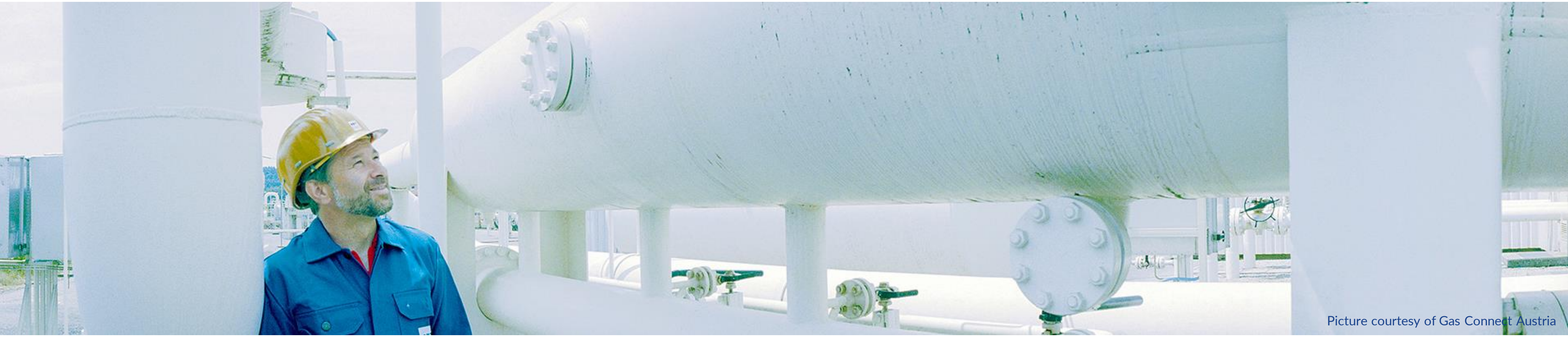


Picture courtesy of Gas Connect Austria

Prime movers' group on Gas Quality and H_2 handling

#10 meeting, 30 June 2021 (10:00 – 13:00 CET)

Online

Disclaimer

The information included in this presentation is subject to changes. The proposals are presented for informative purposes only since the work is still in progress.

The organisation is not liable for any consequence resulting from the reliance and/or the use of any information hereby provided.

Agenda

Agenda

Topic	Time
Welcome and agreement on agenda	10:00 – 10:05
PMG-SG2 #4 meeting – Gas Quality & H_2 management tools & costs. Presentation and discussion about findings	10:05 – 11:00
H_2 transformation paths of the gas distribution networks (Andreas Schick, Managing Director at Netze-Gesellschaft Südwest)	11:00 – 12:00
Hydrogen Europe (Michael Diderich, Technology Manager at Hydrogen Europe)	12:00 – 12:50
A.O.B. & next steps	12:50 – 13:00

PMG-SG2 #4 meeting – Gas Quality & H2 management tools & costs

Presentation and discussion about findings

- Material available here

H2 transformation paths of the gas distribution networks

H_2-transformation paths of the gas distribution networks in Nordbaden and Oberschwaben

A joint study by Netze Südwest and DBI

Andreas Schick
Managing Director

June 2021

An Erdgas Südwest Company

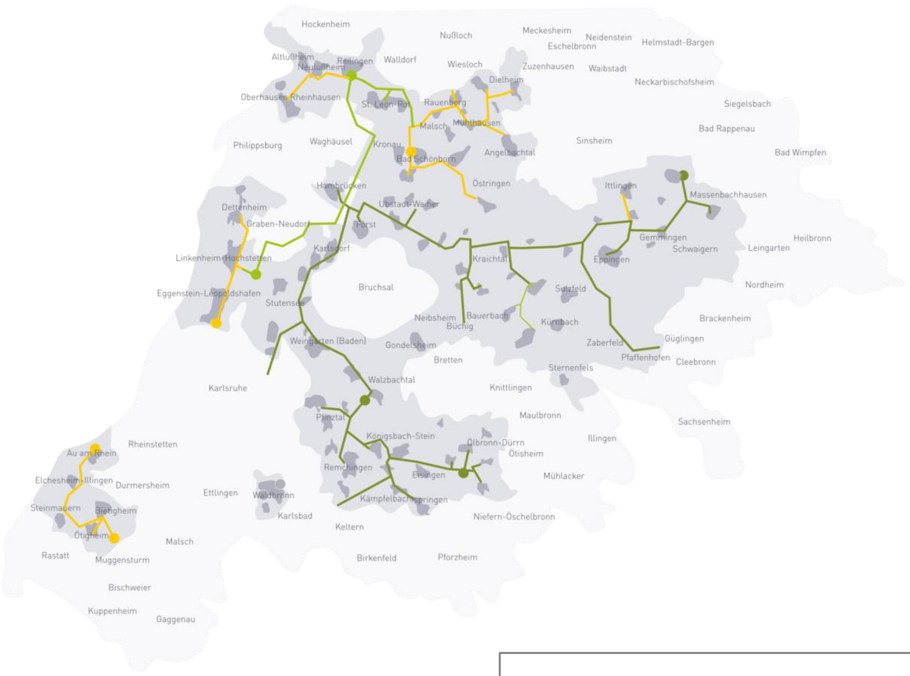
Netze Südwest

Agenda

1. **Study context**
2. **Settings**
3. **Results**
4. **Outlook for implementation**

Overview of network areas Netze Südwest:

Nordbaden



Oberschwaben

Basic data:

Total network length: 4,964 km // Total network area: 2,973 sq km

Number of towns & municipalities: 101 // Upstream grids/TSO: 4

1

Study context

Initial situation of the ‘Transformation paths Oberschwaben and Nordbaden’ study

Netze Südwest

- development of ‘grid rehabilitation plan’ for the next 20 years
- proactive preparation of the grids to achieve climate targets
- create possibility for distribution of green gases, especially hydrogen, in the natural gas grid

DVGW Research Project

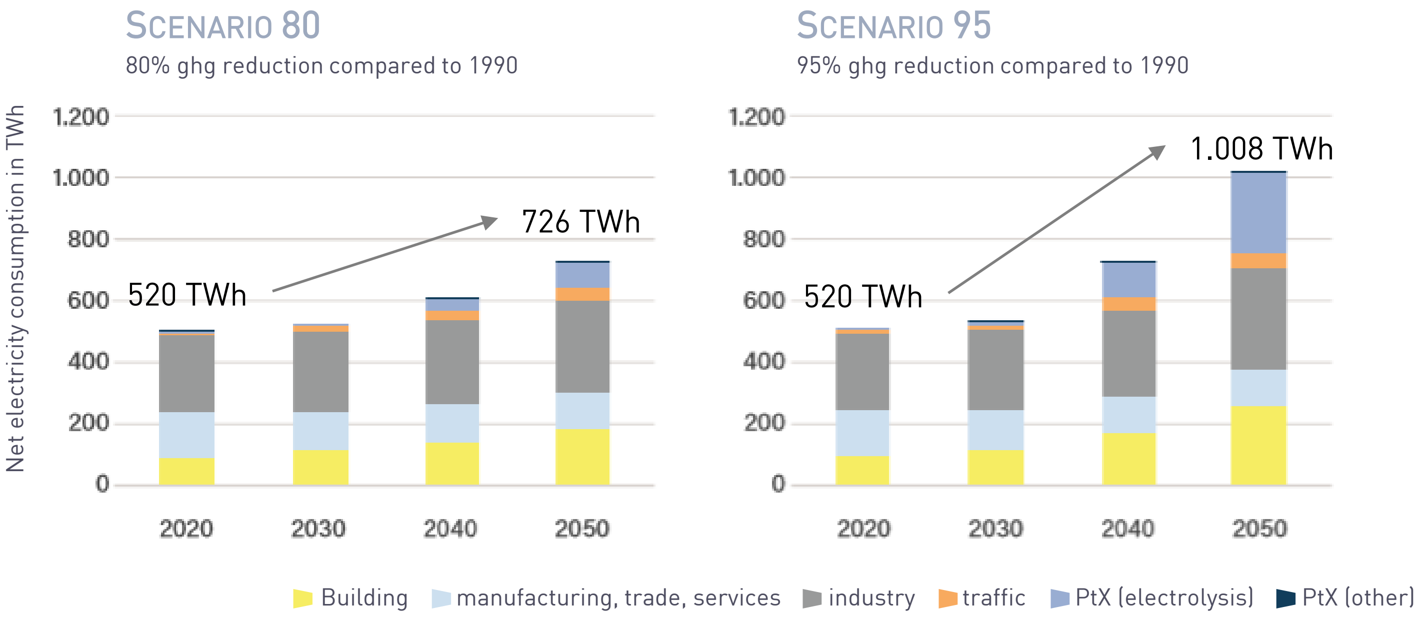
- Strategic use of replacement investments reduces costs of grid transformation
- Non-expansion or delay increases overall macroeconomic costs

Transformation paths support strategic planning at Netze Südwest

Initial situation of the study

Development of net electricity consumption up to the year 2050

Research Center Jülich, Robinius, M. et al. (2019): Cost-efficient and climate-friendly transformation strategies, S. 24



Initial situation of the study

Key drivers of rising net electricity consumption

Research Center Jülich, Robinius, M. et al. (2019): Cost-efficient and climate-friendly transformation strategies, S. 25

In Scenario 95, net electricity consumption reaches a value of **1008 TWh in 2050** (80% increase compared to 2020). The main drivers of the additional consumption include:

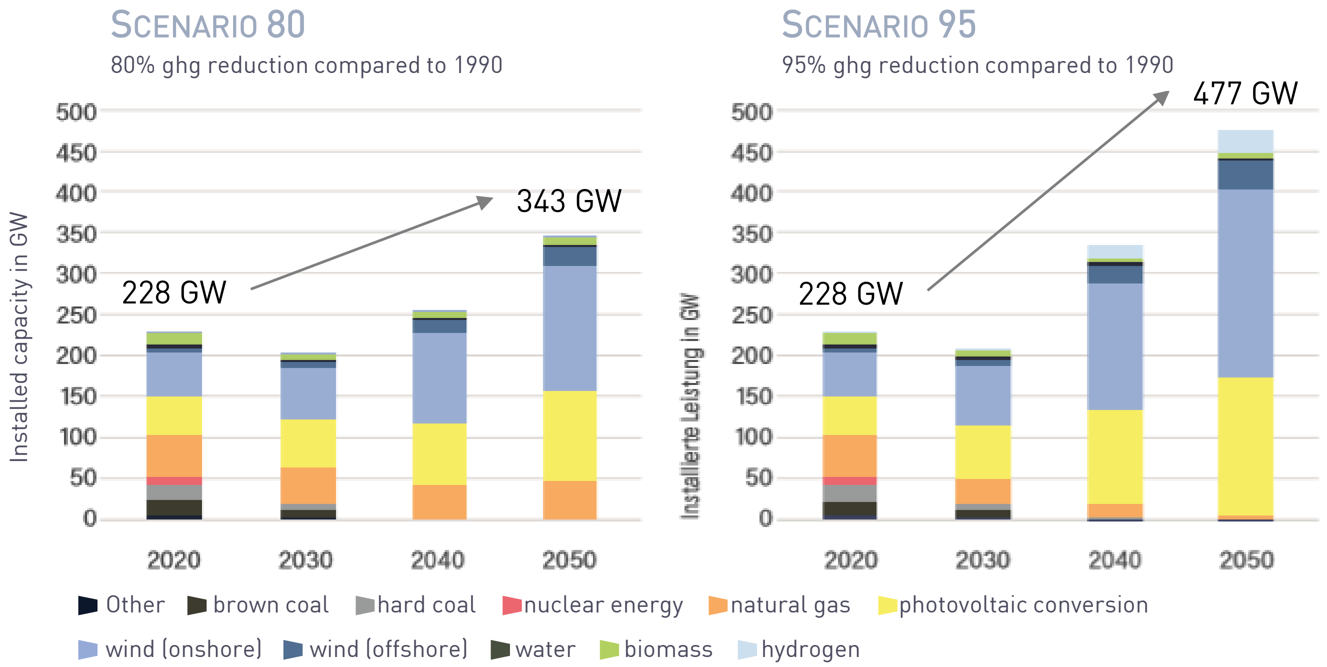
- massive use of heat pumps to generate space heat
- increasing electricity consumption in industry
- increasing use of electricity for electrolysis

There is further electricity demand for the electrification of heavy industry, which is not included in the 1008 TWh.

Initial situation of the study

Development of installed power (without storage) up to the year 2050

Research Center Jülich, Robinius, M. et al. (2019): Cost-efficient and climate-friendly transformation strategies, S. 24



Settings

Underlying settings and scenarios

Main settings

1. **Technical parameters**
   - classification of H_2-sensitive com-ponents/breakdown construction year
   - period of use
   - replacement costs

2. **Assumptions on future grid usage**
   - gas demand
   - technology paths and scenarios for hydrogen concentration in the gas grid

Scenarios developed

1 Grid renovation/maintenance without transformation

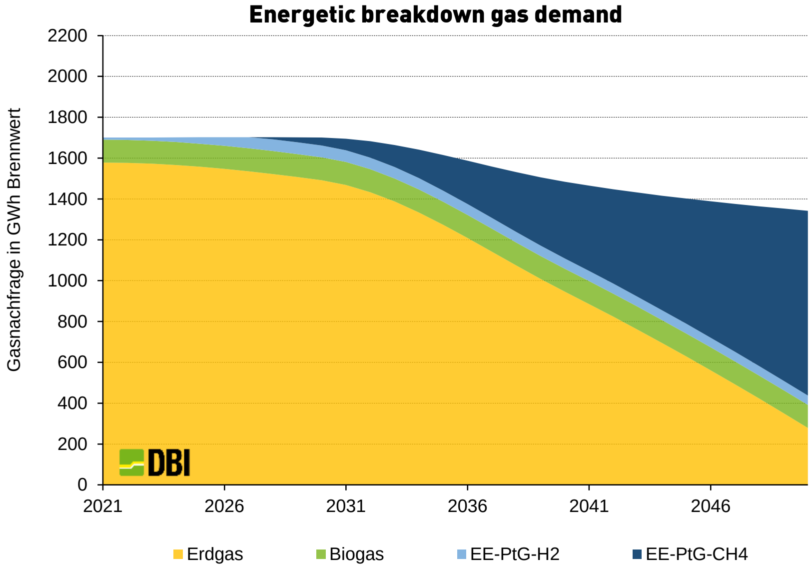
2 Grid renovation/maintenance with transformation to 20 Vol.-% H_2

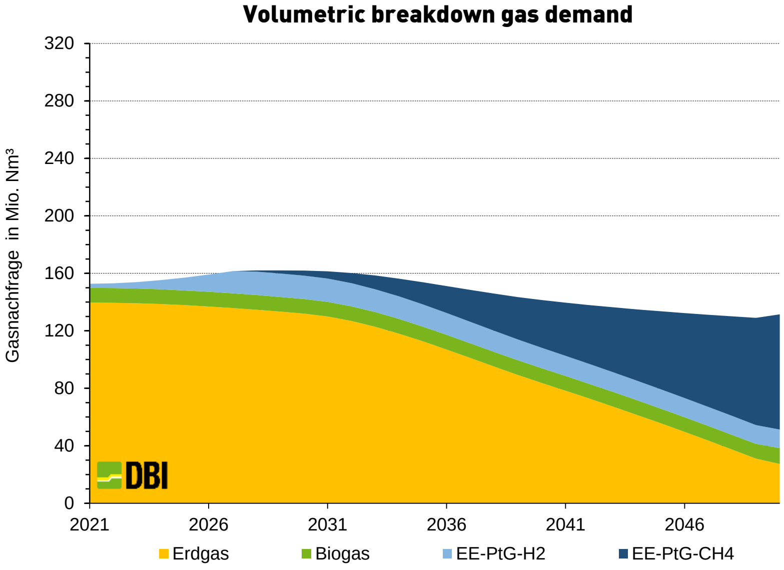
3 Grid renovation/maintenance with transformation to 100 Vol.-% H2

Results

Scenario 1:
Grid renovation/maintenance without transformation (Oberschwaben)

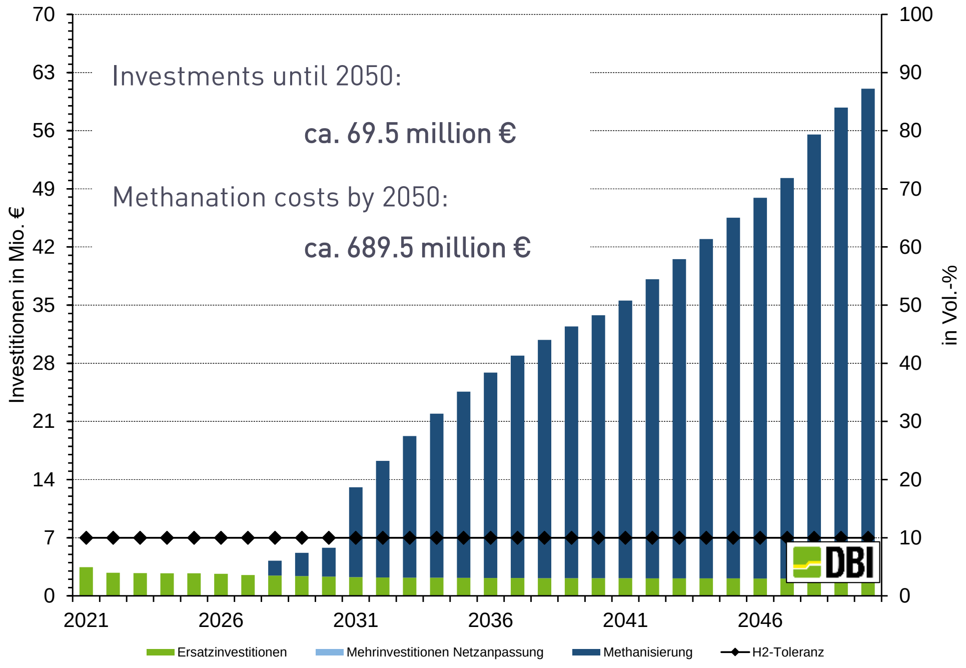
Gas demand Oberschwaben 2021 to 2050





Scenario 1:
Grid renovation/maintenance without transformation (Oberschwaben)

Investment grid Oberschwaben



Only replacement investments

- No asset replacement before the end of the depreciation period
- No extraordinary costs for grid adaptation

H_2-readyness of the grid remains at 10vol-% until 2050

Limiting assets are

- ball valves construction year ↗ 2010
- slide valves construction year ↗ 2000

Cost of RE gas feed-in

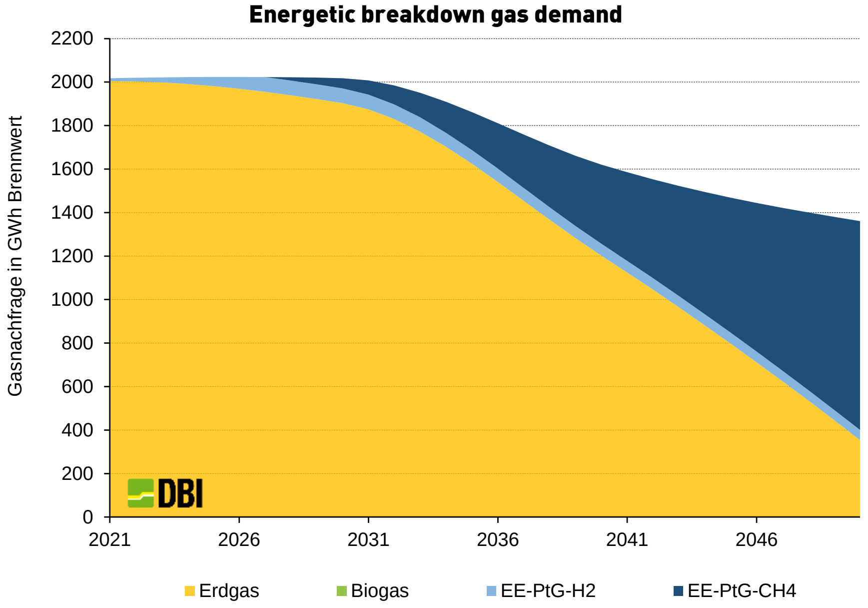
EE-PtG-H_2: 6.9 million €

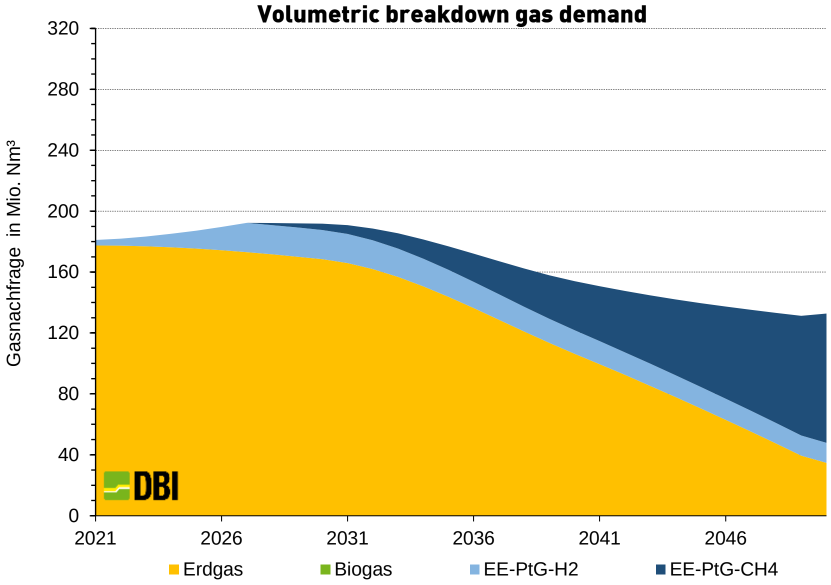
EE-PtG-CH_4: 17.1 million €

Installation of around 259 MW of methanation plants.

Scenario 1:
Grid renovation/maintenance without transformation (Nordbaden)

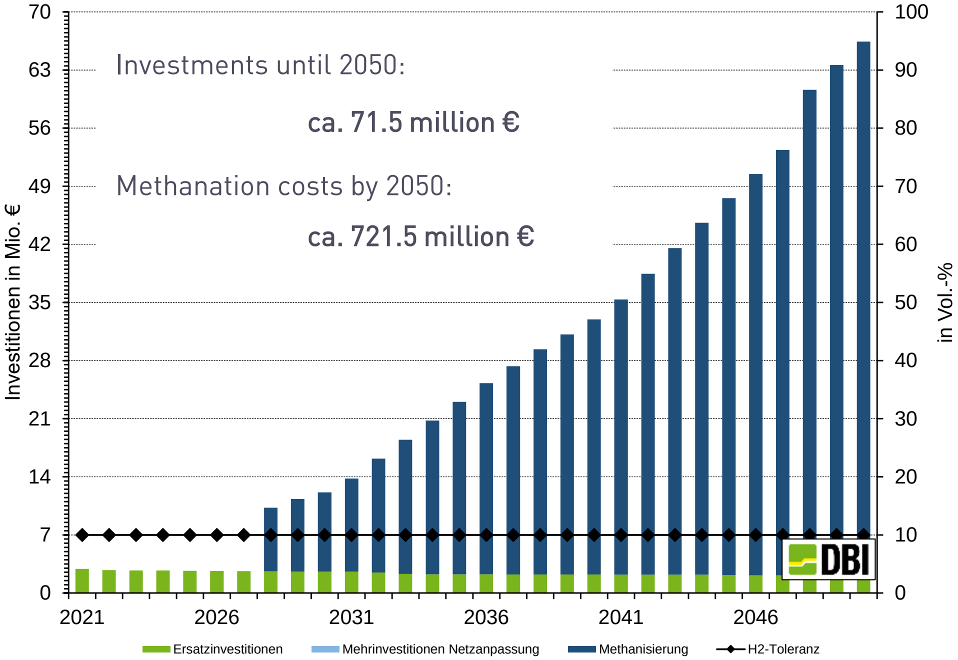
Gas demand Nordbaden 2021 to 2050





Scenario 1:
Grid renovation/maintenance without transformation (Nordbaden)

Investment grid Nordbaden



Only replacement investments

- No asset replacement before the end of the depreciation period
- No extraordinary costs for grid adaptation

H_2-readyness of the grid remains at 10vol-% until 2050

Limiting assets are

- ball valves construction year ↗ 2010
- slide valves construction year ↗ 2000

Cost of RE gas feed-in

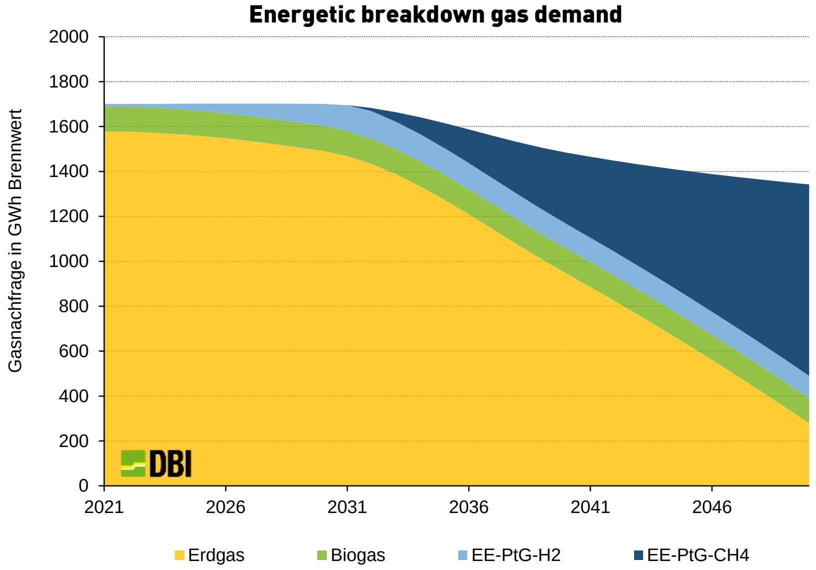
EE-PtG-H_2: 6.0 million €

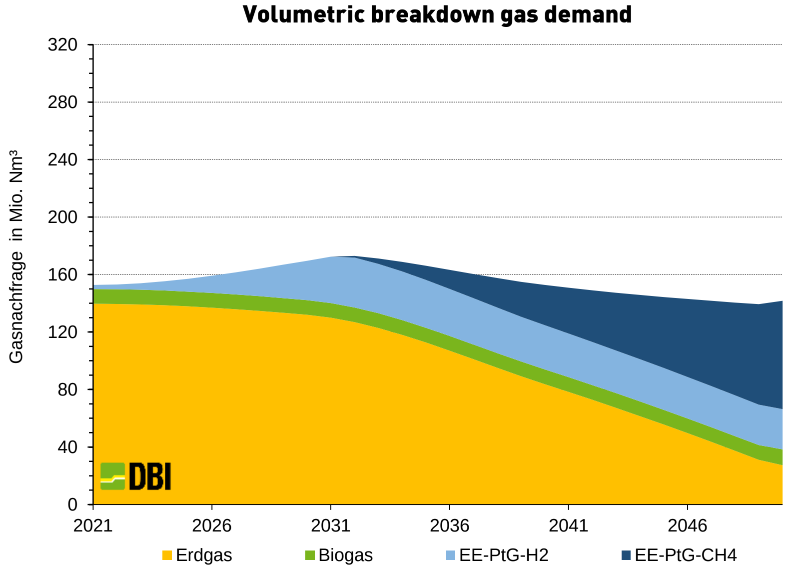
EE-PtG-CH_4: 17.6 million €

Installation of around 275 MW of methanation plants.

Scenario 2:
Transformation to 20 vol.-% H_2 readiness (Oberschwaben)

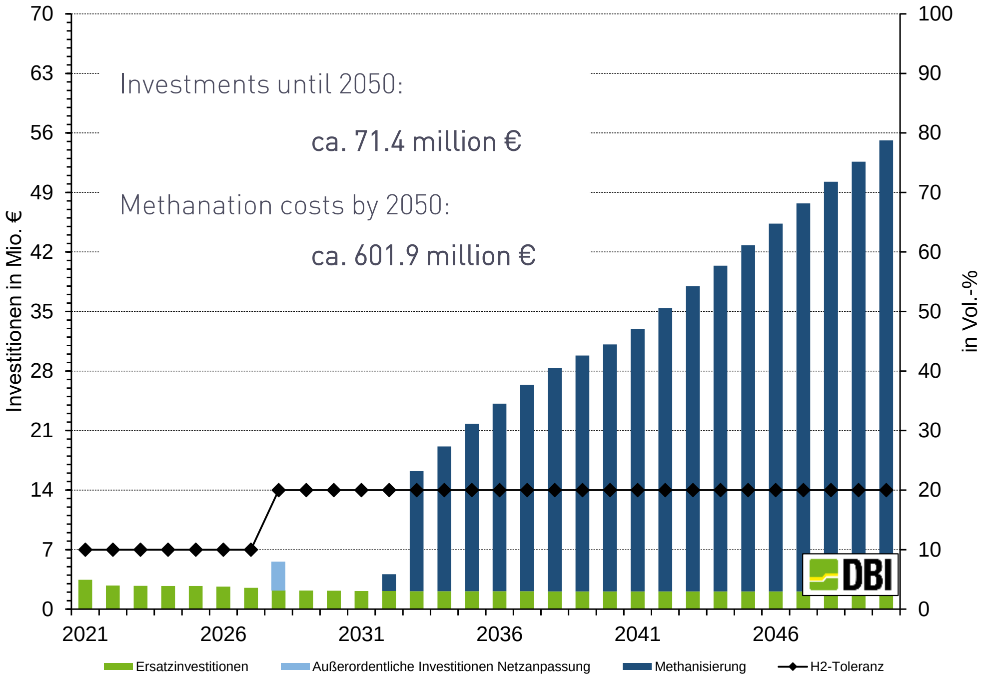
Gas demand Oberschwaben 2021 to 2050





Scenario 2:
Transformation to 20 vol.-% H_2 readiness (Oberschwaben)

Investment grid Oberschwaben



This results in additional costs for the grid adjustment of approx. **2.0 million €.**

These are made up as follows:

- Extraordinary investments in grid adaptation, i.e. costs for unscheduled grid measures of approx. 3.4 million €.
- Savings on regular replacement investments of approx. € 1.4 million

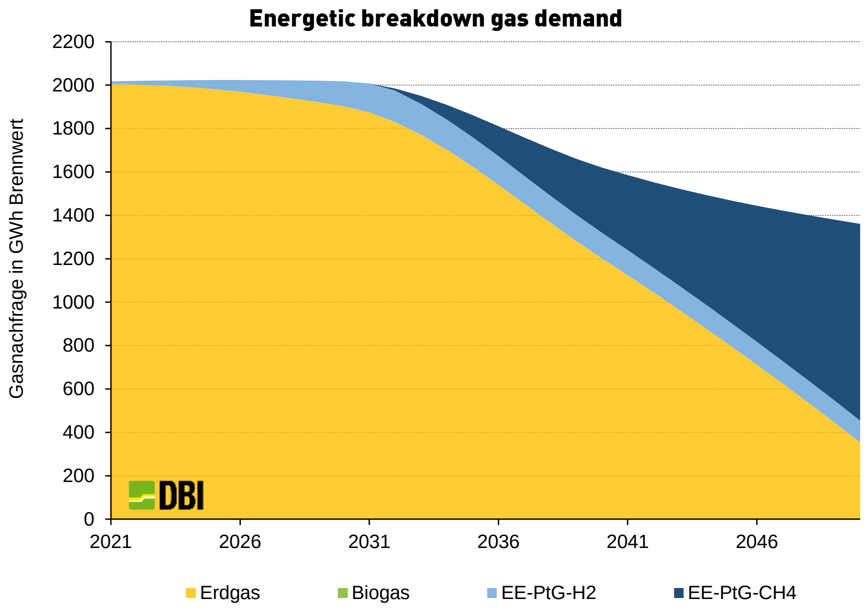
Cost of RE gas injection

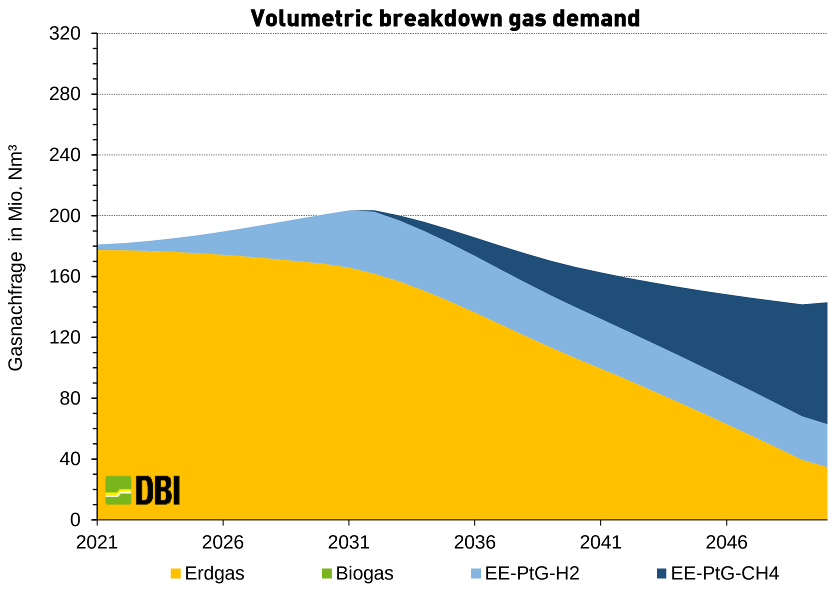
- EE-PtG-H_2 10.7 million €
- EE-PtG-CH_4: 14.4 million €

Installation of about 244 MW methanation plants.

Scenario 2:
Transformation to 20 vol.-% H_2 readiness (Nordbaden)

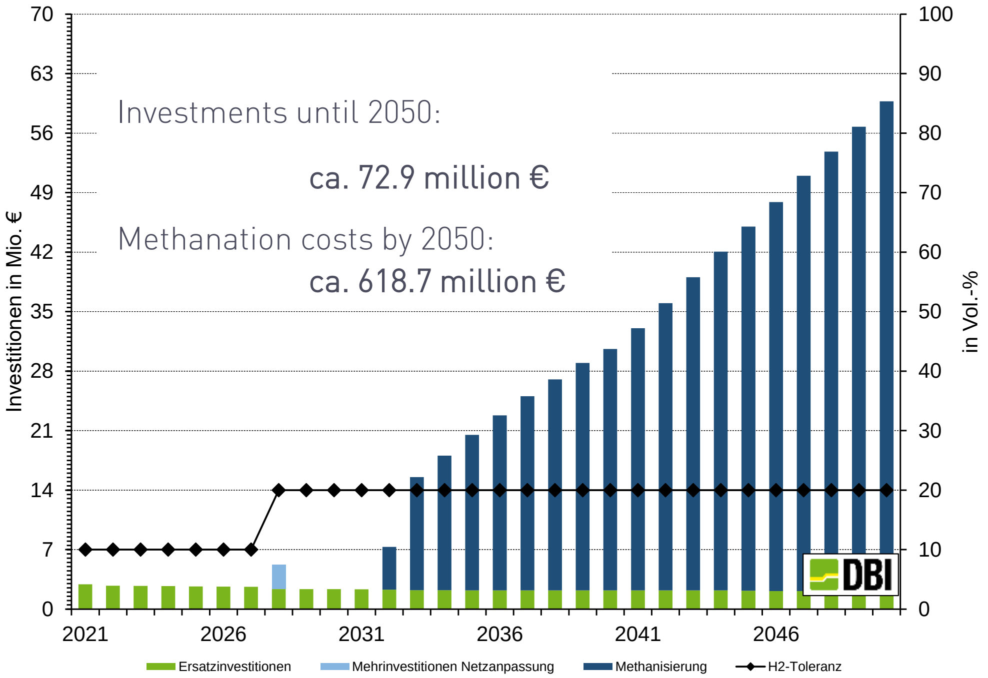
Gas demand Nordbaden 2021 bis 2050





Scenario 2:
Transformation to 20 vol.-% H_2 readiness (Nordbaden)

Investment grid Nordbaden



This results in additional costs for the grid adjustment of approx. **1.3 million €.**

These are made up as follows:

- Extraordinary investments in grid adaptation, i.e. costs for unscheduled grid measures of approx. 2.9 million €.
- Savings on regular replacement investments of approx. € 1.6 million

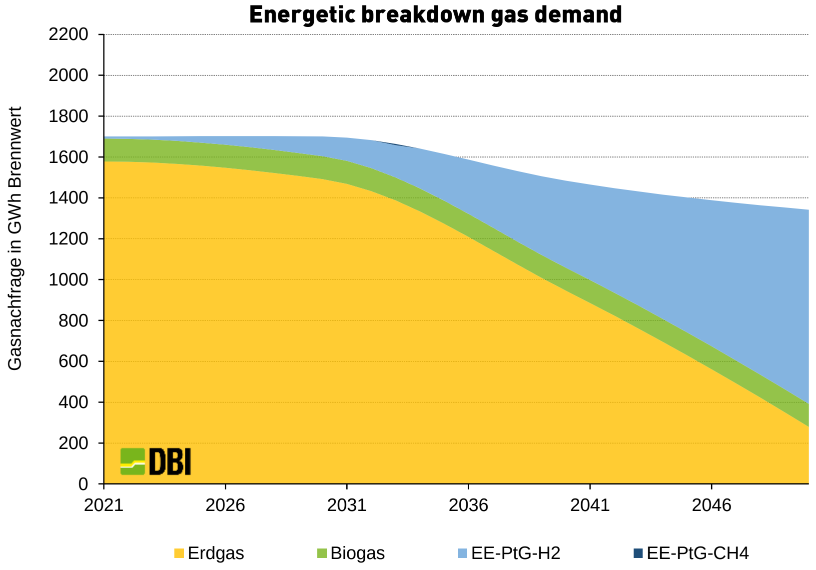
Cost of RE gas injection

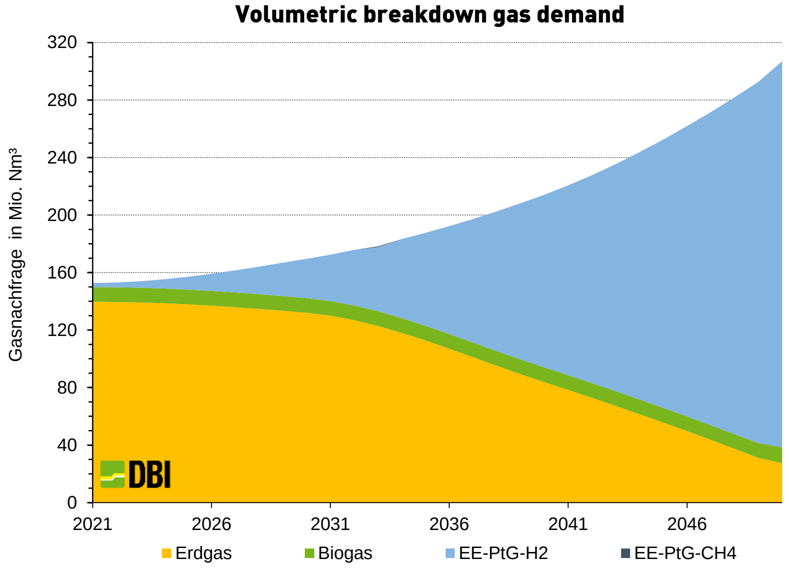
- EE-PtG-H2 11.2 million €
- EE-PtG-CH4: 15.2 million €

Installation of about 259 MW methanation plants.

Scenario 3:
Transformation to 100% H_2 readiness (Oberschwaben)

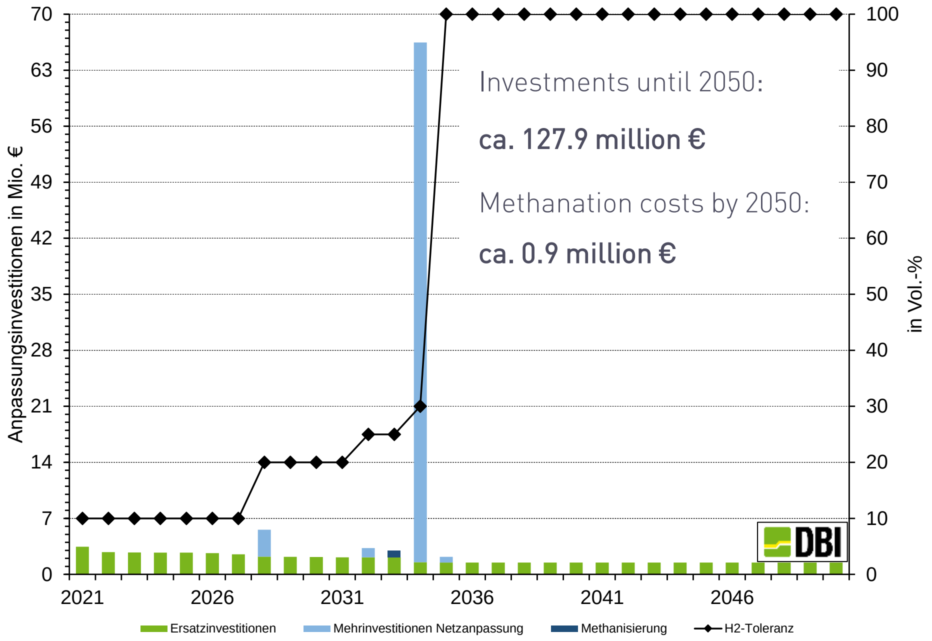
Gas demand Oberschwaben 2021 to 2050





Scenario 3:
Transformation to 100% H_2 readiness (Oberschwaben)

Investment grid Oberschwaben



This results in additional costs for the grid adjustment of approx. **58.5 million €.**

These are made up as follows:

- Extraordinary investments in grid adaptation, i.e. costs for unscheduled grid measures of approx. 70.2 million €.
- Savings on regular replacement investments of approx. 11.7 million €.

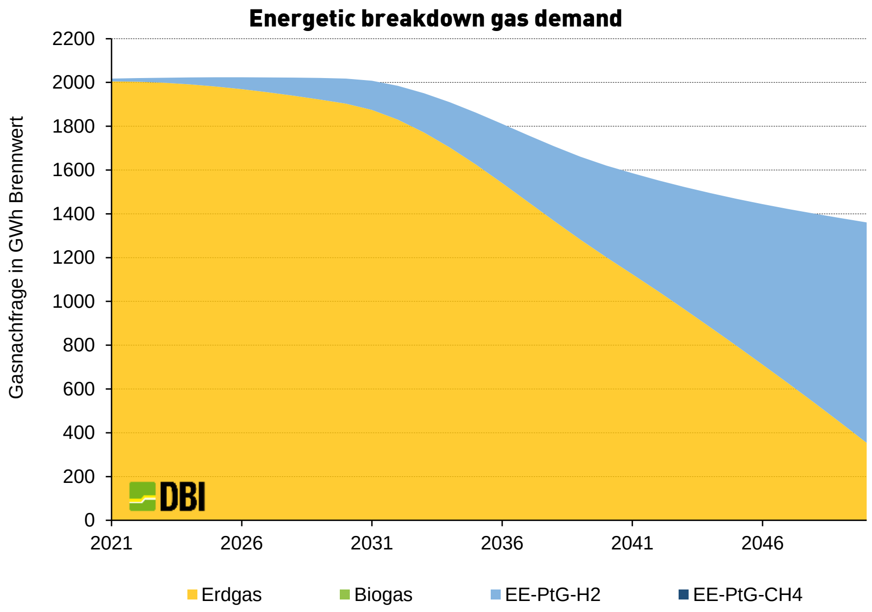
Cost of RE gas injection

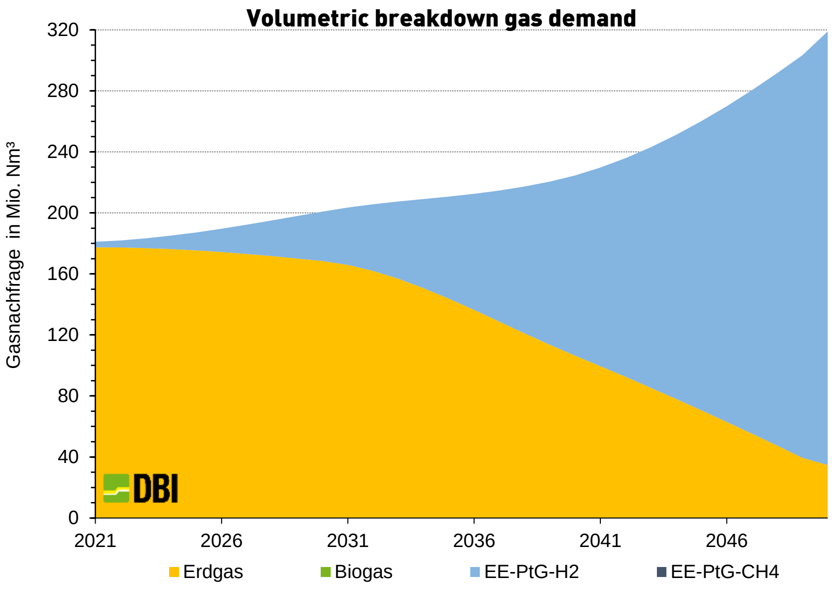
- EE-PtG-H2: 35.6 million €
- EE-PtG-CH4: 0.5 million €

Installation of about 1.67 MW methanation plants.

Scenario 3:
Transformation to 100% H_2 readiness (Nordbaden)

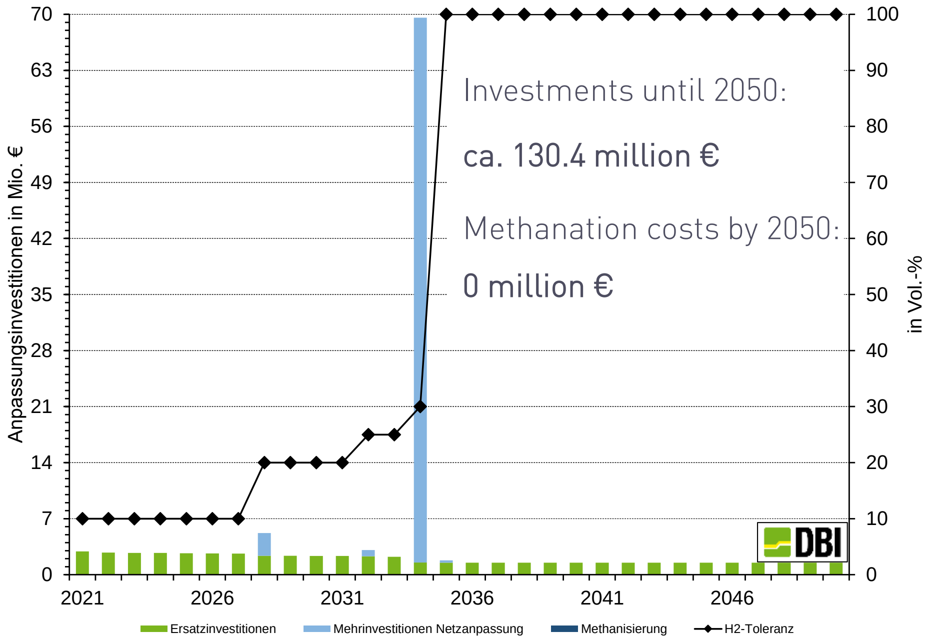
Gas demand Nordbaden 2021 to 2050





Scenario 3: Transformation to 100% H_2 readiness (Nordbaden)

Investment grid Nordbaden



This results in additional costs for the grid adjustment of approx. **58.9 million €.**

These are made up as follows:

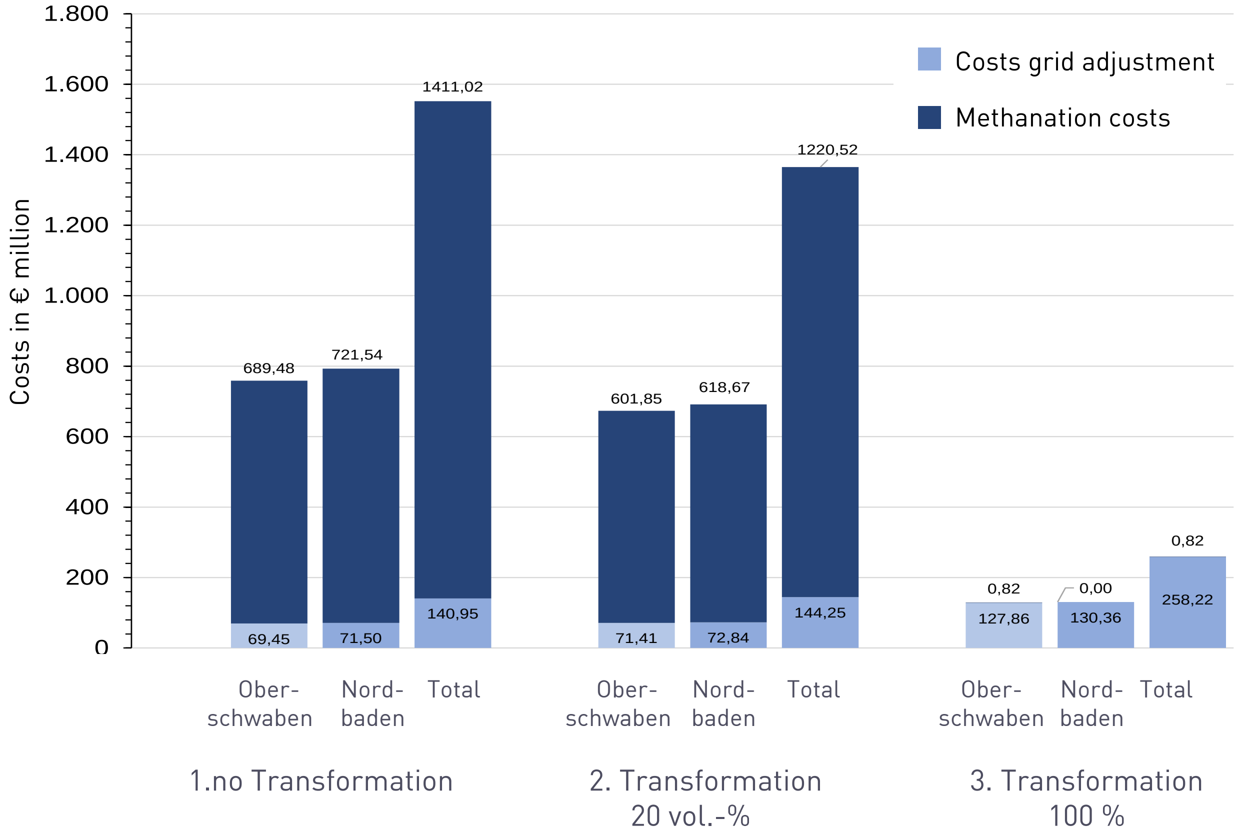
- Extraordinary investments in grid adaptation, i.e. costs for unscheduled grid measures of approx. 72.0 million €.
- Savings on regular replacement investments of approx. 13.1 million €.

Cost of RE gas injection

- EE-PtG-H2: 37.3 million €
- EE-PtG-CH4: 0.0 million €

No installation of methanation plants

Result: Scenarios in cost comparison



Conclusion and recommendations for action

1 The **macro-economically most cost-effective path** for the transport of renewable gases according to the scenario dena Leitstudie TM95 + Klimapaket until 2050 is achieved with a transformation of the grids Oberschwaben and Nordbaden towards a H_2 readiness of 100 % (avoiding high methanization costs).

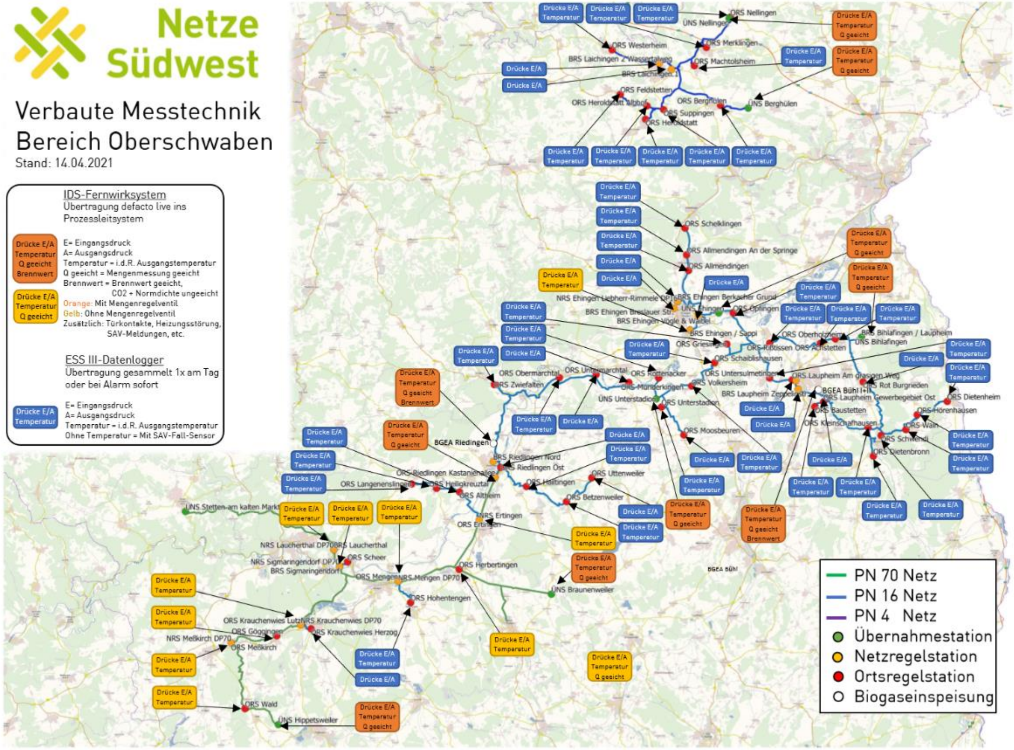
2 Between 2021 and 2050, the **additional costs** for the grid adaptation towards an H_2 readiness of 100% amount to a total of about **€58.5 million** for the Oberschwaben grid and about **€58.9 million** for the Nordbaden grid (largest cost item: adaptation of the pipelines in the mid-2030s).

3 **Early use of hydrogen-ready materials** as part of the regular replacement investment measures can significantly reduce the costs of adapting the grid to H_2 readiness (taken into account here) - otherwise, additional costs will be incurred due to extraordinary investments required.

4 The **customers connected to the gas grid are another limiting factor** for the transport of gas mixtures with high H_2 concentrations. In this regard, the following measures are recommended:
→ Communication → Establishment of a dialog process with customers

Outlook for implementation

Installed measurement technology in Oberschwaben



IDS remote control system

live transmission to the process control system

pressure temperature	with flow control wave
pressure temperature	without flow control wave

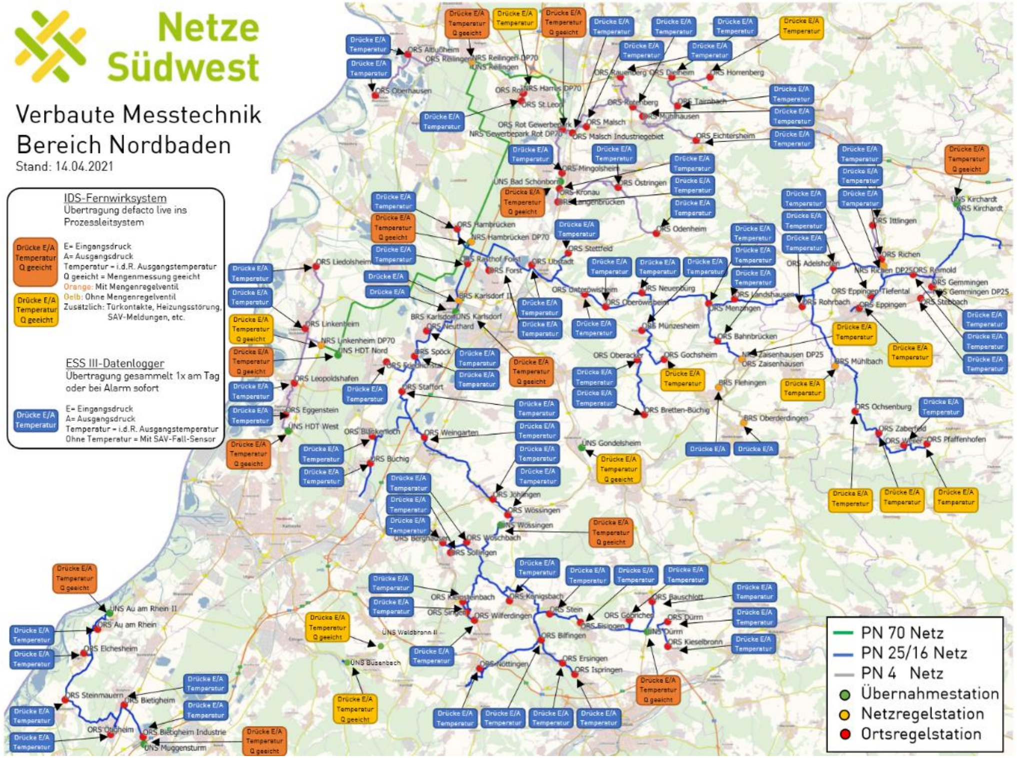
Additionally: door contacts, heating fault, SAV messages, etc.

ESS III data logger

Transmission once a day or immediately in case of alarm

pressure temperature

Installed measurement technology in Nordbaden



IDS remote control system

live transmission to the process control system

pressure
temperature

with flow control wave

pressure
temperature

without flow control wave

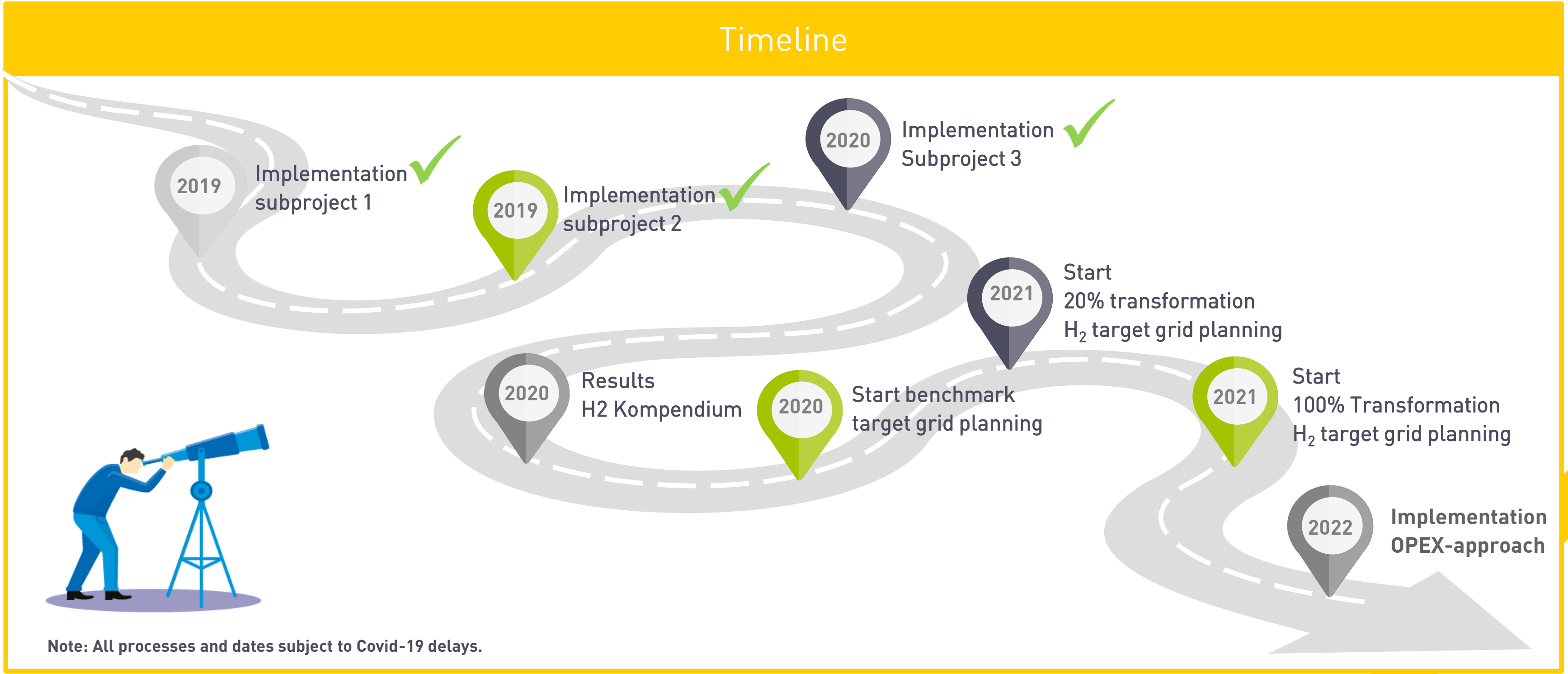
Additionally: door contacts, heating fault, SAV messages, etc.

ESS III data logger

Transmission once a day or immediately in case of alarm

pressure
temperature

Outlook for implementation



Note: All processes and dates subject to Covid-19 delays.

Thanks for your attention

Andreas Schick

Managing Director Netze Südwest
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+49 711 289-42689

Classification of H_2-sensitive components, period of use of piping and assets.

Classification of H_2-sensitive components and breakdown by year of manufacture.

- piping (steel, by pressure level)
- pressure regulators
- gas meters
- shut-off valves
- ball valves
- safety valves
- filters
- gas preheaters

Components	Period of use/depreciation period = Techn. useful life [a].
Piping (steel)	75
Pressure regulators	40
Gas meters	32
Shut-off valves	75
Ball valves	40
Safetey valves	40
Filters	40
Gas preheaters	30

The study results are based on the periods of use and replacement costs determined by NGS.

Replacement costs for piping and components

Replacement costs for pipes

Components	Dimension	Total costs*	
		grid Nordbaden	grid Oberschwaben
PE-pipes (up to DP4)	DA32	87,70€/lfm	125,30 €/lfm
	DA63	149,82 €/lfm	165,34 €/lfm
	DA90	160,95 €/lfm	173,46 €/lfm
	DA110	165,70 €/lfm	176,98 €/lfm
	DA125	170,06 €/lfm	183,64 €/lfm
	DA160	179,90 €/lfm	189,55 €/lfm
	DA180	185,29 €/lfm	199,76 €/lfm
	DA225	190,58 €/lfm	220,54 €/lfm
steel pipes (DP16)	DN200	270,00 €/lfm	270,00 €/lfm
steel pipes (DP70)	DN200	350,00 €/lfm	350,00 €/lfm

*Source: Netze Südwest

Replacement costs for piping and components

Replacement costs for components

Components	Specific costs *
pressure regulator	7.100 €/piece
gas meter	6.000 €/piece
shut-off valve	4.000 €/piece
ball valve	1.500 €/piece
safety valve	3.600 €/piece
filter	4.700 €/piece
gas preheater	5.400 €/piece

*Source: Netze Südwest

Cost table biological methanation

CAPEX	year	2020	2025	2030	2040	2050
	Plant size [MW*]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]
„very“ small plants	1	1.500.000	600.000	300.000	275.000	250.000

OPEX	year	2020	2025	2030	2040	2050
	Plant size [MW*]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]
„very“ small plants	1	29,64	29,64	29,64	29,64	29,64

* Plant capacity in relation to renewable methane production (EE-PtG-CH4)

Cost table catalytic methanation

CAPEX	year	2020	2025	2030	2040	2050
	Plant size [MW*]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]
„very“ small plants	1	900.000	900.000	850.000	800.000	750.000
small plants	5	900.000	900.000	850.000	800.000	750.000
medium plants	20	850.000	700.000	700.000	650.000	600.000
large plants	100	700.000	500.000	400.000	400.000	300.000

OPEX	year	2020	2025	2030	2040	2050
	Plant size [MW*]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]
„very“ small plants	1	16,85	16,85	10,85	9,73	8,73
small plants	5	16,85	16,85	10,85	9,73	8,73
medium plants	20	10,60	10,60	4,98	4,60	4,35
large plants	100	7,10	7,10	3,35	3,04	2,73

* Plant capacity in relation to renewable methane production (EE-PtG-CH4)

Cost table CO_2 capture from air

CAPEX	year	2020	2025	2030	2040	2050
	plant size [MW*]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]
„very“ small plants	1	900.000	825.000	726.667	628.333	530.000
small plants	5	900.000	825.000	726.667	628.333	530.000
medium plants	20	900.000	825.000	726.667	628.333	530.000
large plants	100	900.000	825.000	726.667	628.333	530.000

OPEX	year	2020	2025	2030	2040	2050
	plant size [MW*]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]
„very“ small plants	1	9,750	9,188	8,450	7,713	6,975
small plants	5	9,750	9,188	8,450	7,713	6,975
medium plants	20	9,750	9,188	8,450	7,713	6,975
large plants	100	9,750	9,188	8,450	7,713	6,975

* Plant capacity in relation to renewable methane production (EE-PtG-CH4)

Hydrogen feed-in plants

CAPEX	year	2020	2025	2030	2040	2050
	plant size [MW*]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]
	0,7	685.028	685.028	685.028	685.028	685.028
	1,4	342.514	342.514	342.514	342.514	342.514
	2,8	171.257	171.257	171.257	171.257	171.257
	3,5	171.257	171.257	171.257	171.257	171.257
	17,7	76.095	76.095	76.095	76.095	76.095

OPEX	year	2020	2025	2030	2040	2050
	plant size [MW*]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]
	0,7	2,242	2,242	2,242	2,242	2,242
	1,4	1,121	1,121	1,121	1,121	1,121
	2,8	0,561	0,561	0,561	0,561	0,561
	3,5	0,561	0,561	0,561	0,561	0,561
	17,7	0,280	0,280	0,280	0,280	0,280

* Plant capacity in relation to renewable methane production (EE-PtG-H2)

Methane feed-in plants

CAPEX	year	2020	2025	2030	2040	2050
	plant size [MW*]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]	CAPEX [EUR/MW]
	2,2	220.455	220.455	220.455	220.455	220.455
	4,4	110.227	110.227	110.227	110.227	110.227
	8,8	55.114	55.114	55.114	55.114	55.114
	11,0	55.114	55.114	55.114	55.114	55.114
	55,0	24.489	24.489	24.489	24.489	24.489

OPEX	year	2020	2025	2030	2040	2050
	plant size [MW*]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]	CAPEX [EUR/MWh]
	2,2	0,722	0,722	0,722	0,722	0,722
	4,4	0,361	0,361	0,361	0,361	0,361
	8,8	0,180	0,180	0,180	0,180	0,180
	11,0	0,180	0,180	0,180	0,180	0,180
	55,0	0,090	0,090	0,090	0,090	0,090

* Plant capacity in relation to renewable methane production (EE-PtG-CH4)

Hydrogen Europe presentation by Michael Diderich, Technology Manager at Hydrogen Europe

30-June 2021, telco

HYDROGEN EUROPE

Prime movers' group on Gas Quality and H2 handling – #10 meeting

Michael Diderich
Technology Manager

Agenda

- Hydrogen Europe in a nutshell
- Introduction to the PPP
- Internal structure & processes
- Cooperation
- Roadmap H2 in the gas grid
- Q&A

Hydrogen Europe

HYDROGEN EUROPE IN A NUTSHELL

Who we are?

We represent:

- 200+ Industry members
- 26 National Associations
- 90+ Research organisations (through our sister association, Hydrogen Europe Research)

As an organisation:

- We have a partnership with the European Commission in the Innovation Programme called Clean Hydrogen JU. The Partnership is a key instrument for the implementation of the EU H2 Strategy. Hydrogen Europe cooperates with public authorities to facilitate this coordination through its participation in the Partnership, the EU Clean Hydrogen Alliance and the Important Projects of Common European Interest (IPCEIs).
- Alongside other six non-profit organizations, Hydrogen Europe is facilitating the work of the six Roundtables in the European Clean Hydrogen Alliance, and is in particular in charge of their overall support and coordination. ECH2A aims at creating a pipeline of scale up investment projects by 2030, that ensures the deployment and roll out of renewable and low-carbon hydrogen production, hydrogen transmission and distribution, and fosters demand in industry, mobility and the buildings sectors.

Hydrogen Europe

HYDROGEN EUROPE IN A NUTSHELL

What do we do?

Represent the views and aspirations of the hydrogen and fuel cells industry in Europe.

Promote hydrogen and fuel cells as clean and efficient technologies.

Dedicated resource for stakeholders wanting more information on the benefits hydrogen and fuel cells could bring to society.

Develop, in coordination with our members, the necessary materials, documents and position papers to achieve our mission.

Help our members to develop their business activities in Europe and beyond.

Our Work

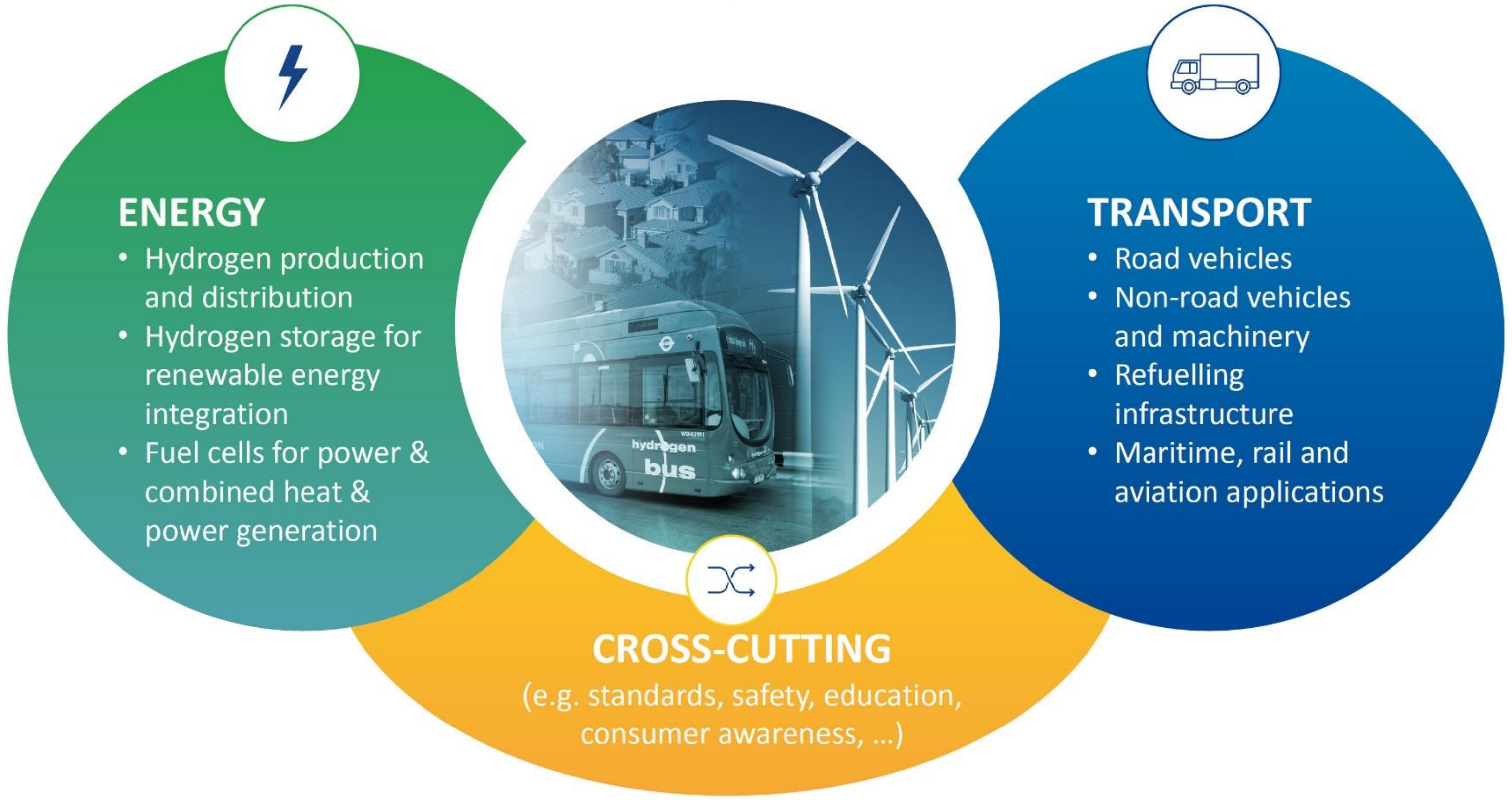
POLICY	INNOVATION	INTELLIGENCE	COMMUNICATIONS
Our advocacy work serves as the industry's reference point. Working Groups on topics: Mobility, Trucks, Energy, Infrastructure, Maritime, RED II Implementation, Funding & Finance	We partner with the EC and Research through the PPP Clean Hydrogen JU. Our Technical Committees are responsible for shaping upcoming CH-JU Calls.	We provide expert industry knowledge and business intelligence. We conduct data analyses and generate fact sheets and reports on a variety of relevant topics.	General communication focusing on the latest development of the sector. We facilitate events, webinars, various educational and networking opportunities.

GENERAL STRUCTURE OF THE PPP

Hydrogen Europe & European Commission → FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

Hydrogen Europe Industry

Hydrogen Europe Research



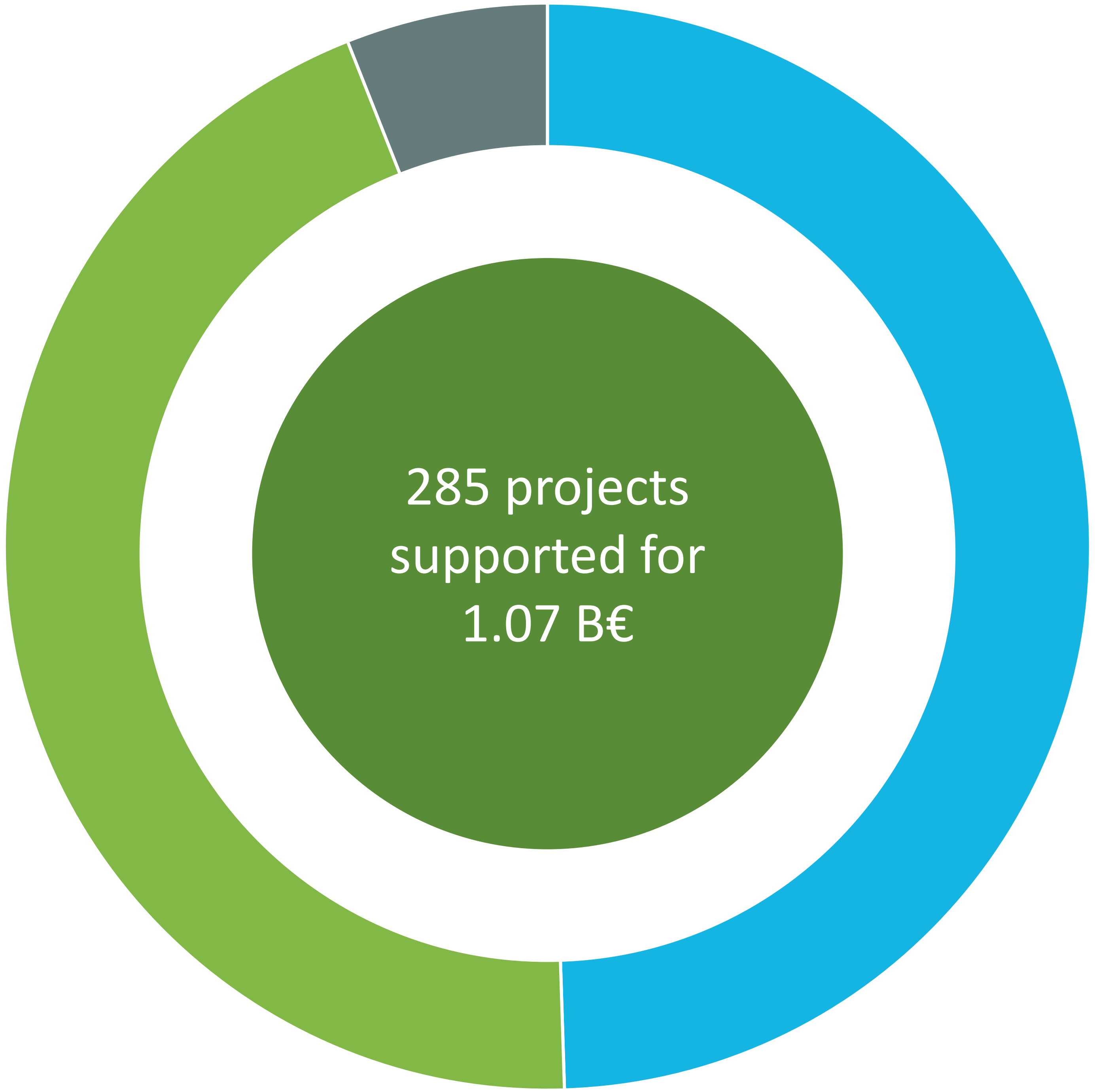
A portfolio of clean, efficient and competitive solutions based on fuel cells and hydrogen technologies **in energy and transport.**

FCH-JU & FCH2-JU

Energy
- Hydrogen production and distribution
- Hydrogen storage for renewable energy integration
- Fuel cells for power & combined heat & power gen

Transport
- Road vehicles
- Non-road vehicles and machinery
- Refuelling infrastructure
- Maritime rail and aviation applications

Cross-cutting
- E.g. standards, safety, education, public awareness, etc.



45%
481 million euros
153 projects

41.4%
443 million euros
77 projects

6.3%
67 million euros
48 projects

7.3%
79 million euros
7 projects

FCH JU programme implementation 2008-2019
Similar leverage of other sources of funding: 1.08 b€

OBJECTIVES FOR THE NEXT PPP (Clean Hydrogen JU)

GO-1: Accelerate the commercial maturity of individual hydrogen technologies across transport, heating & power, and industry.

- SO-1: Produce Clean Hydrogen
- SO-2: Integrate renewables in the energy system
- SO-7: Decarbonise Industry (electrolysis for Industry)
- **SO-3: Deliver Clean Hydrogen at low cost**
- SO-4: Develop hydrogen infrastructure
- SO-5: Develop competitiveness of hydrogen-based transport
- SO-6: Develop hydrogen technologies for heat and power applications
- SO-7: Decarbonise Industry (heat and power)

GO: General Objective
SO: Strategic Objective

GO-2: Enable at scale and integrated deployment

- SO-8: Integrate hydrogen ecosystems combining multiple applications (Hydrogen Valleys)
- SO-9: Develop key supply-chains

GO-3: Ensure a safe and frictionless deployment

- SO-10: Addressing cross-cutting activities (LCA, recycling, PNR RCS & Safety, Education, etc.)

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SET OF 20 ROADMAPS TO ADDRESS OUR OBJECTIVES

TC5

S10 Cross-Cutting
RM18.1 - LCA, Sustainability & Recycling, RM18.2 RCS & Safety, RM18.3: Education & Awareness

Comms
Knowledge
Safety
Int'l coop.

PILLAR H2 PRODUCTION

SO1 Produce Clean H2
RM01 - Electrolysis
RM02 - Other modes of production

SO2 Integrate renewables
RM03 - Role of electrolysis in the energy system

SO7 Decarbonise Industry
RM17 - H2 in industry

TC1

PILLAR H2 DISTRIBUTION

SO3 Deliver Clean H2 at low cost
RM04 - Large scale storage
RM05 - Pipeline transport (grid)
RM06 - Liquid carriers
RM07 - Non-pipeline transport
RM08 - Key technos for distribution

SO4 Develop H2 infrastructure
RM09 - HRS for multiple applications

TC2

PILLAR H2 END USES

TC3

SO5 Competitive H2 vehicles
RM10 - Building blocks
RM11 - Road Heavy-Duty
RM12 - Maritime (inc. ports)
RM13 - Aviation (inc. airports)
RM14 - Rail

SO6 H2 for Heat & Power
RM15 - Stationery H2 fuel cells
RM16 - H2 Turbines & burners

SO7 Decarbonise Industry
RM17 - H2 in industry

TC4

TC6

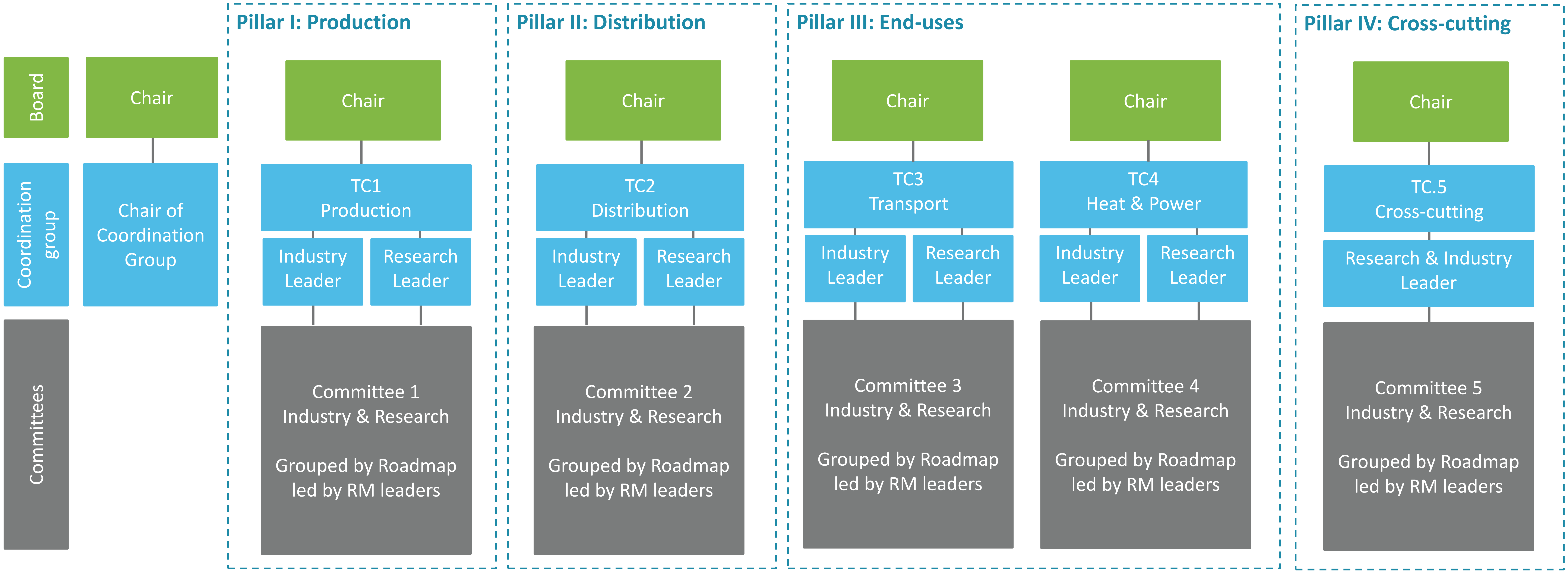
SO9 Supply Chain
Manufacturing & scale-up

S08 Hydrogen Valleys
Integrated H2 ecosystems combining multiple applications (ports, airports, industrial hubs, cities, etc.)

TC7

Hydrogen Europe

STRUCTURE OF OUR TECHNICAL COMMITTEES



+ supply-chain & H2 valleys, TBC

Coordination: HE-HER Secretariats

3+1 R&I PROCESSES RUNNING IN PARALLEL

Example: Year 2023. We work on an annual basis.

Open to the Public

(AWP22) Use funding Call Y-1	Projects start	Projects development Monitored by PO			
AWP23 Apply for funding	Publication of the Call	Applicants send their bid	Evaluation of bids	Prep of Grant Agreement	Projects start

Members only

AWP24 Prepare Y+1 Call	Issue Strategic Directions (GB)	Development of 1st drafts	Development of 2nd drafts	Development of final drafts	Publication of the Call
AWP25 Identify Priorities Y+2 Call *(new, under development)*	Discuss priorities	RM/TC monitoring	Recomd’s to GB	Review of recomd’s by GB	Issue Strategic Directions (GB)

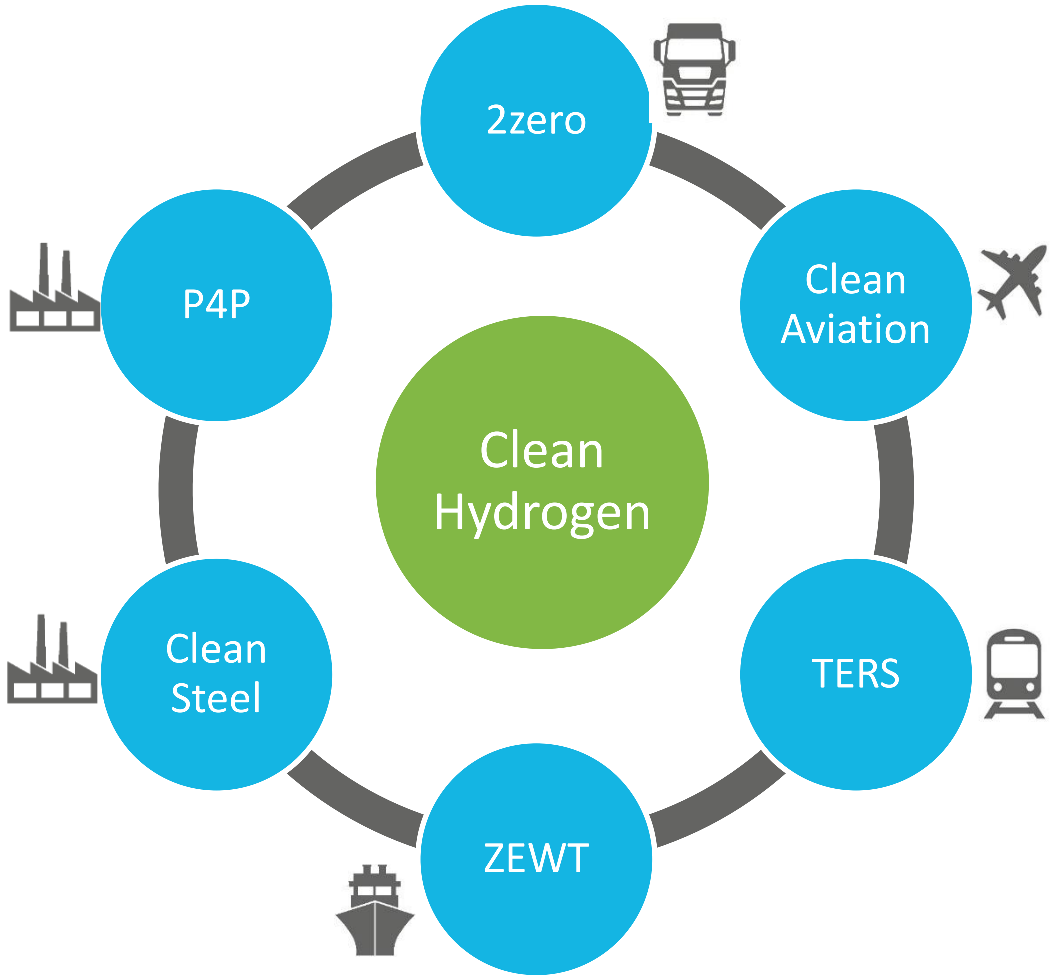
After review by HE-HER Boards

OTHERS PPPs ALSO ADDRESSING HYDROGEN

Synergies and Impact are main keywords to the EC

Several end-uses PPPs will also tackle H2 issues, hence need for a coordinated approach, several options available at different levels:

• Members	Bridging members
• Association	Discussion between associations
• JU	Discussion between JUs/EC services (for CoP)
• EC	H2 inter-partnership assembly
• Governing Board	



Consultation between PPP should become systematic

- Feedback on topics under development
- Common roadmaps based on SRIAs, common objectives

General (and over-simplified) concept:

- Clean Hydrogen JU develops technology bricks
- Others PPP integrate them
- In some case, Clean Hydrogen JU will do Demonstration

COOPERATING WITH OTHERS BODIES

Background

- Growing interest for hydrogen in general
- We received several manifestations of interest in our PPP
- There is a lot of knowledge inside but also outside of HE-HER

Idea

As much as possible, messages should be aligned across stakeholders and global consensus on priorities on specific areas to be addressed should be reached

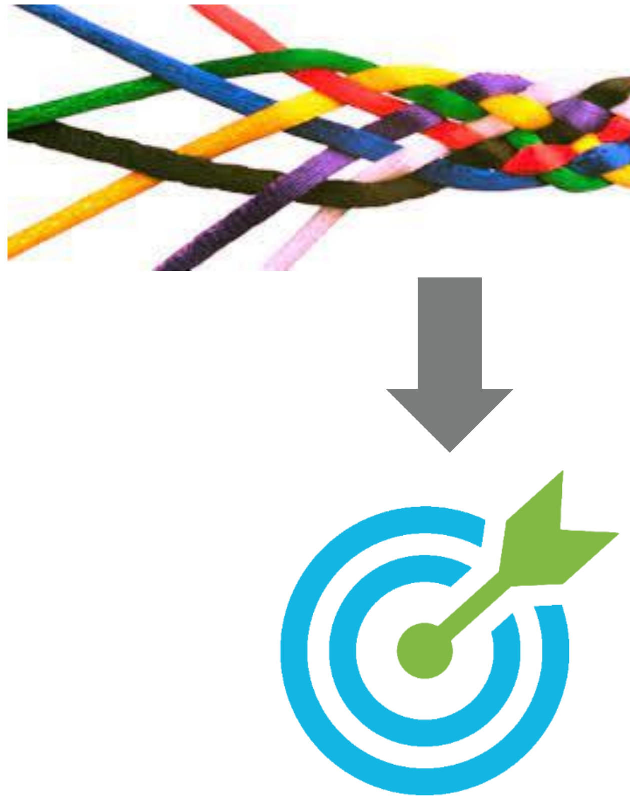
Implementation

Option to:

- gather the view of 3rd parties on priorities they see, as recommendations
- compare existing roadmaps and identify gaps
- make use of common members between associations

Limitations

- Implementation as sanity check on priorities rather than influencing a process
- Need to ensure value for our members



Impact!

(only few examples)

RM05
Gas Grid

Hydrogen in gas infrastructure: proposed areas for support 1

Stage of development and potential areas for support (needs careful coordination with eg RM04, RM07 etc)
Early Stage Research Actions (TRL 2-3)

- Precisely map the influence, with testing techniques developed, of hydrogen on:
  - grades of steel in pipes and their welded joints and induced phenomena (embrittlement, crack propagation, etc.). Develop mitigation techniques based on testing to reduce any barriers. Develop mitigation techniques (including oxygen passivation)
  - metallic materials existing on the distribution network (cast iron, copper, brass, lead, aluminium) and induced phenomena (embrittlement, propagation of cracks, fatigue, etc.). Develop mitigation techniques
  - materials of elastomer types present mainly in equipment in the distribution network (regulator membranes, meters, etc.)
  - cathodic protection and external coatings
- Precisely model the influence of hydrogen including blends on identified safety and risk areas in order to update design and operating methods, and ensure safe operation
- Develop rehabilitation technologies to limit the impact on hydrogen on the existing network using an internal coating and in situ robotic application or others solutions (pipe in pipe ..)
- Development of real time energy content tracking for energy billing
- Develop insight in the effects of contamination in existing networks on the purity of the hydrogen at the exit point
- Techno-economic analyses of >20% concentrations in future scenarios and temporal and spatial mapping of P2G plant impacts on gas networks.

SRIA of Hydrogen Europe & Hydrogen Europe Research: https://www.hydrogeneurope.eu/publications/

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RM05 Gas Grid

Hydrogen in gas infrastructure: proposed areas for support 2

Stage of development and potential areas for support (needs careful coordination with eg RM04, RM07 etc)
Development Research Actions (TRL 4-6)
• Identification and development of new materials (steels, joints, components, …) optimized for hydrogen transport • Accelerate development and testing of scalable separation technologies • Specify, develop and adapt our leak detection tools in the presence of hydrogen • Compact blending and mixing units for hydrogen injection • Check the metrological response and the potential drift of metering at different levels of hydrogen rate under dynamic network conditions • Qualify the impact of hydrogen on network compressors in the presence of hydrogen and develop new compatible components
Innovation Actions (TRL 7-8)
• Develop methods for connecting current off-grid projects to the gas market (TRL 7-8) • Construct local demonstration projects for blending and 100% with cross border participation, also developing programmed timings for a move to 100%
Application Flagship (TRL 7-8)
• Flagship cluster projects demonstrating cross border transmission, blending and industrial / mobility / residential use. Current example is the HyNet / H100 project in the UK

SRIA of Hydrogen Europe & Hydrogen Europe Research: https://www.hydrogeneurope.eu/publications/

Q&A SESSION

Hydrogen Europe

Thank you for your attention!

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Thank you for your attention

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