Low carbon hydrogen supply chain

Maritime Conference, Floro, September 18th, 2019

Charline Dubois, Business Development Manager

Floro, Norway
60 years of development in Hydrogen for our customers

Production & Supply chain

- Production
- Supply-chain (GH2 / LH2)

Distribution Networks

- US Gulf Coast
- Northern EU
- Singapore

Markets Segments

- Process industries
  - Oil & Gas
  - Steel, Glass
  - Electronics

Space Transport

14 bn m3 / yr
AL - Electrolyser scaling up

HYBALANCE One of largest PEM
In operation

1,25 MW

< 2017

more than 30 electrolyzers in operation worldwide
usual range: 50 - 100 Nm³/h H₂
Mainly Alkaline technology

ONSITE

BECANCOUR Largest PEM project
Under execution

2019

2018

2018

2019

1,25 MW

20 MW

Air Liquide signs long-term power purchase agreement for renewable electricity

Air Liquide invests in the world's largest membrane-based electrolyzer to develop its carbon-free hydrogen production

Hydrogenics announces $20.5m private placement and technology partnership with Air Liquide

Hydrogenics announces $20.5m private placement and technology partnership with Air Liquide

Scale up Preparing the next step

100 MW+
A complete & integrated low carbon solutions portfolio

Air Liquide joins innovative large scale Carbon Capture and Storage project in Norway

Cryocap™
CO2 cold capture system

- Design and build Group’s industrial gas production units
- Solution oriented towards our gas customers
- Plant life-cycle optimization
- Supporting operations
H2 for mobility: already a reality worldwide - AL Examples

**Key Elements**

- > 100 HRS built worldwide
- > 40 HRS* for FCEV (controlled by AL)
- > Member of 2 consortia developing HRS networks, each time with 25% of 80-100 HRS

**Americas**

- Mobility for **Professionals**
  - US+EU
  - 2013-2017
  - 9 sites

- Mobility for **Consumers**
  - US North-East
  - 2015
  - 12 HRS + Supply chain

- Mobility for **Consumers**
  - California
  - 2014-2018
  - 5 HRS
  - 30 tpd LH2 plant

**Europe**

- Mobility for **Consumers**
  - Paris
  - 2015-2018
  - 4 HRS

- Mobility for **Consumers**
  - Germany
  - 2014
  - 27% of 100 HRS

**ME - Asia**

- Mobility for **Consumers**
  - Japan
  - 2014-2017
  - 6 HRS
  - 25% of 80 HRS by 2021

- Mobility for **Consumers**
  - Dubai HRS
  - 2016

**5 Startups**

* HRS: Hydrogen Refuelling Station
Let’s scale up!

Contacts:

**Alexandre Nordvik** (Nordics)
Business Development Manager
alexandre.nordvik-sc@airliquide.com
+47 932 53 415

**Charline Dubois** (Europe)
Business Development Manager
charline.dubois@airliquide.com
+33 6 30 02 95 06
Developing our skills in the operations of PEM electrolyser

1,25 MW

In operation

Hybalance plant, Hobro, Denmark

20 MW

In execution

Becancour, Canada: the world’s largest membrane-based electrolyzer
Key drivers for investments in low carbon H2 production

- Serving growth markets ⇒ **develop new H2 markets**
- **Clear long term** framework for environmental attributes
- **Level playing field** between alternative pathways taking into account the different objectives
- **Phased** approach: aligning environmental and economics