Netbeheer Nederland

Memorandum

Hydrogen as part of the future energy system

The energy landscape is undergoing a fundamental transformation. Alternative, climate-neutral energy sources are becoming more important, and the use of natural gas is set to decrease. This will be replaced by other gaseous energy carriers like green gas, biogas and hydrogen (green or otherwise). Compared to electricity, gaseous energy carriers can be transported more efficiently over longer distances and stored more efficiently and for longer, making these the more economical option. By linking the different energy networks together and improving the existing connections, new possibilities for transmission and storage can be created and the reliability of the system maintained. By exploiting this combination of electricity and renewable gases, the peak load on the power grid can be reduced. This prevents having to make costly investments in the electricity grid and allows us to make better use of the existing gas network. Moreover, given that we already have an expansive, finely meshed, well-maintained gas network in the Netherlands, one which also has sufficient capacity for the transmission of hydrogen, it would often not even be necessary to adapt existing gas grids for the transmission of alternative gaseous energy. A smart combination of electrons and molecules can help us meet the climate goals in good time and at the lowest costs to society.

Hydrogen: alternative to natural gas and storage medium for electricity

The Dutch Climate Agreement targets having 3-4GW of installed electrolysis capacity for the production of green hydrogen by 2030. Hydrogen can play several roles in the energy supply system of the future. It can, for example, be used to temporarily store excess electricity produced by solar and wind energy (flexibility/seasonal storage). Fed into the regular natural gas grid, hydrogen could provide an option for the built environment (either blended with natural gas or as a substitute for natural gas: 100% hydrogen). The use of hydrogen is not new: it is already being used in the industrial sector. However, this is still ‘grey hydrogen’, i.e. hydrogen that is produced from fossil fuels in a process that releases CO_2 into the atmosphere. One way to reduce carbon emissions in the existing hydrogen production process is to capture the released CO_2 and use it in commercial greenhouses or industry, for example, or store it underground. This is then called ‘blue hydrogen’. The ultimate goal for the future, though, is to produce ‘green hydrogen’, a clean, carbon-free energy carrier and feedstock. No greenhouse gases are released during either the production or use of green hydrogen.

Hydrogen in the built environment

By 2050, the entire built environment in the Netherlands must be carbon neutral. Green hydrogen, in addition to green gas and biogas, is a gaseous alternative to natural gas that can be used in the built environment. This means that the existing gas grid will, in many cases, continue to play a role in the sustainable heating of the Dutch built environment. The transmission and distribution system operators, along with the Dutch government and other Dutch Climate Agreement partners, have stated that they want to be able to use hydrogen as a fully-fledged option for sustainable heating of homes (in addition to all-electric and heat grids) from 2030 onwards. This means that the existing natural gas grid will, in many cases, continue to play a role in the sustainable heating of the Dutch built environment. To achieve this, efforts will have to be made to reduce the heat demand through better insulation of homes and buildings and the use of hybrid systems. Then we can use the available green hydrogen to maximise sustainability. Hydrogen must also contribute to reducing carbon emissions in industry by 4 megatonnes.

Joint initiatives in which parties are working together on these ambitions include the H2 Platform and the Hydrogen Coalition.

Getting to work right away

To get a running start, comply with the agreements under the Dutch Climate Agreement, realise the government's vision and, ultimately, be able to use hydrogen (green or otherwise) seriously in the built environment from 2030, we need to act now. It is the aspiration of the network operators to get to work energetically in regions and industry clusters to help develop local energy strategies. To ensure that the infrastructure is in place and the preconditions are met in good time, several pilots have been set up at various locations in the Netherlands to experiment with hydrogen as a storage medium and replacement for natural gas. The knowledge gained during these pilots is openly shared among the network operators so that each pilot can take things one step further. These pilots are an essential part of how we will jointly shape the energy transition in the coming years.

There are several scenarios on how the current gas network can be used for the transmission of hydrogen. In addition to transmitting hydrogen gas, admixing hydrogen with natural gas also offers a route towards increasing sustainability. It is expected that various applications will develop in parallel. Given that developments in the area of green gas are also expected, the network operators are taking into account the development of gas networks to transmit various types of gas mixtures. Safety, reliability and practical application for today's natural gas customers are key elements in the pilot phase. Accelerated innovation to ensure that these aspects remain at the same level as for natural gas is a prerequisite if hydrogen (green or otherwise) is to play the intended significant role from 2030 onwards.

Hydrogen integration: what are the prerequisites

Technically, the gas networks can handle an addition of up to about 30% hydrogen to natural gas without major problems. The biggest obstacles to admixing concern the end-use appliances and systems and correct energy settlement. With a low mixing ratio, these obstacles have no or little impact. However, as the percentage of hydrogen in the mixture increases, so too does the role played by these obstacles. Using 100% hydrogen in the gas networks is a bigger task, partly because the end-use appliances and systems would need to be replaced, which would require the following:

- Providing additional clarification of the technical risks associated with the transmission and distribution of hydrogen;
- establishing control measures for these risks;
- determining the costs for the construction and management of networks for the transmission and distribution of hydrogen, mainly for existing districts, but where necessary also for new districts;
- continuing to collaborate in Europe to conduct research and draft standards and laws that allow wide application of hydrogen, despite the different frameworks and choices of the individual countries;
- from 2025, being allowed to use existing (regulated) gas networks for the distribution of hydrogen and collective switching. This requires amendments, both in the short and long term, to laws and regulations.

Given the number of questions and the range of topics, there is still a lot to be done to ensure we have all the answers so that we are ready to roll out on a large scale from 2030. That is why we have to get started now and ensure that we, as system operators, have done all our homework by 2030. The system operators only control part of the gas supply chain, which means that to allow hydrogen developments to flourish we need the involvement of all supply chain partners, like technical

service providers, installation companies, and electronics and technology retailers. Safety authorities, regulatory authorities and municipalities also have an important role to play. Regulation by the authorities concerns not only the system operators, but also the appliances and systems. Although our customers' appliances and systems are not officially the responsibility of the system operators, safe use of hydrogen indoors is a major concern throughout the total supply chain.

Market regime and legislation arise from choices made

The parties must explore the feasible routes together, answering questions like the following along the way. How and where do 'we' (the Netherlands for example) want to use hydrogen? Are we going for 100% hydrogen, blending as much as possible with natural gas, first blending and then moving up to 100%, or a combination of these options? How will the switch from natural gas to hydrogen actually (physically) be brought about? What is the role of green gas in the whole story? The answers to these questions determine which laws, regulations and market regime would be appropriate. The system operators do not (as of yet) have a statutory duty to transport/distribute hydrogen or arrange energy storage. Our ambition is that the system operators be given that role, which is why we are focusing on what is needed to be able to use the existing, regulated gas networks for the feed-in of hydrogen (green or otherwise).

The system operators recognise the significant value of hydrogen serving a function within the energy system and as one of the elements of a robust and affordable energy system. We still have a lot to do to bring it that far, which is why we have to get to work right away. We know that we cannot achieve this alone and so are happy to work with our partners to exploit the potential of hydrogen. As system operators, let us not be the impeding factor but instead be the accelerating force in the transition to hydrogen, and ensure that we are ready for it.