



DET KONGELIGE
OLJE- OG ENERGIDEPARTEMENT

NORWAY - MISSION INNOVATION COUNTRY NARRATIVE

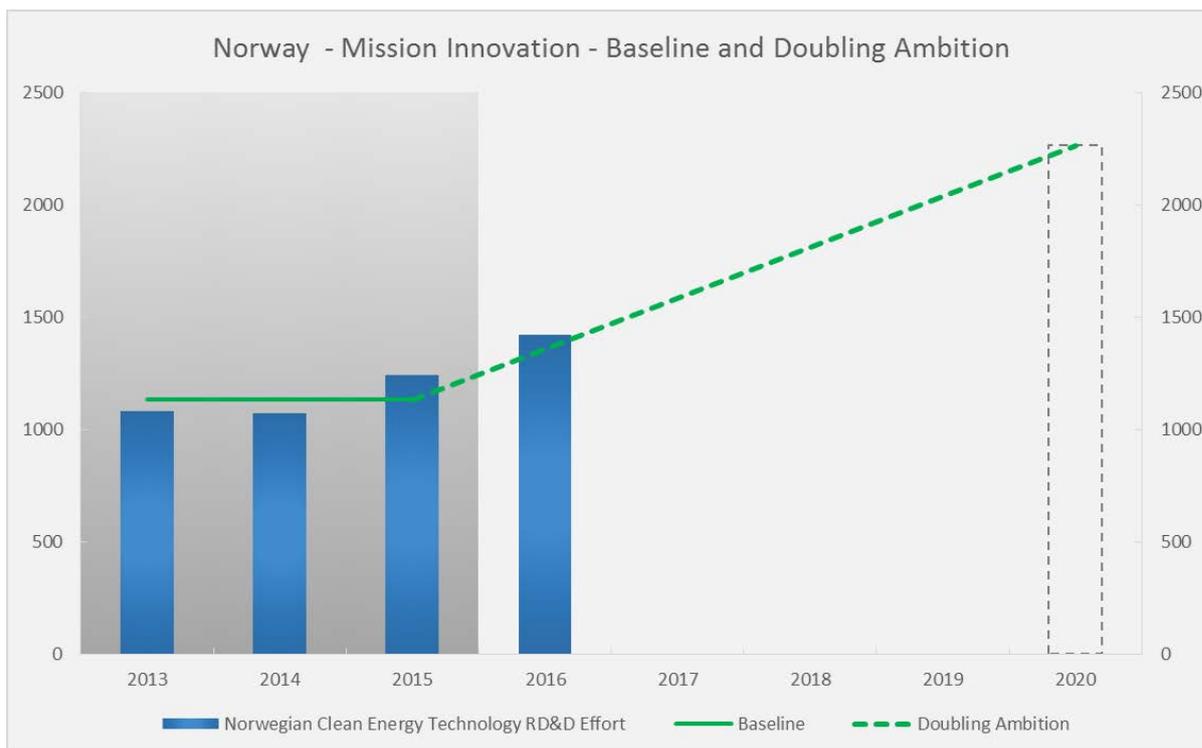
1. INTRODUCTION

Norway acknowledges the need to accelerate clean energy innovation to respond to our shared climate challenge. What is needed is a massive push for research, development, dissemination and deployment of clean energy technologies, but also cooperation between governments as well as governments and private investors.

As a country rich in energy resources and with a history of developing and using innovative energy technologies and solutions Norway is pleased to play a part in Mission Innovation. By 2020, Norway will seek to double the already considerable public resources devoted to developing and demonstrating clean energy technologies and solutions. This means increased efforts on renewable energy technologies, energy efficiency and carbon capture and storage. Important stakeholders will be the Research Council of Norway (RCN) and our two state energy enterprises, Enova and Gassnova, as well as energy research institutions and the private sector.

Norway has always given high priority to the development, use and deployment of environmentally sound technologies. Mission Innovation will put the world on a faster route to the point where we can secure energy access for all, while at the same time curbing global emissions of greenhouse gases.

	2013	2014	2015	2016	MI Baseline (average 2013-2015)	2016 Increase compared to baseline	2016 Funding Percent Increase
Energy R&D (~TRL 1-6)	384	384	396	445	388	57	15 %
Energy and Climate Technology Demonstration (~TRL 7-)	183	220	367	455	257	198	77 %
CO2 Capture and Storage R&D (~TRL 1-6)	170	200	200	230	190	40	21 %
CO2 Capture and Storage Large-scale Demonstration (~TRL 7-)	344	270	279	289	298	-9	-3 %
Sum	1081	1074	1242	1419	1132	287	25 %



Below a more detailed description of the schemes included in the MI baseline for Norway is given.

2. NATIONAL R&D STRATEGY

2.1 Energi21

Energi21 is the Norwegian strategy for research, development and commercialisation of new climate friendly energy technologies. Established in 2008 it focuses on how increased efforts in research and development and new technology can result in enhanced value creation and efficient use of energy resources in the sector.

Energi21 sets goals and advises on research and development of technology for renewables, energy efficiency, as well as carbon capture and storage (CCS). Commissioned by the Ministry of Petroleum and Energy (MPE), the strategy has been developed by the industry, research institutions and relevant government bodies. Energi21 aims at contributing to a coordinated, efficient and goal-oriented focus on research and technology, with a strong commitment by the energy sector at its centre.

The government-appointed board of Energi21 is responsible for the follow-up of the strategy and gives advice to the MPE on research funding allocations. The board's representation is dominated by the industry, but research institutes and authorities are also represented.

The board's revised strategy from September 2014 recommends more public funding for research, development and demonstration within six priority areas:

- Hydropower
- Flexible energy systems
- Solar power
- Offshore wind power
- Energy efficiency

- Carbon capture and storage

In these areas Norway enjoys competitive advantages, thanks to its natural energy resources, a strong technology and knowledge base and industry experience. Among the priority areas, Energi21 recommends especially investments in hydropower and flexible energy systems. In addition, Energi21 underlines the need to maintain and develop a knowledge platform relevant for the whole energy area.

http://www.energi21.no/prognett-energi21/Home_page/1253955410599

3. SCHEMES COUNTED IN UNDER THE MI BASELINE

3.1 ENERGY R&D

3.1.1 ENERGIX (RCN)

The ENERGIX programme provides funding for research on renewable energy, efficient use of energy, energy systems and energy policy. This encompasses both natural science and engineering as well as social science-based research and development. ENERGIX has a wide range of funding instruments, and both industry, research institutes and universities can apply for funding. The programme is a key instrument in the implementation of Norway's national RD&D strategy, Energi21, as well as for achieving other energy policy objectives.

http://www.forskningsradet.no/prognett-energix/Home_page/1253980140022

3.1.2 CENTRES FOR ENVIRONMENTALLY-FRIENDLY ENERGY RESEARCH (RCN)

The scheme of the Centres for Environment-friendly Energy Research (FME) seeks to develop expertise and promote innovation through long-term research in selected areas of environment-friendly energy. There are today 11 FME centres within renewable energy, energy efficiency, social sciences and CO2 management. The centres are hosted by either research institute or universities. The research activity is carried out in close cooperation between prominent research communities and industry partners.

http://www.forskningsradet.no/prognett-energisenter/Home_page/1222932140849

3.2 ENERGY AND CLIMATE TECHNOLOGY DEMONSTRATION

3.2.1 ENOVA

Enova is a state-owned enterprise that manages the assets in the Energy Fund. Enova's objective is to promote a shift to more environmentally friendly consumption and production, as well as development of energy and climate technology. Enova's tasks are set out in a four-year agreement between the Ministry of Petroleum and Energy and Enova. With regard to technology, the agreement requires that work on energy and climate technology must result in a reduction of greenhouse gas emissions and promote a long-term shift in energy consumption and production through the development and market introduction of new technologies and new solutions. Enova must focus its efforts on the development of new technology and support for technologies and solutions close to market introduction.

Enova offers investment grants for full-scale demonstration projects involving new energy and climate technology under real-life operating conditions. Enova has a particular responsibility for support for new energy and climate technologies in industry.

<http://www.enova.no/about-enova/about-enova/259/0/>

3.3 CO₂ Capture and Storage R&D

3.3.1 CLIMIT (RCN/Gassnova)

The CLIMIT Programme is Norway's national programme for research, development and demonstration of CO₂ capture and storage technology (CCS). The MPE established CLIMIT in 2005 to support the development of CCS technology for gas power plants. The scheme was expanded in 2008 to include power generation based on all fossil fuels and in 2010 industrial emissions were included. The programme is directed towards companies, research institutes and academia. Collaboration with international partners is encouraged.

The programme consists of two support schemes; CLIMIT R&D and CLIMIT-Demo, run by the Research Council of Norway and Gassnova respectively. CLIMIT aims for a balanced project portfolio and supports technology projects spanning from basic research to demonstration in the final stage before commercial launch.

<http://www.climit.no/en>

3.4 CO₂ Capture and Storage Large-scale Demonstration

The Norwegian government's strategy for CCS, presented in October 2014, spans across a broad range of measures including research, development and demonstration, realising a full-scale CCS-facility, transport, storage and alternative use of CO₂ and international co-operation for promoting CCS. A continued, strong support of CLIMIT, Centres for Environmentally-friendly Energy Research (FME) and international research activities is an important part of the strategy, c.f. above.

3.4.1 Technology Centre Mongstad (TCM)

TCM bridges a gap in the technology chain by enabling testing, verification and demonstration of CO₂ capture technologies on an industrial scale. The main objective of the centre is to support test campaigns and identify actions leading to reduced costs and technical, environmental and financial risks associated with implementing CO₂ capture technologies in full scale. The facility has been in operation since 2012, and has completed a large number of test campaigns for different vendors.

TCM has been constructed with two different CO₂ capture technologies, one for amine-based concepts, and one for GE (formerly Alstom's) patented chilled ammonia process. The facility has been built so as to enable testing of the capture technologies on two different flue gas sources: the combined heat and power plant at Mongstad (3,5% CO₂) and the refinery cracker (13% CO₂). This makes the testing on TCM relevant for capture from different CO₂-sources. The facility has a maximum capacity of 100,000 tonnes CO₂/year.

<http://www.tcmda.com/en/>

3.4.2 Large-scale CCS Demonstration Facility

The government's ambition is to realise at least one full-scale demonstration facility for CCS by 2020. Realising such a facility in Norway is challenging as there are few large, suitable emissions sources. The government has since 2014 conducted studies on potential full scale projects in Norway. It is crucial that the first facilities are suitable reference projects which can provide a maximum of learning and contribute to further spreading big scale CCS internationally.

The Norwegian projects Sleipner/Gudrun and Snøhvit are Europe's only large-scale CCS-projects in operation. At Sleipner and Snøhvit CO₂ is separated from natural gas before the gas is sent to the customers. Compared to this, capturing CO₂ from power stations or industrial plants is more complicated and expensive. The Norwegian continental shelf (NCS) is suited for CO₂ storage and already used to this end for CO₂ from the gas fields Gudrun, Sleipner, Snøhvit. Norway has thus gained considerable experience on storing CO₂ in geological formations. The Norwegian Petroleum Directorate's CO₂ storage atlas for the NCS shows several possible storage sites.

In late 2015, the government commissioned feasibility studies of three potential capture sites: a cement plant, an ammonia plant and a waste-to-energy plant. Three different storage sites are evaluated in conjunction with ship-based transport solutions. A final report is to be delivered to the Ministry of Petroleum and Energy by 1 July 2016.

3.5 International Cooperation

In the field of energy R&D, international cooperation is given high priority in Norway and it is an important supplement to national research efforts. Cross-border cooperation is important for maintaining high scientific standards in Norwegian research institutions, and also for strategic reasons, in making it possible to establish contacts and alliances with other countries.

Participation in international projects provides opportunities for building up professional expertise and gives scientific and financial support in solving important research tasks. International cooperation also provides a showcase for Norwegian technology and know-how suppliers.

In the energy field, Norway is primarily involved in cooperation under the EU system, the International Energy Agency (IEA) and at Nordic level. Norway is also involved in a number of bilateral (the US, Japan) and multilateral (CSLF, IPHE¹) agreements.

¹ **CSLF – CARBON SEQUESTRATION LEADERSHIP FORUM**

IPHE – INTERNATIONAL PARTNERSHIP FOR THE HYDROGEN ECONOMY