



## **IPHE Country Update March 2019: Norway**

<b>Name</b>	Ole Kristian Sollie
<b>Contact Information</b>	<a href="mailto:ole.kristian.sollie@vegvesen.no">ole.kristian.sollie@vegvesen.no</a> +47 95 70 1659
<b>Covered Period</b>	2017 to March 2019

### **1. New Initiatives, Programs, and Policies on Hydrogen and Fuel Cells**

The Norwegian government is currently working on a broad hydrogen strategy. The strategy will encompass research, development, commercialization and use of hydrogen, and is due to be presented by the end of 2019.

[Energi21](#) is the Norwegian national strategy for research, development, demonstration and commercialisation of new energy technology. It is the Ministry of Petroleum and Energy's permanent strategic body for research, development and demonstration in the energy sector. The Energi21 strategy document from 2018 highlights hydrogen as one of the prioritized areas and the need for building a robust knowledge- and technology platform within this area.

The National Transport plan (2018-2029) includes an ambitious climate strategy with specific targets related to uptake of zero-emission technology in the transport sector, dependent on technology maturity. Among others:

- After 2025:
  - new private cars, and light vans are to be zero-emission vehicles
  - new city buses are to be zero-emission vehicles or to be run on bio gas.
- By 2030:
  - new heavy vans, 75 % of new long-distance buses, and 50 % of new lorries are to be zero-emission vehicles; and,
  - approximately all goods distribution to be zero emission in city centres.

The Government policy also states that zero-emission technology (and low-emission technology) should be included in all future tenders for public ferries, when the technology allows for it.

Further policies that could lead to development of hydrogen solutions in the maritime industry involves the decision made in May 2018, where the Norwegian Government decided to ban all ships with harmful emissions from the world heritage fjords by 2026.

### **2. Hydrogen and Fuel Cell R&D Update**

In 2017 the research centre Mobility Zero Emission Energy Systems (MOZEES) was kicked off after being granted funding from The Research Council of Norway (RCN). MoZEES focuses on battery and hydrogen value chains, systems, and applications where Norway can take a leading position in the future. See [www.mozees.no](http://www.mozees.no) for more information with respect to R&D activity and results.

MoZEES is part of RCN's scheme for Centres for Environment-friendly Energy Research (FME). The objective of the scheme for FME is to establish time-limited research centres,



## INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

which conduct concentrated, focused and long-term research of high international calibre in order to solve specific challenges in the field

ENERGIX is a research program funded by RCN, aiming to support research related to environmentally friendly energy, including both basic research and more applied research on hydrogen production, transport and use. Funding of basic research on hydrogen has for the last two years focused on improvement of electrolysis processes, while funding of more applied research has mainly focused on safety and other applied issues like large-scale export of hydrogen from Norway. With respect to the latter, this is also done together with the [CLIMIT](#) research program for CCS.

Within ENERGIX, RCN also funds projects lead by industry with the aim of bringing hydrogen solutions out in the market. The current innovation projects running are all being led by NEL.

Basic research projects, applied research projects, and innovation projects receive 100%, up to 80% and up to 50% funding, respectively.

### **3. Demonstration, Deployments, and Workforce Developments Update**

In 2018 the Ocean HyWay Cluster was granted funding from Innovation Norway with the aim to realize maritime use of hydrogen. The cluster have around 65 members and is run by Maritim Forening Sogn og Fjordane. Several projects for the use of hydrogen as fuel for maritime applications are currently maturing, including ferry, high speed passenger boat, fishing boat and service vessel for fish farming.

In 2017 Norwegian Public Roads Administration (NPRA) initiated a tendering process for a development contract for a hydrogen-electric ferry. In January 2019 NPRA and Norled signed the contract for development of such a ferry and Norled is now working on the final design. Plans are for the hydrogen-electric ferry to be in operation 2021.

Pilot-E is a joint program established by The Research Council of Norway, Enova and Innovation Norway aimed at facilitating a fast-track route for ideas within environmental friendly energy technology to the market. In 2018 the program was focused on environmentally friendly maritime transport and climate neutral industry. Six projects were granted a total funding of NOK107M (approximately US\$12M). Among these, 4 within maritime transport possibly involving hydrogen and fuel cells technology and one industry project involving hydrogen production related to realisation of a value chain for green mineral fertilizers.

SINTEF is the project coordinator of the FCH JU funded project Haeolus (*Hydrogen-Aeolic Energy with Optimised eLectrolysers Upstream of Substation*) that proposes a new-generation electrolyser integrated within a state-of-the-art wind farm in a remote area with access to a weak power grid. One of the objectives is to demonstrate the ability to run a wind-hydrogen system in a remotely controlled setup, with only occasional on-site maintenance. Varanger Kraft is an energy utility, owning both the Raggovidda wind park and the regional grid, is part of the project and have the responsibility for preparation, maintenance and operation of the demonstration site. According to plan, the demonstration site will be in operation late fall 2019.



## INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

### 4. Events and Solicitations

Among all the smaller and larger events in Norway;

- The Norwegian International Maritime Hydrogen and Marine Energy Conference September 18-19 <https://www.maritimsfj.no/arrangement/conference-maritime-hydrogen-amp-marine-renewable-energy>
- 2nd International Conference on Electrolysis 2019 <https://www.sintef.no/projectweb/ice2019/>

### 5. Investments: Government and Collaborative Hydrogen and Fuel Cell Funding

ENOVA is the governmental funding body for projects and measures leading to energy efficiency and GHG reduction in companies and householdings. In 2018 Enova granted around NOK2,1Billion (approximately US\$240M) in various projects and measures. As part of the ENOVA funding scheme also funding for hydrogen infrastructure and purchase of hydrogen vehicles is included. For example in 2018, NOK24M (approximately US\$3M) was granted for building of 4 hydrogen filling stations for private cars, and NOK38M was granted for 10 hydrogen busses in Oslo (part of JIVE 2 project).

### 6. Regulations, Codes & Standards, and Safety Update

Based on the initiative from Norway, and other countries, the Working Group “Hydrogen Safety” was established in 2018 under the CEN/CLC/JTC 6 - Hydrogen in energy systems. The Working Group will address hydrogen safety issues related to parking structures, garages, and tunnels. Norway contribute with 4 experts to the group.

In 2018 the Norwegian Maritime Authority granted the hydrogen-electric ferries competing for the development contract Approval of preliminary design, according to MSC.1/Circ.1455 (IMO). This is a milestone in enabling approval of hydrogen-electric maritime transport. The winner of the contract is now working towards Approval of Final Design.



### Summary Country Update March 2019: Norway

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
Fuel Cell Vehicles <sup>1</sup>		159	ENOVA funding scheme for hydrogen infrastructure.	<ul style="list-style-type: none"> <li>• ENOVA funding scheme for hydrogen infrastructure.</li> <li>• Incentives for purchase, the same as for EVs.</li> </ul>
FC Bus		5		ENOVA funding scheme for purchase of zero-emission buses
Fuel Cell Trucks <sup>2</sup>				ENOVA funding scheme for purchase of zero-emission trucks
Forklifts		10	ASKO, Norway's largest grocery wholesaler, holds 10 forklifts	
H <sub>2</sub> Refueling Stations	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
70 MPa On-Site Production		1		<ul style="list-style-type: none"> <li>• ENOVA funding scheme for installation of hydrogen infrastructure.</li> <li>• No subsidy for operation</li> </ul>
70 MPa Delivered		4		<ul style="list-style-type: none"> <li>• ENOVA funding scheme for installation of hydrogen infrastructure.</li> <li>• No subsidy for operation</li> </ul>

<sup>1</sup> Includes Fuel Cell Electric Vehicles with Range Extenders

<sup>2</sup> As above



## INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

35 MPa On-Site Production		1		<ul style="list-style-type: none"> <li>• ENOVA funding scheme for installation of hydrogen infrastructure.</li> <li>• No subsidy for operation</li> </ul>
35 MPa Delivered		0		<ul style="list-style-type: none"> <li>• ENOVA funding scheme for installation of hydrogen infrastructure.</li> <li>• No subsidy for operation</li> </ul>
<b>Stationary</b>	<b>Target Number<sup>3</sup></b>	<b>Current Status</b>	<b>Partnerships, Strategic Approach</b>	<b>Support Mechanism</b>
Small <sup>4</sup>				
Medium <sup>5</sup>				
Large <sup>6</sup>				
District Grid <sup>7</sup>				
Regional Grid <sup>8</sup>				
Telecom backup				
<b>H<sub>2</sub> Production</b>	<b>Target<sup>9</sup></b>	<b>Current Status</b>	<b>Partnerships, Strategic Approach</b>	<b>Support Mechanism</b>

<sup>3</sup> Targets can be units installed and/or total installed capacity in the size range indicated

<sup>4</sup> <5 kW (e.g., Residential Use)

<sup>5</sup> 5kW – 400 kW (e.g., Distributed Residential Use)

<sup>6</sup> 0.3MW – 10 MW (e.g., Industrial Use)

<sup>7</sup> 1MW – 30 MW (e.g., Grid Stability, Ancillary Services)

<sup>8</sup> 30MW plus (e.g., Grid Storage and Systems Management)

<sup>9</sup> Target can be by quantity (Nm<sup>3</sup>, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target



## INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

Fossil Fuels <sup>10</sup>				
Water Electrolysis <sup>11</sup> (PEM, Alkaline, SOEC)				
By-product H <sub>2</sub>				
<b>Energy Storage from Renewables</b>	<b>Target<sup>12</sup></b>	<b>Current Status</b>	<b>Partnership, Strategic Approach</b>	<b>Support Mechanism</b>
Power to Power <sup>13</sup> Capacity				
Power to Gas <sup>14</sup> Capacity				

<sup>10</sup> Hydrogen produced by reforming processes

<sup>11</sup> Please indicate if targets relate to a specific technology (PEM, Alkaline, SOEC)

<sup>12</sup> Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity

<sup>13</sup> Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity

<sup>14</sup> Operator has the opportunity to provide the stored energy in the form of hydrogen back to the energy system through multiple channels (e.g., merchant product, enriched natural gas, synthetic methane for transportation, heating, electricity)