



ENERGY FUTURES
— INITIATIVE —

WORKSHOP SUMMARY

Energy Security and Economic Interdependence in the U.S.-Asia Relationship

March 2022

ABOUT ENERGY FUTURES INITIATIVE

The Energy Futures Initiative (EFI) advances technically grounded solutions to climate change through evidence-based analysis, thought leadership, and coalition-building. Under the leadership of Ernest J. Moniz, the 13th U.S. Secretary of Energy, EFI conducts rigorous research to accelerate the transition to a low-carbon economy through innovation in technology, policy, and business models. EFI maintains editorial independence from its public and private sponsors. www.energyfuturesinitiative.org.

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REPORT SPONSORS

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Workshop Framing

The Energy Futures Initiative hosted a workshop on “Energy Security and Economic Interdependence in the U.S.-Asia Relationship” on February 8, 2022. This workshop marked the formal launch of Phase Two of EFI’s *Future of Natural Gas in a Deeply Decarbonized World* study. Close to 100 representatives from government, industry, academic, and non-profit organizations from around the world joined the workshop to discuss various energy, economic, geopolitical and climate security dimensions of U.S. LNG exports.

Phase One of EFI’s [The Future of Natural Gas in a Deeply Decarbonized World](#) study sought to inform the ongoing debate on the role of natural gas as a transition fuel to a lower-emissions future and provide clear insights on how natural gas is consumed and viewed in different regions of the world, both now and in the future, and how this might affect U.S. policy. EFI held eight workshops in 2021 with experts and stakeholders from key regions across the world to explore the role of natural gas in the transition to low- and zero-carbon energy systems in those regions and globally.

EFI’s first report, published in June 2021, summarized the findings from these workshops and explored a range of issues in the context of global and regional energy policy, climate policy, trade, investment options, and geopolitical and energy security implications. Observations shared by participants in all regions are summarized in Figure 1.

Figure 1. Phase I, The Role of Natural Gas in a Deeply Decarbonized World: Cross-cutting Issues from Eight Workshops



As noted, this workshop launched the second phase of EFI’s study and was held at a time of rapidly changing dynamics for natural gas markets, where geopolitics, the supply crisis, and the energy transition raise critical issues for Asian natural gas markets. The results of the workshop, summarized here, will inform the broader analysis of Phase Two of the study, which will investigate the future of international and regional natural gas and clean fuels markets, with a specific focus on Asia, Europe, and North America. The Ukraine crisis makes these areas of focus and the analysis very timely and important from both geostrategic and climate change perspectives.

Participants, in framing the discussion, noted that the price of LNG is dramatically increasing and that there are serious concerns about stability of the supply of gas because of the Ukraine crisis.

Concerns are very high in Japan and Asia which depend heavily on LNG, including imports from the U.S. They noted the value of U.S. gas to our allies and for China, and that the U.S. option enables the region to be less reliant on gas from Russia and the Middle East/North Africa. There was a strong view that the U.S. is a much more stable and flexible LNG supplier, with fewer constraints and the ability to adjust to market needs quickly.

Participants also acknowledged that there is “a strong headwind against LNG and natural gas” in the context of a strong push for carbon neutrality. They noted the view that while coal is a greater problem, natural gas is viewed as a key contributor to climate change and that many policymakers and interest groups believe that all gas projects should be stopped and that no more

investments should be made in gas production and infrastructure, including LNG.

The Ukraine crisis however raises questions about these arguments and strongly suggests that upstream and midstream investments, as well as investments in LNG export infrastructure, are needed to secure sufficient supply and LNG exports for U.S. trading partners and allies. Most participants thought that financing for upstream projects should be available. Many noted that natural gas will be a major source of blue hydrogen and ammonia and that gas can be decarbonized with CCS to make the transition to carbon neutrality possible. Many also expressed the view that the geostrategic and economic value of the U.S.-Asia LNG relationship would be reconfirmed and considered in decision-making relative to the crisis in Ukraine.

Another critical framing issue expressed by participants was that the U.S. was committed to “accelerating its clean transition at unprecedented scale and pace, while, at the same time, ensuring that people have affordable reliable secure energy throughout transition.” There was support expressed for the ongoing need to meet the energy needs of our allies, for whom U.S. LNG is a vital energy source, especially for Japan and South Korea. Participants expressed the view that gas supply needs to be available to ensure stability in the region and that this is especially important where infrastructure is already in place, and where there are climate benefits from fuel switching from coal to natural gas. At the same time, going forward, climate impacts will need to be considered for the buildout of all new U.S. energy infrastructure, including natural gas.

DYNAMICS OF THE ROLE OF NATURAL GAS IN THE CONTEXTS OF GEOPOLITICS, SUPPLY CRISIS, AND ENERGY TRANSITION

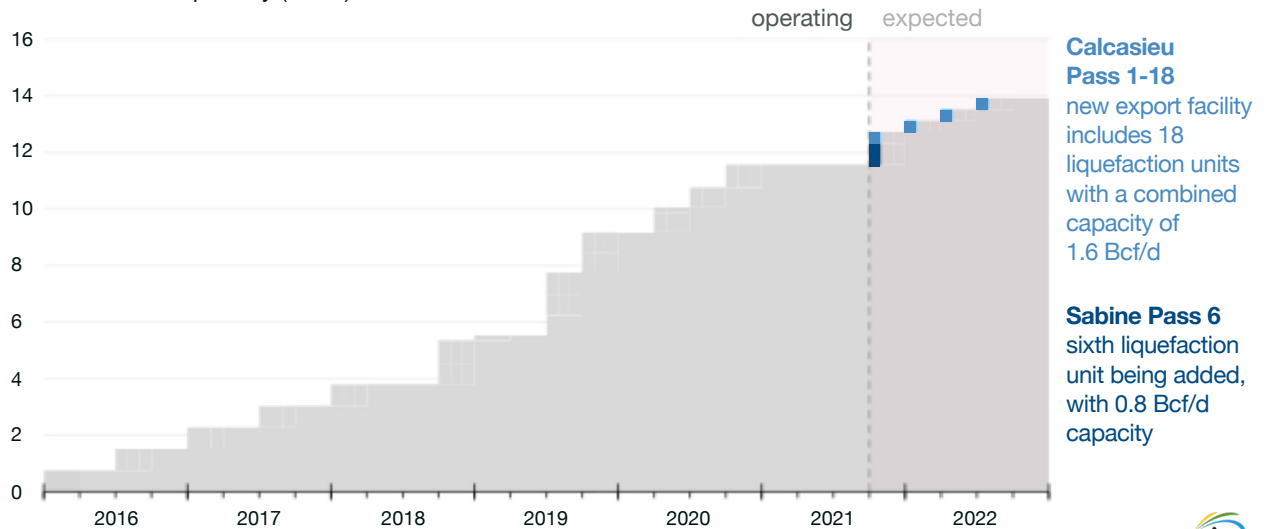
Political tensions in Europe have raised concerns about natural gas prices and supply adequacy across the globe. Recently, Germany halted the Nord Stream 2 Baltic Sea gas pipeline project, which was expected to double the supply of Russian gas to Germany, in reaction to Russia’s recognition of the self-proclaimed republics in east Ukraine.ⁱ Fatih Birol, the head of IEA, noted that in the last quarter of 2021 Gazprom had reduced gas exports to Europe by 25% compared to the previous year, and that this action was taken at the same time there are “heightened geopolitical tensions over Ukraine.”ⁱⁱ

The events in Ukraine and their impact on global and regional energy security needs underscore the critical importance of the climate, geostrategic, energy security, and economic implications of U.S. LNG exports for its allies and trading partners. The U.S. is now the number one natural gas producer in the world and has a robust natural gas export infrastructure. In fact, the Energy Information Administration (EIA) forecasts that in 2022, the U.S. will be the largest LNG exporter in the world (Figure 2), a position that is supported by abundant domestic natural gas supplies and a robust midstream pipeline infrastructure.

Figure 2. U.S. Liquefied Natural Gas Export Capacity Will be the World's Largest in 2022ⁱⁱⁱ

U.S. quarterly liquefied natural gas peak export capacity (2016-2022)

billion cubic feet per day (Bcf/d)



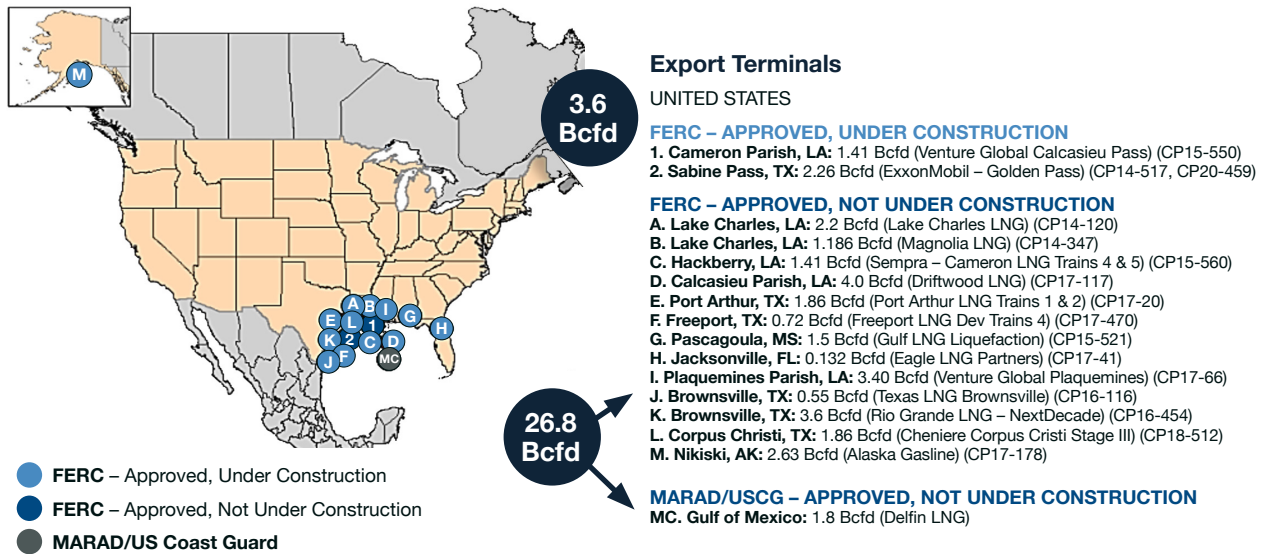
Source: EIA, 2021



Total U.S. LNG exports increased by almost 970% between 2015 and 2020. Total U.S. exports of LNG via vessel increased 120% between 2018 and 2020 alone. Importantly, in 2020, 100% of U.S. LNG exports went to OECD countries; 65% went to G20 countries; and 25% to G7 countries.

Figure 3 offers a slightly different perspective on U.S. LNG exports, showing approved facilities under construction, and approved facilities not under construction. It should be noted that those facilities under construction are fully subscribed as are several of those not yet under construction.

Figure 3. Approved North American LNG Export Terminals, Under/Not Under Construction as of February 26, 2022^{iv}

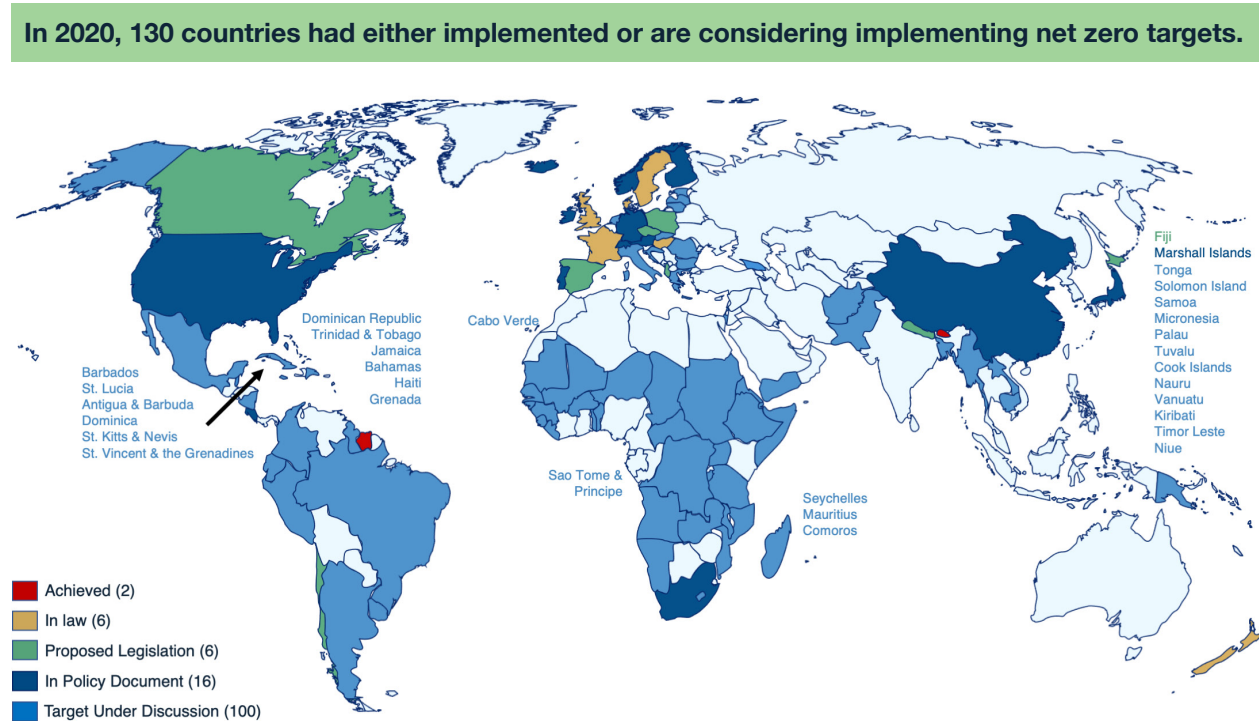


Source: Federal Energy Regulatory Commission, 2022

Concerns about climate change and the lack of clarity around the future of fossil fuels, especially natural gas, have been further exacerbated by the challenging geopolitical developments in Eastern Europe and fierce competition for extant LNG supplies in increasingly globalized markets. All these developments have pushed natural gas prices, and fuel prices more broadly, to historic highs all over the world.

At the same time, the dialogue around the role of natural gas as a “transition fuel” in the global energy transition to decarbonized economies has changed rapidly in recent years. The global push for net zero targets is growing. Figure 4 shows the number of countries in 2020 (note the U.S. is added to this figure per Biden Administration policies in 2021) that had net zero targets in law or policy or are considering net zero targets.

Figure 4. Countries that Have Met, Have Laws, Policies, Proposals Under Discussion for Net Zero Emissions Targets, 2020^v

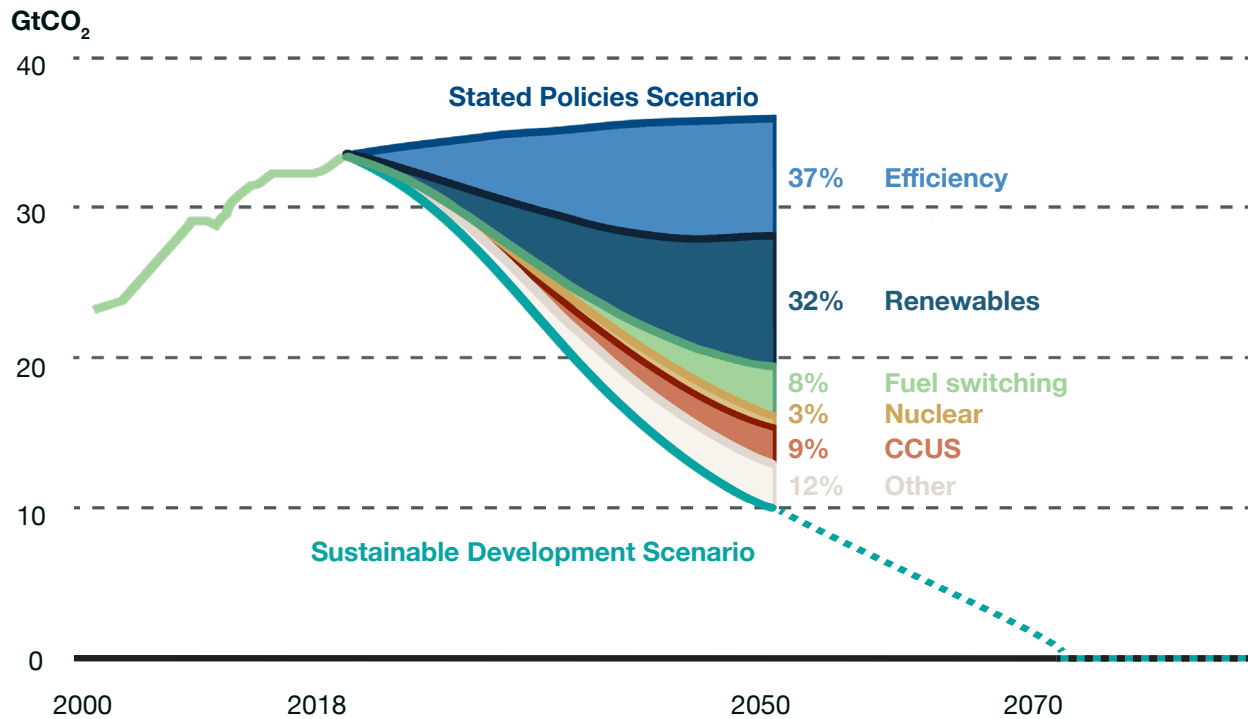


Source: Net Zero Tracker

The May 2021 International Energy Agency (IEA)'s Net Zero by 2050 report reinforced the need to sharply reduce demand for and uses of all fossil fuels, including natural gas.^{vi} While this scenario describes large reductions in gas use, it also suggests a continuing (if evolving) role for natural gas in a net-zero compliant world. It – and current events – also beg additional questions and analyses for understanding whether natural gas should provide a “short bridge” or “longer bridge” in its role as a transition fuel.

Another IEA scenario, the Sustainable Development Scenario, says, “It is virtually impossible to reach net zero without CCUS.” Figure 5 shows the contributions of CCS to meeting net zero targets by 2070 relative to its Stated Policies Scenario (also shows the value of fuel switching).

Figure 5. Energy-related CO₂ Emissions Reductions by Source in Needed in IEA's Sustainable Development Scenario Relative to its Stated Policies Scenario^{vii}



Source: Adapted from IEA, 2019

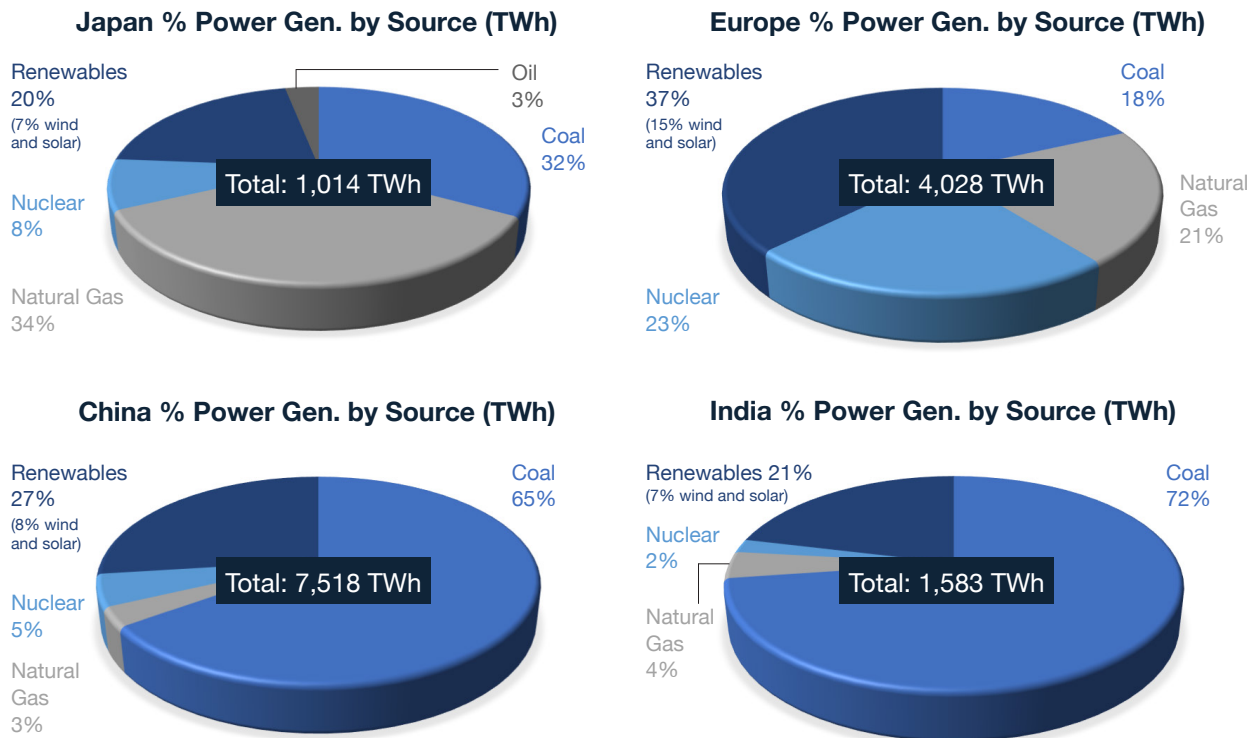
In this context, it's also important to understand power generation mixes in several large emitting countries/regions of the world. Figure 6 shows power generation sources in Japan, Europe, China, and India.

The high percentage of coal generation in India and China underscore the value of fuel switching from coal to gas for emissions reduction and the importance of U.S. LNG imports. In Japan, natural gas is the largest source of power generation and in Europe, it's the third largest source at 21% but is only slightly less than the largest source, nuclear (23%) and other renewable, largely hydro (renewables are split at 15% wind and solar, 22% other renewables); this highlights the ongoing need

for gas and a thoughtful, planned transition that supports both deep decarbonization and reliability.

The recent Conference of the Parties (COP) 26 in Glasgow, Scotland followed on a wave of net-zero pledges from some of the world's largest and highest-emitting economies (the United States, Japan, China, and others). Natural gas was increasingly grouped together with other fossil fuels throughout negotiations at COP26, with limited public acknowledgment from the key parties present on the role of gas as a transition fuel or contexts where fuels switching to natural gas might still achieve substantial near-term emissions reductions. The United States and nineteen other countries, for example, signed the

Figure 6. Power Generation in Selected Countries/Regions by Source, 2019^{viii}



pledge to end all international public financing for fossil fuels – including natural gas infrastructure – except for very limited circumstances.

On natural gas in Europe, on January 1, 2022, the European Union released a statement noting that:

“Taking account of scientific advice and current technological progress, as well as varying transition challenges across Member States, the Commission considers there is a role for natural gas and nuclear as a means to facilitate the transition towards a predominantly renewable-based future. Within the Taxonomy framework, this would mean classifying these energy sources under clear and tight conditions (for example, gas must come from renewable sources or have low emissions by 2035), in particular as they contribute

to the transition to climate neutrality... In addition, to ensure transparency, the Commission will amend the Taxonomy Disclosure Delegated Act so that investors can identify if activities include gas or nuclear activities, and to what extent, so they can make an informed choice. The activities covered in this complementary Delegated Act would accelerate the phase out of more harmful sources, such as coal, and in moving us towards a more low-carbon greener energy mix. As for the other activities under the Taxonomy Regulation, the criteria for the gas and nuclear activities will be updated as technology evolves.”^{ix}

It was clear at the workshop that there is a strong commitment to decarbonization and that, Glasgow notwithstanding, natural gas will continue to play a role in both meeting energy security and climate

needs. Given the EU's announced position and the Ukraine crisis, a participant noted that Europe may become the premium market for U.S. LNG, rather than Asia, although China has been buying up a lot of long-term contracts.

A participant also noted that LNG will likely be important for decades even as we work toward achieving net zero and that “producers may see feast before there is famine. Divestment pressures will hit public companies before it hits state owned enterprises”.

Other key framing issues:

- **Is LNG and natural gas a source of geopolitical power?** The old geopolitics of energy has largely been focused on OPEC and oil.
- **Energy transitions take a long time and tend to be very difficult, with many pitfalls and diversions along the way.** The scale and pace of this transition – rapidly transforming energy systems to meet mid-century decarbonization targets and needs is unprecedented.
- **Hydrogen trade will increase but could be bumpy.** The worst thing for the transition would be a low carbon fuel shock just as the hydrogen economy is just taking off.
- **There is a concern that transition could exacerbate anti-globalization trends and could damage the U.S.-Asia energy and trade relationships.** This shifting power from West to East.

THE SIGNIFICANCE OF ASIAN NATURAL GAS MARKET

Asia is currently the number one destination for U.S. LNG exports, although U.S. exports to Europe in 2020 increased dramatically and volumes were almost as large as those to Asia. The mounting pressure to resist building or financing any new natural gas infrastructure in the U.S., including LNG infrastructure, has raised concerns throughout Asia that the region's energy and economic security could be undermined by policies that could reduce or eliminate the availability of abundant and affordable supplies of LNG, a key transition fuel for the region.

LNG exports from a range of suppliers have created a more liquid gas market but this market must be adequately supplied on an ongoing basis to meet critical needs for importing countries. Many Asian governments believe strongly that ample U.S. LNG supplies are critically important for ensuring diversity and security of supply, deterring price discrimination, and preventing any single supplier from manipulating gas markets for geopolitical gain in an increasingly competitive global gas market.

Although there is significant U.S. LNG capacity approved and/or under construction, questions remain about limitations on U.S. domestic natural gas production, pipeline approvals, new requirements for LNG export facility approvals, and an evolving posture on public, multilateral, and private financing for natural gas infrastructure. These issues have raised concerns with U.S. allies in Asia that the cumulative impact of these and other policies could chill investment in new gas infrastructure around the world.

WORKSHOP FORMAT AND PARTICIPANTS

The workshop had three sessions: (1) The Economic Impacts of U.S.-Asia Energy Trade; (2) The Role of U.S. LNG in Energy Transition of Asian Economies; and (3) The Geostrategic Role of U.S.-Asia Energy Trade. Speakers were asked to provide brief remarks or presentations, depending on the sessions.

Session 1 focused on the Economic Impacts of U.S.-Asia Energy Trade and included a presentation of the EFI's Global Gas Study Phase One results and a presentation of IEEJ's recent study covering the importance of U.S. LNG to the energy transition and U.S. economy.

Session 2 focused on the role of U.S. LNG in the Asian energy transition. This session included discussion on the current role of LNG in supporting energy, economic, and environmental goals in the region, how U.S. LNG specifically can support these goals and what considerations should U.S. LNG developers bear in mind as exporters to the region. The framing questions of the session are:

- What is the current role of LNG in supporting energy, economic, and environmental goals in Japan/Korea/developing Asia? What is LNG used for, power or industry? Does it have a role in deep decarbonization in any sector?
- How might policy commitments made by governments and the private sector at COP26 in Glasgow change the place of LNG in the region's

energy mix? How might it impact investment in LNG supply or receiving infrastructure?

- Can U.S. LNG contribute to lower emissions in East Asia, and how could these emissions benefits be maximized?
- What environmental and climate considerations should U.S. LNG developers bear in mind as they export to East Asian countries? [e.g., supply chain methane emissions and efforts to reduce/track them]

Session 3 focused on the geostrategic issues associated with the U.S.-Asia energy trade. This session included discussions of the role of U.S. LNG in supplying and stabilizing the global natural gas market; how U.S. LNG supports Asian energy security amid decarbonization; and what steps importers might take to ensure regional stability and availability of supply. The framing questions of the session were:

- What is the role of U.S. LNG in supplying and stabilizing the global natural gas market? How might this role evolve in the coming years and decades?
- What steps can or should importers take to support market stability and security of supply, such as market/regional interconnection or coordinated storage of natural gas?
- How does U.S. LNG factor into the broader discussion of energy security in Asia as the region pursues decarbonization amid accelerating economic and population growth?

KEYNOTE SPEAKERS

Ernest J. Moniz,

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David Turk,

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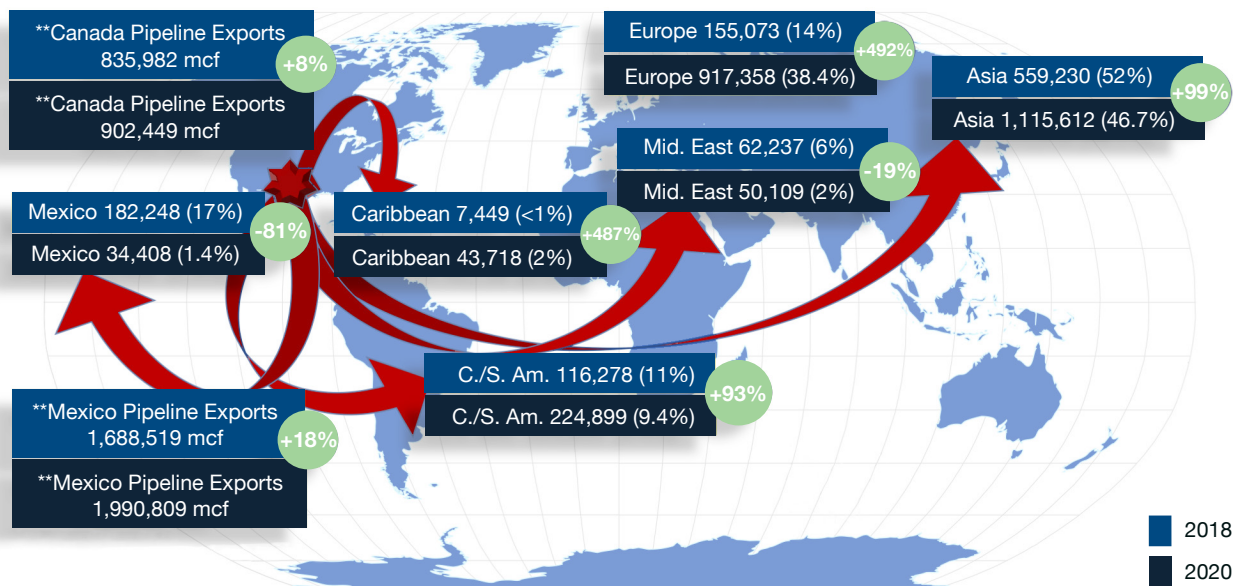
David Goldwyn,

President,
Goldwyn Global Strategies, LLC

Workshop Summary and Findings

The dynamics of global and regional natural gas markets are rapidly evolving in the contexts of geopolitics, supply challenges, and the increasing commitments to deep decarbonization. The last several years have witnessed major shifts in the role of U.S. LNG in major regional export markets: between 2018 and 2020, U.S. LNG cargoes to Europe increased by a factor of five, while Asia—the region importing the most U.S. LNG in the world—doubled its demand (Figure 7).

Figure 7. U.S. LNG Vessel/Pipeline Export Destinations by Region, total volume (mcf) & %*, 2018 and 2020



*trucked volumes not included, **pipeline exports, not included in total/% for regional LNG exports, numbers are rounded

Source: EIA website

Increased Asian demand is likely to continue as new infrastructure is built there and in the U.S: as of April 2021, the total capacity LNG export terminals under construction in the United States

is 8.4 billion cubic foot per day (bcfd), almost as much as all the country's exports in 2021. The total capacity of the terminals already approved but not yet under construction is 24 bcfd.

In 2020, 37 countries received U.S. LNG via vessel. The top 15 importers by volume in 2020 were: S. Korea; Japan; China; Spain; the UK; India; Turkey; Brazil; France; Netherlands; Chile; Italy; Taiwan; Greece; and Portugal. These 15 countries represented 86% of total U.S. export. It's not just total volume, however, it's a dramatic increase in demand in just two years. Large percentage increases of U.S. LNG imports between 2018 and 2020 of the top 15 importers are: Japan (129%); South Korea (25%); Taiwan (285%); China (137%); India (116%); Chile (96%); Italy (294%); Turkey (434%); Portugal (195%); France (393%); the UK (212%); Netherlands (602%); Brazil (214%); Spain (1893%); and Greece (1200%).

The geopolitical role of natural gas could be a major driver of future developments in the international market for LNG, as has been made particularly vivid through the events in Europe in early 2022. Due to low levels of domestic production in Western Europe, the region relies on imported gas from Russia, the U.S., and the Middle East. Russian reliance could significantly increase pending completion of Nord Stream 2.

Increased power sector gas demand through electrification and fuel switching—and later, through hydrogen production—could further increase foreign reliance. Amidst these trying circumstances, U.S. LNG has played an important role in diversifying supply away from Russia, helping moderate prices and increase security of supply during a difficult period in Europe.

Another driver of global LNG markets is the sustainable investment movement. In North America, companies face increasing pressure for clean energy investments and for natural gas with lower supply chain emissions, if the fuel is deemed acceptable at all. In Europe, the EU's inclusion of natural gas in its green financing criteria

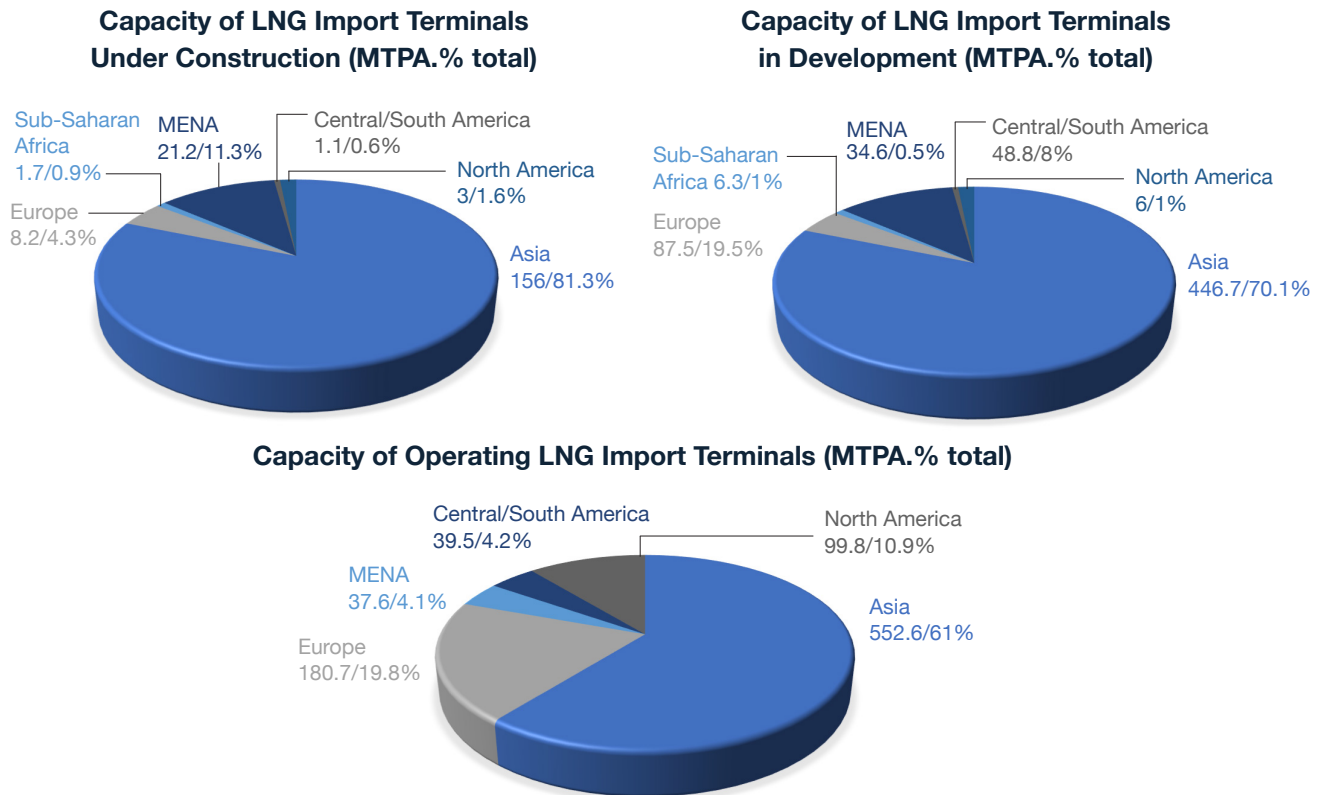
Key Framing Issues

- **Is LNG and natural gas a source of geopolitical power?** The old geopolitics of energy has largely been focused on OPEC and oil.
- **Energy transitions take a long time and tend to be very difficult, with many pitfalls and diversions along the way.** The scale and pace of this transition – rapidly transforming energy systems to meet mid-century decarbonization targets and needs – is unprecedented.
- **Hydrogen trade will increase but could be bumpy.** The worst thing for the transition would be a low carbon fuel shock just as the hydrogen economy is just taking off.
- **There is a concern that transition could exacerbate anti-globalization trends and could damage the U.S.-Asia energy and trade relationships.** Shifting power from West to East is another tenet to be considered for energy transition.

framework could provide a counterpoint to souring retail and institutional investor sentiment.

Understanding regional LNG supply and demand is important for understanding the geostrategic importance and value of LNG. Figure 8 reinforces the workshop discussion on LNG demand. It shows the capacities of existing LNG import facilities, those under construction and facilities in development (under construction and planned) by world region. It is important to note that existing global LNG import/regasification facilities as of

Figure 8. Capacity of LNG Import Terminals, Operating, Under Construction, in Development (MTPA/% of world total)^x



As of 06/06/21

Source: Global Fossil Infrastructure Tracker

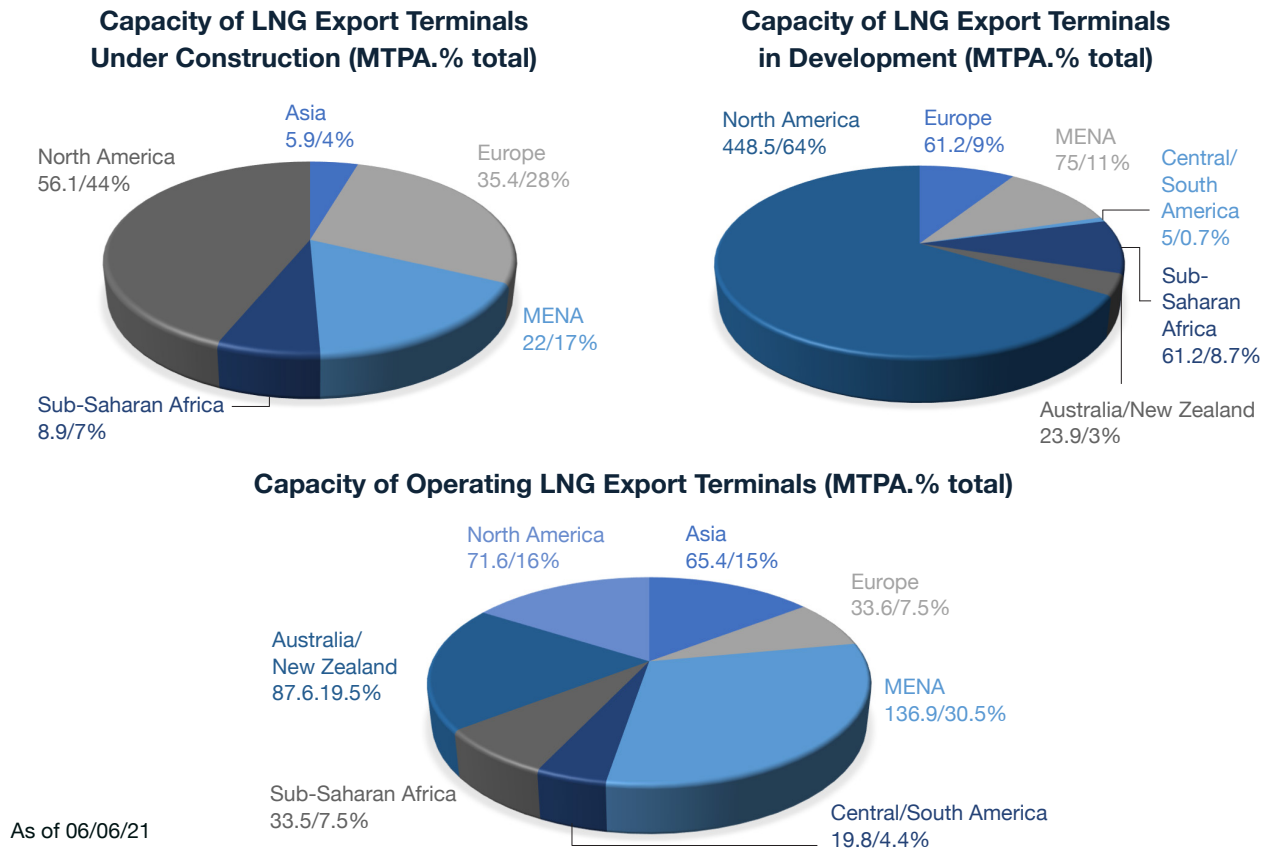
June 2021, including facilities under construction totaled 1102 million tons per year; 64% of this demand is in Asia.

Figure 9 also underscores key points made in the workshop about LNG supply and suppliers. It shows the capacity of existing LNG export facilities, capacity of those under construction and those in development (under construction + planned). Total volumes of existing export terminals and those under construction totals 576 MTPA, just over half that of import demand; 64% is in North America.

Planned capacity is critical for making up this shortfall. When one subtracts volumes “under construction” from total volumes “in development”, the total “planned” export capacity is 571 MTPA; 48% of this planned capacity is in the U.S.

The Ukraine crisis underscores the need for additional capacity. First, Russia is looking for new markets for its gas. Russia has demonstrated its lack of reliability on many levels; it is not in the strategic interest of the U.S. or its trading partners for Russia to fill that gap. Also, while meeting the immediate needs of Europe in the crisis is essential,

Figure 9. Capacity of LNG Export Terminals, Operating, Under Construction, in Development (MTPA/% of world total)^{xi}



Source: Global Fossil Infrastructure Tracker

the largest recipients of U.S. LNG exports are South Korea and Japan. One participant noted, “It is very important for all of us to weigh in with our government to talk about free flow of molecules, to get those permits out to show that we can do this as cleanly as possible, provide data and assurances to governments that we are bending the curve.”

SESSION 1. ECONOMIC IMPACTS OF U.S.-ASIA ENERGY TRADE

Growing LNG and hydrogen exports could provide tens of thousands of jobs and billions of dollars of

economic value to the U.S. economy. Participants discussed recent analysis of the economics and jobs impact of increased LNG export, finding that under a range of scenarios U.S. GDP contributions could reach as high as \$38 billion annually with direct and indirect employment reaching 58,000 (Figure 10).

Alternatively, the U.S. could export hydrogen produced using natural gas. Analysis by IEEJ concludes that the U.S. would realize substantial economic benefits from the development of a blue hydrogen based global market. Its analysis, shown in Figure 11, specifically indicates that U.S. blue hydrogen exports could have a market value as

high as \$80 billion by 2050 (sevenfold the value of 2020 LNG exports).

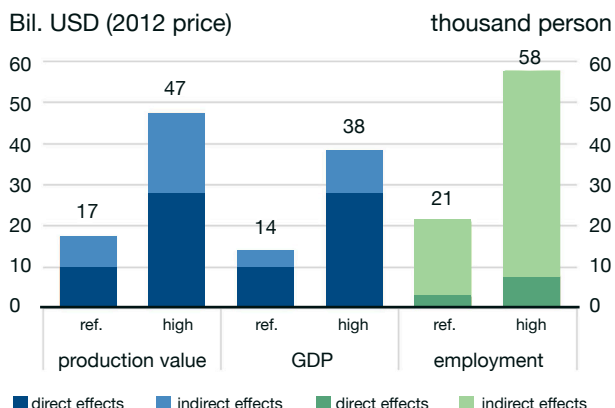
SESSION 2. THE ROLE OF U.S. LNG IN ENERGY TRANSITION OF ASIAN ECONOMIES

The U.S. and its allies in Asia share a commitment to the clean energy transition, providing opportunities for shared benefits to clean energy technology development. The Biden Administration in the United States has set ambitious decarbonization targets, and the U.S. Department of Energy is advancing technological solutions to meet those targets across a range of RD&D (research, development, and demonstration) and financing programs. The climate solutions under development in the U.S. could support Japan and other Asian allies' efforts to achieve their own climate targets and ensure access to affordable, reliable, and secure energy throughout the ongoing global clean energy transition.

Participants highlighted several specific areas of shared interests, including on issues such as methane management, advancements in carbon capture, long-duration energy storage and much more; and that the Biden administration remains committed to a close international partnership on these and other technologies. One of the participants noted that there were currently few regulatory challenges to building LNG infrastructure in the U.S. The issues were instead commercial; the dominant factor for who is building what and who can get long-term contracts and the associated financing.

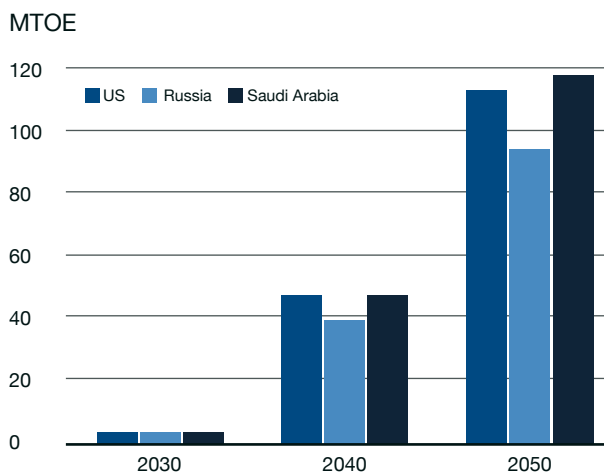
Natural gas will continue to play a critical role in Asia. Participants generally agreed

Figure 10.
Impact of LNG Exports on the U.S. Economy by 2030 in Two Scenarios



Source: IEEJ

Figure 11.
The Potential Value of U.S. Blue Hydrogen Exports



U.S. blue hydrogen export rises up to 113 MTOE in 2050, second largest after KSA

Hydrogen export value amounts at 80 billion USD in 2050, 700% of LNG export value in 2020

Source: IEEJ, IEEJ Outlook 2022

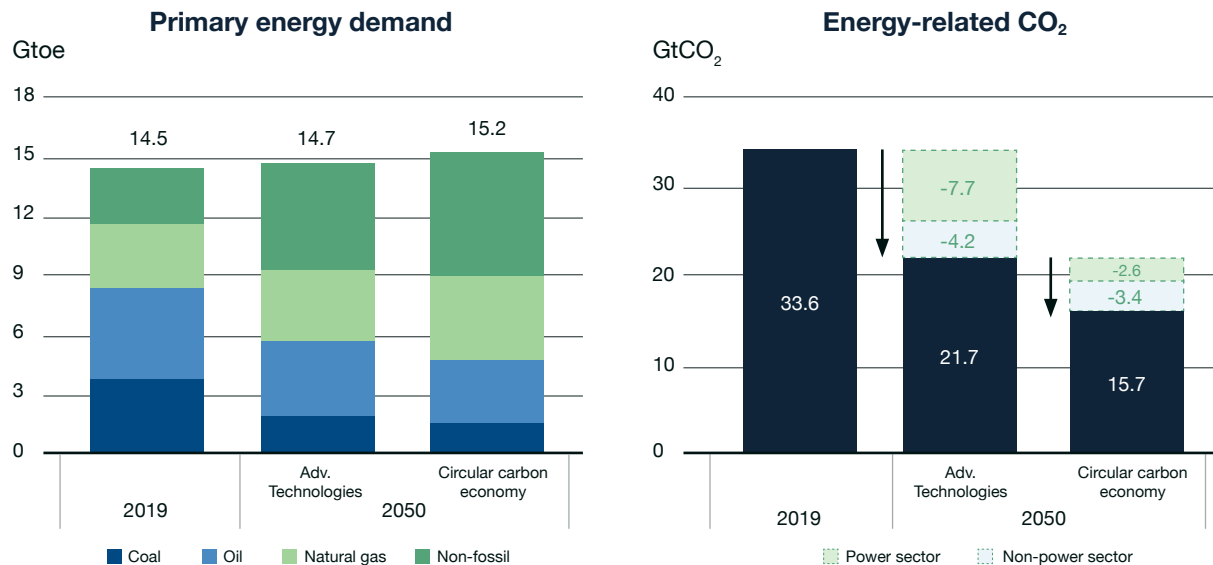
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on the importance of natural gas for energy security, economic development, and the energy transition in Asia; one participant suggested that LNG can help Asian countries “smooth the energy transition with minimal costs.” The demand of natural gas has been increasing and is expected to continue to grow in the region. In Southeast Asia, the demand for natural gas is expected to grow by two or three-fold driven by coal-to-gas switch in power generation and a growing demand for blue hydrogen and ammonia. In Korea, the demand for natural gas across all sectors is expected to grow, especially in the power sector; the countries target of 40% emissions reduction by 2030 implies a 44% reduction from the power sector. Renewable energy resources alone will be insufficient to reach that goal, participants said, and coal-to-gas fuel switching, as well as clean hydrogen production, would likely be needed and are enabled by continued LNG imports. Figure 12, from IEEJ’s 2022 Outlook, shows the value of clean hydrogen to CO₂ reductions. Because of the value of blue hydrogen to deep decarbonization in the Advanced Technologies Scenario (ATS) and Circular Carbon Economy Scenario (CCE), some participants voiced the view that, “gas is not just a bridge.”

Key Questions

- **What is the current role of LNG in supporting energy, economic, and environmental goals in Japan/Korea/developing Asia?** What is LNG used for, power or industry? Does it have a role in deep decarbonization in any sector?
- **How might policy commitments made by governments and private sector at COP26 in Glasgow change the place of LNG in the region’s energy mix?** How might it impact investment in LNG supply or receiving infrastructure?
- **Can U.S. LNG contribute to lower emissions in East Asia, and how could these emissions benefits be maximized?**
- **What environmental and climate considerations should U.S. LNG developers bear in mind as they export to East Asian countries?** [e.g., supply chain methane emissions and efforts to reduce/track them]

Figure 12. Clean Hydrogen Contributes to Substantial CO₂ Reductions Without Reducing Fossil Fuel



Fossil fuel consumption in the CCE scenario is almost the same as that in the ATS. Demand for natural gas for hydrogen production will increase slightly.

On the other hand, the CO₂ emissions decline significantly. The center of gravity for emission reductions is shifting to the non-power generation sector.

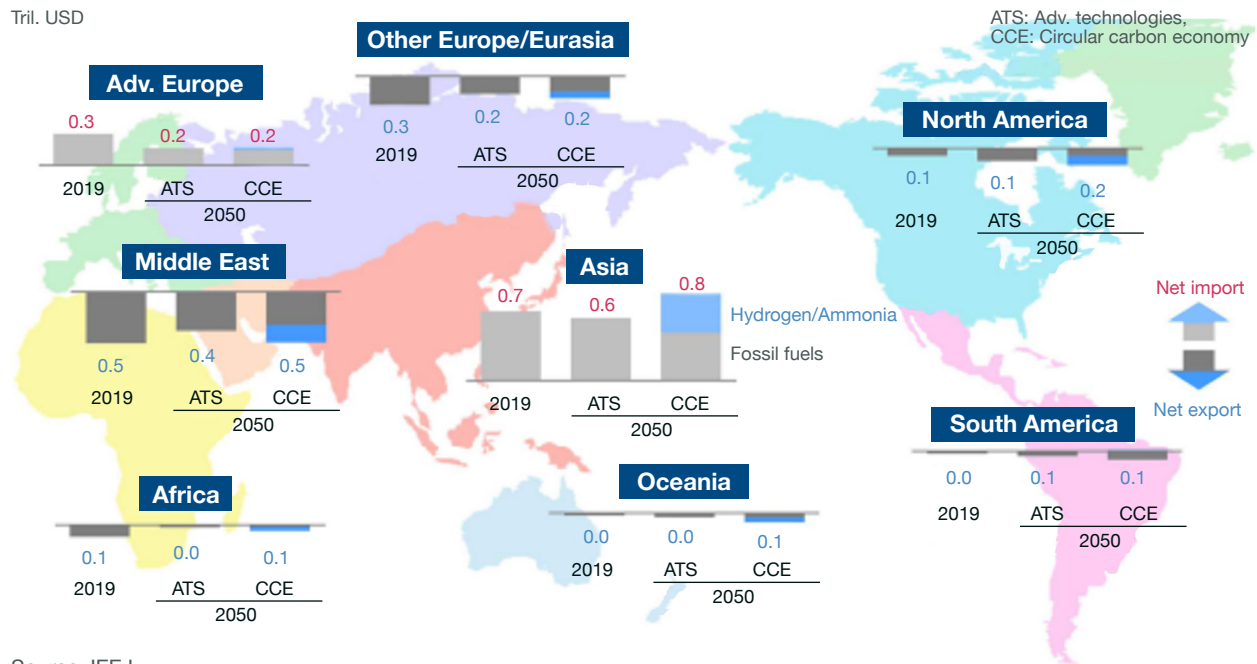
Source: IEEJ, IEEJ Outlook 2022

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Ambitious clean hydrogen initiatives in Asia also suggest continued importance for natural gas in a deeply decarbonized future. Another role natural gas could play in supporting Asia's emission reduction targets is through its use for producing clean hydrogen or hydrogen carriers like ammonia. Workshop participants envisioned the possibility that hydrogen was produced in Asia using imported LNG, or exported directly from natural gas-producing regions like the U.S. While there is great potential clean hydrogen in the energy transition, the technologies for

producing hydrogen at the scale of an energy commodity and greatly reducing/eliminating emissions from its production are still in relatively early stages; natural gas will still be needed before these technologies are widely deployed. Another discussant added that a stable supply of natural gas will be essential as backup for power generation while these nascent technologies are being developed. Figure 13, from IEEJ analysis, shows the regional importance of clean hydrogen in advanced technology and circular carbon economy scenarios.

Figure 13. Trade Plays an Important Role in Advanced Technology and Circular Carbon Economy Scenarios



Source: IEEJ

The inability to finance new natural gas infrastructure could lead to increased emissions in the region. The displacement of existing or potential coal demand using natural gas is anticipated to be a major pillar of regional climate policy in some countries. In that light, participants questioned narratives that link coal and natural gas together as fossil fuels that require immediate phase-out and divestment. They noted that the transition from coal to gas, especially in Asia, would mandate greater—not less—investment in gas infrastructure such as downstream natural gas power plants. Absent these investments, the necessity to meet growing energy demand may force countries to turn toward coal, undermining the climate benefits sought by those proposing eliminating divestiture from fossil fuel infrastructure.

Additional natural gas infrastructure is needed, and investment certainty on the U.S. side can help improve financing on the Asian side.

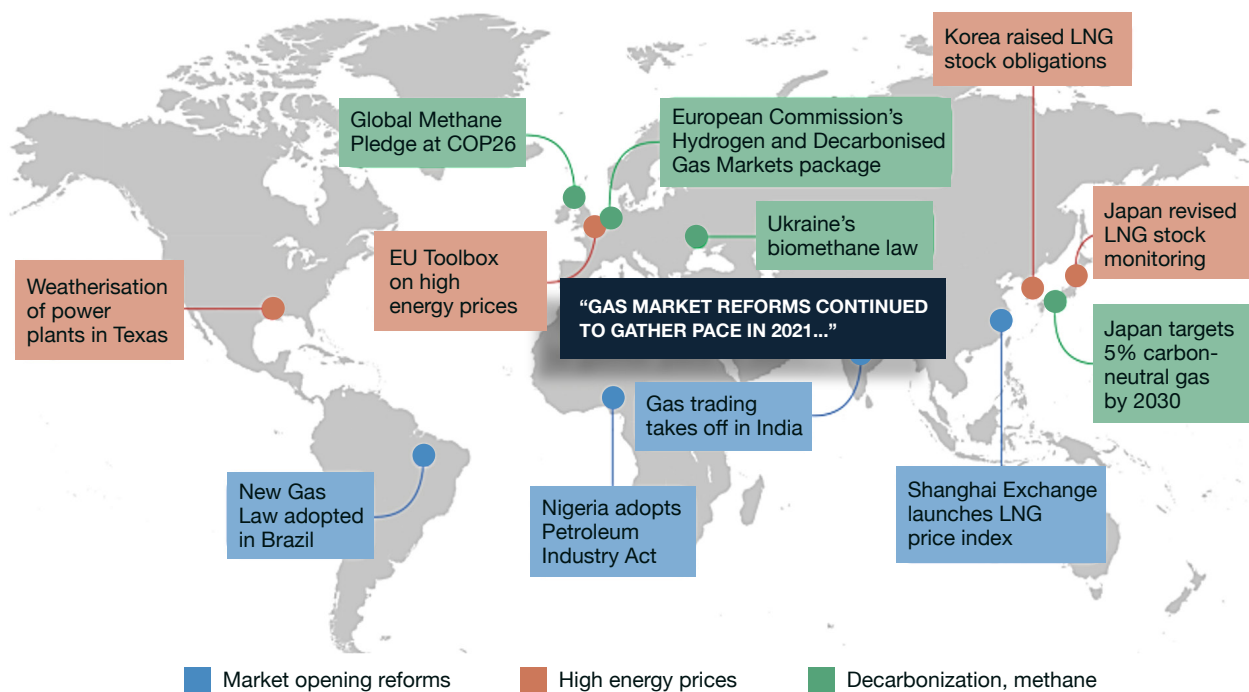
There was general agreement on the needs of investments in infrastructure for additional supply of U.S. LNG. One panelist noted that the U.S. is not supply constrained but rather infrastructure constrained: the United States has sufficient supply to meet not only the U.S. demand but global demand. They suggested that global natural gas demand has not yet peaked, and decisions to build natural gas infrastructure with very long lead times should be made anticipating this future demand. The panelists from Asian countries asserted that their investments in new natural gas infrastructure hinge on the availability of future supply; a clear and consistent message that LNG infrastructure will be built in the United States will help better rationalize demand-side investments.

Every opportunity should be taken to reduce natural gas production/supply chain emissions.

Participants stressed the need to “green” natural gas production and supply chains so natural gas infrastructure can support, not undermine, low carbon policy ambitions, can be financed, and can receive regulatory approval. One participant said that the supply chain of LNG should be as clean as possible to ensure LNG can play the strongest possible role in decarbonization; without such reductions, politicians and policy makers will look to other sources of energy to meet demand.

Figure 14 highlights major gas market reforms in 2021, with several focused-on methane and decarbonization of both gas and hydrogen. This figure also highlights policy areas for natural gas that require thoughtful balancing as the world transitions to net zero: affordability, reliability, market formation and supply chain management, and climate impacts.

Figure 14. Major Gas Market Reforms Undertaken in 2021^{xii}



Source: IEA (2022)

New policies and sustainability commitments by infrastructure financiers are also encouraging cleaner supply chains. LNG exporters are increasingly focused on constructing facilities with the lowest possible Scope 1 emissions, participants noted, because they anticipate increased scrutiny from regulators, buyers, and investors. One participant noted, however, that investors do not yet appear to be overly concerned with upstream emissions in their investment decisions.

Finally, supply chain emissions are an increasingly important consideration for receiving regulatory approval of new export capacity in the United States. The Federal Regulatory Energy Commission recently announced a new policy of evaluating gas infrastructure emissions when issuing permits for new projects, and the U.S. Department of Energy's congressionally mandated national interest determination review process for export facilities will consider climate impacts of proposed projects, participants noted.

The frameworks and tools for monitoring, reporting, and verification (MRV) of emissions, however, leave much room for improvement. One participant pointed out that the verification of the green credentials of natural gas supplies is important, but significant work remains to develop a framework for verifying the emissions intensity of natural gas production and value chains. Also, transparent and robust methodologies should be developed for all energy sources, including supply chain emissions.

SESSION 3. THE GEOSTRATEGIC ROLE OF U.S.-ASIA ENERGY TRADE

A robust definition of international energy security should include infrastructure security,

Key Questions

- **What is the role of U.S. LNG in supplying and stabilizing the global natural gas market?** How might this role evolve in the coming years and decades?
- **What steps can or should importers take to support market stability and security of supply, such as market/ regional interconnection or coordinated storage of natural gas?**
- **How does U.S. LNG factor into the broader discussion of energy security in Asia as the region pursues decarbonization amid accelerating economic and population growth?**

energy affordability, and availability of supply.

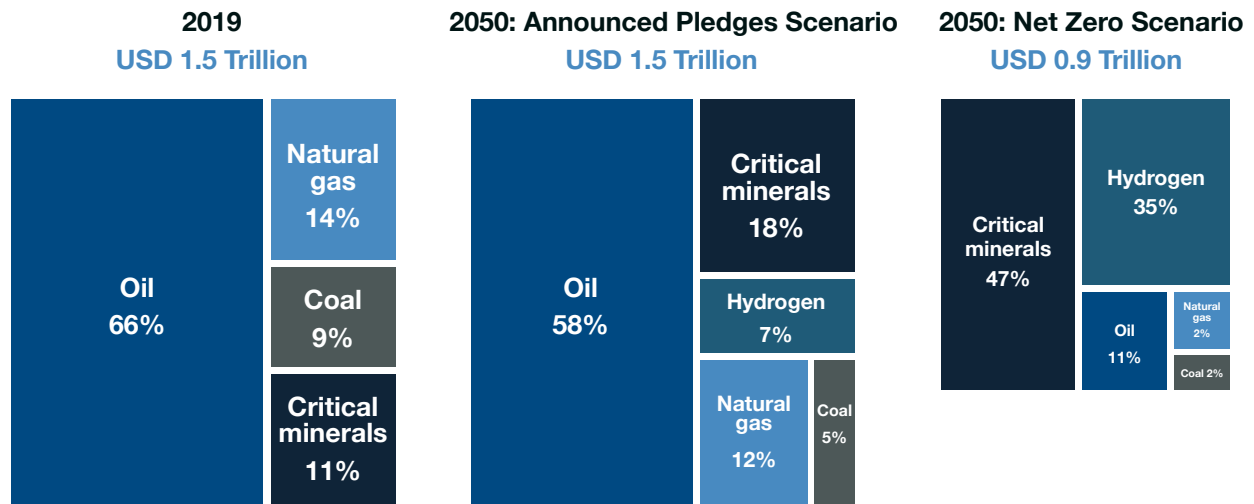
Participants highlighted the importance of considering physical and cyber security of infrastructure, facilitation of stable and affordable global energy prices, and the continued availability of energy to meet domestic demand as key tenets of energy security.

Participants also noted that the United States and its allies have a collective responsibility for maintaining the balance of these three pillars in the global energy markets, and that climate action cannot be successful if energy reliability, affordability, security, and supply are not addressed in the energy transition as well. Supporting these global energy market features will require a strong U.S.-Asia energy relationship. (It should be noted that the G-7 Energy Security Principles adopted in Brussels in 2014 included climate change as an energy security issue as well.)

The role of internationally traded fuels as a source of geostrategic advantage will evolve slowly in the decades ahead, and the role of metals and materials will increase in prominence. The geopolitics of oil, OPEC, and Europe’s dependence on Russian gas will remain important but there is a range of new energy concerns that will affect the geopolitics of energy. LNG will be important for decades even as the world’s countries move to meet net zero targets. Participants underscored that the energy transition will take a long time and will encounter many roadblocks and pitfalls. Hydrogen trade will increase but the path to hydrogen economy will be

challenging. Geostrategic concerns about natural resources will increasingly include critical metals and minerals, in addition to oil and gas – in fact, in a net zero scenario, critical metals and minerals will be the largest segment of global energy trade. Supply chain issues and protections for key metals and minerals should be a major focus in a range of forums such as the G-7, the G-20 (although the current Russian membership raises issues for the G-20), and the OECD is one of examples of forums like G7 and G20. Figure 15 highlights the global growth new energy commodities under two different scenarios, “Announced Pledges” and “Net Zero” relative to a 2019 baseline.

Figure 15. The Rise of New Energy Related Commodities^{xiii}



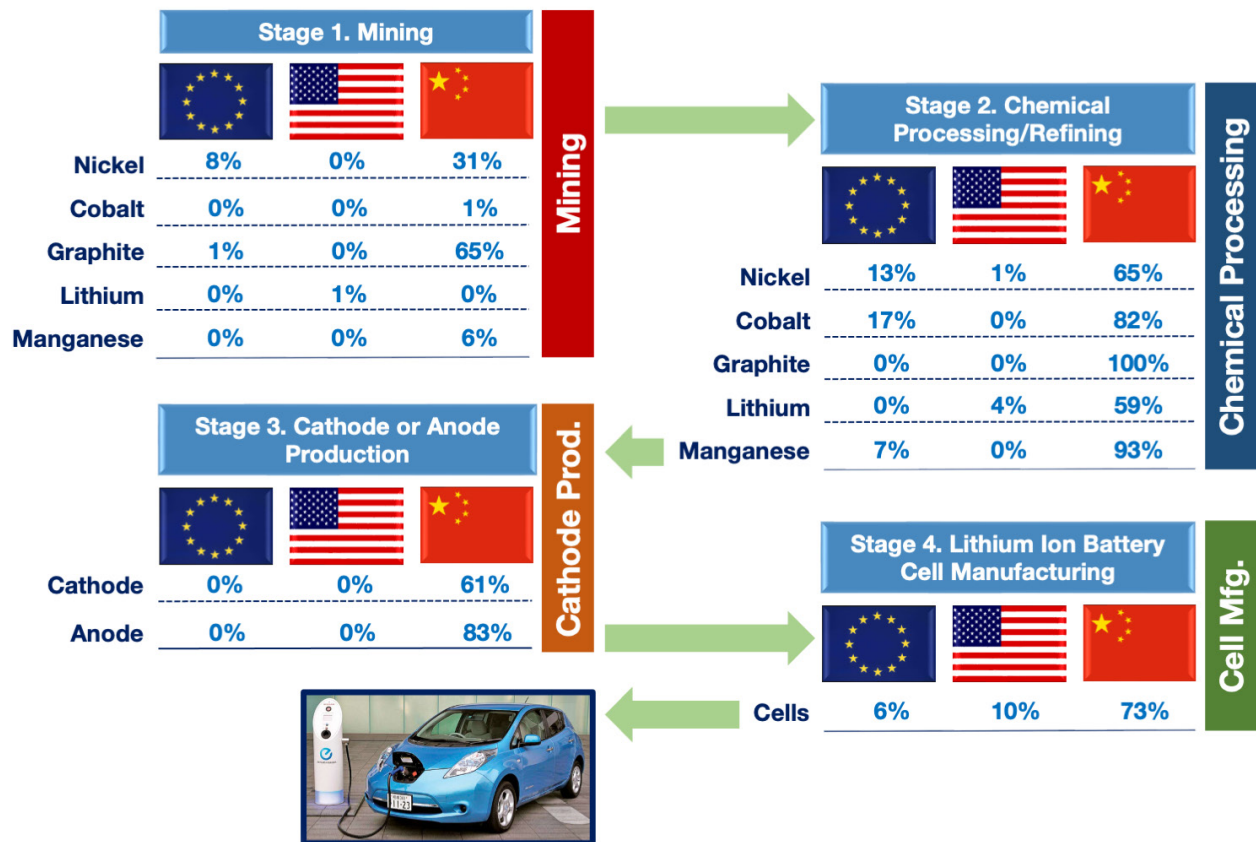
Under announced pledges, a growing share of oil and gas trade flows toward developing economies in Asia. In all scenarios, but especially in the net zero pathway, critical minerals and hydrogen-based fuels are on the rise.

Source: IEA (2021)

Absent a more sustained and thoughtful roadmap for Western democracies, geopolitical influence could shift to the East. Participants noted that dominance in clean energy is not only about what a country has, but about innovation, manufacturing, processing, and access to capital. China does not have oil resources but can manufacture solar panels.

Russia and China are dominant in the nuclear sector. Partnerships and cooperation on a range of issues, including clean innovation initiative such as Mission Innovation are needed. Figure 16 highlights the percentage of metals and minerals needed for mining, processing, manufacturing, and producing lithium-ion batteries in the EU, the U.S. and China.

Figure 16. Needs of Metals for Manufacturing Lithium-ion Batteries in the EU, the U.S. and China



Source: Benchmark Mineral Intelligence

This underscores a range of geopolitical and supply chain concerns and the point that, absent focused policies and programs, the EU and the U.S. will be ceding these critical activities to China.

The evolution of the energy system in response to emissions reduction efforts could exacerbate anti-globalization trends. Clean energy, especially renewables including wind, solar, and hydro, is very location-specific, making it a local, not a global resource. Notwithstanding the metals and minerals needed for clean energy, there will be less global energy trade. The IEA's net-zero scenario projects a reduction in international energy trade of about two thirds compared to the volumes for the current energy system.^{xiv}

Europe is considering a carbon border adjustment, and in near future, there could be coercive measures such as economic sanctions to compel the countries to take climate actions. Russia is also facing substantial sanctions from the U.S., Europe, and their allies; it remains to be seen how China will respond.

The China-U.S. relationship is a key issue to watch. One participant suggested that natural gas may be a geostrategic currency for the United States, especially with China. China is one of the largest buyers of U.S. LNG and the United States is one of the largest suppliers. This could help ease any tensions between two countries as the world grapples with the fallout of Russia's invasion of Ukraine. A countervailing concern was also raised at the workshop: The United States and China have competed aggressively over technology, talents, market, and standards for clean energy transition. This competition may accelerate the pace of clean energy deployment, but it may also create more tensions between the two great powers.

U.S. LNG supports stable and liquid gas markets. Participants generally agreed on the

crucial role of U.S. LNG for global gas markets and especially for Asian economies. One participant said that U.S. LNG brings “size, speed, and flexibility” to global gas markets. On size: the United States currently accounts for 16 percent of globally traded natural gas and will soon be the largest LNG supplier in the world followed by Australia and Qatar. On speed: participants noted that the U.S. market can scale supply capacity relatively quickly with appropriate contractual arrangements, and the country's shift from a major source of gas demand to a top global supplier during the 2015-2020 period shows the ability of U.S. industry to move quickly and at scale. On flexibility: U.S. LNG cargoes do not have destination clauses, allowing for shippers to re-direct supplies to adapt to shifting market conditions, as seen in the redirection of many cargoes at sea to the European market in early 2022.

The flexibility of U.S. LNG helps add liquidity and stability to market prices, supporting Asian investment in new demand-oriented gas infrastructure especially in Southeast Asia. That stability is useful for exporters too: the risk of oversupply of U.S. LNG is thought to be very low because the U.S. volumes can be easily resold and moved wherever they are needed. Participants highlighted that stakeholders in Asia had worried about the Biden Administration's position on LNG exports and potential ramifications in expanding sources of demand, but several people indicated that the current Administration fully appreciated the importance of a stable gas market for U.S. allies in Asia and Europe.

There are hurdles, both commercial and lack of clarity on climate policy, to expanding U.S. LNG export capacity. The constraints to grow the capacity of U.S. LNG comes from markets and lack of clarity about key areas of regulation and policies, although one participant stated that

there are few regulatory challenges to build LNG infrastructure in the United States and thought that the challenges are largely commercial such as market prices, commercial terms, and the potential for loss of access to capital. Others thought these issues were exacerbated by uncertainty as investors embrace policies to not invest in fossil fuel projects. The Biden administration's climate actions posed concerns and most discussants thought that further clarity on the role of natural gas was needed from the Administration to help expedite export capacity expansion. Commercial factors that dominate expansion decisions include infrastructure needs, long-term contracts, and financing. Better pricing, better commercial terms, and the improvement of the greenhouse gas (GHG) emissions profile of LNG were all thought to support continued investment in export capacity.

The role of natural gas infrastructure should be considered in the context of the full energy system transformation. An affordable low-carbon future needs to be considered in the context of overall energy systems with demand and supply needs in balance. One participant emphasized the need for more sophisticated energy systems analyses going forward, analyses that fully consider storage needs, changing demand, and what each source can supply to the system. They added that the leveraging all available infrastructure in pursuit of decarbonization is important to consider, along with what infrastructure may be helpful or necessary to achieve common international goals. India was highlighted as offering an example of assessing natural gas in the context of the fuller energy system and a fruitful regulatory and policy environment, which obviated the need for some new assets and infrastructure.

Areas for Further Research

The workshop discussion highlighted several areas warranting further investigation.

EFI's Phase Two of EFI's *The Future of Natural Gas in a Deeply Decarbonized World* will examine these questions in detail.

First, research on the role of natural gas, hydrogen, and ammonia in the near-, medium-, and long-term for the energy transition is needed. Participants agreed on the critical role of natural gas for the energy transition in the near-term, and the importance of hydrogen and ammonia for the longer-term, but these pathways are uncertain due to many factors concerning energy reliability, affordability, security, and supply as well as net-zero emissions goals. Current challenges that natural gas faces, such as security risks, supply chain challenges, and decarbonization needs, should be evaluated to develop potential solutions from both technology and policy perspectives. In addition, investigating the lessons learned from the past growth of international natural gas markets and the role this development played in enabling economic growth and emissions management was considered essential. Also,

analyzing the attributes of international natural gas market formation and their relevance to the development of clean fuels market is also needed to develop policies to guide the market formation for hydrogen and ammonia.

Further, regional case studies on the pathways of regional energy systems and the role of natural gas and clean fuels in achieving both decarbonization and other energy and development goals are needed to better understand the future of global natural gas markets. One of the findings from this workshop and Phase One of EFI's study was how distinctive the role of natural gas is across different regions and even by country. Therefore, the future of natural gas should be investigated in the regional or country context considering each country's energy, economic, and security challenges.

Post-Workshop Events and Actions

The launch of Phase II of the global gas study took place on February 8 as tensions were rising in Ukraine. On February 24th, Russia launched a full-scale, open military invasion of Ukraine. While EFI workshop reports typically report only on activities from the workshop, including analysis/data that support those activities, this is a highly unusual situation that has the potential for dramatic impacts on global LNG demand and related issues.

In response to the Russian invasion, on March 4, IEA released “A 10-Point Plan to Reduce the European Union’s Reliance on Russian Natural Gas.” When it was released, Fatih Birol, executive director of the IEA noted, “Nobody is under any illusions anymore. Russia’s use of its natural gas resources as an economic and political weapon show Europe needs to act quickly to be ready to face considerable uncertainty over Russian gas supplies next winter... The IEA’s 10-Point Plan provides practical steps to cut Europe’s reliance on Russian gas imports by over a third within a year while supporting the shift to clean energy in a secure and affordable way. Europe needs to rapidly reduce the dominant role of Russia in its energy markets and ramp up the alternatives as quickly as possible.” The IEA recommendations are:

- Do not sign any new gas supply contracts with Russia.
- Replace Russian supplies with gas from alternative sources.

- Introduce minimum gas storage obligations to enhance resilience of the gas system by next winter
- Accelerate the deployment of new wind and solar projects.
- Maximize power generation from bioenergy and nuclear to reduce gas use
- Enact short-term tax measures on windfall profits to shelter vulnerable electricity consumers from high prices
- Speed up the replacement of gas boilers with heat pumps
- Accelerate energy efficiency improvements in buildings and industry
- Encourage a temporary thermostat reduction of 1°C by consumers
- Increase and enhance efforts to diversify and decarbonize sources of power system flexibility

As seen in this plan, an immediate concern raised by the Russian invasion is ensuring that our allies in Europe have adequate supplies of natural gas, reflected in the first three IEA recommendations: sign no more gas supply contracts with Russia; replace Russian supplies with gas from alternative sources; and introduce minimum gas storage obligations to enhance resilience of the gas system by next winter.

The paper released by the IEA on the 10-point plan also notes (emphasis added):

- The EU has greater near-term potential to ramp up its LNG imports [than its pipeline imports], considering its ample access to spare regasification capacity. LNG trade is inherently flexible, so the crucial variables for the near-term are the availability of additional cargoes, especially those that have some contractual leeway over the destination, and *competition for this supply with other importers, notably in Asia.*
- The EU could theoretically increase near-term LNG inflows by some 60 bcm, compared with the average levels in 2021. However, all importers are fishing in the same pool for supply, so (in the absence of weather-related or other factors that limit import demand in other regions) *this would mean exceptionally tight LNG markets and very high prices.*

This plan and points related to natural gas are consistent with the G-7 energy security principles adopted by the G-7 leaders in Brussels after Russia invaded then annexed Crimea in 2014. Three of those principles relate to natural gas:

- Development of flexible, transparent, and competitive energy markets, including gas markets
- Diversification of energy fuels, sources and routes, and encouragement of indigenous sources of energy supply

- Reducing our greenhouse gas emissions and accelerating the transition to a low carbon economy as a key contribution to sustainable energy security

The leaders also recommended the following immediate actions:

- Promote the use of low carbon technologies (renewable energies, nuclear in the countries which opt to use it, and carbon capture and storage) including those which work as a base load energy source; and
- Promote a more integrated Liquefied Natural Gas (LNG) market, including through new supplies, the development of transport infrastructures, storage capabilities, and LNG terminals, and further promotion of flexible gas markets, including relaxation of destination clauses and producer-consumer dialogue.

The recommendations for these “immediate actions” at that time addressed both climate needs and fossil fuels (LNG). This approach is also needed today as the U.S. and its allies are working hard to address Europe’s near term need for natural gas, the ongoing need to mitigate climate change, while simultaneously meeting the energy and security needs of our friends and allies in Japan and other countries in Asia. This requires carefully sequenced actions and policies to address all three critical imperatives.

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