



# GERG Hydrogen Projects

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DECEMBER 3<sup>RD</sup>, 2021

60 YEARS ANNIVERSARY CONFERENCE



# The European Gas Research Group

## Our members



## Friends of GERG

## EC-funded Projects



DEO • CONRAD • DIGBUILD • VOGUE • MICROMAP • PRESENSE • LABNET • GIGA • COMBO • NATURALHY • ORFEUS • INTEG-RISK • GASQUAL • LNG DENSITOMETER • ELEGANCY • THYGA • Biomethane Barriers • H2PNR

- Collaborative R&D group for gas with strong industry focus
- Over 30 members - gas companies, research centres and universities
- Young Researchers Event – Awards supporting the best students
- Links to Brussels Institutions and External Organisations



ELEGANCy

HIPS



OIL & GAS  
HYREADY

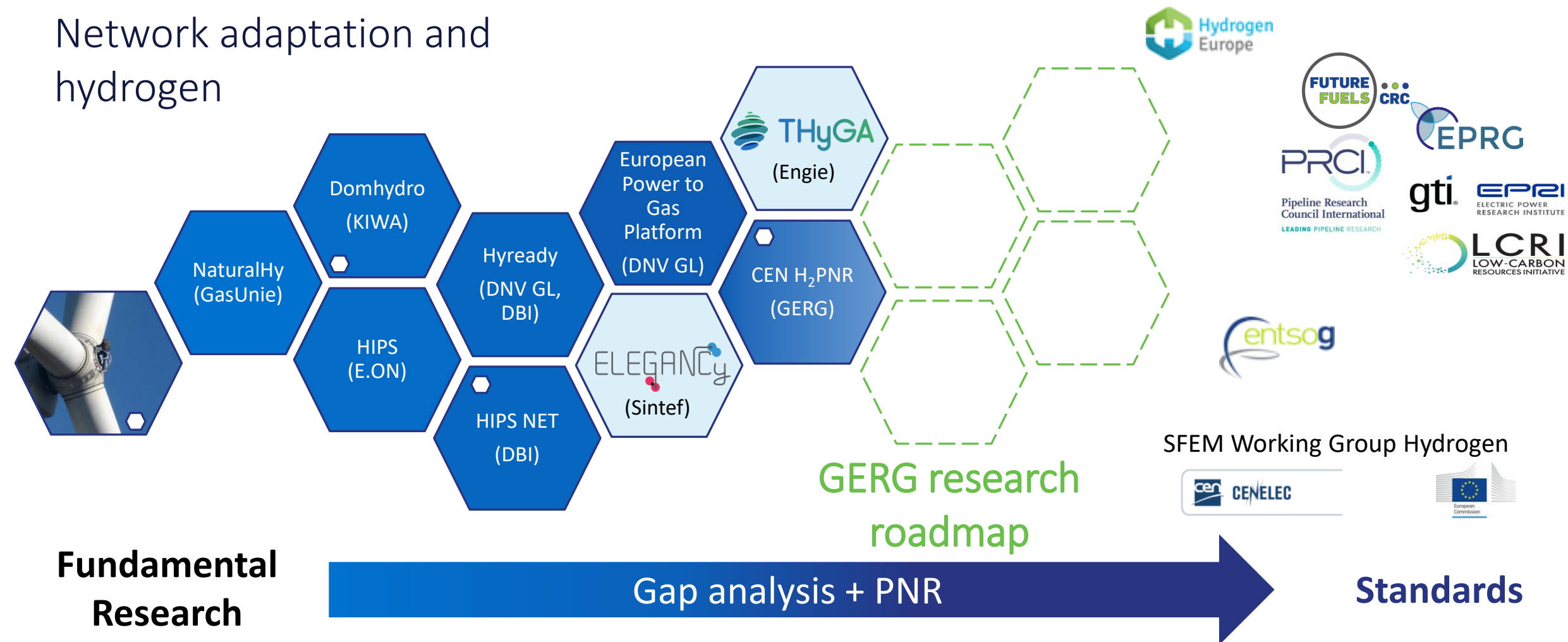
NATURALHY

## A pioneering hydrogen association: Some past H2 GERG projects



# Overview of GERG Hydrogen activities

Network adaptation and  
hydrogen



# NaturalHy (2004)

Preparing for the hydrogen economy by using the existing natural gas system as a catalyst.

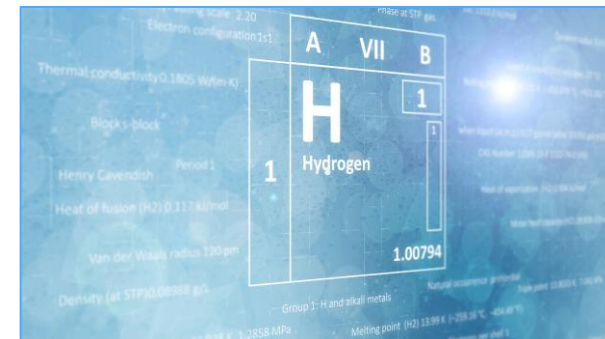


- ◇ The NaturalHy project investigated the **use of the existing natural gas system for hydrogen**.
- ◇ Partially funded by the EC.
- ◇ About **40 European partners** studied how a transition to a hydrogen economy could be facilitated in a short timeframe based on use of the existing gas infrastructure to convey a natural gas/hydrogen mixture.
- ◇ Divided into **6 technical work packages**.
- ◇ Key focus on:
  - Socio-economic and **life cycle analysis**.
  - **Durability** and **integrity** of pipelines.
  - Impact on overall **safety**.
  - Effect on existing **gas appliances**.
  - **Membranes** to withdrawn hydrogen.
  - Decision tool to aid assessment of **system suitability**.



## Gas companies and gas research institutes:

DBI	BP
DGC	Gaz de France
DEPA	Gasunie
GERG	Shell Hydrogen
IFP	Statoil
IGDAS	Total
ISQ	Transco
Natural Gas Midt-Mord	



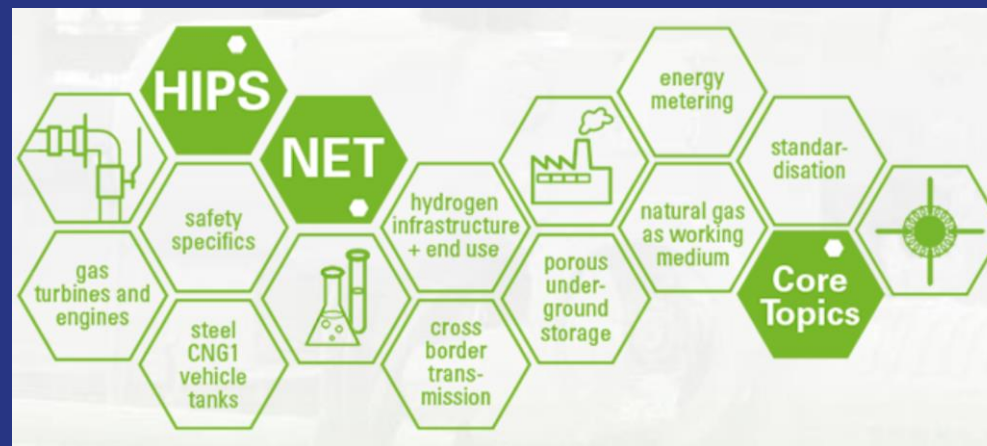
# HIPS: Hydrogen in Pipeline Systems (2012)

Through this GERG project, over **30 partners** worked on a benchmark study to understand the impact of **hydrogen blending** in gas networks up to **10% v/v**.

The report is on the GERG website.



The HIPS project was also the precursor of the HIPS-NET network, which is still running with around 40 partners, managed by DBI



# Elegancy (2017-2020)

Enabling a low-carbon economy via hydrogen and CCS



- ♦ The Elegancy project was launched by an international collaboration between **21 research and industry partners, including GERG**, with the aim of developing scientific and technical progress to face these challenges. Its aim was to broaden public awareness of **CCS** while creating a commercial model for the industry.
- ♦ Coordinated by SINTEF Energy Research, the project provides **innovative, cutting-edge solutions to key technical challenges for H2-CCS chains**.
- ♦ The research programme comprises six work packages:
  - WP1: Hydrogen supply chain and hydrogen-carbon dioxide (H2-CO2) separation
  - WP2: CO2 transportation, injection and storage
  - WP3: Business case development for H2-CCS integrated chains
  - WP4: H2-CCS chain tool and evaluation methodologies for integrated chains
  - WP5: Five case studies, one per participating country
  - WP6: Project management, network building and dissemination



# HyReady (2017-2021)

## Engineering Guidelines for Preparing Natural Gas Networks for Hydrogen Injection



- Many stakeholders are considering the use of hydrogen in the natural gas grid as a way of supporting the decarbonisation of the energy system. Yet, there are no **guidelines for TSOs and DSOs on how to proceed to the injection of hydrogen on their natural gas transmission and distribution networks and the impact this will have.**
- Partnership led jointly by DNV and DBI-GUT, aiming to provide **engineering guidelines** to European gas system operators to make sure their networks are ready to accept hydrogen-natural gas mixtures.
- The project distinguishes between the following levels:
  - **Grid level:** It sets the extent to which the system functionality is affected.
  - **Component level:** It shows the extent to which the performance, maintenance, repair and safety are affected.
  - **Location level:** It indicates the level to which the installation requirements are affected by hydrogen addition.



OIL & GAS

**HYREADY**





# CEN H2PNR

Introduced by Hiltrud Schülken  
Secretary CEN TC234

This work was performed by GERG on behalf of CEN under Specific Agreement CEN/2019/ENER/C2/452-2019/SI2.831737 with funding Provided by the European Commission



# CEN H2 PNR

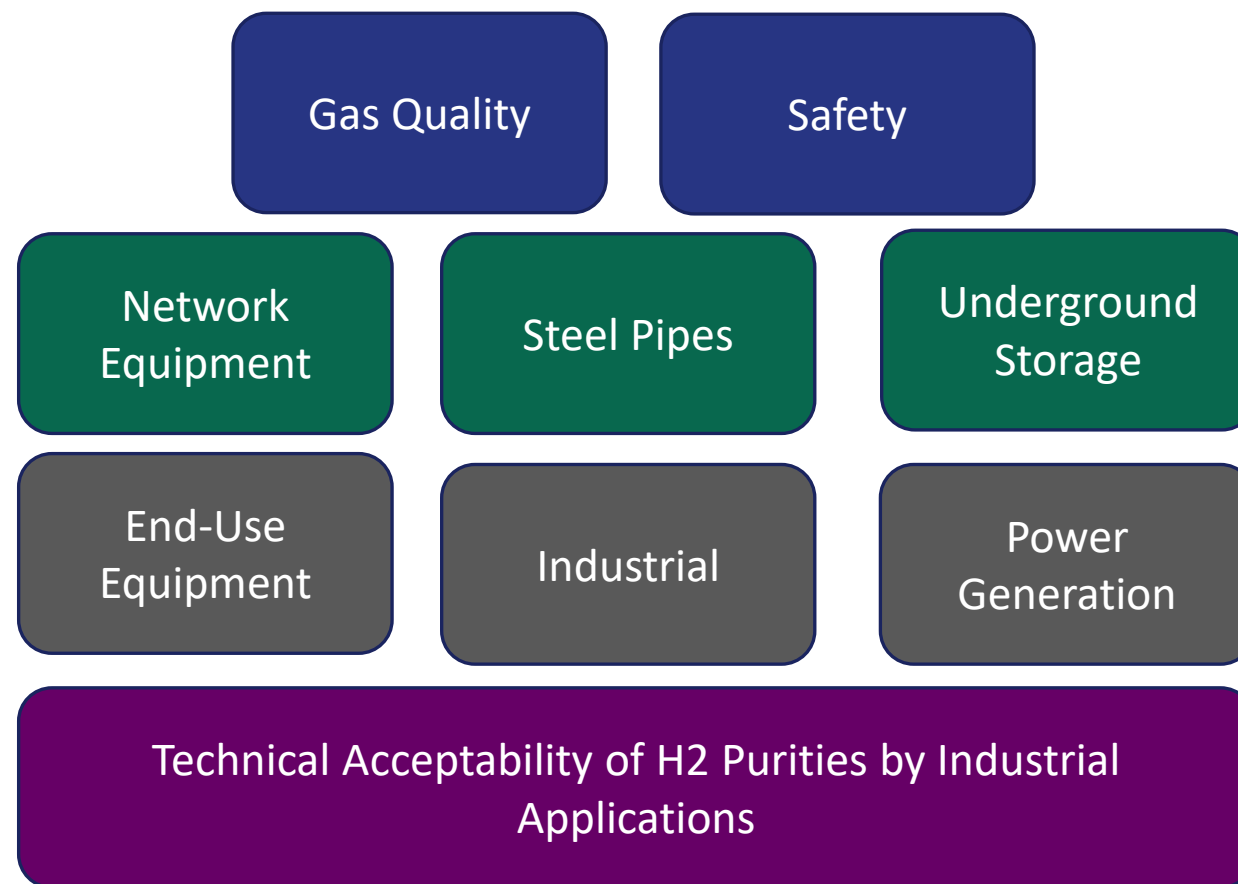
Removing the technical barriers to use of hydrogen in natural gas networks and for (natural) gas end users



## Work Packages

Pre-normative research requirements for the introduction of hydrogen in European natural gas grids. Priorities selected through consultation with CEN TCs.

## Delivery Partners



# CEN H2 PNR

Removing the technical barriers to use of hydrogen in natural gas networks and for (natural) gas end users



♦ Work performed by GERG on behalf of CEN with funding provided by the EC.

♦ Project steered by a new CEN TC 234 (Gas Infrastructure) Working Group

♦ Goal → allowing the development of:

- Addition of hydrogen to the natural gas networks and use of H2NG admixture in gas applications, in increasing quantities, therefore progressively reducing the carbon footprint of gas end-use.
- Transformation of the natural gas networks and connected applications to enable their use with hydrogen.

♦ Objectives:

- To perform detailed knowledge surveys on the priorities.
- To develop a detailed understanding of the state of the art relating to hydrogen injection in the gas networks based on international information sources.
- To understand gaps in knowledge and develop proposed plans for mitigation.
- To develop recommendations which include planned PNR activities to lower or remove barriers.





# Data Collection Methodology

Klaas van Alphen (Future Fuels CRC)	Plastic pipes for hydrogen and blends	Project Report	3.1-03 Future proofing plastic pipes	2022	Australia	Deakin University, University of Wollongong, APA, Jemena, Worley Parsons, OSD, AusNet	Develop a standardised suite of tests to identify polymer/elastomeric compatibility with hydrogen and its blends and generate an understanding of the capacity for current pipeline materials (plastics and elastomeric) to transport future fuels
Robert Judd (GERG)	Storage	External publication	Current status of chemical energy storage technologies	2020	Europe	Joint Research Center (JRC)	The aim of this report is to give an overview of the contribution of EU funding, specifically through Horizon 2020 (H2020), to the research, development and deployment of chemical energy storage technologies (CEST). In the context of this report, CEST is defined as energy storage through the conversion of electricity to hydrogen or other chemicals and synthetic fuels. On the basis of an analysis of the H2020 project portfolio and funding distribution, the report maps research activities on CEST at the European level. In addition, projects funded at national and international level, occurring within the same timeframe, have been considered.
Maxime Bertin (GRTgaz)	General	External publication	Options of natural gas pipeline reassignment for hydrogen : Cost assessment for a Germany case study	2020		S. Cerniauskas et al.	
Maxime Bertin (GRTgaz)	Integrity	Internal Report	Impact sur la ténacité d'un mélange 99,5%N2 + 0,5%H2 et calculs API	2020	France, Europe	GRTgaz	Experimental study of the effect of hydrogen on toughness of an API X70 steel and defect assessment using API579 "Fitness for Service"
Maxime Bertin (GRTgaz)	Integrity	Internal report	Impact de l'ajout d'hydrogène sur les critères du Guide d'Analyse des Défauts	2020	France, Europe	GRTgaz	Study of the effect of hydrogen of GRTgaz defect assessment criteria
Amelie Louvat (GRTgaz) Graham Hill (GHD)	General	External publication	H2@Scale: Opportunities for Hydrogen as an Energy Intermediate	2020	USA	NREL	Document summarizes objectives of H2@Scale project and desired outcomes for future of hydrogen in energy systems.
Robert Judd (GERG)	Summary of projects	Internal Report	National Grid Hydrogen Innovation Programmes	2020	UK, Europe	Antony Green	A complete list of Completed, ongoing and Future National Grid Hydrogen Projects
Robert Judd (GERG)	Summary of projects	Internal Report	Strategic Hydrogen projects of GERG Members Overview	2020	Europe	GERG	To understand the current panorama of member activities in order to construct a Roadmap for hydrogen introduction
Gary Choquette (PRCI)	Boiler End-Use	External publication	The Development of Natural Gas/Hydrogen Boiler System	2020	Netherlands, Europe	DNV	A sustainable route to reduce the CO2 emission of industrial heating processes is the addition of hydrogen to natural gas and on the long term to replace natural gas completely by hydrogen. In this study a burner system that allows the safe and reliable combustion of natural gas, natural gas/hydrogen mixtures and hydrogen is developed and tested.
Klaas van Alphen (Future Fuels CRC)	Fracture control	Review Report	FFCRC 3.1-01   Review of future fuels	2020	Australia	University of Wollongong, Deakin University, APA, Jemena, Worley Parsons, OSD, AusNet	Literature review - Review fracture control methodologies and testing methods for future fuels pipelines, review past and present projects along with existing fracture control methods for future fuels pipelines and materials to be developed

Identification  
Initial review  
by:

Subtopic

Nature of  
knowledge

Document  
Publication title

Publication  
year

Geographic  
area (Country)

Authors

Objectives

Results

%H2 studied

%H2 acceptable

Availability of  
data

Sharing  
modalities

Source

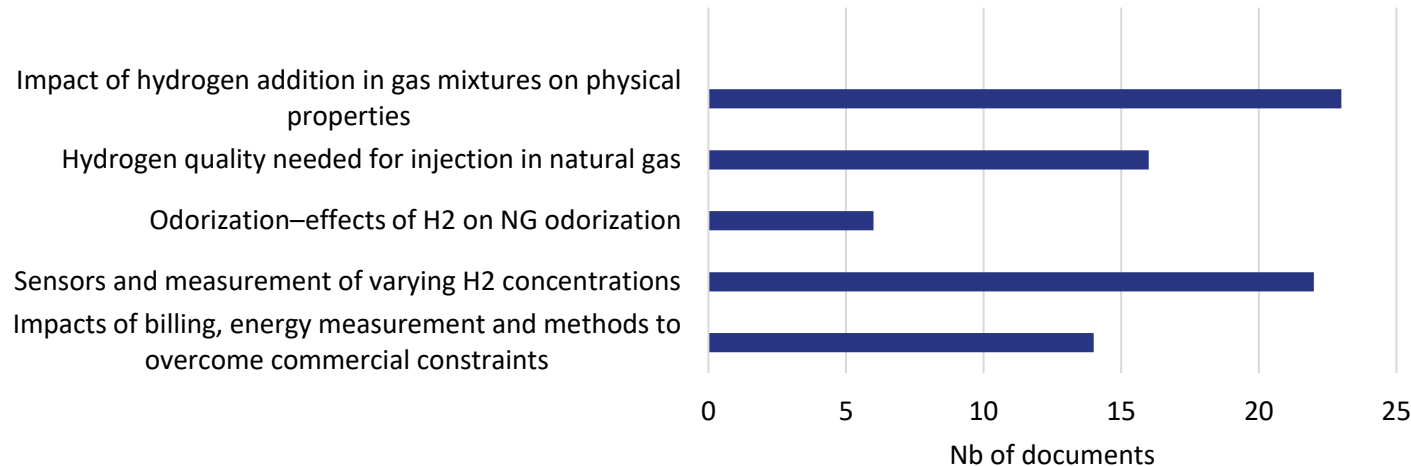
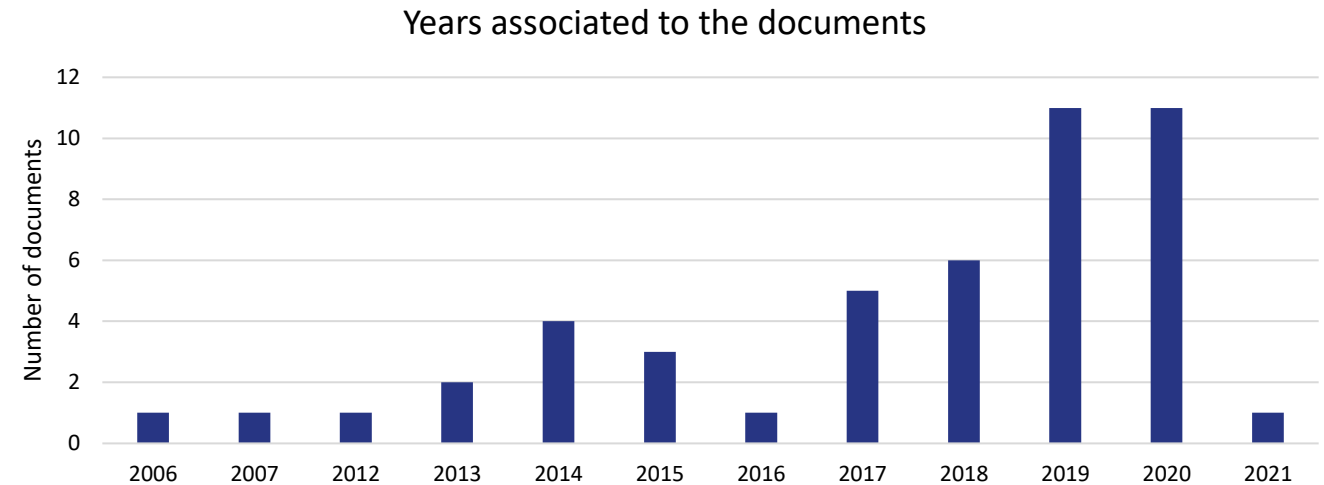
Relevance of  
study

- Adapting **approach** used in recent PRCI SoTA study
- Developing **Datasheet** with all relevant **parameters** and **indexed** according to sector:
  - Build in **recent knowledge** gained from **other studies**
  - **Strong industry input** to add knowledge from across European operations
  - **Liaise with existing projects** and initiatives e.g. THyGA, NewGasMet, SFEM, national activities, IGEM, CEN TCetc.

# Example Priority 2 Gas Quality

## Step 1: Knowledge survey

- Mapping of H2GN and H2 **reports** dealing with Gas Quality
  - Bibliographic documents, internal reports, project reports, ....
  - 66 documents listed
  - Good distribution between the subtopics

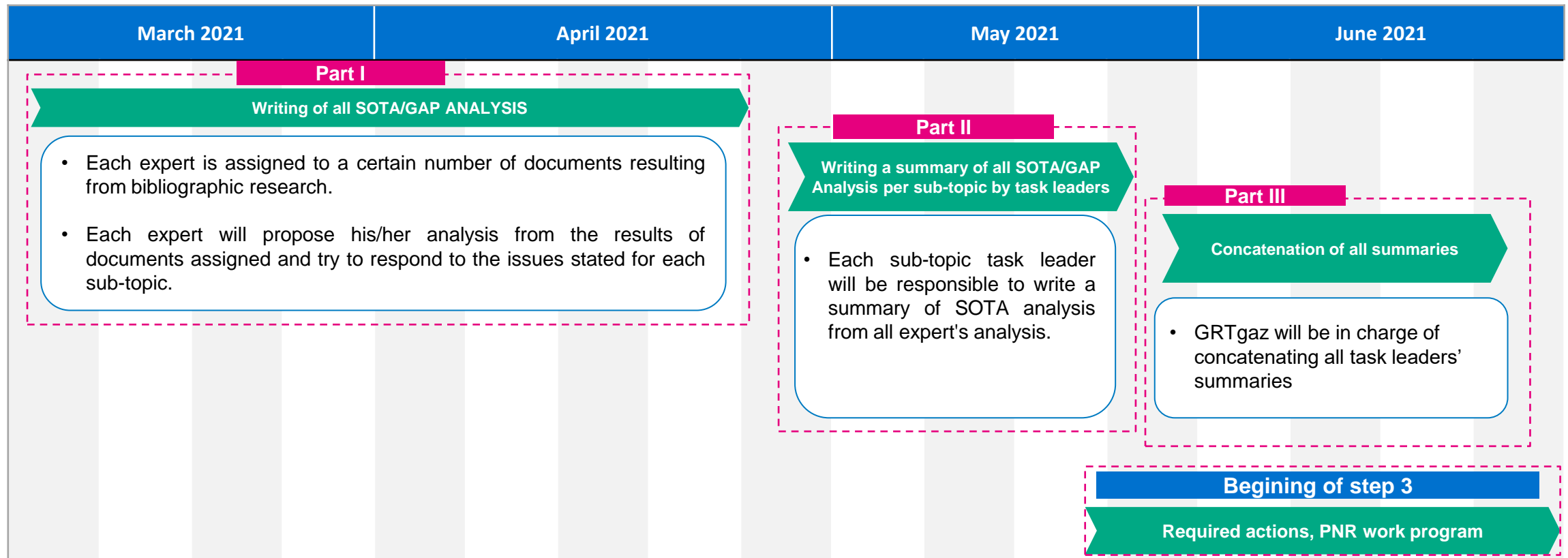


- Distribution of the 66 documents through the WP → study of each document collected by the linked expert

# Example Priority 2 Gas Quality

## Step 2: Knowledge assessment

- Proposed organization for WP2



# PNR Actions tables – format example



Work Package	No.	H2NG/H2/ both	Topic	Gap in knowledge to fill or challenge to tackle	Proposed solution(s)	Research project (PNR)	Category	Objectives, targets, expected results	Expected Duration (years)	Expected budget range (€)	Content, Notes (work content)	Previous projects, building on (recent or running projects where partners are involved)	Partner contributors & skills (testing facilities) (cf initial proposal GERG project)	Standards
7	6	both	Seals and connections	Seal compatibility at higher hydrogen partial pressures	Develop understanding of materials suitability of materials in the existing gas networks by materials testing particularly at higher concentrations of hydrogen, higher pressures and longer term testing of materials.	Perform materials testing at laboratory and field tests particularly at higher concentration of hydrogen, higher pressures and longer term testing of materials.	Material	Validate materials suitability in hydrogen service	2y	2M		FutureGrid pilot testing facilities at DNV Spadeadam site. Components from networks will be tested for operation in hydrogen blends up to 100% H2. Materials compatibility and leak tightness test included. Previous NaturalHy	Pilot test facilities at DNV Spadeadam site	ISO/TR15916:2015 [GERG844]

# Project outcomes

- Project Executed from Jan To Nov 2021
- Final Supervisory Board Presentations 29<sup>th</sup> November
- Summary report and 9 Work Package reports produced
  - Canvas of over 1000 hydrogen related references also produced
  - Collated reference list of prioritized PNR actions to be taken forward for possible project creation
- Reports to be used by CEN Technical Committees with wider circulation expected in due course

