AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE

"The Role of Renewables in the Energy Transformation: The Need for Innovation in Technology, Business Models and Policy"

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The next wave of technologies
How can they escape the valley of death

IEA Working Party on Renewable Energy Technologies

25 March 2014, Paris MGEN Auditorium, 3, square Max Hymans

Contest

The role of hydrogen and fuel cells in the decarbonisation of the energy system:

- Hydrogen as an energy vector both for transport and stationary applications
- Fuel cells will replace incumbent technologies:
  - In transport - moving toward full electric vehicles
  - In stationary applications (power, heat and cooling) - replacing mainly ICE and GT, from few kWs to multi MWs plants
  - In portable applications replacing batteries whatever size


STORAGE
Forklifts
SPECIAL/NICHE
Toys
Tools
PORTABLES
Cell phones
Laptops
PDAs
Auxiliary Power Units
Home Appliances
CHP & Micro CHP
END USE SECTORS/ MARKETS & APPLICATIONS
Automotive
Back-up Power
Buses
UPS
STATIONARY APPLICATION
Trucks
Maritime
Utility Vehicles
TRANSPORTATION
Refueling Stations
Trains

Hydrogen Economy

What is needed for an economy based on hydrogen as a carbon-free energy carrier :

- ✓affordable technical solutions for energy-efficient hydrogen production chains, energy-dense storage and delivery infrastructures
- ✓fuel cells as electricity generation units for transport, stationary power and combined heat and power and portable applications.
- ✓transportation and refuelling infrastructures for FC vehicle deployment
- ✓new integrated distribution grid concept
- ✓safety, code and standards, education and training,
- ✓ incentives, directives, commercialization strategies

Hydrogen Fuel Cell Vehicles

What is needed:

- Reduce the technology cost and improve performance (mainly FCs and on board hydrogen storage)
- Establish the right infrastructures for hydrogen (mainly filling stations)
- Identify environmentally friendly hydrogen production processes (mainly from renewable sources)

What is the status:

- Growing interest in fuel cell vehicles have advanced the necessary technologies, although improvements are still needed
- Current renewed focus on creating affordable technologies is helping the FCs to become the alternative to other power train technologies.
- Recent plans from Hyundai, Daimler, Toyota, Honda etc. are making hydrogen and FC vehicles available to consumers this decade.

H2&FC vehicles : can they escape the valley of death?

Yes!!

The players

1. **Big oil companies** are exploring the opportunities to incorporate hydrogen delivery infrastructure into their end-to-end transportation fuel delivery networks.
2. **Big industrial gas** suppliers could become either their possible competitors or partners in joint ventures or partnerships.

They could potentially join the efforts for a wider technology adoption and a delivery model and get involved in the realization of the entire chain : production, storage, distribution and delivery infrastructures.

3. **Car manufacturers**

They will take advantage of the effort made by oil and gas companies with the help of public support (H2 mobility initiatives : Europe, USA , UK, France, Germany, Japan, Korea, and many others will join the first movers)

4. **"transport community" and main countries** at governmental level are convinced

5. **Consumers** they will clearly see the benefits in terms of more efficient and cleaner technologies (minimizing tail pipe emissions). In any case they will adapt to what car manufacturers will bring to the market (substitution market) (See Formula1, with increasing electric power on board).

FC for stationary applications

What is needed:

- Reduce the technology cost and improve performances
- Develop the market, which means:
  - Fully develop the strategy to pass from centralised energy production to decentralised production
  - Enhance the concept of co and tri generation and even poli generation
  - Fully explore the potential contribution of FCs to the quality of life for the citizens (Smart cities)
  - Establish new rules for energy transmissions and new standards for energy distribution (Smart grids)
  - Connect FC deployment with renewables (energy storing: power to gas and gas to power concept)
  - Set invectives and/or directives (like the ones set for the transport sector)

FC for stationary applications

What is the status:

- More and more suppliers have develop products ready for the market. Some of them are penetrating niche markets and conventional markets (forklift, APU, remote areas/telecom antennas, back up, portable, CHP for domestic and residential applications)
- Some products have reached the target to enter the market, but “the market is not ready for the product”
- Some technologies still need breakthroughs
- Last years governmental support and EU support helped the deployment of quite big number of FC systems (Japan, Korea, Germany, EU, USA, Italy, Denmark, etc.)

Yes!! No!! Perhaps yes, but!!

The players

1. **Fuel cell manufacturers:** SME: they must invest quite big amount of money (high risk investment) to go towards industrialised production in order to lower the cost without knowing if they will be able to sell their annual production
2. **System integrators**, again mostly SME, the same problem.
3. **Big industrial gas** suppliers they could be interested but they don't have a clear picture of the future
4. **Big Electricity companies**: their first reaction is that FC manufacturers are a kind of competitors, thus they are either neutral or against
5. **Grid operators:** they see FC and in general small producers as a problem, because all the electricity transmission and distribution systems should be completely rebuilt

Yes!! No!! Perhaps yes, but!!

The players

6. **Consumers:** they are used to take electricity from the grid and produce heat and cold by boilers and heat pumps: why they should change?
7. **Politician, policy makers: they are the only ones that could make the difference, but they have to be convinced to be convincing**
8. **Politician, and as consequence, citizens** should start considering the so called externalities: local pollution and related damage mainly on health are very important factors. **The quality of the life should become one of the main parameter.**
9. **The global worming:** more efficient and cleaner systems will also results in less fuel consumption (primary energy saving) and in less greenhouse gas emissions

FC for stationary: can they escape the valley of death?

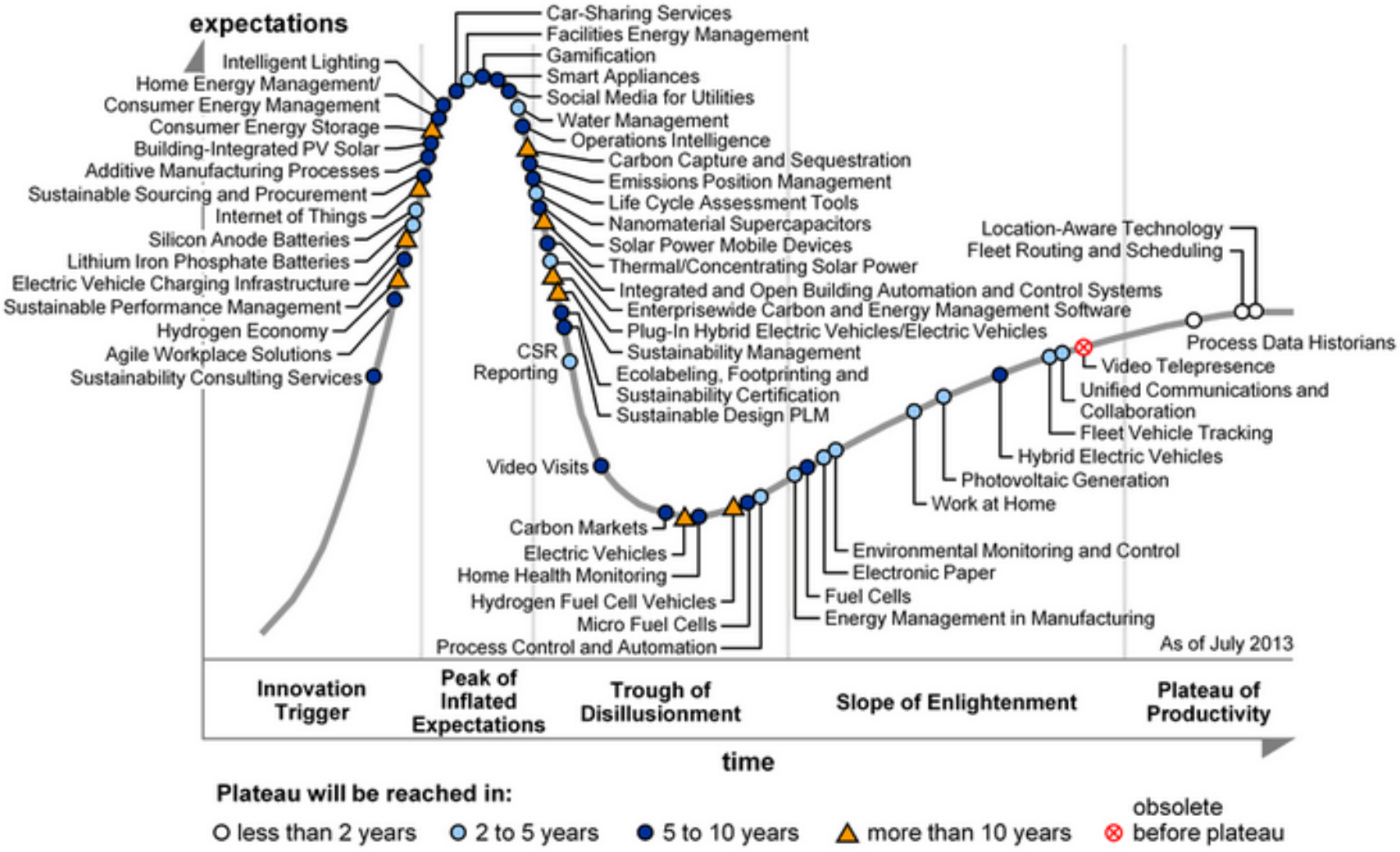
Yes!! No!! Perhaps yes, but!!

Some good and bad experiences

1. **Two European companies manufacturing MCFC, both died in the valley of death.** Reasons:
   - ✓ Overestimated potentialities (technical reason)
   - ✓ Lack of market (political reason)
   - ✓ Lack of public support (political reason)
2. **One Italian company** is investing in the industrialization, very risky. The product is ready for the market, the market is not yet there, they could survive but:
   - ✓ political support is needed: strong need for directives, policy, no incentives are requested.
3. **Another Italian company** has already invested to manufacture systems for telecom antennas already penetrating both the Italian market (almost 350 antennas) and the global market. They almost survived but again directives could help a lot (example: get rid of lead acid batteries)

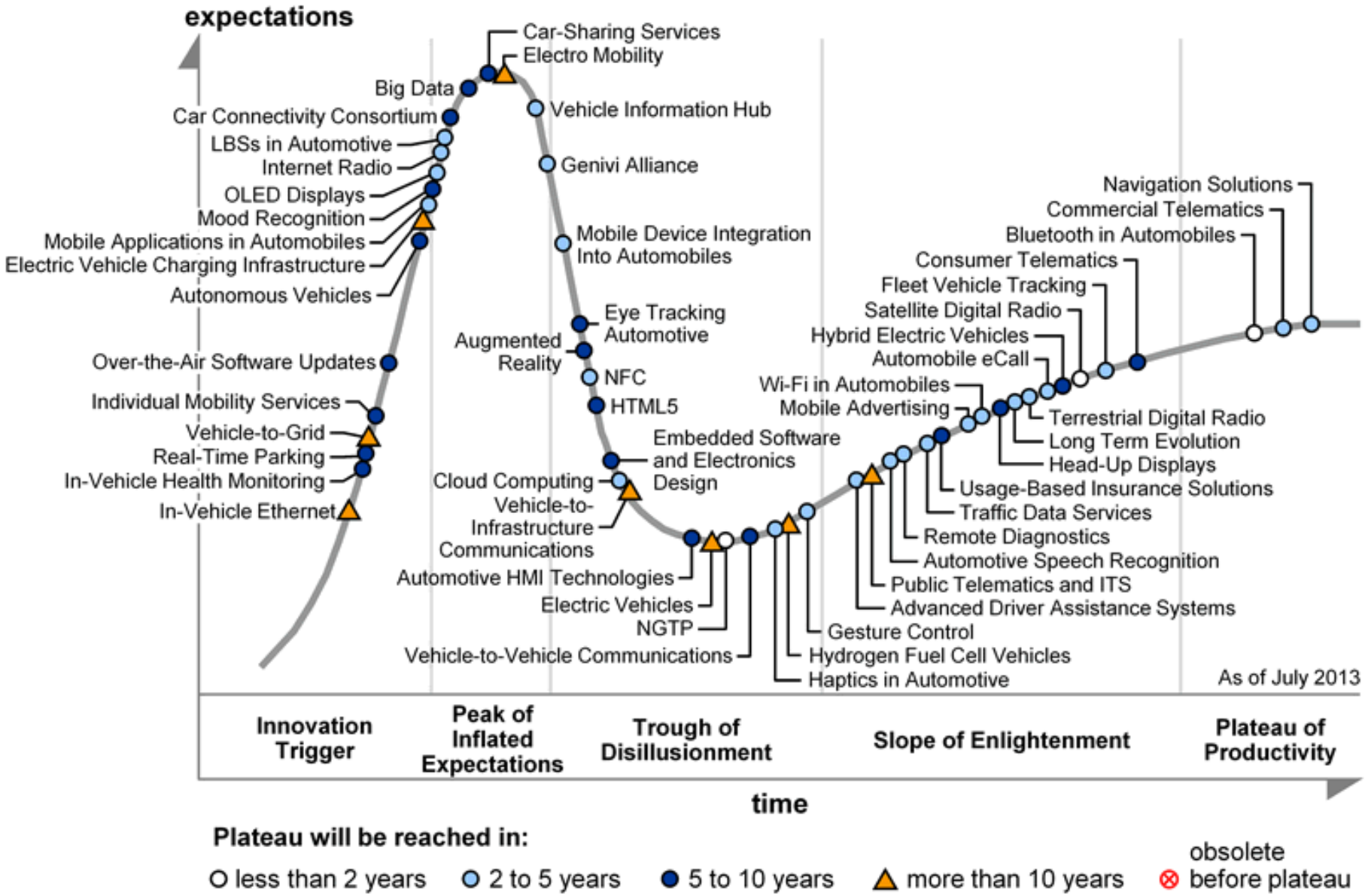
Hype Cycle for Sustainability, 2013

Figure 1. Hype Cycle for Sustainability, 2013



Source: Gartner (July 2013)

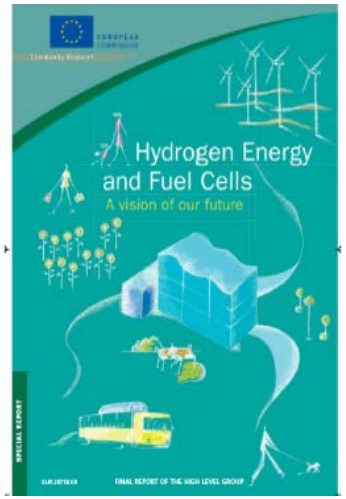
Hype Cycle for Vehicle-Centric Information and Communication Technology (Vehicle ICT), 2013



Source: Gartner , July 2013

European roadmap: Role of hydrogen and fuel cells in the strategy for a decarbonised society

VISION
Hydrogen Energy And Fuel Cells (2003)



FCH JU ☐ Background „Technology Plattform“

STRATEGY
Strategic Research Agenda
Deployment Strategy
Strategic Overview
(2005)

IMPLEMENTATION
Implementation Plan (March 2007)

Thank you for your kind attention