
Gasification Centre of Excellence
Pitch Deck
Start presentation
TNO innovation for life


nerkem

Outline

- Background and Vision for this CoE
- What does it comprises
- What is in it for you
- Some examples (upstream / downstream)
  - Synova gas prediction
  - RWE RDF
  - Federated learning
- What is next

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Background

- Gasification based processes are **complex** to operate, much like a refinery complex
- Gasification processes struggle with deployment, mainly because it is costly to go through the learning curve.
- Gasification knowledge in the Netherlands is high, but there is no proper training/education at MBO to University level.

- Still the need for green molecules is high and the technology is the way to make that happen.

Ministerie van Economische Zaken en Klimaat

De Nationale Technologiestrategie

Bouwstenen voor strategisch technologiebeleid

van bio residuen is er nog een groot innovatie potentieel zoals bijvoorbeeld vergassings- en pyrolysetechnologie. Deze technieken kunnen worden ingezet voor lokale industriële verwerking van biogrondstoffen en als technologie exportproduct.

Ministerie van Klimaat en Groene Groei

Ontwerp-Meerjarenprogramma Klimaatfonds 2026

- Dit gaat in eerste instantie om technieken voor hoogwaardige hernieuwbare energiedragers die pas kosteneffectieve CO_2-reductie kunnen faciliteren bij substantiële opschaling. Gestart wordt daarbij met innovatieve en kansrijke technieken op de terreinen elektrolyse, vergassing en pyrolyse wat bijdraagt aan de beschikbaarheid van 3 tot 4 GW waterstof in 2030 en de opschaling van groen gas.

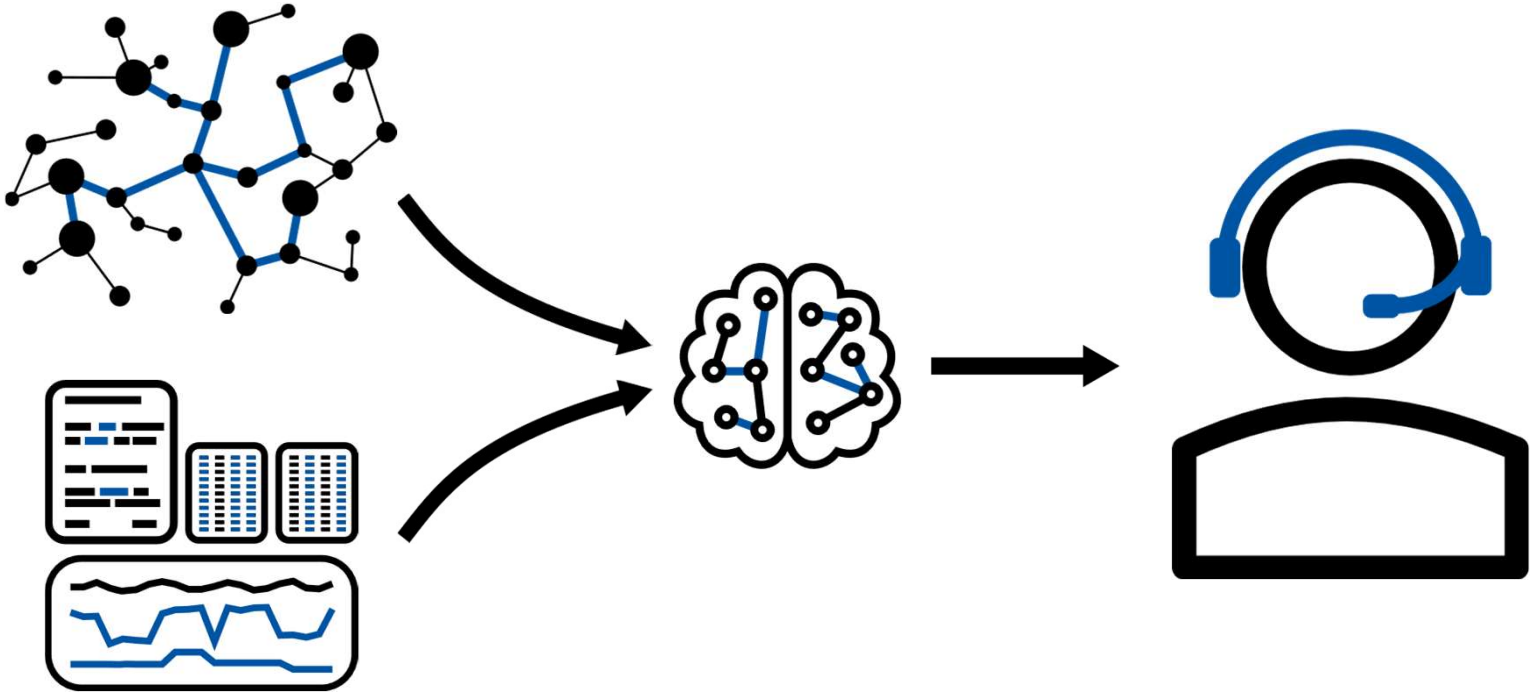
Rijksoverheid

Visie op duurzame koolstof in de chemische industrie

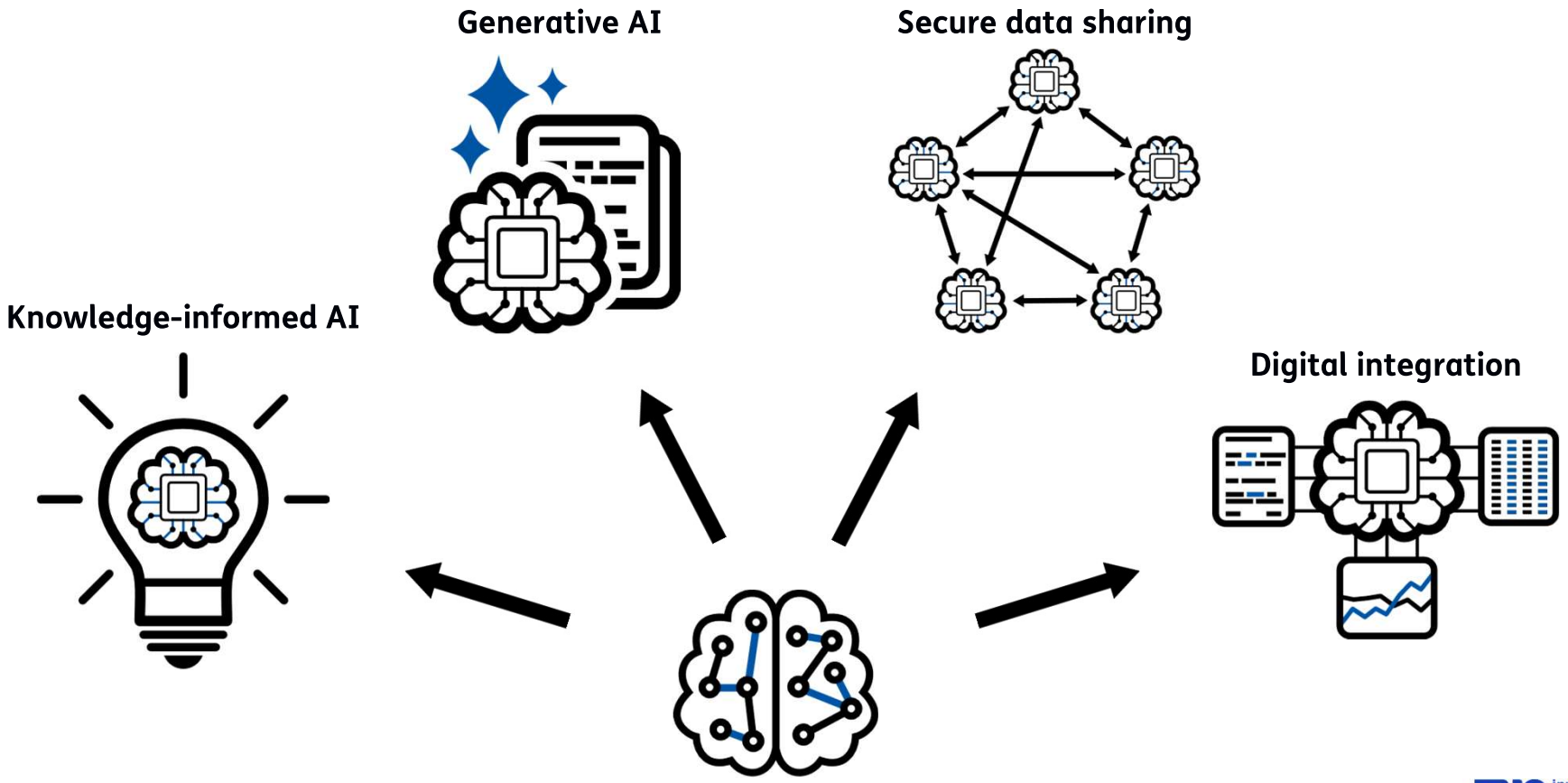
- Het *opbouwen* van **nieuwe chemie** en **alternatieve routes** voor de productie van duurzame chemicaliën en kunststoffen. Nieuwe chemie kan chemicaliën en kunststoffen produceren met potentiële voordelen in termen van koolstofopbrengst, benodigde energie voor de omzetting en functionaliteit. Vergassing is breed inzetbaar, zowel qua grondstoffen als in de verwerking naar bestaande tussenproducten[23]. Het biedt daarmee een robuuste **alternatieve route** voor het gebruik van duurzame koolstof in de chemie. In 2025 wordt een toekomstvisie op de chemiesector ontwikkeld waar in de groeimarkt voor toekomstige groene en geavanceerde chemie verder wordt uitgewerkt.

Our philosophy

Combining domain knowledge with digital technologies to provide decision support to operators



Our main (technological) focus areas as TNO



Application of AI & Digitalization

Design
- Workflow automation
- New material or workflow design
- Optimizing energy system design
- Sensor layout design

Operation
- Optimization and process control
- Flexibility of processes under renewable power and uncertainties
- Automating anomaly detection
- Smart decision support systems

Maintenance
- Predictive maintenance of facilities
- Root cause failure analysis
- Spares and maintenance analysis

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Proposition for a Gasification Centre of Excellence

Goal: To support deployment of gasification technologies in the Netherlands and abroad.

How? By combining knowledge and digitization in different fields.

- Build Digital Twins of existing gasification line ups to connect AI with real time data
- Build a learning environment based on the DT for operator training (MBO/HBO)
- Use AI for identification of fail components in gasification line-ups
- Use physics informed ML to optimize process conditions and improve the Business Case
- Develop an exchange mechanism between different platform, to reduce risks in the sector.

Build digital twins on existing plants

ESKA Groningen

1. Support the operation of the plant running on paper rejects
2. Prevent failures and/or unnecessary shuts downs
3. Setup a maintenance plan using the DT
4. Use it for training operators online and allowing training sessions with the real plant

BEN Amsterdam

1. Support the operation
2. Support their development
3. Use it for training operators online and allowing training sessions with the real plant

TNO Petten

1. Improve the quality of R&D
2. Speed up data processing and identification of trends
3. Provide a derisking platform for larger scale implementation
4. Reduce the operation needed

Key activities to be developed in the CoE

1. Application of AI and digitization on the design, operation and maintenance of gasification plants (ESKA, BEN, TNO)
2. Develop training tools in an online environment using the DT to:

- Train new operators (make it part of an MBO/HBO curriculum)
- Develop emergency scenarios, running extreme cases and training operators how to deal with it.
- Develop a physics informed tool in collaboration with Universities to use it in ongoing research
- Develop a learning platform to exchange knowledge also with external stakeholders, which are part of the supply chain

3. Expand the DT approach to projects under development (RWE, Perpetual Next, Torrgas, Synova, Gidara, etc.)

- Build DT for back end solutions (CO_2 removal, MeOH synthesis, SAF synthesis or CH4 synthesis) and train the DT with steady state gas, from time to time creating known disturbances (impurities, different ratios, pressure chances, flow changes etc.)
- Emulating line-ups that show the dynamics of various gasifier types (RWE, Torrgas, Gidara, Synova etc)

4. Expand the Centre of Excellence to European developments. Bringing together knowledge and expertise of key stake holders in the field.

The four pillars to be worked out in detail

Digital Twinning

- Develop DT for existing gasification plants
- Predictive maintenance
- Combine more intel in plant operation
- Improve process control

Learning community

- Develop online training simulators for operators
- Connect to educational system, for curriculum development
- Work on including AI, ML and LLM into DT on the operation side

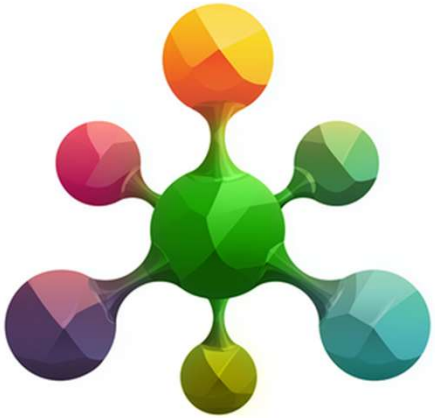
Process emulation

- Start building a library of emulated process (cleaning, catalysis etc)
- Mix real time gasification data with emulated back-ends
- Develop engineering tools from the emulated process pathways.

Expanding community

- Start involving outside NL developments in the CoE in order to maximize impact

Call to Action - Program definition will take place in 2026 → Get in touch



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Thanks for your attention!