MISSION INNOVATION

August 2022

National Innovation Pathway Round-up

SWEDEN

National Innovation Pathway Round up - Sweden

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

Government bills stating the resources, activities and goals for Energy R&I are presented regularly to Parliament (Riksdag). The national clean energy innovation strategy is currently set out in the Government bill 2016/17:66 "Research and innovation in the energy area for ecological sustainability, competitiveness and security of supply" and the resulting decision by Parliament . The implementation is also given detailed instructions in the annual Letter of appropriation.

The overall goal of the Energy R&I strategy is to contribute to reaching established goals on energy and climate, the long-term energy and climate policy and energy related environment policy goals. Focus should be on areas that can contribute to economic growth and international trade.

To accomplish this, energy R&I should:

- build scientific and technological knowledge and competence to enable the transition to a sustainable energy system,
- develop technologies and services that can be implemented in Sweden or elsewhere, and to
- contribute to and make use of international energy cooperation.

The main current goals established by Parliament are

- 50 % more efficient energy use by 2030 in relation to 2005 .
- 100 % renewable electricity production by 2040, while not excluding nuclear production2.
- No net greenhouse gas emissions by 2045 .

The main activity of the clean energy research and innovation efforts is a broad programme of research, development, pilot- and demonstration projects, as well as commercialisation and product development that is implemented by the Swedish Energy Agency.

In addition, there are also the following support mechanisms:

- The Industrial Leap programme supports pilot studies, research, demonstration, and investment to decrease greenhouse gas emissions from industry, to achieve net-zero emissions and strategic industry projects contributing to climate mitigation. The 2022 budget has increased from 750 million SEK in 2021 to 909 million SEK.
- The national strategy for electrification of industry and transport has been launched by the Government. Implementation is being initiated and a number of tasks are given to government agencies to carry out.
- The Swedish Energy Agency supports a special R&I effort for aviation biofuels or electric aviation with a funding of 50 million SEK 2021 and 50 million SEK 2022.
- A system of state credit guarantees for green investments is in operation.
- The investments of the Almi Invest GreenTech Fund continue to back Swedish early-stage start-ups that significantly reduce greenhouse gas emissions.

1.2 Methodology

Different initiatives of intervention are formulated through the overall methodology of Swedish governance, e.g., through Government bills to Parliament, through the Budget bill or through special tasks given to Government agencies. Preparation is done through e.g., the work of a committee, through public consultations, etc. as appropriate in relation to the dignity of the proposal.

Regarding the periodic Government Bills on the programme on Energy Research and Innovation, these are based on input from the Swedish Energy Agency, as well as the six main research funding agencies, and overall evaluations of the work in the programme.

The detailed strategy for the Energy Research and Innovation Programme is then developed by the Swedish Energy Agency.

In general, the strategy evolves through extensive consultations with the research community, industry, and society in various energy system areas. Key challenges and thematic areas are identified.

The funding is both top down and bottom up.

Much of the R&D is implemented using R&D Programmes, consortia, or centres of different kinds. To launch such an effort, "Programme" decisions are taken that spell out

- Programme Vision
- Goals and their relation to political goals, environmental goals, or the UN SDGs.
- Programme goals: i.e., what the programme activities are to result in during the active phase, and
- Indicators to follow progress

There are of course also time plans, budgets and a description of scope and activities eligible for funding. In general, an external advisory committee leads the programme implementation.

Support for demonstration, business and product development and commercialisation are to a great extent bottom up, depending on applications from small and medium sized businesses.

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)
Government Bill Research and innovation in the energy area for ecological sustainability, competitiveness and security of supply"	Decision on goals and guidelines for the funding of energy Research and Innovation by the Swedish Energy Agency	As described in Summary	2016/17	Forskning och innovation på energiområdet för ekologisk hållbarhet, konkurrenskraft och försörjningstrygghet Proposition 2016/17:66 - Riksdagen
The Industrial Leap	Support to pilot studies, research, demonstration, as well as investment to decrease greenhouse gas emissions from industry, etc	R&I and investment projects to decrease climate impact of industry.	2022	The Industrial Leap (energimyndigheten.se)
Government Bill on Energy Policy	Decisions on energy policy and goals	Sets out the energy policy of Sweden	2017/18	Energipolitikens inriktning Proposition 2017/18:228 - Riksdagen

Government Bill on Climate Policy Framework	Decisions on climate policy and goals	Sets out the climate policy of Sweden	2016/17	Ett klimatpolitiskt ramverk för Sverige Proposition 2016/17:146 - Riksdagen

2. Clean Energy Innovation Priorities

2.1 Overview of Clean Energy Innovation Priorities

The clean energy innovation priorities of the energy research and innovation programme are carried out in a framework of thematic areas, viz.: 1) Energy in the Transport System, 2) Energy in Buildings, 3) Energy in Industry, 4) Bioenergy, 5) Electricity Production and the Electricity System, 6) Sustainable Society, 7) Energy Systems Studies, 8) Business Development and Commercialisation, and 9) International Collaboration.

In these areas, there are more than 55 different programmes, centra or consortia, each with their specific scope, approach, and goals. In addition, there are individual projects as well as clusters.

In all these R&I activities, the type of projects is determined by the specific challenges of the project/programme topic: basic energy related research, research, applied research, development, pilot- and demonstration studies, business development and commercialisation.

In the Industrial Leap, it is also possible to support investments. The GreenTech fund invests in start-ups that can reduce climate impact.

It is not possible to list all these goals, scopes, and activities in a table as suggested; there would be hundreds of table rows.

The Swedish Energy Agency maintains a publicly accessible database of all funded activities; unfortunately, only in Swedish.

2.2 Tracking Progress (Optional)

Overall progress of the Energy R&I programme is reported annually by the Swedish Energy Agency to Government.

Progress of individual programmes, centres and consortia are regularly measured against the indicators adopted for each one. External evaluations are carried out regularly, e.g., at mid-term or end of programme/centra/consortia.

Evaluation of effects is sometimes carried out for larger groups of activities, after sufficient time has elapsed.

General indicators include indicators for **Input**, **Activities**, **Results**, **Outcomes** and **Effects**.

Input: Funding provided; strategic goals etc.

Activities: Funding per thematic area, per type of grant recipient, per type of activity, cofounding, gender of project leaders, etc

Results: Direct results like exams and degrees, numbers of scientific publications, citation index data etc

Outcomes: Reporting by project leaders on contributions to overall goals, patents, further use of results, external evaluation results, etc.

Effects: Special evaluations to document long-term effects and developments due to the R&I funded. Also, good examples of R&I projects etc.

The business development and commercialisation activities are followed up with indicators for number of employees, revenue, collaborations, stock exchange listings, subsequent investments etc.

3. Private Sector Engagement (Optional)

The different activities in the Swedish Energy Agency R&I Programme are to varying degrees co-funded by industry. The overall co-fund is slightly more than 50 percent.

Industry is the recipient of in excess of 30 percent of the R&I funding. In addition, approximately 10 percent of funding is allocated to industry associations and centres.

Strategies etc are developed in consultation with researchers, industry, and society.

Programmes etc. are generally implemented with the help of advisory committees etc. with industrial representation.

The Industrial Leap is in entirety aimed at supporting industry in decreasing their climate footprints

The system of state credit guarantees for green investments is a de-risking instrument to promote large green industrial investments.

Funding for Demonstration projects are given to industry

The business development and commercialisation activities are meant for Small and Medium Sized Enterprises or start-ups.

4. International Collaboration (Optional)

One of three priority activities of the Swedish Energy Agency's Research and Innovation Programme is to "Contribute to and benefit from international co-operation".

In general, SE gives priority to multilateral collaborations.

First among these is, obviously for us, the European Union and its different energy R&I related instruments: The framework programme Horizon Europe and its different initiatives like Missions and Partnerships, the Innovation Fund, the Strategic Energy Technology Plan, some Important Projects of Common European Interest (IPCEI), and others.

We also give priority to different activities in the Nordic co-operation like the Nordic Energy Research, as well as the collaboration under the International Energy Agency, the IRENA, the Clean Energy Ministerial and the Mission Innovation.

There are also several bilateral collaborations; some more research focused and other more targeted on innovation.

The Swedish Energy Agency has defined a number of priority countries for bilateral co-operation.

5. National Energy Innovation Ecosystem (Optional)

Government decisions are all taken in plenum. Government bills are then sent to parliament for discussion and decision.

The overall research and innovation policy of Sweden is the responsibility of the Ministry of Education and Research. The **Energy research and innovation programme** is, however, the responsibility of the Minister for Energy, currently part of the Ministry of Infrastructure.

Actual funding is the task of a number of government agencies. For the Energy and Innovation programme, this is the Swedish Energy Agency. Other agencies are

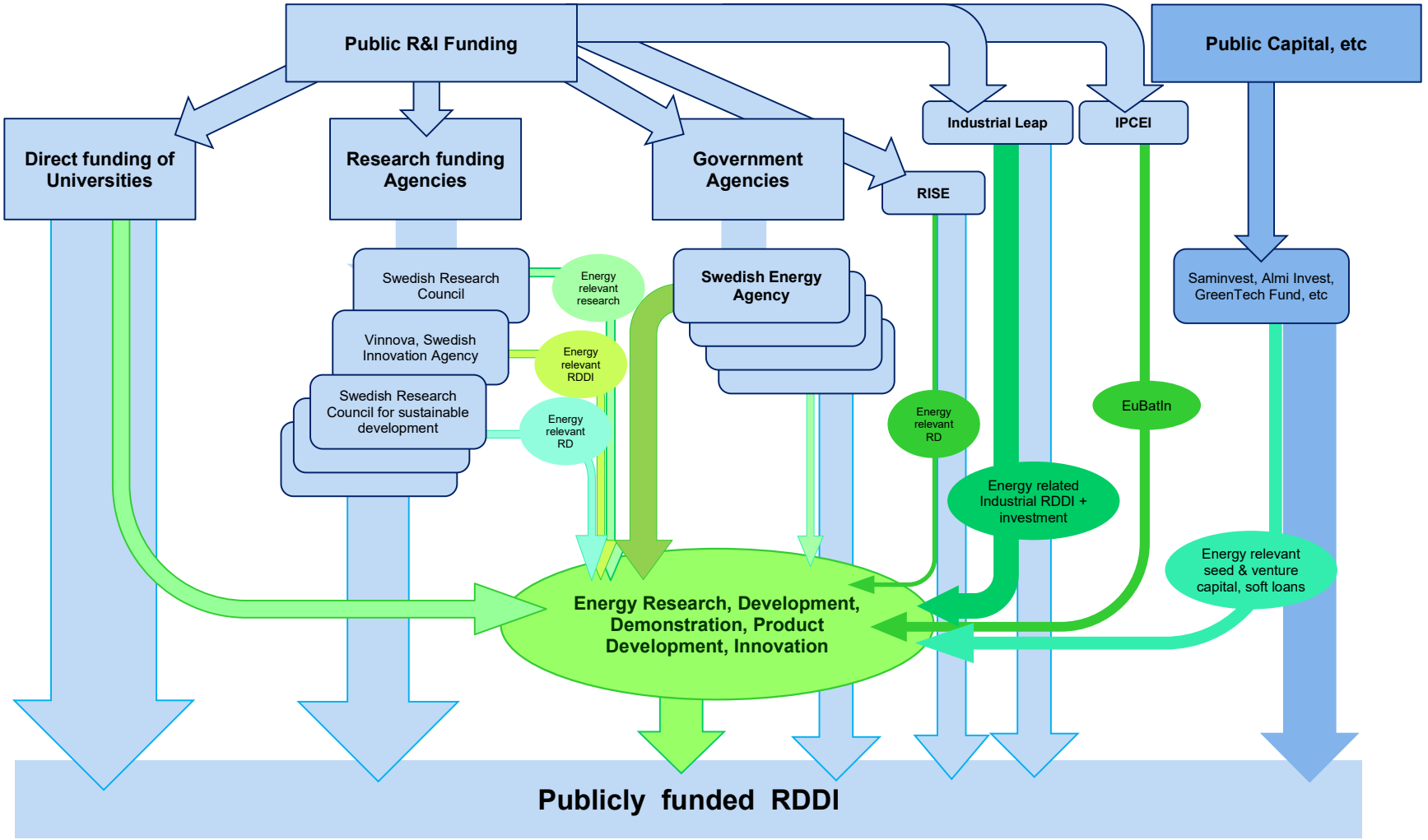
- The Swedish Research Council, a government agency under the Ministry of education and Research, supports research of the highest quality within all scientific fields. Funding is 8 billion SEK per year.
- The Swedish Innovation Agency, Vinnova, is a government agency under the Ministry of Enterprise and Innovation. It funds research, development, and demonstration to make Sweden competitive and to meet the societal challenges.
- The Swedish Research Council for Sustainable Development, Formas, is a government agency under the Ministry of the Environment that funds research and innovation on the environment, agricultural sciences, and spatial planning.

Energy related R&I funding includes activities carried out in collaboration between the Swedish Energy Agency, the Swedish Research Council (energy related basic research), Vinnova and Formas.

Together, the Swedish Energy Agency, Vinnova and Formas for instance fund seventeen Strategic Innovation Programmes (SIP).

The SIPs aim at providing sustainable solutions to global societal challenges and increased international competitiveness. Within the programmes, companies, academia, and organizations together develop sustainable products and services of the future. A number of these SIPs are energy related.

RISE, the Research Institutes of Sweden AB, is an independent, state-owned research institute supporting sustainable growth and strengthening the competitiveness and capacity for renewal of Swedish industry, as well as promoting the innovative development of society as a whole. Parts of the activities or RISE are energy related.



Schematic picture of some main components of the energy related research and innovation effortys in Sweden. The arrows are not showing funding sizes in any formal or quantitative way but only indicate contributions. Measures for deployment are not shown.

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