First hydrogen refueling station in Bulgaria - lessons learned

Assoc. Prof. Blagoy Burdin

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SCIENCE AND EDUCATION
FOR SMART GROWTH

HITMOBIL CENTER OF COMPETENCE

Technology and Systems for Generation, Storage and Utilization of Clean Energy

Goal and purpose:

- ✓ Establishment and development of a Center of Competence, focused on research, experimental development and knowledge transfer in the field of "Technologies and systems for generation, storage and utilization of clean energy".
- ✓ Unique infrastructure for development, testing, optimization and introduction of modern systems for mobility and energy storage at regional and national level.
- ➢ Infrastructure optimized to provide the possibility to carry out applied studies in both of their modifications - breakthrough and underpinning research.

HITMOBIL CENTER OF COMPETENCE

Technology and Systems for Generation, Storage and Utilization of Clean Energy

Structure:

- **Module 1: Industrial research** - module contrived as an incubator of innovations.
- **Module 2: Experimental development** - Involves pre-commercial proceedings with Technology Readiness Level (TRL) above 4, such as: scaling of laboratory prototypes, optimization of the regimes of industrial operation, testing and validation of pre-commercial systems for energy conversion and storage.
- **Module 3: Communications and transfer of knowledge -** ensuring efficient functioning and integration of the competence center as a broad range distributed research and development infrastructure.

…United in 6 Laboratories

Field Laboratory L6 "Integrated Energy Systems“

Designated area for the location of the facilities – 10 000 m2

Field Laboratory L6 "Integrated Energy Systems“

Main technological elements of the laboratory:

- Different photovoltaic panel technologies and layouts
- Wind emulator
- Different energy storage technologies
- Electric vehicle charging stations and **hydrogen refueling station**
- Battery electric (BEV) and **hydrogen electric (FCEV)** cars

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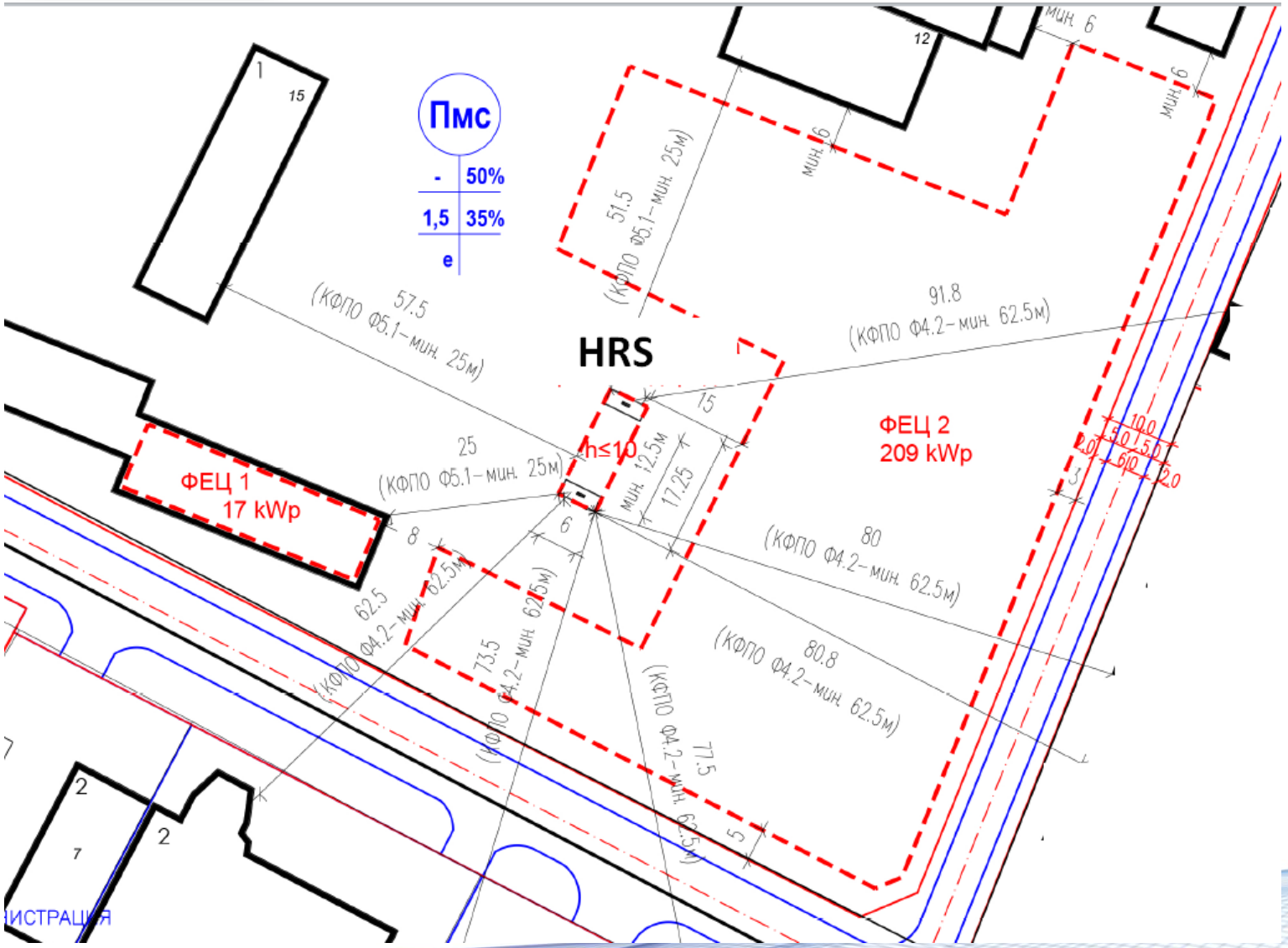

Distances from buildings and facilities.

- Lag of the word hydrogen in the regulations.
- In Bulgaria there are only distances for installations with hydrocarbons.
- HRS consume a lot of land because safety distances
- Concrete walls will increase the budget

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- **Photovoltaic power generation** - divided into 6 production plants, including different layouts, single-axis and dual-axis tracker systems, mono- and bifacial panels with total installed power 250kWp

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- Industrial energy storage technologies – Li-ion; Lead acid and Vanadium redox-flow battery storage systems with total installed capacity 1MWh

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- Hydrogen generation via PEM electrolysis
  - Hydrogen production: 4 Nm3/h (8,5kg/day);
  - Outlet pressure: 30bar;
  - Hydrogen purity: 99,9995%

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- Hydrogen refueling station
  - 20” container
  - Pressure: 350 bar; 700 bar;
  - Refueling time (vehicles) < 10min;
  - Hydrogen compression speed: ≈3,5kg/h
  - Hydrogen storage: up to 73kg at 550bars
  - Two inlets: <200bar; <300bar;
  - Certification trough ADR agreement as movable refueling station

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- The Hydrogen Refueling Station

Own electricity production via solar panels and respectively on-site green hydrogen production

Electricity

Electricity

Hydrogen

Lessons learned

- Plan very carefully
- All the consultants say they have experience (but in fact most of them don’t)
- Lag in regulations but local authorities are assisting (most of the times) when full and adequate information
- Use only proven technologies and companies in the beginning
- Don't buy cheap to save money
- All people getting used fast to the „dangerous“ hydrogen

Lessons learned

- Safety first - need for active and passive safety measures and periodic staff training
- PEM electrolyser is very useful in Demo projects
- Own production of electricity and green hydrogen is very useful for low system OPEX
  - High electricity price
  - Very high hydrogen price when buy from gas supply companies
- Don't try to convince everyone to become a supporter of hydrogen technologies

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Thank you for your attention!

Blagoy Burdin
Institute of Electrochemistry and Energy Systems
b.burdin@iees.bas.bg