



Smart Energy

The innovation agenda of East Netherlands



East Netherlands: the living lab for integrated energy systems for decentralised generation, storage, conversion and use of renewable energy.

Our motivation

The emission of greenhouse gases, such as CO2, must be drastically reduced. The energy transition leads to a new system. With it, we can generate the energy we need to live and work, without depleting the earth. Investing in knowledge and innovation is crucial for the maintenance and growth of broad-based prosperity of the energy transition.

The energy transition brings major challenges and also offers unique opportunities to the East Netherlands. Challenges are associated with making the scattered large industry more sustainable, which must make the built environment and mobility more sustainable. There and the emergence of is great pressure on the power grid. This is because the energy system must move from centralized to decentralized and integrated.

The East Netherlands is developing as the living lab for integrated energy systems for decentralised generation, storage, conversion and use of renewable energy. This is due to the strong high-tech manufacturing industry, engineering firms and knowledge institutions in the region, many of which are leaders at home and abroad in the field of energy storage technology, hydrogen technology and/or system integration. Its location - on the two major transport corridors, the North Sea-Baltic corridor and the Rhine-Alps corridor, and in the heart of the Dutch electricity and gas infrastructure - also makes the East Netherlands an excellent partner to help the Netherlands and Europe accelerate the energy transition. The focus is on the development and upscaling of integrated decentralised energy systems. Or Smart Energy

With an active and intricate network of knowledge and innovation clusters of companies, educational and research institutions, the East Netherlands is working on innovative solutions that are brought to the market faster. This strengthens the competitive position of the whole of the Netherlands, both for innovative companies and for companies that apply innovations in their business operations.

This Strategic Innovation Investment Agenda (SIIA) shows what the East Netherlands has to offer. The SIIA was created in close cooperation between the provinces of Gelderland and Overijssel, the development company Oost NL and the regional economic network, Th!nk East Netherlands and the Economic Boards.

We want to invest particularly in smart energy and are looking for partners to do so. In this document, we show where our focuses lie. Then, together with you, we will discuss which programmes contribute most to economic growth and a sustainable future.

Helga Witjes
Provincial Executive member for Economy

Erwin Hoogland
Commissioner for Energy, Environment and Labour
Market Province of Overijssel

Wendy de Jong
Managing Director of Oost NL

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The strength of East Netherlands

Eastern Netherlands is the living lab for decentralized energy systems. Developing, integrating, testing and applying energy systems is in the DNA of our region (RIS3, 2020). All components of the value chain for decentralized energy systems are present. We develop the key technologies that make this value chain possible here in the East Netherlands. East Netherlands has technology developers for energy storage in batteries, flywheels or electrochemical energy carriers, such as hydrogen, but also integration of systems serving charging infrastructure and heavy mobility are present. Necessary material knowledge, components, integration knowledge IT and Artificial Intelligence, testing facilities and certification knowledge are also present.



Provincial, national and European objectives

With the Smart Energy investment agenda, we contribute to the energy transition, one of the four themes in the national mission-oriented innovation policy. Within the investment agenda, we also give substance to the CO2 reduction targets in the Programme New Energy Overijssel, the Gelderland Energy Programme, the National Climate Agreement and from there the Climate Plan and the Paris Climate Agreement with the implementation agenda 'Fit for 55'. In all sectors, this places high demands on the innovative capacity of our economy and society.

In the energy field, we must make the transition to a sustainable electricity system and a built environment that uses less and less natural gas and generates more and more energy. We are also committed to a climate-neutral and competitive industry, agriculture and sustainable mobility, where we want to combine replacement investments in production with innovative integrated decentralised energy systems.

The European Commission has laid down its roadmap for making the economy more sustainable in the 'Fit for 55' Green Deal program and is developing an approach to remove bottlenecks to sustainable plans. For example, the European Commission is committed to adjusting laws and regulations and setting up new funds and schemes for further sustainability. In the East Netherlands, we are providing solutions for grid congestion and energy network balancing, with new business cases for energy solutions and scaling up energy technology innovations (energy storage technology, hydrogen, e-mobility and systems integration and IT/AI) for industry, built environment and mobility.

In East Netherlands, we offer solutions for netcongestion and balancing the energy network

SDG's

The developments as described in this investment agenda also contribute to the Social Development Goals, in particular to: education (SDG4), affordable and sustainable energy (SDG7), fair and sustainable economic growth (SDG8), industry, innovation and infrastructure (SDG9), sustainable cities (SDG11), responsible consumption and production (SDG12), climate (SDG13) and living on land (SDG15). From East Netherlands, we focus strongly on this social added value and we only invest in projects and programmes when they lead to (parts of) solutions.

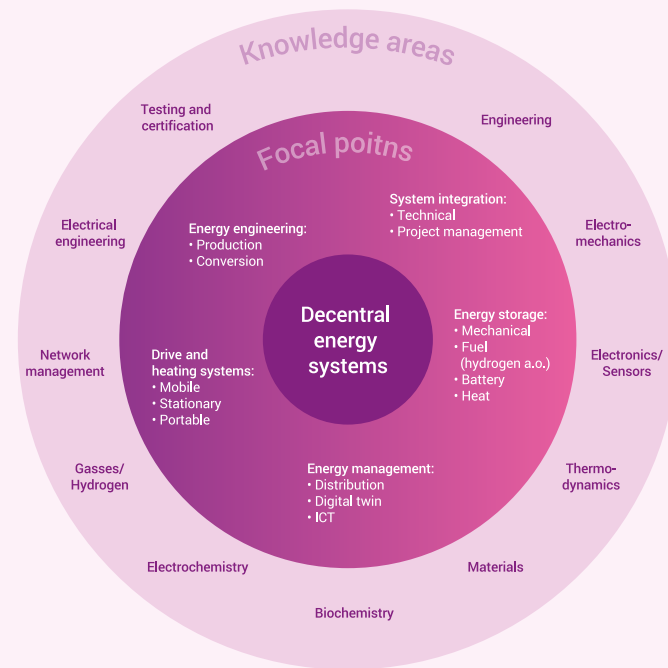


Our focal points

The East Netherlands is working on decentralised integrated energy solutions that fit in well with the environment. We use the region's strengths, namely its innovative capacity and strong knowledge areas (energy technology, production technology and environmental and agricultural technology). These knowledge areas form the basis of specific technological spearheads of companies and knowledge institutions in the region. Our five spearheads:

- System integration
- Energy storage
- Energy management
- Drive and heat systems
- Energy technology

We apply these spearheads in a number of large-scale projects/programmes.



The region has internationally recognised educational and knowledge institutions with a specific focus on energy issues, such as:

- University of Twente with the new Centre for Energy Innovation (CEI) focused on research into new storage, material and information technologies linked to societal challenges;
- Twente Centre for Advanced Battery Technology (TCABT) with the connection and collaboration with MEET Münster Electrochemical Energy Technology and the Fraunhofer Gesellschaft;
- The Sustainable Energy (Supply) lectorates of

- Saxion and Windesheim, which contribute to making the built environment and industry more sustainable;
- Hogeschool Arnhem Nijmegen and TU Delft. Together they have the Sustainable Energy Lectureship and much expertise in the field of energy technology and specifically hydrogen and propulsion systems (including SEECE);
- Wageningen University & Research (WUR), which contributes a great deal of knowledge in the field of bio-based economy and the University of Nijmegen with its knowledge of IT, artificial intelligence and business models.

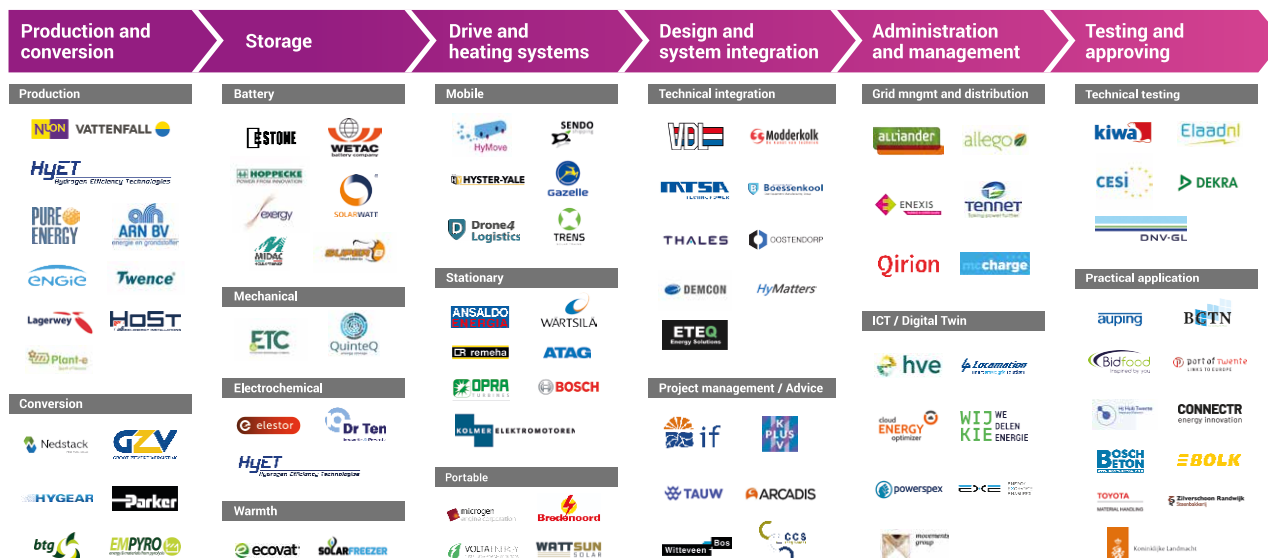
Smart Energy in focus

The East Netherlands is strong in developing innovative applications and products for the energy system. There are many innovative SMEs, which are the engine of innovative and sustainable growth.

What is unique is that the entire chain is present in the region: from suppliers of specific technologies, components and (sub)systems to system integrators, developers and users.

Companies, and educational and research institutions work together in clusters. These are clusters in the areas of testing and certification, energy storage technologies, mechanical engineering, electrochemistry, hydrogen technology, smart industry (mechatronics, sensor technology IC, artificial intelligence (AI), electric mobility, heat) and several larger energy network operators.

Parties are present for all essential parts of the chain for decentralised energy systems.



This is a selection of companies and does not claim to be exhaustive. Source: stratelligence and ekinetix, research on energy transition opportunities East - NLD

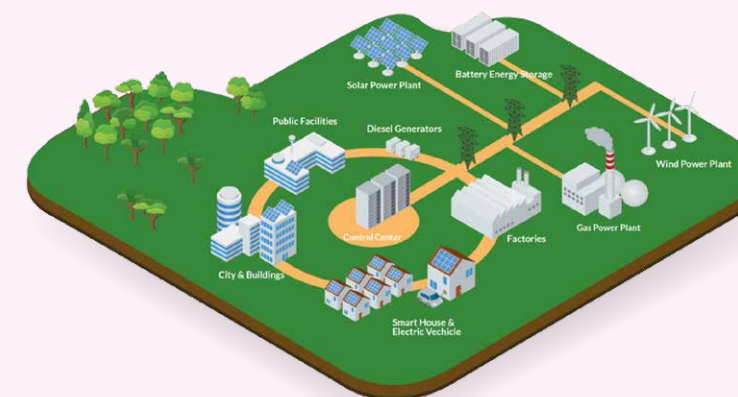
What can we do in the energy transition?

In the future, the energy system will be more sustainable, but also considerably more complex. Smaller and larger regional energy users - in industry, mobility and the built environment - will need new low- carbon technologies. The energy network is coming under increasing pressure from the growing use of electricity and from green gas from local sustainable sources. The variety of demanders and suppliers of this sustainable energy is also increasing. In order to better balance supply and demand, there is a strong need to organise the energy supply in a more decentralised way.

Substantial investments are needed to strengthen the grid or to make it more flexible and to balance the electricity network. Scalable and affordable solutions on a decentralised scale help to accelerate the energy transition. And that requires innovations. Innovations

by knowledge institutions, start-ups and scale-up technology companies, supplemented by industrial manufacturing companies that jointly innovate, test and demonstrate, thus solving problems such as grid congestion and grid balancing.

Eastern Netherlands has now designated ten decentralized energy systems we also call Smart Energy Hubs. Smart Energy Hubs are places where we use the generation of sustainable energy by sun, wind and/or biogas in a smart decentralized energy system and integrate it with emission-free applications for both industry, built environment and mobility. With an implementation force program, knowledge exchange and promotion, we ensure rapid implementation and a sharp learning curve.



East Netherlands Investment Agenda

To accelerate the energy transition, we are asking the national government and the European Union to invest with us in the following three themes:

- Developing open innovation programmes and shared facilities. Places where various parties work together on innovations, facilities to test and demonstrate these innovations on a small scale, and the development of knowledge and talent.
- Demonstrating system innovations around decentralised energy systems in a real-life setting of Smart Energy Hubs
- Supporting companies to scale up promising energy technologies

Based on the current inventory, there is an investment demand of approximately €300 million. In addition, we are asking the national government to join us in considering the scope and possibilities for experimenting at the decentralised energy system level.

Development and testing in Innovation programmes and open test facilities

The energy transition calls for different knowledge and skills, because the energy system of the future will work with new combinations of disciplines and worlds. Think of the combination of chemistry and electrical engineering in fuel cells and electrolysis. Working with flammable gases and electricity makes demands on the testing and approval of new products. Knowledge of ICT and AI is needed for smart charging of batteries and the return of electricity. Or for installing integrated systems in homes, industries or converting vehicles.

The knowledge and research institutions and companies in the East Netherlands have a position in various relevant technology areas. On this we are now developing a number of innovation programs under Connectr and in a national and international context. In these programs, universities, colleges, companies and governments work together for rapid business growth. Each program involves an interplay of technology development, collaboration, training and knowledge sharing, valorization and internationalization. The programs we currently distinguish are Charging Infrastructure, Battery Technology, Hydrogen Technology and Smart Energy Hubs.

Testing and certification

An important and unique knowledge position in East Netherlands is in the field of testing and certification. Since testing and certification have a long history with companies like KIWA, DEKRA and KEMA|CESI, we see various open test facilities in the region. Examples of these test facilities are: the KEMA lab, Elaad's Open Charge lab, HAN's Hydrogen lab, most likely Het, the Twente Safety Campus for puff tests for battery safety, among others, VDL Energy systems' test centre at New Energy Garden for pressure and rotation tests, the Twente Centre for Advanced Battery Technology (TCABT) and the connection to MEET/FFB in Munster. Further development and growth of the number of test facilities is necessary to bring innovations of knowledge institutions and companies faster to the market.

We strive for a well-coordinated total offer, so that entrepreneurs with test or demonstration needs can find a suitable place in East Netherlands or just across the border in Germany.

We invest in organisational capacity, unprofitable top and applied research grants and facilities for collaborating companies.

Connectr Energy Innovation

The East Netherlands has a strong energy cluster. By ensuring the dynamism and growth of this cluster, Connectr contributes to the energy transition, the regional economy and the human capital agenda. Connectr's strength lies at the implementation level: new ideas are immediately tested and put into practice, and can grow from there.

Connectr consists of an innovation program, an innovation lab and shared facilities such as the office and the energy Demo field. The Connectr innovation program focuses on three program lines: charging infrastructure, energy storage and integrated energy systems. Amid these strands, the core organization provides connection, reinforcement and acceleration.

Leading by example in Smart Energy Hubs

The East Netherlands is and will remain the demonstrator of new technology through the development of Smart Energy Hubs. These hubs are in line with the regional task concerning sustainability and solve bottlenecks such as (the threat of) grid congestion. At the same time, they are demonstrations of new innovations (such as new generation batteries, heat pumps, hydrogen-fuelled central heating systems, electrolyser components, sensors, AI and new generation charging stations) that address the challenge and/or bottlenecks. They are an example of the East Netherlands' approach to integrated decentralised energy

For each Smart Energy Hub we foresee investments in organisational capacity, infrastructure (cables, pipes, equipment), IT/AI around energy systems, energy storage such as batteries and hydrogen of at least €20 million.

Energy hub

Energy Hub Hessenpoort in Zwolle has the potential to generate 200 megawatts of sustainable electricity, while the companies together consume a maximum of 7 megawatts per day. Supplying electricity back to the grid is impossible due to a lack of capacity. That is why Hessenpoort is working with businesses,

government bodies and knowledge institutes to create a sustainable decentralised energy system in which grid congestion will be resolved through innovations in energy storage, smart balancing and hydrogen.

Industry

The carpet industry in Genemuiden wants to become more sustainable. The industry consumes a lot of natural gas and the ambition is to get rid of it in the long run. Together, the entrepreneurs have drawn up a roadmap towards energy neutrality. It makes clear that the greatest gains can be achieved through innovations in the production processes.

The eastern Netherlands is and will continue to be the demonstrator for new technology through the development of Smart Energy Hubs

This also applies to other energy-intensive process industries in East Netherlands: the ceramic industry along the Waal, the paper industry in the Veluwe and the plastics industry in Hardenberg. The energy-intensive process industry is spread throughout East Netherlands, which makes decentralised solutions necessary. In the provinces of Gelderland and Overijssel, the companies in the industry, together with government authorities and knowledge institutes, are developing a programme to realise further sustainability through innovations. This programme is aimed at saving energy and reducing CO2 emissions so that this industry can continue to operate in East Netherlands.

'Wet' logistics

The cooperating ports Port of Zwolle ports are investing in shore-based and support facilities for hydrogen-powered inland navigation. A large-scale Smart Energy Hub will provide the necessary demonstration facilities. These possible changes in waterborne goods transport are also at play in Gelderland and are part of the Long-Term Inland Shipping Investment Programme.

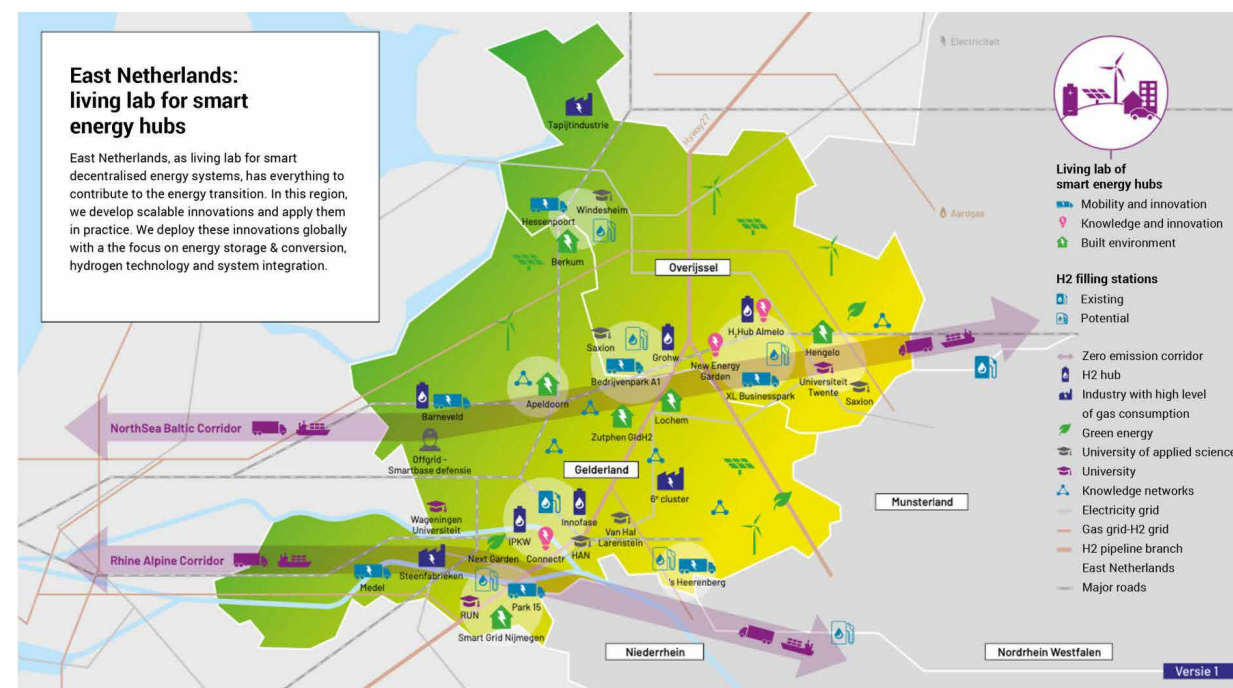
Scaling up

In some key technologies, the East Netherlands has an excellent position in knowledge and skills. There is a high concentration of companies specialised in the development and production of materials and components needed for energy carriers. But also in the field of stack and system integration, electrolysis and energy storage, various Eastern Dutch companies are active ("Electrolysis: Opportunities for the Dutch Manufacturing Industry" and "Hydrogen: Opportunities for Dutch Industry"). This strong base must be able to be utilised and needs launching customership from the government and larger industrial site managers.

In order to make a substantial contribution to an affordable energy transition and sustainable economic growth, an increase of scale from proven technology to affordable products will be needed in the coming years. We foresee investments in the production of electrolysers, stacks (fuel cell technology), industrialisation of the construction of energy-neutral houses and a production facility for hydrogen-electric power trains for heavy vehicles (such as trucks, construction equipment and inland navigation) and charging infrastructure (charging stations, charging plazas, charging infrastructure for construction sites, etc.).

Technology company HyGear

Arnhem-based HyGear is an example of a technology company that has grown into an internationally operating business through continuous innovation and production technology with conventional gas distribution methods, enabling it to guarantee a cost-effective and reliable gas supply. HyGear has also developed technology to reuse the residual gases from the process. HyGear's products are now sold internationally. With support from the region, the government and the European Union, HyGear has grown from a start-up into a global player..



Renewable energy and CO₂ reduction

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Knowledge of ICT is needed to smart battery charging and feed electricity back



Human Capital

he labour market and education are important factors in the transition to a sustainable economy. Together with the companies involved, Eastern Dutch educational institutions want to retrain and upskill the required future personnel. The goal of the provinces of Gelderland and Overijssel is to have sufficient skilled workers in the longer term in a flexible labour market. To achieve the climate goals, many tens of thousands of extra workers are needed. The energy transition offers professionals at intermediate vocational, higher vocational and university level plenty of job opportunities.

The labour potential and the knowledge infrastructure of the region fit in well with the required practical implementation of the transition. Compared to other regions, the region has a relatively large number of technical staff, many of whom are qualified for intermediate and higher vocational education. In East Netherlands, we pay a lot of attention to the professional field. They do this by shaping research programmes between companies and knowledge institutions from secondary vocational education to university education, such as ROCs, Saxion, HAN, University of Twente and TU Delft. But they are also betting on learning and developing existing workforce in demonstration environments with tomorrow's techniques and

technologies with master classes and training courses, among other things.

Together, the ROC van Twente, Saxion Hogeschool, HAN and the three universities in our region are training the professionals who are shaping the energy transition. Students from the MBO, HBO and WO work together on solutions for the energy transition through challenge-based learning, learning from each other and developing develop broad, application-oriented knowledge. Existing professionals are also participating in this, including through the Lifelong Development programs. The focus on international talent must also be broadened.

If you would like to contribute, please contact info@thinkeast.nl

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