The Environment Council

Sustainable Development Commission Tidal Power Stakeholder Workshop

29th March 2007 - Cardiff

Transcript

Date of issue: 23rd April 2007

212 High Holborn
London WC1V 7VW
tel 020 7836 2626
fax 020 7242 1180
email info@envcouncil.org.uk
www.the-environment-council.org.uk

Registered Charity Number 294075 Certificate of Incorporation Number 2004003 VAT Number 577 8121 11

NOTE ON THIS WORKSHOP REPORT

This transcript was produced by The Environment Council, based on the wall record taken on flip charts during the course of the meeting. It has been produced as a record of the outcomes and outputs of the meeting and to inform non-attendees about the proceedings and discussion.

While the meeting flipcharts serve as a vital record and aide memoire for the participants, they are inevitably quite cryptic in places. This transcript is based upon the flip chart records and so its meaning may not be clear to people who did not attend the meeting. Please contact The Environment Council for clarification if necessary.

Text in italics indicates notes on the process of the meeting.

Produced by The Environment Council

If you have any comments or queries regarding this summary report please contact:

Name: Winsome Grigor
Direct Line: 0207 632 0108
E-mail: winsomeg@envcouncil.org.uk

Registered Charity Number: 294075

The Environment Council

SDC tidal power workshop – Cardiff, 29/03/2007

Please sign in

Name	Organisation
George Ashworth	Severn Estuary Partnership
Natasha Barker	Severn Estuary Partnership
Rob Niblett	Gloucestershire CC
Steve Hill	The Environment Council
Diane Warburton	Shared Practice (evaluator)
Hywel Matthews	WAG-EPC
Clive Baker	
Olivia Errey	The Environment Council
Helen Phillips	SDC Wales
Karla Hill	SDC
Phillip Chapman	Wales Office
Roger Barker	Trinity House
Chris Grieve	The Environment Council
Catherine Butler	Cardiff University
Phil Elliott	Environment & Heritage Services (NI)
Maggie Hill	Countryside Council for Wales
Richard Howell	Environment Agency
Nigel Clark	BTO
James Craig	AEA Energy & Environment
Ian Lewis	MCA
Rob Iles	Eng. Heritage
Mike Valt	Sharpness Dock Ltd
Garry Strickland	Sharpness Dock Ltd
Mark Russell	BMAPA
Miles Willis	Swan Turbines
Morgan Parry	WWF Cymru
Trevor Auld	ABP
Peter Kydd	Parsons Brinkerhoff
John Callaghan	Carbon Trust
Alun James	WAG
Craig Frost	SWRA
Stuart Anderson	Conwy CBC
Maeve O'Keeffe	The Environment Council
John Redman	Severn Tidal Power Group
Erica Sutton	The Environment Council
Tom Woolley	The Environment Council
Anne Savage	Entec
Tamsin Watt	Entec
Martin Brough	RNLI
Andy Cummins	SAS
Neil Crumpton	Friends of the Earth Cymru
Peter Hall	Bristol Port Company
Adrian Jowitt	Natural England
Mervyn Bramley	University of West of England / RSA
Mike Johnson	Goucester Harbour Trustees

Name	Organisation
Nick Murphy	E.ON
David Kerr	Institute of Civil Engineers
Caroline Season	Defra
Glyn Jones	Welsh Federation of Fishermen
Peter Jones	RSPB Cymru
Dave Brown	Dawson Construction Plant Ltd.
Peter Fraenkel	Renewable Energy Assoc. & Marine Current Turbines Ltd.
Jim Poole	Cynnal Cymru
Jonet Waldock	South West RDA
Peter Ullman	
Ian Trebinski	E.OS
Mark Lloyd	Fisheries & Angling Conservation Trust/Anglers Conservation Assoc.
Ben	The Crown Estate

Outline agenda

- Welcome and introductions
- Overview of today
- Meeting other stakeholders
- Presentation on tidal technologies
- SD aspects of different technologies
- Government roles in supporting tidal power
- Presentation on concepts for the Severn
- Stakeholder views on concepts for the Severn
- Conditions for acceptability for tidal power
- Overview of the day and evaluation
- Closing remarks from SDC

Working agreements

- One person speaking at a time
- Respect the views of others
- Mobiles etc. switched off
- Non-attribution

Meeting other stakeholders - Gives & gets exercise

Participants were asked to introduce themselves to each other within their groups and record one key thing they brought to the day (Gives) and one key thing that they would like to take away from the day (Gets).

Gives	Gets
Blue	
Knowledge of shipping movements in the Severn	Impact of barrage on navigational safety

Gives	Gets
Knowledge of the Severn from a mariners viewpoint	Meet new contacts and gain a better understanding of stakeholders views
An open mind in listening mode	Understanding of other views on the benefits or disadvantages of tidal power
Knowledge of navigational safety and shipping	In depth understanding of the projects
Bring to the table safety of all mariners	Support for a detailed reappraisal of the Severn
Knowledge of UK renewables industry; support of marine renewables	General information to help form policy; specific information on Severn barrage
Experience of power generating design and construction	An understanding of tidal power. - Severn barrage proposal - Views of different stakeholders
Local authority perspective and SEP view	A greater understanding of the barrage
Knowledge of ecology. Concern about climate change	An update of peoples views and a challenge to my own
A background in environmental risk research questions from a social science perspective	Wider range of perspectives; understanding of drivers of economic development
Knowledge of the Severn Estuary and effects of tidal power devices	
Knowledge of the commercial operations of ports in the Severn Estuary	
Green	
An open mind	Understand other's views
Knowledge of industry	To know a bit more about tidal power in the South
The governments recognition and desire to pursue renewables including tidal/wave power to meet the challenges of climate change and security of supply	Awareness of SEP services to coordinate SE stakeholders views
A knowledge across renewable energy technologies	More information impacts/benefits on the barrage versus other tidal energy
A view on the poor level of public understanding of the issues of tidal power and sustainability as a reasonably informed engineer and environmentalist	Better understanding of the underlying economic, environmental, social, technical facts and arguments related to tidal power in the South West
Perspective of an existing offshore developer	Gauge views of stakeholders on tidal power & the barrage in particular
To guide you through the day	Hear a wide range of views from a wide range of stakeholders

Gives	Gets
Movement of commercial vessels in the Severn	Better understanding of the issues, potential and development process
Conduit to S.E. stakeholders. Info and LA views (14)	Assurance to continuous commercial activity above the barrage
Potential access to broad spectrum of civil society	Understanding of stakeholder views
Awareness of commercial shipping activities on River Severn	Tips on how to access that spectrum (of civil society)
Views of the SAS members and some of the water sports community	Information & assurance that ports & commercial activities are recognised
Red	
Process curiosity	Understand views & types of technology available
Academic input (multidisciplinary)	Contact & information on environment balance
User of waterways statutory harbour authority	Views of other stakeholders & help debate on technical aspects
Background on R & D – Esp. tidal stream technology	Understand views on range of tidal power schemes
Understanding of all energy technologies & practicalities	Understanding views
Views & concerns of anglers	Vision of truly sustainable tidal power
Experience of licensing tidal turbine & risk assessment	ID of areas of conflict & possible mitigation
Views of SW England contribution to SW strategies	Better understanding of range of views
Represent technology & project developer involved in tidal stream	Would like to understand individual views on the industry & how these can be used to help it develop more efficiently
Concept on continuous power development	Viability of concept on continuous power development & surrounding issues
An NGO view of energy in general and Severn Barrage in particular	Awareness of opinions & reasons of others
Yellow	
Listening mode	Any evidence/argument that might seem to override concerns i.e. ecological and environmental impacts
Provide some thoughts and comments on small ports/communities view of tidal power proposals	Clarity of government policy

Gives	Gets
- Desire for renewable energy development - Open mind re: barrage/other technologies	Faces to names of S/H
- experience with tidal power development Eagerness to proceed on towards commercial development	Reassurance that proposals really are sustainable and proven – that information gathered is accurate
Knowledge of the energy policy implications of a Severn Barrage & other marine technologies; and concern i.e. the ecological impacts of, in particular, the principle barrage proposal	Informed comments on pros and cons
South West RDA have a focus on renewable energy & an interest in the potential of tidal energy in the South West	Keen to understand stakeholder concerns
Developer of tidal stream turbines – unique 'hands-on' experience. 30 years in 'Renewables'	To gain further understanding about tidal power
Hopefully a fairly open mind	Hope to gain a further understanding of main issues and the technology
Knowledge of Welsh fishing industry. Represent nearly all Welsh fishermen	- Get information on the various options for energy development of the Severn - Alternatives to a barrage - Potential impact/benefits of any developments
An open mind; a willingness to discuss pros & cons without preconception; a desire to protect the environmental concerns in the Severn	South West RDA to understand the views of other stakeholders
Orange	
Overview of a wide range of environmental issues raised by tidal energy	Overview of Severn & national tidal power intentions
Practical seafarers & navigational knowledge	Strategic context for consideration of individual tidal energy proposal
Understanding of nature conservation issues around the Severn	Broader understanding of strategic plan & impacts
Unsure = Short notice. Possible comment on needs/impact on coast	Better understanding of tidal power nationally
Expertise of environmental effects of tidal power especially birds	A balanced view of how to go forward in SD and implementation terms

Gives	Gets
Knowledge of Shoots Barrage proposal – an alternative to Barrage option in the Severn	Better understanding of other issues around tidal power in general
1 – Flood victim experience ("Towyn = New Orleans"). 2 – 'Ecostar' principle energy capture obtainable by storage for tidally augmented release. 3 – The Resurgen Project, pilot offshore tidal impoundment	1 – Meeting people. 2 – Getting Ideas. 3 – Planting ideas
Severn Estuary Partnership (SEP) perspective on major issues	Information on benefits of major scheme to inform SEP SAC

Points of clarification following presentation by Entec

- There is a difference between energy and electricity
- There are different barrages, not only one
- UK tidal stream resource is large compared to the rest of the world; the UK could be a global leader

SD aspects of different technologies

Groups of participants were asked to consider the sustainability (Environmental, Social, Economic) aspects of three tidal power technologies. Each group had the opportunity to visit each station and contribute. Entries marked with a star (*) indicate notes made by the first group to visit any one particular station.

Tidal barrages

TIDAL BARRAGES – ENVIRONMENTAL (1 of 2)	
Benefits	**Disbenefits**
* Less pressure for land based windfarms	* Man-made influence on natural resources with unknown effects
* Less pressure for offshore renewables	* Tidal range altered upstream but still present
* Long term climate change amelioration	* Loss of intertidal area
* Virtually limitless, free resource (energy)	* Wildlife impacts
* Renewable energy generation potential to mitigate climate change	* Damage to biodiversity interest
* Levels of pollution reduced (long term)	* Impacts on resident biodiversity
* Significant CO_2 emission reduction in one location	* Impacts on migratory fish (salmon, eels etc.)
* Low carbon technology	* Initial construction & resultant effects/disruptions

TIDAL BARRAGES – ENVIRONMENTAL (1 of 2)	
Benefits	**Disbenefits**
* Low carbon energy	* Ship-locks needed. Fish life needs protection (trout runs etc.)
Electricity demand close to barrage	* Change of geophysical environment
Less dynamic and turbid water environment, benefiting some invertebrate species and, possibly, dependent bird species	* Appearance impact upon sea/landscape
Maximises energy output from tidal range	* Loss of 'unique' habitat present due to tidal scour
If sited SSI or SAC exists may protect area further? Sited sensitivity could be viable. Reduction in CO_2 from energy production	* Reduction of migratory bird populations
	Not easy to remove
* Large scale potential to capture the public imagination for renewable energy	Once barrage is constructed the natural balance will never be restored, even after barrage is removed
	EU birds/habitats designations would be overridden in the Severn
* Tidal barrages can be located to optimise balance between energy & environment	Redirection of intertidal habitats and saltwater marsh environment in the Severn
	Non sustainable! Silts up
* Potential for some positive environmental impacts with reduced tidal scour	SG/T water -> "fresh"/sewage pit
* Significant opportunities for mitigation in large estuaries	Likely to have a large impact on historic environment resource in construction
	Loss of unique environment in areas with big tidal ranges
* Potential for flood defence upstream of barrage	Visual impact may be large (but less than wind turbines!)
* Drainage – two-way barrage (only). – Gives long term flood defence. – Prevents sedimentation	
Flood defence benefits	* Environmental impact of materials e.g. cement aggregate – extraction & production
	* High resource (aggregates) demand
	Huge disruption to environment in UK and other countries as vast quantities of materials are sourced

TIDAL BARRAGES – ENVIRONMENTAL (1 of 2)	
Benefits	**Disbenefits**
	* Impeded lowland drainage
	* Limited scope for mitigation
	Problems with sea defence downstream
	Highly inefficient use of tidal resource
	Blocks flow of sewage, creates increased flood risk downstream

TIDAL BARRAGES – ENVIRONMENTAL (2 of 2)	
Benefits	**Disbenefits**
Comparisons between barrages can be misleading	* Seabed, silting effect on existing navigable channel
	* Salinity changes
* Saves CO_2	Estuarine modification is (globally) threatening ecosystem services
* 'Cleaner' form of energy than fossil	* Reduces feeding areas for wading birds
* Reduced demand for fossil fuels	* Possible habitat loss. Impact on water quality (+ or - ?)
* Possible (it may not replace others) contribution to carbon-free electricity	* Sediment
* Climate change mitigation	Sediment + disruption -> Complications. ? on feasibility with sediment at potential site
Reduces CO_2 via infrastructure impact	Loss of intertidal habitat + estuary landscape
* Flood protection	Decommissioning?
Flood protection to estuaries & rivers	
Creates a sea wall protecting marinas from storm damage	Regional scale impact – Significance -> large scale impacts
* Improves water quality	* Changing water flow
* Protects wildlife	
	* Underwater noise + vibration
* Reduces 'harshness' of environment (is change bad?), changes ecosystems, new species	* High impact, major modification of natural/semi-natural ecosystem (local)
Creates a new environmental niche	

TIDAL BARRAGES – ENVIRONMENTAL (2 of 2)	
Benefits	**Disbenefits**
	* Further pressure on migrating fish species
	* Significant onshore development (cables etc.)
	* Construction traffic impacts. Pollution, lorry movements
	* Visual impact
	* Increased lighting:- effect on navigating at night
	Difficulty in predicting environmental impacts on ecosystem, therefore we must adopt a precautionary approach
	* Traffic density in local area near barrage. Collisions may result in incidents of pollution
	* Demand/source of aggregate/fill etc.
	* Carbon cost of building technology?
	* Climate impacts of associated – infrastructure – development significant
	Sewage/pollution -> stop natural flow

TIDAL BARRAGES – SOCIAL (1 of 2)	
Benefits	**Disbenefits**
* Flood protection	* Visual impacts
	* Impacts of the landscape due to structure & associated development
100+ years of predictable power – preferred by grid – has greater value	
Indigenous energy = helps stabilise/protect. Cost to consider	* Jobs – negative effect on existing local infrastructure (e.g. ports)
One less nuclear power station	
	* Displacement of water transport to roads?

TIDAL BARRAGES – SOCIAL (1 of 2)	
Benefits	**Disbenefits**
Raises local awareness of sustainable energy issues	
	Higher energy costs than 'brown' electricity. Fuel poverty could increase
Sustainable development overall	
	Destroys the Severn Bore
Gain in amenity!	
	* Terrorist target
* Employment	
	* Restriction of leisure activities & transport generally
* Recreational opportunities	* Impacts on recreational fishing
Recreational navigation easier	
	Loss of amenity
Benefits to shipping – tidal harbours & channels improved due to higher water levels	Reduced quality of well-being, health and access for locals? (loss of natural landscape)
* Transport links	Adds development pressure in communities near ends
Visual impact -> pride -> something great to look at	Construction -> Local impacts
Major engineering feature therefore major visitor/tourist attraction	
	Back up generation needed (on/off)
	UK SD hypocrisy, damage to protect site
	How can the views of future generations be represented?
	Conflict with our sustainable development commitment -> changing environment for next generation
	Should precautionary principle apply to preserving the current or living with the future?

TIDAL BARRAGES – SOCIAL (2 of 2)	
Benefits	**Disbenefits**
* Flood risk alleviation	* Potential flood risks due to changed geomorphology
* Potential flood risk benefits	

TIDAL BARRAGES – SOCIAL (2 of 2)	
Benefits	**Disbenefits**
* Two-way only: Gives really long term flood risk alleviation AND economic optimisation	* Aesthetic impact and knock-on effects to land/property values
* Recreational potential of water area	* One-way: Flood/drainage issues set against economic issues
* New recreational opportunities	
	Very expensive means of flood alleviation
Recreational potential to upstream lake	
* Job creation construction, operation & maintenance	* Increase in people movement = increase in CO_2 emissions
* Local employment during construction. Training of local unskilled youths	
Job creation	* Increased carbon usage due to developments around barrage
* Jobs during construction	* May drive C intensive economic development
	* Impact on inland shipping/logistics network & tourism
* improved amenity value in some areas, mudflats -> water & potential positive impact on property value	
	* Lack of local involvement in construction & operation
Public involvement in mainstreaming of renewable energy	* Ability to house construction workers/disruption to communities
Opportunity for Wales/SW/West to act as renewable flagship	* Disruption caused by scale of construction project
* Integrated designs can benefit communities transport links	Destroys public enjoyment of a purely natural environment
* Potential transport links	* Loss of existing recreational benefits (salmon fishing)
* Opportunity for improved transport links	
Possible new transport links	Adverse impact on port-related/transport related employment
Potential to enhance rail transport network or other transport links thus reducing pollution from roads	

TIDAL BARRAGES – SOCIAL (2 of 2)	
Benefits	**Disbenefits**
	Mega projects may distract attention from need to develop other technologies
Wealth creation e.g. increased land value	
	Extremely peaky power – bad grid integration. 7GW for 4 hours, 0GW for 8 hours
Increase in tourism	
Schemes that require no reinforcement of national grid benefit society	

TIDAL BARRAGES – ECONOMIC (1 of 2)	
Benefits	**Disbenefits**
* Tourism	Maintenance costs. Unknown costs of sedimentation etc. Lifespan? Increased liability for future generations
* Flood protection	Inhibits other tidal technology developments (e.g. lagoon)
	* Detracts investment from newer technologies (modular)
* More work for consultants, ecologists	
* Supply chain (aggregates etc.)	Requires back up generation
Construction etc. jobs	
Safe water for recreational water users = jobs	* Managed flow of shipping controlled by barrage not ports -> less freedom of business
	* Costs of planning + safety to ship owners
Potential for continuous power generation	* Increased costs to commercial shipping -> access -> assessment of risk to ships (insurance)
* Long-term economic benefits – uncertainty	Reduces available drafts (depth) for shipping through siltation process
Integration of other renewables	* Decreased access through barrage – number + size
	* Ship delays, locks
Enables economic growth in low carbon economy	Provision of ship locks etc. Reduced water levels above barrage for commercial shipping

TIDAL BARRAGES – ECONOMIC (1 of 2)	
Benefits	**Disbenefits**
Growing/emerging business clusters	* Concentration of economic activity in SE Wales/Bristol area at expense of elsewhere
* Attracts development either side of barrage	
	* Small, sustainable businesses based on environment will be threatened
Proven technology, low economic risk	Effects on other marine activities – aggregates, fisheries etc. up/down stream
* Reduce political power of existing suppliers -> no one industry has dominant control	* Land values of fishery owners upstream -> (from lack of fish)
Some barrages too big for one UK utility – requires consortium	
Could be used conjunctively to even out supply to grid	
* No fuel costs	
Stable fuel price	
* Increased access by shipping (upstream)	
* Secure energy source – not reliant on global politics	
National security of avoiding imported energy	

TIDAL BARRAGES – ECONOMIC (2 of 2)	
Benefits	**Disbenefits**
* Construction costs	Wildly overpriced power at about 22p/Kwhr
V. competitive with other renewables	Requires Massive public subsidy, according to DTI spokesman Lord Sainsbury
	One-way generation: value decreased by 30% with 1m of sea level rise
* Secure energy source	
Aids security of energy (electricity) supply	Diverts funding from other more sustainable renewable energy
	* Construction costs

TIDAL BARRAGES – ECONOMIC (2 of 2)	
Benefits	**Disbenefits**
* Mitigation of climate change costs	* Diversion of transport/logistics links effecting smaller communities & businesses
Stern CO_2 impact on economy	
	* Ports impacts
* Long term energy resource	
Long term generation once built	Exclusion of recreational and commercial use of area. No power generation during 'slack water'?
Reliable & predictable	The owner of the worlds only large barrage – EDF – has preferred to invest in M.C.T's tidal stream turbines
Low running costs	
Long term generation	Huge pulses in power generation creates a problem for grid
Two-way generation could multiply by factor of four!!	Cost of decommissioning is huge and often overlooked
* Flood defence upstream	* May displace more cost effective C reduction (e.g. energy efficiency)
	* Diversion of funds from other projects
* Wealth creation, jobs. Increased skills base	
	Initial cost v high
Port benefit if located u/s of ports – can improve navigation to Sharpness	* More costly to repair/refit with greater impact due to permanence
	* Potential high cost of energy compared to other technologies
	* Impact on other users, ports, shipping, fishing

Tidal stream

TIDAL STREAM – ENVIRONMENTAL (1 of 2)	
Benefits	**Disbenefits**
CO_2 reduction	* Unknown risks
* CO_2 reduction	Long term effects hard to track
CO_2 abatement	Connection to grid risks/impacts
1. Meet renewable targets reduce CO_2. 2. Sustainable resource	
	None significant
Navigational marking	

TIDAL STREAM – ENVIRONMENTAL (1 of 2)	
Benefits	**Disbenefits**
	Scour sediment movement
Low visual impact	
	Viable resource areas tend to be in environmental designated areas (high energy = biodiversity = design)
* Minimal concrete requirement relative to barrage	
* Probably very benign indigenous renewable energy	* Hazard to shipping, impact on 'flight path'
Comparatively low environmental impact	Ship to device, ship to ship
Lower energy/material use in construction than barrages	
Low impact	Construction impacts
	Construction impacts
No take zones encouraging more sustainable fishing stock	
	* Effects on mammals –Noise - Collision
* No impediment to fish migration	Anti-fouling
Should not include dredging	Pollution control difficult
Can be removed if problems arise	

TIDAL STREAM – ENVIRONMENTAL (2 of 2)	
Benefits	**Disbenefits**
* Carbon-free electricity generation	* Disruptive fish stocks?
Renewable power – displaces fossil fuel	
* Carbon-free electricity generation, mitigating impacts on global warming	* Potential problems for navigation and fishing
* Renewable power, reduction of use of fossil fuels	
* High ERoEI = big potential contribution to fossil fuel substitution	* Potentially may have a negative visual impact
* 'Free' energy, decrease in CO_2 footprint	
* Renewable energy potential for climate change mitigation	* No benefit for flood alleviation due to tidal range
* Not visually intrusive	* Direct environmental impact in case of failure/breakdown

TIDAL STREAM – ENVIRONMENTAL (2 of 2)	
Benefits	**Disbenefits**
Less pressure for on land windfarms	May disrupt sharks & rays due to EMF etc.
	Under-water electrical cable
* No-go fishing zones benefit fish stocks	
Exclusion zones potentially create 'marine reserves'	Construction & maintenance disruption to environment
Base can form artificial reefs	* Potential for some negative impact during construction
* When in operation, reduced likelihood of disruption to fish etc.	* Potential changes to immediate vicinity currents, sediments
* Need V. large scale deployment to have significant effect therefore major environmental impact	Change in tidal energy downstream e.g. impact on sand banks
* No disruption to birds & minimal disturbance of habitats	
* No/limited impact on above water environment e.g. birds	* Need V. large scale deployment to have significant effect therefore major environmental impact
* Navigation? Fish kill/migration?	
	* Navigation? Fish kill/migration?
* Much less environmental impact than barrages & lagoons	
* Less impact than barrage solution	* Potential for 'collision' with marine mammals
* Minimal impact on flora & fauna	
	Many devices needed to make significant contributions to UK electricity output
* No significant impact on tide height & thereby flood risk	Need many devices to generate significant power

TIDAL STREAM – SOCIAL (1 of 2)	
Benefits	**Disbenefits**
* Energy security for UK	Public perception – site specific
Modular – less risk (security)	
	Public over-estimation of resource – disappointment
Predictable power	
Opportunity to use phased tides around country = constant generation	Search and rescue within farm, hazards/risks within area
Public perception on back of wind power	
	Excuses, nimbyism on land based renewables

TIDAL STREAM – SOCIAL (1 of 2)	
Benefits	**Disbenefits**
* Good practice UK leadership	
Positive community leadership	Visual impact tower tops
Political gain	
	* Displacement user of the sea
Maintenance jobs	Effects of sub-surface structures on recreational/fishing
	Restriction to sailing/angling
New industry with massive growth potential (UK leader?)	
	* Human risk - navigation
Warm feeling locally	
	Potential health and safety issues in maintaining and servicing
Reduced commercial fishing	
Exclusion zones = artificial reefs	
Awareness of green issues	
* Tourism & education	
Improved fish stocks?	
Low visual impacts	

TIDAL STREAM – SOCIAL (2 of 2)	
Benefits	**Disbenefits**
* Curiosity -> tourism 'green' aura	* Disruption during construction
* Job creation & 'feel good' factor of renewables	
* Jobs in developing new industry	* May exclude marine users from areas where apparatus is sited
* Wave creation opportunities & maintenance	* Potential disruption of waterborne activities in the area, e.g. fishing, navigation
* Potential new UK industry – jobs – wealth; export potential!	
	* 'Feel-good' factor could create the illusion of 'problem solved'
* People more aware of need for renewable energy	
* Awareness raising of energy & climate change mitigation	* Common positioning requirements often impact shipping routes therefore increased CO_2
Local jobs will be in remote areas where greatest need	Lack of flood defence benefit

TIDAL STREAM – SOCIAL (2 of 2)	
Benefits	**Disbenefits**
* Minimal impact on community/area in terms of pollution (e.g. noise)	* High risk to shipping as their undetectable
* Little disruption during operation	
* Area for academic research	
Modular technology – rapidly deployed once technology has matured	

TIDAL STREAM – ECONOMIC (1 of 2)	
Benefits	**Disbenefits**
* New industry & potential for wealth creation, jobs	* Positioning & deployment is costly in time, money & CO_2
* Large export potential	
* Potential job creation – maintenance etc.	* Economically risky; maintenance expense unknown; no track record for equipment; expense of power?
* Job creation seed-stage industry	* May further reduce an already small area in which to fish around coast of Wales (Cu. 71% designated as SAC etc.)
Scope for increased growth & learning to produce efficiencies	* Conflict to some degree with other interests e.g. shipping, fishing
* Maintenance/renewal of equipment more easily/(cheaply?) carried out	* More expensive to mark as a navigational hazard
* Economies of scale & 'learning curve' only apply to tidal stream	* Difficult & costly to maintain & repair & monitor
* 'Clean' technology at a competitive cost	* Resource not matched to grid capacity
* Increased skills base, R & D	* Strong tidal stream not close to greatest demand for electricity
* Contribution to RE output targets at low cost	Cost of transmission

TIDAL STREAM – ECONOMIC (1 of 2)	
Benefits	**Disbenefits**
* Move towards energy security & less reliance on imported fossil fuels	

TIDAL STREAM – ECONOMIC (2 of 2)	
Benefits	**Disbenefits**
* Energy security	* Risk for financial backers high at the moment
Long-term security of supply, investment in national assets	Money spent on unproven technology – reduces finance available for other viable technology
* Help achieve low carbon economy – enables economic growth	Uncertain future market
UK business, esp. overseas	
UK leading technology	Environmental impact EU fines
* Embed supply chain in UK for global market (exports)	
Development of local service industry	Grid connection costs
	Tide turning – off line
Harness natural resources	
	Competes with oil & gas for operation & maintenance vessels (£60K +/day hire)
Tourism & education	
Rental revenue -> Government	* High development costs
	* Low energy output for cost
Underpinning economy of Anglesey; Anglesey Aluminium	
	High start up costs – environmental monitoring
More flexible in energy terms	
	Maintenance
High value jobs	Vulnerable in a harsh marine environment – high maintenance costs
Resource in remote areas = employment opportunities	Prototype technology – needs government support in short-mid term
* Leading expertise export	Effect on fishing industry? (They will say!)

TIDAL STREAM – ECONOMIC (2 of 2)	
Benefits	**Disbenefits**
	Costs of navigation aid marking may be high esp floating
UK/regional supply chain growth potential	Spatial impact on other marine industries e.g. aggregates
Predictable power	Areas to avoided -> converging shipping traffic, risk + cost
	Cost of detour
* Predictable energy generation costs	
	Impacts on tourism
Jobs	
Low decommissioning cost	
Adaptable: Flexible/modular development approach	

Tidal lagoons

TIDAL LAGOONS – ENVIRONMENTAL (1 of 2)	
Benefits	**Disbenefits**
Less pressure for on land wind farm	Large amount of aggregate needed
	Ability of the aggregate supply to resource demand
* Renewable energy potential for climate change mitigation	
	Impact on inter-tidal habitat (for on-shore lagoons, i.e. those attached to land)
Doesn't close estuary – so no obstruction to shipping	
	Visual impact
Minimal disruption of bird habitats, a potential for roosting, feeding and breeding for marine bird species	
Creates wildlife habitat	Disruption to navigation
Enforced 'nursery' area for some species	Problems for navigation & fishing
- Does not impede fish migration or navigation - Does not change tidal regime	* Creation of large 'stagnant' bodies of water
Ideal test bed for tidal range schemes in UK	Currents around lagoons need studying

TIDAL LAGOONS – ENVIRONMENTAL (1 of 2)	
Benefits	**Disbenefits**
	* Negative impact on ecology due to impoundment of large area
	* Volume of contained water limiting water change
	Likely to have impact on tidal flow
	Possible change to shoreline and offshore sandbank morphology
	Large 'footprint' on seabed benthos
	May impact on seabed habitat
	* Potential for siltation within lagoon & impact on contained seabed
	Greater potential for negative impact on historic environment in construction
	Loss of shallow water environment
	Require frequent dredging to maintain efficiency

TIDAL LAGOONS – ENVIRONMENTAL (2 of 2)	
Benefits	**Disbenefits**
* Site specific (instead of whole estuary)	* Unknown hydromorphological impacts
* Limited impact	* Will have large impact on internal environment within lagoon
* Can be sited in less environmentally-damaging locations	* Effect on sandbanks, shoreline?
* Confines area, little disturbance to local area	* Sediment transport impact
* Fixed location, chosen area	Silting up
* Do not obstruct estuaries	Create (possibly) tidal race around lagoon
	May, due to size, affect approaches to a navigable channel port entry
* Climate change security of supply	
	* Loss of intertidal habitat
* Provide additional littoral habitat	* Impact on habitats, wildlife during construction & decommissioning

TIDAL LAGOONS – ENVIRONMENTAL (2 of 2)	
Benefits	**Disbenefits**
* Habitats for: - Fish spawning - Birds	* Large footprint of sea area taken
	Footprint – large impacts on seabed
* Combat climate change by reducing CO_2	
* Relatively large CO_2 reduction	* CO_2 benefit against environmental cost in terms of scale
	LCA to show full CO_2 equivalence (massive construction)
* Reduces impact on fish navigation (relative to barrage)	
	* Construction impacts
Modular construction	* Decommissioning?
	* More concrete construction & operation & decommissioning challenge
Can integrate & facilitate more renewables (wind)	Aggregate demand impacts on source of aggregates
Potential for fish nurseries	No flood protection
Relatively low visual impact (compared to other RE)	* Significance of impact – site specific to estuary scale
	Grid connection & damage to environment ashore
	Barrier effects (animal life)
	Fish kill
	Fishing area reduced
	* Hazard to shipping
	Visual impact
	Obstructs view of horizon

TIDAL LAGOONS – SOCIAL (1 of 2)	
Benefits	**Disbenefits**
Potential for community trust scheme – local ownership e.g. Swansea Bay project	* Limits 'use' of area impounded
Awareness of renewable electricity in general public	Transmission links
* Work creation, build, ops + maintenance	* Size of devices impacts heavily on all users of area

TIDAL LAGOONS – SOCIAL (1 of 2)	
Benefits	**Disbenefits**
	May exclude marine users freedom to enjoy area?
Pilot scheme will attract worldwide interest, exhibition centre etc.	
	Disruption from major project
Low visible impact	
Increase in tourism, green aura and would be first in world	

TIDAL LAGOONS – SOCIAL (2 of 2)	
Benefits	**Disbenefits**
Some storm surge protection	* May create short-term no-go leisure areas including during construction & decommissioning
* Not just to provide tidal energy, also flood protection, recreation?	* Impact on leisure activities
* Sheltered water for recreational water users	* Potential local disruption of water sports and sailing
* Leisure industry safe areas	* Block waves at beaches
* Local visitor attraction of a major engineering feat	Muddy beaches
	* Visual impact
* Construction jobs	* Changed estuary landscape
* Local regeneration, jobs etc.	
	* Noise of construction
* Shouldn't effect the Severn Bore (too much)	
	No flood defence!
* Strong link with adjacent community in sense of having developed sustainable resource	
* Widely replicable (& therefore able to be community driven)	Displacement of users of the sea
* Pioneering technology 'feel good factor' + UK – World	
	Not safe for leisure, rapid tidal movements!
* Increased energy security	
* Predictable power for dispatch to grid	Unauthorised access
* Renewable energy with 100+ year plant life	
Visible structures can be seen by sea users	

TIDAL LAGOONS – ECONOMIC (1 of 2)	
Benefits	**Disbenefits**
* Can be sited optimally in relation to power demand	* Never actually built yet therefore some investor uncertainty
	* Not proven technology
* Can be located away from shipping routes therefore no impact on existing activities	* Concept not proven in practice yet
Reduces impact on shipping – relative to barrage	* Big civil engineering & capex risk
* UK potential market leader	* Dredging lagoon
* UK could take a world lead	
	Confusion over cost (order of magnitude)
* Increased diversity of security & security of supply	
	* Restructuring the tideway & shipping movements
* Relatively easy to construct in relation to barrage	* Obstruction to navigation
* Relatively cheap to construct through use of local aggregates & geo-textiles	* Local disruption of shipping and leisure navigation
* Aggregate demand for construction	
	* Disrupt other offshore industries – aggregates, fisheries
Potentially highly economic	
	* Offshore lagoons – highly uneconomic; not viable!
* Avoid ship locks etc. With back pumping generation period	
	Low power output compared to a barrage
* Inshore lagoons in sheltered water could be economic (viability)	
	* Does not generate as much energy as barrage & life span will be shorter
Pioneering use of geo-textile bag/silt construction	Increased cost of channel maintenance due to sediment transfer
	* More expensive than 'brown' electricity – costs fall on taxpayers/consumers
Some storm-surge defence	
	Not economic, 10p/Kwhr+ ?

TIDAL LAGOONS – ECONOMIC (1 of 2)	
Benefits	**Disbenefits**
More flexible power output compared to barrage	
	Cost of environmental monitoring
	Limited in scale & scaling up
	Limited cost reduction potential

TIDAL LAGOONS – ECONOMIC (2 of 2)	
Benefits	**Disbenefits**
Nested/linked lagoons give greater flexibility of production	Unknown and unproven technology and structure
Commercial – does NOT require public funds	* Not as secure as sub-surface devices or wind farms
Storage for tidally augmented release – multiplies operation x4	Not much scope for cost reduction
	Difficult to finance as no upside
No port disruption	
	* Removal of sea-room which could be used for other industries/revenues
Can create pleasure maritime facilities	Again may exclude commercial fishing interests from an already small area in which to fish
	* Impacts on other users, shipping, fishing
Job creation maintaining lagoon structure?	
* New industry, job creation	Cost of aggregate makes the scheme uncompetitive cf other renewables
Secure energy source	Very limited potential overall
Timed release of power	
Large scale, pumped storage capacity, competitive cost power	

Government roles in supporting tidal power

Groups of participants took part in a facilitated discussion at their tables relating to government roles in supporting tidal power.

Blue

1) Decision-making

Policy
Strategic policy, and decisions on implementation should both be made with a "good consultation process". The table all agreed that this was important, although there was some disagreement about the amount of time that should be given to this consultation. Some felt that it should last "as long as it takes", while others felt the Government should make that strategic decisions after a set consultation.

There needs to be more joined up thinking between environmental legislation and legislation for development. Government departments could be better linked.

Local authorities could also develop individual official strategic views on tidal power to help in development schemes. However, there was acknowledgement that this could be a risk in terms of disjointed national strategy and planning applications.

Consents process
There needs to be central Government clarity about the consents process.

Consultation/Dialogue
Participation from stakeholders should be included at the EARLIEST STAGE POSSIBLE. The Government should both co-ordinate and encourage this.

Planning
Local planning applications should be more democratic, with local stakeholders having more of a voice. There should be significant debate about all big infrastructure projects with local authority engagement programmes as standard.

2) Finances

Overall role
Government should fund stakeholder participation at the EARLIEST POSSIBLE STAGE, running for a long enough period of time for thorough consultation with all stakeholders.

The funding programme offered by the Scottish Executive for tidal and wave power should be mirrored by the DTI and the other devolved administrations.

The Government needs to clarify its role in funding for tidal. Will it be public money, or through the PFI?

Government roles in supporting tidal power continued

Capital investment
The Government should provide capital investment to assist in new tidal developments. However, how they spend this capital should be properly consulted on.

Subsidies

R&D
The current research is 20 years out of date. The Government needs to update this research with the commissioning of a **solid appraisal** of the potential of tidal power options.

Green

Tidal energy appears to be isolated and not included in a strategy at any level. Any policy for tidal power should come from central government and defused through subsequent levels of hierarchy by way of a national strategy. However, this strategy, though directed centrally, needs to be driven from the bottom up.

Importantly, any national strategy must be in line with government sustainable development guidance.

Securing the future for regions should be an important part of a sustainable development strategy.

Local government should be more supportive of tidal power and related planning processes should be made easier for its development. However, all tidal power issues should be considered in the context of national interest therefore central government needs to execute an applicable strategy.

The planning process for the UK is not fit for the purpose of delivering tidal power.

Local government is perceived as particularly resistant to proposed schemes of all types.

A scheme as large as a proposed barrage across the Severn would require political support at the level of Royal assent.

A particular difficulty presented to tidal power developers in the UK is the interaction between terrestrial and marine based planning mechanisms. It was noted that the proposed Marine Bill might help to overcome some of these difficulties depending upon its final form.

Government roles in supporting tidal power continued

An example of the difficulties presented by the planning system was put forward via the issues surrounding the London Array wind farm that although gaining planning permission for the offshore installation, has encountered problems in sighting the necessary terrestrial substation. Reasons for these problems were suggested in the form of visual impact and increased traffic issues relating to construction.

An overlying strategy (including energy policy) and implementation at the local level need to interact better with one another.

Information sharing networks at the regional level were considered important, as local authorities (LAs) will generally look after their own back yards. If a regional strategy is to succeed in implementing any strategy, the LAs will need to coordinate their approach; information sharing is a good way of doing this.

Specific planning guidelines for LAs relating specifically to marine renewables would be very useful.

Regional development agencies (RDAs) are currently not fully exploited and should apply more powers in delivering regional spatial strategies (for example that for the SWRA - http://www.southwest-ra.gov.uk/nqcontent.cfm?a_id=836, *ref. put forward by member of the group post-discussion*). With many tidal projects, a regional view is needed to drive progress.

Different levels of government should be able to set context for a full debate to be had (pros and cons of all energy options) and answer the questions: What is the national energy picture? What are the constituent parts of different options?

A complete overview of our energy future is needed.

Outside energy, there is a strong need for the UK's energy future to be built on the basis of sustainability including issues indirectly related to energy, particularly flood defence. How does the UK's energy future fit with the overall future picture for the UK?

The central government should 'put their head out' and 'champion the facts'. For tidal power, this could be the role of the Sustainable Development Commission (SDC).

There needs to be strong leadership on the issue, people listen to central government. The drive to develop policy through consensus is good but in the end someone has to make the difficult decisions.

All involved must take a realistic view. Developers accept that the credibility of tidal power has been damaged by over-optimistic statements relating to the ability of proposed installations particularly relating to tidal stream devices.

Government roles in supporting tidal power continued

A realistic view is essential from all sides, in particular developers and government, as public money should be used to aid in development of tidal power and it must deliver.

There should be stronger financial incentives for developers relative to carbon dioxide.

The overall cost of tidal power has to be reduced.

Unproven technology combined with evidence-based decision-making is problematic. It requires the government to be less averse to 'risk-taking' with regard to its investment in tidal power.

£50m is now available for the research and development of tidal power. This is not enough to develop commercially viable technologies. There is a risk that some technologies will fail and the government must accept this in taking a realistic view.

The approach employed by the Scottish executive to award funds to tidal power projects without the three months worth of data required by national government to attain funding is the right approach and should be applied throughout the UK.

The bigger picture of climate change must be considered seriously and there is a risk that the UK is doing too little too late. If climate change is indeed the biggest threat facing the world, and the UK wish to do something about it, it must take it seriously (e.g. 'Sharing the UK's future' document).

The current government regime does not lend its self to long-term solutions as terms do not last long enough for politicians to take risky decisions that may have negative connotations or not be of immediate benefit the electorate.

There should be a committed 'something' to ensure that governments deliver on long-term solutions and commitment to them is maintained; cross-party consensus tends to be lost.

An important step to take would be to educate people e.g. using adverts along the lines of those used to stop people smoking illustrating the adverse effects of climate change. This approach would be aimed at focusing people's opinion.

Red

Government has a role in ensuring that there is fair debate and unbiased reporting – balanced and independent.

Government roles in supporting tidal power continued

Government has a role in enabling good science – funding for independent research to build up the evidence base both for and against the various tidal technologies.

Long-term support for development of the industry and the specific technologies should come from government.

As the scale of work on barrages and lagoons is large, with high corresponding study costs, government should provide support for research and development.

Consistent message from the Red Group around the need for central government to offer a joined-up, integrated and strategic framework. Noting,

- The EU Habitats Directive (and Birds Directive and Natura 2000) require government to take a strategic view.
- Joined-up coordination of information dissemination, research and development efforts and support is needed.
- Central government should be assessing and balancing regional benefits and disbenefits, as well as providing compensation to displaced/disrupted economic activity.

European Union obligations on energy targets (2-20%) and CO_2 reductions suggest there should be strong political and financial support for all renewables technology development, including but not limited to tidal technologies.

- Demand management should be a focus for central government – provide and support a much stronger package to reduce energy demands.
- Strategic push from central government for marine renewable energy projects.
- Central government needs to be strategic about messaging.

Central government needs to be aware of its global responsibility regarding renewable energy generation given the tidal resources available to it.

Planning system needs improvements.

Planning for grid connection needs improvement.

Marine Bill provides an opportunity to improve planning system.

Policy required – for when public interest intersects with licensing issues.

Local government – must build local engagement into processes, especially relating to impacts and benefits.

Guidance – central government should be providing assessment tools and guidance.

Government roles in supporting tidal power continued

Environmental monitoring – central government should be creating initiatives and subsidising ongoing environmental monitoring as the burden on developers / industry acts as a disincentive to develop the technologies.

Yellow

Government should help tidal technology to happen and facilitate its development.

Government has a regulatory role with regard to environmental protection. Combating climate change for example through supporting tidal technology is part of that.

The Welsh Assembly Government has responsibility for sustainable development and therefore for ensuring that tidal technologies are developed in a sustainable way.

Government should create a positive environment for tidal energy through financial support. This could be applied in terms of banding, giving tidal energy equal financial support as wind energy. This would contribute to a reduction in the UK's carbon footprint.

Funding for tidal technology currently comes from private investment. Government could create confidence to draw in this investment.

Longer tem investment is needed. Currently the Department for Trade & Industry gives funding for research and development grants. There is also project support subsidy, however wind technology gets a greater amount than tidal technology. New technologies need support. It should be noted that even current energy technologies are subsidised.

Government has a role in coordination: It is important that tidal technologies should be developed in line with other carbon reducing initiatives like transport. There is no point in taking these initiatives forward in isolation.

The main role that government should have is that of leadership.

The UK has an economic development opportunity due to its suitability for tidal technology. Once technologies are developed, the UK could then become an exporter of this technology.

Government is playing a big enough role already – and not in a positive way. For example it has interfered with potential investors in tidal lagoon technology.

Government should support the creation of a skills and research and development base.

Government roles in supporting tidal power continued

Government needs to keep environmental risk assessments proportionate: in perspective and in balance. Rising prescriptions are impeding technology development.

There is a need for environmental protection and government has a role in this.

There may be environmental disbenefits with the technologies. These may be covered by EU protection legislation for which government has a responsibility.

Local authorities have a role to play. There is a potential for a community trust to be developed for a community tidal technology scheme and local authorities could input to this financially. An example of this is Swansea Bay.

There is a role for government to be open-minded and base its decisions on support of tidal technologies on sound science.

The opportunity for tidal technology needs to be grabbed with both hands. It should be made national and in this respect government has a role. Climate change is a national problem and is of national importance, it needs to have responsibility taken for it properly i.e. by government. The government also needs to take responsibility for tidal technology's environmental disadvantages and overcoming any conflict with the Habitats Directives.

Note: There is also the view that climate change initiatives should take account of the protection of biodiversity.

Government should liaise with key interest groups to gain relevant understanding.

Environmental Impact Assessments (EIAs): It should be remembered that the purpose of EIAs is for the gathering of scientific evidence. Government has a role to oversee that this is done usefully and effectively.

Orange

Government should be looking at tidal power in terms of 'total carbon'.

Need for strategic assessment

Severn should be seen as one entity

- It has unique potential
- Should not be governed by several Local Authorities*
- Needs a regional approach
- Has been constrained in this by central government

Government roles in supporting tidal power continued

What does 'strategy' mean? Need a clearer definition

- Looking at tidal range schemes without a strategic overview will not achieve the best result

Need a UK wide overview

- To look at the mix of energy generation and energy efficiency (a twin-track approach) to provide the country with the energy it needs, in a low-carbon environment, within different timescales
- *Do also need a local approach, but if split down too much there is a danger of losing the 'big picture' and NIMBYism

Government should give a long-term signal regarding the cost of carbon, which will give security, and reduce uncertainty and risk, to the market

Barrages are a blindspot.

- There is need for a pilot scheme for tidal range technology
- Government should facilitate this

Need for a logical top-down view

- This overview, together with a signal on the long-term costs of carbon, would facilitate the market allowing it to take advantage of opportunities that are align with UK-wide objectives

Technological development requires a well-rounded understanding

- This is best done by government
- E.g. ETSU in 80s and 90s was taking the right approach: made value judgements
- Danger that developers will invest the minimum not optimum into environmental aspects
- Need a balance between private and public sector innovation
- Government should: encourage innovation, and fill the gaps

Government policy provides a framework for issues around sustainable development (which are hard to pin down absolutely but people sign up to conceptually), e.g. biodiversity limits set by the Habitat Directive

- A role for central government here

Missing: a series of shared objectives (or, at least an understanding of where there are differences) between the pro and anti lobbies

All levels of government should facilitate this

Marine Bill should join up integrated marine and land planning

Approaches should be bespoke, such as the Severn Estuary Partnership

There is uncertainty about how grid capacity can be increased

Presentation by Black & Veatch and AEA

LUNCH

Severn options - points of clarification (following presentation)

- Views expressed in presentation suggested that there would be no benefit to 2-way barrage but example in Seattle demo's a load factor of 36.1%
- Load factors may actually be higher than suggested in the presentation
- 6 cost studies on tidal lagoons show much lower costs (x5) than presentation
- Non-typical discount rate used, usually 10%
- Onshore & offshore (referred to in this discussion) lagoon impoundment structures are different in terms of:
    - Cost
    - Hydrodynamics etc.
- Been mislead by paper
- Less uncertainty around tidal turbines (than portrayed) as there is more data
- This presentation is incorrect in terms of economics
- 'Outside' – What is meant by that term? -> Downstream
- Habitats & birds directive legislation: still need for package of mitigation measures even if established that tidal barrages are in the overriding public interest
- No reference to economic interests of British shipping
- Definition of SD is inadequate: must anticipate affect of rising sea levels
    - Argument for 2-way generation & long-term interests

Stakeholder views on concepts for the Severn

Groups of participants were asked to consider the Strengths, Weaknesses, Opportunities and Threats relating to tidal barrages and alternative technologies in the Severn.

Blue

Key Points

- Uncertainty over many complex and interrelated issues
- Further research needed

Tidal barrages	Alternative technologies
Strengths	
Highest tidal range in UK	Tidal stream = Less influence on environment than barrage

Tidal barrages	Alternative technologies
Good grid connections	Can work in tandem with other technologies
Lots of information known about Severn	Close to population centres
Close to populations centres	Ease of removal (modular technologies)
	Good grid connectors
	Small marine mammal population
	Visual impacts may be less
Weaknesses	
Protected area locations	Limited range of options
Main shipping channel	Affects on fish populations -> in Severn
Regional planning policies don't currently include the barrage & infrastructure	Area: power output for less than a barrage
Important migratory fishery in Severn	
Time scale -> building & planning	
Port operations above barrage	
Cost	
Information on Severn out-of-date & has uncertainties	
Opportunities	
Generation of energy -> ongoing	Leading edge technologies -> expert opportunities Lsp. Tidal stream
Water recreation	Lots of diverse areas that can be utilised
Opportunity for rail linkages	Initial construction & maintenance operations for the ports
Traffic relief from 2 bridges if a transport link over barrage	

Tidal barrages	Alternative technologies
Threats	
Uncertainty in water depth effects on shipping	Costs (capital & upkeep) outweighing benefits
Shipping is a key UK industry	
	Concern about lagoon in Swansea bay re: sediment & stream
Removal of spoil grounds for dredgers?	
	How do you police floating device to prevent unauthorised access?
Restriction on free flow of shipping	
	Obstruction to safe navigation
Sterilising aggregate sources	Unknown effect on siltation
Constricted traffic to locks inhibition of marine transport	Sterilising aggregate source
Impact on port business	Floating tidal stream technologies breaking adrift & -> threat
Associated development currently may increase CO_2	
Sediment effects on channels -> no current clear modelling	

Green

Tidal barrages	Alternative technologies
Strengths	
Predictive energy generation	Tidal stream flexibility in design ->upgradeable – not all eggs in one basket
Power generation	Tidal stream quicker to install (at least start soon!)
5% UK energy demand	
Quantum step forward in clean generating capacity	Modular construction approved – more able to adapt as conditions change
Green power & large scale	
	Tidal stream does not preclude a barrage
Significant contribution to lowering CO_2 & energy production	
Significant (predictable) generation resource	Tidal stream low impacts (visual, footprint, env. habitats) in comparison with lagoon & barrage

Tidal barrages	Alternative technologies
Harness the 2nd highest tidal range in the world; seems a waste not to!	Lagoon – flexible choice of location, incremental approach
Economic regeneration in Cardiff & W-S-M	Tidal stream less disruptive for shipping
Better alternative to problems associated with nuclear	Tidal stream lower visual impact (than barrage & lagoon)
UK and also locally available resource utilised	
Indigenous source	
Known cost through life, no fuel variability	
Quickly implementable compared to nuclear	
Protection from flooding	
High profile – will have national impact on raising energy issues	
Weaknesses	
Uncertainty in predicting environmental impact	Smaller scale energy production than a barrage
High initial carbon footprint (construction)	Limited contribution (energy/CO_2 saving) -> based on potential
Cost v. benefit – understand SD position (full life cycle)	
Upstream environmental impact SSSI, SAC etc.	Tidal stream less proven technology than barrage
	Not proven in practice yet. Lagoon & turbines -> unsure of long-term costs & energy generation
Loss of intertidal habitat	Tidal stream prototype technologies – currently uneconomic
Manageability vs. other generation sources in competitive market (priority dispatch?)	
Tradeability (of power)	
Demand may not match supply	
What if demand not sufficient to warrant scale of supply? (Above baseline)	
Inability of UK Ltd. To take long-term strategic decisions	

Tidal barrages	Alternative technologies
Once started we will have to finish – whatever the cost	
Commercial V security safety?	
5-6 years to build minimum	
Who pays?	
Security threat if road open to public access	
Negative impact on environment, society & economy (sustainability)	
London Olympics syndrome	
Would be the largest engineering project the UK has seen for a very long time! Have we got the expertise to produce what is promised?	
Lost opportunity cost to develop alternatives	
Economic downturn during construction	
Impact on shipping	
Structure maintenance liability	
Major grid reinforcement needed = usual impact of overhead lines = risk of planning	
Is there energy strategy in place to accommodate it?	
Opportunities	
Additional benefits over and above power generation road/tourism	Replicable (any non-barrage solutions) at all locations away from Severn (therefore export opportunity?)
New leisure opportunities – upstream – kite surfing, kayaking, dingy sailing	UK as market leader

Tidal barrages	Alternative technologies
	New market, UK world leaders; lagoons & tidal stream
New habitats for wildlife – birds & fish	
	Tidal stream develops industry for UK =exports, =jobs, =view that UK global leader
Wind farm & wave energy development on the barrage	
	Increased recognition of need for 'joined-up' approach to development generally
UK Plc. -> Develop capacity & capacity -> tech, construction etc.	
Export expertise -> technology engineering construction	
Construction jobs & industry knock on effects	
Supporting industries (component manufacturing etc.)	
'Totemic' -> use to raise profile of energy issues locally & internationally, nationally	
Land prices upstream will boom (flood defence)	
Focus for ongoing (sustainable; Economic & Social) development of region	
Breaks down English/Welsh divide	
Transport links & road & rail = tourism, trade, etc.	
Improved deep water channels upstream of barrage to Avonmouth – benefits shipping	
Threats	
Bird populations already in decline, removes habitat for wintering/waders	Tidal stream, complexity of on-going maintenance and servicing of many small units compared to barrage (1 big one)
Land prices downstream could decrease (flood risk increase)	Tidal stream & lagoons, big unknowns as to capital & operation costs
Change in habitat (loss) birds & fish & mammals	Less energy? – but proven?

Tidal barrages	Alternative technologies
Sewage processing – water quality upstream	
With barrage will the Severn area feel they have done all they need to do for generating green energy? (Targets)	
Will barrage divert momentum?	
Decommissioning liability (financial cost)	
Complex future decision/requirement to decommission or refurbish	
Terrorist target	
Threat to upstream ports due to restricted water levels (Sharpness) – local economic loss	
Barrier to leisure links (e.g. Ilfracombe – Cardiff) U/S-D/S e.g. across and around estuary	
Constrain exhibiting marine interests – fishing, aggregates, cables	
Doesn't deliver energy / CO_2 reduction promised	
Water resources	

Red

Tidal barrages	Alternative technologies
Strengths	
Proven technology	Tidal stream – flexibility in both location & scale
Turbine technology understood	Tidal stream – easily and relatively cheaply removed
	Stream – smaller less impact
Increased jobs	Turbines – less environmental impact?
Carbon free energy resources	Iterative technology (tidal stream)

Tidal barrages	Alternative technologies
CO_2 saving	
	Tidal stream – can be built quicker
Quantity of power generation	
	Tidal stream – can operate downstream of a barrage
Life 100 years+	
	Lagoons (large scale)(possibly plus a Shoots barrage OR barrier) much more probability of much lower ecological impacts
Transport infrastructure	
Flood defence (a) to estuary (b) to river	Tidal stream – big export potential (therefore more local £)
Flood defence IF sea level rises more than 1-2m – but reduced power	
	Tidal stream – SW has reasonable success & grid capacity to allow for progressive development
Increased diversification of carbon free energy (security)	
Weaknesses	
Grid availability	Is there enough research into capacity?
Environmental impact	All – very small output compared to barrage
Loss of highly protected ecology	
Modification of sediment deposition and erosion	All – patchy political support/understanding
Will enhance smolt and adult salmon mortality	
Mammal/cetacean impact	Research? Tidal stream & lagoons
	Lagoons – No detailed studies
Perception of 'problem solved' business as usual	
	Political attractiveness: scale doesn't allow substitution of nuclear (stream & lagoons)
Decommissioning costs/impact	
River flow combined with increased mean level tide	
Time for return on investment	
8Gw/hour pulses wrecking load – following plant (coal or CCGT)	

Tidal barrages	Alternative technologies
Beyond UK contractors/construction capability	
Loss of jobs in angling economy in South Wales & indirect impact	
Locks in long term	
Need for concrete/aggregates – impacts	
Weakness in analysis – other barrage options (e.g. Minehead with different costs/benefits) not properly considered	
Opportunities	
Substantial contribution. Logically sensible	Tidal stream & lagoon – Not tidal barrage
Increasing knowledge of area	Lagoon power storage
Regeneration of Welsh villages	Tidal stream; learn & modify tech
Without barrage no chance of 20% (renewable) target (energy EC)	Tidal stream – quicker to deploy
	All- easier to attract investment, lower value/quicker return
Constructed largely off site to spread environmental impact	
	Opportunity to make offshore wind feasible on same supports/sharing grid connections
Political attractiveness scale means less/no nuclear needed	
Potential harbour improvements	
Transportation hub	
Learning gathered can help development of more sustainable barrages globally (China)	
Spread of employment opportunities (UK + Europe)	
Economic development potential	

Tidal barrages	Alternative technologies
Could be configured for continuous power generation	
Threats	
Shipping concerns to address	Lagoons – Navigation impacts
Flood risk below barrage	Lagoons & turbines – potential ecological threats
Effect on upstream & downstream tidal renewables	Lagoons – large scale redistribution of sediments
Essentially excludes tidal lagoons in basin	
	Lagoons in basin area would preclude barrier
Pressures on local communities – sustainability	
	Stream – threat to local fishing areas
Traffic & airport development (Hansard – Hain)	
	Tidal/lagoon - unknown costs / Kwh
Aggregates industry concerns	
	Tidal stream – tidal streams are unique ecosystems
Potential extinction of Wye (& Usk) salmon & shad unique genetic stock	
Changes during construction (rapid)	
Jobs are assumptions (valid)	
Public perception of scale of output 4.3% electricity, 0.75% final energy	
Threat to other renewables 20% by 2020 (if take into RO)	
Navigation impacts	
Taking up grid capacity for other renewables	
Pulls relevant workforce away from other renewables	
Unknown impacts – precautionary principle	
Is the barrage climate change proof?	

Yellow

Tidal barrages	Alternative technologies
Strengths	
Predictable outputs	Reduces dependence upon imported natural gas
Opportunity to achieve predictable input to energy requirement	
	Significant renewable energy generation
Cardiff: significant 4.5% of UK electricity demand	
	Non-nuclear
Reduces dependence upon imported natural gas	
	Reduced environmental impacts
Recreation benefits (upstream lake)	Much less environmental impact
	Less environmentally damaging
Large amount of low-carbon electricity for long time (more than 100 years)	
	Easier to remove
Barrage technology lowish risk as tried before	
	Lagoons are commercially feasible with private finance & larger output than barrage
Offers potential additional transport links	
Transport links	The owner of the only tidal barrage – La Rance – interested in tidal stream rather than more barrage
Wonderful project for construction industry	Less impact on conflicting interests e.g. shipping/fishing
Positive economic effect in terms of jobs	
Large number of long-term jobs	Sewage outfalls unchanged
Significant renewable energy generation	Tidal stream is modular – can be developed more quickly with less risk or environmental impact
	Alternative technologies could benefit from economies of scale
Non-nuclear	New technologies can be utilised as they become available unlike barrage
	Tidal stream is more efficient and cost effective
Flood defence benefits	

Tidal barrages	Alternative technologies
Flood defence possibilities	Alternative technologies e.g. tidal stream, can be used more widely than in the Severn
	Potential to be used in a range of locations
	Reduced need for fossil fuels & less environmental impact
	Can be sited in non-EU designated areas
	Predictable outputs
Weaknesses	
Non-reversible	No transport link opportunities
If found not to be efficient etc. hard to remove? Upstream sewage problem	
	Less power output
Takes finance from other renewable options	
Requires massive public subsidies	Fewer local jobs created cf barrage
Not economic	Numerous small projects not so pleasing for large construction industry
Very expensive to construct	
High upfront cost with years before financial return	Links to grid connection, disperse locations increase cost of grid upgrades
Cost!	
	Lack of government support
Energy intensive to build	
	May impinge upon existing fishing effort further than it already is. Also shipping
Not a proven technology; only 2 tidal barrages ever built & owners will not build any more	
	Much more seabed could be taken up by alternative schemes in order to produce same output as a barrage
Unsustainable, silts up eventually	Numerous devices required to generate approximately 5% UK energy needs
Uncertainty over environmental impact and balance with climate change benefits	Technological risk dependent upon technology & time of operation

Tidal barrages	Alternative technologies
Probable significant adverse environmental impact	
Potential impact on shipping	
Huge adverse impact on port & shipping activities	
No plan for sewage outfalls	
Very inefficient	
Big pulses of power	
6Gw for 4hours, 0Gw for 8hours; power too 'peaky' for the grid. Poor load factor	
Flood offence downstream	
Opportunities	
Close to where power needed	Economic development; jobs, skills
Economic development; jobs, skills	Takes pressure away from new nuclear
Opportunity of creating employment for construction industry etc.	
Supports UK construction industry	Opportunity to explore alternative ideas instead of adhering to one e.g. wind, barrage etc.
Tourism boost	Opportunity for government to invest in studies for all types of tidal generation
Recreational potential	
	Green aura
Takes pressure away from new nuclear	Encourages people to think small and local re energy
Large scale renewable energy generation	
Maximises harnessing of tidal energy	New UK industry in exportable technologies
	Economic benefit growth of new industry jobs/skills/export opportunity
Potential transport links especially rail (Shoots)	Opportunities for small engineering companies and for exports
Could offer road or rail link	
Offers exciting ride on windy days +67 meters high bridge	
Threats	
Potential damage to protected species	Could take pressure off need for other renewables
Loss of rare protected areas	

Tidal barrages	Alternative technologies
Serious impacts for protected habitats – 60% loss of intertidal – EU designations and SSSIs	Durability over time may be less than anticipated
'Mega' projects tend to have big cost over-runs, long lead times to construct	Proliferation of small schemes could reduce area of navigable water – could lead to increase in ship traffic density and risk of collision leading to pollution!
'We can so we should' attitude	Threat to commercial fishing effort if excluded from the area. May require more maintenance?
Shipping restricted	No one 'major' project may decrease public interest hence decrease the political capital of doing anything
Unforeseen effects	Environmental impacts – technology variable
Underestimation of negative impacts, environmental & on other industry	
	UK businesses do not take the lead
Changes in economics could lead to private pullout leaving the public in debt	
Government backing for barrage send message UK is not serious about renewables & supports nuclear	
Could take pressure off need for other renewables	
Could divert finance from better alternatives	
Deflects attention from other marine renewables, wave & tidal stream	
Mops up all potential funding in renewable energy which will limit growth of other technologies	
Will silt up and have declining output	
Maintenance costs, dredging to keep clear etc. ma threaten marine users interests	

Tidal barrages	Alternative technologies
Reduces available flows for current turbines	
Impact on UK economy/regional economies due to effect on maritime import/export viability	
Peaky output may lead to inability to use all available electrical energy	
Creates illusion that big energy solutions remove need for demand reductions	

Orange

Tidal barrages	Alternative technologies
Strengths	
Secure energy source	Strengths similar to barrages but smaller scale
Reliable and predictable energy source	
	Reduced biodiversity impacts
Lessened risk of flooding could increase developable area around estuary	
	Lagoon: aggregates more readily available
Large contributor to CO_2 reduction from one location	
Major contribution to renewable targets	Not competing with barrages
Decrease risk of tsunamis: 2 issues:- 1. Population threat 2. Structural threat	Scope for incremental development & investment
Proven construction techs and technology	Ideal for wind; offshore farms due to prevailing winds & local geography
Shoots barrage offers a compromise solution between energy and extent of area impacted; no impact on major ports	
Weaknesses	
Generally negative public perceptions	Fewer (or nil) flood risk benefits
Post barrage environmental modelling needs referencing	Fewer/nil infrastructure benefits (road/rail)

Tidal barrages	Alternative technologies
Lack of up to date data/research to make a considered decision (ecological, geomorphological, economic etc.)	
	Extensive requirement for aggregates (tidal lagoon) (not aligned with SD principles of minimising use of natural resources)
Damage to internationally important biodiversity resources	
Major threat to biodiversity	Water too shallow for submerged devices -> tidal streams
Effects on tidal stream will result in complete resurvey & reassessment of admiralty charts	Many coastal communities & rural settings to consider
Will actively increase CO_2 & pollution risks as ships will spend longer in transit due to locks	Generally negative perceptions by public
Implications for nuclear on banks of Severn	
Uncertainty in legislative regime, European court	
One way (ebb-only) scheme forecloses on future generations flood defence needs	
Opportunities	
Catalyse wider economic & social low carbon developments	Basin/lagoons: recreation benefit
Rail link across Severn to improve high speed rail to south Wales	
Tourism/recreation	
Scope to develop new ecosystem within barrage	
Threats	
Construction of locks need to consider future port expansions & increasing ship sizes (Large barrage)	

Tidal barrages	Alternative technologies
Major threat to ports with potential knock-on to increased carbon (cargo going to SE resulting in more road miles)	
Very insecure source & could become a target of opportunity	
Not sorting out optimal workings (E, E, S – sustainability) first via smaller pilot schemes	
Letting add-ons (rail links etc.) dictate mode of construction/capacity	
Economic development offsets C reduction from barrage	
Risk that changed tidal regime will result in increased erosion and flood risk up stream	
All encompassing – no room for error	
Shoots – big sedimentation issues, uncertainty	
Cardiff-Weston rail link will threaten shipping	

Conditions for acceptability for tidal power

This process used an open-space technique in which participants were asked to add their input on an individual basis, as opposed to in groups, under the headings provided relating to acceptability issues arising from different tidal power options. Participants were given the freedom to visit any of the stations they chose and to spend as much time at each as they wanted within the time given.

Tidal power - generic

What would make it **MORE** acceptable?

Full ecological/environmental impact study of all options
Reduce uncertainties around environmental impacts especially morphology/sediments/hydrology

All environmental effects are properly assessed and acceptably mitigated according to their significance
How to make tidal power more acceptable. Evidence that impact not detrimental to protected species and habitats
Lagoons more acceptable. If a full and complete comparison with a barrage is carried out.
Position devices such that safety of the mariner is not comprised
Tidal power systems must fit around existing shipping requirements
Clarification of EU view on interaction with habitats/birds/WFD
Accurate, independent, centrally – collated research
Figures from reports differ too much. Parties enables better judgement of facts
Independent studies on all forms of tidal generation – pros & cons
New environmental and updated feasibility studies
A pilot scheme – e.g. OT! Somewhere where it is actively wanted for 'other reasons'
Strategic assessment of planned range of energy production
More acceptable if seen as alternative to nuclear power
If evidence that protected species under severe threat from climate change
More honest discussion about alternatives
Planned to take account of social, economic & environmental implications
If socio-economic impact was positive – i.e. created opportunities and NOT removed others at the same time
Clear and strong national (Govt, industry & public) support for TP as a long-term energy measure
Evidence that a long term (>100 year) approach is being taken
If implemented in a holistic fashion – i.e. in conjunction with recycling, public transport, infrastructure & home efficiency initiatives
Creation of a 'virtual voice' to future generations in the debate

What would make it **LESS** acceptable?

Less acceptable if cost much higher than other renewables
If it cost more financially than current schemes etc. If it resulted in loss of livelihoods (e.g. fishing & shipping)
Attempts to make it a universal solution for all – flood, rail, road, CO2 – will result in one big compromise which solves non-entirely
Less acceptable if siltation problems (e.g. at shoots) shown to limit lifetime of barrage to < 100 years

Poor & inaccurate research
If they catalyse conventional (i.e. high carbon) development
Unplanned development
If there were associated on-shore infrastructure developments (roads, urbanisation)
If it takes "eye off the ball" re energy efficiency
How to make less acceptable; if detracted from other renewable technology development
If it detracted from looking at other forms of renewable energy especially micro-generation

If **nothing** would make it acceptable, **WHY**?

No comments on sheet

Tidal lagoons

What would make them **MORE** acceptable?

Evidence that their "benefits" outweighed their "costs"
Better information on costs/benefits, outputs etc
Convincing evidence that the costing is sound
More "up-front" recognition/discussion of wider benefits & dis-benefits
Not being seen as an opportunity/license for unsustainable "metropolis" development
If detailed studies show low costs & low environment impact
Proof that "big sand bags" would be used to construct the lagoon
Less construction material required
If they could be built without virgin aggregates/concrete
Assurance that they could be decommissioned effectively and economically
Demonstration projects to prove cost, environmental impact and energy operation
A pilot scheme in North Wales intended to demonstrate optimal workings for ALL tidal range future developments
A successful demonstration scheme
A working example
A government funded study into lagoons scenario for basin area – fair comparison with s. barrage
More modelling & studies on potential environmental impact
Research efficiency

Effects on fish/turbine turbulence understood
Research evidence that ecological/environmental impacts were minimal
Environmental studies into impacts
Clearer understanding of potential from this technology research funding
Large scale lagoons (or barrage) not included in 20% by 2020 R.O. (Renewables Obligation)

What would make them **LESS** acceptable?

If it directed any support away from other renwables
Placed so they block waves – less acceptable, not unacceptable
Proposers should consult properly with stakeholders & agencies – honesty please
Environmental impact outweighs climate change benefit
If located in environmentally sensitive sites
Evidence that their "costs" outweighed their "benefits"
Maybe uneconomical (i.e. costs vs generation)
If decommissioning costs were not factored in – especially if it doesn't work first time (can't be scaled up)
Environmentally damaging use of construction materials
'Encroaching' on approaches to navigable channels for shipping entering/leaving port
If short term 'fix' which blocked better opportunities later

If **nothing** would make them acceptable, **WHY**?

Uneconomic due to significantly greater aggregate requirement by comparison with barrages
Resource demands are unsustainable

Tidal stream

What would make it **MORE** acceptable?

Consult & position devices such that safety of the mariner is not compromised
Better prototype performance data
Built-in flexibility

Device developers to meet targets & stop making unrealistic claims of future potential & installation dates
Full consultation with harbour and port authorities
Looking at navigation and transmission costs more seriously
Research into efficiency
More modelling & studies on potential environmental impact
Planned to take account of social, economic & environmental issues
Very acceptable already
Good measures for safe navigation
Improved grid connections
Consider in sites where it is optimal and close to grid
Government investment now
If government makes the necessary development investment
Better support from central government
More government investment
Increased funding percentage in emerging technologies
Successful demonstration projects
Move from pilot to commercial scale to gain better evidence on costs, environmental impacts etc

What would make it **LESS** acceptable?

Prototype performance not proven or continually slow to be demonstrated
Unplanned development
The only option used
Incident occurrence (e.g. fatality in construction/O&M), ship collision, environmental incident etc
If the UK did not benefit economically from device development & production
Costs do not reduce as expected
If not tied into an overall tidal energy strategy taking account of the timing – quantities of grid inputs
Too many 'farms' near shore which will impact on Anglers, leisure users

If **nothing** would make it acceptable, **WHY**?

No comments on sheet

Barrages in the Severn

What would make it/them **MORE** acceptable?

Proper consideration of problems with varying power generation
Government intervention on big picture net benefit
Find way of dealing with migratory fish passage
Smaller barrage with multi-basins to improve load faster & better than a 'mega' single basin barrage
Less uncertainty in ecosystem impact
More certainty about impact on sediment movement
Modelling of downstream implications
More accurate & up-to-date research
Study on impact on shipping in area
Research into hydrodynamics, sedimentation, erosion, turbidity etc
Evidence weighed not just against other tidal technologies or renewables but also comparisons with nuclear and fossil fuels
If all potential significant environmental effects are acceptably mitigated
Resolve uncertainty on long term effects on sediments, salt marshes & beaches
If the total energy potential of the Severn is utilised
Independent, centrally collated research
More reasonable costs for electricity in terms of p/kwh
Package of actions to minimise impact on wintering/wading birds onsite and improve sites elsewhere
For the barrages' energy production to be far greater than the other tidal renewables, offsetting the environmental impact
Development of a clear route map for satisfying requirements of directives (e.g. birds etc)
Estuary-wide overall impact assessment

Better energy capture than 24% quoted
Detailed re-appraisal
Further increases in predicted sea level rise
Proper consideration of continuous power generation schemes
More work to clarify sediment & hydrology implications – knock on implications for ecology
If environmental impact was lessened
If more comparison was made with other methods of tidal generation
Very public cross-stakeholder support – NGOs, energy companies, local groups & so on
Investigation of mitigation of adverse environmental effects – with costs
Balance of environmental impact with/without a barrage – tipping to better with a barrage
Climate change environmental benefit being greater than current environmental impact
Up-to-date analysis of costs/benefits on all aspects, not just energy
Independent appraisal of all the different barrage options (i.e. routes)
EBB & flow generation and no road link
Assessment of impact of climate change on Severn estuary
Pilot scheme (could be an OTI) showing possibility and benefits of two-way generation
Compensation measures for operations upstream of barrage (i.e. improved infrastructure to meet newly created restrictions such as larger lock gates to compensate for reduced water levels therefore maintaining existing restrictions/dimensions & vessel size
More studies on flood impact "outside" (downstream) of the barrage
Greater consideration of SD principles in promotion (e.g. Shoots barrage vs Cardiff Weston)
Rail rather than road link: a major sustainability consideration

What would make it/them **LESS** acceptable?

If it directed any support away from other renewables
If it restricted development of wind, wave & tidal stream in SW
Better understanding of tidal stream/lagoon technologies through research funding
If it meant opportunities for other tidal barrages were not explored…why start with biggest & most difficult?
Would be less unacceptable if research could show conclusively that bird species & numbers would not be significantly reduced. However, remain opposed because "big energy" solution with uncertain ecological impacts
Design poor impact on environment
Increasing evidence that the local environment would become less diverse post-barrage
Poor construction & operational reliability
No long term economic or climate change benefit
If the total energy potential is not utilised
If it's a stalking horse for high C economic development
Political decisions without evidence base
Destroying the Severn Bore

If **nothing** would make it/them acceptable – **WHY**?

Barrage is non-sustainable. It eventually ill silt up and lose capacity – it cannot easily be removed – was a legacy!
Barrages have failed so far – the owners of the only significant ones at La Rance and Annapolis Royal. Do not plan to build more!
Because the Severn ecosystem depends on its tidal range which would be lost in the basin
The barrage will divert resources from more effective investments in renewable energy
Too big, too costly, too high impact, too permanent
Barrage is a physical barrier to freedom of shipping movement

What next?

A closing plenary was held to allow participants to express views on next steps following the workshop.

- Stakeholder engagement: need to involve shipping industry from early stage

What next? (Continued)

- Early identification of stakeholder groups
- Provide a workshop for Severn Estuary stakeholders
- Need a stakeholder workshop like this in North-West
- Next phase depends on understanding output of area
    - Country like this should have academic ability/awareness
- When government comes to taking forward a considered recommendation, it's worth taking into account sustainable development appraisal methodologies e.g. the strategic sustainable appraisal carried out to inform the RSS's (Regional Spacial Strategies)

Messages to the SDC

Throughout the day participants had the opportunity to leave messages for the SDC on a specially designated message board.

- Two-way generation doubles your options for true sustainability!!

- The proposed c/w barrage is a 'big energy' solution, that is not compatible with sustainable development or, in particular, with species and habitats protection under EU designations.

- SDC should recommend to government that the decision making framework for taking tidal energy (& Severn barrage in particular) forward is made open & transparent, so the criteria are known before decisions are made.

- All options need investment to achieve a 2007 baseline – most studies of barrages date back to 1980/1990's.

- Until arriving at the workshop, the Chamber of Shipping, & Trinity House, had no details of the proposed Severn tidal barrage.

- EU target of 20% renewable energy. UK 10 years ago 1%, UK now 2% -> 20%??

- Total carbon equation needs to be considered i.e. that of any spinoff developments/growth.

- Solutions need to achieve the appropriate balance between:
    - Energy/economic
    - Environment
    - Social

- The decision about the Barrage needs to take into account everything so that the final decision is what's best for the country as a whole – not for a particular group/subsection.

Messages to the SDC continued

- Any development needs a full carbon positive/negative assessment, which takes into account not just the construction but also all the spin offs i.e. – increased development, growth, and industry. We cannot assume that growth is good thing.

- Alternative technologies may gain strength through diversity of location & timing of inputs to grid (?) [Question is: to what extent? E.g. Severn barrage vs. N. of Scotland MCT arrays]

- All options needs to be considered. Reducing CO_2 will require a mix of different solutions.

- 1: Local authorities are crucial stakeholders who appear to have been overlooked – need to be engaged. 2: Focus seems to be on energy benefits/costs – needs to be far more on costs/benefits of other impacts, particularly of barrage options.

- Disappointed at range of non-barrage options which have been assessed for the Severn & Bristol Channel.

- Barrage will lead to ecosystem degradation and energy intensive/carbon emitting infrastructure development. Modular technologies allow removal/modifications if unforeseen impact appear.

- Please discuss tidal stream with activists such as Marine Current Turbines – a lot of information given as 'base level' is incorrect.

- Consult closely with those who rely on the marine environment for a sole income generator.