MPP3
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Journées Annuelles des Hydrocarbures
8 & 9 octobre 2014
Some facts & figures (Annual Report 2013)

- **Sales**: 122 billion euro
- **Net income**: 2.5 billion euro
- **Investments**: 8 billion euro
- **Sales electricity**: 704 TWh
- **Sales gas**: 1.091 TWh
- **Households**: 30 million
- **Employees**: 62,000

**Europe**: Focused and synergistic positioning

**Outside Europe**: Targeted expansion

Cleaner and better energy
MPP3 key data

Gross capacity  1,100 MW
Efficiency        ~ 47%
Steam conditions  620°C
                  285 bar
Start construction April 2008
In operation      2014
Technology Choice

- Pulverized coal = proven technology, safe, reliable, economic, clean & innovative
- MPP3 has high efficiency (47% versus 38%)
  - This leads to approx. 20-30% less CO₂-emissions
- Complex technology, T-24 boiler material, steam 600 °C, 285 bar, sea water cooling
- Once through boiler >> turn down ratio 83%
- Hot start to full load in 105 minutes
- Ramp up speed 50 MW/minute
- Electrical power (net): 1,069 MWₑ
  - ID size fan limits flue gas duct to 800 MWₑ
  - Generator limits capacity to about 1,155 MWₑ
- MPP3 is CO₂ capture ready
- MPP3 is ready for heat supply to industries and residential areas in the region
- Possibility for co-firing biomass (up to 30%)
- Flue Gas Cleaning to comply with emission levels far below BAT
Maasvlakte: a history of land and water

- Very large scale industrial area
- Deep waterway: easy transport of coal and biomass
- Sufficient cooling water
- Infrastructure present
- Building space available
- Maasvlakte 2 = new co-siting opportunities

Maasvlakte is one of the best options in Europe for a coal fired power plant
Maasvlakte MPP3 co-siting

- Waste fuel Lyondell -> -/- 84,000 ton CO$_2$/year
- Biopropane Neste -> -/- 300,000 ton CO$_2$/year
- Gate -> 60,000 m$^3$ waste heat water per hour -> -/- 180,000 ton CO$_2$/year
Energy-efficient = CO$_2$-efficient

- MPP3 has high efficiency (~47%). This leads to approx. 20% less CO$_2$-emissions per KWh
- MPP3 is CO$_2$ capture ready
- MPP3 is ready for heat supply to industries and residential areas in the region
- Possibility for co-firing biomass is being researched and is part of the environmental permit
CO₂-projects E.ON Benelux


- Project is part of CATO, the national research project for capture, transport and storage of CO₂.

- Announcement CATO 2.

- CATO 2 leads to ROAD project.
ROAD Project – Full Chain CCS Demonstration

Capture: 250 MWe, 1.1 Mton/yr
Transport: 25 km pipeline, 16” max. capacity 5 Mton/yr
Storage: depleted offshore gas field (P18-A)
Start of operation: 2016
Capital investment: approx. M€ 400 (M€ 330 funded)
Project Developer: Maasvlakte CCS Project C.V.
Journées Annuelles des Hydrocarbures
Paris, 8 et 9 Octobre 2014

ROAD-CCS project

Hans Schoenmakers
Rotterdam Opslag en Afvang Demonstratieproject
Co-operating Partners ROAD

- **Maasvlakte CCS Project C.V.** is a joint venture of:
  - E.ON Benelux
  - GDF SUEZ Energie Nederland
- In **co-operation** with intended partners:
  - TAQA Energy
  - GDF SUEZ E&P
- With **financial support** of:
  - European Commission (EU)
  - Government of the Netherlands
  - Global CCS Institute
  - Private partners (discussions pending)
Integrated CCS Chain ROAD

Maasvlakte Power Plant 3
Capture Plant
Compression

Onshore Pipeline: 5km

Offshore Pipeline: 20km

P18-A Platform

NOT ON SCALE

Depleted Gas Reservoir P18-4

-3,500m
CO₂ Transport

- **Pipeline length:**
  - 5 km onshore, 20 km offshore
- **Diameter:** 16 inch
- **Transport capacity:**
  - 5 Mt/yr (dense)
- **Design specs:**
  - 140 bar (max.)
  - 80 °C (max.)
- **Pipeline insulated**
CO$_2$ Storage Location

- Depleted gas reservoir P18
- Operator: TAQA
- Depth: -3,500 m
- Storage capacity:
  - 35 Mt (P18)
  - 8 Mt (P18-4)
- Available: 2014
- Alternatives / future expansion options are in focus (I.a. EOR)
Status ROAD

• **Engineering**
  - Detail engineering of capture plant underway
  - Some long lead suppliers chosen and components engineered
  - Pipeline route engineered and ‘flow assurance’ study completed
  - ‘Tie-ins’ (i.a. flue gas, steam) with power plant installed
  - Storage design complete, detail FEED ready to start

• **Permits**
  - Permitting procedures finalized (beginning 2012)
  - Capture permits are definitive and irrevocable
  - Storage permits are definitive and irrevocable (TAQA) - Sept 2013
  - Transport permits agreed, with publication imminent

• **Contracts**
  - Capture supplier selected and EPC contract was ready to be signed
  - Contracts with power plant (utilities etc) ready for signature
  - Commercial contracts for transport (GDF Suez) and storage (TAQA) are agreed textually, and will be signed at FID
  - But, price validity has expired - reconfirmation once funding gap is closed

• **Finance**
  - Very low CO₂ prices have caused a financing gap compared to plan (>€100M)
  - Delay in CCS role-out and loss of confidence in EU low carbon energy policy has also weakened the strategic case for the demo
  - Currently, phased approach is being investigated by EC and several Member States in order to finance operational phase

ROAD remains ready to start construction as soon as the funding gap has been closed
# ROAD: Not a Typical CCS Project...

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<thead>
<tr>
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<th>ROAD</th>
<th>Typical CCS Project</th>
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<tbody>
<tr>
<td>Minimum Injection Period</td>
<td>3-5 years</td>
<td>&gt;15 years</td>
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<tr>
<td>Total CO₂ injected</td>
<td>3-8 Mt</td>
<td>&gt;50 Mt</td>
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<tr>
<td>Storage field life (from FID to full decommissioning)</td>
<td>≈10 years</td>
<td>&gt;50 years</td>
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<tr>
<td>Storage risk</td>
<td>Single well into deep depressurised gas field</td>
<td>Large connected reservoir, multiple wells</td>
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<td>Financial Risk</td>
<td>CAPEX largely grant funded, OPEX loss-making, therefore it can stop without major financial impact</td>
<td>Major financial impact for whole chain if unable to operate</td>
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... ROAD is funded as a true demonstration
The Rotterdam CO$_2$ Hub - Existing OCAP System

**OCAP System:**

- Supplies 400 kt CO$_2$ to ≈600 greenhouses
- Shell Pernis CO$_2$ is from natural gas-based hydrogen production facility
- Abengoa is a first generation bioethanol plant
- OCAP claims CO$_2$ emission reduction of ≈200 kt/year through avoidance of natural gas use in the greenhouses
- There is additional CO$_2$ demand OCAP can’t meet
The Rotterdam CO₂ Hub - OCAP Potential

### Monthly Demand

- **Jan**: 200 (Estimated Demand ROAD), 100 (Estimated Demand Shell/Abengoa), 50 (Potential additional storage)
- **Feb**: 150 (Estimated Demand ROAD), 120 (Estimated Demand Shell/Abengoa), 70 (Potential additional storage)
- **Mar**: 220 (Estimated Demand ROAD), 180 (Estimated Demand Shell/Abengoa), 100 (Potential additional storage)
- **Apr**: 250 (Estimated Demand ROAD), 200 (Estimated Demand Shell/Abengoa), 150 (Potential additional storage)
- **May**: 300 (Estimated Demand ROAD), 250 (Estimated Demand Shell/Abengoa), 200 (Potential additional storage)
- **June**: 350 (Estimated Demand ROAD), 300 (Estimated Demand Shell/Abengoa), 250 (Potential additional storage)
- **July**: 400 (Estimated Demand ROAD), 350 (Estimated Demand Shell/Abengoa), 300 (Potential additional storage)
- **Aug**: 450 (Estimated Demand ROAD), 400 (Estimated Demand Shell/Abengoa), 350 (Potential additional storage)
- **Sept**: 500 (Estimated Demand ROAD), 450 (Estimated Demand Shell/Abengoa), 400 (Potential additional storage)
- **Oct**: 550 (Estimated Demand ROAD), 500 (Estimated Demand Shell/Abengoa), 450 (Potential additional storage)
- **Nov**: 600 (Estimated Demand ROAD), 550 (Estimated Demand Shell/Abengoa), 500 (Potential additional storage)
- **Dec**: 650 (Estimated Demand ROAD), 600 (Estimated Demand Shell/Abengoa), 550 (Potential additional storage)

### Max. CO₂ Supply

- ROAD: 650
- Shell/Abengoa: 600
- Potential additional storage: 550