

La Economía del Hidrógeno: una visión global



@AeH2_ENG
@JavierBrey

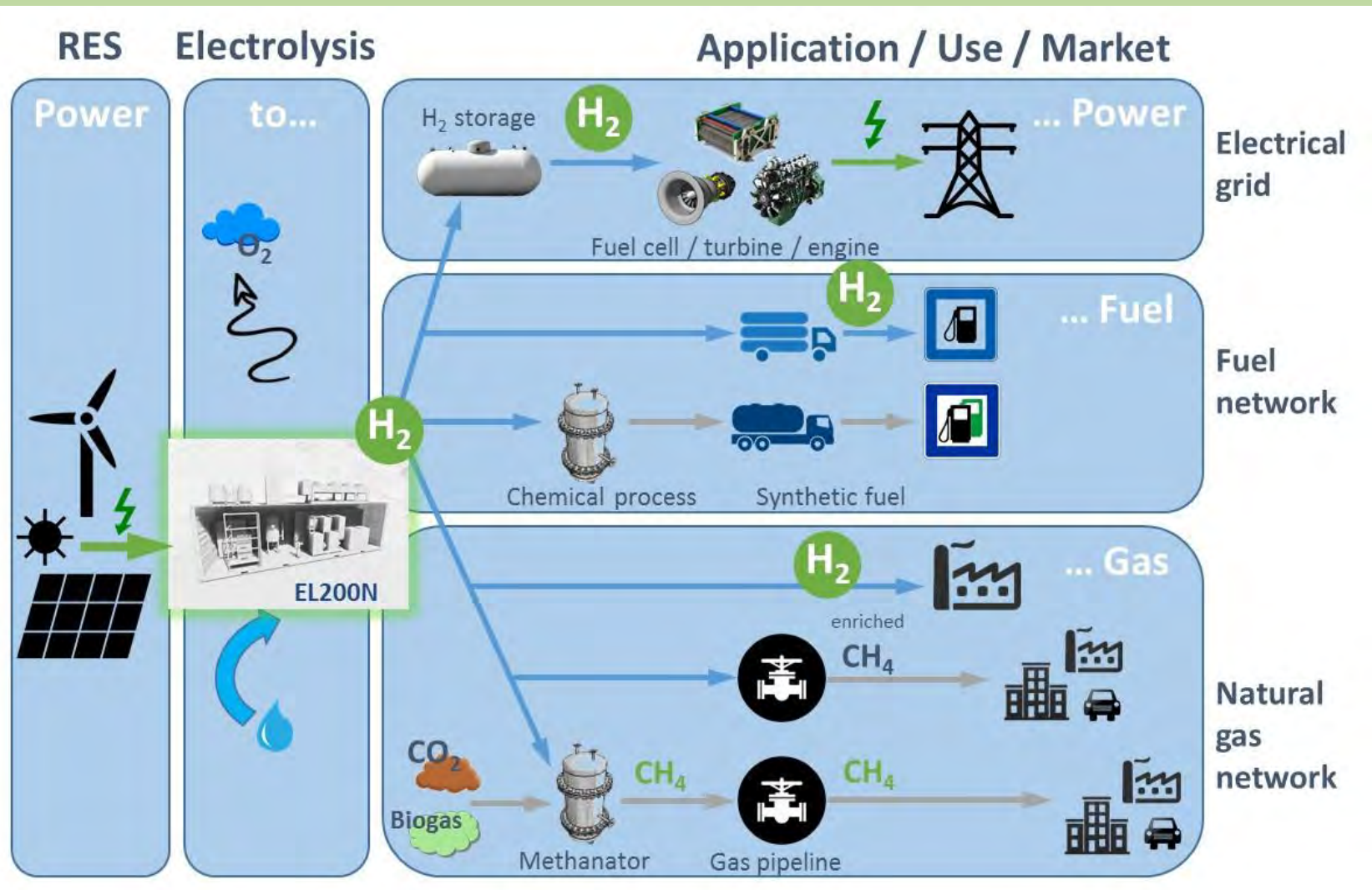
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15 Promoting H₂ technologies
years
2002 - 2017

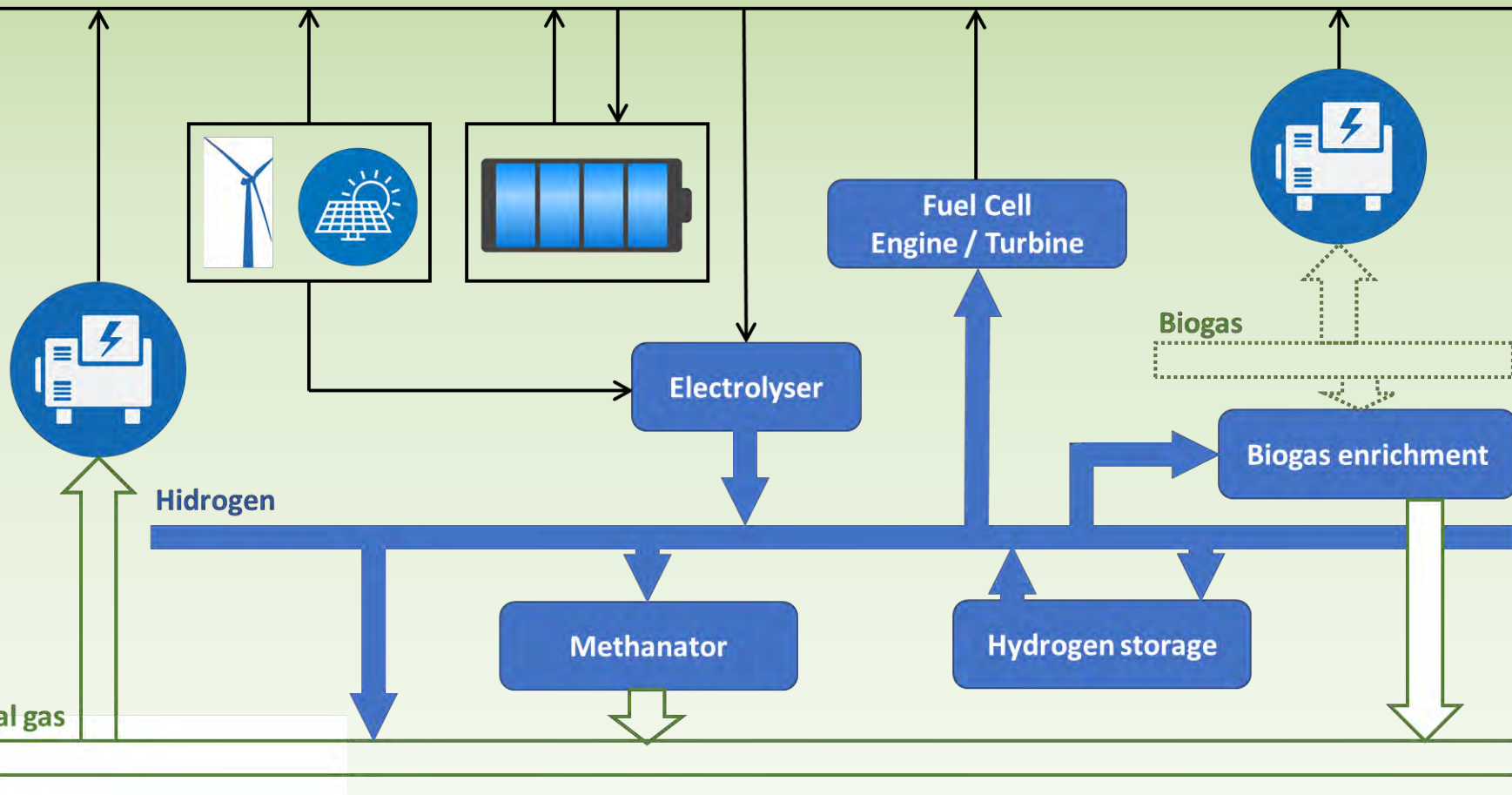
AeH₂ celebrates 15 years.
15 years promoting hydrogen and fuel cells.
15 years supporting the sector.
15 years bringing technology closer to society.
15 years collaborating with the Public Administration.
15 years fostering R&D.
15 years of great progress.
15 years counting on your support,
THANK YOU

Un ejemplo de “economía circular”...



... y un “vector energético” no tan desconocido

Electricity



Mercados del hidrógeno: pasado, presente y futuro



Industrial

M. Size: \$10,000M

Traditional H₂ market: Refinery, steel & glass industries, fat hydrogenation

Benefits

- Cost-effective on-site production, enhancing **availability** (to substitute hydrogen supply)
- Meets critical hydrogen **purity requirements**
- Meets environmental **regulations** (i.e. fuel quality directive)



Mobility

M. Size: \$3,700M (regulated)

H₂ as an alternative fuel for sustainable transportation

Benefits

- Alternative fuels help to solve urban **pollution problems**
- Performance matches electric vehicles; **range** and **refueling time** same as a conventional vehicle
- It is a **renewable fuel** that just emits **water vapor** when used in a vehicle



Energy storage

M. Size: \$19,000M (regulated)

Electrical energy storage in the form of H₂, including synthetic natural gas

Benefits

- Meets grid **ancillary services** needs (discharge time, response time)
- Increases **surplus** renewable energy
- Future proofing needs of **seasonal** and **large** storage capacities

El mercado industrial: ejemplos

Large scale	Nm ³ /hr H ₂
Chemical (basic)	5,000-100,000
Refining	40,000-200,000

Medium scale	Nm ³ /hr H ₂
Laboratory	1-5
Generation (turbines)	1-5
Glass (polished)	15-20
Steel (inc stainless steel)	10-200
Glass (float)	50-200
Electronics	50-800
Aerospace	100-120
Food (fat)	700-800
Glass (fiber optic)	800-1,000
Chemical (special)	2,000-5,000
Food (sorbitol)	2,000-8,000



European refineries (barrels per day)

Refineries

H₂ demand (EU):

46 b Nm³/yr

Growth (EU):

3.2%/yr

127,000 ton/yr

725 MW installed ely/yr

Light industry

H₂ demand (EU):

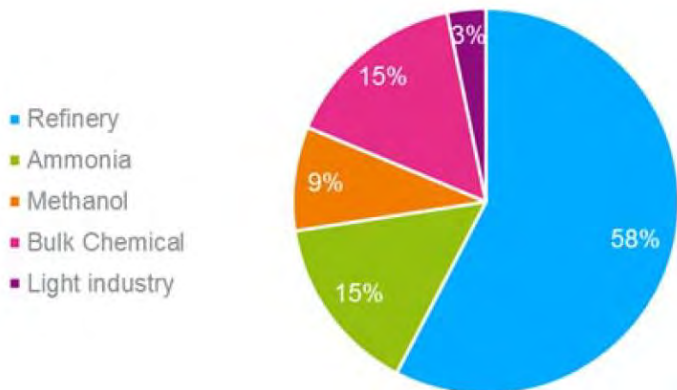
2 b Nm³/yr

Growth (EU):

4.1%/yr

7,100 ton/yr

40 MW installed ely/yr

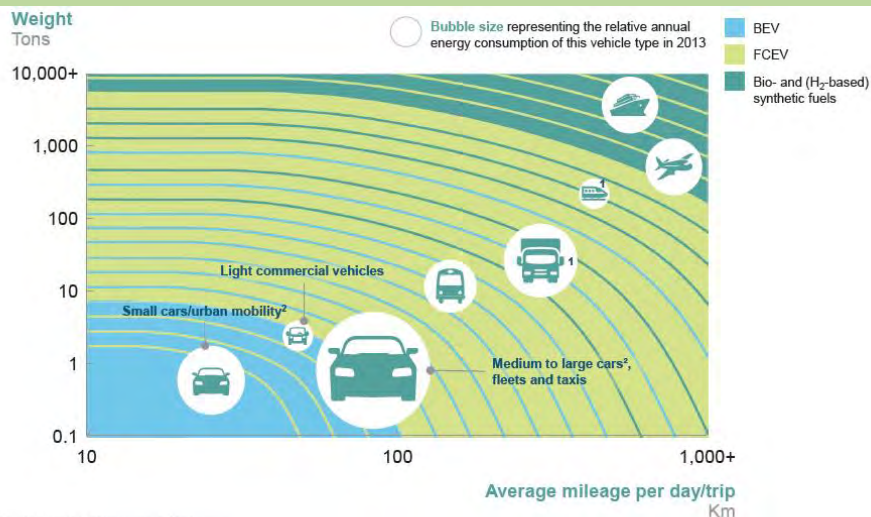


European hydrogen annual demand growth per industrial sector (2014)

El mercado de movilidad: historia



El mercado de movilidad: ejemplos



¹ Battery-hydrogen hybrid to ensure sufficient power
² Split in A- and B-segment LDV's (small cars) and C++-segment LDV's (medium to large cars) based on a 30% market share of A/B-segment cars and a 50% less energy demand
 Source: Toyota, Hyundai, Daimler



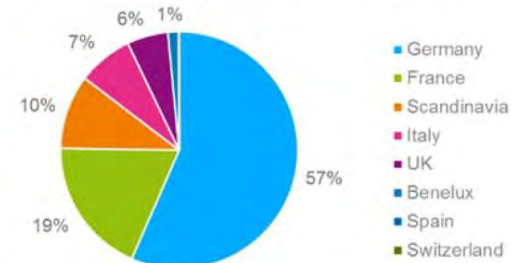
Mobility (2025)

H₂ demand (EU)
 120,000 ton/yr
 690 MW ely

EU-wide	2017	2020	2025
# FCEV	600	4 000	800 000
# Buses	85	575	1 800
# HRS	85	740	1 500
H ₂ demand (t/yr) *	550	3 650	120 500
Equiv. Electrolyser (MW baseload/yr)	3	21	690

*Assuming FCEV 0.5 kg/d and buses 20 kg/d @ 270 days

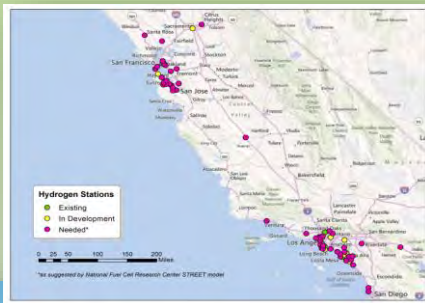
Total H₂ demand for EU mobility in 2025



<http://hydrogeneurope.eu/wp-content/uploads/2017/01/20170109-HYDROGEN-COUNCIL-Vision-document-FINAL-HR.pdf>

Early business cases for H₂ in energy storage and more broadly power to H₂ applications – Draft Final Report.

El mercado de movilidad: ejemplos



2016: start of commercialization

From 2030: full-scale commercialization

The hydrogen infrastructure goal is approx. 100 locations, mainly in the 4 major cities.

A Joint Statement regarding hydrogen infrastructure and the introduction of fuel cell vehicles in the domestic Japanese market: January 13, 2011

Nationwide network established

Based on the COCN "Fuel cell vehicles and hydrogen filling infrastructure project" proposal and modified by Toyota

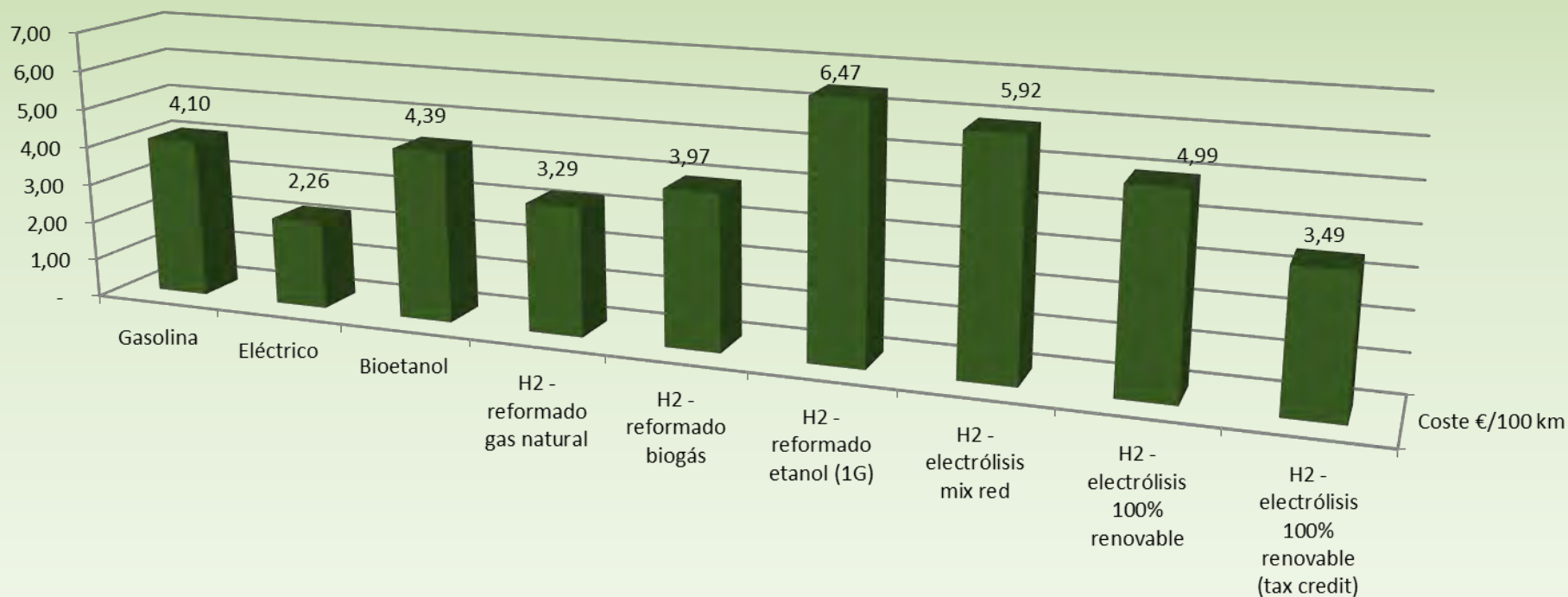
Infrastructure concentrated in hydrogen town cities



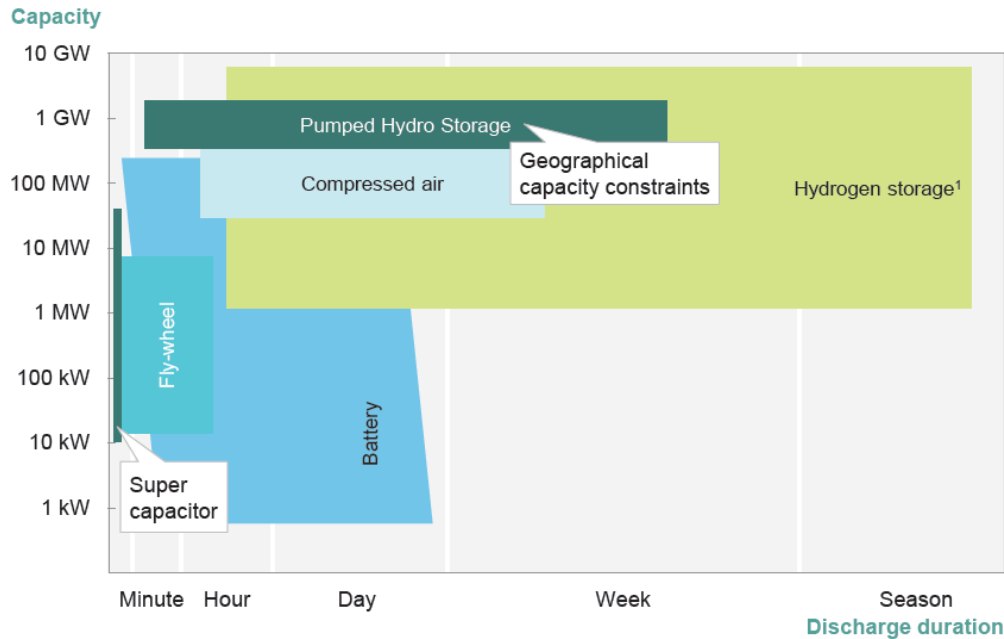
2015	44 HRS 179 FCEV		
2016/17	51 HRS	50 HRS 200 FCEV	80 HRS 500 FCEV
2018	65 HRS 10,500 FCEV		
2020	80 HRS 30,000 FCEV	100 HRS	160 HRS 40,000 FCEV
2023/25	100 HRS	400 HRS 250,000 FCEV	320 HRS 200,000 FCEV
2030		1,000 HRS Mass market	800,000 FCEV

HRS: Hydrogen Refueling Station // FCEV: Fuel Cell Electric Vehicle

El mercado de movilidad: recorrer 100 km en EEUU



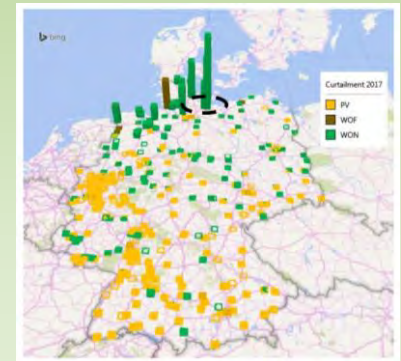
El mercado del almacenamiento de energía



¹ IEA data updated due to recent developments in building numerous 1MW hydrogen storage tanks

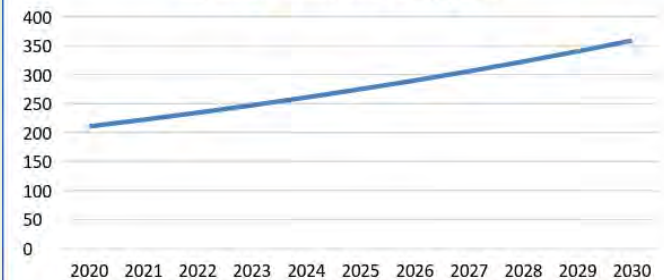
Source: IEA Energy Technology Roadmap Hydrogen and Fuel Cells, JRC Scientific and Policy Report 2013

Renewable energy
curtailment
(Germany, 2017)

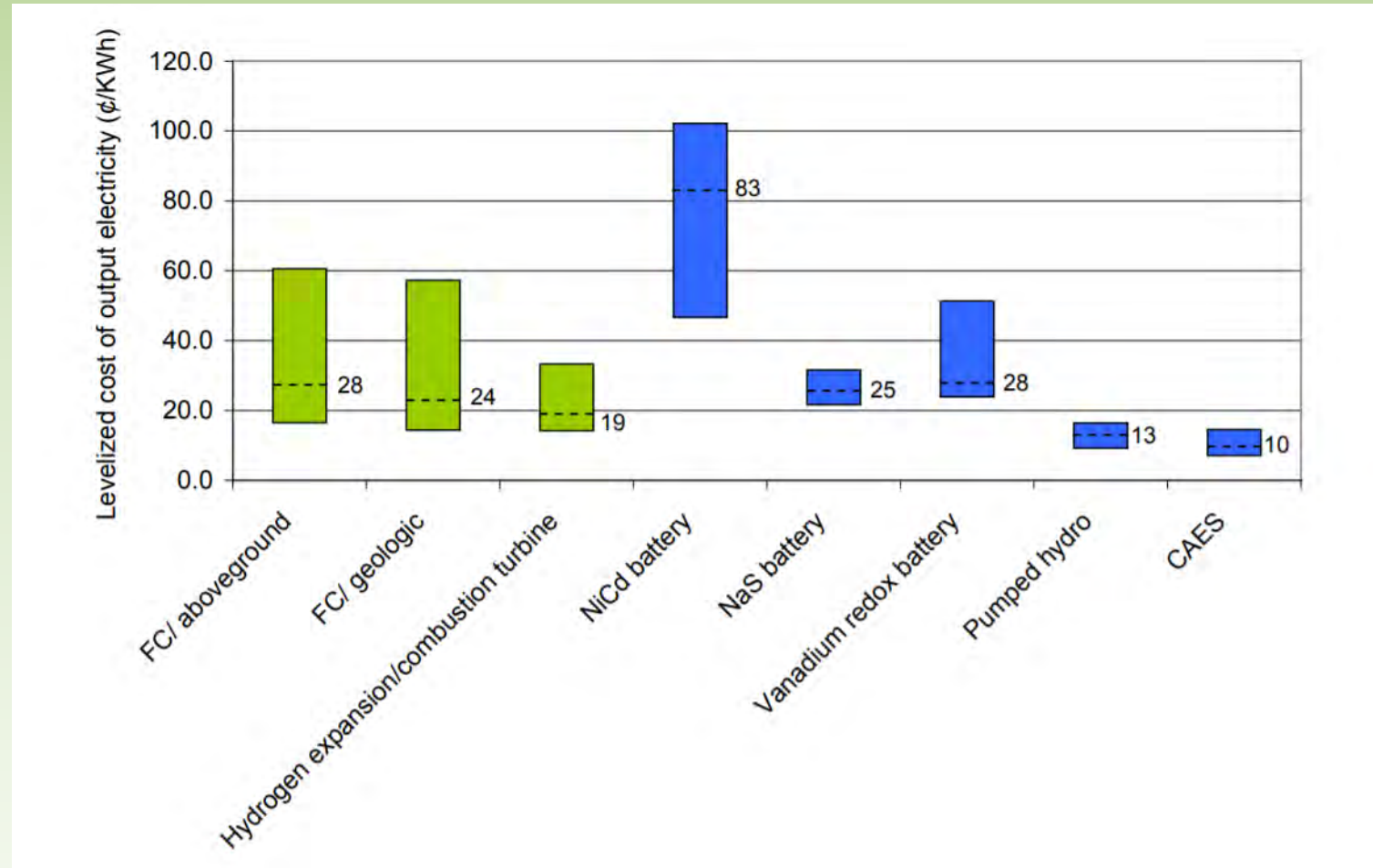


4 big geographies: US, EU28, China, India
New power generation, on a yearly basis
6% storage coverage by hydrogen (only
electrolysis applies)

Storage market M\$/year

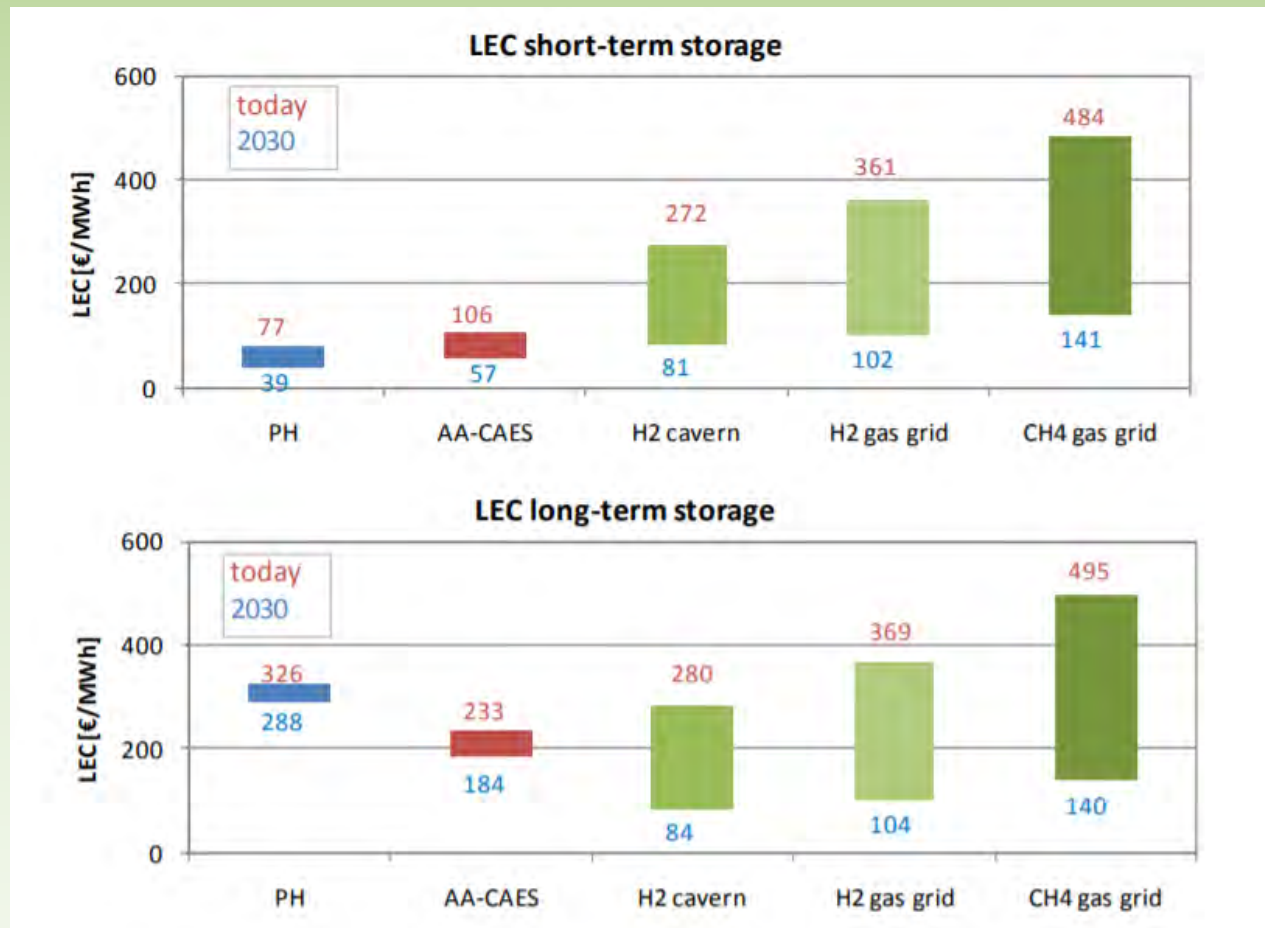


El mercado del almacenamiento de energía



LCOE, according to NREL (2009)

El mercado del almacenamiento de energía



LCOE, according to Fitchner GmbH (2015)

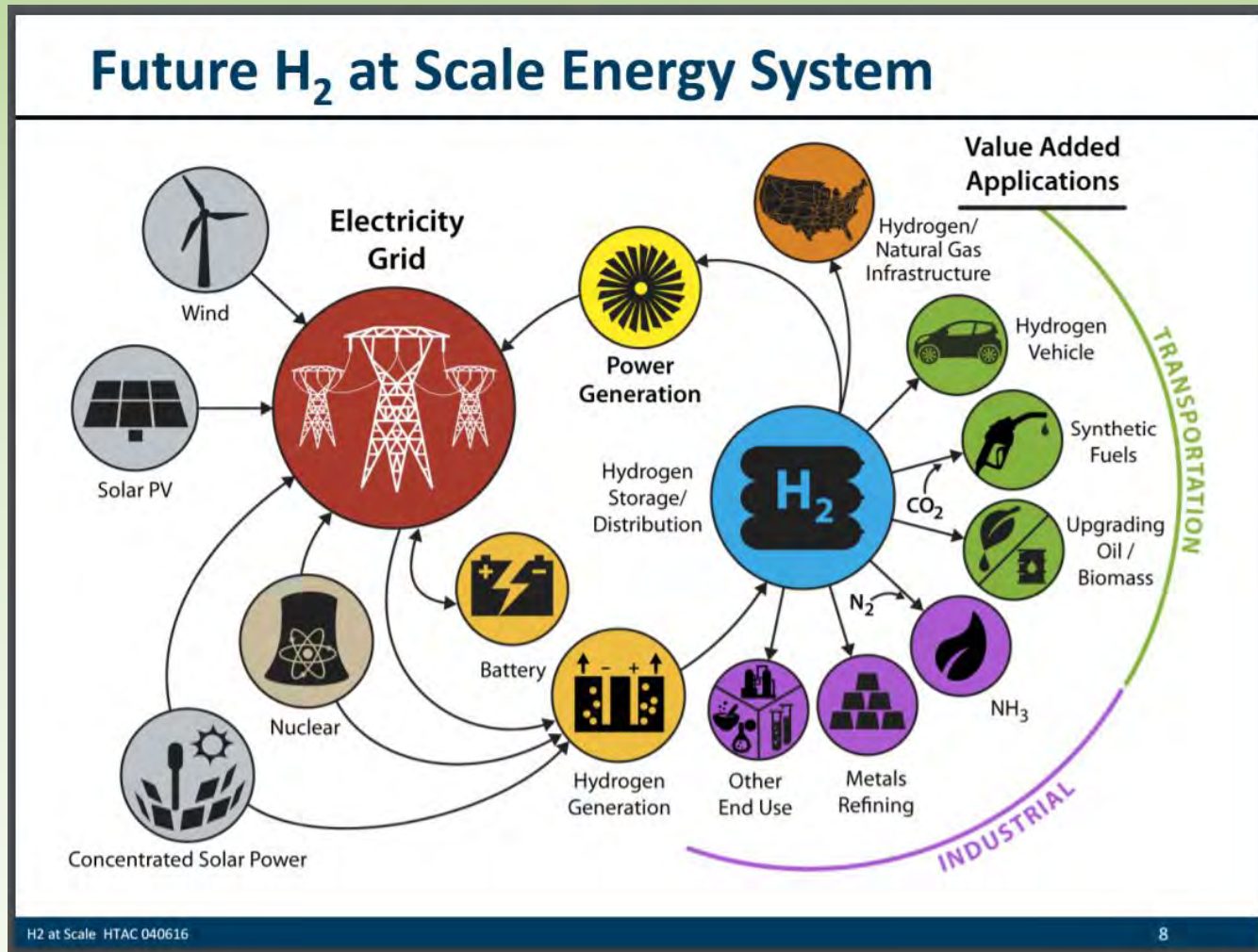
Hidrógeno y sostenibilidad: estrategia energética



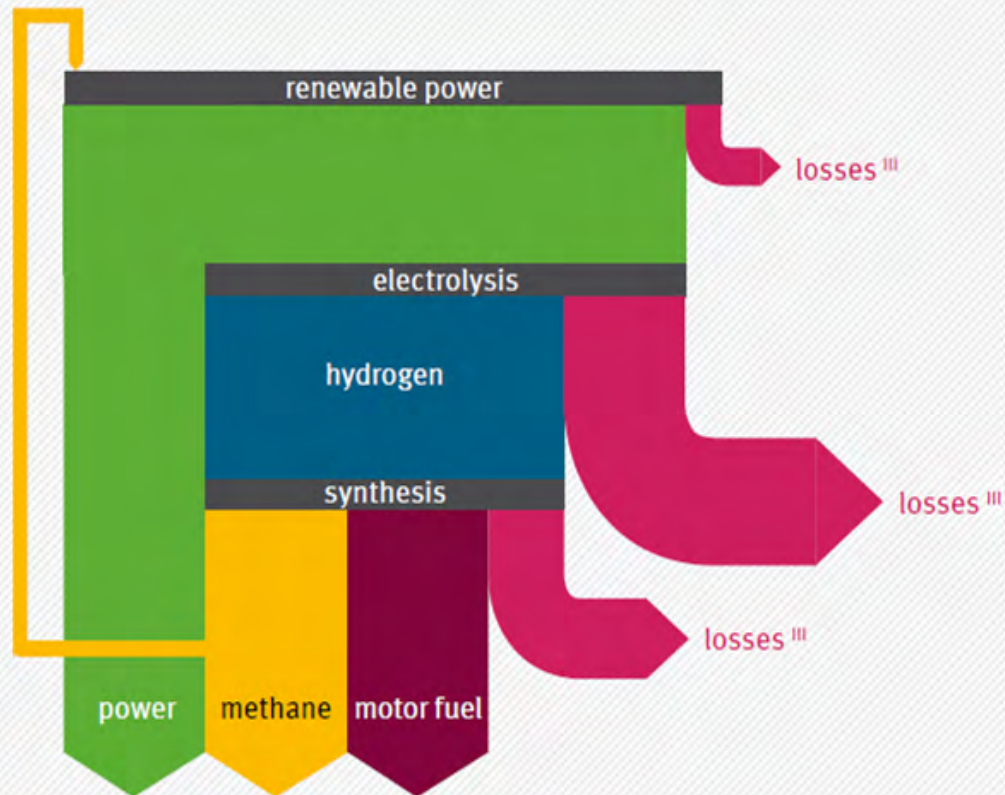
La sostenibilidad de la Economía del Hidrógeno:

- Medioambiental
- Seguridad Energética
- Economía local / balanza de pagos

Ejemplos de países: EEUU



Ejemplos de países: Alemania



Ejemplos de países: Holanda

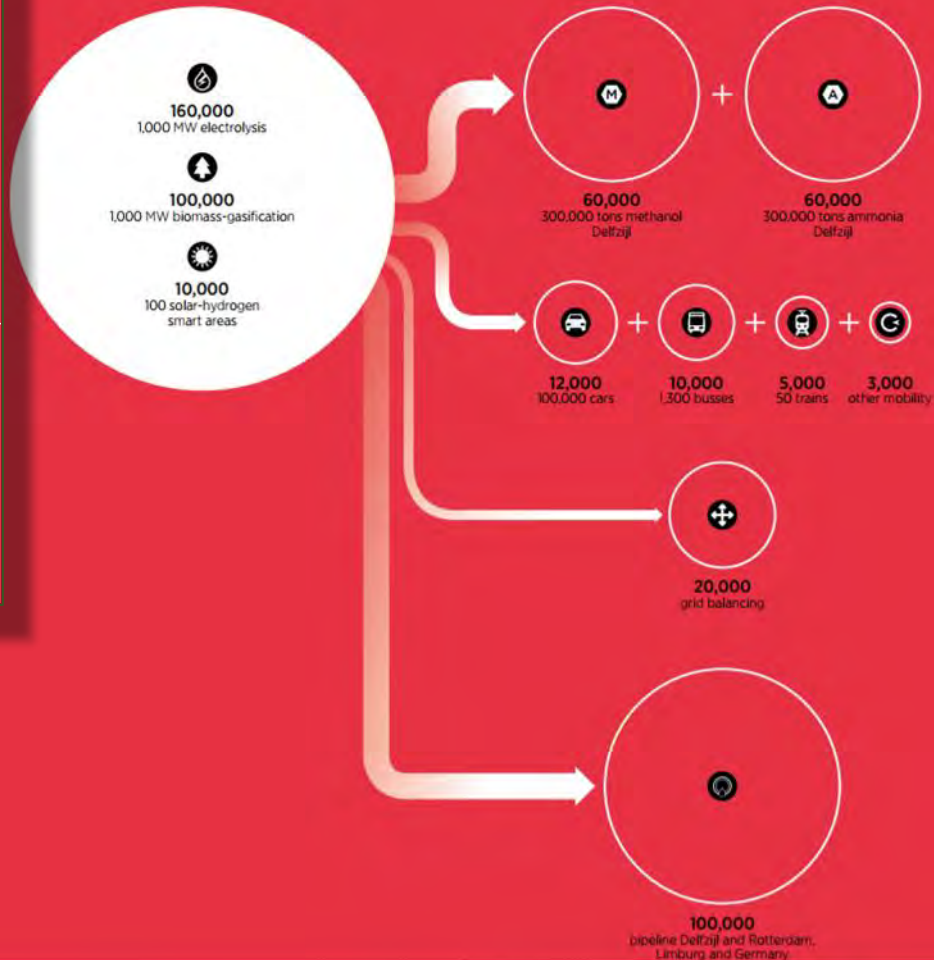
The Green Hydrogen Economy in the Northern Netherlands

270,000

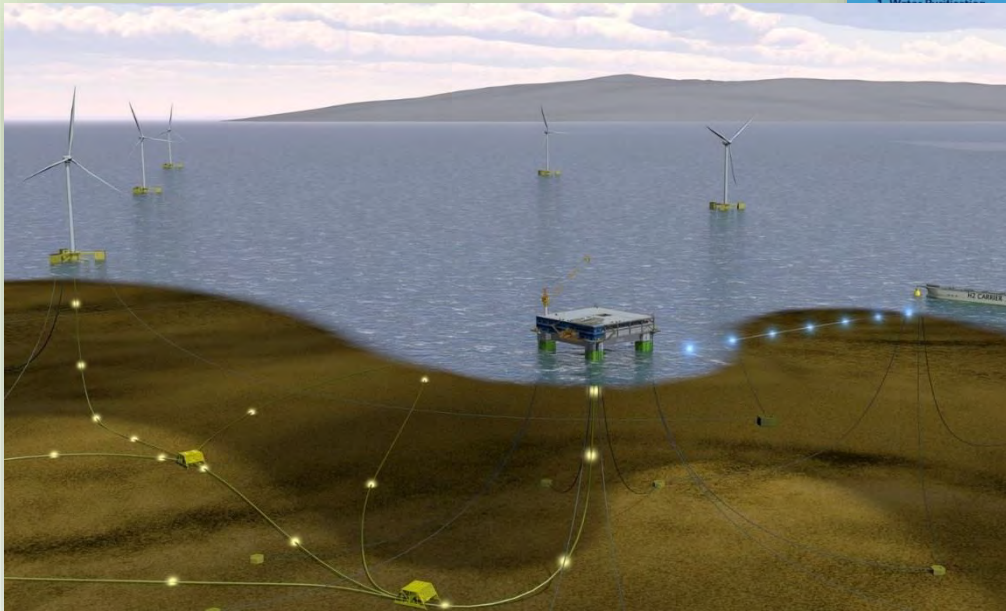
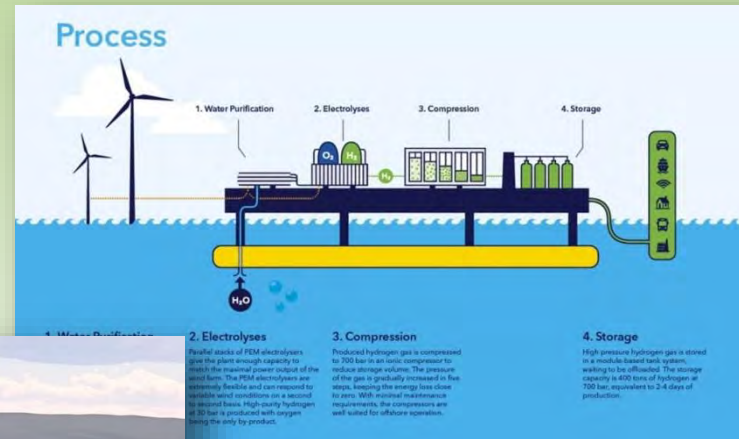
Total hydrogen
production

270,000

Total hydrogen
consumption



Ejemplos de países: Japón



A modo de conclusión...



- Un elemento masivamente **utilizado**
- Un combustible **conocido**
- Un vector energético **limpio y eficiente**
- Integrable con **EERR**
- **Local y sostenible**
- **Mercado** existente
- Disponible **ahora**

¡Gracias!

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