



Electrolysers: opportunities for the Dutch manufacturing industry

Regional opportunity map and recommendations for the development of a Dutch production chain for electrolysers

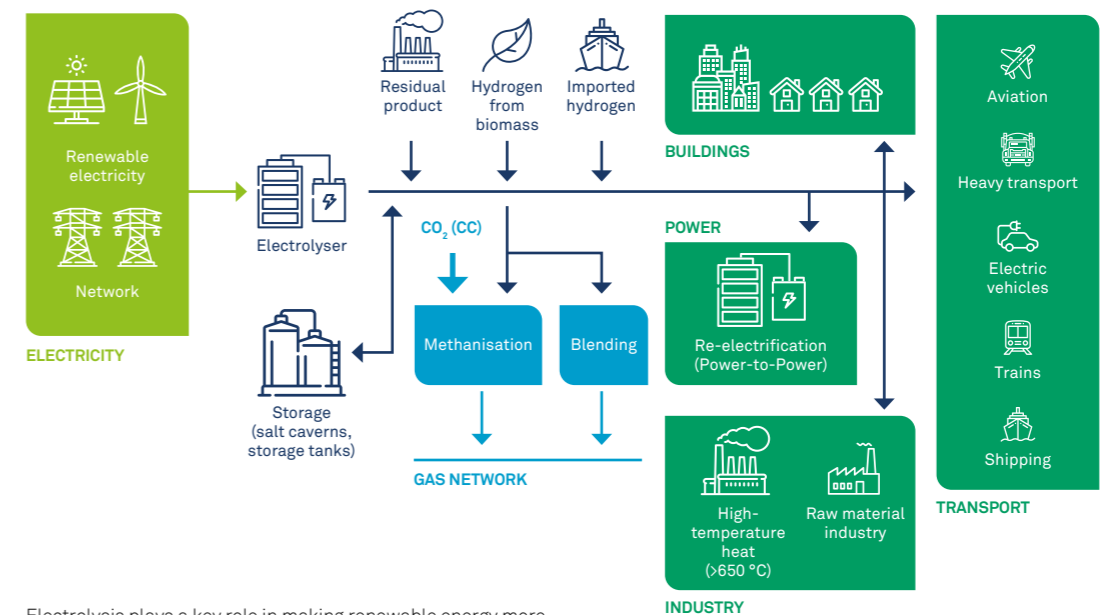
Electrolysers

Key technology for the energy transition

Hydrogen has a crucial role to play in all scenarios for a successful energy transition. The Netherlands is excellently positioned to develop a CO₂-neutral hydrogen economy – and to lead the way internationally as a supplier of electrolysers. Where do the growth opportunities for Dutch industry lie and how can we exploit them?

TNO's Faraday laboratory in Petten is one of the largest hydrogen research facilities in Europe. Here, TNO works with industrial partners on technologies for scaling up electrolysis. This is one example of cross-fertilisation between Dutch knowledge hubs and industry in the field of hydrogen.

Hydrogen is referred to as the missing link in the energy transition. The conversion of sustainably generated energy into hydrogen is a key technology which offers a solution for the most problematic aspects of the future energy system. Examples include hydrogen for the long-term storage and long-distance transport of (sustainably generated) electricity, as the replacement of natural gas as a raw material in industry and as a sustainable fuel for (heavy) transport by road and water.



Electrolysis plays a key role in making renewable energy more widely usable. Source: IRENA.

Growth potential of electrolysers

Worldwide, there are high expectations and great ambitions surrounding (green) hydrogen. These are currently being translated into policy plans and objectives. In its hydrogen strategy, for instance, the European Commission presents an objective of 6 GW (or 1 million tonnes of green hydrogen) by 2024 and 40 GW (10 million tonnes of green hydrogen) by 2030. The Dutch Climate Agreement refers to the scaling up of the electrolysis capacity to 500 MW by 2020. The target for 2030 is 3-4 GW. Other European countries also have quantified targets for electrolysers; Germany, for instance, has set an objective of 5 GW by 2030 in a National Hydrogen Strategy. For comparison, the total European electrolysis capacity is around 150 MW.

The growth potential for electrolysers is therefore enormous, as is the potential for the Dutch economy. After all, our country has a highly developed manufacturing industry with hundreds of companies that have the knowledge and competences to acquire a place within one or more links of the electrolyser production chain. And this is well worth working on: the European electrolyser market alone is expected to be worth tens of billions of euros over the next ten years.

The Netherlands as a catalyst for innovation

The aim of this study is to help realise the potential that exists in the Netherlands. After all, this does not take place spontaneously and requires a strategic vision and targeted actions. At the moment, the (international) market volumes for electrolyzers are still low, leaving room for only a handful of suppliers of which almost all are foreign companies, the so-called system integrators. Demand is also held back by the relatively high cost price of water electrolysis, which is up to four times greater than the cost price of 'fossil' or 'grey' hydrogen.

At the same time, however, this offers opportunities for Dutch industry to catch up and to position itself internationally as a developer and supplier of (components for) electrolyzers. An important factor in the high cost price of electrolysis is the fact that the production process is automated to only a limited degree. In the Netherlands in particular, a lot of expertise is available (including from other industrial markets) to improve the production process and to increase the quality and efficiency of electrolyzers.

Insights into (regional) opportunities

As mentioned, the Netherlands can play a key role in scaling up and professionalising the production chain for electrolyzers. In doing so, we are performing an important service for our country in several respects. This makes a crucial contribution to achieving our own climate ambitions but also to economic growth at a national level and in various regional hotspots. In a joint study, TNO and FME have identified the parts of the production chain for which the Netherlands has a strong starting position, as well as what is needed to capitalise on this.

The starting point for this innovation agenda is a regional opportunity map, drawn up by TNO and FME on the basis of discussions with companies and organisations (see page 7). This offers good insights into the knowledge and capacities present in the Netherlands. Some of the companies mentioned are already active in the electrolyser market and others are preparing for it.

Focus on innovation potential

In this study, we started with two forms of water electrolysis which are already commercially usable: PEM and Alkaline (see box). Both technologies still offer plenty of room for innovation and efficiency gains in production. This is important because, as already mentioned, the market for electrolyzers is currently dominated by foreign players. The further development and improvement of these existing technologies offers the Dutch sector a unique opportunity to catch up and gain an (international) market share.



How the chain is structured

The opportunity map distinguishes between four steps in the production chain:



Stack components:

These are separate components of an electrolysis installation, such as membranes, electrodes, catalysts, coatings, sheeting and the crucial bipolar plate (BPP).

Stack integration:

This category includes companies which can assemble the electrolyser from the separate components, the core of an electrolysis installation.

Balance-of-Plant:

These are suppliers of essential technologies relating to the electrolyser, such as power electronics, sensors, cooling and gas and water purification technology. A great deal of added value is created at this stage of production.

System integration:

These are companies which can assemble complete electrolysis installations. These parties play an important role in organising the suppliers in the production chain.

Customers:

In addition to the production chain, (potential) electrolyser customers can also play an important role in the further development of a production chain for Dutch electrolyser technology.

Alkaline and PEM

There are currently two market-ready technologies for water electrolysis. For many years, alkaline systems have been applied on a large scale (6-100 MW), mainly in the production of chlorine. The more recent PEM systems are generally smaller, more efficient and more flexible, but currently have a maximum capacity of about 10 MW.

Both technologies will likely play a role in the energy transition. PEM, for example, is well suited for integration with renewable energy generation, while Alkaline technology is more appropriate for large, continuously running industrial applications. A particularly important aspect is that both technologies are still undergoing further development. This is where opportunities lie for the Netherlands.

Opportunity map for electrolysers

Number of companies per region with relevant knowledge and ambitions for the electrolyser production chain

- 📍 Number of companies with relevant knowledge and ambitions for the production of (components of) electrolysers (potentially relevant)
- 🏢 Number of companies which are actually active in the production chain (currently relevant)
- 🔬 Research institutes and/or clusters of knowledge and (research) activity in the field of hydrogen/electrolysis

NB Several companies are active in more than one area of the production chain, the sum total for the various categories therefore does not correspond to the total number of companies per region.

WEST REGION

Stack components: 🏢🏢🏢

BOP components: 🏢🏢🏢🏢🏢🏢

Stack integration: 🏢🏢

System integration: 🏢🏢🏢🏢

Electrolyser customers: 🏢🏢🏢

NORTH REGION

Stack components: 🏢🏢🏢

BOP components: 🏢🏢🏢🏢🏢🏢🏢

Stack integration: 🏢🏢

System integration: 🏢🏢

Electrolyser customers: 🏢

EAST REGION

Stack components: 🏢🏢🏢🏢🏢🏢

BOP components: 🏢🏢🏢🏢🏢

Stack integration: 🏢🏢🏢

System integration: 🏢🏢🏢🏢

Electrolyser customers: 🏢🏢🏢🏢

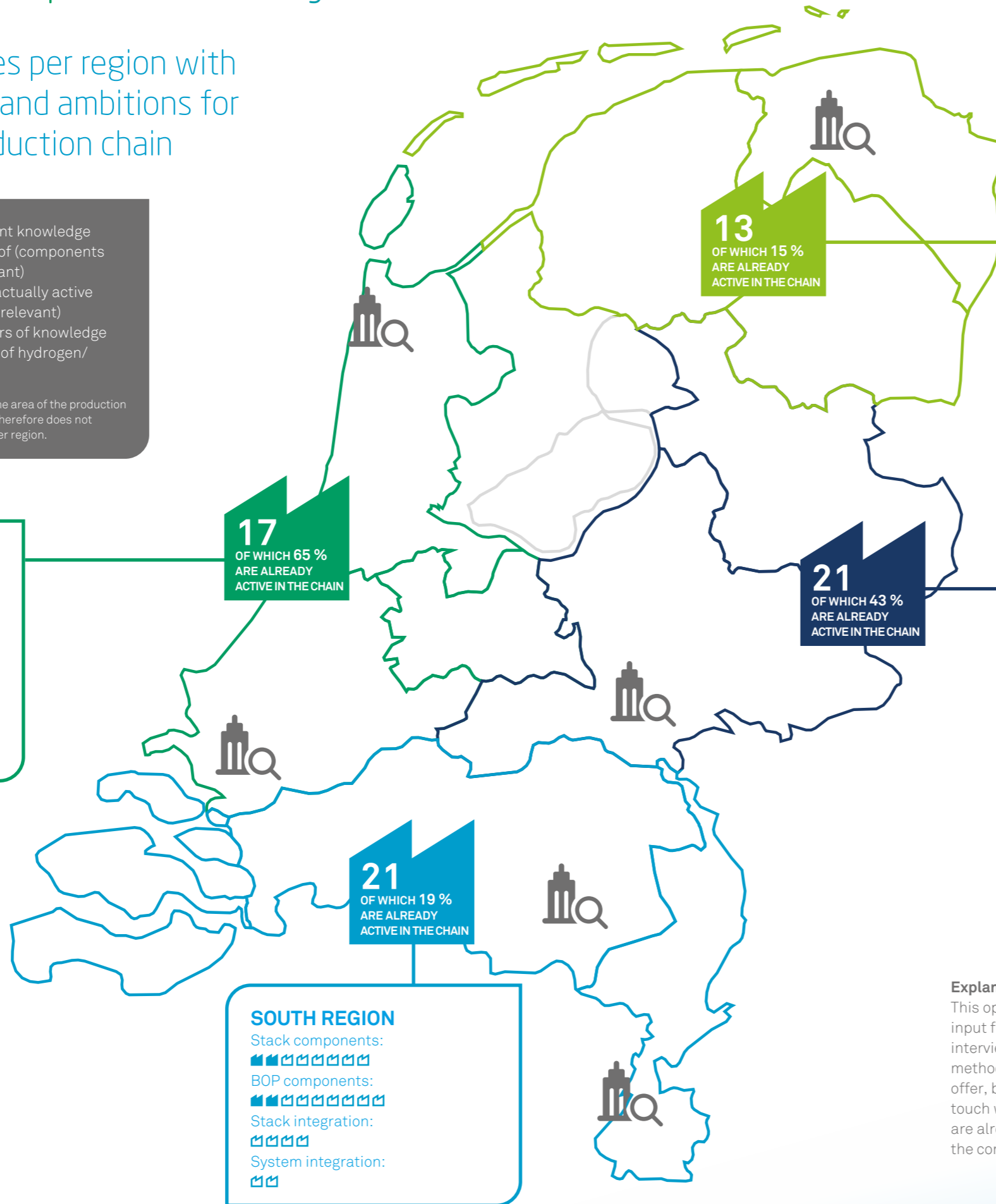
SOUTH REGION

Stack components: 🏢🏢🏢🏢🏢🏢

BOP components: 🏢🏢🏢🏢🏢🏢🏢

Stack integration: 🏢🏢🏢

System integration: 🏢🏢



Explanation

This opportunity map was created on the basis of an extensive survey, input from experts from various organisations and more than 80 interviews with relevant companies throughout the country. This working method has provided a solid impression of what the Netherlands has to offer, but we do not pretend that it is complete. We would like to get in touch with any companies that are missing from this overview but which are already active in the chain or are considering becoming so. Please see the contact details in the colophon.

Explanation of the opportunity map

A number of important conclusions can be drawn from the opportunity map. First and foremost, the Netherlands has several companies at every step in the value chain for electrolysers:



Stack components

The Netherlands has the required companies which can make stack components, almost a third of which are already active in the production chain. The emphasis here is on PEM and generic technology. The dominant regions in this area are the east and the south. The latter is also interesting because of the presence of companies which can play a role in the automation and mass production of components. The west region is also interesting because the companies there are already active in existing production chains.



Stack integration

Several companies have the technical means to produce stacks in the short term. At the moment, a small number are already active as developers and/or producers, especially of PEM systems. It is notable that the south region, in particular, is not yet active in the market even though its potential is in no way inferior to that of the other regions.

Regional aspects, national perspective

Various regional aspects emerged from the study. Around Arnhem, for example, there is a cluster of companies specialising in hydrogen technology, whereas there is a relatively large number of companies specialising in materials technology in Overijssel. In Noord-Brabant, the HTSM cluster in Eindhoven is an important focal point. In general, regions with a relatively large manufacturing industry also have great potential as hotspots for the production of critical components.

In the BoP segment, we see (potential) players throughout the country, although sizeable concentrations are also visible in the existing industrial clusters. Potential system integrators are also spread throughout the country. For a more detailed description of the opportunities and challenges per region, please refer to the full report.



BoP components

This is a relatively large category with a remarkably good spread throughout the Netherlands. A substantial number of these companies are already active in existing production chains for electrolysers. This is particularly true in the east and the west. The other two regions have manufacturing industries that work predominantly for other markets, such as fuel cells or the automotive sector.



System integration

(Potential) system integrators are active throughout the Netherlands and are generally large companies. A handful are already active in this market, but mainly as developers and manufacturers of small systems. Series production is not yet ongoing in the Netherlands. An important conclusion is that there is a potential manufacturer of electrolysers in almost every province. The question is if and how such parties will also become active.



Customers

Several companies in the Netherlands are already using electrolysers for the production of hydrogen on a pilot scale or plan to do so in the near future. These are currently concentrated predominantly in the west and east regions but all industrial clusters have potentially interesting application areas, including the north (Eemshaven) and the south (Chemelot).

Agenda and recommendations

The opportunity map shows that the Dutch manufacturing industry has a lot of potential in the field of water electrolysers. However, the presence of companies with the right knowledge position is no guarantee of success. Which concrete development steps are needed to capitalise on these opportunities?

The strategic innovation agenda proposed by TNO and FME is based on three pillars:

Knowledge & Technology

The aim is to help Dutch industry to build and maintain a unique and internationally competitive knowledge position and to make this visible to (inter)national chain partners. In order to achieve this, it is important to set up a Dutch Production Pilot for Electrolysis aimed at facilitating knowledge and technology development within the chain of Dutch production companies. Carry this out in close collaboration with industry and knowledge institutions, linked by a collective roadmap.

Business & Chain Integration

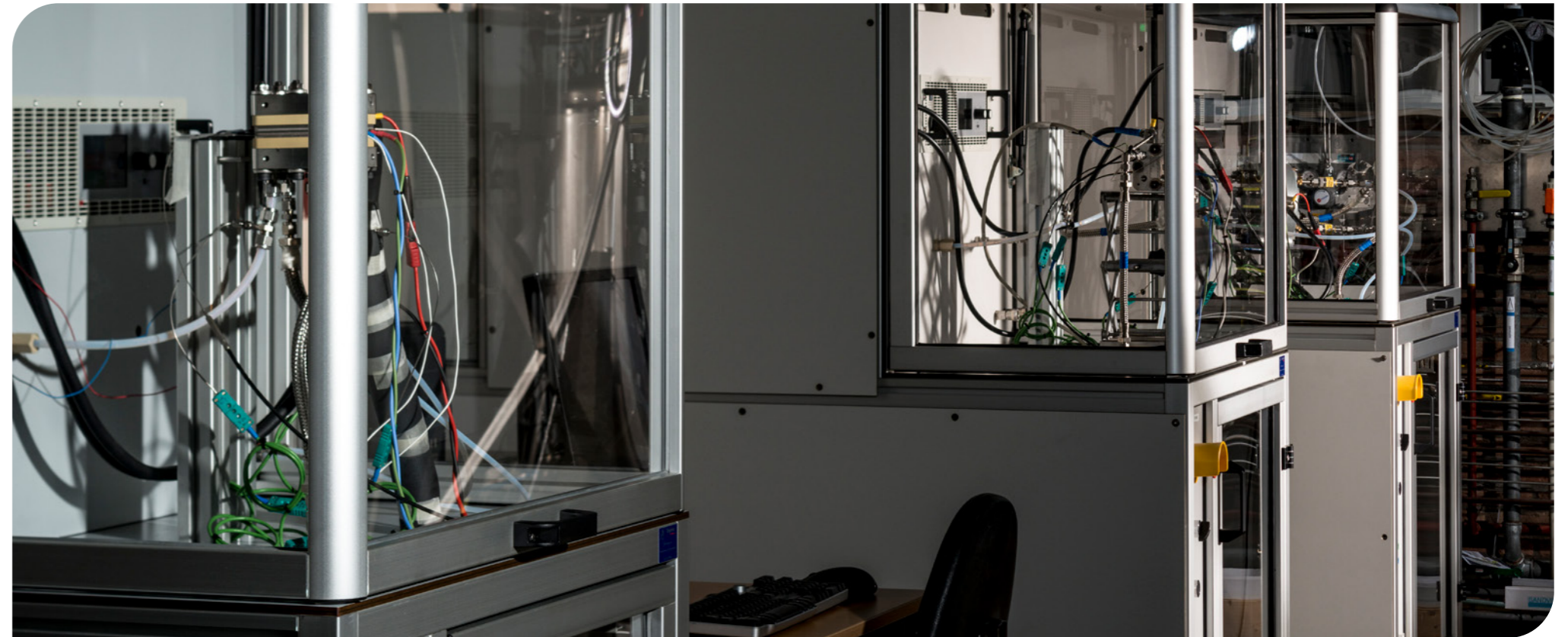
In order to convert the existing business potential into concrete economic and societal value, it is important for Dutch parties to collaborate more and to organise themselves. This can be done by facilitating supra-regional collaboration and knowledge exchanges between production companies via a Dutch manufacturing platform. Do this with a national focus but seek out collaboration and coordination with international networks.

Preconditions & Market Activation

In order to stimulate innovation in the manufacturing industry, a specific industrial policy is needed. An essential part of this policy is the creation of initial market demand. This can be done, for example, by consolidating the demand for electrolyser capacity which is currently spread across various regional projects. Do this in collaboration with potential system integrators and electrolyser customers. The regions would do well to coordinate their regional plans, resources and regulations in a national consultation body.



Recommendations



1

Accelerate innovation through demand consolidation and a production pilot

Dutch parties are ready to develop materials, components and systems. A quick learning curve is also a possibility. Develop a pilot in which companies can experiment with the production of (components for) electrolysers. Link this to a (consolidated) demand from launching customers but also to support for the testing and validation of Dutch products. One example would be through a 'voucher' scheme for the use of laboratories, field labs and other knowledge infrastructure. Speed is required in order to be ready in time for the upcoming (international) market demand.

Who?

Central government, provinces, knowledge institutions and sector organisations.

2

Establish a national 'Electrolyser Manufacturing Platform'

Develop and support an active community of manufacturing companies that (want to) focus on the production of electrolysers and/or the components needed for this. This is an important way of connecting companies to work together on the necessary preconditions for innovation and to increase the international visibility of Dutch companies. The platform can also play an important role in matching supply and demand.

Who?

TNO and FME in collaboration with existing networks, (potential) electrolyser customers and system integrators.

3

Give shared direction to innovation and standardisation

In order to build and maintain a unique and/or competitive knowledge position, it is important to draw up a chain-oriented innovation roadmap for all materials and components. This should be in coordination with HTSM sectors and European networks. The aim must initially be to accelerate innovation, but it is also important to already work together on standardisation. This will promote collaboration and chain integration and pave the way for series production.

Who?

Government, knowledge institutions, sector organisations and industry with coordination at a European level.

4

Streamline administrative processes

This requires, among other things, better structural coordination of initiatives, investments and strategy. Periodic, supra-regional policy consultations are needed, supported by experts with knowledge of technology and the current state of industry. In order to stimulate the demand for green hydrogen and electrolysers, it is also important to accelerate, clarify and simplify licensing procedures for hydrogen applications.

Who?

Provinces/regional development agencies and knowledge institutions (supra-regional consultation), central government, provinces and municipalities (licences).

5

Invest in international collaboration and a Dutch proposition

The Netherlands is too small to act alone or to focus on the internal market. The aim of a fully Dutch electrolyser is not an end in and of itself but should be an international springboard for companies. In all areas – but in knowledge development, standardisation and market stimulation in particular – it is important to develop a strong Dutch hydrogen proposition. This requires a willingness on the part of all those involved to look across borders: the real opportunities arise within the preconditions of an emerging European playing field.

Who?

All parties involved: companies, sector organisations and the (central) government.

Financing

In order to achieve the stated ambitions, an investment fund is needed to finance the unprofitable side of large-scale projects.

It is also important to create the necessary preconditions. These support both the Dutch climate ambitions and the national earning power. This is in view of the large international export potential of electrolysers but also because the Netherlands can become an international pilot for electrolysers by creating a sales market.



Colofon

This brochure is a summary of an extensive study by TNO and FME, commissioned by all of the provinces discussed and supported by the TNO SME programme/Branch Innovation Agenda and the FME Innovation Cluster.

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