STORAGE RESEARCH INFRASTRUCTURE ECO-SYSTEM

RI Information sheet 2022

TNO, Energy Storage Platform Netherlands

Technology(ies) of Energy Storage (thermal, chemical, thermochemical, cross-cutting, electrochemical)

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Project Acronym	StoRIES
Call	H2020-LC-GD-2020
Grant Agreement No.	101036910
Project Start Date	01-11-2021
Project End Date	31-10-2025
Duration	48 months

1. Photo

Take the virtual tour: Rijswijk Centre for Sustainable Geo Energy

https://my.matterport.com/show/?m=fHGFY7PsZ91&f=0&ts=0

(examples, we have photos and virtual tour options for almost all facilities)

This project has received funding from the European Union's Horizon 2020
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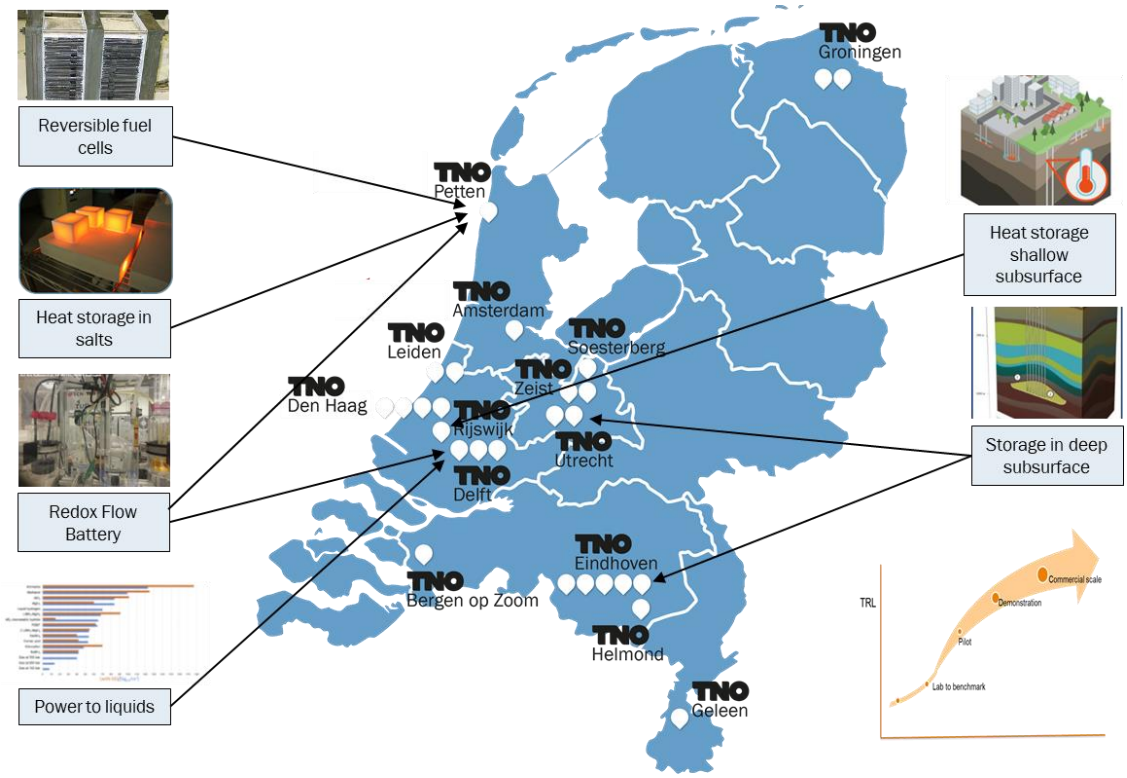

2. Geographical coordinates (˚, ", … N/S, E/W)

Petten, Netherlands, 52.78500416875027, 4.674690543733483

Utrecht, Netherlands, 52.08860119714208, 5.166014055336071

Rijswijk, Netherlands, 52.035713729860724, 4.3298930728511715

Delft, Netherlands, 51.99848991743896, 4.372951043683004

Eindhoven, Netherlands, 51.41302725568168, 5.453284204562015

3. Description of the research infrastructure for the webpage

The TNO Energy Storage Platform is situated in the Netherlands and comprises several connected research facilities with complementary infrastructure on:

- Energy storage in salt caverns and depleted gas fields
  - Hydrogen and (synthetic) gas storage
  - Reversible solid oxide cell technology for electricity storage
  - Redox flow electrolytes (can also be applied in surface facilities)
  - Compressed air energy storage (CAES)
- Thermal energy storage (surface and subsurface)
  - High Temperature (>25C - 95C) heat storage in subsurface aquifers
  - High temperature (>100) heat storage in molten salts
  - Thermo chemical heat battery at residential scale (<90C)
- Power to liquids and storage

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- Development of direct production of NH4
- Jet Fuels

The following infrastructure hosts the connected Energy Storage Platform equipment and field labs

- Rijswijk Centre for Sustainable Geo Energy: state of the art facilities available for full-scale testing and experimentation with new drilling techniques and materials under high pressure and temperature for subsurface applications like storage technologies. Facilities for open innovation research include various equipment, including a 385m deep cased experimental well, flow loops, testing units for drilling under in-situ conditions and pressure benches that can be applied for storage studies. Also, a test facility for controlled experiments for High Temperature (>25C - 95C) heat storage in subsurface aquifers: expected operational end 2022 comprises an unique aquifer heat storage test well with advanced measurement (fibre optics). This is supported by research facilities (lab scale) in Utrecht and Eindhoven to study geochemical reactions of stored substances with rocks and fluids in the subsurface, and geomechanical effects of cyclic pressure and temperature variations, and their potential impact on the long-term integrity of rocks, well materials and interfaces, and technical performance of the storage.
  Unique: state of the art equipment for subsurface storage technologies. For hydrogen and heat no such combination of research facilities exist in Europe with these multidisciplinary options for research: From lab to field lab scale.
- Reversible solid oxide cell technology as part of the Faraday lab in Petten. The Faraday lab is an open innovation lab that focuses on optimising existing electrolysis technologies such as PEM, alkaline, SOEC and AEM. Component and technology suppliers can develop and test new electrolyzer materials, components and applications in collaboration with TNO for the aforementioned electrolyzer technologies from single cell to stack level. In the field of energy storage and conversion emphasis is on the development of reversible solid oxide cell technology capable of energy efficient operation in the high temperature reversible electrolysis and fuel cell mode. TNO is working with national and international partners in both high and low temperature electrolyzer related projects with the ultimate overall goal to accelerate the time-to-market of the technologies.
- Carnot Lab for heat pump technology and Carnot batteries facilities in Petten hosts lab scale equipment for high temperature (>100) heat storage in molten salts. Delft and Eindhoven locations have state of the art expertise on heat storage and operate field labs with thermo-chemical heat battery at residential scale (<90C).The Delft lab also hosts synthetic fuels at lab scale equipment and lab scale equipment for redox flow electrolytes development and testing. The synthetic fuels laboratory aims at the development of (reactor) technologies to produce hydrocarbons and ammonia. The facilities comprise of two skids containing membrane reactors and slurry reactors for hydrocarbon production and one skid containing a Haber-Bosch type of reactor to produce ammonia

4. Availability of the research infrastructure

2022, some specific equipment may have limited availability over the next 2 years. Contact us for more information.

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5. Special considerations (confidentiality / NDA agreements, insurance requirement, special training, HSE training)

- Depending on the facility the final modality and costs of access will be determined.
- Scientific: excellent support with recognised researchers.
- Technical: every facility will have its own technical support that will support the visiting researcher
- Logistics: TNO has location managers that facilitate logistical support for visiting researchers, including support for housing, on-boarding and IT services.
- Note that every location may have additional training requirements. Contact us for more information.

6. Energy storage technology that can be analysed/studied by using the research infrastructure

- Electrochemical ☒
- Chemical ☒
- Thermal ☒
- Mechanical ☐
- Superconducting Magnetic ☐
- Cross-cutting ☒ (Specifically: power to x, power to heat, power to hydrogen)

7. Key words for the webpage

thermal, chemical, thermochemical, cross-cutting, electrochemical, hydrogen, liquids, lab-to-field

8. TRL level (if applicable):

- 1-3 ☒
- 4-6 ☒
- Above ☐

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