Hydrogen first deployment road map and H2 territories call for projects

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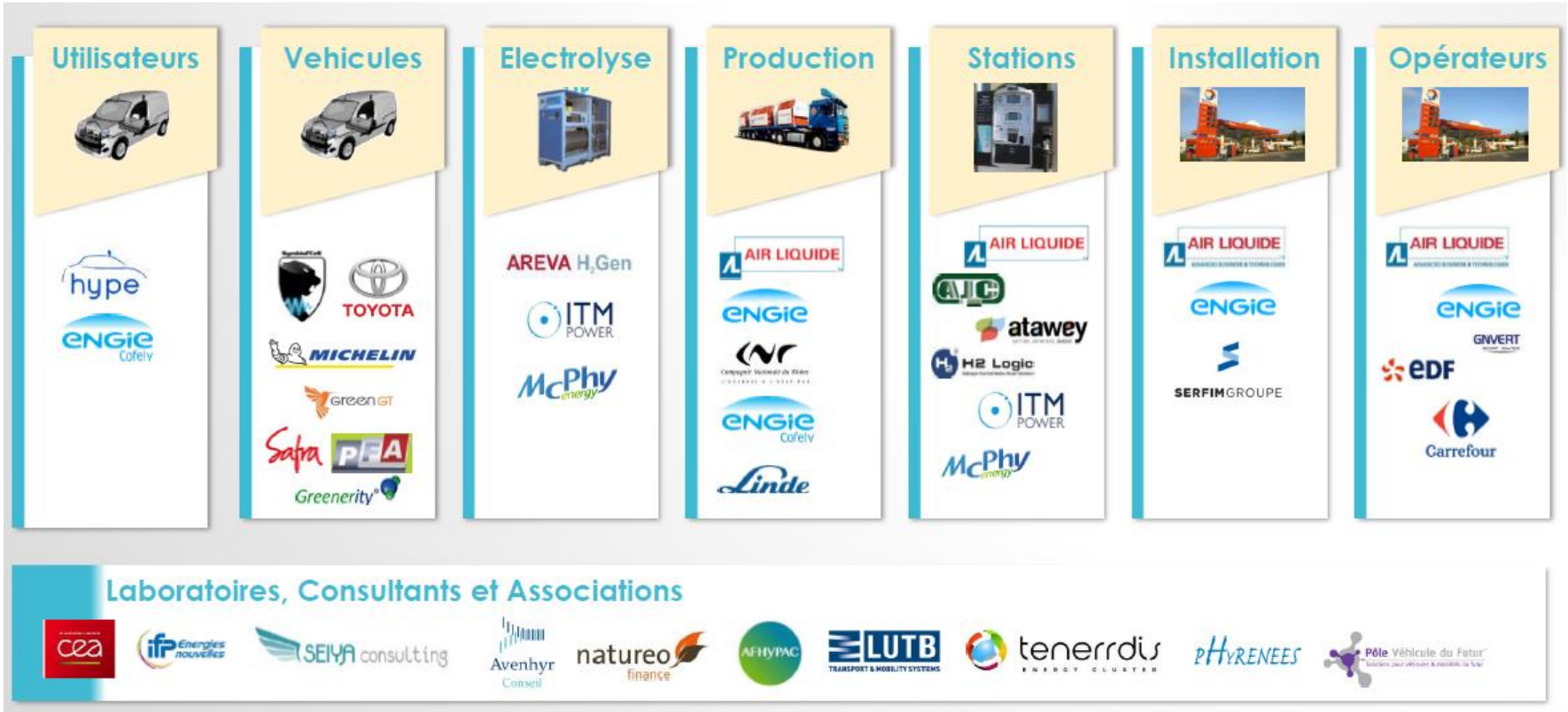
H2 contribution to the French energy transition

- « Loi n°2015-992 relative à la transition énergétique pour la croissance verte», a global framework for the French energy transition adopted in 2015:
  - *GHG reduction : 40% in 2030 ; 75% in 2050*
  - *Energy consumption reduction : 20% in 2030 ; 50% in 2050*
  - *Renewables targets : 32% in 2030 (40% for electricity ; 38% for heat ; 15% for fuels)*
- A cleaner transport and mobility sector:
  - *H2 vehicles, a part of the panel of solutions, flexibility for the electric grid and users*
- Electric renewables developments:
  - *H2 to convert electric production in gas (H2 or CH4) injected in the natural gas network*
- Self-sufficency for off-grid sites, buldings or urban areas:
  - *PV production, H2 and battery storage to be autonomous*
- GHG emissions of the industry sector:
  - *H2 from renewable to substitute H2 produced from natural gas*

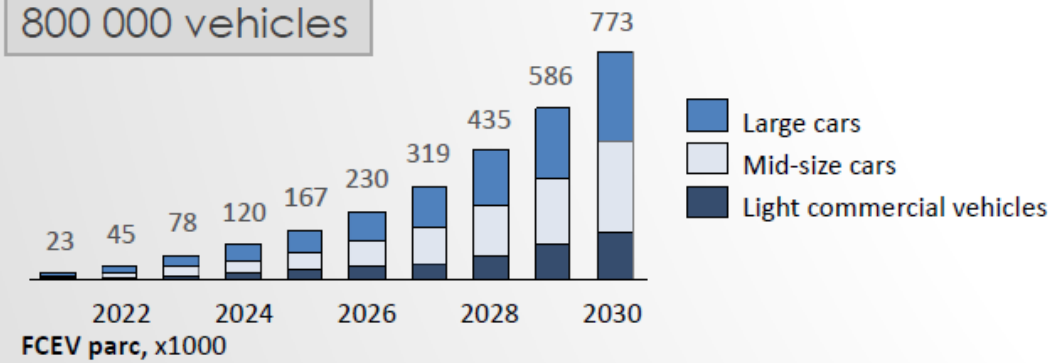
Mobilité H2 France

- A road map adopted by a consortium gathering actors, from energy sector to final customers:



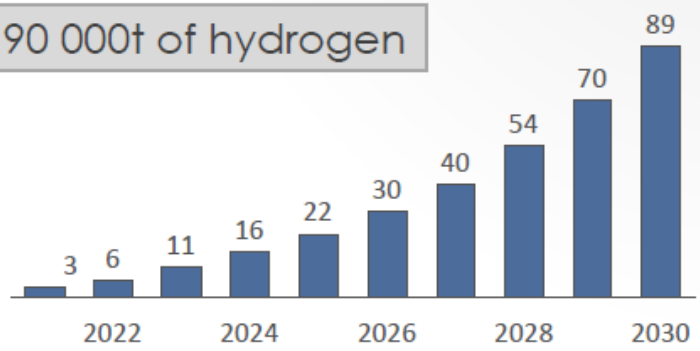
The FCEV market could reach 800 000 vehicles in 2030

800 000 vehicles



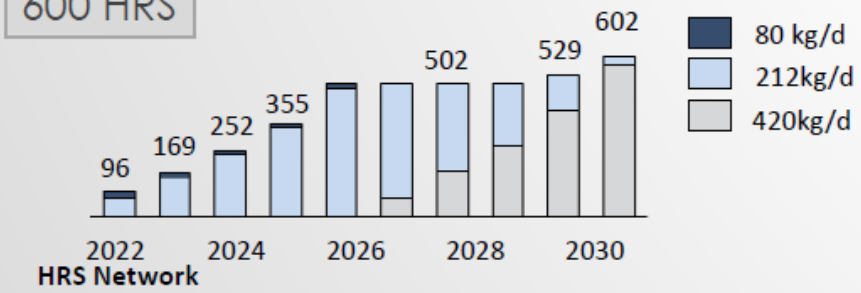
FCEV parc, x1000

90 000t of hydrogen



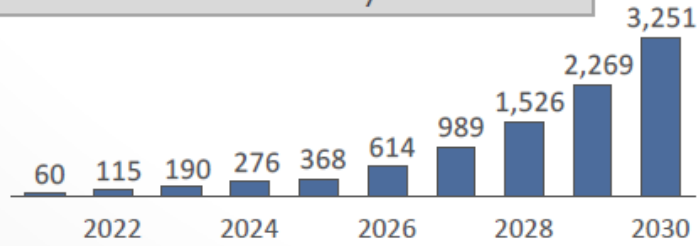
Hydrogen demand, tons x1000 p.a.

600 HRS



HRS Network

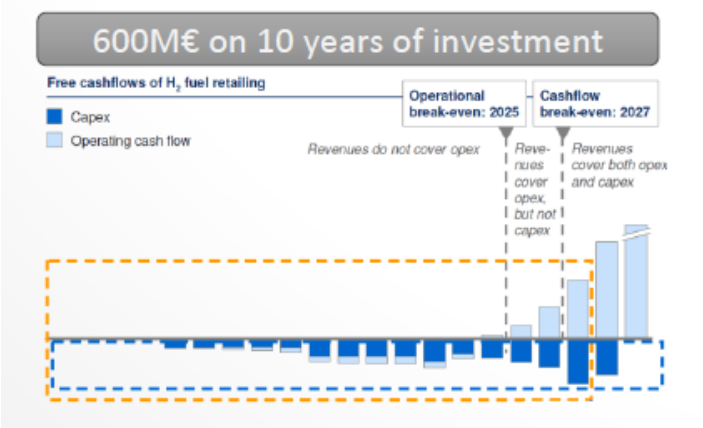
3 TWh of electricity demand



Electricity demand for electrolysis, GWh p.a.

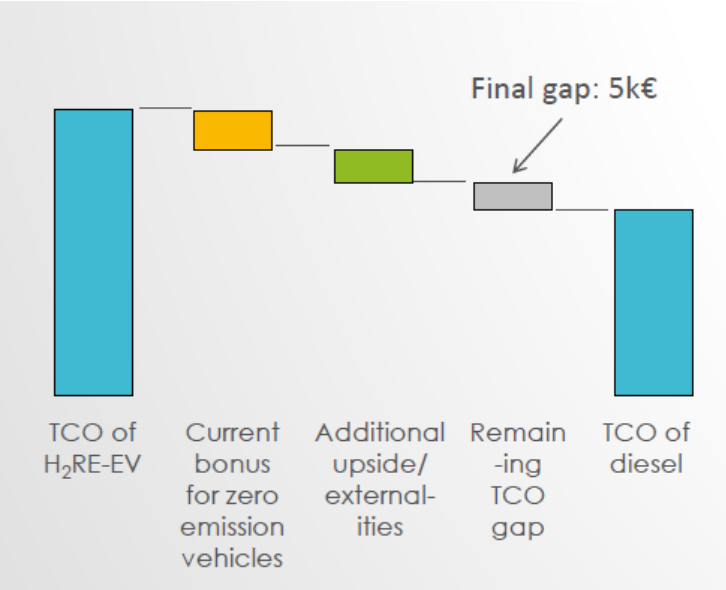
A roll out to minimize risks in the early years

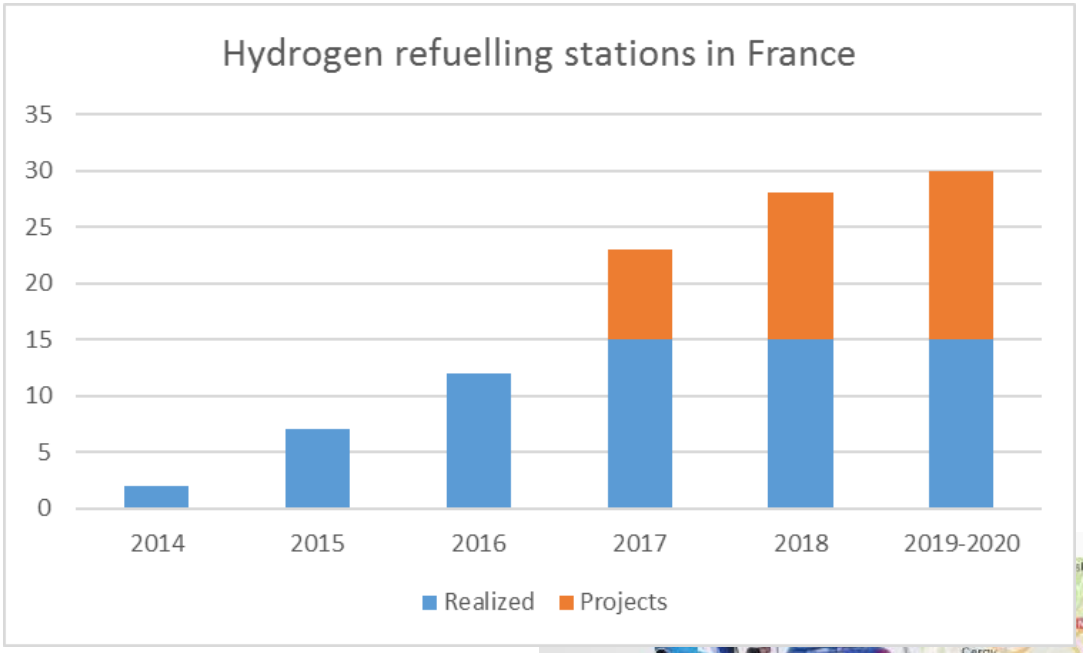
- For a real passenger car market:
  - *A nation-wide infrastructure is needed from the very start*
  - *Large investments and operating losses the early years*
- A roll-out focused on local fleets
  - *Vehicles and H2 stations are deployed once enough local clients are identified*
  - *A good H2 station load factor is achievable from the beginning*
  - *Initial investment capacity and risk of under-utilization are greatly reduced*
  - *Suitable markets segments:*
  - *Cluster approach, a station shared by multiple fleets within a defined area*



Complementary to EV mobility

- Battery and fuel cell hybridization, to go over actual electric perfoms for some use cases:
  - *More autonomy or capacity per day*
  - *Short time refuelling, vehicles availibility guarantee*
  - *Usefull charge for heavy trucks, ships*
- Competitiveness: example with H2 range-extender for Kangoo ZE :
  - *10 €/kg H2 ; 25 000 km/y*
  - *Total Cost of Ownership : a gap limited to 1000 €/y with diesel*
  - *For a fleet: less electric vehicles but more used*



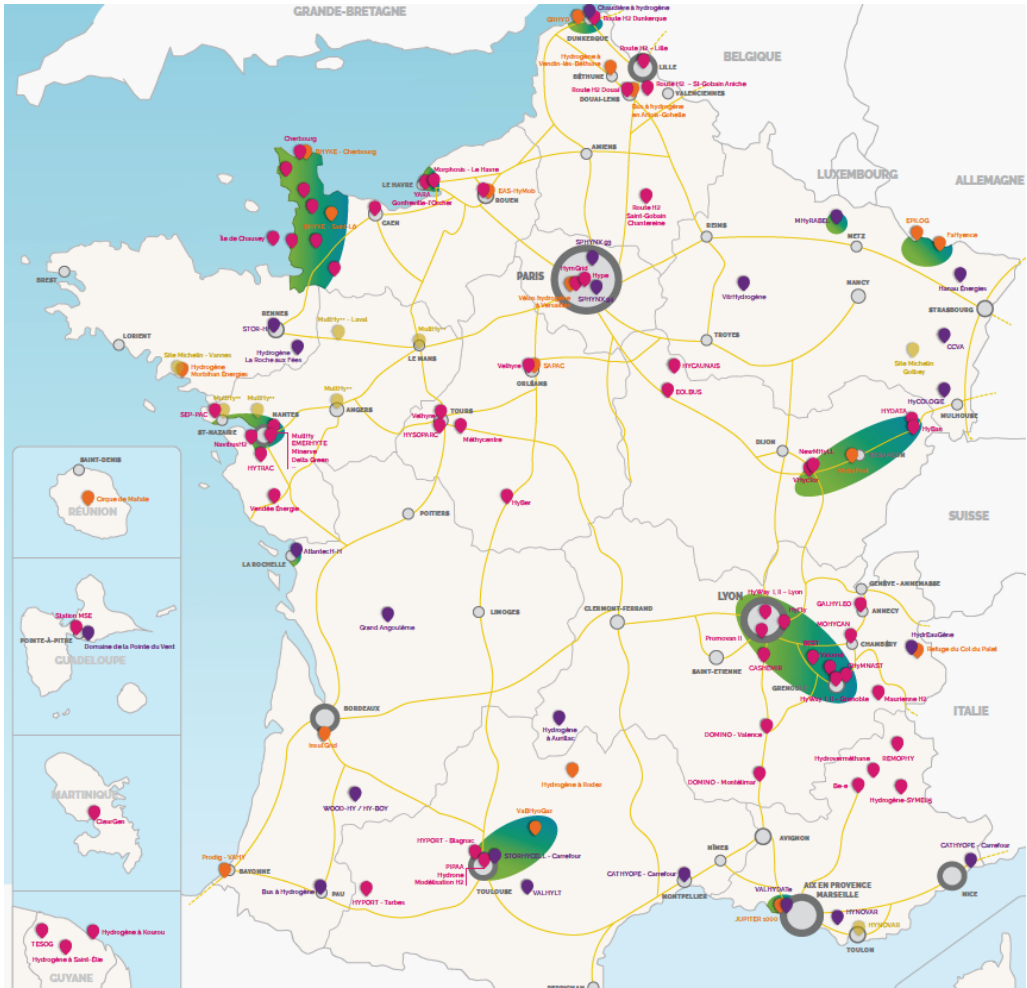


In 2017, 15 operating hydrogen stations

- 4 stations around Paris :

Territories initiatives

- In 2016, « H2 Territories » call for projects launched by both industry and environment ministries
- 100 candidates, 29 selected all over the country: R&D, innovations, experimentations
- Examples:
  - *Occitanie Region: aeronautic applications*
  - *Pays de la Loire Region: ships, maritime applications*
  - *Auvergne Rhône Alpes Region: land transport ; 20 stations & 1000 vehicles*
- Local cycles: H2 from renewables for local uses



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Thanks for your attention !