Written testimony
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Prospects for global energy markets, including the role of the United States

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Chairman Murkowski, Ranking Member Manchin and distinguished Members of the Committee, thank you for the opportunity to appear before you today and to present the International Energy Agency's view on global energy.

It has been my privilege to serve as the Executive Director of the International Energy Agency (IEA) for over three years. And it is my distinct pleasure to share with you our very latest views on prospects for global energy markets and in particular the role of the United States.

A brief overview of the IEA

But first I would like to give you a brief introduction to the IEA. Since the founding of the IEA almost 45 years ago, the United States has played a critically important role – US support has come not only from the Executive Branch, including the White House, Department of State and Department of Energy, but also very much from this Committee and from the Congress more generally. I've been privileged to appear before this Committee each of the past three years and have benefited from the perspectives, dialogue and guidance from Committee Members.

The IEA was founded by United States and 16 other countries in the wake of the 1974 oil crisis to promote energy security, cooperation and stable markets. Since that time our Agency has evolved, growing to become the world's leading energy advisor across the entire energy mix, providing data, analysis and advice to governments and industry on all fuels and all technologies.

Today the IEA is made up of 30 member countries, and over the last three years, we have welcomed eight IEA Association partner countries: Brazil, China, India, Indonesia, Morocco, Singapore, South Africa and Thailand. This broader IEA family more accurately reflects the global nature of the energy system, accounting for almost 75% of the world's energy consumption compared to less than 40% in 2015.

Key global trends

Economic growth, urbanization and industrialization – primarily in Asia – are set to drive global energy consumption 25% higher by 2040 in the IEA's central scenario. This growth would be even more rapid without vital energy efficiency measures.

Air pollution concerns are increasingly motivating energy policy all across Asia. The result is massive new investment in cleaner energy sources, especially renewables and natural gas, for which Asian supply is increasingly coming from imported liquefied natural gas (LNG). The IEA has long emphasized

the role of China, India and other countries in Asia in driving global gas demand, but the recent upswing has exceeded even our expectations. Satisfying expected gas demand growth in Asia would require additional supply equal to building one new average-sized US LNG project every 5 months.

Economic growth is also driving oil demand, with the vast majority of growth coming from trucks, aviation and petrochemicals where oil is very likely to stay dominant in the foreseeable future. Even though we are increasingly optimistic about electric cars, we have also recently raised our expectation for oil demand in 2025 by 2 million barrels per day given the strong dynamism of oil demand growth especially in petrochemicals and aviation. The efficiency measures currently implemented only slow down the growth of global oil demand, which we expect to reach 106 million barrels/day by 2040.

Yet in parallel with global oil demand growth, in the absence of additional investment, existing conventional oil production in ageing fields is set to decline on average by around 3 million barrels per day, every year. In addition, it appears that a host of geopolitical risks will continue to affect oil supply. As a result, robust upstream investment, infrastructure development and collective preparedness for supply security remains as important as ever. Even if domestic supplies in the United States surpass domestic demand, the country would still be vulnerable to the consequences of a global oil supply disruption. A spike in oil prices can result in higher gasoline prices for consumers all around the world, including the United States. Large disruptions can also result in serious negative consequences for the global economy.

This is one of the fundamental reasons IEA member countries maintain strategic oil stocks, to be collectively pledged to markets when a disruption occurs. The United States, together with Japan, Korea and Europe are the central pillars of this system. We are now considering how we might begin to involve other large consumers, from the emerging economies, more closely in this system. US strategic stocks have proved themselves useful not only during cases of global oil disruptions but also during domestic disruptions, such as during the hurricane seasons of 2005 and 2008 and as recently as 2017 in the aftermath of hurricane Harvey.

The rate at which the world uses electricity is growing twice as fast as growth in overall energy consumption – that is, a higher and higher proportion of energy demand is being met with electricity. Despite the popular narrative of the age of electric vehicles, the largest drivers of electricity demand are actually electric motors in industry and air conditioners in emerging markets. As industrialization creates wealth, the emerging middle class buys new electric appliances. The electricity consumption of the digital economy is also increasing.

As a result, electricity has bypassed oil as the largest target for energy investment. Within electricity, wind and solar are increasing their shares of new investment. While wind and solar provide only 6% of global power generation today, together they will account for half of the growth in electricity generation over the next two decades.

This growth in wind and solar, driven by improving technology and reductions in cost, is an unprecedented opportunity – one that will require the electricity system to become much more flexible. Flexibility refers to the ability of the electricity system to react to changes in supply and demand. Dispatchable power plants – namely hydro, gas, coal and nuclear – can be key flexible resources; involving consumers in flexible demand response and electricity storage are also growing in importance.

The unique leadership role of the United States – oil and gas

We forecast that around 70% of the growth of world oil production to 2025 will come from the United States. In fact, the United States has essentially compensated for recent production shortfalls in Venezuela and Iran, and, in the process, stabilized oil prices at a level conducive for global economic growth.

The importance of the US shale industry for the global economy cannot be overemphasized. And shale oil is not the only contribution from the United States; we are increasingly optimistic about the impact of cost declines, technological improvements and modular development approaches on offshore investment in the Gulf of Mexico. In addition, major new discoveries in Alaska have confirmed the quality of the resource base. If shale oil in the Permian is the superstar of the team, these other regional opportunities are key supporting players.

The United States continues to break records in natural gas as well. Last year US gas production increased by 12%, adding almost 10 bcf/d, the highest recorded production increase in absolute terms by any country, ever. US LNG has already played a major role in expanding supply, improving security and creating more efficient markets. Whether it is increasing energy security and diversity in Poland or compensating for the disruption of Turkmen supplies in China, American LNG could step into the gap.

We think a further wave is coming. Over the period to 2040, our projections suggest that North America could account for one-third of the increase in global LNG trade, helping to improve market efficiency and supply security. While the pacific coast of Canada is also attracting investment, the large majority of investment will be in the United States. Along with Australia and Qatar, we expect US LNG to play a growing role in meeting market demand in Europe, India, Japan, China and elsewhere in Asia.

However, there are energy security and sustainability challenges to overcome. In particular, the Northeastern United States needs more robust gas pipeline infrastructure to maintain supply security. In addition, more progress needs to be made in reducing methane leakage, a major concern for efforts to address climate change. For years, the IEA has highlighted the need to reduce methane emissions from oil and gas operations, and we are working with countries and leading companies on how to achieve this.

The unique role of the United States – electricity

The United States is also a world leader in technological, policy and business innovation for transforming the electricity system. The share of wind and solar in US power generation is over 8% and growing by 1% per year. 13 states already have a higher share of wind and solar generation than the European average.

The United States is leading innovation in terms of technology and system integration – that is, how to ensure that the power generated by these variable sources is used efficiently and effectively. For example, an average new wind turbine in the United States generates up to twice as much electricity as the global average.

Texas is a notable success story. In the past decade, wind generation tripled while the proportion of curtailed renewable production has been reduced to less than one-tenth. This was a result of policy

reforms, infrastructure investment and better technology. The United States also has a strong manufacturing capability for wind.

In addition, the United States is playing a major role in both regulatory and business model innovation. At both federal and state levels, regulators have pioneered policies that ensure that the electricity grid performs as efficiently and effectively as possible. Last but not least, the wind and solar industries have created a substantial number of jobs, especially in blue collar installation and maintenance.

Nevertheless, the transformation of the electricity system is an unfinished journey. First, the United States needs to continue to build upon successful regulatory and market reforms that have enabled efficient integration of wind and solar. The United States can take advantage of its abundant wind and solar resources. However, doing this in a cost-effective manner and without compromising electricity security will require enhancing power system flexibility.

Addressing this flexibility issue requires a broad portfolio approach including more flexible operation of conventional power plants, continued electricity market integration, and an appropriate regulatory framework that engages consumers in demand response and encourages investment in storage. In addition, renewable producers should be exposed to market signals according to the value and system cost associated with their production.

There are several additional policy challenges that need to be overcome. For example, the US transmission system is segmented, resulting in a number of bottlenecks. There are promising initiatives for new transmission to remove these bottlenecks, including the use of innovative direct current technology, as well as expansion of transmission lines from Canada, but permitting is usually slow and burdensome. Policymakers need to ensure that infrastructure investment is financially attractive and is not hindered by undue administrative burdens. Finally, there is also a need to adopt regulatory models that are adapted to decentralized, bottom-up electricity generation.

The unique role of the United States – other key energy technologies

I believe that one of the greatest strengths of the IEA is that we are an all-fuels, all-technologies agency. We track trends throughout all energy sectors with our detailed, global data, and we use rigorous analytical tools that provide actionable insights to key global actors. With this in mind, let me share some other data and insights I thought you might find useful.

Coal is the second largest energy source in the world after oil, and while demand actually grew slightly over the past two years, our expectation is that demand worldwide will continue to plateau. Most future coal demand will be driven by power generation in emerging Asian countries.

75% of the current global coal-fired power fleet is in Asia, and Asian coal plants are only 12 years old on average. This is much younger than those in the United States, where coal plants are 45 years old on average. Given this young Asian fleet, technology innovations will be critical to balance the future of coal with environmental sustainability concerns.

The United States has made major progress on ***carbon capture, utilisation and storage*** (CCUS), especially with the passage of the 45Q tax credit legislation. We believe this vital legislation – and congratulations to all who were involved in its passage – will create a viable business model for various CCUS opportunities. Let me add – including from my co-chairing recent CCUS summits (one of which I

had the privilege to co-chair with Secretary Perry) – that we are optimistic about the investment appetite for CCUS projects. In short, we applaud the new policy design and US leadership.

Previous approaches to CCUS around the world have tended to be top-down and focused on handpicked projects. 45Q puts a value on this important clean technology and helps unleash the innovation and business savvy of the private sector. No doubt, there will be a continued need for fine tuning, but in this field the United States has clearly taken a strong global leadership role.

This kind of innovation will be crucial to reducing emissions in both the United States and worldwide. The good news is that since 2000, the United States has cut emissions by 800 Mt – the largest decline in the world by any country in absolute terms. While there was a 3% increase in emissions in 2018, our analysis shows that weather conditions – an unusually cold winter and hot summer – accounted for a large part of this increase.

I also believe that ***nuclear*** should be seen as a key asset in the United States. The United States has been a leader in nuclear power generation technology for 60 years, alongside France, Japan and Russia. The new leader is set to be China, if US policies don't change.

China has rapidly developed nuclear power over the past two decades, increasing from just 3 operating reactors in 2000 to 46 at the end of last year. Nuclear capacity in China is set to overtake that of the United States within ten years.

Nuclear still generates twice as much low-carbon electricity in the United States as wind and solar combined. The baseload capacity of nuclear power plants also plays a major role in maintaining electricity security. This is especially true in the Northern regions of the United States which experience spikes in electricity and gas demand during extreme cold spells like the recent polar vortex – times when solar production can be challenged. Nuclear plants also provide frequency control and other system services as well.

There is today significant international appetite for innovative approaches to nuclear power, including small modular reactors (SMRs). SMRs can offer significant benefits, such as factory fabrication, flexibility in where they can be deployed and lower upfront investment. This is yet another opportunity for American innovation to play a leading role.

That all said, nuclear in the United States is facing major challenges. Without effective policy action the United States will be on track to lose a substantial proportion of its capacity. From my vantage point, this would be detrimental to both energy security and clean energy objectives.

A first priority should be to safeguard the existing fleet. Nuclear plant lifetimes should be extended as long as safety considerations allow. In large parts of the United States this presents a challenge, as wholesale markets don't value the energy security and clean energy contribution of nuclear. In order to safeguard the long term contribution of nuclear, the United States also needs to continue to accelerate innovation in new nuclear technologies, including SMRs.

Chairman Murkowski, Ranking Member Manchin and distinguished Members of the Committee, thank you again for the opportunity to appear before you today and, even more importantly, thank you for your continued support on behalf of the International Energy Agency.