INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update Nov 2018: The Netherlands

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

At the request of the Ministry of Economic Affairs and Climate Policy, TKI Nieuw Gas produced a report, "Outlines of a Hydrogen Roadmap", published March 2018. The objectives of this report are to:

- Indicate the potential of hydrogen in a sustainable energy system in 2050;
- Give an overview of actors and activities on hydrogen in the Netherlands; and,
- Advise what steps should be taken and which activities are necessary to realise the potential of hydrogen.

The "Outlines of a Hydrogen Roadmap" has been an input for the discussions and the policy initiatives in the framework of the National Agreement on Climate Change. In July this year (a Proposal for key points of) the Climate Agreement has been presented by the Chair of the Climate Change Conference. The proposal represents extensive consultations and discussions by the five sector platforms: built environment, industry, agriculture and land use, mobility, and electricity, on how The Netherlands could achieve its Paris Agreement targets. Hydrogen has been identified as a cross-sectoral solution and as an enabler for the integration of sustainable energy in the energy system.

More in particular, it states that:

> *"Hydrogen plays a key role in the transition towards a climate-neutral society. The distinction between green, blue and grey hydrogen is important in this context. At present in the Netherlands, we are mainly producing grey hydrogen, but we are striving to introduce a green hydrogen economy in the future.*
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> *For years, hydrogen has been produced in the Netherlands and also worldwide on a large scale for many industrial applications, in particular ammonia production and oil refining. Furthermore, hydrogen is used for the production of high-temperature process heat in industrial boilers and furnaces. More recently, work has started on the use of hydrogen as transport fuel. This will allow road-vehicles, trains, mobile equipment and probably also vessels to become fully electric in combination with fuel cells.*
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> *Hydrogen becomes liquid under pressure and can then be stored in a compact form for various applications. In due course, hydrogen could take over the role of natural gas in the Dutch situation for low-temperature heating in houses and buildings. Furthermore, hydrogen can be highly valuable for the storage of electricity and energy transport from offshore wind farms to the shore. It can also be relatively easily transported and buffered in pipelines and stored in tanks. In due course, hydrogen could therefore play a key role in improving the flexibility of the electricity system (storage and CO2-free controllable capacity).*

Broad use of hydrogen as an energy carrier for mobility and transport, in the industry, the energy sector and possibly also in the built environment, presents realistic opportunities to achieve a large-scale reduction of CO2 emissions and at the same time facilitate the transition to sustainability by building a future-oriented infrastructure. According to expectations, large sections of the current national network for natural gas should be usable for this, which could limit the costs. The process will also benefit from a strong knowledge infrastructure that has been built up in the field of natural gas in the Netherlands.

The expectation, shared by all the stakeholders, is that the application of hydrogen as a feedstock in the industry and as an energy carrier will mainly be scaled up after 2030. The "Outlines of a roadmap for hydrogen" document from TKI Gas and the "Hydrogen as an essential building block for the energy transition" manifest from the Hydrogen Coalition show that there is a large potential demand for hydrogen in the Netherlands.

We share the ambition to accelerate the development and roll-out of green hydrogen by means of a programmatic approach. The aim is not only to lower the costs for renewable electricity, but also to accelerate the reduction of the production and investment costs for electrolysis, to allow green hydrogen to play a key role in the future.

Additional knowledge is required on the potential, demand development and options for cost reductions in order to make good arrangements that enjoy broad support on the development of the hydrogen market in the Climate Agreement later this year/next year. PBL (Netherlands Environmental Assessment Agency) has been invited to share the latest national and international insights on the future of hydrogen with us when performing the calculation. In collaboration with the industry and other network managers, Gasunie will map out the potential and demand for hydrogen and hydrogen infrastructure. At the same time, they will engage in "joint fact-finding" together with participants of the Industry platform and scientific experts. One of the questions addressed at this time will concern the desired growth rate of the capacity for electrolysis towards 2030. The participants in the hydrogen manifest estimate its potential at 3 to 4 GW. All of this should contribute to a good decision-making process on the further specification of the programmatic approach."

2. Hydrogen and Fuel Cell R&D Update

First Call from the R&D Programme (sustainable) Hydrogen was published in June 2017.
Call Budget: € 750k. 3 Proposals have been granted.
Topics for research: industrial applications of hydrogen (high temperature); mobility (zero emission); and, power supply (system integration of hydrogen and energy-storage). Initial results are expected in 2019.

Second Call on this R&D programme was made in March 2018.
Call Budget: €3.88million. 8 proposals were approved including on the topics of electrochemical compression and purification, feasibility study CCS-project in the Rotterdam Harbour area and hydrogen/fuel cell application in in-land and short-sea shipping.

Last year several (feasibility) studies were announced, concerning:

- Production of green hydrogen by electrolysers, scale: from 1 MW up to 100 MW
- Use of hydrogen for heating buildings and parts of cities.

3. Demonstration, Deployments, and Workforce Developments Update

A 4th hydrogen refuelling station (HRS) opened in January 2018 in Groningen (northern part of The Netherlands). For now, this HRS only refuels at 350 bar, and is designed especially for a (demonstration) project of 2 FC Buses for public transport in the Groningen-area. This demonstration project started in February 2018.

Another demonstration project with 2 Hydrogen Buses started in the Arnhem-region (eastern part of NL) last September.

Currently, there are 8 FC-buses running in service, in 4 different regions.

Scaling-up
In order to get costs down it is important to scale-up the production of the FC-buses. This is the goal of the FCH JU JIV- project. Several Dutch parties (province of Groningen and South-Holland) are participating in JIVE-2 that has the aim is to introduce 50 FC-buses in to service by 2020.

4. Events and Solicitations

The 2018 Wind Meets Gas Symposium (in Groningen, October 2018) was a great success with significant participation by high-level energy experts from the industry. Key highlights include:

- acting fast to 'green' energy both as a product and as a feedstock is key: laggards lose;
- hydrogen, either blue (i.e. within carbon from production stored), or green (from renewable energy) is probably the key energy carrier of the future that will enable a successful energy transition;
- fossil free hydrogen production needs to ramp up soon. The pilot phase of proving the technologies is done; over 100 GW electrolyser capacities and substantial megatonnes of offshore CCS will need to start soon to enable blue hydrogen production;
- industry should not wait for government policy or yet another study but rather, it is time to launch demonstration initiatives, several of which were presented during the symposium;
- further steps will require clear policy guidance on the role of hydrogen, as well as triple helix collaboration (between (local) government, industry and science); and,
- the North of the Netherlands belongs to the regions within Europe with probably the best conditions to develop into one of the first hydrogen valleys of Europe; the offshore renewable power is there, storage facilities for gases are there, the energy knowledge is there, the chemical cluster, the gas grid and local transport needs are there, and finally the spirit to work together on enabling a new hydrogen energy system is there.

All presentations (please click on the speaker's name in the programme) are available on the website www.windmeetsgas.com as well as a selection of photos and videos from the event.

The next (4th) edition of Wind meets Gas Symposium will take place in the autumn of 2019

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

Programme for the demonstration of low-carbon technologies and innovations in transport
Multi-annual demonstration programme (financing for example Living Labs) was published in October 2017
Budget Call of 2017/2018: €17Million
Focus of this Call 2017/2018:

- Acceleration of development of low-carbon vehicles (transportation of goods and passengers (M2);
- Deployment and use of infrastructure for alternative fuels; and,
- Co-financing of EU-supported infrastructure for alternative fuels (mainly hydrogen).

Results of the 2017/2018 Call:
12 new HRS will be built in NL and will come into service by the end of 2020.

Preparations for the next Call are ongoing.
Estimated budget: € 32 Million.
Scope: more or less the same.

6. Regulations, Codes & Standards, and Safety Update

The Hydrogen Innovation Safety Program was set up and launched in 2017. Program Leader is NEN, the Dutch Normalisation and Safety Institute.
Several working groups are operational, on the subjects of:

- Permit for a HRS;
- Risk management and instructions for the First Responders; and,
- Codes and Regulations.

Summary Country Update November 2018: The Netherlands

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
Fuel Cell Vehicles[1]	2.000 by 2020	53 as of Oct. 2018	Working Group Demand Gathering, (part of the Dutch Hydrogen Platform). Main Task: Stimulate en co-ordinate activities of fleet-owners and HRS-business	Some Fiscal measures: • No purchase tax (BPM) • No road tax (MRB). • Low addition of 4% (instead of 22%) per year (Income tax) • Fiscal rebate on investments in a hydrogen car(9% of investments costs)
FC Bus	100 by 2020	12 (scheduled), 8 in operation	• National Agreement on Zero Emission Regional Public Transportation By Bus • Dutch provinces (South-Holland and Groningen) are partner in JIVE-2 (i.e. FCH JU project on scaling up Public Transport buses on hydrogen)	Fiscal rebate on investments in a hydrogen bus (9% of investments costs)
Fuel Cell Trucks[2]	500 by 2020	3 as of Sept. 2018	Green Deal Zero Emission InnerCity Logistics https://greendealzes.connekt.nl/en/the-livable-city/	
Forklifts	No target	0		

[1] Includes Fuel Cell Electric Vehicles with Range Extenders

[2] As above

H_2 Refueling Stations	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
70 MPa On-Site Production	20 by 2020	1	• Fuel Vision • Covenant (Green Deal) Sustainable Hydrogen Economy • National Agreement Climate Change	Subsidy Scheme: Up to 100% Subsidy of the investments costs for a (public) HRS No Subsidy for operation
70 MPa Delivered		1		
35 MPa On-Site Production	20 by 2020	2		
35 MPa Delivered		2		
Stationary	**Target Number[3]**	**Current Status**	**Partnerships, Strategic Approach**	**Support Mechanism**
Small[4]	No target	0		
Medium[5]	No target	0		
Large[6]	No target	0		
District Grid[7]	No target	0		
Regional Grid[8]		0		

[3] Targets can be units installed and/or total installed capacity in the size range indicated
[4] <5 kW (e.g., Residential Use)
[5] 5kW – 400 kW (e.g., Distributed Residential Use)
[6] 0.3MW – 10 MW (e.g., Industrial Use)
[7] 1MW – 30 MW (e.g., Grid Stability, Ancillary Services)
[8] 30MW plus (e.g., Grid Storage and Systems Management)

Telecom backup	No target			
H_2 Production	**Target[9]**	**Current Status**	**Partnerships, Strategic Approach**	**Support Mechanism**
Fossil Fuels[10]	Climate neutral as soon as possible (no CO2- emission well to wheel)	Large share of fossil fuelled H2-production (by SMR)	• Covenant (Green Deal) Sustainable Hydrogen Economy • National Agreement Climate Change	
Water Electrolysis[11] (PEM, Alkaline, SOEC)	No target			
By-product H_2	No target	Large production facilities in Rotterdam harbour area and Groningen harbour area	Production based on chlorine-alkali production process, H2 as by-product.	
Energy Storage from Renewables	**Target[12]**	**Current Status**	**Partnership, Strategic Approach**	**Support Mechanism**

[9] Target can be by quantity (Nm^3, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target
[10] Hydrogen produced by reforming processes
[11] Please indicate if targets relate to a specific technology (PEM, Alkaline, SOEC)
[12] Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity

Power to Power[13] Capacity	No target	0		
Power to Gas[14] Capacity	No target	0		

[13] Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity

[14] 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)