MISSION INNOVATION

August 2022

National Innovation Pathway Round-up

DENMARK

National Innovation Pathway Round up - Denmark

Introduction

Mission Innovation members agreed to develop **National Innovation Pathways (NIPs)** to describe and build collective understanding on how each member plans to pioneer clean energy technologies to meet their climate and energy goals.

Each member has their own approach to developing and identifying innovation needs and priorities, with some already having undertaken extensive strategy development. The Roundup provides a **single location of summary information on countries' innovation priorities** utilizing existing sources of information so members and interested stakeholders can easily find key information of interest.

All MI members were asked to provide answers to a survey (Annex A) providing as much information as possible, with some questions being optional. The survey asked questions relevant to each element of the National Innovation Pathway described in the Joint Launch Statement:

1. Energy transition scenarios and priority national-level energy innovation needs / priorities until at least 2030;
2. Strategies or national-level plans to address these energy innovation needs / priorities, including institutional design and working internationally
3. Information on how Members will measure innovation outcomes and innovation ecosystem developments;
4. Members' preferred modes and methods of collaboration; and
5. Any further supporting evidence that was used to identify the energy innovation needs / priorities, such as analysis of domestic competitiveness, economic opportunities or national level climate and clean energy plans.

Members will be asked to refresh this document annually if significant changes to national policy have taken place

1. Clean Energy Innovation Strategy

1.1 Summary

In one week, the Danish Government reached three agreements with parliament covering a green investment fund of 7.2 bio. EUR, a new unified carbon tax, and a renewable energy package that will quadruple the production of solar and land wind energy by 2030 and permit a fivefold increase of offshore wind power. Russia's invasion of Ukraine has left the EU in a new geopolitical situation and the need for sustainable solutions and more renewable energy is more urgent than ever. The Danish Government has taken several major decisions that will fast track the green transition. With a new renewable package, it is the ambition that all gas in Denmark should be green by 2030, and to completely phase out gas heating in Danish households from 2035. At the same time, Denmark will send a clear message to the private sector with an ambitious CO2 tax and new a green fund. With the green tax reform, Denmark's emissions of CO2 will be reduced with 4.3 million tons by 2030. The tax reform is thus the largest single contribution to Denmark's 2030 climate goals. More specifically this has materialised into three agreements:

1. Renewable energy package: A broad majority has agreed on a historic expansion of renewable energy. The parties agree to offer 4 GW of extra offshore win by 2030 at the latest. In addition to 2 GW already agreed Denmark can now fivefold the production of offshore wind power over the next eight years. The agreement also aims for a quadrupling of the total electricity production from solar energy and onshore wind until 2030.
2. CO2 tax: The tax reform is the largest single contribution to Denmark's 2030 climate goals of reducing emissions by 70 % by 2030 compared to 1990. With the reform, Denmark's emissions of CO2 will be reduced by 4.3 million tons until 2030. The reform is a long-term decision that creates predictable framework conditions and allows companies to adapt. At the same time, there is agreement on targeted help for green conversion of the companies that are hit the hardest by the CO2 tax. The reform thereby minimizes the risk of emissions and jobs moving abroad.
3. The new green fund: The fund will support the green transition of Denmark and the phasing out of fossil fuels. It covers 7.2 bio. EUR investments from 2024 to 2040

More initiatives are to be enacted in the coming to ensure that Denmark can fulfil its legally climate target of 70 percent reduction in 2030.

Table 1: RELEVANT DOCUMENTS AND POLICIES

Document or policy name	Description of the document or policy	Specific outcomes, goals or targets identified in the document or policy	Year	Web Link(s)
Danish Climate Act	Act to reduce Denmark's greenhouse gas emissions and establish a climate-neutral society to achieve the Paris Agreement	The purpose of this Act is for Denmark to reduce greenhouse gas emissions in 2030 by 70% compared to the level of emissions in 1990, and for Denmark to achieve a climate-neutral society by 2050 at the latest, taking into account the Paris Agreement target of limiting the global temperature rise to 1.5 degrees Celsius.	2020	https://en.kefm.dk/Media/1/B/Climate%20Act_Denmark%20-%20WEBTILG%C3%86NGELIG-A.pdf
Danish Climate Agreement for Energy and Industry 2020	Denmark will show the world that climate action and economic recovery go hand in hand. A broad majority of the Danish Parliament has adopted a climate agreement on green transformation of industry and the energy sector. Combined with the Climate Agreement for Waste Management, the agreement will reduce emissions by 3.4 million tonnes of CO2 equivalents in 2030.	The agreement contains the following initiatives: • Establishment of the world's first energy islands • Transition to market-driven expansion of solar cells and onshore wind • Green technologies of the future – Power-to-X and capture of CO2 • Green transformation of the industry • Support for biogas and other green gases • Energy efficiency improvements • Green restructuring of heating taxes • Promotion of utilization of excess heat • Phasing out of individual oil and gas boilers	2020	https://kefm.dk/Media/C/B/faktaark-klimaaftale%20(English%20august%2014).pdf

		• Green district heating • Sustainability requirements of biomass for energy • Green transport pool • Transportation • Development of business accounts in agriculture • Green tax reform		
Follow-up agreement in relation to Climate agreement for energy and industry etc. Subsidy pools for phasing out oil and gas boilers and supporting measures.	The parties agree that oil and gas boilers must be phased out and replaced with heat pumps, district heating, etc. It must be more attractive to choose green heating.	The agreement must ensure that a CO2 reduction of 0.7 million tonnes is achieved in 2030.	2020	https://kefm.dk/Media/2/3/Aftaletekst%20om%20tilskudspuljer%20og%20underst%C3%B8ttende%20tiltag%20-%20varme.pdf
Agreement on the future of oil and gas extraction in the North Sea	Denmark introduces cut-off date of 2050 for oil and gas extraction in the North Sea and cancels all future licensing rounds.	A 2050 cut-off date for all oil and gas extraction, a cancellation of the 8th licensing round and all future licensing rounds, a commitment to lead a global campaign on the role of fossil fuel producing countries, a just transition initiative in the affected region to ensure development and employment, an analysis of the potential of electrification of current North Sea production, an initiative to explore the potential of carbon capture and storage, using old oil and gas wells	2020	https://en.kefm.dk/news/news-archive/2020/dec/denmark-introduces-cutoff-date-of-2050-for-oil-and-gas-extraction-in-the-north-sea-cancels-all-future-licensing-rounds

Danish participation in an "Important Projects of Common European Interest" (IPCEI) regarding hydrogen	Denmark allots DKK 850 million to green hydrogen projects.	DKK 850 million is set aside, from which Danish projects that will be selected to be part of the IPCEI on hydrogen can be allocated support.	2021	https://kefm.dk/Media/637596033297952211/IPCEI%20aftale%20(webt).pdf
Investments in a continuously greener Denmark	The parties agree to prioritize DKK 247.8 million in 2022, DKK 397.3 million in 2023, DKK 328.1 million in 2024 and DKK 335.7 million in 2025 for targeted climate and environmental initiatives.	Initiatives: Expansion of renewable energy. CO_2 capture. Strengthen drinking water efforts. Better marine environment. Reestablishment of rock reefs in Denmark. Forest plan. Climate assistance. Strengthening of the Consumer Ombudsman.	2021	
DKK 100 million for green continuing education and upskilling	With the Finance Act for 2021, DKK 100 million was set aside annually in 2021-2022 for upskilling and further training in climate adaptation and green transition.	DKK 58.4 million is reserved for applications from providers of business and labour market education within the main areas 1) Agriculture and food and 2) Technology, construction and transport. DKK 39 million is reserved so that all providers of business and labour market education can apply for funds.	2021	https://www.uvm.dk/aktuelt/nyheder/uvm/2022/apr/220406-ny-aftale-100-millioner-kroner-til-groen-efteruddannelse-og-opkvalifice
Green Fuels	Agreement to earmark DKK 1.25 billion to develop green fuels for aircraft, ships and trucks in Denmark and abroad within the Power-to-X Strategy.	The agreement sets out an ambition to build up an electrolysis capacity of 4 - 6 GW in Denmark by 2030. The Danish target of up to 6 GW is among the top three most ambitious national targets in Europe.	2022	https://en.kefm.dk/news/news-archive/2022/mar/broad-agreement-earmarks-billions-of-danish-kroner-towards-

				boosting-development-of-new-green-fuels
Agreement on targeted heat checks and the phasing out of fossil heat	With the agreement on targeted heat checks and the phasing out of fossil heat, DKK 250 million has been set aside to ensure a faster phasing out of fossil heat sources in Danes' homes, especially to support more green district heating.	DKK 40 million set aside to support energy saving activities. DKK 130 million set aside to support municipal effort to roll out district heating and smaller, shared heating solutions, etc. DKK 175 million set aside to support the costs of being disconnected from the gas network.	2022	https://kefm.dk/Media/637887897604084857776/Delaftale%20om%20disponering%20af%20midler%20fra%20aftale%20om%20m%C3%A5lrettet%20varmecheck%20og%20udfasning%20af%20sort%20varme.pdf
Renewable Energy Package	The parties agree to offer 4 GW of extra offshore win by 2030 at the latest. In addition to 2 GW already agreed Denmark can now fivefold the production of offshore wind power over the next eight years.	The agreement also aims for a quadrupling of the total electricity production from solar energy and onshore wind until 2030.	2022	https://en.kefm.dk/news/news-archive/2022/jun/a-green-reform-wave-in-denmark
CO2 tax	The CO2 tax reform is a long-term decision creating framework conditions and allows companies to adapt. The reform is the largest single contribution to Denmark's 2030 climate goal.	With the reform, Denmark will reduce CO2 emissions by 4.3 million tons until 2030.	2022	https://en.kefm.dk/news/news-archive/2022/jun/a-green-reform-wave-in-denmark
The New Green Fund	The fund supports the green transition in Denmark and the phase out of fossil fuels.	The fund covers 7.2 billion EUR investments from 2024-2040.	2022	https://en.kefm.dk/news/news-archive/2022/jun/a-green-reform-wave-in-denmark
Denmark can do more 2	A proposal by the Danish government focused on green solutions and renewable energy,	The proposal aims to harvest the full potential of offshore wind and accelerate the production of renewable	2022	https://en.kefm.dk/news/news-archive/2022/apr/denma

		energy on land to ensure Danish and European independence from Russian fossil fuels.		rk-set-to-build-more-energy-islands-and-accelerate-renewable-energy-production-to-secure-independence-from-russian-gas
International Energy Agency Conference in Sønderborg	At the IEA's conference on energy efficiency in Sønderborg, climate leaders from all across the world did exactly that. At the ministerial roundtable chaired by Dan Jørgensen, Danish Minister for Climate, Energy and Utilities, the participants endorsed a joint statement containing the 'Sønderborg Action Plan'. The Sønderborg Action Plan contains strategic principles and policy-toolkits that illustrate available and energy efficient solutions for governments.	In the joint statement, Ministers for Energy stress the importance of energy efficiency as a central remedy towards many of the different challenges that we are facing today. It contains a number of strategic principles on energy efficiency as well as policy-toolkits to illustrate solutions for governments across the world.	2022	https://en.kefm.dk/news/news-archive/2022/jun/soenderborg-action-plan-a-global-promise-to-energy-efficiency-
Agreement regarding development and enhancement of hydrogen and green fuels (Power-to-X Strategy)	Strategy for PtX and CCU to create the necessary framework conditions for PtX in Denmark, which are intended to facilitate the contribution of these technologies to the objectives of the Danish Climate Act, the realisation of their commercial	1) Power-to-X must be able to contribute to the realisation of the objectives in the Danish Climate Act. 2) The regulatory framework and infrastructure must be in place to allow Denmark's strengths to be utilised and for the Power-to-X industry to operate on market terms in the long run.	2022	https://ens.dk/sites/ens.dk/files/ptx/strategy_ptx.pdf

	potential and their integration into the Danish energy system.	3) The integration between Power-to-X and the Danish energy system must be improved. 4) Denmark must be able to export Power-to-X products and technologies.		
Framework conditions for CO_2 storage in Denmark	CCS plays a significant role in meeting the national climate targets. Analyses from GEUS show that the Danish underground is particularly suitable for storing CO2, just as an increasing demand for CO_2 storage capacity is expected in Northern Europe towards 2030. However, there are currently no CO2 stores in Denmark, and there is therefore a need for concrete initiatives.	• A foundation must be created for safe and environmentally responsible storage of CO2 in the underground. • Denmark must be able to import and export CO_2 to and from abroad • Further investigations of new storage locations in Denmark must be initiated.	2022	https://kefm.dk/Media/637606718216961589/Principaftale%20om%20CO2-lagring.pdf
Climate agreement on green electricity and heat 2022 – Denmark can do more 2	Denmark and Europe must be safer and greener. This requires a significant expansion of renewable energy sources, where solar parks and onshore wind turbines can deliver cheap, green energy quickly in the years leading up to 2030. Denmark's large sea areas, with good wind and seabed conditions, provide ideal conditions for harvesting	It was agreed to ensure framework conditions that can enable a quadrupling of the total electricity production from solar energy and onshore wind towards 2030. The parties also agree to enable the tendering of at least 4 gigawatts (GW) of offshore wind for realization by 2030 at the latest, on the condition that the offshore wind does not negatively burden the state's finances over the project period.	2022	https://www.regeringen.dk/media/11470/klimaaftale-om-groen-stroem-og-varme.pdf

	the sea wind and profits in the North Sea in the future as well, and the Danish waters have the potential to become a green power plant also for Europe.			

2. Clean Energy Innovation Priorities

2.1 Overview of Clean Energy Innovation Priorities

Table 2: CLEAN ENERGY INNOVATION PRIORITIES

Innovation priority	Focus of innovation activity (tick all that apply)	Targets/Goals (if applicable)	Technologies or topics of interest	Total RD&D funding allocated, (include budget years where applicable)	Planned demonstration Investments (include budget years and indicate if domestic or international spending where possible)	Links to relevant reports or plans
Example 2: Carbon capture and storage or utilisation (CCUS)	☑ Early-stage research ☐ Applied research ☐ product development ☑ Product development ☐ Demonstration ☐ Commercialisation Other:					https://ufm.dk/en/publications/2020/filer/green-solutions-of-the-future
Example 3: Green fuels for transportation and industry (Power-to-X etc.)	☑ Early-stage research ☐ Applied research ☐ product development ☑ Product development ☐ Demonstration ☐ Commercialisation Other:					https://ufm.dk/en/publications/2020/filer/green-solutions-of-the-future

The commitment to investment in green technologies of tomorrow – carbon capture and Power-to-X – is a key part of the Danish Climate Agreement for Energy and Industry 2020. Achieving the goal of a 70% reduction in emissions in 2030 goal will require innovative new tools and investments in the green technologies of the future. The agreement allocates the equivalent of DKK 800 million annually, to be phased in from 2024, for carbon capture and storage. These funds will reduce emissions of CO2 equivalents by 0.9 tonnes in 2030 and will support the development and implementation of solutions that can capture carbon emissions from sources such as industry and put them to use. The agreement also includes a tender to support the establishment of large-scale Power-to-X plants with a total capacity of 100 MW. This is more than five times the capacity of the largest plants found in the world today.

3. National Energy Innovation Ecosystem (Optional)

Table 3: CLEAN ENERGY INNOVATION INSTITUTIONS

Institution name	Description of role	Innovation priority(ies) that they contribute to (taken from Table 2)	Description of funding modalities (e.g. grants, co-investment, where in tech development cycle focused)	Links
Ministry of Higher Education and Science Denmark	The Ministry is responsible for Science, Innovation and Higher Education. The Danish energy sector has a long tradition of close public-private sector partnerships in research, development and demonstration, not least through project financing via Innovation Fund Denmark under the Danish Ministry of Higher Education and Science and EUDP under the Danish Ministry of Energy, Utilities and Climate.	The key research needs that are expected to prove dominant in the next few years mainly cover the following headings: energy production; energy storage and conversion; intelligent, integrated and flexible energy systems; energy efficiency measures. The research effort must also help to make Denmark independent of fossil fuels by 2050.	Grants awarded by the Danish Parliament to strategic research priorities will be implemented as a general rule by Innovation Fund Denmark and typically through large and long-term investments. The funds will be distributed according to the arm's length principle in open competition, so that only the absolute best new research ideas are supported.	https://ufm.dk/en/the-ministry/mission-vision-and-strategic-objective https://ufm.dk/en/publications/2018/filer/forsk25_katalog_eng_enkelt.pdf

Annex A – National Innovation Pathway Roundup Survey Questions

1.1 Summary: Please provide a summary of your national clean energy innovation strategy i.e. the overall policies, framework and/or goals that help to define the innovation priorities you will describe in Section 2. We recommend including information about your national climate or energy targets (such as NDCs or renewable energy targets) as well as national innovation strategies and policies. You can share links to relevant documents in Table 1.

1.2 Methodology: Please describe the methodology to develop your national clean energy innovation strategy such as analysis, modelling or stakeholder engagement and include any links to relevant documents in Table 1. This will be used to help share learning between members**.**

2.1 Overview of Clean Energy Innovation Priorities: Please provide a list of your national clean energy innovation priorities (i.e. specific technologies, sectors or needs). Please complete Table 2 to provide information about where you are focusing in the innovation cycle for each priority; any targets or goals; RD&D interests; current allocated budgets (including specific demonstration funding) and links to relevant strategies or reports. In the text box following please provide a brief description of how you plan to respond to each innovation priority in the coming years, such as through future plans over the next 3-10 years to mobilise further investments for innovation, launch new major programmes and timelines for major demonstration projects**.**

2.2 Tracking Progress: Please describe how you plan to measure progress towards addressing your identified energy innovation priorities. Please describe any governance processes to manage and review energy innovation efforts and, where able, please list

tracking indicators that are commonly used (e.g. such as patents, publications, rates of company formation, follow-on capital and private co-investment, technology performance upgrades).

3. Private Sector Engagement: Please can you describe your strategic approach and priorities to engagement with the private sector to address the clean energy innovation priorities identified in section 2. This could include for instance prioritising co-funding of RD&D initiatives; incubator/accelerator programs that are funded (in part or fully) by the private sector; tax credits and other fiscal incentives; initiatives that the private sector can engage with, grants, de-risking instruments such as loan guarantees etc.

4. International Collaborations: Please describe your strategic approach to international collaboration to tackle your clean energy innovation priorities (e.g. do you have an international strategy, or particular types of collaboration you are prioritising).

5. National Energy innovation Ecosystem: Please provide an overview of your national institutions, funders and organisations and describe how they contribute to tackling the innovation priorities identified in Section 2. Please either provide this information in the box or complete Table 3.

6. Further Supporting Information: Please add below any further information about your national energy innovation needs or approaches to tackling these that has not been covered above.

Mission Innovation – Catalysing Clean Energy Solutions For All