Hydrogen and FC technologies in Russia

Country Update

14th IPHE ILC-SC meeting

23-24 September 2010

Shanghai, China

Policy context

- Presidential Commission on Modernization and Technical development of the Russian economy

  - Innovative Energy Sector (additional funding for energy technologies, including hydrogen technologies)

- Energy Strategy 2030

  - improving energy & resource efficiency

  - increasing the share of REW (up to 4,5 %)

  - reducing negative environmental impacts

H2 and FC technologies as instruments for

- improving power supply (as portable and back up systems, systems for combined heat and power supply, for distributed customers and autonomous power supply in industry),
- increasing energy efficiency and environmental safety of power plants,
- increasing the share of renewables in the general energy mix,
- providing an efficient way of energy accumulation and thus balancing the irregularly distributed load in the energy systems.

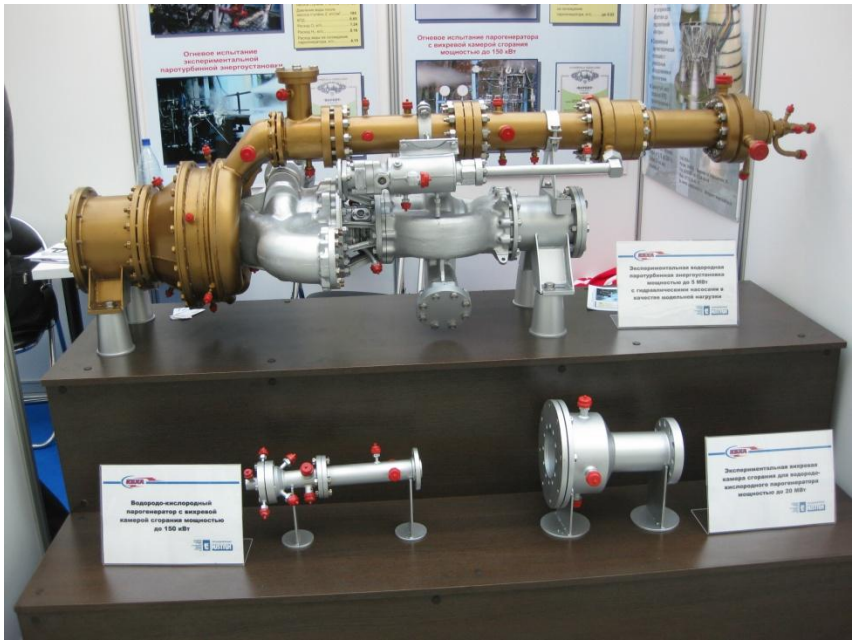
Key RDD areas

- Hydrogen production
- Hydrogen storage
- Hydrogen combustion technologies
- Hydrogen safety
- Fuel cells

Advantages of hydrogen steam generation technology

- ❑- Low cost of steam generators
- ❑- High temperature of steam with no practical limitations
- ❑- High efficiency of steam generators
- ❑- High efficiency of power units
- ❑- Upgrade of existing power plants
- ❑- Efficient load management while main power units are in the base mode
- ❑- Environmentally friendly
- ❑- Non-energy applications: H_2/O_2 steam generators can be used as sources of high temperature steam and steam-gas mixtures for variety of technological processes (solid fuel processing, syn-fuel production, biomass conversion, etc.)

$H_2\backslash O_2$ steam generator

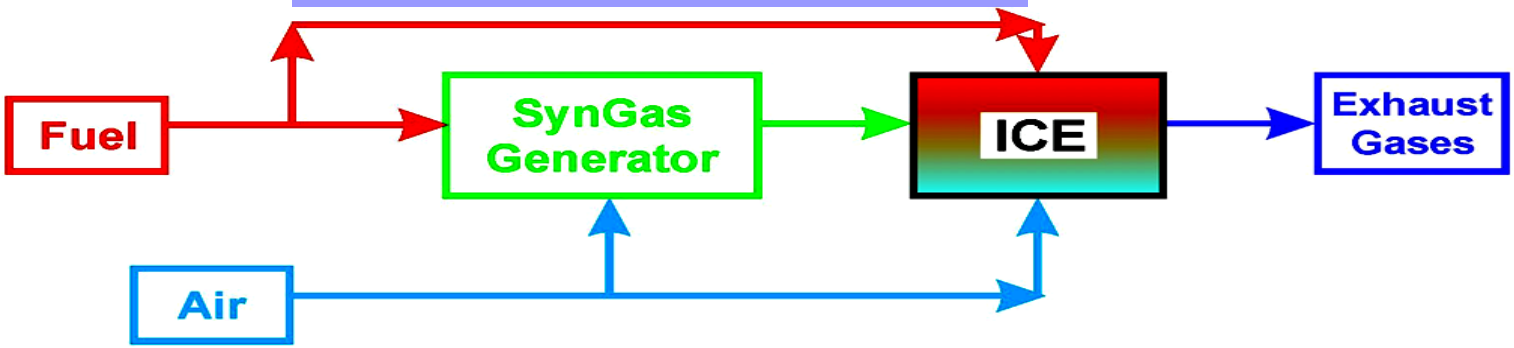


A model high temperature steam turbine unit with hydrogen-oxygen steam combustors of up to 5 MW capacity has been designed and tested by Joint Institute for High Temperatures and JSC “Chemical Automatics Design Bureau”. Currently demonstration project with hydrogen-oxygen steam generator integrated in turbine units is being prepared.

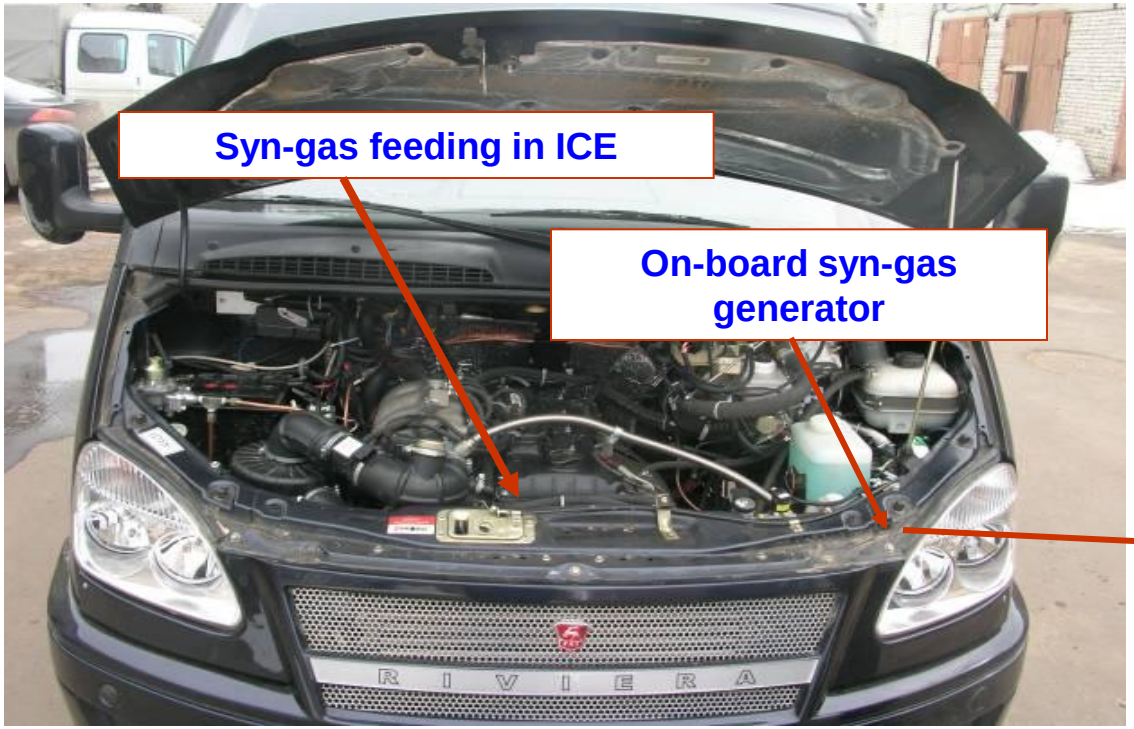
Syn-gas could make any vehicle green

Principal idea – to create conditions for stable engine operation based on mixtures with low content of fuel. The task is solved by adding hydrogen-rich gas (syngas) to fuel-air mixture supplied to the engine. The syn-gas is generated on-board a vehicle in a catalytic generator through air conversion reaction.

Scheme



Syn-gas generator on-board a minibus



On-board converter with nanostructured catalysts

Road tests: Moscow-St.Peterburg-Moscow and Moscow-Sochi-Moscow (4620 km)

Road Test Results (for a vehicle with on-board syn-gas generator)

Emission	Gasoline	Natural Gas	Natural Gas +Syn-gas	Euro-3 Standard (max)	Euro-4 Standard (max)
CO, g/km	1.56	1.92	0.81	5.22	2.27
CH, g/km	0.16	0.16	0.045	0.29	0.16
NOx, g/km	0.97	0.47	0.107	0.21	0.11
CO_2, g/km	308.0	232.7	200.4	-	-
Fuel consumption per 100 km	11.5 litre	10.5 m3	8-9 m3	-	-

Demonstration projects

- Institute of Innovative Energy (a branch of the National Research Center “Kurchatov Institute”) – a testing ground
- A pilot project “Ikebana” where hydrogen is used for energy storage and improving efficiency of power generation:

  - a variety of power sources (including REW)
  - electrolyzer
  - hydrogen storage system
  - power generation (including combustors)

Commercialization

Pilot production of SOFC based power units (with capacity 0,5 – 5 Kw) for stationary application at cathodic protection stations

The project – to be implemented on PPP principles (to be funded by JSC “Gazpom” and “Nanotechnologies” Corporation)

Contact points:

Ministry of Education and Science
of the Russian Federation
reutov-bf@mon.gov.ru