Energy Transitions Commission

PRESS RELEASE

CLEAN ELECTRIFICATION AND HYDROGEN CAN DELIVER NET-ZERO BY 2050, SAYS GLOBAL PRIVATE-SECTOR COALITION

NEW REPORTS BY THE ENERGY TRANSITIONS COMMISSION SET OUT PATH TO ELECTRIFY ECONOMY AND GROW COMPLEMENTARY ROLE FOR CLEAN HYDROGEN

UNDER STRICT EMBARGO:
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LONDON, 27 April 2021 - The Energy Transitions Commission (ETC), a coalition of more than 45 leaders from global energy producers, energy industries, financial institutions and environmental advocates – including ArcelorMittal, Bank of America, BP, Development Research Center of the State Council of China, EBRD, HSBC, Iberdrola, Ørsted, Shell, Tata Group, Volvo Group and the World Resources Institute among others – released two new reports analysing the feasibility of achieving a net-zero greenhouse gas emissions (GHG) economy by 2050 and the actions required in the next decade to put this target within reach. Clean electrification will be at the heart of this transformation enabled by the rapidly falling costs of renewable energy, with a complementary role for clean hydrogen technology in sectors that are difficult or impossible to electrify.

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 the size of the global power system by 5, 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.

Net zero by 2050 is possible
The Paris climate accord committed the world to limiting global warming to less than a 2°C increase from pre-industrial levels — and striving for no more than a 1.5°C rise in the planet's average temperature. For this objective to be reached, the world needs to achieve net-zero GHG emissions by around mid-century. The ETC states that achieving a net-zero GHG emissions economy within the next 30 years is technically and economically feasible. A profound transformation of the global energy system is ahead – a net-zero GHG economy will be built on abundant, affordable zero-carbon electricity.

Pace of renewables deployment to be multiplied by 5-7 times by 2030
Electricity could represent up to 70% of final energy demand by 2050, versus 20% today, with total electricity use expected to grow as much as 5 times in the coming decades. Transitioning to clean electricity as the main source of final energy represents the cheapest and most efficient way to decarbonise the economy. The rapidly falling costs of renewables and storage solutions make it possible to achieve the required massive expansion of clean power systems at low cost, according to the reports. However, wind and solar must increase from today's 10% of total electricity generation to about 40% by 2030, and over 75% by 2050. Annual wind and solar installations must therefore grow by 5-7 times by 2030, and more than 10 times by

2050. They must also be accompanied by the parallel deployment of other zero-carbon generation technologies (like hydro and nuclear), flexibility solutions, storage and power networks to deliver zero-carbon power systems at scale.

The ETC states that this is undoubtedly within reach if clear national strategies for decarbonisation are put in place and appropriate power market design unlocks private financial flows. Investments in renewable power, primarily wind and solar, will represent the vast majority (around 80%) of total investments required to achieve a net zero economy. Over $80 trillion of investment will be required globally over the next 30 years (ca. $2.5 trillion per annum on average). This includes investment in renewable generation to support both direct and indirect electrification, in addition to investment in electricity grid infrastructure. Whilst large, this represents less than 1.5% of global GDP and is manageable in the current macroeconomic environment.

Clean hydrogen production costs to be brought well below $2/kg by 2030

Clean hydrogen will play a complementary role to decarbonise sectors where direct electrification is likely to be technologically very challenging or prohibitively expensive, such as in steel production and long-distance shipping. A net zero GHG emissions economy by mid-century will likely need to use about 500 to 800 million tonnes of clean hydrogen per annum, a 5-7 fold increase compared to hydrogen use today. Green hydrogen, produced via the electrolysis of water, is likely to be the most cost-competitive and therefore the major production route in the long-term, due to falling renewable electricity and electrolyser equipment costs. It could account for approximately 85% of total production by 2050. However, blue hydrogen, produced from natural gas with carbon capture (with 90%+ capture rates) and low methane leakage (<0.05%), will play an important role in transition and in some specific very low-cost gas locations.

The report highlights how critical rapid ramp-up of production and use in the 2020s is to unlock cost reductions (bringing clean hydrogen costs below $2/kg) and to make mid-century growth targets achievable. However, even once clean hydrogen becomes cheaper than grey hydrogen, using hydrogen in different industry and transport sectors will often still impose a "green cost premium" compared to current high-carbon technologies. Public policy is therefore essential to drive uptake of clean hydrogen at pace. Policymakers will also need to anticipate growing hydrogen transport and storage needs. In total, 85% of investments required to ramp-up hydrogen production is for renewable electricity provision (included in the renewables investment above). Additionally, ca. $2.4 trillion ($80 billion per annum) will be required between now and 2050 for hydrogen production facilities and transportation & storage.

Critical milestones to be reached by 2030 to put 2050 targets within reach

"We now have the technologies to completely decarbonise electricity generation at low cost: and electrification is the key to zero carbon production in most of the economy. By mid-century even rich developed countries will need 2-3 times as much electricity as today, and developing economies 5-10 times as much. Governments, businesses and investors need to recognise the scale of the new industrial revolution required and the huge opportunities it creates," Lord Adair Turner, Chair, ETC.

With regards to power, the ETC recommends that developed countries should achieve grid emissions intensity below 30gCO_2/kWh by the mid-2030s and developing countries by the mid-2040s. To achieve those medium-term objectives, critical actions in the 2020s include:

- Clear national medium-term targets for power decarbonisation and for the electrification of the economy

- Appropriate incentives for renewables deployment at scale, including power market design encouraging private investment, with a continued role for long-term contracts
- Unlocking financial flows for investment in developing countries, including via blended finance vehicles
- Anticipating the build-up of network infrastructure and capabilities required for simultaneous mass electrification and power system decarbonisation
- Planning and permitting processes that accelerate implementation
- Developing the technologies and business models of the future, especially for long-term energy storage and flexibility provision

"The ETC demonstrates that rapid decarbonisation of the global power system is desirable, attainable and affordable. It's the bedrock of the Race to Zero emissions and provides the expansion of zero carbon power needed for other sectors to also decarbonise. The ETC highlights how countries setting out clear strategic plans for electrification and decarbonisation will enable companies and innovators to deliver the massive increase in clean power needed," Nigel Topping, UK High Level Climate Action Champion, COP26

Meanwhile, public policy needs to pull forward clean hydrogen demand in the 2020s to drive production volumes up (reaching 50 million tonnes by 2030). This requires a rapid decarbonisation of hydrogen production for already existing uses and accelerated technology development, piloting and early adoption of hydrogen in other key sectors with lower levels of technology readiness but large potential demand, like steel, shipping and synthetic aviation fuels. Instruments to achieve that early demand growth, while supporting the scale-up of clean hydrogen supply, include:

- Carbon pricing to create broad incentives for decarbonisation
- Sector-specific policies to create demand for low-carbon technologies, and financial support mechanism for investment and to overcome the "green cost premium" challenge
- Targets for the development of large-scale electrolysis manufacturing and installation
- Public support and collaborative private-sector action to bring to market key technologies
- Developing hydrogen industrial clusters to enable the simultaneous development of hydrogen production, storage, transport and end-use, de-risking investments for all players involved
- Establishing rules and standards on safety, purity and GHG-intensity of hydrogen

"Clean hydrogen will be key to decarbonising sectors where direct electrification is impossible or too expensive. Steel can be made zero carbon using hydrogen as the reduction agent; ocean-going ships will likely burn ammonia made from green hydrogen: and hydrogen can provide electricity when the wind isn't blowing and the sun not shining. In total the world may need to produce and use 5-7 times as much hydrogen as today, and there are no inherent barriers to achieving that. But strong public policy support and visionary private investment is needed to drive clean hydrogen growth at the fast pace now required," Lord Adair Turner, Chair, ETC.

"Green hydrogen made from renewable electricity will be the best complement to deep electrification to achieve a sustainable and decarbonised energy sector. It will bring investment opportunities and qualified jobs, while making our economy cleaner and more competitive. Policy commitments to scale up this new economy are necessary and will bring important economic and environmental benefits in the years to come," Agustin Delgado, Chief Innovation and Sustainability Officer, Iberdrola.

To read the full ***Making Clean Electrification Possible*** report, please visit: https://www.energy-transitions.org/publications/making-clean-electrification-possible/

To read the full ***Making the Hydrogen Economy Possible*** report, please visit: https://www.energy-transitions.org/publications/making-hydrogen-economy-possible/

About the Energy Transitions Commission

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 line with the Paris climate objective of limiting global warming to well below 2°C and ideally 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.

Making Clean Electrification Possible: 30 Years to Electrify the Global Economy and **Making the Hydrogen Economy Possible: Accelerating Clean Hydrogen in an Electrified Economy** were developed by the Commissioners with the support of the ETC Secretariat, provided by SYSTEMIQ. They bring together and build 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.

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.

For further information please visit the ETC website at www.energy-transitions.org

The list of ETC Commissioners can be found here.

QUOTES FROM OUR COMMISSIONERS:

Quotes – Clean Electrification

This important report from the Energy Transition Committee highlights the central role that zero-carbon electricity needs to play in order for the world get to net zero. It describes dramatic declines in the cost of renewable energy and storage that will make it both possible and affordable to decarbonise the power system and electrify the majority of the world's energy use. To deliver this will require a significant increase in investment in renewables and other low-carbon generation technologies.
Spencer Dale, Group Chief Economist, bp

This new report shows that the electricity sector is ready to be the cornerstone of the decarbonisation of the global economy. We have the technology, the resources and the ambition to go from words to deeds in this decisive decade. Renewable energies and deep

electrification will bring the better future we all want while making our economy more competitive and fair for all.
Agustin Delgado, Chief Innovation and Sustainability Officer, Iberdrola

Modern Energy is proud to support ETC's first report focused on decarbonising the global power sector. As the report indicates, one of the most critical factors in enabling flexibility and affordability in the power sector is the widespread adoption of distributed energy resources (DERs). At Modern, we are excited to invest in distributed energy and grid reliability businesses driving the clean energy transition.
Mark Laabs, Managing Partner, Modern Energy

Electrification is one of the corner stones of our business strategy as we focus on developing the future landscape of sustainable transport and infrastructure solutions for the Net Zero economy. We see an increasing and urgent demand for sustainable solutions from our customers and we are convinced that the required technical and economic developments in this area are achievable.
Johan Lundén, SVP Head of Project and Product Strategy Office, Volvo Group

Quotes – Hydrogen Economy

This report highlights the critical role low-carbon hydrogen, both blue and green, can play in helping the world reach net zero. In particular, it shows the importance of hydrogen in helping to decarbonise hard-to-abate sectors like iron and steel production and long-distance transportation. The report also highlights how business investment at scale, enabled by governments action, is necessary to build-out a hydrogen economy.
Spencer Dale, Group Chief Economist, bp

Green hydrogen made from renewable electricity will be the best complement to deep electrification to achieve a sustainable and decarbonized energy sector. It will bring investment opportunities and qualified jobs, while making our economy cleaner and more competitive. Policy commitments to scale up this new economy are necessary and will bring important economic and environmental benefits in the years to come.
Agustin Delgado, Chief Innovation and Sustainability Officer, Iberdrola

This is an important publication from the ETC, and we have been closely involved in the work. Green hydrogen for energy is a new market that will ultimately be worth trillions. The falling costs and huge increase in production forecast in this report will be enabled by the invention and improvement of electrochemical technologies, which have been an area of investment focus for IP Group for nearly a decade.
Robert Trezona, Partner, Head of Cleantech, IP Group

Zero-emission hydrogen is a critical resource for business across many industries. This report from the ETC highlights how important hydrogen is for reaching our 1.5ºC objective and gives companies a clear road map for investments and unlocking further innovation.
María Mendiluce, CEO, We Mean Business coalition

Quotes – Clean Electrification & Hydrogen Economy

These timely reports address two pivotal areas for accelerating the energy transition and meeting the climate challenge. There is broad consensus on the central role of a decarbonised power sector in heading off catastrophic climate change, and the need to develop a hydrogen economy to decarbonise sectors that cannot be easily electrified. Underpinned by the ETC's customary rigour, these reports confirm this consensus. Moreover, they underline the scale of the energy transformation needed, and, importantly, show how it can be achieved. The ETC's work is already informing many of the EBRD's activities, and these reports provide invaluable insights for what we need to do in our Countries of Operation to meet the climate challenge.
Nandita Parshad, Managing Director, Sustainable Infrastructure Group, EBRD

Across the UK and the US, transforming our energy system to prepare for a sustainable future, is at the forefront of our mind. This will involve a range of changes from how we

generate, transport and use electricity to how we utilise the potential of hydrogen. To reach net zero goals, every home, workplace and industry will need clean energy. The time is now to make a long-lasting impact for generations to come.
Timothy Jarratt, Chief of Staff, National Grid

A zero-emissions society is possible. But it can only be achieved if wind and solar power are deployed at a much greater pace and scale, and if we ramp up the production and use of renewable hydrogen. At Ørsted, we applaud the two recent reports from the ETC. We are firm in our commitment to cooperate with governments, investors, businesses and civil society to achieve a net-zero society and a world that runs entirely on green energy.
Thomas Thune Andersen, Chair, Ørsted

Both the reports from the Energy Transitions Commission emphasize the importance of clean energy in achieving a zero carbon economy. It is clear that low cost clean energy will be instrumental in not only pushing adoption of clean electricity but also in bringing down the cost of green hydrogen, thereby paving the way for decarbonising many other sectors, including hard to abate industries. Hence, policy makers and regulators must focus on measures that can phase out existing fossil fuel generation and enhance storage and flexibility options so that more variable sources of energy can be deployed at scale.
Sumant Sinha, Chairman and Managing Director, ReNew Power

Electricity and hydrogen are at the core of a net-zero economy, according to two new reports from the Energy Transition Commission (ETC). Getting there means fuelling as much of the world's economic activity as possible with zero-carbon electricity, and using hydrogen made primarily from renewable electricity in many sectors that are difficult to decarbonise, the reports suggest. Developing a hydrogen economy relies on sectoral policies to stimulate both supply and demand. As a member of the ETC, Shell welcomes this thinking. It too recognises the importance of a sectoral approach to decarbonising energy use in sectors such as transport, industry and buildings. Shell remains focused on working with its customers and across sectors to accelerate the transition to net-zero emissions, in step with society.
Chad Holliday, Chairman, Shell

The new ETC-reports deliver important results and is a great opportunity to share knowledge on how to prioritize and develop strategies to tackle the greatest challenge of our time. For Vattenfall the way forward is clear, our sustainable business strategy and industrial innovations such as HYBRIT, together with partners LKAB and SSAB, is how we build a fossil free future within one generation.
Andreas Regnell, Senior Vice President, Head of Strategic Development Vattenfall.

Third Party Quotes

Clean electrification is the key to unlocking a Net Zero economy. The latest ETC reports demonstrate that massive and rapid electrification complemented by clean hydrogen will achieve global decarbonisation. In the next crucial decade for climate action, the combination of both provides government and business with a path to accelerate action. Our mission is to deliver on the Paris agreement and this is now Mission Possible.
Christiana Figueres, Founding Partner – Global Optimism

I welcome the contributions of the ETC in its latest reports, on power and hydrogen, as an authoritative private sector voice on the energy transition. The ETC helpfully shows that hydrogen is not a cure-all for still-unabated emissions: that green hydrogen will cost-effectively dominate the decarbonization of a few no-regrets sectors does not minimize its own competition with renewable electrification and innovation. In the Race to Zero emissions, the ETC offers us foresight that businesses and policymakers will need to embrace the positive disruption offered by green hydrogen to stabilize temperatures below 1.5 degrees.
Nigel Topping, UK High Level Climate Action Champion, COP26

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