

Severn Barrage Costing

The Severn Barrage in context

Leaders in the design, implementation and operation of markets for electricity, gas and water.

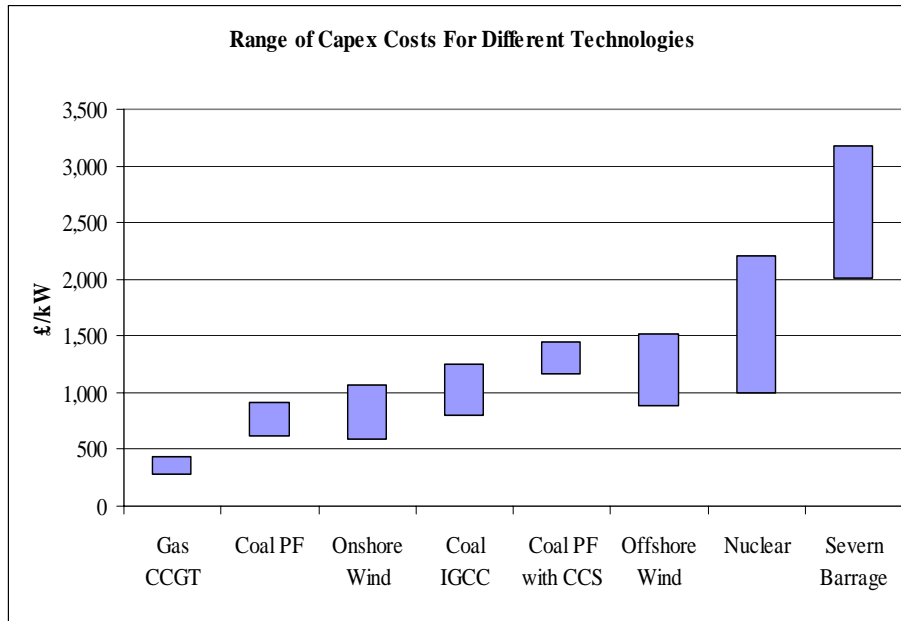


Objectives

- **Comparison of Generation Costs**
 - Comparison of levelised costs (p/kWh) with other options on a consistent basis
 - Potential capacity that could be developed at similar cost to Severn Barrage
- **Contribution to security of supply**
 - Ability to offer flexibility
 - Compatibility with GB demand profile
 - Capacity contribution
- **Barrage Effects on Electricity System**
 - How the system would operate with a Barrage
 - Can the existing system accommodate a C-W scheme?



Comparison of Generation Costs



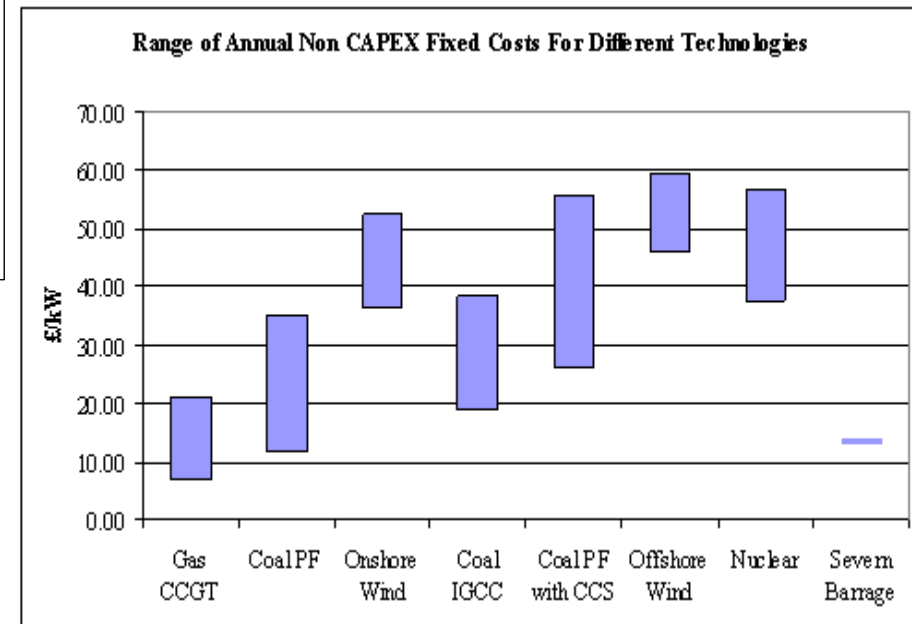
Data Sources:

PB Power: *Powering the Nation, A review of the costs of generating electricity*, March 2006

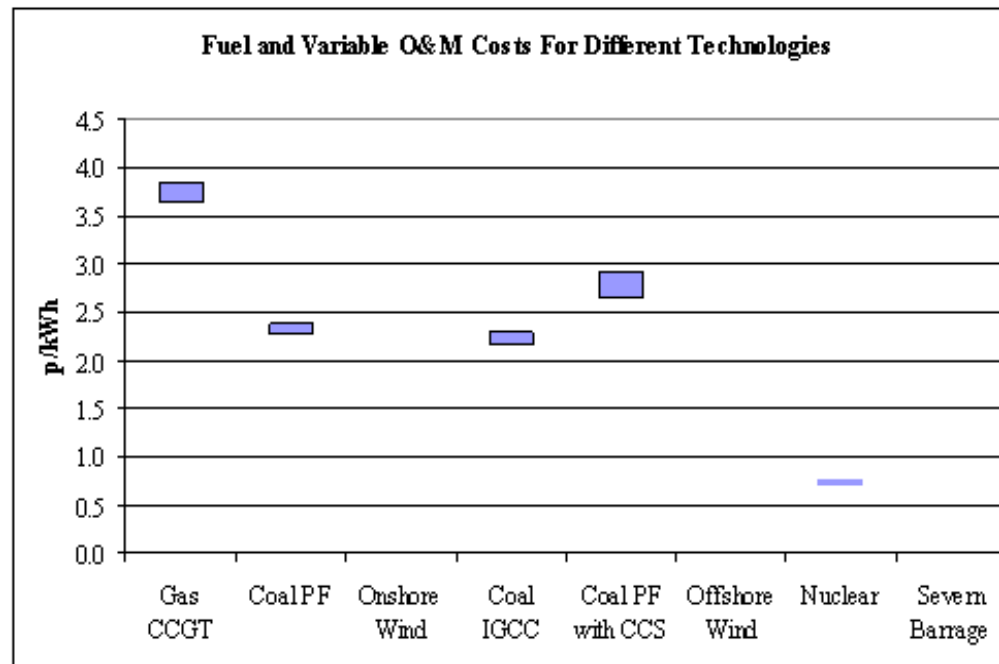
SDC: *Tidal Power in the UK, Research Report 3 – Review of Severn Barrage Proposals*, May 2007

VGB PowerTech: *Role of Electricity, Building Block Supply*, 2006

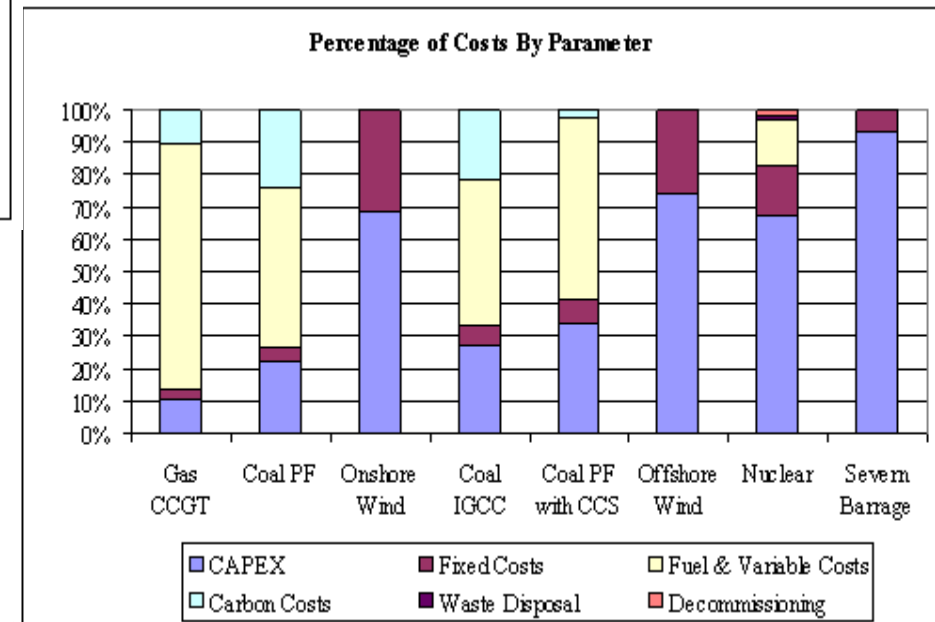
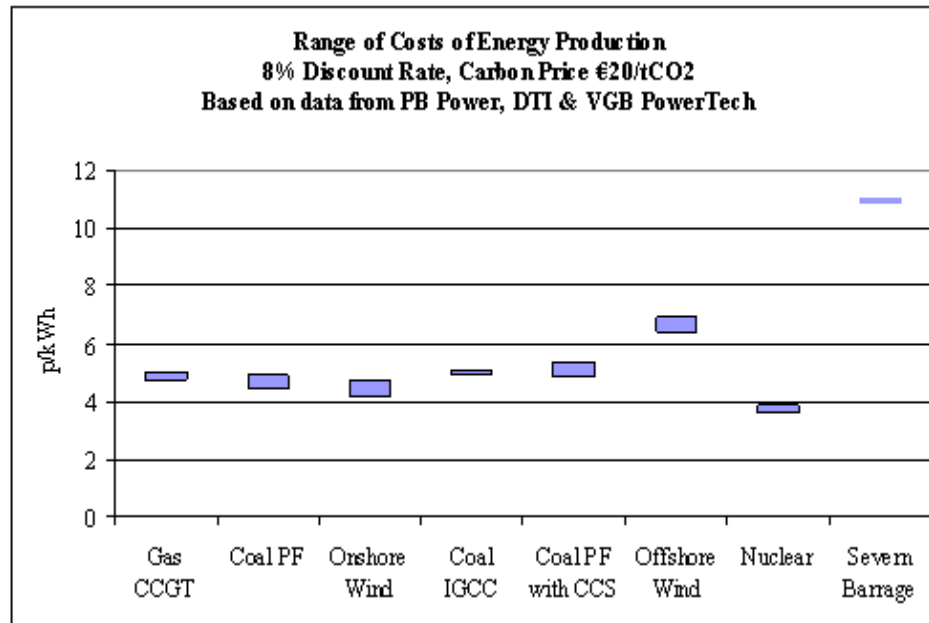
The DTI: *Energy Review 2006*



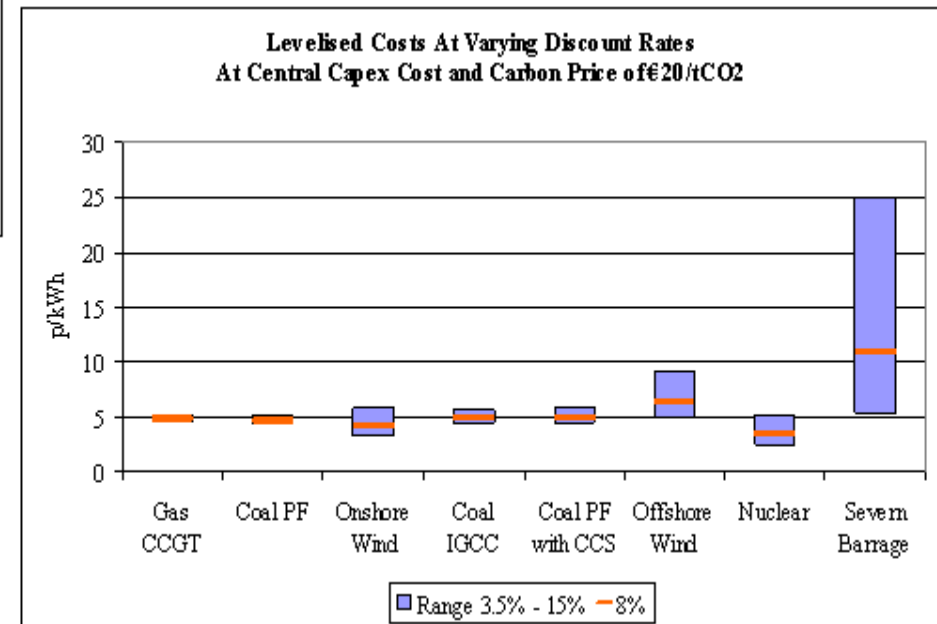
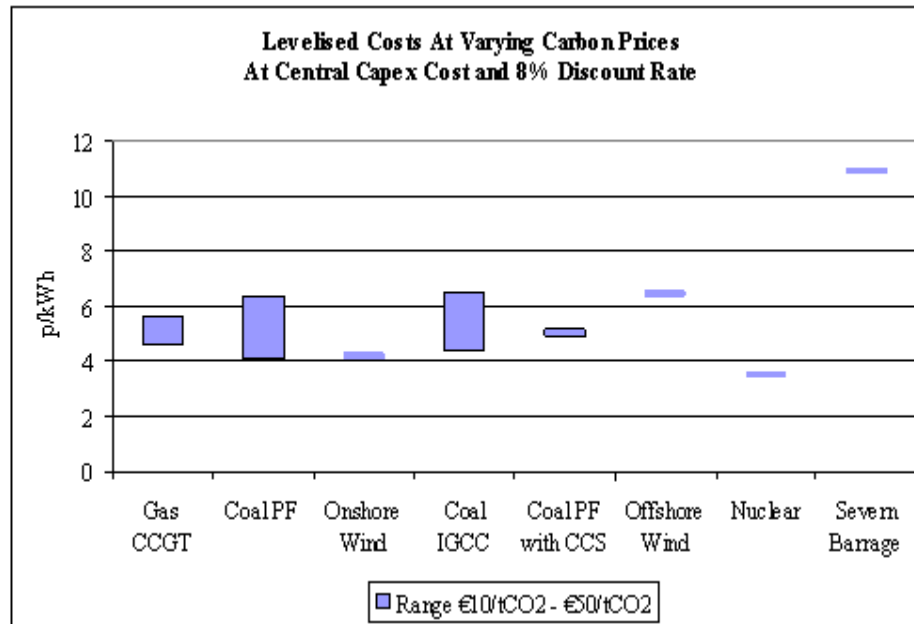
Comparison of Generation Costs



Comparison of Generation Costs – Levelised Costs

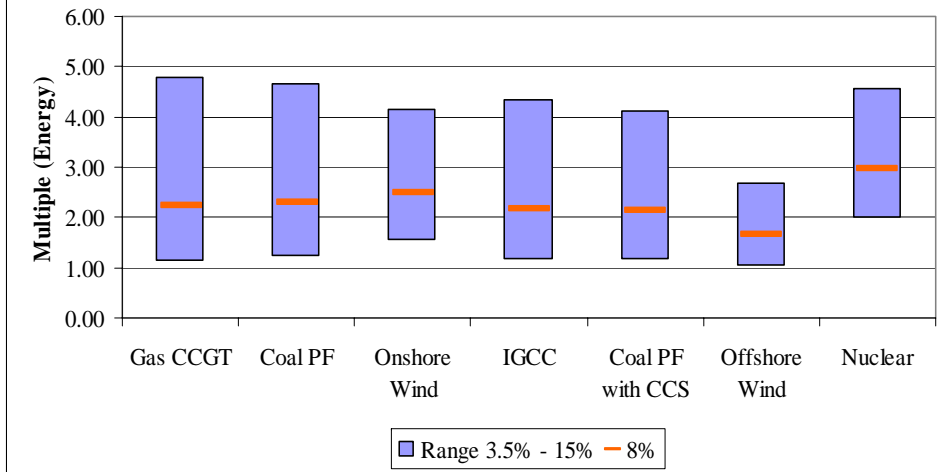


Generation Costs - Sensitivities

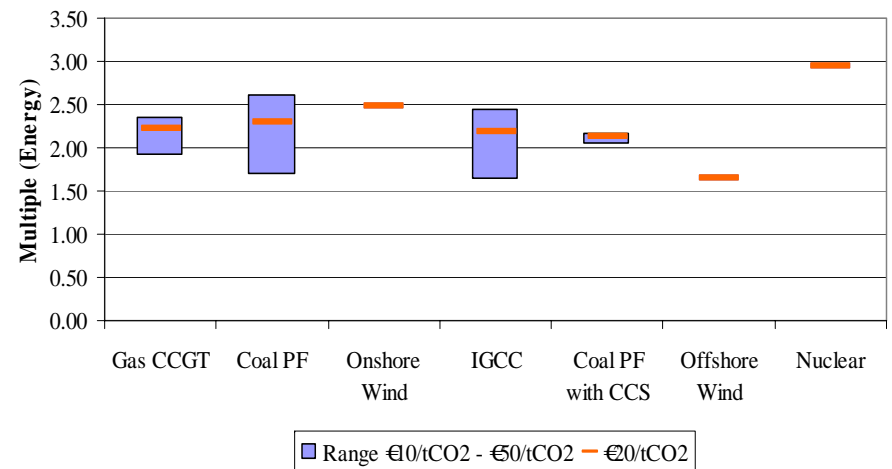


Generation Costs – Potential Capacity

**Energy From Different Generation Sources For Same Cost as Severn Barrage At Varying Discount Rates
At Central Capex Cost and Carbon Price of €20/tCO₂**

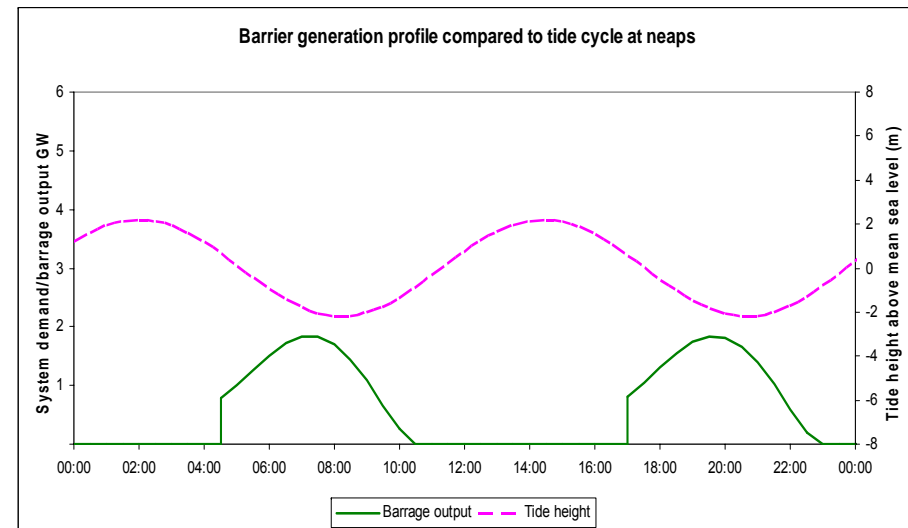
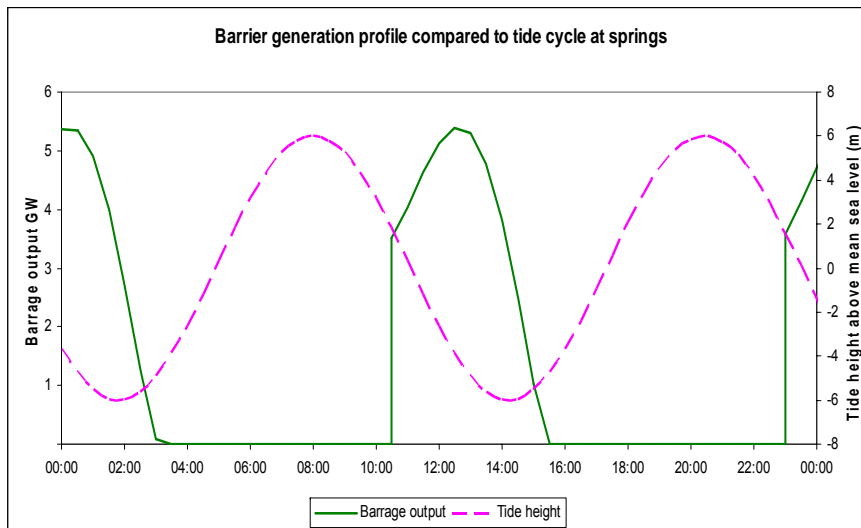


**Energy From Different Generation Sources For Same Cost as Severn Barrage At Varying Carbon Prices
At Central Capex Cost and 8% Discount Rate**



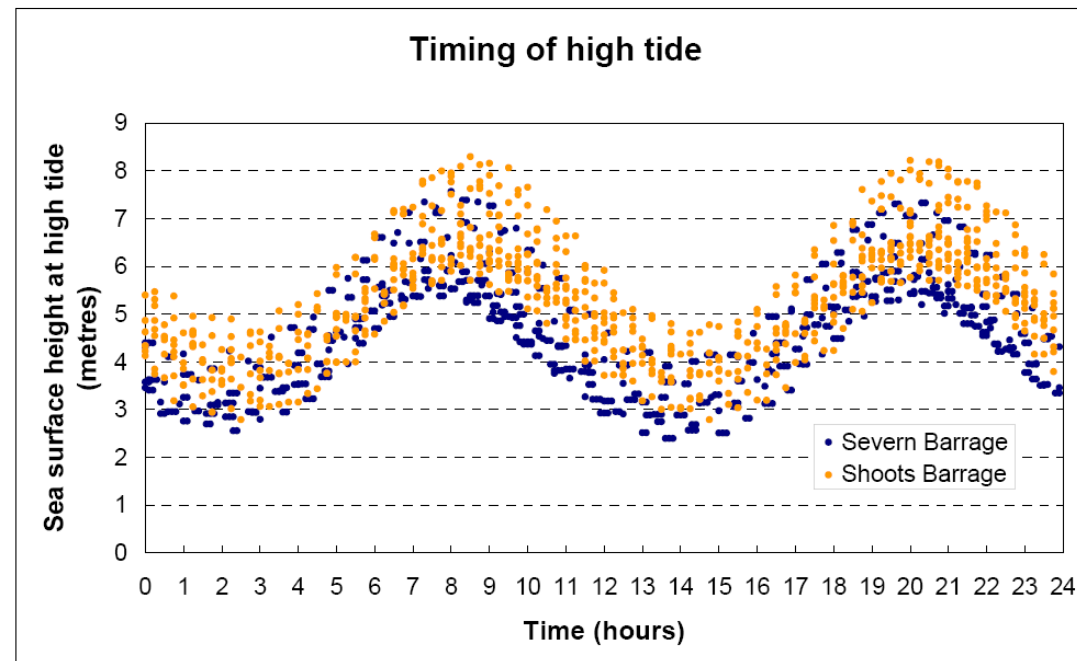
Contribution to Security of Supply

- Optimum operation in one direction only
 - Therefore will only operate twice a day instead of 4 times
 - Generation lasts ~ 2-6 hours (depending on tidal range)
- Flexibility
 - Shift generation peak by 1-2 hours at expense of energy output (depending on tides) without additional CAPEX
 - Better match demand requirements
 - Greater flexibility & output from additional basins but very high CAPEX cost



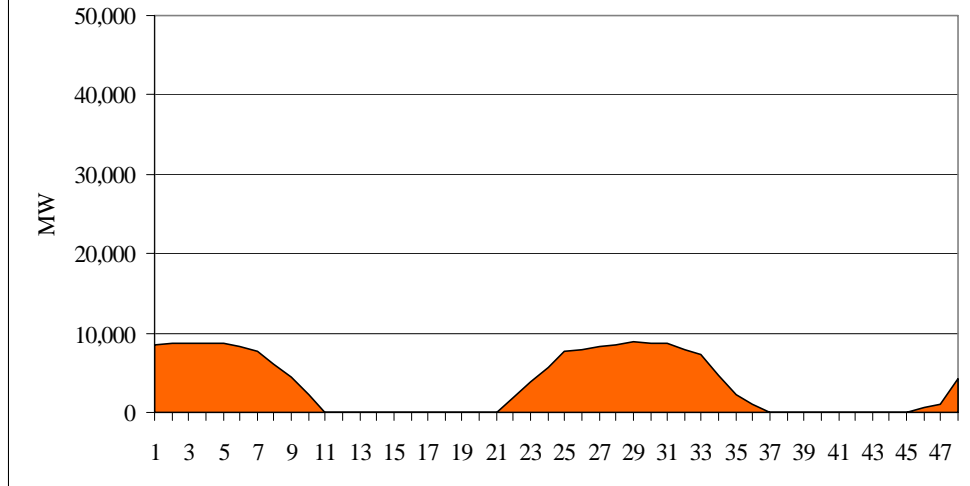
Barrage Contribution

- Dependent upon level of generation at peak demand
- Strongly influenced by tide cycles (springs ~40GWh/day, neaps~15GWh/day)



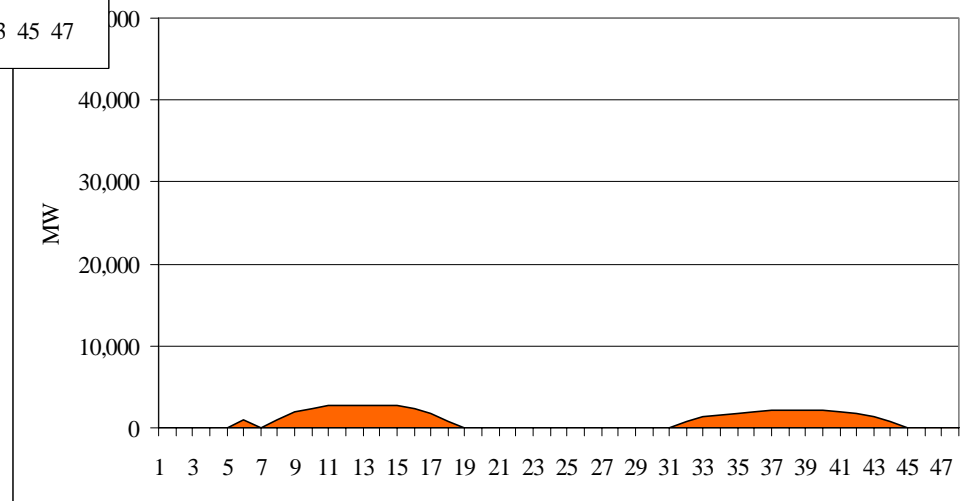
Barrage Generation

Severn Barrage Output
Spring Tides



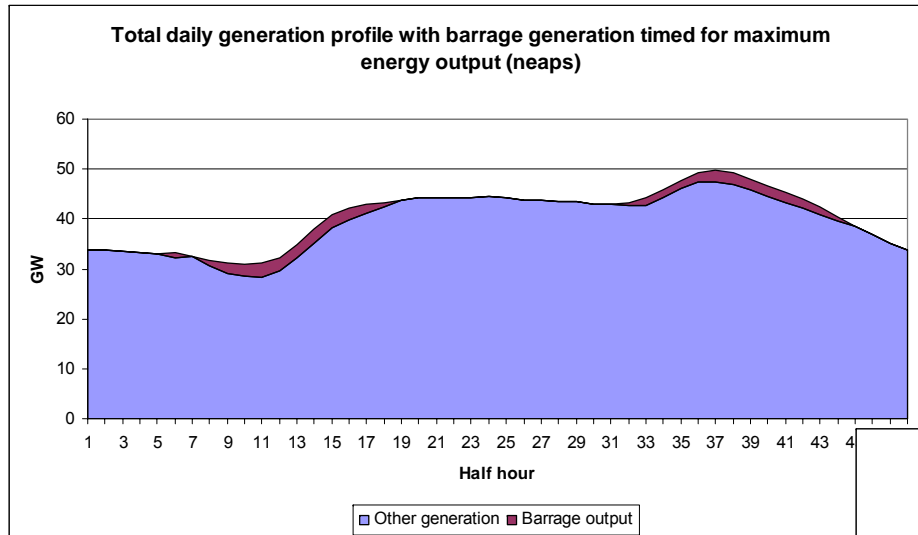
Spring Tide Peak
~9GW

Severn Barrage Output
Neap Tides



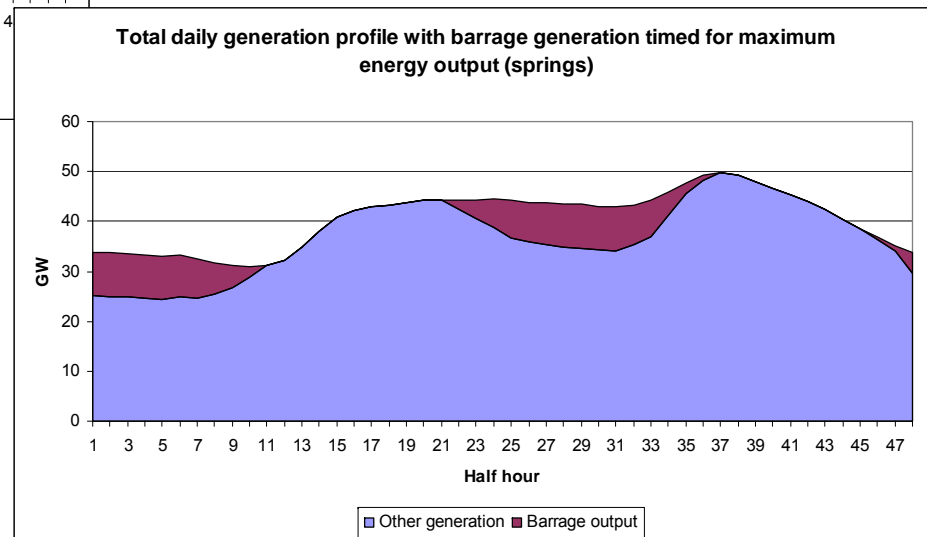
Neap Tide Peak
~2GW

Barrage Capacity Contribution

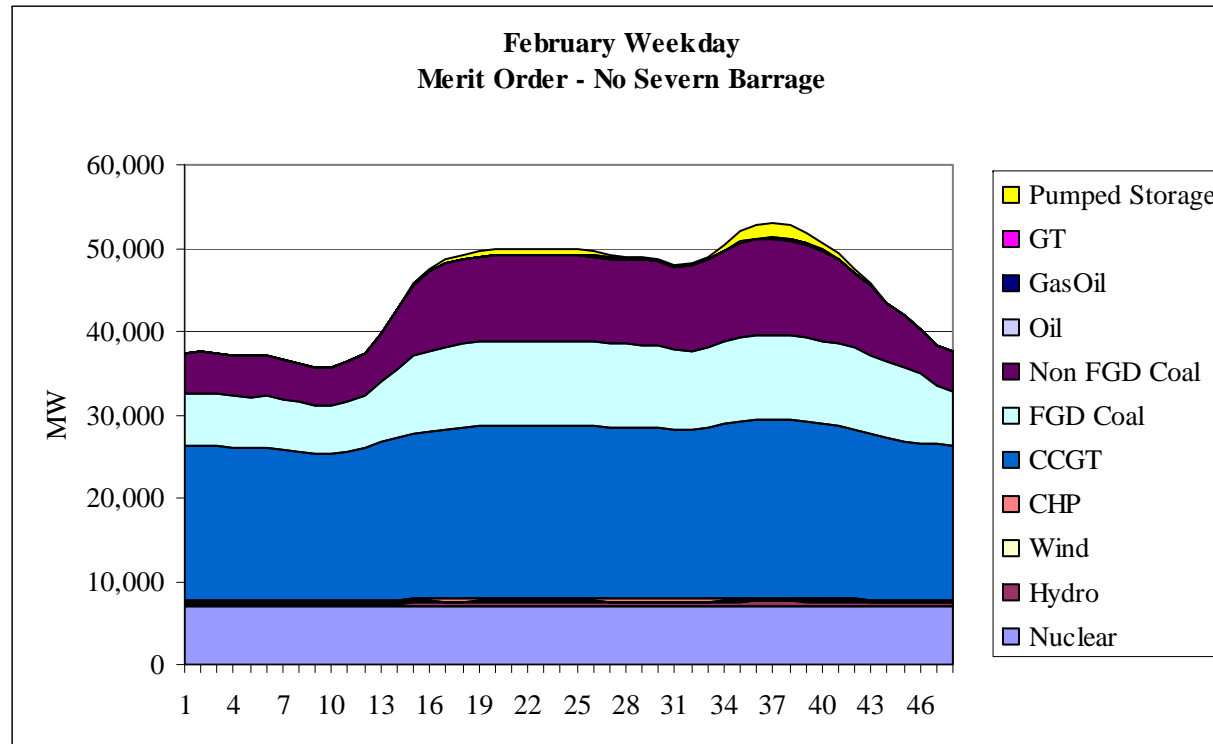


~2GW contribution at peak

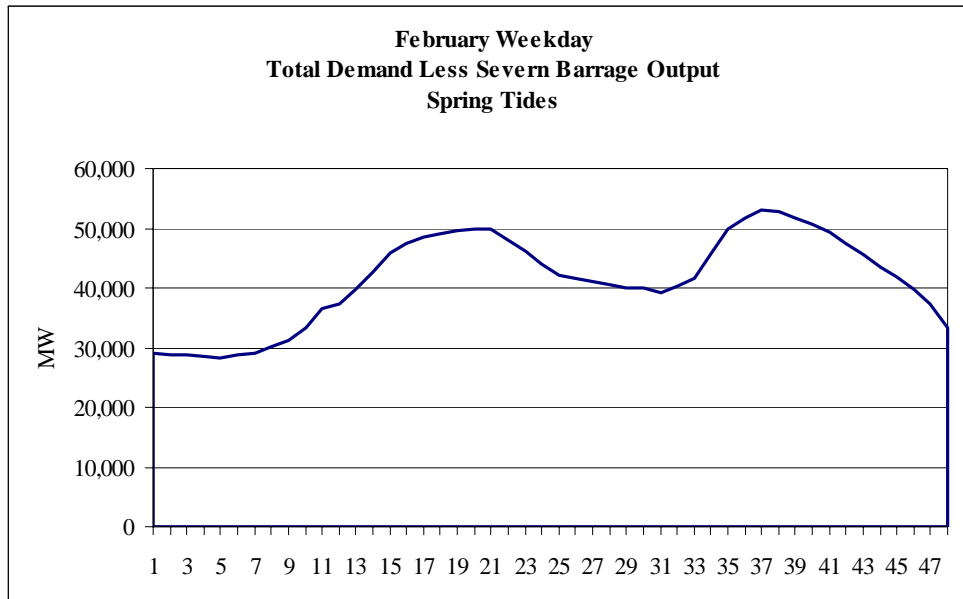
~0GW contribution at peak



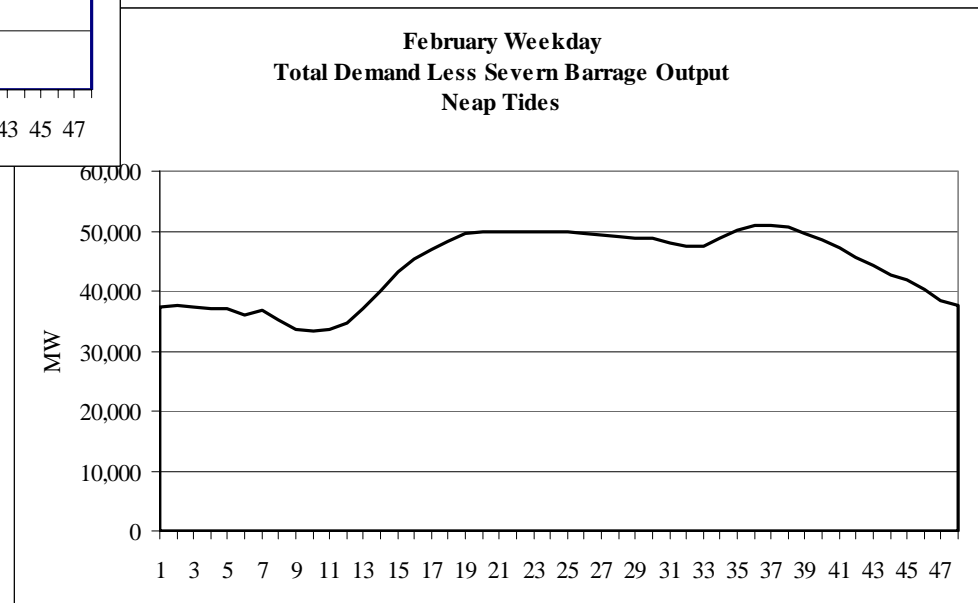
February Merit Order Generation



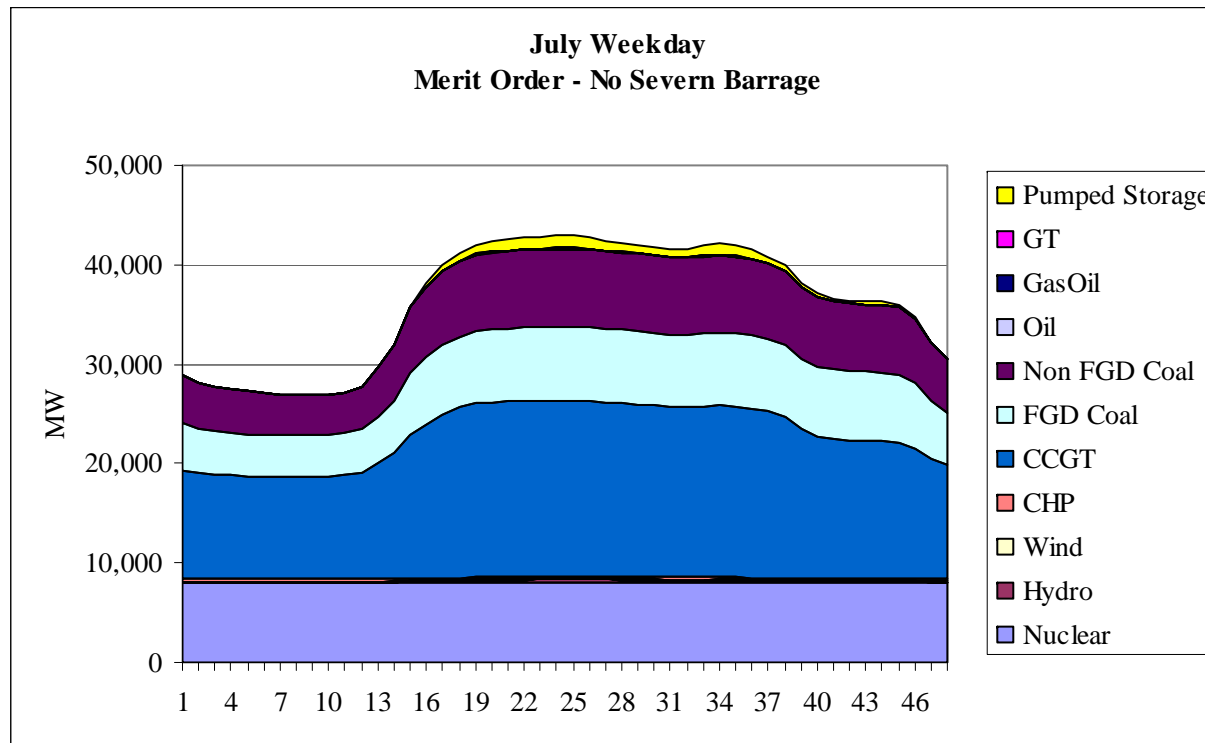
February Generation Excluding Barrage Output



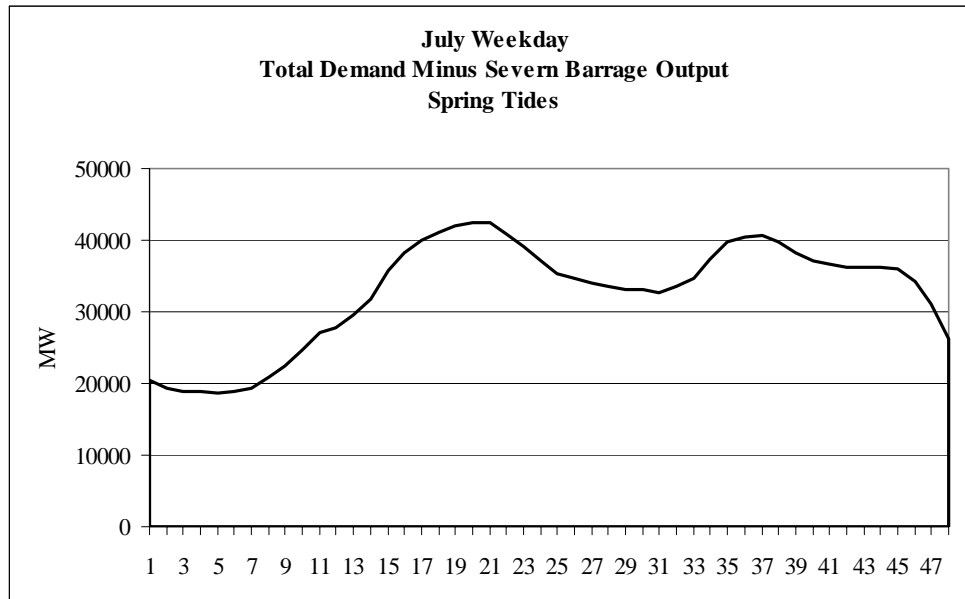
Max system
capacity change
required in any
half hour =
3.5GW



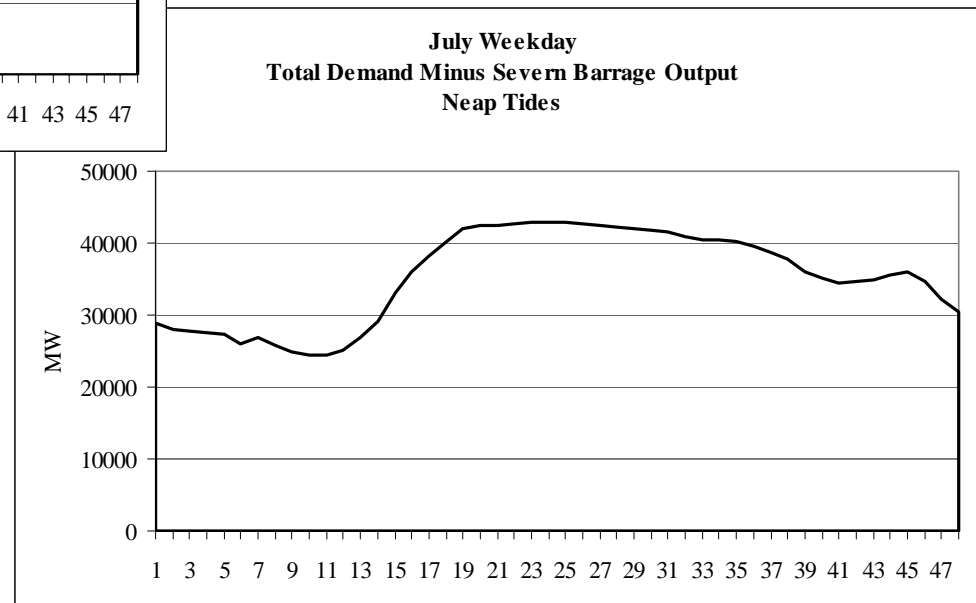
July Merit Order Generation



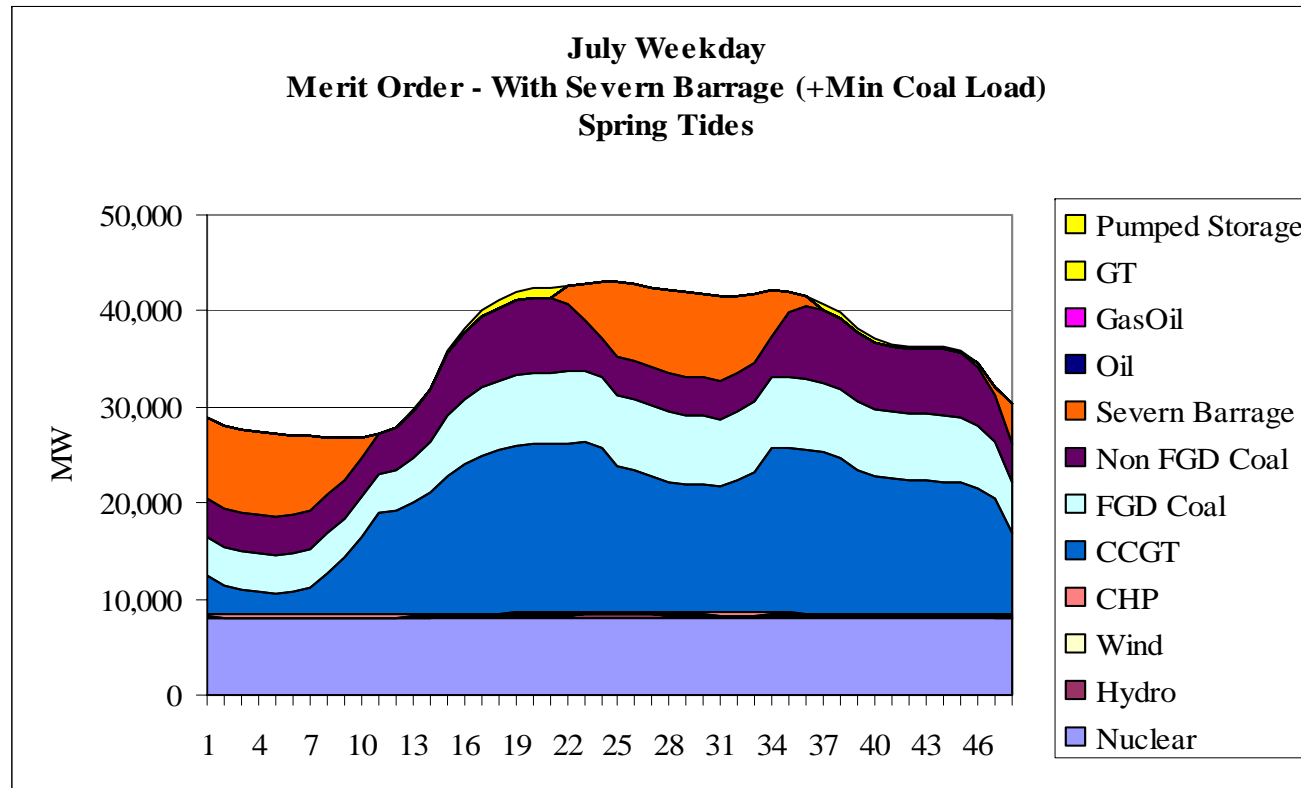
July Generation Excluding Barrage Output



Max system
capacity change
required in any
half hour =
3.8GW



Merit Order Generation including Severn Barrage

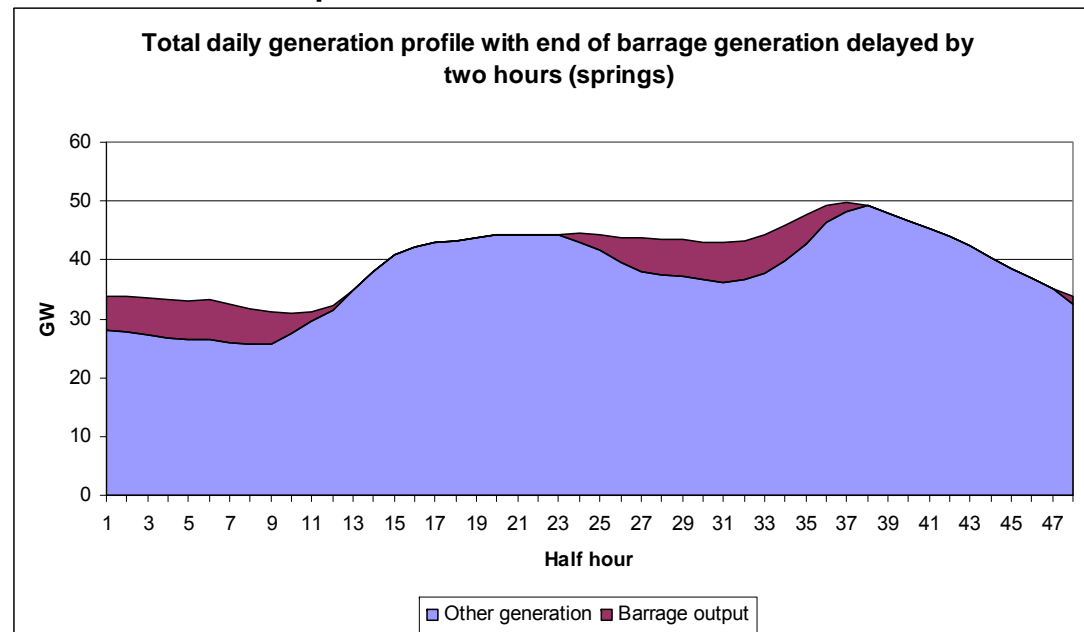


Includes assumptions on minimum coal loading – but system likely to require higher levels of CCGT operation for stable generation overnight and therefore Barrage output likely to be constrained

Impact on CO₂ emissions from conventional plant

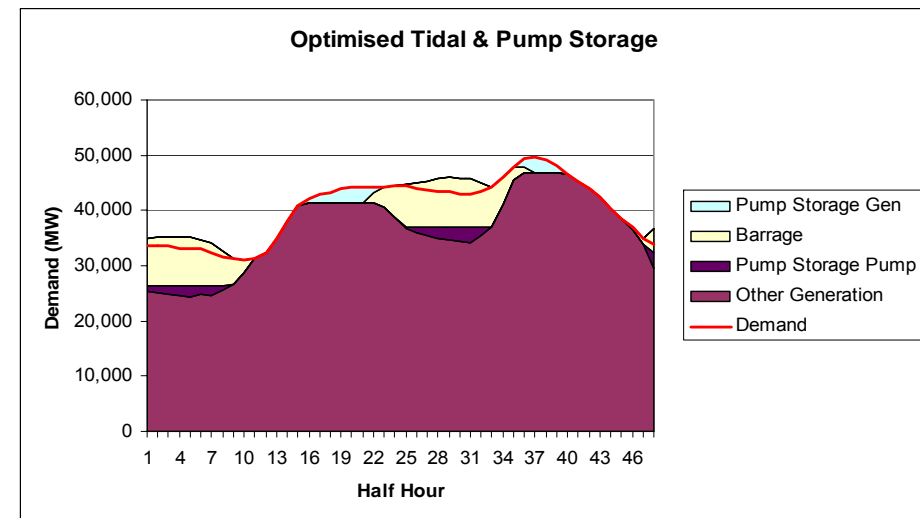
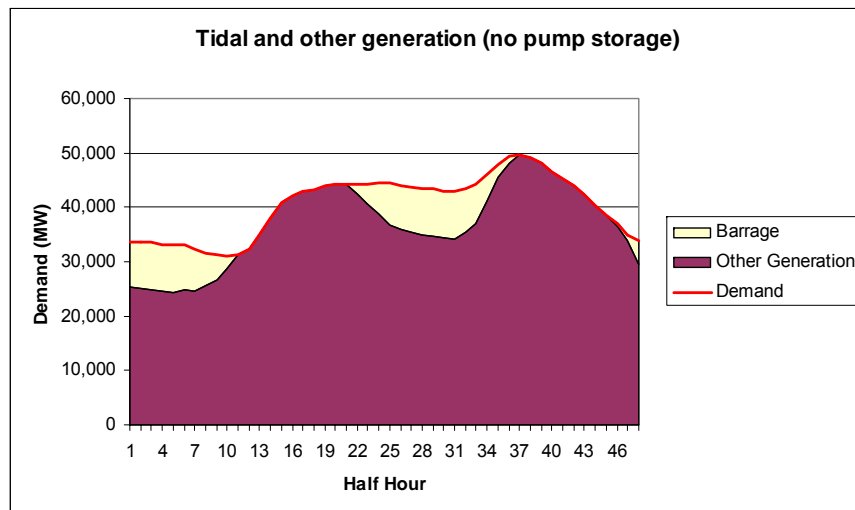
Barrage Capacity Contribution

- Flexing generation to meet peak?
 - Delay start by ~2 hrs, but lose 25% energy
 - Potential to increase barrage generation at peak from 0 to 1.5GW at Spring Tides
 - Capacity value only ~15% of “nameplate”
 - Increases cost per kWh



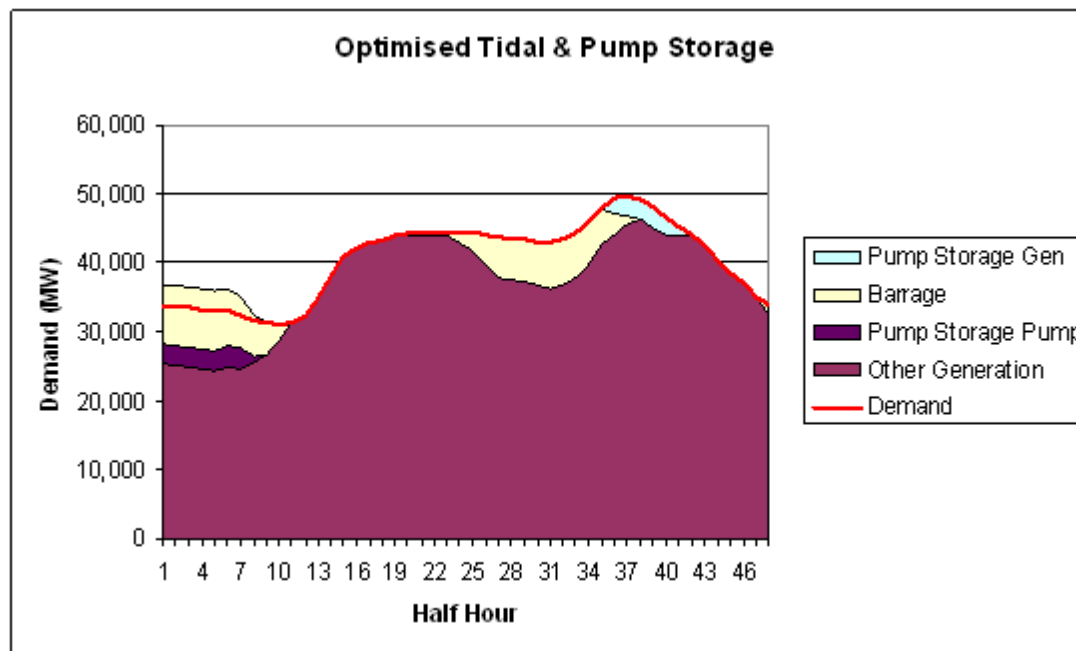
Barrage Effects on the Electricity System

- >16% of energy requirements in GB
 - Likely to require significantly more flexibility across system as a whole
 - 3GW of pump hydro storage
 - Pumped Storage is currently well utilised to provide system services, which will need to be provided elsewhere



Barrage Effects on the Electricity System

- Look to optimise (flex barrage operation to match demand)



Barrage Effects on the Electricity System

- Barrage will have significant impact upon generation profile of conventional plant
 - But pump storage and flexing barrage output
- Barrage will greatly reduce over night generation requirements
 - Will increase magnitude of morning ramp and require flexibility throughout the day (spring tides)
- As a whole, system would require a greater degree of flexibility than currently required to meet existing demand
 - Likely to increase costs
 - Impact on emissions
 - Impact of wind of requirement for flexibility

Summary

- Barrage is high costs alternative to conventional and other renewable sources (~2 -3 times more expensive)
- Timing of the tidal cycle means that the contribution to Security of Supply <<9GW
- Shifting the generation pattern can increase this to about 1.5GW but with a cost of 25% of energy produced
- The timing of the generation exacerbates current system operation problems in terms of increasing requirements for flexibility and response and increases CO₂ emissions

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