managing this impact through providing good visibility on timing, transparency in decision making and budgets for retraining or compensation and lost community revenues are important.

"Transitioning into" issues can also be significant. Renewable energy deployment can deliver economic benefits but could also risk losing its social license to operate if communities and other stakeholders are not consulted. Displacement of well-paid jobs, environmental impacts and electricity price increases are some of the legitimate concerns that could lead to project delays and reputational or legal risks for companies. Best practices for accelerating the transition sustainably and equitably include engaging worker representatives and other stakeholders in workforce; considering community and environmental concerns throughout the development process; adopting responsible contracting policies; and providing local benefits and access to clean affordable energy for communities, especially where they have been historically marginalised [65].

While it may be challenging for power companies to fully reconcile the conflicting interests of multiple stakeholders in the transition to net zero, many already have experience in balancing the needs of their workers, investors, consumers and communities. Company management and Boards should disclose their assessment of Just Transition Risks and oversight to ensure they are able to deliver the pace of decarbonisation needed, which will require active management of the broader social impacts of the transition and a commitment to extensive and meaningful stakeholder engagement.

CASE STUDY: SSE

SSE: A comprehensive just transition plan put into practice

1. **About the company:** SSE plc is a UK-listed energy company that operates throughout the UK and Ireland. It is involved principally in the generation, transmission and distribution of electricity and in the supply of energy and related services to customers.
2. **The rationale for a just transition plan:** Partly as a result of shareholder engagement*, SSE is actively seeking to understand the way in which future injustices may arise while adapting to possible new challenges for its business, workforce and other stakeholders. This will help to pre-empt and mitigate against them with policy and practical actions like partnerships with key stakeholders and advocacy. Ultimately, the prize of a fair and just transition to net zero is that the actions and investments required to decarbonise energy systems attract long-term public support and legitimacy.

"Along with key stakeholders, including investors and shareholders, SSE recognises the energy system transition is at risk of creating injustice and, as a result, is at risk of losing public support for the actions and investments required to deliver a net-zero electricity system"

3. **Planning for a just transition.** In November 2020 SSE published a fully-fledged strategy report setting out its support for a socially just energy transition. The document is structured around the concept that the climate transition is composed of two processes 1) exiting from high-carbon emissions activities (transitioning out of) and 2) entering new or reformed activities with low or no emissions (transitioning into). The report sets out the company aims to:

- Provide an early analysis of the impact SSE might have on key stakeholder groups, specifically, employees, consumers and communities.
- Define the principles underpinning the choices it will make as a basis for ongoing engagement.
- Summarise the actions it has already taken to date to deliver a just transition.
- Establish the basis on which it will report on the progress it makes.

4. **Set of principles:** SSE lays out its just transition strategy through 20 principles structured in five main pillars that are separated into the "transition into" and "transition of out" categories:

Transitioning into a net zero world

1. **Good green jobs – Principles:** Guarantee fair and decent work, attract talent, inclusivity and diversity, and communication with employees.
2. **Consumer fairness – Principles:** Tackle fuel poverty, involve stakeholders in decision making, advocate publicly for fairness and make transparent, evidence-based decisions.
3. **Building new assets – Principles:** Support domestic supply chains, share value with communities (e.g. community benefit funds, co-ownership structures of assets with local communities), set social safeguards and implement responsible developer standards.

Transitioning out of a high-carbon world

4. **People in high-carbon jobs – Principles:** Repurpose thermal generators, honest communication with employees, provide forward notice of change and prioritise retraining and redeployment.
5. **Supporting communities during the transition – Principles:** Provide robust stakeholder consultation, form cross-sector enabling industrial clusters, respect and record cultural heritage and promote industrial development.

* In the summer of 2020, Royal London Asset Management and Friends' Provident Foundation engaged with SSE in advance of the publication of its Just Transition Strategy report. SSE Sustainability report, 2021, page 36.

Source: SSE Just transition strategy

"PRINCIPLES INTO PRACTICE"

In each of the five pillars of principles, the company provides specific and often quantified examples in which their just transition principles were successfully applied. The example below falls into the fourth pillar "People in high-carbon jobs" and outlines the process to decommission SSE's last coal-fired plant.

The transition out of coal generation

SSE closed its last coal-fired power station, Fiddler's Ferry, in Warrington UK, at the end of March 2020. While it is well understood that there is no role beyond 2025 for generating electricity from unabated coal, Fiddler's Ferry power station has represented a hugely important industrial contribution to the local community for over 50 years.

During this process, SSE's priority was to bring operations to a close carefully and sensitively, and to ensure that the legacy site is decommissioned in such a way that future economic development can occur and environmental improvements can be made. To achieve that, SSE established a specialist task force to work closely with the local Councils to ensure that key stakeholders were engaged in the process.

As a result of Fiddler's Ferry power station closure, 39 employees transitioned to work on the station's decommissioning programme, five were redeployed to other roles within SSE, one retired and 95 redundancies were completed following collective consultation with employees and unions. Several training courses were delivered ahead of station closure, which included support for redeployment in alternative roles in new sectors.

SECTION 5:
THE DISCLOSURE AND METHODOLOGICAL CHALLENGES TO ASSESSING PROGRESS

SECTION 5: THE DISCLOSURE AND METHODOLOGICAL CHALLENGES TO ASSESSING PROGRESS

The way power companies currently express their climate ambitions and the metrics they choose to disclose to investors often varies. Some variation is understandable as it reflects different business mixes and strategic priorities. However, this can make it difficult for investors to accurately compare their existing carbon footprint and evaluate their ambitions. Consistent disclosure that captures both the specific actions the power sector needs to take to align to net zero (see Exhibit 1) and allows progress to be clearly tracked and compared against stated ambitions, is needed. Such a framework is also in the interests of companies seeking to communicate genuine net zero commitments.

The fundamental components of this framework are consistent measures of:

- Electricity generation (in TWh) and the corresponding emissions (typically Scope 1).
- Total energy sold externally, including a break out for sales of electricity generated by a third party, natural gas and heat (financial trading should be excluded but any adjustment disclosed). The corresponding emissions should also be disclosed.
- Other relevant value chain emissions from fossil fuels used to generate externally sold energy.

This disclosure is relatively straightforward and already provided in most cases. However, it can sometimes be stated on inconsistent or partial footprints. Sometimes Scope 1 emissions from generation are not broken out from total Scope 1 or are stated on a footprint that is inconsistent with electricity generation figures. Targets to reduce emissions from generation are also sometimes set on an inconsistent footprint or using amalgamated emissions boundaries (i.e. Scope 1 & 2).

In some cases, power companies are evolving ownership structures to move emissions outside the boundary of existing assessment methodologies. For example, by leasing or treating generating assets as "investments", Scope 1 emissions are effectively moved to Scope 3 (Category 13 or 15 of the GHG Protocol).

In addition to the disclosure challenges of assessing progress towards net zero there are also methodological challenges to assessing alignment. This report has largely focused on what companies generating electricity should do to align with net zero. However, while electricity generation is typically the main part of a power company's energy portfolio it is often not all of it; electricity companies may also sell natural gas, heat (via Combined Heat and Power or CHP) or electricity generated by a third party. All sales of fossil fuel-based energy products potentially create substantial and additional transition risks for a power company. CHP releases emissions directly (Scope 1), while reselling fossil fuel generated electricity or natural gas leads to Scope 3 emissions (category 3 and 10 respectively).

The decarbonisation of heat is a big and difficult problem to solve, particularly for countries in higher latitudes. The IEA estimated that emissions from heat in 2015 accounted for 12.5 $GtCO_2$ (39% of annual energy sector emissions, [66]). In a net zero scenario these activities must rapidly and substantially decarbonise, whilst reducing natural gas sales would have a further significant benefit in reducing methane emissions across the supply chain [67]. However, there are currently no established sector specific methodologies for benchmarking the decarbonisation of this energy. This report proposes that all energy related sales should be assessed but acknowledges it is only possible to directly benchmark electricity generation currently using the sectoral decarbonisation model [19]. Companies should set targets to decarbonise their whole energy portfolio (i.e. electricity, heat and third party-generated electricity) but also set targets explicitly relating to electricity generation.

Finally, the increasing use of PPAs to supply renewable electricity blurs the boundary of what activities should be considered as electricity generation. If a power company has signed a long-term contract (i.e. matching the asset life) to buy power from a solar farm, the guaranteed revenue from that contract has effectively enabled the project to be funded and built. Arguably power from this project should be included within the boundary of its generation activities but a clear set of disclosure parameters need to be established.

REFERENCES

[1] CA100+, "Climate Action 100+ Net-Zero Company Benchmark," December 2020. [Online]. Available: https://www.climateaction100.org/wp-content/uploads/2020/12/Net-Zero-Benchmark-Indicators-12.15.20.pdf. [Accessed 30 January 2021].

[2] AIGCC, "Investor Expectations of Asian Electric Utilities Companies: Crossover to net zero," 01 December 2020. [Online]. Available: https://www.aigcc.net/wp-content/uploads/2020/11/Asia-Utilities-IE-final.pdf. [Accessed 28 January 2021].

[3] Carbon Tracker Initiative, "Powering down coal," November 2018. [Online]. Available: https://carbontransfer.wpengine.com/wp-content/uploads/2018/12/CTI_Powering_Down_Coal_Report_Nov_2018_4-4.pdf. [Accessed 20 February 2021].

[4] International Energy Agency (IEA), "Net Zero by 2050," May 2021. [Online]. Available: https://www.iea.org/reports/net-zero-by-2050. [Accessed 10 June 2021].

[5] IIGCC, "Accelerating the transition to zero emissions in the power sector," 16 November 2020. [Online]. Available: https://www.iigcc.org/download/iigcc-background-paper-accelerating-power-sector-decarbonisation/?wpdmdl=4007&refresh=602a56bbe74b31613387451. [Accessed 28 January 2021].

[6] Science based targets (SBTi), "Setting 1.5oC aligned Science based targets: quick start guide for electric utilities," June 2020. [Online]. Available: https://sciencebasedtargets.org/resources/legacy/2020/06/SBTi-Power-Sector-15C-guide-FINAL.pdf. [Accessed 1 February 2021].

[7] Transition Pathway Initiative, "Management Quality and Carbon Performance of Energy Companies: September 2020 Update," October 2020. [Online]. Available: https://www.transitionpathwayinitiative.org/publications/61.pdf?type=Publication. [Accessed 1 February 2021].

[8] Tranistion Pathway Initiative (TPI), "Carbon Performance Assessment of Electricity Utilities: A note on methodology," October 2020. [Online]. Available: https://www.transitionpathwayinitiative.org/publications/64.pdf?type=Publication. [Accessed 28 January 2021].

[9] IPCC, "Global Warming of 1.5oC. An IPCC Special Report on the impacts of global warming of 1.5oC above pre-industrial levels and related global greeenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change," 2019.

[10] BCG, "Value Creation in Power and Utilities 2020: Accelerating Transformation for an Uncertain Future," 26 August 2020. [Online]. Available: https://www.bcg.com/publications/2020/creating-value-in-power-and-utilities-industry. [Accessed 4 April 2021].

[11] SBTi, "SBTi Criteria and Recommendations. TWG-INF-002 | Version 4.2," 2021.

[12] Powering Past Coal Alliance (PPCA), "Powering Past Coal Alliance (PPCA): Who we are," Powering Past Coal Alliance (PPCA, June 2021. [Online]. Available: https://www.poweringpastcoal.org/about/who-we-are. [Accessed 11 June 2021].

[13] Climate Analytics, "Global and regional coal phase-out requirements of the Paris Agreement: Insights from the IPCC Special Report on 1.5°C," September 2019. [Online]. Available: https://climateanalytics.org/media/report_coal_phase_out_2019.pdf. [Accessed 20 February 2021].

[14] International Capital Market Association (ICMA), "Climate Transition Finance Handbook: Guidance for Issuers," December 2020. [Online]. Available: https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/Climate-Transition-Finance-Handbook-December-2020-091220.pdf. [Accessed 20 February 2021].

[15] Rocky Mountain Institute (RMI), Sierra Club, Carbon Tracker (CTi), "How to Retire Early: making accelerated coal phaseout feasible and just," 2020. [Online]. Available: https://rmi.org/insight/how-to-retire-early. [Accessed 20 February 2021].

[16] United Nations (UN), "The race to zero emissions, and why the world depends on it," 2 December 2020. [Online]. Available: https://news.un.org/en/story/2020/12/1078612. [Accessed 1 February 2021].

[17] "World Bank, Access to Energy is at the Heart of Development," 2018. [Online]. Available: https://www.worldbank.org/en/news/feature/2018/04/18/access-energy-sustainable-development-goal-7.
[18] Transition Pathway Initiative (TPI), "Carbon Performance of European Integrated Oil and Gas Companies: Briefing Paper," May 2020.
[19] O. Krabbe, G. Linthorst, K. Blok, W. Crijn-Graus, D. P. van Vuuren, N. Hoehne, F. P. and N. C. P. A. Aden, "Aligning corporate greenhouse-gas emissions targets with climate goals," *Nature Climate Change*, vol. 5, pp. 1057-1060, 2015.
[20] International Energy Agency (IEA), "World Energy Outlook (WEO) 2020," Paris, 2020.
[21] UNFCCC (United Nations Framework Convention on Climate Change, "Paris Agreement," 2015. [Online]. Available: http://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf. [Accessed 30 June 2021].
[22] National Grid, "Future Energy Scenarios (FES)," July 2020. [Online]. Available: https://www.nationalgrideso.com/document/173821/download. [Accessed 01 February 2021].
[23] IRENA, "Renewable power generation costs in 2019," Abu Dhabi, 2020.
[24] Lazard, "Lazard's Levelised cost of energy analysis - version 14.0," 2020.
[25] CTI (Carbon Tracker), "Do Not Revive Coal: Planned Asia coal plants a danger to Paris," 30 June 2021. [Online]. Available: https://carbontracker.org/reports/do-not-revive-coal/. [Accessed 30 June 2021].
[26] BNEF, "New Energy Outlook 2020," 2020. [Online]. Available: https://about.bnef.com/new-energy-outlook/#toc-download. [Accessed 30 June 2021].
[27] MJ Bradley for Ceres, "Benchmarking Air Emissions of the 100 Largest Electric Power Producers in the US," [Online]. Available: https://www.ceres.org/resources/reports/benchmarking-air-emissions-100-largest-electric-power-producers-united-states-4. [Accessed 1 February 2021].
[28] World Benchmarking Alliance (WBA), "Electric Utilities: total ranking," [Online]. Available: https://www.worldbenchmarkingalliance.org/publication/electric-utilities/rankings/. [Accessed 28 February 2021].
[29] Science Based Targets (SBTi), "Companies taking action," 1 February 2021. [Online]. Available: https://sciencebasedtargets.org/companies-taking-action?target=1.5%C2%B0C&sector=Electric%20Utilities%20and%20Independent%20Power%20Producers%20and%20Energy%20Traders%20(including%20fossil%2C%20alternative%20and%20nuclear%20energy)#table. [Accessed 1 February 2021].
[30] Sierra Club, "The Dirty Truth About Climate Pledges," January 2021. [Online]. Available: https://www.sierraclub.org/sites/www.sierraclub.org/files/blog/Final%20Greenwashing%20Report%20%281.22.2021%29.pdf. [Accessed 20 February 2021].
[31] Bloomberg NEF, "Investing in the Recovery and Transition of Europe's Coal Regions: White Paper," 6 July 2020. [Online]. Available: https://poweringpastcoal.org/assets/docs/insights/BNEF-white-paper-EU-coal-transition-Final-6-July.pdf. [Accessed 20 February 2021].
[32] C. Tracker, "Do Not Revive Coal: Planned Asia coal plants a danger to Paris," 2021.
[33] Reuters, "Fact check: The causes for Texas' blackout go well beyond wind turbines," Reuters, 19 February 2021. [Online]. Available: https://www.reuters.com/article/uk-factcheck-texas-wind-turbines-explain-idUSKBN2AJ2EI. [Accessed 23 June 2021].
[34] O. J. Guerra, "Beyond short-duration energy storage," *Nature Energy,* vol. 6, pp. 460-461, 2021.
[35] P. L. Joskow, "Transmission Capacity Expansion Is Needed to Decarbonize the Electricity Sector Efficiently," *Joule*, vol. 4, no. 1, pp. 1-3, 2020.
[36] Reuters, "China launches its longest extra-high voltage power line -Xinhua," [Online]. Available: https://cn.reuters.com/article/china-power-transmission/china-launches-its-longest-extra-high-voltage-power-line-xinhua-idUKL4N244136.
[37] J. M. a. Q. Zhang, "Macro Grids in the Mainstream: An International Survey of Plans and Progress.," Americans for a clean energy grid, 2020.

[38] P. J. Heptonstall and R. J. K. Gross, "A systematic review of the costs and impacts of integrating variable renewables into power grids," *Nature Energy*, vol. 6, pp. 72-83, 2020.
[39] J. D. Jenkins, M. Luke and S. Thernstrom, "Getting to Zero Carbon Emissions in the Electric Power Sector," *Joule*, vol. 2, no. 12, pp. 2498-2510, 2018.
[40] International Energy Agency (IEA), "World energy investment 2020," Paris, 2020.
[41] e. a. Tong D., "Committed emissions from existing energy infrastructure jeopardize 1.5°C climate target," *Nature*, vol. 572, pp. 373-377, 2019.
[42] International Energy Agency (IEA), "The Oil and Gas Industry in Energy Transitions," 2020. [Online]. Available: https://iea.blob.core.windows.net/assets/4315f4ed-5cb2-4264-b0ee-2054fd34c118/The_Oil_and_Gas_Industry_in_Energy_Transitions.pdf. [Accessed 24 June 2021].
[43] G. Lumsden, "Renewable funds could plunge 40% on 'cannibalisation' threat, say JPM analysts," Investment trust insider, 27 January 2020. [Online]. Available: https://citywire.co.uk/investment-trust-insider/news/renewable-funds-could-plunge-40-on-cannibalisation-threat-say-jpm-analysts/a1317406. [Accessed 24 June 2021].
[44] K. Taylor, "Energy Charter Treaty strikes again as Uniper sues Netherlands over coal phase-out," 20 April 2021. [Online]. Available: https://www.euractiv.com/section/energy/news/energy-charter-treaty-strikes-again-as-uniper-sues-netherlands-over-coal-phase-out/. [Accessed 22 April 2021].
[45] Bloomberg, "BlackRock Joins Citi to Study Plan to Shut Coal Plants Early," [Online]. Available: https://www.bloomberg.com/news/articles/2021-08-03/blackrock-joins-citi-and-hsbc-in-plan-to-close-coal-plants-early.
[46] International Energy Agency (IEA), "Energy technology perspectives 2020," Paris, 2020.
[47] Global CCS Institute, "Is CCS expensive: decarbonisation costs in the net-zero context," May 2020.
[48] S. K. S. M. D. N. B. N. a. H. A. Budinis, "An assessment of CCS costs, barriers and potential," *Energy Strategy Reviews*, vol. 22, pp. 61-81, 2018.
[49] E. d. l. Cornot-Gandolpe, "Carbon capture, storage and utilisation to the rescue of coal?," Paris, 2019.
[50] Institute, Energy and Policy, "Petra Nova carbon capture project stalls with cheap oil," [Online]. Available: https://www.energyandpolicy.org/petra-nova/.
[51] Y. Rack, "Enel to phase out gas as part of 2050 net zero pledge, dismisses carbon capture options," Institute for Energy Economics and Financial Analysis, 1 February 2021. [Online]. Available: https://ieefa.org/enel-to-phase-out-gas-as-part-of-2050-net-zero-pledge-dismisses-carbon-capture-options/. [Accessed 20 February 2021].
[52] International Energy Association (IEA), "Energy Technology Perspectives," 2017.
[53] "Grantham Institute Briefing paper No 28: BECCS deployment: a reality check," January 2019. [Online]. Available: https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/BECCS-deployment---a-reality-check.pdf. [Accessed 24 June 2021].
[54] G. Realmonte, L. Drouet, A. Gambhir, J. Glynn, A. Hawkes and A. C. T. M. Köberle, "An inter-model assessment of the role of direct air capture in deep mitigation pathways," *Nature Communications*, vol. 10, 2019.
[55] Greenpeace UK, "Net expectations: Assessing the role of carbon dioxide removal in companies climate plans," January 2021. [Online]. Available: https://www.greenpeace.org.uk/wp-content/uploads/2021/01/Net-Expectations-Greenpeace-CDR-Briefing-updated2.pdf. [Accessed 29 January 2021].
[56] R. Gold and B. Howard, "Climate-Forward Efficiency Efforts for Utility Customers Advance in Three States," ACEEE (American Council for an Energy-Efficient Economy), 7 June 2021. [Online]. Available: https://www.aceee.org/blog-post/2021/06/climate-forward-efficiency-efforts-utility-customers-advance-three-states. [Accessed 30 June 2021].
[57] Green Finance Institute, "Coalition for the Energy Efficiency of Buildings: Towards a protocol for metered energy savings in UK buildings," 2021.

[58] N. Robins, V. Brunsting and D. Wood, "Climate change and the just transition: A guide for investor action," 2018. [Online]. Available: https://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2018/12/Climate-change-and-the-just-transition_Guide-for-investor-action.pdf. [Accessed 30 June 2021].

[59] OECD, "Just Transition: A Report for the OECD," May 2017. [Online]. Available: https://www.oecd.org/environment/cc/g20-climate/collapsecontents/Just-Transition-Centre-report-just-transition.pdf. [Accessed 30 June 2021].

[60] International Labour Organisation (ILO), "Guidelines for a justtransitiontowards environmentally sustainable economies andsocieties for al," 2015. [Online]. Available: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_432859.pdf. [Accessed 30 June 2021].

[61] UNPRI, "Statement of Investor Commitment to Support a Just Transition on Climate Change," 2019. [Online]. Available: https://www.unpri.org/download?ac=10382. [Accessed 30 June 2021].

[62] D. Wodds and V. Brunsting, "Investor Expectations on the Just Transition: Publicly Traded Energy," October 2020. [Online]. Available: https://iri.hks.harvard.edu/blog/new-iri-report-identifies-investor-expectations-publicly-traded-utilities-just-transition. [Accessed 30 June 2021].

[63] WBA (World Benchmarking Alliance), "Just transition," 3 February 2021. [Online]. Available: https://www.worldbenchmarkingalliance.org/research/assessing-a-just-transition-measuring-the-decarbonisation-and-energy-transformation-that-leaves-no-one-behind/. [Accessed 30 June 2021].

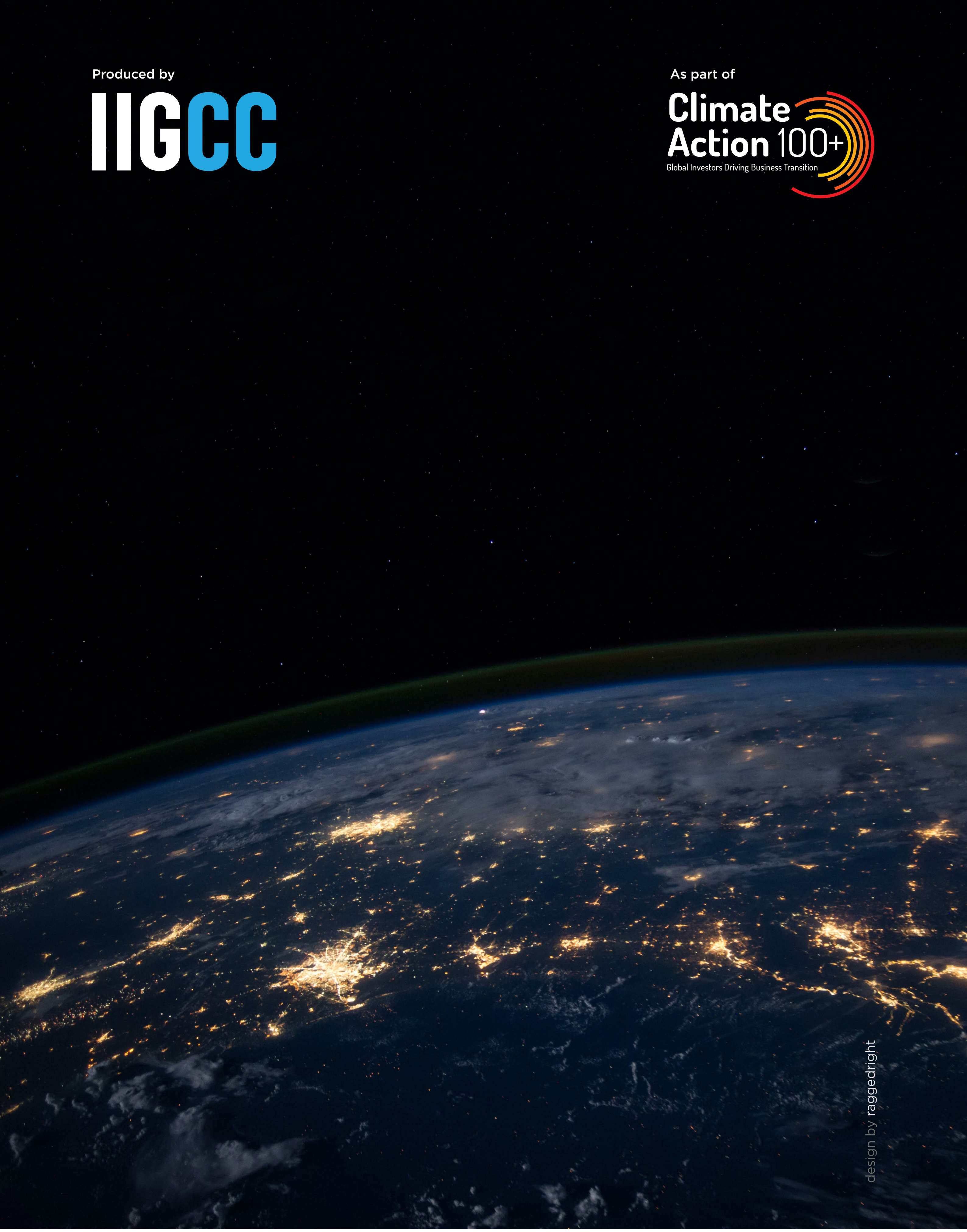
[64] SSE, "Supporting a Just Transition," November 2020. [Online]. Available: https://www.sse.com/media/xtrlsctj/just-transition-strategy-sse-final.pdf. [Accessed 30 June 2021].

[65] Ceres, "Practices for Just, Sustainable and Equitable Development of Clean Energy," 2020.

[66] International Energy Agency (IEA), "Renewable heat policies: delivering clean heat solutions for the energy transition," January 2018. [Online]. Available: https://www.iea.org/reports/renewable-heat-policies. [Accessed 20 February 2021].

[67] D. Burns and E. Grubert, "Attribution of production-stage methane emissions to assess spatial variability in the climate intensity of US natural gas consumption," 8 April 2021. [Online]. Available: https://iopscience.iop.org/article/10.1088/1748-9326/abef33. [Accessed 30 June 2021].

[68] Reuters, "Problems plagued U.S. CO2 capture project before shutdown: document," 7 August 2020. [Online]. Available: https://www.reuters.com/article/us-usa-energy-carbon-capture-idUSKCN2523K8. [Accessed 2021].



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