Marine Science Symposium
Liverpool
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Tidal Power from the estuaries of NW England

joule CENTRE

Joule Project JIRP106/03

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Northwest REGIONAL DEVELOPMENT AGENCY

Oct 2006 – Dec 2008

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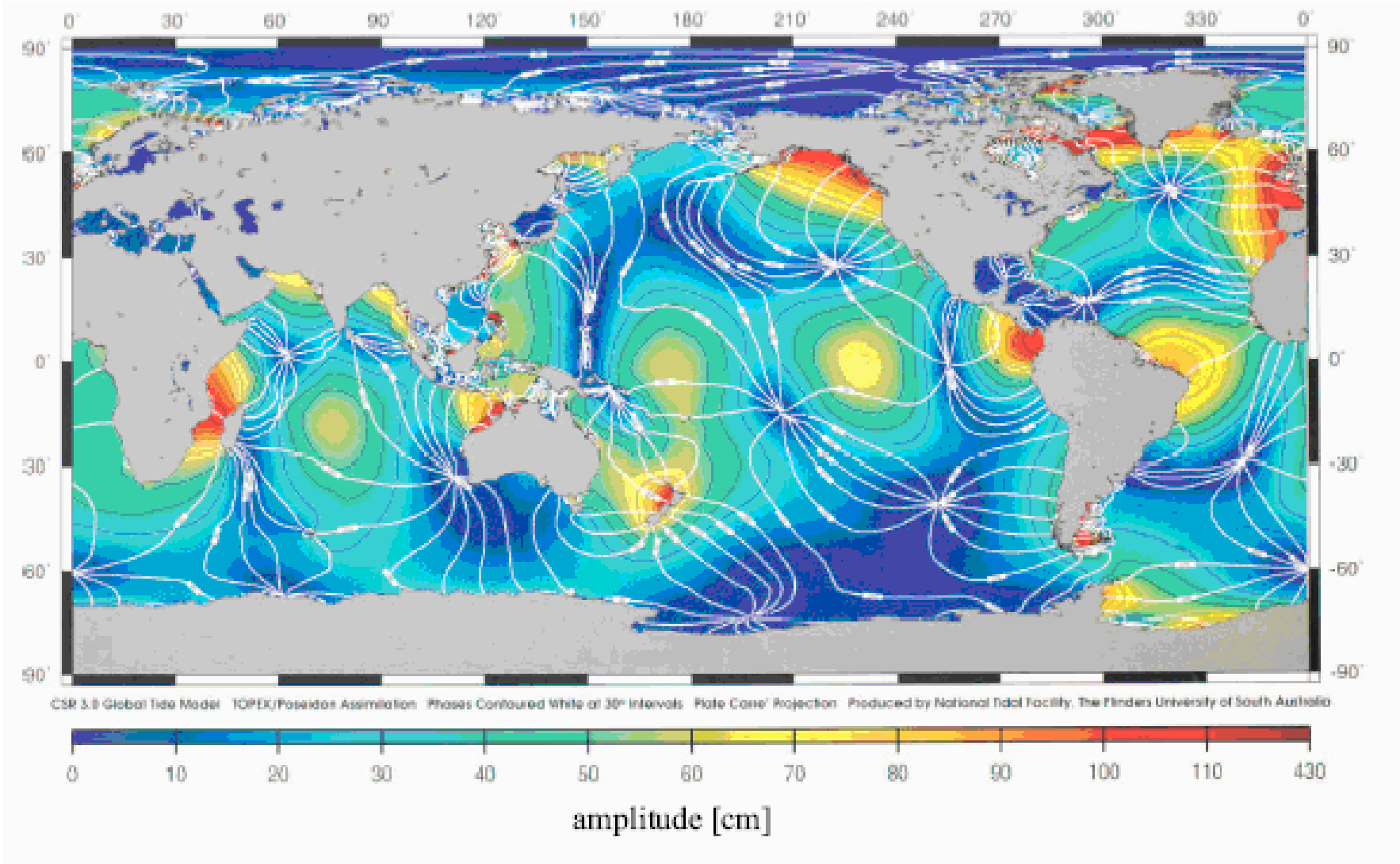
NATURAL ENVIRONMENT RESEARCH COUNCIL

www.liv.ac.uk/engdept/tidalpower

Global Tidal Amplitudes



Getting Power from the Tides

Tidal Range

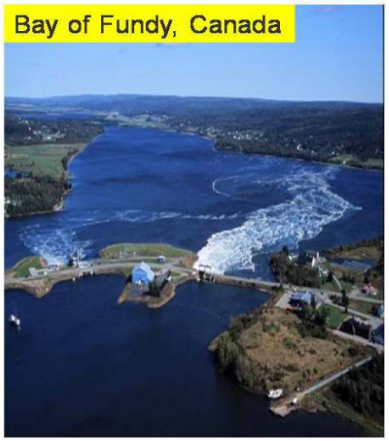
Energy from water level differences

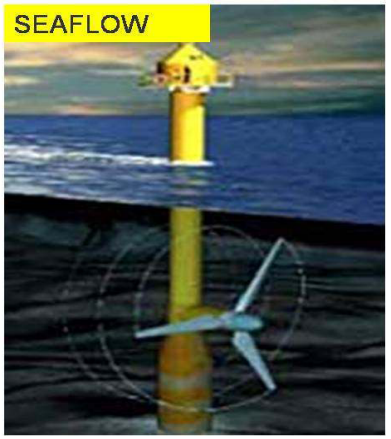
α Basin Area x (Tidal Range) ^{2}

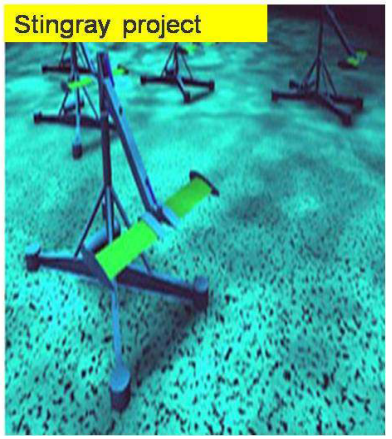
Tidal Stream

Energy from tidal currents

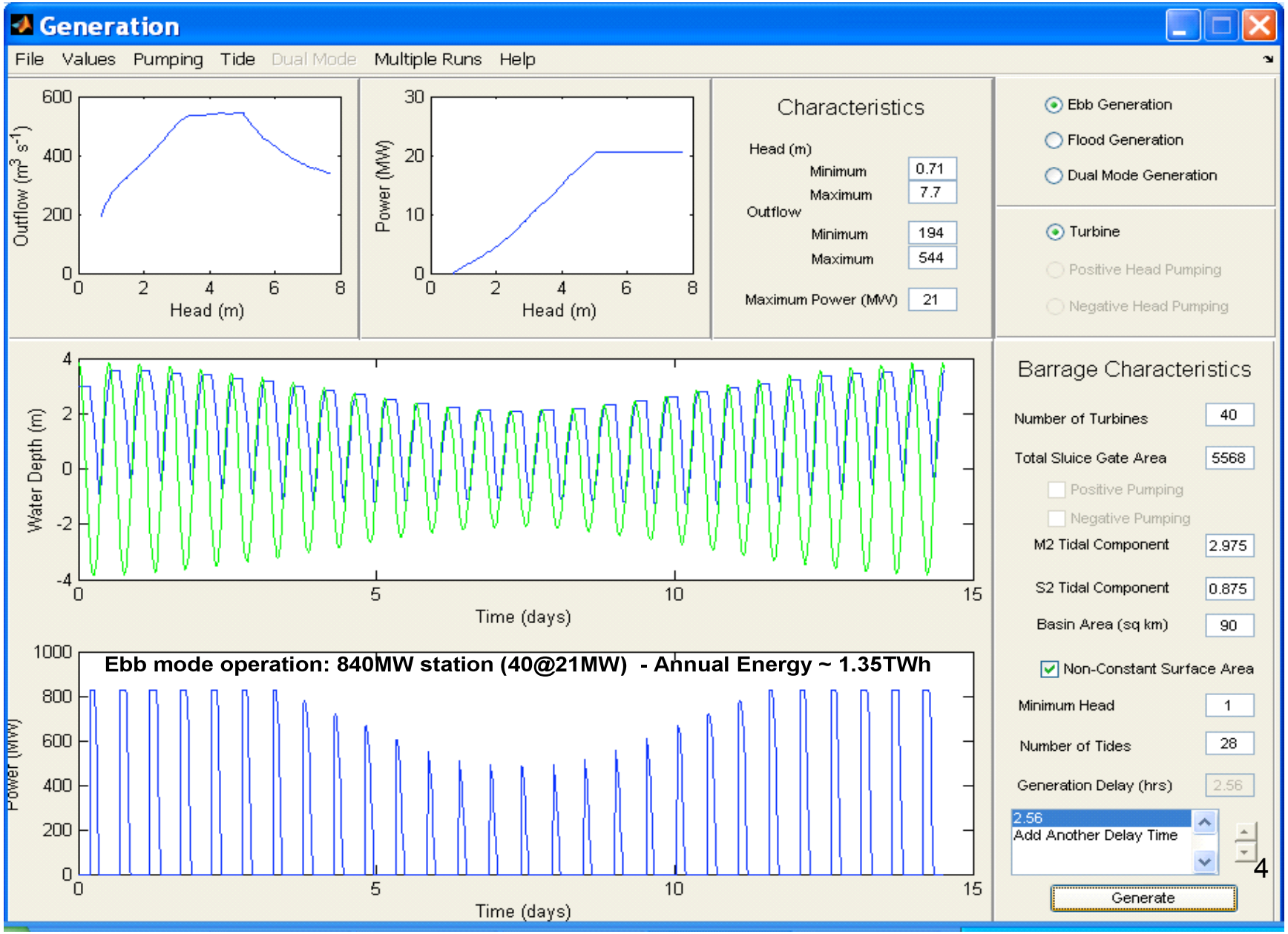
α (Tidal Velocity)^3







‘Flat-Estuary’ 0-D Modelling: Dee Estuary (8m turbines)

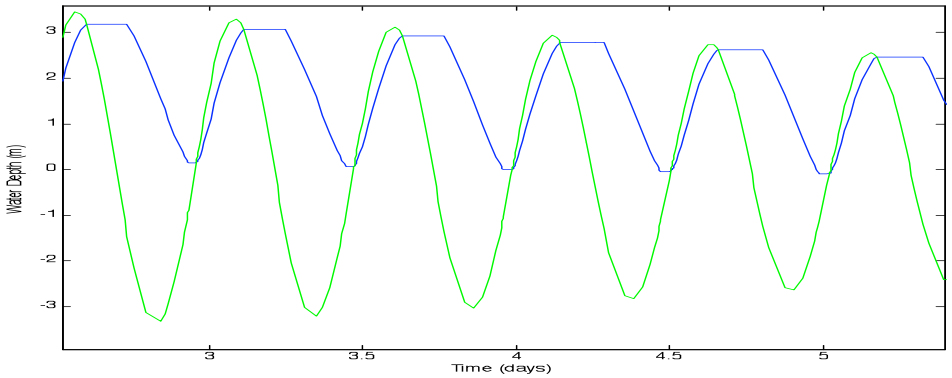


Operating Modes

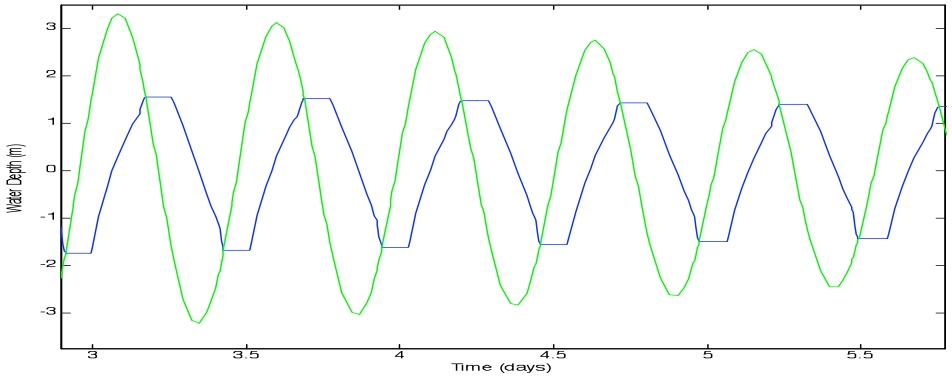
Dee Estuary

(40x21MW 8m turbines, 40x8mx12m sluices)

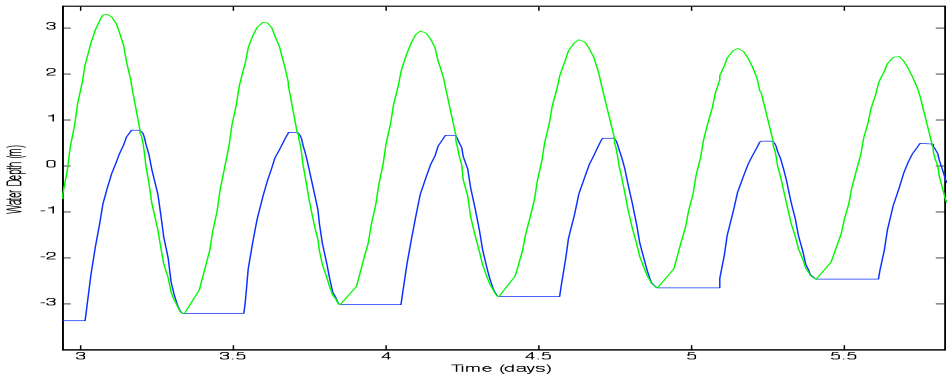
Ebb
1.35 TWh



Dual
1.30 TWh

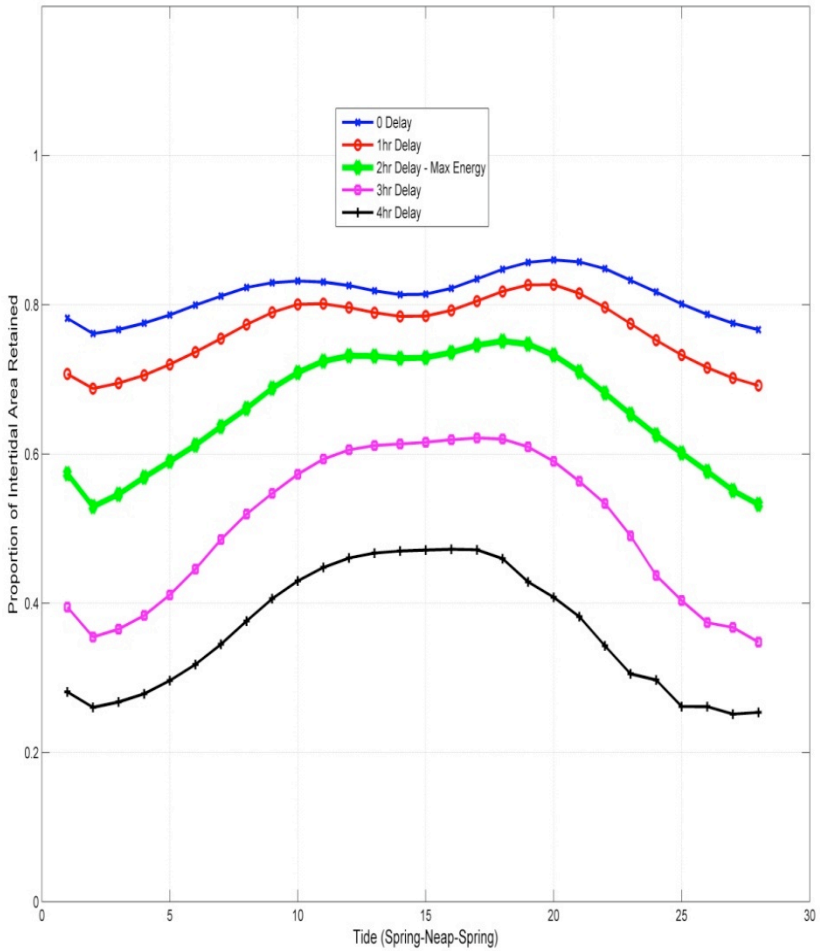


Flood
0.79TWh

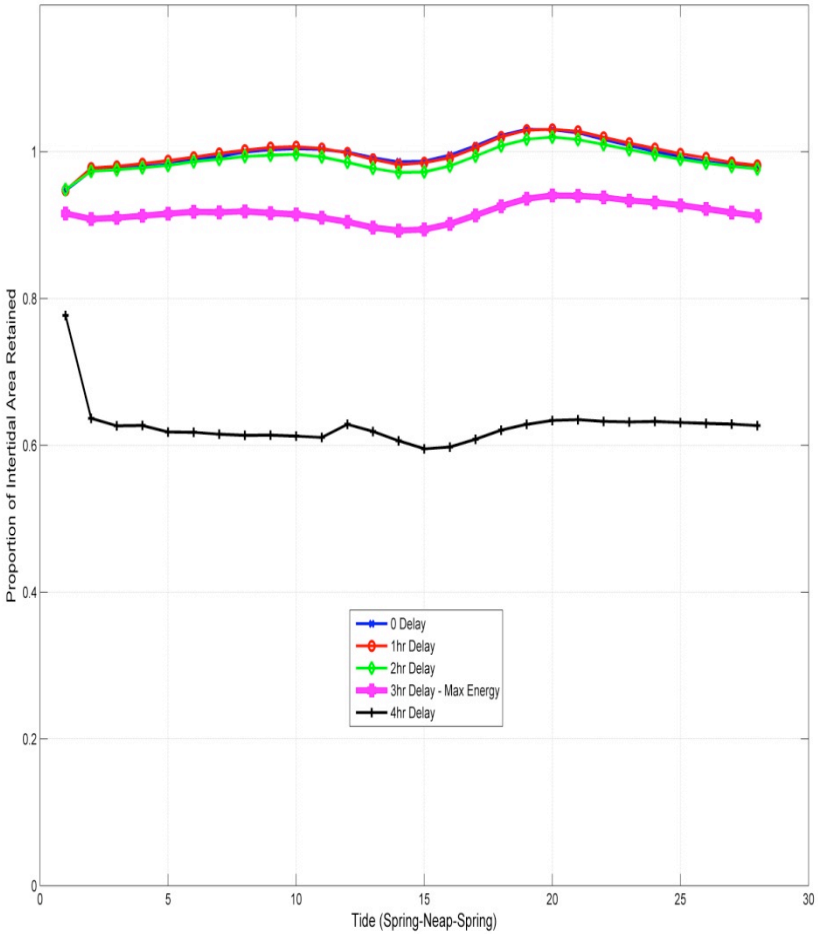


Intertidal Area Retained in Mersey

1xDoEn Ebb

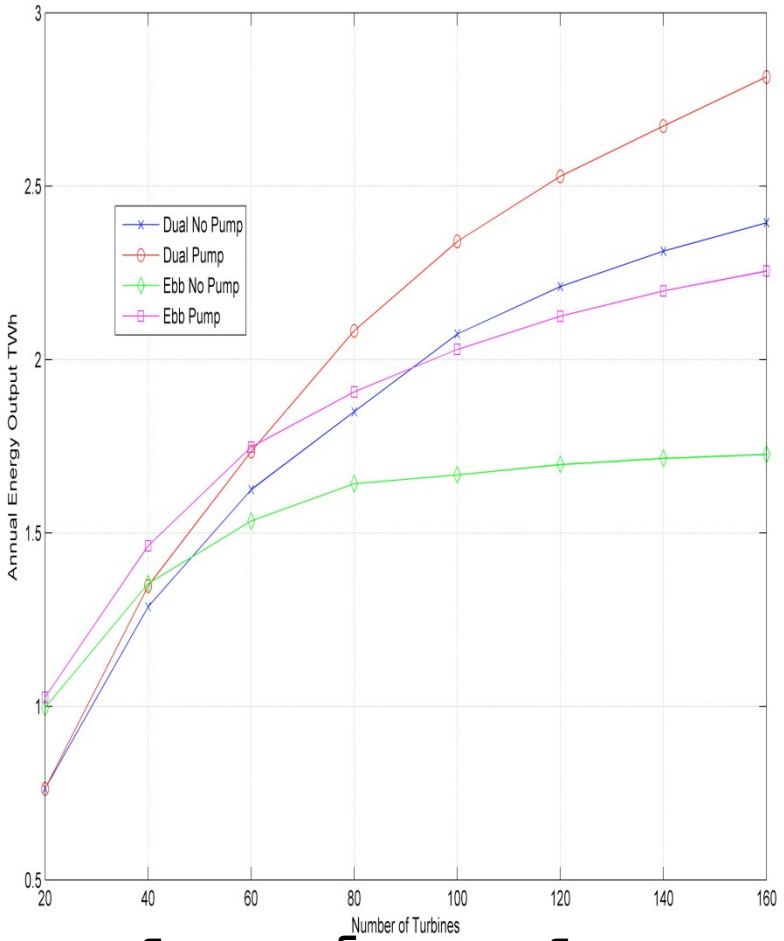


3xDoEn Dual



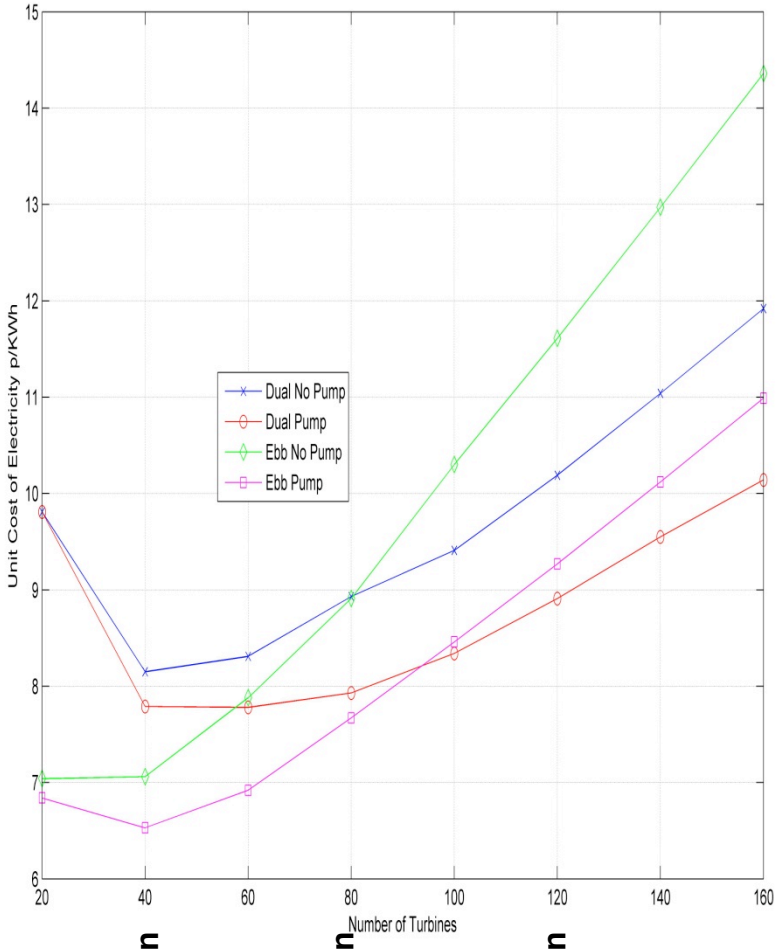
Dee – Increasing installed capacity

Energy (TWh)



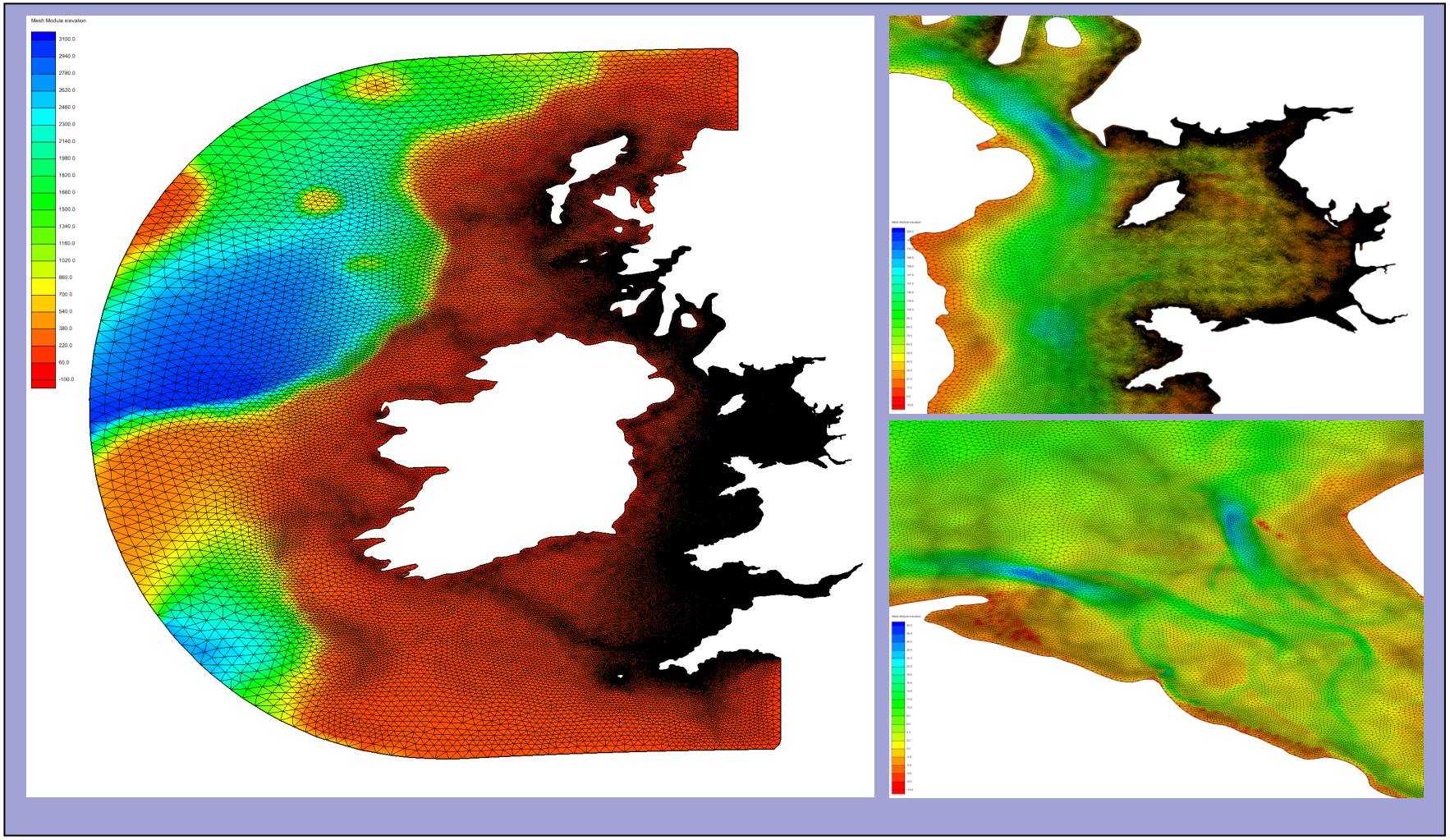
1 x DoEn **2 x DoEn** **3 x DoEn**

Cost (p/KWh)

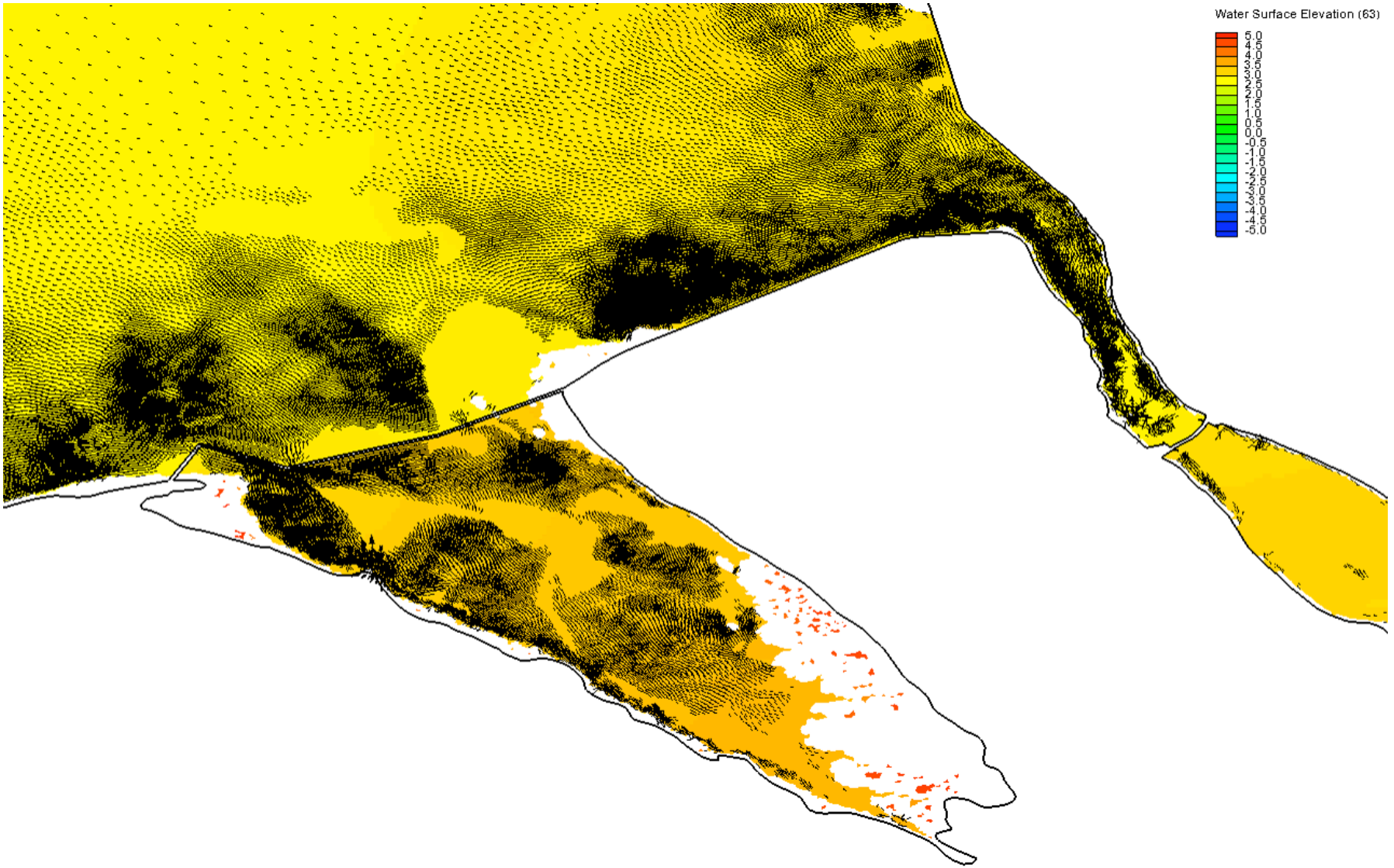


1 x DoEn **2 x DoEn** **3 x DoEn**

2-D Modelling using ADCIRC and Unstructured Grid Generation



Flow simulations around the Dee & Mersey Barrages

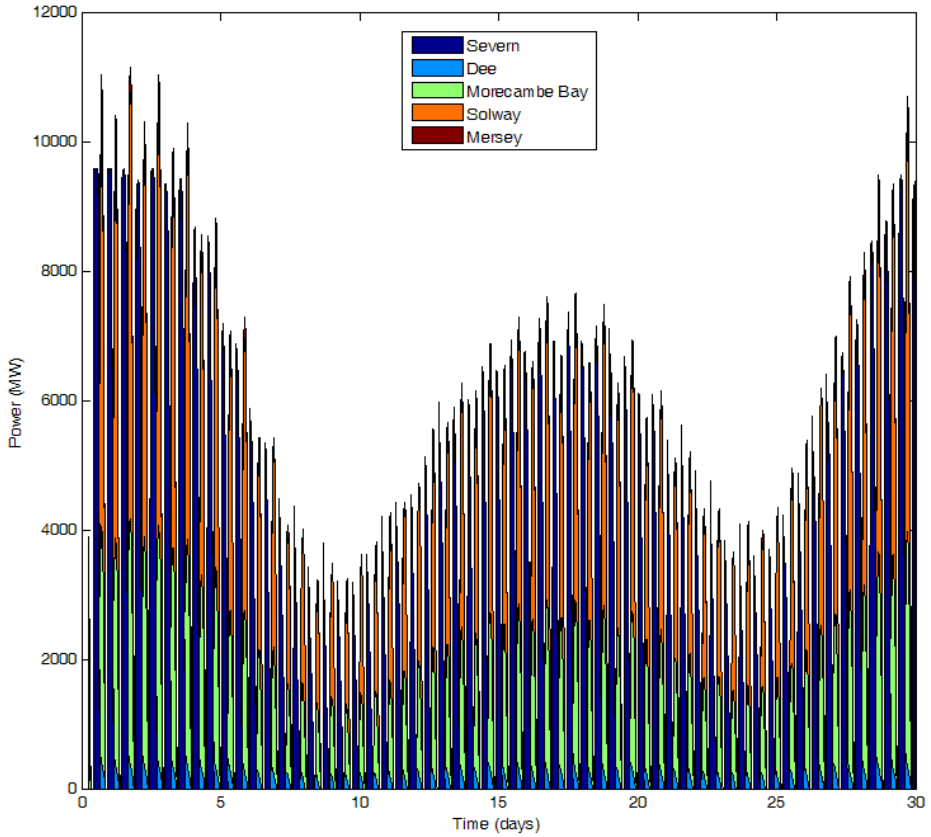


Energy Outputs from 2-D Modelling
- provisional figures not fully validated

	1xDoEn Ebb-Mode Energy (TWh)		1xDoEn Dual-Mode Energy (TWh)	
Solway	**9.66**		**6.82**	
Morecambe Bay	**5.98**		**3.99**	
Mersey	**0.57**		**0.74**	
Dee	**0.89**		**0.80**	
	Total Energy (TWh)	**UK (%)**	**Total Energy (TWh)**	**UK (%)**
North West	**17.10**	**4.5**	**12.34**	**3.2**
Severn	**15.81**	**4.2**	**14.01**	**3.7**
Total	**32.91**	**8.7**	**26.35**	**6.9**

(1xDoEn)

Ebb Mode Power Output

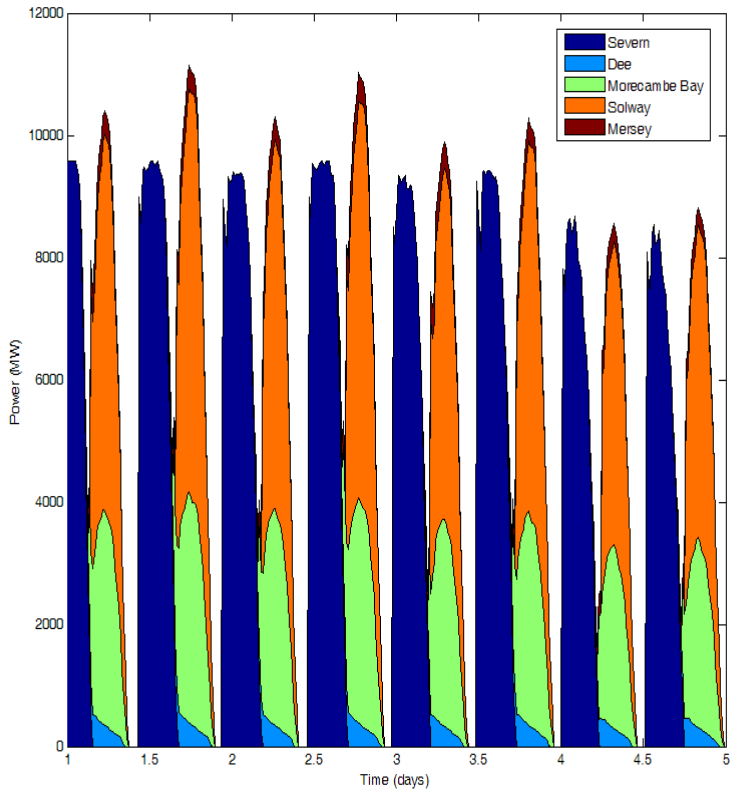


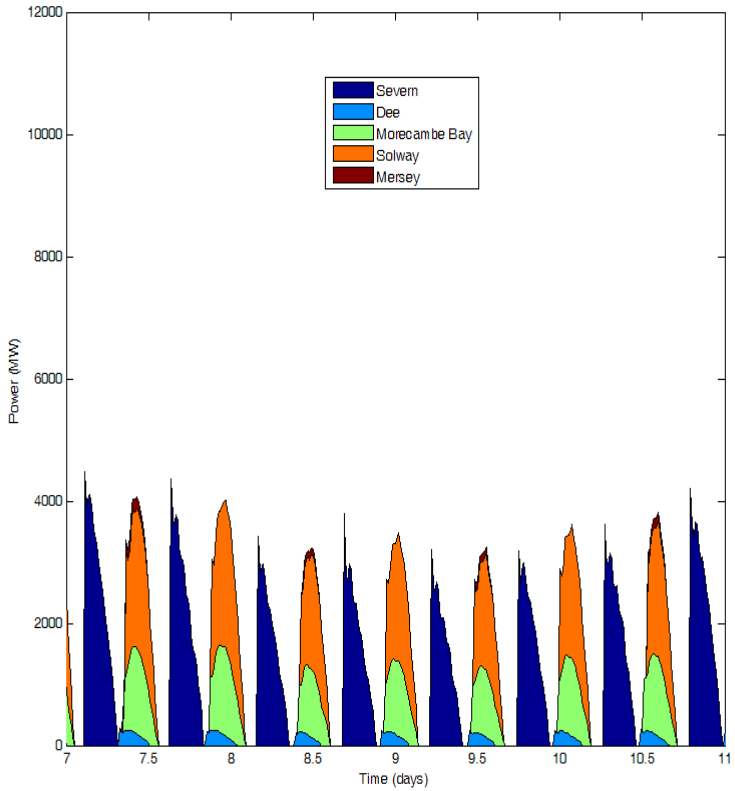
	Annual Output (TWh)
Severn	15.81
Dee	0.89
Morecambe Bay	5.98
Solway	9.66
Mersey	0.57
Total	32.91

Common Delay of 2 hours imposed

(1xDoEn) ebb

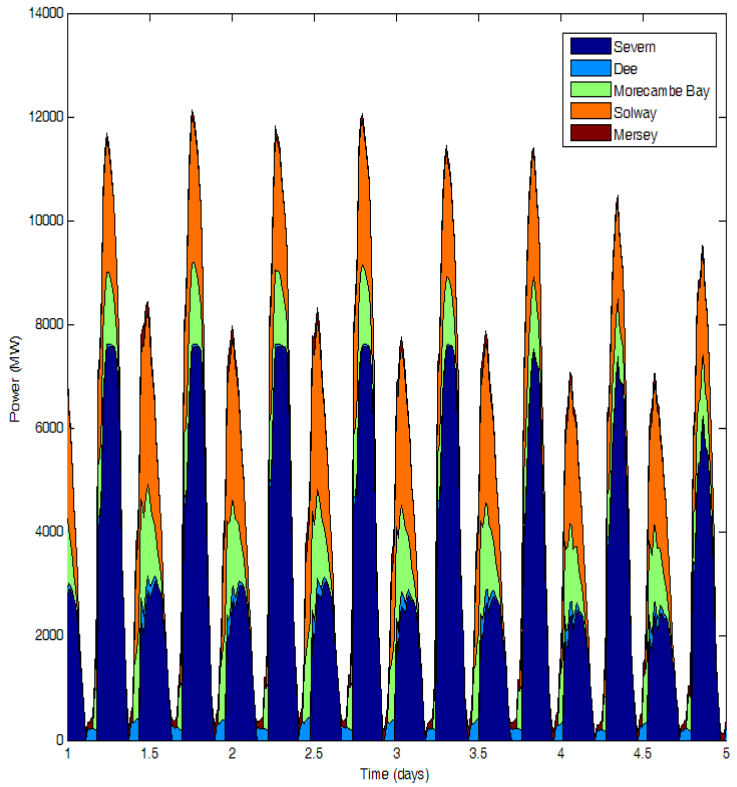
Spring / Neap Power

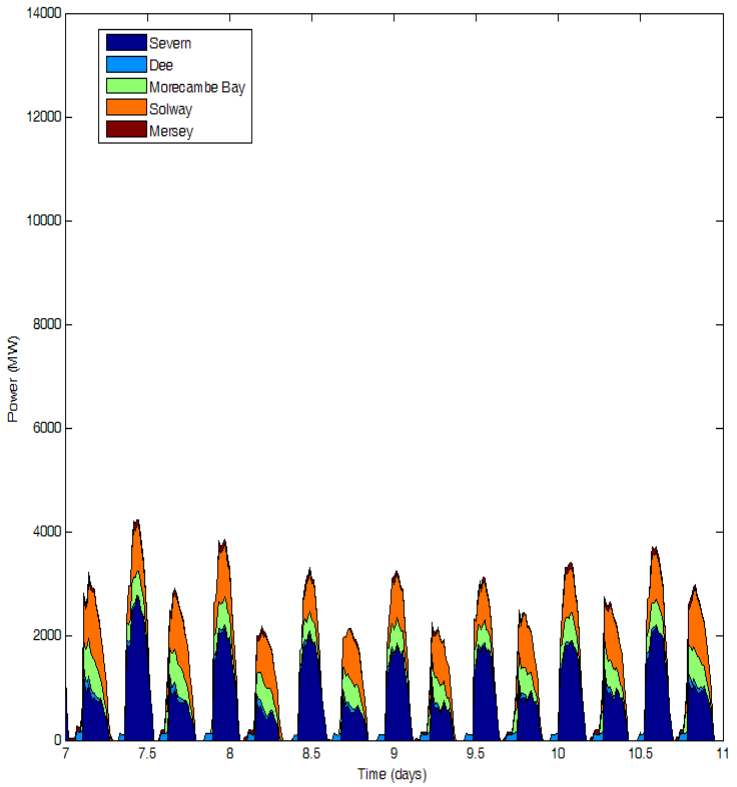




(1xDoEn) dual

Spring / Neap Power





CONCLUDING COMMENTS

- NW potential from barrages is about ~5% UK(2005) electricity demand
- Potential CO_2 savings ~6 million tonnes – but depends on how you count it
- Energy is cost effective, secure, and predictable – despite issues with the accounting methodology
- UK realisable tidal potential is ~20% UK electricity demand (Wind is currently about 1%).
- Difficult to see how else EU (UK) target of 15% renewable energy by 2020 can be met (= ~40% renewable electricity)

- Tidal barrages in the estuaries of the Northwest would be capable of meeting about half the region's electricity need.