

# EleCtrically Heated nOvel rEactor Development : ECHOED

## Publieke samenvatting / Public summary

### Aanleiding

Today the chemical industry is struggling to become climate neutral and circular. According to the Dutch climate agreement (MMIP6), the industrial sector must be climate neutral and at least 80% circular by 2050. As energy and raw materials are intertwined in the process industry, process electrification and reverse water-gas shift (RWGS) technology implementation are poised as attractive solutions for such challenges. Endothermic reactions i.e. RWGS are largely representative of the processes in the chemical industry which is one of the largest CO<sub>2</sub> emitters in Dutch industrial landscape. RWGS is a promising technology to convert CO<sub>2</sub> and green H<sub>2</sub> into synthetic liquid fuels and industrial feedstock, promoting circularity and a business case for captured carbon and optimal use of green H<sub>2</sub>. RWGS reactor offers a predominant route for CO<sub>2</sub> conversion into synthesis gas for synthetic liquid fuels and industrial feedstock. Electrification of RWGS contributes to the circular CO<sub>2</sub> ambitions laid down in MMIP6. Furthermore, the proposed project fits perfectly in MMIP 8 – Maximum electrification and radically new processes.

### Doelstelling

The objective of the ECHOED project is to showcase direct electrification and carbon circularity of chemical processes together with flexibility of operation and prepare for a first commercial demonstration in a follow-up project led by industry partners. ECHOED will pilot an electrically heated RWGS reactor on lab scale based on the learnings

#### Projectinformatie / Project information

**Projectnummer / Project number**  
MOOI324034

**Subsidiebedrag / Grant amount**  
€ 3.897.108,00

#### Algemene informatie / General information

**Penvoerder / Secretariat**  
Nederlandse Organisatie voor  
Toegepast-Natuurwetenschappelijk  
Onderzoek TNO

#### Publicaties en materialen / Publications and attachments

- 01.04.2026

**MOOI324034**  
**Voortgangsrapportage 1**

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from the technology developments of its predecessor projects (THOR, SFINCS and SUBLIME) funded under TSE O&O schemes. The ECHOED project will bring two developments together, electrification of high temperature processes and RWGS reactor development, via multidisciplinary stakeholders approach i.e. bring knowledge from various partners.

### **Korte omschrijving**

- Design evaluation and modelling of electrically heated reactors based on radiative, resistive, inductive and molten salt heating
- Electrically heated e-RWGS pilot development and testing
- Radiative high-voltage driven heater design, development and testing, for heating and/or endothermic reacting of high pressure fluids in temperature range 200 to 800 °C in a hot-box-like (furnace) arrangement
- Resistive electric heater design, development and testing, for heating and/or endothermic reacting of low pressure fluids in temperature range 200 to 800 °C, possibly as integrated heating option on the reactor wall
- Inductive heater design, development and testing, for heating and/or endothermic reacting of low pressure fluids in temperature range 200 to 1000 °C
- Molten salt indirect heating & heat transfer fluid development in temperature range 200 to 800 °C
- TEA, LCA and market analysis
- Electrical system integration with e-heating technologies and flexibilization
- Full scale design and development roadmap
- Dissemination and societal studies

### **Resultaat**

The ECHOED project will develop a cost and energy efficient electrified RWGS reactor to produce synthesis gas. The electric heating technologies will be designed and tested for large delivery temperature range 200 to 1000 °C. The reduction of operating temperatures of RWGS reaction will also be investigated. The results can be widely deployed for electrification of hard to abate sectors like (petro-)chemical, metal and minerals, refineries etc. ECHOED will develop electrical infrastructure requirements and grid congestion reduction mechanisms which are crucial for electrification of

energy intensive processes. ECHOED will develop first-of-a-kind demonstrator electrified RWGS reactor. The dedicated techno-economic assessment (TEA) will quantify the capital investments of the scaled electrified RWGS reactor for different design choices. Various chemical companies in the VNCI network will be the first adopters of the results developed and tested in the project. The environmental benefits of such an electrified reactor will be demonstrated through societal innovation studies, detailed impact, safety and application studies, and sustainability assessments including carbon footprint.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

Voor meer informatie over de Topsector Energie, ga naar [www.topsectorenergie.nl](http://www.topsectorenergie.nl).

Voor meer informatie over de TSE / Energie-Innovatie regelingen die RVO aanbiedt, ga naar [www.rvo.nl/tse](http://www.rvo.nl/tse).