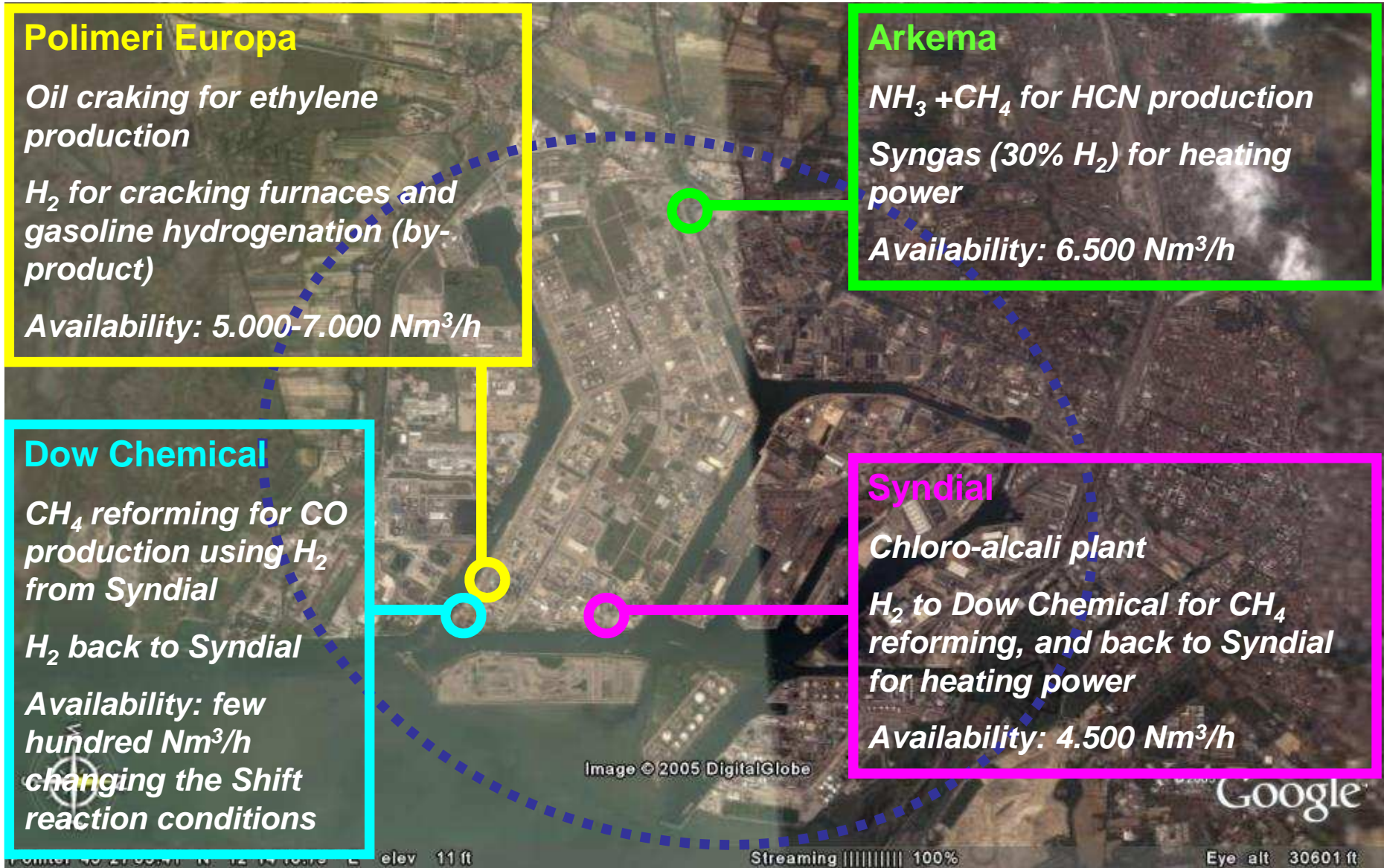


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PARCO SCIENTIFICO TECNOLOGICO DI VENEZIA  
VENICE GATEWAY FOR SCIENCE AND TECHNOLOGY

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# Hydrogen: a new resource for the Venice industrial area



**H<sub>2</sub> Production Plants**

	Syndial	Polimeri Europa	Dow Chemical	Arkema	TOTAL
<b>Availability</b> Nm <sup>3</sup> /h (H <sub>2</sub> 100%)	<b>4.500</b>	<b>6.000</b>	<b>(500)</b>	<b>6.500</b>	<b>17.000</b>
T (°C)	amb.	amb.	amb.	15	
P (bar)	2.5	27-34	15	1.7	
H <sub>2</sub> % (v/v) min.	99.5	90	---	16.9	
mean	99.97	96	99.95	31.4	
<b>Impurities % (v/v)</b>					
N <sub>2</sub>	0.02	1.0	0.015	56.2	
CO		0.2	<0.01	8.1	
CH <sub>4</sub>		2.8	0.02	0.3	
Ethylene		0.006		<0.01	
Ar				1.0	
H <sub>2</sub> O				1.0	
CO			0.015	1.0	



**H<sub>2</sub> Availability**

# HYDROGEN PARK

- **2003 - Consortium**
- **2005 - no profit Company**
  - 53% ENEL
  - 9% VEGA (Venice Science & Technology Park)
  - 9% Venezia Tecnologie
  - 9% Sapio
  - minor partners (EVC, Berengo, SAE Impianti, Unindustria)
- **Mission: to coordinate the activities for the utilization of hydrogen resources available in Marghera promoting and developing studies and projects.**

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Hydrogen Park

## Public Authorities commitment

- **March 25, 2005 - Agreement between Ministry of Environment and Veneto Region**
  - ... to realize a hydrogen district dedicated to experimental projects to be developed inside Marghera area ...
  - 10 M€ (5+5) funds
- **August 9, 2005 – Veneto Region Resolution**
  - call for projects (deadline: October 10, 2005)
  - 11 projects presented
  - total costs 36,6 M€

## **Industries commitment**

- **Hydrogen will be available at a price equivalent to the methane calorific value**

## Cofunded Projects (10 M€ on 20 M€ requested)

- Hydrogen Centre;
- Electric and thermal power generation with hydrogen obtained from biomass and other organic wastes;
- Zero emission cycles development with hydrogen combustion;
- Innovative technologies development for hydrogen and electric power production with coal and biomass use;
- Innovative storage systems for hydrogen;
- Heating and electric power micro-generation for persons/goods transportation inside/outside a plant;
- ~~Innovative PEM Fuel Cell prototype;~~
- Heating and electric power micro-generation for persons/goods transportation inside/outside a plant;
- Experimental activities to fit out a hydrogen “vaporetto” (the Venetian water bus).

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Projects

# Projects points of reference

Projects 2. 3. 4. 5.

ENEL 12 MW combined cycle  
electric power plant

(12.000 Nm<sup>3</sup>/h H<sub>2</sub> from existing chemical plants)

Project presented for Veneto Region approval on June 29, 2005

H<sub>2</sub> from coal gasification process  
considered

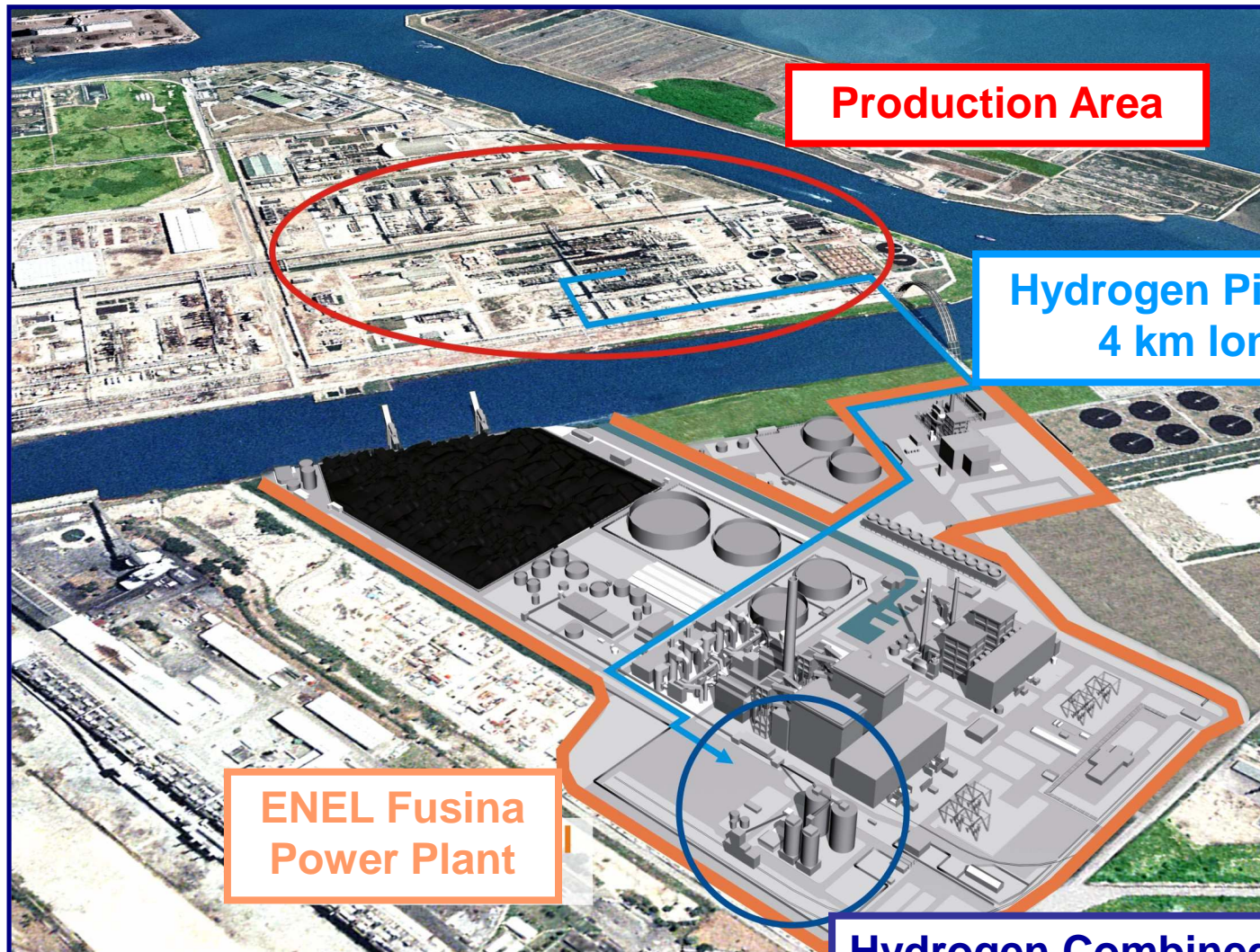
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Hydrogen Park



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H<sub>2</sub> Power Plant



**Production Area**

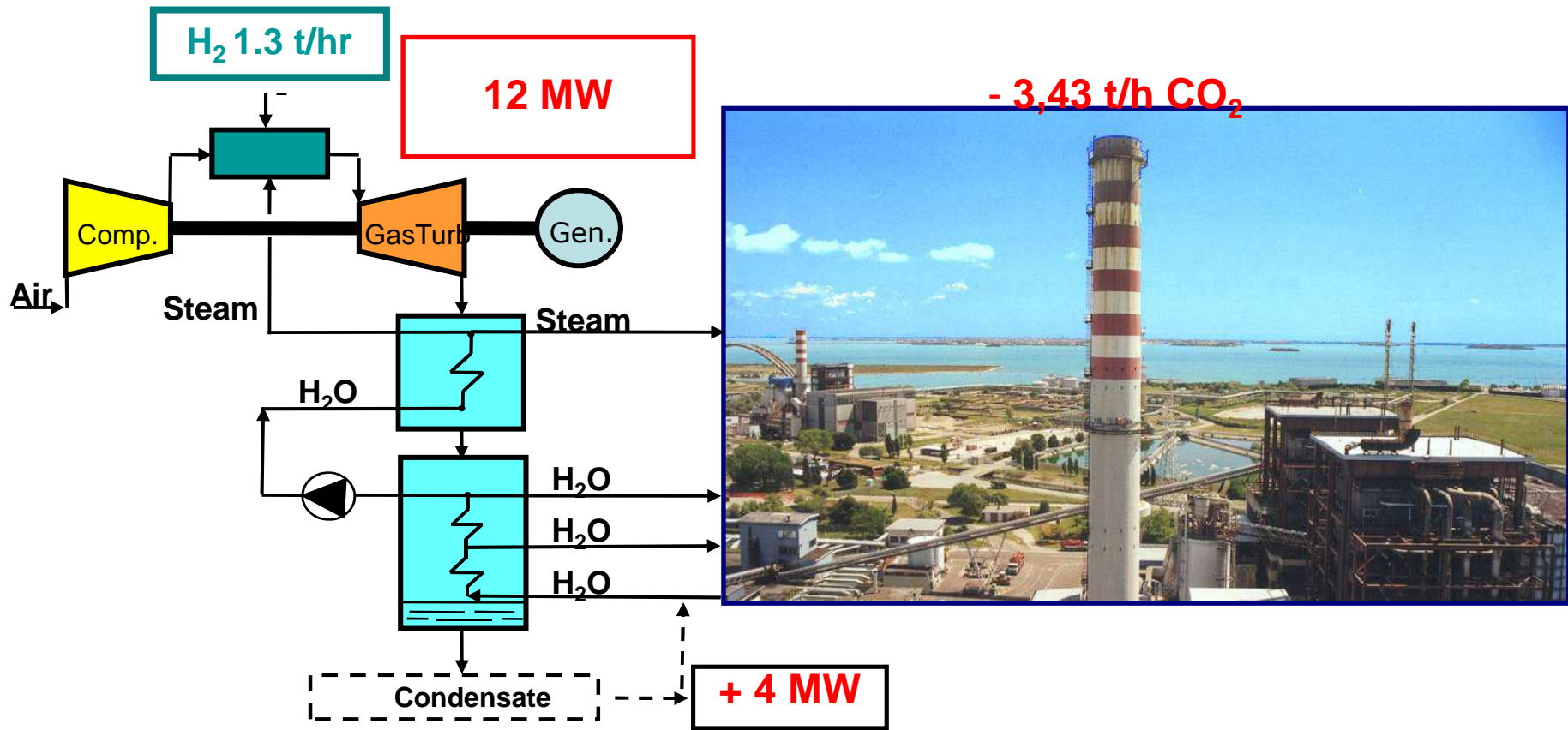
**Hydrogen Pipeline  
4 km long**

**ENEL Fusina  
Power Plant**

**Hydrogen Combined Cycle**

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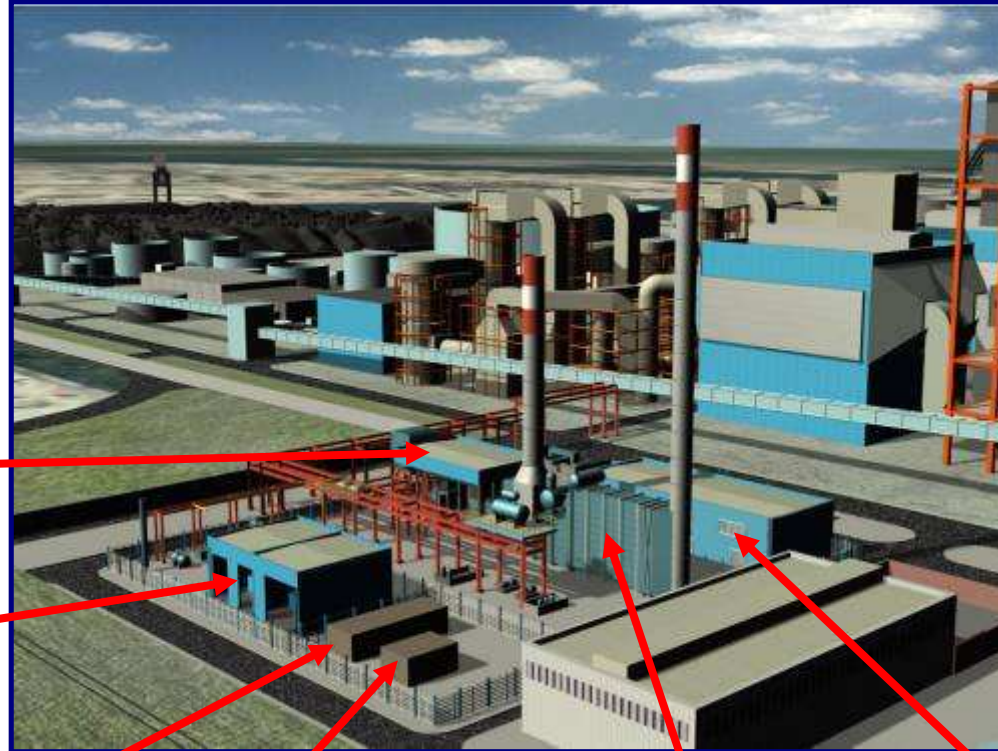
**H<sub>2</sub> Power Plant**



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H<sub>2</sub> Power Plant

# The principal components



Gas turbine

Hydrogen  
compressor

Materials test  
station

Hydrogen storage  
pilot plant

Recovery  
generator

Control Room

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H<sub>2</sub> Power Plant

# The Project development

## Combustion chamber set-up



Commercial use

- Hydrogen 59 million Nm<sup>3</sup>/year
- Produced power 60 GWh/year
- Saved CO<sub>2</sub> 17.000 t/year
- Plant cost 43.8 MEuro
- R&D costs 3.2 MEuro
- Engineering 46.000 hours
- Building manpower 100 units



**H<sub>2</sub> Power Plant**

# Most important technological innovations

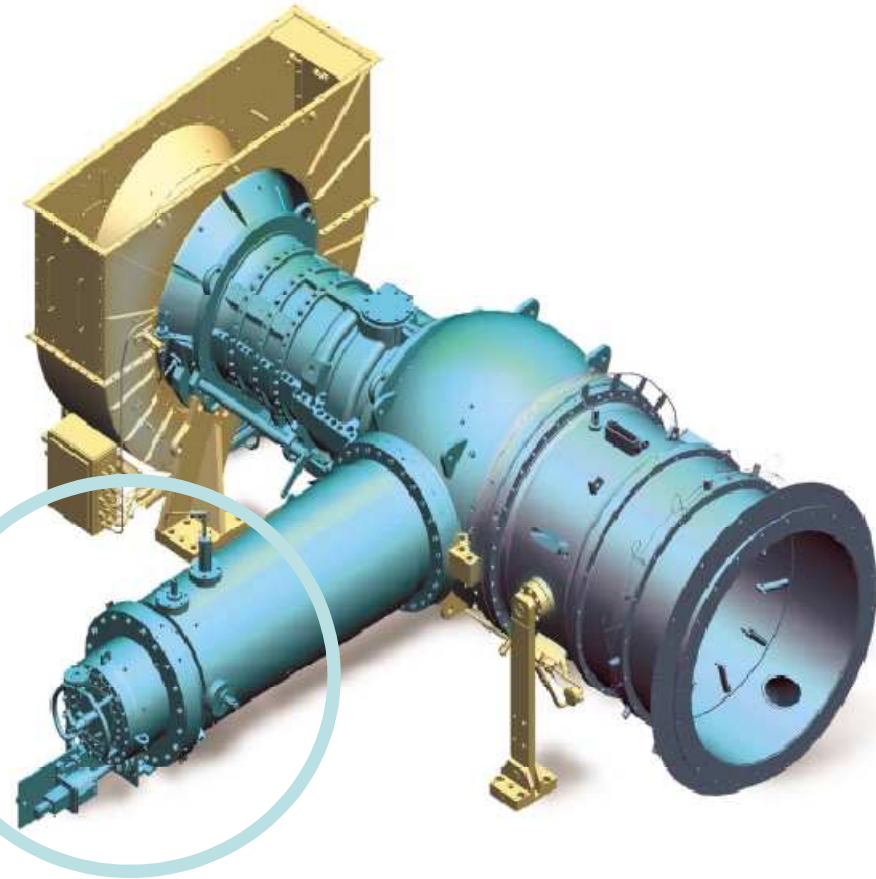
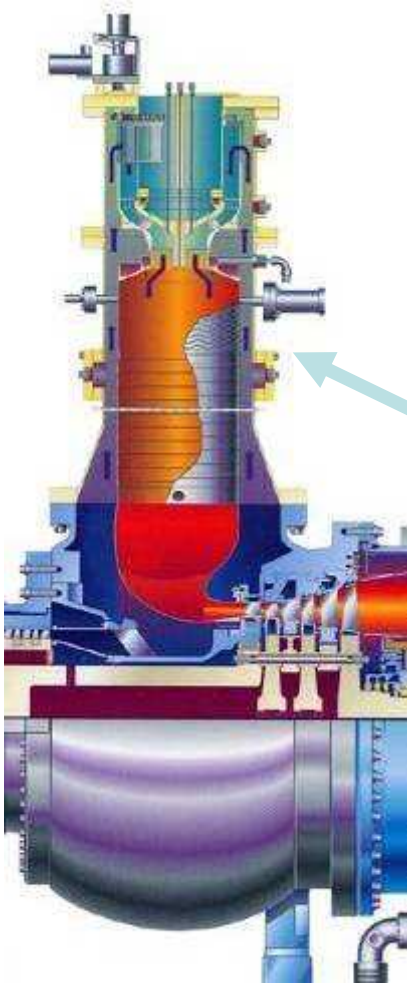


- Totally hydrogen feeded turbine
- Different methane/hydrogen mixtures possible use
- Very low NO<sub>x</sub> emission burner
- Innovative cycle with extreme energy recovery

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H<sub>2</sub> Power Plant

# The new burner



**GE 10 Nuovo Pignone**

**VEGA**

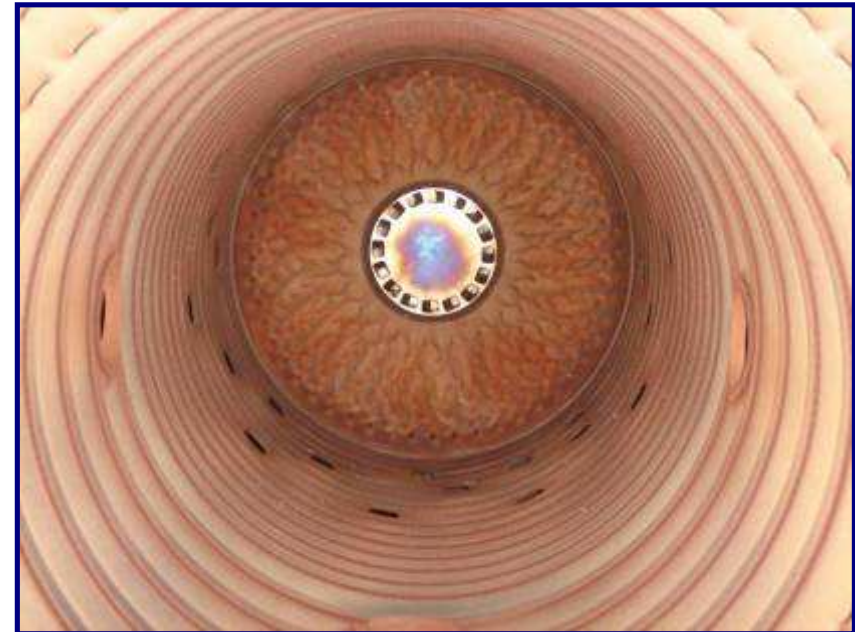
**H<sub>2</sub> Power Plant**

# The tests in Sesta



The front-end

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Combustion chamber  
TG GE10 STD

H<sub>2</sub> Power Plant