



Mapping less sensitive areas with a view to the potential installation of solar and wind electricity generation units

**CA-RES4 7th Plenary Meeting
Brussels, Belgium
23rd October 2024**

Based on work of GTAER coordinated by LNEG

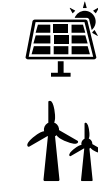
LNEG

Sofia G. Simoes, Juliana Barbosa Paula Oliveira, Teresa Simões, Lídia Quental, Paula A. Costa, Ana Picado, Justina Catarino, Pedro Patinha



Context and approach of mapping activities in Portugal: RAAs and more

National 2030 solar
PV & wind targets

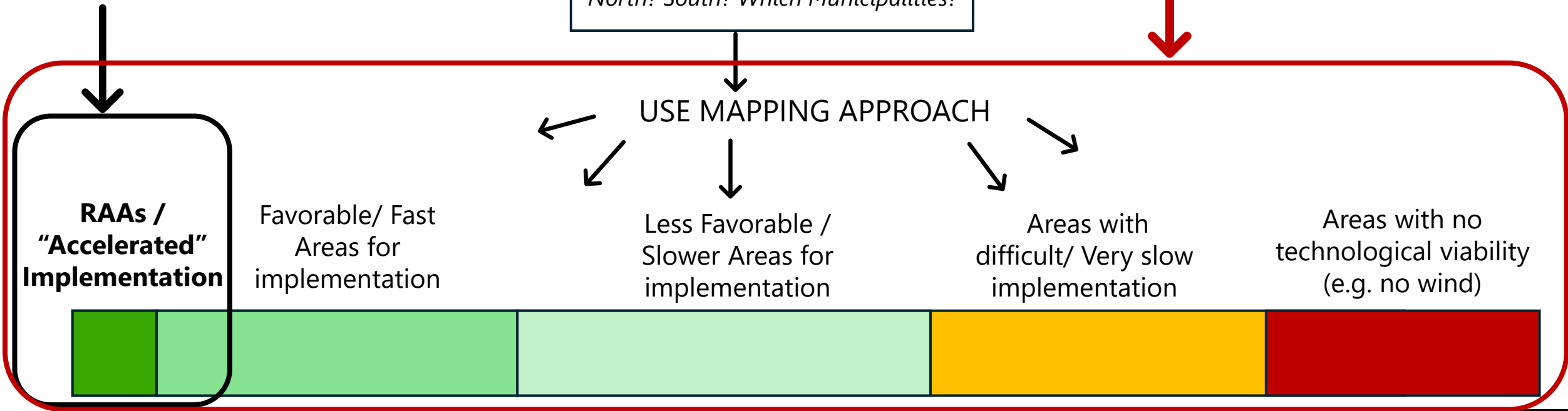


15.1 GW plant size
5.7 GW decentralized/roof
10.4 GW

This has been the
scope of previous
LNEG et al work for
mainland Portugal

Where to implement these
in the territory?
North? South? Which Municipalities?

This is the scope of ongoing work mapping
deployment of renewable energy



Domestic renewable potential mentioned in art 15°b of REDIII Directive has been identified by LNEG



Includes a detailed assesement of decentralized solar PV potential in built areas in mainland Portugal:

~23.33 GW generating up to 36.84 TWh/yr, disaggregated

- per municipality and neighborhood
- per built area type (e.g. parking areas, single houses, shopping malls, industry areas, etc.)

Technical Renewable Potentials Portugal
([here](#))
JULY 2023

Sofia G. Simões, Teresa Simões, Juliana Barbosa, Carlos Rodrigues, et al (2023) **Estimativa de potenciais técnicos de energia renovável em Portugal**. pp. 112. LNEG: Relatório Técnico, julho 2023, Amadora, Portugal. Disponível: <http://hdl.handle.net/10400.9/4077>
(in portuguese)

Previous LNEG et al. work for mainland Portugal: RAAs

Sep '22

start mapping
"Go-To Areas"
**Informal
interinstitutional
Group**



**PATRIMÓNIO
CULTURAL**
Direção-Geral do Património Cultural



Jan '23

1st (single)
map

Feedback from
municipalities,
experts & NGOs

Jun '23

2nd version
(4 scenarios)
mineral resources,
groundwater,
buffer/houses
LNEG work

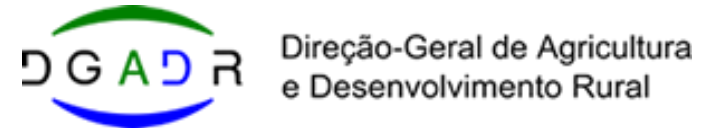
Nov '23

Start 3rd version
**Formal working
group GTAER
coordinated by
LNEG (all previous &)**

+ species distribution,
land use classes, irrigation,
minimum area threshold
& power grid

Mar '24

3rd version
(5 scenarios)



Inputs from:



Associação
de Energias
Renováveis



Associação
Nacional de
Energia e
Ambiente



Federação
Portuguesa de
Agricultura,
Pecuária e
Pescas



Entidade
Reguladora
para a Energia



Associação
Portuguesa de
Energia e
Ambiente



Liga para a
proteção da
natureza



Associação
Portuguesa de
Energia e
Ambiente



Associação
Portuguesa
para o Estudo das Áreas



Exclusion factors for the definition of potential future “RES acceleration areas”

A) Land use classes not considered

1. Erosion risk (slope >20%) 

2. Technically unviable terrain: 

Bare rock, beaches and dunes, tidal and marsh zones, Natural surface water bodies (saline, natural, water streams artificial/modified, natural lakes and lagoons, ponds, aquaculture, coastal lakes, estuaries, ocean)

B) Classified nature protection areas or environmentally sensitive:

1. Classified nature protection areas :

RNAP National Protected Areas Network, Natura 2000, UNESCO biosphere reserves, RAMSAR sites, SCI (SIC) Sites of Community Importance, SPZ (SPE) Special Protection Zones and **IBAS**

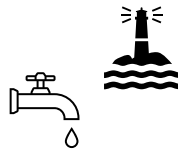
2. Nature conservation hotspots:

“Red book of birds”; areas important for: eagle owl; iberian lynx; black vulture; butterfly *Euphydryas desfontainii*; Bonelli's eagle; Sagres bird migration route; iberian wolf packs (+5km)

500m buffer on the edge of wetlands and natural water bodies

3. Coastal protection areas (+ 2 km buffer)

4. Relevant zones for mineral and natural water



5. Relevant zones for water protection within the Water Framework Directive and for Flood protection



6 Areas with mining relevance and **Mineral Resources Safeguard Areas**

7. Areas with forestry relevance

8. Areas with identified geological heritage

9. **Groundwater aquifers (disaggregated according to vulnerability)**

D) Cultural heritage

1. Classified /under classification heritage and respective administrative protection areas

2. Archeological heritage sites

C) Types of current land use potentially controversial

- i. Protected agriculture and nurseries
- ii. Vineyards
- iii. Orchards
- iv. Olive groves
- v. Cork trees agroforestry zones (SAF)
- vi. Holm oak (*azinheira*) trees agroforestry zones (SAF)
- vii. Stone pine (*pinheiro manso*) trees agroforestry zones (SAF)
- viii. Holm oak and cork trees agroforestry zones (SAF)
- ix. Cork forests
- x. Holm oak forest
- xi. Other oaks forests
- xii. Chestnut forests
- xiii. Other hardwood forests
- xiv. Stone pine forests
- xv. Rice fields
- xvi. Temporary cultures and /or improved pasture lands associated to vineyards, orchards or olive groves
- xvii. Other oak trees agroforestry zones (SAF)
- xviii. Other species agroforestry zones (SAF)
- xix. Other mixed agroforestry zones (SAF)
- xx. Other resinous forests
- xxi. Maritime pine (*pinus pinaster*)



Red color –
modifications from
1st versions

+RAN (agriculture reserve)*

+REN (ecological reserve)

+ 100 m buffer in houses

* Adjusted RAN as sent by Agriculture Ministry, removed low quality irrigated soils

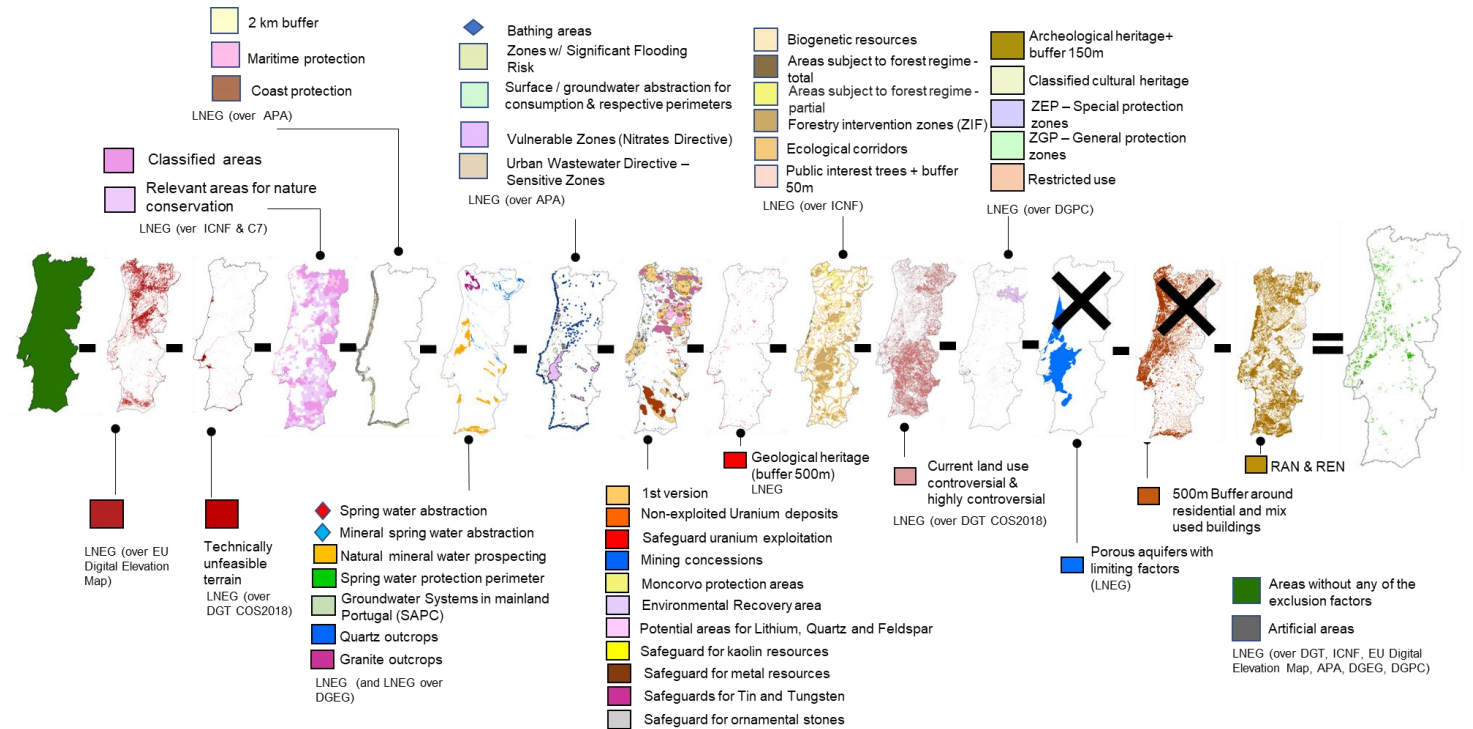


Result are 5 scenarios mapping potential future RAAs reflecting differentiated application of the exclusion factors:

~6.2% to ~2.2% of the area of mainland Portugal

No agreement on different criteria for solar PV and wind

The process created a tool that can be used to relatively quickly test impact of considering different exclusion factors, adding up more layers of information and zooming in in some region(s)



Complementary Maps

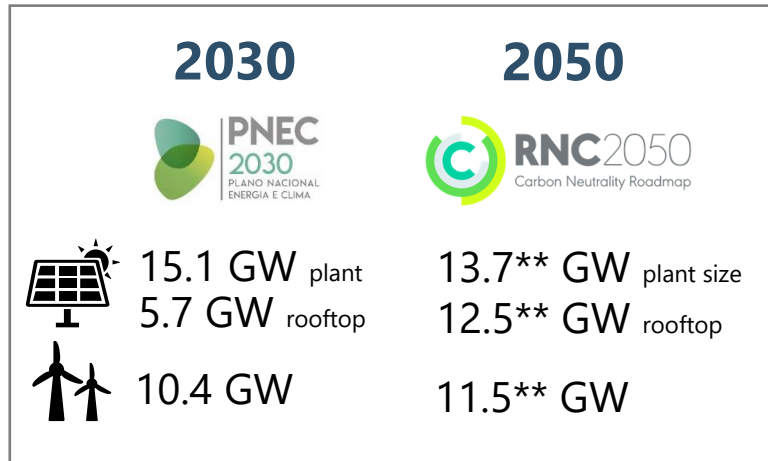
- Existing/planned **renewable power production units** and **% occupation of the total area of the municipality for renewable electricity generation**
- Current and planned national electricity transmission grid**
- Solar and wind resources**
- Gas and oil pipelines** and respective easements
- Primary network of forestry fuel management corridors (for rural fires minimization)
- Current **industry power consumption** (future consumption map is ongoing)



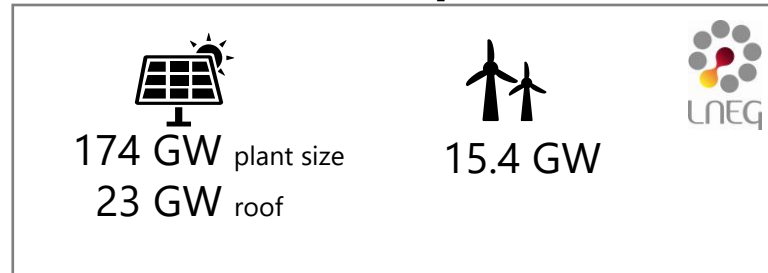
LNEG Technical Report – [How electricity consumption in industry is mapped in Portugal and how solar PV could supply it](#)

Potential for solar PV and onshore wind in less sensitive areas

National targets



National technical potentials*



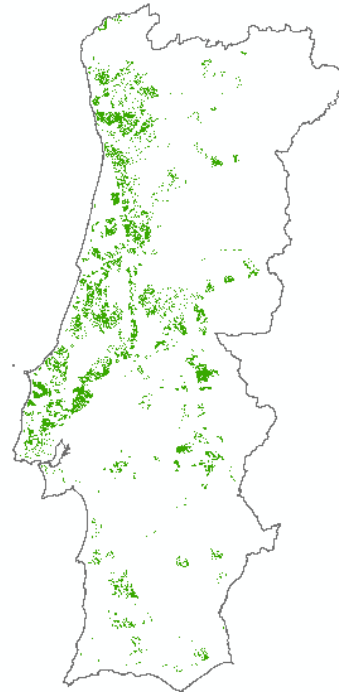
*It does not consider limitations on access to the power grid and permitting, which are currently the main limiting factor. The solar PV potential must be defined based on market responsiveness and permitting and not based on the potential of the solar resource and/or available areas.

** under revision

Scenario A

< sensitivity areas
5 557 km²

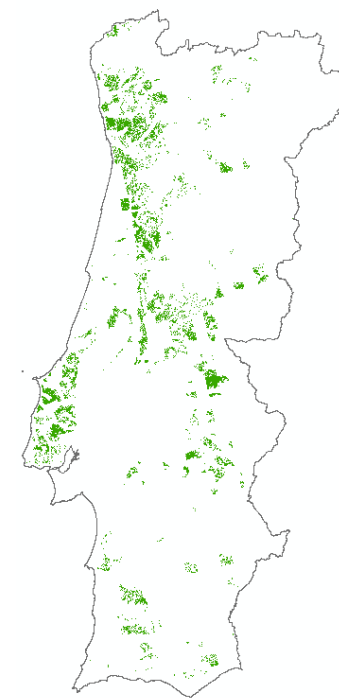
~6.2% area mainland Portugal



Scenario B

< sensitivity areas
4 207 km²

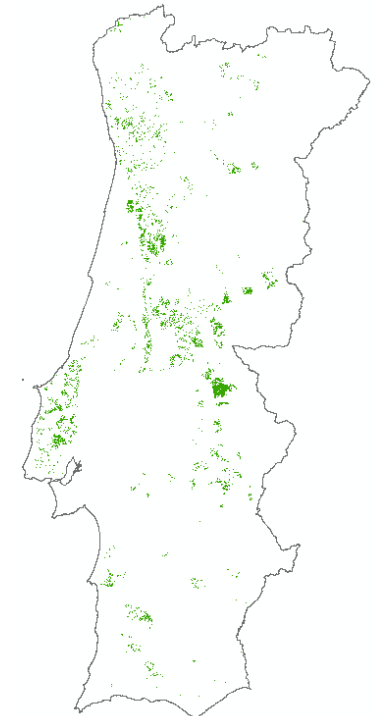
~4.7% area mainland Portugal




Scenario E

< sensitivity areas
1 996 km²

~2.2% area mainland Portugal



 Lower sensitivity areas

PV assuming between 100% and 5% less sensitive areas.

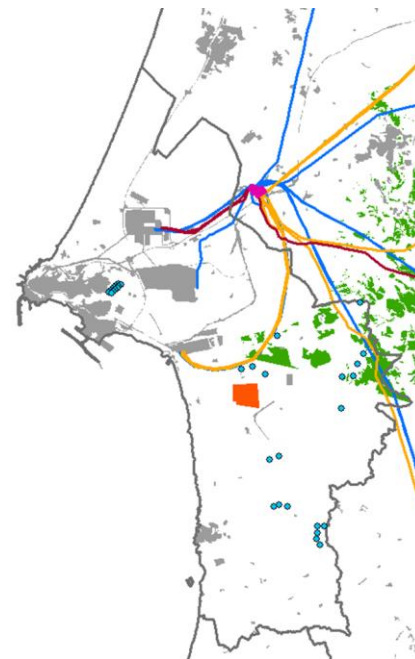
Wind power considering only viable resource and taking into account soil density occupation factor per municipality.

Potential RAAs Map is available at LNEG

It can be consulted ([here](#))



Zooming in Sines municipality



- Existing Solar plants
- Existing Wind plants
- Potential RAAs
- Built Areas
- REN substations (power grid)
- Circuits 400kV
- Future grid
- Circuits 150 kV

LNEG (over DGT, DGE, ICNF, APA, REN, EU Digital Elevation Map)



Technical report (in Portuguese) ([here](#))

Some key take aways

- › **Concerns with accuracy and up-to-datedness of maps, but especially of land use and species distribution.** A special note to resolution of data, which in land use and land cover is sometimes 1ha – large uncertainty in the mapping exercise! We are working with EU EU Agency for the Space Programme exploring usability of COPERNICUS data
- › **Subjectivity** in defining which are the “best areas” - need to **build consensus and have a flexible mapping making system in place** to allow for learning. A map can show very effectively that what seemed to be a major concern is in fact not as relevant as initially perceived
- › **Power grid access is a major bottleneck** – if immediate/soon access to the grid was a constraint, no areas would be available. It is important to map substations but that does not mean that they are available for connection
- › **Land speculation** concerns are being voiced by the industry



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

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



<http://www.lneg.pt>



LNEG Estrada da Portela
Bairro do Zambujal
Apartado 7586, Alfragide
2610-999 Amadora
Portugal



+351 210 924 600 / 1



Sofia G. Simoes sofia.simoese@lneg.pt

