Concept/Challenges

The main goal of the FLEXnCONFU project is to develop and demonstrate in a combined cycle (CC) power plant an innovative, economically viable and replicable power-to-X-to-power (P2X2P) solution. The objective is to design and implement an integrated power plant layout that can increase the operational flexibility in order to respond to the electricity demand. This will be done by converting surplus electricity production when demand is low into hydrogen (H_2) or Ammonia (NH_3). These carbon free fuels can then be converted back to electricity when demand increase.

Project Pillars

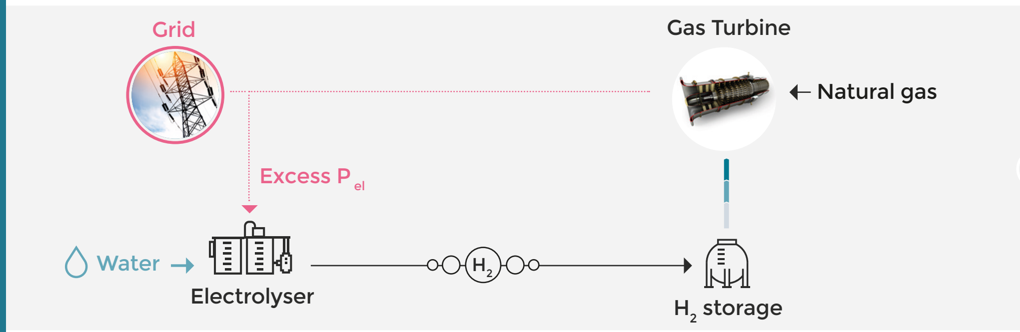
PILLAR 1
Use of non-conventional carbon free fuels in gas turbine combined cycles for increased flexibility and sustainability

PILLAR 2
Integration and demonstration of P2X2P technologies in existing power plants

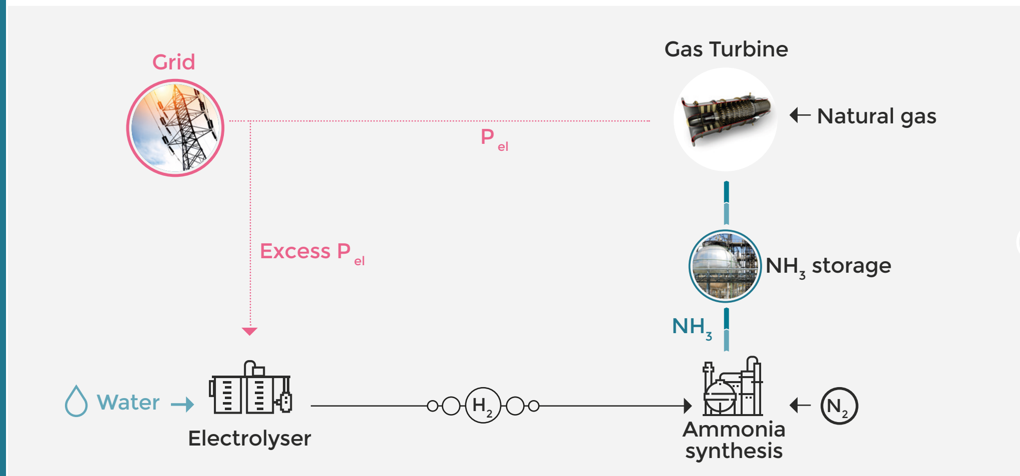
PILLAR 3
Development of proper grid oriented control strategies

PILLAR 4
Promotion of a hydrogen and ammonia energy society

Objectives



Power to Hydrogen: Development, integration and demonstration of power to hydrogen solution to increase the CC power plant flexibility and efficiency, while decreasing GHG emissions and use of natural gas.
Target: 1000 operating hours for the Power to Hydrogen solution connected with the combined cycle power plant.



Power to Ammonia: Demonstration of power to ammonia solution at lab scale in a small-scale ammonia reactor for NH_3.
Target: Power to Ammonia system working at T<300°C and p<35bar.

Gas Turbine fuel flexibility: Design, development and test a gas turbine combustion system able to burn hydrogen and/or ammonia.
Target: 30%H_2 and 100%NH_3 in combustion test for representative heavy duty gas turbines; 100% NH_3 in modified micro gas turbine.

Advanced Control System: Development of control algorithms focusing on flexibility enhancement and power grid interoperability that will be implemented and tested in both power to ammonia and power to hydrogen systems.
Target: computational duration reduction up to 25%.

Economic, Safety and Environmental Sustainability: Demonstration of economic and safety feasibility, social viability and environmental sustainability of the novel solutions.
Target: GHG reduction up to 20% – Pay Back Period up to 8 years – 3 Feasibility studies performed.

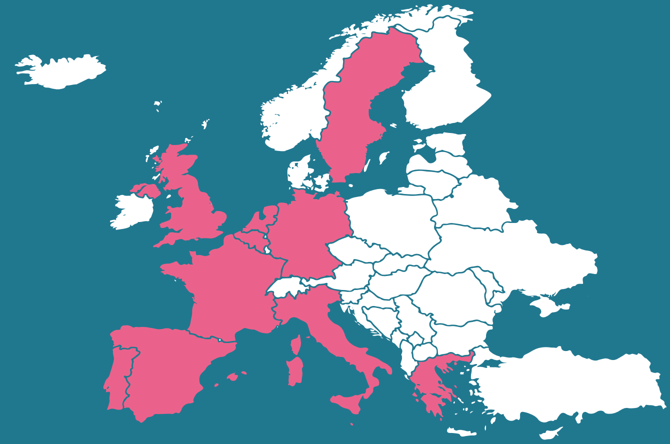
Expected Impacts

Contribution to a smart, secure and more resilient power system through the integration of energy storage in fossil fuel power generation.

Increase the flexibility of fossil fuels power plants at optimal efficiency and environmental performance

Better adaptation to an energy system that will increasingly be dominated by intermittent renewable energy.

Partners



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Project details
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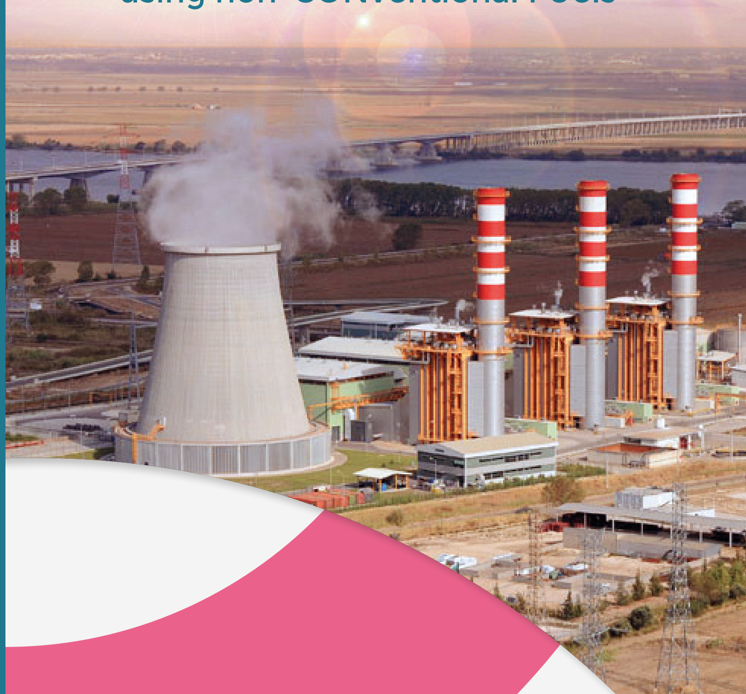
FLEXnCONFU

FLEXibilize combined cycle power plant through Power-to-X solutions using non-CONventional FUels



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