G20

Energy Sustainability Working Group (ESWG)

Circular Carbon Economy (CCE) Platform – Accelerator

Annex A. G20 Members and Guest Countries Compendium on CCE-related Initiatives

G20
SAUDI ARABIA 2020

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Non-Biomass Renewables	RenovAr, Mater, distributed generation and new renewable energy regulation.	2016 - 2025	The World Bank / BICE / Tesoro Nacional, private funding/Private funding.	CAMMESA, generators and consumers.	N/A	20% of de demand by 2025.	N/A
Non-Biomass Renewables	Permer II (Renewable Energy Project in Rural Areas)	2019 - Ongoing	The World Bank (BIRF), contributions from the public sector (national funding).	Government and households, schools, communities and small rural productive enterprises.	N/A	Total investment of 10.9 million dollars to acquire renewable energy solutions for 23,350 homes.	N/A
Non-Biomass Renewables	Large Hydro (>50 MW)	Planned: end by 2027.	Public sector (provincial and national funding).	Provincial national government, private sector and IESA.	N/A	Incorporation of 2,503 MW.	N/A
Non-Biomass Renewables	IRESUD (Interconnection of PV Systems to the electrical network in Urban Environments and Smart Grid).	2014 - Ongoing	FONARSEC (Argentine sectoral funds).	CNEA, UNSAM and Government.	N/A	Introduce new technologies associated with interconnection to the electricity grid (pilot tests).	N/A

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Energy Efficiency (EE)	Energy Efficiency project in Argentina.	Ongoing - end of may 2021	European Union	Fundación Bariloche (Argentina)	GFA Consulting Group (Germany), CEDDET Foundation (Spain) and EQO-NIXUS (Spain).	Development of Useful Energy Balance, Energy consumption diagnoses and Energy Efficiency Plan. Establishment of 5 Energy Efficiency learning networks, implement Energy Management (ISO standard), Certification Pilots and Energy Audits in residential and public buildings, organization of international events.	N/A

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Energy Efficiency (EE)	EUROCLIMA+ Energy Efficiency Project.	Ongoing - end of 2022	EUROCLIMA+	Public sector	N/A	Contribute to environmental sustainability and development resilient to climate change (Incorporation of Energy Management Systems in energy-intensive companies, pre-investment studies/ energy diagnostics for SMEs, training in Energy Mgmt Systems, intelligent pilot monitoring systems in public buildings, etc.).	N/A
Energy Efficiency (EE)	PLAE (Efficient Public Lighting Plan) and PROUREE (Energy Savings and Efficiency Program in Public Buildings).	2017 - Ongoing	Public sector (national funding).	Public and private sector	N/A	Make Public Lighting Systems more efficient by replacing with LED tech. in Municipalities and Provincial Routes and implementation of Energy Efficiency measures in the buildings of the National Public Administration.	N/A

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Energy Efficiency (EE)	Import and Marketing Ban on Halogen Lamps (Law 27,492).	2019 - Ongoing	N/A	Public Sector	N/A	Provide information about energy consumption of appliances and their level of energy efficiency. Regulate the commercialization of equipment that meets a specific MEPS.	N/A
Energy Efficiency (EE)	Energy efficiency through cycle closure and co-generation of thermal power plants.	Ongoing - till end of 2020/2021	Public sector (national funding).	IEASA, public and private sector.	N/A	1810 MW (Resolution 287) + 3GW (Resolution 21).	N/A
Energy Efficiency (EE)	Efficient leveling and MEPS (minimum energy performance standards) of appliances, vehicles and building.	2005 - Ongoing	N/A	Public Sector	N/A	Provide information about energy consumption of appliances and their level of energy efficiency. Regulate the commercialization of equipment that meets a specific MEPS.	N/A

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Energy Efficiency (EE)	Smart Way Transport Program (Res 1.075/2016)	2016 - Ongoing	Global Environmental Found "GEF".	Public sector	N/A	Create a community of good practices and promote the use of efficient transport solutions.	N/A
Energy Efficiency (EE)	GEF (Energy Efficiency and Renewable Energy Program in Social Housing).	2017 - Ongoing	N/A	N/A	N/A	Develop new minimum standards of habitability; incorporating bioenvironmental design strategies, energy efficiency measures and renewable energy solutions.	N/A

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Nuclear Power (NU)	CAREM (Central Argentina de Elementos Modulares)	Built by 2023	National funding	National Government and Private Funding	INVAP (Investigaciones Aplicadas Sociedad del Estado) CNEA (Comisión Nacional de Energía Atómica) NASA (Nucleoeléctrica Argentina Sociedad Anónima)	N/A	Incorporation of 1.230 MW Nuclear Power
	IV Central Nuclear	Built by 2028	CNNC (Rep of China)			N/A	N/A

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Biomass and Bioenergy (BM / BE)	RenovAr, Mater, distributed generation and new renewable energy regulation.	2016 -2025	The World Bank / BICE / Tesoro Nacional, private funding/Private funding.	CAMMESA, generators and consumers.	N/A	20% of de demand by 2025.	N/A
Biomass and Bioenergy (BM / BE)	PROBIOMASA (Project for the promotion of energy derived from biomass).	2016 - 2030	BICE and public sector (provincial and national funding).	Government and the United Nations Food and Agriculture Organization (FAO).	N/A	Convert a total of 12,515,637 tons of waste by 2030 saving 16.2 billion pesos for 2030. Incorporation of 1,325 MW thermal power.	N/A
Biomass and Bioenergy (BM / BE)	Effective cut of fuels with Biofuels (regulation).	2016 - Ongoing	N/A	Fuel and biofuel producers.	N/A	12% Gasoline and 10% Diesel.	N/A

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Non-Biomass Renewables (RE)	International Solar Alliance (ISA)	Treaty-level organisation. No end date.	Public and private	India and France Co-Presidents and member country Ministers	ISA is keen for partner engagement. Decided through Secretariat.	The ISA seeks to facilitate the global uptake of solar energy at scale.	Headquarters are in India
Non-Biomass Renewables (RE)	Clean Energy Ministerial (CEM)	Multilateral ministerial initiative. No end date.	Public mainly	Rotating lead, hosting by members	Partnerships differ over various initiatives.	The CEM has various initiatives that cover a range of policy issues. Short-term campaigns are developed for pressing issues.	2020 CEM meeting postponed at this stage
Energy Efficiency (EE)	Energy Efficiency Hub	The Energy Efficiency Hub was established in December 2019 and does not have a planned cessation date.	Likely to have an annual budget of 900,000 Euro, drawn from voluntary contributions from member country governments.	Currently chaired by Germany. Members are Argentina, Australia, Brazil, Canada, China, Denmark, European Commission, France, Germany, India (joining), Italy (joining), Japan, South Korea, Luxembourg, Morocco (joining), Russia, Saudi Arabia and United States.	The Energy Efficiency Hub welcomes new members. All nations are eligible to join.	The Energy Efficiency Hub aims to be the primary mechanism for international collaboration on energy efficiency. The inaugural work program is currently being developed.	N/A

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Energy Efficiency (EE)	Energy Management Working Group (EMWG)	The EMWG does not have a planned cessation date.	The EMWG is funded by Natural Resources Canada, United States Department of Energy, and United Nations Industrial. Development Organisation (UNIDO).	Led by Canada and the United States. Members are Argentina, Australia, Chile, China, Denmark, European Commission, Germany, India, Indonesia, Japan, South Korea, Mexico, Russia, South Africa, United Arab Emirates.	The EMWG has a range of global and in-country technical partners.	The EMWG is an initiative of the Clean Energy Ministerial, and seeks to accelerate broad use of energy management systems (EnMS) in industry and commercial buildings worldwide.	N/A
Energy Efficiency (EE)	Asia Pacific Economic Cooperation (APEC) forum's Expert Group on Energy Efficiency and Conservation (EGEEC)	The APEC EGEEC was established in 1993 and does not have a planned cessation date. Research and knowledge sharing projects typically run over approximately 12 months, with two funding sessions per year.	The EGEEC receives funding for research and knowledge sharing projects through central APEC funds and direct member contributions.	All APEC member economies are able to participate in the EGEEC. It is currently Chaired by Hong Kong, China.	The EGEEC partners with academia and non-government organisation on an adhoc basis for research and knowledge sharing projects. A closer relationship with the Energy Efficiency Hub is sought.	The APEC EGEEC was established to assist in achieving energy security, advancing economic and social well-being, and realizing environmental benefits in the Asia-Pacific region through energy conservation and the application of energy-efficiency practices and technologies.	N/A

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Carbon Capture and Utilization (CCU)	Mission Innovation Carbon Capture Challenge	November 2016 - present	N/A	Lead: Mexico, Saudi Arabia and the UK.	Accelerating Carbon Capture and Storage Technologies (ACT-CCS) consortium.	N/A	R&D

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Future Energy Carriers: Hydrogen, Methanol, etc.	International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE): 20 partners (member countries) organize, evaluate, and coordinate multinational research, development, and deployment programs that advance the introduction of hydrogen and fuel cell technologies on a global scale.	Commenced: 2003, Ongoing	N/A	Current Chair: Sunita Satyapal, United States. Current Vice-Chair: Toshi Shirai, Japan Chairs have included: Canada, Germany, Japan, France, and the U.S. The United States Department of Energy and its Department of Transportation facilitated the formation of IPHE in 2003.	Examples of past activities of the members in one of the working groups includes: • Round robin testing and protocol dissemination for high pressure hydrogen storage tanks and development of templates to share infrastructure reliability and safety data across countries. • Foster dissemination of critical information to relevant stakeholders, particularly related to the safe production, distribution, storage and utilization of hydrogen. •Share incident databases and training resources for code officials and first responders among the countries to avoid duplication and leverage knowledge and resources. (e.g. www.H2tools.org and HIAD 2.0)	IPHE's two active working groups: the Education & Outreach Working Group and the Regulations, Codes, Standards & Safety Working Group	Biannual IPHE Steering Committee meetings

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Future Energy Carriers: Hydrogen, Methanol, etc.	Clean Energy Ministerial: International Hydrogen Partnership: to drive international collaboration on policies, programs and projects to accelerate the commercial deployment of hydrogen and fuel cell technologies across all sectors of the economy.	May 2019, Ongoing	N/A	Leads: Canada, the United States, Japan, the Netherlands and the European Commission with participation by several other CEM member countries.	The International Energy Agency (IEA) will be coordinating efforts under this initiative.	The Initiative will focus on how hydrogen can contribute to cleaner energy systems, while promoting sustainability, resiliency and energy security.	Drawing on the recommendations from the Hydrogen Energy Ministerial Meeting in 2018 in Japan, this cross-country collaboration will build on the successes of other global collaborations on hydrogen such as the Hydrogen Challenge under MI

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Future Energy Carriers: Hydrogen, Methanol, etc.	Mission Innovation International Challenge (IC) 8: Renewable and Clean Hydrogen (The "Hydrogen Challenge"): to accelerate the development of a global hydrogen market by identifying and overcoming key technology barriers to the production, distribution, storage, and use of hydrogen at gigawatt scale.	May 2018, Ongoing	Public and Private	Co-leads: Australia, European Commission, Germany	Participants: Austria, Canada, Chile, China, France, India, Italy, Japan, Netherlands, Norway, Saudi Arabia, United Kingdom, United States	Members will collaborate to identify and accelerate key breakthroughs needed to achieve a cost-competitive hydrogen value chain. Innovation Challenge 8 will provide a platform to understand and progress selected issues around how a global hydrogen market would function as a system (particularly where these issues are not being actively contemplated in other forums).	In March 2019, over 80 representatives from governments, industry and the research community met in Antwerp for a two-day workshop on "Hydrogen Valleys" held by IC8. •IC8 participants met in Berlin, Germany in October 2018 for a deep dive workshop involving industry, government and academics. •IC8 was launched in May 2018 at the third Mission Innovation Ministerial to address the need for further technology improvements to enable hydrogen to be cost-competitive in the energy system.

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Future Energy Carriers: Hydrogen, Methanol, etc.	Hydrogen Energy Ministerial Meeting: the world's first platform to encourage countries worldwide to promote global-level utilization of hydrogen and to further consolidate collaboration among member countries in a synergistic manner.	2018 - Ongoing	N/A	Lead: Japan. Japan hosted the first two meetings in 2018 and 2019	Responsible ministers and officials from 21 countries, region and organizations as well as over 300 representatives of companies, governmental stakeholders, and experts in the field of hydrogen.	Participants exchange views on the importance of hydrogen toward energy transition and decarbonization, current situations and future perspectives of hydrogen-related technologies, need for international collaboration to create a new market for hydrogen that is self-sustainable.	The member countries released the Tokyo Statement as a chair's summary of the meeting.

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Future Energy Carriers: Hydrogen, Methanol, etc.	Hydrogen Energy Supply Chain (HESC) is a world-first pilot project to produce and transport clean hydrogen from Victoria's Latrobe Valley to Japan.	The HESC Project is being developed in two phases, beginning with a pilot phase; construction for the pilot phase will begin in 2019, following planning approvals. The pilot phase is expected to operate for roughly one year from 2020 to 2021. If the pilot is successful, the Project Partners will move towards commercial scale operations and a multi-billion dollar commercial phase. The decision to proceed to a commercial phase will be made in the 2020s with operations targeted in the 2030s, depending on the successful completion of the pilot phase, regulatory approvals, social licence to operate and hydrogen demand.	Public and Private	Leads: Australia and Japan	The Australian, Victorian and Japanese Governments are jointly working with reputable and highly experienced industry partners on this initiative. The pilot phase is expected to demonstrate a hydrogen supply chain that includes production, transportation and storage, with the ultimate goal of a commercial-scale phase in the 2030s. The Australian portion is coordinated by a consortium of Project Partners, including Kawasaki Heavy Industries (KHI), J-POWER, Iwatani Corporation, Marubeni Corporation and AGL. The Japanese portion is coordinated by HySTRA.	Hydrogen is a clean, adaptable energy and a commodity of the future. It has the exciting potential to enable an energy transition that will result in a substantial reduction of global carbon emissions, particularly in currently hard to abate sectors.	Key elements of the HESC pilot project include: •A newly constructed hydrogen production plant, located at AGL's Loy Yang Complex in the Latrobe Valley, will produce hydrogen gas using existing technologies adapted specifically for Victorian brown coal •The hydrogen gas will be transported by road to a liquefaction and loading terminal at Bluescope's existing site at the Port of Hastings •The hydrogen gas will be liquefied at the Port of Hastings then shipped to Kobe, in Japan, by a marine carrier specifically developed for the task. Kawasaki Heavy Industries Ltd., a project partner, launched the world's first liquefied hydrogen carrier, SUISO FRONTIER, at its Kobe worksite in Japan in December 2019, achieving a major milestone for this element of the project.

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Future Energy Carriers: Hydrogen, Methanol, etc.	International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE): 20 partners (member countries) organize, evaluate, and coordinate multinational research, development, and deployment programs that advance the introduction of hydrogen and fuel cell technologies on a global scale.	Commenced: 2003, Ongoing	N/A	Current Chair: Sunita Satyapal, United States. Current Vice-Chair: Toshi Shirai, Japan Chairs have included: Canada, Germany, Japan, France, and the U.S. The United States Department of Energy and its Department of Transportation facilated the formation of IPHE in 2003.	Examples of past activities of the members in one of the WG's include: • Round robin testing and protocol dissemination for high pressure hydrogen storage tanks and development of templates to share infrastructure reliability and safety data across countries. • Foster dissemination of critical information to related stakeholders. •Share incident databases and training resources for code officials and first responders among the countries to avoid duplication.	IPHE's two active working groups: the Education & Outreach Working Group and the Regulations, Codes, Standards & Safety Working Group	Biannual IPHE Steering Committee meetings

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Biomass and Bioenergy (BM / BE)	Participating in the development of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) through the International Civil Aviation Organisation (ICAO).	Under the CORSIA strategy, the international aviation industry aims for carbon-neutral growth from 2020 (that is, international aviation emissions should remain at a 2020 baseline level).	Participants in the negotiations provide resourcing in kind.	Department of Infrastructure, Transport, Regional Development and Cities; Department of Foreign Affairs and Trade; Department of Industry, Science, Energy and Resources; Qantas (ICAO only); Virgin Australia (ICAO only).	Participation in the CORSIA and IMO negotiations.	None identified	Biofuels represent one of the most significant sources of emissions reductions for existing aircraft and for existing shipping.
Biomass and Bioenergy (BM / BE)	Participation in the International Maritime Organisation (IMO) 'strategy on the reduction of greenhouse gas emissions from ships'.	The International Maritime Organisation has set a target of reducing emissions from international shipping by 50 per cent by 2050, compared to 2008 levels.	Participants in the negotiations provide resourcing in kind.	Department of Infrastructure, Transport, Regional Development and Cities; Department of Foreign Affairs and Trade; Department of Industry, Science, Energy and Resources; Qantas (ICAO only); Virgin Australia (ICAO only).	Participation in the CORSIA and IMO negotiations.	None identified	Biofuels represent one of the most significant sources of emissions reductions for existing aircraft and for existing shipping.

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Carbon Capture and Storage (CCS)	Carbon Sequestration Leadership Forum (CSLF)	Multilateral ministerial initiative, no end date	Public	USA (Policy) and Norway (Technical)	Australia is a member of the CSLF; DISER and Geoscience Australia sit on the CSLF policy and technical groups respectively.	A Ministerial level climate change initiative to develop improved cost-effective technologies for CCS; also promotes and champions legal, regulatory, financial and institutional environments conducive to such technologies.	N/A
Carbon Capture and Storage (CCS)	IEA Greenhouse Gas Technologies (GHGT) R&D Programme	Established in 1991	Public/Private	Intergovernmental organisation	Australia hosted the 2018 conference in Melbourne.	A conference series focused on international research for CCUS.	N/A
Carbon Capture and Storage (CCS)	Clean Energy Ministerial - CCUS initiative	unknown	Public	Lead: UK	Presently, Australia is an observer and considering to join the initiative as a member.	To strengthen public/private collaboration frameworks for CCUS.	N/A
Carbon Capture and Storage (CCS)	Mission Innovation (MI) - Carbon Capture and Storage Innovation Challenge	from 2016	Public	Leads: USA & Saudi Arabia	Australia is 1 of 21 members involved in MI's CCS innovation challenge	To identify breakthrough tech and recommend pathways for collaboration and RD&D pathways required to promote CCUS.	N/A

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Biomass and Bioenergy (BM / BE)	Programa RenovaBio	Fuil implementation started april 2020. No end date.	not applicable	Ministry of Mines and Energy, ANP regulatory agency, universities and institutes, national stock exchange, fuel distributors, certifier companies, biofuel producers.	Seek collaboration/partnerships to disseminate the RenovaBio model around the world, and create an internationally fungible market for CBIOs financial assets.	RenovaBio is a market driven policy. Imposing annual mandatory carbon intensity reduction targets on fossil fuel distributors, who then have to buy fuel emissions reductions certificates (CBIOs) issued when certified biofuels are sold.	N/A
Biomass and Bioenergy (BM / BE)	LNBR/CNPEM - continuous R&D activity up to TRL 6	(2018, on-going R&D activity)	public funding (MCTI)	Brazilian Biorenewables National Laboratory (LNBR)/Center for Research in Energy and Materials (CNPEM)	No current partnerships	Development of Brazilian technology to create opportunities for advanced biofuels with non-edible biomass to meet RenovaBIo requirements	Seeking partners to license the microbial platform and the industrial enzymes associated with this development

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Biomass and Bioenergy (BM / BE)	LNBR/CNPEM - Sugarcane Renewable Electricity (SUCRE) project	2015 - 2020	public funding (MCTI), UNDP/Global Environment Facility (GEF)	Brazilian Biorenewables National Laboratory (LNBR)/Center for Research in Energy and Materials (CNPEM)	No current partnerships	Comprehensive assessment with fied experiments for usage of straw, sugarcane co-product, for biomass based electricity. Increase renewable options in Brazilian energy matrix	Straw is a non-edible lignocellulosic material that can also be used for advances biofuels such as bioethanol or sustainable aviation fuels
Biomass and Bioenergy (BM / BE)	LNBR/CNPEM - Comparison of Biofuel Life Cycle Analysis Tools (2016-2019)	2016 - 2019	public funding (MCTI)	Brazilian Biorenewables National Laboratory (LNBR)/Center for Research in Energy and Materials (CNPEM)	No current partnerships	Relevant for harmonization of models used worldwide to estimate GHG emissions of ethanol	Applicable to comparison with other advanced biofuels

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Non-Biomass Renewables (RE)	The Emerging Renewable Power Program	2018-2023	$200M in public funding	N/A	N/A	N/A	Eligible technologies include: offshore wind; geothermal (both hot fractured rock and sedimentary rock resources); tidal; and, advanced photovoltaic.
Non-Biomass Renewables (RE)	The Smart Grid Program	2018-2022	$100M in public funding	N/A	N/A	N/A	Projects from utilities, electrical system operators, and transmission owners and operators are eligible for funding.
Non-Biomass Renewables (RE)	The Clean Energy for Rural and Remote Communities Program	2018-2024	$220M in public funding	N/A	N/A	N/A	supports the deployment and demo of renewables solutions and local capacity building to reduce diesel reliance in rural, remote and Northern communities and off-grid industrial sites. The program is tech. neutral and targets commercially available, renewable energy solutions.

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Non-Biomass Renewables (RE)	Regional Electricity Cooperation and Strategic Infrastructure Initiative	2017-2018	$2.5M in public funding	N/A	N/A	N/A	Natural Resources Canada facilitated regional dialogues and commissioned studies that identified the most promising electricity infrastructure projects with the potential to have significant greenhouse gas reductions. This initiative will help shape future investments to maximize economic and environmental benefits.
Non-Biomass Renewables (RE)	Atlantic Clean Power Roadmap	2019-ongoing	Internally funded	N/A	N/A	N/A	The plan will inform how govt's invest in electricity infra across the region, including transmission interconnections, next-generation renewable energy techs, all areas where governments are continuing to invest.

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Energy Efficiency (EE)	The Biofuture Platform (BfP) - low carbon fuels	N/A	N/A	N/A	a collaboration among 20+ countries, (including Germany)	accelerate development and scale-up deployment of sustainable low carbon alternatives to fossil-based solutions in transport, chemicals, plastics and other sectors.	The Government of Canada aims to maintain a strong market signal to encourage investments to grow the production and use of low carbon fuels in Canada and for export. We would like to explore areas of collaboration with global counterparts to further grow our low carbon fuel industry and advance new technologies.
Nuclear Power (NU)	Canada's Moltex Energy	2018- till now	$1.2 billion over 10 years	Federal Nuclear Science and Technology (FNST)	the Canadian Nuclear Laboratories (CNL), the Canadian Nuclear Research Initiative (CNRI)	developed a small modular reactor that can burn nuclear waste, reducing the hazardous lifetime a thousandfold. Given large stockpiles of nuclear waste world-wide this has the potential to make a large impact.	N/A

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Carbon Capture and Utilization (CCU)	Energy Innovation Program	2017- till now	Funding the following entities: 1. Svante: Carbon capture demo project at a Husky Energy heavy oil facility. 2. Carbon Engineering: Development of an 'Air-to-Fuel' technology where DAC is used to capture atmospheric CO2, which is then combined with green hydrogen to make low-carbon fuels. 3. Carbon Upcycling: Development of technology to use CO2 to create additives to strengthen materials, which will be tested at the Alberta Carbon Conversion Tech Centre, under a Canadian competition for innovators called the "CarbonXPrize".	N/A	N/A	N/A	N/A

Recycle Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Future Energy Carriers: Hydrogen, Methanol, etc.	The Hydrogen Initiative	2019- Ongoing	N/A	European Commission, Japan, the Netherlands and the United States	N/A	N/A	N/A
Biomass and Bioenergy (BM / BE)	The Biofuture Platform	launched at COP22 (2016) in Morocco.	N/A	Brazil, India, the Netherlands, the US, and the UK, and 15 member countries	public-private collaboration for commercial scale global bioenergy deployment and advance bioenergy as a key enabler in the global clean energy transition.	N/A	N/A
Biomass and Bioenergy (BM / BE)	Integrated Biogas Alliance (IBA)	N/A	N/A	N/A	N/A	Internationally recognized technology companies in the biogas industry are collaborating on a global organic waste-to-renewable energy platform solution to help first-time platform to help first-time developers of biogas plants lower their project costs and risks.	N/A

Remove Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Carbon Capture and Storage (CCS)	Oil and Gas Clean Tech Program - British Columbia Carbon Capture and Conversion Institute (CCCI)	N/A	N/A	N/A	N/A	N/A	This smaller-scale test facility provides earlier stage CO2 capture and conversion technologies.
Carbon Capture and Storage (CCS)	Breakthrough Energy Solutions Canada initiative	N/A	Funding the following entities: 1. CarbonCure: Technology to produce CO2-derived low-carbon concrete. 2. CERT Systems Inc: Conversion of CO2 to be used as an alternative to fossil fuels in the production of conventional petrochem such as ethylene. 3. Ekona Power: Technology to convert natural gas into clean hydrogen, clean electrical power, and CO2 that can be stored or used.	N/A	N/A	N/A	10 winning projects were selected under "Breakthrough Energy Solutions Canada" (BESC) – a public-private initiative aimed at accelerating the development of clean energy techs with the potential to reduce global GHG emissions – which launched at CEM10/MI. Each of the winners gain access to investment from BESC partners, Breakthrough Energy Ventures and the Business Development Bank of Canada, among others.

Reduce Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Energy Efficiency (EE)	Top Ten Energy Efficiency Best Available Technologies and Best Practices Objective: Select and promote the best available technologies (BATs) and best practices (BPs) in use today, and improve the energy efficiency globally	2013 - Ongoing	Co-funding from the member countries	Leading countries: China and Australia	Member countries: the United States, Japan, Canada, France, South Korea	Promote and transfer best available technologies and best practices.	The energy efficiency technologies in the industrial and building sectors are selected and promoted widely.
Non-Biomass Renewables (RE)	China-ASEAN Clean Energy Capacity Building Programme	2017 - Ongoing	Public funding	Executing Entity is China Renewable Energy Engineering Institute (CREEI), Guiding entity is National Energy Administration of China	energy administrations of ASEAN member states	N/A	Program objective is to enhance the knowledge sharing and capacity of in the field of clean energy within the ASEAN region.

Reuse Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Carbon Capture and Utilization (CCU)	OGCI Xinjiang CCUS Hub	TBD	TBD	China National Petroleum Corporation	TBD	N/A	objective is to reduce CO2 emissions from refineries and enhancing oilfield recovery

Reduce Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Energy Efficiency (EE)	Energy Efficiency in Large Industries Perform Achieve and Trade (PAT)	2012- Ongoing	i.Governement-INR 223 Crore ii. Private- INR 26000 crores	Ministry of Power, Bureau of Energy Efficiency, Large Energy Intensive Ind.	Industry Associations, Bilateral Partners (GIZ, Germany)	Energy Conservation Act, 2001, National Mission on Enhance Energy Efficiency	N/A
Energy Efficiency (EE)	Enhancing Energy Security in Micro, SMEs	2007- Ongoing	i. Governement -INR 27 Crore ii. Private- INR 100 Crore	Ministry of Power, Bureau of Energy Efficiency, Ministry of Micro, SME's	Industry Associations, UNIDO, GEF, World Bank, Non-Gov Org.	Energy Conservation Act, 2001	N/A
Energy Efficiency (EE)	Energy Efficiency in Residential Buildings (Standards and Labelling Programme)	2006- Ongoing	i.Governement -INR 90 Crore ii. Private - Original Equipment Manufacturers (OEMs)	Ministry of Power, Bureau of Energy Efficiency, OEMs	Industry Associations, Standard making bodies, Check testing agencies, Bilat partners (CLASP)	Energy Conservation Act, 2001	N/A
Energy Efficiency (EE)	Energy Efficiency in Commercial Buildings- Implementation of Energy Conservation Building Code	2007- Ongoing	i. Governement -INR 45 Crore ii. Private- INR 500 to 1000 Crore	Ministry of Power, Bureau of Energy Efficiency, Ministry of Housing, Urban Affairs	Bilateral Partners (USAID, GIZ, SDC), Technical Institutions/ Uni's, Non-Gov Org.	Energy Conservation Act, 2001	N/A
Energy Efficiency (EE)	National LED Programme- Unnat Jyoti by Affordable LEDs for ALL (UJALA)	2015- Ongoing	PPP	Energy Efficiency Services Ltd. (EESL), Ministry of Power	LED Manufacturers, Industry Associations	Energy Conservation Act, 2001	N/A
Energy Efficiency (EE)	Street Light National Programme (SLNP)	2015- Ongoing	PPP	EESL, Ministry of Power	LED Manufacturers, Industry Associations	Energy Conservation Act, 2001	N/A

Reduce Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Non-Biomass Renewables (RE)	Biofuel Mandatory Program	2008 - Ongoing	1.24 Billion USD	MEMR, PT Pertamina, PT AKR, APROBI	Ministerial/Institutions, Association, Private Sector, Expert, Scientist	Law, Presidential Decree, Ministry Regulation, Guidelines	N/A
Non-Biomass Renewables (RE)	Kamojang Geothermal Power Plant Unit 5	2013 - 2015	US 104 Million dollars (PPP)	PT Pertamina Geothermal Energy, PT Indonesia Power	Independent Power Producer	Law, Presidential Decree, Ministry Regulation, Guidelines, MoU (Gov Drill)	N/A
Non-Biomass Renewables (RE)	Muara Laboh Geo Power Plant Unit 1	2010 - 2019	US 580 Million dollars (PPP)	PT Supreme Energy, ENGIE and Sumitomo Corp	Private Sectors Collaboration	N/A	N/A
Non-Biomass Renewables (RE)	Sorik Merapi Geo Power Plant Unit 2	2016 - 2019	US 260 Million dollars (PPP)	PT Sorik Marapi Geothermal Power	Private Sectors Collaboration	N/A	N/A
Non-Biomass Renewables (RE)	Lumut Balai Geo Power Plant Unit 1	2019 - on going	US 110 Million dollars (PPP)	PT Pertamina Geothermal Energy	Independent Power Producer	N/A	N/A
Non-Biomass Renewables (RE)	Flores Geo Island	2017 - on going	Rp 500 milion dollars/year (Public)	MEMR (EBTKE, Lead), Bappenas, State Government (Ministerial), Government of NTT (Local), PT PLN	Government Collaboration (UK, NZ, UNDP)	N/A	N/A
Non-Biomass Renewables (RE)	Government Drilling (GEUDP)	2018 - 2022	US$ 106,38 Million dollars (Public (PISP) + WB (CTF + GCF)+ NZ Aid)	Joint Committee (MoF+MEMR), PT SMI, and PT GDE	Government + Public + Private Sectors Collaboration	N/A	N/A

Reduce Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Energy Efficiency (EE)	Energy Manajemen in Industry and Building Sector	Since 2014	Around USD 150000 per year (Government Funding)	Ministry of Energy Mineral Resources (Lead); Ministry of Industry, Ministry of Public Works, Ministry of Environment and local government (Involved Parties)	Certification Body and Association	Mandatory for big energy consumer (> 6000 TOE per year)	Revise regulation to capture more energy consumer
Energy Efficiency (EE)	Standard and Labeling for Household Appliances	2012 - Ongoing	Around USD 150000 per year (Government Funding)	Ministry of Energy Mineral Resources (Lead); National Standard Body, Ministry of Trade, Ministry of Industry and Local Government (Involved Parties)	Certification Body and Association	Mandatory for CFL and Air Conditioner	It will expand for industry appliances (boiler, motor etc)
Energy Efficiency (EE)	Funding Mechanism for Energy Efficiency Project	2015 - Ongoing	Around USD 150000 per year (Government Funding)	Ministry of Energy Mineral Resources (Lead); OJK and Ministry of Finance (Involved Parties) Ministry of Energy Mineral Resources (Lead); Ministry of Edu. and local govt (Involved Parties)	Financial Institution and ESCO	Incentive for interest rate and pilot project	Cooperation with PT SMI

Reduce Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Energy Efficiency (EE)	EE Campaign	2010 - Ongoing	Around USD 200000 per year (Government Funding)	Ministry of Energy Mineral Resources (Lead); Ministri of Education and local government (Involved Parties)	Association	Campaign	Campaign through printing media, electronic media and online media

Recycle Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Biomass and Bioenergy (BM / BE)	Biomass Power Plant (Government Budget)	2011 - 2015	2.3 Million USD	MEMR, PT PLN (Persero), Local Government	Ministries/Institutions, Associations, Private Sectors	Law, Ministry Regulation, Guidelines	Feedstock: Kaliandra, Palm Waste. Technology: Gasification
Biomass and Bioenergy (BM / BE)	Biomass Power Plant (Private Sector Budget)	2010 - now	196.15 Million USD	MEMR, PT PLN (Persero), IPP	Ministries/Institutions, Associations, Private Sectors	Law, Ministry Regulation, Guidelines	Feedstock: Palm Waste, Pulp and Paper, Baggase, others. Technology: Combustion, Gasification
Biomass and Bioenergy (BM / BE)	Biogas Power Plant (Government Budget)	2013 - 2016	16,07 Million USD	MEMR, PT PLN (Persero), Local Government	Ministries/Institutions, Associations, Private Sectors	Law, Ministry Regulation, Guidelines	Feedstock: POME. Technology: Covered Lagoon
Biomass and Bioenergy (BM / BE)	Biogas Power Plant (Private Sector Budget)	2011 - now	94.69 Million USD	MEMR, PT PLN (Persero), IPP	Ministries/Institutions, Associations, Private Sectors	Law, Ministry Regulation, Guidelines	Feedstock: POME, others. Technology: Covered Lagoon, Anaerobic Digester
Biomass and Bioenergy (BM / BE)	Municipal Solid Waste (Government Budget)	2014	1,5 Million USD	MEMR, PT PLN (Persero), Local Government	Ministries/Institutions, Associations, Private Sectors	Law, Ministry Regulation, Local Government Regulaton, Guidelines	Feedstock: MSW. Technology: Landfill Gas
Biomass and Bioenergy (BM / BE)	Municipal Solid Waste (Private Sector Budget)	2015 - now	8.58 Million USD	MEMR, PT PLN (Persero), IPP	Ministries/Institutions, Associations, Private Sectors	Law, Presidential Decree, Ministry Regulation, Local Government Regulaton, Guidelines	Feedstock: MSW. Technology: Landfill Gas, Thermal

Recycle Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Biomass and Bioenergy (BM / BE)	CPO Power Plant (Government Budget)	2016	7.04 Miliion USD	MEMR, PT PLN (Persero), Local Government	Ministries/Institutions, Associations, Community, Islamic Boarding School	Law, Ministry Regulation, Local Government Regulation, Guidelines	Feedstock: CPO. Technology: Generator Set/Diesel
Biomass and Bioenergy (BM / BE)	Biogas Program (Government and Private Sector Budget)	2011 – now	20.4 Million USD	MEMR, Hivos, Community	Ministries/Institutions, Associations, Community, Islamic Boarding School	Law, Ministry Regulation, Guidelines	Feedstock: Livestock and Human Manure. Technology: Anaerobic Digester

Reduce Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Energy Efficiency (EE)	Technologies and essential materials for the energy transition	2019 - 2021	152 million EUR	Italian Public Research Center	Public and Private	Investment focused on R&D	See note *
Energy Efficiency (EE)	ELECTRIC SYSTEM: to encourage the introduction in the sector of technologies, systems and organizational and management models functional to the energy transition and safety	2019 - 2021	58 million EUR	Italian Public Research Center	Public	Investment focused on R&D	See note **

*note: High efficiency photovoltaic Storage systems, including electrochemical and power to gas, and related interfaces with networks
Frontier materials for energy use Components and materials for safety and resilience Technologies, techniques and materials for energy efficiency and energy saving in the electrical end uses of new and existing buildings Energy efficiency of products and industrial processes Technologies for efficient penetration of the electric vector in end uses Electricity from the sea Thermodynamic solar.
**note: Tools and models, also sectoral, for energy and electrical scenarios, adapted to the evolution of the system - Analysis of market and regulation evolution; Models of architecture and management of the system and electricity grids and regulation that favor the integration of renewable and non-programmable generation, self-production, storage, energy communities and aggregators, and that take into account electrical penetration; Application to the electrical system, as expected in evolution and also to improve security and resilience, of information technologies, internet of things, peer to peer

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Future Energy Carriers: Hydrogen, Methanol, etc.	Hydrogen	2019 - 2020	25/50 million EUR	Italian Public Research Center & Private Stakeholder	Public and Private	Investment focused on R&D and Proptypes	25 public funds and 50 million EUR private funds (tbc)
Future Energy Carriers: Hydrogen, Methanol, etc.	Smart grid, AI, Blockchain	2020 - 2020 (less than 1 yr plan)	10 million EUR	Italian Public Research Center	Public	Investment focused on R&D	N/A
Future Energy Carriers: Hydrogen, Methanol, etc.	New Material	2020 - 2021	12 million EUR	Italian Public Research Center	Public	Investment focused on R&D	N/A
Future Energy Carriers: Hydrogen, Methanol, etc.	Other Sectors (not planned yet)	2021	24 million EUR	Italian Public Research Center	Public	Investment focused on R&D	N/A

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Energy Efficiency (EE)	The strategic energy conservation technology innovation program	2012 - Ongoing	FY2020 budget：73.5 billion yen Public	METI, NEDO	domestic project	"5th Energy Strategic Plan" (2018) "Energy Efficiency Technology Strategy" (2016)	The strategic energy conservation technology innovation program is a publicly offered technology development project that provides consistent support for innovative energy conservation technologies from seeds discovery to commercialization. Approximately 200 projects have been adopted, and 46 projects have been commercialized so far.

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Carbon Capture and Utilization (CCU)	Osaki Coolgen Project	ongoing: The first stage of the oxygen-blown IGCC demonstration test ended at the end of February 2019. The verification test of CO2 separation and capture by the second-stage physical absorption method is underway in FY2019-2020. In March 2019, the third stage of CO2 separation and capture IGFC demonstration project was started.	Public	Osaki Cool Gen Co. >>>OCG is composed by Chugoku electric power and J-power supported by NEDO	domestic project	"Roadmap for Carbon Recycling Technologies" (2019) "3C Initiative" announced at International Conference on Carbon Recycling(2019)	Osaki CoolGen Co., Ltd. (*) is conducting an IGFC demonstration project that combines the world's first commercial-scale fuel cell with a CO2 separation and recovery type oxygen-blown IGCC. Japan will establish a R&D and demonstration research base for Carbon Recycling that effectively uses CO2 as a resource and promote intensive R&D and it will be utilized as a showcase of various carbon recycling technologies such as biofuel, chemicals and carbonates.

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Future Energy Carriers: Hydrogen, Methanol, etc.	Japan-Brunei Hydrogen Supply Chain Pilot Project	ongoing (demonstration project toward 2020)	PPP	This project is operated by the consortium "AHEAD"(Advanced Hydrogen Energy Chain Association for Technology Development) >>>AHEAD is composed by Chiyoda co, Mitsubishi Co, Mitsui Co and Nippon Yusen Kaisha (NYK) and supported by NEDO	Bilateral cooperation	"Basic Hydrogen Strategy" (2017) "The Strategic Road Map for Hydrogen and Fuel Cells" (2019) "Global Action Agenda" (2019)	This project is the worlds's first global hydrogen supply chain demonstration project. Key Technology is New Catalyst of Dehydrogenation (Methylcyclohexane). Project Scale: supply of 210 tons of hydrogen in 2020, equivalent to filling 40 thousands FCV.

Recycle Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Future Energy Carriers: Hydrogen, Methanol, etc.	Japan-Australia Hydrogen Energy Supply Chain Pilot Project	ongoing (demonstration project toward 2021)	PPP	This project is operated by the consortium "HySTRA" and "HEA". NEDO portion Consisting of gasification in Australia, LH2 carrier and unloading terminal in Japan supported by NEDO, performed by HySTRA Australian portion: consisting of gas refining and loading terminal in Australia supported by Australian Govt, coordinated by HEA, Kawasaki's subsidiary.	Bilateral cooperation Japan and Australia signed the joint statement on cooperation on hydrogen and fuel cells in 2020.	"Basic Hydrogen Strategy" (2017) "The Strategic Road Map for Hydrogen and Fuel Cells" (2019) "Global Action Agenda" (2019)	This demonstrates brown coal gasification, hydrogen refining, liquefaction and storage of liquified hydrogen in Australia and marine transport of liq. hydrogen from Australia to Japan and unloading of liq. hydrogen in Japan. Production of hydrogen: low costs from unused resources (brown coal) and/or abundant recyclable energy via CCS. Transport: using Liq. hydrogen cargo ships and containers. On December 2019, the naming and launching ceremony for the liq. hydrogen carrier "Suiso Frontier" was held, planning to transport brown coal hydrogen to Japan by the world's first large-scale sea transportation of liq. hydrogen around winter of 2021.

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Future Energy Carriers: Hydrogen, Methanol, etc.	Fukushima Renewable H2 Project (Power to Gas)	ongoing: held an opening ceremony on March 7, 2020.	PPP	Toshiba Energy Systems & Solutions Corporation, Iwatani Corporation, Tohoku Electric Power Co.,Inc. and supported by NEDO	domestic project	“Basic Hydrogen Strategy” (2017) "The Strategic Road Map for Hydrogen and Fuel Cells" (2019) "Global Action Agenda" (2019)	At the Fukushima Hydrogen Energy Research Field in Namie Town, Fukushima Prefecture, solar power (20 MW) is used to electrolyze water to produce hydrogen (about 200 tons per year). To realize commercialization of water electrolysis technology, we will perform technical demonstrations of production efficiency and confirmation of durability. The hydrogen is considered to be used for the Tokyo Olympic Games.
Future Energy Carriers: Hydrogen, Methanol, etc.	Japan-Brunei Hydrogen Supply Chain Pilot Project	ongoing (demonstration project toward 2020)	PPP	This project is operated by the consortium "AHEAD"(Advanced Hydrogen Energy Chain Association for Technology Development).AHEAD is composed by Chiyoda co, Mitsubishi Co, Mitsui Co and Nippon Yusen Kaisha (NYK) and supported by NEDO	Birateral cooperation	“Basic Hydrogen Strategy” (2017) "The Strategic Road Map for Hydrogen and Fuel Cells" (2019) "Global Action Agenda" (2019)	This project is the worlds's first global hydrogen supply chain demaonstration project. Key Technology is New Catalyst of Dehydrogenation (Methylcyclohexane). Scale: supply of 210 tons of hydrogen in 2020, equivalent to filling 40 thousands FCV.

Remove Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Carbon Capture and Storage (CCS)	Large-scale CCS Demonstration Project at Tomakomai	ongoing CCS demonstration facilities constructed from FY2012 to 2015, CO2 injection started from FY2016. Achieved initial target in November 2019. METI positioned Tomakomai city as the base of promoting Carbon-recycling and carry out feasibility study from this year (FY2020).	PPP	Japan CCS Co supported by METI	domestic project	"5th Energy Strategic Plan" (2018) "Long-term Strategy" (2019)	CO2 injection started from FY2016. Achieved initial target of approximately 300 thousand tonnes cumulative injection in November 2019. Japan is conducting FS with Indonesia and KSA: 1. Indonesia - A FS is underway to realize a joint CCS demo project in the country where CCUS is highly interested. 2. KSA - A FS was conducted on the production and supply of carbon-free ammonia derived from NG and petroleum residual gas, and actual production and supply to Japan are planned as a demonstration this year.

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Non-Biomass Renewables (RE)	Feed-in Tariffs System for Renewable Energy (existing)	2002 - ongoing	Funded by the government	Ministry of Trade, Industry and Energy (MOTIE) & Korea Energy Agency (KEA)	Private-Government	Completion of new applicant registration (2012 -)	N/A
Non-Biomass Renewables (RE)	Renewable Energy Deployment Program (existing)	1993 - ongoing	Funded by the government	MOTIE & KEA	Private-Government	Supports for renewable energy installations to be used for household consumption	N/A
Energy Efficiency (EE)	Supports for SMEs to establish FEMS (existing)	2017 - ongoing	Private and public	KEA	Private-Public	Provision of subsidies	N/A
	Energy Audit Assistance (existing)	2007 - ongoing	Private and public	KEA	Private-Public	Provision of subsidies	N/A

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Carbon Capture and Utilization (CCU)	Development of integrated process for CO2 capture and utilization from NG-fired flue gas (ongoing)	Nov. 2017 - Nov. 2020	Funded by the government: 3.755 billion	Korea District Heating Corporation Academy Institute for Advanced Engineering (IAE), Korea University Research & Business Foundation, Airrane Co., Ltd.	Private-Public	R&D and installation investment to enhance economic feasibility of CCU	R&D (biological conversion)
Carbon Capture and Utilization (CCU)	Verification of a demo-scale process for converting CO2 into CO (ongoing)	May 2018 - Dec. 2021	Funded by the government: 10.495 billion	Poohung Photo-Chemical Co., Ltd. Korea East-West Power (EWP), Korea Research Institute of Chemical Technology, Chungnam National University Research & Business Foundation	Private-Public	R&D and installation investment to enhance economic feasibility of CCU	R&D (chemical conversion)
Carbon Capture and Utilization (CCU)	Development of technology to commercialize high-performance heterogeneous catalysts to synthesize ethylene carbonate utilizing CO2 (ongoing)	May 2018 - May 2020	Funded by the government : \1.42 billion	Chemtros Co., Ltd. Korea Institute of Science and Technology, Korean Foundation for Quality	Private-Public	R&D and installation investment to enhance economic feasibility of CCU	R&D (chemical conversion)

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Carbon Capture and Utilization (CCU)	Development of syngas production process via high-temperature co-electrolysis of CO2 and steam (ongoing)	Oct. 2018 - Sep. 2021	Funded by the government: 4 billion	IAE Kceracell Co., Ltd., Korea Institute of Ceramic Engineering and Technology, Korea Metal Material Research Association, Yonsei University Research & Business Foundation	Private-Public	R&D and installation investment to enhance economic feasibility of CCU	R&D (chemical conversion)
Carbon Capture and Utilization (CCU)	Development of CO2 conversion process based on enzyme catalysis systems with high activity and stability (ongoing)	Oct. 2018 - Sep. 2021	Funded by the government: 4 billion	Korea Institute of Energy Research (KIER) GeneFocus Co., Ltd., Gyeongsang National University Research & Business Foundation, Korea University Research & Business Foundation, Korea Advanced Institute of Science and Technology (KAIST)	Private-Public	R&D and installation investment to enhance economic feasibility of CCU	R&D (chemical conversion)
Carbon Capture and Utilization (CCU)	Development of alkylene production process utilizing CO2 (ongoing)	Jul. 2020 - Dec. 2024	Funded by the government: 2.36 billion	University, Research Institute and Industry	Private-Public	R&D and installation investment to enhance economic feasibility of CCU	R&D (chemical conversion)

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Future Energy Carriers: Hydrogen, Methanol, etc.	Project to Construct Hydrogen Production Facilities (Existing)	2019 - ongoing	small-scale (public funds 5 billion won/unit), mid-scale (40% subsidies provided, public funds 8 billion won/unit)	chosen after having annual public contests	N/A	N/A	N/A

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Carbon Capture and Storage (CCS)	Establishment of a technical, economical, and policy foundation for large-scale CCS demonstration and commercialization of CCU technology (Multi-ministry program, planned)	Apr. 2021 - Dec. 2023	Funded by the government: 49 billion	Company, Research Institute, University, etc.	Private-Public	1. R&D and installation investment to enhance economic feasibility of CCU 2. Supports for law and system to secure social acceptance of CCS	A foundation for large-scale CCS demo and commercialization will be established with cooperation b/w multiple ministries (MOTIE, Ministry of Science and ICT, Ministry of Oceans and Fisheries, and Ministry of Environment) to respond to climate change and reduce GHG emissions. Key foundations for CCUS will be established by securing large-scale ocean storage, models for safe and economic CCS demo/CCU commercialization will be developed. Political/social acceptance of GHG reduction and CCUS technologies will be secured.

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Non-Biomass Renewables (RE)	En+ Group, the parent company of EuroSibEnergo, implements the large-scale "New Energy" modernisation programme aimed at raising the efficiency of turbines at its HPPs, providing improved power supply quality and boosting the reliability without increasing water flow rates.	2019-2026-2046	Private. Including funding to date, the investments will amount to 21 billion roubles by 2026. At current prices, the valuation of additional investments by 2046 will reach approximately 34 billion roubles.	En+ Group, the parent company of EuroSibEnergo	En+ Group, the parent company of EuroSibEnergo	N/A	As a result of the program, starting from 2022 the group's Siberian hydroelectric power plants are expected to increase their clean electricity generation by 2 TWh, from the same amount of water passing through the turbines. This will reduce the Group's greenhouse gas emissions by 2.3 million tons per year, which will have a positive impact on the ecology of the Siberian regions
Energy Efficiency (EE)	Comprehensive plan to increase of EE of the Russian economy. Plan target: reach decrease of 23% in energy intensity of Russia's GDP by 2030 from 2016 level by EE measures.	2018-2030	No funding is expected	Government of Russia (by lead of Ministry of Economic Development)	N/A	Governing measures: improvement of legislation, stimulating investments in energy efficiency	N/A

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Energy Efficiency (EE)	Comprehensive plan on increase of energyefficiency of the economy of the Russian Federation. Plan target indicators: to reach decrease of 23% in energy intensity of Russia's GDP by 2030 from the 2016 level by energy efficiency measures.	2019-2029	Private (21,5 billion of USD)	Energy companies	Different types of partnership and collaboration for sharing experience and implementing the best world technologies, practices and approaches in terms of energy efficiency might be invited	Investment return within 15 years	Modernization and replacement of the old and used-up equipment to the new one
Energy Efficiency (EE)	Program for the resettlement of residents of the Russian Federation from dilapidated houses. Key targets: to build new apartment buildings with high standards of energy efficiency and comfort instead of dilapidated houses.	2008-2025	Public (7,74 billion of USD)	Government of Russia (by lead of Ministry of Construction, Housing and Utilities), State Corporation - Housing and Utilities Reform Support Fund	Different types of partnership and collaboration for sharing experience and implementing the best world technologies, practices and approaches in terms of energy efficiency might be invited	N/A	https://www.reformagkh.ru/relocation-about

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Energy Efficiency (EE)	Housing Renovation program in Moscow. Key targets: to build more than 5000 apartment buildings with high standards of energy efficiency and comfort.	2017-2032	Public (5,71 billion of USD)	Moscow Government, Moscow Renovation Fund	Different types of partnership and collaboration for sharing experience and implementing the best world technologies, practices and approaches in terms of energy efficiency might be invited	Government subsidies	5174 apartment buildings to be built, 1 million of people to be ressetled https://www.mos.ru/city/projects/renovation
Energy Efficiency (EE)	Measures to optimize the cost of electric energy for lighting roads and wide-spread implementation of energy-saving technologies. Key target: to decrease the cost of electric energy for lighting roads.	2020 – to completion	Evaluation process	Ministry of Construction, Housing and Utilities, Ministry of Transport, Ministry of Economic Development, Ministry of Energy, etc.	Different types of partnership and collaboration for sharing experience and implementing the best world technologies, practices and approaches in terms of energy efficiency might be invited	N/A	N/A

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Energy Efficiency (EE)	The program of improving the energy efficiency of state institutions by reducing the consumption of energy and water. Key target: to decrease the cost of energy and water consumption.	2021 – constantly	Evaluation process	Government of Russia (by lead of Ministry of Economic Development)	Different types of partnership and collaboration for sharing experience and implementing the best world technologies, practices and approaches in terms of energy efficiency might be invited	Government subsidies and energy service contracts	N/A
Energy Efficiency (EE)	The National project "Ecology" (provides for creation of infrastructure for waste management). Project target indicators: to increase a share of solid waste for processing up to 60% by 2024.	2019-2024	Public and private (4,29 billion USD)	Ministry of Nature, Russian Ecology Operator	Different types of partnership and collaboration for sharing experience and implementing the best world technologies, practices and approaches in terms of energy efficiency might be invited	Government subsidies, investment partnership agreements, loans, etc.	https://нацпроектэкология.рф/proekt/
Energy Efficiency (EE)	Modernization of bus fleets in Moscow. Key target: to replace diesel and gasoline buses with buses powered by electricity.	2018 to completion	Public (66 million USD per one year)	Moscow Government, Ministry of Transport, KaMAZ, GAZ Group (manufactures of buses)	Different types of partnership and collaboration for sharing experience and implementing the best world technologies, practices and approaches in terms of energy efficiency might be invited	Government subsidies	N/A

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Energy Efficiency (EE)	The National project "Safe and high-quality roads" (includes a program on purchase 2000 buses operating on gas, innovative trams and trolley buses). Key targets: to increase energy efficiency of public transport, to provide different fuel sources for public transport.	2019-2024	Public (285 million USD)	Ministry of Transport, State Transport Leasing Company	Different types of partnership and collaboration for sharing experience and implementing the best world technologies, practices and approaches in terms of energy efficiency might be invited	Government subsidies	http://government.ru/projects/selection/733/35558/
Nuclear Power (NU)	Conceptual framework: Regional Nuclear Power Centres - To establish economical and regulatory frameworks and indicators for Regional Nuclear Power Centres	2021-2023	TBD	IAEA, NPP vendor Countries	OECD, IEA	TBD	N/A

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Non-Biomass Renewables (RE)	Solar PV simulation, validation, and integration	2012-2030	$2 Million SR	Saudi Aramco	Research Services Agreements	N/A	R&D
Energy Efficiency (EE)	High-Efficiency Air Conditioners initiative (Ongoing)	April 26, 2019 - December 31, 2021	~$100 Million SR	Saudi Energy Effeciency Center (SEEC)	PPP (Public-Private Partnership)	1. Every Saudi citizen of 21 years old and above is eligible for 6 Acs in the initiative. 2. Local OEMs to improve their capabilities to meet high efficiency standards required to participate in the initiative (Minimum EER of the AC is 13 & above).	Aligned with vision 2030 goals: o Develop local private sector: Incentivize the private sector to manufacture locally. o Encourage public and private sectors to rely on local products. o Increasing competitiveness of locally produced products and services. o Safeguarding natural resource requirements through improved efficiency of household appliances. o Benefits citizens by improving quality of appliances owned at affordable price while decreasing their energy consumption.

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Nuclear Power (NU)	Saudi National Atomic Energy Project	The project development and pre-project activities started in 2017- (e.g. Site characterization is ongoing and expected to be completed by the end of 2020)	N/A	Oversight: Ministry of Energy Lead Organization: KACARE Owner : Saudi Nuclear Energy Holding Company (Under Formation) Regulator : Nuclear and Radilogical Regulatory Commission	Pending	KSA has formulated the policy and the legal and regulatory framework of the civil nuclear program of Saudi Arabia by promulgating the KSA has formulated the policy and the legal and regulatory framework of the civil nuclear program of Saudi Arabia by promulgating the following: • National Policy for the Atomic Energy Program of the Kingdom of Saudi Arabia. • Statute of the Nuclear and Radiological Regulatory Commission. • Law of Nuclear and Radiological Control. • Law of Civil Liability for Nuclear Damage.	KACARE is in continuous dialog with the 5 contesting technology vendors for the development of project of building the first nuclear power plant in KSA housing two commercial reactors.

Reuse Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Carbon Capture and Utilization (CCU)	CO2 to eFuels	Now into 2023	~ $110 Million SR	Saudi Aramco (Lead), Haldor Topsoe, Siemens, Sasol, Tyssen Krupp, Exxon.	JDAs	Land and aviation transport regulations	R&D
Emissions to Value (E2V)	Carbon conversion to feedstock	2020 - 2025	Private	SABIC Affiliates / Saudi Aramco	N/A	SABIC Have captured and utilized total of 4000 KTA converting CO2 to valuable chemicals of Urea and Methanol. Currently exploring further potential opportunities to recover and utilize total of 2200 KTA MT available quantity.	1. Extraction of engineered high-value chemicals from algal cultures. 2. Disruptive reactor concept and family of catalysts that convert, in one single step, Arabian Light crude into high added value petrochemicals.

Recycle Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Future Energy Carriers: Hydrogen, Methanol, etc.	Hydrogen for mobility applications	Now until 2050	~$30 Million SR	Saudi Aramco (Lead)	JDA	Land and maritime transport regulations	R&D stage project
Biomass and Bioenergy (BM / BE)	Alternative Fuels	2017 - 2025	Private	KAUST (Mani Sarathy)	McLaren	N/A	Biofuels, etc.

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Carbon Capture and Storage (CCS)	CO2 sequestration in aquifers	Planning starting in 2020, Selection of aquifers, sources of Co2 etc ongoing	Private funding by Saudi Aramco	PE&D (EXPEC ARC, SARMD & RDSD), Exploration, Drilling & Workover, SAOO (SAPED & SAWCOD) and Gas Operations	Identifying external entities	It's part of the company's circular carbon economy initiative and Corporate De-carbonization Strategy	We are currently identifying reservoirs and sources of CO2 for CCS applications. Feasibility studies (both technical and economic) will be conducted to determine the its application in our aquifers.
Direct Air Capture (DAC)	CO2 DAC	Ongoing till 2030	N/A	Saudi Aramco (Lead), KAUST, Global Thermostat, Acwa Power, Svante Inc., Climeworks	N/A	emissions offset options	R&D

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Non-Biomass Renewables (RE)	SolarNova: the programme aggregates demand from government agencies to install solar panels on public housing roofs.	2014-2030	N/A	Economic Development Board and Housing & Development Board	N/A	N/A	N/A
Energy Efficiency (EE)	Minimum Energy Performance Standards	N/A	N/A	National Environment Agency	N/A	N/A	N/A
Energy Efficiency (EE)	Mandatory Energy Labelling Standards	N/A	N/A	National Environment Agency	N/A	N/A	N/A
Energy Efficiency (EE)	BCA Green Mark Certification	N/A	N/A	Building Construction Authority	N/A	N/A	N/A

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Carbon Capture and Utilization (CCU)	CCUS consultancy study	2018-2019	N/A	National Climate Change Secretariat, Economic Development Board, Energy Market Authority	N/A	Exchange of best practices	N/A

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Future Energy Carriers: Hydrogen, Methanol, etc.	Hydrogen feasibility study	Sep 2019 - 2020	N/A	National Climate Change Secretariat, Economic Development Board, Energy Market Authority	N/A	N/A	N/A

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Non-Biomass Renewables (RE)	RE Programme coordinated by DMRE Independent Power Producer Office (responsible for managing RE and other technology auctions)	2018-2030	Public Source is through the South Africa-Germany Energy (SAGEN) Partnership	Lead entity is the DMRE and involves Germany (GIZ), CSIR, Eskom, and Sustainable Energy Africa NPC (SEA).	South Africa-Germany Energy collaboration	Transition to a low carbon economy	• Supports various Eskom departments and other relevant South African energy sector institutions in the grid and system integration of variable renewable energy. • SAGEN provides technical support to municipalities on the safe integration of Small-Scale Embedded Generators (SSEG) into municipal infrastructure as well as reviews of the business models of municipal utilities. he Council for Scientific and Industrial Research (CSIR) and Sustainable Energy Africa NPC (SEA) are the main implementing support partners.
Non-Biomass Renewables (RE)	Grid and system integration of variable renewable energy					Environmental sustainability and resilience	
Non-Biomass Renewables (RE)	Implementation ofSmall-Scale Embedded Generation (SSEG) at distribution leve					SDG 7 Clean Energy	
Non-Biomass Renewables (RE)	Electricity sector regulatory framework development and reform					SDG 13 Climate Change Action	

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Energy Efficiency (EE)	Promotion of energy efficiency investment	2018-2021	Source is from Germany through the South Africa-Germany Energy (SAGEN) Program Source is from Germany through the South Africa-Germany Energy (SAGEN) Program	Lead entity for SAGEN is the DMRE, Germany (GIZ), SANEDI and SALGA. Lead entity for SAGEN is the DMRE, Germany (GIZ), SANEDI and SALGA.	South Africa-Germany Energy collaboration	SDG 11 Sustainable Cities and Communities	N/A
Energy Efficiency (EE)	Energy management systems in municipalities	2018-2021				SDG 11 Sustainable Cities and Communities	N/A
Energy Efficiency (EE)	Energy Efficient in Public Buildings and Infrastructure Program (EEPBIP)	2018-2021	20 million EUR grant for EEPBIP	Lead entity for EEPBIP is SA-National Treasury and partners are DMRE, DEFF, DPWI, SANEDI, NBI, Carbon Trust, IDC and GIZ .		SDG 12 Sustainable consumption and production	N/A
Energy Efficiency (EE)	Energy Efficient Street Lighting Retrofit Project (EEStLRP)	2018-2021	50,700,000,00 EUR grant for EEStLRP	Lead entity for EEStLRP is National Treasury of RSA		SDG 13 Climate Change Action	N/A
Nuclear Power (NU)	The Koeberg nuclear power plant will have an extended lifeline of more 20 years instead of its original planned decommissioning by end of its design life in 2024. NECSA is considering replacing SAFARI 1 with a new Research Reactor.	Koeberg Extended to 20 years after 2024; Additional Capacity post 2030	Public	ESKOM for Koeberg NECSA for Safari 1	ESKOM AND NECSA active in IAEA related work, as well in the GEN IV Nuclear Forum	N/A	N/A

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Non-Biomass Renewables (RE)	Existing: Energy Law: 11400 GWh of new renewable electricity + avg 37400 GWh of hydro by 2035.	Target date 2035	Grid surcharge of CHF 0.023/kWh (ab. CHF 1.2 billion) allocated for renewable development, efficiency tenders, etc	N/A	N/A	N/A	N/A
Non-Biomass Renewables (RE)	Planned: Recast CO2 Law to reach Paris Agreement commitment (-50% GHG vs 1990, of which min. -30% domestic), and to reach net zero carbon by 2050	N/A	N/A	N/A	N/A	N/A	N/A

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Energy Efficiency (EE)	Energy Law: -43% per capita energy consumption, -13% per capita electricity consumption by 2035.	Target date 2035	N/A	N/A	N/A	N/A	N/A
Energy Efficiency (EE)	CO2 tax on stationary fuels, 1/3 of revenue earmarked for Building Renovation Program	Buildings refurbishment program (max. CHF450M/year) thru CO2 tax revenue + cantonal co-finance.	N/A	N/A	N/A	N/A	N/A
Energy Efficiency (EE)	Max. CHF0.015/liter surcharge for projects to offset 10% of transport fuel imports.	Compensation of 10% of emissions induced by fuel imports funded thru max CHF0.015/liter surcharge (ab. CHF160M).	N/A	N/A	N/A	N/A	N/A

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Carbon Capture and Storage (CCS)	Swiss Federal Office of Energy R&D and Pilot and Demonstration program; Swiss Federal Office of the Environment Technolgoy Fund; Horizon 2020,	ongoing	Public funding USD 5 million per year; privately funded unknown.	Swiss Association of Waste-to-Value plants, individual industry players	Pipeline companies, gas distribution network operators; CO2 storage site operators	Subsidies for research and innovation (exist); subsidies for market diffusion; adequate CO2-pricing	emerging technologies; bilateral arrangements on government level are useful to overcome challenges related to CO2-storage availability.

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Direct Air Capture (DAC)	Swiss Federal Office of Energy R&D and Pilot and Demonstration program; Swiss Federal Office of the Environment Technology Fund; Horizon 2020	rolling - since 2010	Total funding (R&D): USD 50M, of which privately funded 45, public funding 5 (Swiss, EU, other countries)	Spin-offs (e.g. Climeworks) and the public funding agencies (Swiss Federal Office of Energy, Swiss Federal Office of the Environment, Innosuisse, Swiss National Science Foundation, Eur Commission). Variety of start-up financing available in Switzerland and other countries.	Adjoining elements of the value chain (CO2-storage, energy- and CO2 handling-infrastructures); downstream/market facing: collaborations with certifiers and certificat markets, carbon removal markets and marketmakers, cates, carbon removal market places (e.g. Nori) to overcome illiquidity of markets. Collaborations with location-specific providers (DAC in deserts requires different infrastructures compared to DAC in northern European latitudes). Sorbent material and process developers.	Continued research and innovation support for pilot scale plants 0.05-1k tons of CO2 per year; but gap in policies for significant upscaling of plants/DAC(S) wich require market diffusion support (prices paid for carbon removed inversely proportional to incremental volumes captured in DAC plants; market making mechanisms (e.g. earmarking of reveneues generated from air travel levies); US-type 45Q tax breaks with higher initial price per ton removed; availability of CO2-storage sites). Permanent CO2 removal requires support at higher rates per ton CO2 than emission reductions.	Emerging technology; bilateral arrangements on government level are useful to overcome challenges related to CO2-storage availability.

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Energy Efficiency (EE)	Energy Law: -43% per capita energy consumption, -13% per capita electricity consumption by 2035.	Target date 2035	N/A	N/A	N/A	N/A	N/A
Energy Efficiency (EE)	CO2 tax on stationary fuels, 1/3 of revenue earmarked for Building Renovation Program	Buildings refurbishment program (max. CHF450M/year) thru CO2 tax revenue + cantonal co-finance.	N/A	N/A	N/A	N/A	N/A
Energy Efficiency (EE)	Max. CHF0.015/liter surcharge for projects to offset 10% of transport fuel imports.	Compensation of 10% of emissions induced by fuel imports funded thru max CHF0.015/liter surcharge (ab. CHF160M).	N/A	N/A	N/A	N/A	N/A

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Non-biomass Renewables (NE)	IPA 2015 Supply of Equipment for Renewable Energy and Energy Efficiency Support for the Municipalities Lot 1-5	November 2019 - May 2020	3,610,162 Euro (85% EU, 15% Beneficiary)	MENR, EU, CFCU, 5 metropolitian municipalities (Denizli, Hatay, Kahramanmaraş, Malatya, Şanlıurfa)	Union of Municipalities of Turkey	To contribute to increasing share of renewable energy in municipalities supported.	1 MW solar power plant will be constructed for selected municipalities.
Non-biomass Renewables (NE)	IPA 2015 Supply of Equipment for Renewable Energy and Energy Efficiency Support for the Municipalities Lot 6	November 2019 - December 2020	2,469,969 Euro (85% EU, 15% Beneficiary) 3. 4,500,000 Euro (100 %EU) 4. The budget will be announced later.	MENR, EU, CFCU, Trabzon Metropolitan Municipality 3. MENR, EU, CFCU, Municipalities and Universities	Union of Municipalities of Turkey	To contribute to increasing share of renewable energy in municipality supported.	2 MW hydroelectric power plant will be constructed for selected municipality
Non-biomass Renewables (NE)	Technical Assistance for Renewable Energy and Energy Efficiency Support for the Municipalities and Universities	April 2019 - October 2020	2,469,969 Euro (85% EU, 15% Beneficiary) 3. 4,500,000 Euro (100 %EU) 4. The budget will be announced later.	MENR, EU, CFCU, Trabzon Metropolitan Municipality	Union of Municipalities of Turkey, NGOs (GÜNDER, TÜREB etc.)	To contribute to achieving energy savings in municipalities and universities supported; to contribute to increasing share of renewable energy in municipalities and universities supported.	Capacity of the municipalities and universities in relation to renewable energy and energy efficiency applications is enhanced, Energy Efficiency and renewable energy utilization in municipalities and university campuses are increased and R&D applications for RE and EE supported.

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Non-biomass Renewables (NE)	IPA 2018 Supply for Equipment for Pilot Renewable Energy Efficiency Applications for BOTAŞ and TEMSAN	The program will be activated in 1st quarter of 2021.	N/A	MENR, EU, CFCU, TEMSAN and BOTAŞ	No partnership	To contribute to increasing share of renewable energy in TEMSAN and BOTAŞ facilities	Solar power plants will constructed in TEMSAN and BOTAŞ's facilities.
Non-biomass Renewables (NE)	IPA 2018 Pilot Renewable Energy And Energy Efficiency Applications on Different Sites At Facilities/Buildings of Municipalities, Their Subsidiaries and Municipal Service Providers for Self-Consumption Purposes	The program will be activated in 1st quarter of 2021.	The budget will be announced later.	MENR, EU, CFCU, 3 municipalities (Adıyaman, Isparta and Sivas)	Union of Municipalities of Turkey	To contribute to increasing share of renewable energy in municipalities supported	Solar power plants will constructed in selected municipalities.
Non-biomass Renewables (NE)	Identifying and Mapping Off-Shore Wind and Wave Energy Potential in Turkey	June 2019 - May 2020	350,000 Euro	MENR, EU and EBRD	Turkish State Meteorological Service and private companies	To identify the off-shore wind and wave energy potential of Turkey	To improve the existing renewable energy potential atlases of Turkey.

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Non-biomass Renewables (NE)	Road Map for Offshore Wind in Turkey	February 2019 - December 2022	12 million DKK (with district heating project, 100% Ministry of Foreign Affairs of Denmark)	MENR, Danish Ministry of Climate, Energy and Utilities, Ministry of Foreign Affairs of Denmark	MoEU, EMRA and all related parties about offshore wind in Turkey	To raise the awareness and to share Denmark's experiences in offshore wind development MENR and other relevant authorities about offshore wind in	To prepare a roadmap for offshore wind development in Turkey
Non-biomass Renewables (NE)	Tuz Gölü 1 MW Solar Power	2018-2019	Public	BOTAŞ	No partnership	Reducing Carbon Emissions	Tracking System
Non-biomass Renewables (NE)	IPA 2015 Supply of Equipment for Renewable Energy and Energy Efficiency Support for the Municipalities Lot 1-5	November 2019 - May 2020	3,610,162 Euro (85% EU, 15% Beneficiary)	MENR, EU, CFCU, 5 metropolitian municipalities (Denizli, Hatay, Kahramanmaraş, Malatya, Şanlıurfa)	Union of Municipalities of Turkey	To contribute to increasing share of renewable energy in municipalities supported.	1 MW solar power plant will be constructed for selected municipalities.
Energy Efficiency (EE)	NEEAP	2017-2023	10.9 billion USD, Public+Private	Lead: Ministry of Energy and Natural Resources of Turkey, Involved Parties : there are 16 responsible institutions and 36 related institutions including all other Ministries of Turkey, Municipalities, Various chambers and unions	No collaboration sought	Financial support mechanism, regulations, mandatory acts, promotion and awereness, education and training.	National Energy Efficiency Action Plan (NEEAP) is governed by inter-ministerial body that acts as a "steering board".

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Nuclear Power (NU)	Akkuyu Nuclear Power Plant (NPP) Project (under construction)	2023 (1.Unit) – 2024 (2.Unit) – 2025 (3.Unit) – 2026 (4.Unit)	Estimated CAPEX is 20 billion USD. The financial model is Built-Own-Operate (BOO). Russian state owned company Rosatom is responsible for funding the Project. Turkish government provides power purchase guaranty for approximately half of electricity generated over 15 years with fixed price.	Akkuyu NPP Project: Owner and Operator of the Plant: Akkuyu Nuclear Joint Stock Company Main Contractor: Atomstroyexport EPC Contractor: Titan2 – IC İctas JV	N/A	N/A	NPPs to be installed in the country will be based on Gen III/III+, proven LWR technologies.
Nuclear Power (NU)	Sinop NPP Project (planning)	2035	N/A	N/A	N/A	N/A	N/A
Nuclear Power (NU)	Third NPP Project (planning)	2035	N/A	N/A	N/A	N/A	N/A

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Carbon Capture and Utilization (CCU)	Biomass and Coal gasification to produce synthetic fuels (TRIJEN- Phase 1/Phase 2)	15.06.2010-15.06.2016/01.03.2017 - 15.04.2020	6.060.000 USD/Public	Turkish Coal Enterprises, TUBITAK Marmara Research Centre Energy Institute	N/A	N/A	R&DI
Carbon Capture and Utilization (CCU)	ntrained flow coal gasification, gas cleaning, methanol synthesis (3 ton/day) electricity generation (25kWe)	2009-2020	2.505.000 USD/Public	Turkish Coal Enterprises, TUBITAK Marmara Research Centre Energy Institute	N/A	N/A	R&DI

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Energy Efficiency (EE)	UAE National Strategy 2050	2017-2050	PPP	Ministry of Energy and Infrastructure all local utilities	N/A	Demand side reduction target of 40% w.r.t BAU, 50% clean energy in total energy mix	https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/federal-governments-strategies-and-plans/uae-energy-strategy-2050
Nuclear Power	Barakah Nuclear Energy Plant	Ongoing	$20 Billion	ENEC	N/A	The Plant's four APR1400 design nuclear reactors will supply up to 25% of the UAE's electricity needs once fully operational.	https://www.enec.gov.ae/barakah-plant/
Non-Biomass Renewable	Mohammed Bin Rashid Solar Park	2013-Ongoing	N/A	DEWA	N/A	N/A	https://www.dewa.gov.ae/en/about-us/strategic-initiatives/mbr-solar-park
Non-Biomass Renewable	Shams 1	2013-Ongoing	$600 Million	Masdar	N/A		https://masdar.ae/en/masdar-clean-energy/projects/shams-1 https://u.ae/en/information-and-services/environment-and-energy/water-and-energy/types-of-energy-sources/solar-energy

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Non-Biomass Renewable	Noor Abu Dhabi	2019-Ongoing	N/A	ADPower EWEC	N/A	N/A	http://www.ewec.ae/en/power-plants/noor-abu-dhabi
Non-Biomass Renewable	Al Dhafra	Ongoing	N/A	ADPower EWEC	N/A	The latest tender of Al Dhafra project received a levelized cost of electricity of US$ 0.0135/kWh, a sum which would rank as the world's lowest.	http://www.ewec.ae/en/media/press-release/ewec-receives-bids-worlds-largest-solar-power-plant-project-al-dhafra-region
Non-Biomass Renewable	Shams Dubai	Ongoing	N/A	DEWA	N/A	N/A	https://www.dewa.gov.ae/en/consumer/solar-community/shams-dubai
Non-Biomass Renewable	Umm AlQuwain Solar Plant	Ongoing	N/A	Government of Umm AlQuwain FEWA	N/A	N/A	https://www.pv-magazine.com/2020/01/08/emirate-of-umm-al-quwain-launches-tender-for-500-mw-solar-park/

Reuse Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Biomass and Bioenergy (BM / BE)	Waste-to-Energy (Sharjah)	2017-ongoing	N/A	SEWA	MASDAR	N/A	https://masdar.ae/en/masdar-clean-energy/projects/sharjah-waste-to-energy-project https://u.ae/en/information-and-services/environment-and-energy/water-and-energy/types-of-energy-sources/waste-to-energy-
Biomass and Bioenergy (BM / BE)	Waste-to-energy (Dalma)	2017-ongoing	N/A	TAQA	Center of Waste Management - Abu Dhabi	N/A	https://www.enec.gov.ae/news/latest-news/enec-hosts-successful-public-forum-on-dalma-island-in-the-western-region-of/
Biomass and Bioenergy (BM / BE)	Converting waste to energy station in Abu Dhabi and Alain	N/A	N/A	Abu Dhabi Power Corporation, Emirates Water and Electricity Company, Abu Dhabi Center for Waste Management - Tadweer.	It produces a maximum of 90 megawatts of electricity annually, which is equivalent to providing electrical energy to 22.5 thousand homes in the UAE, making it one of the largest waste-to-energy facilities in the region	N/A	https://meconstructionnews.com/40293/ad-power-to-build-two-waste-to-energy-plants-in-the-uae
Hydropower	The hydroelectric station to generate electricity(Hatta)	N/A	N/A	DEWA	N/A	N/A	https://www.dewa.gov.ae/en/about-us/media-publications/latest-news/2019/08/dewa-awards-aed-1437-billion

Reuse Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Biomass and Bioenergy (BM / BE)	Waste-to-Energy (Sharjah)	2017-ongoing	N/A	SEWA	MASDAR	N/A	https://masdar.ae/en/masdar-clean-energy/projects/sharjah-waste-to-energy-project https://u.ae/en/information-and-services/environment-and-energy/water-and-energy/types-of-energy-sources/waste-to-energy-
Biomass and Bioenergy (BM / BE)	Waste-to-energy (Dalma)	2017-ongoing	N/A	TAQA	Center of Waste Management - Abu Dhabi	N/A	https://www.enec.gov.ae/news/latest-news/enec-hosts-successful-public-forum-on-dalma-island-in-the-western-region-of/
Biomass and Bioenergy (BM / BE)	Converting waste to energy station in Abu Dhabi and Alain	N/A	N/A	Abu Dhabi Power Corporation, Emirates Water and Electricity Company, Abu Dhabi Center for Waste Management - Tadweer.	It produces a maximum of 90 megawatts of electricity annually, which is equivalent to providing electrical energy to 22.5 thousand homes in the UAE, making it one of the largest waste-to-energy facilities in the region	N/A	https://meconstructionnews.com/40293/ad-power-to-build-two-waste-to-energy-plants-in-the-uae
Hydropower	The hydroelectric station to generate electricity(Hatta)	N/A	N/A	DEWA	N/A	N/A	https://www.dewa.gov.ae/en/about-us/media-publications/latest-news/2019/08/dewa-awards-aed-1437-billion

Recycle Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Future Energy Carriers: Hydrogen, Methanol, etc.	Green Hydrogen	2019 - ongoing	N/A	DEWA	N/A	N/A	https://www.dewa.gov.ae/en/about-us/media-publications/latest-news/2019/10/dewa-stand-at-wetex-2019-to-showcase-its-innovative-projects
Future Energy Carriers: Hydrogen, Methanol, etc.	Converting waste to energy station in Abu Dhabi and Alain	2020-2021	N/A	Abu Dhabi Power Corporation, Emirates Water and Electricity Company, Abu Dhabi Center for Waste Management - Tadweer.	N/A	It produces a maximum of 90 megawatts of electricity annually, which is equivalent to providing electrical energy to 22.5 thousand homes in the UAE, making it one of the largest waste-to-energy facilities in the region	https://meconstructionnews.com/40293/ad-power-to-build-two-waste-to-energy-plants-in-the-uae
Biomass and Bioenergy (BM / BE)	Produce energy in Warsan station	Ongoing	N/A	Dubai Municipality	N/A	N/A	https://www.google.ae/amp/s/www.cbnme.com/news/dubai-municipality-launches-biogas-to-electricity-plant-at-warsan/amp/

Remove Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Carbon Capture Utilization and Storage (CCUS)	Al Reyadah	2017-Ongoing	N/A	ADNOC	N/A	AlReyadah capturs 800,000 tonnes of CO2 per annum. By 2030, ADNOC expansion capacity of CCUS projects by 500%, aiming to capture 5 million tonnes of CO2.	https://www.thenational.ae/business/energy/adnoc-s-carbon-capture-programme-on-track-to-increase-five-fold-by-2030-1.984479

Reduce Component	Program Name (Existing and Planned)	Program Timeframe (Planned start date - end date)	Funding (total funding and sources, e.g. Private, Public, or PPP)	Lead Entity and Involved Parties	Partnerships / Collaborations Sought	Policy Options	Additional Information (e.g. nascent technologies, R&DI, governance, etc.)
Non-Biomass Renewables (RE)	Mission Innovation Innovation Challenge 1 - Smart Grids (arguably energy efficiency)	Ongoing since January 2017. Future TBA by MI 2.0.	E.g. £11m UK-Canada Power Forward Challenge	Co-leads: China, India, Italy. 21 total members.	IC1 has engaged policy makers, researchers and the private sector, utilising deep dive workshops to bring together groups with a focus on creating new "on-the ground" impact.	Smart and flexible energy systems provide efficiency and renewables support, adapting for varying supply and demand. IC1 investigates a wide range of energy storage and smart systems technologies, with a focus on solutions.	Mission Innovation Initiative. Further detail here. http://mission-innovation.net/our-work/innovation-challenges/smart-grids/
Non-Biomass Renewables (RE)	Mission Innovation Challenge 2 - Off Grid Access to Electricity	Ongoing since January 2017. Future TBA by MI2.0.	N/A	2. Co-leads: France, India. 18 total members.	N/A	Poor or non-existent access to electricity is a challenge for 17% of the worlds population. VRE can provide for differing contexts and needs. IC2 focuses on adapting existing innovations and supporting new research to create new solutions.	Mission Innovation Initiative. Further detail here. http://mission-innovation.net/our-work/innovation-challenges/off-grid-access-to-electricity/

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Non-Biomass Renewables (RE)	CEM Energy Storage Initiative (Planned)	Planned start date: Q3 2020	TBC	CEM, World Bank	CIF, Energy Storage Partnership (World Bank), IEA, IRENA, WEC	Energy storage and flexibility	N/A
Energy Efficiency (EE)	Mission Innovation Challenge 7 - Affordable Heating and Cooling in Buildings	Ongoing since January 2017. Future TBA by MI2.0.	E.g. Global Cooling Prize was a $6m competition for cooling technologies. Sourced through state and philanthropic funding.	Co-leads: United Kingdom, United Arab Emirates, European Commission. 21 total members.	IC7 has convened policy makers, researchers, the private sector and industrial bodies like the Institute for Refrigeration in the UK.	Heating and Cooling will represent an increasing dominant portion of global emissions in the future, with a 300% increase in space cooling demand anticipated by 2050, and over 75% of heating requirements met by fossil fuels. Driving cost reductions is critical in these established industries, which IC7 tackles via R&D calls and identification of priority technologies.	Mission Innovation Initiative. Further detail here. http://mission-innovation.net/our-work/innovation-challenges/affordable-heating-and-cooling-of-buildings/

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Energy Efficiency (EE)	Energy Efficiency for Access	2017-2020	UK funding £18million	UK, USA, Sweden, Germany	N/A	The Efficiency for Access (EforA) Coalition is a global initiative that is scaling up and bringing together a range of programmes and support mechanisms to accelerate energy efficiency in clean energy access efforts. The LEIA contribution involves research to accelerate the availability, affordability, efficiency and performance of Appliances suited to developing country contexts.	Official Development Assistance funding focussed on Sub-Saharan Africa and South Asian countries.
Energy Efficiency (EE)	CEM Industry Decarbonisation Initiative (Planned)	Planned start date: Q3 2020	TBC	UNIDO, Sweden, Finland, Germany, Japan, Saudi Arabia, UAE, Brazil, Netherlands, UK	TBC	Reduce emissions from heavy industry with various technologies.	N/A

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Energy Efficiency (EE)	CEM International Smart Grid Action Network (ISGAN)	2011 - Ongoing	UK pays £10k/yr for membership. It is funded by its 20+ member countries.	Italy, India, Sweden, South Korea and the US lead. 16+ member gov'ts. Energy Systems Catapult is UK's 'alternate delegate' (does technical work, leads consortium of stakeholders (the 'UK National Team,' e.g. universities, SMEs, etc.).	IEA's Technology Collaboration Programme, CEM, various national and international industry bodies and companies	Demand-side management and energy grid flexibility through smart applications of tech, e.g. smart metres, digitisation.	N/A
Nuclear Power (NU)	CEM NICE Future Initiative	2018 - ongoing	Funding for the initiative and campaign mainly comes from the US ($200k). The UK contributes expertise from its Nuclear Innovation Research Office (NIRO). UK also has earmarked up to £10k if needed.	US, Canada, Japan lead. UK a member, along with UAE. Argentina, Poland, Romania and Russia are partner countries. The US National Renewable Lab (NREL) is the operating agent. CEM Secretariat oversees.	NREL, CEM, NRCan, NIRO, Nuclear Energy Agency, IEA	Aim: provide reliable, resilient clean energy to global market for electric and non-electric applications. How: cross-sectoral dialogues on nuclear's role in clean energy systems, resources for policymakers, partnerships.	N/A
Nuclear Power (NU)	CEM NICE Future's Flexible Nuclear Campaign	2019 - (for 12-14 months)	N/A	US, Canada, Japan lead. UK, Saudi Arabia are members.	N/A	Model the revenue opportunities for flexible nuclear power stations in various parts of the world.	N/A

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Carbon Capture and Utilization (CCU)	Mission Innovation Challenge 3 - Carbon Capture	Ongoing since January 2017. Future TBA by MI 2.0.	E.g. Accelerating CCUS Technologies Call. Multinational R&D funding call from states. 2018's 2nd call raised ~EUR30m for CCUS projects.	Co-leads: United Kingdom, Saudi Arabia, Mexico. 21 total members.	IC3 has convened policy makers, researchers and private sector through major workshops and funding platforms like ACT.	CCUS provides options for removing and reusing carbon emissions CCUS has developed over the past 10 years, but IC3 seeks to drive greater cost reductions, create better business and regulatory models, and discover new uses for CO2.	Mission Innovation Intiative. Further detail here. http://mission-innovation.net/our-work/innovation-challenges/carbon-capture/
Carbon Capture and Utilization (CCU)	CEM CCUS Initiative	Ongoing	Member countries each contribute $25,000 per year which pays for a member of staff to be operating agent.	The UK, Norway, Saudi Arabia and US lead. Canada, China, Japan, Mexico, South Africa, UAE participate. CEM Secretariat oversees.	Carbon Sequestration Leadership Forum, IEA Greenhouse Gas R&D Programme, Mission Innovation, Global CCS Institute (GCCSI).	N/A	N/A
Carbon Capture, Utilization and Storage (CCUS)	Accelerating CCS Technology (ACT)	2018-2022	30.05 million EUR	EU, Germany, France, The Netherlands, Norway, USA, UK (and Spain, Switzerland, Romania, Turkey, Greece).	N/A	An international initiative to fund research and innovation projects that can lead to safe and cost-effective technology.	http://www.act-ccs.eu

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Future Energy Carriers: Hydrogen, Methanol, etc.	Mission Innovation Challenge 5 - Converting Sunlight	Ongoing since January 2017. Future TBA by MI2.0.	E.g. Solar Fuels policy roadmap, funded by academic + state sources.	1. Co-leads: European Commission, Germany. 21 total members.	IC5 works closely with academics and researching bringing together international community and linking to policymakers. In UK, works with Solar Fuels Network.	Solar fuels offer an opportunity to generate clean fuels using the plentiful energy provided by the sun. However the high cost and early development stage of technologies requires high R&D investment to develop to demonstrable levels.	Mission Innovation Intiative. Further detail here. http://mission-innovation.net/our-work/innovation-challenges/converting-sunlight/ Mission Innovation Intiative. Further detail here. http://mission-innovation.net/our-work/innovation-challenges/renewable-and-clean-hydrogen/
Future Energy Carriers: Hydrogen, Methanol, etc.	Mission Innovation Challenge 8 - Clean Hydrogen	Ongoing since June 2018. Future TBA by MI2.0.	E.g. Hydrogen valley projects securing support from state, academia and private sources.	Co-leads: Australia, European Commission, Germany. 16 total countries.	Collaborates with other IC challenges, including 3, 4 and 5. Works with Hydrogen Council, IEA TCPs and IPHE.	The focus of IC8 is to accelerate the key breakthroughts needed to achieve a cost-competitive hydrogen value chain. To achieve this, ambition is on establishing large scale demonstrators such as "Hydrogen Valleys".	N/A

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Future Energy Carriers: Hydrogen, Methanol, etc.	CEM Hydrogen Initiative	Start date 2019; ongoing	UK does not contribute funding to the initiative. Countries who are full members contribute in kind, rather than in cash.	Canada, European Commission, Japan, the Netherlands, US lead. IEA is operating agent. CEM Secretariat oversees.	1. Hydrogen Energy Ministerial 2018 in Japan, Mission Innovation Hydrogen Challenge, International Partnership for Hydrogen and Fuel Cells, IEA. CEM Secretariat oversees.	The UK supports a range of methods for hydrogen production, while the international community skews slightly towards electrolysis (green hydrogen).	N/A

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Biomass and Bioenergy (BM / BE)	Mission Innovation Challenge 4 - Biofuels	Ongoing since January 2017. Future TBA by MI2.0.	N/A	Co-leads: Brazil, Canada, China, India. 16 total members.	N/A	Biofuel usage is restricted by the limited availability of inexpensive biomass in some countries. IC4 focuses on sustainable generation and creating cost reductions to reach economic feasibility.	Mission Innovation Intiative. Further detail here. http://mission-innovation.net/our-work/innovation-challenges/sustainable-biofuels/
Biomass and Bioenergy (BM / BE)	CEM Biofuture Platform and CEM Biofuture Initiative	The Biofuture Platform was launched at COP22 (2016), and the concurrent CEM initiative is planned to launch in Q3 2020.	No funding commitments have been made.	Brazil/Canada lead. India, Netherlands, UK, US co-sponsor. IEA is the 'facilitator.'	CEM/IEA + core group of countries. UK benefits diplomatically from visibility by Brazil and IEA from active participation - both are priority stakeholders.	Seeks to expand the use of bioenergy as a way to transition away from fossil fuels through policy frameworks and market access promotion, however the absence of clearly defined policy objectives restricts the programme's value.	N/A

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Carbon Capture and Storage (CCS)	Mission Innovation Challenge 3 - Carbon Capture	Ongoing since January 2017. Future TBA by MI2.0.	E.g. Accelerating CCUS Technologies Call. Multinational R&D funding call from states. 2018's 2nd call raised ~EUR30m for CCUS projects.	Co-leads: United Kingdom, Saudi Arabia, Mexico. 21 total members.	IC3 has convened policy makers, researchers and private sector through major workshops and funding platforms like ACT.	CCUS provides options for removing and reusing carbon emissions which make up the bulk of GHG emissions. CCUS has developed over the past 10 years, but IC3 seeks to drive greater cost reductions, create better business and regulatory models, and discover new uses for CO2.	Mission Innovation Intiative. Further detail here. http://mission-innovation.net/our-work/innovation-challenges/carbon-capture/

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Non-Biomass Renewables (RE)	Wind Energy Technologies Office (WETO)	ongoing	N/A	Office of Energy Efficiency and Renewable Energy (EERE) Office of Renewable Power (RP)	N/A	WETO achieved its 2020 cost target for offshore wind early, surpassing it by 3 cents per kilowatt-hour. Following this milestone, WETO significantly adjusted its offshore LCOE targets downward to 8.6 cents/kWh in 2020 and 5.1 cents/kWh in 2030. The heavy-tow textile carbon fiber results in 25% less mass than traditional wind turbine blades, and costs 40% less than commercial carbon fiber	WETO supports research and development activities that enable the innovations needed to advance U.S. wind systems, while continuing to address market and deployment barriers, including siting and environmental impacts.

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Non-Biomass Renewables (RE)	Geothermal Technologies Office (GTO)	ongoing	In April 2020, FORGE and the University of Utah announced the opening of their first solicitation for up to $46M to develop enhanced geothermal systems (EGS) technologies.	Office of Energy Efficiency and Renewable Energy (EERE) Office of Renewable Power (RP)	in partnership with industry, academia, and DOE's National Laboratories on research and development activities in the areas of enhanced geothermal systems, hydrothermal resources, low-temperature and coproduced resources, and systems analysis.	works to reduce the costs and risks associated with geothermal development by supporting innovative technologies that address key exploration and operational challenges.	N/A
Non-Biomass Renewables (RE)	Solar Energy Technologies Office (SETO)	ongoing	N/A	Office of Energy Efficiency and Renewable Energy (EERE) Office of Renewable Power (RP)	N/A	Researchers at the National Renewable Energy Laboratory (NREL) set a new world record for solar conversion efficiency by fabricating a six-junction solar cell with an efficiency of nearly 50%.	SETO supports early-stage research and development in three technology areas—photovoltaics, concentrating solar power, and systems integration—with the goal of improving the affordability, reliability, and performance of solar technologies on the grid.

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Energy Efficiency (EE)	Advanced Manufacturing Office (AMO)	ongoing	N/A	Office of Energy Efficiency and Renewable Energy (EERE) Office of Renewable Power (RP)	N/A	N/A	AMO is dedicated to improving the energy and material efficiency, productivity, and competitiveness of manufacturers across the industrial sector. AMO brings together manufacturers, not-for-profit entities, research organizations, and institutions of higher education to identify challenges; catalyze innovations; and develop cutting-edge material, process, and information technologies needed for an efficient and competitive domestic manufacturing sector.

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Energy Efficiency (EE)	Federal Energy Management Program (FEMP)	ongoing	FEMP leverages private-sector financing with no up-front capital costs and supports federal projects with technical and procurement expertise.	DOE Office of Energy Efficiency and Renewable Energy (EERE), Office of Energy Efficiency (EE)	N/A	The U.S. Federal Government is the nation's largest energy consumer. Energy used in buildings and facilities represents about 36% of the total site-delivered energy use of the federal government, with vehicle and equipment energy use accounting for 60%. These efforts have resulted in the federal government achieving a 49% reduction in energy intensity since 1975.	FEMP focuses on key services that help U.S. Federal Agencies meet energy- and water-reduction requirements and goals.
Energy Efficiency (EE)	Vehicle Technologies Office (VTO)	ongoing	N/A	DOE Office of Energy Efficiency and Renewable Energy (EERE), Office of Sustainable Transportation	N/A	N/A	N/A

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Nuclear Power (NU)	DOE Nuclear Energy Technology Research and Development	ongoing	$1 to 1.5 billion per year with approximately 20% cost share in private industry partnerships	DOE Office of Nuclear Energy	Private/public/university partnerships and international collaboration	~20% of budget dedicated to university-led projects, private/public funded programs prioritized	N/A

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Carbon Capture and Utilization (CCU)	Carbon Capture Program	2009-ongoing	N/A	DOE Office of Fossil Energy (FE)	N/A	The program has the potential to reduce the cost of carbon capture by 50 percent to $30 per ton compared to today's technology for power plants.	The Carbon Capture program focuses on reducing the cost of capture and associated energy penalty. The program develops post-combustion, pre-combustion, and direct air capture technologies. The strategy for the program is to conduct laboratory-, bench-, and pilot-scale testing of advanced technologies that are applicable for multiple commercial sectors. the program has the potential to reduce the cost of carbon capture by 50 percent to $30 per ton compared to today's technology for power plants.

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Future Energy Carriers: Hydrogen, Methanol, etc.	Hydrogen and Fuel Cell Technologies Office (FCTO)	N/A	N/A	Energy Efficiency and Renewable Energy (EERE), Office of Sustainable Transportation	N/A	The ultimate targets are the following: 30,000 hours for fuel cell durability; $60/kW for fuel cell cost; and $8/kWh for onboard hydrogen storage costs. Achieving these targets, in conjunction with the program's hydrogen production target of <$2/kg, can allow hydrogen fuel cell powered vehicles to be competitive in terms of cost and performance with incumbent technologies.	The affordable generation, storage, and use of hydrogen as an energy currency can facilitate integration across transportation, industrial, and energy sectors, offering unique economic and environmental benefits. Integrated hydrogen and fuel cell systems, for example, can improve energy sector flexibility by avoiding curtailment of variable renewable sources like solar and wind, enabling more optimal capacity utilization of baseload nuclear, coal, and natural gas plants; and can also support resiliency in the electric grid through voltage and frequency stabilization

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Biomass and Bioenergy (BM / BE)	Bioenergy Technologies Office (BETO)	N/A	N/A	Energy Efficiency and Renewable Energy (EERE), Office of Sustainable Transportation	N/A	By 2030, the U.S. has the potential to produce 1 billion dry tons of non-food biomass resources without disrupting agricultural markets for food and animal feed. This could potentially produce up to 50 billion gallons of biofuels (25 percent of U.S. transportation fuels), while also generating: up to 50 billion pounds of co-produced, high-value chemicals and materials, up to 75 billion kWh of electricity (enough to power 7 million homes) and bring additional jobs and revenue to the U.S. economy.	BETO focuses on applied R&D of transformative, sustainable bioenergy technologies that can support a growing bioeconomy. Price-competitive, advanced technologies to convert the Nation's abundant domestic, renewable biomass and waste resources into biofuels, biopower, and co-produced bioproducts are a key contributor to U.S. energy affordability, economic productivity, energy security, and overall competitiveness.

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Carbon Capture and Storage (CCS)	1. Carbon Storage Program 2. Carbon Sequestration Regional Partnerships 3. Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative	N/A	N/A	DOE Office of Fossil Energy (FE)	N/A	N/A	1. The Carbon Storage program focuses on developing technologies and protocols for the secure geologic storage of captured CO2. Captured CO2 can be stored either onshore or offshore—in deep saline formations, coal and shale seams, and basalts—or injected and stored as part of enhanced oil recovery (EOR) operations 2. To support the development of regional infrastructure for carbon capture and storage (CCS), the U.S. Department of Energy (DOE) created a network of seven Regional Carbon Sequestration Partnerships (RCSPs). The RCSP Initiative began in 2003 with characterization of each region's potential to store carbon dioxide (CO2) in different geologic formations 3. The CarbonSAFE Initiative builds off the work done by the RCSPs to fund and develop projects focused on ensuring carbon storage complexes will be ready for integrated CCUS system deployment in the 2025-2030 time frame. The CarbonSAFE projects focus on development of geologic storage sites for the storage of 50+ million metric tons (MMT) of CO2 from industrial sources

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Direct Air Capture (DAC)	N/A	N/A	In March 2020, DOE's Office of Fossil Energy (FE) and the Office of Science (SC) announced plans to provide up to $22 million for research on DAC, spanning span the spectrum from fundamental research in materials and chemical sciences to field testing of prototypes. SC plans to provide a total of $12 million for projects three years in duration, with $4 million in Fiscal Year 2020 dollars and outyear funding contingent on congressional appropriations. FE will provide $10 million in FY 2020 funds for projects from 2 to 3 years in duration.	N/A	N/A	N/A	N/A