The Green Injection
- into the existing gas grid of Endinet or GTS -

Henk Kluytmans – Manager Projecten & Engineering
Rick Donders – Asset Management

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Agenda

• Definitions
• Study assigned by Agentschap NL
• Introduction
• Endinet and Green Gas
• Green Gas Injection
• Potential natural gas replacement
• Demand versus production
• Technical solutions
• Grid investment costs
• Conclusions
• Questions
Definitions

**Biogas** = gas produced by digestion of biomass, Synthetic Natural Gas or landfill gas

**Green Gas** = upgraded biogas that meets the properties of natural gas quality and can be injected into the existing gas grid

**Distribution grid** = grid operated by the regional grid operators

**Transmission grid** = grid operated by the national grid operator
Study assigned by Agentschap NL

“Green Gas Injection into the Natural Gas Grid – Scenario Development”

• Possibilities and grid investment costs of Green Gas Injection into:
  • 8 bar distribution grid of Endinet
  • 40 bar transmission grid of GTS

• Study performed by KEMA & Endinet
Introduction

Endinet is grid operator of the region Eindhoven and Oost-Brabant

Number of connections
- Electricity: 107,000
- Gas: 385,000
Endinet and Green Gas

- Landfill gas injection (Nuenen, 1990)
- Several new initiatives
- Endinet’s vision:
  - Long term perspective
  - Facilitate injection
  - Number of pilot projects
  - Controlled expansion
  - Conform current corporate values:
    - Safety
    - Security of supply
    - Cost effective
Green Gas Injection

• Green Gas can be injected into the existing natural gas grid

• Preconditions injection:
  • Quality must be equal to natural gas
  • Sufficient capacity current grid
  • According to current pressure ranges
Potential replacement of natural gas in the Endinet region

Yearly amount [ Million m³]

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount [ Million m³]</th>
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<tr>
<td>Manure</td>
<td>12</td>
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<tr>
<td>Biogas</td>
<td>249</td>
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<tr>
<td>Green Gas</td>
<td>124</td>
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<tr>
<td>Natural gas replacement</td>
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12%
Gas demand profile total distribution grid of Endinet

![Graph showing gas demand profile with seasonal variations](image-url)
Duration curve total distribution grid area of Endinet
Gas infrastructure
draaien en versimpelen conform dia 12?
Overproduction in supply area of Endinet
Technical solutions

Overproduction on distribution level

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
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<tr>
<td>40 bar Transmission grid</td>
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<td>8 bar Distribution grid</td>
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Level

Transmission

Distribution

A1 C1 B1 B2 D1 D2 D3

Pipeline
Buffer
Connection pipeline
Transferring point
Grid investment costs - individual solutions

<table>
<thead>
<tr>
<th>Technical solution</th>
<th>Location A</th>
<th>Location B</th>
<th>Location D</th>
<th>Location H</th>
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<tr>
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<td>€ 200.000</td>
<td>€ 400.000</td>
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<td>€ 1,800.000</td>
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# Grid investment costs – individual solutions

## Technical solutions

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### Cumulative costs [€]

- **€ 1,400,000**
- **€ 1,200,000**
- **€ 1,000,000**
- **€ 800,000**
- **€ 600,000**
- **€ 400,000**
- **€ 200,000**
- **€ 0**
Grid investment costs – 12% natural gas replacement

- Financial worst-case scenario
  - Injection into transmission grid

- Financial realistic scenario
  - Injection into distribution grid & transferring to transmission grid

- Financial best-case scenario
  - Injection into distribution grid
Conclusions

• Potential: 12% natural gas replacement by Green Gas

• Summer: demand < production capacity
  • Particularly demand distribution grid < production capacity: use of transmission grid is necessary

• Several technical solutions to facilitate Green Gas injection

• Costs injection distribution grid << injection transmission grid
  • Minimal capacity scale necessary for injection to be cost effective

• Preferable solution injection distribution grid and transferring to transmission grid
Questions