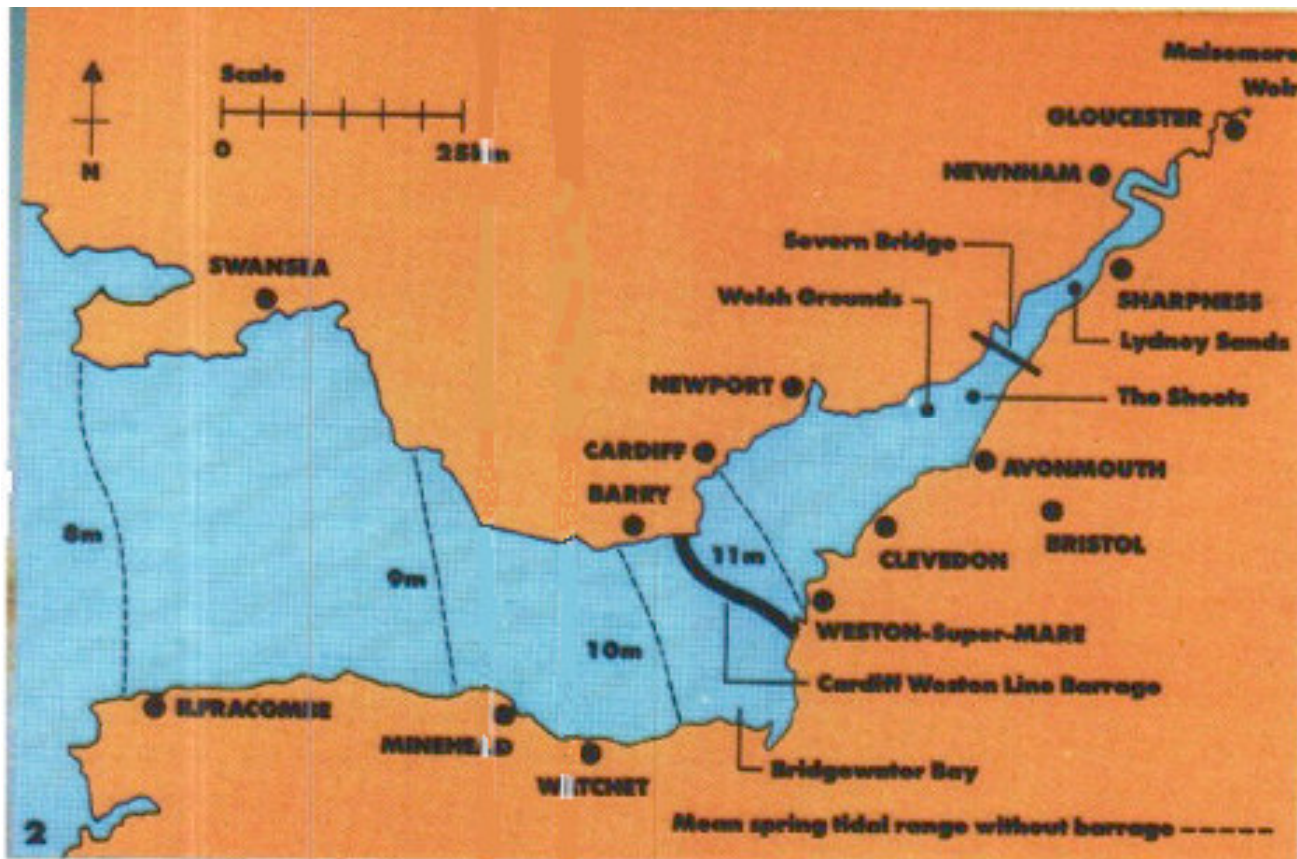


COUNTRY	COMPANY	DEVICE	TYPE	PROTOTYPE RATING	PHASE (TRL)	SCALE	TEST RATING
UK	Aquamarine Power	Oyster	Inertia	500 kW	3-4	1:1	500 kW
Finland	AW Energy Oy	WaveRoller	Inertia	5*15 kW	3	1:1	15 kW
UK	AWS Ocean Energy	Wave Swing	Inertia	2 MW	3	1:1.75	250kW
Canada	Finavera	AquaBuOY	Inertia	250 kW	3	1:2	25 kW
Norway	Fred Olsen	FOBOX3	Inertia	2.5 MW	3	1:3	50 kW
Ireland	Ocean Energy	OE Buoy	Floating OWC	2 MW	3	1:4	15 kW
Australia	Oceanlinx	Oceanlinx	Floating OWC	2 MW	3	1:3	45 kW
USA	OPT	PowerBuoy	Inertia	150 kW	3	1:1.5	40 kW
UK	Pelamis Wave Power	Pelamis	Inertia	750 kW	4-5	1:1	750 kW
Australia	Seapower Pacific	CETO	Inertia	180 kW	3	1:6 (1:3)	10 kW
Denmark	Wave Dragon	Wave Dragon	Floating Overtopping	7 MW	3	1:5.2	20 kW
Ireland	Wavebob	Wavebob	Inertia	2 MW	3	1:4	15 kW
UK	Wavegen	Limpet	Fixed OWC	500 kW	4	1:1	500 kW
Norway	WAVEnergy	SSG	Fixed Overtopping	150 kW	2	1:1	150 kW
Denmark	WavePlane	WavePlane	Floating Overtopping	500 kW	3-4	1:1-2	250 kW
Denmark	Wavestar	Wavestar	Inertia	5 MW	3	1:10	5.5 kW

Table 3.1 Leading Technologies

### 3.2 Successive Devices

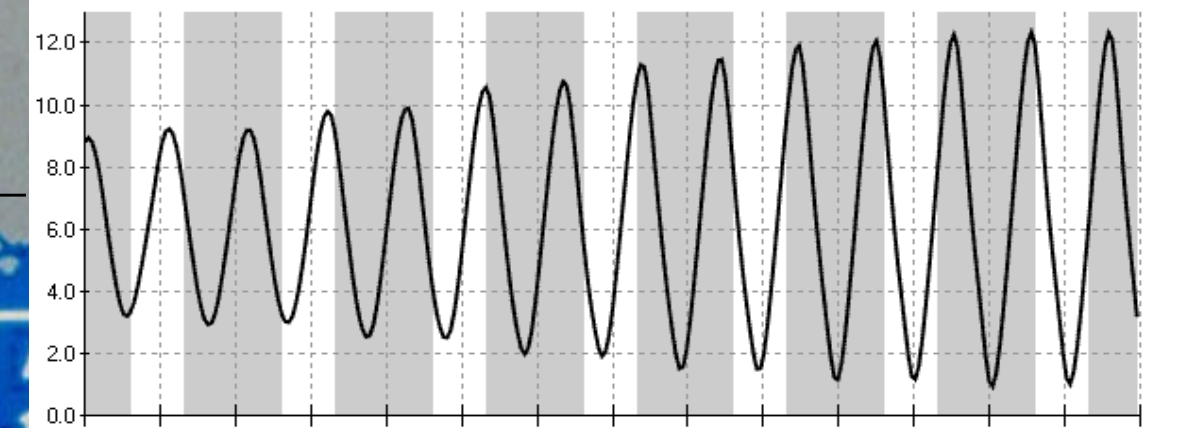
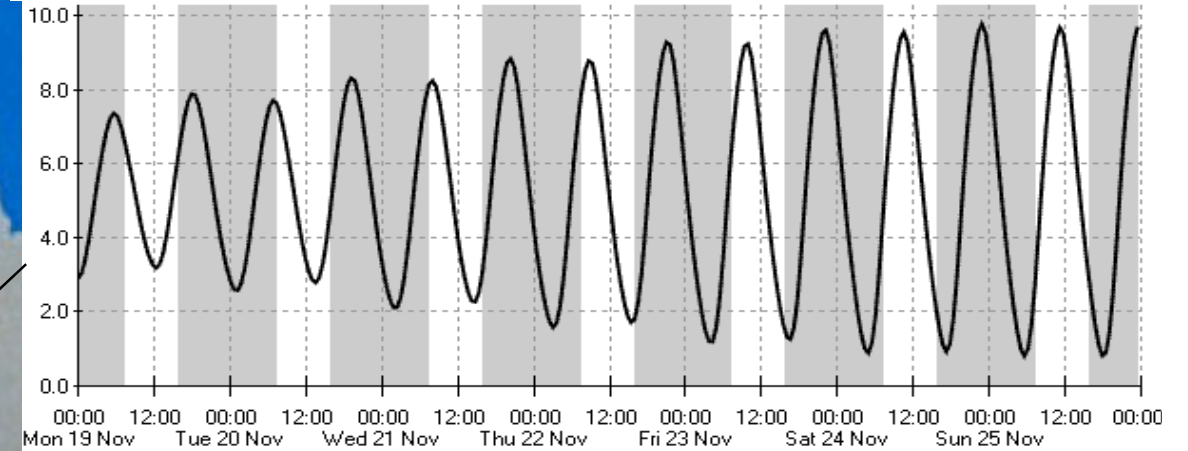
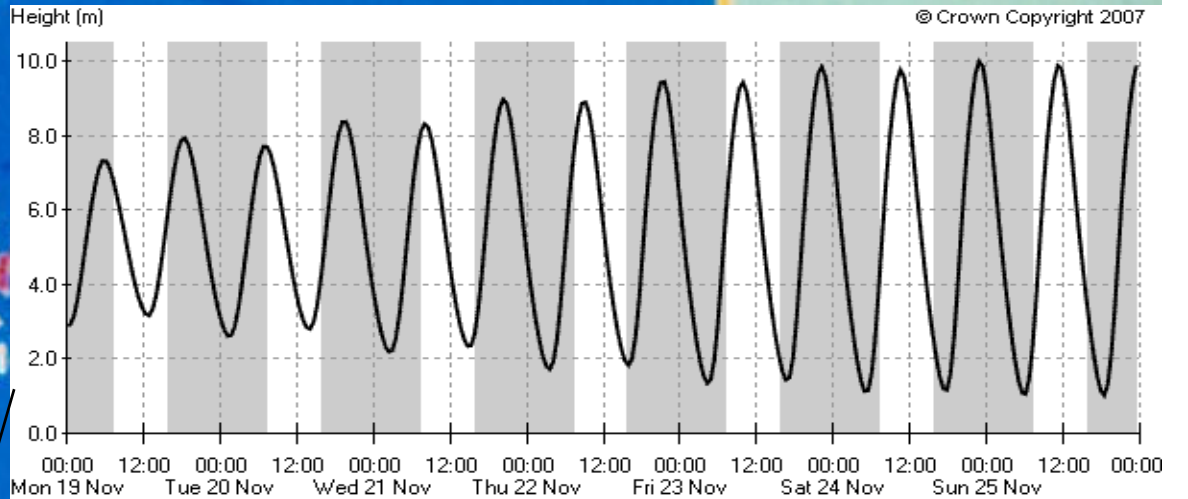
# Tidal Power



Severn Estuary

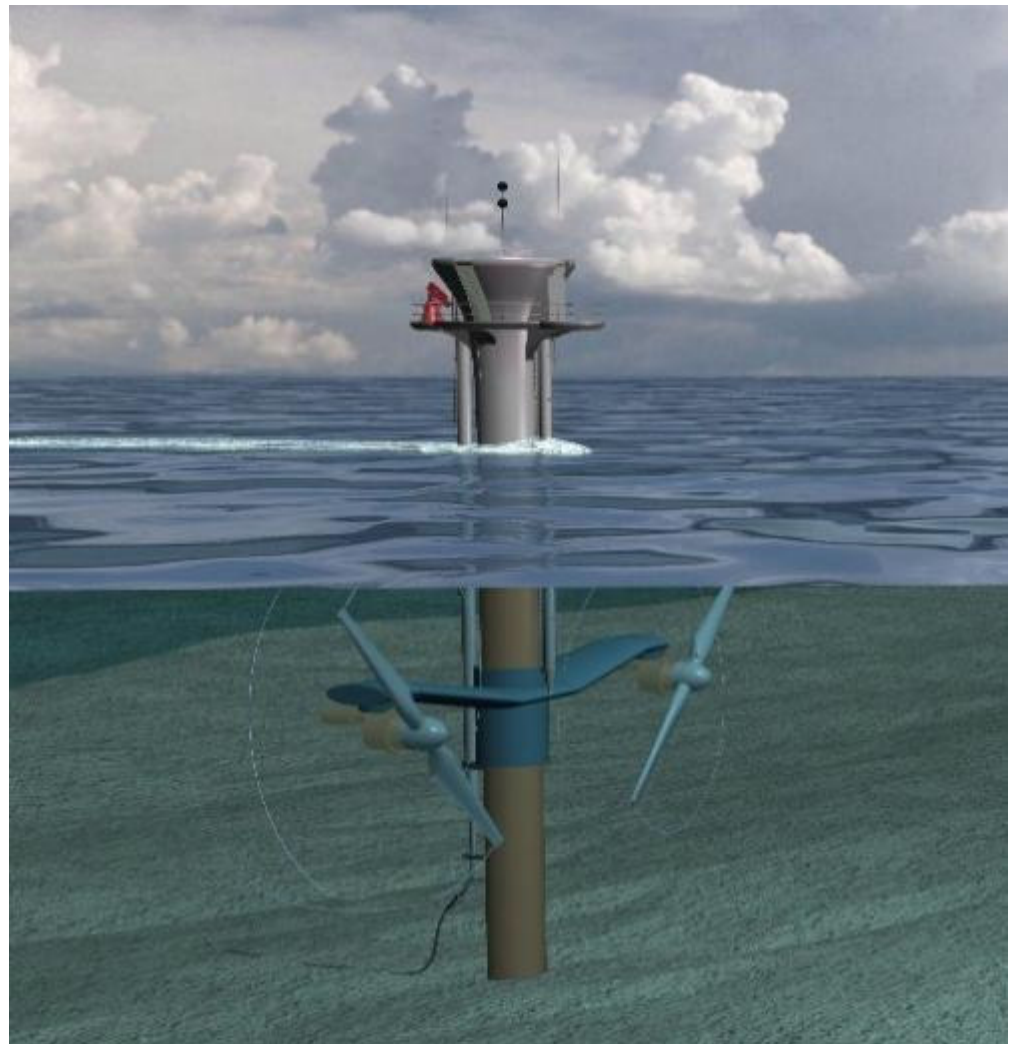
# La Rance tidal barrage





# Marine Currents

$$P = \frac{1}{2} \rho \int_A (U^3 dA),$$



# Openhydro



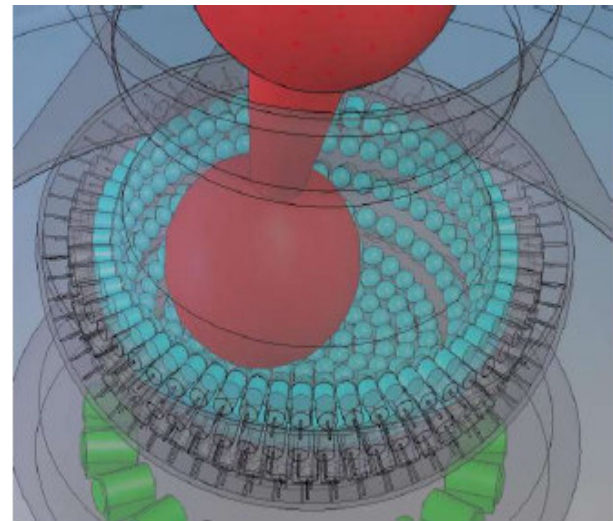
# Pulse device



# Tidal Fence



# Williams Vortex device

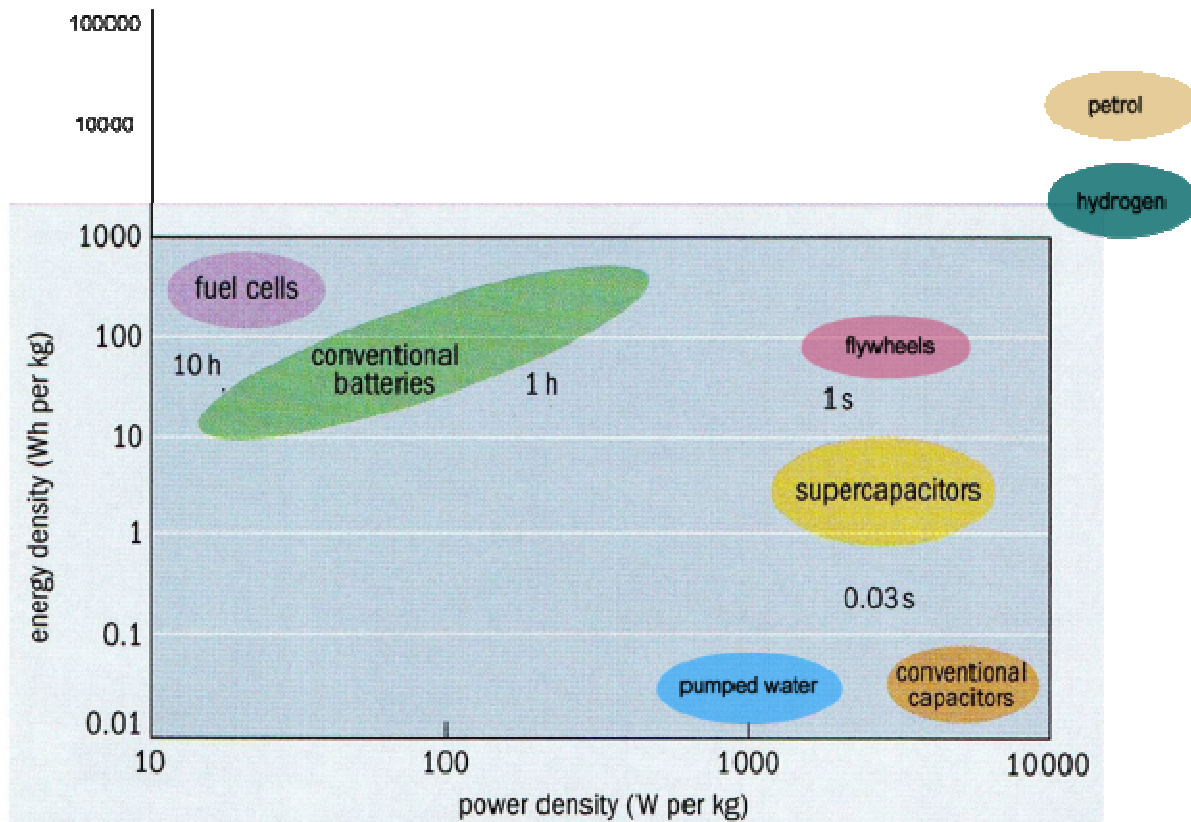


# Cluster issues

- Is resource available local to cluster ?
  - Yes, then exploit as a single company, or cooperate to establish co-owner venture
  - Share costs and benefits, local grid/heat supply
  - Distributed load may help

No, then cofund distant biomass, hydro, wind, wave, tidal farm

# Energy Storage (adapted from Houghton 2009)

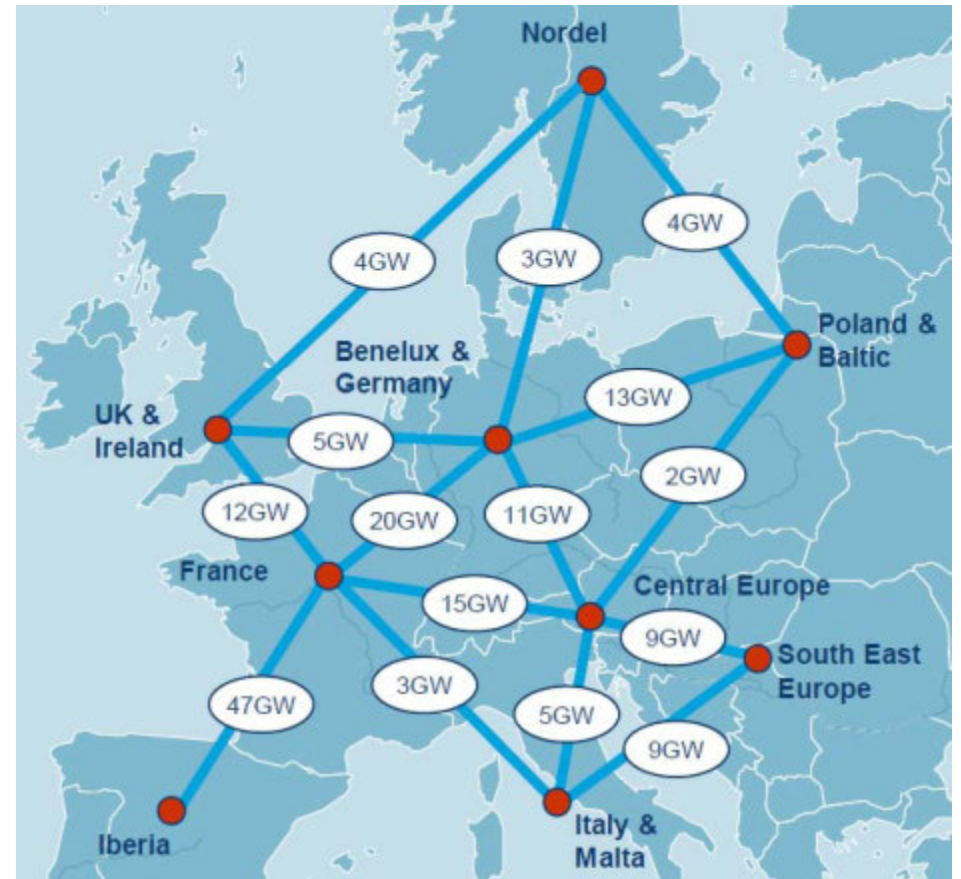
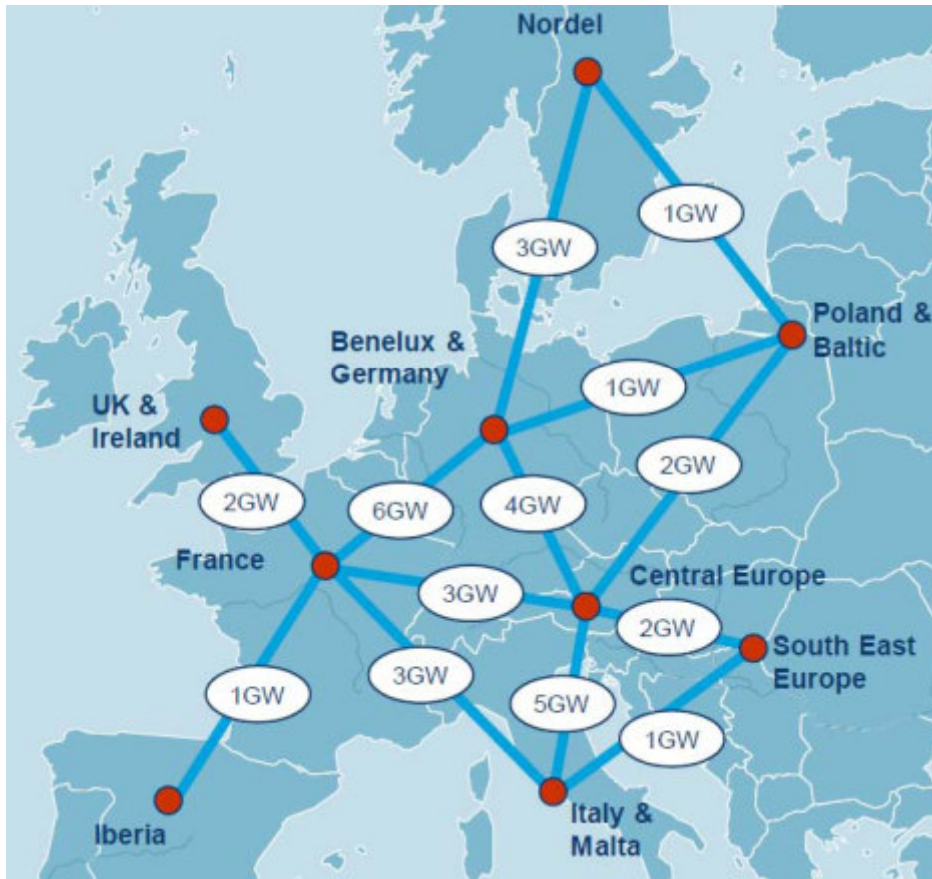


This “Ragone” diagram compares the performance of different energy-storage devices. Energy density is how much energy is available and power density shows how quickly that energy can be delivered: conventional capacitors, for example, do not store more energy but can deliver it very quickly. A conventional lead-acid battery has an energy density of about 30–40 Wh per kg and modern lithium-ion batteries about 160 Wh per kg. Nanotechnology is leading to new kinds of supercapacitor that can store and release lots of energy quickly, as well as novel forms of batteries. The times indicate how long the devices release their energy over.

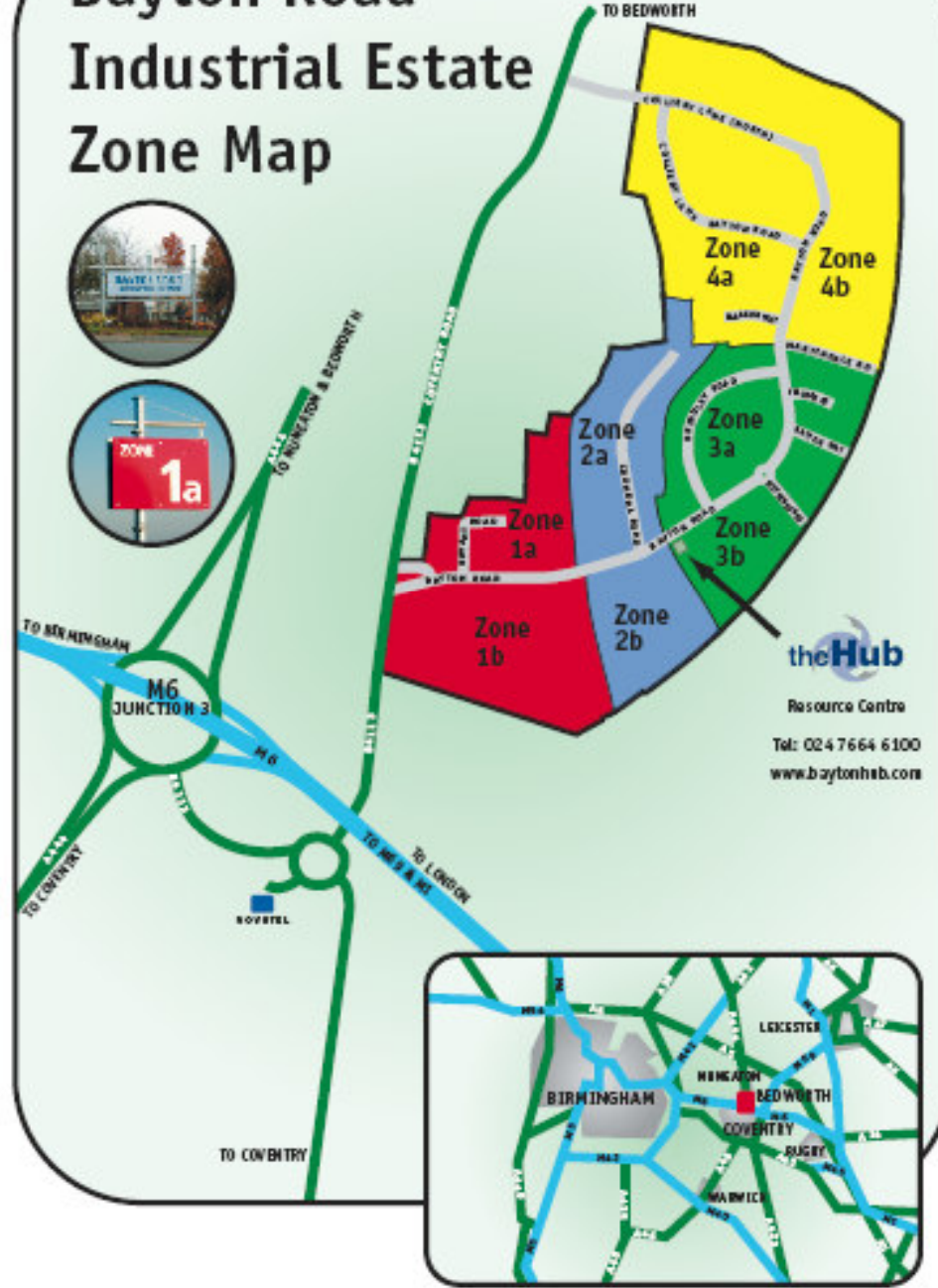
# Energy storage and management

- Management techniques such as DSM may be possible as a consortium
- Energy storage is complex and expensive, but it may be possible for a cooperative approach to storing biomass for example. In the case of Bayton road, there is already an oil depot on the estate which could be used to store biodiesel.
- Common grid to permit exchange of energy and/or heat

# Strengthen interconnections



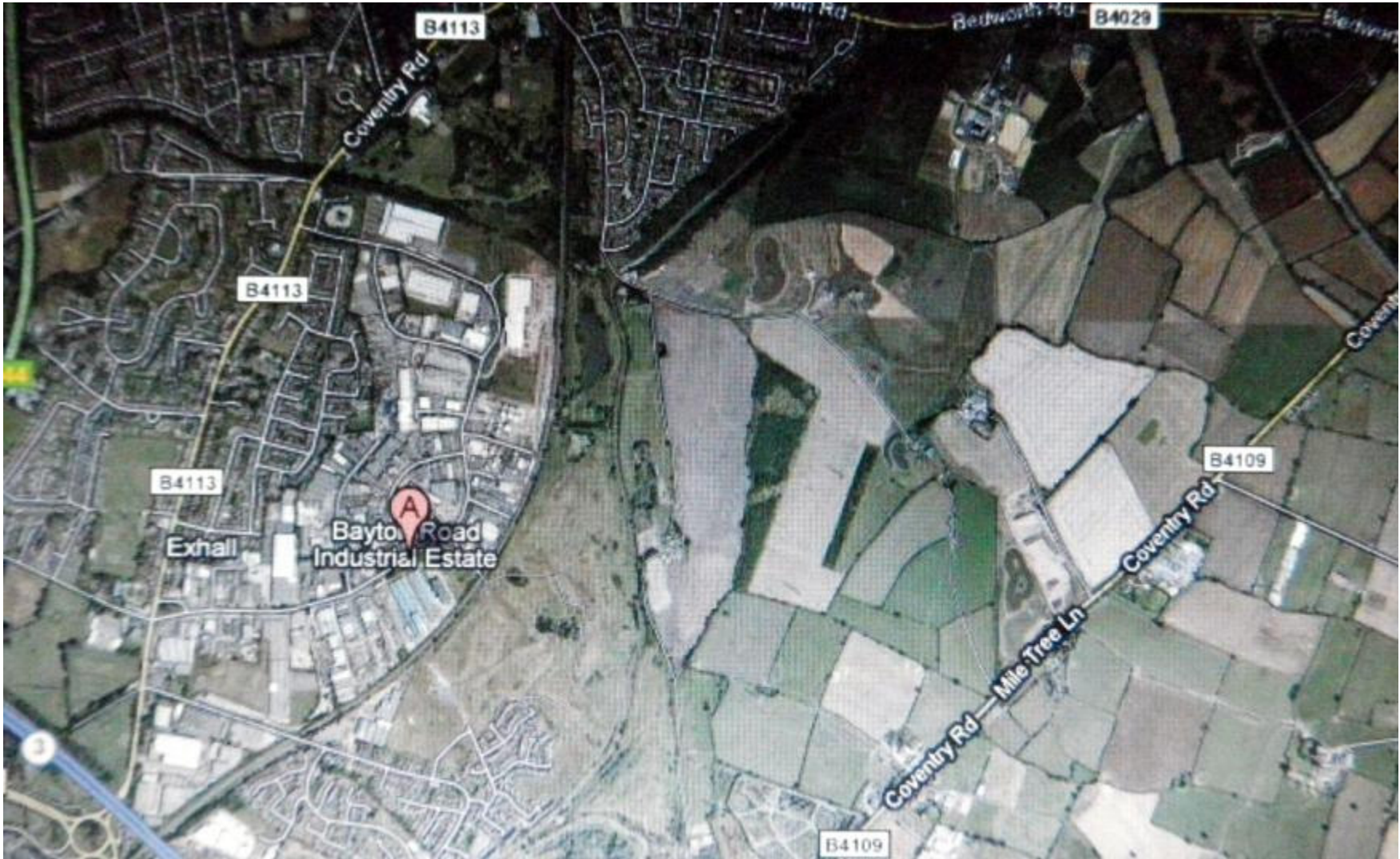
# Bayton Road Industrial Estate Zone Map



Resource Centre  
Tel: 024 7664 6100  
www.baytonhub.com

# Bayton Road Industrial Estate

Urban areas to N,W&S  
Agricultural to E



# Carbon reduction study

<b>Option</b>	<b>Cost per t CO<sub>2</sub></b>	<b>Investment</b>	<b>Long-term jobs</b>	<b>Installations</b>
1.5MW wind turbines on sites > 6.5m/s	£33	£83 million	8	83
Community 600kW wind turbines on sites > 6.5 m/s	£36	£93 million	9	208
Farm-scale 6kW wind turbines on sites > 5 m/s	£142	£347 million	52	24 800
2MW community-scale biomass generating stations	£152	£108 million	97	22
Rooftop micro-wind turbines 1.5kW on sites >4 m/s	£153	£317 million	106	211 309*
Purchase of green electricity	£201	0	0	53 074**
78 sqm 10kWp solar photovoltaic (PV) electrical installations	£672	£1723 million	173	36 815

**Table 2. Initial sample of 10% heat supply options**

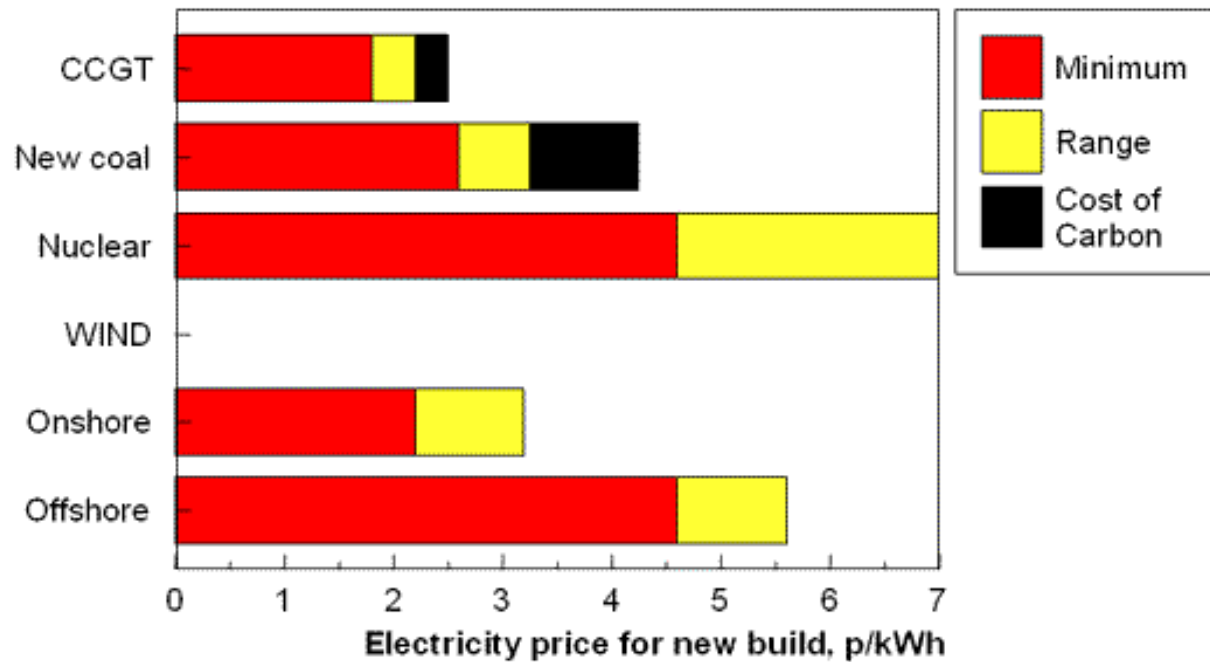
<b>Option</b>	<b>Cost per t CO<sub>2</sub></b>	<b>Investment</b>	<b>Long-term jobs</b>	<b>Installations</b>
Domestic woodchip-fuelled boilers (15kW)	£101	£136 million	26	28 953
Rooftop 4.2 sqm solar water heating systems	£155	£469 million	45	223 220**
Domestic condensing boilers (8kW, A-rated) – do nothing option.	£649	£75 million	46*	57 906

**Table 3. Initial sample of 10% heat supply options using CHP**

<b>Option</b>	<b>Cost per t CO<sub>2</sub></b>	<b>Investment</b>	<b>Long-term jobs</b>	<b>Installations</b>
Community biomass-fired 2MWt CHP with district heating	£150	£248 million	223	47
Domestic micro-CHP (8kWt/1.1kWe units)	£433	£174 million	69	57 906
Community gas-fired 2MWt CHP with district heating	£585	£165 million	50	47
Domestic condensing boilers (8kW, A-rated) – do nothing option.	£649	£75 million	46*	57 906

# Large-Scale Energy Generation

*New build costs by technology*



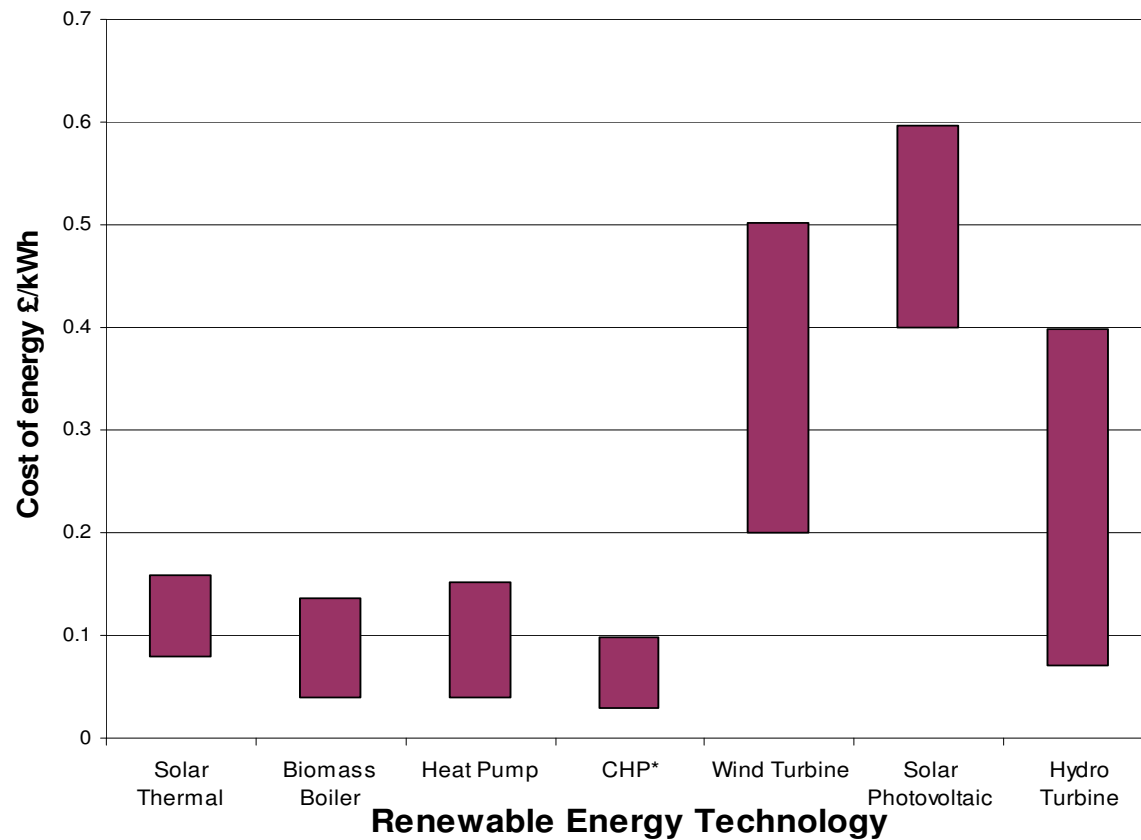
Source: Thermal plant - UK Government White Papers

Renewables: SRO3 contracts

Comparison of new build costs



# Micro-Renewables - Cost of energy



# Clare's wave resource

- Clare has at least 50km of coastline when - taken as a straight N-S line.
- With an average power density of 50kW/m this represents an incident power of 2.5GW
- In practical terms we may only be able to harvest 30% of this --- 0.75GW

