

## **Frequently Asked Questions**

### **Making Clean Electrification Possible and Making Clean Hydrogen Possible launches (20/04/2021)**

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#### **Section 1: About the ETC**

##### **What is the Energy Transitions Commission and what is its mission?**

The Energy Transitions Commission (ETC) is a global coalition of leaders from across the energy landscape committed to achieving net-zero emissions by mid-century in order to limit global warming to well below 2°C and as close as possible to 1.5°C.

Our Commissioners come from a range of organisations – energy producers, energy-intensive industries, technology providers, finance players and environmental NGOs – which operate across developed and developing countries and play different roles in the energy transition. This diversity of viewpoints informs our work: our analyses are developed with a systems perspective through extensive exchanges with experts and practitioners. Our ambition is to inform the decisions of public and private decision-makers and support the leaders at the forefront of climate action to speed up the deployment of low and zero carbon solutions.

A list of our commissioners can be found here: <http://www.energytransitions.org/who-we-are>.

##### **Who funds the ETC?**

The ETC is primarily funded by the organisations with which our Commissioners are affiliated. Membership fee levels depend on the size and nature (for-profit or not-for-profit) of the organisation. Commissioners all have equal voice and representation on the Commission regardless of whether their affiliate organisation finances the ETC or not. In addition, some of the ETC's work programmes, in particular ETC China and ETC India, are funded by philanthropic organisations.

The funding we receive finances the ETC's secretariat, analytical programmes, stakeholder outreach and communications.

##### **Who are the Commissioners and how were they selected?**

As of April 2021 the Commission's membership includes 49 leaders coming from energy companies, energy-intensive industries, technology providers, financial institutions, environmental NGOs and academia. They operate across developed and developing countries and play different roles in the energy transition. Commissioners are selected based on their commitment to working towards a net-zero-emissions economy by mid-century.

We endeavour to diversify the Commission's membership in terms of sector, nationality and gender. The Commission is chaired by Lord Adair Turner who works alongside

Faustine Delasalle, Director ETC. A list of Commissioners and ETC team members can be found on our website at <http://www.energytransitions.org/who-we-are>.

### **Are the organizations with which your members are affiliated backing this report?**

This report constitutes a collective view of the Energy Transitions Commission. Members of the ETC endorse the general thrust of the arguments made in this report but should not be taken as agreeing with every finding or recommendation. The institutions with which the Commissioners are affiliated have not been asked to formally endorse the report.

### **Why is [a given Commissioner] not available for questions?**

Some of our Commissioners are unfortunately unavailable for questions due to prior commitments, but five global reports have now been developed by the Commissioners who not only agree on the importance of reaching net-zero carbon emissions from the energy and industrial systems by mid-century, but also share a broad vision of how the transition can be achieved.

### **Why have not all ETC Commissioners endorsed the report?**

Nearly all our Commissioners have endorsed the *Making Clean Electrification Possible: 30 years to electrify the global economy* and parallel *Making the Hydrogen Economy Possible* reports. A few were unable to formally endorse the report before publication due to procedural formalities within their organisation, or have only very recently joined the Commission and therefore were not able to participate in the development of the report.

**How does the ETC deal balance achieving impact with the demands of fossil fuel members?** Commissioners all have equal voice and representation on the Commission. We believe it is critical that the ETC brings together voices from across all sectors, including energy intensive industries, in order to design realistic yet ambitious pathways to net-zero emissions and mobilise all key stakeholders towards this goal. All members of the ETC have agreed to work together to pursue a global net-zero emissions target by mid-century. Our reports are anchored in robust quantitative and qualitative analyses, which are stress-tested and refined with a large panel of experts coming from both our members' organisations and a broader network. The ETC creates a unique space for open dialogue, creating the right conditions for change and advancing the climate agenda.

### **Does the ETC speak to the challenges of both developed and developing countries?**

The ETC develops global roadmaps, while highlighting differences between regional pathways, especially between developed and developing countries. We work with local partners – in China, India, Europe, U.S. and Australia – who have deep country knowledge and play a key role in strengthening and stress-testing our global analyses in light of regional specificities.

The ETC believes that all rich developed economies should and can reach net-zero emissions by 2050 and all developing countries by 2060 at the latest, but the developing countries will require development finance to de-risk and crowd-in private investment. However, some developing countries may be able to achieve full decarbonisation by 2050 or earlier, for example, because they are blessed with significant potential solar and wind resources, dramatically reducing decarbonisation costs.

These reports examine scenarios for developed and developing markets and recommend that developed and developing countries should adopt strategies to achieve grid emissions intensity below 30gCO<sub>2</sub>/kWh by the mid-2030s and mid-2040s respectively. Overall, achieving massive electrification and early power decarbonisation – ahead of economy-wide decarbonisation – must be at the heart of all countries' paths to net zero.

## **Section 2: About the reports and their impact**

### **What topics do these reports cover? Why have you developed them?**

The report *Making Clean Electrification Possible: 30 years to electrify the global economy* sets out why it is essential but also feasible and affordable to multiply by 5 the size of the global power system while shifting to renewable-based electricity provision. The parallel report *Making the Hydrogen Economy Possible: Accelerating clean hydrogen in an electrified economy* sets out the complementary role for clean hydrogen and how a combination of private-sector collaboration and policy support can drive the initial ramp up of clean hydrogen production and use to reach 50 million tonnes by 2030.

Our 2020 *Making Mission Possible* report laid out the building blocks to achieve a net-zero emissions energy and industry system globally by mid-century. Our clean electrification and hydrogen reports provide i) a refined view of the long-term role of each zero-carbon energy source, ii) more detailed information on the feasible pace of that transition from now to mid-century, and iii) how precisely to accelerate progress in the 2020s to ensure mid-century goals are attainable, providing more precise guidance to policymakers and business leaders.

The reports are part of *The Making Mission Possible Series* which aim to provide analysis on the feasible scale-up trajectories of the four underlying zero-carbon energy vectors: clean electricity, clean hydrogen, sustainable bio-energy and the use of fossil fuels combined with CCS/U. Together these analyses will enable the ETC to draw-together the implications for scale up of zero-carbon energy systems, using this point of view to further understanding of the feasible pace of energy system transition and economy wide-decarbonisation.

### **Who are these reports aimed at? Who is your target audience?**

These reports are aimed at policymakers around the world, who are preparing the revision of their Nationally Determined Contributions and mid-century strategies ahead of the UNFCCC COP26 summit in November 2021. We aim at putting the objective of “real net-zero” by mid-century at the heart of the revised Nationally Determined Contributions (NDCs) and long-term low greenhouse gas emissions development strategies (LT-LEDS) soon to be submitted to the UNFCCC under the Paris Agreement.

The reports can also inform the strategies of business leaders and investors who aim to anticipate the profound market transformations that climate action will generate in the global economy. It provides civil society, economic, political and social thought-leaders with guidance on how specific energy pathways to achieve Net Zero.

### **Why are you launching the two reports at the same time?**

The ETC's clean electrification and clean hydrogen reports are complementary and therefore have been developed in parallel and are published alongside one and other.

Clean electrification must be at the heart of all strategies to achieve a zero-carbon economy - direct electricity use could and should grow from today's 20% of total final energy demand to reach close to 70% by 2050. While direct electrification the most efficient way to meet most energy needs, in some sectors direct electrification will likely remain impossible or uneconomic for many decades. In many of these, hydrogen can play a major role in decarbonisation, used directly or via hydrogen derived fuels such as ammonia or synthetic fuels. Together direct electricity and clean hydrogen and its derived fuels could account for more than 85% of final energy demand in a net-zero emissions mid-century economy.

Given the major role for green hydrogen production expected, the scale up of green hydrogen production and clean electrification are also likely to be mutually reinforcing:

- Hydrogen production is likely to be predominantly via a green route (ca. 85%) and generate very large electricity demand, increasing the total required supply of zero carbon electricity by 30,000 TWh or more on top of the 90,000 TWh potentially needed for direct electrification. The scale up of clean hydrogen is therefore dependant on the parallel scale up of clean electricity production.
- Large green hydrogen production capacity can also aid management of electricity systems dominated by variable renewable generation. Green hydrogen production can provide large scale demand side flexibility, with production only when wind and solar are producing (and therefore abundant and cheap). Further, the generation of electricity through the combustion of clean hydrogen in CCGTs provides a viable route to overcome the seasonal and unpredictable week-by-week balancing challenge.

These reports are part of *The Making Mission Possible Series* which builds on the mid-century net-zero vision illustrated in *Making Mission Possible* and provides analysis of the feasible scale-up trajectories of the four underlying zero-carbon energy vectors: clean electricity, clean hydrogen, sustainable bioenergy and the use of fossil fuels combined with CCS/U.

The ETC is also undertaking analysis of the remaining zero-carbon energy vectors – sustainable bioenergy and the use of fossil with CCS/U - which will be published later this year.

### **How much of the report is constituted of new analyses vs. integration of previous publications?**

These reports follow from the ETC's landmark report *Making Mission Possible* (September 2020) which showed that a net-zero global economy is technically and economically possible by mid-century, and will require a profound transformation of the global energy system. The mid-century vision for the shape of a net-zero economy, including the critical role for zero-carbon electricity and the massive growth in low-carbon hydrogen required, were inherited from *Making Mission Possible*, itself building from prior ETC analysis:

- *Making Mission Possible* was a synthesis of the ETC's work over its first four years, building on previous ETC analysis including two landmark reports: *Better Energy, Greater Prosperity* (April 2017), which described a path to halving CO<sub>2</sub> emissions by 2040 focusing on power decarbonisation and electrification, and *Mission Possible* (December 2018), which showed it was possible to decarbonise even the "harder-to-abate" heavy industry and heavy-duty transport sectors.
- In *Making Mission Possible*, we updated our past analysis to reflect the latest cost and technological trends. New elements were included in order to provide a fuller picture of the climate challenge. In particular, the report gives a high-level view

of how to decarbonise land use and food systems, and what the implications are for the role of nature-based solutions and of bioenergy in the decarbonisation of the energy and industrial system.

Building on this, analysis of the feasible trajectory from now to mid-century has been undertaken over the last year, in close partnership with experts from the organisations making up the Commission and the ETC's broader network. The reports draw upon analyses carried out by a wide range of partners, in particular those carried out by ETC knowledge partners SYSTEMIQ and BloombergNEF. We also reference analyses from the International Energy Agency and IRENA. We warmly thank our knowledge partners and contributors for their inputs.

### **Who has carried out the underlying analysis?**

The underlying analysis for this report was developed by the ETC Secretariat, provided by SYSTEMIQ. It brings together and builds on past ETC publications, developed in close consultation with hundreds of experts from companies, industry initiatives, international organisations, non-governmental organisations and academia. The reports draw upon analyses carried out by ETC knowledge partners SYSTEMIQ and BloombergNEF, alongside analyses developed by Climate Policy Initiative, Material Economics, McKinsey & Company, Rocky Mountain Institute, The Energy and Resources Institute, and Vivid Economics for and in partnership with the ETC in the past. We also reference analyses from the International Energy Agency and IRENA. We warmly thank our knowledge partners and contributors for their inputs.

### **Is this report overly ambitious?**

We are presenting a set of opportunities and are both realistic and ambitious with regards to implementation. We are convinced that decarbonising the economy by mid-century is technically and economically feasible. Our findings and recommendations are rooted in robust data analysis which itself builds on work from reputable global institutions. The pace of innovation, technology deployment and cost reductions has been steadily increasing, which considerably facilitates the decarbonisation of many sectors like power or light-duty vehicles. However, our research shows that this speed must be considerably accelerated to reach a net-zero target by mid-century, which requires the immediate and collective mobilisation of governments, investors, corporates, innovators and civil society.

The Commission is not making predictions about the future. We are identifying opportunities that we believe governments, investors and businesses should seize, and we are highlighting where we believe they should focus their efforts in order to have the most positive impact.

While the speed of scale-up of both wind and solar capacity and clean hydrogen production are undoubtedly highly ambitious and reflect a step change in activity levels compared with today, global resources are sufficient to meet scale up requirements. Scaling renewables and clean hydrogen production will require the development of extensive new supply chains for key materials and capabilities. These developments are physically feasible within the required timescale, but failure to anticipate in advance could result in bottlenecks, both locally and globally, which could slow progress and increase costs.

We do not underestimate the barriers to implementation and our report discusses how they vary depending on regional challenges and opportunities and how they could be overcome. We emphasize detailed actions and policies required immediately and over

the next decade to drive initial emissions reductions and to make the path to net-zero by mid-century feasible. Examples of critical actions include:

- Clear medium-term targets (e.g. quantitative targets for renewables, future bans on ICE sales) embedded in a strategic vision for economy decarbonisation, including an economy-wide carbon price, to provide investors and businesses with certainty on the direction of travel
- Incentives for renewables deployment at scale, in particular through appropriate power market design (e.g. continued use of long-term electricity auctions to drive rapid growth of renewable capacity)
- Sector specific policies to support clean hydrogen demand growth and compensate the “green premium” in particular applications, via a combination of i) mandates and regulations requiring a percentage use of low-carbon energy / lifecycle emissions standards, ii) voluntary private-sector commitments to purchase low-carbon services and products, iii) green public procurement policies, iv) financial incentives for hydrogen uptake, through mechanisms like contracts for difference to bridge the “green premium” of low-carbon products.

### **Are the conclusions of these reports valid for all geographies? How did you address regional challenges?**

Many of the routes to decarbonisation are relevant in all countries; and in many sectors – such as steel, aviation and shipping – a global policy approach would be ideal. Much of the ETC’s work has therefore focused on global trends in technologies and costs. But there are important differences between regions and countries. Countries have different natural resource endowments, different economic fabrics, different income levels and very different current emissions; and they start from different positions – for instance, in relation to existing coal generation capacity.

Through its global work as well as its regional initiatives across China, India, Europe, U.S. and Australia, the ETC has sought to identify major regional differences and highlight these in these reports, drawing on regional analysis developed by ETC regional initiatives, by ETC knowledge partners BloombergNEF and SYSTEMIQ, in addition to key third party studies, such as the *Net Zero America* study undertaken by Princeton University, the UK Climate Change Committee's *Sixth Carbon Budget Report* and *China Renewable Energy Outlook* from China's National Renewable Energy Centre (CNREC) – the research institute of China's National Development and Reform Commission (NRDC).

### **What are the next steps for the ETC after the launch of this report?**

The ETC will continue to work with our Commissioners to educate and stimulate discussions on the journey to net-zero emissions and priorities for the 2020s in advance of COP26. Our ambition is to inform the decisions of public and private decision-makers in the run up to COP26, in particular, encouraging high ambition in the next iteration of country Nationally Determined Contributions.

Our activities encompass the energy sector itself, as well as key energy-consuming sectors in industry, transport and buildings. In each sector, we work with corporate leaders to define a pathway to net-zero emissions and establish the building blocks of net-zero value chains. This work is generally undertaken with a range of partners, industry associations, NGOs and experts. In the harder-to-abate sectors specifically, we work under the umbrella of the Mission Possible Platform, an initiative established by the ETC and the World Economic Forum.

The ETC is continuing to work on the ground across five regions: China, India, Europe, the United States and Australia. In each region, we continue to work with local delivery partners to develop a vision of how to speed up the national energy transition, leveraging both global insights and local knowledge; crystallise a corporate voice in support of policies aligned with a net-zero target; and engage with policymakers to inform long- term national strategies and the revision of their Nationally Determined Contributions ahead of COP-26.

### **Section 3: Net-zero targets and negative emissions**

#### **The term “Net Zero” is used a great deal – but what is “Net Zero” and why should we set “Net Zero” targets?**

The concept of “net-zero emissions” is based on the climate science and what we must do to limit global warming. The IPCC’s illustrative pathways for limiting global warming to 1.5°C indicate that CO<sub>2</sub> emissions need to be reduced to net-zero globally by around 2050. In this expression, the “net” reflects the fact that there may still be a small amount of residual emissions by 2050 – the ETC estimates that 2-4 Gt of CO<sub>2</sub> might still be emitted by the energy system – and those should be compensated by negative emissions, obtained via carbon removals (for instance from afforestation or DACCS).

We must therefore aim to decarbonise the economy by mid-century, reducing CO<sub>2</sub> emissions from energy, industry, transport and buildings to as close to zero as possible. Net-zero goals and targets are powerful, because they give us this galvanising clarity of action for government, business, and civil society, focusing the minds on a tangible objective associated with a clear timeline. They are a vital step in accelerating progress and urgency as we must act now to deliver them.

But achieving net-zero alone will be insufficient to limit global warming to 1.5°C for three reasons. First, as CO<sub>2</sub> accumulates in the atmosphere, it is the total cumulative amount of emissions between now and 2050, and therefore the pace of emissions reduction, that will matter for global warming; this carbon budget is currently estimated at 500 Gt by the IPCC. Second, beyond the energy, industry, transport and buildings sectors, emissions from waste, agriculture, food and land-use should also be taken into account. Finally, non-CO<sub>2</sub> emissions, in particular nitrogen oxide and methane emissions, also contribute to global warming effects and need to be cut.

#### **What role does the ETC envision for negative emissions?**

The ETC is currently undertaking research to assess the scale of carbon removals needed over the coming decades to bring net CO<sub>2</sub> emissions in line with the carbon budget that the IPCC defined as the maximum amount of cumulative anthropogenic CO<sub>2</sub> emissions from today to 2050 for the world to have 50% chance to limit global warming to 1.5°C. At this stage, when comparing reasonably ambitious emissions reduction scenarios for all sectors of the economy (including energy, industry, transport and buildings, as well as waste, agriculture, food and land use) with this carbon budget, we find that cumulative emissions will likely overshoot the carbon budget.

Hence, it is likely that carbon dioxide removal (also called negative emissions) will be an indispensable component in addition to, rather than instead of, economy-wide ‘real’ decarbonisation (i.e. emissions reduction within the GHG-emitting sectors themselves) over the next 30 years, if we are to successfully limit global warming to 1.5°C.

There are three core reasons for deploying carbon removal solutions:

1. Offset the ongoing residual emissions which will still be produced by the energy, industry, transport, buildings, waste, agriculture, and land-use sectors beyond mid-century;
2. Offset the fact that emissions from those sectors cannot be reduced fast enough in the 2020s and 2030s to stay within the cumulative carbon budget; and
3. Potentially, to generate “absolute negative emissions” in the second half of the century if these are needed to compensate for an overshoot of the carbon budget between now and mid-century.

Such carbon removals could be achieved via multiple routes including Natural Climate Solutions (conservation, restoration, and/or improved land management actions to increase carbon storage and/or avoid greenhouse gas emissions across global forests, wetlands, grasslands, agricultural lands and oceans), BioEnergy with Carbon Capture and Storage (BECCS) and Direct Air Carbon Capture and Storage (DACCS).

The voluntary purchase of offsets by corporates could play a positive role in financing these necessary efforts, as long as they do not replace efforts to reduce their own emissions at the fastest possible pace.