

Environment and Economics

Macro- and microeconomic analysis of marine energy

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Key areas of research

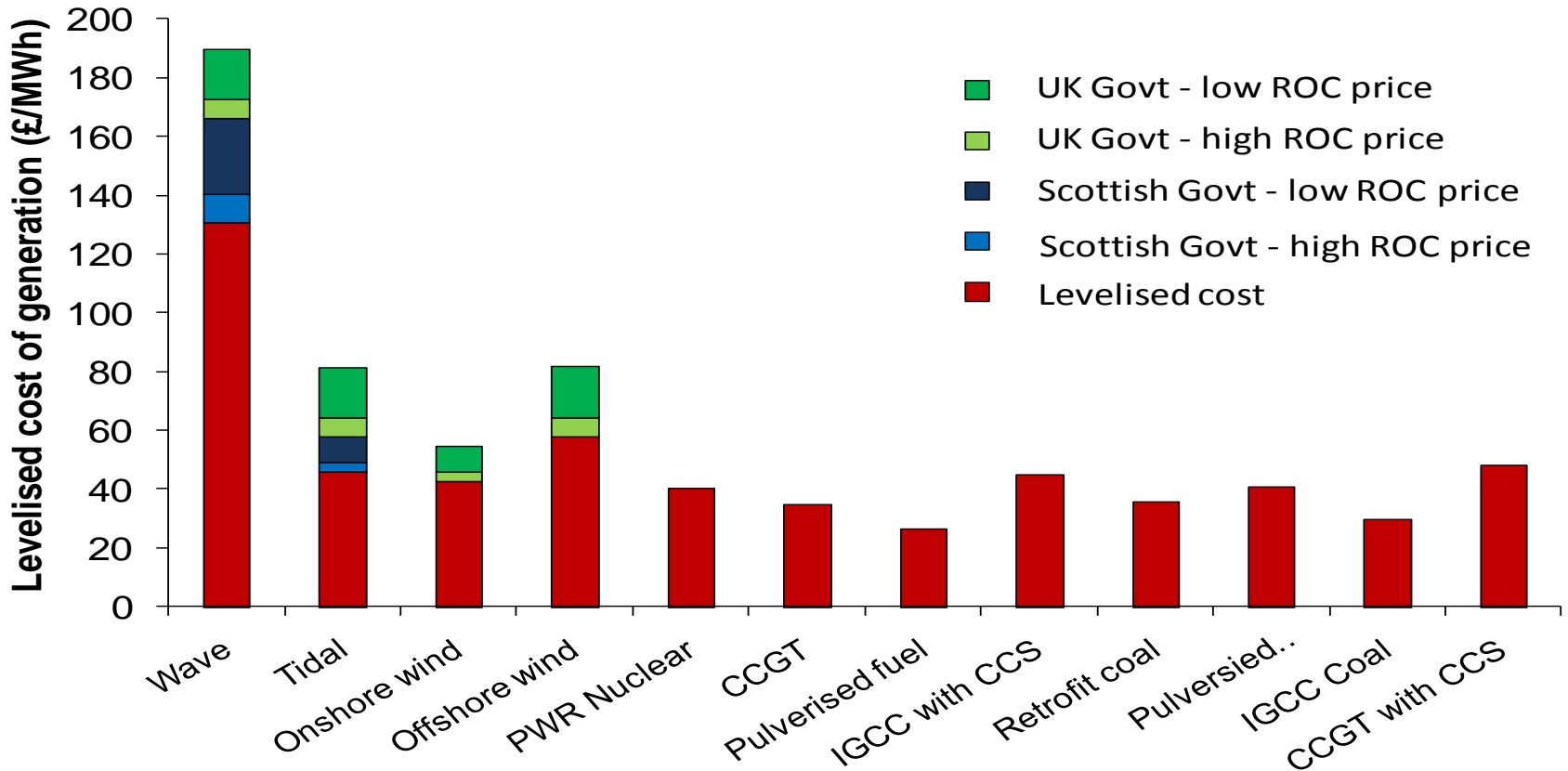


- Costs and benefits of wave and tidal energy provision
 - Private developer costs
 - Wider social costs and benefits
- Portfolio theory applications for wave and tidal energy in the UK
 - Potential role of marine technologies in reducing the “risk” of a future UK electricity generation portfolio
- The relationship between developments in the marine energy industry and wider economic activity
 - Quantifying the GDP & employment benefits of marine installations

Levelised costs of marine energy



- Cost of energy provision incorporating lifetime costs, £/MWh
- We have shown how marine energies compare to other technologies



- Helps us assess the appropriateness of policy measures (ROCs) in supporting marine energy cost competitiveness

Cost benefit analysis of marine energy



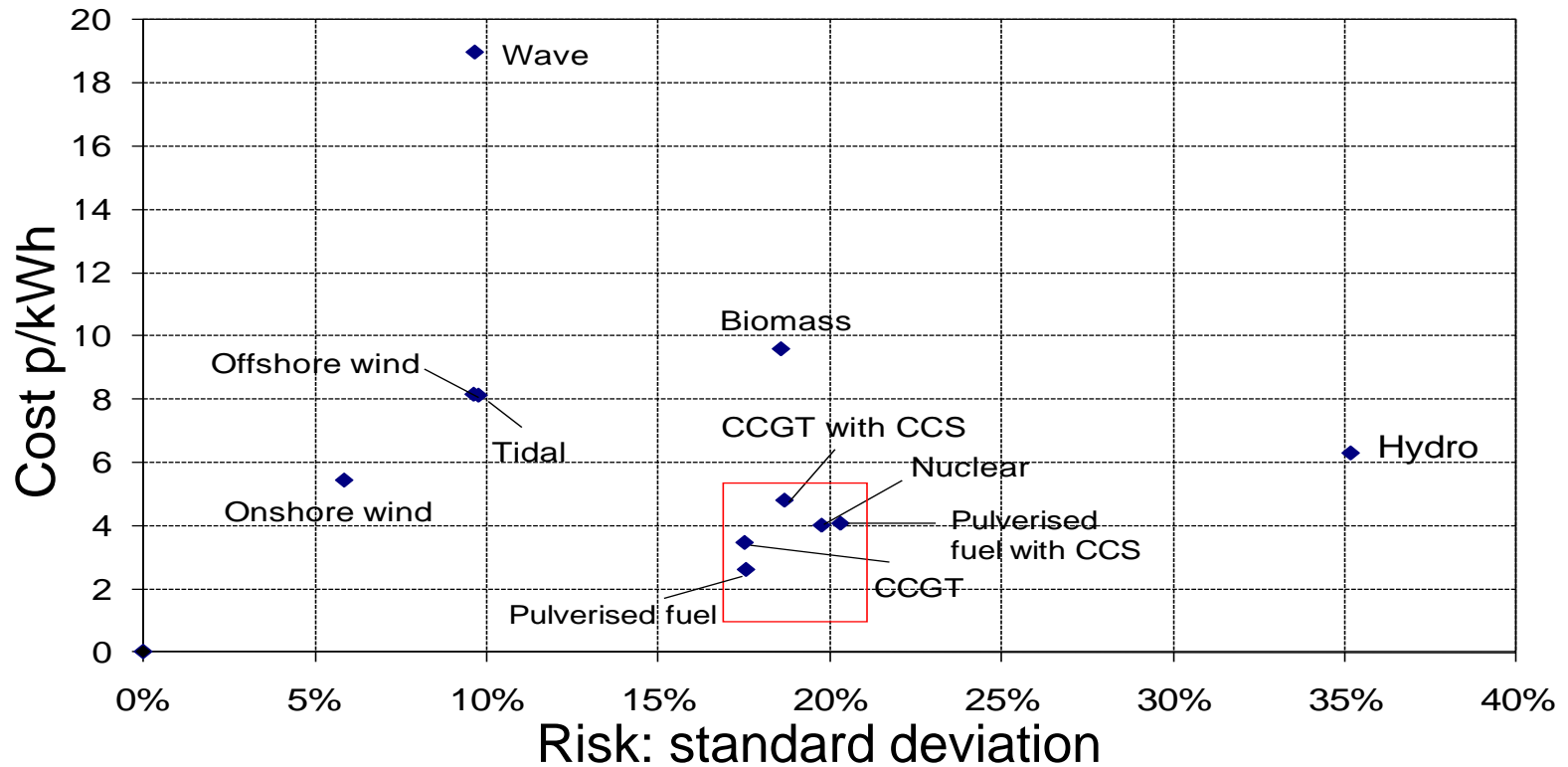
- Levelised costs tell us about private developers' costs
- But social optimality drives public policy
- We identify and quantify financial and non-financial costs and benefits associated with marine relative to a coal/gas/wind farm

	£ MILLIONS	TIDAL DISPLACES GAS	TIDAL DISPLACES COAL	TIDAL DISPLACES WIND
COSTS	CONSTRUCTION	67.61	53.04	35.38
	O&M	13.38	10.96	-9.95
	EXTRA BALANCING COSTS TO GRID	30.15	30.15	-47.10
	CO2 RELEASED DURING MANUFACTURE	0.85	1.93	-
	VISUAL DISAMENITY	-	-	-74.08
	NON-USE DISAMENITY	-101.86	-101.86	-61.12
	TOTAL COSTS	10.13	-5.78	-156.87
BENEFITS	AVOIDED FUEL COSTS	45.47	15.17	-
	AVOIDED GDP LOSSES	6.06	6.06	-
	AVOIDED CO2 DURING OPERATION	19.40	43.91	-
	TOTAL BENEFITS	70.93	65.14	-
NET PROJECT BENEFIT		60.80	70.92	156.87

Portfolio benefits of marine energy

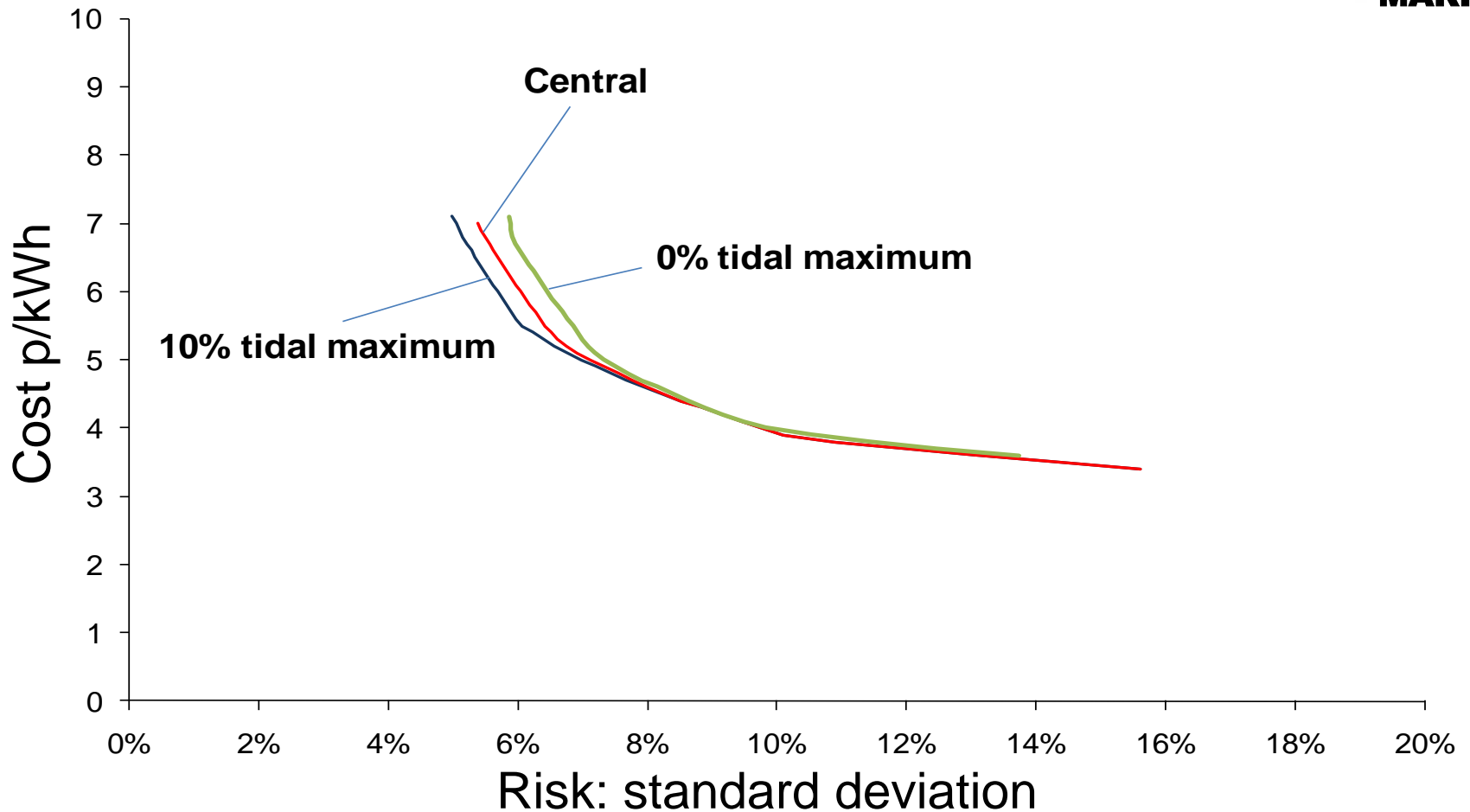


- UK electricity portfolio made up of a range of technologies
 - What contribution can marine energy make to the portfolio?
 - Different technologies have different cost/risk characteristics
 - Marine energy costs uncorrelated with fuel prices – low “cost variability”



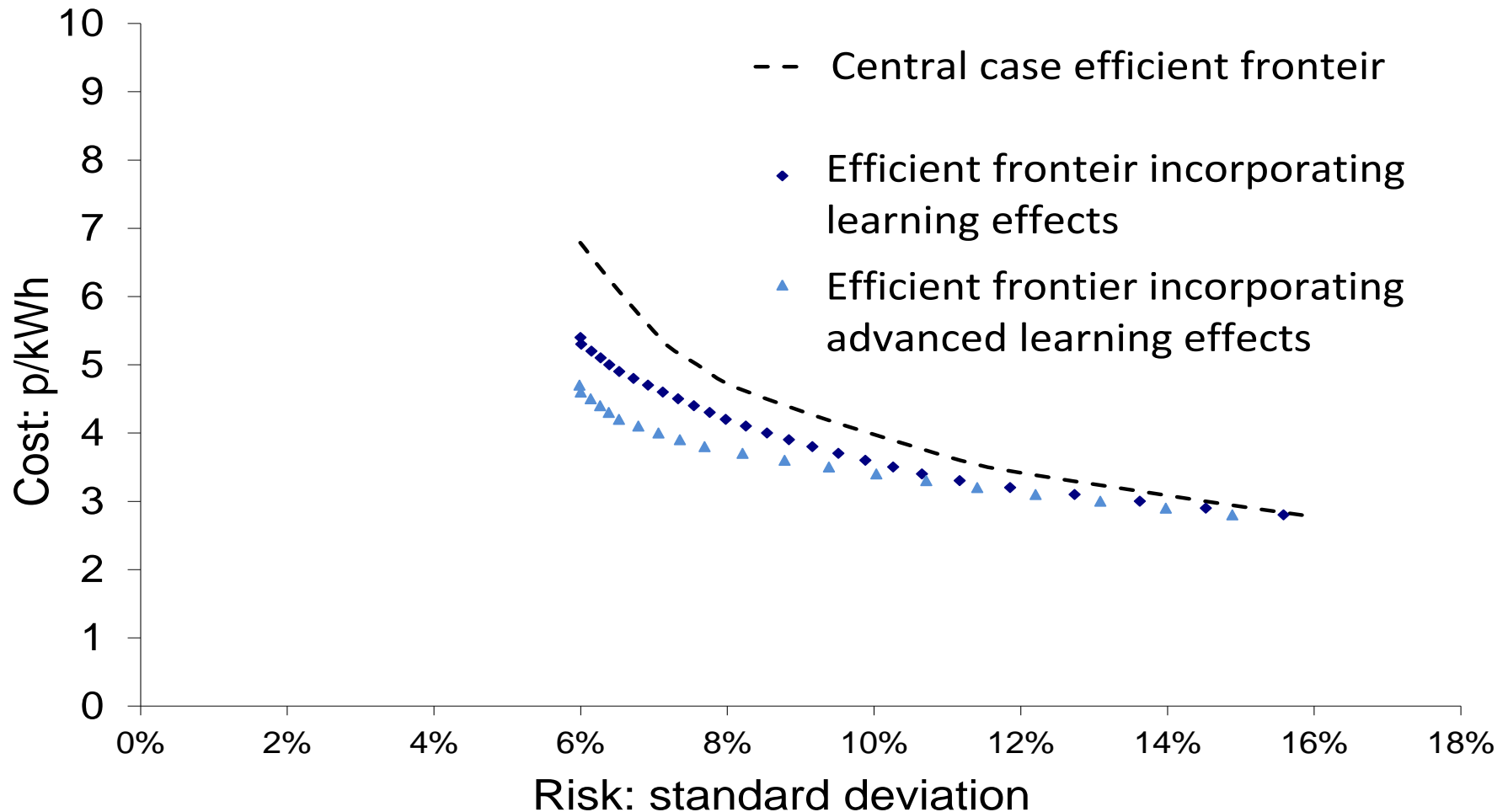
- Reduce potentially damaging economic effects of energy price variability

Portfolio benefits of marine energy



- Increasing the share of tidal energy in a UK electricity portfolio can lower the risk (cost variability) of the overall portfolio without increasing cost

Portfolio benefits of marine energy

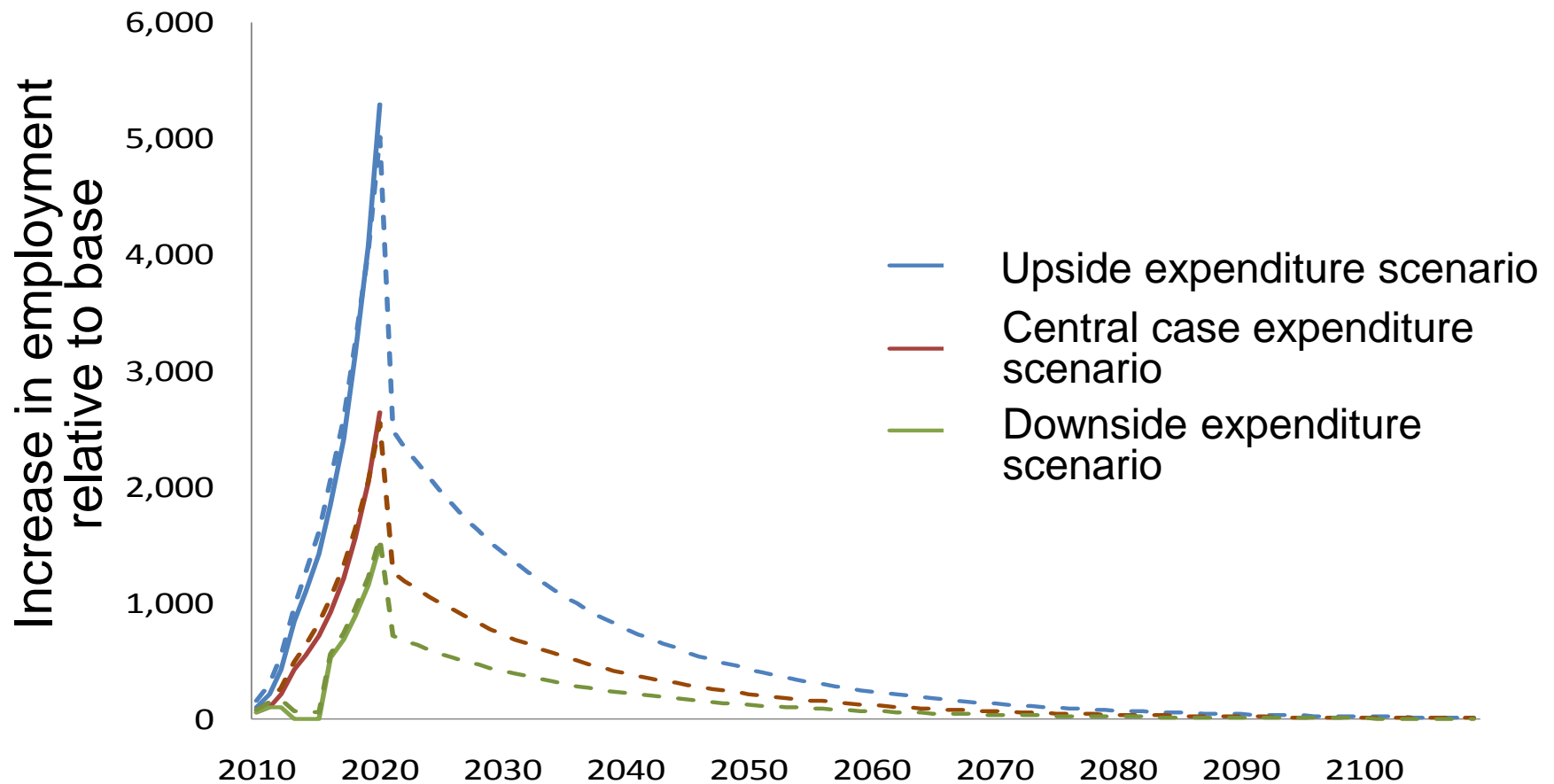


- We have demonstrated the additional “portfolio benefits” associated with learning effects for wave and tidal energies

Testing the link between marine energy installations and economic activity



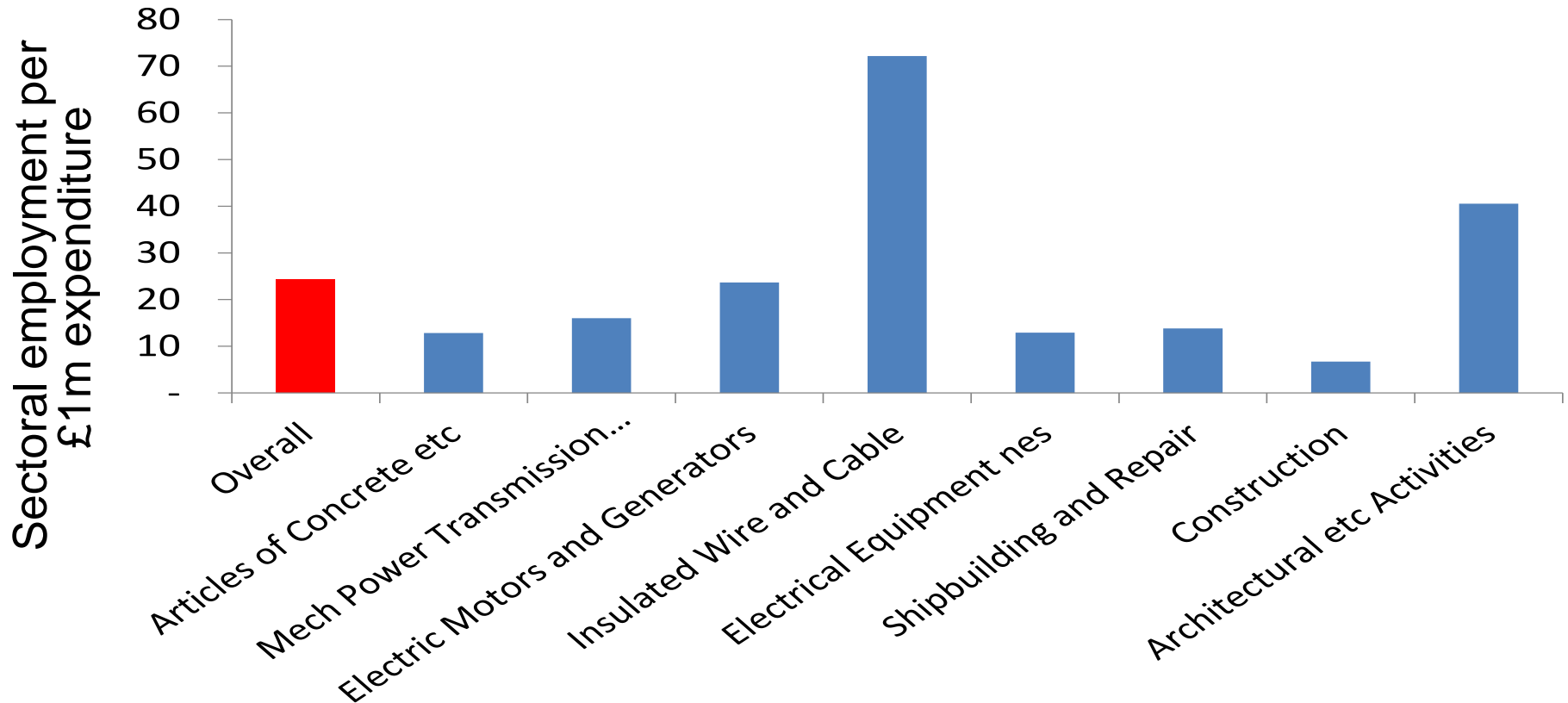
- We demonstrate the potential for ‘legacy’ effects of expenditures



Economic impacts across sectors



- We identify which sectors create most employment per £1m spend



- Sectoral analysis informs us about potential areas of skill shortage
- Adds value to policy makers' knowledge base

Looking forward



- Further development of macroeconomic impact analysis
 - Developed an intertemporal CGE model
 - Disaggregated electricity sector, including marine electricity
 - Show how Scottish Government will meet target of 100% electricity consumption from renewables by 2020
 - Learning effects; capital subsidies required to meet target
- Range of policy options for marine renewables, both at regional and national levels.
- Interaction between a possible carbon tax and existing fiscal energy measures, such as ROCs