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Reframing of Global Strategies and Regional Cooperation Pathways for an Inclusive Net-Zero Strategy in the Energy Transition Framework*

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As carbon dioxide emission reductions become increasingly urgent to counter climate change, many nations have announced net-zero emissions targets. Achieving a net-zero economy will require the decarbonisation of electricity generation, massive expansion of low-carbon energy systems, and investment in net-zero-carbon technologies. These adjustments must consider the existing energy, economic, and social development imperatives of advanced and developing countries, while encouraging regional cooperation. This brief assesses energy transition challenges for the Association of Southeast Asian Nations and the Gulf Cooperation Council (GCC), and proposes new policy pathways towards an inclusive global net-zero economy.

Key Messages:

- Although various methods are available for achieving a net-zero economy, there are significant hurdles, particularly for emerging countries, including challenges in meeting basic energy needs; the high cost of renewable energy related technologies and sustainable bioenergy; challenges in energy security, green recovery, and geopolitics; and high costs of several circular economy pathways.
- A G20-initiated monitoring and evaluation body should be established to track how national coronavirus disease (COVID-19) recovery initiatives align with the fulfilment of the Paris Agreement obligations.
- Focusing on renewable energy sources that are flexible and versatile – such as carbon capture, utilisation, and storage; hydrogen; and ammonia – could help stimulate large-scale innovation in the circular low-carbon economy.
- Emerging and developing economies would benefit greatly from a reorientation of the energy markets towards greater competition and lower costs associated with adopting low-carbon transformative technologies.
- Cross-regional cooperation should be strengthened to reduce the cost of the energy transition globally and bring much-needed economic resilience and energy security to emerging and developing countries.

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Challenges in the Energy Transition Towards a Net-Zero Economy

Governments have made commitments to reduce greenhouse gas (GHG) emissions since the Paris Agreement was ratified in 2015. Many governments in the Association of Southeast Asian Nations (ASEAN) and the Gulf Cooperation Council (GCC) have set net-zero emission planning targets for their economies by 2040–2060, as well as committing to significant investments in renewable energy production and decarbonisation.

While encouraging rapid adoption of renewables as part of the net-zero economy (NZE) goals is critical, there is an urgent need to decarbonise fossil fuels without jeopardising energy security or exacerbating existing economic development issues. Since 2020, new frameworks such as the circular carbon economy

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(CCE) have been discussed at the G20 level. Although various methods are available for achieving a net-zero energy economy, there are significant challenges, particularly for developing and emerging economies.

Challenge 1: Meeting basic energy needs. Many least-developed and upper middle-income nations still face crucial development concerns – including access to clean energy, such as electricity, clean cooking, and pollution-free mobility. These nations have trouble financing energy transformations. Given the substantial dependence on affordable fuels and development imperatives, leapfrogging fossil fuels is unfeasible.

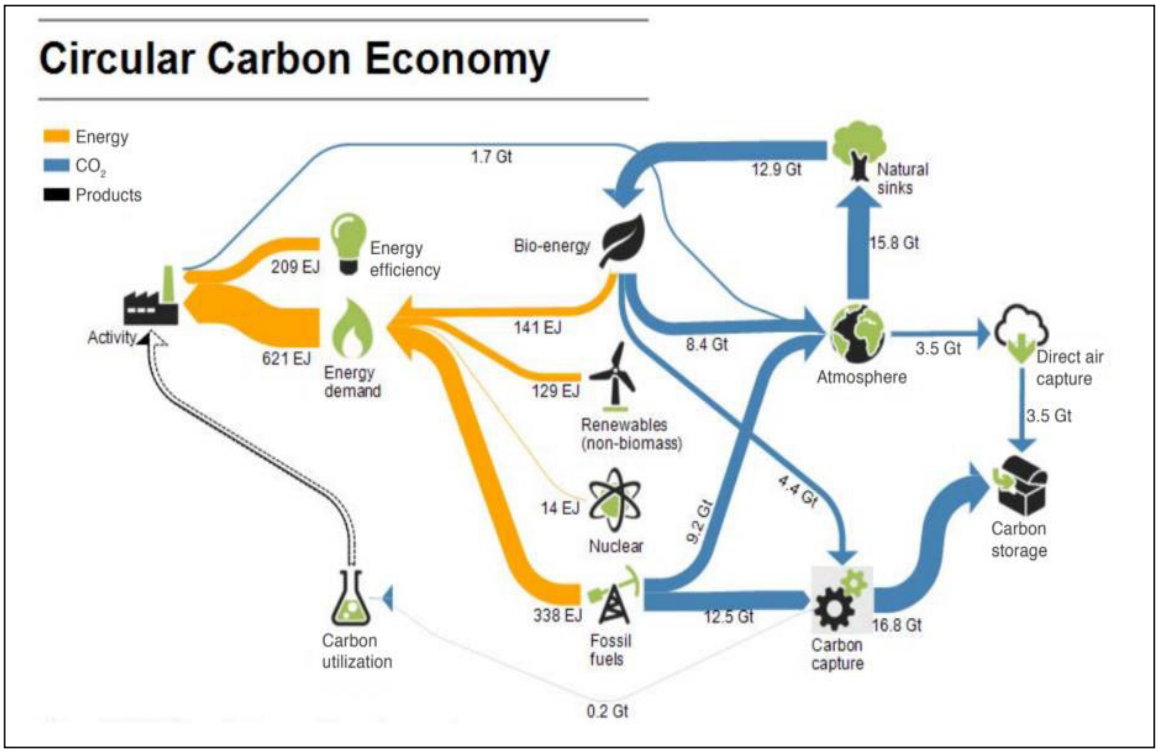
Challenge 2: High cost of renewable energy related technologies and sustainable bioenergy. Despite falling solar and wind prices, other renewable energy technologies, new energy supplies, and carriers remain expensive in developing nations, especially considering integration and implementation expenses. Rapid deployment involves the elimination of trade and investment barriers for renewable energy products and services, along with the development of local capacities (IPCC, 2018; Susantono et al., 2021; IRENA, 2021). Advanced biofuels, such as hydrotreated vegetable oil and second-generation biofuels, continue to be more expensive than fossil fuels. Land use changes and their negative impacts on food prices (Shrestha, Staab, and Duffield, 2019) and the environmental and social impacts of feedstock cultivation (German, Schoneveld, and Pacheco, 2011) are barriers to biofuel deployment, while market volatility from seasonal supplies and the rising costs of raw material collection, transportation, and processing are barriers to developing biomass co-firing for electricity and industry.

Challenge 3: Energy security, green recovery, and geopolitics. The economic upheaval caused by the coronavirus disease (COVID-19) has hampered energy investment. Low-income communities, which are less able to sustain price rises, are worried about energy supplies and security. Global renewable energy capacity growth declined 13% in 2020 (Eisen, 2021). Renewable energy deployment slowed. Oil and gas have not recovered. Oil and gas investment in 2021 was 23% below pre-pandemic levels (IEF, 2021). Oil prices have not increased investment. The International Energy Agency (IEA, 2022) anticipated that oil and natural gas investment in 2022 would be 25% below the amount needed by 2030. In these scenarios, 90% of the investment compensates for declining output at existing fields, not extra demand. Berns et al. (2022) claimed that natural gas may be the sole fossil fuel to receive greater short-term investment because it bridges traditional hydrocarbons and renewable energy sources. Creating value is crucial during the shift to greener energy. Developed regions are working on green recovery packages to promote cleaner societies while boosting economic growth and employment creation (UNEP, 2021). Emerging regions have their own green recovery programmes. The scope of these programmes is restricted, and recovery efforts have been disrupted by geopolitical crises like the war in Ukraine and Iranian nuclear discussions. Internal concerns in African, Middle Eastern, and Latin American states also affect energy deployment.

Challenge 4: High costs of several circular economy pathways. A circular low-carbon economy (Figure 1) helps manage and reduce emissions. It uses the 4Rs: reduce, reuse, recycle, and remove. Saudi Arabia's 2020 G20 presidency adopted a CCE framework to reduce global carbon footprints and attain net-zero emissions. Circular paths are expensive and hard to implement, requiring policy backing.

In response to these challenges, this brief suggests shifting the focus to an all-encompassing NZE strategy through a variety of regional cooperation pathways. Specific net-zero emission pathways include establishing a monitoring and evaluation body to track the alignment of COVID-19 recovery actions with the Paris Agreement of 2015, enhancing cross-regional cooperation

Figure 1: Circular Carbon Economy



CO_2 = carbon dioxide, Gt = gigatonne.
Source: Williams (2019).

on CCE frameworks, improving access to electricity and energy connectivity, enforcing cross-regional cooperation to reduce the cost of energy transitions, and bringing economic resilience and energy security to emerging and developing countries. These pathways have been translated into the following four proposals:

Establish a G20-Initiated Monitoring and Evaluation Body Aligned with the Paris Agreement

G20 members account for around 90% of global gross domestic product (GDP) (Statista, 2022) and emit about 80% of GHG emissions (OECD, 2021). As energy-related carbon dioxide (CO_2) emissions account for 80% of GHG emissions, decarbonisation of the energy system is essential for achieving the Paris Agreement.

Between 2000 and 2019, G20 countries tripled their renewable energy capacity (IRENA, 2022). This investment lifted the G20's green energy supply to 17.9% (BP, 2021). COVID-19 disrupted decarbonisation (Anbumozhi, Kalirajan, and Yao, 2022). Many nations have adopted economic recovery programmes to expedite the transition to green energy. Fourteen G20 members, accounting for 61% of global GHG emissions, plan to reach net zero by 2050. Germany vowed to reach net-zero emissions by 2045, China and Indonesia by 2060, and India by 2070 (BBC, 2021). Saudi Arabia and the United Arab Emirates have committed to reach net zero by 2060 and 2050, respectively (Reuters, 2021).

The G20 has adopted the IEA's Sustainable Recovery Tracker as policy guidance to monitor how much COVID-19 recovery investment has been channelled to clean energy (IEA, 2021). The G20 should establish a monitoring and evaluation organisation to track how individual COVID-19 recovery strategies correspond with Paris treaty responsibilities.

The body would compile national plans, activities, and outcomes on a user-friendly dashboard. This could expand on the G20 Data

Gaps Initiative, which produces low-carbon economy transition metrics (Ducharme, 2022). Current knowledge on climate change and attempts to combat it could help G20 donor countries target technology transfer and capacity building for the developing world.

Spur Large-Scale Innovation in the Circular Low-Carbon Economy, Focusing on Renewable Energy Sources, CCUS, Hydrogen, and Ammonia

Spur innovation in the circular low-carbon economy

Circular low-carbon paths in the energy sector include electrochemical and thermochemical methods, which may be capable of delivering substantial emission reductions following the displacement of conventional energy production and consumption (Meys et al., 2021). The demand-pull mechanism could be used to prioritise the early development of markets for low-carbon circular pathways (e.g. electrochemical carbon monoxide synthesis, the carbon cure concrete process) with lower production costs than existing sales prices (Lee, Keller, and Meyer, 2017). It is currently not cost-effective to recycle carbon from synthesis fuels. The G20 governments could use public procurement policies to accelerate the most promising 4R pathways, and the G20 energy task force could work to eliminate obstacles to and encourage investment in the construction of onshore and offshore renewable electricity, transmission lines, electrolysers, and captured carbon transport and trade within and across national borders.

Therefore, promoting solar and wind energy, taking into account local innovation capacity for recycling and green financing; strengthening local innovation capacity and participation in global networks to produce clean energy technologies; ensuring circular carbon pathways are fed by 4R technology inputs and prioritising circular carbon pathways in the G20; and creating a cooperative research, development, and deployment system are all ways to spur innovation in the circular low-carbon economy by focusing on variable and versatile renewable energy sources; carbon capture, utilisation, and storage (CCUS); hydrogen; and ammonia.

Focus on bioenergy

Bioenergy is an important aspect of an energy-secure and net-zero energy mix. A circular bio-based economy should include bioenergy (IEA Bioenergy, n.d.). Sustainable bioenergy is vital for domestic and regional energy security, as locally produced biofuels can increase the self-sufficiency of countries through net energy imports and lower the economic burden of importing crude oil (IEA, 2019). Focusing of biofuel deployment by: 1) realisation of a G20 agreement that commits to the use of sustainable bioenergy, i.e. bioenergy whose use does not trigger GHG emissions connected to land use change and has no effect on air and water quality and biodiversity (IRENA, 2021). 2) As part of the Clean Development Mechanism, help developing nations create more sustainable bioenergy, particularly second-generation bioethanol and green (drop-in) biofuels. 3) As part of IEA's Biofuture Platform, ensuring that G20 cooperation supports the sustainability of advanced biofuels and biomass co-firing via the CCE Platform and G20 Bioenergy Platform. By prioritising G20 collaboration on stable bioenergy regulations, subsidies, blending mandates, technological transfer, funding support, and incentives for GHG reduction, risks to global food sources will be mitigated.

Emphasise the deployment of clean hydrogen and ammonia along with support for CCUS

Hydrogen will be the key to energy security by 2030 (Han, Kimura, and Arima, 2020; IRENA, 2021). Hydrogen is a promising alternative to fossil fuels due to its physical characteristics, and it could solve energy storage issues while dramatically lowering carbon emissions. Hydrogen and ammonia have the potential to replace higher-carbon fuels in the future. Combining them with CCUS is vital for lowering GHG emissions.

Focus should be placed on developing markets for hydrogen and ammonia, as well as decreasing carbon emissions through CCE frameworks, by (i) promoting CCUS technologies (e.g. direct air capture and conversion of capture into value-added products) as low-carbon and net negative emission technologies under a G20 cooperation project for the transfer of technology to developing countries; (ii) promoting international collaboration to develop a proven carbon sink capacity, a hub-and-cluster business model by assigning risks to parties and reducing costs through shared infrastructure, and a platform for international cooperation and consolidation of efforts to manage emissions in hard-to-abate industries; (iii) harmonising standards for large-scale hydrogen deployment and strengthening carbon accounting and verification mechanisms for the hydrogen supply chain; (iv) incubating cross-border public–private partnerships for carbon capture and storage (CCS) finance to build risk-sharing mechanisms for CCS-ready projects, particularly with respect to financial/monetary and public/institutional concerns; (v) investigating the application of carbon storage units inside the international carbon trading system; (vi) promoting the use of CO_2 in enhanced oil recovery activities by sequestering huge volumes of CO_2 in hydrocarbon-bearing zones to reach net-zero emission goals; and (vii) assisting developing nations in comprehending, learning about, and implementing CCUS, e.g. through feasibility and cost-effectiveness studies, to narrow the knowledge gap between developed and developing nations.

Reorient Power Markets to Encourage Competitiveness and Affordability in Emerging and Developing Countries' Adoption of Low-Carbon Transformative Solutions

Even though most developing nations have established policies to subsidise energy bills to increase affordability and accessibility, such programmes have budgetary ramifications. Critical challenges affect the stability, visibility, and dependability of transmission and distribution in these nations. As feed-in tariffs necessitate additional government expenditures, renewable sources of energy are typically limited.

Building an intergovernmental alliance comprising nations with liberalised electricity markets and a high penetration of renewables is encouraged – particularly amongst G20 members such as Canada, European Union member states, and the United Kingdom, as well as nations in ASEAN and the GCC – to increase their renewable energy share in power generation. Solar, wind, hydro, geothermal, and biomass sources of renewable energy should be used. The alliance would serve as a platform for enhancing the capacity to advance the liberalisation of electricity markets, develop strategies to boost the spread of renewables, reduce market distortions, monitor and evaluate energy market performance. An alliance between G20 members, ASEAN, and GCC states should only be the beginning. In the next step, nations from other areas should be included.

Strengthening Cross-Regional Cooperation to Reduce the Cost of the Global Energy Transition and Bring Economic Resilience and Energy Security to Emerging and Developing Countries

In terms of energy commerce and innovation, ASEAN and the GCC have complementary elements. The two regions have collaborated in energy, agriculture, trade, and investment during the past 2 decades, establishing the groundwork for future collaboration in the global energy transition. A coordinated approach between ASEAN and the GCC in key sectors might serve as a model for G20 nations to integrate their energy plans and generate new growth impetus. The proposed ASEAN–GCC framework for free trade and investment could be used to shape aid to non-G20 nations or organisations and enhance South–South cooperation.

ASEAN and the GCC could serve as a role model by (i) creating an ASEAN–GCC free

trade and investment framework, with the goal of removing tariff and non-tariff barriers to trade flows of low-carbon technologies and services, and increasing investment in new infrastructure for using hydrogen and CCUS in hard-to-mitigate sectors; (ii) testing the viability of carbon-neutral approaches, such as carbon footprint standards and labelling for energy trade and carbon storage unit trade; (iii) establishing CCE knowledge-sharing facilities that place a focus on the growth of indigenous innovative capabilities; and (iv) enhancing downstream petrochemical integration and supporting joint oil stockpiling in ASEAN with GCC crude exporters to improve energy security for both regions.

Policy Recommendations

1. Establish a G20-led monitoring and evaluation body to assess the conformity of national COVID-19 recovery efforts with Paris Agreement obligations.
2. Focus on renewable energy sources, CCUS, hydrogen, and ammonia; and promote large-scale innovation in the circular low-carbon economy.
3. Reorient electricity markets to promote competition and affordability in the adoption of low-carbon transformative solutions for emerging and developing economies.
4. Strengthen cross-regional collaboration to minimise global energy transition costs and provide emerging and developing countries with economic resilience and energy security.

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