In situ H2 supply technology for micro fuel cells – ISH2SUP-project

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Motivation of the project

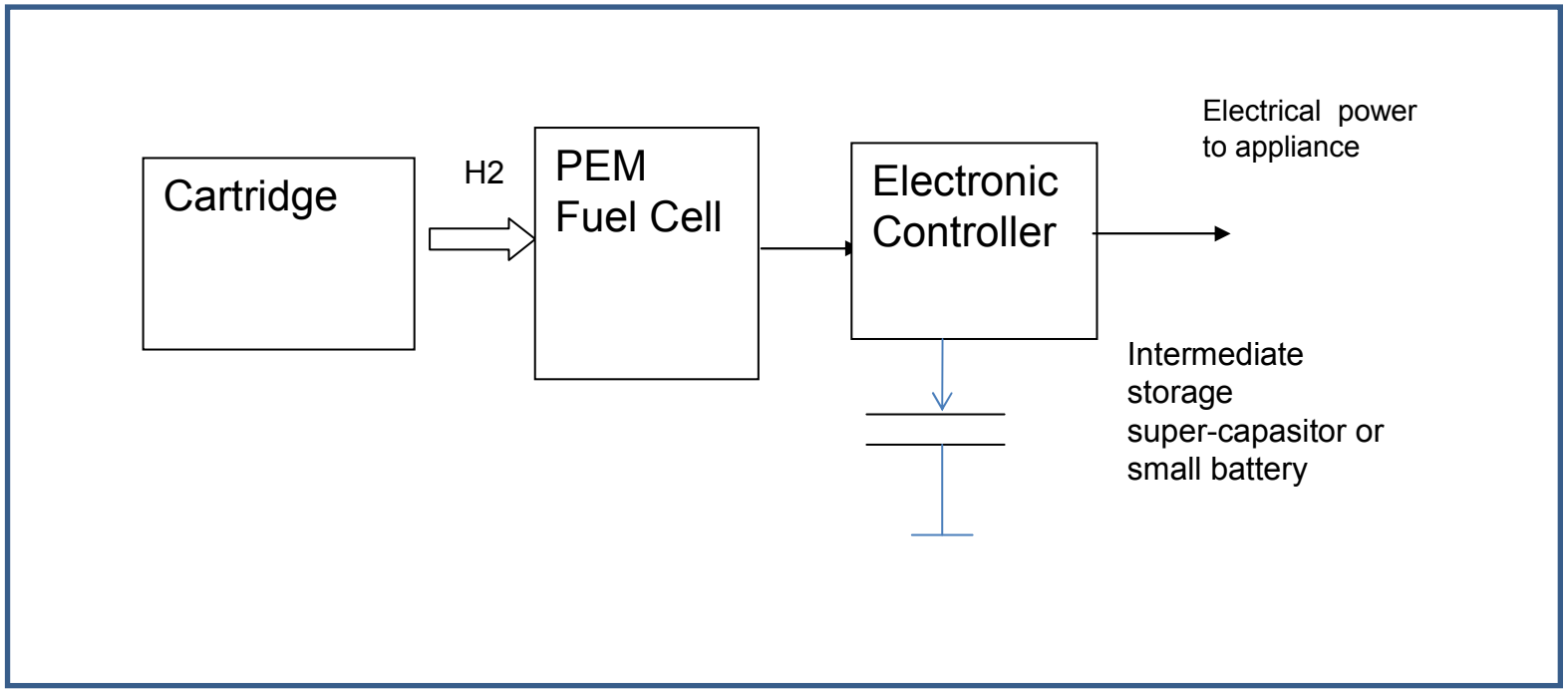
- Market pull for mobile and portable fuel cell based power sources
  - Increasing power gap of many mobile electronics devices, like laptops, smart phones, cameras, etc
  - Light mobile power for outdoor activities
  - Emerging markets with poor availabilty of grid or no grid especially in developing countries
- Most of the on-going developments are based on PEM technology, either DMFC or H2-PEM
- H2-PEM would be preferred over DMFC provided hydrogen would be easily, safely and sufficiently available in situ.

-> There is a need of easy to use and logistically feasible fuel cartridge technologies to make hydrogen really mobile.

Goals of ISH2SUP-project

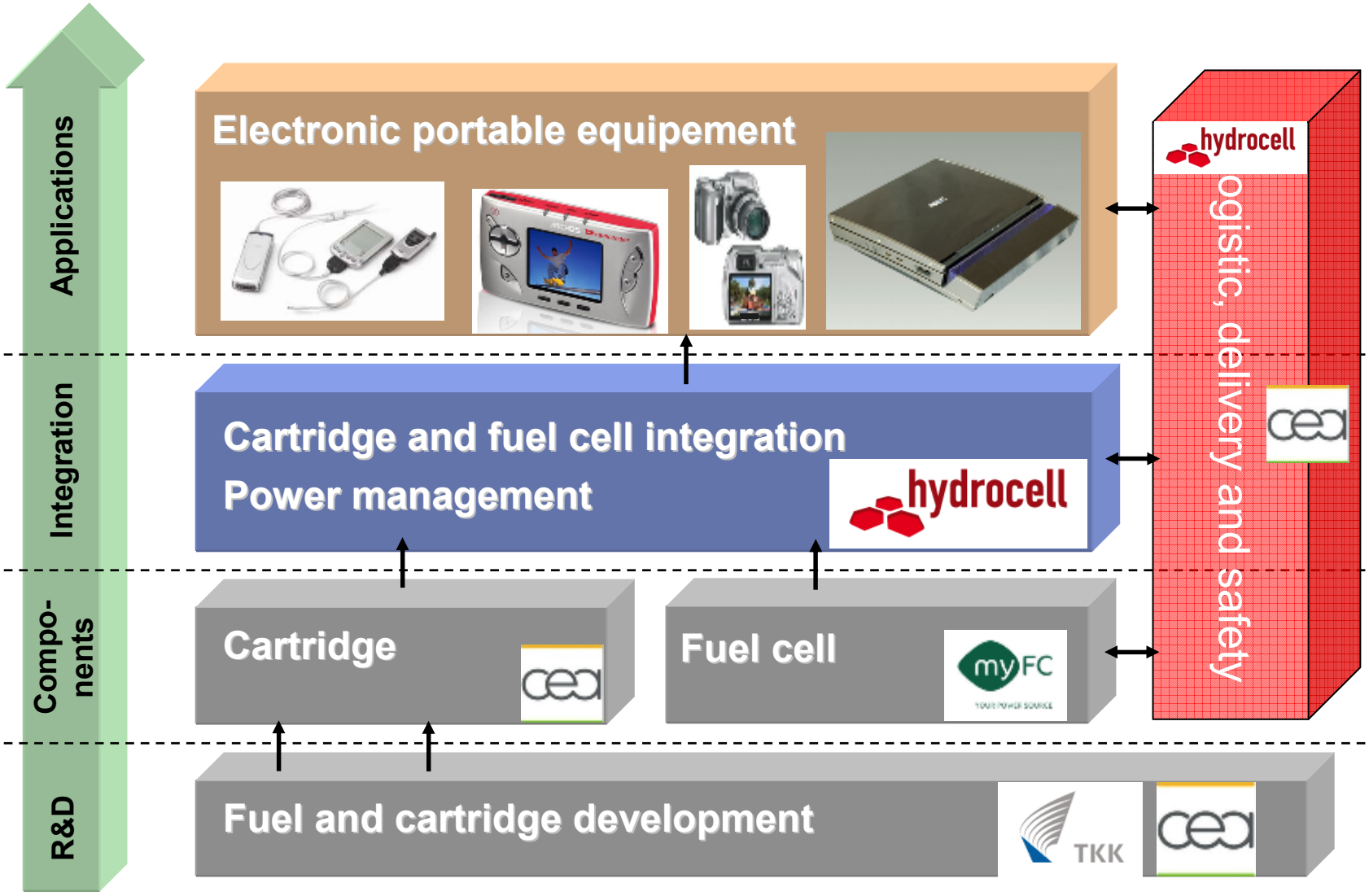
- Development of controllable hydrogen production units, which utilize sodium borohydride (NaBH) or methanol as the primary fuel - the fuel cartridge
- Integration of the fuel cartridge and a micro fuel cell unit
- Prove feasibility of the concept taking into account all the safety regulations
- Targeted test case applications
  - 5 W mobile charger of 5 h operation time
  - 5-10 W portable power source of one month operation time
- Envisioned application: a replaceable/disposable fuel cartridge providing hydrogen gas in-situ and on-demand to a fuel cell power unit integrated in a mini laptop, a smart phone or an internet camera.

ISH2SUP concept – a hybride power system



AR3

Partner strategy of the ISH2SUP project



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Anja Ranta; 7/09/2010

Operation principles of the ISH2SUP hydrogen cartridges

- Production of hydrogen gas from a primary fuel
  - Methanol
  - Sodium borohydride
- Conversion of the generated hydrogen to electricity by a micro PEM fuel cell

  - in the case of methanol conversion the additional energy is provided by the fuell cell

Principle reactions - conversion to hydrogen

– Methanol; electrolysis by a metal or biocatalyst

- $CH_3OH + H_2O \rightarrow CO_2 + 3\ H_2$ metal (Pt) catalyst
- $CH_3OH + H_2O \rightarrow CHOOH + 2\ H_2$ enzyme (MDH)catalyst

– Sodium borohydride

- $NaBH_4 + H_2O \rightarrow 4\ H_2 + Na(OH)_4$

The ISH2SUP hydrogen cartridge

- Can be manufactured of plastic or other light and inexpensive packaging material
- Expected easier logistics than with pressurised small scale gas canisters
- Disposability with normal household waste

Technical innovations:

- Overall efficiency of converting methanol to electricity via combined electrolysis and a H2-PEM fuel cell is higher than that of a DMFC (Wh/l 100% MeOH).
- NaBH cartridge functions passively, provides hydrogen on demand and is orientation independent
- In both cases release of hydrogen is easy to control

Project details

Name: In situ H2 supply technology for micro fuel cells powering mobile elelctronic appliances ISH2SUP

Partners: Aalto University School of Science and Engineering (FI), CEA (FR), Hydrocell (FI), myFC(SE)

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