

IPHE Workshop

“A smart role for fuel cell and
hydrogen in creating liveable cities”

Round table

**Strategic vision, potential and scope for FCH
technologies in the Smart Cities,**

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**The Multiple Advantages
of Fuel cells for Smart Cities**

Rationale

Green and clean technologies

- Worldwide, cities represent three quarters of the energy consumption and contribute 80% of CO₂ emissions.
- Cities are the areas where major energy savings could be made.
- It is necessary to identify the areas that are least efficient in their energy management

Reduce energy consumptions for buildings and transport

- **Buildings** contribute as much as one third of total global greenhouse gas emissions, primarily through the consumption of fossil fuels.
- **Transport** is placed as the second biggest greenhouse gas emitting sector and is responsible for around a quarter of EU greenhouse gas emissions.
- **Reduce the energy consumption of these two sectors will facilitate the path towards decarbonisation.**
- **Fuel cells are a promising option to address this challenge.**

Why Fuel cells?

What makes fuel cell systems so attractive and is gaining them competitiveness in the energy market?

- They can generate clean electricity at or very near the point where it is needed
- They provide fuel flexibility
- They provide efficient and reliable power generation and are suitable for combined heat and power production
- They can balance power in the grid
- Currently fuel cells in the electricity grid are used chiefly as prime power generators, powering up from a single residence, to an entire building, industrial facilities or even small towns.

Fuel cells & renewables

- Enormous potential could be unleashed with their capacity to operate in reversed mode as well
- Conversion of excess (renewable) electricity to hydrogen and other fuels in order to stabilize the grid and guarantee maximum use of renewable energy sources.
- Energy storage will play a key role in the successful implementation of smart grids because it provides stability and reliability to the grid enabling the storage of energy when demand is low and the release of energy during peak demand periods, which represents an improvement in the system's flexibility.

Increasing efficiency in Buildings

- Fuel cells generate electricity and heat *on site*, so that the heat generated can easily be recovered and reused
- co-generation (CHP) is an excellent option for all residential and commercial buildings, as its total energy efficiency reaches in excess of 85%.
- Additionally, fuel cells are regarded as superior to other technologies for small scale cogeneration since :
 - they maintain their efficiency at part load,
 - reduce CO₂ emissions due to their higher efficiency
 - almost completely avoid the emission of harmful pollutants,
 - possess good load following capability,
 - are compact and quiet and potentially fuel-flexible.
 - Polygeneration is possible in several forms, since it is possible to produce hydrogen and cold in addition to power and heat given appropriate system engineering.

Electric mobility

- Fuel cells are set to become a major player in the transport sector. Vehicles can use the electricity produced by the fuel cell for propulsion as well as for on-board generation.
- Fuel cell electric vehicles (FCEV) make extended driving ranges possible thanks also to weight-efficient, on-board fuel storage.
- With a process similar to gasoline refuelling, FCEV could tank up hydrogen in less than five minutes and cover similar distances to a conventionally fuelled vehicle.
- “Decarbonising” transport is a priority for the European Commission considering the aspects of efficiency and congestion as well as environmental impact.
- In this context, among the priority areas for road transport are alternative fuels, electric transport and hydrogen-powered fuel cell vehicles

Waste management and energy supply

- Another critical area of action where fuel cells can be useful is in waste management.
- Wastes contain significant quantities of energy which can be converted into useful forms (e.g. biogas) while contributing to waste processing by reducing the volume.
- Conversion in a fuel cell would increase the exploitation of biogas through a larger yield of high-value electricity, where the fuel cell plant would generate heat as well, which could be used to thermally control the digester, making the overall system even more efficient.

FC in ICT

- A Smart city cannot expect to achieve really complete zero emissions if the infrastructure providing the “intelligence” to the smart city relies on highly pollutant infrastructures.
- The International Telecommunication Union (ITU) has estimated the contribution of ICTs (excluding the broadcasting sector) to climate change at between 2 and 2.5 % of total global carbon emissions. Of these, one quarter is due to fixed and mobile telecommunications.
- Fuel cell technology could be an optimal solution especially if they can be operated in reverse mode, storing excess electricity (from e.g. a PV panel) and generating back-up power when needed.
- Fuel cell systems have already been considered for remote stationary power applications with a high cost of downtime