

A Collaborative Endeavor

Templates for the G20 Karuizawa Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth

Submitted by Volunteers

Note

The document is an annex to the the G20 Karuizawa Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth, which is composed from templates of the overview of selected joint or individual actions submitted by the following contributors that promote innovation for energy transitions and global environment for sustainable growth. Japan expects further submission from other contributors.

Contributed by (listed in alphabetical order):

- ◆ Argentina
- ◆ Australia
- ◆ Canada
- ◆ The European Union
- ◆ France
- ◆ Germany
- ◆ Indonesia
- ◆ Italy
- ◆ Japan
- ◆ The Netherlands
- ◆ Kingdom of Saudi Arabia
- ◆ Singapore
- ◆ Spain
- ◆ Turkey
- ◆ The United Kingdom

This compilation is not for discussion.

Argentina

1. An overview of selected joint or individual actions by your country that promote energy and environment innovation for energy transitions and global environment for sustainable growth

National Program for Sustainable Entrepreneurs

The National Program for Sustainable Entrepreneurs (PROESUS) is a policy from the Secretariat of Environment and Sustainable Development in Argentina that aims to promote sustainable development through the encouragement of the local entrepreneurial ecosystem by enabling the access to support tools and growth opportunities.

The main objective of this program is to strengthen a national network of entrepreneurs working in different areas that promote sustainable development, which currently includes over three thousand and seven hundred (3700) entrepreneurs from around the country connected through an online platform. These initiatives provide innovative solutions for environmental challenges around the country, generating employment and economic opportunities throughout the supply chain as well, therefore showcasing the possibility of addressing combined environmental and economic concerns.

The Program includes a yearly call for proposals, in which the fifteen (15) most relevant sustainable projects from around the country are identified and promoted. These enter a track of incubation and acceleration while also strengthening their ability to grow their sustainable, innovative solutions and enhance the positive environmental reaches of their action.

Among the almost fifty (50) projects recognized by the National Program for Sustainable Entrepreneurs, those dedicated to energy, waste management and sustainable construction are the most frequent. There are current experiences of entrepreneurs that, by these strengthening processes, have been able to grow in their scale and capillarity in ways that have enabled them to generate a real positive impact in the environmental situation.

RenovAr program

In 2016, in order to speed up the process of addressing the target established in Law No. 27.191 (the increase of the renewable energy share in the energy mix to reach 20 % of the domestic electricity consumption by 2025), the Government of Argentina implemented a series of initiatives, among which the most relevant is the **RenovAr program**. All of them contemplate a series of fiscal incentives and financial support mechanisms, along with regulatory and contractual enhancements aimed at overcoming some of the investment barriers, obstacles for previous renewable schemes in Argentina. Promoting renewable generation is considered a strategic objective in order to achieve two major goals: improving energy security and mitigating climate change.

A key feature of the RenovAr program relies on this particular incentive/guarantee mechanism as a risk mitigation instrument. Its contractual framework is based on two main contracts: a) Renewable Energy Power Purchase Agreement (PPA) and b) the FODER trust adhesion agreement.

Through RenovAr, awarded renewable energy project companies enter into a 20-year PPA with CAMMESA (ISO & wholesale market administrator), who acts as off-take aggregator on behalf of distribution utilities and wholesale market large users. Under the PPA, renewable energy project companies assume the obligation to construct and reach commercial operation within a timeframe set by each bidder in its bid.

One of the most important incorporations of the Law 27.191 is the **FODER Trust Fund**, as it has been crucial for the performance of the recent RenovAr rounds (6 & 9 fold oversubscription vs. offered capacity). The main purpose for the trust fund's creation is to provide investors with energy payment (liquidity) and termination payment (solvency) guarantees, which enhance the legal framework under the current market conditions in Argentina. The first level, "Energy Payment Guarantee", guarantees that the renewable energy delivered to the grid at the point of interconnection under the PPA is duly paid for. Additionally, at a second level, in case CAMMESA is unable to pay in full for the electricity on due date, FODER backstops CAMMESA (i.e. FODER guarantee plus sovereign guarantee). Finally, at the third level there is a Triple A guarantee provided by the World Bank.

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

Argentina is an implementing country of the Partnership for Market Readiness (PMR). The PMR provides support to prepare and implement climate change mitigation policies—including carbon pricing instruments—in order to scale up GHG mitigation. Serving as a platform to share lessons, countries work together to shape the future of cost-effective GHG mitigation. The PMR is a grant-based, capacity building trust fund administered by the World Bank. It provides funding and technical assistance for the collective innovation and piloting of carbon pricing instruments (CPIs) that reduce greenhouse gas emissions.

Under this framework, Argentina explores the choice of policy instruments that support meeting mitigation objectives of its NDCs, such as assessing renewable energy and energy efficiency certificates trading. In this way, Argentina will develop an in-depth analysis in this field that will collect experiences of different countries of the world and will be used to conduct a pre-feasibility analysis.

Argentina submitted its first NDC on October 2015, with an unconditional target to reduce GHG emissions by 15% below business as usual (BAU) by 2030, and a conditional target is to reduce emissions by 30% below BAU by 2030, including and land use, land-use change and forestry (LULUCF). However, one of the first decisions of the current national government was to revise the goal, to increase its ambition in a feasible and sustainable way. Ambitious national action on climate change is central to achieving the Paris Agreement's goal. The NDC revision was made based on the NCCC

process by defining the potential mitigation measures of each sector and setting specific mitigation measures for each one.

The revised NDC was submitted to the United Nations Framework Convention on Climate Change in November 2016, establishing an unconditional absolute emissions reduction target limiting emissions to 483 MtCO₂e by 2030. This target includes LULUCF emissions (405 MtCO₂e excluding LULUCF). Argentina has also put forward a conditional target to limit emissions to 369 MtCO₂e by 2030 including LULUCF (310 MtCO₂e excl. LULUCF).

Scaling up mitigation efforts in Argentina are a critical component of the country's overall socio-economic transformation and commitment to sustainable development. With a completion of sectorial climate change action and plans, national mitigation plan and national climate change response plan in the coming years, climate change mitigation will be increasingly integrated into all aspects of policy making and policy implementation. In this context, the PMR proposes to support the development of carbon pricing instruments that support national policy goals and Argentina's NDC commitments. This will include exploring policy options in the transport sector, evaluating options for possible expansions of the already present carbon tax, and studying implicit carbon pricing instruments in the form of Renewable Energy Certificate and Energy Efficiency Certificate Schemes.

<https://www.thepmr.org/country/argentina>

(2) Actions to mobilize private finance and investment for development and deployment of innovation

Law No. 27.424 sets forth the Legal Framework on Renewable Distributed Generation connected to the Public Electricity Grid. The Office for Distributed Generation is responsible for the design and implementation of public policies for the promotion and implementation of the use of renewable sources for electricity generation for self-consumption with potential feed-in of any energy surplus into the distribution grid.

<https://www.argentina.gob.ar/energia/generacion-distribuida>

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

Argentina has already set in place a series of actions aimed at reaching the mandated targets in the shortest possible timeframe. Besides RenovAr program, which has already awarded almost 5 GW of new renewable capacity; the corporate PPA market, together with self and distributed renewables-generation are set to become important drivers in the pathway to achieve, and hopefully exceed, the mandated targets.

The **Corporate Power Purchase Agreement Legal Framework** (MATER) is a legal framework that applies to Large Users with an average annual demand greater than 300 kW (Authorized Large Users). It sets forth the contracting mechanism for private parties who are interested in executing power purchase agreements. MATER is an alternative to the renewable joint purchase mechanism (RenovAr program). In addition, it authorizes the purchase of energy through free negotiation between the

parties to facilitate the achievement of the mandatory targets. In this way, the Authorized Large Users may choose their renewable electricity supplier and negotiate the purchasing conditions with it. Currently, there are more than 2,000 large users in Argentina, which accounts for a monthly consumption of around 31,000 GWh/year; that is 23% of the total energy demand.

(<https://www.argentina.gob.ar/energia/energia-electrica/mater>)

All the aforementioned schemes can be summed up as follows:

1. Diversify the national energy matrix in favor of renewable sources
2. Replace the use of fossil fuels for power generation
3. Reduce the import of fuels and the average cost of the system
4. Increase national energy security
5. Increase the installed power of renewable energies in the short, medium and long term
6. Take advantage of the large number of projects in an advanced stage of development with rapid technical installation possibilities
7. Encourage and develop investment in infrastructure and the value chain of the productive sector related to renewable energy both in the manufacture of equipment and components and in the provision of services
8. Collaborate in the mitigation of the emission of greenhouse gases

Australia

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

Energy Innovation and Transition

- Australia's energy system is in transition. Australia like other G20 economies is looking to ensure energy supply is secure, reliable and affordable while transitioning to a low emissions energy system.
- Australia is investing in energy innovation across the R&D system including through the Clean Energy Finance Corporation (CEFC) and the Australian Renewable Energy Agency (ARENA). Australia like a number of G20 economies has commenced developing a National Hydrogen Strategy.

Energy Security

- Australia is a trusted and major supplier of energy to international partners and is committed to support open and transparent energy markets.
- Australia is supporting international energy organizations to work towards energy governance is representative and inclusive of emerging and developing economies including those in the Asia-Pacific.

Energy Efficiency

- We welcome discussion on demand side measures to improve energy efficiency, which are important to Australia like many G20 economies.

Power System

- Australia welcomes the G20 sharing knowledge and experience on well-functioning energy markets and on long term planning for grid integration of distributed renewables.

Renewable Energy

- Australia expects to exceed its large-scale Renewable Energy Target of 33,000 gigawatt hours of additional renewable generation in 2020, and clean energy investment reached a record level of \$13 billion in 2018. Australia has among the highest per-capita uptake of rooftop solar in the world (one in five households).
- Australia is interested in the G20 sharing ideas and information on policies and measures to integrate renewables into the energy mix, including energy storage and transmission, to deliver energy security and affordability.

Fossil Fuels

- Australia has committed over \$600m to a suite of low emission fossil fuel technology programs. This includes the commissioning of Australia's largest Carbon Capture, Utilization and Storage (CCUS) program to-date, the Gorgon CO₂ injection project.
- Australia participates in lower carbon fossil fuel initiatives internationally such as through the Clean Energy Ministerial.

Energy Access and Affordability

Australia is participating in and supporting a range of energy access activities in our region and globally such as: co-financing renewables in Tonga, upgrading electricity transmission in rural Cambodia, and through investments in multi-lateral development banks. We welcome the opportunity for G20 economies to reflect on how to accelerate existing initiatives and identify gaps.

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

Australia has participated in a number of international energy innovation initiatives.

Mission Innovation Hydrogen Challenge

- Australia is leading an innovation challenge on hydrogen to bring together researchers, governments and industry across 14 countries to: deliver cost reductions and technology improvements along the hydrogen supply chain, accelerate development of a global hydrogen market, and address technology barriers to the production, distribution, storage, and use of hydrogen at gigawatt scale.

Hydrogen Energy Supply Chain pilot project

- Industry, researchers and governments in Australia and Japan are delivering the four-year \$496 million pilot project to convert brown coal to hydrogen using existing technology, including CCS, and demonstrate the feasibility of a hydrogen supply chain from Australia to Japan.

Carbon Capture, Utilisation and Storage

- Australia participates in the Carbon Sequestration Leadership Forum; the IEA Greenhouse Gas Technologies R&D Program; the Clean Energy Ministerial CCUS Initiative under; and the Mission Innovation carbon capture innovation challenges to accelerate global clean energy innovation.

Earth observation

- Australia is a leader in the use of Earth observation satellite data to support decision making by governments, investors and communities to address energy and environmental challenges. Australia will host the 2019 Group on Earth Observations Plenary and Ministerial Summit in November 2019.

(2) Actions to mobilize private finance and investment for development and deployment of innovation

- Australia's Clean Energy Finance Corporation (CEFC) is the world's largest green bank, which invests for a commercial return, but only in partnership with other financiers. CEFC has committed in debt and equity funding a total of \$6.4 billion since 2013 for projects worth over \$21 billion.
- The Australian Renewable Energy Agency (ARENA) has provided over \$1.3 billion in research, development and deployment grant funding to almost 450 projects since 2012, with an estimated \$3.8 billion in additional private and public sector investment.

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

Australia is taking a range of actions to improve the business environment including on energy efficiency and regulatory reform. We welcome ways to promote innovative technologies and infrastructure for energy and environment objectives being discussed in the G20.

Canada

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

Canada understands that environmental leadership and economic growth go hand-in-hand. We are investing in developing infrastructure and cleaner technology to support the transition to a clean energy future.

- To address Canada's Paris Agreement emissions targets, Canada's federal and provincial governments, in consultation with Indigenous stakeholders, developed the [Pan-Canadian Framework \(PCF\) on Clean Growth and Climate Change](#) to drive innovation and growth by increasing technology development and adoption to ensure Canadian businesses are competitive in the global low-carbon economy.
- British Columbia's and Canada's governments worked with project investors to implement a plan to make LNG Canada the world's cleanest LNG facility.
- In 2017, Canada's government committed \$2.3 billion through the [Clean Growth Hub](#) to support clean energy innovation (solar, wind, CCUS, alternative fuels and energy efficiency) RD&D in Canada.
- Canada is investing up to \$950 million over five years in the [Innovation Superclusters Initiative](#) to support business-led innovation superclusters with the greatest potential to build world-leading innovation ecosystems.
- During Canada's 2018 G7 Presidency, members committed to undertake international and/or domestic initiatives to address, and sustainably manage, marine plastic pollution, and launched the G7 Innovation Challenge to Address Plastic Marine Litter. The G7 Innovation Challenge was developed in consultation with all G7 members and consensus support was achieved on this outcome.
- In May 2019, Canada will host energy Ministers, clean energy leaders, private sector partners and key stakeholders from around the world at the tenth Clean Energy Ministerial and fourth Mission Innovation Ministerial ([CEM10/MI-4](#)).
 - Canada will work with international actors to advance the low carbon energy future, accelerate clean energy innovation and encourage private sector investment in transformative energy technologies through the sharing of best practices, policies and programs.
 - Canada will co-launch (with U.S., Japan, Netherlands) a new hydrogen initiative at [CEM10](#) to foster large-scale deployment of hydrogen and fuel cell technologies across all sectors of the economy.
 - Under MI, Canada participates in all eight innovation challenges, while co-leading on *sustainable biofuels* and *clean energy materials*.
- Under MI, Canada pledged to double federal spending on clean energy RD&D from \$387 million in FY 2014-15 to \$775 million in FY 2019-20. Canada has taken an active leadership role in MI, as Chair of the Steering Committee, co-lead of the Analysis and Joint Research subgroup, participant

in the Business and Investor Engagement subgroup, Chair of the Ministerial Planning Team, and a member of the Secretariat.

- Canada has established frameworks that support investments in clean innovation while encouraging people and businesses to pollute less, this includes a Pan-Canadian approach to carbon pricing (fuel charge and output based pricing system). Carbon pricing will encourage implementation of new, innovative technological processes, and encourage consumers to switch to less carbon-intensive fuels. The plan is supported by:
 - Over \$20B in green infrastructure including for smart grids, renewables, reducing diesel in remote communities, and electric vehicle infrastructure;
 - \$2.3B to develop clean technologies in areas such as cleaner oil and gas, alternative transport fuels, and energy storage;
 - A \$150 million investment in Canada's industry-led Ocean Supercluster that will help enable the development of cleaner offshore energy such as tidal and wind;
 - \$400M to develop and demonstrate pre-commercial clean technologies;
 - \$200M for clean technology RD&D and adoption across the natural resource sectors;
 - \$75M for high-impact clean technology challenges;
 - nearly \$1.4 billion in new financing to help Canada's clean technology firms; and,

Teaming up with the Mars Discover District (MaRS) to support women clean-tech entrepreneurs by launching the [Women in Cleantech](#) Challenge. The competition will give five women the opportunity to develop scalable technological solutions to energy and environmental challenges.

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

- Canada hosting [CEM10/MI-4](#), working with Japan to facilitate momentum from that meeting through Japan's G20 Energy and Environment Ministerial. MI-4 will host public-private roundtables focusing on the most groundbreaking deep-tech applications, one of which will be on CCUS and low carbon hydrogen; Japan and the United Kingdom will co-chair that roundtable.
- Canada actively supports collaboration in energy innovation via the International Energy Agency (IEA), International Renewable Energy Agency, and the Carbon Sequestration Leadership Forum. The IEA encompasses 38 [Technology Collaboration Programmes](#) involving collaboration among independent experts, governments and industries on a wide range of energy technologies and related issues. Canadian researchers are active members in 22 of the IEA [TCPs](#) focused on research and development in areas such as efficient end-use, cleaner fossil fuels, cross-cutting issues as well as the [IEA Clean Energy Education and Empowerment \(C3E\) TCP](#), an initiative to recognize and build a community of women leaders in the field of clean energy.
- Canada has committed \$1 million over four years to the [IEA's Clean Energy Transitions Programme](#) – a multi-year plan to support clean energy transitions around the world. Canada is also engaging

bilaterally with key international partners, such as the U.S., Mexico, China, United Kingdom, South Korea and Japan on various collaborative RD&D initiatives.

- Since becoming a member of The International Renewable Energy Agency ([IRENA](#)) at the beginning of 2019, Canada has sought to mobilize its renewable energy industry partners through IRENA's Coalition for Action. The Coalition encourages industry to participate in the network to discuss industry trends, determine actions, share knowledge and exchange best practices with the vision to drive the global energy transition in line with the Sustainable Development Goal on energy.

(2) Actions to mobilize private finance and investment for development and deployment of innovation

- In 2018, under its G7 Presidency, Canada convened a G7 Development and Finance Ministers panel on private sector investment for international development, with the aim of discuss [Investing in Growth that Works for Everyone](#), including: lack of women in leadership positions; a persistent global infrastructure gap, especially in emerging markets; and the threats posed by climate change.
 - Environment and Climate Change Canada is leading an [Expert Panel on Sustainable Finance](#). Recommendations are expected in April 2019.
- To support the G7 Innovation Challenge, Canada committed \$20 million to undertake an international challenge aimed at engaging private sector and innovators, both within Canada and internationally, to accelerate research and development of new technologies and/or social innovations and sustainable solutions that can help to address the issue of plastics waste entering the oceans from developing countries with possible focus on waste management.
- At CEM10/MI-4, Canada will again address sustainable finance. Participants will explore challenges to attracting public and private sector finance (at scale), and how policies can influence investment in and financing of clean energy projects and infrastructure. CEM10/MI-4 is a prime opportunity to connect existing efforts seeking to address challenges and promote opportunities in clean energy and sustainable finance.
 - Canada is an active member of the [MI Business and Investor Engagement Sub-Group](#). This group acts as a focal point of member efforts to partner with the private sector and encourage greater public-private collaboration.
- At MI-4, Canada will organize a public-private breakfast for Ministers and business leaders to discuss how the public and private sectors can jointly invest in clean energy research, development, and demonstration (RD&D). MI-4 will feature the MI-PFAN Investment Forum, during which entrepreneurs from developing countries and emerging economies will pitch their technologies and business solutions to investors.
- Canada is one of five MI partner countries working with the Breakthrough Energy Coalition. This collaboration will help match promising research with innovation interested in commercializing the technology.
- Domestically, Canada provides a [competitive environment](#) for the LNG industry with low corporate tax rates (15%) to favorable tax treatment for LNG developers (accelerated capital

allowance). Canada's regulatory system provides clear timelines and extended export license term lengths (up to 40 years).

- In March 2018, the Province of British Columbia [announced](#) four measures that address LNG competitiveness and will help attract investment, these include, LNG tax removal; PST exemption and a Clean Growth Incentive Program (announced in the 2018 BC Budget).
- In September 2018, Canada [committed](#) to contributing \$20 million to the Global Infrastructure Hub to establish Toronto as the centre of its North American operations. The Centre will focus on effectively mobilizing private investments for resilient, sustainable infrastructure.

Canada's budget for 2019 proposes a number of initiatives to drive energy efficiency and the electrification of transportation, including:

- \$1.01 billion in 2018–19 to increase energy efficiency in residential, commercial and multi-unit buildings.
- [Build Smart - Canada's Buildings Strategy](#): \$182M over 8 years to transform the built environment.
- \$130 million over five years, starting in 2019–20 to expand the network of zero-emission vehicle charging and refueling stations.
- \$300 million over three years, starting in 2019–20 to encourage more Canadians to buy zero-emission vehicles. Budget 2017 also included major investments to improve energy efficiency:
- Electric Vehicle and Alternative Fuel Infrastructure Initiative: \$120M over 4 years to build a coast-to-coast network of EV fast chargers along Canada's highways, natural gas stations along key freight corridors, and hydrogen stations in key metropolitan areas.

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

Canada has taken concrete actions to put in place a competitive investment climate to foster greater innovation.

- The Government established an industry-led Economic Strategy Table on clean technology to identify sector-specific challenges and bottlenecks, and lay out a roadmap to achieve their goals.
- To respond to these challenges, the Government announced several targeted investments and initiatives with a view to: modernize regulations, increase market adoption, improve access to venture capital, enhance innovation funding, expand global access, and grow jobs and skills development.
- In 2018, Canada created a whole-of-government focal point for clean technology called the [Clean Growth Hub](#). The core function of the Hub is to help Canadian companies and not-for-profit organizations identify federal funding programs and services that will help bring their clean technology solutions to markets.

Canada is taking direct actions at home to support the G7 Innovation Challenge. Canada committed over \$12 million towards domestic challenges to address plastic waste. We are challenging Canadian innovators to develop new solutions and technologies in areas such as food packaging, construction waste, separation of mixed plastics, sustainable fishing and aquaculture gear, removal and management of ghost fishing gear and marine debris, recycling of glass fibre-reinforced plastics, and biodegradable bioplastics. So far, seven challenges were launched by five departments in fall 2018. Winners will receive up to \$150K to develop a proof of concept and, in a second stage, up to \$1M to develop a prototype. To date, 18 companies have been selected to receive funding.

The European Union

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

In 2015, the Commission adopted an ambitious [Circular Economy Action Plan](#) to stimulate Europe's transition towards a circular economy, which would boost global competitiveness, foster sustainable economic growth and generate new jobs. Three years after adoption, its 54 actions have been delivered or are being implemented.

The [EU Strategy for Plastics in a Circular Economy](#) adopts a material-specific lifecycle approach to integrate circular design, use, reuse and recycling activities into value chains. The strategy sets out a vision with quantified objectives, so that *inter alia* by 2030 all plastic packaging placed on the EU market is reusable or recyclable.

To accelerate the transition to a CE in innovation and to provide support for adapting the EU's industrial base, the Commission has stepped up efforts funding more than €10 billion for the transition from 2016 to 2020. To stimulate more investments, the [Circular Economy Finance Support Platform](#) produced recommendations to improve bankability of projects, coordinate funding and share good practices.

Sound and efficient waste management systems are an essential building block of a circular economy. To modernise waste management systems in the Union a revised [waste legislative framework](#) entered into force in July 2018. This includes, among others, new ambitious recycling rates, clarified legal status of recycled materials, strengthened waste prevention and waste management measures. Smart design at the beginning of a product's lifecycle is essential for ensuring circularity. With the implementation of the [Ecodesign Working Plan 2016-2019](#), the Commission has further promoted the circular design of products, together with energy efficiency objectives. Ecodesign and Energy Labelling measures for several products now include rules on material efficiency requirements such as availability of spare parts, ease of repair, and facilitating end-of-life treatment.

Through the EU Ecolabel and [Green Public Procurement](#) the Commission is moreover promoting products with excellent environmental performances throughout their life-cycle.

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

- The **EU Eco-innovation Index and Scoreboard**¹ and the Country Profiles² that are published regularly provide quantitative and qualitative information about eco-innovation policies and measures in EU Member States including their effectiveness.

¹ http://ec.europa.eu/environment/ecoap/scoreboard_en

² <https://ec.europa.eu/environment/ecoap/about-action-plan/map-national-strategies>

- The **European Forum on Eco-innovation**³ is an annual event organized by the European Commission that brings together public and private sector participants to discuss different eco-innovation related issues.
- The report [Insights from research and innovation to inform policy and funding decisions](#) published by the European Commission on 4 March 2019 aims to inform policy and funding decisions on a circular economy for plastics by providing research and innovation insights from EU-funded projects and the wider scientific community. The report covers the entire plastics value chain, highlighting a broad range of challenges and opportunities. Based on scientific evidence, the insights presented contribute to the transition towards plastic production from renewable feedstock and product design for use, reuse, repair, and mechanical, chemical, or organic recycling. In addition, the report explains how this systemic change can be supported by innovation in business models, collection systems, and sorting and recycling technologies. In this way, plastics could circulate through our society with full transparency at high-value usage, while minimising the risks to human health and the environment
- The joint **EU-UNEP eco-innovation project** (2013-2017) strengthened local capacity on eco-innovation in developing and emerging economies. It developed a set of tools for implementing eco-innovation in businesses and for mainstreaming eco-innovation in circular economy. (publications that resulted from the project were the “Business Case for Eco-Innovation”⁴ and the “Eco-innovation Manual”⁵.)
- With the amount of harmful plastic litter in oceans and seas growing ever greater, the European Commission proposed a **new EU-wide rules to target two top sources of marine litter in Europe: single use plastics and fishing gear**. The top 10 of most found single use plastic items on EU beaches, plus fishing gear constitute 70% of marine litter items. The new EU directive on Single-Use Plastics will be the most ambitious legal instrument at global level addressing marine litter. It envisages different measures to apply to different product categories. Where alternatives are easily available and affordable, single-use plastic products will be banned from the market, such as plastic cotton buds, cutlery, plates, straws, drink stirrers, sticks for balloons, products made of oxo-degradable plastic and food and beverage containers made of expanded polystyrene. For other products, the focus is on limiting their use through a national reduction in consumption; on design and labelling requirements; and waste management/clean-up obligations for producers. Companies will be given a competitive edge: having one set of rules for the whole EU market will create a springboard for European companies to develop economies of scale and be more competitive in the booming global marketplace for sustainable products. By setting up re-use systems (such as deposit refund schemes), companies can ensure a stable supply of high quality material. In other cases, the incentive to look for more sustainable solutions can give companies the technological lead over global competitors.

³ https://ec.europa.eu/environment/ecoap/news-events/european-fora-eco-innovation_en

⁴ www.unep.org/BCForEI

⁵ <http://www.switchafricagreen.org/sag2/index.php/links/sag-knowledge-repository/tools-for-greening-msmes/67-eco-innovation-manual-tools/file>

(2) Actions to mobilize private finance and investment for development and deployment of innovation

- The [Sustainable Finance Action Plan](#) sets out a roadmap for further work and upcoming actions covering all relevant actors in the financial system. These include establishing a common language for sustainable finance, i.e. a unified EU classification system – or taxonomy – to define what is sustainable and identify areas where sustainable investment can make the biggest impact; establishing a EU label for green financial products under the current EU Ecolabel scheme; clarifying the duty of asset managers and institutional investors to take sustainability into account in the investment process and enhance disclosure requirements; requiring insurance and investment firms to advise clients on the basis of their preferences on sustainability.
- The [Circular Economy Finance Support Platform](#) has produced recommendations to improve the bankability of circular economy projects, coordinate funding activities and share good practices.
- The **EU LIFE Programme** is the biggest EU funding programme dedicated solely to environment, nature conservation and climate action. LIFE plays an important role in supporting the transition to a circular economy. LIFE promotes the take-up of the circular business models and supports Circular Economy related projects since 1992 with over 700 waste reduction, recycling and re-use projects totaling over €1 billion of overall investment. This continues under the new LIFE Programme 2014-2020: over €110 million were invested so far into over 90 projects contributing to Circular Economy. [These projects](#) have overall mobilized some €270 million in favour of the circular economy. There is more to come – namely further strengthening of LIFE's focus on Circular Economy and prioritisation of circularity projects via Action Grants to innovative or demonstrative projects and large-scale Integrated Projects, such as LIFE IP CIRCWASTE from Finland."

LIFE: some examples of projects / circular economy & recycling

LIFE 2014 CRMRecovery - Critical Raw Material Closed Loop Recovery (UK)

LIFE14 ENV/UK/000344

The LIFE 2014 CRMRecovery project aims to demonstrate viable approaches to increase the recovery of target CRMs by 5% within the project lifetime. The target product categories are: display, consumer electronics, ICT and small household appliances; and the target materials are graphite, cobalt, antimony, tantalum, rare earths, silver, gold and platinum group metals (PGMs), but the project will not be limited to these materials.

<http://www.criticalrawmaterialrecovery.eu/>

<https://twitter.com/CRMRecovery>

LIFE-PSLOOP - Polystyrene Loop (NL)

LIFE16 ENV/NL/000271

The objective of the PSLoop project is to recycle both EPS construction waste and extruded polystyrene (XPS) and to demonstrate an economically viable alternative to incineration. The

recycling process is based on the dissolution of PS foam and the removal of the HBCD. The process delivers a PS gel ready for use as a raw material for EPS or XPS. Furthermore, bromine is recovered from the HBCD and recycled.

The project will construct a recycling plant to demonstrate the process on an industrial scale; the process will have already been tested in a pilot plant. The process has been designed to deal with different qualities of input material to maximise internal recycling of the solvent used and to obtain optimised polymers that are in line with virgin quality PS. In addition, the project aims to create a value chain for EPS/XPS with recycling and collection companies by demonstrating a standard collection and pre-treatment system.

http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_pr oj_id=6263

GYPSUM TO GYPSUM (Belgium)

Project developed an innovative process to recycle all sorts of gypsum waste. The related SME Ritleng Revalorisations => first player on the market able to recycle “complex waste of plaster” (e.g. plastics, glass wool, polystyrene, metal, wood, rubble, paper etc) - operates a recycling center in ROHR, aiming to develop a second plaster waste treatment center in St-Souplet.

[LIFE11 ENV/BE/001039](http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_pr oj_id=4191)

http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_pr oj_id=4191

LIFE SOL-BRINE (GR)

Wastewater treatment project that enabled a start-up company SEALEAU which developed and demonstrated a technology for efficient salty wastewater management and recovery of resources, providing a highly innovative solution for industrial wastewater market.

[LIFE09 ENV/GR/000299](http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_pr oj_id=3679)

http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_pr oj_id=3679

<http://solbrine.uest.gr/index.php/en/>

LIFE Programme – further information :

ec.europa.eu/life [facebook.com/LIFE.programme](https://www.facebook.com/LIFE.programme) twitter.com/LIFE_Programme

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

- **EU LIFE Programme** has comparative advantage to other financing instruments as a one-stop shop offering single point for all private and public actors including SMEs, mid-size or large companies developing innovative green technologies at diverse levels of technical readiness. LIFE can act as a catalyst and pre-opener for companies, in particular SMEs and start-ups, it offers a low rate of co-financing and de-risking factor connected to the due diligence and continuous monitoring. LIFE

projects are monitored from the start till the very end (and beyond via post-LIFE missions to selected projects), which enables detecting the promising ones at a very early stage and accompanying them throughout their implementation from lab to upscaling and market application. Environmental sustainability is the LIFE Programme's primary objective. The results of the diverse range of LIFE close-to-market activities carried out in 2018 and early 2019 indicate that supporting the business and financial viability of highly innovative LIFE projects greatly contributes to addressing multiple environmental impacts with a prospect well beyond the project duration.

- The **European Circular Economy Stakeholder Platform** was launched in March 2017 to foster policy dialogue, to exchange expertise among stakeholders, including businesses, and to identify barriers in relation to the circular economy. Its website includes business good practices, national, regional, local strategies, studies and report and voluntary commitments, etc. A Coordination Group composed of representative from existing networks working on circular economy was set up to multiply the impact of the platform. The platform's website provides a comprehensive overview of the activities on circular economy.
- A **Smart Specialisation Platform on Industrial Modernisation** has been launched in June 2016 to facilitate cross-regional cooperation towards industrial modernisation projects, e.g. on resource efficiency, remanufacturing/sustainable manufacturing.

In 2018 the **Pilot Project 'Boosting the circular economy amongst SMEs in Europe'** provided online training to SME support organisations and policy advice to regional authorities. It also helped companies which offer highly promising green solutions for a circular economy to scale-up their solutions across Europe. In addition, the European Resource Efficiency Knowledge Centre was also set up.

France

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

1. Announced in November 2018 by the President of the Republic, France published in early 2019 the Multiannual Energy Program (PPE) which will form the basis of France's energy future for the next ten years. The PPE sets out priorities for public authority action in the energy domain in order to meet the targets set in the Energy Transition law.

<https://www.ecologique-solidaire.gouv.fr/programmations-pluriannuelles-lenergie-ppe>

2. The French National Energy Strategy for Research sets up the research priority in order to meet the Multiannual Energy Program targets and the French National Strategy for Research and Development.

<https://www.ecologique-solidaire.gouv.fr/sites/default/files/SNRE%20vf%20d%C3%A9c%202016.pdf>

3. France released in June 2018 its roadmap regarding hydrogen. This roadmap provides a long-term vision for the deployment of hydrogen in the different sectors: industry, energy (gas and electricity) and mobility.

<https://www.ecologique-solidaire.gouv.fr/nicolas-hulot-annonce-plan-deploiement-lhydrogene-transition-energetique>

4. The PIA (Investments for the Future Programme) was established in 2009, and covers the period 2010-2022. It aims to prepare France to face multiple challenges such as competitiveness, environment, energy, health. The PIA is intended to support projects fostering innovation and the creation of jobs in sectors with strong potential for the French economy. The implementation of the Investments for the Future programme is steered by the Prime Minister services. It is supported by several operators, including ADEME, who is one of the major actors responsible for innovation for energy and ecological transition in France. In the energy transition sector, 2.5 billion Euros were allocated to more than 750 projects.

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

1. France actively participates from the very beginning to the Mission Innovation (MI) initiative and is a member of the steering committee.

<http://mission-innovation.net/our-members/france/>

2. France co-leads with India the MI innovation challenge 2 “off-grid access to energy”. In this framework, France launched in 2018 a call for project making possible the funding of nine projects

receiving a total of €1.8M. The projects cover a range of renewable energy technologies (hybrid systems, solar, river stream generator and biomass), but also different uses of electricity to enhance economic development (irrigation, agriculture, desalination and mobility).

3. France joined the hydrogen innovation challenge from its foundation in 2018, this topic being considered as a major lever of the energy transition.

France actively participates to the events organized by the challenge among which the workshops of Berlin and Antwerpen in 2018 and 2019.

France is looking forward to contributing to the actions which will be performed in the frame of the “Hydrogen valleys” initiative launched by the European Commission. The Zero Emission Valley (Auvergne Rhône-Alpes Region) was selected to participate to the international cluster of hydrogen valleys.

(2) Actions to mobilize private finance and investment for development and deployment of innovation

1. The French Environment and Energy Management Agency (ADEME) launched this year in the frame of the program “Investments for the Future”, a call for project “Production and supply of carbon-free hydrogen for industrial consumers”. The aim of this call is to endorse the developments of hydrogen in a path of ecological and energy transition and in a process of competitiveness of the sector. It is part of the Hydrogen Deployment Plan for the energy transition announced in 2018.

2. The Breakthrough Energy Coalition (BEC) is committed to building new technologies that can enable the energy transition and minimize the impacts of climate change. The BEC and France built a partnership to identify the ways to strengthen the entire French ecosystem of innovation in low-carbon technologies. For this purpose the BEC launched a study to provide an overview of the French innovation financing landscape, particularly in the renewable energy sectors: electricity, transportation, building, industry and agriculture.

<http://www.b-t.energy/>

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

1. In 2019, the French Environment and Energy Management Agency created the company Ademe Investissements SAS which will manage Ademe's equity investments, on behalf of the French Government, in innovative energy infrastructure projects, both in France and abroad. This is the first public equity tool for innovative infrastructure, alongside private investors. It will support the first commercial implementations resulting from research and innovation projects in the field of ecological and energy transition. The company will invest 400 million euros equity.

2. To reach the targets in terms of energy transition, France has set-up specific tools to support financially the deployment of renewable energies with dedicated tools to support innovative projects at commercial scale (e.g. solar panels, renewable heat). These tools pay particular attention to funding innovative technologies likely to become competitive on top of their environmental added value.

Germany

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

Energy innovation in Germany is promoted mainly within the framework of the 7th Energy Research Programme – Innovations for the energy transition. As a strategic element of energy policy, the programme is aligned with the energy transition and will address current and emerging challenges. The interministerial, thematic programme setup enables a coherent funding policy all the way from basic research to large scale demonstration projects. While RD&D on individual technologies like wind, photovoltaics or efficient industrial processes will continue to be funded, a new emphasis is placed on system integration (grids, storage, sector coupling) and cross-system research topics (e.g. digitization, CO₂ technologies, energy transition and society). Under its 7th Energy Research Programme for 2018 – 2022, the Federal Government will provide a total of some EUR 6.4 billion for researching, developing, demonstrating and testing viable future technologies and concepts. This amounts to an increase of about 45% on the previous period of 2013 – 2017.

Besides the 7th Energy Research Programme, energy innovation in Germany is supported by a number of other measures, including for example the National Innovation Programme on Hydrogen and Fuel Cell Technology, or the SINTEG Smart Energy Showcases. Another important project is Carbon2Chem, which develops solutions for mitigation of CO₂-emissions in the steel industry.

The German Government funds industrial-scale pilot projects in key environmental sectors such as climate protection and resource efficiency. These projects show how innovative technologies can be implemented to help to reduce and prevent harm to the environment. The so-called Environmental Innovation Programme focuses on projects that are well suited for demonstration purposes and hence for replication. The projects also lead to further refinement both of the technologies involved and of the environmental regulatory framework. Small and medium-sized businesses receive priority funding: <https://www.umweltinnovationsprogramm.de/englisch>

German Resource Efficiency Programme II (adopted 2 March 2016 by the Federal Government): An important measure is the nationwide expansion of resource efficiency support for companies. One example is the launch of a Competence Centre for Resource Efficiency in companies which is currently run by the VDI Centre for Resource Efficiency (VDI ZRE): <http://www.resource-germany.com>

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

Germany is participating in the international initiative Mission Innovation, placing a strategic focus on the inherently global topics of hydrogen and solar fuels. In addition, the German Federal Government supports researchers in participating in the IEA Technology Collaboration Programmes.

(2) Actions to mobilize private finance and investment for development and deployment of innovation

The German Government has recently launched a programme to support innovative decarbonisation investments in energy-intensive sectors such as steel, cement, lime and chemicals. At the same time, a competence center for climate protection in energy-intensive industries, which will be opened later this year.

Establishment of a national funding system for investment grants to promote the construction of energy-efficient refrigeration and air-conditioning systems with non-halogenated refrigerants, which cause substantially lower CO₂ –emissions from electricity generation as well as no fluorinated greenhouse gases resp. F-gas-emissions: <https://www.klimaschutz.de/en/promoting-climate-action>

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

Technology and innovation transfer is central to the 7th Energy Research Programme of the Federal Government. So called “Living Labs for the Energy Transition” are being established, that will demonstrate innovations in a systemic context and on an industrial scale. Energy Research Networks aim to bring experts from research and business and industry together around diverse thematic issues and to facilitate exchange of experience in an open setup. A closer involvement of startups in energy research is another measure to speed up innovation transfer. Finally research communication is crucial for improving technology and innovation transfer, hence the Federal Government is stepping up its efforts in this area.

Establish “Learning Energy Efficiency Networks” of companies, in which 10 to 15 companies come together voluntarily to share their experiences in company-related energy efficiency activities, set up individual goals for the further improvement of energy efficiency in their companies and subsequently initiate and implement economically efficient measures to reach their goals. The networking helps to be ambitious and fast in this process (<https://www.leenize.com/en/leen-netzwerke/>).

Further specific climate innovation projects in the context of sector coupling include:

- making climate-neutral synthetic fuels available for sectors facing particular challenges to decarbonize (besides national R&D projects Germany supports a pilot in Brazil to produce power-to-liquid kerosene from hydropower and use it in aviation; see: <https://www.giz.de/en/worldwide/63299.html>)
- providing the fast growing sector of heavy duty road transport an efficient and zero-emission option (several real-life “e-Highway” pilots with electric hybrid trucks and fast recharge power supply via catenary system; includes international collaboration; for quick overview see

<https://edition.cnn.com/2019/05/07/tech/e-highway-a5/index.html>, for scientific background see
<https://www.oeko.de/fileadmin/oekodoc/Climate-friendly-road-freight-transport.pdf>, for collaboration see
<https://www.viktoria.se/projects/collERS>).

Indonesia

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

Green Fuel/Biofuel Development Programme

Indonesia develops biofuels into two main types of programme. First, we develop biofuels through blending-based Fatty Acid Methyl Esters (FAME) productions. Second, we also currently develop Hydrotreated Vegetable Oil (HVO) to produce green diesel and biogasoline, which will be further explained in No.2. While lowering emission transport sector and reducing oil consumption, biofuel programme has also empowered palm oil industry as one Indonesia's strategic sector which creates 19 million jobs (directly and indirectly) and empowers smallholder estates and enterprises, taking one-third of the national production of 46 million tons. Through the utilization of palm oil-based FAME biodiesel, starting 2018, we currently reach 20% blending or B20, and we continue to increase the mix rate to 30% or B30 by 2019. Indonesia has included 13.8 million Kiloliter biofuel contributions in the renewable energy share target by 2025.

Renewables Utilization for Energy Access in Remote Areas

In order to provide energy access and improve electrification in remote areas and islands, Indonesian Government have launched Solar Lighting System Programme for remote villages. Starting in 2017, this programme has provided renewable energy access to more than 250,000 houses (in total) in 2018. The program plays an important role to achieve 99% electrification ratio as our key target in 2019 to electrify off-grid areas.

Gas Infrastructure Expansion in Indonesian Urban Areas

Mainstreaming the utilization of gas as one source of clean and safe energy, in particular in urban areas, the Indonesian Government, in cooperation with State Gas Company, has expanded urban gas network in the last five years, providing access for 463,619 houses in 2018.

Environmentally-friendly Cooking Devices

In order to reduce kerosene and subsidized-LPG consumption, Indonesian Government and State Electricity Company have successfully done pilot projects to substitute LPG stoves to electric stove.

Electric Vehicle Development Programme

Aiming to decarbonize transport sector, Indonesian Government is finalizing regulations on electric vehicle. This initiative also includes private and business participation in a certain scale. For example, three national electric motorcycle manufacturers have begun its production and one Indonesian Taxi Company started to deploy EV. Automobile manufacturers will follow the path starting in 2020.

Clean energy conversion in household sector utilizing gas energy

In line with gas network development and implementation, the Indonesian Government has done massive conversion from kerosene to cleaner gas for household cooking, utilizing Liquid Petroleum Gas (LPG) with total productions of 12.2 million tonnes from 2015-2018. The effort has been expanded in distributing LPG for small fisherman boats. Going forward, its utilization will be expanded into other sector, such as agriculture, in using LPG to replace gasoline for farming activities.

Inefficient Fossil Fuel Subsidy Reform to fund productive sectors

Since 2015, Indonesian Government has successfully cut half of fossil fuel subsidy budget, sparing only the targeted subsidy and reallocating the cut to finance productive public sector programmes. As a result, Indonesian government can provide more fiscal space in financing sectors such as education, health, social assistances and infrastructure including clean energy infrastructure, such as gas network expansion. Moreover, Indonesia can cut poverty rate below double-digit rate in 2018. In 2018-2019, Indonesia together with Italy have also conducted G20 Peer Review on this programme, which has become one of best policy practices for other countries.

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovations

○ Solar PV Rooftop Programme

Harnessing solar potential for buildings and residences, Indonesian Government has issued MEMR Regulations No 49 / 2018 on Solar PV Rooftop Utilization. It enables greater public participations in renewables development in Indonesia as well as supporting our national efforts to reach the 2025 national target on solar capacity aiming for 6.5 GW. It also enables implementation of net-metering program in Indonesia's single-buyer market system.

○ Green Fuel and Green Refinery Innovation

Indonesia develops green fuels in two main refineries as pilots. Plaju refinery has successfully used 10% of RBDPO to produce green diesel, and Dumai Refinery, around 12,5% of RBDPO to produce green gasoline. Both expected to co-process higher rate of green fuel in next trial.

○ Co-Firing Power Plant with Variable Renewable Energy (VRE)

Indonesia has initiated co-firing pilot project on coal power plant with RDF (Refused-Derived Fuel) from municipal-waste pellets. Developed by PT Indonesia Power and PT PLN, it took place on 25 MW Jeranjang Coal Power Plant in Lombok Island, West Nusa Tenggara. The RDF comes from Local Recycle Center in the Sister Island's region of Klungkung Regency, Bali. The RDF's co-firing processes contributed to 5% of the power plant supply, enhanced the thermal quality to 3,800 kcal/kg and reduces emissions on CO₂, NO_x and SO_x.

○ Renewable Energy Island Programme

As one of the world's most favorite tourists destination with best-rated resort and beauty, Sumba is also planned as an island that is supported by renewable energy. The multi-stakeholders programme has increased Sumba's electrification ratio from only 24.5% in 2010 to 50.9% in 2018, reducing poverty as well as enhancing clean and affordable energy access for Sumba people. Solar, hydro, biogas and wind are utilized for various electricity purposes, such as water pumping, fertilizer for farming and clean cooking. Following Sumba, Lombok, the Indonesia's second-largest tourist destination and Bali's sister island will be the next renewable island as forecasted by the Lombok Energy Outlook 2030. These programs are aimed to be replicated by other islands in Indonesia.

(2) Actions to mobilize private finance/investment for development and deployment of innovation

We have been striving to create affordable financing facilities for supporting green development and climate-related projects. We have implemented some strategic financing measures. We have released Green Bonds and Green *Sukuk* for funding climate-related projects, and we have also established a project funding institution named PT Sarana Multi Infrastruktur (PT SMI), that is also aimed to finance green projects.

(3) Actions to improve business environment/promotion of business activities for dissemination of innovative technologies and infrastructure

○ Indonesian Government's commitments for Investment Support and Permit Simplification in energy sector

Some deregulations in various sectors have been implemented to simplify permit and non-permit licenses. In energy sector, we have terminated 188 regulations in oil and gas, coal, power and renewables for creating more competitive business environment. For further information see www.esdm.go.id

○ Indonesian Government Promotes One-Stop Services (OSS) for Energy Investment

Having previously been scattered in numerous government ministries and agencies, investment-related licenses are now integrated in the OSS of Indonesian Investment Coordinating Board (BKPM).

<https://www.investindonesia.go.id> ; <https://www.bkpm.go.id/en/contact/one-stop-service-contact-center>

○ Indonesian Government and Stakeholders are keen to conduct international investment forums to promote business development in energy

a. International Exhibition on New, Renewable Energy and Energy Conservation (EBTKE Conex) – held annually – 2019 TBC: www.indoebtkeconex.com

- b. Indonesia International Geothermal Convention and Exhibition (IIGCE) – held annually: www.iigce.com
- c. Gas Indonesia Summit and Exhibition – July 2019: www.gasindosummit.com
- d. International Indonesia Gas Conference and Exhibition – Annually – last time, February 2019: www.indogas2019.i-eec.com

Italy

3. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

The proposal of Italian Plan for Energy and Climate (NPEC), that has been sent by the Italian Ministry of Economic Development to the European Commission in December 2018, according to the Governance of the Energy Union and Climate Action, sets out measures to ensure the creation of a secure, sustainable and competitive energy system in order to tackle climate change, achieve sustainable growth and environmental targets, as envisaged by European 2030 targets. This NPEC is under evaluation by EU Commission and the final text will be definitely approved by the end of 2019 and it will be binding for Italy.

*The Italian Plan has an energy scenario to 2030 with the following **very challenging targets**:*

- *-full **phase out from coal** in power generation by 2025,*
- *-reaching a **30% share of renewables** in total **energy consumption** by 2030, and a **55% share of renewables in electricity** consumption by 2030;*
- *-reaching a **21,6% share of renewables** in **transport** consumption by 2030;*
- *-reaching a **43% energy saving** in total **energy consumption** by 2030, compared to an European target of 32,5%.*

*One of the five dimensions of the NPEC is represented by the research, innovation and competitiveness's dimension. Italy is part of the EU SET-Plan and is a promoter of **Mission Innovation** launched at COP21 to boost frontier projects for clean energy technologies and committed to **double public funds** for R&D for clean energy from **222 Million Euro in 2013** to **444 Million Euro in 2021**.*

*The participation in Mission Innovation has above all increased sensitivity and interest for research and innovation in the clean energy sector. With regards to Mission Innovation technologies and challenges, Italy is engaged in all the 8 Innovation Challenges-IC with different levels of interest and involvement. In particular, Italy is very active in the following Innovation Challenges: **Smart Grids (IC1), Sustainable Biofuels (IC4), Clean Energy Materials (IC6), Renewable and Clean Hydrogen (IC8)**.*

Research and innovation have a fundamental role in the achievement of the Italian NPEC targets with an effective collaboration among the Italian main public actors and stakeholders:

- *Italian Ministries such as the Ministry of Economic Development (MISE), the Ministry of Education, Universities and Research (MIUR) and the Ministry of the Environment and Protection of Land and Sea (MATTM);*
- *the main public Research Centers such as CNR (National Research Council), ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development) and RSE S.p.A. (Ricerca sul Sistema Energetico);*
- *Italian Universities and Regions by means of the European Cohesion Funds for R&I.*

Moreover, the Ministry of Economic Development is about to approve also the 2019-2021 three years-plan of the National Electric System Research Fund. The resources allocated will amount to approximately EUR 210 million. ENEA, CNR and RSE are the leading public research institutions involved. A call-for-proposals for the private sector is also foreseen on a co-funding basis. The activities are aimed at innovating and improving the performance of the system in terms of economics, safety and the environment. The programme's coverage ranges from system governance to R&D and deployment of renewable energies, smart grids, storage systems and end-use technologies (EVs included). It is financed through a specific component of the end-user electricity tariff.

Besides Mission Innovation, Italy is also part of the EU SET-Plan.

Italy is working on the following actions:

- development of advance clean energy materials enabling high performance and low costs for PV, energy storage, efficiency in buildings and industrial processes, components of electric power transmission lines;
- development of management models of electricity system and grids that favor the integration of renewable and non-programmable generation, self-production, storage, energy communities and aggregators;
- application of advanced information technologies, internet of things, peer to peer to the electricity system, to improve grid security and resilience;
- development of models and tools to increase the penetration of the electric mobility in the transport sector and improve its integration and interaction with the electricity system;
- upgrade of electricity grids, smart grids. Evolution of distribution grids, with focus both on hardware components (eg to make networks bi-directional) and software (eg to enable demand response management initiatives);
- promotion of the diffusion and integration of renewable energies, while minimising environmental impacts (for example priority for PV plants on buildings to preserve the soil, heat pumps to avoid particulate emissions, advanced biofuels to use residues and waste).

4. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

It is desirable to strengthen the synergy and the collaboration among the multilateral initiatives represented by **Clean Energy Ministerial, Mission Innovation, International Energy Agency, through the Technology Collaboration Programmes (TCPs)**, in order to encourage the Research, Development and Deployment in clean technologies and to reach the sustainable energy targets at international level.

(2) Actions to mobilize private finance and investment for development and deployment of innovation

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

Japan

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

1. Based on the “Strategic Energy Plan”, approved in July 2018, we strengthen efforts to achieve an optimal energy mix towards 2030, and seek to achieve energy transitions, pursuing all tenable options towards 2050.

https://www.meti.go.jp/english/press/2018/0703_002.html

2. The “National Energy & Environment Strategy for Technological Innovation towards 2050”, decided in April 2016, identifies a number of innovative technologies related reducing GHG emission and the entire energy system. We promote R&D of the prioritized technologies in the medium-to-long term.

https://www8.cao.go.jp/cstp/nesti/honbun_e.pdf

3. The “Basic Hydrogen Strategy”, decided in December 2017, sets a goal to reduce hydrogen costs to the same level of conventional energy such as LNG. To achieve the goal, we promote policies ranging from hydrogen production to utilizations.

<http://www.meti.go.jp/press/2017/12/20171226002/20171226002.html>

4. Through “Plan for Global Warming Countermeasures”, decided in May 2016, Japan will reduce GHG emission by 26.0% in 2030FY compared to 2013FY (25.4% reduction compared to 2005FY) based on the amount of domestic emission reductions and removals assumed to be obtained.

https://www.meti.go.jp/english/press/2016/0419_02.html

5. Based on “Interim Report by Strategic Commission for the New Era of Automobiles”, decided in August 2018, we set long-term goal that Japanese Cars should achieve by the end of 2050 including list of actions under three pillars: Promoting Open Innovation, Cooperating Internationally and Establishing System.

http://www.meti.go.jp/english/press/2018/0831_003.html

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

- Host the ICEF (Innovation for Cool Earth Forum) in Japan

Japan has hosted an international conference of ICEF every year since 2014. ICEF continues to provide opportunities to raise awareness and promote discussion on the latest trend of climate action through innovation of energy and environmental technologies as well as to expand the international network of leading figures of industry, academia and government.

- Host an annual RD20 conference in Japan in collaboration with the ICEF
Japan hosts an annual international conference of RD20 to enhance alliance and facilitate international joint R&D activities among leading R&D institutes of G20 members, with gathering experts from leading R&D institutes of G20 members, in collaboration with the ICEF. With making use of RD20 opportunity, Japan encourages Japanese R&D institutes to develop international joint R&D activities for innovation in clean energy technology field, in cooperation with R&D institutes in G20 members.

- Hold Hydrogen Energy Ministerial Meeting (HEM), the annual LNG Producer-Consumer Conference and the International Conference on Carbon Recycling (TBD) in Tokyo this autumn.
Promote further international cooperation and discuss the concrete actions of energy innovation such as 1) Hydrogen: harmonization on standards, regulation, evaluation of hydrogen's potential, 2) "Carbon Recycling": investments, financing and sharing roadmap for Carbon Recycling, and 3) LNG : promoting innovative use for a flexible and transparent global LNG market through these frameworks.

- Expand existing modeling exercise by RITE to develop low energy demand modeling
Hold a workshop to build an international cooperation network for demand model development next fall as a kick-off for International Integrated Assessment Model Comparison Projects.

- Participated in Innovation Challenges(ICs) in Mission Innovation(MI)
Japanese government has tried to take a high risk of innovative clean energy technology project with various type of budgets for increasing the possibility of global collaboration in the future.
<http://mission-innovation.net/our-members/japan/>

- Leading initiatives of Clean Energy Ministerial (CEM) and strengthening R&D and international collaboration on deployment of Carbon Capture
Promote deployment of energy technologies such as hydrogen, CCUS and nuclear under initiatives of Clean Energy Future (NICE Future), CCUS and Hydrogen (TBD) as the leading country.

- Hosted the World Circular Economy Forum (WCEF) in October 2018 in Japan
Japan, together with Sitra, Finland hosted WCEF2018 which presented the world's best circular economy solutions and brought together over 1,000 key thinkers and doers from around the world. Through this Forum and others, Japan will continue to contribute to sharing with the world best practices related to a circular economy.

- Host a G20 Resource Efficiency Dialogue in Japan.
Japan will host a G20 Resource Efficiency Dialogue in this October to promote information sharing of resource efficiency policies including marine plastic litter policies among G20 countries.

-Host an international symposium on behavioral sciences in Japan this May.

In the symposium, in collaboration with behavioral insights teams in the UK, World Bank, etc., Japan discusses how to elicit sustainable behavior change and realize SDGs through use of behavioral insights.

- Host a biennial/annual international symposium on CCUS in Japan.

Japan holds international symposiums on CCUS since January 2016.

-Launched GOSAT-2 successfully in October 2018

Japan has been operating GOSAT, the world's first GHG observing satellite, for ten years, which shows the applicability as a highly transparent tool for verifying anthropogenic GHG emissions. Japan will further contribute to the reduction of GHGs by proactively developing the global observation by the GOSAT-2 launched last October.

- Make 'Progressive Environment Innovation Strategy'

Japan has a plan to make 'Progressive Environment Innovation Strategy' in 2019, which aims, for example, to set clear targets such as cost targets, to maximize public and private resources, to discover and create technology seeds domestically and internationally, to set an agenda on the basis of needs, and to strengthen support that connects to business.

(2) Actions to mobilize private finance and investment for development and deployment of innovation

- Establishment of the TCFD Guidance by METI

Ministry of Economy, Trade and Industry of Japan (METI) has released a guidance for companies to follow the TCFD recommendations in a proactive manner last December. METI promotes companies' disclosure of their opportunities related to climate change in such a way as to promote mobilization of private finance.

https://www.meti.go.jp/english/press/2018/1225_006.html

- Practical Guide for scenario analysis in line with TCFD recommendations

MOE has released Practical guide for scenario analysis in line with TCFD recommendations in March 2019 as the first practical guideline to show how companies should implement scenario analysis to integrate climate-related risk and opportunities into their own management strategies by utilizing TCFD recommendations.

- Inauguration of the TCFD Consortium

In May 2019, METI, JFSA, and MOE arranged an industry-led TCFD consortium for supporters to further promote quality reporting. The consortium aims to facilitate constructive dialogues between

institutional investors and financial institutions and companies specifically on the climate-related financial disclosures recommended by the TCFD for mobilizing investment for innovation.

- Hold an international TCFD Summit in Tokyo this Autumn

Japan will host the world's first TCFD Summit this Autumn in Tokyo with leaders from industrial and financial community and relevant international organizations to discuss challenges and opportunities around climate-related disclosures and to raise momentum for mobilizing private finance for innovation.

- Promoting the disclosure of ESG information "ESG Dialogue Platform"

The platform provides the database function for companies to register the environmental information and for investor to acquire and utilize information with analysis tools. The Platform also provides dialogue function.

<https://www.env-report.env.go.jp/en/portal.html>

-Based on the "The Export Strategy for Infrastructure Systems", revised in June 2019, we welcome the actions taken by NEXI to establish a new trade insurance measure for energy innovation.

<http://www.kantei.go.jp/jp/singi/keikyou/dai43/siryu2.pdf>

- Efforts to promote ESG Finance

MOE held ESG Finance High Level Panel in February 2019 and will regularly held for follow-up as the place for each industry leader in the financial and investment fields and the government to discuss actions to improve the awareness and efforts on ESG finance. In addition, MOE published "Findings from case studies on ESG Regional Finance" in March 2019 which will help regional financial institution to evaluate the ESG factors for project with positive environmental and social impact.

- Budgets in 2019FY as an incentive for private finance/investment for development and deployment of innovation

Japan has 591.8 billion yen to promote development of next-generation energy and environmental technologies towards green growth strategy, which includes for hydrogen-based society, low-carbonization of fossil fuels by CCUS, future-oriented renewable energy and power storage technologies, and expanding Green finance Information Infrastructure to make a transition to a decarbonized society while achieving SDGs in parallel.

Examples:

1) 66.9 billion yen for hydrogen-based society including

-Establish a hydrogen supply chain utilizing untapped energy resources

-Supply chain projects and, R&D for hydrogen related facilities and mobility such as a FC truck

-Offer subsidies toward public hydrogen station development for fuel-cell vehicles, etc.

2) 28.8 billion yen for low-carbonization of fossil fuels by CCUS including

-Support International CCUS demonstration projects

-Establish some utility-scale technologies on CCUS until 2023

- 3) 52.6 billion yen for future-oriented renewable energy including wind and solar power, and power storage technologies
- 4) 126.7 billion yen for Improving safety, reliability and maneuverability of nuclear power
- 5) 133 billion yen for Innovative energy saving by decarbonization technologies including
 - Improve further energy saving through AI systems development and new mobility services brought about by IoT and AI
 - Develop innovative energy saving technologies (GaN, CNF), etc.
- 6) 31.5 billion yen for creating mid- and long-term innovation including international collaboration in demonstration projects overseas and international standardization
- 7) 102.3 billion yen for Deployment of innovative energy saving, renewable energy and power storage technologies at houses, offices and regions
 - Achieve ZEH/ZEB on average with regard to newly constructed buildings by 2030 for newly constructed buildings
 - Develop decarbonized areas or cities through the sector-coupling in the energy industry and transport industry, etc.
- 8) Others
 - 9 billion yen for expanding Green finance
 - 8 billion yen for Information Infrastructure to transit decarbonized society
 - 16 billion yen for international contributions (The Joint Crediting Mechanism etc.)
 - 17 billion yen for research development of carbon-neutral technologies including behavioral Insight technologies

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

- Market development by introducing energy-saving labeling and environmentally friendly public procurement criteria etc.

A market utilizing innovative technologies and infrastructures will be created or expanded through arrangement of adequate policy and institutional framework. For example, energy-saving labeling and standards as well as environmentally friendly public procurement criteria may be introduced to raise public awareness about energy efficiency and cleaner environment and facilitate the technology deployment.

- Capacity building for several countries

To establish and maintain adequate policy and institutional framework to improve business environment, human resources development and capacity-building programs will be provided for relevant officials and experts in several countries.

- Convene public and private forum to share good practice in several countries

Exchanging good practices and lessons learned among several countries will contribute to further improving business environment and promoting business activities for dissemination of innovative

technologies and infrastructure. For this, forum inviting representatives from public and private sectors will be organized.

- Establish global energy efficiency benchmarking

Developing the foundation that can promote policies for improving domestic energy efficiency while being conscious of international standards by sharing common indicators and data on energy-intensive industries and end-use sectors.

- Japan established Behavioral Sciences Team (BEST) in April 2017 to help people make better choices by guiding their own autonomous decisions through the combination between behavioral insights and cutting-edge technology including AI/IoT (BI-Tech).

-“The Fifth Basic Environment Plan” decided in April 2018, set out an idea that environmental policies from now on play a role of creating innovations across all perspectives including those concerning socio-economic systems, lifestyles, and technologies, and providing simultaneous solutions for economic and social challenges.

http://www.env.go.jp/policy/kihon_keikaku/plan/plan_5/attach/ref_en-01.pdf

-Based on “Fourth Fundamental Plan for Establishing a Sound Material-Cycle Society” decided in June 2018, Japan promotes innovations concerning the recycling of resources and the improvement of living environments in developing nations, as well as to the alleviation of global resource constraints.

The Netherlands

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

- Development of a mission oriented knowledge & innovation agenda for climate & energy, consisting the sectors Electricity, Industry, Mobility, The built environment and Agriculture & land-use.
- This agenda has been developed in a multi-stakeholder process and has been derived from the missions that the Netherlands wants to have achieved in 2050 and the concrete objectives for 2030 for the national climate agreement.
- In 2019 the 13 mission oriented research & innovation programs in the Agenda will be further elaborated, aiming at putting it in practice from 2020 onwards. That implies: drawing up the specific activities, prioritizing them considering the international landscape, the role that Dutch knowledge institutes & companies play and the available funding and finalizing it in agreements and contracts as well as research & innovation subsidy schemes.
- Specific focus is on the interaction between the innovation program and the other policy measures that will help create the right market incentives for the deployment of the innovations.
- The 13 mission oriented research & innovation programs are:
 1. Renewable electricity offshore
 2. Renewable electricity production on shore and in the built environment
 3. Acceleration of energy renovations in the built environment
 4. Sustainable heating (& cooling) in the built environment
 5. A balanced new energy system in the built environment
 6. Closing industrial cycles
 7. CO₂-free industrial heating system
 8. Electrification & radically new processes
 9. Innovative propulsion systems and use of sustainable energy carriers for mobility
 10. Effective transportation for people and goods
 11. Climate neutral production for food and non-food
 12. Optimal use for land & water for CO₂-binding and usage.
 13. A robust & societal accepted energy system.
- From these 13 mission oriented research & innovation programs, the Netherlands wants to reassess and strengthen the relevant international collaboration programs under the IEA (TCP's), MI and CEM, as well as bilateral collaboration with neighbouring countries.

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

- Strengthening the collaboration with IEA, MI and CEM.

(2) Actions to mobilize private finance and investment for development and deployment of innovation

- Innovation and energy innovation subsidy schemes, that require private investment according to the European State aid Rules.
- Establishment of Invest NL.
- Programs for valorization and specific support programs for startups, scale ups & SME's in the light of the mission oriented Top Sector policy in the Netherlands.

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

- See point 2

Kingdom of Saudi Arabia

Multilateral Actions

CCUS Clean Energy Ministerial Initiative

Saudi Arabia, United States, United Kingdom and Norway are leading Carbon, Capture, Utilization and Storage (CCUS) under Clean Energy Ministerial; this initiative strengthens the framework for public-private collaboration on CCUS, with an objective to increase the momentum of CCUS development and catalyze public-private partnerships to drive CCUS investments and achieve a significant CO₂ emissions reduction from fossil power generation and industrial processes, while ensuring energy security. Other G20 members participating in this initiative are; Canada, China, Japan, Mexico and South Africa

CCUS Mission Innovation Challenge

Under the Mission Innovation activities, Saudi Arabia is working with the United Kingdom, Mexico, and Norway for identifying innovation opportunities in higher technology readiness levels that of particular interest to industry partners, in order to accelerate the Carbon Capture Utilization and Storage deployment and to enable near-zero CO₂ emissions from power plants and carbon intensive industries. Other G20 members participating in this initiative are: Australia, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, and United States.

Bilateral Actions

Collaboration on Clean Fossil Fuels and Carbon Management

Collaboration between Saudi Arabia and United States on clean fossil fuels and carbon management in the areas of supercritical carbon dioxide (sCO₂) power cycles; carbon capture, utilization, and storage (CCUS); chemical looping and oxy-combustion; the energy-water nexus, as well as other areas of mutual interest related to clean fossil fuels and carbon management. The two countries will exchange experts, engineers, and scientists and facilitate the transfer of technology

Collaboration on Clean Energy

Collaboration between Saudi Arabia and United Kingdom on clean energy to work closer on developing technologies that will reduce carbon emissions while growing their respective economies. As part of the agreement, the two countries will share innovation, technical knowledge and expertise on clean energy, including smart grids, electric vehicles and Carbon Capture Utilization and Storage

UAE-KSA on CCUS Collaboration

Cooperate in the research, development, and deployment of converting carbon emissions into value (E2V) through utilizing it as a feedstock or converting it into product to ensure that carbon emissions will be recycled away from the atmosphere and create value through its utilization.

National Actions

Carbon Capture Utilization and Storage Research Center

Saudi Arabia established CCUS research center to increase adaptation resilience in energy system, encourage research and innovation in this area, unify efforts at the local level among researchers and engage the private sector, and to cooperate with the global centers of excellence in these technologies. In addition to convert carbon dioxide emissions into economically valuable products.

Carbon Dioxide (CO₂) Emissions to Value (E2V) Project

As a part of its sustainability program and climate resilience, Saudi Basic Industries Corporation (SABIC) built the world's largest plant for capturing and utilizing carbon dioxide. It captures and purifies CO₂ from an existing ethylene glycol production facility located in Jubail, Saudi Arabia. With an annual capacity of 500,000 tons, the carbon capture and utilization (CCU) of CO₂ emissions are mainly used as a feedstock for production of methanol, urea, oxy-alcohols, and polycarbonates on economic and value-added merits. plant will prevent about 500,000 tons of carbon dioxide a year.

Mangrove Initiative

The Arabian Gulf coastline features many inlets and bays, fringed by mangrove trees that provide a critical habitat for birds and marine life. A Saudi Aramco initiative was initiated to preserve and protect this natural resource for future generations, by developing a mangrove eco-park, which when its completed will protect 63 square km of mangrove forest, salt marsh and sea grass habitats – important nurseries for fish and shrimp. The park will help foster knowledge and appreciation of this fragile ecosystem. The mangrove plantation initiative to restore lost mangrove habitats in the Kingdom's Eastern Province coastal areas is on track to plant two million mangrove seedlings by the end of 2018. In addition to restoring critical habitat for marine life and birds, these mangrove forests serve as the most significant natural CO₂ sink in the Kingdom.

Home of Innovation

Lunching of the Home of Innovation. The Home of Innovation™ is a SABIC growth initiative that combines marketing, innovation and technology to create demand and grow business on a local, regional and global level. The Home of Innovation has over 200 advanced systems, materials and products including many that reduce the energy and water use. The facility includes a modern home designed with locally available technology to achieve a net-zero energy balance (LEED platinum certified). If all homes in Saudi Arabia were as efficient as the demonstration house it would reduce CO₂ emissions by the equivalent of six coal-fired power plant.

Singapore

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

A. Encouraging R&D in Singapore

Singapore has launched the Research, Innovation and Enterprise 2020 (RIE2020) Plan, which sets aside SGD\$19 billion over the period of 2016-2020 to support R&D in Singapore. Besides fostering our universities' collaborations with their international counterparts, Singapore also encourages public-private research such as the establishment of corporate laboratories in our universities.

<https://www.nrf.gov.sg/rie2020>

B. Grant Call to Boost Innovation

The Energy Market Authority (EMA) and Enterprise Singapore had announced a joint grant call in September 2018 for local enterprises to develop solutions for deploying solar energy and optimising energy consumption. This would help local enterprises build capabilities while creating opportunities for their businesses in Singapore and in overseas energy markets. In addition, a total of S\$15 million grant was awarded to seven energy innovation projects to strengthen the resilience of our power system and energy markets. These projects will involve the use of technologies such as blockchain, data analytics, artificial intelligence and machine learning.

https://www.ema.gov.sg/media_release.aspx?news_sid=20180919ygPkGNjxyt64

C. Regulatory Sandbox for Energy Solutions

EMA launched the Regulatory Sandbox Framework in 2017 to allow regulations to evolve to accommodate new technologies and business models. This creates a safe space for testing the feasibility of innovative energy solutions in a live environment, without the usual regulatory requirements. One example is the use of energy storage systems at a substation in a residential area in Singapore. Findings will guide our regulatory approach for the grid operator.

<https://www.ema.gov.sg/sandbox.aspx>

D. Achieving Water Sustainability

Water is an existential issue for Singapore. The Public Utilities Board (PUB), Singapore's National Water

Agency, has adopted an integrated approach to managing our water resources, and has put in place a diversified water supply strategy with the Four National Taps - water from local catchments, imported water, high-grade reclaimed water known as NEWater, and desalinated water. Technology and innovation are key enablers in achieving Singapore's water security and sustainability.

E. Recycling Every Drop of Water Used – NEWater

Introduced in 2003, NEWater is ultra-clean, high-grade reclaimed water that meets the World Health Organization's (WHO) guidelines for drinking-water quality. NEWater is produced using advanced membrane technologies, namely microfiltration, reverse osmosis, and ultraviolet disinfection. By recycling every drop of used water, Singapore has expanded its water resources, and built a water source that is climate resilient.

F. Lowering Energy Footprint of Desalination

The energy needs for water production will increase as Singapore relies more on desalinated water. To manage this increase, Singapore has been investing in R&D to reduce the energy requirements for desalination from the current 3.5kWh/m³ to 1.5kWh/m³ in the middle term, and eventually reaching 1kWh/m³ in the long-term. This will be achieved through the use of low-energy desalination technologies such as electrochemical desalination and biomimetic membranes.

G. Energy Recovery from Used Water Treatment

PUB is actively testing technologies to make the used water treatment process energy self-sufficient. The target is to move from the current 25% energy self-sufficiency to 75% in the short-term, and ultimately to 100% energy self-sufficiency in the long-term. This shall be achieved through the use of energy-efficient technologies and enhanced biogas production. In addition, Singapore's future Tuas Water Reclamation Plant will be co-located with a new Integrated Waste Management Facility to form the Tuas Nexus, which will harness the synergies of the water-waste-energy-nexus to maximize energy and resource recovery efficiencies.

H. Floating Solar Photovoltaic Systems

PUB and the Singapore Economic Development Board (EDB) are pursuing large-scale floating solar photovoltaic systems on the surface of our reservoirs to advance the growth and adoption of solar energy. Deploying floating solar systems on reservoirs not only maximize land use, but enable PUB to harness solar energy to reduce its overall carbon footprint. The solar energy generated will be used for PUB's water treatment processes.

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

A. Singapore International Energy Week (SIEW)

Singapore organises the annual SIEW to bring together governments, international organisations, industry players and academia to discuss key energy challenges and innovative solutions. The theme for the 12th edition of SIEW is “Accelerating Energy Transformation”. Discussions at the 12th SIEW will focus on energy transformation, electrification and digitalisation. The event will be held from 29 October – 1 November 2019 at Marina Bay Sands, Singapore.

www.siew.sg

B. Energy Innovation (EI)

Singapore organises the annual EI event to encourage collaboration among industry, researchers and government to grow key local capabilities to meet Singapore’s energy and low carbon objectives. Through this platform, stakeholders can exchange knowledge and views about cutting-edge energy technologies and commercialisation strategies to translate these technologies to application. The EI 2019 will be held on 28 May 2019 in Singapore.

<https://poweringlives.sg/events/energyinnovation2019>

C. Digitalisation and Energy Workshop for Association of Southeast Asian Nations (ASEAN)

Singapore hosted a Digitalisation and Energy Workshop for ASEAN with the International Energy Agency (IEA) and the United States Department of State on 27 June 2018. Discussions focused on the use of smart data and demand response programmes that impact energy consumption and supply, as well as the impact of digitalisation on cybersecurity in the energy sector.

D. CleanEnviro Summit Singapore (CESS)

Singapore organises the CleanEnviro Summit Singapore (CESS), which is a biennial global platform for thought leaders, policy makers and industry captains to connect, discover and discuss practical solutions to address environmental challenges in the context of the global waste-water-energy nexus. The next edition will be held from 5 - 9 July 2020 at the Marina Bay Sands Expo and Convention Centre in Singapore. CESS 2020 will feature several highlights. The Clean Environment Leaders Summit consists of exclusive high-level plenary sessions that gather the world’s top environmental leaders from the public and private sectors, international organisations and think-tanks to discuss global environmental trends and develop impactful solutions. The City Solutions Singapore exhibition showcases the latest environmental innovations from global, regional and local enterprises.

www.cleanenvirosummit.sg

E. Singapore International Water Week (SIWW) – A Global Platform to Co-Create Innovative Water Solutions

The biennial Singapore International Water Week (SIWW) is a leading global platform to facilitate and showcase integrated water solutions. SIWW delivers a range of flagship programmes and platforms that bring together the global value chain of water to share leading thought leadership in water management and the latest developments in water technologies and innovations. Held in conjunction with the World Cities Summit and the CleanEnviro Summit Singapore, the event attracted more than 24,000 participants from 110 countries and regions. The next edition of SIWW will be held from 5 to 9 July 2020.

www.siww.com.sg

(2) Actions to mobilize private finance and investment for development and deployment of innovation

A. Capacity Building Roadmap on Energy Investments and Financing for ASEAN

Singapore has worked with the IEA to co-develop a Capacity Building Roadmap on Energy Investments and Financing for ASEAN to enhance regional capabilities in attracting investments and developing sustainable financing models. Singapore hosted the Singapore-IEA Clean Energy Investments and Financing Training Programme as the first activity under the Roadmap on 28 – 30 August 2018. This was attended by over 100 participants from 16 countries.

B. Singapore Water Exchange

The Singapore Water Exchange was established to provide an integrated and conducive environment for water companies to operate and collaborate. It will house a vibrant ecosystem of water companies and leverage mutual strengths to push the frontiers of water innovation and business growth.

www.pub.gov.sg/sgwx/about

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

A. Supporting Small and Medium Enterprises (SMEs) and Startups through Centre of Innovation in Energy

In April 2019, Singapore launched the EcoLabs Centre of Innovation in Energy at the Nanyang Technological University (NTU) to develop innovation in areas such as energy efficiency, renewable energy and electric mobility. Ecolabs will provide SMEs and startups with access to cutting-edge R&D equipment and NTU's pool of research scientists to assist in their development of technologies. In addition, Ecolabs will provide services such as business incubation and investment facilitation. EcoLabs will also aggregate test-bedding infrastructure so that companies can easily validate their innovations at scale and build a track record for internationalisation. This addresses a longstanding gap in the energy sector by bringing together partners from academia, industry and government.

http://news.ntu.edu.sg/pages/newsdetail.aspx?URL=http://news.ntu.edu.sg/news/Pages/NR2019_Apr16.aspx&Guid=5e20fbfa-6360-4b17-922c-3b7c796d0381&Category=@ntu

Spain

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

Spain is fully aligned with the EU counterparts in terms of Research, Development and Innovation policies. In this respect, the main instrument of the Spanish Central State Administration is the **National Plan For Scientific and Technical Research and Innovation 2017-2020**, that aims for an innovative environment that allows responding to the great challenges of society, being **Energy and Climate Change** among those challenges. In the energy field, the actions derived from this National Plan are coordinated with different European initiatives, in particular, with the European **Strategic Energy Technology Plan (SET Plan)**. The SET Plan is the primary decision-making support tool for European energy policy. Spain takes active part in the SET-Plan and is involved in its main activities alongside other European countries, Research Centers, Academia and Industries.

It is worth mentioning that our **Draft National Energy and Climate Plan** refers to the possibility to design a **Strategic Action on Energy and Climate Change** in the forthcoming National Plan for Scientific and Technical Research and Innovation and includes the possibility to join **Mission Innovation**, a global initiative to accelerate clean energy innovation.

The main areas where innovation plays a key role to combat climate change are: (i) energy efficiency, (ii) renewable energy technologies, (iii) energy system optimization, flexibility and storage, (iv) electric vehicles and (v) carbon capture, storage and use.

Besides that, we are promoting innovative business models and financing tools. In this regard, we have developed new models for **energy performance contracts (EPC)**, to improve energy efficiency in public buildings without the need for upfront capital investment. We are also designing **on-tax financing mechanisms**, inspired by the **PACE model**, where the credits for investments in energy efficiency in buildings can be repaid through property-related tax bills. Finally, we are convinced that the emerging role of the prosumer, a new **empowered citizen** enabled by ICT tools and platforms, will play a decisive role as a **driver of innovation**. In this vein, Spain is adopting **new provisions to support self-consumption**.

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

Spain participates in several funding programs such as EUREKA, IBEROEKA, EUROSTARS, ERANETS, etc. since international collaboration projects offer an excellent platform to exchange information, join efforts and develop new innovative solutions.

It is worth highlighting the **EUREKA network**, a decentralized intergovernmental initiative to enhance European competitiveness by supporting businesses, research centers and universities that take part

in trans-national projects. **EUROGIA2020** is a particular cluster of EUREKA, a bottom-up, industry driven, market oriented program that addresses all areas of the energy mix, from renewable energy to efficiency and reduction of carbon footprint of fossil fuels. The city of Madrid hosted a **EUROGIA2020 Information Day and Project Pitch session** in collaboration with SET-Plan in **October 17, 2018**.

(2) Actions to mobilize private finance and investment for development and deployment of innovation

- Our **Draft National Energy and Climate Plan** acknowledges the importance of promoting public-private collaboration and research and innovation businesses, specially national and international collaborations, private investments accompanied by public subsidies, implementation of new schemes for public and pre-commercial purchase of scalable solutions based on the technical developments achieved.
- **EU Innovation Fund** and the future **Horizon Europe**, complemented by our **National Plan For Scientific and Technical Research and Innovation**: it gives a new and improved approach to demonstration projects, as well as a specific **auction schemes for renewable power** (see paragraph below) to leverage private investments.

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

Our **Draft National Plan** includes measures to promote innovation and new renewable generation infrastructure, taking into consideration technologies that offer a great potential, although since they are not yet competitive they need to be developed and further tested (e.g. marine energy or offshore wind in deep waters). The Plan includes the possibility to set a specific **auction calendar** for a reduced volume of renewable power involving innovative technologies, especially to deploy demonstration or first of a kind (FOAK) projects.

The Plan also envisages that the auction can be complemented with public financing if needed.

A National Energy and Climate Plan with a clear roadmap, a favorable and stable legal framework and a well-defined auction calendar will improve the business environment and will significantly contribute to future investments.

Turkey - Energy Efficiency

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

Sustainable development has a strategic importance for economic growth, social development and energy sector for all countries as well as Turkey with its rapidly growing economy and urbanization with a dynamic and young and dynamic population.

Particularly in terms of security of supply, in the electricity and natural gas sectors, the potential to reach a more efficient, competitive and environmentally sustainable structure.

In this context, the National Energy and Mining Policy, defined in three pillars of supply security, localization and predictability as it was announced by the Ministry of Energy and Natural Resources in 2017, is considered as a very important step towards the future.

In this context, 10 GW capacity for both solar and wind is expected to be added to the existing renewable installed capacity between 2017-2027. In addition, new policies and strategies are being developed in order to increase the share of other renewable resources in the portfolio and to utilize renewable resources as much as possible.

National Energy Efficiency Action Plan 2017-2023 (NEEAP), in line with EU Directive 2012/27/EU was issued in Official Gazette of January 2, 2018. Under the NEEAP, the aim is aimed to reduce the primary energy consumption of Turkey by 14% until 2023 through 55 actions defined in 6 categories, namely buildings and services, energy, transport, industry and technology, agriculture and cross-cutting (horizontal) areas. It is also projected that 23.9 Million TOE cumulative savings will be achieved by 2023, for which 10.9 billion USD of investment will be made according to 2017 prices. It is also projected that 66.6 million tonnes of carbondioxide equivalent (MtCO₂-eq) will be mitigated by implementing 55 actions within the scope of NEEAP.

Energy Performance Certificate, defined as a result of Building Energy Performance (BEP) Regulations in 2008, is a document declaring and comprising minimum energy needs and energy consumption classification, insulation properties and efficiency of heating and/or cooling systems of buildings. It is used in sales and –building leasings. This certificate describes the buildings with building licences before January 1, 2011 as existing buildings, to which mandatorily energy performance certificate had mandatorily been given before 2020. The authorization to prepare Energy Performance Certificate is under the responsibility of EVD companies. New buildings should not be equal or lower than C Energy Performance Certificate class.

Furthermore, Energy Efficiency Project Competitions in Industry (SENVER) are arranged every year for the purpose of exposing, introducing and promoting energy efficient and environmentally-conscious projects and technologies, that are implemented by our industrial establishments, and increasing exchange of information among industrial establishments and encouraging new and similar studies on

energy efficiency. In addition to these, activities for “Energy Efficiency Week” have been arranged in the second week of January of each year for the purpose of increasing energy efficiency awareness of the society, increasing efficiency in production and usage of energy, promoting national energy efficiency movement.

National Energy Efficiency Forum and Fair is hold with the participation of national and international experts where the progress, bottlenecks and solution proposals in energy efficiency are discussed every year in March or April. As part of this event, discussion sessions like conferences and panels, fair activities including energy efficient products and technologies, activities for awarding persons and establishments doing successful studies with prizes and various cultural and art activities are performed.

Energy Performance Contracts (EPCs) mechanism will be developed to suit public sector, particularly in Turkey. Either energy or monetary savings will be guaranteed by this mechanism in ESCOs business model. As of early 2018, an article on energy performance contracts, which allow energy efficiency implementations in public buildings and facilities through ESCOs, was added into the EE Law.

In the international project between Turkey and Denmark entitled “Efficient and Low Carbon Heating and Cooling”, implementation of legislation for discrete heating in Turkey, undertaken feasibility studies for discrete heating systems and capacity building of relevant beneficiaries in Turkey have been carried out.

Also, Turkey’s first technical high school specialized on renewable energy Technologies was opened in 2017 for the purpose of providing training for growing number of qualified labor force in the energy sector. It is planned that there will be additional 10 technical high schools specialized on renewable energy and natural resources. It is expected that these activities will enable innovation and transition to improve more rapidly in the energy sector.

Cezeri Green Technology Technical and Industrial Vocational High School is the first environment-friendly public building and creates a model to demonstrate how to reduce energy consumption and related GHG emissions in public buildings in Turkey in a cost-efficient way.

Cezeri Green Technology Technical and Industrial Vocational High School complex has a land area of 17.030 m² and indoor area of 21.940 m² and the school complex has 26 classrooms, 6 laboratories, 10 ateliers, a sports hall, a dormitory building with 52 rooms with 147 bed capacity.

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

The activities conducted by various institutions within the framework of energy efficiency and developments in this area are followed and monitored closely by our related institutions. In this respect, the activities of related international organizations are also very valuable. International

conferences and seminars are substantial platforms in order to be able to follow latest developments.

We aim to establish educational and financial support mechanisms for incentives to reach the target of low carbon emissions and to increase awareness by organizing various activities.

(2) Actions to mobilize private finance and investment for development and deployment of innovation

Three Energy Efficiency Support Programs are implemented by MENR: Efficiency Increasing Projects (EIPs) with maximum five Million Turkish Liras cost (investment cost) in total and less than 5 years pay back periods, of industrial establishments that have around 500 TOE to 1000TOE energy consumption annually with a grant up to one and a half Million Turkish Liras.

Under the Voluntary Agreement implementations, reducing energy intensity of the industrial establishments that have around 500 TEP and 1000 TEP annual energy consumption to at least 10% as an average in three years have been granted 30% of energy expense of the year, and the contract had been signed, up to one Million Turkish Liras.

As per Communiqué 2017/1 published in the Official Gazette of July 26, 2017, investments for energy efficiency projects designed to save energy by at least 20% on the baseline, with a simple payback period of 5 years or shorter in manufacturing industry plants with minimum 500 toe of annual energy consumption are allowed to benefit incentives depending on the investments made in the fifth region according to Project approval of MENR.

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

Turkey adopted the EU Eco-Design and Labelling Directives (2010/30/EU and 2009/125/EU). Now the new framework directive for Energy Efficiency Labelling and its regulations are under harmonization process.

Turkey - Nuclear

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

Nuclear energy program is implemented through technical cooperation with vendor countries and international organizations. As an embarking country in nuclear energy, local industrial involvement and funding for R&D are priority areas for Turkey. Turkey also takes part in the projects with international organizations on advanced nuclear energy technologies and improvement of nuclear safety

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

Nuclear Industry Cluster (NÜKSAK) was established in 2017 under Clustering Support Program of the Ministry of Industry and Technology (<https://kumelenme.sanayi.gov.tr/Default.aspx>). The objective of NÜKSAK is to realize the acquisition of technology and to increase the domestic capability in design and manufacture by taking part in the supply chain of Turkish nuclear power program. The IAEA projects under Technical Cooperation Framework include Human Capacity Building Related to Nuclear Science and Technology (<https://www.iaea.org/projects/tc/int0095>) and Capacity Building for Small Modular Reactors (<https://www.iaea.org/projects/tc/rer2014>). The projects co-financed by the EU and Turkey include the Improvement of Nuclear Safety Infrastructure and Management of Spent Nuclear Fuel and Radioactive Waste (<https://www.enerjiprojeleri.eu/en/>).

(2) Actions to mobilize private finance and investment for development and deployment of innovation

The activities of NÜKSAK are financed by the Ministry of Economy and Ministry of Industry and Technology with total allocation of 32 million Turkish Liras.

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

NÜKSAK members make to technical visits to the countries with established nuclear power programs and take part in the national and international conferences.

United Kingdom

1. An overview of selected joint or individual actions that promote energy and environment innovation for energy transitions and global environment for sustainable growth

The UK is committed to tackling marine plastic litter through a number of initiatives:

- Call for evidence on biodegradable plastics: This will explore the benefits of these types of plastic, the technical feasibility of standards, and whether standards could help to address consumer confusion with regards to the difference between them and how to properly dispose of them.
- Microbeads ban: A ban on the manufacture and sale of rinse-off personal care products containing microbeads came into force in 2018 as part of our efforts to prevent entering the marine environment. This ban – which was praised by campaigners as one of the toughest in the world- will now prevent billions of microbeads ending up in the ocean every year.
- CCOA: The Commonwealth Clean Ocean Alliance calls on other countries to pledge action on plastics, be this by a ban on microbeads, a commitment to cutting down on single use plastic bags, or other steps to eliminate avoidable plastic waste. These ambitions are supported by up to £70m million of funding to boost global research and help countries across the Commonwealth stop plastic waste from entering the oceans in the first place. During our Prime Minister’s visit to Africa last year, she announced an increase in the Technical Assistance part of the Alliance from £5m to up to £10m. Twenty five countries, over one third of the Commonwealth, have pledged their commitments and are members of the Alliance.
- UK plastics pact: In April 2018, environment NGO WRAP launched The UK Plastics Pact partnership with The Ellen MacArthur Foundation The Pact is a trailblazing collaborative initiative that brings together businesses from across the entire plastics value chain with UK governments and NGOs to tackle the scourge of plastic waste. The Plastics Pact will transform the plastic system from a linear (make-use-dispose) system to a circular economy,- thereby addressing the cause of the problem and less focused on the result of the current system (e.g. clean up).
- A new tax on plastic packaging: Tax on plastics with less than 30% recycled content (subject to consultation) and Packaging Producer Responsibility regulations to drive the development of more sustainable packaging.

Mangroves

- Through International Climate Finance, the UK has committed to investing £10 million to support the sustainable use and protection of mangroves in Madagascar and Indonesia. Mangroves play a critical role in carbon sequestration. They also support endangered biodiversity and a range of other ecosystem services such as storm protection and erosion prevention. The Blue Forests project also aims to create new sustainable livelihoods, support community health and women’s empowerment and increase climate resilience in

coastal communities. The project is expected to benefit more than 100,000 people over a 20 year period.

- Moreover, the UK recently announced a new £12.7m mangroves programme in Latin America and the Caribbean in partnership with the Inter-American Development Bank that will accelerate the development of the Blue Economy across the region. The programme will focus on encouraging public and private sector investment in Blue Carbon and other closely linked areas such as sustainable aquaculture and coastal zone management.
- Through this programme we are aiming to restore or protect up to 6000 hectares of mangroves.

Impact Investments

- The UK recognises that more finance needs to be directed to sustainable land management rather than business as usual practices. Available public funding is not sufficient, therefore attracting private finance is key to scaling up and operating at a meaningful level. Therefore, the UK's International Climate Finance currently invests in an innovative financial instrument known as 'impact investment funds' (IIF), seeking to provide a model for environmentally sustainable lending. In 2015, Defra made a £20m investment into a public-private IIF: The Eco. Business Fund (EBF), lending to financial institutions supporting sustainable land use practices across Latin America. EBFs current portfolio lends to borrowers holding a total of 140,000 hectares of well managed land, committed to deforestation free activity.

The UK has continued to [make good progress](#) on implementing our Clean Growth Strategy and have announced new initiatives to deliver this Strategy, including:

- **Green GB Week:** We hosted the inaugural [Green GB Week](#) in October 2018 – an example of Government, academia, business and civil society coming together to raise awareness of clean growth. More than 100 events were held across the UK and over 50 commitments were made from Government and business.
- **Buildings Mission:** In May 2018 the Prime Minister announced the first mission under the UK's Clean Growth Grand Challenge, which is to at least halve the energy use of new buildings by 2030. In Green GB Week, Minister Perry announced the Home of 2030 design competition, aiming to galvanise collaboration across the public and private sector to generate housing design fit for the future.
- **Clusters Mission:** In December 2018 Minister Perry announced the second Clean Growth mission, which is to establish the world's first net-zero carbon industrial cluster by 2040 and

at least one low carbon cluster by 2030. The UK Government will be investing up to £170m in innovation support to kick-start this mission.

- **Carbon Capture, Usage, and Storage (CCUS) Action Plan:** The government released this new Action Plan in November 2018. It sets out the steps the government and industry should take in partnership to achieve the UK's ambition of having the option to deploy CCUS at scale during the 2030s, subject to costs coming down sufficiently.

Mission Innovation (MI): The UK has been a member of MI since its launch in November 2015 in Paris. The UK is Head of the MI Secretariat; incoming Chair of the MI Steering Committee; and a member of all MI Innovation Challenges. Mission Innovation is helping to encourage transparency between member countries regarding energy innovation activities and initiatives. Further details on UK actions can be found at: <http://www.mission-innovation.net/our-members/united-kingdom/> along with links to other member country details.

2. Present and future actions that may be included in one of the pillars of the G20 Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth (TBD)

(1) Actions to collect wisdom from around the world to encourage innovation

- The UK remains proactive in Mission Innovation, participating in all of the Innovation Challenges in 2018-19 and co-leads Carbon Capture (IC3) and Heating & Cooling (IC7). A few highlights are illustrated below:

IC3 – Carbon Capture

The UK joined Saudi Arabia and Mexico as co-leads of the Carbon Capture Innovation Challenge at the 3rd MI Ministerial. Over the past year, the UK has facilitated the international expansion of the [CCUS ACT Consortium](#) that provides R&D and innovation grants to collaborating countries. The second call launched in June 2018 with a total budget of €30.05m including £6.5 million from the UK and involving 6 MI members and five other countries. The UK ensured that the call text actively encouraged projects to address the Priority Research Directions (PRDs) developed during the [2017 Houston Mission Innovation Workshop](#). The UK is planning the next IC3 workshop in Norway in June 2019.

IC5 – Artificial Photosynthesis

The UK hosted an international meeting at Cambridge University on 25th March to agree the IC5 Global Actions for Sunlight Conversion and a plan for taking it forwards. The document was drafted by the UK IC lead Prof. James Durrant from Imperial College with Prof Leif Hammarstrom from Uppsala University, Sweden.

IC7 – Heating & Cooling of Buildings

Effort this year has focused on the development of 24 research foci in 6 priority areas and increasing communication activities. The UK represented Mission Innovation and the Heating & Cooling Innovation Challenge at the launch of the Global Cooling Prize by Indian Minister Harsh Vardhan. The \$3M [#GlobalCoolingPrize](#) aims to spur the development of technologies with 5x less climate impact than air conditioners being sold today by 2020. The UK has also supported workshops to develop a Technology Assessment Document on Sorption Heat Pumps, Predictive Maintenance and Operation, and the “Comfort and Climate Box”.

- **UK-Canada Power Forward Challenge**

The winning teams from the first stage of the joint £11m [UK-Canada Power Forward Challenge](#) were announced which has brought together innovators from the UK and Canada to demonstrate our shared ability to aggregate and manage distributed generation, energy storage and flexible loads in future energy systems.

- **Power Forward Challenge: UK-Canada joint challenge on smart energy systems innovation**

As electric vehicles, smart devices, storage systems and remote connectivity become more commonplace, the demands placed on our electricity grids are becoming highly complex and very different from when they were built. Through the Power Forward Challenge, the UK and Canada are jointly offering over £11 million to develop the best smart energy systems for the 21st Century with the aim of having pilot-scale demonstrations by December 2020. The Challenge is looking for innovators who can bring disruptive technologies or new thinking to develop clean, robust and flexible power grids and energy systems that anticipate and meet the needs of networks around the world, looking ahead to 2030 and beyond.

- **UK-South Korea Competition on Smart Energy Innovation**

The winners of the £6 million [UK / South Korea bilateral programme](#) to collaboratively develop innovative smart energy solutions were announced.

(2) Actions to mobilize private finance and investment for development and deployment of innovation

- The UK is one of five MI governments working with the Breakthrough Energy Coalition (BEC), an initiative led by Bill Gates that includes over 30 influential investors from around the world. We are continuing to explore opportunities to boost private sector investment to support UK researchers and companies.
- The UK remains a leader on green finance. The government and the City of London’s Green Finance Initiative was established in 2016 and supported the LENDERS project. This aims to improve the estimations of energy costs for homeowners when calculating mortgage affordability.

- The UK has established a Green Finance Taskforce with leaders of the financial sector to accelerate the growth of green finance and help deliver the investment required to meet the United Kingdom's carbon reduction targets. In addition, the UK Government promotes the recommendations of the Task Force on Climate-related Financial Disclosures to integrate the risks and opportunities posed by climate change into mainstream financial disclosures.
- The UK has announced a new early stage **Clean Growth Fund**. The government will invest up to £20 million on commercial terms alongside at least £20 million of private sector capital in order to catalyse the market. The fund will support early stage clean technology companies in the UK to accelerate the commercialisation of promising technologies.

(3) Actions to improve business environments and to promote of business activities for dissemination of innovative technologies and infrastructure

- Green GB Week: We hosted the inaugural [Green GB Week](#) in October 2018 – an example of Government, academia, business and civil society coming together to raise awareness of clean growth. More than 100 events were held across the UK and over 50 commitments were made from Government and business.
- The UK's Energy Entrepreneurs Fund (EEF) offers capital grants to support the development and demonstration of innovative technologies and/or processes in the areas of energy efficiency, power generation, and heat and energy storage. The scheme seeks the best ideas, irrespective of source, from the public and private sector. However, the scheme particularly aims to assist small and medium sized enterprises, including start-ups. Those companies that are selected receive additional funding for incubation support and many have already attracted significant additional private sector investment.
- On 13 March 2019, the Chancellor of the Exchequer announced an independent review of the economics of biodiversity, to be led by Professor Sir Partha Dasgupta. The objective of this review will be to quantify the economic benefits of biodiversity globally, and identify a range of actions that can be taken to simultaneously enhance biodiversity and deliver economic prosperity. This evidence should help shape the international response to biodiversity loss and successors to the Aichi biodiversity targets, with an audience of both economic and environmental policymakers. The Review will report in 2020, ahead of the 15th meeting of the Conference of the Parties (COP15) to the Convention on Biological Diversity in China in October 2020.