

Decarbonising Portugal: Impact of climate change on renewable energy resources

Objective :

The aim of this work is to assess the impact of climate change on renewable energy resource variability in Portugal, using high-resolution weather prediction modelling centred on 2050. This will be done considering wind, solar photovoltaic and hydroelectric energy potential in Portugal to achieve the optimal balance between decarbonisation of the energy supply and costs.

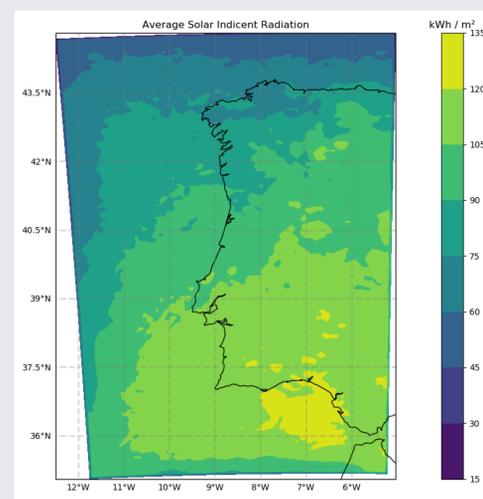
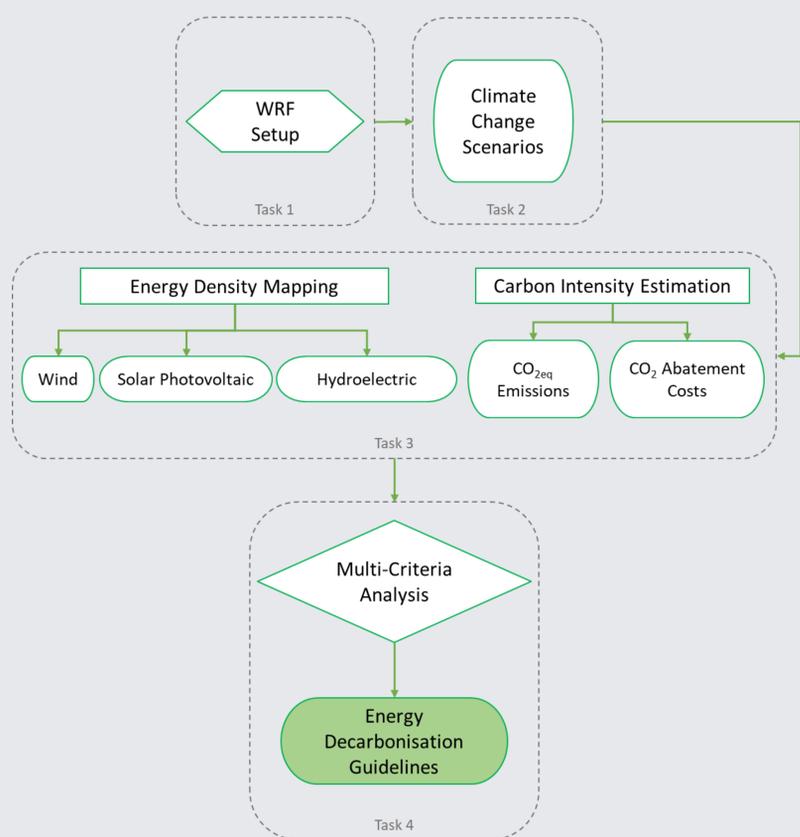
The main objective addresses the following research questions:

- Which are the most adequate WRF initial conditions and parameterization options to evaluate future renewable energy resource availability?
- How do future climate change scenarios impact renewable resource availability?
- What is the optimal energy mix for Portugal to comply with established 2050 GHG and renewable energy targets, in a climate change scenario?

Methods and preliminary results:

TASK OVERVIEW

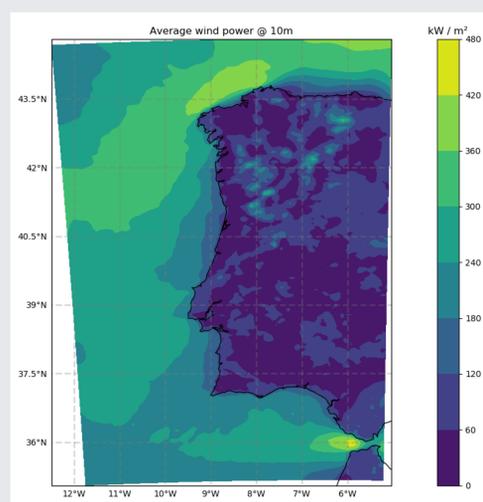
- Task 1 – WRF setup and scenario definition
- Task 2 – Base year and climate change scenarios simulation
- Task 3 – Renewable energy potential and CO₂ep calculations
- Task 4 – Multi-criteria analysis and compliance with 2050 targets



METHODOLOGY AND RESULTS EXAMPLE

The simulation results will be mapped out at a horizontal grid resolution of 1km x 1km. The top example is the solar incident radiation for a 6km x 6km grid cell (top image), averaged throughout 24h for a given day.

Using this method, the average solar photovoltaic and wind power will be calculated and mapped (wind power example below at a height of 10m, also averaged throughout 24h).



Mapping out the areas of interest will both aid us in identifying possible regions of interest, as well as provide a clear form of exposition of the results to decisions makers and the scientific community.

Calculations for the present scenario (2014) will then be compared to future scenarios (2055 with SSP2-4.5 and SSP5-8.5) to quantify the variation in available renewable power for wind, solar and hydroelectric facilities.

Expected outcomes:

After the study is completed, it will be possible to recommend the best decarbonisation scenario for Portugal, considering future political strategy and climate change conditions. This scenario will take into account the variation in existing wind, solar and hydro power installations, as well as advise on future installation sites to achieve 2050 energy goals.

In aid of the decision making process, one of the main outputs of this work will be an atlas of both onshore and offshore wind and solar renewable power potential. Since multiple future SSP scenarios will be considered, this work will also be able to provide a range of variation in future climates, which could potentially decrease uncertainty in the planning stage.

Acknowledgements:

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