



FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

Hydrogen for Sectorial Integration

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PRD 2018
15th November 2018



Agenda

PROGRAMME REVIEW DAYS 2018
FUEL CELLS AND HYDROGEN JOINT UNDERTAKING
 14 - 15 NOVEMBER, BRUSSELS

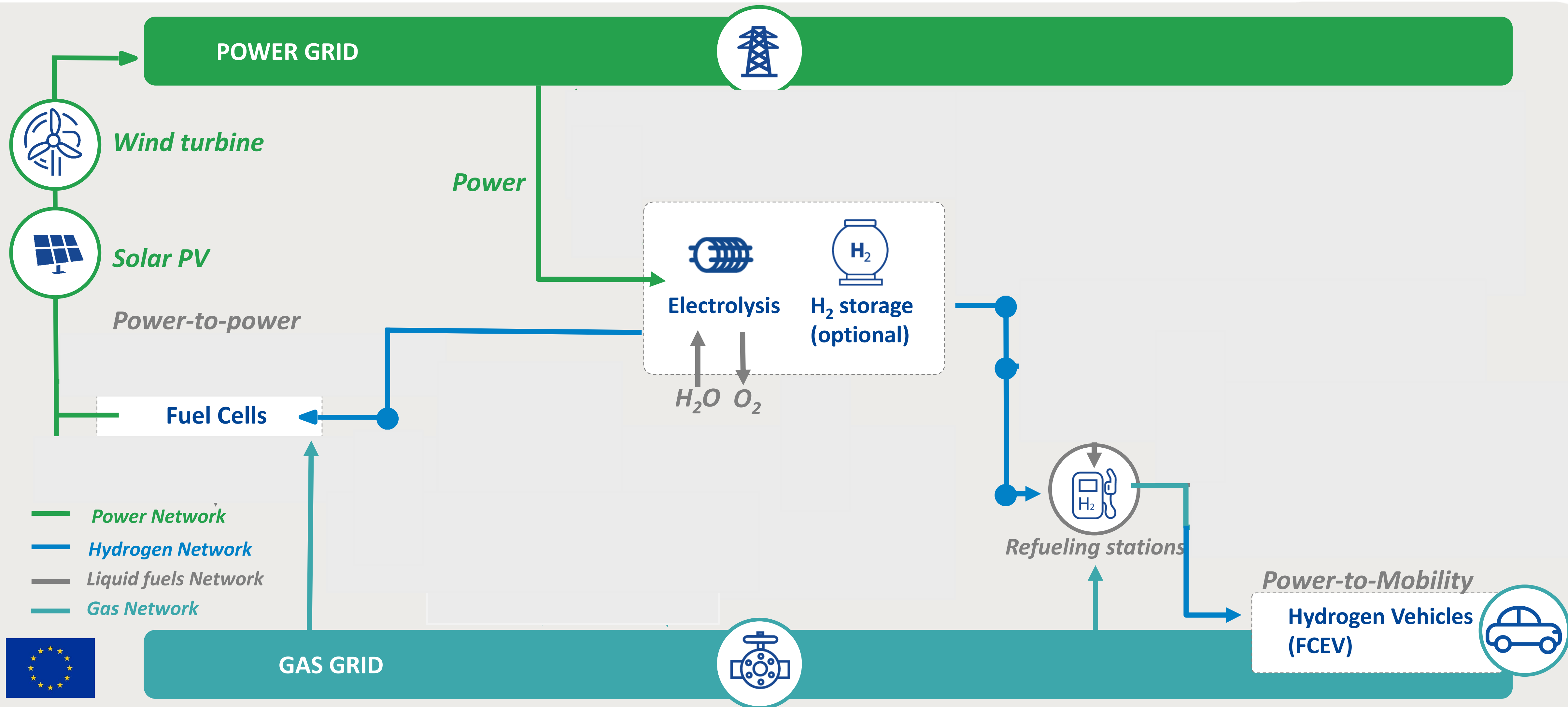


	TRIALS AND DEPLOYMENT OF FUEL CELL APPLICATION - TRANSPORT	NEXT GENERATION OF PRODUCTS - TRANSPORT	TRIALS AND DEPLOYMENT OF FUEL CELL APPLICATION - ENERGY	NEXT GENERATION OF PRODUCTS - ENERGY	HYDROGEN FOR SECTORIAL INTEGRATION	SUPPORT FOR MARKET UPTAKE
14:30 - 14:50	H2ME HAWL HYFIVE HYLIFT-EUROPE HYTRANSIT	AUTO-STACK CORE COBRA COSMHYC DIGIMAN Fit-4-AMandA	ALKAMMONIA AUTORE CH2P CLEARGEN DEMO D2SERVICE	Cell3Ditor DIAMOND ENDURANCE FLUIDCELL HEALTH-CODE	BIONICO BIOROBURplus Demo4Grid DON QUICHOTE Eco	HYACINTH HYCORA HyLAW HYFACTOR HySEA
14:50 - 15:10	JIVE SWARM H2ME 2	H2REF HYCARUS INLINE INN-BALANCE INSPIRE	DEMCOPEM-2MW DEMOSOFC ENE.FIELD ONSITE PACE	HEATSTACK INSIGHT MATISSE NELLHI PROSOFC	ELECTRA ELY4OFF ELYntegration GrInHy H2Future	HYTECHCYCLING KNOWHY NET-Tools SOCTESQA
15:10 - 15:30		MARANDA NANO-CAT SMARTCAT VOLUMETRIQ COMPASS	PEMBEYOND POWER-UP STAGE-SOFC	qSOFC SCORED 2:0 SECOND ACT SOSLeM INNO-SOFC	HELMETH HPEM2GAS HyBalance HYDROSOL-PLANT HyGrid INSIDE MEGASTACK PECDEMO PECSYS	
15:30 - 15:50		Giantleap			QualyGridS SElySOs SOPHIA BIG HIT MEMPHYS	
15:50 - 16:10						
16:10 - 16:30						
16:30 - 16:50						



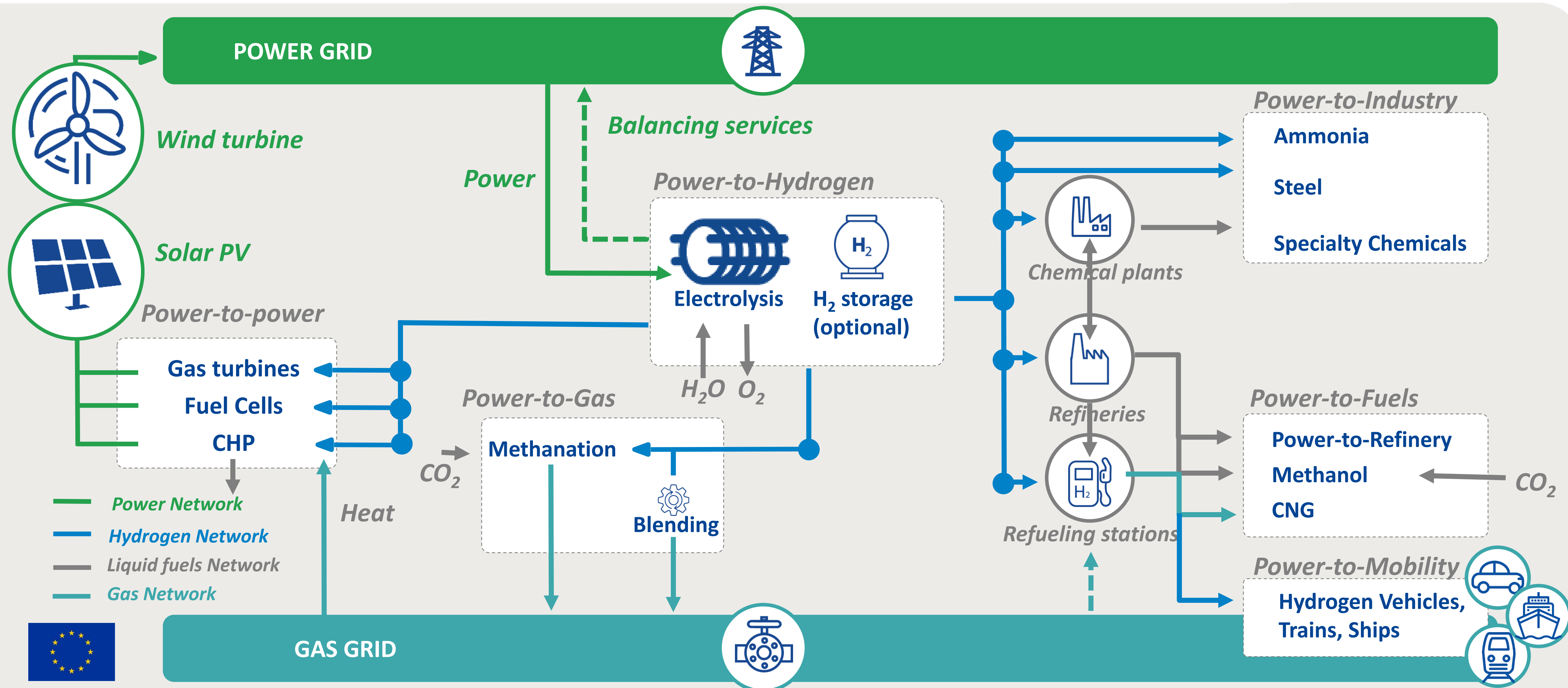
Early H₂ Production: a facilitator of FCs in Transport and Energy

P2P & FCEVs + "Where will the Hydrogen come from?"



Today's H₂ Production: enabler of Sectorial integration

H₂ is the best option for deep decarbonisation for a number of sectors

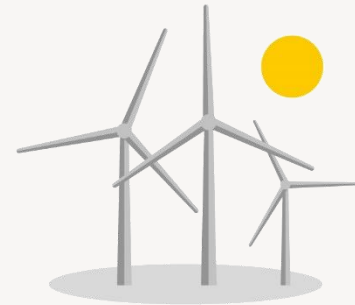


Hydrogen for Sectorial Integration

Well-positioned FCH JU objectives & Budget

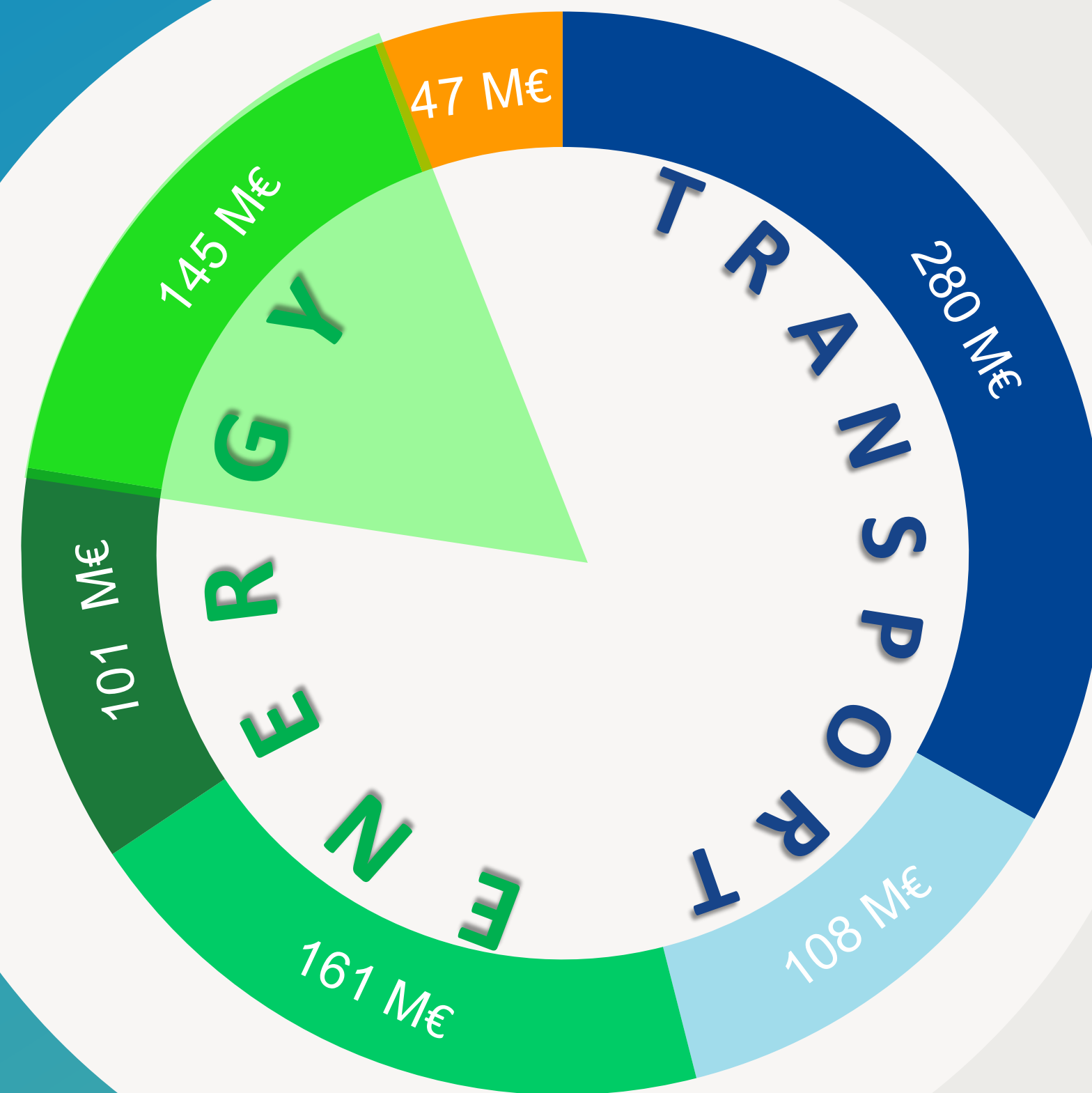


Related FCH JU Objectives



Increase efficiency and reduce costs of H₂ production, mainly from water electrolysis and renewables

Demonstrate on a large scale H₂'s capacity to harness power from renewables and support its integration into the energy system



H₂ production, distribution & storage

17.2%

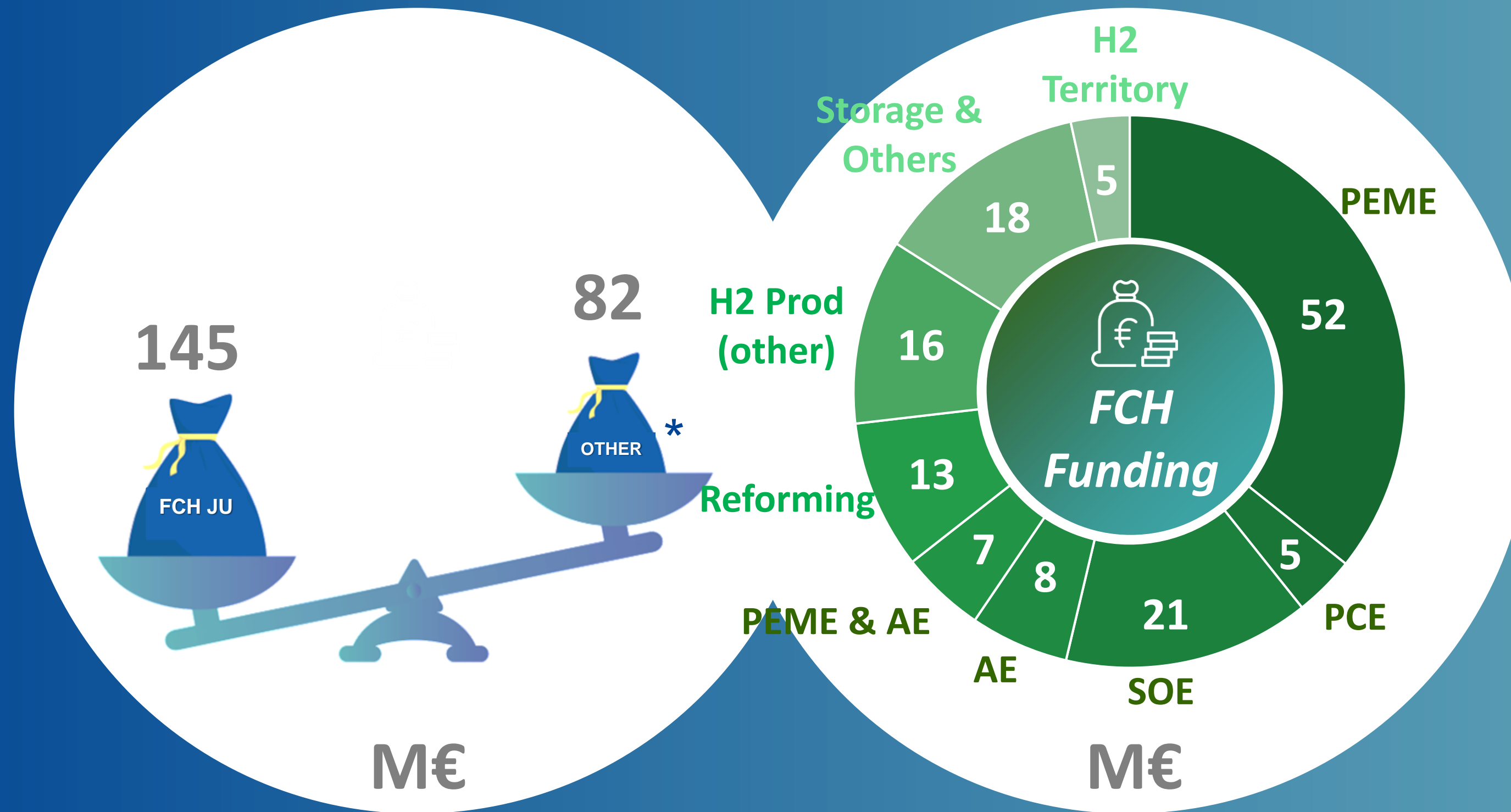
145 M€

54 Projects



FCH JU programme implementation – H₂ for Sectorial Integration

54 projects – 227 M€



Electrolysers proving themselves in Industrial forecourts & Energy Market



Niche H₂ Territories



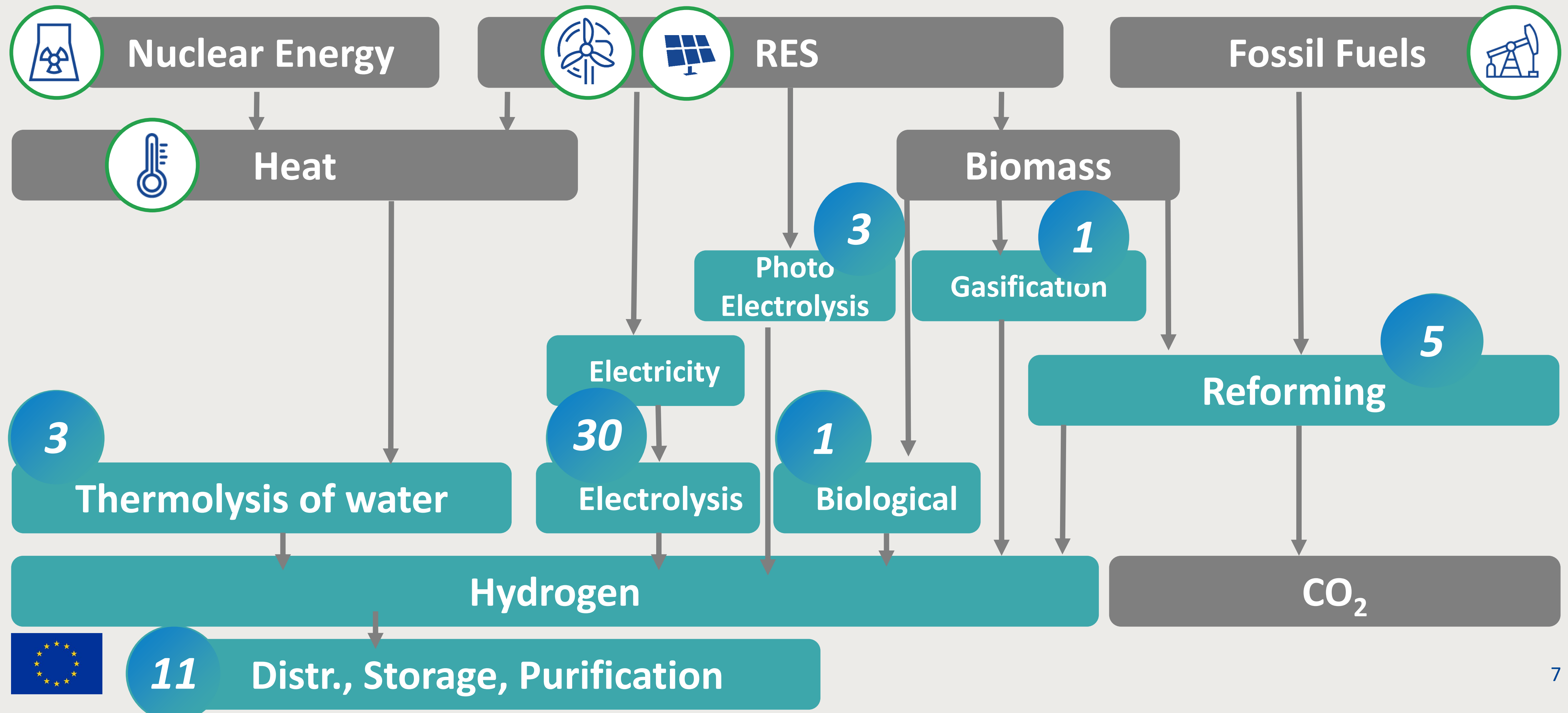
Viable Early Business Cases

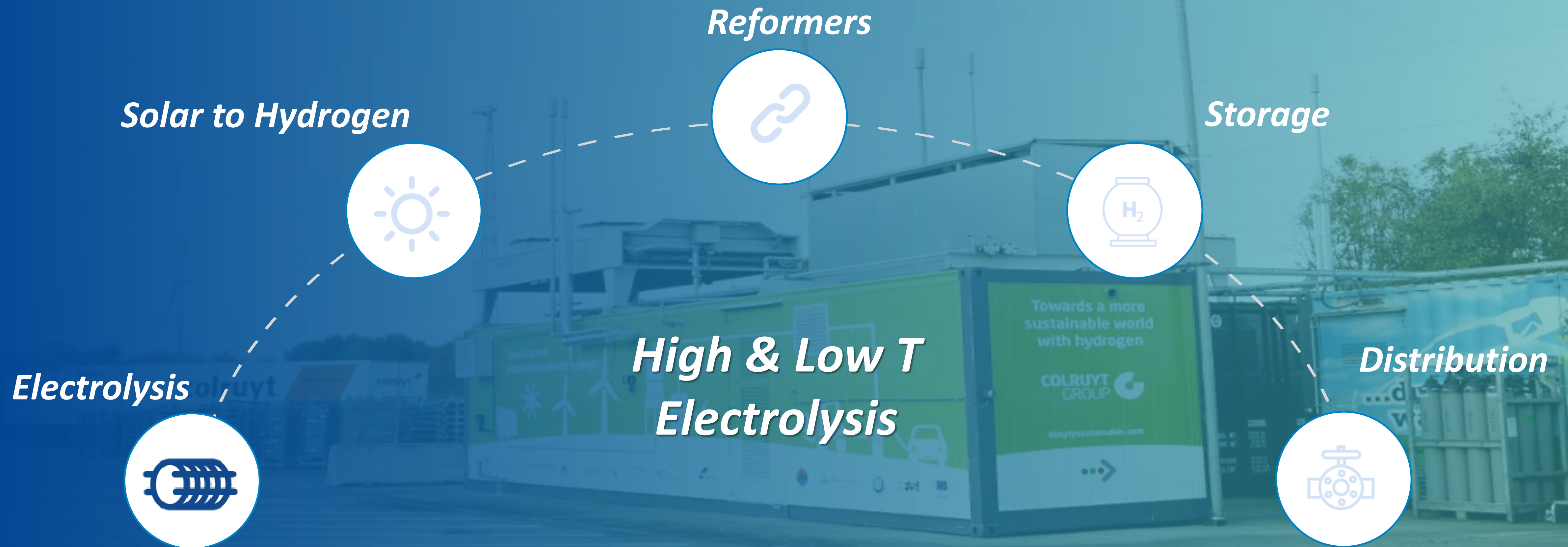


* Other resources including private and national/regional funding

Hydrogen Production Technical Coverage

95% of FCH JU support to green Hydrogen production



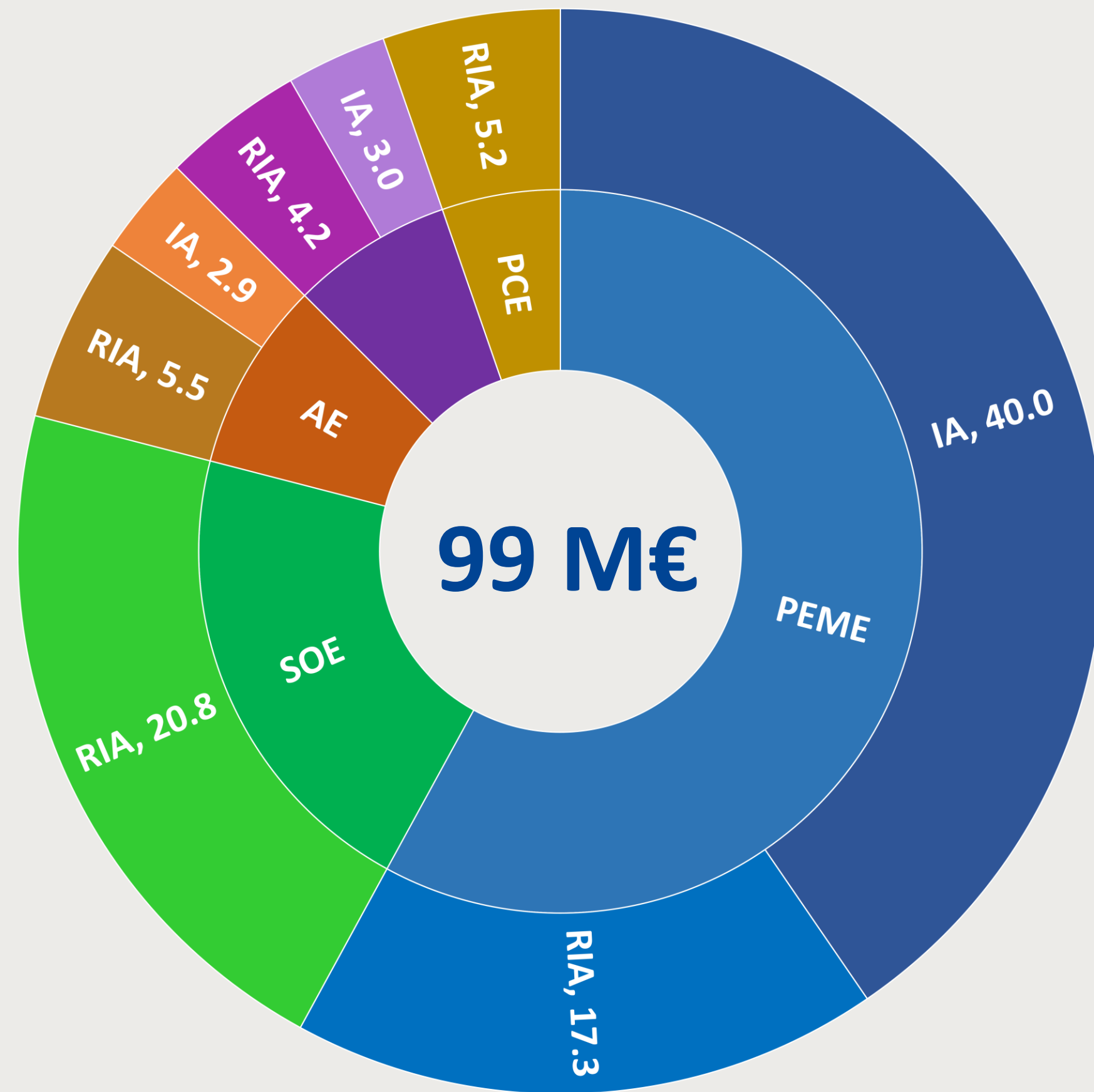


Electrolysis Research and Demonstration

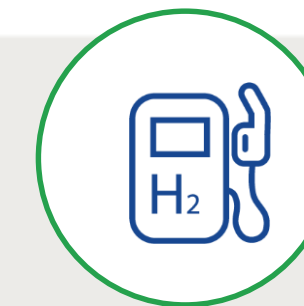
The potential of Hydrogen for the greening of industry has led to fast capacity increase and cost reduction



Electrolysers, M€ FCH JU support



30 Projects



HRS



Steel industry

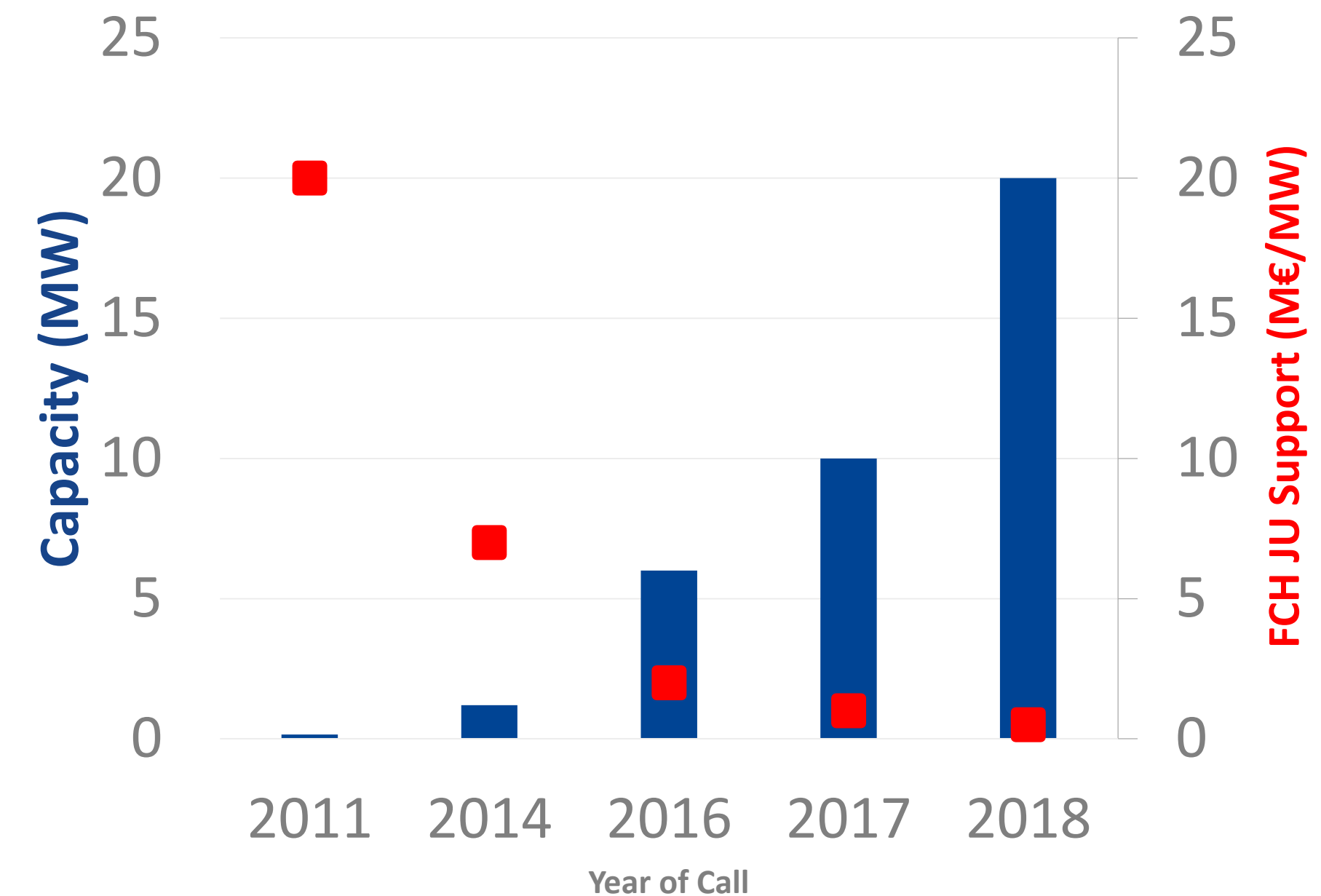


Refineries



Food industry

Electrolyser Demo Projects

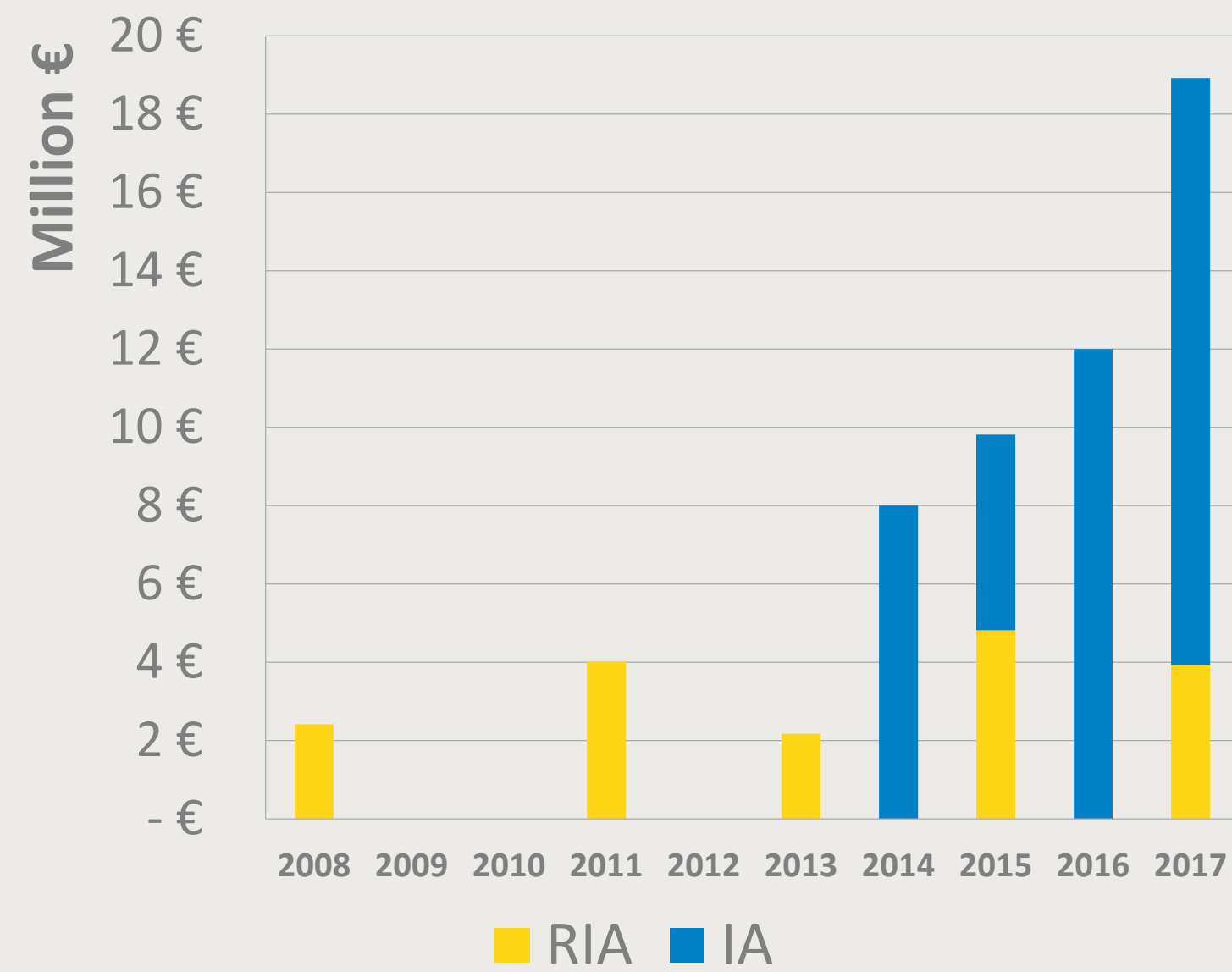


Electrolysis Research and Demonstration

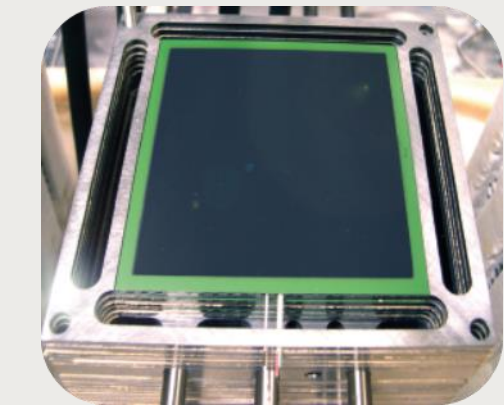
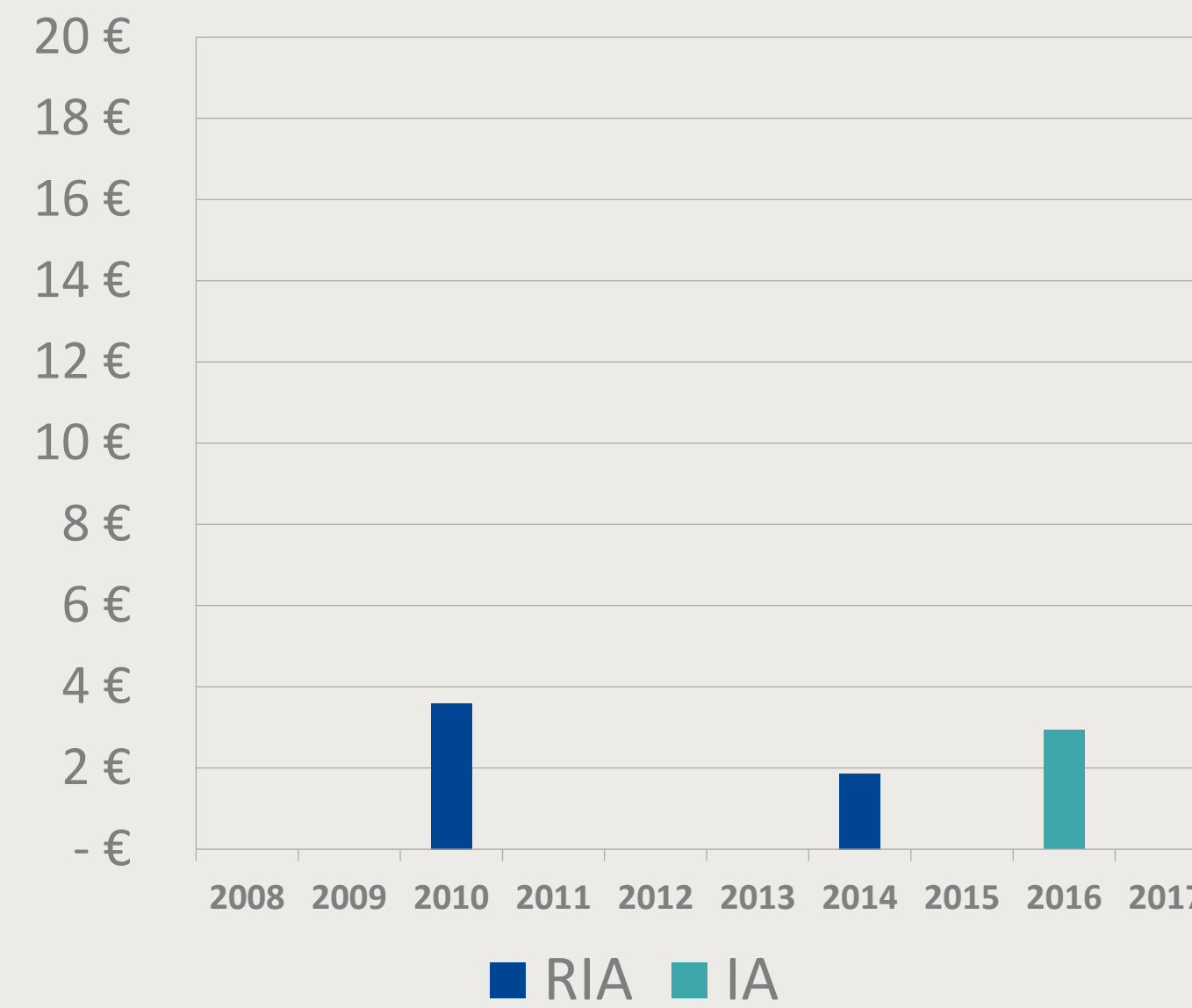
Support over time for electrolysis



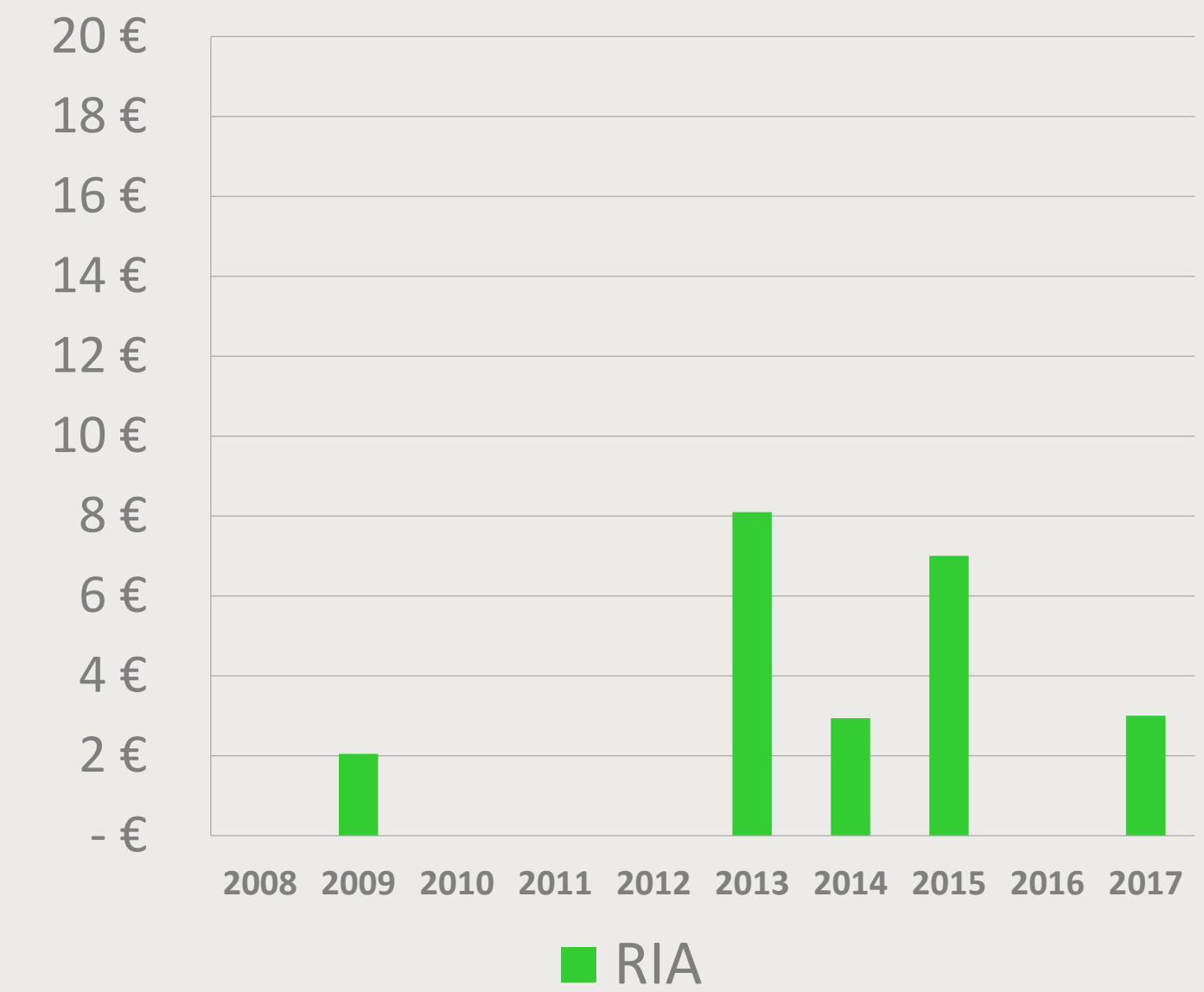
PEM



Alkaline



Solide Oxide

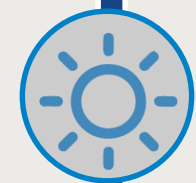


Safeguarding Europe's leading position in Low Temp electrolysis

Vibrant community of OEMs and R&D institutions



Capex targets for AE and PEME < 1.2 k€/kW



Current density > 3 A/cm²



Efficiency at system level < 55 kWh/kg



Dynamic op / Testing Harmo / Degradation / Diagnostics



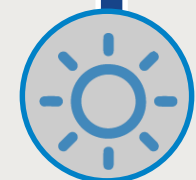
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HPeM₂GAS



SLIDO Question

DEMO4GRID project

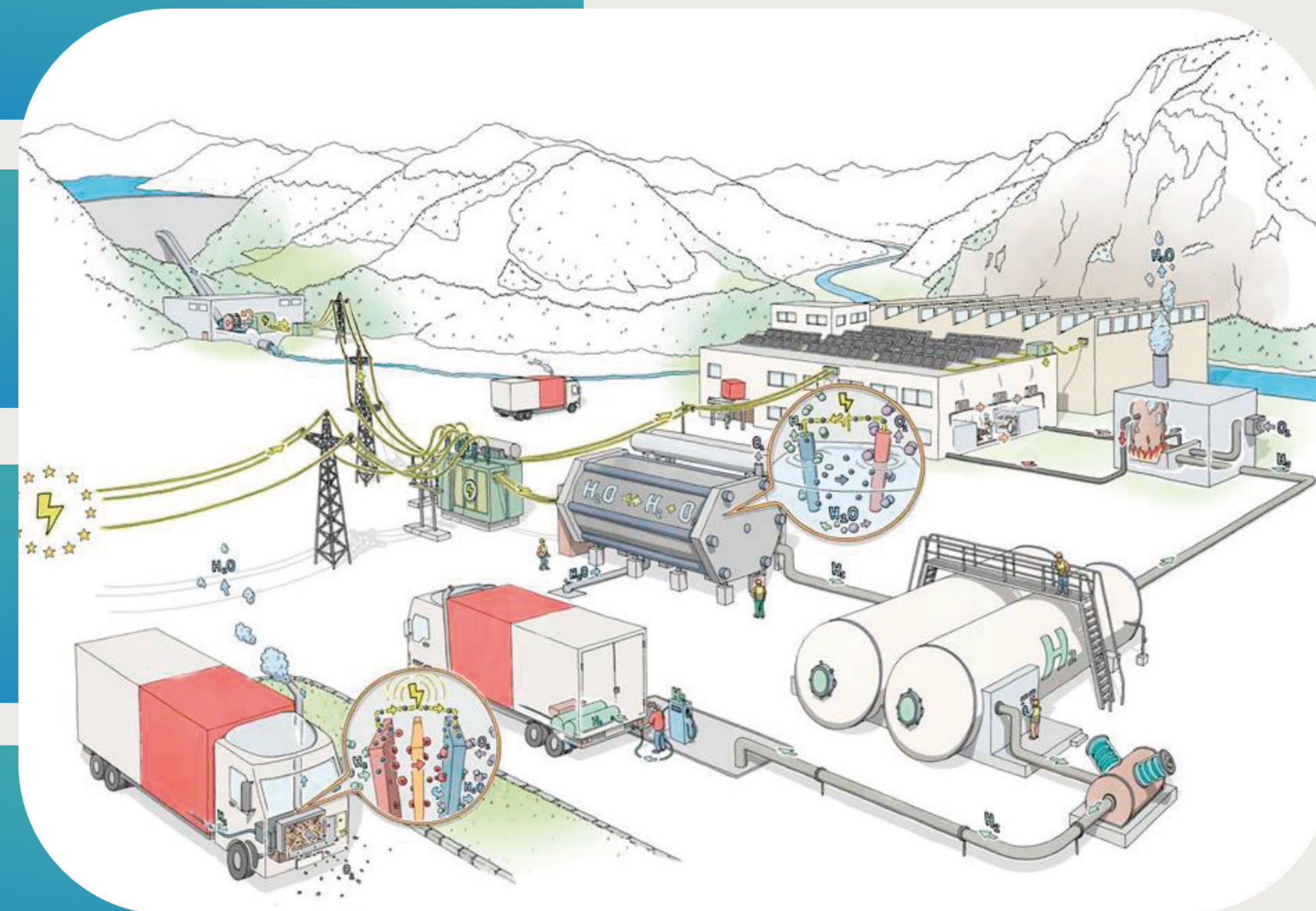


Q: How much CO₂ is emitted to bake a 800 g loaf of bread?

A1: 200 g

A2: 400 g

A3: 600 g



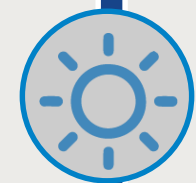
Use your smartphone; go to www.sli.do and insert the code #PRD2018

European leadership in High Temp electrolyzers

Highest capacities & innovative concepts



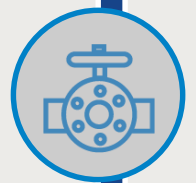
Electricity consumption < 40 kWh/kg



Production loss rate < 1.9%/1000h

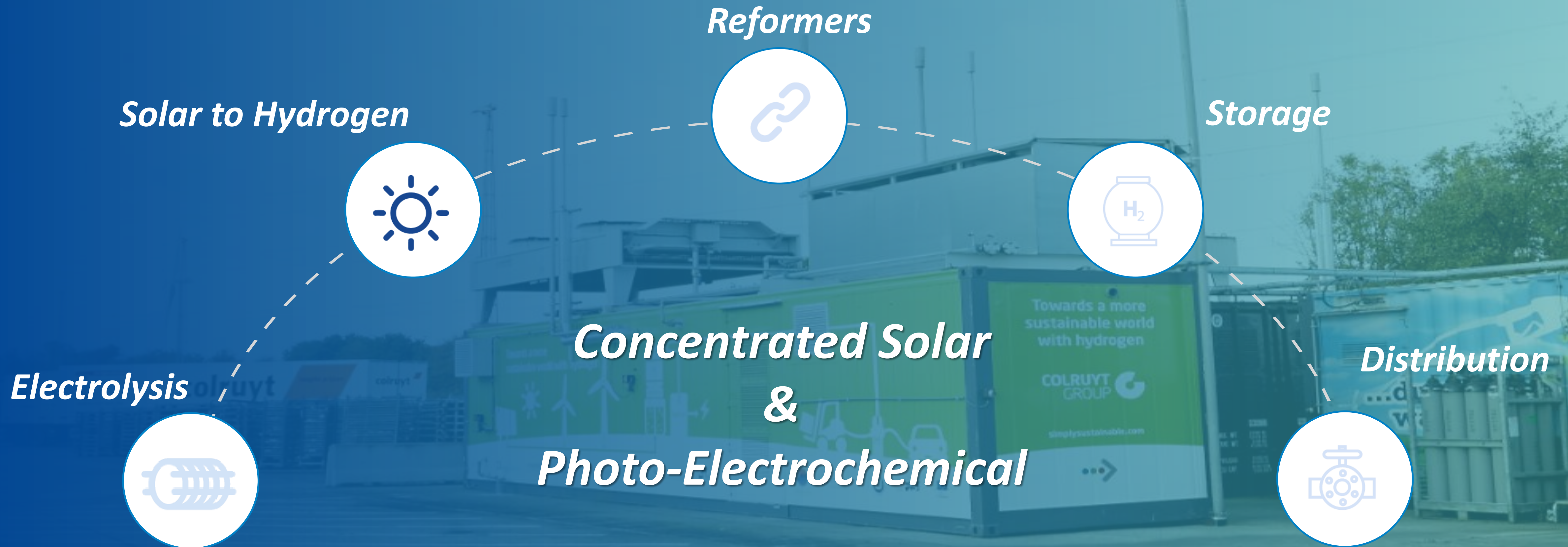


Availability >95%, reversible efficiency 54%



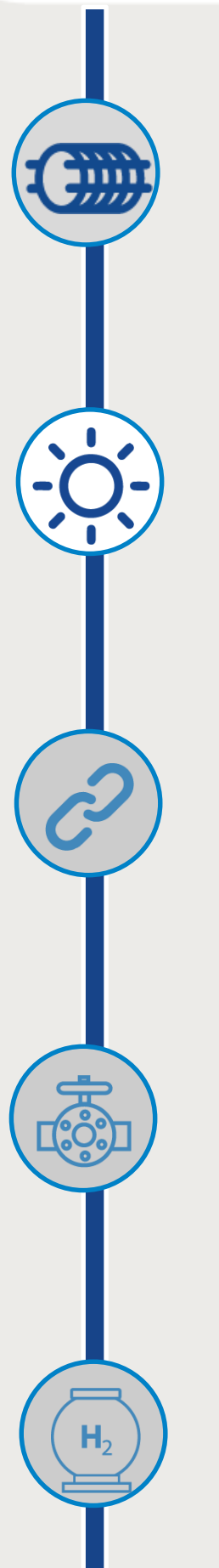
Integrated methanation/ Co-electrolysis







Concentrated solar demonstrated in the field



Redox and HyS cycles supported

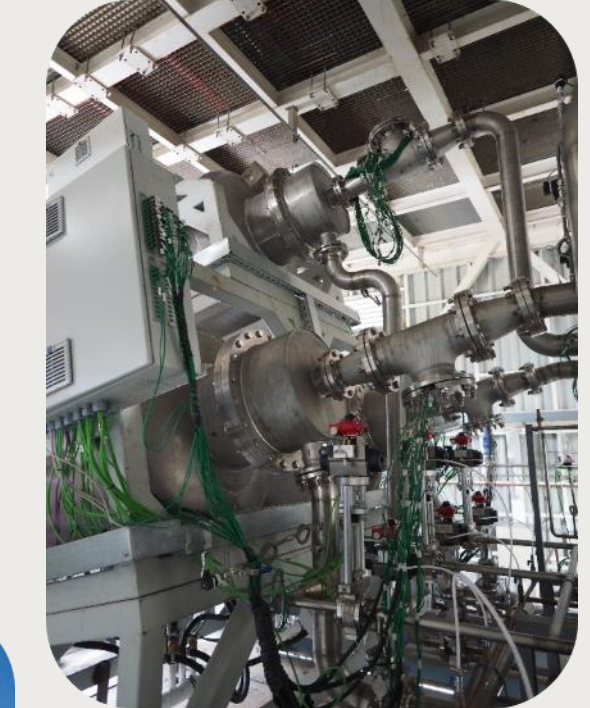


 Solar Thermal capacity 0.75 MW 

 H₂ production capacity < 3kg/week 

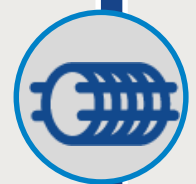
 Material lifetime > 1,000 hr 

 Recovery of high temp heat, stability, cyclability 

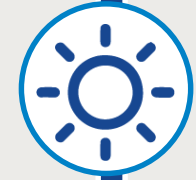


PEC devices: moving to practical sizes

High efficiencies at specimen scale; challenges at scaling up and “under sun” operation



Lab: 12.8%



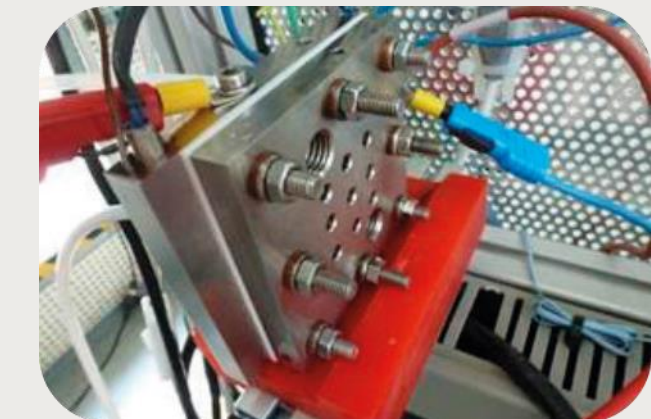
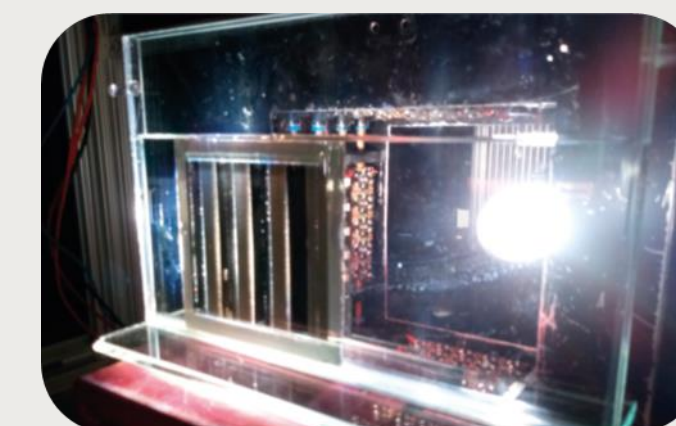
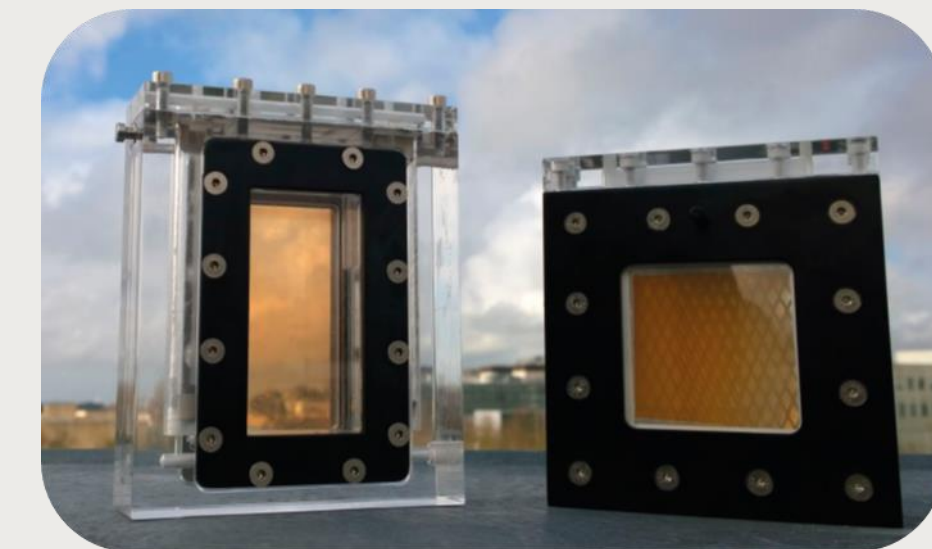
Lab: 1,000 hours for Fe_2O_3 photo-anodes

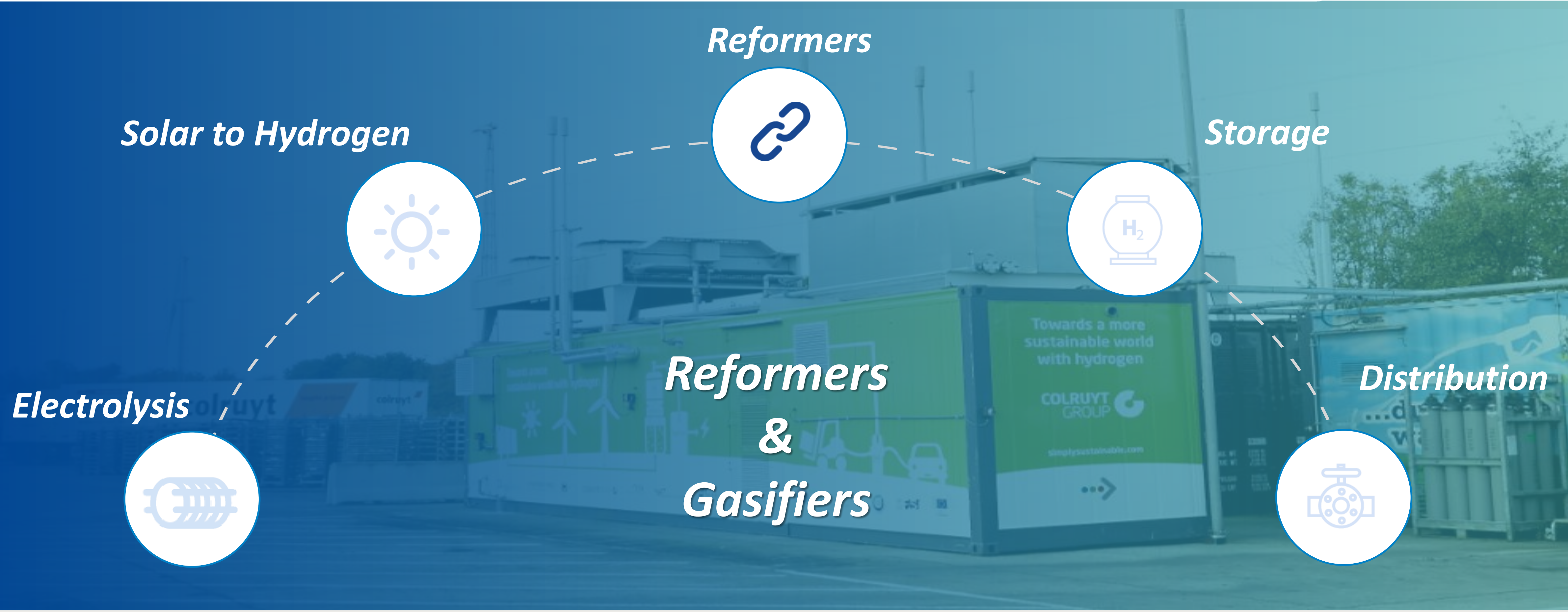


4x50cm² done; working on 100 cm², aiming for 10m²












9 €/kg estimated for house system with η 8%

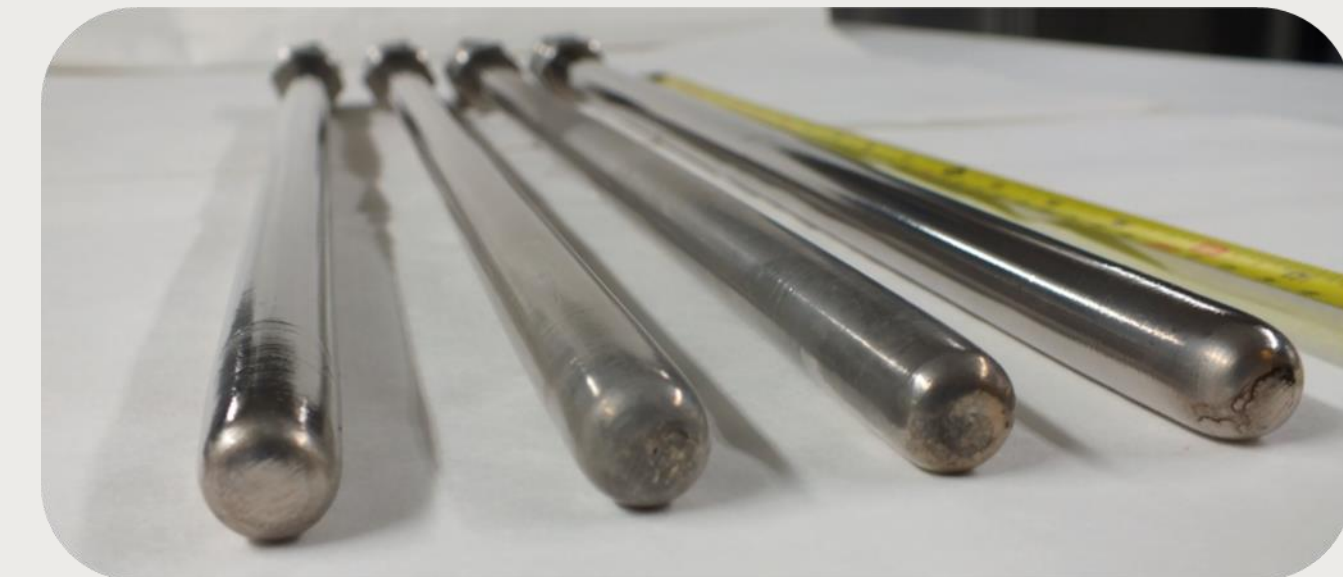


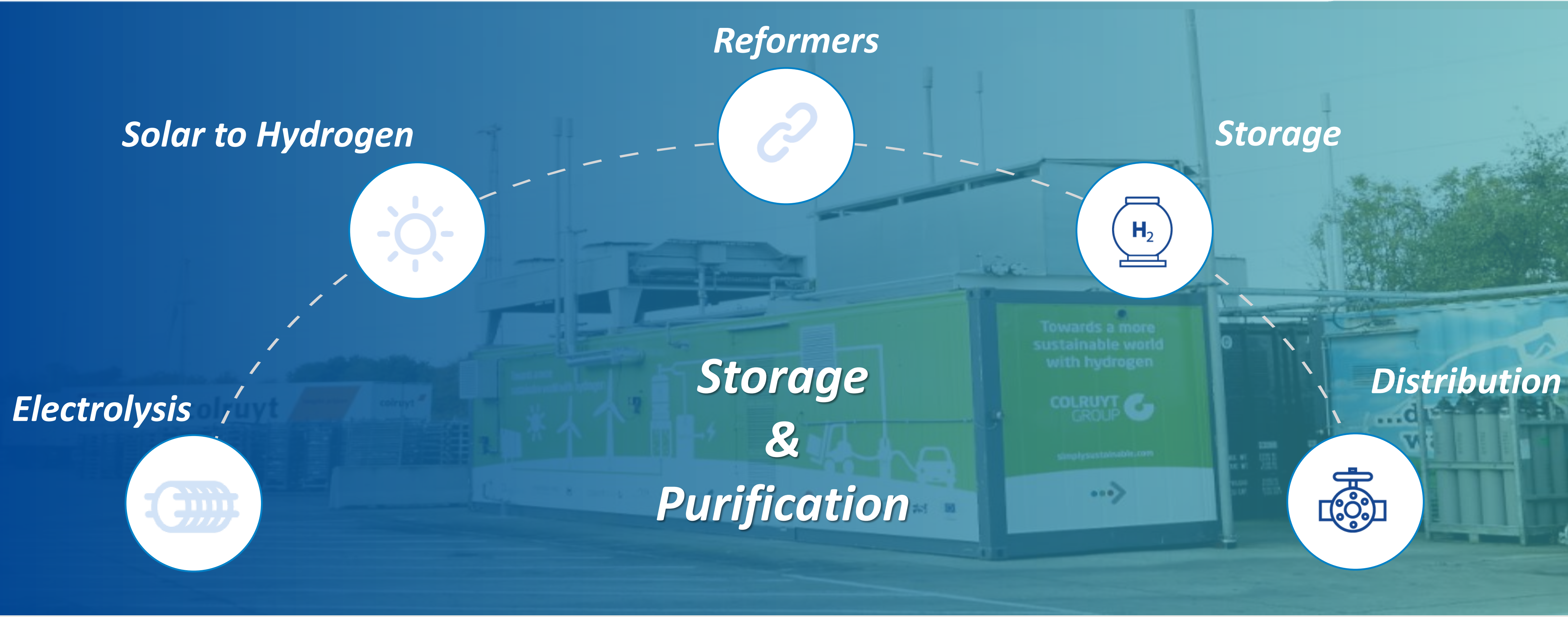


Compact reformers

Green hydrogen from raw biogas

-  Various biofuels, capacities 3 -300kg/day 
-  Biogas without CO₂ prior removal 
-  100kg/day H₂  conversion $\eta = 71.5\%$ 
-  4.8 €/kg demonstrated @ landfill site 





Efficient separation of H₂

Preparing for Hythane, underground storage, H₂ as byproduct



Hydrogen recovery rate > 90%



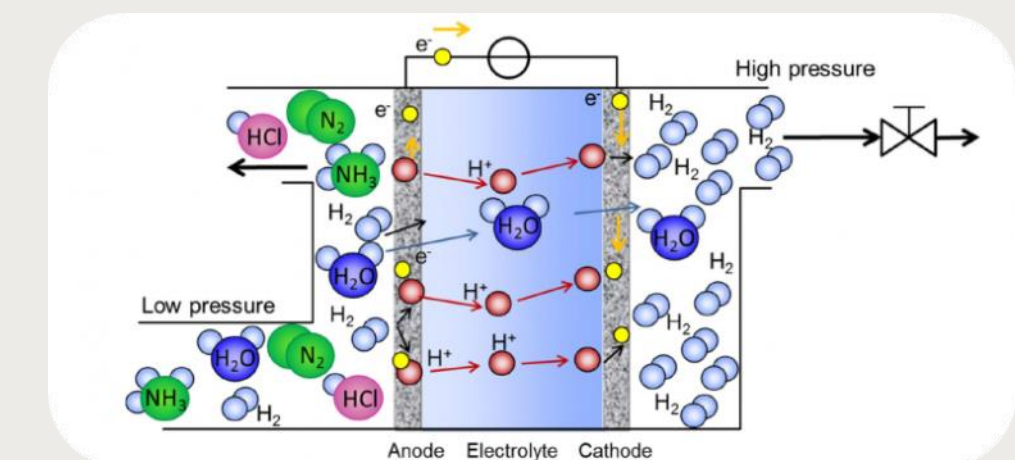
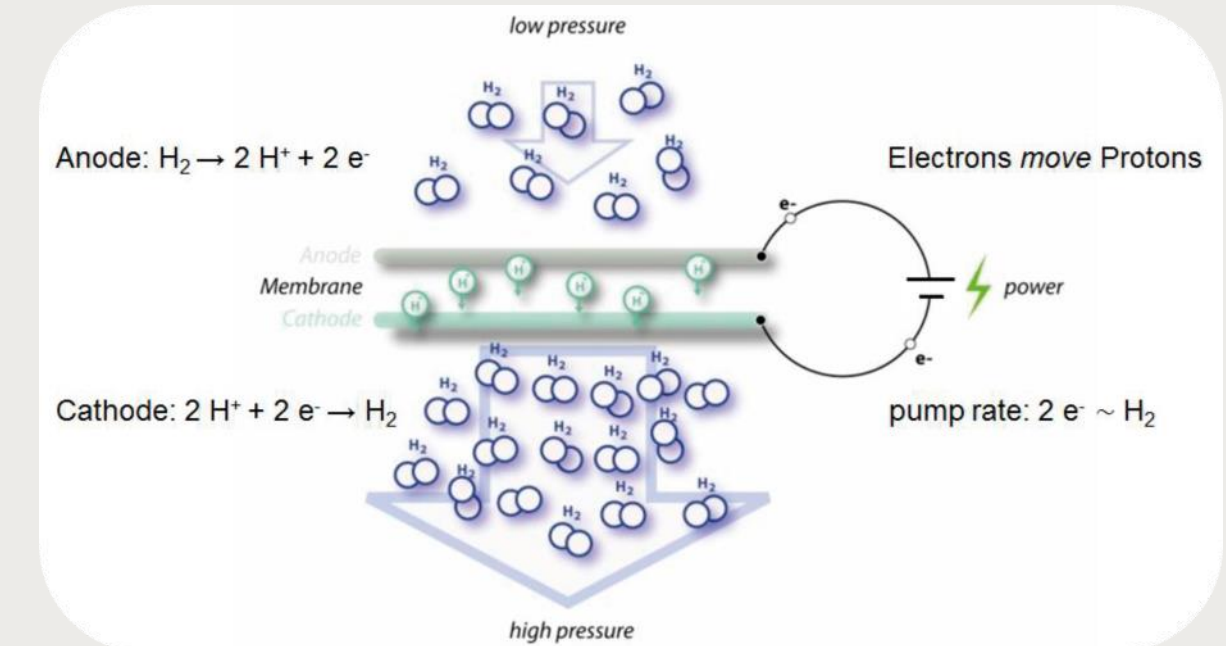
H₂ recovery using membranes < 5kWh/kgH₂



Cost of purified H₂ < 1.5 €/kg



5-25 kg H₂/day, H₂ delivery @ 200 bar



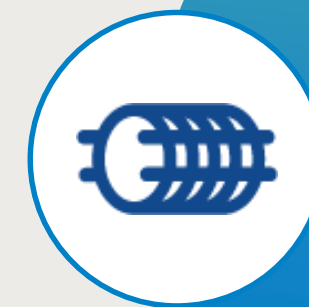
Summary



Sectorial integration, Energy storage, Decarbonizing industry & the Gas grid: mainstream energy policy terms



H₂: important component – Electrolyser: key technology



FCH JU: continuous support in moving electrolysers from kW to MW, improving performance & reducing costs



Alternative routes for green H₂ production, H₂ storage and purification enjoying equivalent support





FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

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