

Hydrogen: the sales market and methods of delivery

Tasks

- To define Consumers
- To develop methods of delivery
- To calculate the return on investments (payback period)

Hydrogen: the initial data

- Gas: hydrogen
- Specification /: H_2 99,99 %, H_2O 0,005%, O_2 0,005%
- The proposal volume: 1000 Nm^3/h
- Location of the manufacturing plant: town of Mikhailov (Ryazan region)
- Cost at the manufacturing plant: 50 rub./ Nm^3 (without filling, transportation, etc.)
- Payback period: not more than 5 years
- Geography of sales / within the European part of Russia

Hydrogen properties

Presence in the world

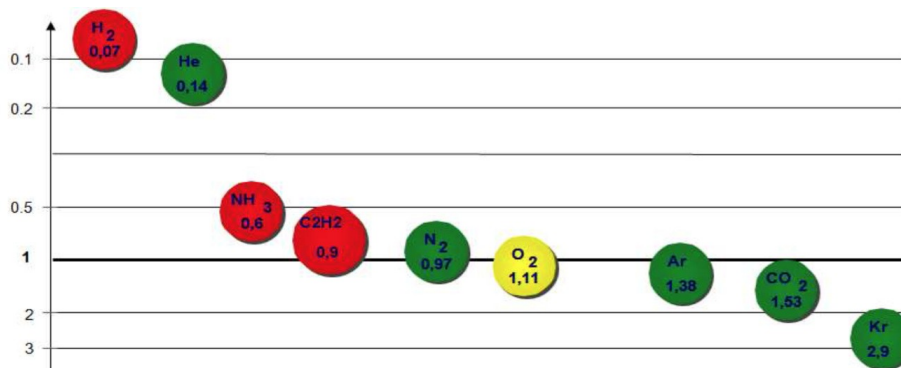
- The most common molecule in the Universe.
- The lightest of gases (14 times lighter than the air).

Physical properties

- The gas is without color and odor, it's not toxic. Flammable, causes embrittlement of materials..
- Quickly dissolves in the air.

Application

- Hydrogen is used as a chemical agent in various processes, including refining.
- It is used as combustible gas. For example, as rocket fuel, as well as a "clean" source of energy in fuel cells.



Liter	Nm^3	Kg
1	0,788	0,071
1,27	1	0,09
14,13	11,74	1

Key principles of application

Chemical properties

Removal of oxygen
Ability for hydrogenation

Flammable properties

The highest density of energy
- 1kg \approx 3kg of benzene
"Clean" combustion
- Water as a product of combustion

Hydrogen business of Air Liquide in the world

Experience

More than 40 years in industry
More than 10 years in fuel cells

Expertise

Technologies
Production and transportation

World infrastructure

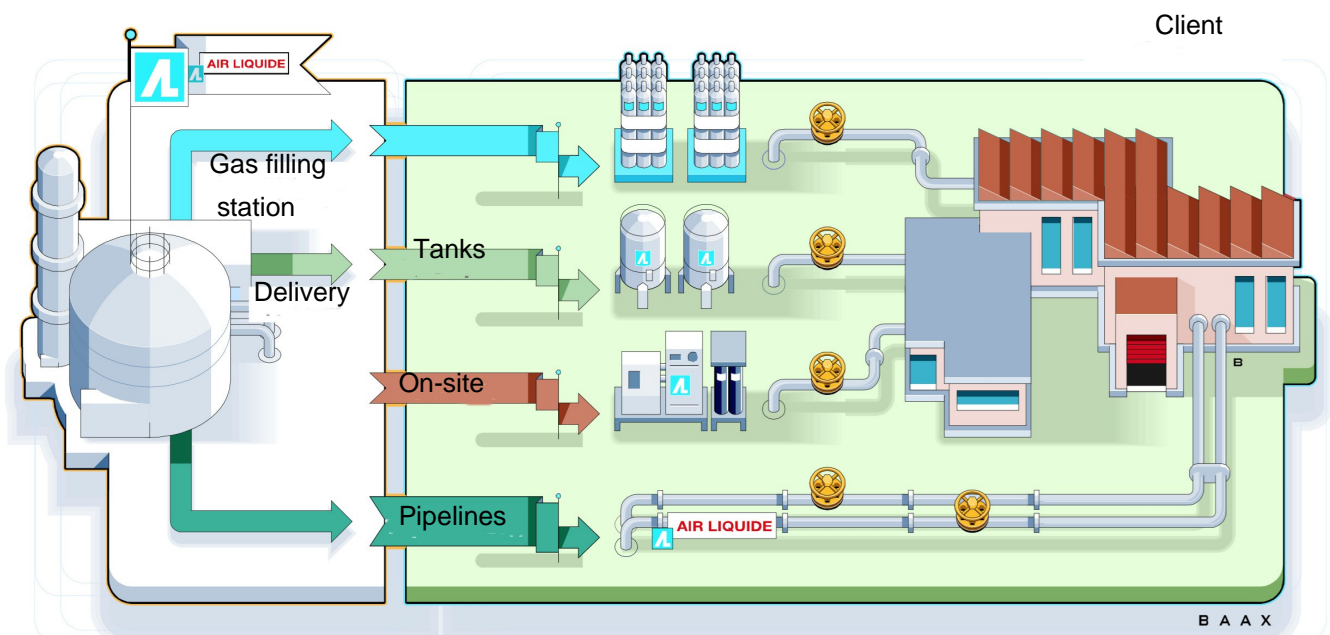
More than 200 hydrogen plants
1 800 km of pipelines in Europe, the USA
and Asia

Sales

1,7 billion
10 billion m³ of hydrogen produced

Air Liquide methods of hydrogen delivery

Gas filling station – Delivery – Tanks – On-site – Pipelines – Client



Hydrogen: to define consumers

To indicate for each consumer

- The company name
- Fields of hydrogen application
- Geographical location
- Volume of hydrogen consumption

(We are not going to estimate this value in terms of correspondence with the volume known to us).

Hydrogen: to develop methods of delivery

Description of the supply chain + equipment required for this purpose

- Hydrogen packing (tare)
- Ways of transportation
- Additional equipment for delivery

Hydrogen: to calculate the return on investments (payback period)

Return of investments

- Investments / expenditures (and their description)
- Revenue
- Volumes of sales
- The product price
- Profit
- Risks and their impact on profit

Hydrogen: evaluation criteria

Criteria for evaluation: 30%

- Number of potential Customers. *Justification of choice.*
- Number of fields of application. *Justification of choice.*
- Geography of the Customers' location.

Technical solution 30%

- Description
- Justification of choice
- Innovativeness

Economic justification 30%

- Number of revenue items
- Number of expense items
- Risks

Presentation skills 10%