



HYDROGEN ACTIVITIES OF TOTAL GERMANY

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HYDROGEN ACTIVITIES OF TOTAL DEUTSCHLAND (TD): LONG-TERM INVOLVEMENT WITH CLEAR OBJECTIVES

In 2002 TD started H₂ activities with a first station delivering gaseous hydrogen to the BVG Busses (Berlin public transports)



objectives



- **Analysis and evaluation of distribution technologies and operation of Hydrogen Refueling Stations (HRS)**
 - **Monitor technology**
 - **Contribute to technical improvements**
 - **Gain experience through day-by-day operation of HRS to increase internal know-how**
 - **Evaluate cost structure (CAPEX and OPEX)**
 - **Study consumers behavior (customers expectation)**
- **Create and/or improve relationships with automobile OEMs**

HYDROGEN EXPERIENCE FOR MORE THAN 10 YEARS

Hydrogen Stations of TOTAL

2002: Berlin



2008: Ruisbroek



First TOTAL H₂ station

Test unit supplying the first H₂ busses in Berlin in a bus depot of the Berlin public transport (BVG)

First public H₂ station of TOTAL combined with a conventional station

First self-service station for cars and buses; the world's most frequented HRS

2006: Berlin



2010: Berlin



Shared investment with Statoil and Linde

TOTAL Station with on-site electrolyzer communicational hot-spot for hydrogen

2006: WM



2011: Hamburg



H₂-Upgrade of an existing station

Test for subsequent integration of H₂ during conventional site is fully operational

2007: München



2011: Berlin



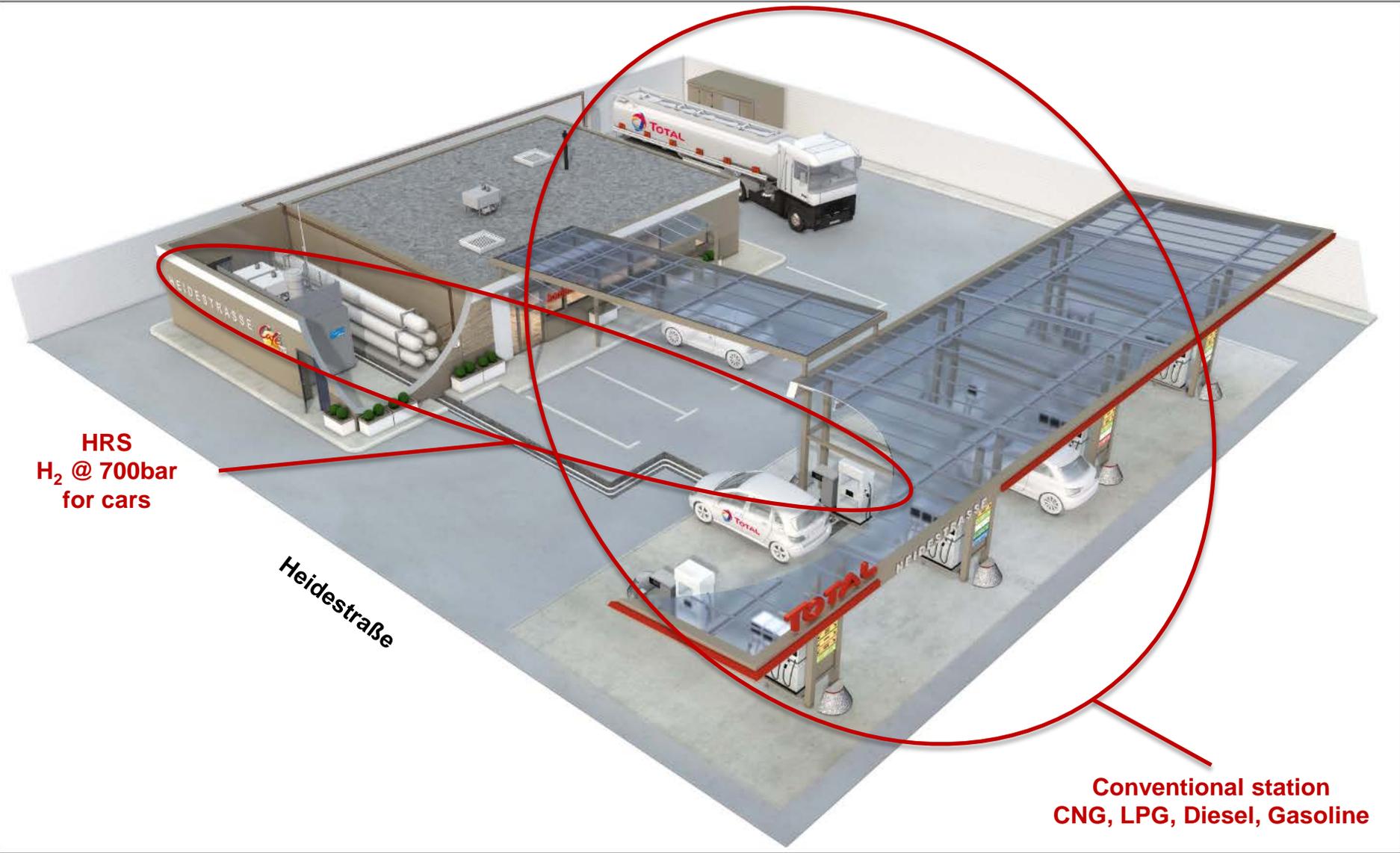
HRS fully integrated in conventional station with new corporate design

Gas station offers all kind of products (CNG, conventional fuels, LPG, H₂)



EXPERIENCE WITH PERMISSION PROCESS OF TOTAL HRS

TOTAL-HRS: HEIDESTRASSE IN BERLIN, GERMANY



**HRS
H₂ @ 700bar
for cars**

Heidestraße

**Conventional station
CNG, LPG, Diesel, Gasoline**

PERMISSION OF TOTAL-HRS HEIDESTRASSE, BERLIN

1 Application



- Expert's opinion (Technical Inspection Agency)
- CE certificate for HRS container
- Construction (including fire protection plan)
- Operation
- Additional (e.g. Water Resources Law)

2 Installation



- Approval for construction
- Approval for operation
- Explosion protection (ATEX, including documentation)
- Additional company requirements (e.g. crash sensor in Dispenser)
- Commissioning certificate (Technical Inspection Agency)
- Commissioning by local authorities
- Involvement of fire brigade

3 Operation



- Company guidelines (e.g. filling procedure)
- CEP-Commissioning of refueling protocol (SAE J2601)
- Training of operator
- Customer training
- ...

EXCURSE/ADDITIONAL: EXISTING INTERNATIONAL STANDARDS AND REFERENCES

EC-wide regulation and permitting framework

- ...

Gaseous hydrogen refueling stations

- ISO/TS 20100 (IS in preparation)

Dispenser testing/acceptance

- ISO 20100 IS in preparation
- CSA NGV 4.1 in preparation

Hydrogen production

- ISO 22734 Electrolysers
- ISO 16110 Fuel processing technologies

Stationary storage of hydrogen

- [ISO 15399 in preparation]

Hazardous area classification

- IEC 60079 - 10

Safety distances

- Local German regulations
- ISO/TS 20100 (IS in preparation)



Refueling procedure

- SAE TIR J2601

Refueling Safety

- ISO/TS 20100 (IS in preparation)

H₂ quality

- ISO/TS 14687 (IS in preparation)
- SAE TIR J2719

Refueling connection

- SAE J2600 (35 Mpa)
- SAE TIR J2799 (70 MPa)
- ISO/TS 17268 (IS in preparation)

Liquid hydrogen refueling interface

- ISO 13984

Hydrogen detection apparatus

- ISO 26142 (FDIS)

Hydrogen components

- ...

H₂ metering

- ...

Hydrogen fuel tanks

- ISO/TS 15869 – Gaseous H₂ fuel tanks
- ISO 13985 – Liquid H₂ fuel tanks

TOTAL'S EXPERIENCE

experience

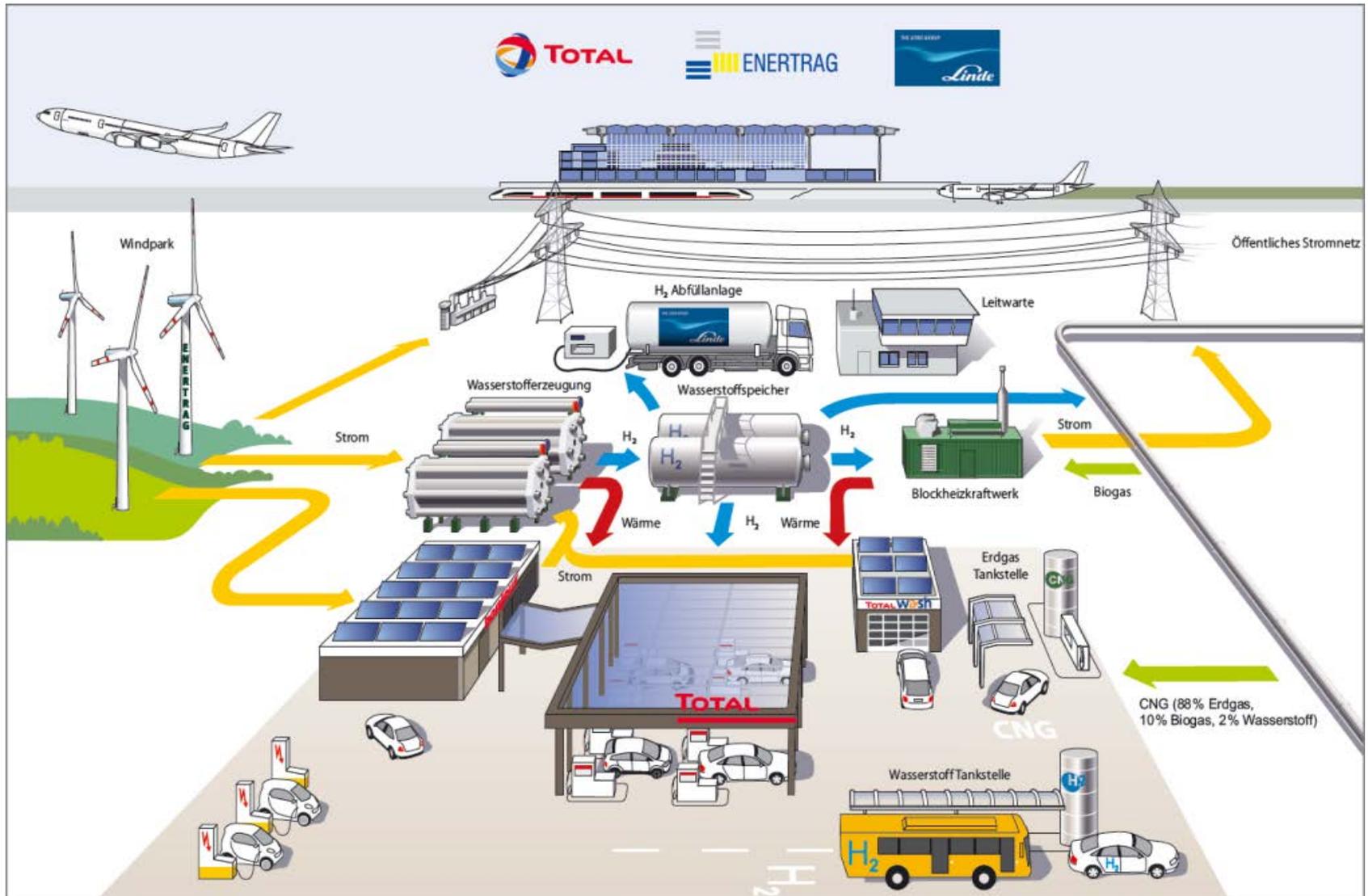


- Excellent collaboration with TÜV (Technical Inspection Agency) due to long-time cooperation (gained together experience for 10 years)
- Know-How of local authorities for HRS in Berlin
- Pre-communication, sensitization of local authorities before application
- Standardized integration in conventional business shortened application process
- Learnings:
 - Local authorities need to be as much informed as possible
 - Overall guideline for permission of HRS (DIN, EN or ISO) to feel comfortable with permission process → Acceleration of process
 - Communication between local authorities within Germany is inevitable
 - Exchange of experience in Industry (currently CEP)
- Commercialization, crucial open topics as:
 - Mesuring
 - H₂ quality sampling
 - Commissioning of refueling protocol of 700bar H₂ need to be solved (currently discussed within CEP).



UPCOMING PROJECT H₂BER

CO₂-NEUTRAL STATION @ BERLIN AIRPORT BER



THANK YOU!