



**LNEG**  
Laboratório Nacional de Energia e Geologia, I. P.

# H<sub>2</sub> developments Portugal

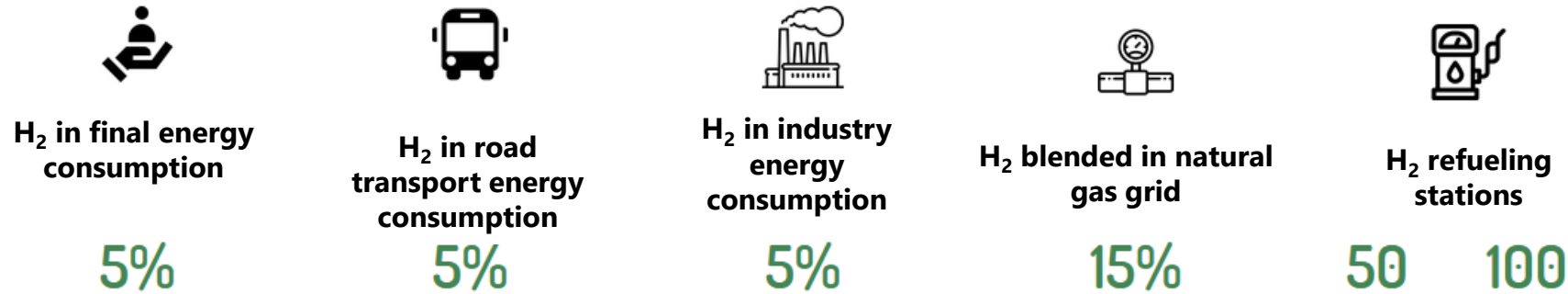
**Sofia G. Simoes**  
**Resource Economics Unit**  
**LNEG – National Energy Geology Laboratory Portugal**

**Member States' Perspective on the EU Hydrogen Accelerator**  
***Green(ing) H<sub>2</sub> Project***  
**Online**  
**14th July 2022**

# EN-H2 Portugal National H<sub>2</sub> Strategy

**Green H<sub>2</sub> only - mainly produced from water electrolysis input with renewable electricity**

## 2030 targets



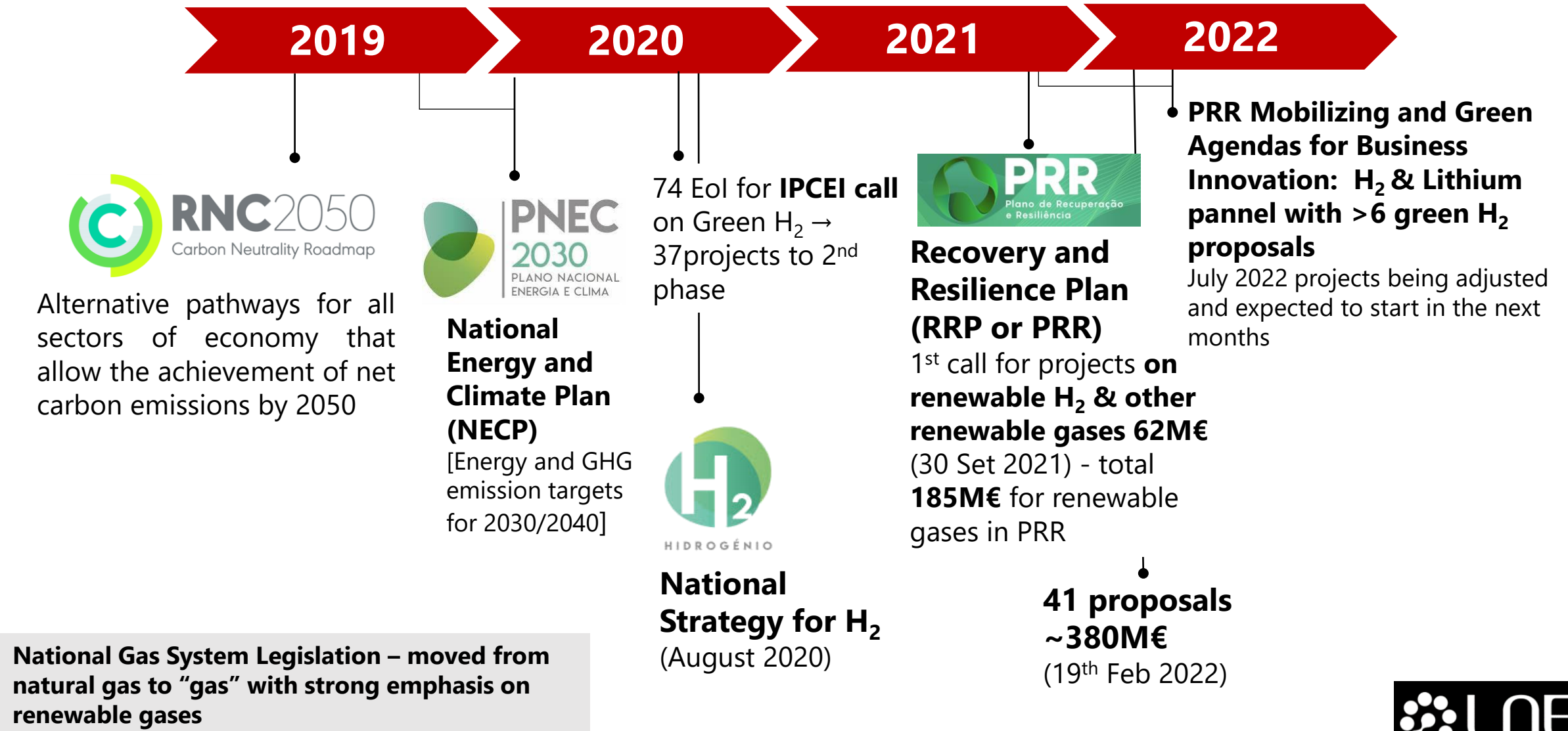
- ✓ 10% to 15% **blending of green H<sub>2</sub> in natural gas grid**;
- ✓ 2% to 5% of green H<sub>2</sub> in the **energy consumption of the industrial sector**;
- ✓ 1% to 5% of green H<sub>2</sub> in **road transport energy consumption**;
- ✓ 3% to 5% of green H<sub>2</sub> in **domestic maritime transport energy** consumption;
- ✓ 5% of green H<sub>2</sub> in **final energy consumption**;
- ✓ 2 GW to **2.5 GW of installed capacity** in electrolysers;
- ✓ 7000 M€ **investment** to stimulate production and consumption.



[Council of Ministers Resolution no. 63/2020, 14th August](#)

**H<sub>2</sub> EXPORTING COUNTRY**

# Portugal: becoming a green H<sub>2</sub> economy



# H<sub>2</sub> production investment in Portugal (non-exhaustive)

**BEHYOND** project (EDP, TechnipFMC, CEiiA, ...) assessing green H<sub>2</sub> production using offshore energy

**A multitude of different projects with different business models and offtakers is appearing in Portugal**

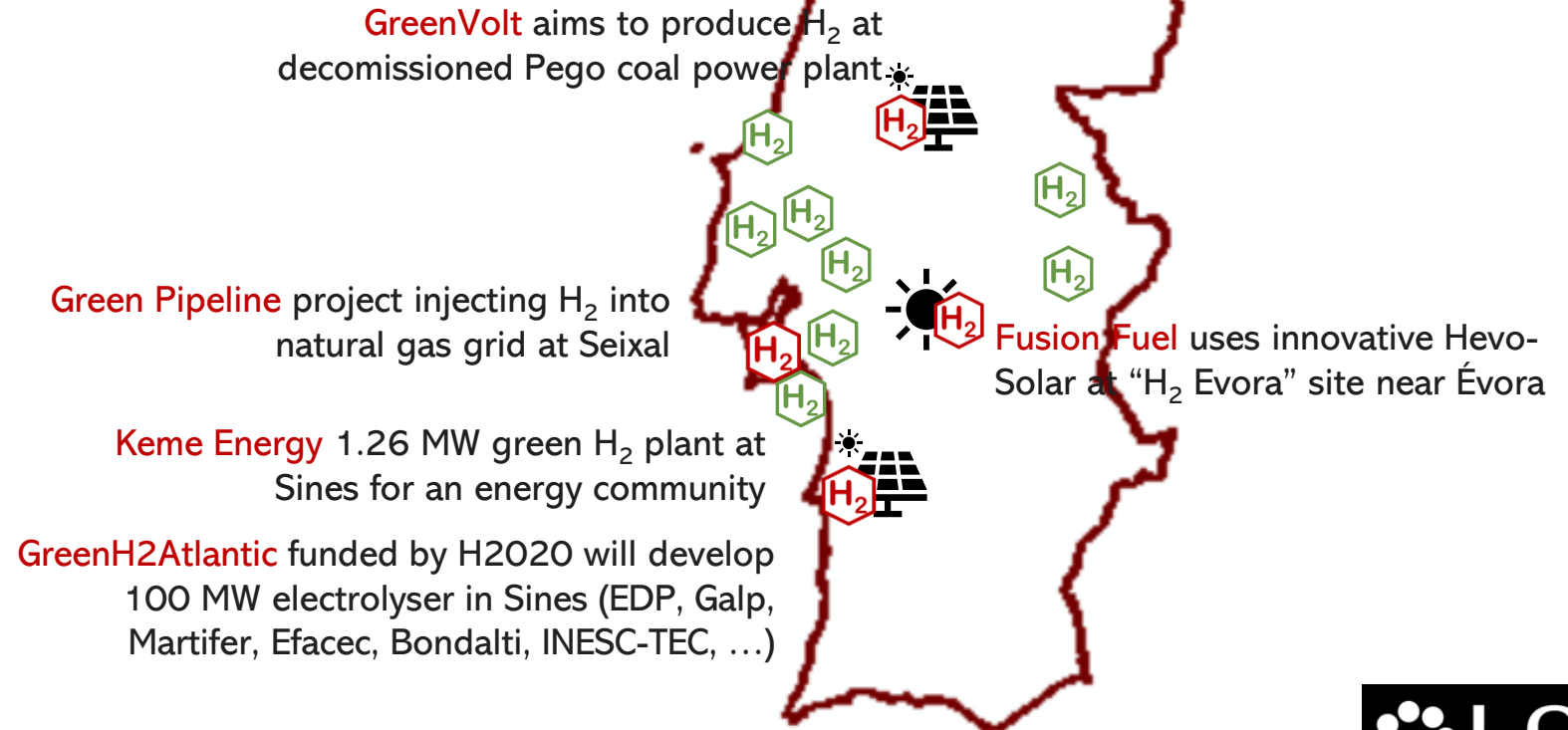
European Clean Hydrogen Alliance

Kick-starting the EU Hydrogen Industry to achieve the EU climate goals

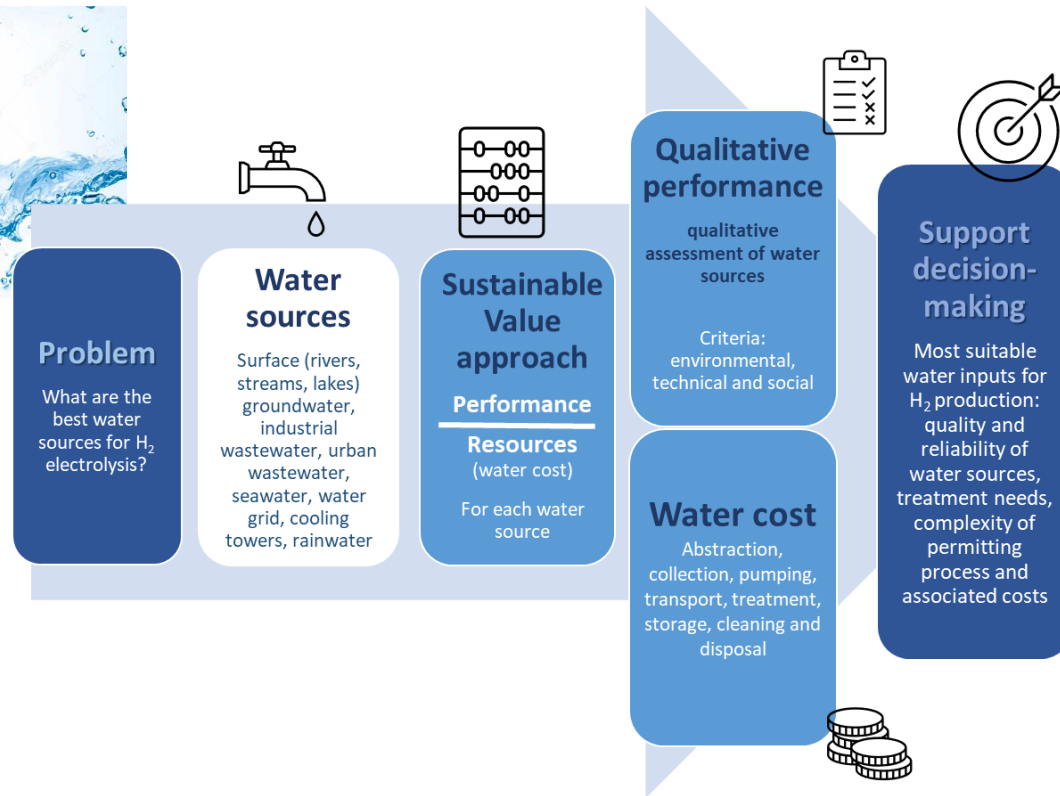


**H<sub>2</sub> 29 H<sub>2</sub> production projects in Portugal** registered with European Clean Hydrogen Alliance Project pipeline (Nov 2021) **2981 MW (1500 MW in Sines)**

[https://ec.europa.eu/growth/industry/strategy/industrial-alliances/european-clean-hydrogen-alliance/project-pipeline\\_en](https://ec.europa.eu/growth/industry/strategy/industrial-alliances/european-clean-hydrogen-alliance/project-pipeline_en)

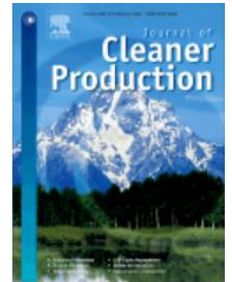


# water resources for H<sub>2</sub> electrolysis



Policy brief | H<sub>2</sub>O for H<sub>2</sub> (in PT)

[https://www.lneg.pt/wp-content/uploads/2021/10/PB\\_UER\\_Fontes\\_de\\_Agua\\_para\\_H2\\_2021\\_PT\\_v7.pdf](https://www.lneg.pt/wp-content/uploads/2021/10/PB_UER_Fontes_de_Agua_para_H2_2021_PT_v7.pdf)



Water availability and water usage solutions for electrolysis in hydrogen production

<https://doi.org/10.1016/j.jclepro.2021.128124>

- > Highly relevant for countries with **water scarcity**
- > **Increasing concern** due to climate change
- > **Wastewater** use can be a sustainable “circular” solution – additional treatment costs
- > Meeting Portugal EN-H2 2030’s H<sub>2</sub> goals require ~**1% of current wastewater volumes**

# Although it is very positive to see exciting developments around H<sub>2</sub> production in Portugal there are still a number of concerns that have to be considered as well:

- › **Water resources** to input electrolysis – Portugal has scarce water resources and reusing wastewater is possible, but regulation clarification is necessary
- › Clarifying regulations and procedures (as well as technical issues) regarding using **natural gas pipelines** for H<sub>2</sub> transport including guarantees of origin
- › Accelerating **permitting process** while minimizing land-use and other environmental impacts (mainly due to land use required by PV power plants)
- › **Delays in global supply chain** of electrolysers (waiting times of 1.5 years have been reported)
- › Assess **underground H<sub>2</sub> storage** possibilities and all associated regulatory aspects
- › ...

Which determinants affect (environmental) permitting process?

- Industrial hazards
- Water sources for electrolysis
- Industry emissions
- (...)

Which criteria determine potential location exclusion from land management point of view?

- Nature protected areas
- Urban areas
- Agriculture areas
- (...)

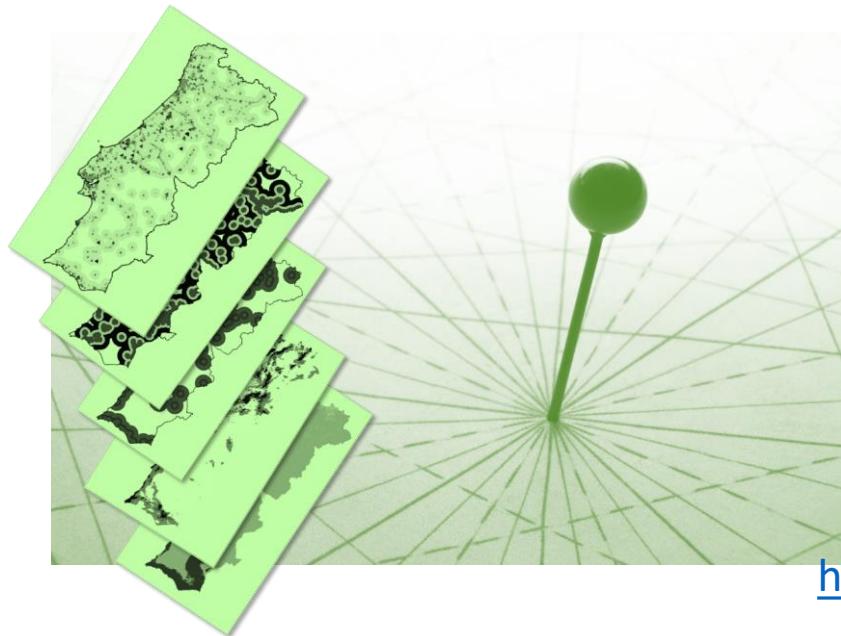
Which possibilities regarding available infrastructure for storing, transporting and distribution of H<sub>2</sub>?

- Distance to consumers
- Gas grid injection points
- Other transport possibilities
- Storage in salt caverns

Which options to input electrolysis with renewable electricity?

- Solar power
- Wind power
- Hydropower
- Bioenergy power
- Distance to power grid

## Portuguese Atlas for Sustainable Green H<sub>2</sub>



Define criteria for assessing adequacy of green H<sub>2</sub> production plant's location

Mapping and assessing land use restrictions

Alternative scenarios for assessing location suitability

<https://geoportal.lneg.pt/mapa/#>



|   |   |   |  |  |
|---|---|---|--|--|
| <br><b>Geology and Geological Risk</b> | <br><b>Mineral Technology</b>              | <b>BUILDING<br/>A STRONGER AND<br/>CLEANER FUTURE</b> |  |  |
| <br><b>Resource Economics</b>          | <br><b>Geo-Information</b>                 |   | <br><b>Geological Resources</b>                                   |  |
| <br><b>Bioenergy and Biorefineries</b> | <br><b>Energy in the Built Environment</b> |   | <br><b>Integration of Renewable Energies in the Energy System</b> |  |
|                                        |   |   | <br><b>Materials for Energy</b>                                     | <br><b>Renewable Energies</b> |


<http://www.lneg.pt>


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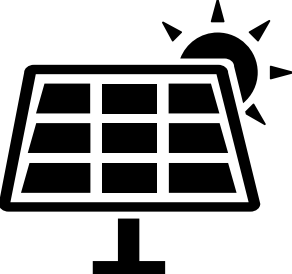
# Renewable electricity capacities and H<sub>2</sub> in Portugal

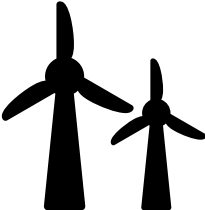
2019

  
0.8 GW

  
5.44 GW

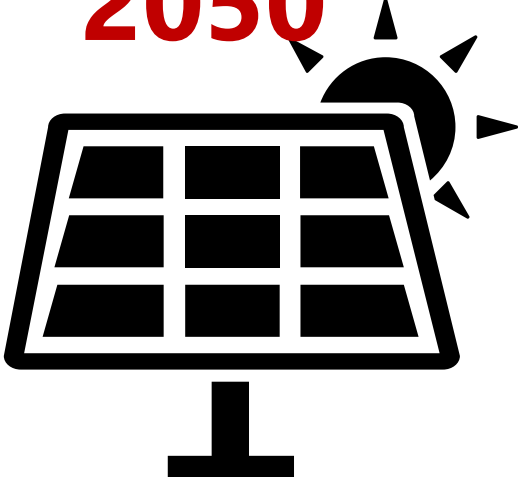
2030

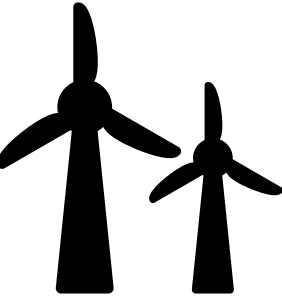
  
+8GW

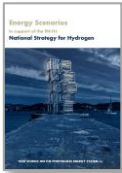
  
+3.5 GW



2050

  
+21GW / +45 GW

  
+11GW/ +15 GW



Energy Scenarios in support of the EN H<sub>2</sub> National Strategy for Hydrogen. Supporting scenarios - should not be considered as targets or goals!!!

# H<sub>2</sub> in Portugal today

## Main H<sub>2</sub> activities

- H<sub>2</sub> production from natural gas (methane) SMR in oil refinery in Sines
  - capacity 70 kt H<sub>2</sub>/year | in 2018 65 kt were produced consuming ~222 ktoe natural gas

## Other

- Chemical industry BONDALTI produces H<sub>2</sub> via electrolysis for their chlor-alkali production (~4.3 kt/year)
- 1 H<sub>2</sub> refueling station in the city of Cascais
- production of H<sub>2</sub> fueled buses in Salvador Caetano factory
- H<sub>2</sub> submarines in the Portuguese navy using imported H<sub>2</sub> from The Netherlands
  
- ...and much activity on new projects across the overall H<sub>2</sub> economy