



## Towards 2nd generation of IGCC plants, Nuon Magnum multi-fuel power plant

Maarten Berkhout  
Project Manager Magnum gasification and CCS  
**Nuon BD&P**

Clean and efficient power generation from coal, Gliwice Poland 24-25 September 2009

# Content

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- Nuon
- Rationale IGCC
- The Nuon Magnum project
- Relevant steps towards 2<sup>nd</sup> generation IGCC

# Overview Nuon

*Nuon is active in the Benelux and has recently become a part of the Vattenfall group. The ambition is to bring the CO<sub>2</sub> emissions of power production back to 0 in 2050.*

## Nuon figures

- Customers in NL, Belgium, (Germany)
  - Power: 2,5 million
  - Gas: 1,9 million
  - Heat: 150,000
- Number of employees: 7.000
- Trading in 14 European countries

## Electricity production assets

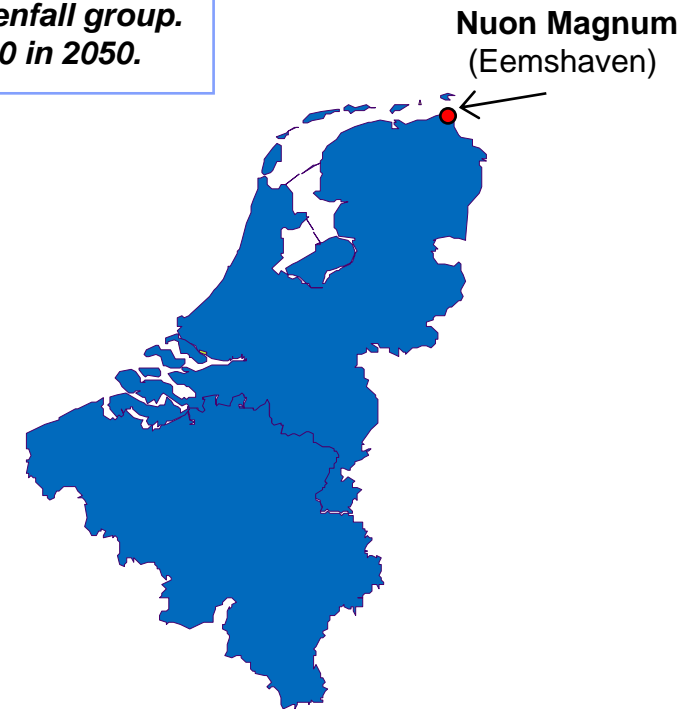
- “Grey” – 3800 MW installed capacity
- Green – 410 MW in 7 EU countries

## Other assets

- Gas storage at Epe (Germany) and Zuidwending (NL)
- Recently acquired gas fields

## Innovations

- Helianthos flexible solar film
- Clean fossil fuel: gasification, biomass, hydrogen, CCS





# Nuon portfolio based on Trias energetica

## Energy saving

- Energy advice
- Smart meters
- Demand response
- Customer education



## Renewable energy

- Wind  
*Offshore windfarm Egmond aan Zee (first NL offshore wind park)*
- Hydro
- Biomass
- Solar  
*Helianthos*

## Clean fossil

- Gasification technology
- CO<sub>2</sub> in-house abatement
- CO<sub>2</sub> capture & storage
- Efficient natural gas-fired combined cycle plants

To become CO<sub>2</sub>  
neutral in 2050

# Why Gasification

- Replacement of existing old assets
- Gasification is one of the most versatile and clean ways to generate energy from solid and/or liquid fuels
- Emissions are lower compared to conventional coal plants and gasification has the possibility to capture CO<sub>2</sub> relatively efficiently
- Synergy and options (H<sub>2</sub>, waste, CTL)

## Nuon is building on the Buggenum experience

Buggenum is the first fully integrated gasification plant with a Combined Cycle. The unit was commissioned in 1994. During its first years Buggenum served as a demonstration plant up to 2001 when it smoothly switched into commercial operations. In the time span 2001-2004 the unit operated predominately as a swing unit, optimising Nuon's power position (long or short). From 2005 onwards the unit is fuelled with biomass up to 30% (mass) base.

# The Nuon Magnum project in the Eemshaven



## Phase 1:

- Construction of 3 MHI (F-class GT) CCU's, 1200MW
- Construction restarted recently
- First fire Jan-2012

## Phase 2:

- Gasification, CCS,
- Stevedoring, ASU
- Shell gasification technology license
- Include Learnings Buggenum

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# Technology optimization to improve IGCCCS competitiveness

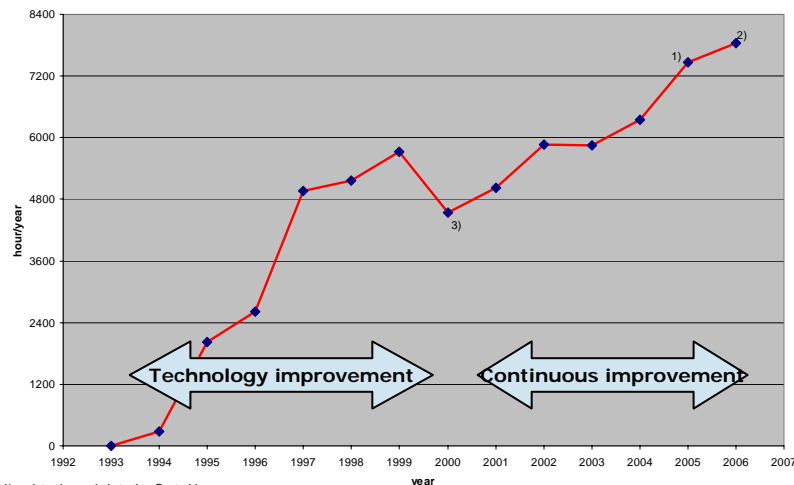
## ■ GT

- H<sub>2</sub> rich syngas burning
- NO<sub>x</sub> abatement

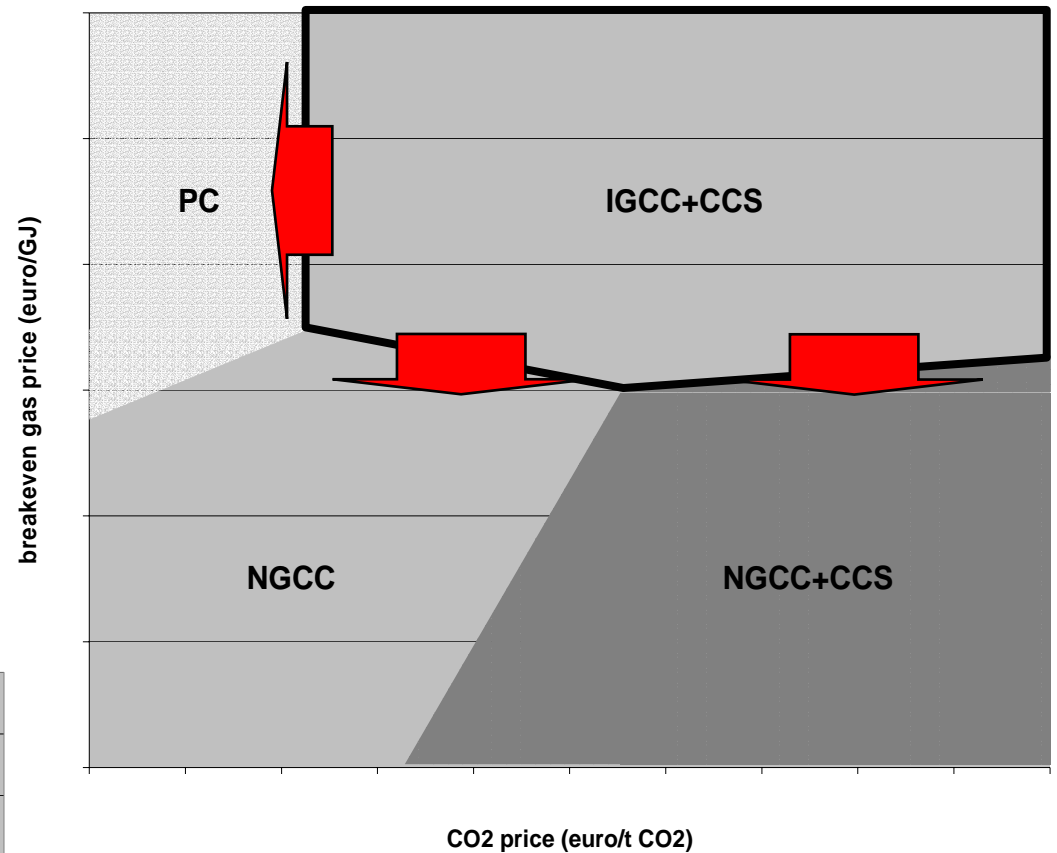
## ■ CAPEX / OPEX reductions

- Value cost engineering
- Life time cost of equipment optimization

### Buggenum



1) excl. testing period starting Gasturbine on syngas  
 2) excl. replacement inner casing Gasturbine  
 3) incl. waiting periode NEA



■ Reliability

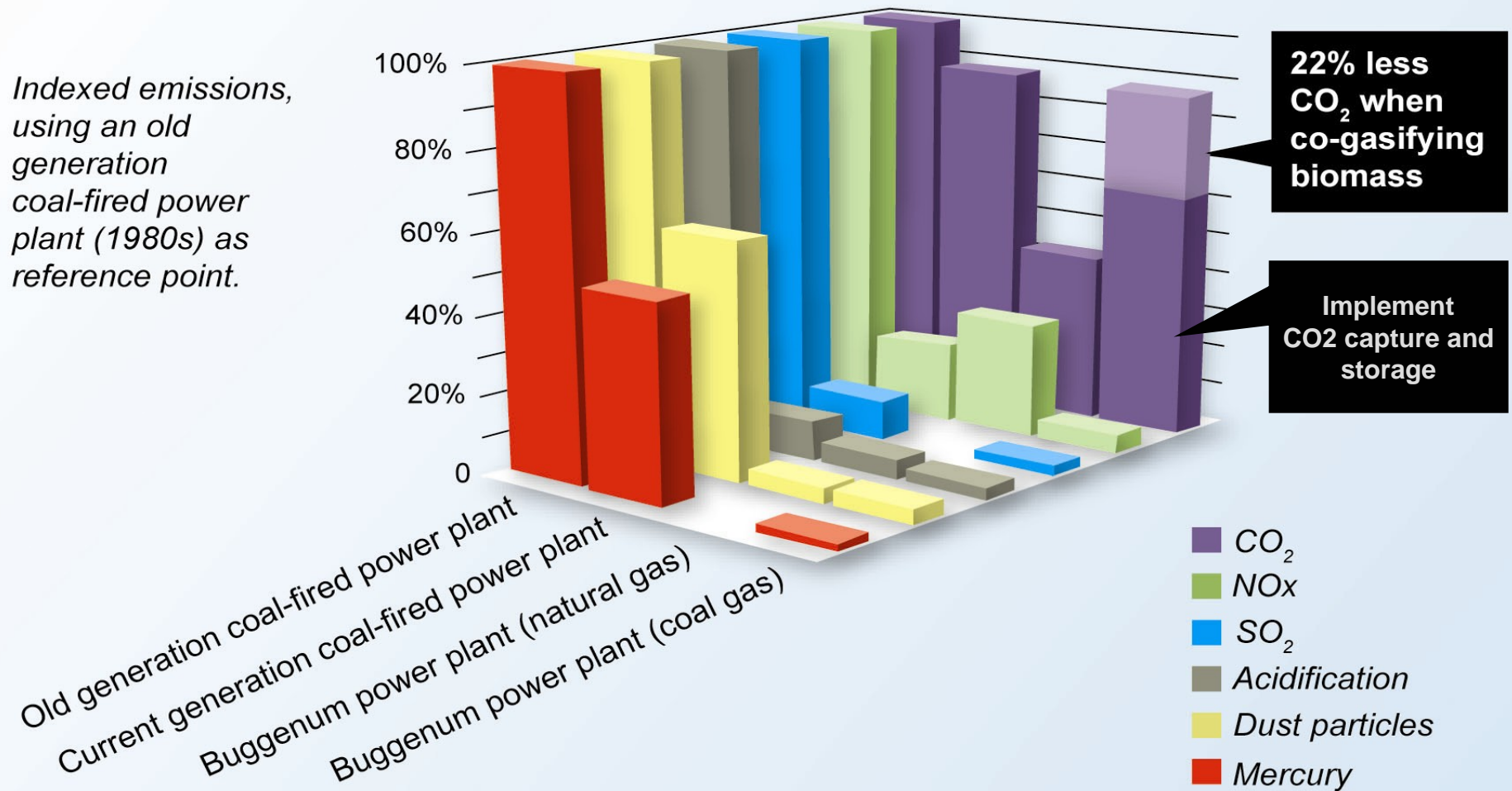
■ Efficiency



# Lower the environmental impact of IGCC

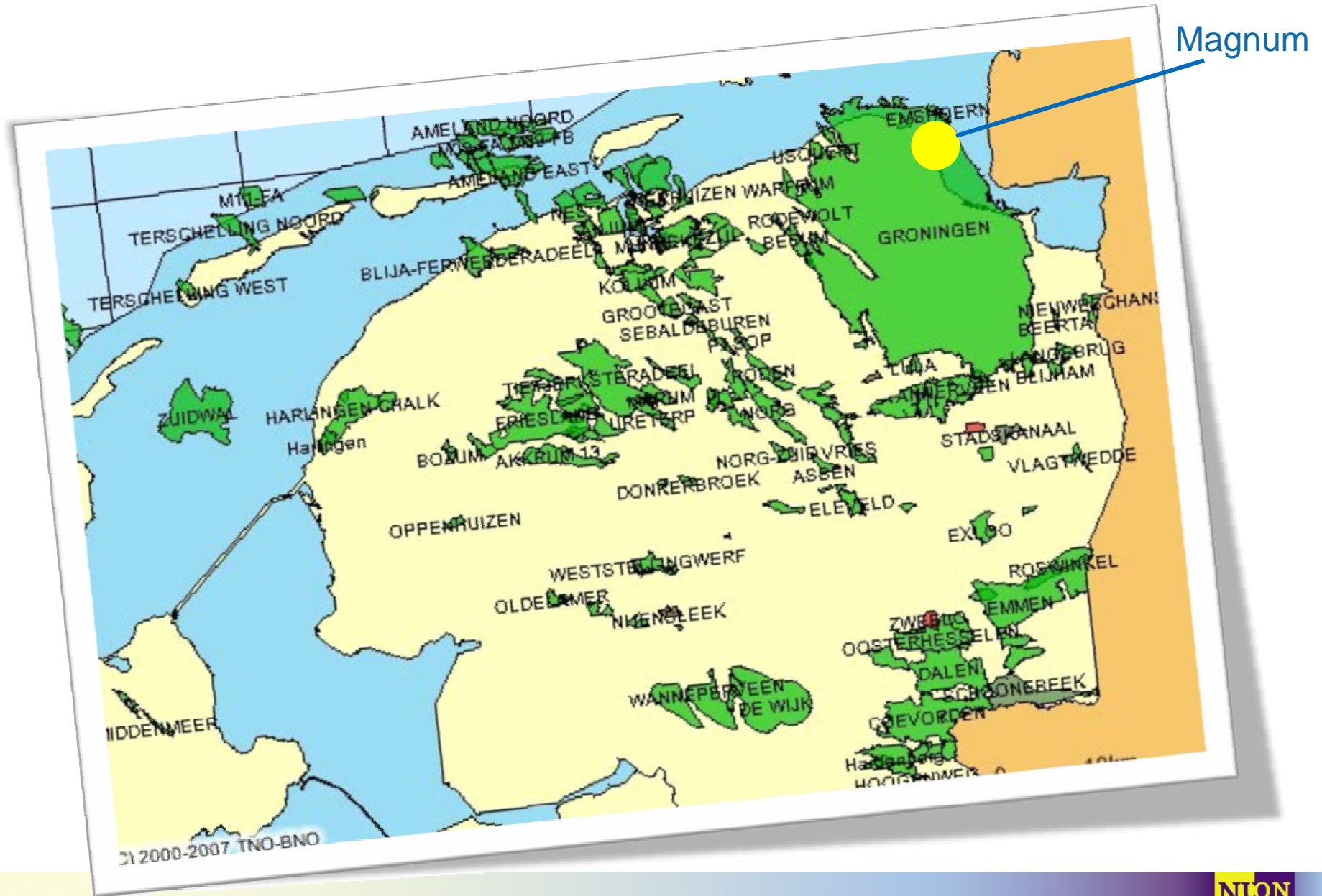
## COAL GASIFICATION - CLEANEST FOSSIL FUEL

*Indexed emissions, using an old generation coal-fired power plant (1980s) as reference point.*



# Onshore gas fields offer CO<sub>2</sub> storage options

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# Activities preparing Magnum CCS implementation

## ■ North NL CCS alliance

- Cooperation to create public acceptance of CO<sub>2</sub>
- Partners:
  - Development agencies
  - Knowledge centers
  - Local authorities
  - Industry, including CCS chain partners

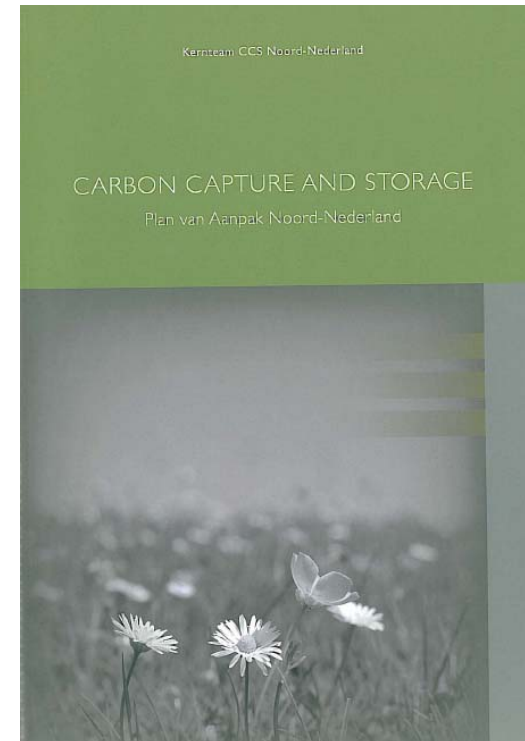
## ■ Study CCS chain

- Cover and optimize full CCS chain
- Study cost of CCS transport and storage chain
- Identification of showstoppers

## ■ CCS subsidization

- EERP
- NER
- Local

## ■ CCS legislation





# CO<sub>2</sub> Catch-up pilot plant at Buggenum

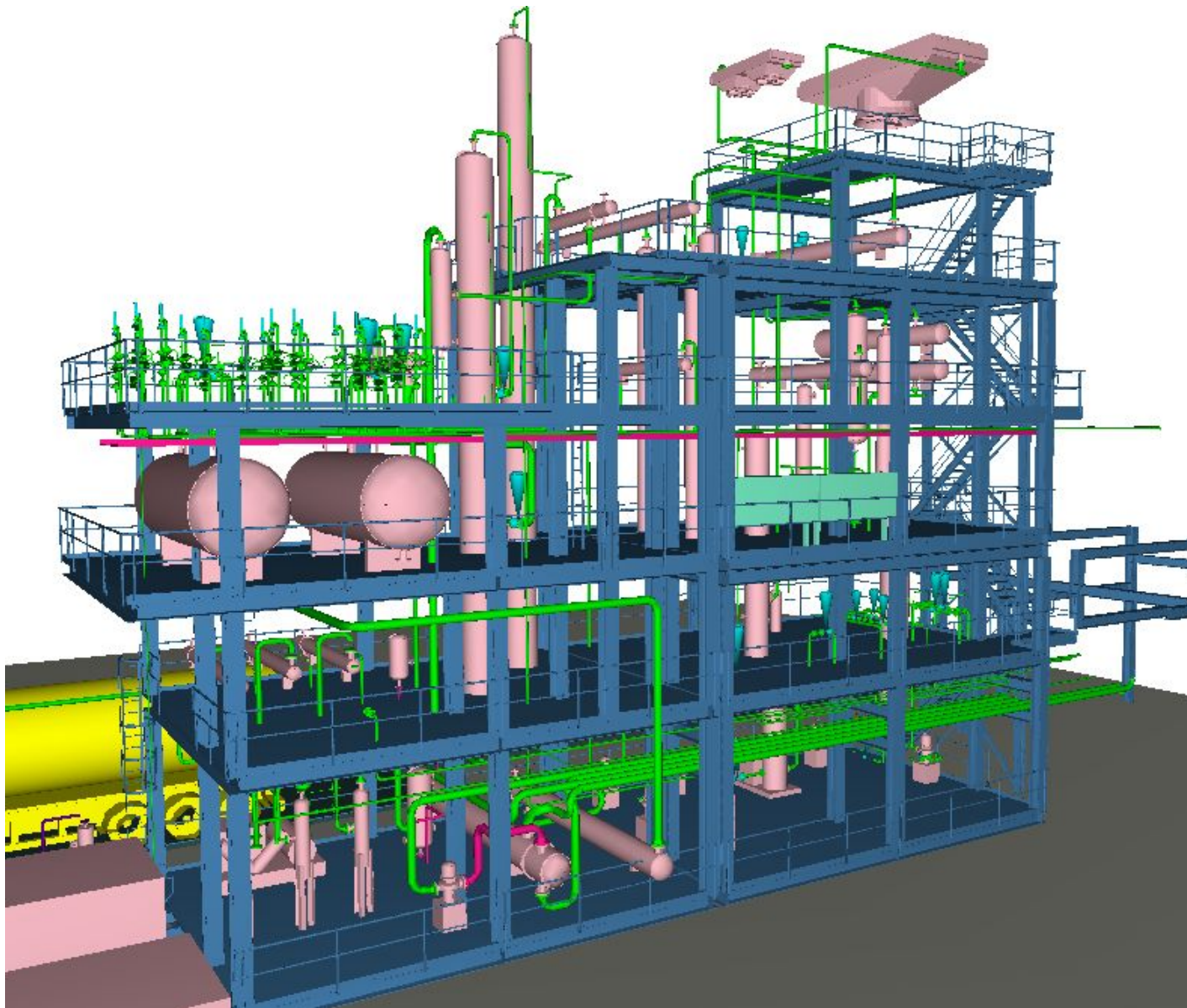
**Objective:** Testing pre-combustion CO<sub>2</sub> capture technology at IGCC

- Identify and mitigate potential risks associated with the novel application of the selected technology
- Verify the technology performance and operation window in the field environment
- Optimize technology selection and design
- Gather operating experience
- Prepare for large-scale application in Magnum



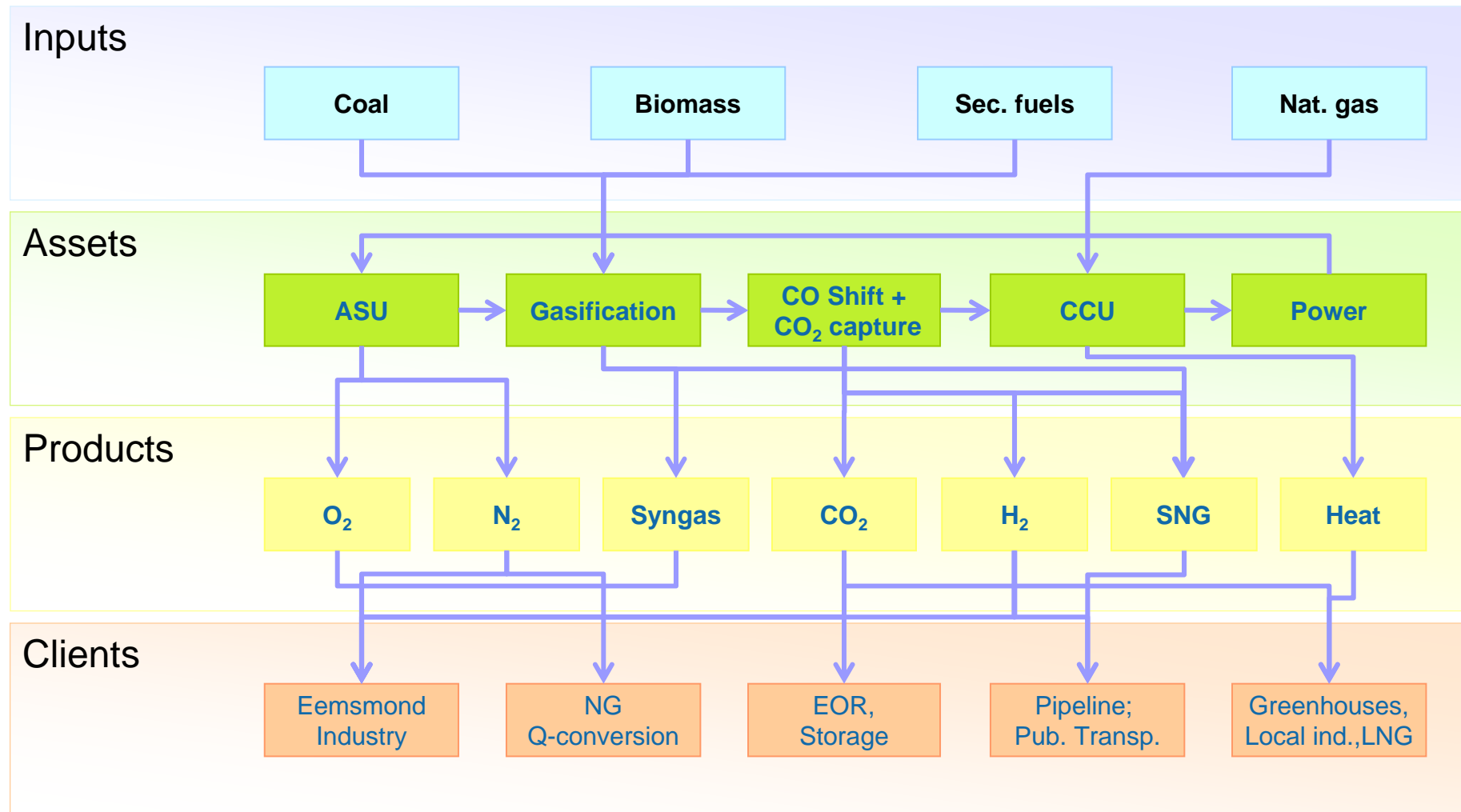


# Visualization CO<sub>2</sub> Catch-up pilot plant



# Prepare for multi-fuel polygeneration concept

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Nuon and its partners are working very hard to make IGCC + CCS  
a competitive power generation and energy supply technology

**Thank you!**