



G20 Karuizawa Innovation Action Plan

on Energy Transitions and Global Environment for Sustainable Growth

《Energy and Environment》

Preamble

1. Breakthrough innovations are an indispensable impetus for a virtuous cycle of environment and growth for leading energy transitions to improve the “3E+S” (Energy Security, Economic Efficiency, and Environment + Safety) as well as addressing key global issues and challenges, such as climate change, biodiversity loss, resource efficiency, sustainable consumption and production, energy poverty, land, fresh water, marine and air pollution including PM2.5 and HFCs, urban environmental quality, and energy access. We emphasize the importance of promoting synergies and an inclusive approach when tackling related issues for sustainable growth in response to the energy and environment dimensions of the 2030 Agenda for Sustainable Development.
2. We, the G20 members, have an important role in supporting the private sector in the promotion of innovation, investment, and a better business environment to develop and deploy affordable, reliable, sustainable, and low GHG emissions energy systems, and to achieve a cleaner, more resilient and sustainable future. Governments play a key role for innovation in providing clear signals and in creating an enabling environment.
3. In this regard, and on a voluntary basis, we take the concrete actions jointly and individually described below. This list is not intended to cover all activities for innovation and we continue to explore further cooperation.
4. We propose that international and regional organizations may (1) collect innovation policy information of G20 members, (2) expand their analysis to better identify “innovation gaps” and actions that support energy transitions and help achieve a cleaner environment, and (3) report to the G20 on their findings. We propose that the next presidency also tasks relevant organizations to work on the subject with guidance and expected outcomes and can utilize the innovation portal and innovation tracking in the energy sector of relevant international organizations.
5. We take the following voluntary actions for international cooperation on innovation.

<Actions to collect wisdom from around the world to encourage innovation>

6. We seek to enhance international cooperation in relevant existing fora and encourage, in a holistic manner, research, development and deployment of innovative technologies and approaches including air and water related technologies, behavioral science for life-style change, bioenergy, Carbon Capture Utilization and Storage (CCUS), clean vehicles, deep renovation and Net Zero Energy Building, demand-side management, energy access technologies, energy efficiency technologies, energy storage, hydrogen, grid digitalization,

low carbon technologies, nature-based solutions, renewables, resilient and sustainable cities and communities with integration of technologies, and resource efficient technologies, depending on national circumstances.

7. We support the expansion of networks for innovation globally among industry, academia, and government in coordination with existing efforts. We also promote international collaboration among leading G20 members' research and development institutes, universities and business to advance innovation for clean energy technologies and resource and energy efficiency and to explore further international joint research and development. We welcome the G20 Japanese Presidency's initiative aimed at spurring innovation in the context of climate change through the international conference, called Research & Development 20 for clean energy technologies ("RD20"), while acknowledging the importance of creating synergies with existing R&D initiatives.
8. We recognize the importance of quantitative analysis on better understanding future energy demand and supply and the role of innovation of both sides driven by digitalization, Artificial Intelligence (AI), the Internet of Things (IoT), and the sharing economy. We encourage efforts made by the global scientific community and international organizations and frameworks to further refine and develop the full spectrum of economy-wide scenarios for energy and climate models.

<Actions to mobilize private finance and investment for development and deployment of innovation>

9. We support efforts to mobilize finance and to improve the market and investment environment for various energy options, innovative technologies and quality infrastructure that enhance energy access, resilience, cleaner environment and water access. We support continued effort to mobilize private finance and investment, including from institutional investors, through public finance and risk mitigation measures such as trade insurance, while recognizing that public finance plays an important role.
10. We promote improving business environments for the power sector, including actions that increase security and flexibility of electricity and that embrace innovative storage and distribution technologies, responding to increasing variability due to increasing deployment of renewable energy. We support development of electricity market mechanisms that drive investments in grid and power sources by increasing the predictability of return on investment, such as capacity markets and market distortion avoidance.

<Actions to improve business environments and to promote of business activities for dissemination of innovative technologies>

11. We explore business matching, workshops and other international collaboration to improve business environments and encourage business activities. The following ideas are suggested from G20 members as possible areas: the development of energy saving labeling and standards, Global Energy Efficiency Benchmark by the IEA, eco-labeling and environmentally friendly public procurement criteria, enhanced transparency and harmonization of rules and

reaching out to local and smaller-scale markets.

12. We welcome launching analytical work to study and deliver recommendations or options on creating better business environments for nurturing business opportunities associated with cleaner environment in coordination with the relevant organizations and business communities, and focusing on public-private partnerships.

《Energy》

Preamble

The G20 Karuizawa Energy Innovation Action Plan is intended to strengthen our cooperative concrete activities on energy transitions on voluntary basis under Japanese presidency in 2019, adopted at the Ministerial Meeting in Karuizawa. This list does not intend to cover all collaborative or national activities for innovation and we will continue to explore further opportunities for cooperation.

<Energy efficiency>

1. We continue to collaborate on a broad range of issues in support of wasting less energy and energy transitions also through the G20 Energy Efficiency Leading Programme (EELP) and take note of the progress on the Energy Efficiency Hub. Noting the IEA's work to develop the Global Energy Efficiency Benchmark, we continue to promote analyses on this with support of capable international and regional organizations in an inclusive manner and by sharing knowledge and best practices.
2. We share the importance of the work on behavior undertaken under Argentina's presidency, and the need for policies, that can drive investments in energy efficiency.

<Renewable energy>

3. We share our best practices in accelerating energy innovation including in the use of policy to provide a signal to markets, and implement capacity building programs, management models of electricity system to promote further expansion of renewable energy, recognizing the importance of new flexibility solutions such as demand side management and off-grid solutions and energy storage technologies. We will strive to share lessons on innovation and technology development to increase direct renewable energy use in the transport, heat and industry sectors. The G20 members stress the importance of policy frameworks, in accordance with their circumstances, that stimulate innovation ecosystems, and recognize the role of startups and Small and Medium Enterprises (SMEs) in promoting energy transitions.
4. We encourage the work of IRENA, the IEA and CEM to continue their work to analyze key technologies for energy transitions to further utilization of renewable energy. IRENA and IEA are encouraged to analyze the impact of energy efficiency in promoting renewable energies. We also support and encourage the work of the IEA, IRENA, the Biofuture Platform, MI, International Solar Alliance (ISA) and other international initiatives in promoting sustainable bioenergy and other renewable energy development and deployment, and will increase our cooperation under these fora.

<Hydrogen and other synthetic fuels>

5. We support the acceleration of our work that will lead to concrete actions which were summarized in the chair's summary at Hydrogen Energy Ministerial Meeting (HEM) 2018, including exchange of best practices, international joint research, evaluation of hydrogen's potential, e.g. for power to x, outreach and addressing regulatory barriers, codes and standards. We promote further international cooperation and discuss concrete actions through frameworks

such as HEM 2019 (autumn), the Clean Energy Ministerial (CEM), Mission Innovation (MI) and the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE), and ask relevant international and regional organizations such as the IEA, IRENA and the ERIA to develop the analysis of potential pathways to a hydrogen-enabled clean energy future, including the use of methanol and ethanol as hydrogen carriers in fuel cells. We note that hydrogen as well as other synthetic fuels can play a major role in the clean energy future with a view to long-term strategies.

<CCUS/Carbon Recycling/Emissions to Value>

6. We strengthen international collaboration on development and deployment of Carbon Capture Utilization and Storage (CCUS) under the frameworks such as CEM, MI, the International CCUS Summit and the Carbon Sequestration Leadership Forum (CSLF). In particular, we recognize the importance of (A) Preparing national readiness assessments or action plans, including developing policy and regulatory frameworks that provide investment certainty, (B) Engaging financial institutions, and (C) Facilitating large-scale CCUS chains, depending on national circumstances.
7. To explore international cooperation on “Carbon Recycling” and “Emissions to Value” among industry, academia and government, we facilitate discussions on research and development, stable investment environments, and attracting finance for innovative technologies through opportunities such as the International Conference on Carbon Recycling to be held in September 2019.

<Digitalization>

8. To explore and expand the potential of digitalization of the energy sector, including in developing more robust and comprehensive energy data to support energy transitions, improving the flexibility of power systems, enabling more efficient energy use through smarter cities, intelligent transport systems and behavioral changes, we note the IEA’s initiative to hosting additional workshops on the interlinkage between digitalization and other policy aims including energy efficiency in hopes of considering on potential outline on how digitalization, e.g. through smart meters, other flexibility options and smart grids, can accelerate the smart production and use of energy and improve grid security and resilience. We also encourage continued work on how to mitigate the potential increased energy demand associated with the digitalization of our economies.

<Value Chain of Energy Resources>

9. We share the importance of analyzing the life cycle of various energy resources from production to end use. Analyses on the energy value chain enhances the efficient and cleaner use of energy resources and can incentivize innovation in areas such as vehicles including life cycle analysis and Well-to-Wheel analysis. We acknowledge efforts of international fora such as Global Fuel Economy Initiative (GFEI) and Biofuture Platform by sharing technology challenges and recognize their role in furthering best practices.

<Power system>

10. We strive to share our best practices and future policy insights on power systems in order to expand low emissions investment and demand side management, biomass power generation, electricity storage, increase connectivity, enhance flexibility, and increase resiliency. We promote knowledge exchange on technologies for system integration of variable renewables under international frameworks such as the IEA, IRENA, MI and CEM, ISA and Biofuture Platform. We note relevant international organization's work such as the IEA to analyze developments in electricity markets and the conditions necessary to support investment in low emissions power systems and power system transformation, and to share those analyses through workshops, publications and in other forms.

<Nuclear>

11. Those countries that opt to continue utilizing nuclear energy encourage the progress in exploring opportunities to collaborate on advanced nuclear energy technologies, including small modular reactors, and innovative uses of nuclear energy including integration of nuclear and renewables, and heat usage, in collaboration with relevant international organizations such as International Atomic Energy Agency (IAEA) , and the IEA and cooperating under international fora including the CEM NICE Future initiative.

12. Those countries that are using, plan to use or have used nuclear energy support accelerating cooperation on final disposal of high-level radioactive waste, and safe and efficient decommissioning. They are invited to share experience and expertise of public dialogue activities and to promote technical cooperation for final disposal of high-level radioactive waste, among countries using nuclear power, including through an international roundtable organized by OECD Nuclear Energy Agency (NEA). As to decommissioning, they share experience and knowledge on regulation, project management, and other points, in IAEA and other relevant international organizations.

<Natural gas and other fossil fuels>

13. We further encourage efforts at various international fora to increase market liquidity, flexibility and transparency as well as open fair and transparent competition and cooperation to support the role of natural gas in new sectors such as transportation including bunkering in the maritime industry, and utilization of small scale LNG. We discuss measures to enhance the security of natural gas such as sharing knowledge and the best practices on mid and long term natural gas supply security as well as on emergency response. We enhance bilateral and multilateral cooperative frameworks, such as the annual LNG Producer-Consumer Conference, that support development of a flexible and transparent global LNG market as well as enhancing energy security of the LNG value chain, in the context of transitions toward lower emission energy systems.

14. We promote producer-consumer dialogue as facilitator of stable and transparent market including through the framework of International Energy Forum (IEF). We note the discussion at High Efficiency Low Emission (HELE) working group last autumn, which includes the role of HELE

technologies and promoting investment and funding of advanced and cleaner fossil fuel technologies, and continue HELE working group activities.

<Access to Sustainable Modern Energy>

15. We highlight the importance and the urgency of advancing universal access to affordable, sustainable and modern energy services and clean cooking facilities, and we will explore ways to enhance the implementation of G20 regional energy action plans. We highlight the important role of international cooperation and public-private partnerships on sustainable technological, financial, business model, policy and planning innovation in line with the spirit of the 2030 Agenda for Sustainable Development. We also highlight the important role of community-based approaches in promoting energy access.