MHPS in the Americas and Globally

- Regional Headquarters
- Offices
- Manufacturing & Repair Facilities

Global Statistics

- $13.1B orders in 2017
- 57 group companies
- 21,000 employees

- ~$1 billion invested into the Americas
- ~2,000 Employees
- ~1 Million sq. feet Factory Capacity

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Hydrogen Vision
# Hydrogen for Multi-day Storage

**L of Clean Energy at Future Capital Costs and Performance**

### 8 Hour Storage Duration

<table>
<thead>
<tr>
<th>Cost of Electricity, Solar Farm $/MWh</th>
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<th>Battery Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>$25/MWh</td>
<td><img src="chart1.png" alt="Bar Chart" /></td>
<td><img src="chart2.png" alt="Bar Chart" /></td>
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### 24 Hour Storage Duration

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*Source: IEA Energy Technology Roadmap Hydrogen and Fuel Cells*
MHPS Hydrogen Gas Turbines

**CO2 reduction by Hydrogen GTCC**

- **LNG GTCC**: 340 G/KWh
- **LNG-30%H2 co-firing GTCC**: 305 G/KWh
- **100%H2 firing GTCC**: Zero Carbon

**CO2 emission (G/KWh)**

- **Today**: 340
- **2030**: 0

- **MHPS Gas Turbine** development contributes to:
  - Energy savings through high efficiencies: today η>63% → near future η>65%
  - Reliable energy supply:
    - high reliability = 99.5%

- **MHPS Hydrogen Technology**
  - Evolitional Technology
    - Proven experience in hydrogen-firing since 1970’s
  - Cutting Edge Technology
    - Applicable to latest J / JAC gas turbines
  - Extensive Technology
    - Ammonia cracking, SOFC
Minimal Gas Turbine Retrofit

Only combustor modifications are required

Overall View of GT ref: MHPS catalogue
Hydrogen GT Project in the Netherlands

Project organization

- Equinor: Energy supplier
- Vattenfall/Nuon: Owner of Nuon Magnum
- Gasunie: Gas infrastructure and transporter
- MHPS: GTCC OEM

Equinor: Upstream part (NG supply, H2 production and, CO2 Transport and Storage)
Gasunie: Mid-stream part (H2 Transport and Storage), Nuon & MHPS: Downstream part (Magnum modifications)

MoU

Schedule

~2018:
Feasibility Study

2019~
Permit approval by the Netherlands Government

2022~2023
Modification work starts

2024
Unit1 H2 firing with Diffusion Combustor
Solid Oxide Fuel Cells (SOFC‘s)

Standard Products Sizes:
- 40 kW Atmospheric
- 250 kW Hybrid
- 1 MW Hybrid