



EIRES

EINDHOVEN INSTITUTE
FOR RENEWABLE
ENERGY SYSTEMS

TU/e

DRIVING THE ENERGY REVOLUTION

Role of R&D for the manufacturing (industry) of electrolyzer systems

Richard van de Sanden, Mark Boneschanscher

NL-IL Mini-Symposium on Desalination and Clean Hydrogen Production

June 17th 2021

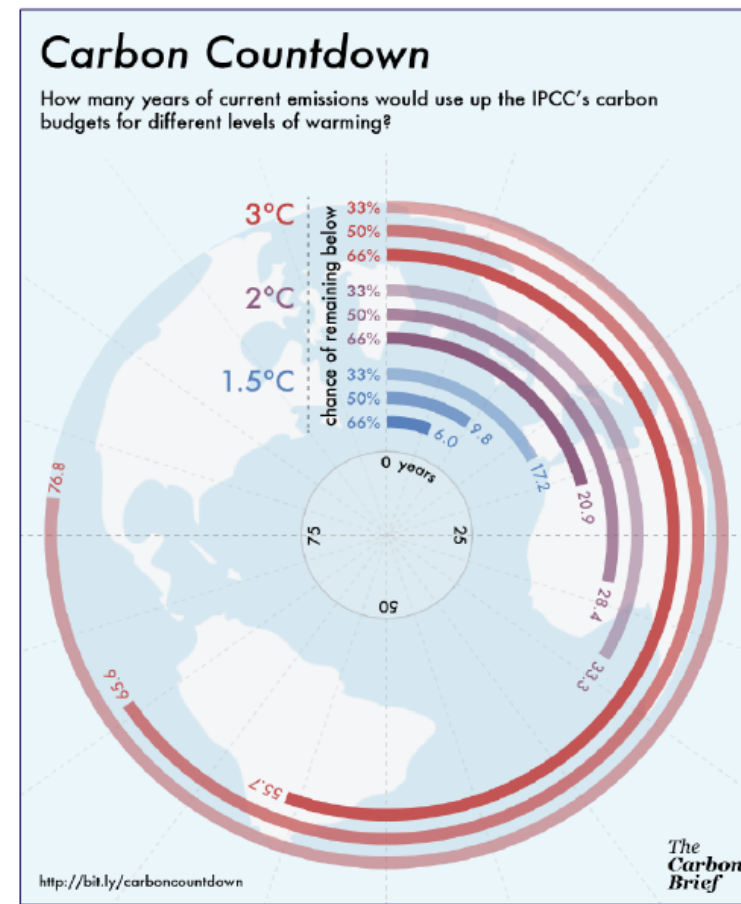
more info: www.tue.nl/eires | eires@tue.nl

The energy transition requires a giant acceleration

Next 20-30 years:

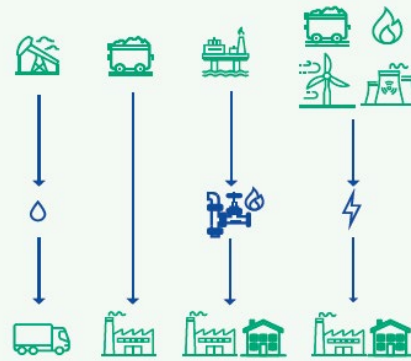
fundamental shift in the way energy is generated, stored, delivered, valued and purchased

Drivers: International agreement (UNFCCC), EU directive (RED), National Policy (Energieagenda)

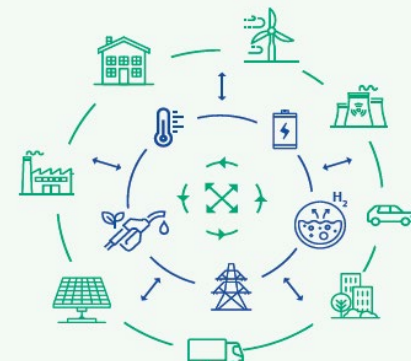


Renewables bring new challenges

The energy system today : linear and wasteful flows of energy, in one direction only

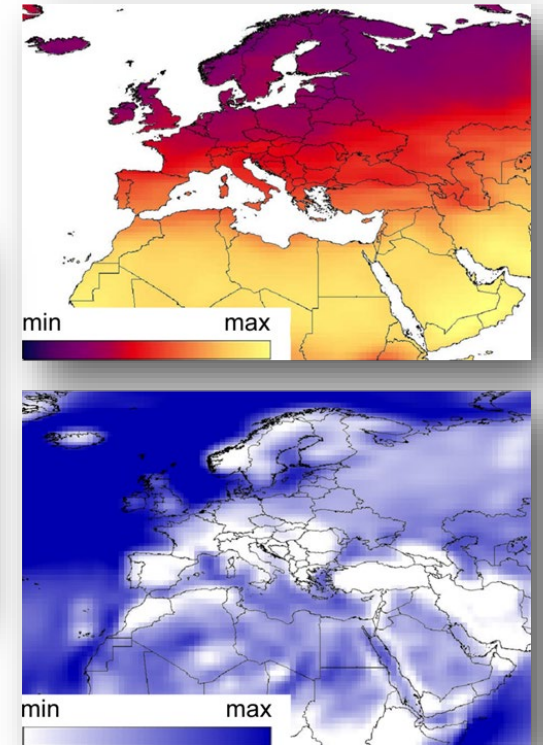
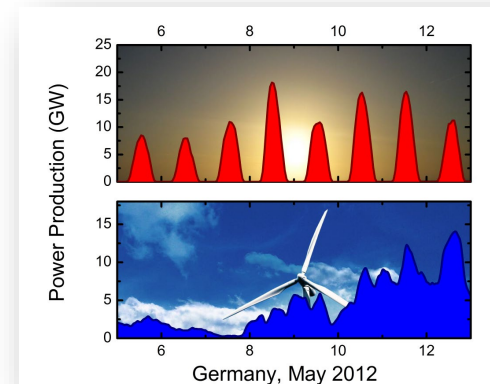


Future EU integrated energy system : energy flows between users and producers, reducing wasted resources and money



An Integrated EU Energy System will have **three main characteristics**:

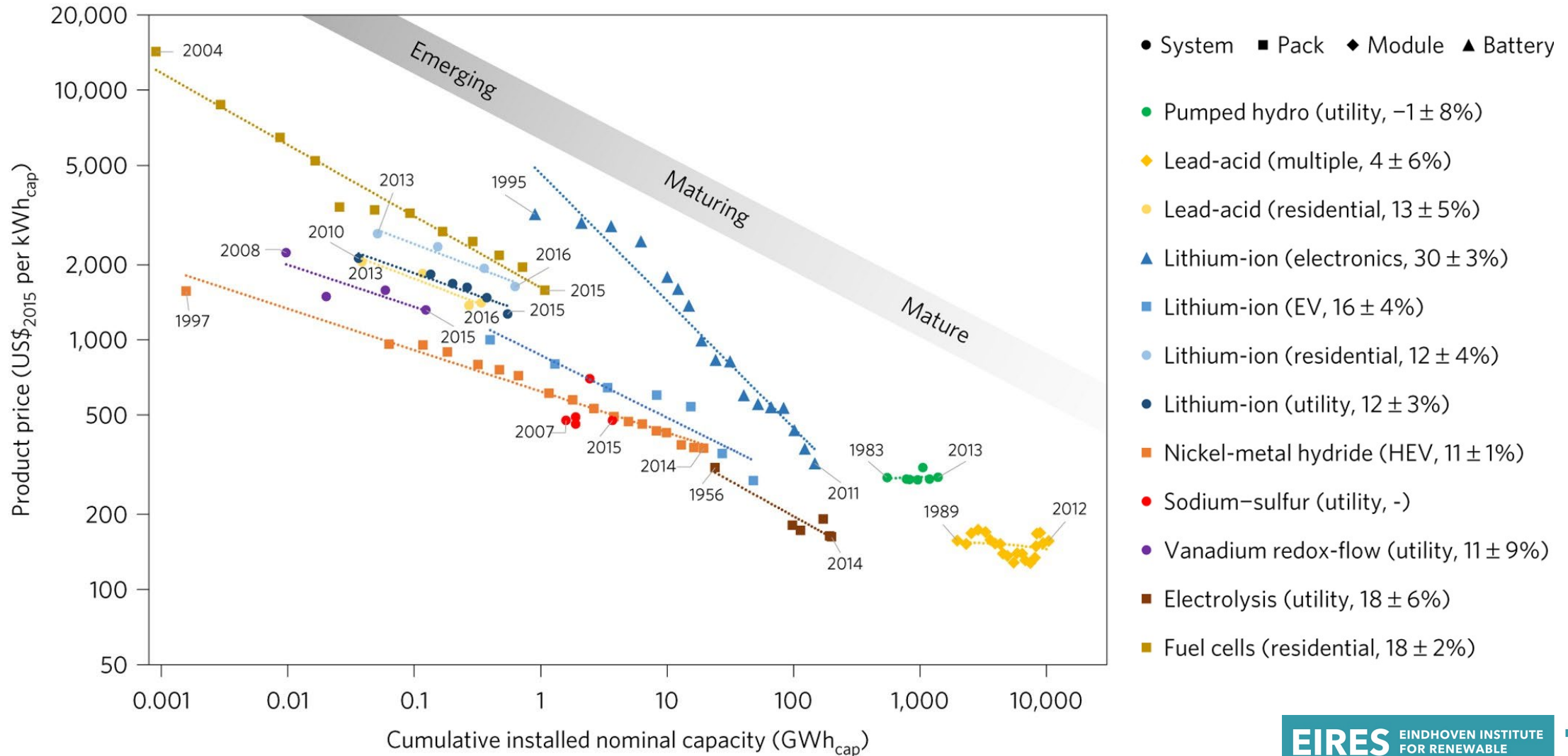
- A more **efficient and “circular” system**, where waste energy is captured and re-used
- A **cleaner power system**, with more direct electrification of end-use sectors such as industry, heating of buildings and transport.
- A **cleaner fuel system**, for hard-to-electrify sectors like heavy industry or transport



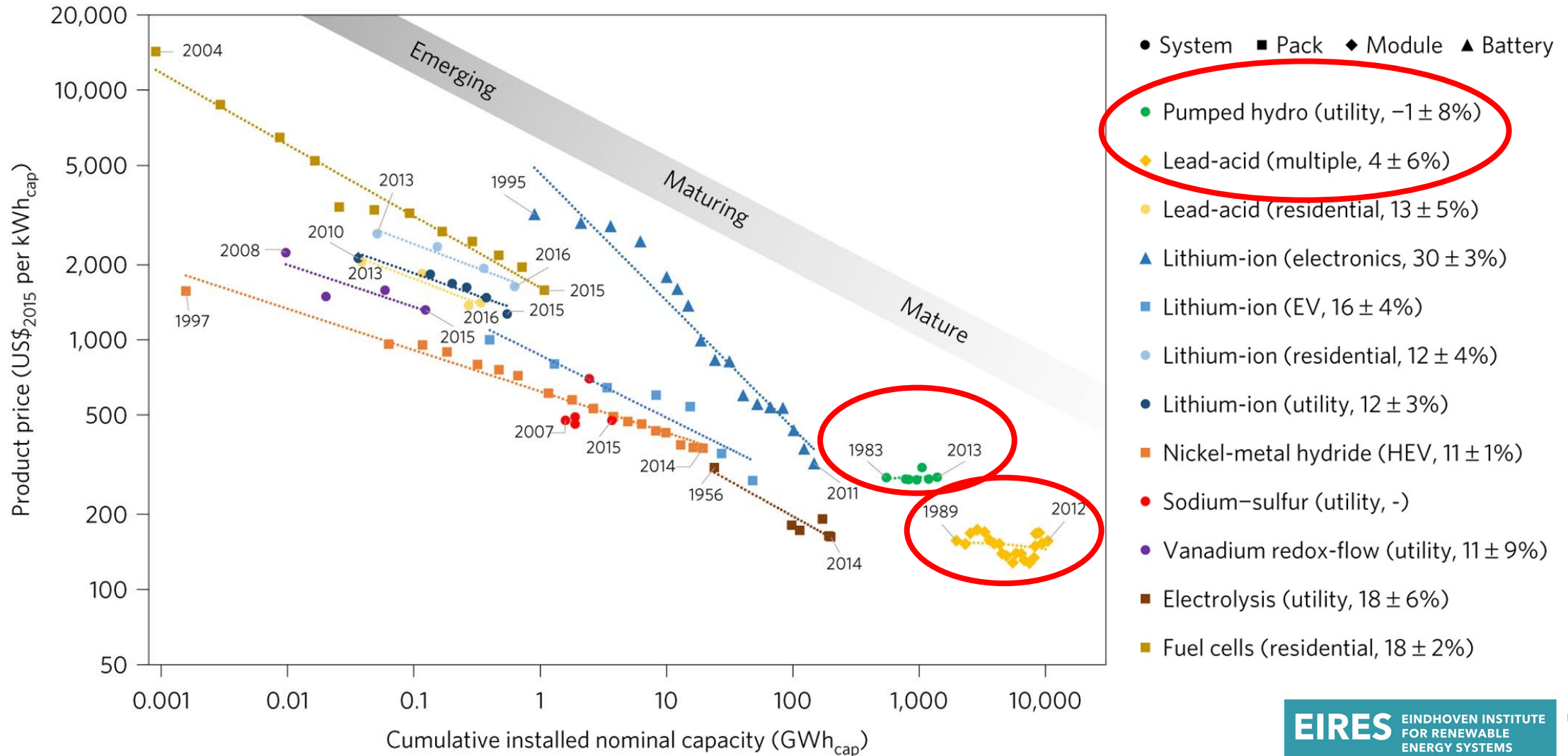
Supply and demand: a mismatch in time and place

→ **Transport, conversion and storage of renewable energy is key!**

How to accelerate? Learning curves of technologies



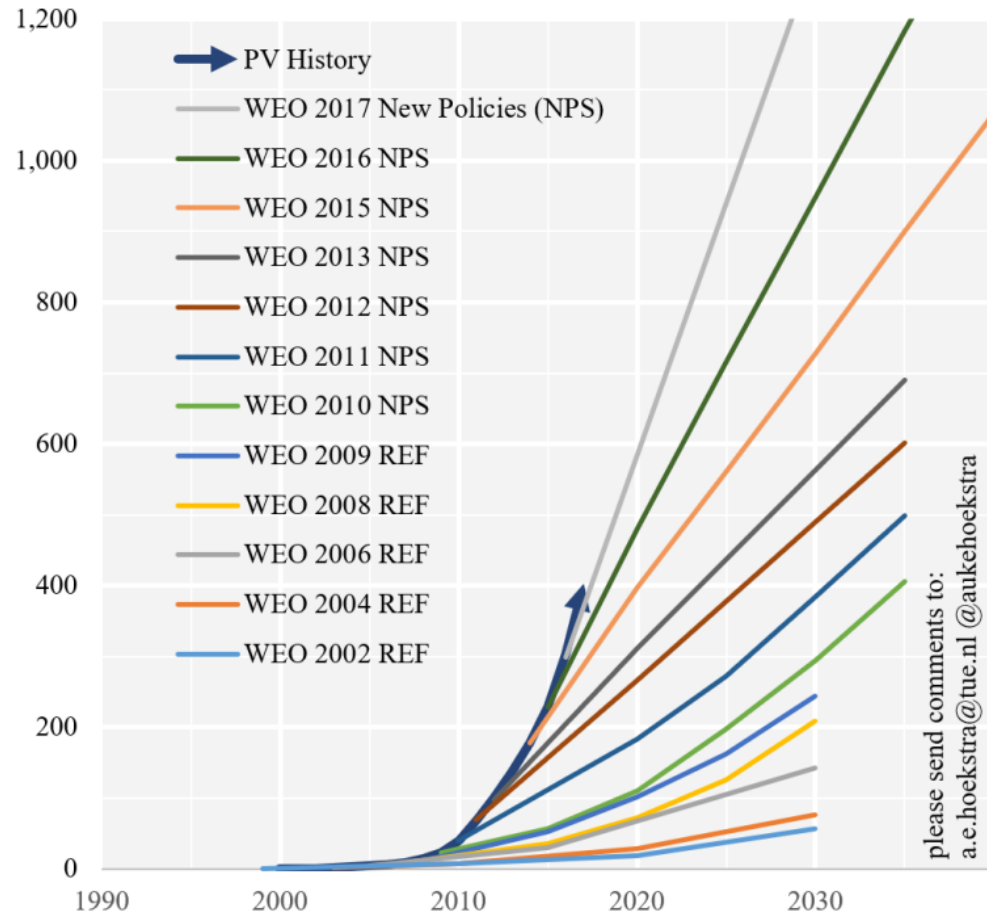
How to accelerate? Learning curves of technologies



How to accelerate?

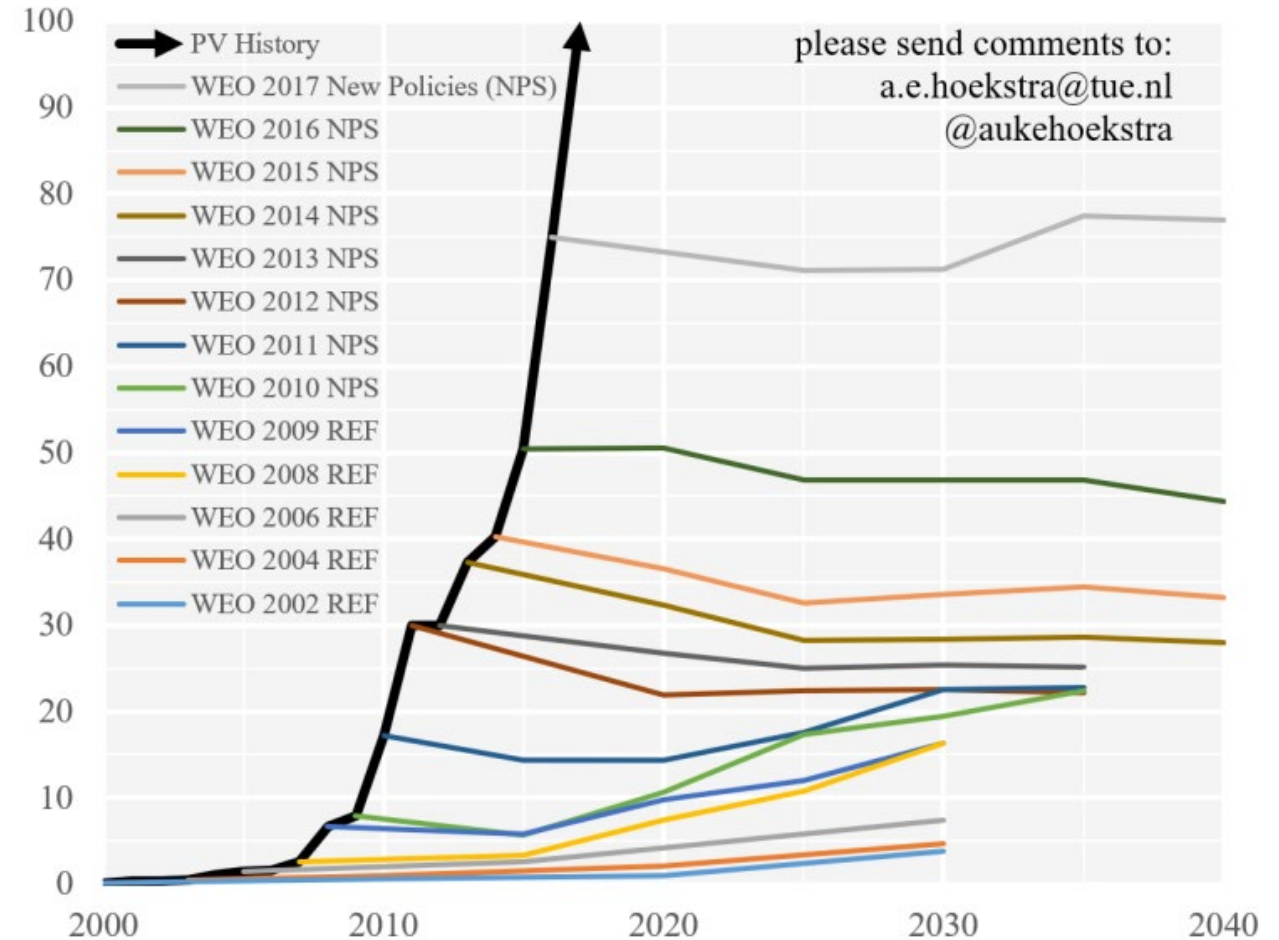
Cummulative PV capacity: historic data vs IEA WEO predictions

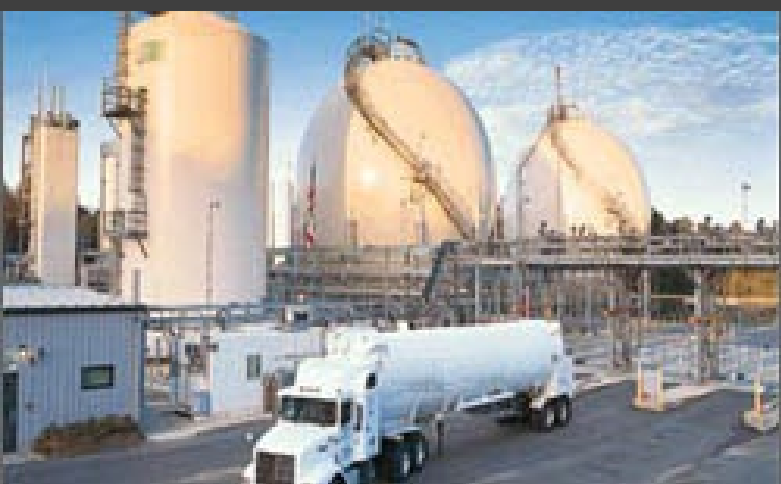
In GW of total installed capacity - source International Energy Agency - World Energy Outlook



Annual PV additions: historic data vs IEA WEO predictions

In GW of added capacity per year - source International Energy Agency - World Energy Outlook





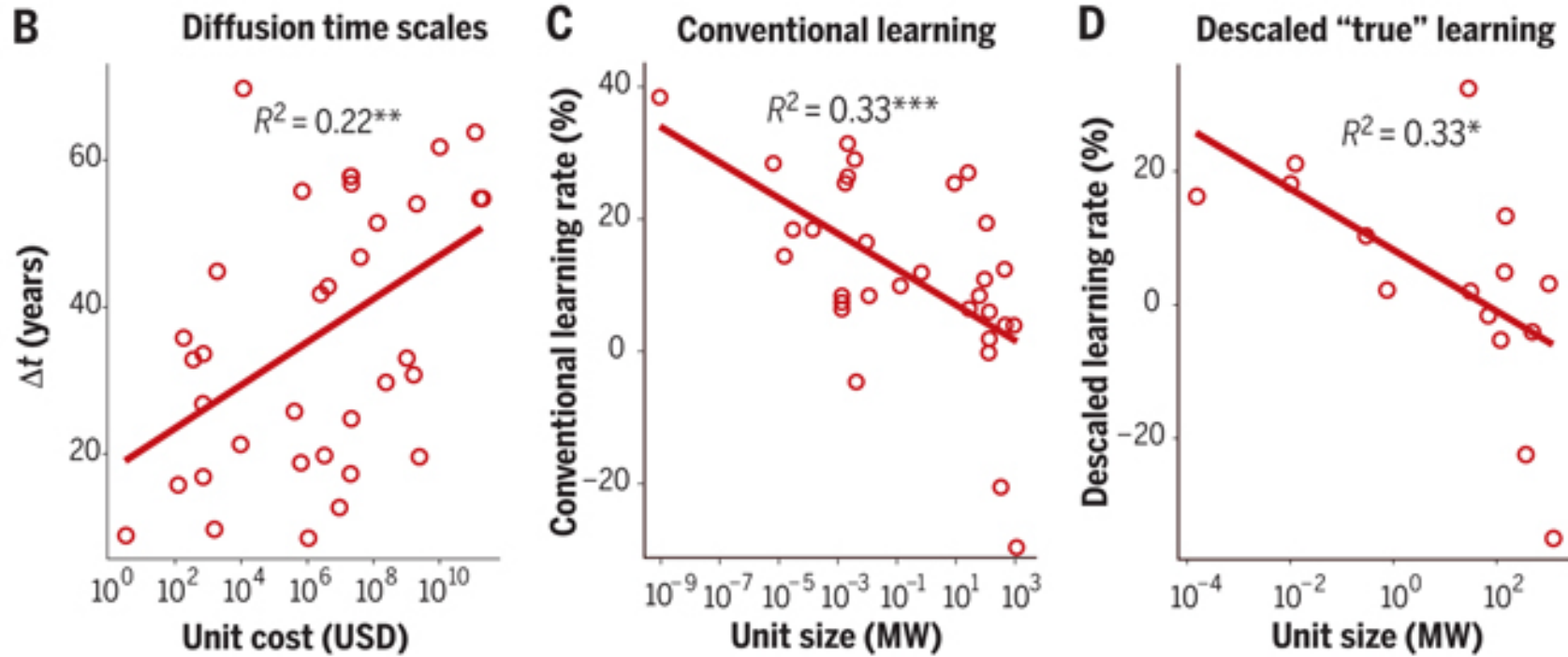
EIRES vision

The role of granularity

C Wilson *et al.*, Science **368**, 6486 (2020)

images taken from Wikipedia

The role of granularity



Eindhoven institute for Renewable Energy Systems (EIRES)

- Opening 31 August 2020 by state secretary Van Veldhoven
- Bringing together TU/e research aimed at systems for renewable energy conversion and storage
- Development of icon systems together with the high-tech manufacturing industry
- Four programmatic lines of research
 - ❑ System for sustainable heat
 - ❑ Chemistry for Sustainable Energy Systems
 - ❑ Engineering for Sustainable Energy Systems
 - ❑ Systems Integration

But also: Solar Cells, Plasma's for sustainability,



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The Netherlands: What business to make from or for H₂?

1. Transfer & Distribution

Gas node infrastructure for North-West Europe, extending/replacing natural gas

2. Chemical conversion

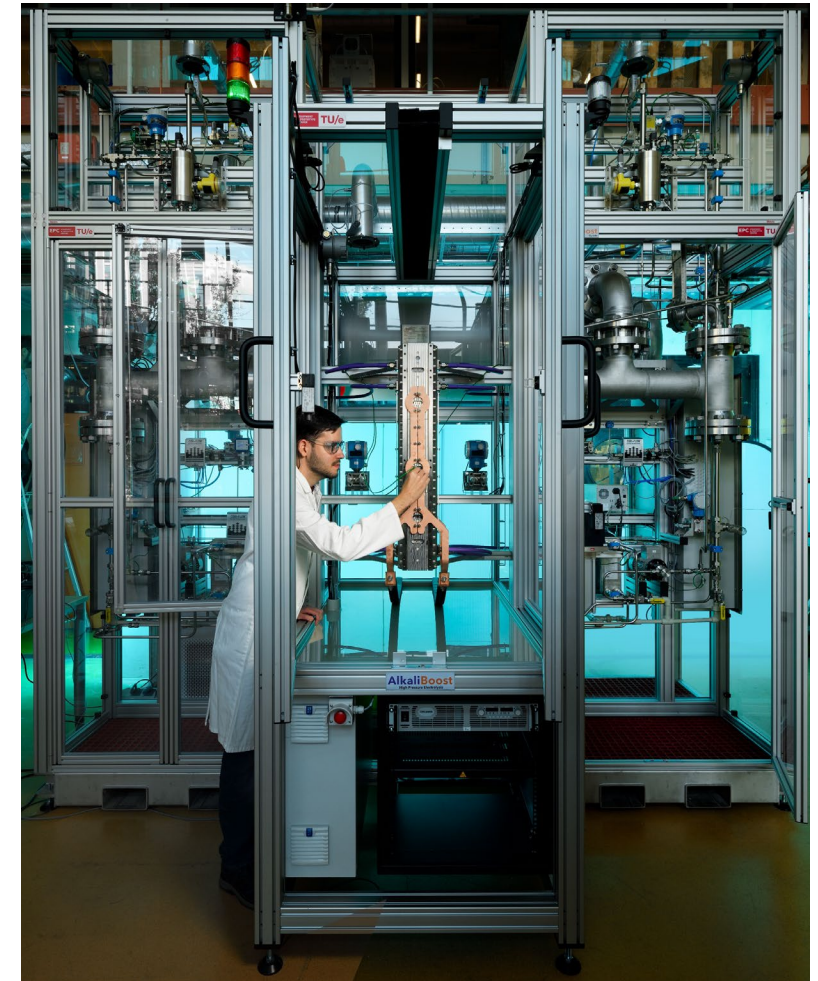
Large clusters of advanced (petro)chemical industries in Bottlek and Chemelot area

*2017: Trilateral strategy for chemical industry in
NL – BE – GER area: 180 B€ turnover, 350 000 jobs*

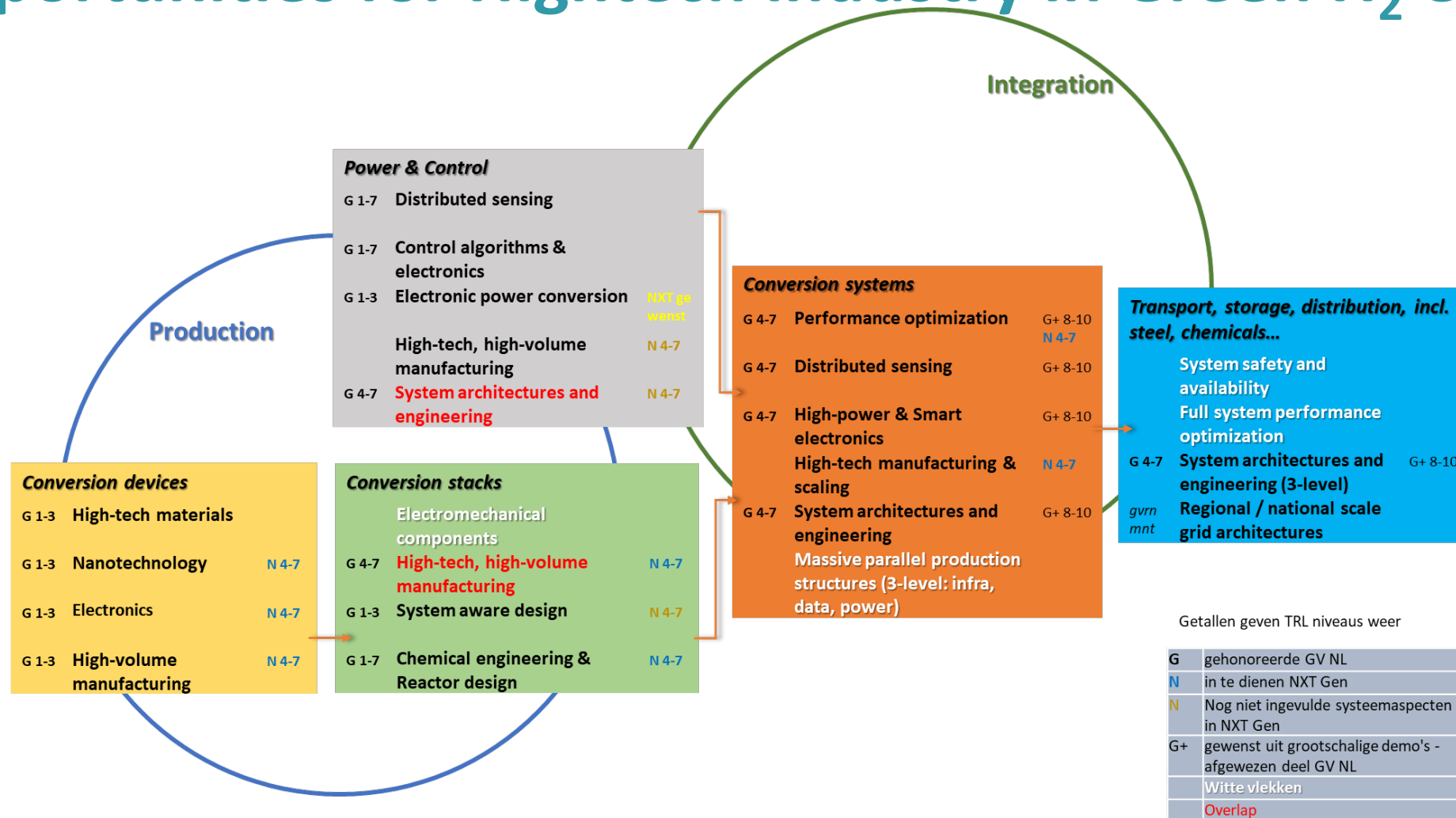
3. High-tech manufacturing industries

Brainport region and Oost.nl as provider of high-tech components, equipment and systems

4. The Dutch Electrolyzer: VDL, DIFFER and EIRES team up

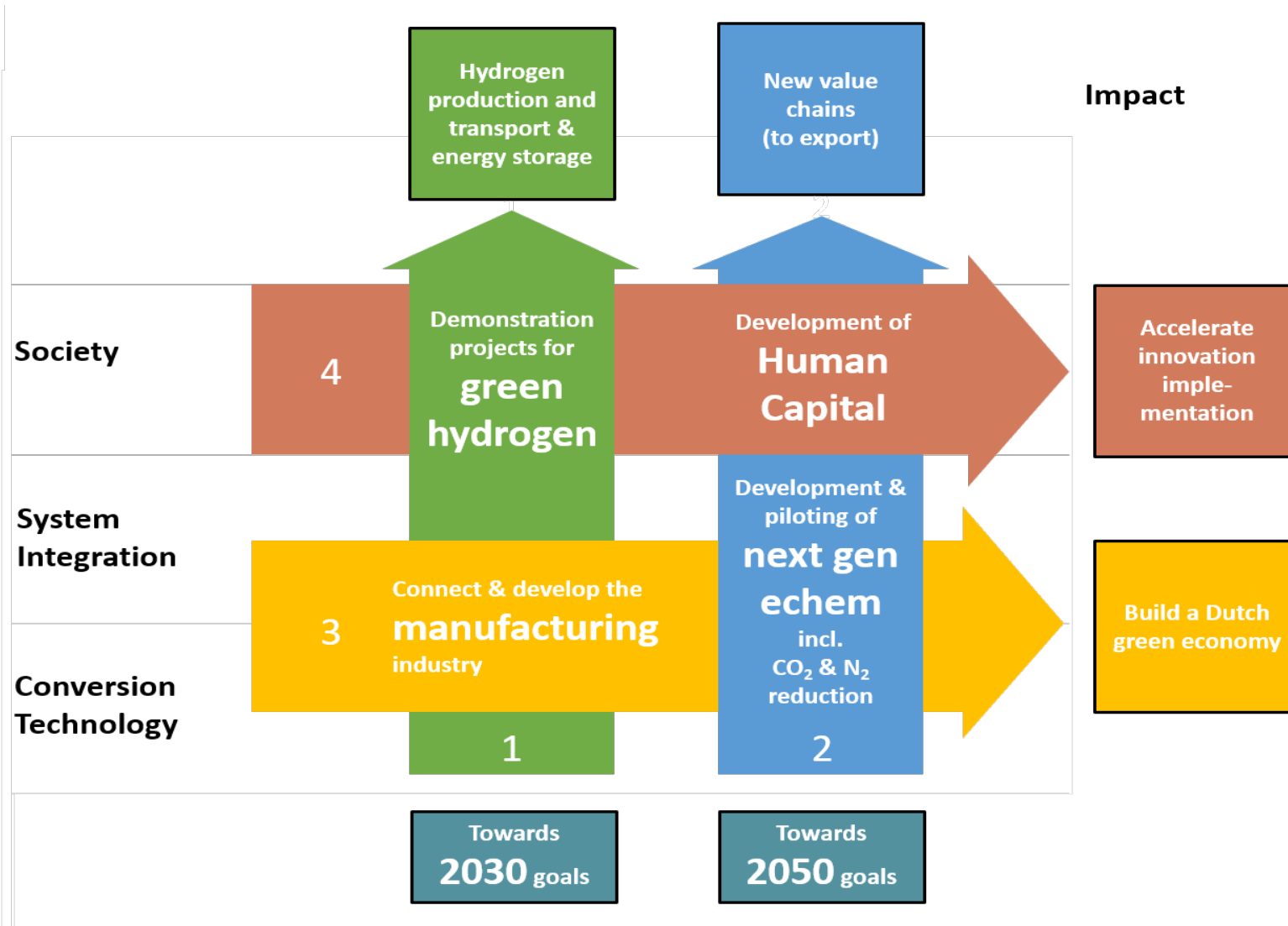


Opportunities for Hightech industry in Green H₂ & Chemistry



Outcome of working group ECCM “Identifying chances HighTech Systems and Materials sector”

Lining up with Advisory report ECCM



Advise of committee Electrochemical Conversion & Materials (ECCM):

1. Develop H₂ technology and indirect H₂ based chemistry
2. Start with R&D for technology on direct electrochemical conversion
3. Built the high tech manufacturing industry for electrochemical conversion technology
4. Educate and train the future human capital needed for the green economy

Growth fund proposal Groenvermogen

Groenvermogen van de Nederlandse economie



Nederland staat met de rest van de wereld voor een immense klimaatopgave. Onze florierende, op fossiele grondstoffen gebaseerde maatschappij en industrie moeten worden omgebouwd. Dit doet Nederland met groene waterstof als trekkkracht voor die transitie. Ook kan Nederland een nieuwe industrie en een aantrekkelijk vestigingsklimaat opbouwen. Goed opgeleide mensen zijn nodig om de klimaattransitie mogelijk te maken.

Dat is wat GroenvermogenNL doet:
opschalen & innoveren, ombouwen & opbouwen, omscholen & opleiden.

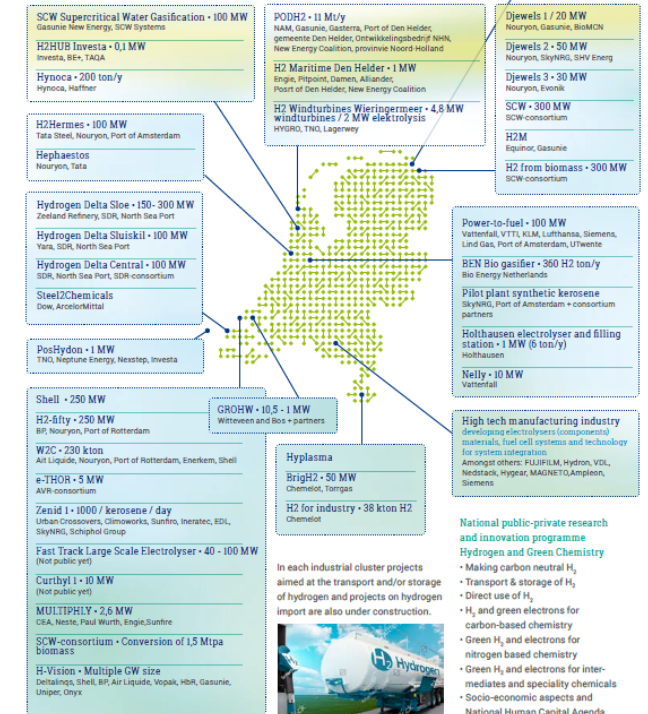


National ecosystem

of hydrogen pilots, demonstration plants and knowledge infrastructure

Overview of investment projects for the 'Green Empowerment of the Dutch Economy' Growth Fund proposal (in Dutch: Groenvermogen van de Nederlandse Economie). It is an indicative list of projects.

Pilot project locations:



Eco systems approach

Essential to *keep* jobs, but moreover to *create* jobs in building up a high-tech manufacturing industry for green high-tech technology



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Questions or comments?

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