

EVOLVE

Place, Time and Value study
for Blue Energy across Europe

System benefits of ocean energy

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Supported by:



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EVOLVE project overview



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ORBITAL
MARINE POWER

UK (Scotland)



RI
SE



Sweden



OCEAN ENERGY
ERA-NET COFUND



Portugal



**Project
partners**

**Funding
agencies**

EVOLVE

www.evolveenergy.eu

EVOLVE project overview

Key question: Can blue energy make an effective contribution to European energy systems and markets, with particular reference to where, what, when, how and at what price?

Spatial modelling:

- 250m RADMAPP model of north-west Europe
 - Resource, demand, grid
 - Technical feasibility, cost of delivery, access to markets

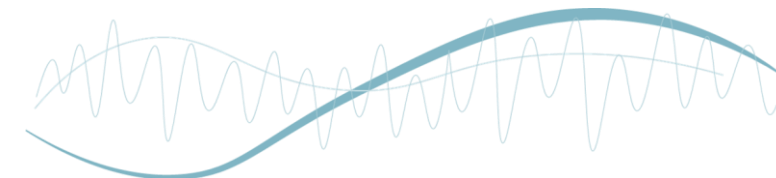


Power systems modelling:

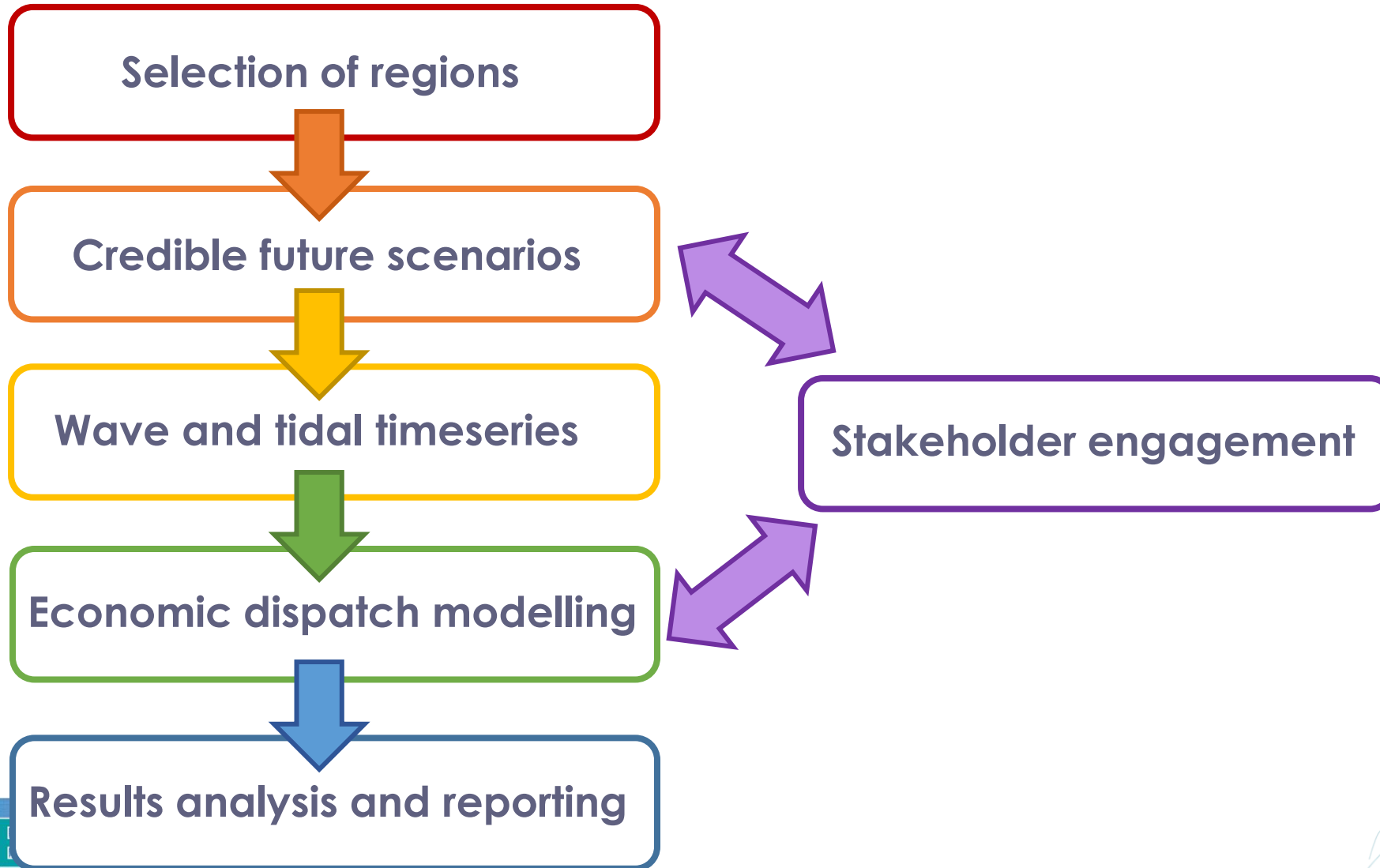
- Country-scale studies (GB, IE, PT)
 - Hourly economic dispatch of net zero deployment 2030 to 2050
 - Marginal electricity prices, costs, carbon emissions
- Microgrid studies (GB)
 - 100% renewable systems
 - Supply-demand matching, storage requirements, system cost



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EVOLVE country-scale modelling methodology



EVOLVE regions of interest

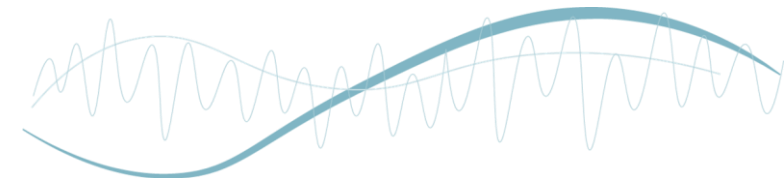
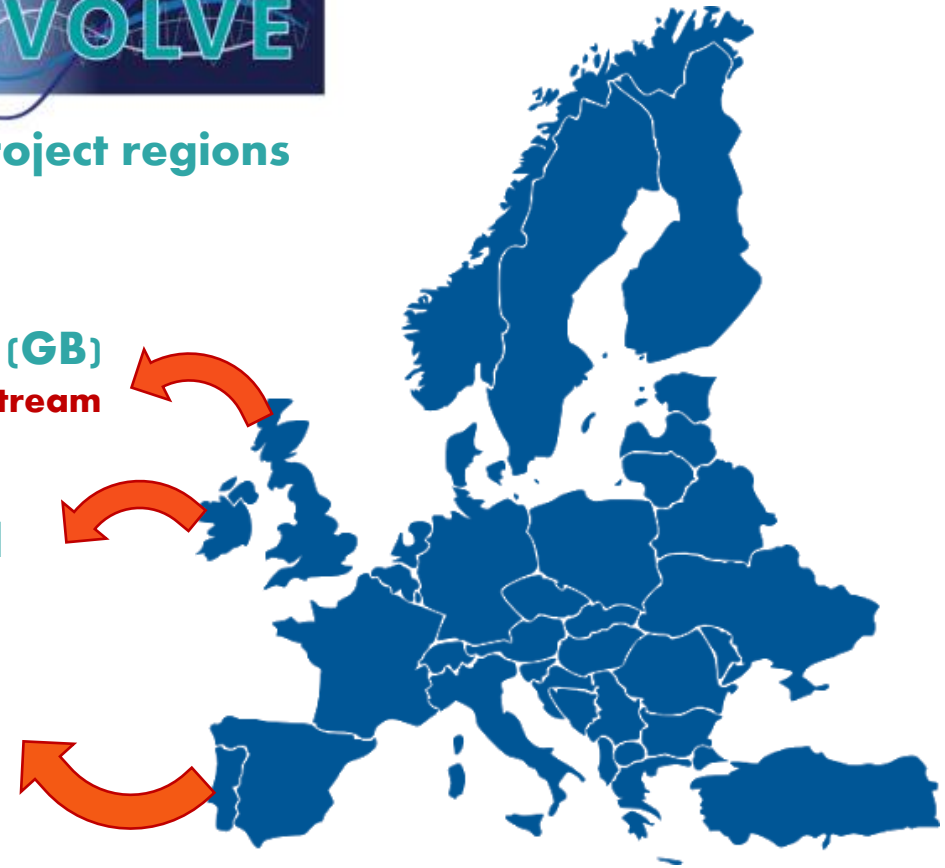
Selection of regions



Great Britain (GB)
Wave & tidal stream

Ireland
Wave

Portugal
Wave



EVOLVE future scenarios

Selection of regions

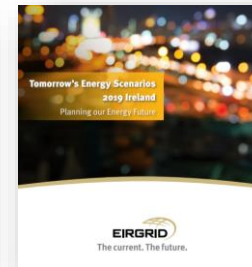


Credible future scenarios

Great Britain



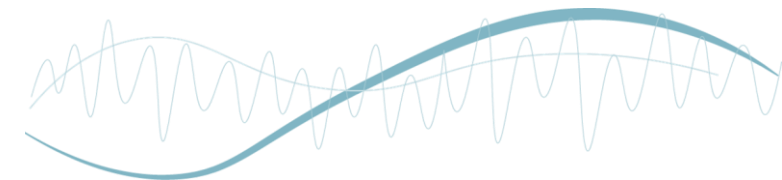
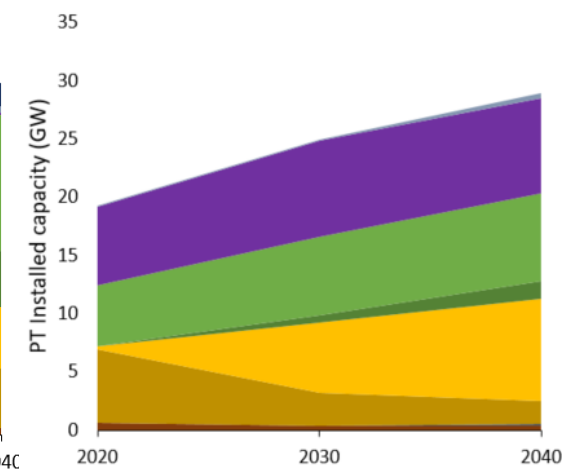
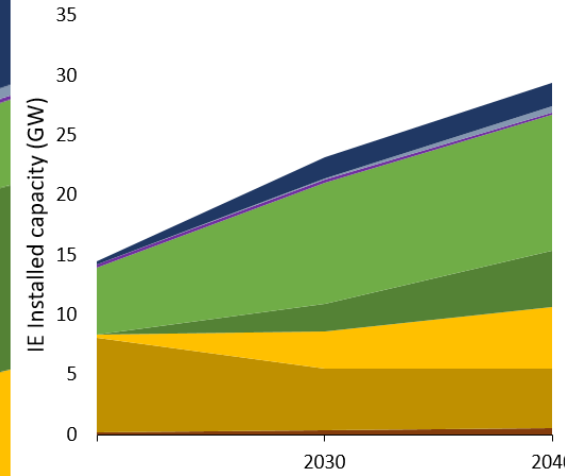
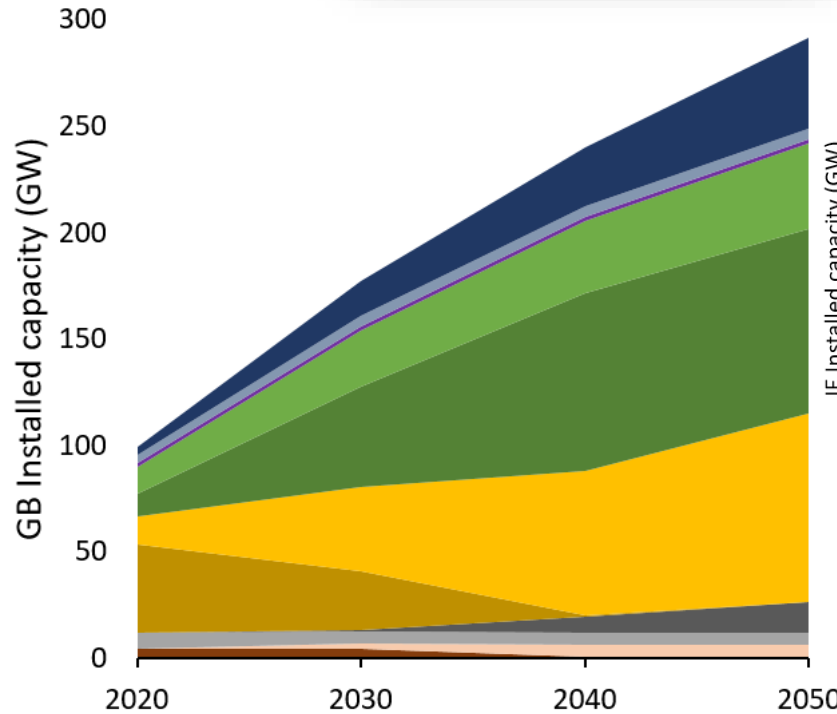
Ireland



Portugal



- Storage
- Other renewables
- Hydroelectric
- Onshore wind
- Offshore wind
- Solar PV
- Fossil Fuel
- Hydrogen
- Nuclear
- BECCS
- Biomass



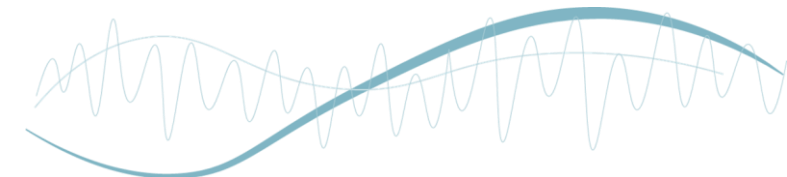
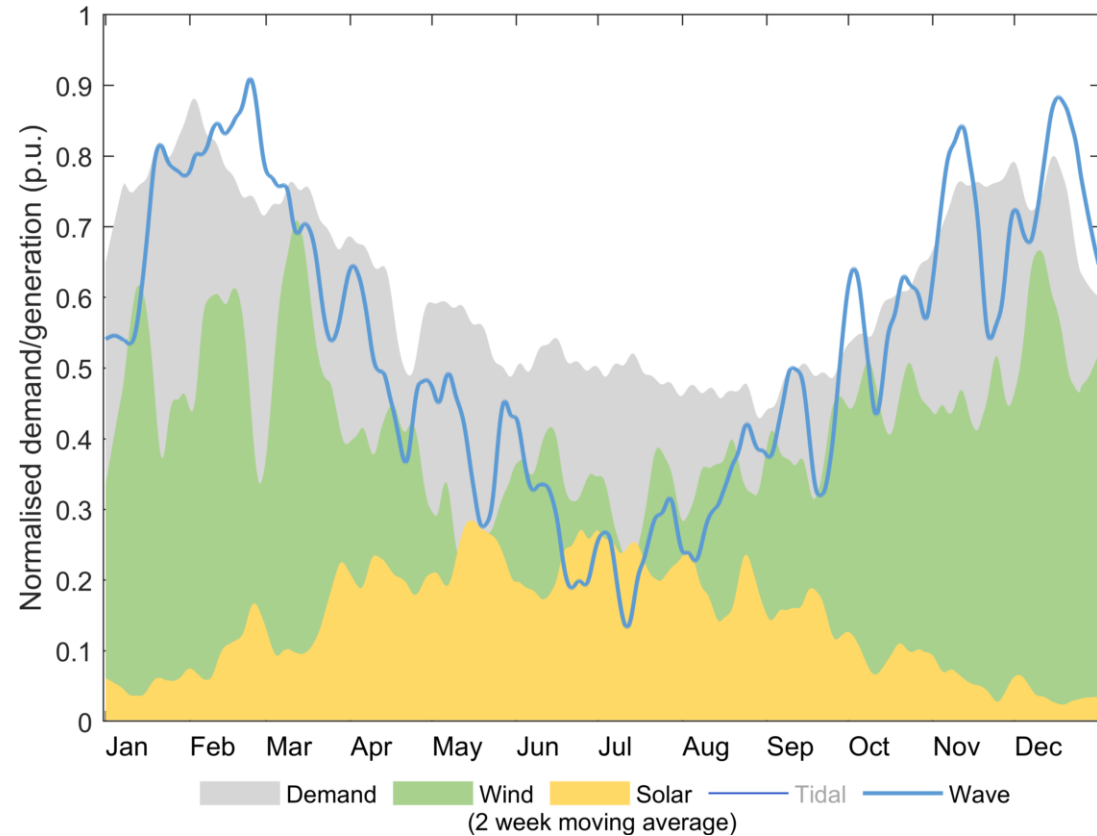
EVOLVE availability profiles

Selection of regions

Credible future scenarios

Wave and tidal timeseries

Wave and tidal timeseries (2 week moving average)



EVOLVE country-scale modelling methodology

Selection of regions



Credible future scenarios



Wave and tidal timeseries

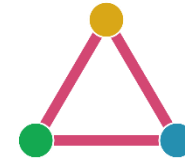


Economic dispatch modelling



Results analysis and reporting

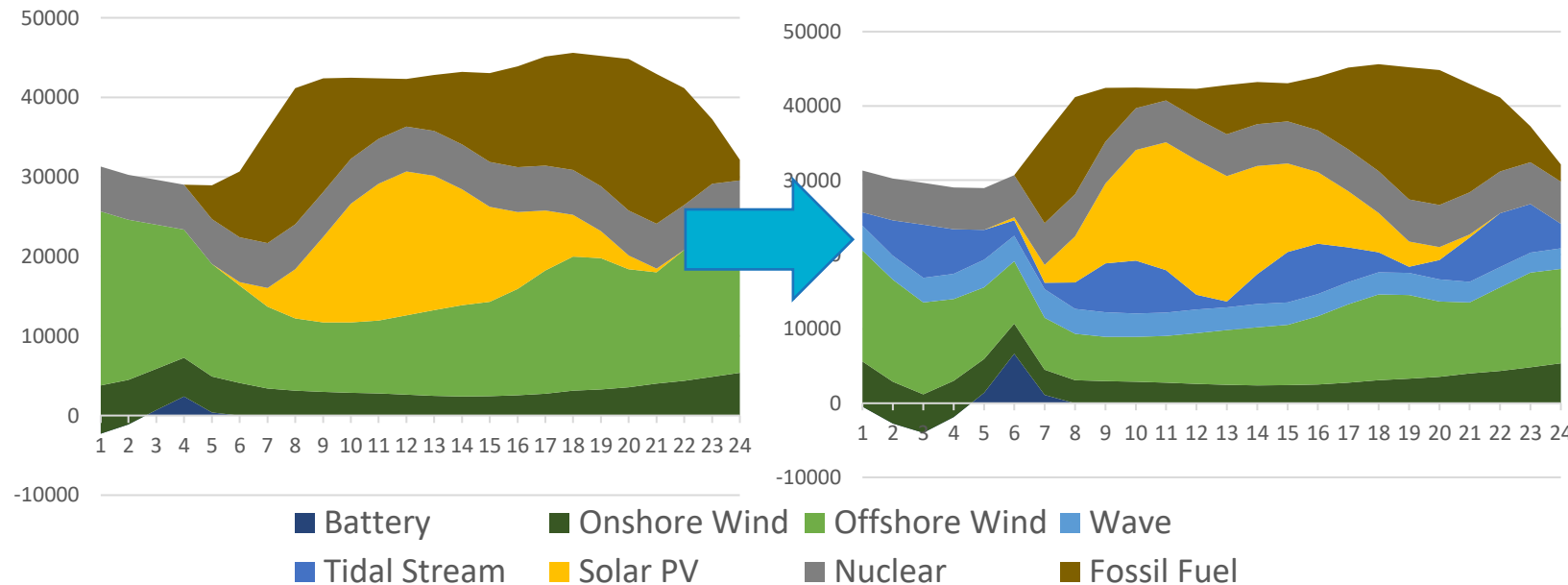
Python for Power Systems Analysis



PyPSA

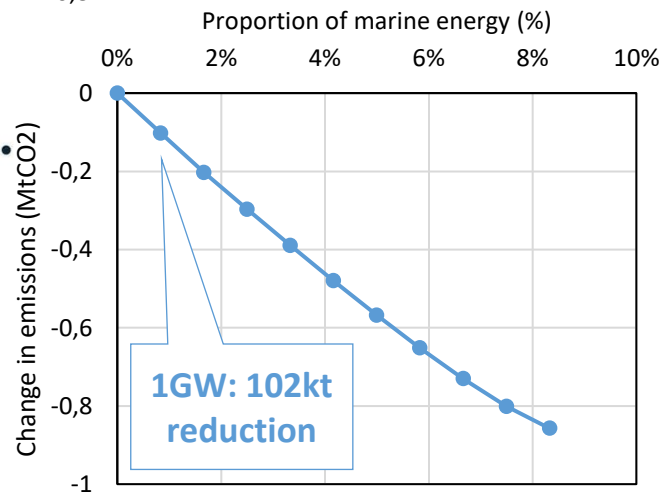
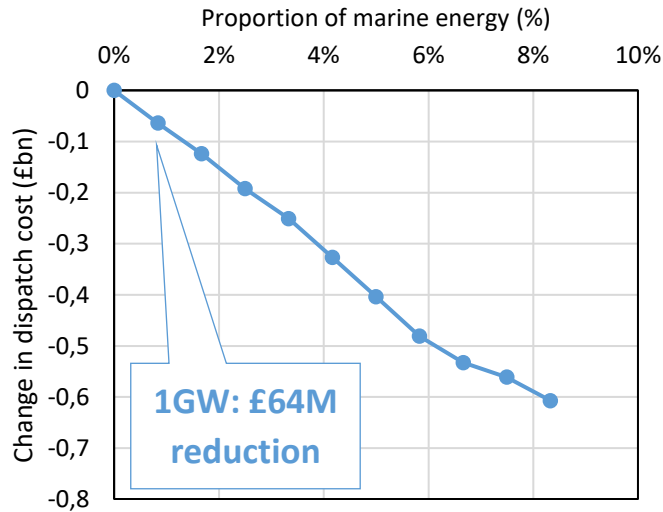
Computes hourly optimal dispatch: supply-demand matching

■ Represents wholesale market operation

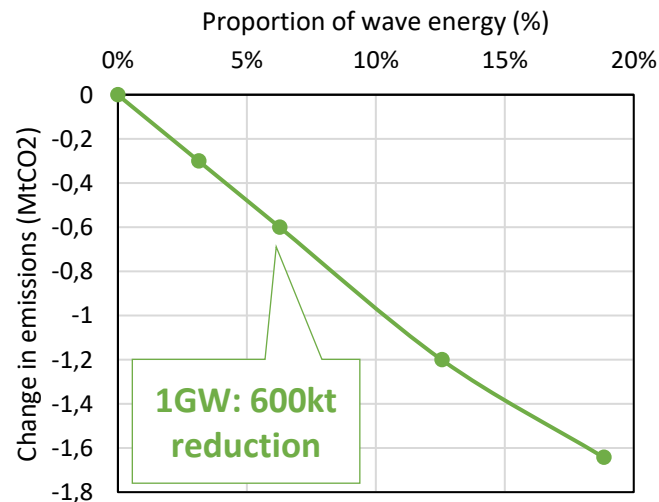
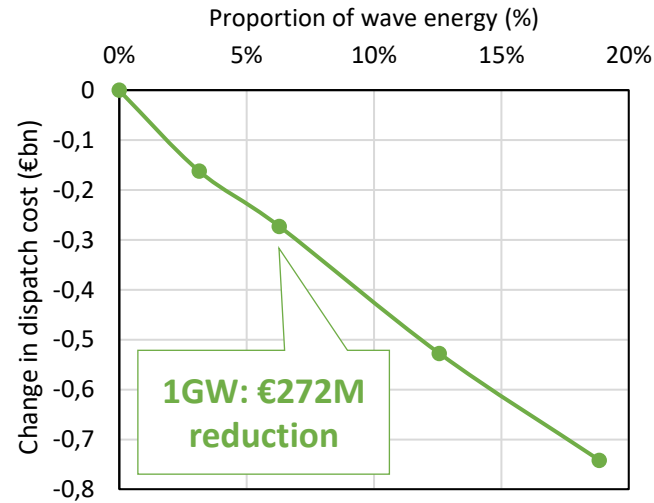


EVOLVE 2030 results – cost and carbon reduction

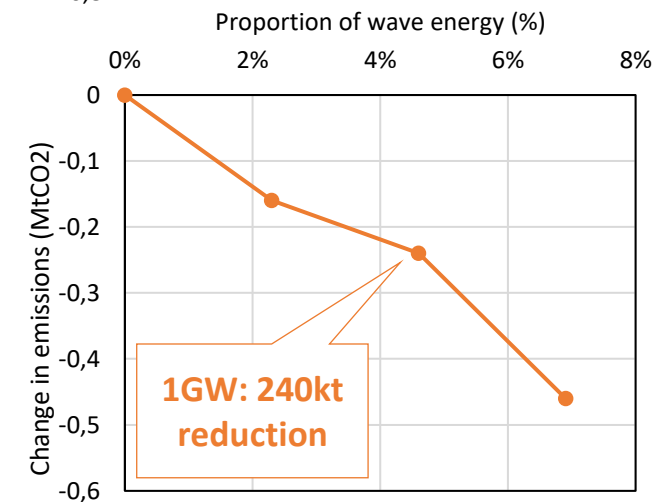
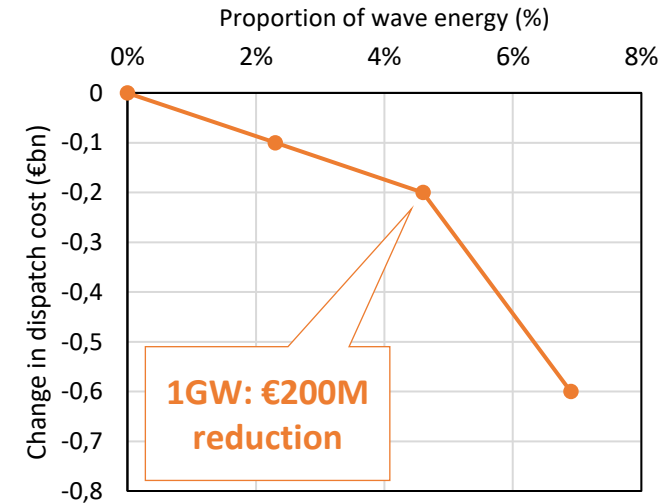
Great Britain



Ireland



Portugal



Dispatch costs reduce

Carbon emissions reduce

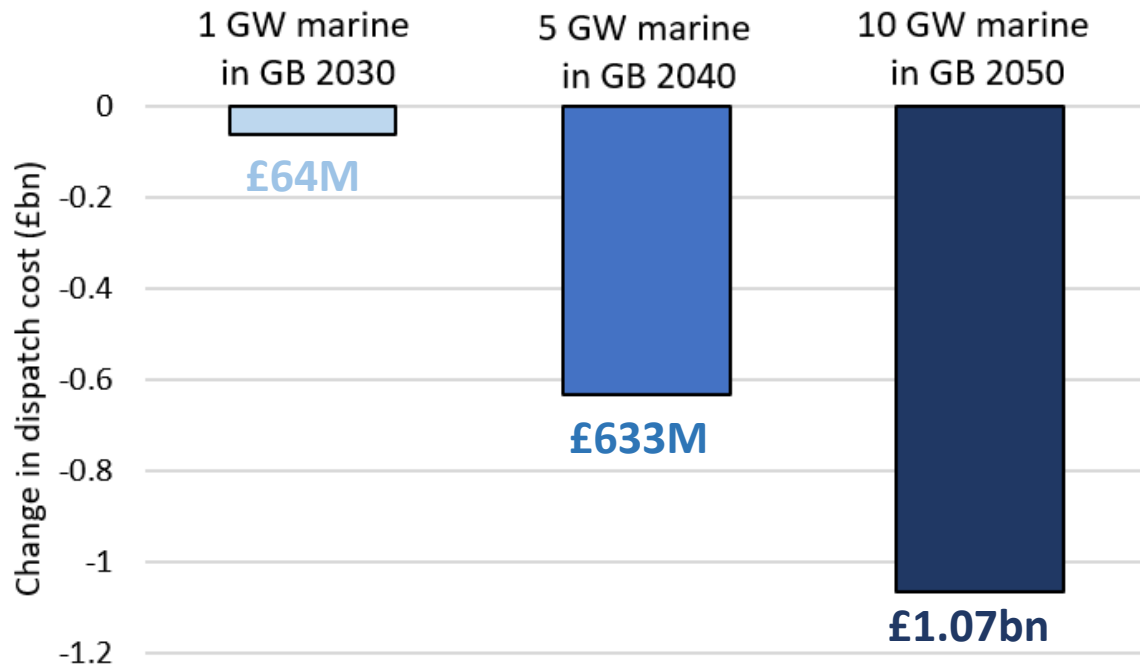
Marine energy installed capacity increases



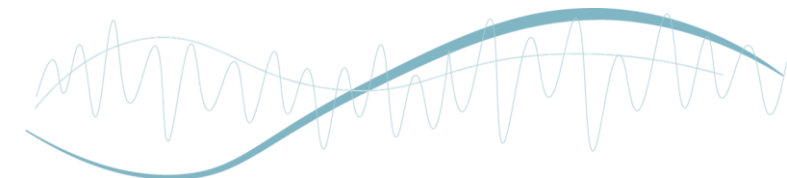
EVOLVE GB results 2030-2050



Highest cost reduction in high renewable future scenarios (2040 and 2050)



- **£64M** cost reduction from 1 GW in 2030
- **£633M** cost reduction from 5GW in 2040
- **£1.07bn** cost reduction from 10GW in 2050



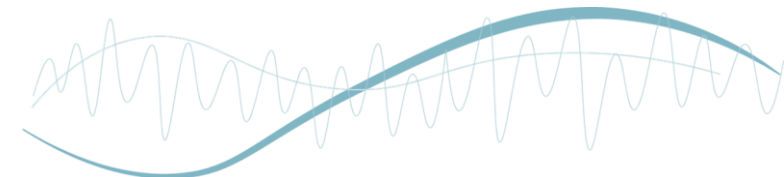
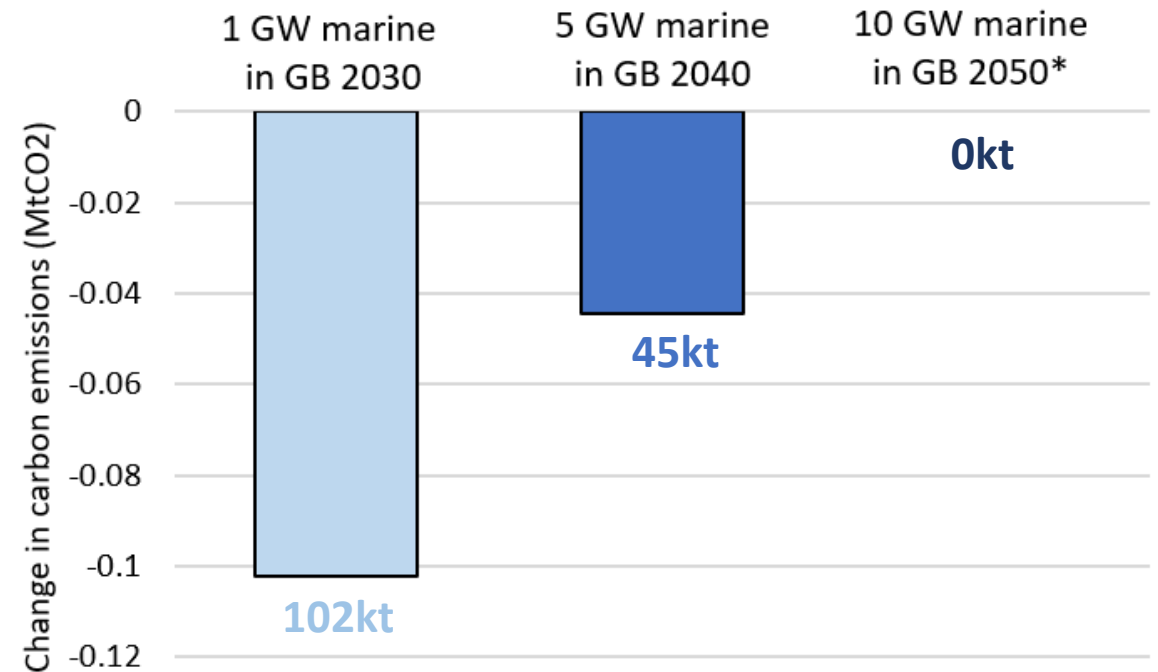
EVOLVE GB results 2030-2050



Highest carbon reduction in lower renewable near-term scenarios (2030)

- **102kt** emissions reduction from 1 GW in 2030
- **45kt** emissions reduction from 5GW in 2030
- **0kt** emissions reduction from 10GW in 2050

***No carbon reduction occurs in 2050 scenario results as net zero target is met – scenario is carbon free in all cases**

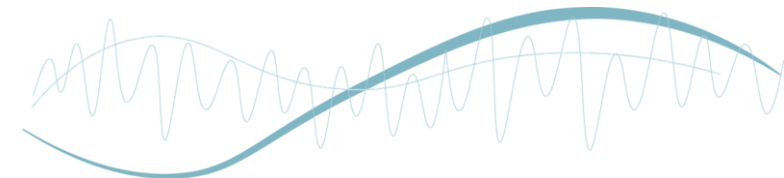
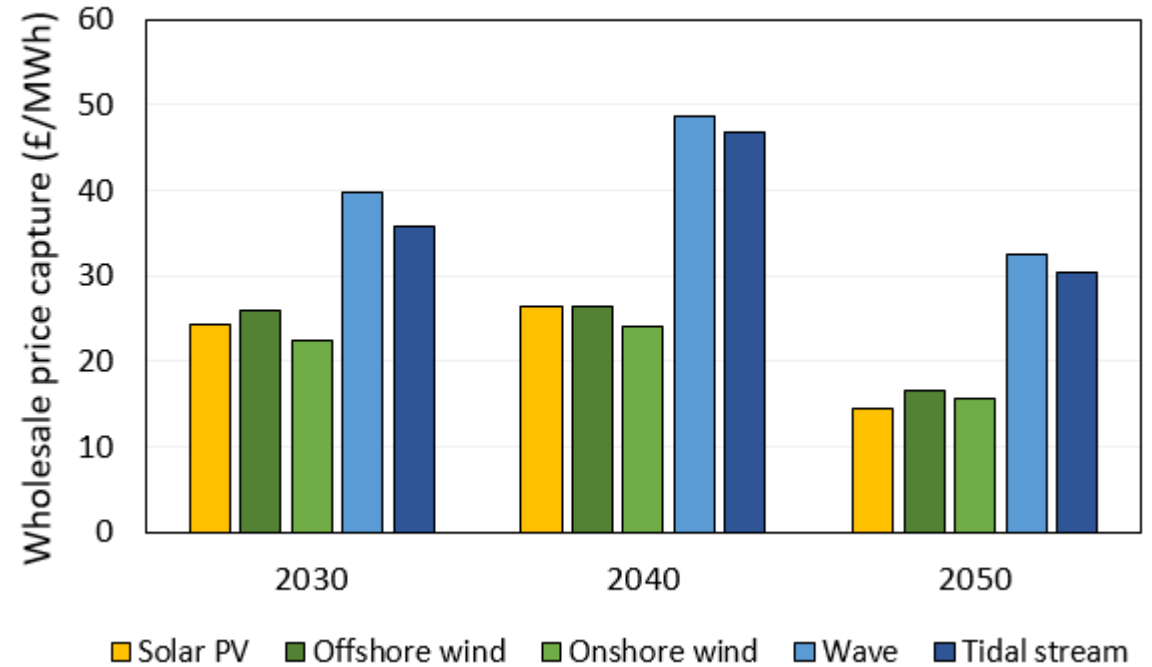


EVOLVE price capture results

Wave and tidal energy **capture higher wholesale prices** than other variable renewables:

- Up to **1.8x higher** in 2030 GB scenario
- Up to **2x higher** in 2040 GB scenario
- Up to **2.1x higher** in 2050 GB scenario

Price capture by technology - GB future scenarios



The EVOLVE project – system benefits of ocean energy

Key results:

Including ocean energy produces system benefits over multiple regions and scenarios:

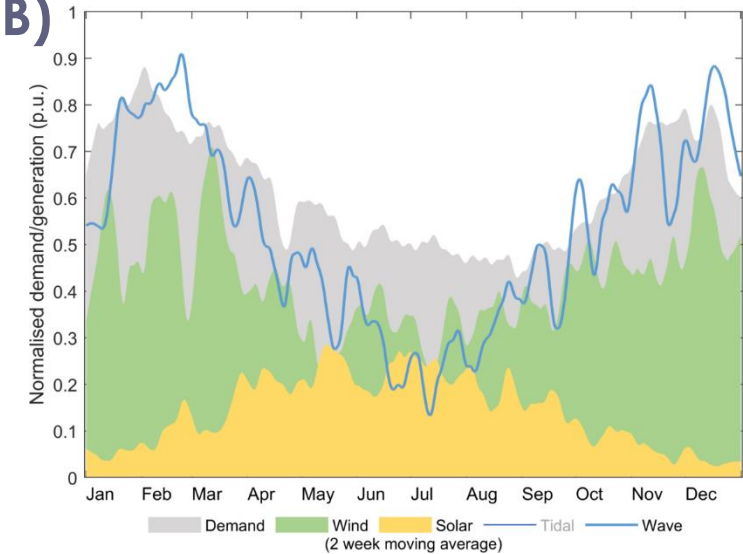
£ Consistently lower dispatch costs - **up to £1.07bn reduction (GB)**

- Especially in long term (2040, 2050) scenarios

CO₂ Consistently lower carbon - **up to 860kt CO₂ reduction (GB)**

- Especially in short term (2030) scenarios

€ Consistently higher price capture – **up to 2.1x higher (GB)**



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<https://evolveenergy.eu/>

