Storing vital products with care

Hari Dattatreya
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Vopak’s meaning to society

Storing vital products…
• The world’s population is increasing
• Vital products like energy, food and chemicals are in growing demand

… with care
• Through our global network of terminals, we connect supply and demand
• We ensure safe, efficient and clean storage of these vital products and reduce our impact on the environment
Vopak at a glance

Full year 2019

Market capitalization
In EUR billions
6.2

Number of employees
In FTE
5,559

Total Injury Rate (TIR)
In 200,000 hours worked
Own personnel and contractors
0.34

84% 16%
Global presence

- Hub terminal
- Terminal

Locations:
- Rotterdam-Antwerp region
- Fujairah
- Houston
- Singapore Strait
Our independent position

We never own the product we store.

We don’t compete with our customers.

Our shareholders are not related to the chemical or oil market.

We are stock listed and transparent.

We give open access.
Energy transition

For new energies, we focus on 4 market segments: hydrogen and CO2 storage, new feedstocks, flow batteries.

We can help speed up the energy transition with our knowledge of infrastructure & supply chains and our global network.

Our 3 lines of action

Reducing our environmental and carbon footprint

Facilitating the switch to lighter fuels and feedstocks

Developing infrastructure solutions for new energies

Solar powered storage

LNG as bunker fuel

Hydrogen

Storing vital products with care
New energies strategy

- Hydrogen
- Carbon Dioxide
- Redox-flow batteries
- Green chemistry
Logistics for renewable energy

**Electrons**
- Convert e⁻ to H₂

**Molecules (H₂)**
- Convert H₂ to e⁻

**Storage e⁻ in battery**
- Lithium battery
- Lead acid battery
- Flow battery
- Graphene battery

**Other storage pathways**
- Compressed air
- Water
- Kinetics

**Storage and transport H₂**
- Liquid, Compressed gas
- LOHC (DBT, Toluene, FA)
- Boron (NaBH₄)
- Ammonia, MeOH

**Use for**
- Mobility
- Heat
- Feedstock
Future logistics for hydrogen carriers
Existing or new infrastructure, dependent on H2 carrier

Electrolysis
H₂ → Capture installation → Storage of carrier → Shipping of carrier → Storage of carrier → Release installation → H₂

Steam Methane Reformer
Carbon capture and storage
Innovative hydrogen logistics
H-vision: \( \text{H}_2 \) as low-carbon energy source for the Rotterdam industry

Enabling
- reuse of refinery fuel gases
- use of low-carbon hydrogen as a fuel for the industry (gas/RFG + CC(U)S)
- transition to green hydrogen
- hub creation
Future CO$_2$ flows

Development of CO$_2$ storage

→ to support CCS
→ to support CCU
→ to develop hydrogen markets & infrastructure ("blue hydrogen")

Many initiatives
Only 17 large-scale CCS facilities in operation, mainly in US
Feedstock decarbonization
Tanks as batteries
Flow batteries store electricity as liquid and gas bulk

Development of large-scale batteries using standard tanks (25MW and 250MWh)
- One tank for hydrogen & one for hydrogen bromide
- Can store and release electricity

This battery is modular and can be scaled up in
- Power → change or add membranes
- Capacity → add tank or scale up tank

Markets to serve:
- Store overcapacity of wind energy
- Peak shaving
- Short- and long-term storage of electrons
- Trading
Challenges going forwards

- Technology readiness
- Partnership development
- System innovation
- Public acceptance
- Attracting talent
- Economic viability
- Timeline
- Political choices & regulations
- Funding