Czech Hydrogen Technology Platform

# $H_2$ technologies in the Czech Republic
## Their representation by HYTEP

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Hydrogen Days, Prague

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# Content

- Energy situation in the Czech Republic
- Hydrogen activites in the Czech Republic
- Czech participation in European programs and visions
- is it a solely Czech problem or post-Soviet syndrome?
- HYTEP – Czech Hydrogen Technology Platform

# Energy situation in the Czech Republic


- CR is not only known for important technical inventions

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- CR is not only known for important technical inventions
- But also for a centralized and reliable energy system

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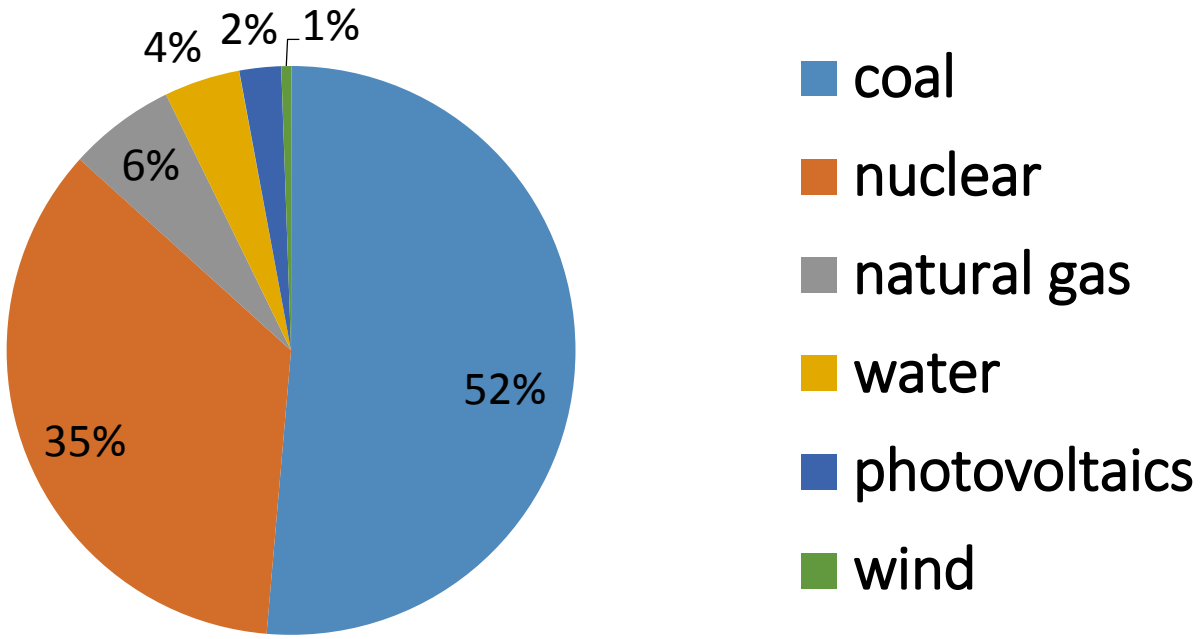
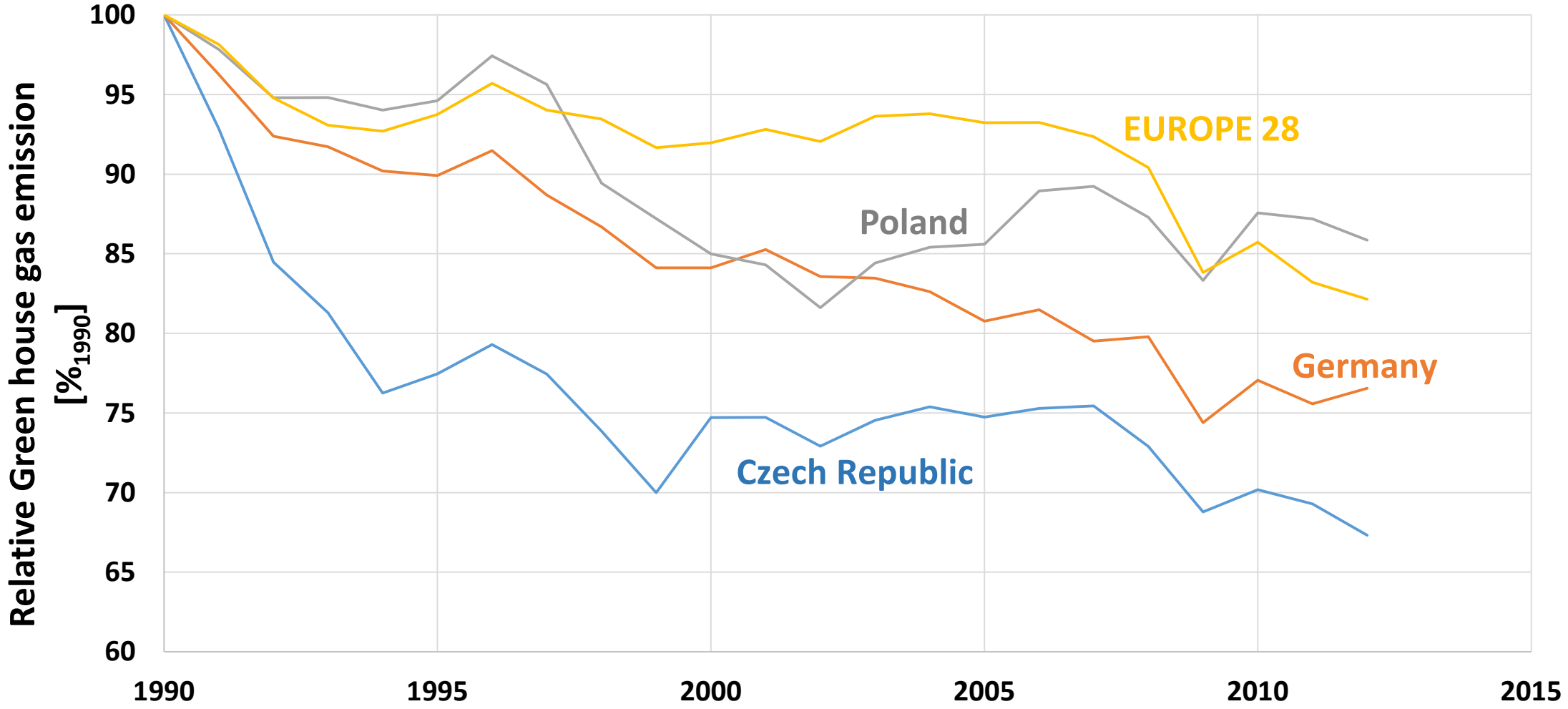
- CR is not only known for important technical inventions
- But also for a strong and reliable energy system
- Changes are necessary not only due to EU climate policy
- Goals in the national energy conception:
  - Reduction of $CO_2$ emissions
  - balanced energy mix
  - improved efficiency of energy systems
  - preserved stability and reliability
- So far no broad consensus how to reach these goals

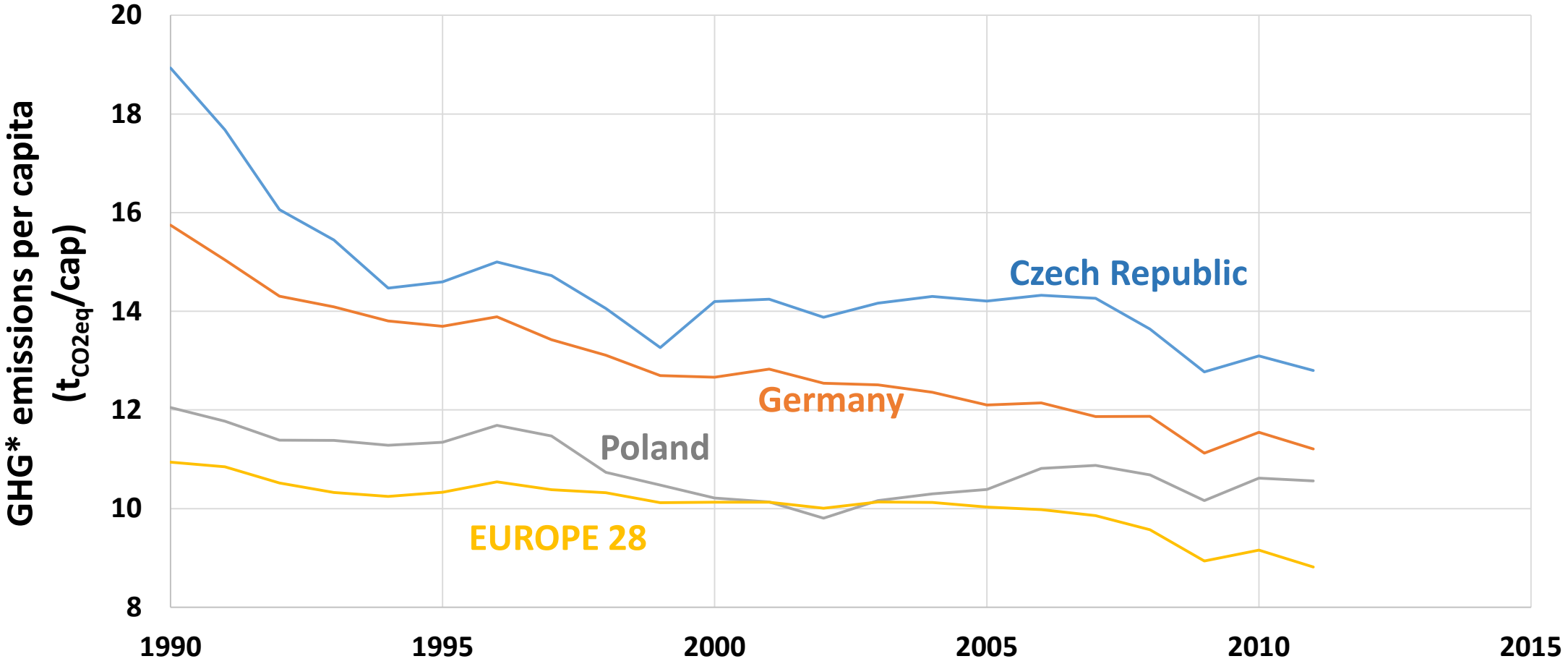
# Energy situation in the Czech Republic



# Energy situation in the Czech Republic



# Energy situation in the Czech Republic




*GHG: green house gases

# Hydrogen activities in the Czech Republic

Successfully finalized projects in CR

- TriHyBus
- Hydrogen filling station, Neratovice
- Solid oxide steam electrolyzer SOSE
- Autarkic system
- Platinum free novel electrocatalyst
- Other research projects

# Hydrogen activities in the Czech Republic


Project Part-Financed by the European Union

European Regional Development Fund

# Hydrogen activities in the Czech Republic

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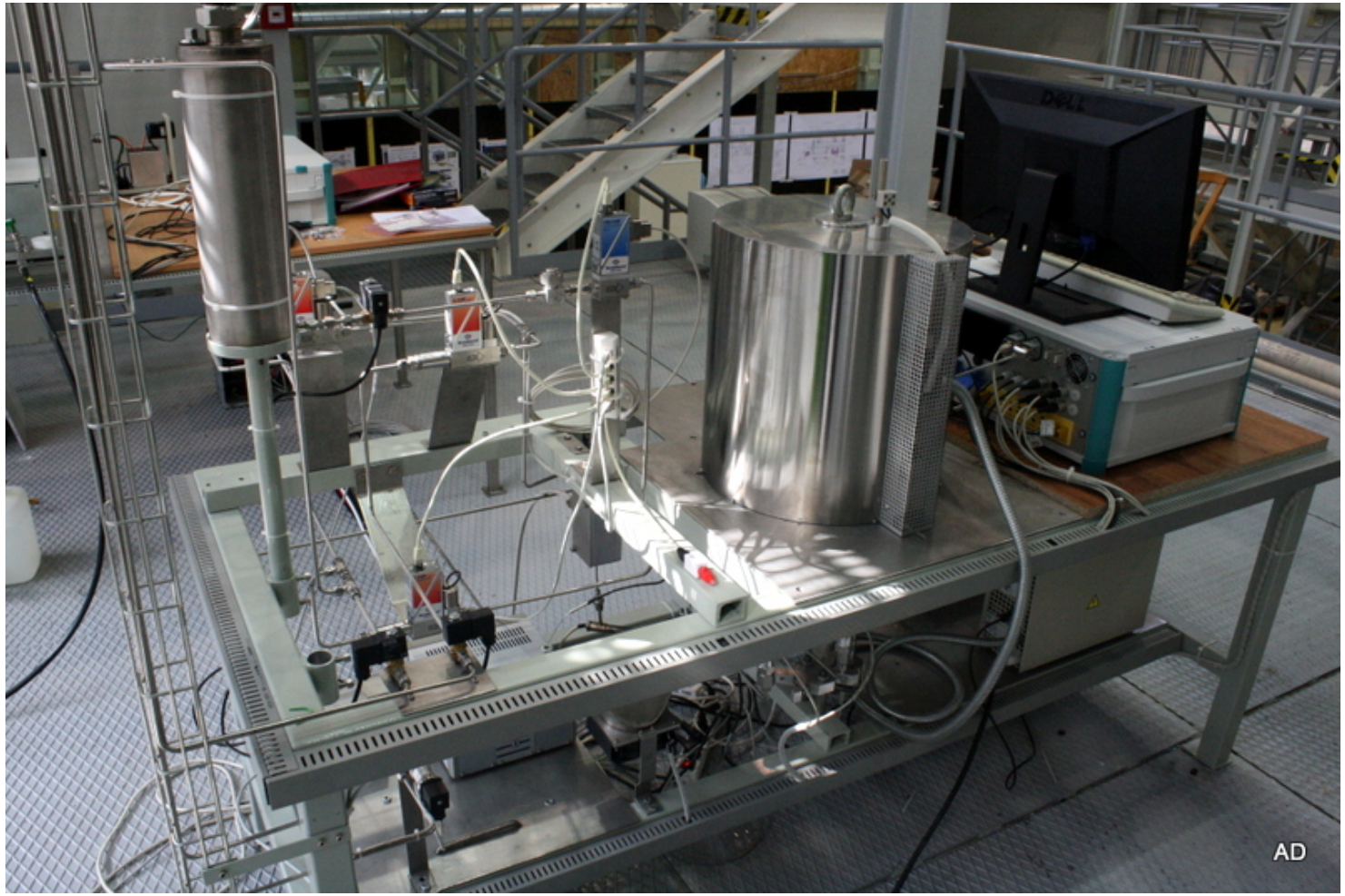
## Hydrogen filling station in Neratovice

- Hydrogen, pressurized to 40MPa
- Refilling time 10 min
- Supplier Linde Gas

# Hydrogen activities in the Czech Republic



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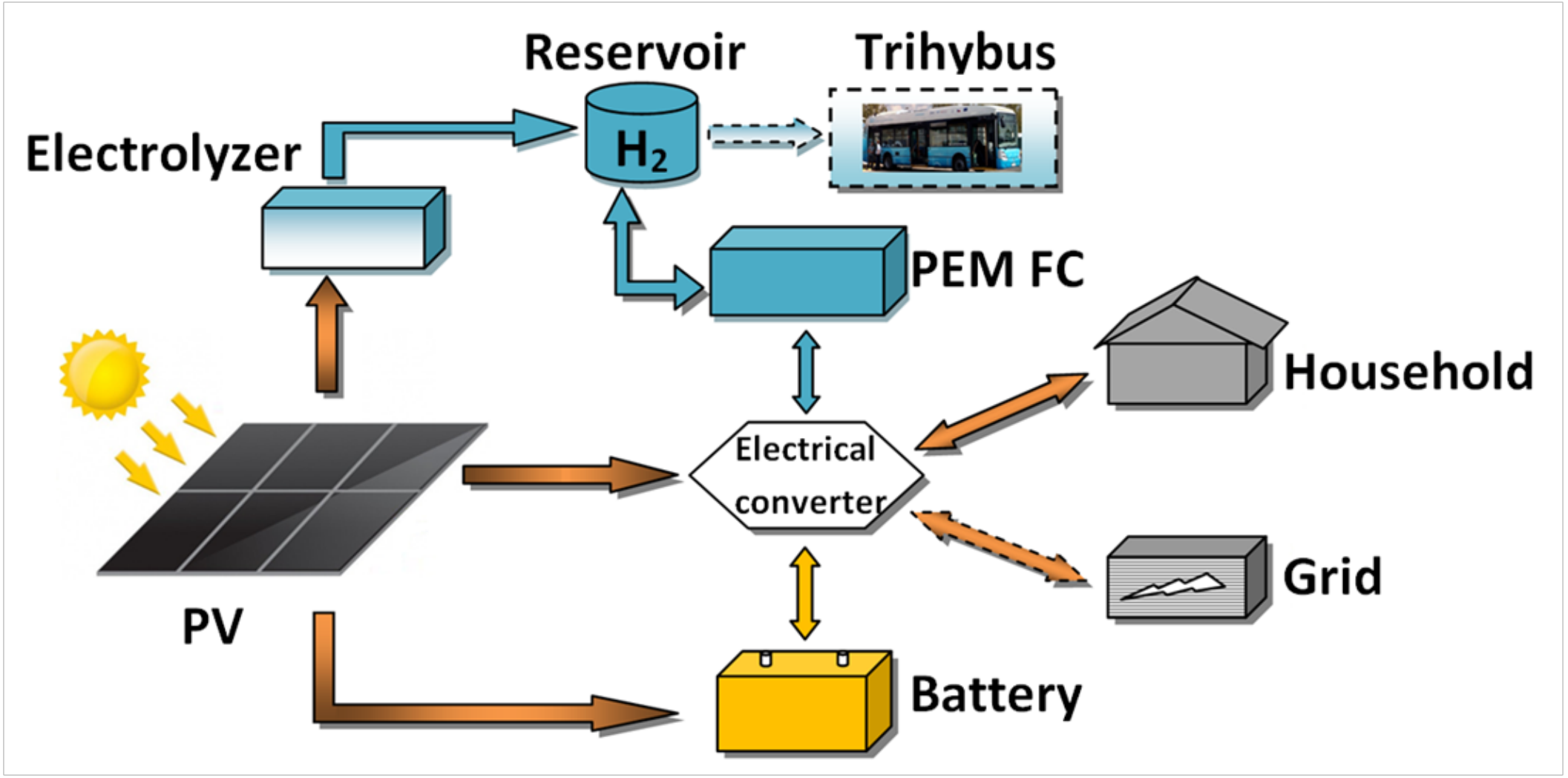


# Hydrogen activities in the Czech Republic

PHOTON ENERGY

# Hydrogen activities in the Czech Republic

# Hydrogen activities in the Czech Republic

Alkaline electrolyzer

# Hydrogen activities in the Czech Republic

Perspectives

- Increase of research capacities and infrastructure (SUSEN, NT VC Plzeň)
- Gradual reorientation - basic vs. applied research
- Role of the national strategy and public funds
- Role of the industry
- Increased significance of the European integration and support – various aspects

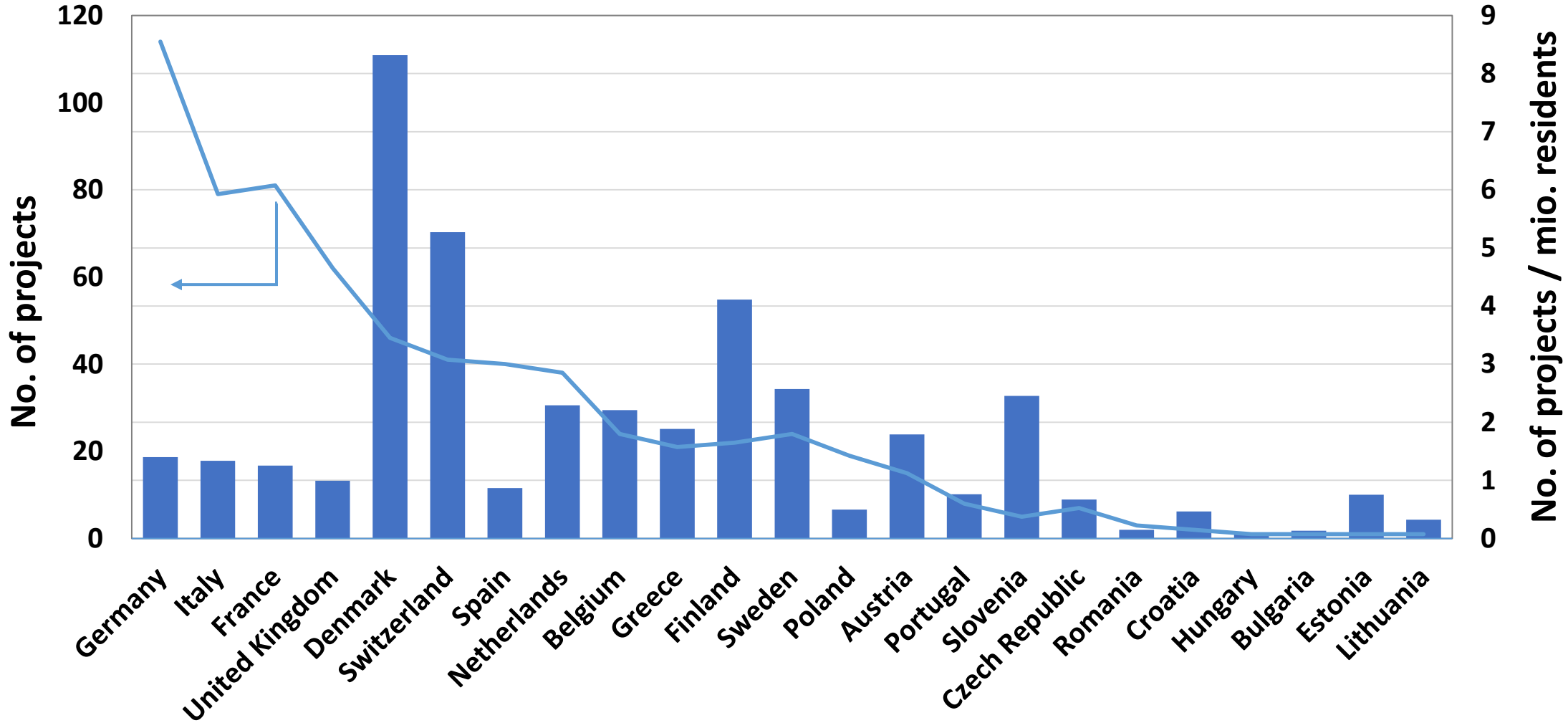
# Czech participation in European efforts

**FCH JU-Funded Demonstration Projects in Transport and Energy**


- Bus transportation
- Car transportation
- Hydrogen refueling stations
- MHV transportation
- Stationary power production

Source: http://www.fch-ju.eu/

# Czech participation in European efforts



# Hydrogen activities in the Czech Republic

- Reasons for inhomogeneity?
  - Research community appears to be competitive (participation in RTD projects)
  - Decisive absence of broad participation of industry
  - Some activity of the industrial subjects visible, but limited to the solution of partial tasks, of tennot directly connected with hydrogen technology as such
- Factors influencing participation of industry
  - Two main aspects:
    - Economical and technological strength
    - Long term strategy
  - Closely interconnected
- Low participation in EU activities does not automatically indicate insufficient national activity

# Hydrogen activities in the Czech Republic

AIR LIQUIDE DAIMLER THE LINDE GROUP

NOW OMV TOTAL

$H_2$ Mobility initiative

**Leading industrial companies agree on an action plan for the construction of a hydrogen refuelling network in Germany**

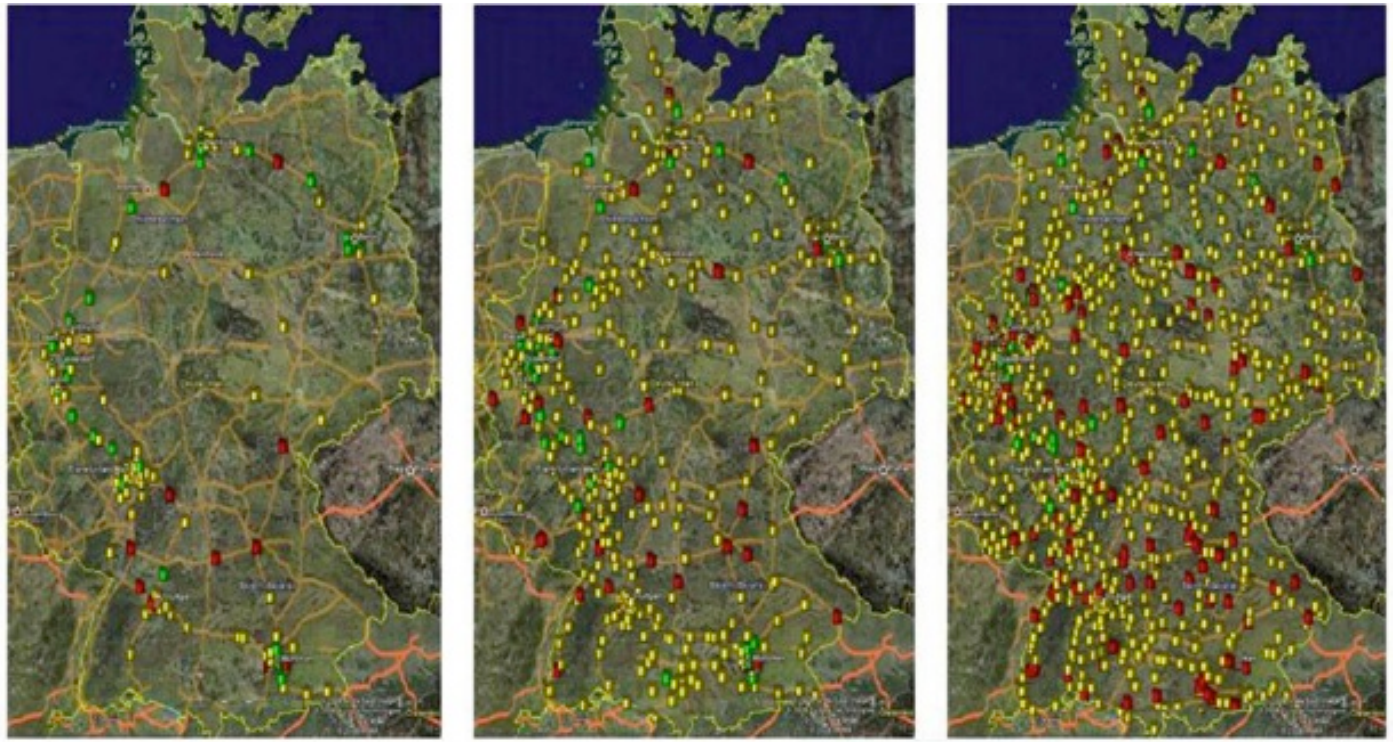
- **Hydrogen refuelling network to grow to about 400 filling stations by 2023**
- **Precondition for the market success of fuel cell powered electric vehicles initiated**
- **Overall investment of around €350 million planned**
- **Development plan represents the benchmark at international level**

**Stuttgart, 30 September 2013** – The six partners in the "$H_2$ Mobility" initiative - Air Liquide, Daimler, Linde, OMV, Shell and Total – have set up upon a specific action plan for the construction of a nationwide hydrogen refuelling network for fuel cell powered electric vehicles. By the year 2023 the current network of 15 filling stations in Germany's public hydrogen infrastructure shall be expanded to about 400 $H_2$ filling stations. As a first step the deployment of 100 hydrogen stations in Germany over the next 4 years is intended. This would ensure a need-related supply for fuel cell powered electric vehicles to be introduced into the market in the next years. An agreement in principle has been signed by representatives of all the partners involved.

In addition to plans for a nationwide filling station network, the agreement includes the principles for the procurement and distribution of the necessary hydrogen and a request for support to the German Federal Government. Following the foundation of a joint venture (subject to necessary regulatory approvals), gradual expansion of the national filling station network will commence next year. This means that an $H_2$ supply suitable for everyday use shall be created not only for densely populated areas and main traffic arteries, but also for rural areas. The objective is to offer an $H_2$ station at least every 90 kilometres of motorway between densely populated areas. According to this plan in metropolitan areas, drivers of fuel cell powered vehicles will have at least 10 hydrogen refuelling stations available each from 2023. Thus zero tailpipe emission $H_2$-mobility is becoming increasingly attractive for customers. The "$H_2$ Mobility" initiative expects that a total investment of around €350 million will be required for this future-oriented infrastructure project.

The launch of fuel cell powered production vehicles on the German market has been announced by first manufacturers for 2015. In addition to attractive procurement and

- Initiative gathering the German government and 6 major industrial companies
- 400 hydrogen stations by 2023
- Investment of € 350 million
- Benchmark at an international level



# Hydrogen activities in the Czech Republic

## Economical and technological strength

- Hydrogen economy represents typical long term strategic RTD
- Two types of private subjects able to participate
  - Financially strong and large subjects capable of financing long term RTD activities with outlook of future benefit
  - Small operative subjects based on specific know-how
- Both of them require stable long term investment
- Sources of necessary investment
- Hardly achievable without strong high-tech national private subjects and/or strong national long term strategy
- Closely related with long-term political stability of the country

# Hydrogen activities in the Czech Republic


Long-term strategy

- Closely related with a political stability and culture (democratic tradition)
- Related to the economical status of the country
  - Basic economic needs satisfied, i.e. space for additional activities
  - Motivation by the public meaning
  - Motivation by the high-tech private subjects
- Based on the national capabilities and preferences
- Has to be based on broad agreement across the political representation and nation
- Requires well educated state administration with up-to-date information

# Hydrogen activities in the Czech Republic

Czech Republic – **past**-presence-future

- Situation follows the above indicated scheme
- In the last decade exclusive position in the “Eastern Block”
  - First demonstration in FC driven bus
  - First hydrogen filling station
  - Demonstration in energy storage
  - Production of the AFC generators
- Significant support from public funds
- Efficient collaboration between private and public sector

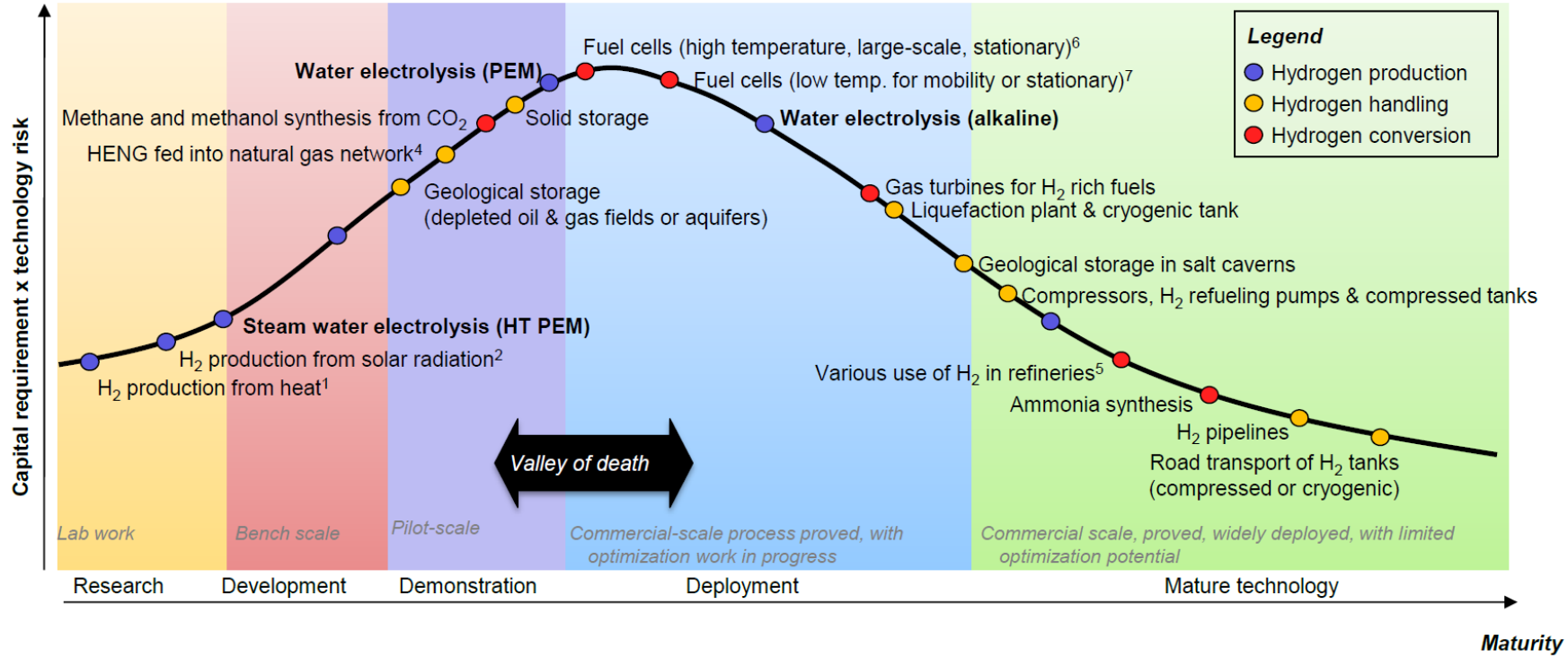
# Hydrogen activities in the Czech Republic

Czech Republic – past-**presence**-future

- Gradual loss of the support targeted to deployment
- Situation extremely difficult for commercial subjects – see next slide
- Uncoordinated support of basic research activities
- Surprisingly in opinion of responsible administrators classified as low TRL technology without objective measures
- Recently on-going development projects going to the end
- Possibility to continue on the national level questionable at the moment
- Collaboration on the European level without industry will not lead to corresponding increase of demonstration activities

# Hydrogen activities in the Czech Republic

**FIGURE 10: COMMERCIAL MATURITY CURVE OF INTEGRATED HYDROGEN PROJECTS**




Note: [1]Nuclear or solar thermochemical water splitting; [2]Photolysis, photo-electrolysis or photo-biological water-splitting; [3]By thermochemical processes, principally: methane reforming, the cracking of petroleum fractions, and coal or biomass gasification; [4]HENG: Hydrogen-enriched natural gas; [5]Includes the upgrading of heavy/sour oil and the synthesis of synfuels from syngas (methanol, DME, MtG etc); [6]Includes SOFC, PAFC and MCFC; [7]Includes PEMFC and AFC.

Source: SBC Energy Institute analysis.

SBC Energy Institute: Hydrogen-Based Energy Conversion, More than storage: System Flexibility, February 2014

# Hydrogen activities in the Czech Republic

Czech Republic – past-presence-**future**

- If not included into the national strategy, exclusive position lost soon
- Consequence in loosing know-how and complicated catch-up later on
- Question is then not only future competitiveness in the field, but even the ability to implement and operate such technology
- European funds seen just as a seeding factor
- Significant potential of the regions and related structural funds
- Regions not interested (smart specialization) – connected with the missing strategic vision
- Situation even more complicated after taking the new infrastructures into the operation

# Hydrogen activities in the broader region

Countries of former Eastern Block

- Deeper analysis still missing
- Comparison with the “Old European Countries” indicates similar problems
- Coordinated action important for the future development
- Unfortunately funds for collaboration on this level limited
- Platform for closer contacts needed (Hydrogen Days?)
- Coordinated action in both directions: national administration and EU

# HYTEP – representative on CZ side

- Attempts to bring together all stakeholders in the Czech Republic
- Informs, beside specialists, also public and decision makers
- Searches for integration of hydrogen technologies into the national context
- HYTEP represents the Czech Republic in other European hydrogen associations

# HYTEP – vision for the future

- Expands activities within the Czech Republic
- Intensifies cooperation with other EU organizations
- Identifies possible applications for hydrogen technologies in CZ
- Hydrogen Days as a broader information platform
- WHTC 2017

# Conclusions


- Through delay with respect to the developed countries ,very good starting position in the Eastern Block
- Unfortunately loosing this position within last years
- Basic aspects of this situation to be analyzed
- Future hardly predictable with respect to the dynamically changing visions of financing research and development in CZ (infrastructures)
- Situation seems to be similar in the other post-communistic countries
- Deeper coordination of those countries necessary to support recognition of this problem primarily on the national levels
- Without corresponding support on the national level European funds will not solve the problem on a sufficiently complex level

# Thank you for your attention!

Czech Hydrogen Technology Platform