

Carbon Neutral Power Plants

Different Paldiski

August 28, 2023

ENR Ranking Tractebel

ENR
Engineering News-Record

INTERNATIONAL
DESIGN FIRMS
2022

POWER &
FOSSIL FUEL
#7



COGENERATION
#10



Petroleum

#23



SOLAR

#10



WIND

#7



HYDRO
PLANTS
#1



TRANSMISSION &
DISTRIBUTION
#9



Supporting our Client throughout the whole project lifecycle

→ STRATEGY



PRE-INVESTMENT



Offering a wide range of consulting and engineering services
and providing a tailored approach to meet Client's needs

← DECOMMISSIONING

← OPERATION

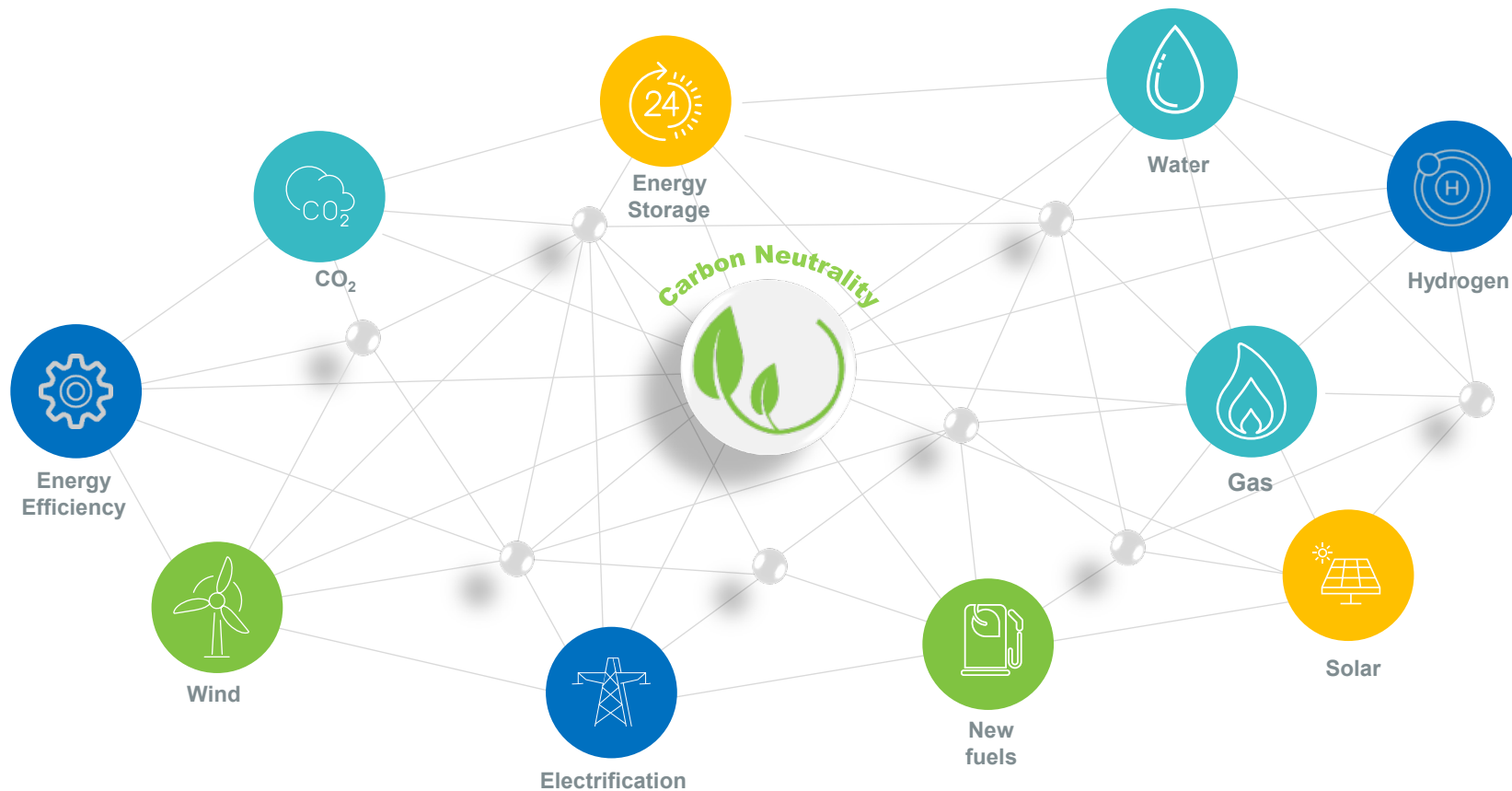
← IMPLEMENTATION

Always looking beyond to deliver excellence
and innovative solutions to make our Clients one step ahead



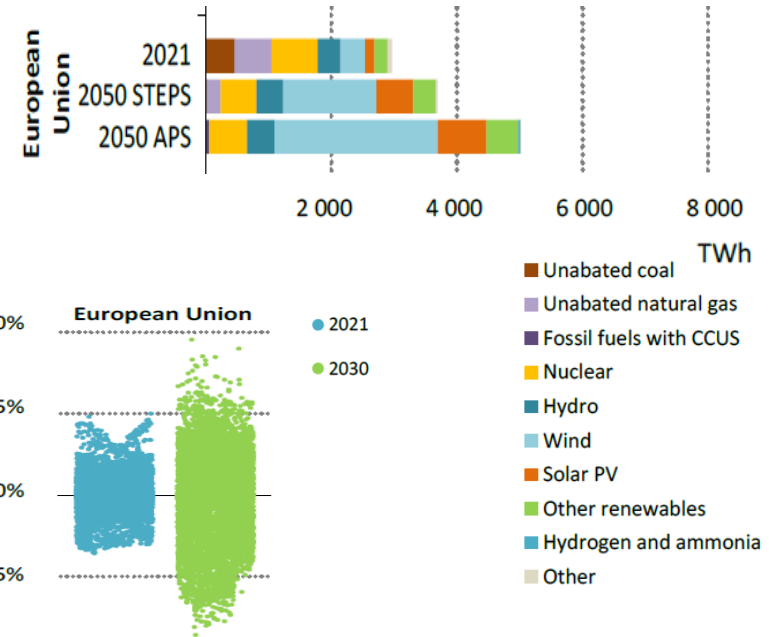
Towards a carbon-neutral future

Carbon Neutrality



Power Generation Trends (WEO 2022 – IEA)

- Increased electricity consumption as a result of electrification
- Increased share of wind and solar in electricity supply as a result of reduction of carbon footprint of energy sector
- Increased need for flexibility from non wind and solar assets
- Ensure energy system stability through dispatchable power generation or consumption
- Electrical Energy Storage, Dispatchable power generation or Dispatchable power consumers (derating)



➔ Capacity Renumeration Mechanism

Capacity Renumeration Mechanism in Belgium

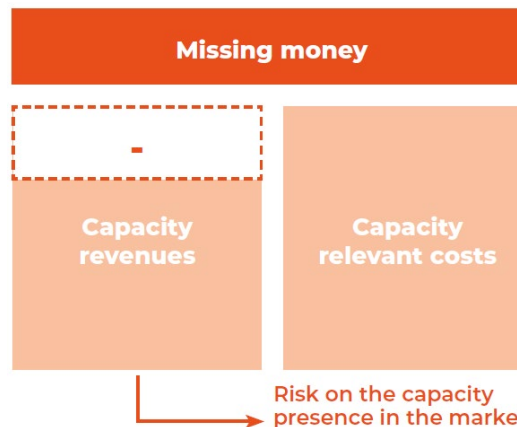
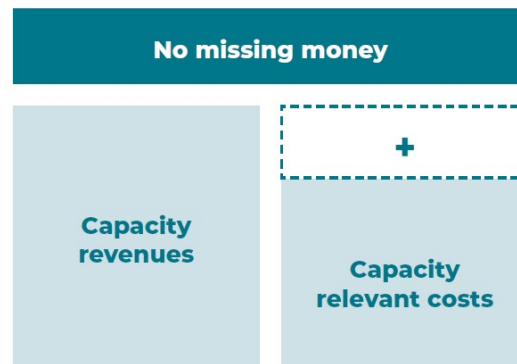
Goal : Maintaining required level of security of supply for the Belgian energy system

Aim : Compensate electrical capacity holders for that portion of their relevant costs that are not compensated by their revenues, i.e. **‘missing money’**

What : Availability based support mechanism for missing money of assets

Who : Current and new capacities to be available on the market in order to avoid security of supply issues

How : Auctions by grid TSO



New Gas Fired Power Plants in Germany

(press communication August 1, 2023)

24GW hydrogen power plants planned by German Government to be in operation by 2035

Tendering of first 9 GW to start in 2024

Subsidy scheme still under discussion with Europe

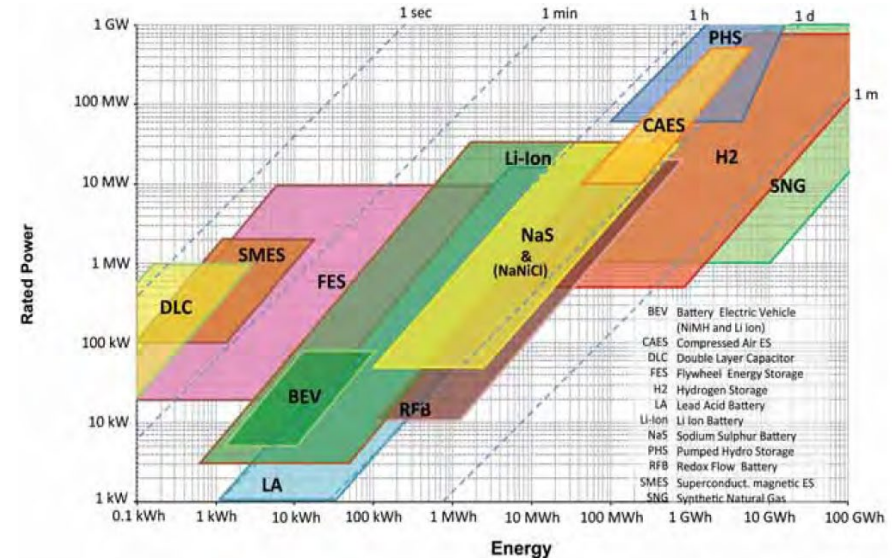
- 4.4GW new and converted gas-fired power plants with renewable hydrogen (tendering between 2024 and 2028)
- 4.4GW new hydrogen hybrid power plants integrating renewable electricity, electrolysis, storage and power production (tendering to be planned)
- 15GW of new or existing gas-fired power plants that must be converted to hydrogen by 2035 (tendering of 10GW between 2024 and 2026)



Electrical Energy Storage

Electrical Energy Storage refers to a process of converting electrical energy from a power network into a form that can be stored for converting back to electrical energy when needed [Source: Baker J.N., 1999]

- Multiple systems
 - Mechanical (CAES, PHS, FES)
 - **Electro-chemical (Batteries Energy Storage)**
 - **Chemical (H2, SNG)**
 - Electrical (DLC, SMES)
 - Thermal (Molten salts, A-CAES)
- Key factor are **Power, Energy and Duration** energy or power should be stored.

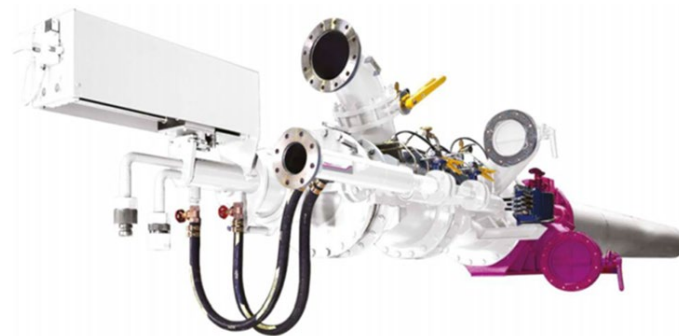


Carbon Neutral Dispatchable Power Plants

Complementary to Electrical Energy Storage (mainly batteries) and Dispatchable consumers

Solutions for carbon neutral dispatchable power generation

- Decarbonized Fuel => bio-methane, hydrogen and synthetic natural gas
 - Blending the natural gas with Green Gas Supply Agreement
- Decarbonized Emissions => carbon capture





References

**Some projects linked to
thermal power generation
decarbonization**



Paldiski Peaking Power Plant

Techno-economical evaluation of a **peaking & carbon neutral** gas fired power plant

CLIENT Balti Gass

LOCATION Estonia

PERIOD 2023 – ongoing

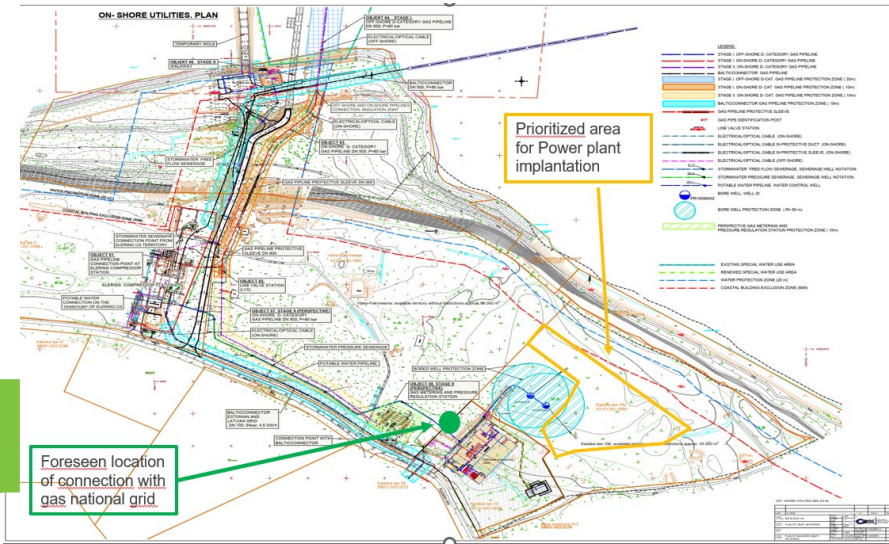
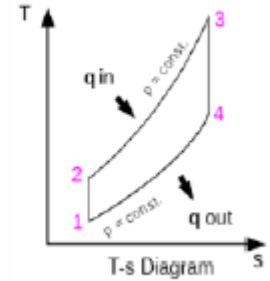
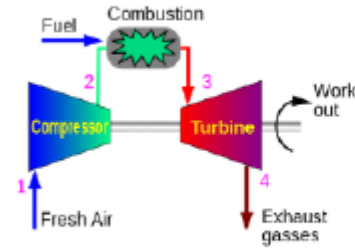
CAPACITY 200MW

CONFIGURATION Peaking Gas Turbine
Hydrogen ready

SERVICES PROVIDED

Pre-Feasibility Study

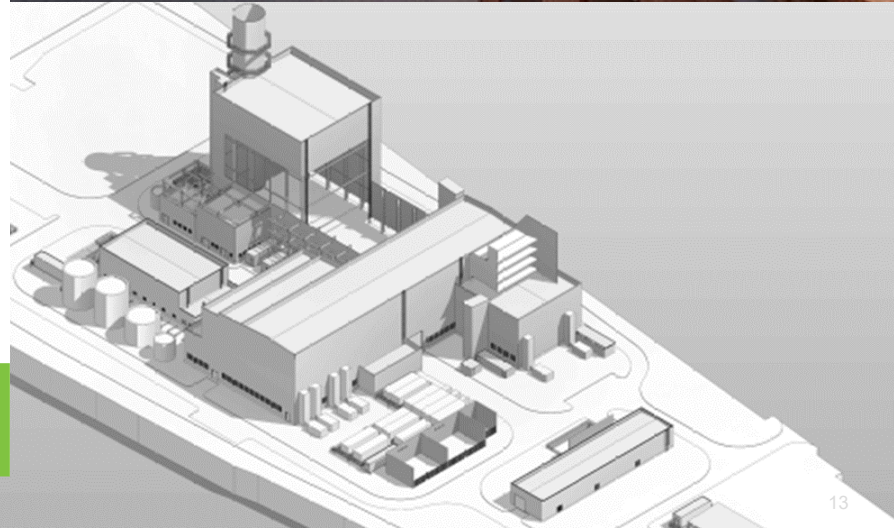
- Design basis
- Selection of technology
- Health, Safety and Environment
- Risk Register
- Techno-Economical Analysis
- Identification of critical aspects to be covered in next stage



Flémalle CCGT

Development and realization of a Combined Cycle power plant within the framework of the Capacity Remuneration Mechanism of the Belgian Government

| | |
|-------------------|--|
| CLIENT | ENGIE |
| LOCATION | Belgium |
| PERIOD | 2019 – ongoing |
| CAPACITY | 875MW with Net Efficiency > 63% |
| CONFIGURATION | Siemens SGT5-9000HL Gas Turbine in multi-shaft configuration with direct river water cooling Biogas, Hydrogen, e-methane ready |
| SERVICES PROVIDED | Client's Engineer <ul style="list-style-type: none">• Site Screening & Pre-feasibility• Feasibility• Tendering/contracting• Technical support for auction EPCM mission <ul style="list-style-type: none">• Engineering• Procurement• Construction Management• Multi-contract |



HyTech Hafen Rostock

Planning of a 100 MW electrolysis plant at the HyTech Hafen Rostock. Tractebel is responsible for the H₂ process systems including water purification, electrolysis, gas compression and storage and trailer filling station.

CLIENT Dornier Power and Heat GmbH –
rostock EnergyPort cooperation GmbH

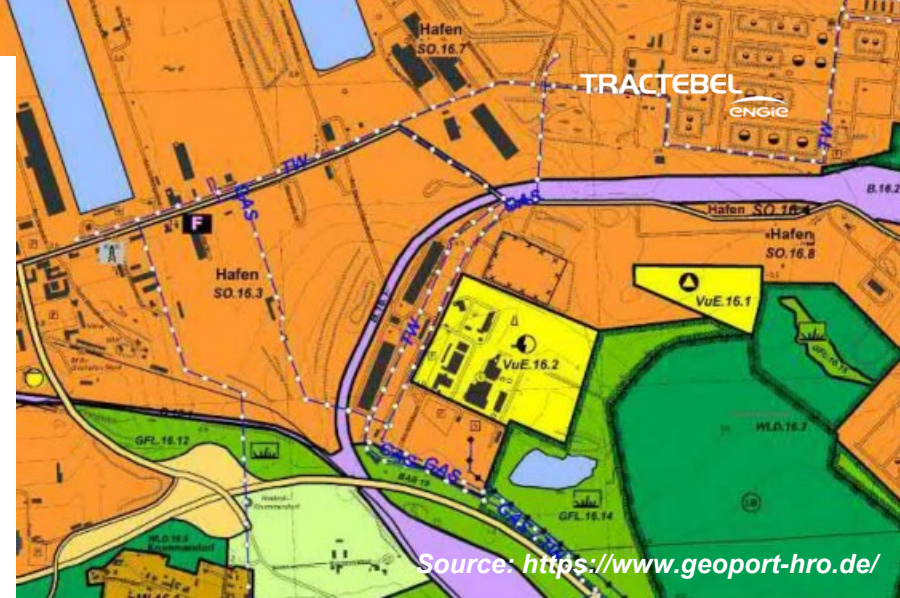
LOCATION Rostock - Germany

CAPACITY 100 MW

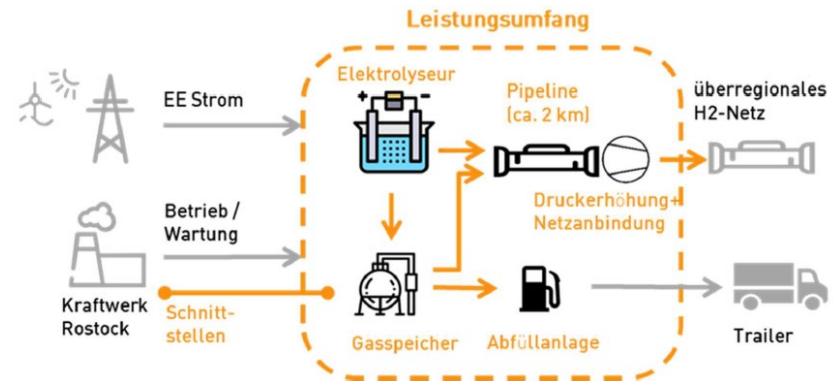
PERIOD 2023 – ongoing

SERVICES PROVIDED **EPCM planner for the H₂ process systems**

- Basis of design
- Pre-engineering
- Basic engineering



Source: <https://www.geoport-hro.de/>



Source: Rostock EnergyPort cooperation GmbH

Industrial combined heat & power plant

Test hydrogen co-combustion on existing gas turbine

TESTS BY ENGIE LABORELEC

LOCATION Antwerp – Lanxess site

PERIOD 2021

- TEST **H₂ blending on existing LM6000 gas turbine**
- Gradually increasing the H₂ concentration from 2.5% to 25%
 - Hardware does not suffer, no additional maintenance is necessary
 - Efficiency and power output remains stable
 - CO₂ emissions resulting from this combustion goes down by 9%
 - NO_x emissions increases as expected. However, by modulating the combustion complete neutralization with H₂ concentrations of up to 10%

Gas fuel mix with up to 25% hydrogen in an SGT-600 gas turbine is safe and requires no hardware modification



Let's get in touch!



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