

Air Liquide roadmap for Hydrogen Energy

Fuel Cells and Hydrogen Joint Undertaking (FCH JU)

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FCH technologies: market opportunity in a changing world

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Air Liquide: a commitment to H2E

- **Our Vision:** “our activities lie at the heart of the most important challenges facing the planet. To meet those challenges, Air Liquide develops innovative technologies and sustainable solutions, **optimizing the use of air and the planet’s natural resources**, enabling progress and preserving life”
- **A strategy** built around 5 growth drivers, of which Energy & Environment
- More than **40 years of experience in hydrogen:**
 - 200 hydrogen plants
 - > 1000 miles pipeline network & > 1000 hydrogen trucks
 - 7 billion Nm3 Hydrogen production, or 1.2 billion € sales
- Developments covering the **full H2 & FC supply chain**

Prepare tomorrow H2 energy economy



Horizon
Hydrogène
Energie

Through Early Markets

... Tomorrow, a sustainable
H2 energy for:

Transportation applications
Stationary

With

Less CO2 emission
Less dependency to fossil energy

Today...

Industrial infrastructures &
competencies

Prototype technologies

Demonstration projects

Costs

Rules, Codes & Standards

Social Acceptance



Horizon Hydrogen Energy (H2E) program

- Europe, 7 years 2009-2015
- Total budget: 190 million €
- Objectives:
 - ✓ Development of **competitive** solutions for hydrogen early markets
 - ✓ Fully **dedicated hydrogen supply chain**
 - ✓ **Commercialization** of global hydrogen energy offers



Markets

Stationary



Mobility



Technologies

H2 supply chain



Fuel cell systems



Supporting activities

Regulations



Social acceptance



Example 1: Market Off-grid sites

- Average power 2.5kw; 70% of the market
- European Market Size:
 - ✓ H2 penetration potential: 20%
 - ✓ 2,000 new systems per year by 2015
 - ✓ New Market value: 50M€ opex/year
- H2 advantages:
 - ✓ Low maintenance
 - ✓ Green at point of use
 - ✓ Achievable Competitive Total Cost Of Ownership
- Today's Air Liquide Product Offer: "NRG" container



Example 2: Market Specialty vehicles

- Captive fleet operations; simple infrastructure
- Power requirement 0.5kw-10kw
- European Market Size, example Forklifts:
 - ✓ H2 penetration potential: 10% (multiple units fleet)
 - ✓ 25,000 new H2 trucks per year by 2015
 - ✓ New Market value: 500M€ opex/year
 - *Excluding base mechanical truck*
- H2 advantages:
 - ✓ Autonomy & productivity between 10% to 20%
- Air Liquide Product Offer: H2 infrastructure



Air Liquide's ambition

Develop Hydrogen Energy solutions:

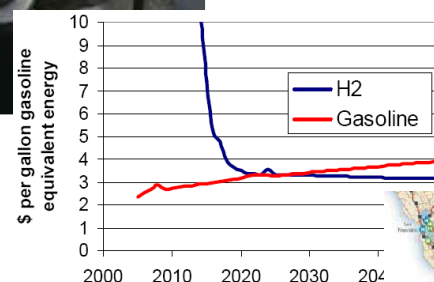
- *Green*



- *Safe*



- *Economical*



- *Available (infrastructures)*



*Need for additional technologies, codes & standards
and well-planned deployments*

Thank you for your attention