Written Testimony
Hearing of the U.S. Senate Energy and Natural Resources Committee
Global Climate Trends and Progress in Addressing Climate Change

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Senator Manchin, Senator Barrasso and distinguished Members of the Committee, thank you for the opportunity to appear before you today and to present the International Energy Agency's (IEA's) latest data and analysis on global climate trends and progress in addressing climate change.

Senator Manchin, it is an honor to be here, and I look forward to continuing to do everything we can at the IEA to help you and all of your colleagues. I have always greatly benefited from your partnership and insights, and I know that this Committee is in incredibly good hands.

Congratulations also to Senator Barrasso. Wyoming is such an energy powerhouse in so many ways, and I look forward to helping you in your work and priorities going forward as well.

I would also be remiss if I did not thank Senator Murkowski for her years of skillfully leading this critical Committee. I have very much enjoyed testifying in front of Chairman Murkowski and Senator Manchin over recent years, and all of us at the IEA have benefited – and I know will continue to benefit from – your global energy leadership. Let me thank you, in particular, Senator Murkowski for being such an invaluable member of our Global Commission on Energy Efficiency.

I am not an expert on the U.S. government, but I know from having first testified in front of this Committee in 2007 that this is a special group and one that has worked on a bipartisan basis to achieve real results for the American people and for the world. Congratulations, in particular, to all Senators and staff responsible for the historic Energy Act of 2020, which will materially advance so many of the key technologies that we will be talking about today.

I am particularly pleased that you have decided to use this first non-nomination hearing to establish a baseline on global climate trends and progress. As many have said before, everyone is entitled to their own opinion but not to their own facts. As a data-driven organization, we at the IEA could not agree more. Put simply, we need a robust understanding of what is happening today if we are to build a better tomorrow.

A brief overview of the IEA

Since the founding of the IEA almost 50 years ago, the United States has been a crucial pillar for the Agency. U.S. leadership and support has come from across the government, including the Senate, the House of Representatives, the White House, the Department of State, the Department of Energy and the National Labs. I would like to particularly express my excitement to work with the new Secretary of Energy, Jennifer Granholm – should she be confirmed. The IEA stands ready to help her and her new team – and all parts of the U.S. Executive Branch – in any way we can.

Since the IEA's founding in 1974, we have evolved, expanding to become the world's leading authority on global energy issues, providing data, analysis and advice to governments and industry across the full energy spectrum. Today, the IEA has 30 Member countries and partnership with key Association countries, including the world's largest emerging economies Brazil, China, India, Indonesia and South Africa. Our IEA family reflects the global nature of energy, accounting for almost 75% of the world's energy consumption.

Energy and Climate are Inextricably Linked

When looking at global climate trends – the focus of this hearing – one has to focus on energy. Currently, over 80% of global CO_2 emissions come from energy production and use – everything from electricity to industry, from heating homes to moving people and product.

The energy sector also contributes around one third of the methane emissions that arise from human activity. The IEA has long focused on this issue, especially on the leaks from oil and gas operations, which are largest part of energy sector emissions and also the most cost-effective to abate.

Early action to bring down these methane emissions will be critical for avoiding the worst effects of climate change, alongside ambitious action to reduce CO_2. Industry around the world needs to act, visibly and quickly, but there is also a strong role for policies to incentivize this action, push for transparency and improvements in performance, and support innovation in getting results.

Turning to IEA data on CO_2 – the primary greenhouse gas – prior to the Covid-19 crisis the energy sector was responsible for around 35 billion tonnes (Gt) of CO_2 emissions each year. The vast majority of these emissions come from the combustion of fossil fuels: around 45% from coal, 35% from oil, and just over 20% from natural gas.

Breaking these combustion emissions down by sector, electricity generation accounted for around 40% of the global total, followed by emissions from transport (around 25%) and industry (20%). The

residential and services sectors, as well as activities such as oil and gas extraction and refining, make up the remainder.

In our estimation, energy-related CO_2 emissions came down by around 7% in 2020, and energy-related methane leaks by a similar amount. However, since these reductions were almost entirely linked to the effects of the pandemic, there is a major risk that these emissions will rebound as economies recover, just as happened after the 2008/9 Financial Crisis.

That is why the IEA continues to put such a strong emphasis on the importance of a sustainable recovery, including our groundbreaking analysis with the IMF last year laying out actionable recommendations, the IEA Sustainable Recovery Plan.

Key Global Trends – Emissions

Let us now look at how global emissions breakdown by country. The largest emitting country in the world is China, with almost 10 Gt of emissions (around 30% of the global total), which is roughly twice the amount from the United States (14% of the total). The United States in turn emits around twice as much as the European Union (8%). Indian emissions (7%) are slightly lower than the European Union, although on a per capita basis Indian emissions are currently among the lowest in the world.

Energy use in developing economies has been driven by building the infrastructure that supports the modern lifestyle that we generally take for granted: the number of people without electricity in Africa is twice the US population. The number of people in India who have basic access to electricity but own neither a refrigerator, a washing machine nor an air conditioner is four times the US population.

Between 2000 and 2019, global emissions grew by around 10 Gt. During this period, emissions in advanced economies fell by more than 10%, with emissions in the United States falling by more than any other country. Meanwhile, emissions in emerging and developing economies more than doubled, mainly due to rising emissions from China.

This divergence in regional trends is also visible if we look to the future. According to our latest IEA *World Energy Outlook*, published last October, today's policies are enough only to secure a flattening of global emissions out to 2040, a trajectory far from what will be needed to avoid severe impacts from climate change.

Within this picture, advanced economy emissions fall by around 30% from where they were in 2019, but these are offset by a 15% rise in projected emissions from the rest of the world. While China's emissions per capita are already above the global average, per capita emissions in most emerging and developing economies remain well below those in advanced economies.

The Transformation of Electricity

There has been a lot of progress on clean energy transitions in recent years, most notably in power generation. As of 2020, coal makes up around 35% of global electricity generation, with renewables just under 30%. In the IEA's view, we are set for a landmark shift before 2025 as the share of renewables overtakes that of coal.

The future is clearly moving towards clean electricity supplies, in particular solar. Thanks to policy and technology progress, as well as low-cost financing, solar PV is now consistently cheaper than new coal- or gas-fired power plants in most countries, and solar projects now offer some of the lowest-cost electricity ever seen. As we put it in our World Energy Outlook, solar is the new king of electricity.

Wind power – onshore and increasingly offshore – is a similar success story, which is something I do not have to tell given the states that many of the Members of this Committee are from. For instance, in Senator Heinrich's state of New Mexico, Senator King's state of Maine and Senator Hoeven's state of North Dakota, wind power now accounts for 20-30% of all electricity generated, thanks to rapid increases in deployment in recent years.

Today, around 10% of total electricity generation is nuclear, and lifetime extensions for existing plants as well as new technologies like Small Modular Reactors can ensure the continued support from nuclear power to a low-carbon transition. Senator Barrasso, I know this technology is a particular focus for you, as well as for many other members of this Committee. Small Modular Reactors can support the rising share of variable renewables, with shorter lead times and lower investment requirements than large-scale nuclear plants.

A Strong Focus on Grids, Electricity Security, and Critical Minerals

As the technologies used to produce electricity change, the rest of the system cannot stand still. Robust and smart electricity grids, demand-side responses, and a variety of storage technologies will be essential to provide the flexibility and reliability that we will need. Working with governments, regulators and industry to ensure high levels of electricity security is a key priority for the International Energy Agency, including with the creation of a new Renewable Integration and Secure Electricity Unit at the IEA.

Electricity grids are the backbone of today's power systems and become even more important in clean energy transitions as they help to integrate rising shares of wind and solar PV. Adequate investment is vital to expand this infrastructure and to make it smarter and more resilient, including against cybersecurity threats.

The rapid deployment of clean energy technologies also brings important new resource and security issues into focus, especially the reliable supplies of critical minerals and metals that are vital to energy transitions. Under more ambitious climate scenarios, the energy sector will become a major force in driving demand growth for copper, lithium, nickel, cobalt and rare earth elements.

This is a key focus for many of our IEA Members countries – from Europe to Australia, from Japan to Canada as well as for several other countries beyond our membership. Accordingly, we are undertaking a major new global analysis that will be released in April 2021 to examine how demand for critical minerals will evolve and explain the implications for security of supply as well as responsible and sustainable developments of the resources.

The Importance of Innovation

Low-carbon sources of electricity will play a vital role in bringing down emissions in other parts of the energy sector, as electricity expands its role in transport and industry. But clean electricity alone cannot deliver a comprehensive solution to climate change on its own.

We will need many more such technology success stories for a global clean energy transition, especially in view of the ambitious net-zero emissions goals that many governments and industries have set for themselves. The European Union, Japan, the UK and many other major world economies are aiming to reach net-zero emissions by 2050. China, the world's biggest emitter, is aiming to be carbon neutral before 2060. And U.S. President Joe Biden announced the nation's return to the Paris Agreement and is putting the fight against climate change at the centre of his administration's goals.

All of these announcements need to be backed up by equally ambitious actions to reach net-zero emissions as soon as possible and prevent global warming from surging past 1.5 degrees. Political, industrial and technology leaders must be laser-focused on innovation because, for the moment, we do not have all the technologies we need to get to net zero, especially in parts of the transport and industry sectors.

Analysis in our latest Energy Technology Perspectives report shows that almost half of the emissions reductions needed to reach net zero by 2050 will need to come from technologies that have not reached the market today. This means that we will not be able to get there by 2050 without giant leaps in innovation in a range of other clean technologies — some of which are still in the lab.

This is especially urgent in sectors like steel, cement, chemicals, shipping and aviation, where emissions are the hardest to reduce and cost-effective solutions are lagging behind. Addressing these emissions will require strong innovation efforts to bring forward technologies that can enhance

electrification of end uses, like advanced battery chemistries, and technologies for the production and use of clean hydrogen, a very versatile energy carrier, and other sustainable fuels.

Avoiding Emissions from Existing Infrastructure

Solving climate change cannot be just a question of building clean from now on. It is also a question of cleaning up what we already have. Coal-fired power plants can operate for 50 years and longer. Iron and steel or cement plants have typical lifetimes of 40 years. And many of those in operation today, especially in many parts of Asia, are still very young.

Even without building any new infrastructure, the energy infrastructure that we currently have in place today alone will lead to a global warming of 1.65 °C if it continues operating as it does today for the full extent of its expected lifetimes.

Fortunately, there are ways to deal with these emissions. Carbon Capture Utilisation and Storage (CCUS) is a key opportunity to ensure that those power and industrial facilities that are still young today and have not yet recovered their upfront investment can contribute to a clean energy transition.

We have seen a lot of momentum on CCUS recently: plans for more than 30 new integrated CCUS facilities have been announced since 2017. The vast majority are in the United States and Europe, but projects are also planned in Australia, China, Korea, the Middle East and New Zealand.

The United States has been a longstanding leader on CCUS. I applaud many of you on this Committee, in particular, for your leadership on the 45Q tax credit that has supported U.S. investment activity in CCUS. I can also tell you that many other countries around the world are eager to learn from your example.

U.S. Leadership in a Crucial Decade for Energy and Climate

We are at a hugely consequential moment for the energy sector and for the urgent global response to climate change. Looking at all the numbers and analysis we have at our disposal at the IEA, let me leave you with three top recommendations as you go about your work during this critical year of 2021:

1) **Invest in a Sustainable Recovery and People-Centric Transitions** – there is a unique strategic opportunity for the United States to ensure that its economy comes out of today's crisis stronger while also bringing it closer a clean energy future. This an area where jobs, competitiveness, energy and climate priorities align. In addition to our work on sustainable recoveries, the IEA last week launched a new global commission on 'Our Inclusive Energy Future', headed by the Danish Prime Minister, along with Ministers from countries ranging from Mexico to Indonesia, from

Canada to Spain and beyond, to consider the social and economic impacts of the shift to cleaner energy technologies, including how to maximize benefits and mitigate negative effects for citizens.

2) **Harness the power of U.S. innovation to energy transitions** – the immense national scientific expertise across the country, exemplified by the U.S. National Laboratories, can play a critically important role in filling the technology gaps of energy transitions. The United States has been at the forefront of many of the technological leaps of the modern era, such as on solar PV, electric cars and advanced nuclear. With strong and bipartisan support for clean energy innovation, it has a huge opportunity to do so again.

3) **The importance of U.S. global leadership on energy and climate –** The U.S. can set the global agenda like no other country in the world. In galvanizing support for rapid clean energy transitions, it can innovate to provide real-world solutions to energy challenges across the developing world, mobilize public and private finance for sustainable energy, and ensure that we have the tools not only to meet today's energy challenge but the foresight to tackle those of tomorrow.

Conclusion

Achieving global net zero emissions in the ambitious time period that the latest science tells us we need to in order to avoid the worst consequences of climate change will require dramatic and accelerated progress across a wide range of technologies, including renewables, efficiency, CCUS, hydrogen and nuclear, among others.

It will require action across all sectors, not just electricity, making the most of those technologies that we have already, and making sure that we innovate to develop those that we still need. It will also require assembling a broad range of skills, resources and stakeholders.

With its boundless human ingenuity, rich resources and track record of successful innovation and commercialization of new technologies, the United States is extremely well placed to lead the world along with other countries in the development and deployment of energy technologies that can help ensure a secure, affordable and sustainable supply of energy for decades to come.

Senator Manchin, Senator Barrasso and distinguished Members of the Committee, thank you again for the opportunity to appear before you today. Thank you again Senator Murkowski for the close collaboration over the past years. And thank you above all for your continued strong partnership and support for the IEA.