

# Synthetic Methane for Power Storage

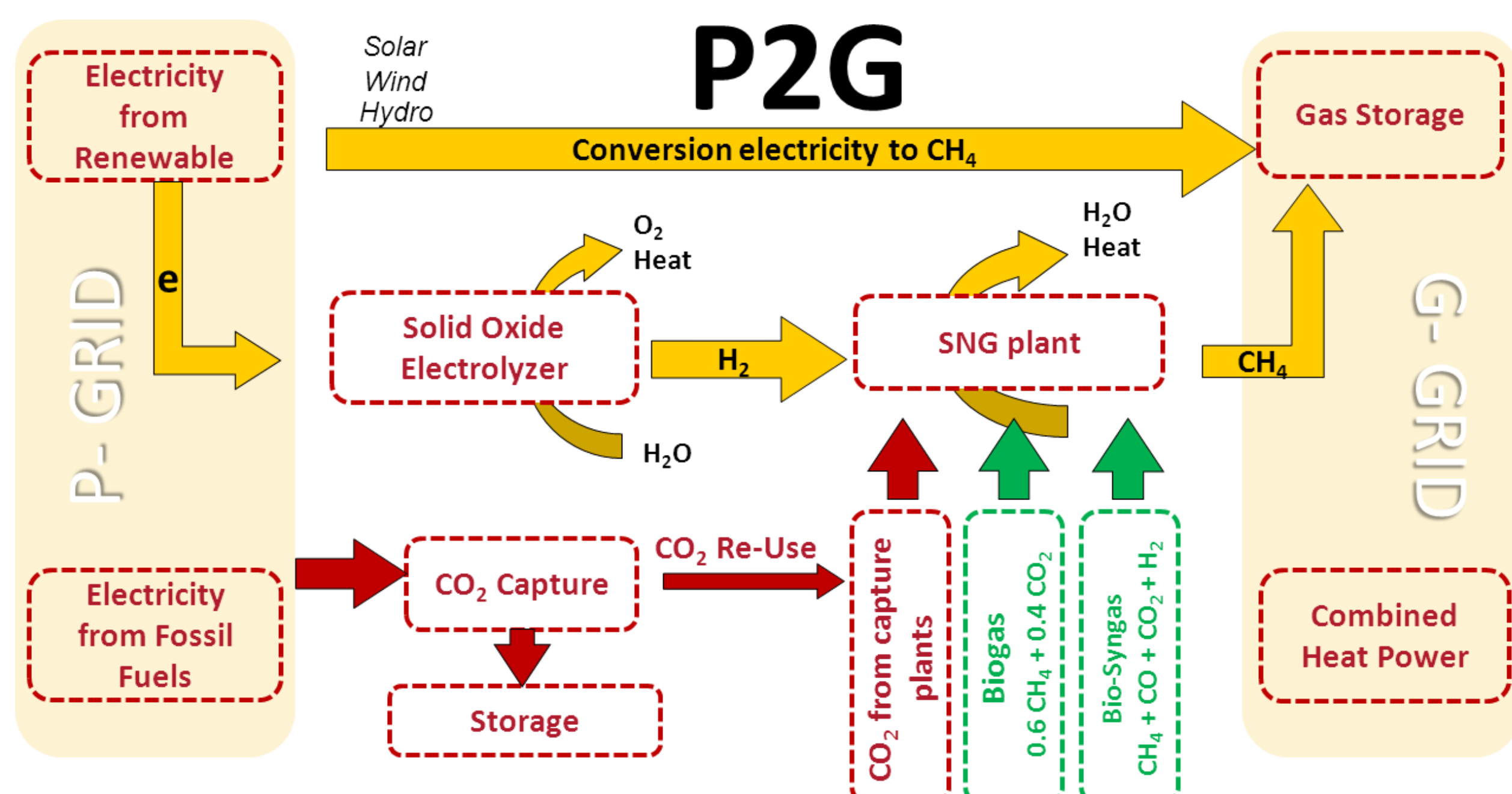
## Authors

G.Botta, M. Barankin, S. Walspurger  
Corresponding author: walspurger@ecn.nl

With increased share of energy generated from variable renewable sources, storage becomes a critical issue to ensure constantly balanced supply/demand. Methane is a promising vector for energy storage and transport.

## High efficiency Conversion Chain

- Connect power grid with gas grid
- Hydrogen production from power surplus by high temperature electrolysis
- CO<sub>2</sub> methanation
- High thermal efficiency / System Integration



## Matching variable supply

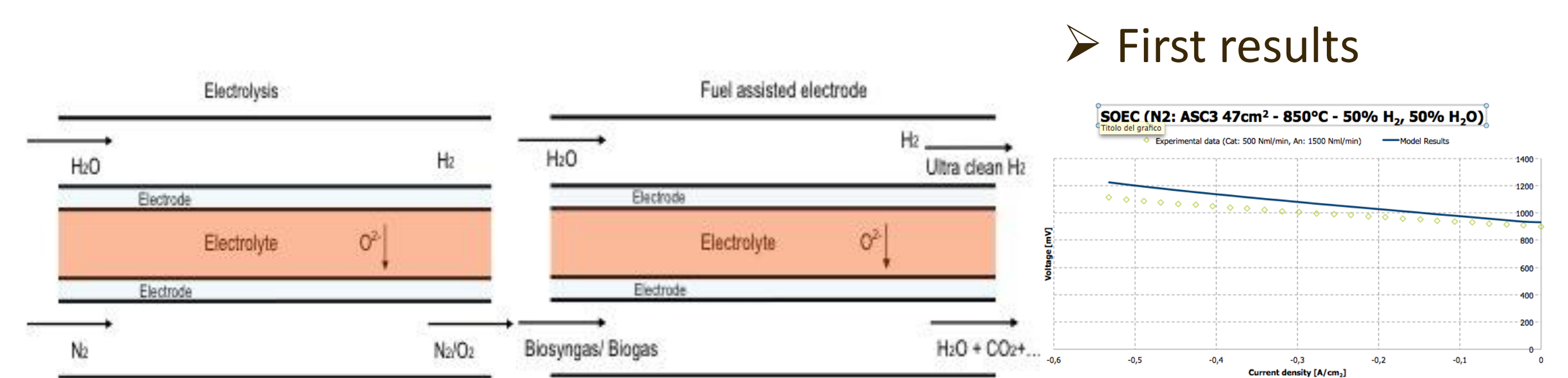
- Electrolyser versatile operational regime:
  - Full electric mode (SOE)
  - Fuel Assisted mode (FA-SOE)
  - Fuel cell mode (SOFC)
- Methanation of CO<sub>2</sub>-rich gas streams:
  - Biogas
  - Producer gas (from gasification)
  - CO<sub>2</sub> from industrial processes
- Response to variable operational conditions
- Appliance response to synthetic methane

## Acknowledgment

This research has been financed by a grant of the Energy Delta Gas Research (EDGaR) program. EDGaR is co-financed by the Northern Netherlands Provinces, the European Fund for Regional Development, the Ministry of Economic Affairs and the Province of Groningen.

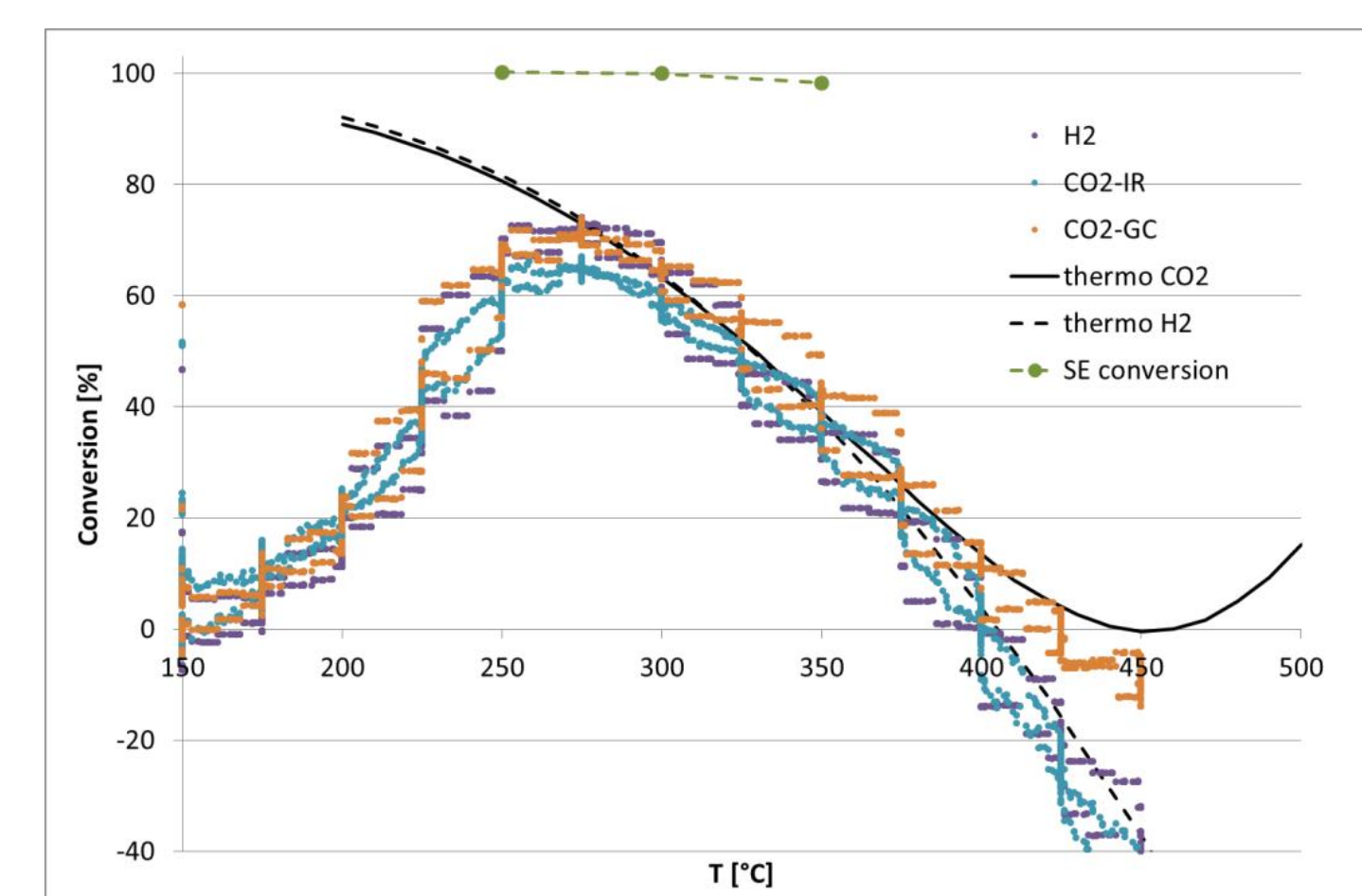
## Solid oxide electrolyser cell

- Development of mathematical Models for SOEC and FA-SOEC and thermodynamic analysis of electrolyser integrated systems
- Identification of suitable cells, theoretical and experimental evaluations
- Applications of clean synthetic methane, CHP/ $\mu$ CHP



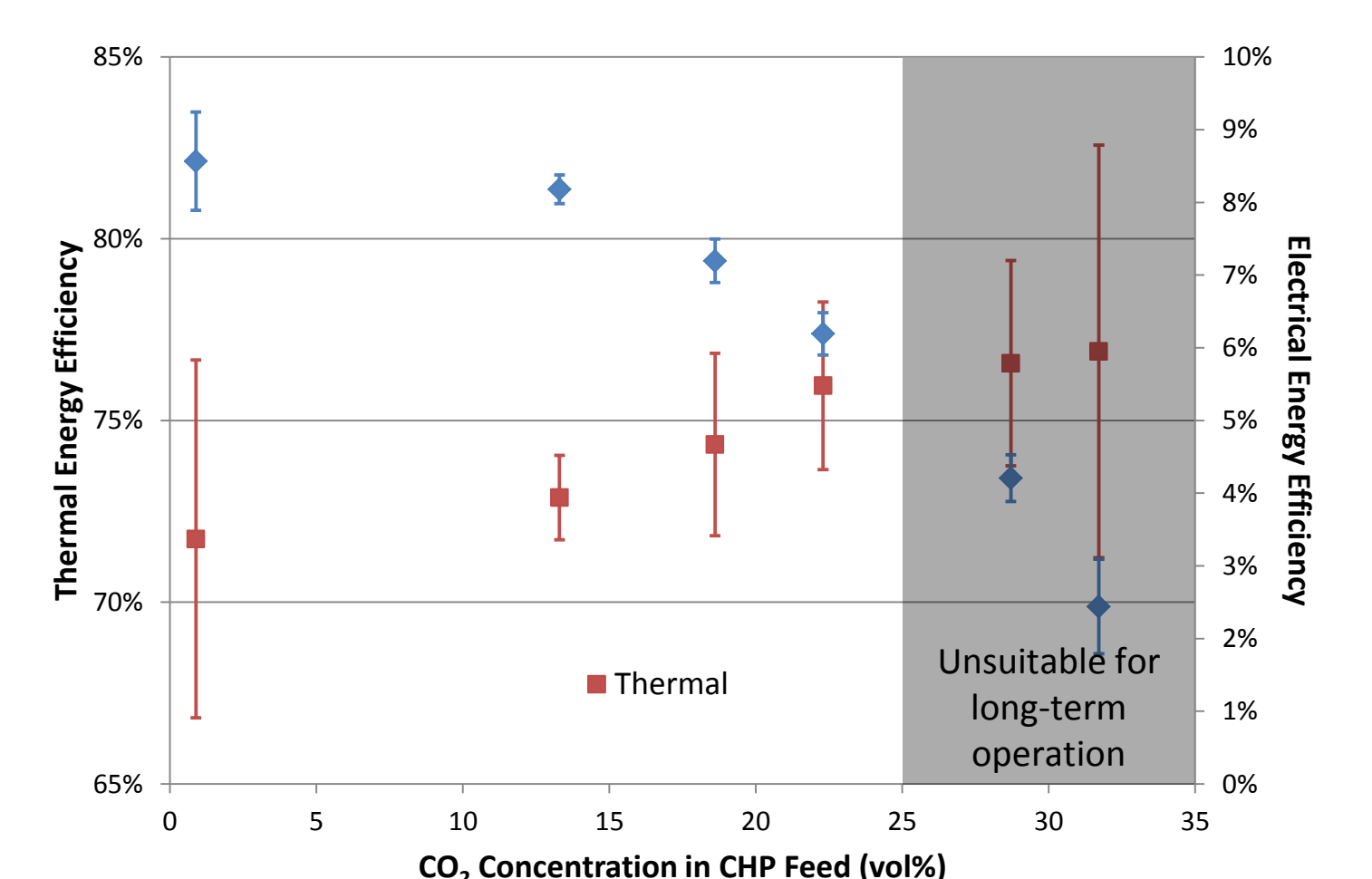
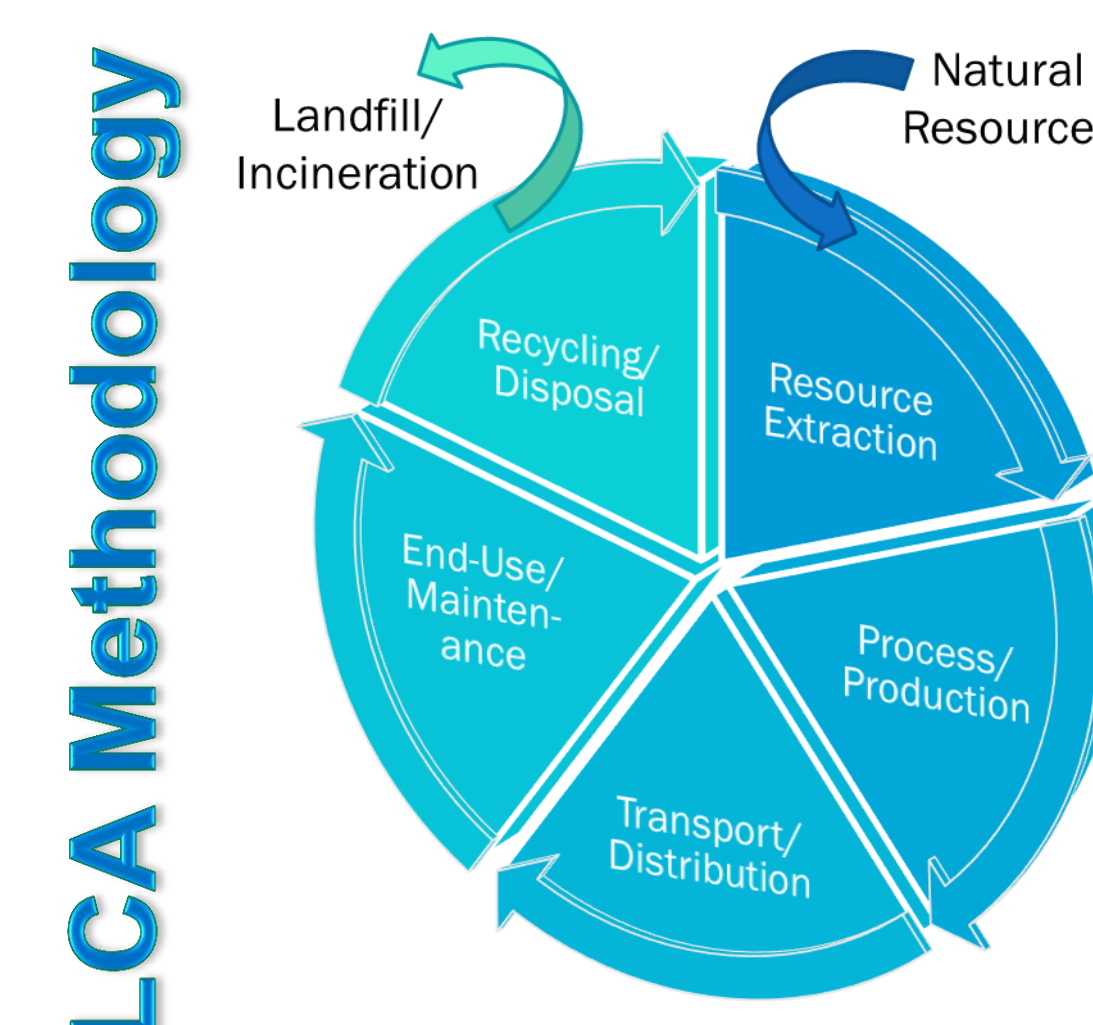
## Innovative methanation

- Complete conversion, high methane quality
- Match high specification requirement at low operating pressure
- Stable response to variable supply
- Conceptual design and integration with SOE



## Well-to-wheel efficiency: Life Cycle Analysis (LCA)

- End-point applications: co-generation (CHP) and solid-oxide fuel cell applications evaluated by teams of undergraduates [EnTranCe].
- LCA's, first streamlined, then comprehensive, performed by M.Sc. [EUREC] students using SimaPro software, based on ISO 14044:2006.



## Partners / Project team



P.V. Aravind, T. Woudstra (TU Delft)  
W. Van Gemert (Hanze)  
J.W. Dijkstra, M. Saric, L. Rabou, W.G. Haije (ECN)