Sweco

SWECO

TRANSFORMING SOCIETY TOGETHER

HYDROGEN – THE COMPLETE VALUE CHAIN

2024-06-12

Europe’s leading engineering and design consultancy

#1

On the European market[1]

2.5 GEUR net sales 2022

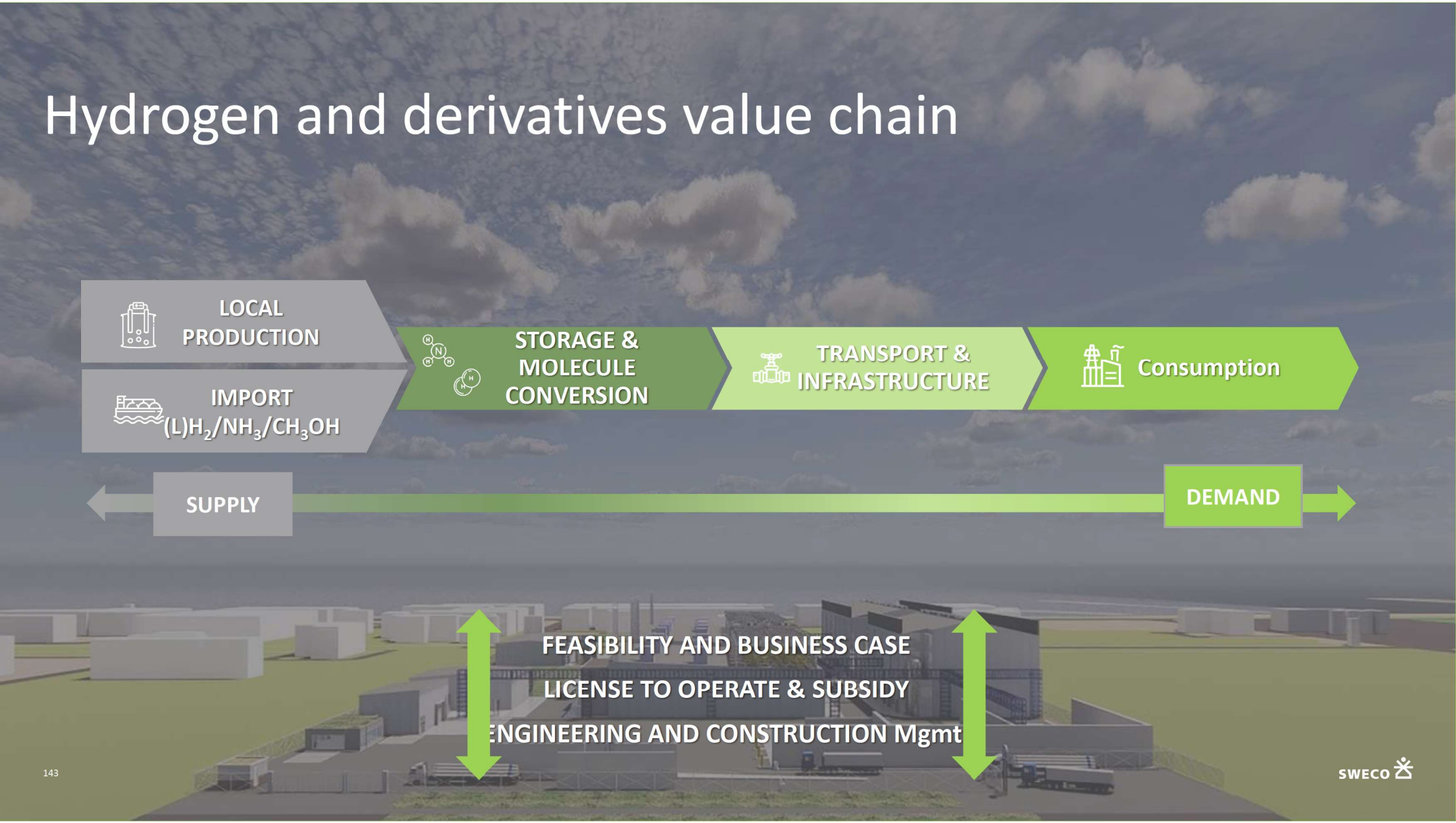
100 000+ projects in 70 countries

[1] Based on reported Net sales 2020, annual reports.

22 000

Full-time employees, with as many different perspectives

Hydrogen and derivatives value chain



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Local production
Understanding the local context is key
Regulatory framework and guided subsidies
Upscaling production capacity versus long lead items
Changing market approach for design & construction
GREEN HYDROGEN PLANTS FOR OUR FUTURE ENERGY
VOLTH2, STORM, VIRYA, GASUNIE, ENECO

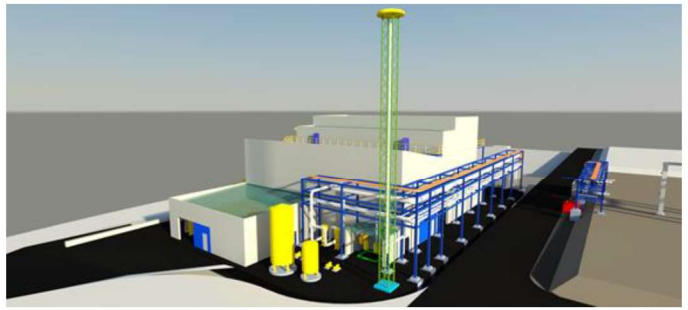
VoltH2: Concept & permit
Green Hydrogen Production Plant

- **Subject:** Concept study, permit and subsidy
- **Topics:**
  - Mass- and energy balances
  - Process & equipment technology and lay-out: electrolyser, cooling, compression
  - H2 and O2 infrastructure and supply to market
  - Electrical installation and connection
  - Heat integration
  - Masterplan lay-out
  - Infrastructure & logistic concept via tubetrailers
  - Environmental impact evaluation
  - Civil construction and safety design
  - Impact capacity on storage and injection in pipeline possibilities
  - Building & environmental permitting
  - Application SDE++ subsidy
- **Period:** 2021-ongoing (permit & subsidy granted)

Feasibility and concept study AQUARIUS PROJECT – Inovyn Norway

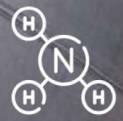
- **Feasibility Study**
  - 30% cost estimate for a 20 MW electrolysis plant (WEP) based on alkaline technology
  - Evaluation building and containerized solution
  - Evaluation of a new hydrogen compressing plant composed out of a hydrogen buffertank and compressor package
  - Evaluation of a hydrogen Trailer Filling Plant consisting of loading bays and its infrastructure
  - Period: 2022

- **Concept Study – FEL 2**
  - 20% cost estimate
  - Evaluation of Alkaline versus PEM
  - Period: 2023



Import of hydrogen

Cost efficient transport mode is key

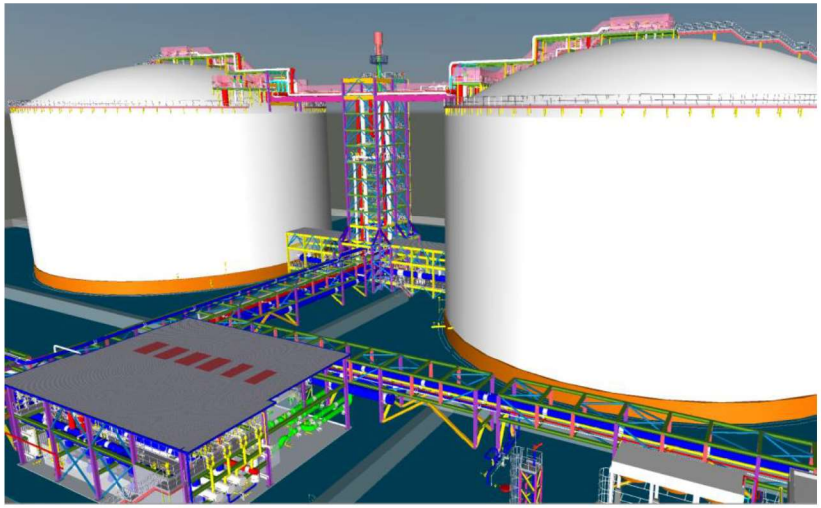


- Cooperation and development in export countries
- Transport mode vs conversion vs efficiency
- Technology readiness level

TERMINALLING TRANSITION MOLECULES IN HARBOURS

Concept study Ammonia Terminal - Belgium

- **Concept study**
  - Ammonia unloading terminal, storage facility and distribution network
  - Evaluate feasibility of green ammonia terminal to result in **+-30% TIC estimate**
  - Unloading cryogenic ammonia from sea going vessels along jetty
  - Distribution through rail car tankers, pipelines, barges and cracker unit.
  - Boil-off gas reliquification, vaporisation, glycol/water fired heating, dock water heating and cooling
- **Challenge**
  - Scale of the project: safety distances and containment of ammonia
  - Dual use design (LPG as well)
- **Period:** 2023



Source: New ammonia import & export terminals - Ammonia Energy Association

Infrastructure for distribution

Timing and permitting are key

- Constructability in a dynamic and complex environment
- Environmental impact versus repurposing
- Open access network versus quality

UNDERGROUND LONG DISTANCE PIPELINES

Fluxys

Hydrogen Backbone Cluster Antwerp - Fluxys

- **Purpose:** This project is the first step toward the development of an open access transport network for hydrogen in the Port of Antwerp and its surroundings. The project is divided into 7 different sub-tracks and has a **total length of 38 km**. Considering the service life of a pipe, the pipes need to be **multipurpose** and need to be able to transport both natural gas and hydrogen
- **Sweco's assignment:** Study for the construction of multipurpose hydrogen transport pipelines in the port of Antwerp
  - Sweco also has the assignment for the construction of a cooling water track in its portfolio. This partly follow the same trajectory as the hydrogen backbone
- **Period:** 2023 - 2024
- **Services:** project management, feasibility study, predesign, detailed design, EIA study, transportation and environmental/building permit, tender phase, safety coordination