Energie mit Zukunft.
Umwelt und Verantwortung.

Gas- und Umwelttechnik GmbH

HIPS NET
"Establishing a European understanding of admissible hydrogen concentration in the gas grid"

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Agenda

- Motivation
- H_2-tolerance of the gas grid - current state of knowledge
- Projects recently launched/underway
- What HIPS NET contributes to the topic
- Conclusion

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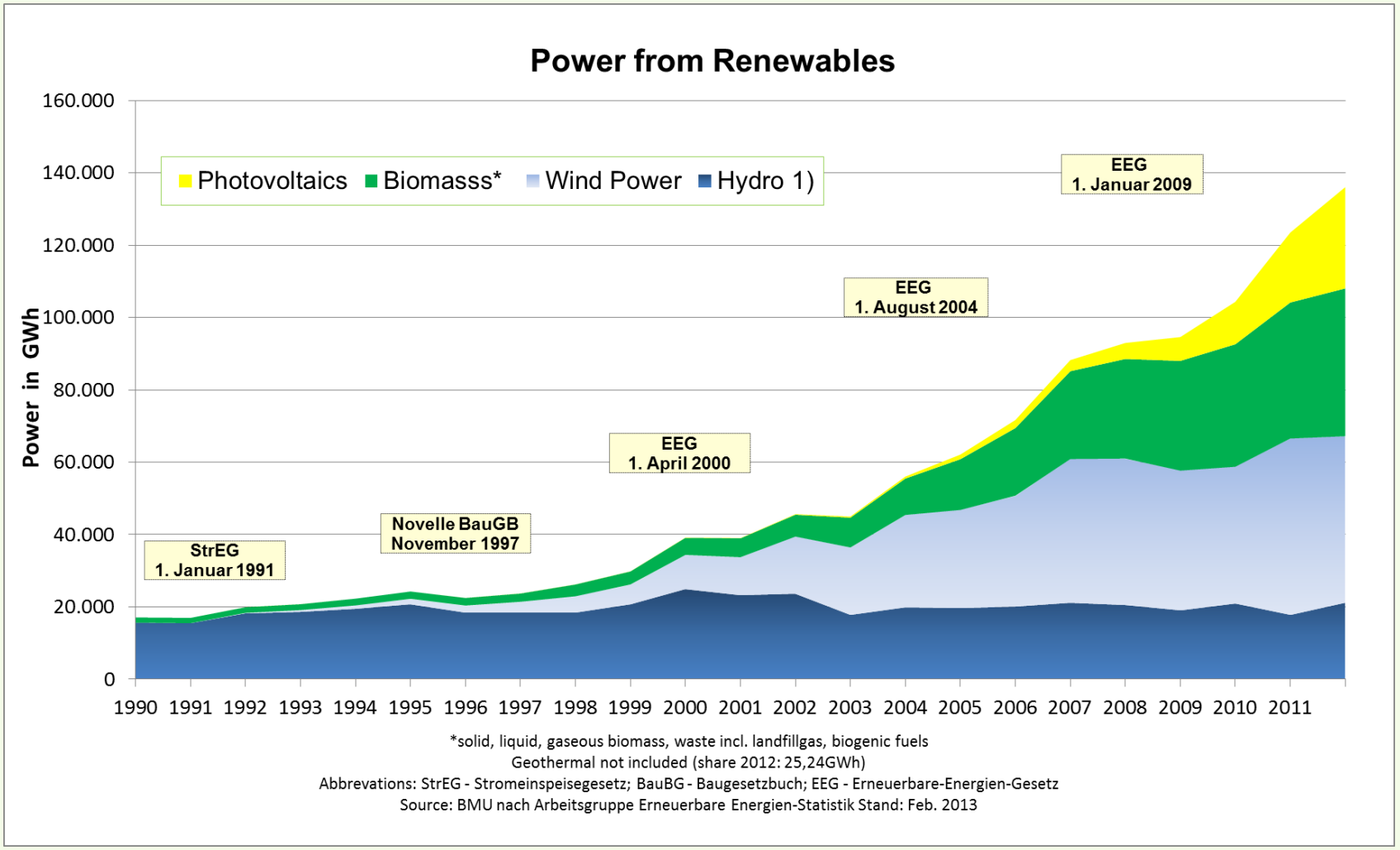
Motivation

DVGW

Motivation
H_2 injection/use is connected to sustainability/energy storage



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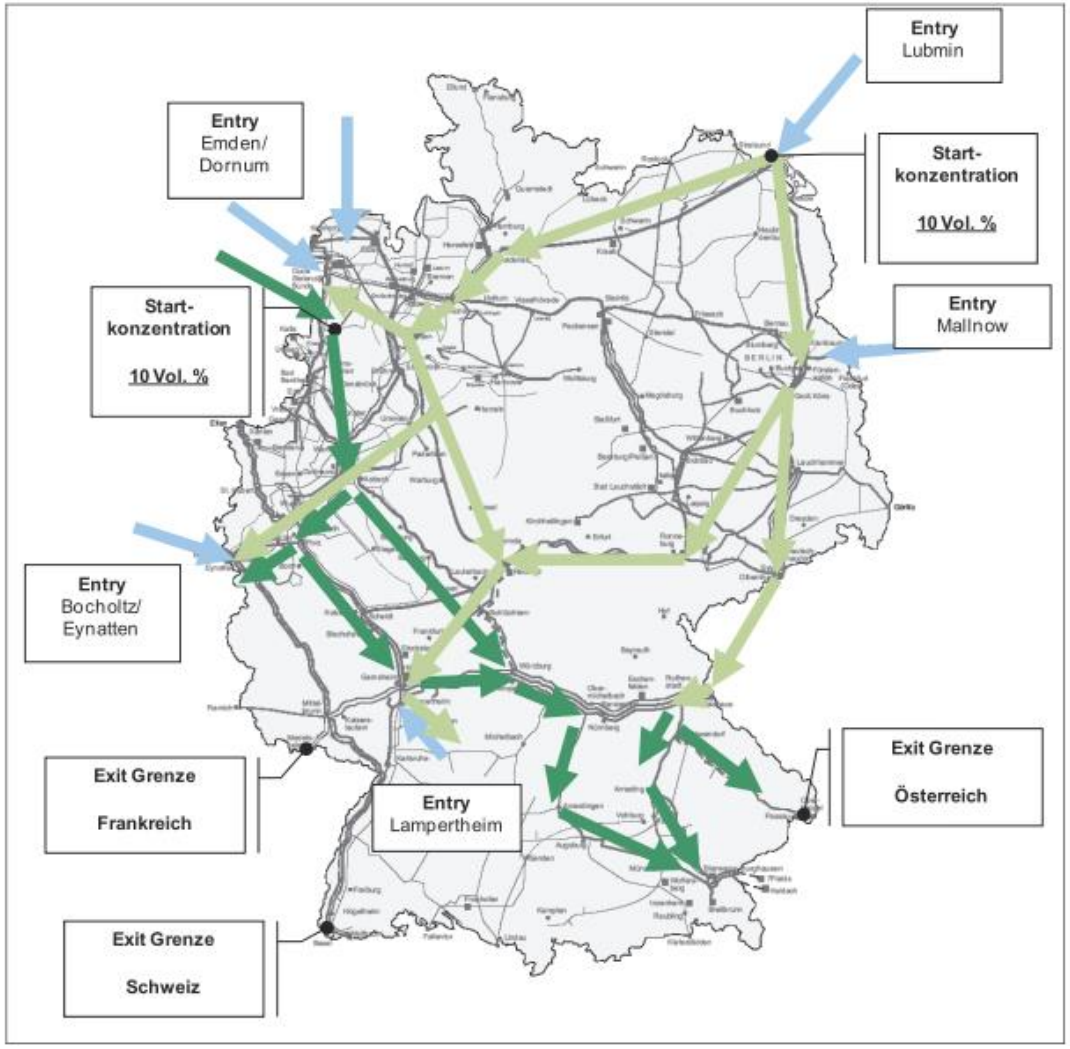
- Long term storage (seasonal) of REN is feasible in the gas grid only (accounts for Germany but different e.g. for Austria and Switzerland).
- GHGE reduction goals in the transport sector needs solutions and Power to gas can reduce the load in the power grids
- Two energy carriers with strengths and weaknesses (H_2 and CH_4).
- In order to decide in which ratio the two should be implemented into the energy system an economic investigation is mandatory.
- Preconditions for such an analysis are:
  - Knowledge on H_2-tolerance of the gas grid
  - Knowing the cost for adoptions of infrastructure
  - Knowing the cost for the e-gases (CH_4/H_2)

Motivation
Hydrogen distribution when injected in Baltic/North Sea entries



→ H_2 injection is an European issue

Source: NEP 2012

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H_2-Tolerance of the Gas Grid

Current state of knowledge

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Selection of studies/projects reflecting the basis for current knowledge on H_2-tolerance

- “Naturalhy”, 2004-2009 (focus on pipelines, end use and safety)
- “Ameland”, 2007-2011(demonstration/ end use)
- “DVGW energy storage concepts”, 2010-2012
  (state of the art analysis/ development and assessment of technical concepts – Germany)
- “HIPS”, 2011-2012 (state of the art analysis – Europe)
- DVGW “Energy Measurement” and “H_2-Tolerance”, 2012-2014

NaturalHY (Natural gas + Hydrogen)
Project Contract No.: SES6/CT/2004/502661

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- "…using the existing natural gas system for hydrogen"
  - Project duration 2003 – 2009
  - EU 6RP (39 Partner - Gasunie, GDF, NUON, DBI, GERG, ...)
  - 8 work packages (LCA, Safety, Durability, Integrity, End Use, …)
  - Funding: 17 Mio EUR
  - Comprehensive testing e.g. pipeline materials has been performed
  - Excerpt of findings
    - In the pipeline system no show stoppers has been identified.
    - Individual consideration of H_2 addition to the gas grid is recommended.
  - Note: Not all elements have been investigated in the frame of the project (underground storages, compressors, turbines etc. were out of scope)

GERG HIPS-Project
Main scope and selection of partners

- State of the art analysis (performance, lifetime and safety):
  - Gas transport and storage
  - Gas distribution and utilisation

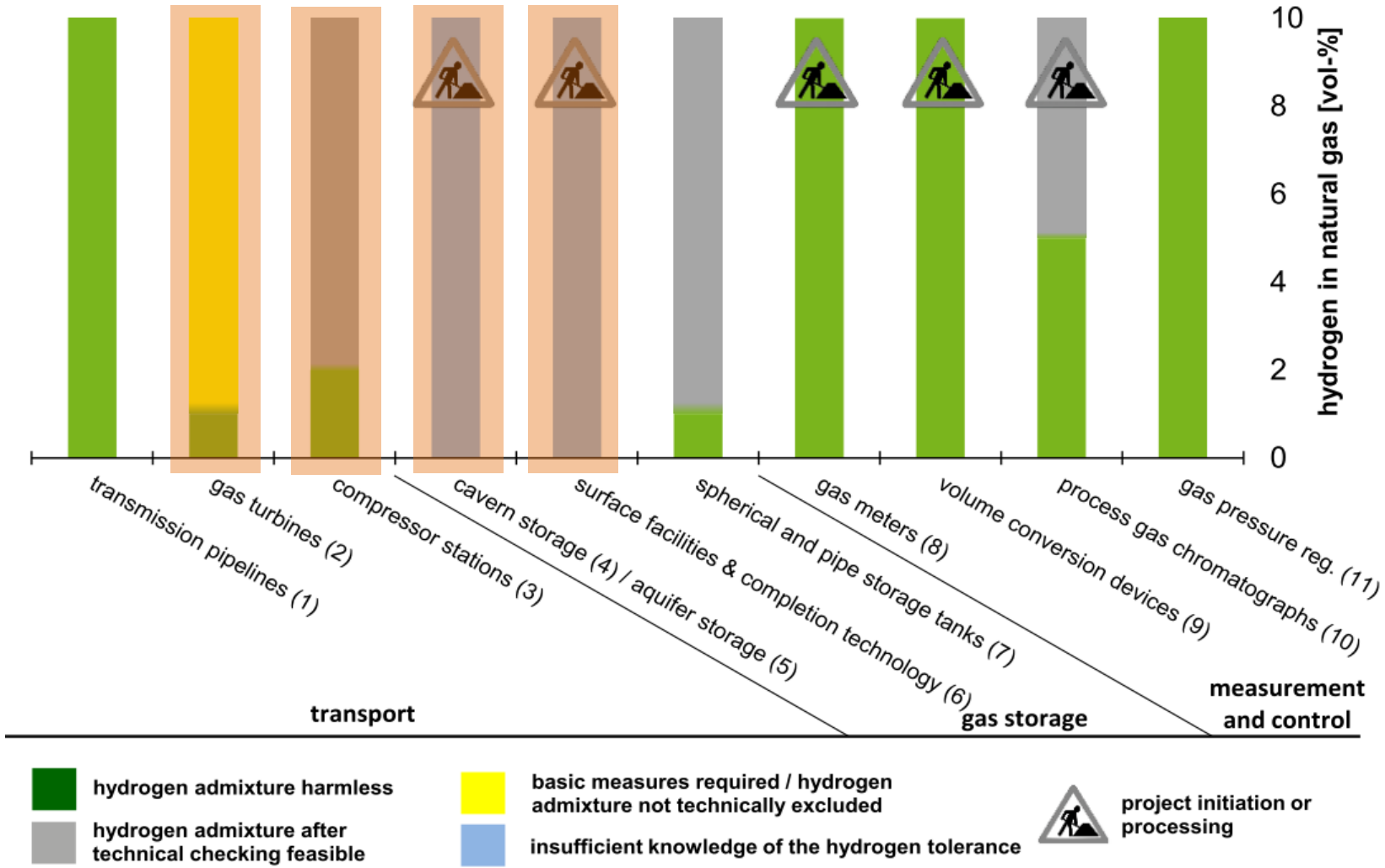
DVGW R&D project „Energy storage concepts “ 2010-2012 (G10/07/1)

- WP1: H_2-tolerance (state of the art)
- WP2: SoA electrolysis and methanation technology
- WP3: Assessment of P2G locations
- WP4: Economic considerations
- Project partners:

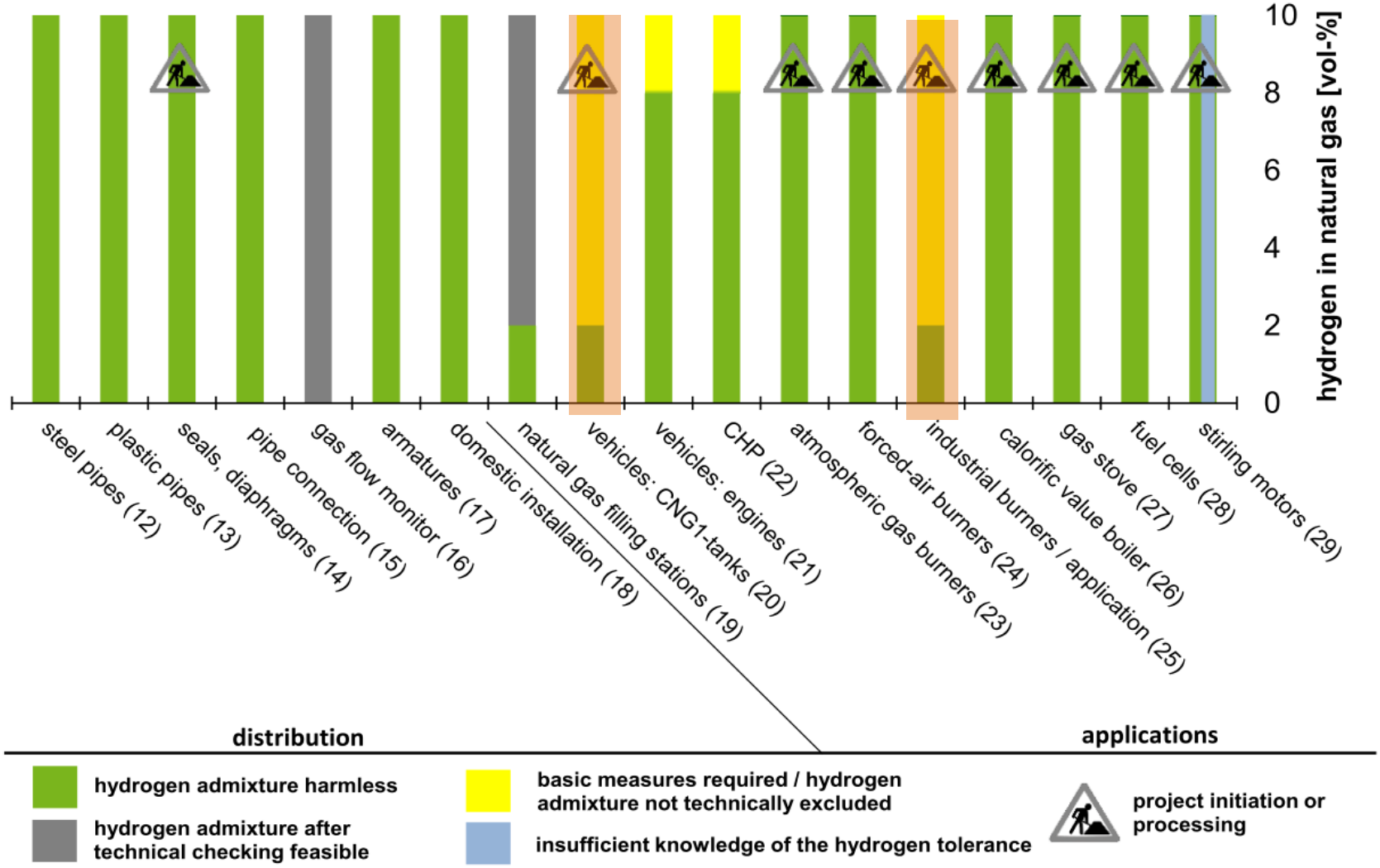
Key results of the SoA studies
“DVGW Energy storage concepts”, “GERG HIPS”

- Findings are comparable
  - Case by case consideration is recommended before H_2 is injected.
  - Porous rock underground storages are currently considered as „show stopper“ and need further investigation.
  - Most gas chromatographs will require modification.
  - It is recommended that manufacturers specifications should be followed, particularly when gas turbines or gas engines are connected to the network.
  - H_2-tolerance of CNG tanks need to be further investigated
  - Most parts of the natural gas system can tolerate admixture of up to 10 % by volume of H_2.

Current state of knowledge
H_2-tolerance results from DVGW project



Current state of knowledge
Preliminary H_2-tolerance results from DVGW project



PROJECTS RECENTLY LAUNCHED/UNDERWAY

Current projects addressing open issues

- DVGW “CNG vehicle tanks”
- Sun Storage RAG and partners
- EDGaR
- ...

- Professional screening would help to collect latest answers and identify remaining open issues

What HIPS NET contributes to the topic

"Establishing a pan-European understanding of admissible hydrogen concentration in the natural gas grid"

HIPS NET
Network „fact sheet“

- The NETWORK aims to establish a common European understanding of the H_2-tolerance of the existing natural gas grid.
- This is supported by
  - Professional "Technology Watch" which will acquire available information on the H_2-tolerance of the gas grid
  - Quarterly newsletter will be issued and distributed to the partners
  - An annual workshop (held 25th and 26th June in Brussels)
  - A short report that summarizes the latest findings
- If you are interested to join the network please contact Gert.Mueller-Syring@dbi-gut.de and davepinchbeck@hotmail.com
- HIPS NET is performed in cooperation with www.gerg.eu

HIPS NET
Partners status quo

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1	Gasum OY, Finland
2	Infraserv GmbH & Co. Höchst KG, Germany
3	KOGAS, South Korea
4	ETIC (Energy Technology & Innovations), Canada
5	Shell, Netherlands
6	DGC, Denmark
7	SVGW, Switzerland
8	Enagas, Spain
9	RWE Dea, Germany
10	Fluxys, Belgium
11	Volkswagen AG, Germany
12	E.ON New Build & Technology, UK
13	SGC, Sweden
14	nPlan GmbH, Germany
15	grzi, Germany

16	Synergrid, Belgium
17	Gasnatural, Spain
18	Solar Turbines Europe S.A.
19	EWE Netz GmbH, Germany
20	OGE, Germany
21	RAG Rohöl-Aufsuchungs Aktiengesellschaft, Austria
22	ÖVGW, Austria
23	Alliander, The Netherlands
24	ITM-Power, UK
25	GRTgaz, France
26	RWE Deutschland, Germany
27	Energinet, Denmark
28	Verband der Chemischen Industrie, Germany
29	GERG, Belgium
30	Gasunie, Netherlands
31	DNV

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CONCLUSION

DVGW

Conclusion

- REN H_2/CH_4 + gas grid are the only long term storages (in many countries).
- Macroeconomic assessment is needed in order to give orientation to which extend (in general) H_2 should be injected.
- That needs answering of a few still open technical question regarding the H_2 tolerance of the gas grid + establishing a European understanding →HIPS NET.
- This is a mandatory precondition for standardisation processes CEN/HYREADY.
- DVGW takes over responsibility for technical clarification but demonstration has to be done by the companies.
- Up to now it is not set, who will produce, distribute and use e-gases in future.
- Goal is a sustainable, macroeconomic feasible and robust energy supply.

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Thank you for your attention!

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DVGW

Who is DBI
and which role plays P2G within DBI?

DBI GUT
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- 4 Departments plus training centre and certification laboratory
- 60 employees
- Owned by DVGW
- More than 10 P2G related projects in the last two years
  - Planning of P2G injection plant for town utilities Mainz
  - Site assessment for 50 Hertz, Greenpeace Energy, ONTRAS…
  - Consultation for RWE (H_2 injection)
  - Establishing and running HIPS-NET together with GERG…

Oil/Gas Product./Storage | **Gas Grids Gas Systems** | **Gas Utilization** | **Gas Chemistry Gas Measurement** | **DVGW-Testing Lab** | **DVGW-Training Center Gas**