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Refreshing global energy security policy and infrastructure for the energy transition

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The Group of 20 (G20) members have discussed energy security for many years, and now have an opportunity to modernize and redefine global, regional, and national energy security frameworks to align with the transition to a lower-carbon energy system. Member countries should take steps to ensure that emerging vulnerabilities stemming from the rapid growth of new energy forms can be understood and managed both collectively and within their specific contexts. As all energy sectors transition, collective efforts toward energy security can progress by (i) developing a timely, transparent, and objective approach to data gathering and dissemination for the production, consumption, and trade of new energy forms and key mineral inputs; (ii) establishing an expert international advisory panel to the G20 on the topic of energy security in the context of energy transitions; and (iii) launching an effort on forward-looking energy security policy.

Challenge

The link between energy availability, price, and macroeconomic performance has been a subject of intense study for the last 50 years and has been central to the energy security context. Energy security has been a frequent topic for discussion at G20 Summits and every "Leaders Declaration" since St. Petersburg (2013) has included a reference to energy security (Appendix). Those declarations originally focused on market transparency and improved data collection for oil, followed by natural gas. More recent Summits have further expanded their discussion to include "all energy sources and technologies" (G20 Buenos Aries 2018).

Despite the attention given to the topic of energy security, it still has no single, universally accepted definition (Bazilian and Roques 2008). Nonetheless, avoiding the macroeconomic malaise associated with an unanticipated price shock or availability of supply of energy is one salient definition (Bohi and Toman 1996). This definition has many variants, including the International Energy Agency's (IEA) own definition of energy security as the uninterrupted availability of energy sources at an affordable price. For the most part, the examination and development of policies and infrastructure aimed at global and national energy security have been primarily focused on (i) consumer's perspectives, an outgrowth of previous oil supply disruptions; and on (ii) oil markets, a result borne out of the predominance of oil in the energy mix and the availability of ample global market data on price, demand, and supply. Moreover, geopolitics and various regional and international policy dimensions have, at times, been impacted by conflicting priorities between oil producers and consumers. This was a major driver for establishing the IEA in 1973 (Florini and Sovacool 2009).

In its formal derivations, energy security requires a rigorous aggregation of dozens of variables that impact energy flows in the real world (for example, see Bazilian et al. 2006; Ang et al. 2015a). It can encompass the security of supply and security of demand as well as variables on the environment and efficiency (Jakstas 2020; Azzuni and Breyer 2017). The complexity of the issues embodied within energy security is

broad and varies depending on the context and perspective from which it is evaluated (Bazilian et al. 2015). Thus, there is a lack of a common definition. One assessment, for example, noted at least 83 separate definitions of energy security presented in the literature over the past decade (Ang et al. 2015).

As the portfolio of energy choices expands, attention must shift to supply chains for all forms of energy. The supply chain function is a classic coordination problem. The scale of future global energy requirements alongside the need for energy sources with lower environmental impacts will have large implications for supply chain development. In turn, energy security concerns will play an increasingly prominent role in establishing low vulnerability energy systems (Elkind 2010; Cherp and Jewell 2014; Finley 2019). Subsequently, the fundamentals of energy security have spilled into discussions about electricity sector resilience and reliability as the sector transitions toward new technologies and energy sources.

Concerns about climate change are central to government and private sector actions aimed at transitioning to a lower-carbon energy future. Moreover, declining costs are increasingly raising the prospect that economic competitiveness, even without government intervention, will drive more rapid adoption of new energy technologies. This will have far-reaching geopolitical implications as energy markets adjust, making it important that emergent risks and vulnerabilities in the value chains of new technologies be adequately considered and addressed. The COVID-19 pandemic has caused many local, national, and international responses, and the full impact of these will likely be felt for years to come. For the energy sector, the fallout remains unclear (IEA 2020) despite ample prognostication, but the uncertainty could have profound implications. Steps to address future energy security, such as measures that enhance interest in international cooperation, are critical.

Proposal

Access to modern energy services is critical for continued global economic growth and achieving a better quality of life. Thus, it is critical to appropriately address emerging risks to all dimensions of energy security, including energy availability, affordability, accessibility, and acceptability, while simultaneously meeting environmental objectives and growth in energy demand. As the world's leading energy producers and consumers, G20 member countries have a unique role to play in advancing energy transitions, in part by ensuring that the security dimensions of the transition are addressed and remain high on the agenda of G20 deliberations. The importance of the G20 is underscored by the fact that they account for over 80% of the world's primary energy consumption and energy-related CO2 emissions, and about 75% of its energy production (BP 2019).

Moreover, unlike the current IEA-Organization of the Petroleum Exporting Countries (OPEC) dialogue for oil security, the G20 can take the energy discussion beyond the traditional, at times adversarial, producer-consumer dynamic. Additionally, a more constructive conversation can be facilitated by the G20 leadership by placing the matter within the higher context of economic growth and climate change. This will only grow in importance as new, lower-carbon energy sources are increasingly utilized. G20 members vary widely in their energy mix, exposure to energy trade, and perceived energy security risks. Their national policies will reflect specific attributes of their domestic economic and energy situations. However, as a group, they share common interests, including ensured access to energy to fuel sustainable economic growth and stable, transparent energy markets. Subsequently, the G20 can ultimately provide an important forum for multilateral energy diplomacy.

In acknowledging the G20 declaration in Osaka (2019), "... the importance of global energy security as one of the guiding principles for the transformation of energy systems, including resilience, safety and development of infrastructure and undisrupted flow of energy from various sources, suppliers, and routes," (G20 Osaka 2019) we make three policy recommendations.

Proposal 1: Expand data gathering and dissemination on global clean energy value chains

I. Rationale

To inform effective decision making, valid, publicly-available data is essential. However, rigorous, objective, timely information on global markets for new energy forms and key mineral inputs is not yet at the standard enjoyed by more established energy forms. For example, the global production of minerals used in electric vehicle batteries is highly concentrated and potentially vulnerable to supply disruptions. More generally, energy transition technologies with important mineral-based value chain dependencies include not just electric vehicles but also solar photovoltaics, wind energy, concentrated solar power, LED lights, power infrastructure, and fuel cells. Key minerals that must be considered include lithium, cobalt, rare earth elements (REEs)[1], indium, tellurium, and silver (Lee et al. 2020). Separately, energy transitions are characterized by digitally connected energy infrastructure, which can be vulnerable to cyber-attacks (Griffiths 2019; IEA 2017).

Comprehensive, timely, publicly-available data is lacking for all of these.

Accordingly, and building on past recommendations (IEA 2018), the G20 should launch an initiative to collect data on infrastructure, production, consumption, trade, and resource availability for clean energy, particularly renewable energy resources and supporting technologies, and the key minerals likely to play a growing role in a future low-carbon global energy system.

II. Suggestions for implementation

Potential templates abound, including the United Nations' (UN) International Recommendations for Energy Statistics; the Joint Organisations Data Initiative (JODI); the IEA's Energy, Statistics, and Energy Efficiency Indicators Manuals; and the UN's efforts to develop indicators for its Sustainable Development Goals (SDGs; IEA 2018). The US State Department's recent Energy Resource Governance Initiative and related tool kit is also a good example[2]. Such an effort should also seek to:

- Develop systems to organize and display data in a timely fashion and consistent units across countries and energy sources.
- Identify and model best practices for energy data transparency, collection, harmonization, organization, and presentation.

Proposal 2: Create an international expert advisory panel

Rationale

To ensure a collaborative approach that builds on existing centers of expertise and represents the diverse interests of G20 members, an advisory panel composed of international experts should be convened. Ideally, such a group would include a range of academic, industry, and government perspectives, representing both producers and consumers, as well as expertise in both established and new energy forms and key minerals. To facilitate robust and balanced conversations, one member should be nominated by each G20 member country and serve a fixed term of five years to maintain continuity, with one-fifth of the membership rotating off the panel each year.

Suggestions for implementation

This group would be charged with:

- Developing a common basis for evaluating and defining energy security and its key dimensions. This includes designing and testing metrics for energy security, particularly during a low-carbon energy transition, as well as understanding potential similarities and differences for various energy forms and inputs. The substantial existing body of literature provides the basis for this work (for example, Singh et al. 2019; Gasser 2020). For example, how might the security implications for fuels differ from inputs such as non-fuel minerals used for various energy technologies?
- Assessing the potential vulnerabilities and risks that member countries could face in driving a rapid transition of the energy system toward greater use of lower-carbon energy sources. Developing an accepted protocol for such an assessment within the G20 could then lead to broader adoption across other regions, which could be the basis for international discourse in many dimensions.

Proposal 3: Launch a collaborative effort to examine current energy security policies, programs, and agreements

Rationale

The G20 should recognize that the current international energy security framework is built around individual national policies, with many focused on hydrocarbons and particularly oil, as well as collaborative multinational arrangements (including the IEA's Emergency Response System). The G20 should, therefore, encourage a coordinated, parallel approach to expand the existing framework to align with the transition to a lower-carbon energy system. Global alignment on energy security policies is important, considering the COVID-19 pandemic's impact on energy demand and global supply chains. The policy response at local and national levels will influence the state of energy-related capital stock for years to come, and hence, determine energy security and energy transition outcomes in the years ahead.

Suggestions for implementation

The G20 should encourage member countries, both individually and collectively, to actively assess new policies to mitigate and manage emerging energy security vulnerabilities and risks associated with energy transitions. While national policies will vary based on the wide differences in the energy mix and perceived security risks, member countries should use this process to build consensus for—and a shared vision of—appropriate areas for collective action.

This effort can be housed in a new, permanent G20 workstream, or a new multinational organization dedicated to energy security spanning

the full range of countries and fuels.

- This could be done in concert with interested third-parties such as the IEA, International Renewable Energy Agency (IRENA), OPEC, Organisation for Economic Co-operation and Development, and the International Energy Forum (IEF).
    - In particular, the IEA's framework for sharing data, aligning (and reviewing) national policies, and coordinating collective action in case of oil supply disruptions (including treaty obligations) can serve as a useful template for coordinated efforts to address the security of new energy forms and key minerals.
    - The dialogue between producers and consumers facilitated by the IEF and JODI can also serve as exemplars for future cooperation.
- Areas of obvious inclusion are policy changes that recognize shifting trade and market landscapes in energy transitions as well as a potential need for augmented IEA-style cooperative agreements that will underpin energy security in the future.
- The policy implications of power sector transition will also be a key focus for G20 members. Key considerations will be the roles of coal and natural gas in power sector transition, power system flexibility and supporting electricity market reforms, regional electricity market integration, flexibility in gas markets, digitalization and cybersecurity, and end-use sector coupling.

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Appendix

[1] . The term "rare earths" refers to 17 elements often found in the same ore deposits, including cerium, dysprosium, erbium, europium, gadolinium, holmium, lanthanum, lutetium, neodymium, praseodymium, promethium, samarium, scandium, terbium, thulium, ytterbium, and yttrium.

[2] . For examples, see: https://iea.org/data-and-statistics, https://www.jodidata.org, https://www.ergi.tools.

Existing Initiatives & Analysis