



# FLEXnCONFU PROJECT

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ONLINE

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This Project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N. 884157

# PROJECT OVERVIEW

48  
MONTHS

9.8  
MIL. €

21  
PARTNERS

1 APRIL  
2020



2022

TRL 6  
PILOT SITE

2024



31 MARCH  
2024



2021

H<sub>2</sub>/NH<sub>3</sub>  
COMBUSTION



2022

TRL 7  
DEMO SITE



H<sub>2</sub> NH<sub>3</sub>



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# DRIVERS

## Project Response

### DRIVER 1

- Major role of Natural Gas in the EU energy system
- NG fueled power plants are the bridging technology to a 2050 decarbonized energy scenario

To demonstrate a cleaner and fast-response solutions to be coupled with the existing fossil fuel power plants, with a significant impact already in the short-term

### DRIVER 2

- Hydrogen is an essential element in the energy transition
- H<sub>2</sub> can achieve a remarkable importance in the future EU economy

To use of hydrogen in fossil fuel power plant in order to accelerate the transition towards a decarbonized and energy efficient society

### DRIVER 3

- Increasing share of H<sub>2</sub> and/or NH<sub>3</sub> combustion in gas turbines (target 100% H<sub>2</sub> by 2030)
- Use of ammonia in gas turbine as energy carrier to unlock the potential H<sub>2</sub> and reduce the NO<sub>x</sub>

To become a reference point in the short term for H<sub>2</sub> and P2G solutions, and in the long term for NH<sub>3</sub> as energy carrier.

### DRIVER 4

- Rapid growth in variable generation is driving the need for a more flexible combined energy and storage technologies
- P2G technologies are receiving particular focus in Europe as the next future best storage to be coupled with RES

Replication of FLEXnCONFU P2X solutions for future applications in other energy sectors in order to enable higher RES penetration.



# MAIN GOAL

- **Demonstrate up to TRL 7** in a real operative plant the **integration of power-to-X-to-power system** able to:
  - increase fossil based power plant flexibility
  - reduce emissions of the power plant
  - use the intermediate product in which power is stored within the power plant itself to produce power again
- To **exploit the potential of NH<sub>3</sub>** combustion in reducing CO<sub>2</sub> emission, combustion tests up to 100% NH<sub>3</sub> will be performed in a Heavy Duty Representative GT Combustion Systems (Cardiff University combustion lab).

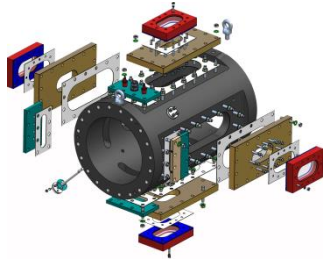
***FLEXnCONFU is promoting a closer RES/GT integration via Power-to-Gas solutions***



# PILLARS

## PILLAR 1

USE OF NON-CONVENTIONAL FUELS IN GT/CC FOR FLEXIBILITY NEEDS AND HIGHER ENVIRONMENTAL SUSTAINABILITY



## PILLAR 2

INTEGRATION AND DEMONSTRATION OF P2X SYSTEMS in REAL POWER PLANT



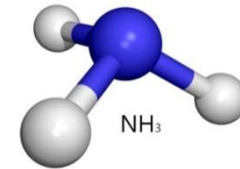
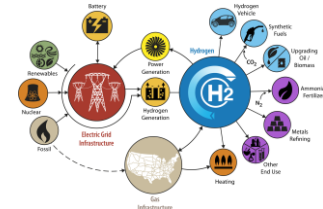
## PILLAR 3

DEVELOPMENT OF PROPER GRID ORIENTED CONTROL STRATEGIES



## PILLAR 4

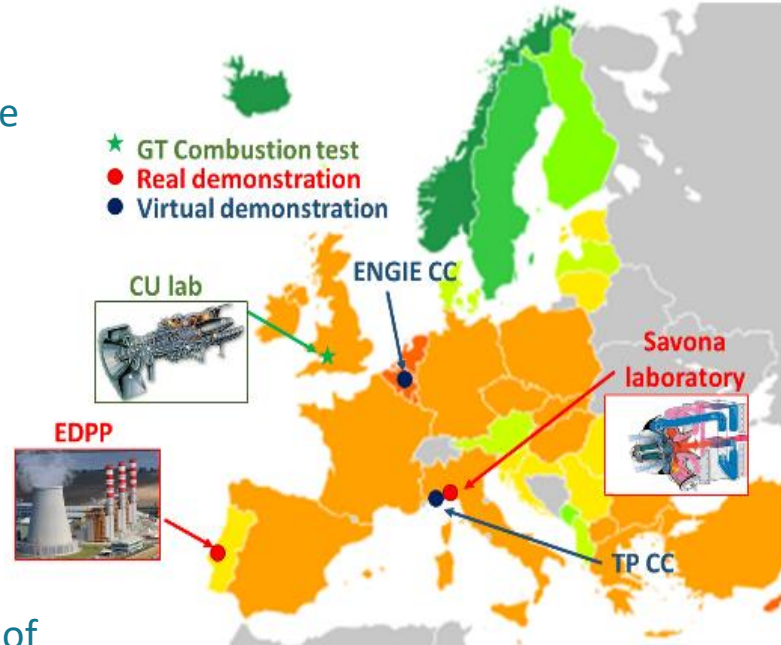
PROMOTION OF A HYDROGEN AND AMMONIA ENERGY SOCIETY



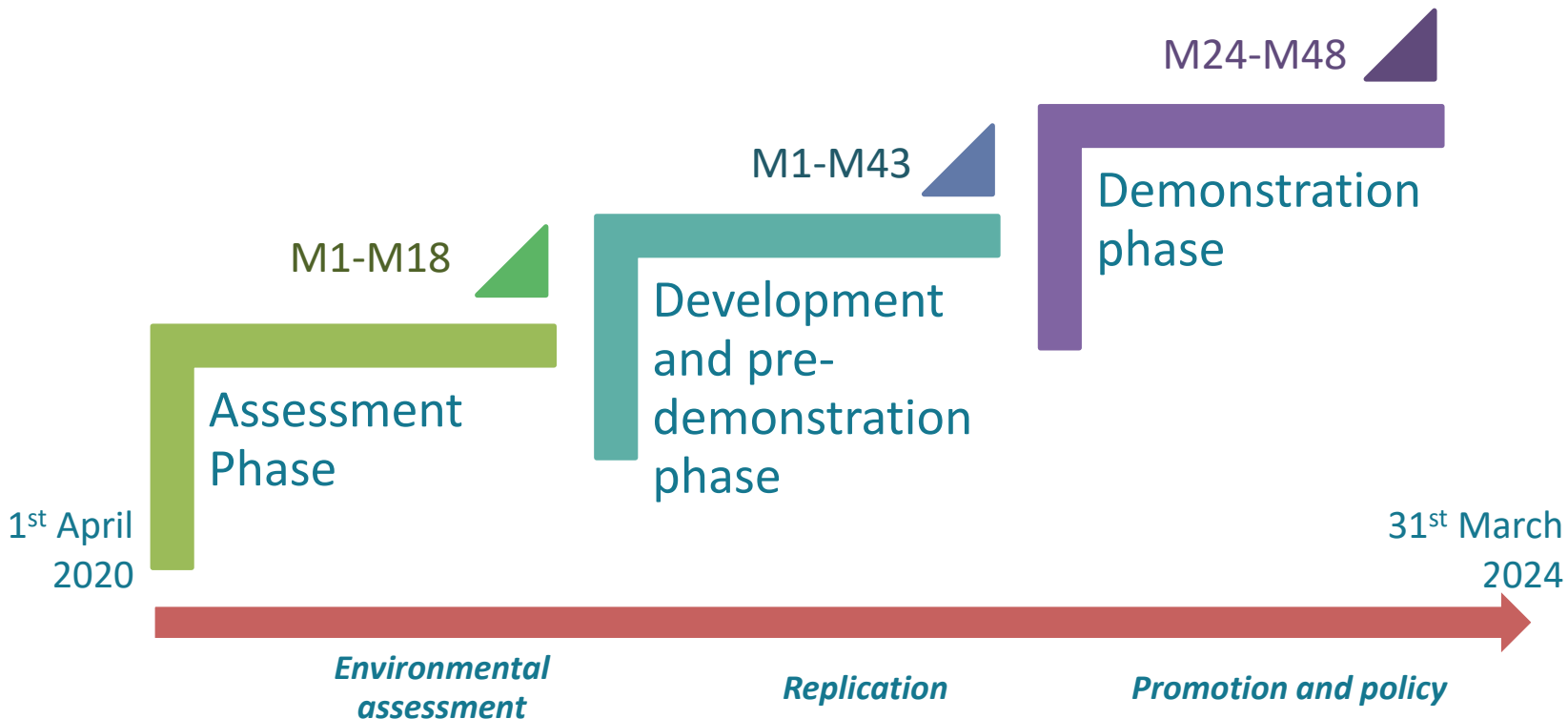
# DEMONSTRATION

Demonstration at **four different levels**:

- Alternative fuel combustions in representative industrial scale GT in Cardiff University laboratory
- TRL6 P2A demonstration in Savona pilot site
- TRL7 P2H demonstration in Ribatejo power plant
- Virtual demonstration towards maximisation of the replication potential



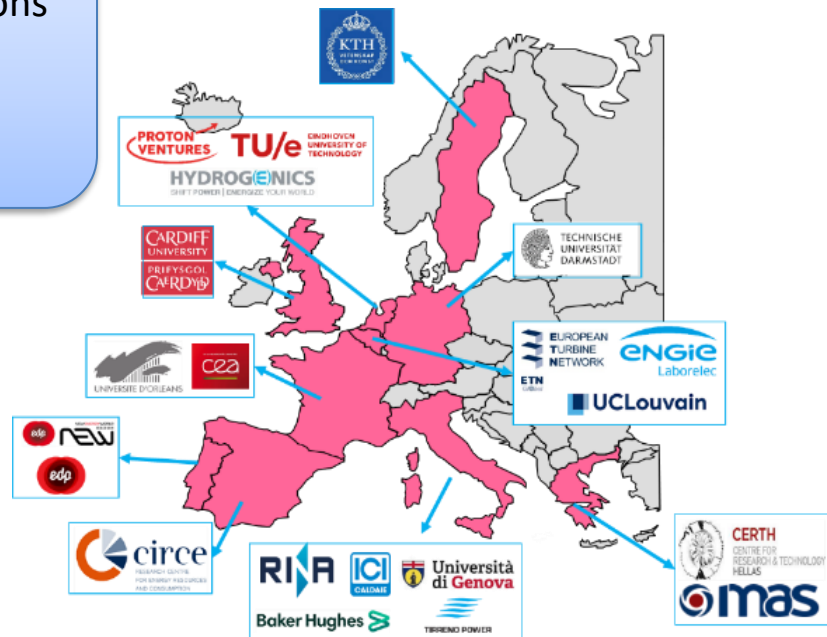
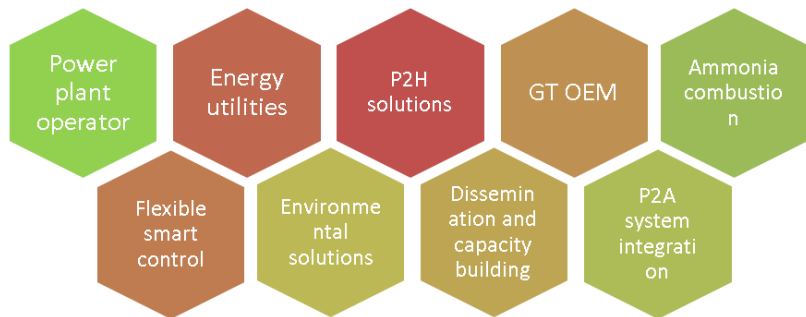
# METHODOLOGY



# CONSORTIUM

## Industrial driven consortium:

- 10 top level Academic Polytechnic Institutions
- 7 Large Enterprise
- 3 Small and Medium Enterprises
- 1 association





# IMPACTS

## Exp.Imp.1: Contribute to a smart, secure and more resilient power system through the integration of energy storage for the purpose of load levelling in fossil fuel power generation

- FLEXnCONFU will enlarge CC possibility of offering services on the ancillary services market guaranteeing a more secure, clean and resilient power system.
- FLEXnCONFU solution will stimulate electric/gas grid interaction and increase EU energy independence enabling EU CC plants to act as hub of gas/electric grid flexibility services.

## Exp.Imp.2: Smoother operation of these plants at optimal efficiency and environmental performance

- *Reduction of minimum load:* - 10%
- *Increase of yearly efficiency:* - 5%
- *Increase yearly EOH:* + 5/10% according to the location of the CC
- *Reduction of yearly start-up numbers:* -10%
- *Quicker ramp up/down with load gradient* +10/15%
- *Reduction of NG consumption and related emissions:* - 10/20% of  $\text{GHG}_{\text{eq}}$

## Exp.Imp.3: Better adapt to an energy system that will increasingly be dominated by intermittent renewable energy

- Promotion of P2G2P solutions for GT/CC, exploiting excess of power to produce potential GT fuels like  $\text{H}_2/\text{NH}_3$  are the best option to flexibilise the cycles, guaranteeing a smoother operation than a traditional battery to be then coupled and releasing power to the grid.





**MANY  
THANKS!**

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<https://flexnconfu.eu/>



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