Sustainable Development Commission

Tidal Power in the UK

Engagement report - Public and stakeholder engagement programme

A report by Opinion Leader and The Environment Council for the Sustainable Development Commission

October 2007

SDC Tidal Power

Public and stakeholder engagement programme

September 2007

Contents

1. Executive Summary

Background and objectives

The Sustainable Development Commission has undertaken a UK-wide study on tidal power with a broad coalition of support and funding from the UK government (Department for Trade and Industry (DTI)), the Devolved Administrations (Welsh Assembly Government, Scottish Executive and Department for Enterprise, Trade and Investment, Northern Ireland), and the South West Regional Development Agency . The SDC has appointed Opinion Leader and The Environment Council to conduct a programme of public and stakeholder engagement on tidal power alongside a wider research programme.

The key objectives for the public and stakeholder engagement programme are to understand:

- attitudes towards tidal power
- attitudes to the sustainable development aspects of tidal power technologies
- attitudes to proposals in the Severn Estuary
- views on financing and decision-making
- the conditions for public and stakeholder acceptability of tidal power

For the public engagement programme, Opinion Leader conducted a programme of national, regional and local consultation with members of the public. This included an omnibus survey of 1,000 adults across the UK, three regional workshops in areas which are close to sites that may be affected by tidal power developments and six focus groups in each of three local communities which could be directly affected by potential tidal power schemes: around the Severn Estuary at Lavernock Point and Brean Down, and in the Orkney Islands. The stakeholder engagement comprised two workshops with key stakeholders from a range of backgrounds. One workshop was conducted in the North (Aberdeen) and one in the South (Cardiff).

Awareness and attitudes to tidal power

Public

Just over half of the UK population is aware of tidal power (55%). This is similar to wave power (57%). Awareness of tidal power is highest amongst males (67%) and amongst those who live close to a potential Severn barrage site.

There is a wide range in the public's levels of knowledge about tidal power. Most have a superficial understanding, and some confuse tidal power with wind/wave technologies. However, a few are well informed and understand how tidal power works.

Prior to deliberation, the public are equally split between being in favour and undecided in their opinions on tidal power. The main reasons for being in favour of tidal power are: the production of clean energy, concerned about global warming and alternative sources of energy such as nuclear. The main reasons for being undecided are the lack of knowledge about tidal power in terms of: the environmental impacts, how much it will cost, what it is and what it will look like.

Stakeholders

Stakeholders are aware of the potential of tidal power to become part of the UK's energy mix, but have varying levels of knowledge about the various issues concerning tidal power and the potential effects of different tidal power technologies.

Most stakeholders were positive about tidal power at the beginning of the workshops. However, in the Southern workshop stakeholders were split between being against and being neutral towards Severn Barrage proposals and only a few were positive.

Attitudes to tidal power technologies

Tidal barrages

Many of the public think that tidal barrages could provide greater potential benefits than other tidal technologies. Key benefits are the significant generation of 'clean' energy, the 100+ year lifespan and the ancillary benefits of road/rail links. However, many also think that the disadvantages of tidal barrages are more profound than other technologies in terms of the environmental impacts on the estuary, the high capital cost and the construction impacts and effects on communities near the barrage. For most, the benefits of tidal barrages outweighed the disadvantages.

Stakeholders perceive the potential benefits and disadvantages of the barrage to be very significant, however they perceive the disadvantages to be more profound than the public. The key benefits for stakeholders are the production of clean, limitless, predictable and secure power from proven technology, job creation, expertise in tidal technology and transport links. The key disadvantages for stakeholders are the reduction of biodiversity and impacts on wildlife and water quality, the public subsidy needed to help finance barrage schemes, the impacts on shipping and ports and the construction impacts and affects on other marine users.

Tidal stream

Many of the public think that tidal stream technology did not seem as viable and beneficial to the wider environment as tidal barrages. The main reasons for this perception are that tidal stream technology produces far less 'clean' energy, the technology is unproven, the electricity produced is presently expensive relative to barrages, devices need to be replaced every 20 years and there are few social benefits. However, the negative impacts of tidal stream technology are generally considered to be far

less severe than tidal barrages. The devices make minimal damage to marine environment with the exception of the risk of collision, there is low capital cost for each device and the main social concern is over visual impact of fixed devices.

Stakeholders perceive tidal stream technology more positively than the public in terms of each of the sustainable development aspects. Many stakeholders are also more positively disposed to tidal stream technology than tidal barrages. The perceived key benefits for stakeholders are that there are fewer environmental and ecological impacts than barrages, the devices are modular and therefore offer better prospects for attracting investment and producing quicker results than large infrastructure projects. They also have comparatively minimal effect on visual amenity. Stakeholders also see the potential for UK industry to become leaders in tidal stream technology. The key disadvantages for stakeholders are the difficulty in controlling noise pollution, the R&D costs associated with unproven technology, the higher transmission and maintenance costs and the potential effects on navigation and search and rescue activities.

Lagoons

Most of the public considered that tidal lagoons would have environmental impacts on an estuary whilst producing lower levels of 'clean' electricity than a barrage; there were also concerns over the unproven concept, high capital cost and the perceived negative visual impact.

Stakeholders perceive tidal lagoon technology more positively than the public. However, they perceive tidal lagoons to have greater negative environmental impacts than tidal stream technology. The key benefits for stakeholders from tidal lagoons are the less extensive environmental impacts on the estuary compared to a barrage, the potential for local ownership and UK technology leadership, as well as having minimal visual and noise impacts and few impacts on the Severn Bore. The key disadvantages for stakeholders are the effects of the construction materials used (especially concrete), issues associated with stagnant water, the loss of shallow water environment, comparatively high costs and the silting effects that could negatively affect tourism by creating muddy beaches and changing the estuary landscape.

Severn proposals

The majority of the public consulted in the Severn Estuary area are in favour of a barrage. However, a few people from the regional workshops are against, mainly due to the environmental effects on the wildlife in the area. Some local people are also against mainly due to the social impacts i.e. construction and effects of development on the local area. Most prefer the large Cardiff-Western Barrage to the smaller Shoots Barrage. The main reasons for this are that it produces a significant amount of electricity (5% of UK production), uses more of the potential of the estuary and thus avoids the possibility of a smaller barrage being replaced with a large scheme at a later date, the ancillary benefits of road/rail links and the benefits of tourism.

Stakeholders recognise the contribution that a large barrage can make in producing significant amounts of clean renewable energy, but want to minimise the negative impacts. The impacts stakeholders consider to have the greatest weight are: the irreversible impact on the environment, ecology and SSSI's, the opportunity cost of investing in other renewable energy projects, and the social impacts of the 7 year construction phase. Many stakeholders therefore prefer the smaller Shoots barrage proposal to the Cardiff-Weston scheme.

Conditions of acceptability

Whilst most of the public are currently in favour of tidal power there are a number of key considerations and factors which make tidal power more acceptable. These conditions include: offsetting the negative environmental impacts, sympathetic design which limit the negative visual impacts.

Stakeholders have a more wide-ranging set of conditions that they believe are important to have in place in order to proceed with the development of tidal power in the UK.

- Full ecological/environmental impact study for all options
- Accurate, independent and centrally coordinated research and evidence base
- Clear government policy on energy, the role of renewables and tidal power
- Improved planning and consents systems
- Full consultation with marine users
- Reduced risk to developers and investors e.g. through a pilot scheme
- Proven economic viability

Government roles on decision making and financing

The public are reassured at the amount and wide-ranging nature of the regulation that is applied to potential energy developments. They believe that the regulations will help to ensure that the range of impacts of energy generation projects is considered from an economic, environmental and social perspective. The public think that local people who will be affected by the project should be consulted and that they should have influence over whether or not the project goes ahead.

Many members of the public think that the government has a role in financing tidal power schemes. In the UK Omnibus, half (51%) of the public think that the Government should pay for researching and supporting new tidal power technologies. Some think that private companies should pay for research and development of tidal power technologies, either because they do not want to pay for the schemes through taxation or because they think private companies are better equipped to research and develop tidal power technology.

Many stakeholders feel that central government should be responsible for 'top-down' direction and policy decisions, with the regions and devolved administrations taking 'ground-up' responsibility for implementation. In doing this, there will need to be a balance between national interests and local impacts. Stakeholders want government to provide strong leadership and champion tidal technologies,

but also to focus on and promote energy efficiency and demand management alongside other renewable forms of energy. They also urge government to adopt a realistic view of the economic aspects of tidal developments, as public money is being used.

2. Introduction

2.1. Background

In 2006, the UK Government (DTI) published its latest review of energy policy. The review contained a commitment to work with the SDC, the Welsh Assembly Government (WAG) and the South West Regional Development Agency (SWRDA) to further explore the potential of tidal power in the UK, with a review of Severn Estuary proposals forming a significant part of the study.

From this commitment, the SDC established a broad coalition of support for a UK-wide study into tidal power with these partners, plus the Scottish Executive, and the Department of Enterprise, Trade and Investment in Northern Ireland (DETI).

The SDC is integrating the engagement and policy analysis by running a comprehensive engagement programme alongside the research programme. The SDC has commissioned Opinion Leader (with facilitator and researcher Gillian Thomas) and The Environment Council to undertake a programme of public and stakeholder engagement.

In addition to the project-specific objectives, the SDC considers that this project will provide a learning opportunity as well as a case study and model for the way it works with engagement. The SDC has appointed Shared Practice to conduct an evaluation of the engagement process and outputs, which will be the subject of a separate evaluation report.

2.2. Objectives

In order to refine the objectives for the public and stakeholder engagement, Opinion Leader and The Environment Council conducted a scoping workshop with the key stakeholders, i.e. SDC commissioners and members of the secretariat and the project funding partners. Interviews were also conducted with some of the key funders, consultants and other stakeholders .

The key objectives of the public engagement are:

- To gauge current public attitudes towards tidal power
- To explore the public's views on the economic, social and environmental costs and benefits of tidal power and different tidal power technologies
- To explore the public's views on the financing of any potential tidal power development
- In the South West and Wales, to specifically explore the public's views on proposals for tidal developments in the Severn Estuary

- To understand the public's views on what role the Government and Devolved Administrations should play with regard to tidal power in terms of financial costs and decision making
- To establish the conditions for public acceptability for any tidal power development
- To understand how public attitudes vary across the UK

The key objectives of the stakeholder engagement are:

- To understand which stakeholders are pro and anti tidal power and to establish the conditions for stakeholder acceptability for any tidal power development
- To explore stakeholders' views on the economic, social and environmental costs and benefits of tidal power and different tidal power technologies
- To explore stakeholders' views on the financing of any potential tidal power development
- To specifically explore stakeholders' views on proposals for tidal developments in the Severn Estuary
- To understand stakeholders' views on what role the Government and Devolved Administrations should play with regard to tidal power in terms of financial costs and decision making

2.3 Methodology and sample

2.3.1 Identifying the topics for public and stakeholder engagement

Topics were identified through the scoping workshop and interviews mentioned above, and through collaboration with the project team.

2.3.2 Public engagement

A programme of national, regional and local engagement was conducted with members of the public. To gain a nationwide view of perceptions about tidal power we conducted an omnibus survey comprising 8 questions with 1,000 adults across the UK (a full list of questions is shown in appendix 5.3).

The omnibus survey covered:

- The public's current awareness and understanding of tidal power
- The public's views on how tidal power technology should be supported
- The main benefits and disadvantages of a tidal barrage across Severn Estuary
- The public's position on a tidal barrage across the Severn Estuary

In order to deliberate the issues surrounding tidal power with people at a regional level a series of three one day deliberative workshops were conducted. Deliberative workshops were conducted because they are particularly valuable in exploring significant and complex policy issues like tidal power. Longer form sessions enable us to fulfil the objective of understanding both initial and considered views about tidal power and to identify the key drivers of public opinion. Participants had sufficient time to assimilate and scrutinise relevant information and debate issues and grapple with the trade-offs. Workshops enabled

shared solutions to be reached during the sessions and the opportunity to reflect on initial points of view on the issues.

The workshops took place in three different locations: two locations around the Severn Estuary (Cardiff and Bristol) and one location in Scotland (Inverness). In order to get a range of opinions on tidal power at a regional level, we recruited from a radius of 30 miles around the chosen locations in order to achieve a good spread of proximity to coastal areas in regions of high tidal resource where tidal power might be developed amongst participants. Twenty participants were recruited for each workshop reflecting the population profile in each area and sat participants on mixed tables to bring together people from different life stages, gender and backgrounds. This ensured that participants were exposed to diverse ranges of views, behaviours and experiences. Participants worked in two tables consisting of ten, each with a facilitator. The breakdown of the profile of the participants for the workshops is as follows:

Workshop participants (Cardiff)

Age	16-29	30-44	45-64	65+
	4	6	6	4
Socioeconomic Classification	AB	C1	C2	DE
	5	6	3	6
BMEs	2 per workshop			

Workshop participants (Bristol)

Age	16-29	30-44	45-64	65+
	4	6	6	4
Socioeconomic Classification	AB	C1	C2	DE
	5	6	3	6
BMEs	2 per workshop			

Workshop participants (Inverness)

Age	16-29	30-44	45-64	65+
	4	5	7	4
Socioeconomic Classification	AB	C1	C2	DE
	5	6	3	6
BMEs	Up to 1 person per workshop			

A total of six local discussion groups were conducted which focused on understanding public opinion in locations that might be directly impacted by tidal power development:

- Lavernock Point and Brean Down which are the points either side of the Cardiff-Weston barrage alignment in the Severn Estuary, which has the greatest concentration of tidal range resource in the UK, and
- Kirkwall, Orkney which is near prototype wave and tidal power device installations, and an area of significant tidal stream resource in the Pentland Firth.

A younger (under 45) and older (45 and over) group was conducted in each of the locations in order to understand whether there were any differences according to the age of the participants. This element of the engagement focused on understanding the current awareness and perceptions of the issues. The focus groups were also used to gauge reactions to specific proposals for tidal power developments in the locations chosen.

The participants for the regional workshops and local focus groups were recruited by Opinion Leader's network of professional recruiters.

The discussion guides and agenda were designed after the scoping workshop and included questions to elicit responses to each of the research objectives. A copy of the agendas/discussion guides for the workshops and the focus groups can be found in Appendix 5.2 and 5.4. The stimulus materials were developed in consultation and collaboration with the SDC.

2.3.3 Stakeholder engagement

The Environment Council worked in an advisory role to assist The Sustainable Development Commission (SDC) in identifying and prioritising stakeholders to participate in the SDC's stakeholder engagement on Tidal Power in the UK. An iterative process of stakeholder analysis was followed, with The Environment Council providing analysis and advice to inform the SDC's decisions.

Stakeholder long list

The SDC created a list of potential stakeholders, some of whom had contacted the SDC proactively to express interest in the project and some of whom were known through previous contact and partnerships. The Environment Council also created a list of potential stakeholder organisations and individuals based on knowledge and experience in the sector. When compiling these lists, consideration was given to different levels of stakeholders (local, regional, devolved administrations, national, UK and European); economic concerns; environmental considerations and social and recreational interests. The UK-wide, national scope of the project was recognised, and national and representative organisations representing a range of interests and sectors identified.

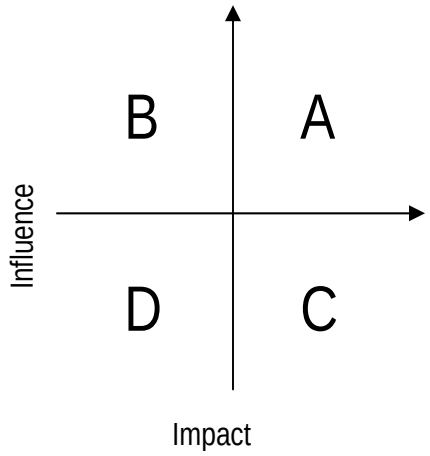
Effort was made to include sectors that historically had not been highly engaged on this issue (for example, commercial and recreational marine interests in fishing, shipping, navigation), in order to gain a broad cross-section of views and to ensure consideration of a diversity of issues. In January 2007, the SDC Tidal Power Project Manager, SDC Engagement Analyst and members of The Environment Council tidal power engagement team met to amalgamate the two lists to create a long list.

Due to the large number of stakeholders on this combined list and the wide diversity they represented, and also to further help identify gaps, stakeholders were divided into sector groups as follows: Non-Government Organisations (NGOs), Industry, Trade and Membership Bodies, Academic/Research, and Government. Due to the large number of stakeholders in the long list, it was agreed to identify trade and membership bodies to represent the many small organisations and individuals identified. In the Severn Estuary, we worked with the Severn Estuary Partnership, among others, to ensure that regional and local interests were taken into account and represented directly or by umbrella groups. For example, local authorities were consulted through the Severn Estuary Partnership and representation sought through the Partnership, local government associations, and regional bodies. We completed a gap analysis to identify further stakeholders before prioritising the long list, which consisted of 107 organisations.

Prioritising stakeholders for invitation to workshops

Due to SDC resources for the project, it was decided that there would be two stakeholder workshops, one in the North of the UK and one in the South. It was decided the workshops could accommodate approximately 100 stakeholders, 40 in the North and 60 in the South.

The next step was to prioritise stakeholders along scales of (i) their likely influence over the decisions to be made and (ii) the likely impact of the decisions upon them. Once plotted along these axis (see Impact/ Influence Axis, below), we prioritised those in section 'A', who had the highest likely influence on decisions regarding tidal power, and those who would be most greatly impacted.Impact/ Influence Axis



After an initial prioritisation, SDC and The Environment Council contacted project funders and key contacts in the marine and energy sectors to identify gaps and to further refine prioritisation of stakeholders.

The Environment Council discussed the initial analysis with the agreed key contacts, and took their feedback and recommendations to conduct further desk-based research on additional organisations and interests that needed to be represented in the engagement. Further iterations of the stakeholder analysis were made with the SDC and invitees were categorised into whether they would be invited to the Northern workshop, Southern workshop, both, or to one of the two, depending on which the stakeholder themselves identified as most appropriate for them.

Prioritisation of stakeholders was also discussed at a Scoping Workshop for the project, held by the SDC in February 2007. This gave attendees, who consisted of funders, SDC Commissioners, and SDC Secretariat with an interest in the project the opportunity to review and comment on the stakeholders identified to be invited to the engagement workshops.

Invitations

146 invitations were sent by email from early February 2007. After three weeks, the response rate was very low, so The Environment Council followed up these correspondences with an intensive programme of further emails and phone calls, to ensure that prioritised interests and stakeholders would be represented in the engagement process, and to achieve a balance across sectors. During this time,

there were further iterations to the list in order to accommodate a diversity of interests. A great deal of time and effort was made to involve specific sectors that traditionally had not been engaged to this extent, and to guarantee participation from key stakeholders who had not responded. This resulted in 50 acceptances for the Southern workshop and 22 for the Northern workshop.

2.3.4 Other SDC Engagement Activity

In addition to the public and stakeholder engagement described in this report, the SDC conducted a number of forms of stakeholder interaction. These were: an email group to circulate project updates and for members to share news and information; an online forum on tidal power; exploration and scoping of tidal power issues with members of its panel of sustainable development stakeholders.

Following the project's core stakeholder engagement undertaken by The Environment Council, we understand that the SDC also conducted a number of additional other forms of interaction with various stakeholders. These were the following:

A workshop with participation from some 30 officers and members representing 18 English and Welsh local authorities from around the Severn. This was to examine tidal options and explore key regional and local issues and was arranged with the South West Regional Development Agency, the South West Regional Assembly and the Severn Estuary Partnership.

A roundtable discussion with 12 participants, including tidal stream device and project developers. This was hosted by the British Wind Energy Association (BWEA) and examined challenges and barriers for tidal stream development, the regulatory and support frameworks, and the implications of long term changes to carbon pricing and electricity market.

3. Main findings

3.1 Views on sustainable energy (public)

Most of the participants taking part in the engagement project are aware of, and worried about, the link between the use of fossil fuels and climate change. Rising sea levels and flooding are often cited as a worrying consequence of climate change, particularly in the south west. They feel that the issue has become higher profile over recent years following extensive media coverage.

However, concern about climate change is not universal. Some people remain unaware of it, or are only aware of it at the most cursory level. Some individuals question the reality of climate change putting it down to 'hype', or believing that the earth has climate cycles which are natural and do not represent a threat to mankind. A few had seen a recent Channel 4 programme on this subject and said it had influenced their view. Those in Inverness appeared least engaged with climate change and energy issues.

The public engagement found fairly low awareness of energy security issues in all locations. Many are aware that fossil fuels are finite but do not know about the risks involved in importing energy or that North Sea gas is running out. When presented with this issue, participants became concerned about it. The public agree in principle that there is a need to explore alternative energy sources and specifically sustainable energy sources in order to combat climate change. They also like the idea of Britain being as self sufficient as possible in terms of energy and believe that sustainable energy will have a role in this. They endorse the idea of sustainability in terms of balancing economic, environmental and social factors in decision making.

"I think it is always best to spread these things out as we've proved with oil and gas and fossil fuels. We're kind of relying too heavily on that one energy source"

Male, Orkney (focus group)

The public believe that there will be more sustainable energy technologies in the future, though they are unsure what these might be. Wind power is the most familiar and visible sustainable energy technology. In the omnibus survey 91% of people have heard of wind power which is higher than for coal and nuclear (82%). Some participants confused wind power with tidal power during the early discussions.

The issue of nuclear power cropped up during discussions with the public and it was very divisive. Some of the participants lived close to a nuclear power station (Hinkley Point, Dounreay) and are worried about safety and do not like their visual apearance. Others expressed support for nuclear power on the basis of their impression that it is more cost effective than sustainable energy sources such as wind power. A few people are aware that nuclear power does not emit CO_2 in the same way as

burning fossil fuels and support it for this reason as well. Support for nuclear is fairly prevalent in Inverness and this dampened their enthusiasm for investment in alternative energy sources.

"Green power would be very nice, but I think with nuclear you know it works"

Female, Inverness (workshop)

3.2. Current knowledge and attitudes towards tidal power

3.2.1 Public

Approximately half of the participants in Bristol and Cardiff were aware of tidal power, this was lower in Inverness. This is in line with the national picture. The omnibus survey reveals that 55% of people in the UK are aware that energy can be generated from tidal power.

Those who are most knowledgeable tend to have the following characteristics:

- Male. Awareness of tidal power is 67% amongst males compared to 42% amongst females
- Higher socioeconomic groups - 58% of people of social grade ABC1 had heard of tidal power compared to 48% of C2DEs.
- Live close to the sea
- Have an interest in science and technology

There is a wide range in the levels of knowledge about tidal power amongst the public. A few members of the public have a good understanding of how tidal power works or could work. Knowledge is greatest in the local areas (Brean, Cardiff and Orkney), and lowest in the regional workshops, especially Inverness.

"Well, I have never come to think about it before, really. But I suppose when you do think about it is an obvious source of power."

Female, Bristol (workshop)

The Severn barrage option is familiar to many people living around the Severn and quite a number of people in Scotland have also heard of it. The overriding perception in the Severn Estuary is that it is a serious proposal which is fairly likely to happen at some point in the future. Some members of the public living around the Severn referred to in a familiar way as "the barrage" and talked about "when" it would happen rather than "if". However, a few people made jokes about it being one of those plans that is more talked about than acted upon.

People in Orkney have some familiarity with tidal stream devices because the test site has received some local press attention. There is a lot of confusion with the new wave technology device 'Pelamis' which is also sited in Orkney and has recently been featured on local and national TV. There is very little public awareness of tidal stream technology outside Orkney which is not surprising since this

technology is in its infancy whereas proposals for barrages across the Severn estuary have been discussed for over 20 years.

Knowledge about tidal power is generated by local press, TV and word of mouth. In addition one or two of people in each region had visited or knew about la Rance barrage in France. A few people living in Orkney had seen the tidal stream test site on the island of Eday.

There was quite a lot of variation and uncertainty in terms of what the public believed tidal power constructions would look like:

- A dam?
- A big road?
- Windmills underwater?
- A snake (like Pelamis)?
- Something only partially visible?

"It just conjures up pictures in my mind of great concrete monstrosities across the channel."

Female, Bristol (workshop)

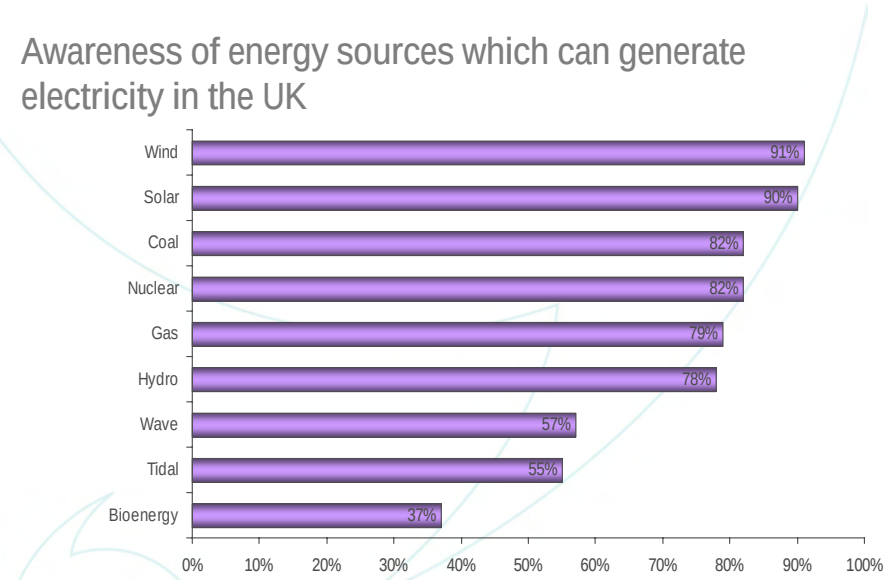
"I picture the Thames barrier."

Male, Bristol (workshop)

"*Is it like windmills underwater?"*

Male, Orkney (focus group)

Most people have a very superficial understanding about what tidal power is. Most do not know the proposed size, location or the potential environmental impacts of the technologies. There are also some people who claim to know about tidal power but are in fact confusing it with wave and/or wind power. In the omnibus survey awareness of wave power (57%) was marginally higher than for tidal power (55%). This is more pronounced in Scotland where 69% of people have heard of wave power compared to 51% for tidal power.



Base: All National – 1010

"Which sources of energy have you heard of that can be used to generate electricity in the UK?" 1

Prior to debating the subject in more detail attitudes to tidal power are mixed. We conducted a straw pole at the beginning of the workshops and the participants were equally split between being in favour (29) and being undecided (31) feeling they do not know enough information to make a judgement. None of the members of the public were explicitly against tidal power at this initial stage.

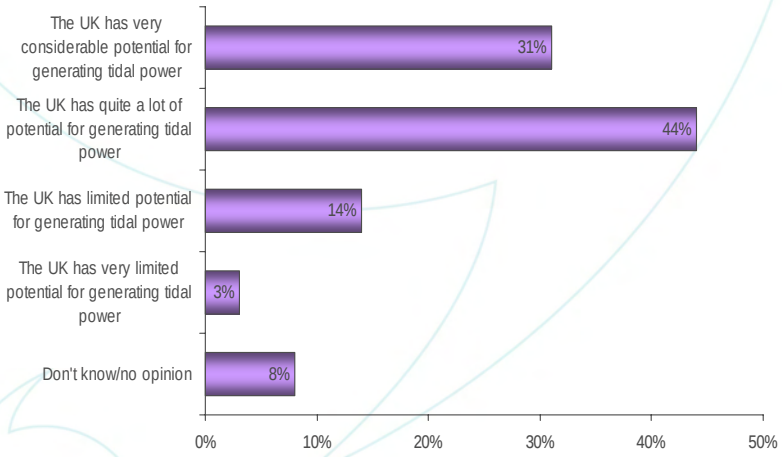
The main reason for being in favour of tidal power is the production of 'clean' energy. The public see tidal power as less polluting and more natural than other energy sources because it does not involve the burning of raw materials and the water remains part of the environment once the energy has been harnessed. They also like the idea that tidal power is not housed in large polluting buildings like fossil fuel and nuclear power stations.

"Clean energy, you're not going to get all these big power stations chucking out smoke and fumes and pollutants into the atmosphere and it looks nicer and more friendly."

Female, Bristol (workshop)

Some members of the public express the feeling that the tides are a powerful natural source of energy which should not be wasted. This view is prevalent amongst those who live closest to the sea and are most aware of its power. Most of those taking part in the omnibus research also think that the UK is well placed for harnessing tidal power. A total of 76% of those taking part think that the UK has very or quite a lot of potential for generating tidal power.

The UK's potential for providing tidal power



Base: All National – 1010

"Which of the following statements best describes your estimation of the UK's potential for producing energy from tidal power?"

3

"When you see the water coming through Bristol you can see how, when it's up high and when it's low the amount of water that leaves it and comes into it and you think, gosh, I think we forgot this stuff here, we must be able to use somewhere to make life easier for everyone."

Female, Bristol (workshop)

"I just think it is a good idea to sort of tap into that resource rather than creating more pollution by making energy"

Female, Bristol (workshop)

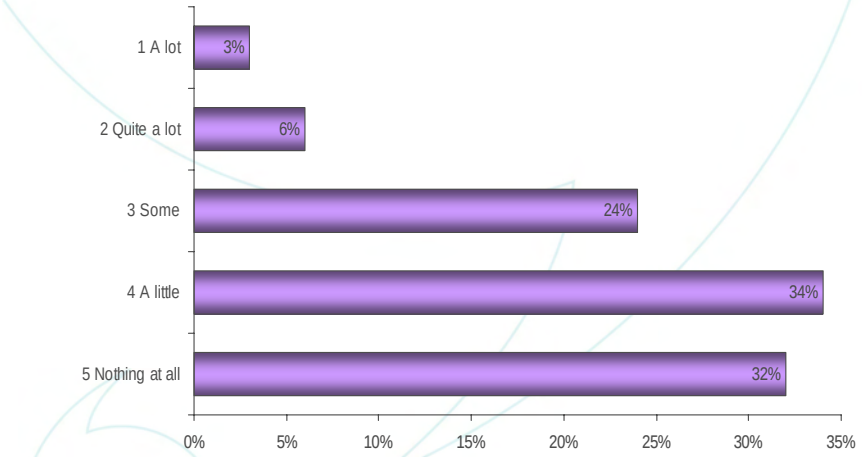
"… Brunel, if he had been alive today, would have done it. And I am amazed that there isn't more money poured into the university) to do that. Because it makes sense, doesn't it, to harness the energy in the world, the natural energy; it makes sense?"

Female, 45+ Lavernock (workshop)

Information needs

Although some superficial knowledge exists, the public feel that they need a lot more information about tidal power to be able to come to a really informed view about it. This is reflected in the omnibus survey where the majority of people felt they knew "a little" about tidal power or "nothing at all" (66%).

Public levels of knowledge about tidal power



Base: All National – 1010

"On a scale of 1-5 where 5 is a lot and 1 is nothing at all how much would you say you know about tidal power?

2

The most important information needs from the public's perspective is as follows:

- The environmental impact
- The cost
- What it will look like
- The impact on local communities
- Examples from other countries
- Opinions from expert organisations/individuals

Environmental impact, global and local, is the most important priority for the public in finding out more about tidal power. They want to know what the impact on habitats and local wildlife would be and whether it could it make a measurable difference to climate change.

"The life in the river itself, if they move is it going to obstruct their path?"

Male, Bristol (workshop)

A few people wanted to know whether the effects of climate change, such as rising sea levels, might make tidal power technologies unworkable in the longer term. In addition a couple of people wanted to know whether there was a risk that the environmental cost of building tidal power structures, in terms of CO_2 generated, would outweigh the ultimate carbon saving.

"The cost of construction in terms of the carbon footprint, as people talk about nowadays. I mean is it producing this enormous concrete structure actually using far more energy than it will actually save in a way"

Male, Bristol (workshop)

The public feel that information about costs are crucial for them to form a informed view about tidal power. They want exact and realistic costs in terms of:

- The capital cost of building and maintenance
- How long it would take to pay for itself
- The impact on householders' bills, if any, and when this would happen

For all the above they ideally want comparisons against other energy generation methods, in particular wind and nuclear power which are perceived to be the main alternatives. The public are very suspicious about spiralling costs and want to know what the risks of this might be, as well as who would own tidal power structures and who would profit from them.

> *"When it comes to things like that then people, being people, all we think about is how much is it going to cost and who is going to pay?"*
>
> Male, Bristol (Workshop)

The issue about what tidal power will look like is important for everyone, but is paramount for those living by the proposed sites. Participants were initially unclear about what tidal power technologies would look like and were very worried that they might be 'an eyesore'. Even small variations in the possible look of tidal technologies, such as lights being present on top of tidal stream devices, could make a huge difference to whether participants felt they would be in favour or against their installation.

The impact on local communities is also of most concern in the local areas where tidal power is most likely to be sited, but it is a key issue in all locations. The main questions from the public are whether the local infrastructure could cope and whether the unique character of the local area would be spoiled by regeneration. Participants do not want to associate themselves with what they call 'NIMBYs' but they do want to be clear that the special value of their area, in terms of intangible factors such as traditions, culture, way of life, and so on, would need to be given proper consideration when deciding whether or not to go ahead with major tidal power projects.

> *"There's no doubt there's not another place like this on this earth."*
>
> Female, Orkney (focus group)

Some members of the public asked why tidal power has not been used already in this country. The main comparison is wind power which has become very visible in the UK in recent years. The public are suspicious that the apparent lack of progress in tidal power could mean that the risks or costs are too high or it is not effective in some way. The public feel that information about tidal power from other countries could help them come to a clearer view about the costs and benefits of the technologies. There is little or no spontaneous understanding that appropriate locations across the world for tidal power are limited.

> *"I wonder why it has not been used already been used in this country"*
>
> Female, Bristol (workshop)

Participants want to know the opinion of respected local leaders and national/local environmental Groups, such as Friends of Earth and Slimbridge Wetland Centre, about tidal power. Those who are undecided about tidal power feel that this could have a strong influence on their view. Some people bemoan the lack of high profile groups or individuals talking about tidal power at the moment.

> *"I don't understand it. I mean, do you need tidal power? Do you need some in the North Sea, some further up the country, some on the Scottish coast, some down here? Or would one mega tidal barge do the whole country? I don't know."*
>
> Male, Lavernock (focus group)

3.2.2. Stakeholders

All attendees are aware of tidal power and its potential as a part of the UK's energy mix, but have varying levels of knowledge of the specific issues, requirements and technologies and their impacts and benefits.

In order to understand stakeholder views and whether the engagement workshop altered their views, we invited attendees to indicate on a scale of 0 (most negative) to 10 (most positive) their attitude to tidal power. They did this at the beginning and end of the day.

In the Southern workshop, stakeholders were asked two questions, being 'how do you feel about a) tidal power in the UK, and b) a Severn Barrage. The results for both workshops are below, and indicate a generally positive view on tidal power in general, and significantly less so about a Severn Barrage specifically.

Stakeholder views at beginning of day

	0-4 (Negative)	5 (Middle)	6-10 (Positive)
Northern Workshop	0	4	14
Southern Workshop (a)	3	4	29
Southern Workshop (b)	15	14	7

3.3. Sustainable development aspects of tidal power technologies

Public

The participants in the regional workshops were given information sheets about the environmental, economic and social aspects of each of the tidal power technologies i.e. tidal barrages, tidal stream and lagoons (copies of the information sheets can be found in appendix 5.7.2.) The order of considering each of the sustainable development aspects was determined by the participants on the basis of perceived importance. For most of the participants the most important aspect was the environmental implications followed by economic and then social.

3.3.1 Environmental costs and benefits of tidal power

Public

The environmental aspects of tidal power are considered to be the most important by participants because they are perceived to be the most significant, both in terms of the benefits and costs. Many participants are surprised that there are potentially significant negative environmental implications of some of the tidal power technologies. Some perceived tidal power to be a non-invasive technology which worked in harmony with the natural environment. The main environmental benefit of tidal power is the production of 'clean' energy and the main environmental cost is the effect on the wildlife and habitats.

Tidal barrages

The main environmental benefit of the tidal barrage is the production of 'clean' CO_2 free energy which will help to reduce the levels of greenhouse gasses in the atmosphere which lead to global warming.

Tidal barrages are perceived to have significant negative environmental impacts for the estuary and surrounding area. These environmental impacts far exceeded the public's estimation of the effects of the technology on the environment. These significant environmental implications for tidal barrages led to some participants revaluating their attitudes to tidal power which led to a small minority becoming against tidal barrages.

"Water quality goes down, has an effect on the fish, if there's no tide or I don't know, rubbish or dirt is being deposited onto the beach, there's an impact on the birds, they're all linked together."

Female, Bristol (workshop)

"…Newport of course was flooded because of the loss of the mud flats when they built the Cardiff barrage…"

Male, Lavernock (focus group)

The most concerning aspects are the effect on the bird habitats and the detrimental effect on the water quality in the estuary. Many are concerned that the barrage would have serious impacts on the feeding grounds for birds and waders which would be irreversibly affected by the barrage. However, others think that the wildlife would adapt to the changing conditions of the estuary or find alternative habitats. The negative effect on water quality due to the barrage is a major concern to some who wanted the water in the estuary to be unpolluted for environmental and recreational purposes.

"What about our water quality? It may be negatively affected by a barrage."

Male, Inverness (workshop)

"I think if you were talking about the Severn estuary, it would fill up with sand very quickly"

Male, Bristol (workshop)

Those who live near the estuary are concerned about the environmental pollution from the construction of the barrage i.e. noise, dust and traffic and the erosion of the coastline in front of the barrage. However, those who live further away from the estuary are less concerned about this since it they are not personally affected and consider these consequences to be unavoidable.

The interruption of the passage of fish in the estuary is not perceived to be a significant environmental aspect since it is perceived to affect a limited number of fish, however, those who used the estuary for recreational purposes including fishing are more concerned about this.

"Fishing for local fishermen or for your general enthusiasts, if they can't fish, that's going to be another problem with the local industry."

Male, Cardiff (workshop)

Tidal stream

Overall, the effects of the tidal stream technology are perceived to be relatively benign, especially when compared to tidal barrages. Since the environmental effects of tidal stream technologies are not fully known due to the infancy of the technology, the participants hope that the environmental implications are minimal.

"I think tidal stream can be less invasive."

Female, Bristol (workshop)

"I suppose the one thing about the tidal stream devices is that they are not as huge as the barrage would be, so if you put them there and it really doesn't work, or things go horribly wrong, you could probably take them down again."

Male, Bristol (workshop)

The environmental aspects participants are most concerned about are the effects on marine life from the installation and decommissioning of the devices. These actions are perceived to be invasive on the sea life on the sea bed since they would disrupt the existing sea life when the devices are installed and the new marine environment which is created as a result of the installation would be disrupted upon decommissioning. The effects of installation and decommissioning are exacerbated by the relatively short life-span of the devices of 20 years compared to over 100 for a tidal barrage. Some are concerned about the risk of ships colliding with the devices which could lead to significant environmental damage. This concern is particularly strong in Orkney which is near the Pentland Firth, a possible site for tidal stream devices which is a busy shipping route where participants think that the risk of collision is significant.

"I would say the tidal steam is the one which causes the least destruction…the only kind of major impact you have got is with shipping."

Male, Cardiff (workshop)

"And would that still allow shipping to go through, I mean they're talking about the Pentland Firth.?"

Male, Inverness (workshop)

A few participants are concerned by the underground sea noise which could be harmful to sea life.

Tidal lagoon

The environmental effects of tidal lagoons are perceived to be significant, albeit less so that tidal barrages since they do not block an estuary and hence do not result in coastal erosion or have significant negative impacts on the water quality in the estuary. The public are most concerned about the effects on the habitats of birds and fish.

Stakeholders

Stakeholders see the environmental benefits of all tidal power technologies as providing carbon savings, a means of climate change mitigation and 'clean', limitless energy. In the South, stakeholders perceive the location of sites close to source of demand as a benefit, but this is less so in the North due to the location of population centres and tidal developments. Stakeholders also see advantage in there being less reliance on other renewable energy sources, and the comparatively small carbon footprint of construction relative to lifetime production.

However, there is a great deal of concern about the unknown effects of any of the technologies on ecology, habitat loss, wildlife, water quality and a variety of other specific and general environmental impacts. Some stakeholders consider biodiversity as an international responsibility. The loss of intertidal area and also the visual impact of tidal devices are considered disadvantages of tidal barrage, lagoon and stream developments. Stakeholders feel very strongly that more research is needed. Other perceived disadvantages common to all three technologies are the implications for decommissioning, and the potential disruption, pollution, negative carbon impact and high resource demands of

construction. The interests of and disruption to fisheries, navigation and shipping lanes are a consistent concern, reflected at both workshops.

Tidal Barrage

In terms of barrage developments specifically, listed benefits include habitats for some invertebrates and therefore possibly birds, the creation of breeding grounds and marine parks, and the barrage as a potential flood defence upstream. One stakeholder asked 'is all change bad?' indicating that some environmental impacts could be beneficial. However stakeholders feel that the impact on migratory fish, salinity changes, sewage pollution, the impact of tourism and visitors on the environment, and tidal scour are significant environmental issues. Some stakeholders feel that a barrage will also impact on tides, reducing flow for current turbines. There is concern that once constructed, a barrage could not be removed easily and effects would not be reversed.

Tidal stream

Stakeholders perceive tidal stream devices to be of less environmental and ecological impact than barrages due to the potentially small scale of the technology. This means that location can be flexible and sites could be selected for minimal environmental, visual and shipping impact and have minimal disturbance to existing habitats. In addition, tidal stream technology is also perceived to have a lower risk of silting and the base can form artificial reefs, providing habitats to invertebrates and encouraging biodiversity. Conversely, it is perceived to be difficult to control pollution, there are significant impacts on marine life from the noise produced during both construction and operation, and there is no understood benefit to flood alleviation. There is concern at the likely impact on tidal regime, sand banks downstream and sediment transport. The advantage of small-scale devices is balanced by the fact that many devices would be needed to produce significant energy, and this increases impact.

Tidal Lagoon

Lagoon technologies, like tidal stream, also provide some flexibility in location and are seen as having similar habitat creation and protection benefits. There is low visual impact and a lagoon wouldn't close the estuary, and so minimise obstruction of fish migration, shipping and recreation. However, large amounts of concrete are needed and there is concern about the impact of obtaining the materials required and the negative effects of their use of the environment. These concerns are both during production (especially in the case of concrete) and use in construction as well as continuous effects post-production. Stakeholders have concern over the creation of large stagnant bodies of water, the loss of the existing shallow water environment, and the impact on the seabed habitat. The need for frequent dredging means that maintenance is also an issue.

A disadvantage of both stream and lagoons is that due to the smaller scale, and greater numbers of devices needed for significant power production, seabed habitats could be far more affected overall than with one large barrage. Some stakeholders suggest that many small schemes could reduce the

area of navigable water, increasing ship traffic density, emissions and likelihood of accident and consequent pollution.

3.3.2 Economic costs and benefits of tidal power

Public

The economic aspects of tidal power are considered to be less important than the environmental consequences, although more important than the social aspects at a national and a regional level. Some of those who live near potential sites for tidal power development consider the social aspects to be more important than the economic considerations since they believe they will be more affected by these than the economic impacts of the proposed developments.

Tidal barrages

The tidal barrage technology is perceived by the majority of the public to have a stronger economic case for investment than tidal stream and lagoon technologies. The main reasons for this are that it produces a significant amount of carbon free power over a 100 year period, it can be combined with road and rail links, it uses proven technology and will create a significant number of jobs.

"It means more jobs to the area basically."

Male, Bristol (workshop)

The production of 5% of the UK's electricity is perceived by many to make a significant contribution to the UK's energy production. However some of the participants do not think that 5% is very significant. This is partly because they had expected the potential energy generated by tidal power to be far higher and partly because they thought that a single power station could produce similar amounts of power.

"It still doesn't seem a significant amount (of electricity) for all the destruction they'll do"

Male, Bristol (workshop)

Many perceive a tidal barrage to be an 'investment in the future' rather than perceiving it as a 'cost' since it provides a significant amount of CO_2 free energy over a long period of time (100 years), unlike some other capital intensive projects such as the Olympics and the Milenium Dome which are perceived to produce predominantly short term benefits.

The potential for improving transport links is perceived to have significant benefits for those living in the region of the barrage since it will reduce journey times and hence make it easier to travel for work and leisure which would have further positive economic effects on tourism and economic mobility.

"You've got the barrage being used for road and rail links. That's (sic) all economic factors…"

Male, Cardiff (workshop)

The creation of jobs is perceived to be an important economic benefit. However, some in the regions express concern that a high proportion of the jobs could be taken by people outside the region and therefore reduce the benefits for local people.

Some over-estimated the revenue from road tolls which they thought would make a significant contribution to financing the barrage.

Most consider it to be more beneficial to have one structure which produces a significant amount of electricity than having many devices as with tidal stream technology.

"…If you had got a toll to go over there, wouldn't it be less expensive than the bridges? You, the upkeep might be less."

Male, Bristol (workshop)

For a large Severn barrage the major negative economic aspect is the cost of £15bn. This cost is perceived to be high, but many participants in Cardiff and Bristol considered this cost to be worthwhile, perceiving it as an investment in the future rather than a cost. However, some are concerned that an investment in a tidal barrage could result in an increase in their electricity bill. Many of those in Inverness think the cost of the barrage is too high and believe that there are other forms of electricity production which require less investment to produce the same amount of energy such as nuclear power. The cost of the barrage is the primary reason for people in Inverness being against tidal power. The cost of a barrage across the Severn Estuary is perceived to be the second most important disadvantage from a national perspective with 15% believing this to be the most important aspect.

"I think it's really high cost but I don't think the output that we're going to get back from it is substantial."

Female, Inverness (workshop)

"I mean, my electricity and gas bill has doubled and– it is not like waves are going up with inflation, you know… so you can obviously bring down the cost of electricity and gas, and I think everyone would be happy, but I think they are going to say alright, we are going to do this tidal power and putting that on your tax, you would not be very happy, would you really?"

Male, Bristol (workshop)

Those in Inverness are less concerned about the environmental effects of nuclear energy than those in Bristol and Cardiff. They will also not benefit directly from having a barrage in their region for example the increased levels of tourism and the ancillary benefits of a road and rail crossing.

Many members of the public are sceptical about the estimate of £15bn being realistic and expect this cost to escalate due to other high profile capital projects overrunning recently such as Wembley stadium

and the Olympics. The cost of environmental compensation and the effects on ports were important issues for a few participants, however many do not perceive this to be significant.

Tidal stream

Tidal stream devices are perceived to be less economically viable than barrages. This is mainly due to the technology being in the early stages of development. This has two principal effects on perceptions of economic viability. Firstly, since the technology is unproven there is a risk that it will not work or will require significant amounts of investment in order to become viable. Secondly, the energy produced at this stage is very expensive. The limited lifespan of around 20 years for tidal stream devices results in participants thinking that the devices are a less worthwhile investment since the payback period in terms of carbon free electricity is significantly less than tidal barrages.

"With the streaming device… there are many unknowns, how much power would the device produce?"

Male, Cardiff (workshop)

There is concern that tidal stream devices will conflict with other sea users. This issue is of particular concern in Inverness where there was concern that the major shipping route of the Pentland Firth will be affected.

"It's a major shipping route and it will impact on the local fishing industry."

Male, Inverness (workshop)

The potential for the UK to be a world leader in tidal stream technology is perceived to be beneficial, however, this is not perceived to be a particularly compelling reason for investing in tidal stream technology due to the significant amount of investment required before tidal stream technology produces electricity at competitive prices.

"On the plus side, if they do work, the UK can proudly say, 'we revolutionised this.'"

Male, Bristol (workshop)

Tidal lagoon

Tidal lagoons are perceived to have the least convincing economic case for investment compared to tidal barrages and tidal stream technologies. The main aspects which undermine the economic case for lagoons are that they produce less power than a barrage, the uncertainty surrounding the costs and the fact that the concept is unproven. The only economic aspects which are positively received are the production of CO_2 free energy for over 100 years and the use of proven hydroelectric power.

"The tidal lagoon definitely sounds like quite a stable thing, going for a hundred years as well."

Male, Bristol (workshop)

"The fact that it said there weren't any in the world indicated to me that there's something that we don't know about these tidal lagoons."

Female, Bristol (workshop)

Stakeholders

Generally stakeholders view the greatest economic benefit of tidal power as its potential to provide the UK with a secure, reliable and predictable long-term source of energy, at low running cost. The Stern Report is relevant in light of investment in climate change mitigation being economically sound. Tidal power is also perceived as being economically competitive with other renewables, especially given the right market conditions. In the South and near centres of population, transmission is cost-effective. Stakeholders view potential investment in local economies, subsequent job and wealth creation and the knock-on potential for tourism and education, as benefits.

At this stage, the need for public subsidy to support the market for tidal power is perceived as a strong disadvantage, as is the very high initial capital investment required to enable commercial viability. The predictable, but variable nature of the power means it would require back up power generation at specific times, which has cost implications. The cost of Environmental Impact Assessment is perceived as a disadvantage, as is the unknown cost of maintenance. The impact on fisheries, shipping and navigation are also seen as having significant economic consequences. All technologies require high capital investment and impact on navigation, shipping access, safety and therefore costs.

Tidal barrage

Stakeholders indicate that additional economic benefits of a barrage would be that it is proven technology, although this is not wholly agreed among stakeholders. Some stakeholders view the potential for flood defence upstream, and commensurate increase in land prices in these areas as a benefit. If located geographically upstream, it could be a benefit to ports, but a potential impediment otherwise. Stakeholders have concerns that associated economic developments may put pressure on local communities, who would also have to go through the process of decommissioning at a later date. There is also a lot of concern about a barrage diverting funding from other tidal technologies' development.

Tidal stream

Due to the modular nature of tidal stream device construction, there is less risk associated with this technology than for others. This makes it easier to attract initial investment, which will have a quicker return. It would deliver faster results and also position the UK as industry leaders and exporters of technology, whilst creating new skilled employment for the marine engineering sector. Maintenance is easier and therefore cheaper, as would be the cost of decommissioning tidal stream devices. However, whilst the learning-curve might be faster with this technology, it is still considered unproven technology and so the cost of necessary further R&D is perceived to be very high. There is difficulty in securing

investment because the technology is unproven. Those devices in remote locations incur higher transmission and maintenance costs.

Tidal lagoon

Tidal lagoons also have the potential for steady, controllable power output. There is the possibility of local ownership, and again to position the UK as industry leaders and exporters of technology. The flexibility of siting allows cheaper transmission and less impact, and lagoons are easier and cheaper to construct than a barrage, but one stakeholder commented that lagoons have "higher material and capital cost vs barrage". They are also considered less efficient than tidal stream and may cause silting of harbours and shipping lanes, while also impacting on tourism.

3.3.3. Social costs and benefits of tidal power

Public

With the exception of some of those who will be directly affected by the proposals, many think that the social aspects of tidal power are less important than the environmental and economic considerations.

Tidal barrages

The social aspects of the barrage are perceived to be neutral overall since the positive aspects are perceived to be counterbalanced by the negative social implications. The main social benefits are perceived to be the additional transport links and the positive effects on tourism and regeneration, and the protection from flooding.

"It could become a tourist attraction."

Male, Bristol (workshop)

As discussed in the economic benefits section, the road and rail links are perceived to generate benefits in terms of shorter journey times across the estuary which will improve the prospects for leisure and economic mobility. However, some who live close to the proposed sites are concerned that these links could spoil the local areas due to the influx of visitors and construction workers. Others hope that the crossing will lead to the regeneration of these areas. The main concerns are the risk of flooding for areas downstream of the barrage and its visual impact.

"They will want it to look pretty, that seems to be the main objection"

Female, Cardiff (workshop)

The protection from flooding behind the barrage is considered to be a positive social outcome from the barrage, however the benefits of this are offset by the increased potential for flooding in areas in front of the barrage.

The generation of tourism is considered to be a positive outcome generally since it will help to regenerate the areas either side of the barrage, however, there is some concern by local people that the current infrastructure is inadequate to support the influx of tourism to the area.

The effects on recreational boating are perceived to be mainly positive with the creation of recreational areas upstream of the barrage.

Whilst participants recognise that there is a potential for the barrage to be visually appealing and imposing, some are concerned that the barrage could be an eyesore and could negatively affect how people perceive their surrounding area.

"This is all hypothetical, but you could be saying in 20 years time: 'remember when Penarth used to be an expensive select little area and now it's a dump because of the barrage.' Who knows?"

Male, Lavernock (focus group)

Tidal stream

The tidal stream technologies are perceived to have more negative social impacts than positive aspects. The main concerns about tidal stream devices are the visual impact of the devices which could negatively affect the visual amenity of areas of natural beauty, and the potential for collision with shipping which could cause environmental damage and hence affect the utility of the seascape. The effect on shipping and fishing is also a concern for some.

The potential of the tidal devices to act as a tourist and educational attraction is perceived to be minimal since the devices are in areas where there are low populations and the devices lack the visual presence of a barrage.

Tidal lagoons

Tidal lagoons are not perceived to have any sizeable social benefits. Few think that the lagoon will generate significant levels of tourism or educational visits due to the lack of visual presence compared with a barrage and the lack of transport links. Many members of the public consider tidal lagoons to be unsightly and think that this would negatively affect the visual amenity in the surrounding area.

"Visually we thought it looked rather bad. With the tides gone out and all you're seeing …looks really awful for a lot of the time"

Male, Cardiff (workshop)

Stakeholders

Stakeholders perceive many social benefits to accompany tidal power in general, including the opportunities for local job creation in construction, operation and maintenance of the devices. Some stakeholders feel that skills developed in the UK could be exported and the UK could act as a source of

best practice for tidal power research and development. Developments could become centres for tourism, with exhibition centres to display renewable energy and increase knowledge and understanding of sustainability issues, both in the local community and internationally. Stakeholders suggest such developments could be seen as something to be proud of and attract wealth and development opportunities to the area(s). Additionally, the benefits to energy security of a domestic, long-term and predictable source of power are recognised. Some stakeholders hold the view that any form of energy other than nuclear has social benefits.

Stakeholders view the potential disruption to local communities during construction and possibly long term, as well as increased carbon footprint from development and associated industry as a potential problem. The advantage of job creation could be offset by the loss of jobs to the local fisheries due to the possibility of decreased fish stocks, or reduced access to them. Stakeholders feel that all technologies will have (negative) visual impact, and will impede recreation and leisure interests. One stakeholder has concern that the 'feelgood factor' of locally based renewable energy generation could lead to complacency and the attitude that the 'problem is solved'.

Tidal barrage

Some stakeholders see the social advantages of a barrage in its potential for transport links, recreation, flood management and its role in stabilising fuel prices. The disadvantages applied to all technologies are reiterated for the barrage, but to a greater degree in that costs, development and impacts on other marine users would all increase due to the scale of a barrage.

Tidal stream

Stakeholders view the small-scale potential of tidal stream, and the fact that the device is submerged, as a benefit, in terms of minimal visual and noise impact compared to other technologies. The creation of artificial reefs and the opportunity for an area of academic research are mentioned. However, again due to the small scale (multiple devices) and the fact that the device is submerged, tidal stream impacts on search and rescue operations and navigation is greater. Maintenance needs are high, which has perceived health and safety implications.

Tidal lagoons

Like tidal stream, the nature of lagoons means minimal visual and noise impact in the opinion of some stakeholders. There is potential for local ownership, and also for international interest in the technology. Lagoons also provide a flood defence. However, other stakeholders have concerns that lagoons limit use of the area, create sediment distribution leading to muddy beaches and change the estuary landscape.

3.4 Reactions to the proposals for tidal developments in the Severn Estuary

Public

The participants in the regional workshops in Bristol and Cardiff and the local focus groups either side of the proposed Cardiff-Weston Barrage (Brean Down and Lavernock Point) were given detailed information about two proposed barrage alignments across the Severn Estuary. The two schemes featured were the Cardiff Weston Barrage and The Shoots Barrage. The Cardiff Weston Barrage is largest scheme and has been studied extensively and The Shoots Barrage is a smaller alternative scheme which would be situated near the M4 road bridge. The public were shown the proposed locations of both schemes on a map of the Severn Estuary. The information provided to the public is in appendix 5.7.2.

Overall, the public in the Severn area are mainly in favour of the concept of a large barrage across the estuary. The main reasons for this are: the production of a significant amount of 'clean' energy over a 100 year period; the ancillary benefits of a road/rail crossing, the creation of new jobs, flood protection and the potential positive impacts on tourism in the surrounding area.

"I think we have to look at this long term for (the) environment, and I think this is the only way you can go … clean."

Female, Cardiff (workshop)

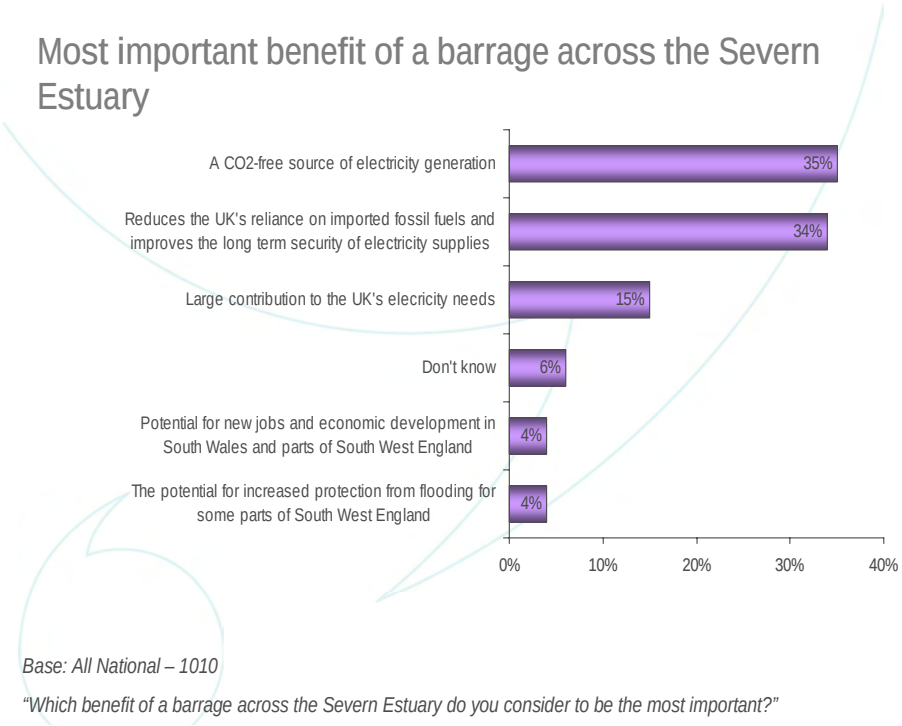
"In the long run you know the benefits are huge."

Female, Cardiff (workshop)

"It would be a wonderful sea defence for the upper reaches of the Severn; you could actually plug it on its own, like the Thames barrage has been plugged for the protection of London. And you wouldn't be just doing Cardiff – right up (to) Somerset, you know, a tremendous area of land would be protected if the barrage was built."

Male, Lavernock (focus group)

The national omnibus revealed that the production of $C0_2$ free energy is the most significant benefit of a tidal barrage. The benefits of a barrage across the Severn estuary are perceived to outweigh the significant negative impacts on the estuary, the most concerning of which are the effects on the habitats of birds and fish, the effects on ports, risk of flooding and erosion and the 7 year construction time.



Some participants in the regional workshops are aware of a proposed barrage across the Severn Estuary. Those living near the proposed sites for the Cardiff-Weston Barrage have a greater level of knowledge about the barrage proposals, particularly older participants. They also had a greater level of knowledge about the barrage scheme due to press coverage in the local area.

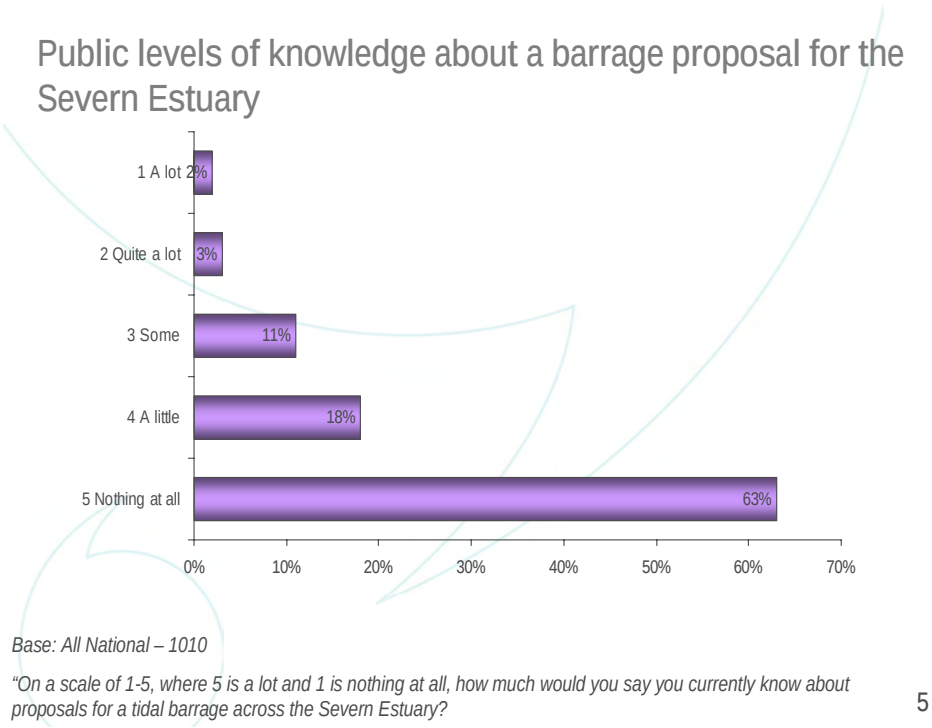
"Living here in Bristol, we do hear a bit about the Severn Barrage, it's been talked about for quite some time and different designs and different drawings…"

Female, Bristol (workshop)

"I know that in this area they're interested in the Severn Estuary because of the size of the tidal flow and the tidal variation, and the plan was to build a barrage between ourselves and south Wales to provide tidal power."

Male, Bristol (workshop)

At a national level, total of 32% of the UK population have a level of awareness of the proposed barrage the across the Severn estuary. Unsurprisingly, those in Wales have the highest awareness levels in the UK with 42% having some awareness of the proposals. This compares to 20% of those in Scotland having any awareness of the proposals.



Base: All National – 1010

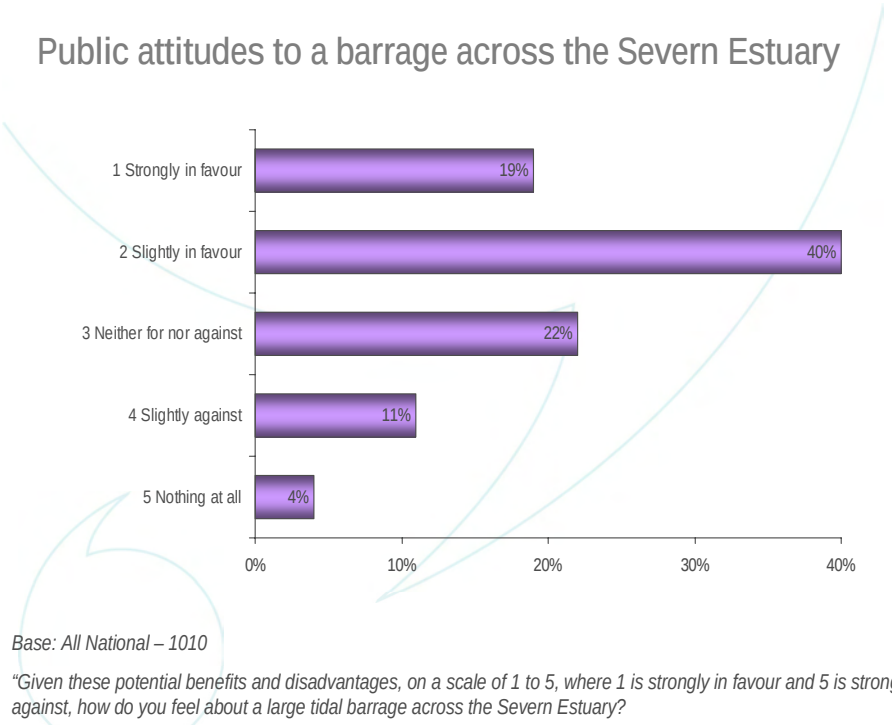
"On a scale of 1-5, where 5 is a lot and 1 is nothing at all, how much would you say you currently know about proposals for a tidal barrage across the Severn Estuary?

5

This section will focus on the specifics of the proposals and how the public think they compare to one another rather than discussing the generic issues surrounding barrages which have been discussed in the previous section.

Cardiff Weston Barrage vs. The Shoots Barrage - overview

Many members of the public think that there is a stronger case for the Cardiff-Weston Barrage scheme than the Shoots Barrage. A Cardiff Weston barrage could produce 5% of the UK's current electricity demand and is perceived to make a significant contribution to CO_2 free energy production whereas the Shoots scheme produces around a fifth of this amount. The Omnibus survey reveals overall levels of support for an (unspecified) tidal barrage across the Severn Estuary with 58% in favour and 15% against.



Base: All National – 1010

"Given these potential benefits and disadvantages, on a scale of 1 to 5, where 1 is strongly in favour and 5 is strongly against, how do you feel about a large tidal barrage across the Severn Estuary? 8

"The barrage across the Severn, the 5% bit is a bit startling – just that one barrage."

Female, Cardiff (workshop)

The fact that the Cardiff-Weston Barrage scheme utilises the majority of the potential tidal resource is perceived by many to be a better use of natural resources than harnessing a small proportion of this. Some are concerned that if the smaller Shoots Barrage option is put in place that this could be replaced at a later date by a larger barrage scheme which they consider to be a waste of resources. This concern may have been exacerbated in the area surrounding the Severn due to the replacement of the first Severn Bridge with a second bridge.

The ancillary benefits of the Cardiff-Weston Barrage are perceived to be far more compelling than the Shoots Barrage. The potential of a road and rail crossing between Cardiff and Weston Super Mare is perceived by many to generate job and leisure opportunities for those either side of the estuary.

"If it was to have a road network it would also alleviate some of the problems on the M5 – M4 junction of the motorway, which is quite a busy section, so it would as I say, improve the road network…it would hopefully improve the local economy…and it would be unique to the area…people do travel many many miles to see things like that"

Male, Brean (focus group)

The Cardiff-Weston Barrage is expected to have a significant visual presence and could become a source of civic pride as an example of excellence in engineering and a tourist attraction. The smaller Shoots Barrage scheme is perceived to have less potential to deliver these aspects, partly because of the proposed location and partly because of the smaller scale of the scheme.

"You can actually make something of a landmark of it. When you take into account Sydney Harbour or Sydney Opera House, it's built on a kind of barrage system as well, so it could actually be something which is actually more visually pleasing."

Male, Cardiff (workshop)

The main disadvantages of the Cardiff-Weston Barrage are the £15bn cost and the estimated construction time of around 7 years. The seven year construction period was of particular concern to some of the residents who live near the proposed site since they believe that the dust, noise and pollution and influx of workers associated with the building of a barrage will have a major impact on their quality of life during the construction phase.

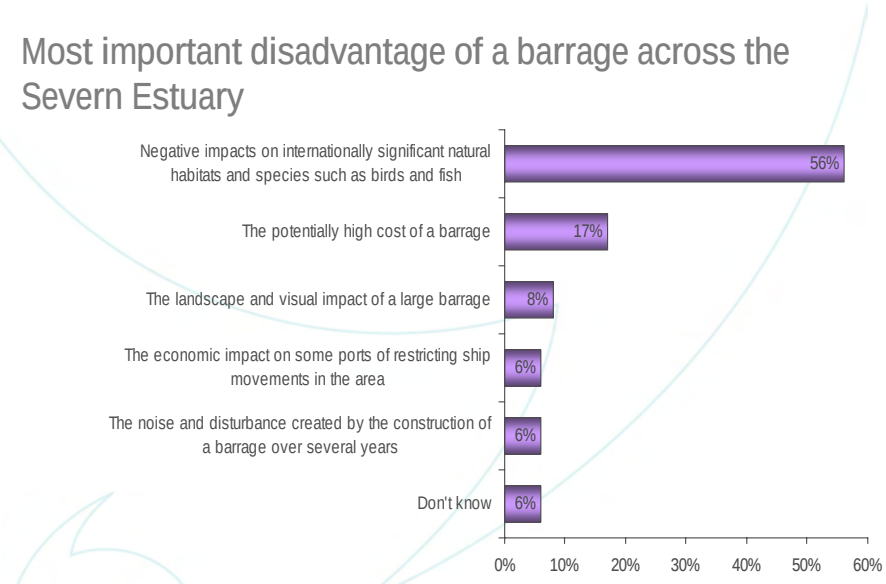
Environmental aspects (public)

The public in the Severn think that there are considerable environmental impacts from the barrage options and think the environmental impacts to be the most important disadvantage of the barrage.

"You build the barrage, now you're going to ruin a bit more farmland because you're going to build another rail (and) road link leading up to that bridge aren't you? I mean, its not just going to be one road, it's going to be a lot more than one road isn't it. It's going to go all the way through Somerset."

Female, Bristol (workshop)

At the national level, 56% of people considered that the negative impacts on internationally significant natural habitats and species and birds are the most important disadvantage of a Severn barrage. Many members of the public in the Severn area are surprised at the extent of the environmental effects which could result from the barrage proposals since these appear to conflict with their perception that tidal power is 'environmentally friendly'.



Base: All National – 1010

"What disadvantage of a barrage across the Severn Estuary do you consider to be the most important?" 7

"We're thinking about Weston Super Mare and Cardiff Bay and places like that, but is it going to have a knock-on effect from that coastal region right the way through?"

Female, Bristol (workshop)

The extent of the negative environmental aspects of the barrages, e.g. the effects on habitats and wildlife led to a shift in the publics' perceptions about the overall environmental impacts of tidal barrages. For many, the environmental benefits in terms of producing CO_2 free electricity over a 100 year period outweigh the negative aspects, however, a few people changed from being positive or neutral towards tidal power to a position against tidal barrages. The production of CO_2 free energy is also perceived to be the most important benefit of the barrage from a national perspective with 35% of those in the national omnibus survey citing this aspect as being the most important.

"I mean, people come first before animals and birds and things, but I would not be happy killing quarter of a million birds just so that I can have a light bulb on"

Female, Lavernock (focus group)

The environmental impacts of both of the tidal barrage schemes are perceived to be high, affecting; international nature conservation sites, intertidal habitats, fish and birds. However, since the Cardiff-Weston Barrage scheme creates over five times the amount of CO_2 free energy compared to the Shoots Barrage scheme the overall environmental impact of this scheme is perceived to be far more beneficial than the Shoots Barrage.

The loss of intertidal habitats is perceived to be the most significant environmental impact of the barrage schemes. The loss of 60% of the intertidal habitats from the Cardiff-Weston scheme is perceived by many of the public to be very detrimental to the wildlife in the estuary. Some of the participants understood the importance of the loss of unique habitats and they are more concerned about the habitat loss than those who did not fully grasp this concept i.e. some thought that the current wildlife species will adapt and find other areas to feed.

"The River Severn and around there is a special site, you know a site of special scientific interest…and they're that way because of the tightening paths and because of the tidal flow it's really the impact of what that will do to it, you can't really predict it at the moment."

Male, Bristol (workshop)

Some think that alternative feeding grounds could be created to help offset the habitat loss if the barrage scheme goes ahead. The 20% loss from the Shoots barrage is perceived by many of the public as still being significant, but far less so than the Cardiff-Weston scheme. Some of the local people in Brean Down, on the Weston side of the barrage are concerned that aspects of the local archaeology could become submerged if the Cardiff-Weston barrage scheme is progressed.

Environmental aspects (stakeholders)

Stakeholders want a great deal more site-specific research and evidence, to gain reassurance that environmental impact will be mitigated. They are concerned that the effects on ecosystem cannot be redressed and some express a preference for smaller barrages over a 'mega' single basin barrage for this reason. They need more information on the balance between environmental impacts and climate change benefits, and are concerned about the specific biodiversity mix of the area, especially as there are many rare protected areas and Sites of Special Scientific Interest (SSSIs). There is a positive attitude towards the identifiable contribution to renewables targets that Wales and the areas around the Severn can make, but concern that developments will be energy intensive to build. Stakeholders also mention the possibility of increased shipping emissions, as they will spend longer in transit due to time in locks.

Economic aspects (public)

Those in the Severn area think that there is a more compelling economic case for the larger barrage. The main reasons for this are the production of over five times the amount of electricity, the potential road and rail links and the greater numbers of new jobs in the area.

On a national perspective reducing the UK's reliance on imported fossil fuels and improving the long term security of energy supplies is perceived to be the second most important benefit from a barrage across the Severn Estuary. A total of 34% of the participants who took part in the omnibus survey believe this to be the most important benefit of a barrage across the Severn Estuary.

Whilst the creation of new jobs is perceived to be beneficial to the economy there is concern expressed at regional and local level about the ability of the infrastructure and local services being able to support a large influx of people.

"I am very concerned about the local infrastructure, and all the new jobs, and new people coming, and we're just packed already in the summer. I just can't see how we can sustain any more people."

Female, Brean (focus group)

Those in the local areas near the Cardiff-Weston Barrage express concerns that their local area would become far more developed due to the construction phase and the influx of visitors after the barrage becomes operational. However, others, especially some of those from Brean think that the influx of tourism could be beneficial to the areas tourism provision.

"It would maintain the water level, and I'd like to see it because of that, because I'd like to see the tide in all the time at Weston and all the way up to Bristol. It would create a massive area of controlled water which is ideal then for tourism…you wouldn't have the tidal flow, so it would be the ideal place for water sports."

Male, Brean (focus group)

The road and rail link in the Cardiff-Weston proposal is perceived to be very beneficial by those in Cardiff and Bristol since people will be able to reduce the journey times between the cities which would make it easier to commute as well as visiting the areas either side of the estuary and the surrounding areas. Some think that the crossing could also reduce carbon emissions due to the shorter journeys between either side of the estuary, however, others think that the barrage could encourage more journeys across the barrage resulting in greater carbon emissions. The proposed high speed rail link across the Shoots barrage is not perceived as particularly beneficial since it is only perceived to make a marginal improvement to the current transport links compared to the road and rail links of the Cardiff-Weston barrage.

"To get from Cardiff to Bristol at the moment you go all the way up across the Severn Bridge and all the way down. You're doing a 60 mile round journey when its only 10 miles away. So, I mean it's the most logical choice, plus you know the amount of power it would actually put out..if you have the big one…the big one rather than the small one makes a lot more sense."

Male, Cardiff (workshop)

The economic impact on the ports is perceived to be an important consideration, however, without accurate information on the financial effects on the ports it is difficult to take this into account. Some of the public think that these effects should be estimated and taken into account when considering whether to pursue a barrage option. The effects on the ports are perceived to be far greater for the Cardiff-

Weston Barrage than the Shoots scheme since it affects four ports whereas the Shoots scheme affects one port which is not perceived to be of major significance.

Economic aspects (Stakeholders)

Even though there is a lot of information about the Severn and specifically a barrage in the area, more certainty and independent balanced evidence of impacts and cost/ benefit is called for to inform decision-making. Stakeholders have concerns that issues such as varying power generation, grid management and full life-cycle costs have not been explored sufficiently in the local context. Many perceive that once a development of the scale and nature of a barrage is committed, it cannot be reversed and will need to be completed, even if project timelines and costs increase.

Many stakeholders state explicitly that they do not want to see a barrage detract funding from other renewables (both regionally and across the UK) and feel that it is too expensive, too high impact and would take too long to build. Others feel that, as the area with the highest tidal range in UK, it would be a waste not to harness this tidal potential. Stakeholders are positive about the potential for the area to meet 5% of UK demand with secure, predictable and 'green' energy and also the subsequent economic regeneration of Cardiff and Weston-Super-Mare.

Whilst any tidal power technology will impede shipping and navigation routes, the current proposal known as the Shoots Barrage (located just south of the M4 motorway) is seen as a compromise between energy needs and the extent of area impacted, especially as it would have no impact on major ports. However, depending on siting in relation to ports, cost and emissions could also increase through more road transportation of goods.

Some stakeholders see opportunities for other forms of energy, e.g. wind farms on a Severn barrage as an opportunity, while others even suggested that it could be a potential terrorist target, especially if it is used as a public transport link.

Social aspects (public)

The main positive social aspects of the barrages are the potential for the barrage to be an impressive and imposing structure which the local population can be proud of and the potential for recreational area for water sports.

There are mixed reactions to the effects on the amenity beaches. Some are concerned about the loss of beaches, however others think that the beech at Weston Super Mare is muddy and could therefore improve the visual amenity of this area.

The main negative aspects are the noise, extra traffic and dust pollution which is associated with the construction of a barrage. Some of people who lived close to the potential barrage sites are particularly concerned about this. However, others think that the benefits to society as a whole from a barrage far outweigh personal inconvenience.

Social aspects (stakeholders)

There is a strong call for broad public and cross-stakeholder support and involvement in whichever option is decided. Some stakeholders said that a barrage is non-sustainable, cannot be easily removed and will be a legacy for future generations. Others see opportunities for leisure in kite surfing, kayaking, dingy sailing, and potential transport links, especially rail if there were to be a Shoots Barrage. This would provide traffic relief and potential for a high-speed rail to South Wales.

Some stakeholders have concern over the attitude that 'we can so we should', without enough research and evidence comparing barrage options with all other forms of energy generation, not just renewables. While stakeholders hope that the small-scale technologies would encourage people to think small and local about energy, they reiterate that consumers still need to reduce energy use. There is also concern that many small-scale devices won't have the same political impetus as a large construction like a barrage, which could be seen as a substitute for nuclear new-build.

Local social benefits such as regeneration of Welsh villages need to be balanced with considering the needs of the many coastal communities and rural settings along the Severn, as there will be a direct impact on communities and jobs, especially angling. There is potential to break down the English/ Welsh divide by literally building a bridge.

3.5. Reactions to the proposals for tidal developments in the Pentland Firth (public only)

Reactions to the proposals for tidal developments in the Pentland Firth received different responses according to location. The Orkney participants were typically more positive than Inverness participants.

Inverness

Compared to other locations, participants in Inverness were more likely to be negative or ambivalent about tidal power at the beginning of the day and to vote against it at the end of the day. One reason for this is that the participants in Inverness were more sceptical about green issues in general.

"They just jumped on the bandwagon, haven't they? Everybody is on the green bandwagon"

Male, Inverness (workshop)

In addition, many participants in Inverness thought that the hypothetical tidal stream proposal has a number of shortcomings. There are concerns that the devices and energy produced will be very expensive. The percentage output in terms of total UK consumption seemed disappointingly low (2-3% in the stimulus material) and many believe that importing energy or using nuclear would be more cost efficient.

There are also concerns about what the devices will look like and the impacts on marine habitats. They are fearful of spoiling Scotland's natural beauty and believe that the locals in Orkney will strongly object (more than was in fact the case in this research).

Orkney

People in Orkney felt fairly well disposed to tidal power at the beginning of the discussions and almost all supported tidal power at the end of the discussion. However, this support was conditional on a number of environmental, economic and social criteria that they feel need to be satisfied to fully ensure their 'vote' (discussed below).

The main reason for supporting tidal power is concern over climate change and a desire to combat it, and a familiarity with depleting supplies of oil and gas. Oil is part of the local economy in Orkney and the locals are aware of the reducing oil and gas supplies and the need to replace these sources of energy. They also have a greater awareness of sustainable energy generally than those in Inverness, possibly because of their proximity to a number of wind farms.

Although they support tidal power in principle a number of participants in Orkney are very sceptical about whether tidal power would work in the Pentland Firth because they have a firsthand appreciation of the challenges of working at sea.

"The sea can be a dangerous thing and it takes lives, so there's that aspect of how are we going to be able to control it? It controls us!"

Female, Orkney (focus group)

The Orkney participants are also concerned about the visual impact at sea and the possible on land industrialisation and wanted more visual examples of how it would look.
Some of the most important points for the public in both locations are detailed by environmental, economic and social factors below.

Environmental factors

The public feel that areas of natural beauty like Orkney should not become over-developed by too many substations, pylons, roads, new buildings and so on. In addition to the effects on Orkney, there were lots of questions about whether new roads and new pylons would be needed in the north of Scotland in order to transport devices north and to bring electricity south.

"It would depend exactly where they were going. If they were on the coastline near the beaches, no way."

Female, Inverness

"One of the issues here is the pylons...because it's despoiling the Scottish landscape, the scenic beauty of the Scottish landscape, to supply England with electricity."

Male, Inverness

The loss of habitats and wildlife is a concern but the public in Scotland are reassured that the impact seems considerably lower for tidal stream than for the barrage option. They want more tests to be conducted on environmental impacts, particularly on the impact of underwater noise on sea life.

Economic factors

Many people expressed the view, particularly in Inverness, that small percentage contribution to energy production in the UK such as the 2-3% cited in the stimulus material, does not necessarily justify the expense and disruption associated with tidal stream technology. Those in Orkney were more likely to feel that the costs would be worthwhile in the long run because they were more likely to be aware of energy issues generally. In addition, they feel that the islands would benefit economically from the investment likely to precede a major tidal power project. Overall the public feel that they needed comparisons with the output of other energy sources to help them come to a view about whether tidal power is truly cost effective.
"Why are we wanting to spend a lot of money on something we're not sure how efficient it's going to be at the end of the day."

Male, Inverness (workshop)

"The percentage quoted is 2-3% of current UK energy demand if all of the resource surrounding the Pentland Firth is used – all of it. That's very little return for a lot of disruption."

Male, Inverness (workshop)

"I think there should be limits set on it to say that they have to be a certain efficiency ... you can't just plonk anything in the water and generate a small amount of energy, it as to be delivering as much as possible for the disruption it's going to cause."

Male, Orkney (focus group)

Shipping exclusion zones emerged as a major concern for the public and they want more information about how this would work. They think that too many exclusion zones could drastically affect the viability of certain ports and local industries such as fishing.

"The thing that would worry me most is definitely the restrictions. Not for the recreational [use] but definitely the fishing and the shipping routes."

Male, Inverness (workshop)

Social factors

In the case study presented the tidal stream devices have a portion of the structure visible above the water and are placed relatively close to, but not on, the coast. The public would ideally prefer devices that are placed underwater, except for a small marker, and for those which are placed further out to sea. In the case study presented the tidal stream resource surrounds the uninhabited island of Stroma. Whilst devices in this location would not affect anyone's 'view' a few people felt strongly that it would be 'sacrilegious' to bring industrialisation to this wild, untouched environment. Women appear more likely to feel strongly about the visual impact of the devices.

"I would want to see them thinking about the visual impact as well. I think it is a good idea but they need to think about the impact it is having on beautiful areas like Orkney."

Female, Orkney (focus group)

"How big would those things be that stick up out of the water? Would they be like this size [small] or would they be like as big as houses?"

Female, Orkney (focus group)

The public would prefer smaller farms of tidal devices (30) rather than larger farms (100) because of the reduced visual impact and also because of the smaller exclusion zones and the reduced likelihood of collisions. Most, however, are very cynical about this issue and believe that if the technology 'takes off' proliferation is inevitable. This view is very much informed by the increasing number of wind farms in the UK.

"If they get away with a few there will be more."

Female, Inverness (workshop)

There are serious concerns from the public about the safety of the devices in terms of boats or debris colliding with it. A few participants believe that collisions might actually be inevitable and question the viability of the scheme for this reason.

"There have been a number of disasters over the years and Pentland Firth is one of the most dangerous stretches of water for shipping."

Male, Inverness (workshop)

"So if they put the device where the tide is strongest, that's where [debris] will be pulled into. And that could cause a lot of damage and a lot of money if they hit one of them wouldn't it."

Male, Orkney (workshop)

3.6. Government roles on decision making and financing

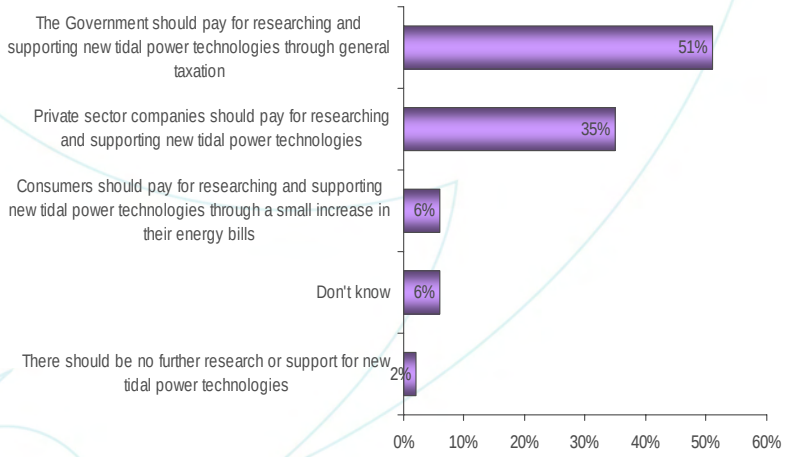
3.6.1 Public

The public are reassured at the amount and wide range of regulation which is applied to potential energy developments. They believe that the regulations will help to ensure that the range of impacts of energy generation projects is considered from an economic, environmental and social perspective.

National Government

The public think that national government should have most influence in decision making and investment because investment in tidal power is seen as a national issue of international importance. Most participants are very in favour of the idea of public ownership and suspicious of private ownership. This view in is reflected in the omnibus survey which found that half (51%) of the public think that the Government should pay for researching and supporting new tidal power technologies. That said, the public do not always trust the government or believe that they will use money wisely, but national ownership is considered preferable to alternatives.

How should the UK best support tidal power technologies?



Base: All National – 1010

"How should the UK best support the development of new tidal power technologies?" 4

"I think it has to be a government body, or an authority like they are forming especially for it. A sustainable power authority."

Male, Orkneys (focus group)

"Our government is not renowned for being on budget."

Male Bristol (workshop)

"I was just thinking the government [should own the technology] because of the maintenance thing seeing as that when things get privatised it does not seem to get maintained as well."

Female, Bristol (workshop)

Private companies

The main objection to private company ownership of tidal power is their priority in making a profit for the company rather than the public. There is also a concern that if private companies finance the tidal power initiatives then this will result in higher electricity bills.

"Private companies won't do anything proper and would not care enough about the social cost, they would just make sure that they make a profit."

Male, Bristol (workshop)

Whilst the public do not want private companies to be leading tidal power initiatives, they acknowledge that their technical input will be necessary at some level.

"I think perhaps some of the energy companies as well need to be involved because they've got technical expertise"

Female, Bristol (workshop)

Who should pay?

When asked who should pay for the technology, most people find it difficult to differentiate between different options such as taxation or a small increase in energy bills, believing that the public would end up paying the same amount in the end.

"It doesn't matter which avenue you pump it through, you're paying anyway."

Male, Inverness (workshop)

Nonetheless, some think that private companies should pay for the researching and development of tidal power technologies either because they do not want to pay for the schemes through taxation or because they think private companies are better equipped to research and develop tidal power technology.

The idea of paying through energy bills is extremely unpopular as they are considered to be too high already. Only 6% of people in the omnibus survey agree with this option. One person felt that there was at least some advantage to the funds coming through consumer bills.

"One of the advantages of the consumer paying a small increase in their energy bills is if you base it on a percentage basis, those people who are using the most electricity will have to fund the largest amount of money."

Male, Inverness (workshop)

Local government

The public agree the local government would have a role in tidal power projects, but feel that their remit was not wide enough to take too much responsibility and worry that a large scale tidal power project would prove too much for them to manage competently.

"It's going to create even more problems, joking apart, between the Welsh and the English. It could ultimately create more problems between the local government on one side and the local government on the other side because you're going to have two local governments who are affected by it and it's just going to be a game of bat and ball over perhaps maintenance or something."

Female, Bristol (workshop)

"I don't think giving it to a local government, I mean they can't get the roads fixed out there so how are they going to handle something like this?"

Female, Bristol (workshop)

A few people living on Orkney had some experience of community owned wind farms and wanted some community ownership and profit options to be available with tidal power as well.

Devolved Administrations

There is quite a lot of variation in public opinion as to the role of the Devolved Administrations. This largely depends on people's personal politics. Most agree that the role of the Devolved Administrations should be as a 'watchdog', protecting the national interest against potential inequalities. A number of people mentioned the historical context of England unfairly sourcing energy from Wales and Scotland, though the English pointed out that they needed to be treated fairly too.

"Cardiff has an awful lot of investment because of the Welsh, and it's a capital which as a result Bristol suffers from. So as long as the benefits are shared equally on both sides."

Male, Bristol (workshop)

European Union

The EU is not popular and participants could not see a role for the European parliament to get involved in tidal power. Some people conceded that the EU would have a role in scientific analysis of the sites and possibly vetoing proposals on environmental grounds.

"Could this project just be stopped by you know the environmentalists and the people for the protection of the birds and that just go no way are you doing this because they are protected? It must hold some weight."

Male, Bristol (workshop)

Consultation

The public have many of ideas about how people should be consulted about tidal power

Public engagement events

Roadshows and exhibitions with visual examples

Local TV, newspapers and radio

Meetings with local groups and campaigning bodies, especially those concerned with the environment

"I think there are quite a lot of groups and organisations in and around Bristol that are dealing with sustainable issues and they should have the opportunity to look at all this information and see the impacts it would have"

Female, Bristol (workshop)

The public engagement also found widespread agreement that local people should have more influence over decision making in terms of whether tidal power should go ahead or not. Whilst the public want local people to be listened to more, they do want them to have the 'final say' because it was felt to be something that affects the whole nation.

"No, [local people should not have] not the whole decision, no, but mainly I think locals should have – they should be listened to more I think."

Female, Inverness (workshop)

People believe that the onus is on the authorities to make contact with those who will be most affected. A few people feel that it is not enough to consult in regional centres, it is necessarily to go to the actual locations where the technology will be built. So for example in the Pentland Firth, the case study showed that the island of Hoy would be the most affected in which case people feel that a separate consultation would have to happen there rather than just in the main town of Kirkwall.

3.6.2. Stakeholders

Decision-making policy

Stakeholders are very clear in their call for clarity and transparency from central government on the specific issues of:

- UK energy policy and the role of tidal power in the energy mix
- Roles of local, regional, devolved administration, central and EU levels of government and their interaction
- Policy framework for sustainable development and the role of tidal power
- The government's regulatory role
- Assessment tools and guidance, specifically for Local Authorities
- Setting targets for renewable energy

There is a strong message for the coordination of all levels of government to share information. Strategic Environmental Assessment (SEA) is seen as an important mechanism for joined-up decision-making and stakeholders feel that long-term cross-political party agreements would provide more certainty for the market. Stakeholders perceive that EU emissions reductions targets and climate change indicate that there should be financial and political support for renewable energy from government. Many stakeholders feel that central government should be responsible for 'top-down' direction and policy decisions, with the regions and devolved administrations taking 'ground-up'

responsibility for implementation. In doing this, there will need to be a balance between national interests and local impacts.

Stakeholders want government to provide strong leadership and champion tidal technologies, but to also focus on and promote energy efficiency and demand management alongside renewable forms of energy. They also urge government to adopt a realistic view on the economic aspects of tidal developments, as public money is being used.

Consents process

Stakeholders want a simplified one-stop shop for gaining the appropriate consents and suggest something like the Marine Management Organisation proposed in the upcoming Marine Bill. They feel that this would help provide clarity from central government and would increase certainty and decrease risk to small developers.

Consultation/ Dialogue

Stakeholders see consultation as vital and say that it needs to happen at the earliest possible stage, with government leading. Many stakeholders see it as the government's role to educate stakeholders on tidal technologies, possibly using the SEA as an instrument. They also feel that the Environmental Impact Assessment (EIA) is an important mechanism for consultation, but central government needs to provide guidance on how best to go through this process.

Planning

Local stakeholders feel they need a greater voice in the planning process and there is the more general view that the current process is not fit for purpose. Stakeholders want an integrated framework implemented through one body, and more specifically want legislation in place to address grid issues. They note the difficulty in the interaction between marine and terrestrial planning, but see that this will be addressed by the Marine Bill.

Financing

Stakeholders want clarity and transparency from central government on:

- Financing mechanisms
- Levels of government investment and spending
- Certainty and confidence for the market and for investment
- A long-term fixed price for carbon

Many see it as the government's role to create an environment for business so that private companies can provide renewable energy at a profit. Some stakeholders want price support to create more certainty for investors and agree that long-term support would aid the development of the industry.

Capital investment

Some stakeholders feel that government should provide capital investment for tidal developments, and should consult with the public on how the money will be allocated, while others feel that investors and industry should lead on capital investment with support from government. The Private Finance Initiative (PFI) is also a potential mechanism to encourage investment in the sector.

Subsidies

There is a strong view that government needs to redress the imbalances in market conditions, grid issues, and funding mechanisms not only between non-renewable and renewable sources of energy, but also within the renewables field. For instance, some stakeholders feel that government needs to provide equal funding for tidal technologies as it does for more mature renewables. Renewables Obligation Certificates (ROCs) are helpful and seen as an appropriate way of consumers paying for renewable energy, but are only effective when the technology is commercial. Many stakeholders say that the Scottish Executive market support scheme is highly successful and should be rolled out to the rest of the UK. Many also broadly agree that it is government's role to provide strong financial incentives for carbon emissions reduction.

R&D

In line with their calls for 'sound science' and evidence base to inform decision-making, stakeholders want central government to fund balanced and independent research to gain baseline information. Some stakeholders also want central government to provide investment in development. Many see it as the government's role to finance and/or incentivise environmental impact monitoring and the SEA.

3.7. Views on tidal power after deliberation

Public

The public in the Severn region are generally in favour of tidal power (32 out of the 40 participants in favour). Many of those who were undecided at the beginning of the discussion prior to receiving information about tidal power became in favour of tidal power after finding out more about it. The same pattern is evident in Orkney.

"Anything we can do to make us greener without a) harming anything in the process and b) too much cost to the public, and I think we should be doing it."

Female, Brean (focus group)

Views on tidal power in Inverness are polarised with around half (8) in favour and half (12) against. The main concern for those against tidal power in Inverness is the potential cost of the tidal power schemes. There were a number of turning points during the deliberation, with some people changing their minds several times on the basis of new information.

Many people became more worried about the local environmental impacts during the discussions because they had been unaware of them or had underestimated these at the beginning. This was particularly true of the barrage option where a number of people had not anticipated the extent to which it alters the tide and the intertidal habitats.

"To be honest I didn't realise there was going to be an impact on the coastline and the habitat of all the birds."

Female, Brean (focus group)

"See if it was actually holding up a water mass I would change my view completely, I'd be against it."

Male, Brean (focus group)

"The only slight doubt I have was the effect it was going to have on the wildlife, but I think that will move anyway. That'll sort itself out."

Male, Brean (focus group)

"It might not be that I live near the river, but I still regard this as my sort of home country and you don't like to think that people sort of just coming in and bulldozing through, but very often we don't start standing up and complaining until things are already underway. But that's what brings it to mind when the media take it up on these, then you suddenly think, oh I didn't know that those things even lived here."

Female, Bristol (workshop)

The percentages of UK energy consumption that tidal power could supply seemed relatively small to the public compared to their own estimates of the potential of tidal power. Some people thought that up to 50% of the UK power could be produced by tidal power. This had the effect of disappointing some of the participants and making them doubt whether tidal power was really worth the cost, even if they felt had been fairly positive about it previously.

The community impacts were considered to be greatest for the barrage option because it takes so long to build and so many workers are required to build it. Even those who had a good level of knowledge about tidal power prior to the discussions said that they had not fully appreciated the amount of disruption it would cause. This made some of the local participants feel that their way of life was potentially under threat. On the other hand, some people, particularly younger participants, were quite enthusiastic about their area being redeveloped.

"I'm more for it now, because I'm just a bit excited about it now. Something's going to happen round here"

Female, Brean (focus group)

Ancillary benefits such as the road and flood defences were extremely influential in the debate about the barrage. The benefits were considered to be increased opportunities (road) and peace of mind and security (flood defences). These factors alone could sway some individuals to vote 'for' the barrage at the end of the day.

The map was an important tool in helping the technologies seem more tangible and real. The map was a turning point in all locations but was particularly influential in Scotland where the location of tidal resources devices appeared to be uncomfortably close to the coast and seemed to dominate certain islands.
The images depicting how the devices could look helped some of the technologies seem more credible. The lack of a photographic or semi-realistic image of the lagoon was a key factor in undermining the credibility of this option.

Stakeholders

Stakeholder comments on their evaluation forms and the opinion sheets indicate that the dialogue, discussion and information exchanged were beneficial and for some stakeholders, contributed to their change of view.

The results show that in the Northern workshop, attitudes largely remained unchanged, with all but three stakeholders recording the same view at the end of the day as the beginning. The two stakeholders with a more negative view at the end of the day comment that they had initially thought that the technology was at a more advanced stage than it is, and discovered in the course of the workshop and its discussions that it is less viable in the short term than previously thought. The one stakeholder that changed their view to become more positive comments that they learnt more about the benefits of tidal stream technology specifically.

In the Southern workshop, stakeholders were asked two questions, one about attitudes to tidal power generally, and one more specifically about a Severn Barrage. Overall people became more positive about both the issue of tidal power in general, and a Severn Barrage specifically.

Ten stakeholders changed their views to become more positive about tidal power in the UK, six of which became more positive on both questions. Generally their reasons focus on having more information and better understanding of the issues at the end of the workshop.
Nine stakeholders changed their views to become more positive about a Severn barrage specifically, six of which became more positive on both questions. Comments on their reasons again focus on having more information and better understanding of the issues, and more clarity on the implications of a barrage.

Three stakeholders became more negative about tidal power in the UK, one of which became more negative on both questions. Reasons given are having more concern about the viability of tidal lagoons as a tidal power, and requiring more information on environmental impacts.
Five stakeholders became more negative on the issue of a Severn barrage, two of which were more negative on both questions. Their rationale is that there are too many uncertainties and risks to proceed at this time, and that the impacts of a barrage would be worse than previously thought, compared to energy output.

Most people that changed their view to become more positive commented that it was because they had the opportunity to learn and understand the impacts, both positive and negative, of the various technologies. Many that changed their view to become more negative said that impacts were worse than they originally thought, or that more evidence and research was required before they would support tidal power, or a Severn Barrage.

Stakeholder views at beginning of day

	0-4 (Negative)	5 (Middle)	6-10 (Positive)
Northern Workshop	0	4	14
Southern Workshop (a)	3	4	29
Southern Workshop (b)	15	14	7

Stakeholder views at end of day

	0-4 (Negative)	5 (Middle)	6-10 (Positive)
Northern Workshop	1	3	14
Southern Workshop (a)	2	1	33
Southern Workshop (b)	13	10	13

In the Southern workshops “a” refers to tidal power in general and “b” refers to a Severn barrage.

3.8 The conditions for acceptability for tidal power

Public

Although most of the public are in favour of tidal power, almost all had reservations of some kind. There were also a handful of people who were steadfastly against tidal power. The most powerful arguments against tidal power from the public's perspective were as follows.

- Too expensive for the return
- Too environmentally damaging
- Better to save energy
- Too many practical problems
- The large figures involved in building and maintaining tidal power devices, combined with low percentage returns undermined the economic credibility of tidal power for many people.

"The only thing that worries me is that the £115 million it costs to sustain it and does that keep growing every year and who pays for that?"

Male, Bristol (workshop)

With the concerns about the feasibility of a project like that the cost and the maintenance, I was worried on that sort of thing."

Male, Orkneys (focus group)

In addition, addressing climate change by creating a whole host of new environmental problems was simply not acceptable to some people.

"The whole concept of having the environment has to be protecting it, so I mean, there is no point in protecting it by destroying it at the same time."

Male, Bristol (workshop)

"They're (Severn Barrages) too invasive on everything – the ports, the wildlife, the way they look. I don't like either idea or scheme."

Female, Bristol (workshop)

A number of people pointed out that it would be much cheaper and simpler to save energy rather that invest in tidal power

"If you go into Bristol, there are buildings with their lights on all in the night and perhaps if we stop that we wouldn't need to build this."

Male, Bristol (workshop)

"We'd be far better off by saving 10% of electricity."

Male, Orkneys (focus group)

Finally some people remain unconvinced about the viability of tidal power from a practical point of view. Specific scenarios people can imagine are; the barrage silting up, the tidal devices being destroyed by collisions with boats and/or objects, the technology being made redundant by rising sea levels.

To help understand what factors would overcome these reservations about tidal power, participants were presented with three scenarios depicting future energy situations.

- The issue of security of supply and a situation where supplies of electricity are disrupted
- The cost of sustainable energy such as tidal power falling below the cost of other forms of energy generation
- An escalation of the effects of climate change in the UK

All of these scenarios are compelling to the public. Of the three however, the public found security of supply of energy the most influential argument for investing in tidal power. The public are very concerned that their supply of energy could be disrupted due to an over reliance on imported energy. This is something that many people are unaware of so it had a high 'shock value' for participants.

The third scenario is the most alarming for the public because it feels apocalyptic. It gives people a sense of urgency about needing to address climate change though people pointed out that it does not necessarily indicate that tidal power is the answer. The view that the UK has very little impact on the global levels of greenhouse gases is also widespread. The second scenario is the most appealing, with some people feeling that they are in crisis with energy bills already.

"If it saves me money, I'm all for it.."

Female, Inverness (workshop)

There were couple of other factors that participants think could increase the acceptability of tidal power. Firstly, offsetting environmental impacts by investing elsewhere, such as in bird sanctuaries could make the tidal power proposals more attractive for some people. Better environmental research could also improve public confidence.

"Shouldn't we consider making places where these birds can go?"

Male, Bristol (workshop)

"I think research is very important, particularly as it has to do with the environment. There needs to be support to understand the sea levels and pollution levels how it impacts on the environment."

Male, Bristol (workshop)

Sympathetic design which is not too disruptive to the seascape could have a major influence on acceptability to the public of tidal power proposals. Quite a number of participants expressed a preference for incorporating tidal power structures into an existing structure such as the Severn Bridge, the Thames Barrier, the Churchill barriers (on Orkney) on the grounds of reduced visual impact as well as cost. Many people also believe that combining wind and tidal power might somehow make the proposals more cost effective.

"You could have that incorporated within the Severn bridge instead of like building all new stuff... I mean that might be a better way of doing it because it's cheaper as well."

Male, Bristol (workshop)

Conditions for acceptability for tidal power

Stakeholders have a range of needs in order to find tidal power acceptable. These include:

- A full ecological/ environmental impact study encompassing all aspects of environmental impact and evidence that environmental impacts will be acceptably mitigated
- A coordinated, holistic strategic approach, using sustainable development principles
- Accurate, independent and centrally coordinated research and evidence base
- Clear government policy on energy, the role of renewables and the role of tidal power
- Improved planning and consents systems
- Full consultation with marine users
- Reduced risk to developers and investors, potentially through a pilot scheme
- Proven economic viability

Additionally, some stakeholders want assurance that the safety of mariners isn't compromised and that any development will fit in with existing shipping requirements. Others are calling for clarification of how tidal developments will be affected by EU Directives, or for evidence that climate change is severely threatening protected species that would be impacted by these developments. Some stakeholders want more investment in the grid, in resourcing the EIA, and in long-term development of the industry. There is a strong view that there needs to be an informed and balanced debate on all of the options, and some said that tidal power is acceptable as an alternative to nuclear power.

Some stakeholders in both the North and South workshops express the view that nothing will make a tidal barrage acceptable to them, but are more amenable to tidal stream and lagoon technologies. In terms of tidal stream, stakeholders want improved efficiency and reliability of the technology and assurance that sensitive habitats will be avoided, to make it an acceptable option for them. Some also feel that using structures as transport or communication links will make tidal stream more economically viable and therefore acceptable. Using it as one technology in a mix and also implementing tidal stream developments through a public private partnership structure are also factors that contribute to some stakeholders' views of what is acceptable.

Due to the different nature of tidal lagoon technology, stakeholders feel that the evidence base for economic viability is even more important than with barrage or stream, and this also applies to the question of decommissioning. This is due to the large construction costs and some stakeholders said that less construction material and use of recycled materials would be necessary to make lagoons an acceptable option.

4. Conclusions

As the aim of the SDC's tidal power engagement process was to gain stakeholder and public views, and not to reach consensus on the role of tidal power in the UK, any conclusions are necessarily high-level. The public currently have low levels of awareness and understanding about tidal power as a potential source of energy for the UK.

At this early stage of understanding the public is equally split between being in favour and being undecided in their opinions on tidal power. During the course of the deliberation on tidal power many of the public were surprised at the extent of the environmental, economic and social disadvantages, which could result from some of the tidal technologies. This resulted in a few changing their attitudes against tidal power.

After deliberation two thirds of the public are in favour of tidal power. The main reason for being in favour is the production of a significant amount of renewable carbon free energy. The main reasons for being against are cost (in Inverness), and the effect on wildlife and habitats (in Bristol and Cardiff). At this early stage in the public consciousness there is the potential to influence public opinion either in favour or against tidal power. Some of the public wanted to know what the environmental organisations' point of view is on tidal power to help them to decide their own personal position.

Public opinion changed in response to the scenarios which were presented to them around climate change and energy security, opinions also changed in response to local environmental and community concerns including habitats and birds as well as noise and construction effects, and the question of where the landfall would be located.

The public's key conditions of acceptability for tidal power and hence the most powerful arguments in favour of tidal power are:

Conditions

- Demonstrating that the negative environmental impacts are offset as far as possible
- Sympathetic design which limits the negative visual impacts

Benefits

- Improving the security of supply
- A significant production of clean energy

Stakeholders want more research and evidence on the different tidal power technologies and their impacts across environmental, economic and social aspects. They also want to see an independent and fair assessment of this evidence base, and a comparison of the different aspects (especially environmental and economic) of tidal technologies, with one another, with other renewable power sources, and with all forms of energy production. Stakeholders feel that this evidence base should

inform government decision-making and are also very clear on the importance of consultation with marine users on any specific proposals to be taken forward.

There is a strong call from stakeholders for government to provide leadership and long-term commitment, to give certainty to investment. They want clarity on energy policy and the role of tidal power in the UK's energy mix. There is concern that funding for nuclear new build or other forms of more commercially viable renewable energies will detract funding from tidal power. Consequently there is a clear message from stakeholders that there will need to be the right market conditions in place, driven by government and energy policy, for tidal technologies to be viable. Furthermore, many stakeholders feel that any tidal energy policy needs to be driven by the bigger picture of tidal energy as part of the UK's energy mix, not driven specifically by a Severn barrage or any other specific development.
Stakeholders express a very strong view that consultation and involvement is vital to reaching the most appropriate ways forward for tidal power in the UK.

The public and stakeholders are generally positive about tidal power; however there are differences in their preferences for individual tidal power technologies. The public generally favour a large barrage option principally because it will produce a significant amount of 'clean' energy over a considerable time period. However, some stakeholders think that the environmental and cost implications of a large barrage are too extensive to be justifiable. The public had concerns about the viability of tidal stream and tidal lagoons technologies and their visual impacts despite their lesser environmental impacts. This may reflect the newness of these technologies and that the information base about what they will be like is less well developed than for barrages which are easier to visualise as an infrastructure scheme. Stakeholders are more positive about these technologies, particularly tidal stream technology on environmental and economic grounds and perceive potential for the UK to become world leaders in these technologies.

Stakeholders and the public also have different preferences for the barrage proposals across the Severn estuary. The public are in favour of a large barrage, mainly due to the significant production of 'clean' energy and the ancillary benefits of improved road/rail links. Some stakeholders prefer the 'compromise' of a smaller barrage, which has fewer environmental and economic impacts whilst making a valuable contribution to producing CO_2 free energy. Other stakeholders express the view that no barrage options are acceptable, due to environmental and economic impacts.

Some stakeholders are in the process of developing their opinions on tidal power and there were some shifts, mainly in favour of tidal power throughout the day. It is clear that stakeholders want more evidence and information about tidal power to inform their views and some are looking to the Government for leadership in shaping policy on tidal power and other renewable energy.

Stakeholders and the public call for more detailed studies and information about the sustainable development effects of each of the tidal power technologies to inform their decision-making about tidal power. The public in particular react negatively to uncertainties and information gaps that affected their perceptions of the tidal streams and tidal lagoons. Stakeholders call for a full ecological/environmental impact study and an accurate, independent and centrally coordinated research and evidence base.

Public and stakeholders agree that central government should be responsible for direction and policy decisions on tidal power and that the regions and devolved administrations should take responsibility for implementation. There is also agreement in the need to balance national interests and local impacts.

Public and stakeholders value being consulted about tidal power and appreciate the opportunity to spend time receiving information and deliberating the issues with others. They think that this is a necessary and valuable way of discussing issues that directly affect them, particularly since there are different levels of knowledge and understanding amongst the public and stakeholders. The post-workshop questionnaires revealed positive feedback from the majority of the public and stakeholders.

The public would value a multi-faceted consultation about tidal power involving public engagement events, road shows and exhibitions, local media events and editorials and public meetings with speakers representing environmental groups.

5. Appendix

5.1 Scoping workshop agenda

SDC Scoping workshop draft agenda London 20 February 07 - 10am-2pm

OVERALL OBECTIVES OF THE WORKSHOP
▪ To clearly understand the expectations of what the Tidal Engagement Project needs to deliver ▪ To gain an understanding of the context, potential content, and potential issues ▪ To scope the main issues that need to be addressed by the public ▪ To scope the main issues that need to be addressed by stakeholders

INTRODUCTION IN PLENARY	
Timings	
9.45-10.00	ARRIVAL AND REGISTRATION ▪ Participant badges and group allocation - we need to ensure the 2 groups are balanced ▪ Tea/ Coffee served
10.00-11.00	WELCOME (10 mins) ▪ Welcome and aims from SDC tidal power team ▪ Summary presentation of the main issues arising from the consultants' reports and scoping interviews from OLR and a summary of the project and how this scoping exercise feeds into the project ▪ OLR provide information on housekeeping, rules and agenda Introductions (10 mins) ▪ Position and role Understanding the expectations of what the Tidal Engagement Project needs to deliver – 40 minutes – in plenary (Explain that some participants will be less involved in the project but that everyone has a really important and valuable contribution to

	make) Silent brain-storming exercise – all to be given post it notes and a pen and write down what they want from stakeholders and the public (one want per post it) all of the wants will then be put onto flipcharts and – placing similar wants together on a board The moderator will then summarise the key expectations and lead a discussion to identify the key priorities Once the key priorities have been identified these will be written up on 2 flipcharts – 1 for each group OUTPUT – Agreement about what the project needs to deliver
BREAKOUT SESSION – 2 separate groups	
11.00-11.40	Working separately in 2 groups: OBJECTIVE: SCOPING THE KEY ISSUES FOR STAKEHOLDERS/ PUBLIC ABOUT TIDAL POWER Flipchart with the key priorities to be referred to when determining the issues for the public and stakeholders Ask participants to consider issues from a national, regional and local basis <u>Determining the issues to discuss with the public' (20 mins)</u> ▪ What are the issues which the public need to discuss? ▪ What are the trade-offs they need to consider? <u>Determining the issues to discuss with stakeholders (20 mins)</u> ▪ What are the issues which the stakeholders need to discuss? ▪ What are the trade-offs they need to consider? ▪ Appoint a participant to feedback the key issues in the plenary session OUTPUT – identifying the issues to be discussed by the public and stakeholders
	Plenary
11.40 – 12.00	Each group to present back the key issues for stakeholders and the public Voting exercise to identify four priorities for stakeholders and the public OUTPUT – identifying the most important issues to be discussed by the public and stakeholders (between 4-6 is ideal)

12.00 – 12.30	Lunch
12.30-13.40	Working in 4-6 mixed groups:– *dividing the initial groups in half* OBJECTIVE – TO IDENTIFY THE SUB-ISSUES/QUESTION AREAS FOR THE PUBLIC AND STAKEHOLDERS (Generating content) Explain to participants that the purpose of the exercise is to identify the sub-issues under each of the main issues. For example an issue could be technology and a sub-issue could be the impact on natural habitats There will be 4-6 stations, one in each corner each with a main issue. Each group will start at one of the stations and write down all of the issues they think are important to cover with stakeholders and the public before moving on to the next station. Groups will spend less and less time each time they move station since they will be adding to the comments which have already been included (Wikepedia style). There will be different colour pens for stakeholder and public issues One person from each group remains at the station to explain the comments to the arriving group Round 1 – 20 minutes Round 2 – 15. minutes Round 3 – 12. minutes Round 4 - 8 minutes Everyone to go back to their original station to see how the discussion has evolved Prioritisation exercise (15 minutes) – participants will be given stickers to prioritise the sub issues for stakeholders and the public OLR – sum up of sub-issue prioritisations Does anyone have any comments before we proceed to the next stage OUTPUT – Prioritising the key sub issues to be included in the public and stakeholder engagement phases
PLENARY	
13.40-14.00	▪ SDC and Opinion leader sum up the key outcomes of the workshop and Opinion Leader and TEC explain the next steps in public and stakeholder consultation, and how the outputs of today will inform ways forward. ▪ Thanks and close

	WORKSHOP EVALUATION QUESTIONNAIRE:

5.2 Objectives for the public and stakeholder engagement programme

SDC Tidal Power

Objectives for the public and stakeholder engagement programme

Introduction

This document is a summary of the outputs from a workshop held on 20th February 2007 with members of the SDC and funding partners for the tidal power project. The aims of the workshop were:

To clearly understand the expectations of what the Tidal Engagement Project needs to deliver
To gain an understanding of the context, potential content, and potential issues
To scope the main issues that need to be addressed by the public
To scope the main issues that need to be addressed by stakeholders
The workshop generated a large amount of feedback, questions and suggestions for the process, so in reviewing the outputs, we have combined some of the questions and made suggestions about what issues lie outside the scope of the engagement programme. We have therefore pulled together the feedback from the workshop into five main sections:

Headline objectives for the process
Detailed questions under each objective
Inputs required to achieve these objectives
Process issues
Issues outside the scope of the engagement programme

2. Headline objectives for the process

For all of the objectives listed below, the public and stakeholders will be given time to express their existing views on the subject before prompting them with detailed questions or information/evidence.

For the public engagement

To gauge current public attitudes towards tidal power

To explore the public's views on the economic, social and environmental costs and benefits of tidal power and different tidal power technologies

To explore the public's views on the financing of any potential tidal power development

In the South West and Wales, to specifically explore the public's views on proposals for tidal developments in the Severn Estuary

To understand the public's views on what role the Government and Devolved Administrations should play with regard to tidal power in terms of financial costs and decision making

To establish the conditions for public acceptability for any tidal power development

To understand how public attitudes vary across the UK

For the stakeholder engagement

To understand which stakeholders are pro and anti tidal power and to establish the conditions for stakeholder acceptability for any tidal power development

To explore stakeholders' views on the economic, social and environmental costs and benefits of tidal power and different tidal power technologies

To explore stakeholders' views on the financing of any potential tidal power development

To specifically explore stakeholders' views on proposals for tidal developments in the Severn Estuary

To understand stakeholders' views on what role the Government and Devolved Administrations should play with regard to tidal power in terms of financial costs and decision making

Note: We are explicitly NOT considering tidal power in comparison to (or as an alternative to) any other means of power generation. The issue is likely to arise spontaneously, so our approach will be to note the comments but close down broader discussions on energy mix to ensure that the focus is firmly on tidal power.

3 Detailed questions under each objective

As there is some overlap between the objectives for the public and stakeholders, we have listed out the detailed questions by objective rather than by audience group.

N.B. We will be focussing on addressing the headline objectives outlined above but will use these detailed questions to inform the development of our discussion guides/agendas and ensure that we meet the headline objectives.

To gauge current public attitudes towards tidal power

- What is the public's current understanding of tidal power?
- For the South West and Wales: What do people know about barrage proposals? What do they imagine? How does this knowledge affect perceptions?

How well, if at all, do they understand the idea and potential of the sea as a resource?

What are their current information sources on tidal power?

What role, if any, does 'the environment' play in their current views of tidal power? And what does 'the environment' mean in this context?

Where does climate change sit in the list of spontaneous considerations?

To understand which stakeholders are pro and anti tidal power and to establish the conditions for stakeholder acceptability for any tidal power development

What drives being pro and anti tidal power?

Is there any movement after considering the issue/reviewing the evidence?

Who remains resolutely pro or anti tidal no matter what the evidence base says?

Are the people who have entrenched positions influential?

Understanding 'technology neutral' stakeholders: how does this position impact on their views of tidal?

What are the blocks to consideration of tidal power (non-negotiables or 'undiscussables') – and for whom?

How should the decision be made?

- Nationally? Within Devolved Administrations? Locally?
- What public involvement should there be?
- Should local views matter more than national views?

What tidal power evidence base is needed?

To explore the public and stakeholders' views on the economic, social and environmental costs and benefits of tidal power and different tidal power technologies

What do they see as the key benefits of tidal power?

What do they see as the key costs of tidal power?

How do they weigh up the short term benefits and costs vs long term benefits and costs?

How to they weigh up the direct impacts on local communities with the wider benefits?

What level of cost is acceptable given the potential benefits and impacts?

What implications does this have for the most appropriate technology (big capital investment cost for barrage vs smaller capital investment costs for tidal stream)?

To explore the public and stakeholders' views on the financing of any potential tidal power development

Who should pay? How does this relate to who benefits?

Who should provide the capital investment?

[For stakeholders] Will the market support significant investment in tidal technology? If not, what should happen?

To explore the public's/stakeholders' views on proposals for tidal developments in the Severn Estuary

What are the strengths, weaknesses, opportunities and threats for tidal development in the Severn Estuary?

What is an appropriate balance of the economic, social and environmental costs and benefits of a tidal development in the Severn Estuary?

Large vs small scale barrage options – which version is acceptable?

How do they feel about the additional developments that could come with a large barrage e.g. road/rail links? What should it include? What would this mean for the surrounding area?

For a large barrage:

- Who should own it?
- Is there the capacity/infrastructure to deliver a large barrage?

How do people feel about the opportunity costs of a large barrage vs multiple smaller tidal power developments around the UK?

Would commissioning a large barrage lead to a danger of complacency i.e. that the low carbon energy problem has been solved?

[For stakeholders] Are there lessons to be learnt from other large scale projects?

To understand the public's/stakeholders' views on what role the Government and Devolved Administrations should play with regard to tidal power in terms of financial costs and decision making

What role should Government/Devolved Administrations have in tidal power development in terms of funding?

- Evidence base funding?
- Pilot funding?
- Full development funding?

How much of a role should Government/Devolved Administrations have in decision making?

To what extent should Government/Devolved Administrations take responsibility for the risks associated with tidal power development?

To establish the conditions for public acceptability for any tidal power development

How should the decision be made?

- Nationally? Within Devolved Administrations? Locally?
- What public involvement should there be?
- Should local views matter more than national views?

What information do people need? How should it be communicated? Who should communicate it?

To understand how public attitudes vary across the UK

How do views vary between locations (Wales, South West, Scotland)?

How do views vary locally, regionally and nationally?

3. Inputs required to achieve these objectives

As well as gauging existing views and opinions, we will prepare information and evidence summaries for the regional public workshops and the stakeholder workshops to ensure that participants can reach an informed conclusion based on comparable knowledge. Given the objectives and question areas described above, we anticipate that the following inputs will be required:

A background briefing on the current UK energy mix and why tidal power technology is being considered now

This will need to clearly establish the potential changes in coastal areas from climate change i.e. that these areas will change whether tidal power developments are built or not

Information on the range of different tidal technologies available (including visuals, potential energy generation, potential locations)

Specific information on the barrage and non-barrage options for the Severn Estuary and how they relate to each other

Scenarios to enable participants to consider the relative impacts, costs and benefits of different tidal power developments

Definitions of the roles and responsibilities of national, regional and local government and the Devolved Administrations in terms of energy planning and decision making

In terms of the economic, social and environmental costs and benefits of tidal power, we will base the information on the research being conducted as part of the wider tidal power project, and will endeavour to represent the wide range of considerations discussed and identified at the workshop as outlined below (though this is dependent on the availability of evidence):

Economic considerations	
Cost of construction	Value of carbon mitigation
Longer term running and maintenance costs	Costs of linking with the National Grid
Decommissioning costs	Cost impact on other industries e.g. ports, fishing
Impact on cost of power	Compensation cost – livelihood, land
Job creation (construction and operation phases)	Economic value of ancillary impacts e.g. road link,
Skills development	rail link, flood control, land value, energy security,
Impact on land values	tourist attraction
Value of technological innovation to UK plc	
Environmental considerations	
Impact on the landscape	Tidal lagoon/barrage potential protection role
Impact on biodiversity and wildlife e.g. fish stocks,	against flood/sea level rise
including shell fisheries, migratory patterns – fish	Resource use in manufacture: embedded carbon
and birds	in manufacturing process, chemicals, etc

Loss of (unique) habitat Creation of different habitats (linked to stagnation, salinity changes, temperature changes, etc) Noise and pollution created by construction phase Low carbon energy production	Potential flooding risk caused by barrage Pollution risk from shipping collision Additional impacts of potential rail/road crossing on noise, pollution, carbon
Social considerations	
Direct impact on local communities (build and operation) Visual amenity/use value of the landscape/area Leisure implications of lake behind Severn barrage Impact on how people feel about their area	Macro social impact on fuel poverty Macro social impact of increased awareness of energy issues Potential planning gain from developments

4. Process issues

In addition to objectives and question areas, a number of process issues relating to the engagement process and the wider SDC tidal power project were raised:

For the engagement process:

- Need to ensure robust engagement
- Need to ensure that engagement is based on a common evidence base
- Constructive engagement between different stakeholders

For the wider SDC tidal power project:

- Solutions focussed
- Desire for an ongoing engagement process to keep the public and stakeholders informed and involved
- How to respond if stakeholders identify evidence gaps or information needs
- How to involve/engage the media

6. Issues outside the scope of the engagement programme

As discussed above, some of the questions and issues raised in the workshop fall outside the scope of the public and stakeholder engagement process. These are captured below for further consideration by the SDC tidal power team.

Questions relating to the broader energy mix

- Is a barrage the best way to spend £14bn on carbon reduction?
- Would energy from the barrage replace or displace other forms of energy e.g. fossil fuel?

Detailed questions relating to the financing, planning and design of tidal developments

- What is the appeal of steady long-term returns from a barrage?
- How do you maximise output from the barrage?
- If designing a barrage, what would it look like?
- How would the planning process work?
- How would regulators, statutory organisations, local authorities, and the EU work together on tidal power?
- Would new legislation be required e.g. planning, market forces, Barrage Bill?
- Who is responsible for interpreting and implementing EU Directives?
- How would you allocate the opportunities?
- How would the rental income work?

Broad questions about energy attitudes and behaviours

- Would the introduction of new technologies impact (decrease) people's energy efficient behaviour?
- Do stakeholders and public understand what living within environmental limits means?

Broad questions about the Government's role in energy policy

- How does this project fit into broader Government energy policy?
- What role does Government have in preserving social and environmental interests?
- How does tidal power fit with the Government policy for demand management/energy efficiency?
- What is Government policy on centralised vs decentralised generation of power?
- Should Government be responsible for energy security, climate change mitigation and the cost of energy?

5.3 Public workshop evaluation agenda

Cardiff and Bristol workshop agenda

SDC Tidal power workshop draft agenda Cardiff and Bristol 9.45am-4.30pm

OVERALL OBECTIVES OF THE WORKSHOP
▪ To establish public existing knowledge about tidal power ▪ To clearly understand public attitudes to tidal power ▪ To understand public attitudes to a range of tidal power options in terms of acceptability, cost, social and environmental implications

INTRODUCTION IN PLENARY	
Timings	
9.45-10.00	ARRIVAL AND REGISTRATION ▪ Participant badges and group allocation - we need to ensure the 2 groups are balanced ▪ Tea/ Coffee served
10.00-11.05	WELCOME (10 mins) ▪ Welcome and aims from SDC tidal power team ▪ OL provide information on housekeeping, rules and agenda OBJECTIVE- To establish current levels of understanding and attitudes towards tidal power Participants split into 2 mixed groups Introductions (5 mins) ▪ Participants to introduce themselves – name, occupation, something they would like to do if they had more time/money Current awareness of tidal power (20 mins)

	▪ What sorts of things do you associate with the sea and coast? – Flipchart responses ▪ Do you ever think of the sea as a potential source of energy? ▪ What do you think about when I say tidal power? (do participants make the distinction between wave and tidal power) ▪ What images come to mind? ▪ Are there particular locations that you associate with tidal power? ▪ What do you think it would look like? ▪ What have you heard about tidal power? ▪ Where have you heard about tidal power? - Probe – local press, tv, radio etc - Has the coverage been positive/negative ▪ Are you aware of the potential for tidal power schemes in the Severn Estuary/Bristol Channel or around the Scottish coastline? ▪ What have you heard about these potential developments? ▪ How much energy do you think could be generated in the UK by tidal power? Why? (as a proportion of UK demand) Current attitudes towards tidal power (30 mins) ▪ Silent brain-storming exercise – all to be given post it notes and a pen and write down if they are in favour, undecided or against tidal power and the factors they have or would consider when deciding their point of view on this. The participants will than be asked to place the factors on a piece of flipchart paper and group them together with others which are the same or similar ▪ The moderator will then make a note of the number of people in favour, undecided and against tidal power and then lead a discussion about why these considerations are important (we will also probe on how participants define the factors e.g. environment ▪ The group will then rank the factors in order or importance OUTPUT – Understanding participants current level of understanding and attitudes towards tidal power
11.05 – 11.10	Plenary – the need for sustainable power generation Presentation on why are we discussing tidal power – 5 mins (SDC) (need to reduce carbon emissions to reduce global warming, international responsibilities including Kyoto, need to evaluate the potential of renewable energy supplies, safeguard future energy

	supplies etc.)
11.10-11.30	Continuing to work separately in 2 groups: OBJECTIVE – EXPLORING PUBLIC ATTITUDES TOWARDS SUSTAINABLE ENERGY *Give out handouts of the presentation* ▪ Spontaneous reactions to the need for sustainable energy generation in the UK ▪ How does this information compare to your current thoughts on energy generation in the UK ▪ Is there anything that you found surprising? ▪ Is there anything that you did not already know? ▪ Is there anything that concerned you? ▪ Does this information change any of your thoughts on the priorities to bear in mind when considering tidal power? OUTPUT: UNDERSTANDING PUBLIC ATTITUDES TO SUSTAINABLE ENERGY
11.30 – 11.40	Plenary – overview of tidal power presentation (explaining the technologies and broad economic, social and environmental impacts of tidal power)
11.40-13.00	Continue to work in 2 mixed groups OBJECTIVE – TO CONSIDER THE IMPLICATIONS OF TIDAL POWER IN MORE DEPTH (Fact sheets will be produced on each of the key implications of tidal power – environmental, social, economic) The order of discussing these issues will be determined by the group in order of importance to them Economic (will need information on the economic benefits and costs of tidal power. we will need information on how much each of the options cost and how much energy they produce in terms of the energy produced i.e. % of UK energy consumption. Different options for funding the projects. Short term costs and long term payback in electricity generation, impact on cost of power decommissioning costs) Benefits job creation, technological innovation, carbon mitigation, value of

	ancillary impacts no need for flood defences (barrage). Disbenefits – land values, link to national grid, impact on other industries, compensation cost) ▪ Which of the economic considerations are most important to you? ▪ Which of the economic considerations are least important to you? ▪ Would any of these effects affect you personally? ▪ Which of the economic considerations are most important to the region? ▪ Which of the economic considerations are least important to the region? ▪ Overall what do you think about the economic case for tidal power Environmental (We will need information on the main environmental benefits and costs of tidal power. Benefits - low carbon energy production, protection from flooding/rising sea levels. Disbenefits – negative impacts on biodiversity, noise and pollution, manufactured resources, flooding risk, pollution risk from shipping collision, impacts of road/rail crossing) ▪ Which of the environmental considerations are most important to you? ▪ Which of the environmental considerations are least important to you? ▪ Would any of these effects affect you personally? ▪ Which of the environmental considerations are most important to the region? ▪ Which of the environmental considerations are least important to the region? Overall what do you think about the environmental case for tidal power Social (We will need information on the main social benefits and disbenefits. Benefits – impact on fuel poverty, increased awareness of energy issues, planning gain from developments, leisure impacts behind the Severn Barrage, feeling about their area. Disbenefits – visual amenity impacts and direct impacts on local communities ▪ Which of the social considerations are most important to you? ▪ Which of the social l considerations are least important to you? ▪ Would any of these effects affect you personally?

	▪ Which of the social considerations are most important to the region? ▪ Which of the social considerations are least important to the region? Overall what do you think about the social case for tidal power Other considerations Are there any other factors which you think are important to consider when evaluating tidal power? Each group to summarise their thoughts on the economic, social and environmental implications for each technology
13.00 -13.10	Plenary – each group to present back their thoughts on the implications for each technology
13.10 – 14.00	LUNCH
14.00 – 14.50	Working in 2 separate groups OBJECTIVE: EXPLORING PUBLIC ATTITUDES TOWARDS POSSIBLE TIDAL DEVELOPMENTS IN THE SEVERN ESTUARY AND THE PENTLAND FIRTH *Give out handouts of the fact sheets on the proposals and show the maps of where the developments could occur* ▪ Spontaneous reactions to the proposals – advantages/disadvantages ▪ How does this information compare to your existing knowledge about tidal power? ▪ Is there anything that you found surprising? ▪ What do you see as the main advantages/disadvantages of each of the proposals? ▪ Preference for tidal stream or barrage options ▪ Severn barrage proposals - preference for a large or small barrage *Small* - who should own it? - what do you think about not maximising the potential output from the Severn Barrage? *Large* - reactions to potential road/rail links – advantages/disadvantages, effect

	on the local area - reactions to additional developments that will come with a larger barrier - Could building a large barrage lead to people thinking that the low carbon energy problem has been solved? - Who should own it? ▪ Prepare a 5 minute presentation to feedback during the plenary session on the advantages/disadvantages of the proposals OUTPUT: INITIAL REACTIONS TO THE PROPOSALS
14.50 – 15.00	Each group to present back the advantages/disadvantages of the proposals
15.00-15.25	OBJECTIVE – TO UNDERSTAND THE KEY ARGUMENTS FOR AND AGAINST TIDAL POWER FROM THE PUBLICS VIEWPOINT Tidal power jury – split the group into two groups and ask one group to consider the case for tidal power and 1 group to present the case against tidal power. Each group will use the issues they deem to be most important for the cases for and against. The groups will work together to identify the key arguments and then present back to the other group. The other group will than have an opportunity to interrogate the presenting group OUTPUT –THE KEY ARGUMENTS FOR AND AGAINST TIDAL POWER FROM THE PUBLICS VIEWPOINT
15.25-16.10	OBJECTIVE – TO UNDERSTAND WHAT ARE THE CONDITIONS FOR PUBLIC ACCEPTABILITY OF TIDAL POWER *Give out information on the role of government* ▪ What role do you think that government and devolved administrations should have in making the decisions about tidal power? - What should be the balance of power between the local authorities, the devolved administrations the government and the European Union be about tidal power? - What do you think about the level of financial support for the development of tidal power from UK government and the devolved administrations? Introduce the options from the omnibus questionnaire ▪ How do you think the tidal power schemes should be financed? *The Government should pay for researching and supporting new tidal power technologies through general taxation*

	Consumers should pay for researching and supporting new tidal power technologies through a small increase in their energy bills *Private sector companies should pay for researching and supporting new tidal power technologies* *There should be no further research or support for new tidal power technologies* ▪ Which of these options do you think is most appropriate for tidal power? Introduce 3 scenarios which make a stronger case for tidal power (these will be developed fully) 1 – Carbon emissions are having a dramatic effect on the UK – rising sea levels, rise in freak weather conditions 2 – Security of energy supply – gas resources become scarce and nuclear power stations are decommissioned leading to a shortage of energy supply 3 – Rising cost of non-renewable energy sources means that tidal power is significantly cheaper than other sources of non-renewable energy so prices of electricity would fall After each scenario participants will be asked if this changes their opinion on tidal power Ask participants to consider tidal power from a UK perspective - Does this change how you feel about tidal power? - What is less/more important to you when thinking from a UK perspective?
16.10-16.30	▪ Participants to be given a 2 post its and will be asked if they are for or against tidal power in their area and in the UK as a whole and the main reason for this opinion. These votes will be then placed on flip charts ▪ SDC and Opinion leader sum up the key outcomes of the workshop and Opinion Leader the next steps in public and stakeholder consultation, and how the outputs of today will inform ways forward. ▪ Thanks and close WORKSHOP EVALUATION QUESTIONNAIRE:

SDC Tidal power workshop draft agenda

Inverness 9.45am-4.30pm

OVERALL OBECTIVES OF THE WORKSHOP

- To establish public existing knowledge about tidal power
- To clearly understand public attitudes to tidal power
- To understand public attitudes to a range of tidal power options in terms of acceptability, cost, social and environmental implications

INTRODUCTION IN PLENARY	
Timings	
9.45-10.00	ARRIVAL AND REGISTRATION ▪ Participant badges and group allocation - we need to ensure the 2 groups are balanced ▪ Tea/ Coffee served
10.00-11.05	WELCOME (10 mins) ▪ Welcome and aims from SDC tidal power team ▪ OL provide information on housekeeping, rules and agenda OBJECTIVE- To establish current levels of understanding and attitudes towards tidal power Participants split into 2 mixed groups Introductions (5 mins) ▪ Participants to introduce themselves – name, occupation, something they would like to do if they had more time/money Current awareness of tidal power (20 mins) ▪ What sorts of things do you associate with the sea and coast? – Flipchart responses

	▪ Do you ever think of the sea as a potential source of energy? ▪ What do you think about when I say tidal power? (do participants make the distinction between wave and tidal power) ▪ What images come to mind? ▪ Are there particular locations that you associate with tidal power? ▪ What do you think it would look like? ▪ What have you heard about tidal power? ▪ Where have you heard about tidal power? - Probe – local press, tv, radio etc - Has the coverage been positive/negative ▪ Are you aware of the potential for tidal power schemes in the Severn Estuary/Bristol Channel or around the Scottish coastline? ▪ What have you heard about these potential developments? ▪ How much energy do you think could be generated in the UK by tidal power? Why? (as a proportion of UK demand) Current attitudes towards tidal power (30 mins) ▪ Silent brain-storming exercise – all to be given post it notes and a pen and write down if they are in favour, undecided or against tidal power and the factors they have or would consider when deciding their point of view on this. The participants will than be asked to place the factors on a piece of flipchart paper and group them together with others which are the same or similar ▪ The moderator will then make a note of the number of people in favour, undecided and against tidal power and then lead a discussion about why these considerations are important (we will also probe on how participants define the factors e.g. environment ▪ The group will then rank the factors in order or importance OUTPUT – Understanding participants current level of understanding and attitudes towards tidal power
11.05 – 11.10	Plenary – the need for sustainable power generation Presentation on why are we discussing tidal power – 5 mins (SDC) (need to reduce carbon emissions to reduce global warming, international responsibilities including Kyoto, need to evaluate the potential of renewable energy supplies, safeguard future energy supplies etc.)

11.10-11.30	Continuing to work separately in 2 groups: OBJECTIVE – EXPLORING PUBLIC ATTITUDES TOWARDS SUSTAINABLE ENERGY *Give out handouts of the presentation* ▪ Spontaneous reactions to the need for sustainable energy generation in the UK ▪ How does this information compare to your current thoughts on energy generation in the UK ▪ Is there anything that you found surprising? ▪ Is there anything that you did not already know? ▪ Is there anything that concerned you? ▪ Does this information change any of your thoughts on the priorities to bear in mind when considering tidal power? OUTPUT: UNDERSTANDING PUBLIC ATTITUDES TO SUSTAINABLE ENERGY
11.30 – 11.40	Plenary – overview of tidal power presentation (explaining the technologies and broad economic, social and environmental impacts of tidal power)
11.40-13.00	Continue to work in 2 mixed groups OBJECTIVE – TO CONSIDER THE IMPLICATIONS OF TIDAL POWER IN MORE DEPTH (Fact sheets will be produced on each of the key implications of tidal power – environmental, social, economic) The order of discussing these issues will be determined by the group in order of importance to them Economic (will need information on the economic benefits and costs of tidal power. we will need information on how much each of the options cost and how much energy they produce in terms of the energy produced i.e. % of UK energy consumption. Different options for funding the projects. Short term costs and long term payback in electricity generation, impact on cost of power decommissioning costs) Benefits job creation, technological innovation, carbon mitigation, value of ancillary impacts no need for flood defences (barrage). Disbenefits – land values, link to national grid, impact on other industries, compensation cost)

	▪ Which of the economic considerations are most important to you? ▪ Which of the economic considerations are least important to you? ▪ Would any of these effects affect you personally? ▪ Which of the economic considerations are most important to the region? ▪ Which of the economic considerations are least important to the region? ▪ Overall what do you think about the economic case for tidal power Environmental (We will need information on the main environmental benefits and costs of tidal power. Benefits - low carbon energy production, protection from flooding/rising sea levels. Disbenefits – negative impacts on biodiversity, noise and pollution, manufactured resources, flooding risk, pollution risk from shipping collision, impacts of road/rail crossing) ▪ Which of the environmental considerations are most important to you? ▪ Which of the environmental considerations are least important to you? ▪ Would any of these effects affect you personally? ▪ Which of the environmental considerations are most important to the region? ▪ Which of the environmental considerations are least important to the region? Overall what do you think about the environmental case for tidal power Social (We will need information on the main social benefits and disbenefits. Benefits – impact on fuel poverty, increased awareness of energy issues, planning gain from developments, leisure impacts behind the Severn Barrage, feeling about their area. Disbenefits – visual amenity impacts and direct impacts on local communities ▪ Which of the social considerations are most important to you? ▪ Which of the social l considerations are least important to you? ▪ Would any of these effects affect you personally? ▪ Which of the social considerations are most important to the region?

	▪ Which of the social considerations are least important to the region? Overall what do you think about the social case for tidal power Other considerations Are there any other factors which you think are important to consider when evaluating tidal power? Each group to summarise their thoughts on the economic, social and environmental implications for each technology
13.00 -13.10 Plenary – each group to present back their thoughts on the implications for each technology	
13.10 – 14.00 LUNCH	
14.00 – 14.50	Working in 2 separate groups OBJECTIVE: EXPLORING PUBLIC ATTITUDES TOWARDS POSSIBLE TIDAL DEVELOPMENTS IN THE SEVERN ESTUARY AND THE PENTLAND FIRTH *Give out handouts of the fact sheet on the proposals and show the maps of where the developments could occur (several potential locations in the Pentland Firth)* ▪ Spontaneous reactions to the potential proposal – advantages/disadvantages ▪ How does this information compare to your existing knowledge about tidal power? ▪ Is there anything that you found surprising? ▪ Pentland Firth potential proposal - How would you feel if there was one device? - What would be the implications of this local/regional/national basis? - How would you feel if there was a farm of 30-40 devices? - What would be the implications of this local/regional/national basis? - How would you feel if there were several hundred devices which would be needed to extract the maximum potential energy in the Pentland Firth? - What would be the implications of this on a local/regional/national basis? ▪ Prepare a 5 minute presentation to feedback during the plenary session on the advantages/disadvantages of the proposals

	OUTPUT: INITIAL REACTIONS TO THE PROPOSALS
14.50 – 15.00	Each group to present back the advantages/disadvantages of the proposals
15.00-15.25	OBJECTIVE – TO UNDERSTAND THE KEY ARGUMENTS FOR AND AGAINST TIDAL POWER FROM THE PUBLICS' VIEWPOINT Tidal power jury – split the group into two groups and ask one group to consider the case for tidal power and 1 group to present the case against tidal power. Each group will use the issues they deem to be most important for the cases for and against. The groups will work together to identify the key arguments and then present back to the other group. The other group will than have an opportunity to interrogate the presenting group OUTPUT –THE KEY ARGUMENTS FOR AND AGAINST TIDAL POWER FROM THE PUBLICS VIEWPOINT
15.25-16.10	OBJECTIVE – TO UNDERSTAND WHAT ARE THE CONDITIONS FOR PUBLIC ACCEPTABILITY OF TIDAL POWER *Give out information on the role of government* ▪ What role do you think that government and devolved administrations should have in making the decisions about tidal power? - What should be the balance of power between the local authorities, the devolved administrations the government and the European Union be about tidal power? - What do you think about the level of financial support for the development of tidal power from UK government and the devolved administrations? Introduce the options from the omnibus questionnaire ▪ How do you think the tidal power schemes should be financed? *The Government should pay for researching and supporting new tidal power technologies through general taxation* *Consumers should pay for researching and supporting new tidal power technologies through a small increase in their energy bills* *Private sector companies should pay for researching and supporting new tidal power technologies* *There should be no further research or support for new tidal power technologies* ▪ Which of these options do you think is most appropriate for tidal power? Introduce 3 scenarios which make a stronger case for tidal power (these will be developed fully)

	1 – Carbon emissions are having a dramatic effect on the UK – rising sea levels, rise in freak weather conditions 2 – Security of energy supply – gas resources become scarce and nuclear power stations are decommissioned leading to a shortage of energy supply 3 – Rising cost of non-renewable energy sources means that tidal power is significantly cheaper than other sources of non-renewable energy so prices of electricity would fall After each scenario participants will be asked if this changes their opinion on tidal power Ask participants to consider tidal power from a UK perspective - Does this change how you feel about tidal power? - What is less/more important to you when thinking from a UK perspective?
16.10-16.30	▪ Participants to be given a 2 post its and will be asked if they are for or against tidal power in their area and in the UK as a whole and the main reason for this opinion. These votes will be then placed on flip charts ▪ SDC and Opinion leader sum up the key outcomes of the workshop and Opinion Leader the next steps in public and stakeholder consultation, and how the outputs of today will inform ways forward. ▪ Thanks and close WORKSHOP EVALUATION QUESTIONNAIRE:

5.4 Discussion guide for focus groups

Tidal power discussion guide for local group discussions

Introductions (5 mins)

Name, occupation/role, something interesting/different about themselves

Main discussion

Current awareness of tidal power (10 mins)

- What sorts of things do you associate with the sea? – Flipchart responses
- Do you ever think of the sea as a potential source of energy?
- Have you heard about tidal power?
- What have you know about it?
- What do you imagine tidal power technologies will look like?
- How much energy do you think they could produce?
- Where have you heard about tidal power?

Current attitudes towards tidal power (15 mins)

- Silent brain-storming exercise – all to be given post it notes and a pen and write down if they are in favour, undecided or against tidal power and the factors they have or would consider when deciding their point of view on this. The participants will than be asked to place the factors on a piece of flipchart paper and group them together with others which are the same or similar
- The moderator will then lead a discussion about why these considerations are important (we will also probe on how participants define the factors e.g. environment)
- The group will then rank the factors in order or importance

Reactions to proposed tidal schemes in their area (50 mins)

Give out and explain a fact sheet explaining why we are discussing tidal power (need to reduce carbon emissions to reduce global warming, international responsibilities including Kyoto, need to evaluate the potential of renewable energy supplies, safeguard future energy supplies etc.)

Give out and explain a fact sheet about the possibilities for tidal power in their area i.e. tidal stream technology in Orkney and different barrage and non-barrage proposals for the Severn Estuary. As well as information about the proposals it will outline the cost, environmental, social, economic implications

- Spontaneous reactions to the proposals – advantages/disadvantages
- How does this information compare to your existing knowledge about tidal power?
- Is there anything that you found surprising?

Considering the implications for the local community

- For each proposal:

- How do you think the local community will be affected by this proposal?
- What do you think are the positive impacts that this proposal could have on the local community
- What do you think are the negative impacts that this proposal could have on the local community
- Does the proposal represent good or poor value for money?
- What do you think about the economic benefits/costs of this proposal?
- What do you think about the social benefits/costs of this proposal?
- What do you think about the environmental benefits/costs of this proposal?

- Pentland Firth potential proposal (Orkney only)

- How would you feel if there was one device?
- What would be the implications of this local/regional/national basis?
- How would you feel if there was a farm of 30-40 devices?
- What would be the implications of this local/regional/national basis?
- How would you feel if there were several hundred devices which would be needed to extract the maximum potential energy in the Pentland Firth?

Are there any other factors which you think are important to consider when evaluating whether it is appropriate to progress tidal power in this area?

Overall issues (10 mins)

- How do you think the local community should be consulted about the tidal power proposals?
- What level of influence over any decisions about tidal power developments in your area should local people have?
- Who should own the technology?
- Have your views changed as a result of the information you have received about tidal power? In what ways

- Who is in favour/against tidal power?

- What are the main reasons for people being for and against?

- (For those against or with reservations) – what would have to change which would make the tidal power proposals more acceptable (prompt with issues such as rising sea levels, compensation, provision of more local amenities, cheaper electricity, reducing global warming in the future)

Summing up and close

5.5 Omnibus questionnaire

Omnibus questions

1. Which sources of energy have you heard of that can be used to generate electricity in the UK? Prompted list

Nuclear
Gas
Tidal
Wave
Bioenergy
Wind
Coal
Solar
Hydro
Oil

2. How much would you say that you know about tidal power where 5 is a lot and 1 is nothing at all?

1 – nothing at all
2 – a little
3 – some
4 – quite a lot
5 – a lot

[INFORMATION PROVIDED FOR Q3]Tidal power
Tidal power is a way of generating renewable electricity by capturing the energy contained in water movements around the coastline due to the regular cycle of the tides.

3. Which of the following statements best describes your estimation of the UK's potential for producing electricity from tidal power?

The UK has very considerable potential for generating tidal power
The UK has quite a lot of potential for generating tidal power
The UK has limited potential for generating tidal power
The UK has very limited potential for generating tidal power
I do not have an opinion on the potential for tidal power in the UK

[INFORMATION TO BE PROVIDED for Q4]: The potential benefits of tidal power are that it produces energy from a predictable and renewable resource that does not release carbon dioxide (CO_2), the major cause of climate change. There are several different ways of generating electricity from the tides, including tidal barrages and a number of newer technologies which capture the energy from fast-flowing water. Many of these technologies are still being developed, and the UK is taking a lead in this area.

4. How should the UK best support the development of new tidal power technologies? [choose one option only]

The Government should pay for researching and supporting new tidal power technologies through general taxation
Consumers should pay for researching and supporting new tidal power technologies through a small increase in their energy bills
Private sector companies should pay for researching and supporting new tidal power technologies
There should be no further research or support for new tidal power technologies

5. How much would you say that you currently know about proposals for a tidal barrage across the Severn Estuary where 5 is a lot and 1 is nothing at all?

1 – nothing at all
2 – a little
3 – some
4 – quite a lot
5 – a lot

Severn Barrage
[INFORMATION TO BE PROVIDED ON SEVERN BARRAGE TO PARTICIPANTS] The Severn Estuary, the body of water between South Wales and the North Somerset and Gloucestershire coast, has the second highest tidal range of any estuary in the world. Some people have proposed that a barrage should be built across the Severn Estuary to generate renewable electricity.
A large barrage across the Severn Estuary could generate up to 5% of the UK's electricity from a renewable resource. The potential disadvantages are that a barrage could cost up to £14 billion, and it could have significant environmental impacts on natural habitats, fish, birds, which are protected by UK and international conservation laws.

6. Which benefit of a barrage across the Severn Estuary do you consider to be the most important? [single choice answer]
    - The potential for new jobs and economic development in South Wales and South-West England
    - A CO_2-free source of electricity generation
    - Reduces the UK's reliance on imported fossil fuels and improves the long term security of electricity supplies
    - The potential for increased protection from flooding for some parts of South-West England
    - Large contribution to the UK's electricity needs

7. What disadvantage of a barrage across the Severn Estuary do you consider to be the most important?
    - The economic impact on some ports of restricting ship movements in the area
    - Negative impacts on internationally significant natural habitats and species such as birds and fish
    - The noise and disturbance created by the construction of a barrage over several years
    - The potentially high cost of a barrage
    - The landscape and visual impact of a large barrage

8. Given these potential benefits and disadvantages, are you in favour or against a large tidal barrage across the Severn Estuary?

Strongly in favour
Slightly in favour
Neither for nor against
Slightly against
Strongly against

5.6 Stakeholder workshop evaluation agendas

Sustainable Development Commission | The Environment Council

Sustainable Development Commission
Tidal Power Stakeholder Engagement Workshop
Aberdeen, 27th March 2007

Outline agenda

0930	1	Arrivals and registration
1000	2 3 4	Welcome Presentation by SDC on the tidal power project Overview of the day
	5	Meeting other stakeholders
	6	Presentation by Entec on tidal technologies
	7	Sustainable development aspects of different technologies
	8	"What is Governments role in supporting tidal power development in a sustainable way?."
	9	Conditions for stakeholder acceptability for tidal power
	10 11	Overview of the day Evaluation
	12	Closing remarks from SDC
1600	13	Close and depart

Sustainable Development Commission | The Environment Council

Sustainable Development Commission
Tidal Power Stakeholder Engagement Workshop
Cardiff, 29th March 2007

Outline agenda

0930	1	Arrivals and registration
1000	2 3 4	Welcome Presentation by SDC on the tidal power project Overview of the day
	5	Meeting other stakeholders
	6	Presentation by Entec on tidal technologies
	7	Sustainable development aspects of different technologies
	8	"What is Governments role in supporting tidal power development in a sustainable way?."
	9	Presentation by Black & Veatch and AEATechnology on tidal power concepts for the Severn
	10	Conditions for stakeholder acceptability for tidal power
	11 12	Overview of the day Evaluation
	13	Closing remarks from SDC
1600	14	Close and depart

5.7 Briefing materials

5.7.1 Public consultation

Information sheets on environmental, economic and social issues

Information Sheet
Tidal power – Role of Government

Regulation

- The Government sets the policy and rules for energy development. The policy sets out what consents developers must apply for before going ahead with a tidal energy development. The consenting requirements for energy are complex and are only summarised here.
- In England, Wales and Northern Ireland, the Secretary of State for Trade and Industry (DTI) is responsible for deciding whether to grant consent to an energy project. In Scotland, the Scottish Executive is responsible for decisions on energy projects.
- Before granting any consents, environmental impacts of a proposal must be taken into account, and the relevant statutory agencies such as Natural England, Countryside Council for Wales and Scottish Natural Heritage must be consulted.
- Developments in the marine environment also require consents from other departments like Defra (Department For Environment, Food and Rural Affairs). A licence or lease from the Crown Estate is also needed.
- Local authorities may also have a role in determining planning applications for infrastructure related to an energy development.

European legislation

- Many coastal and estuary sites are protected by European legislation such as the EU Habitats Directive and the Birds Directive
- Any developments proposed in protected sites must go through strict tests to ensure that the integrity of the site, and the birds and habitats it

contains, are protected.

Innovation and renewables policy

- The UK Government (DTI) provides financial support for tidal energy development through research and deployment grants
- Additional support for research and demonstration of new marine energy technologies is also available in Scotland, Wales and Northern Ireland from the Devolved Administrations.

Information Sheet
Tidal power – Economic factors

Tidal barrages

- High capital cost for construction but uses proven hydroelectric technology - a large barrage across the Severn could cost up to £15bn or £1.5bn for a smaller scheme (depending on the scheme). (Terminal 5 at Heathrow airport costs £4.2bn)
- Additional cost of environmental compensation for barrage development in protected estuaries – could be high
- Would obstruct some shipping routes and affect neighbouring ports
- Reliable, zero carbon electricity for over 100 years at stable prices
- A large barrage across the Severn could meet up to 5% of the UK's electricity needs
- Some projects could be combined with infrastructure developments (e.g. new rail links, roads) or flood defence improvements
- A number of jobs would be created in the region and in the UK, particularly during the construction phase

Tidal stream devices

- Lower capital cost for an individual device – can be installed individually or in large farms
- New device technologies are currently at the testing stage, so the devices and the electricity from tidal stream devices are currently expensive
- Working in the marine environment is challenging – maintenance and environmental monitoring are particularly expensive
- Conflicts with other uses of the sea, especially major shipping routes
- Significant research and investment still needed before tidal stream devices can produce electricity at prices which are competitive with other renewable energy sources e.g. wind
- Reliable, zero carbon electricity for around 20 years (devices might then be replaced with new ones)
- Potential for the UK to be a world leader in this sector with new employment opportunities in the marine sector
- Tidal stream technology could be used in many locations around the UK and costs are likely to fall

Tidal lagoons

- Relatively high capital cost for construction but uses proven hydroelectric technology, although on a smaller scale to tidal barrages
- Uncertain costs, due to lack of experience with tidal lagoons
- Reliable, zero carbon electricity for over 100 years at stable prices
- Less power output than a large barrage

Information Sheet
Tidal power – Social factors

Tidal barrage

- Potential locations for barrages are often estuaries where there is typically a lot of shipping, boating and fishing activity, and industrial, residential and recreational activities on the surrounding coastline
- Recreational boating routes may be restricted by a barrage across an estuary and boats would have to pass through locks in the barrage. There may be new recreational opportunities in the area upstream of a barrage which could provide calmer conditions for boating and water sports.
- Recreational fishing may be affected because fish may be blocked by a barrage or access to fishing grounds may change.
- A barrage can act as a flood protection barrier for low lying areas upstream of a barrage. However, flood risk for areas downstream of a barrage can increase because of increased wave action and coastal erosion.
- A barrage will have a large physical and visual presence which will impact on the landscape and seascape.
- A barrage could become a tourist attraction and bring more visitors to an area.
- The top of a barrage can be used for transport links like road and rail, and these can provide regeneration benefits by increasing accessibility and linking communities.

Tidal stream devices

- Tidal stream devices need to be located in water with high current speeds like the Pentland Firth.
- Safety and access for recreational boating and diving may be affected by the location of groups of tidal devices. Safety no-go zones might be placed

around tidal developments. However, fishing could also benefit from an increase in fish stocks around tidal developments. Some types of tidal devices are submerged beneath the surface so that navigation of small boats and yachts would not be affected.

- The presence of tidal devices can affect the landscape and seascape in areas valued for their natural beauty. Some types of tidal devices may be completed submerged (apart from marker buoys) and so their impacts on visual amenity values in areas of natural beauty may be minimal.
- Tidal technologies could be an educational and tourist attraction for people to see and learn about new renewable energy technology.

Tidal lagoon

- A lagoon will have a large physical and visual presence which will impact on the landscape and seascape.
- Tidal lagoons could be an educational and tourist attraction.

Information Sheet
Tidal power – Environmental factors

All tidal technologies use a renewable resource (tides) to generate electricity. The carbon benefit of tidal power is positive: the carbon (CO_2) that is used in constructing a barrage, a lagoon or tidal stream devices will be quickly compensated by the carbon-free electricity that they generate. However, tidal technologies may also have adverse environmental impacts which vary depending on the type of the technology and the location and scale of development.

Tidal barrage

- Barrages need to be located in estuaries where there is a large tidal range – the difference between the water level at high tide and low tide – like the Severn and Mersey estuaries
- The construction of a barrage across an estuary is likely to have significant impacts

on the natural environment

- Many estuaries in the UK are designated as Special Protection Areas (SPA) for birds and Special Areas of Conservation (SAC) for habitats and are protected by UK and European environmental legislation. Estuaries are an important location for wintering migratory birds and waders. These bird populations are of national and international importance and their habitats would be affected by barrage development.
- Construction takes a number of years and creates noise, dust and traffic
- Barrages change the way sediments and tides move around an estuary and this changes the natural features of an estuary. This may affect water quality and change patterns of sediment erosion and deposit along the coastline. This also affects the environment and organisms that support bird and fish populations.
- Water quality may be negatively affected by a barrage – this may also have implications for European regulations on water quality
- A barrage may interrupt the passage of fish in an estuary
- Large quantities of stones/rocks are needed to construct a barrage, and dredging is required to generate this

Tidal stream devices

- Tidal stream devices need to be located in fast moving water found in channels and around some parts of coastline like the Pentland Firth. Some deep water areas have environment and organisms that have not previously been affected by human activity and are not yet well studied. Some sites with suitable tidal resource may be designated and protected sites under UK and European environmental legislation.
- Few tidal devices have been tested in the sea and there is a lack of information about the potential environmental impact of putting large numbers of devices in farms.
- The environmental impact of small numbers of test devices is likely to be low. But the impacts of the devices on the marine environment will increase over time if they are used at a commercial scale.
- Tidal stream devices could affect coastal processes, and the placement of the device and associated cabling will affect the seabed. Some areas of seabed contain a rich

and diverse community of organisms, but others may have very few organisms. Once in place, the device may provide a new habitat for marine organisms. This new habitat would be disturbed when the device is decommissioned

- Noise and vibrations from a tidal device will travel underwater. Noise is most significant during construction and maintenance. Increased underwater noise can affect fish and marine mammals.
- Risk of marine pollution occurring if ships or boats collide with tidal devices.

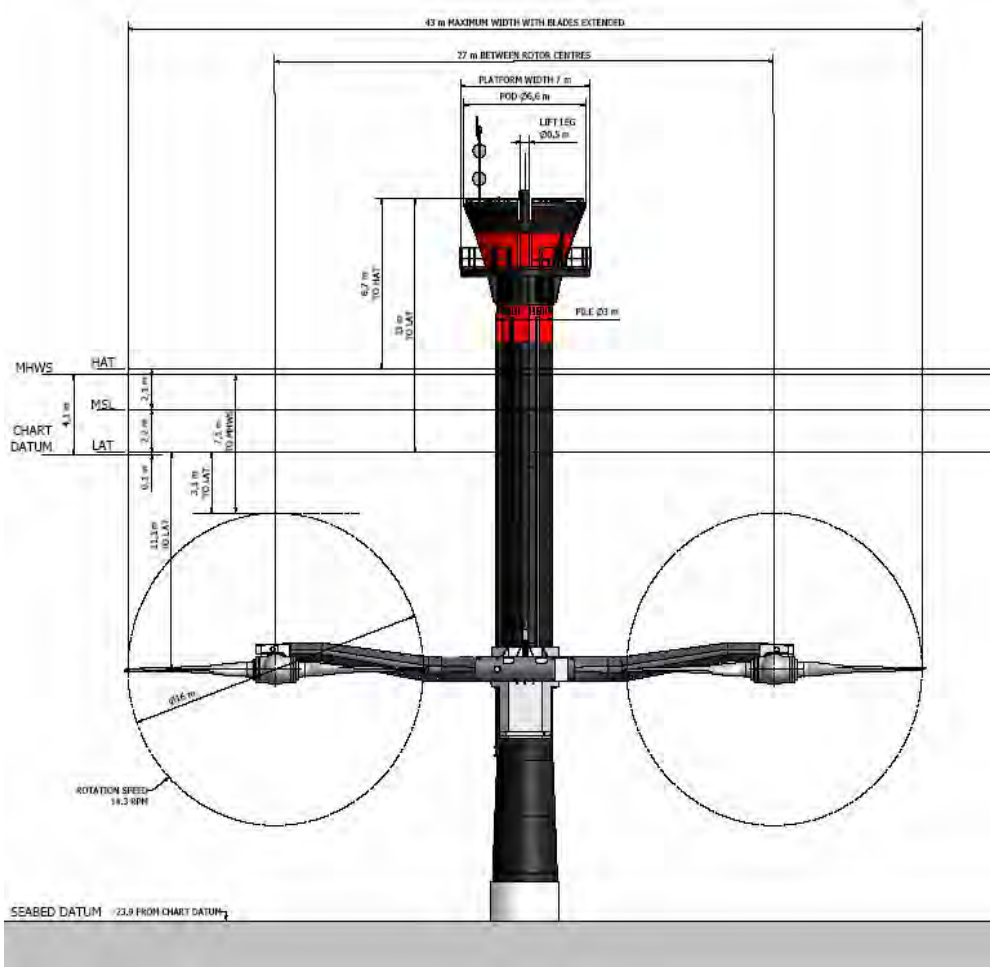
Tidal lagoon

- Tidal lagoons need to be located in areas like estuaries or shallow bays where there is a large tidal range – the difference between the water level at high tide and low tide – like Swansea Bay.
- A lagoon can affect coastal and tidal processes and change sediment transport patterns but does not block an estuary or join onto the coastline as a barrage does.
- Marine species and birds will be affected by habitat loss and changes to the physical and chemical environment as a result of lagoons.
- Large quantities of stones/rocks are needed to construct a barrage, and dredging is required to generate this

Tidal power case study: Scotland

- Scotland has significant tidal stream energy resources located around the Pentland Firth, Orkney, Shetland and the western coast of mainland Scotland.
- Pentland Firth and its approaches contain about 40-50% of the recognised UK tidal stream resource.
- New tidal stream technologies are being developed to prototype device stage.
- Hypothetical case study to test the potential for tidal stream in the Pentland Firth – an array of 35 devices with 3MW, total output for array 200mw. To fully exploit the tidal resource in the Pentland Firth, hundreds of devices would be needed.
- Example technology: The “Seagen” machine developed by Marine Current Turbines Limited. This is the most well developed prototype tidal energy device. The device has limitations because it cannot be used in very deep water – range 29-46 metres. Other types of devices that can be used in deeper water could also be used in other areas of the Pentland Firth.
- 2-3% of current UK energy demand is possible if all of the resource around the Pentland Firth was fully exploited using different types of machines

Proposal	Cost	Energy output	Environmental impacts	Economic aspects	Social aspects
Hypotetical Pentland Firth tidal stream	Very high cost at present but will lower as technology development advances	Pentland Firth contains 40-50% of the UK tidal resource 35 devices with 3MW, total output for array 200mw.	• Close to important areas for nature conservation but areas with highest tidal flows tend to have less life on the seabed • Risk of water contamination from the materials used during construction e.g. concrete and potential leakage of chemicals from the devices • Noise and disturbance of habitats associated with drilling during installation and operation. • Risk of birds (e.g. diving seabirds) and marine animals (e.g. dolphins, harbour porpoise) colliding with the structures. • Low carbon, renewable energy source (carbon payback period less than 1 year)	• Use of the local ports as base from which to install the technology. • Exclusion zones may affect ferry crossings and other shipping. • Little impact on jobs in the area. • Cabling required between the devices and linked to the existing grid with a new substation at the landing point on the coast. New power lines or upgrades of exiting lines might also be needed	• Some exclusion zones could affect recreational sailors. • A new electricity sub-station will be required. • Visual impact of tidal devices being located in Pentland Firth: small numbers, large numbers



SeaGen device, Marine Current Turbines

Height: 55 metres with 21m socket drilled into seabed
Width (horizontal cross beam and blades): 43 metres
Blades: Two 16 metre blades

Artist's impression of SeaGen device, Marine Current Turbines

Severn estuary barrage schemes

This table shows the main features of two possible schemes for tidal power barrages across the Severn estuary. The schemes that we will discuss are:

- the **Cardiff-Weston Severn Barrage** scheme, which is the largest and most well known and studied scheme, and
- a smaller alternative scheme called the **Shoots Barrage**.

There are also other potential Severn barrage alignments. For example:

- **Severn Lakes barrage concept** (Gareth Woodham) which would have 14 electricity generating turbines, road/rail links, four marinas and two lock gates to give ships passage
- **Dawson continuous power barrage** scheme involves a barrage across the outer estuary, near Minehead, and a second basis connected at Brean Down, near Weston, forming a second basin
- A version of the **Cardiff Weston barrage with a second basin** extending towards Minehead would utilise more of the resource and provide additional flood protection for Somerset but would be significantly more costly.

The tidal resource in the Severn estuary and the Bristol Channel could also be used for tidal stream technologies (e.g. Marine Current Turbines). The tidal resource in Swansea Bay could be used for tidal lagoons.

Parameter	Cardiff-Weston barrage	The Shoots Barrage

Parameter	Cardiff-Weston barrage	The Shoots Barrage
	The Severn Barrage scheme promoted by the Severn Tidal Power Group (STPG) between Cardiff and Weston-super-Mare	A smaller, alternative scheme promoted by PB Power. Also known as the English Stones scheme.
1. The site		
Present mean tidal range (m)	7.72	8.52 (Avonmouth)
Present mean spring tidal range (m)	10.46	11.54 (Avonmouth)
Basin area (sq km)	480km^2 at mean sea level	90km^2
Length of barrage (km)	15.9km	6.5km approx
Ports behind barrage	Avonmouth, Newport, Bristol, Cardiff, Sharpness (Gloucester)	Sharpness (Gloucester)
Predicted reduction in tidal range on seaward side of barrage	11%	8%
2. Engineering & cost		
Turbine number x runner diameter	216 x 9.0m	30 x 7.6m
Total installed capacity (MW)	8640MW	1050MW
Annual energy output with reverse pumping (TWh)	17 TWh approx	N/a
Annual energy, ebb generation only (TWh)	16.5 TWh approx.	2.75 TWh
Percentage development of available power available in Severn Estuary/Bristol Channel	68%	11%

Parameter	Cardiff-Weston barrage	The Shoots Barrage
(approx 25TWh/yr) – this is a measure of how much of the potential resource the scheme would use		
Mode of turbine operation	Ebb generation with reverse pumping at high water	Ebb generation
Ship locks, No. x size	2 locks, each 360m x 50m, plus 2 small boat locks each 90m x 15m	1 lock, 225m x 37.5m
Ship lock capacity (dwt) (This recognises that the Cardiff Weston alignment would affect the larger ports like Cardiff)	70,000t approx.	20,000t approx.
Capital cost (2006)	c. £15B	£1.4 - £1.8B
Annual O&M cost	£115M	£22 - £27M
Construction time to first power	7 years (or possibly less)	4 years
Design life (years)	120	120
Unit cost of electricity sent out (real) p/kWh	3.6 – 22.3 p/kWh	3.0 – 15.4 p/kWh
Annual saving in CO_2 (based on 0.43 kg/kWh)	7.3 Mt	1.2 Mt
3. Environmental aspects		
Environmental impact	Major changes in the physical and biological environment (ecology) upstream and downstream of the barrage structure	Major changes although at a lesser scale

Parameter	Cardiff-Weston barrage	The Shoots Barrage
EU Birds and Habitats Directives	The Severn Estuary area is protected as a Special Protection Area (SAC) for birds and is a proposed Special Area of Conservation (SPA). These conservation sites recognise and protect the birds, fish and habitats located in the Severn estuary. The Severn estuary hosts 63,000 migratory and wintering water birds, representing seven per cent of the UK's total estuary resources for wildl	
International Nature Conservation Sites affected	• Severn Estuary SPA • Severn Estuary pSAC • River Wye SAC • Severn Estuary Ramsar site • River Usk SAC	• Severn Estuary SPA • Severn Estuary pSAC • River Wye SAC • Severn Estuary Ramsar site
Potential loss of up to c. 14,500 ha of intertidal habitat (spring / neap) ha	Extensive loss of intertidal habitats 14,428 / 5,842 ha (60% of the total area)	Large loss of intertidal habitats 5,530 / 3,372 ha (20% of the total area)
Migratory fish	Migratory fish of the Severn Estuary and the Rivers Usk and Wye will be affected by the presence of a barrage – populations of some species such as salmon at high risk of high mortality	Landward of the River Usk and potential impacts of a barrage on the migratory fish species of this river are significantly reduced
Wading birds	Birds would be affected by reduction in inter-tidal area, increase in sub-tidal area and lower turbidity in *large* basin.	Birds would be affected by reduction in inter-tidal area, increase in sub-tidal area and lower turbidity in *smaller* basin

Parameter	Cardiff-Weston barrage	The Shoots Barrage
Other impacts	• Water quality • Landscape / seascape and visual impact • Land drainage • Visual and landscape impact of barrage and associated infrastructure • Archaeology	
4. Economic and social aspects		
Employment	Construction and operation phases would create direct and indirect employment opportunities regionally and in the UK. E.g. The estimated jobs during construction phase: 44,600 persons/year each year during construction phase (50% would be employed in the Severnside region)	12,300 persons/year each year during construction phase
Transport links	Road or rail could be included	High speed rail proposed as part of project
Navigation and ports	Several major commercial ports would be upstream of the barrage: Cardiff, Newport, Bristol, Sharpness (Gloucester). Operation and possibly	Sharpness (Gloucester) only commercial port upstream of barrage

Parameter	Cardiff-Weston barrage	The Shoots Barrage
	viability would be affected. Ship locks would be placed in the barrage.	
Fisheries – recreational and commercial	Fish movements and spawning and species distribution would be disturbed by change in estuary and physical presence of barrage with impact on fisheries to different degrees	
Rising sea level/surge tides	Protection of Gwent & Somerset Levels plus other areas from surge tides and impacts of climate change. Potential for increased erosion downstream of the barrage (Bridgwater Bay)	Protection of low lying areas upstream of barrage from surge tides and impacts of climate change
Recreation and tourism	The scheme is likely to stimulate water sports and tourism and recreation visits in a region. Visitor numbers for wetlands and birds could decrease. Visitor numbers could also decrease during construction with extra traffic, noise and dust pollution. Severn bore formation may be affected. Amenity beaches at Barry and Weston-super-Mare may be affected	

Overview of tidal power

March/April 07

opinion leader

Sustainable Development Commission

What is tidal power and what are the key implications

Overview of tidal power

Implications of tidal power

What is tidal power and where does it come from?

Definition

- Tidal power is a way of generating electricity by capturing the energy contained in water movements around the coastline due to the regular cycle of the tides

Where does tidal power come from?

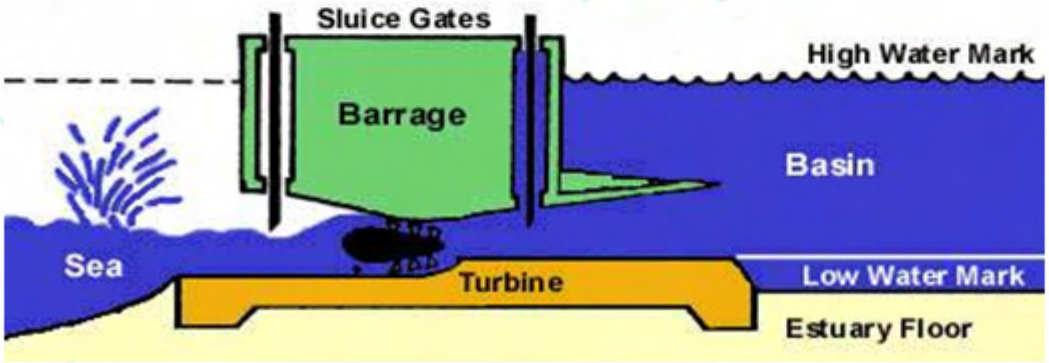
- Tides are created by the gravitational effects of the sun and the moon on our oceans
  - This creates a predictable twice daily rise and fall in sea height
  - The amount of energy which can be extracted at any time can be forecast accurately

What is the potential of tidal energy production in the UK?

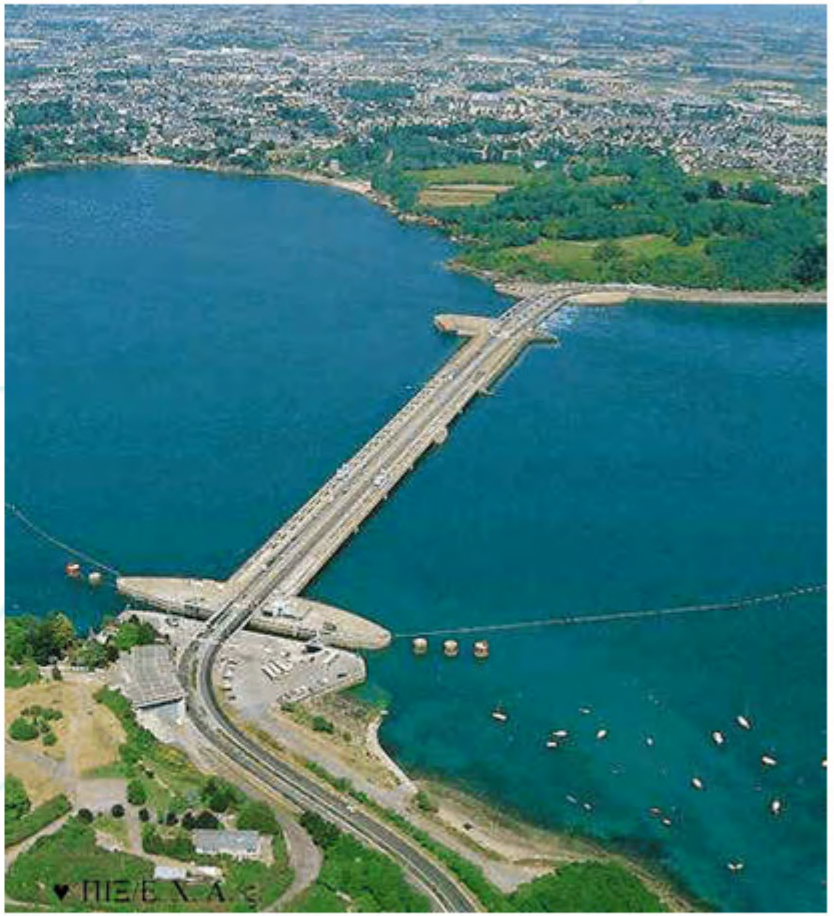
- The potential energy which can be generated from the tidal resource around the coast of the UK is considerable (up to 10% of the UK's energy needs could be generated by tidal power)
  - The UK has many sites with strong tidal streams around its coastline as well as exhibiting some of the highest tidal ranges in the world
  - The UK has about 10-15% of the known Worldwide tidal stream resource (Black & Veatch 2005)
  - The Severn Estuary has the second largest tidal range of any estuary in the world

What are the different technologies?

- **Tidal barrages**
  - A dam/barrage is built across an estuary with a tidal range of more than 5 meters
  - The barrage has gates in it that allow water to pass through
  - The gates are closed when the tide has stopped coming in trapping the water in the estuary
  - As the tide goes out the gates open and water goes past the turbines
  - Power is generated as the water recedes out of the estuary and turns the turbines



What does it look like?

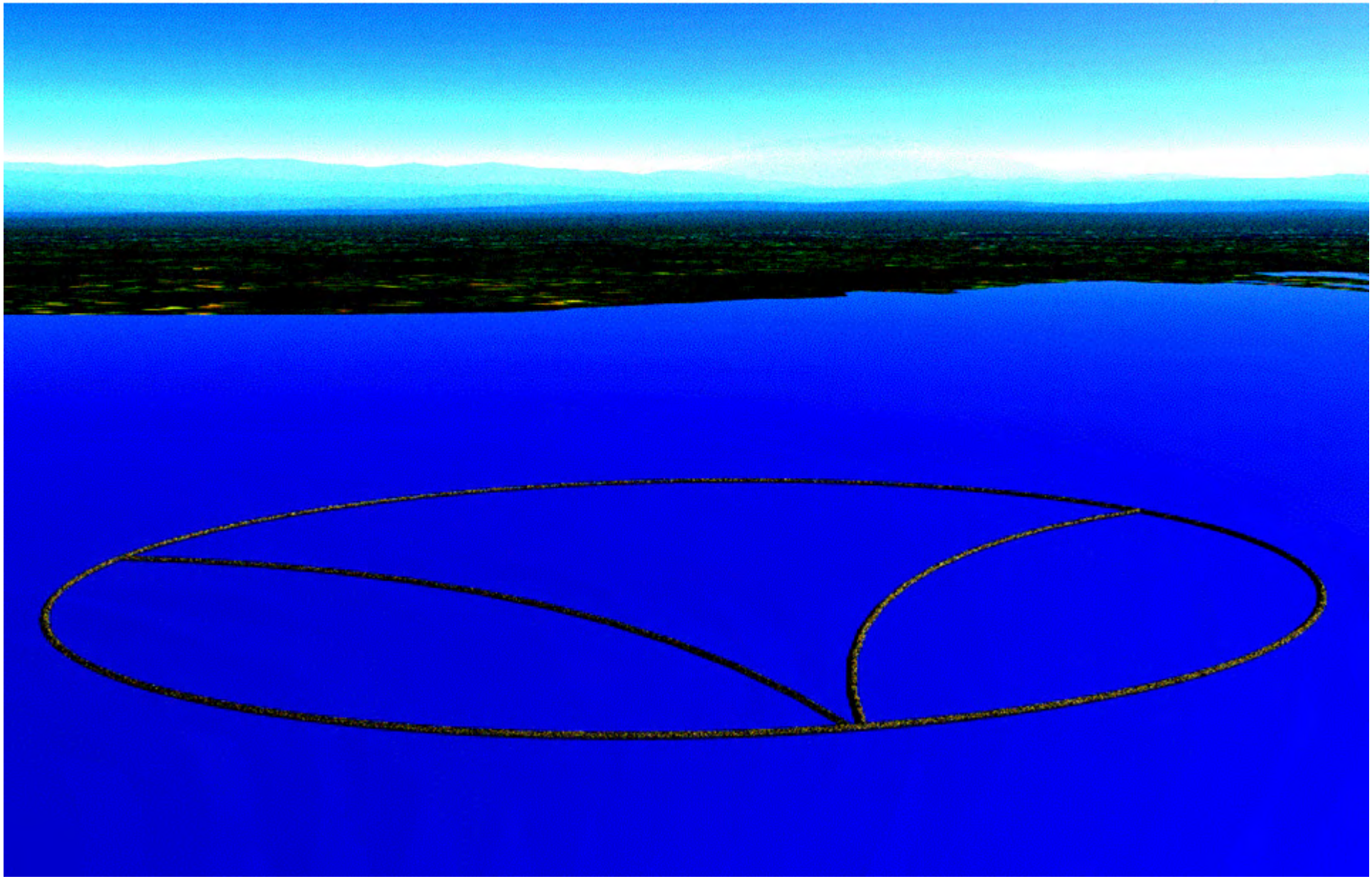


La Rance tidal barrage - France

What are the different technologies?

- **Tidal lagoons**
  - An adaptation of the tidal barrage system
    - Generates power by retaining a body of water behind the turbines
  - Appears like a normal sea wall at low tide
  - Constructed from aggregates such as rubble

What would it look like?



What are the different technologies?

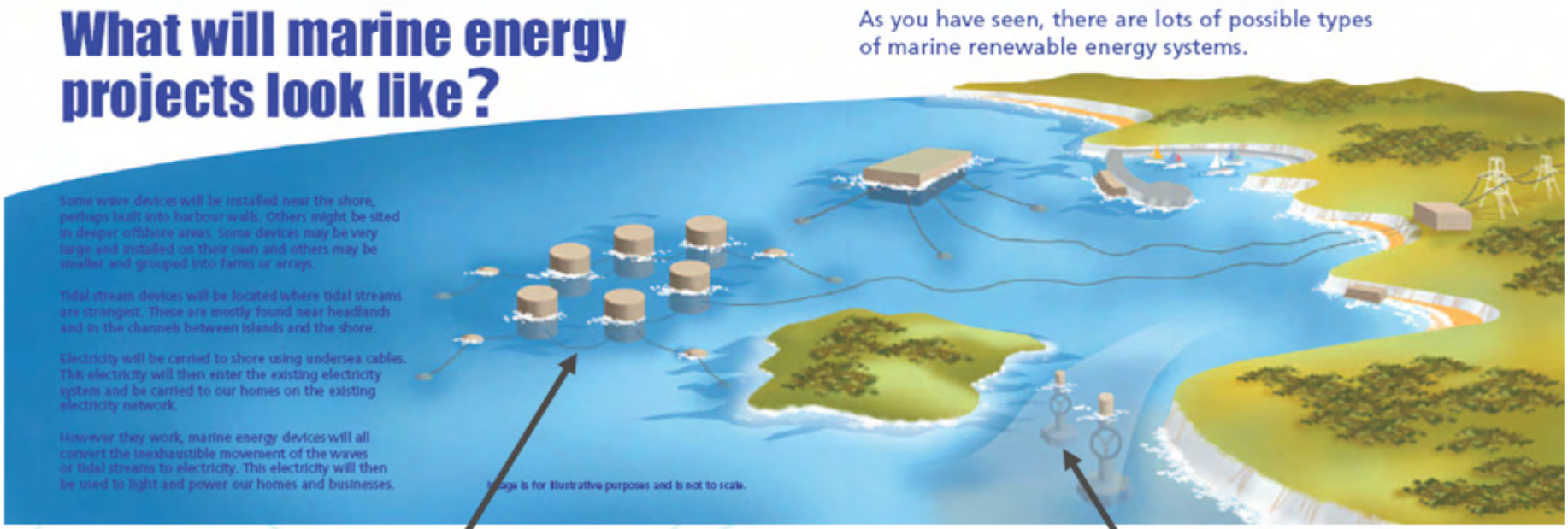
- **Tidal stream technology**
  - It works by harnessing the energy of fast moving water as the tides come in and out
  - Tidal stream technology is in its infancy and is developing quickly

Cross-flow turbine

Ariel Turbine

Hydrofoil turbine

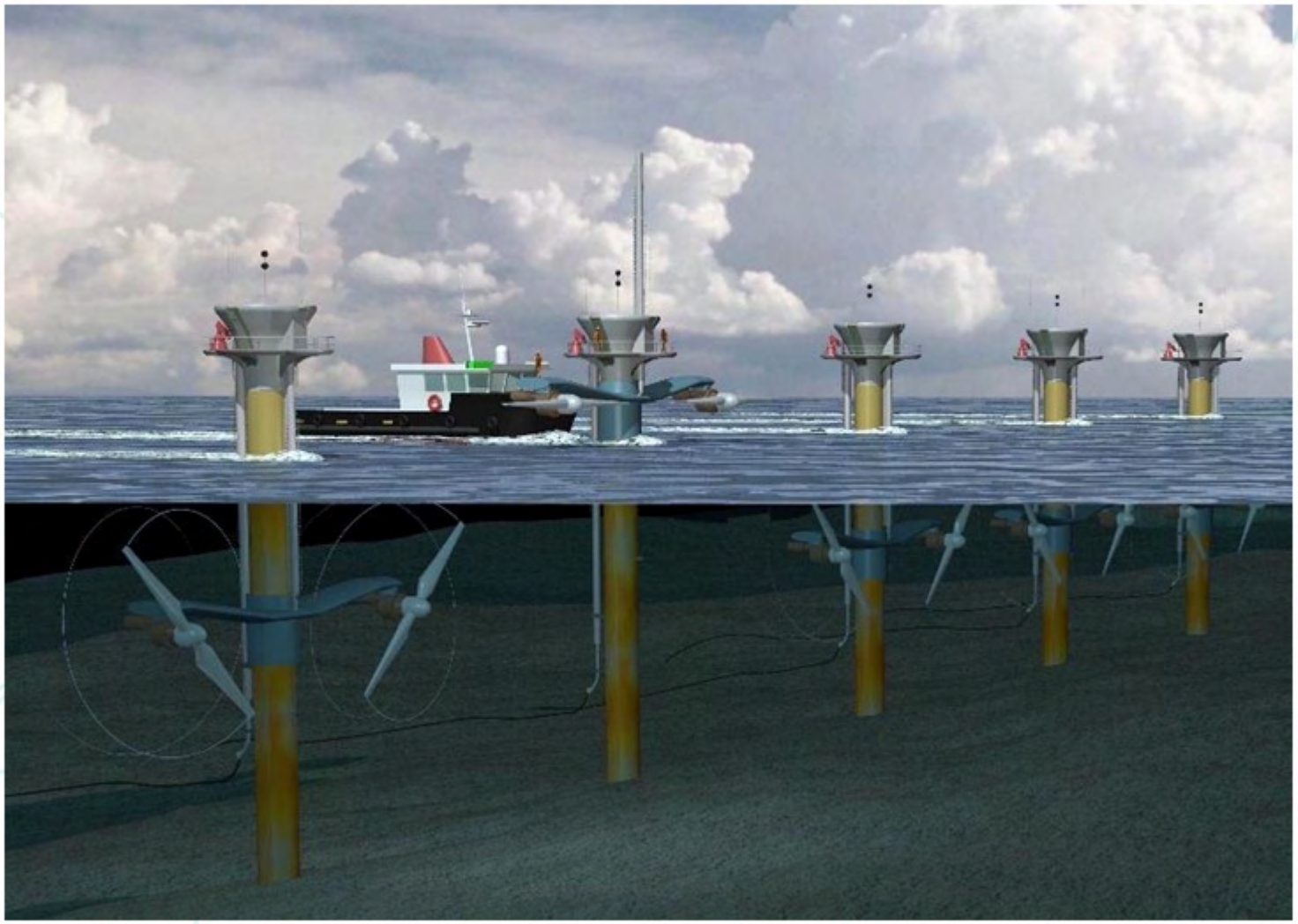
What does it look like?



Wave power technology

Tidal stream technology

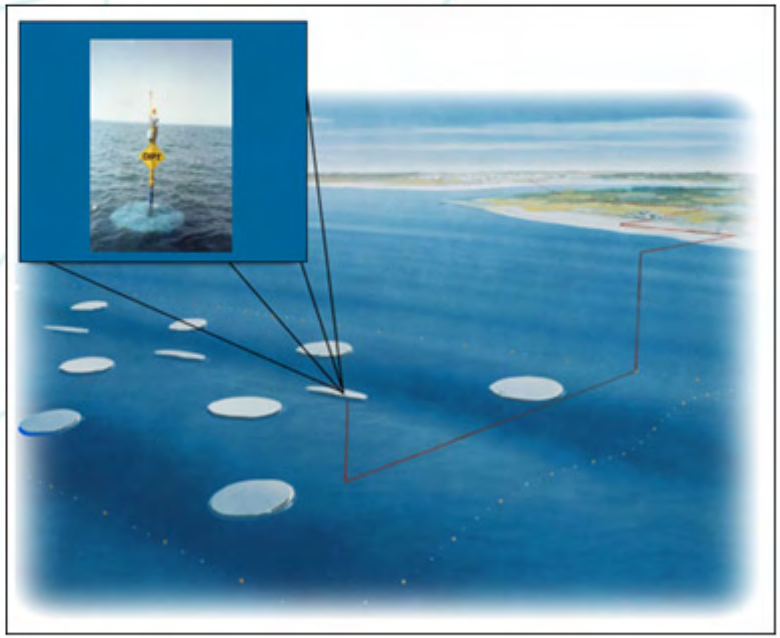
What does it look like?



Example of tidal stream technology

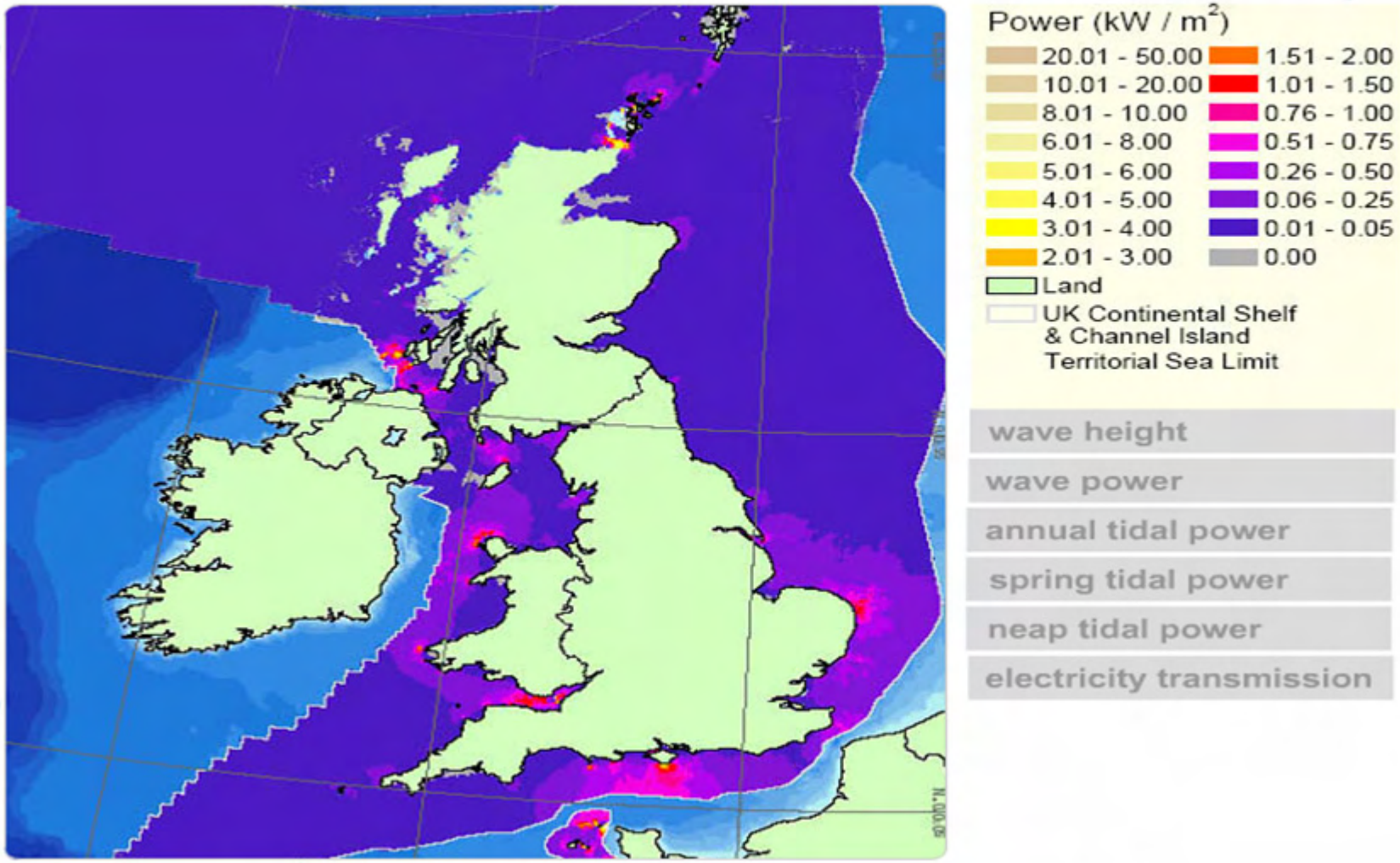
What are the different technologies?

- Wave technology – takes energy out of the motion of the water near the surface.
  - You may have heard of this, however we are not discussing this today



Example of two wave power devices

Where is the UK's tidal resource located?



Source – BWEA – Marine Renewable Energy Resource Atlas

What is tidal power and what are the key implications

Overview of tidal power

Implications of tidal power

Economic considerations

Benefits

- Security of energy supply
- The potential for new jobs and economic development in areas where tidal developments occur
- Large contribution to the UK's electricity needs (up to 10%)
- Impact of road/rail link (some barrage options)

Disadvantages

- Cost – barrage options range from £1.8bn (for 0.8% of UK energy consumption) to £14bn (for 5-6% of UK energy consumption), several large-scale tidal stream farms could cost around £1.2 (for ~0.8% of UK energy consumption)
- Tidal stream technology is in its infancy and needs to be developed further
- Restrictions on some ports (barrages)
- Negative impact on land values (near barrages)

Social considerations

Benefits

- Potential additional amenities/compensation for local people
- Raised awareness of energy issues
- Recreational use of the bay (barrage)
- Potential for people to feel more proud of living in their area (barrage)

Disadvantages

- Noise and disturbance associated with constructing tidal power developments (greater for barrage)
- Impact on the landscape (barrage)
- Negative changes in the way people feel about their area

Environmental considerations

Benefits

- A CO_2 free source of electricity generation
- Increased protection from flooding for some parts of South West England (barrage)
- Significant contribution to the UK target for 20% of electricity through renewable sources by 2020
- Creation of different habitats (barrage)

Disadvantages

- Some serious impacts on ecosystems and wildlife (loss of unique and protected habitat - barrage)
- Visual impact of barrages/tidal stream instillations
- Noise and pollution created during the construction
- Impacts of road/rail crossing (barrage)

Tidal power

- Tidal power is a form of renewable energy – it harnesses the energy from the rise and fall of the tides
- Tidal power reduces CO_2 emissions and helps improve energy security
- The UK could generate 10% or more of its electricity from tidal power
- There are several different ways of generating tidal power
- The SDC is interested in the long-term potential of tidal power in the UK

Sustainable Development Commission

Welcome

SDC tidal power project
Regional public workshop – South Wales

Roath Community Centre, Cardiff
Tuesday 20th March 2007

Oliver Knight
Karla Hill

Sustainable Development Commission

The Sustainable Development Commission (SDC)

Sustainable Development:

- Development that balances economic, social and environmental goals
- Covers a wide range of issues: climate change, housing and communities, nuclear power, transport, and…tidal power

The SDC's role:

- Established in the year 2000 – made up of 20 Commissioners headed by Sir Jonathon Porritt; supported by a team of specialist staff
- The UK's independent advisor on sustainable development
- A critical friend to Government
- A watchdog of Government performance

Sustainable Development Commission

Tidal power project

- The SDC was asked by the UK Government and the Devolved Administrations to do a major project on tidal power, leading to a report
- We want to know what people think about tidal power
- This workshop is part of a wider programme to engage with stakeholders and members of the public
- Your input will help inform the SDC's advice to Government on tidal power

Sustainable Development Commission

Climate change

- Temperatures are increasing due to emissions of CO_2 and other greenhouse gases – the major cause is the burning of fossil fuels
- A serious threat to long-term economic growth and development
- Severe impacts on wildlife, landscapes, and people
- UK continues to play a leadership role
- We must act now to develop new sources of carbon-free energy, whilst doing everything we can to reduce energy demand
- Renewable energy can play a major role

Sustainable Development Commission

Energy security

- UK's sources of oil and gas in the North Sea are now declining
- We will need to import more from abroad
- This makes us more vulnerable to supply disruptions and price rises
- Renewable energy can also help improve energy security because they do not require imported fuel
- The cost of renewable energy can only go down

Sustainable Development Commission

2030: Carbon emissions are having a dramatic effect on the UK

Carbon emissions are linked to significant rises in sea levels, causing changes in the amount and patterns of rain. These changes have brought about a greater frequency of extreme weather events, such as storms, floods, droughts, hurricanes, tornadoes and heat waves. Such freak weather conditions have led to reduced agricultural production. Some animal species have also become extinct.

2030: Reduced security of energy supply

With gas resources now scarce and not always getting through because of political instability and nuclear power stations out of service, there is a shortage of energy. Frequent blackouts occur, leaving homes and businesses regularly without power, light and heat. Consumers are now restricted by law to use energy at certain times of the day. We can no longer rely so much on technology. Life is now without the luxury of convienience that we once took for granted.

2030: Rising cost of non-renewable energy sources

The price of oil, gas and oil has risen considerly over the last few years and is expected to rise further as sources of fossil fuels begin to run out.

Tidal power, a source of renewable energy, would now be a significantly cheaper source of energy than non-renewables.

5.7.2 Stakeholder briefing materials

Briefings were also provided by consultants about the technology and potential of tidal power. Full copies of the consultants reports can be found on the SDC website

Welcome

SDC tidal power project
Northern stakeholder workshop

Aberdeen Exhibition and Conference Centre
Tuesday 27th March 2007

Oliver Knight, Senior Energy Policy Analyst
Phil Matthews, Senior Policy Advisor, Scotland
Ben Rhodes, Engagement Analyst

Sustainable Development Commission

The Sustainable Development Commission (SDC)

The SDC's role:

- Established in the year 2000 – made up of 20 Commissioners headed by Sir Jonathon Porritt; supported by a team of specialist staff
- The UK's independent advisor on sustainable development
- A critical friend to Government
- A watchdog of Government performance
- A UK-wide remit, with a core London staff and dedicated teams in Scotland, Wales, and Northern Ireland

Sustainable Development Commission

The Sustainable Development Commission (SDC)

The SDC in Scotland:

- Team based in Edinburgh led by Maf Smith, Scottish Director
- Two Scottish Commissioners, Prof Jan Bebbington and Hugh Raven
- Commission is the Executive's independent advisor on sustainable development, reporting directly to the First Minister
- Currently working on a first assessment of *Choosing our Future*. Will incorporate an analysis of performance on Climate Change
- Energy a crucial issue for Scotland and the Commission intend to undertake more Scotland-specific work in the future

Sustainable Development Commission

Tidal power project

- The 2006 Energy Review stated that the SDC would be asked to do a major project on tidal power on behalf of Government, leading to a report
- The project is funded by: Department of Trade & Industry, Welsh Assembly Government, Scottish Executive, South West RDA, and the Department of Enterprise, Trade & Investment (Northern Ireland)
- This workshop is part of a wider programme to engage with other stakeholders and members of the public
- Your input will help inform the SDC's work and our advice to Government
- We have also commissioned a series of evidence-based reports and have sought advice from the statutory agencies

Sustainable Development Commission

What next...?

- We are holding two stakeholder workshops – one 'northern', and the other 'southern'
- The southern workshop will be held in Cardiff next week
- The outputs from both workshops will be presented to the SDC in by our engagement consultants (The Environment Council and Opinion Leader Research) in a report
- The SDC is also attending both workshops to get a sense of stakeholders' views directly
- We will begin drafting in April, and hope publish our report later in the summer

Sustainable Development Commission

Further information

- SDC website http://www.sd-commission.org.uk/pages/tidal.html
- Yahoo email group http://uk.groups.yahoo.com/group/tidal_power_uk/
- SDC discussion forum http://www.sd-commission.org.uk/forum_public/

Sustainable Development Commission

Welcome

SDC tidal power project
Southern stakeholder workshop

Novotel Cardiff Centre, Cardiff
Thursday 29th March 2007

Oliver Knight, Senior Energy Policy Analyst
Karla Hill, Project Manager
Helen Philips, Senior Policy Analyst - Wales

Sustainable Development Commission

The Sustainable Development Commission (SDC)

The SDC's role:

- Established in the year 2000 – made up of 20 Commissioners headed by Sir Jonathon Porritt; supported by a team of specialist staff
- The UK's independent advisor on sustainable development
- A critical friend to Government
- A watchdog of Government performance
- A UK-wide remit, with a core London staff and dedicated teams in Scotland, Wales, and Northern Ireland

Sustainable Development Commission

SDC in Wales

The SDC in Wales:

- Reports to the First Minister
- Commissioner: Peter Davies, Vice Chair of SDC
- Expanding team, hosted at the Welsh Assembly
- Healthy Sustainable Wales, Celtic Conferences, partnership projects

Sustainable Development Commission

Tidal power project

- The 2006 Energy Review stated that the SDC would be asked to do a major project on tidal power on behalf of Government, leading to a report
- The project is funded by: Department of Trade & Industry, Welsh Assembly Government, Scottish Executive, South West RDA, and the Department of Enterprise, Trade & Investment (Northern Ireland)
- This workshop is part of a wider programme to engage with other stakeholders and members of the public
- Your input will help inform the SDC's work and our advice to Government
- We have also commissioned a series of evidence-based reports and have sought advice from the statutory agencies

Sustainable Development Commission

The Environment Council

Sustainable Development Commission

BLACK & VEATCH

AEA Energy & Environment
From the AEA group

Tidal power options in the Severn Estuary & Bristol Channel

Sustainable Development Commission stakeholder workshop

29 March 2007, Cardiff

James Craig – AEA Energy & Environment

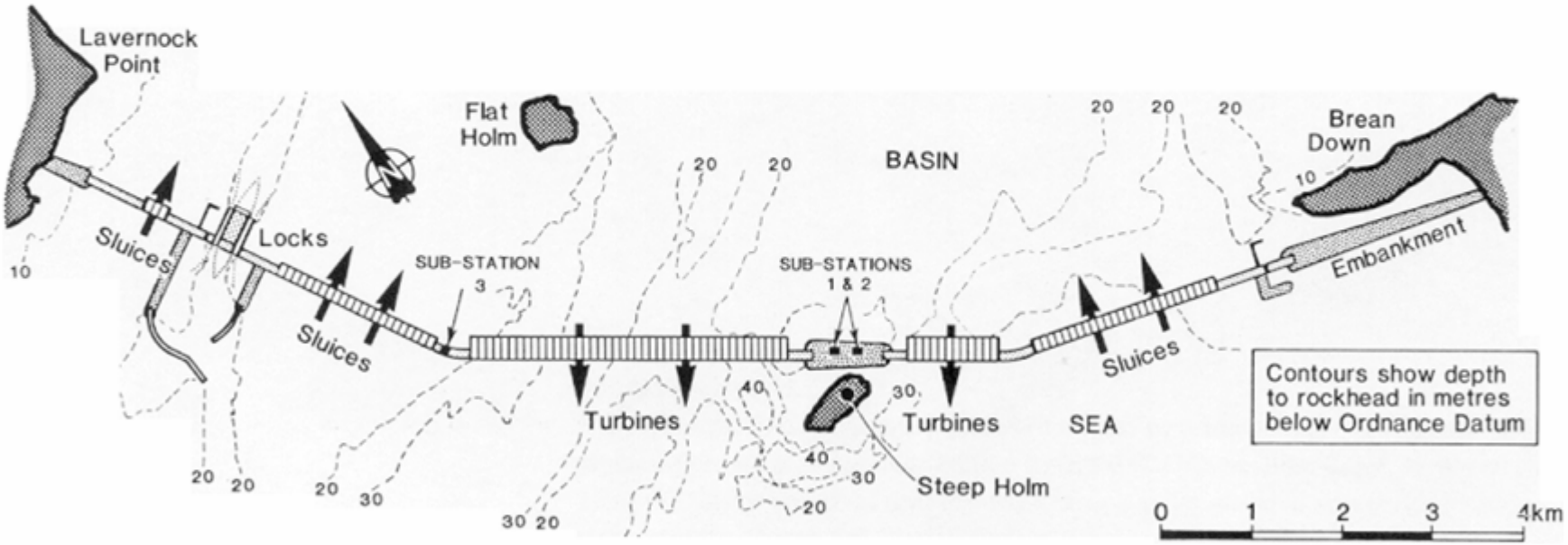
Clive Baker – Consultant, Black & Veatch

Severn estuary & Bristol Channel: options

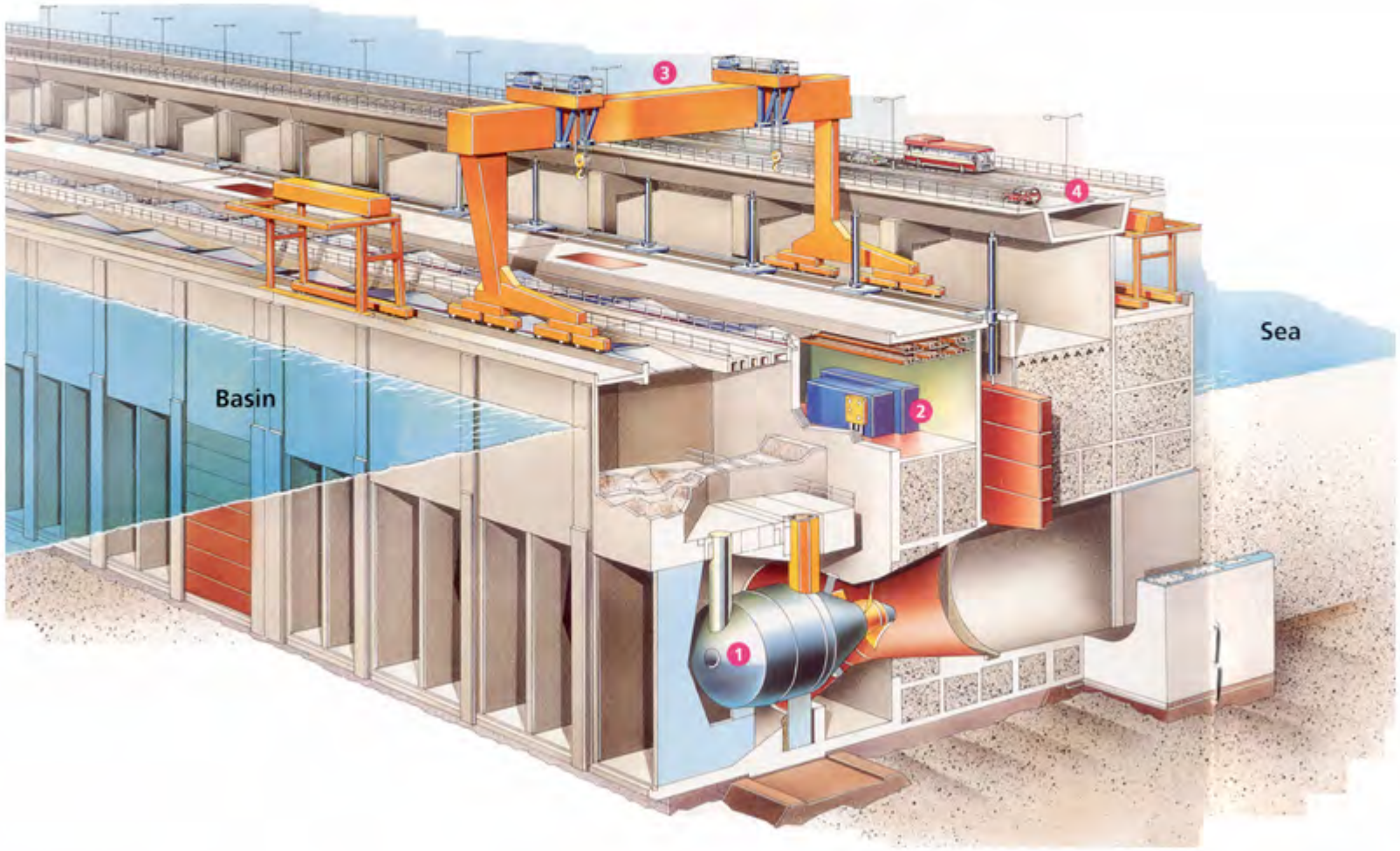
2

La Rance barrage

Severn Barrage options: Cardiff-Weston

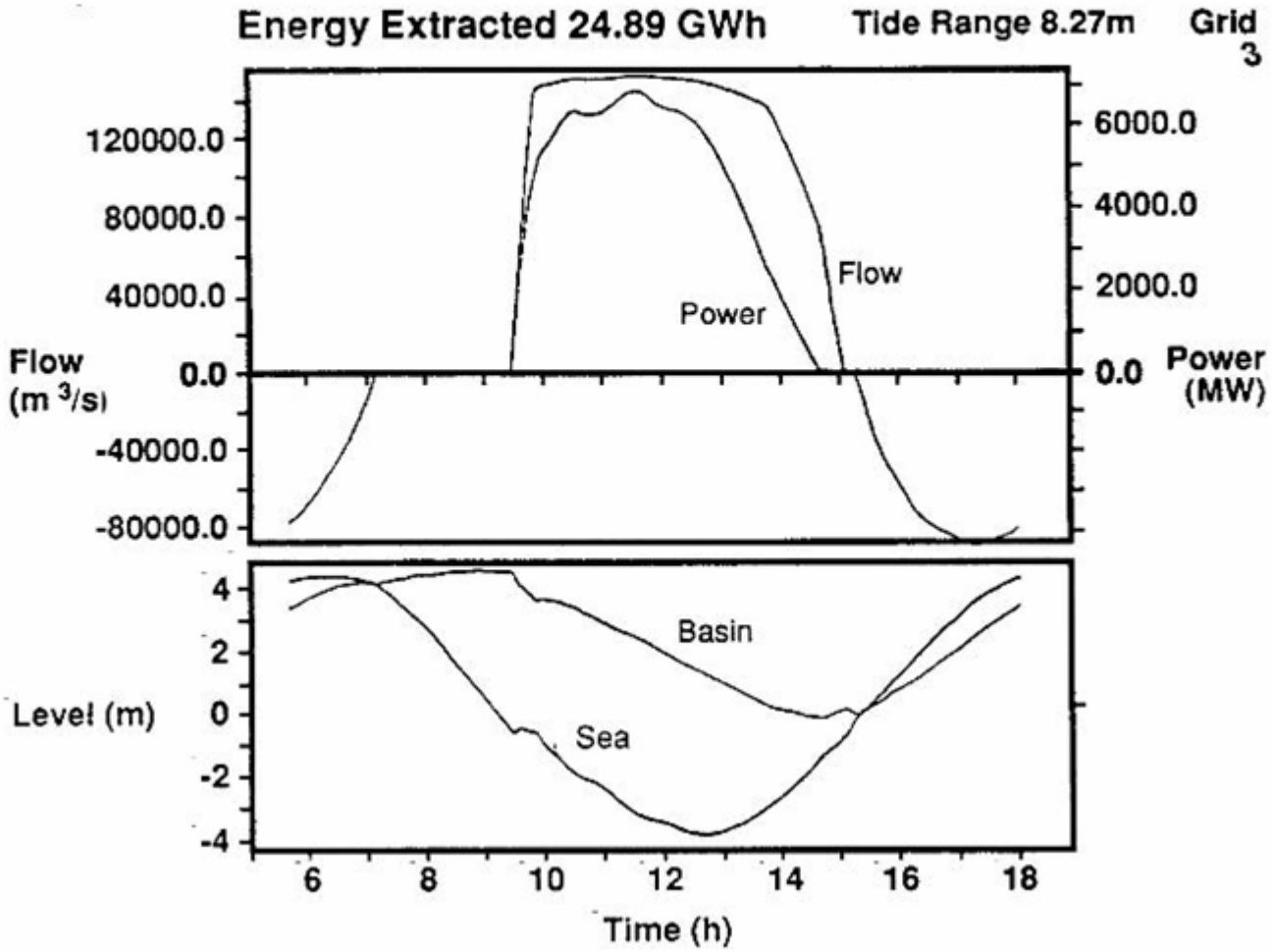


Cardiff-Weston: Turbine caisson

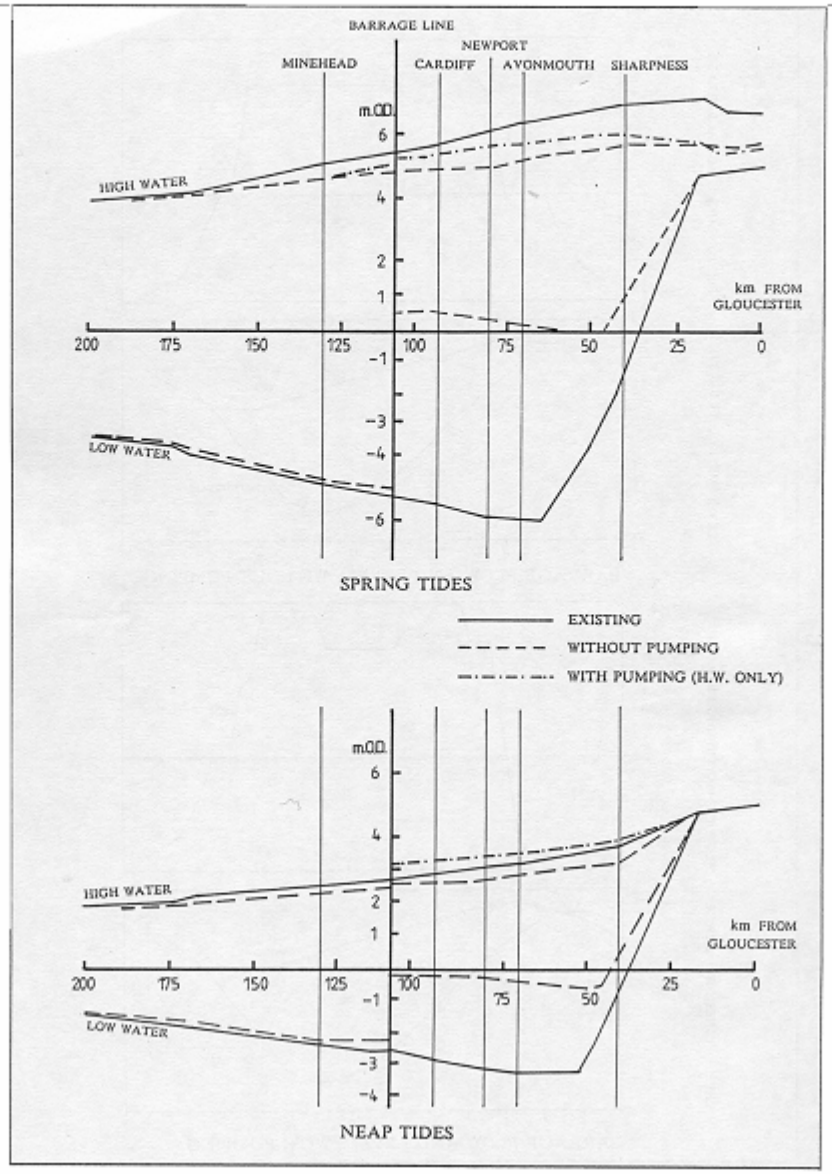


5

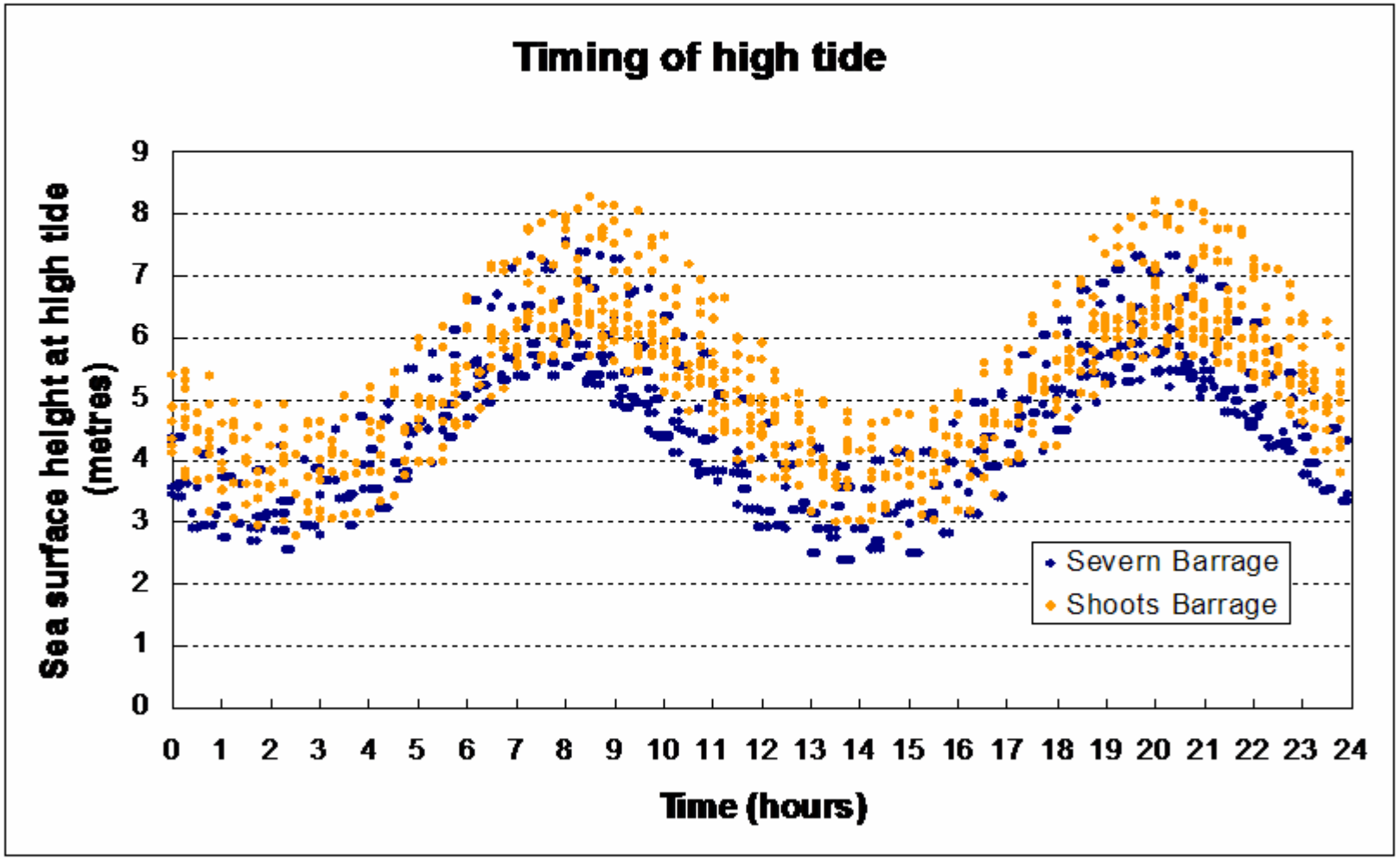
Severn Barrage options



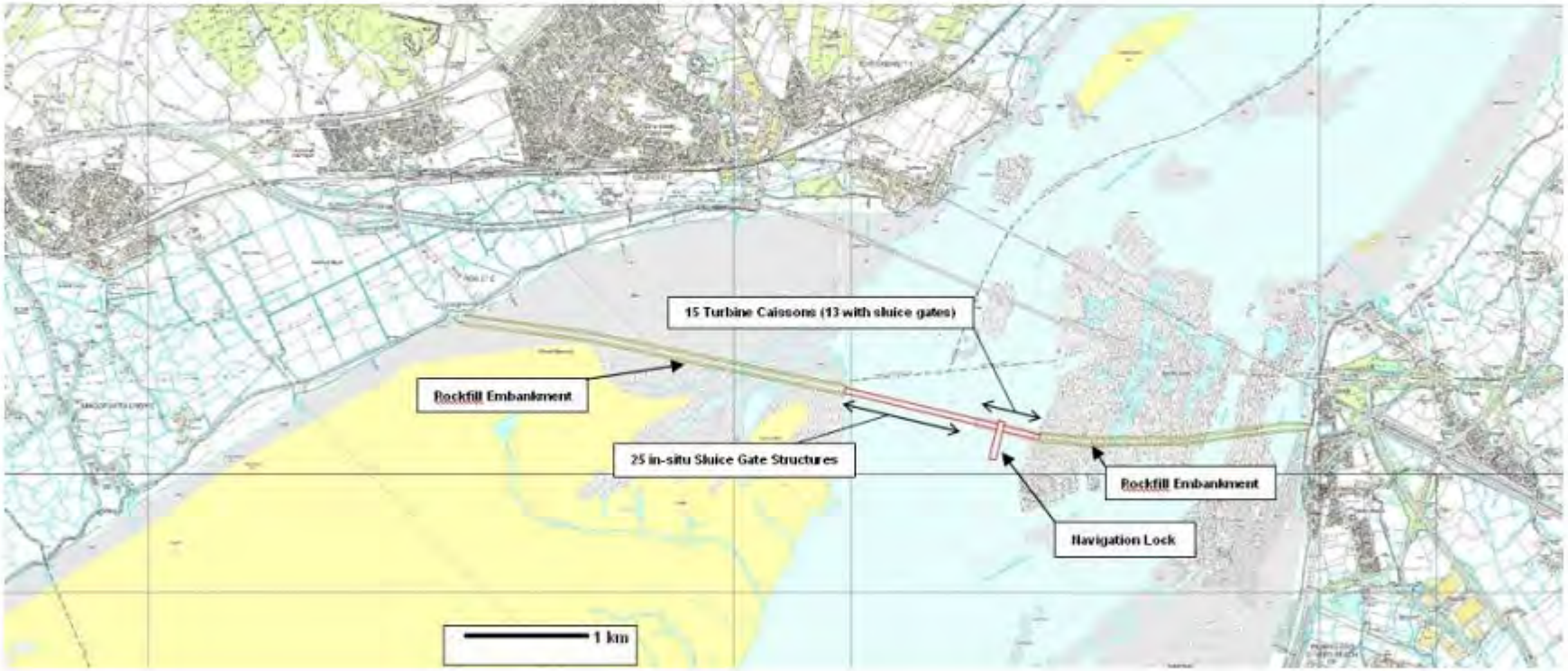
Cardiff-Weston: water levels



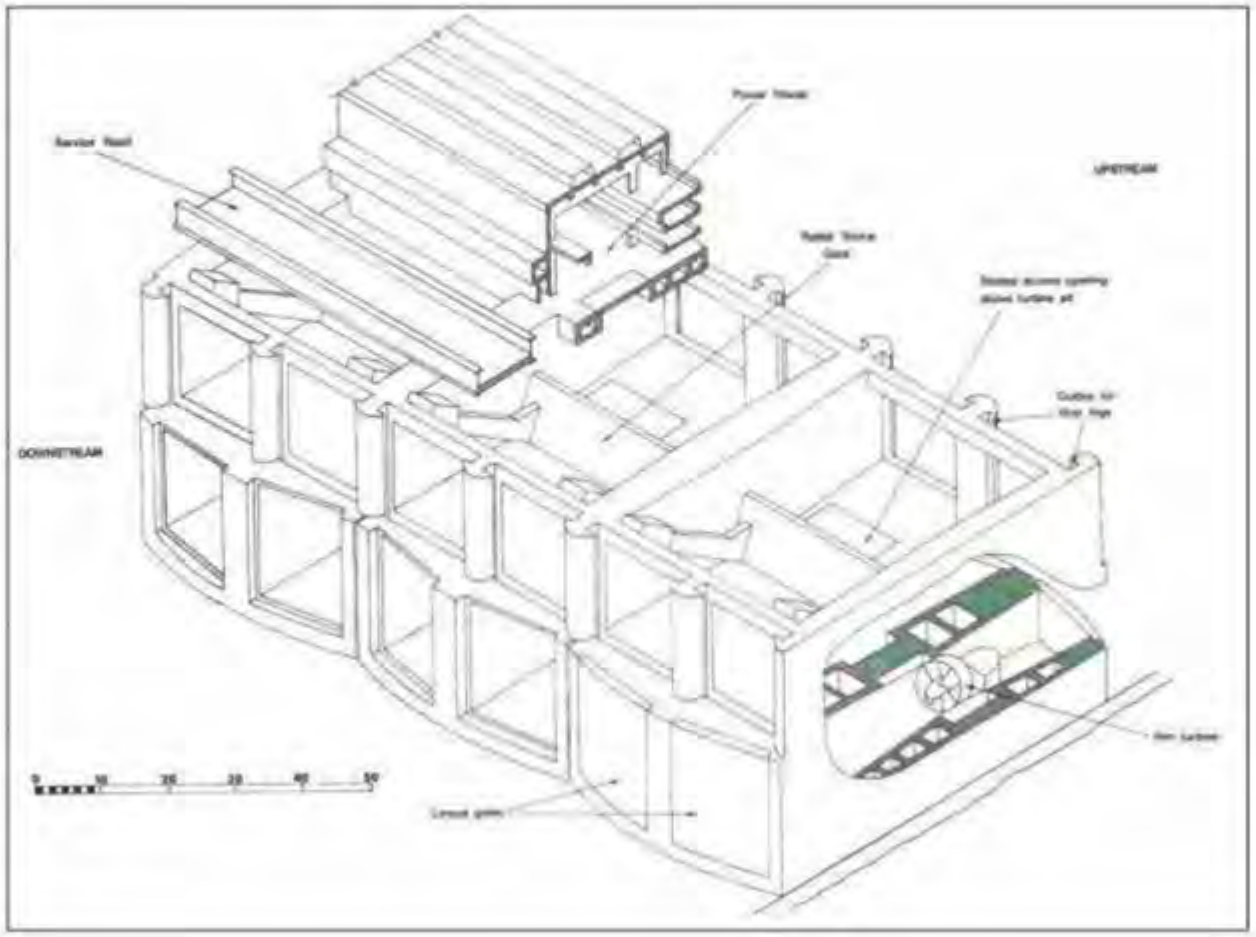
Severn Barrage options



The Shoots barrage: Location plan



The Shoots barrage: Turbine/sluice caisson



Severn Barrage options: Cost of energy (p/kWh)

Cardiff-Weston

Sensitivity Tests:	**3.50%**	**8%**	**10%**	**15%**
5 year programme	3.56	8.54	11.18	19.1
7 year programme	3.68	9.24	12.37	22.31

The Shoots

Sensitivity Tests:	**3.50%**	**8%**	**10%**	**15%**
Low case	2.96	6.08	7.69	12.36
Mid case	3.29	6.8	8.62	13.87
High Case	3.62	7.52	9.54	15.38

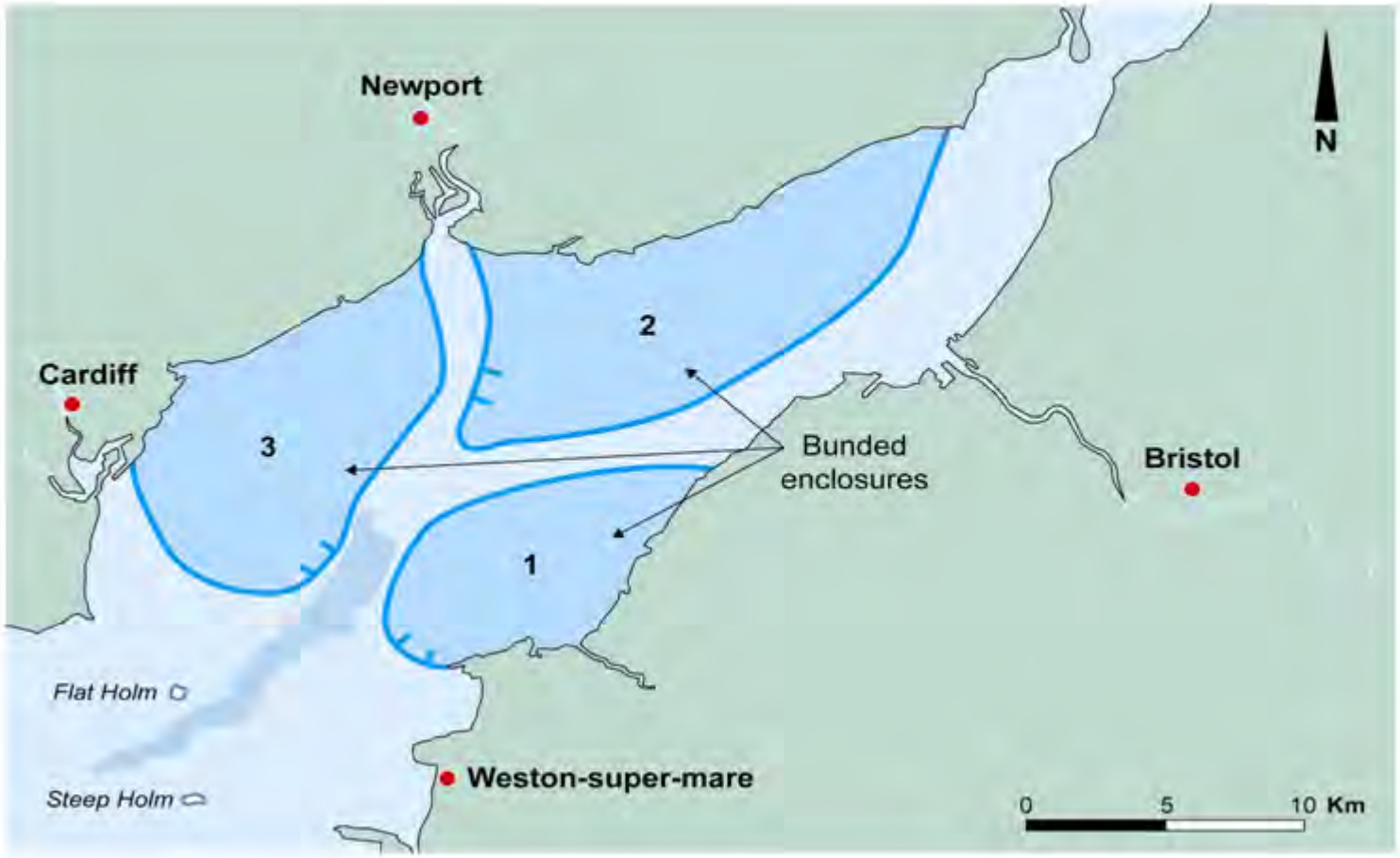
Severn Barrage options: Decommissioning

Unit rate required to accumulate cost of decommissioning (assumed equal to cost of construction) (p/kWh)

	40 year fund accumulation	80 year fund accumulation	120 year fund accumulation
The Shoots Barrage	3.18	2.78	2.74
Cardiff-Weston	5.14	4.5	4.42

These costs would be additional to the generation unit rates

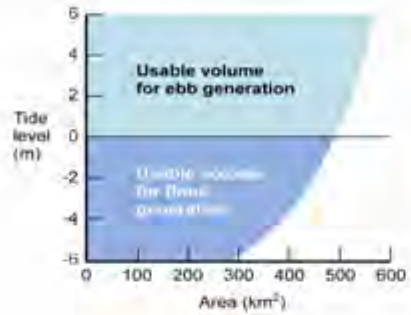
Severn non-barrage options: Russell scheme

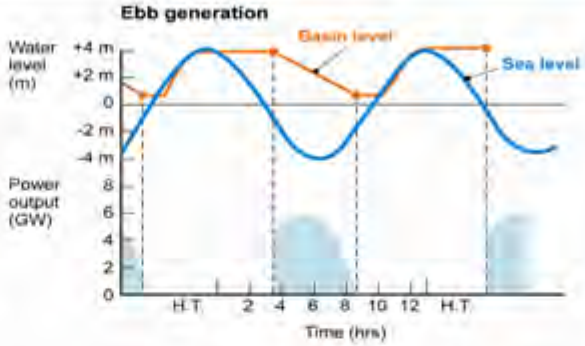


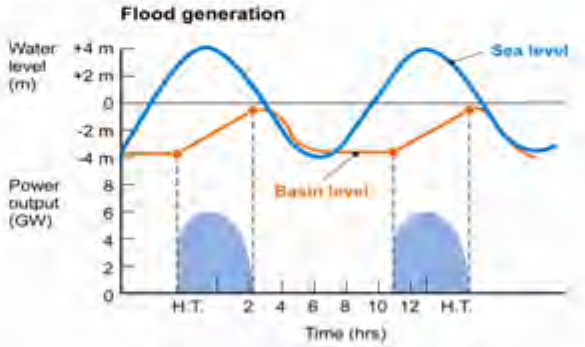
13

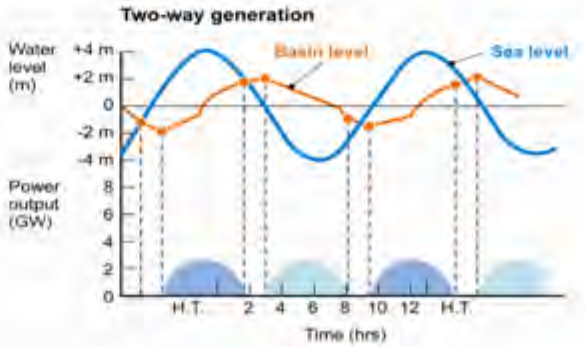
Severn non-barrage options: TEL scheme

Tidal power options: Modes of operation



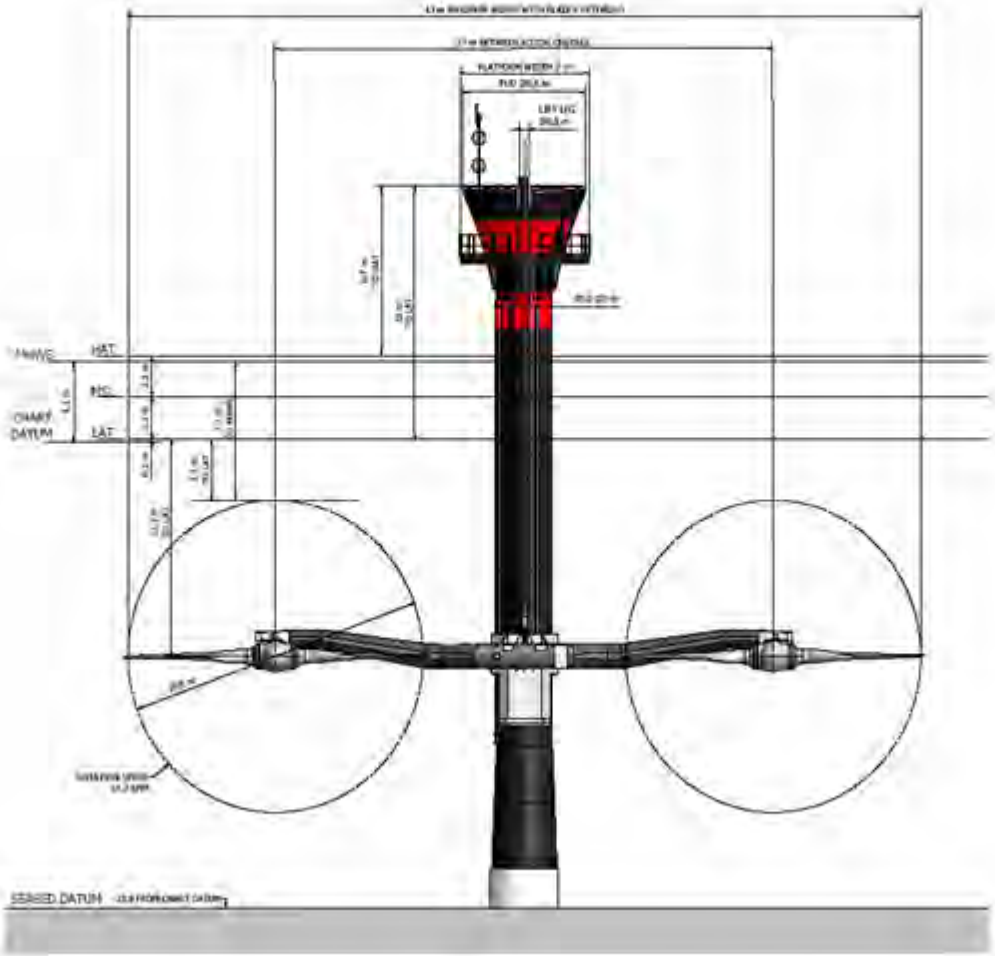




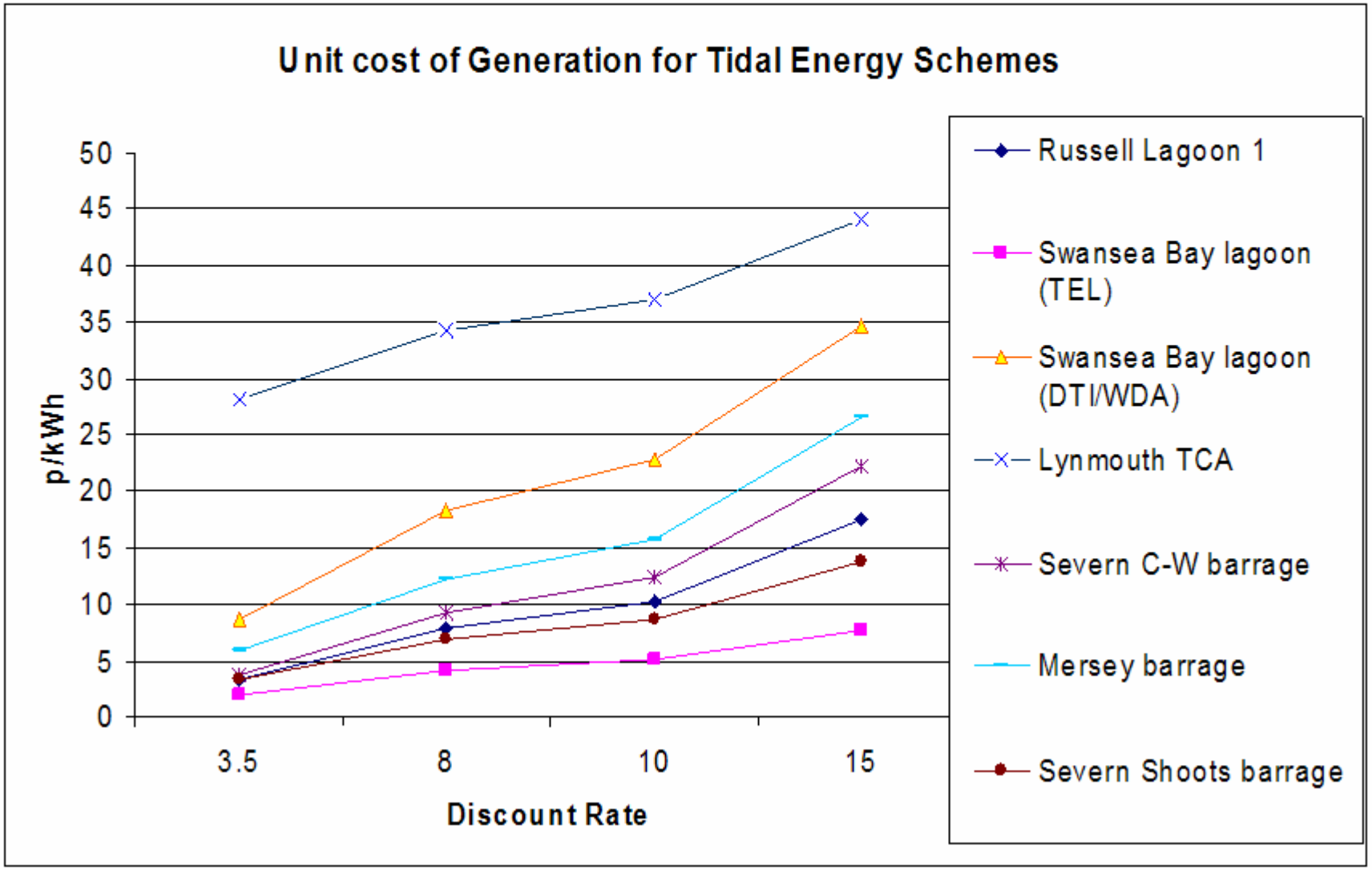


15

Tidal current: SeaGen



Unit costs of energy



Environmental aspects of Cardiff-Weston barrage

- Protective legislation: EU Birds & Habitats Directives, SPAs, SACs, SSSIs, RAMSAR. Estuary hosts 64,000 water birds (7% of UK total in estuaries). *Prevents project proceeding unless IROPI established.*
- Intertidal habitat: potential loss of 14,500/5800 ha (spring/neap) due to reduced tidal range in basin.
- Obstruction to passage of migratory fish of estuary, Usk and Wye, especially travelling to sea - risk of injury through turbines. *Fish passes may help.*
- Sediment movements: c. 85% of present mobile sediment will be deposited, allowing a viable photic zone and increase in biological productivity. *Needs further major study.*
- Water quality ('good' to 'fair', improving for major contaminants) will be reduced.
- Carbon saving: 7.3 Mt/yr as CO_2.

Environmental aspects of The Shoots barrage

- Protective legislation: EU Birds & Habitats Directives, SPAs, SACs, SSSIs, RAMSAR.
- Intertidal habitat: potential loss of 5530/3370 ha (spring/neap) due to reduced tidal range in basin.
- Passage of migratory fish especially travelling to sea - risk of injury through Straflo turbines. Fish passes may help. Usk and Wye not obstructed.
- Sediment movements: Concern that basin volume could be rapidly reduced by transport of sand from seaward deposits - half life of 10-100 years. High-level sluices may help. Needs further major study.
- Water quality ('fair') will be reduced but needs study.
- Carbon saving: 1.2 Mt/yr as CO_2.

Environmental aspects: lagoons & tidal current

Lagoons:

- Siltation within basin likely - needs detailed evaluation
- Effects on sediment outside basin - risk of major redistribution if lagoon obstructs estuary flows
- Water quality: needs detailed evaluation
- Potential loss of inter-tidal habitat within lagoon and changes to habitat outside basin. Could affect migratory birds.
- Potential effects on migratory fish due to changes in flow patterns

Tidal current devices

- To be studied and evaluated (e.g. noise, fishing, sea mammals)

Economic and social aspects

	Cardiff-Weston	The Shoots	Lagoon
Employment during construction	45,000+ persons/yr direct + 22,000+ indirect	12,300+ persons/yr direct + 6000+ indirect	Up to 2,000 direct + 1,000 indirect for large scheme
Employment during operation	1770 persons/yr direct + 30,000+ indirect	350 persons/yr direct + 3000+ indirect	Not assessed
Navigation and ports (17.2Mt freight in 2004)	Cardiff, Newport, Bristol, Lydney, Chepstow affected. Sharpness badly affected	Sharpness, Lydney, Chepstow affected	Adjacent to shipping channel(s). Would need evaluation
Protection from flooding, rising sea levels + surge tides	Control of basin water levels and reduction in tidal range outside give significant benefit	Protection of low-lying areas upstream of barrage	None if offshore. Russell scheme benefits low-lying areas but potential increased flood risk to subestuaries.
Recreation + tourism	Increase of perhaps 5-20%. Employment 11,500 persons/yr	Employment 2500 persons/yr	Some potential depending on access
Transport links	Road or rail crossing (not included in cost)	High-speed rail link to augment Severn Tunnel (not included in cost)	None

Comparison of Technology Options

Scheme	Number of turbines/ devices	Capacity (MW)	Average annual output (GWh/year)	Average Annual CO2 saved (M tonnes)
Cardiff-Weston Barrage	216	8,640	17,000	7.3
Shoots Barrage	30	1,050	2,750	1.2
Russell Lagoons	63	2,835	6,480	2.8
Swansea Bay* Lagoon (Rev)	24	60	124*	0.05
Swansea Bay Lagoon (TEL)	24	60	187+	0.08
Lynmouth Tidal Current Array	45#	30	83.16	0.036

Compatibility of Technology Options

- Cardiff – Weston Barrage
  - Russell Lagoons X
  - Swansea Bay Lagoon ✓
  - Lynmouth Tidal Current Array ✓
- Shoots Barrage
  - Russell Lagoons ?
  - Swansea Bay Lagoon ✓
  - Lynmouth Tidal Current Array ✓
- No Barrage – open estuary
  - Russell Lagoons ✓
  - Swansea Bay Lagoon ✓
  - Lynmouth Tidal Current Array ✓
- Tidal Current – open estuary
  - Limited to Bristol Channel

Severn Estuary & Bristol Channel options

Sustainable
Development Commission

BLACK & VEATCH

AEA Energy & Environment
From the AEA group

Sustainable Development Commission

Tidal energy

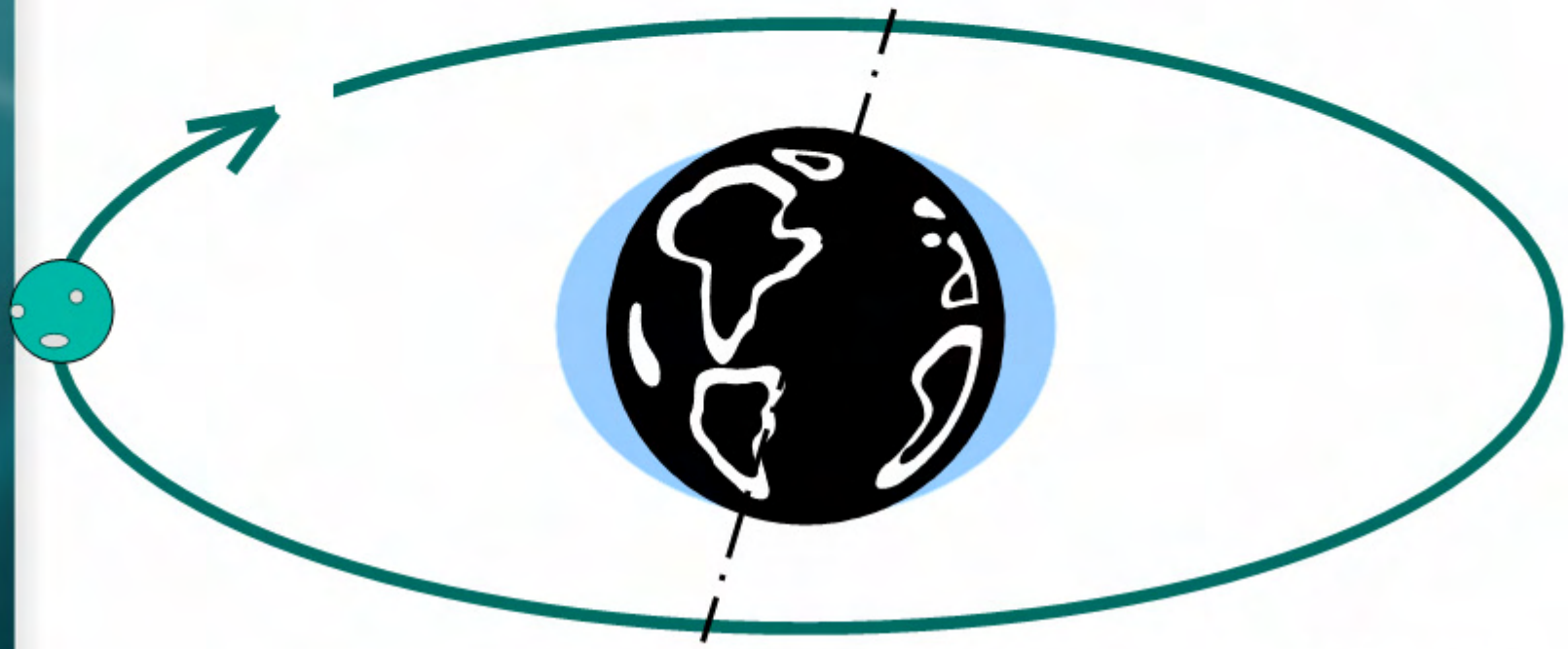
Sarah Graham/Anne Savage
Entec UK Ltd.

Entec

Creating the environment for business

Tidal energy

Tidal energy is derived from the movement of waters in the oceans caused by the interacting gravitation fields of the sun, moon and earth.



Entec

Creating the environment for business

Tidal range and tidal stream technologies

Tidal range is the difference in height between high and low tide.

Tidal barrages and **tidal lagoons** use this resource to generate electricity.

Tidal stream is the accelerated flow of water through channels or around coastlines as a result of tidal water movement.

Tidal stream devices use this resource to generate electricity.

Entec

Creating the environment for business

Tidal barrages

Barrages hold back water at high tide.

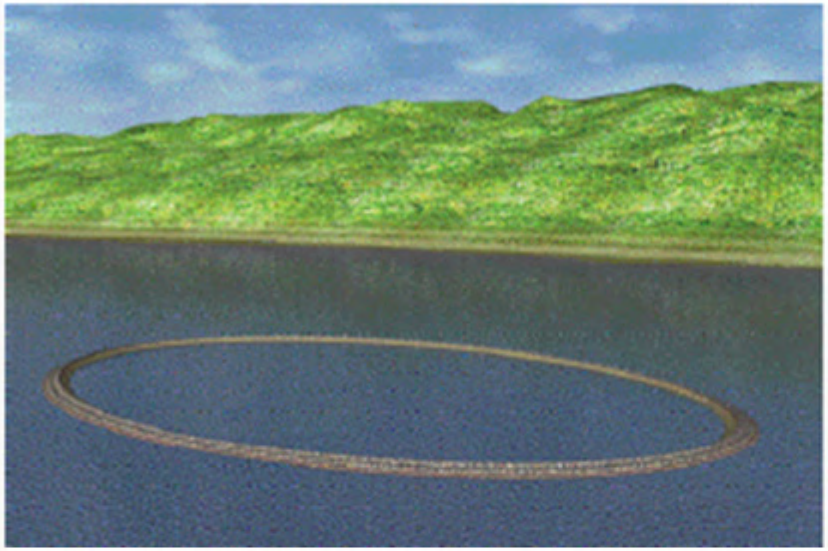
Electricity is generated by releasing this water through turbines.

A commercial tidal barrage is in operation at at La Rance in France.

Entec

Creating the environment for business

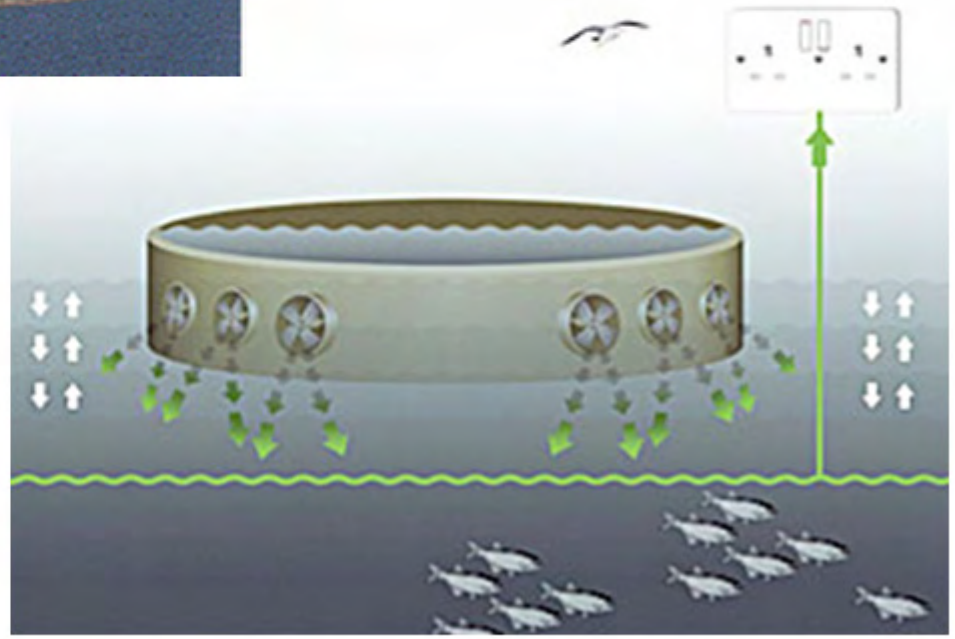
Tidal lagoons



Lagoons work in the same way as barrages.

They are placed in shallow water, but they do not span estuaries.

There are no functioning tidal lagoons in the world.

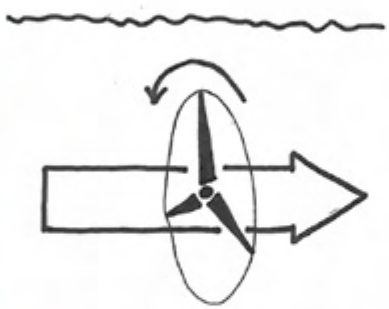


Entec

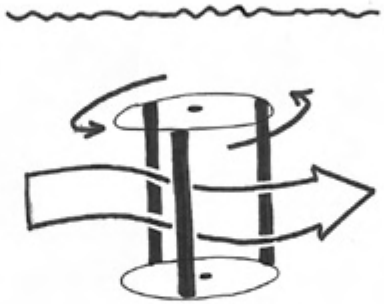
Creating the environment for business

Tidal stream technologies

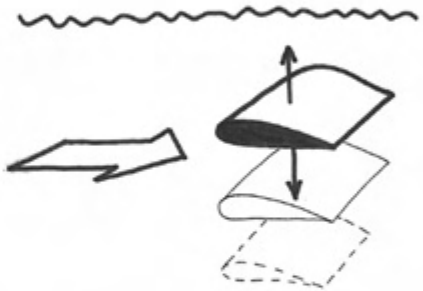
Tidal stream devices generate electricity as the tidal stream causes movement of an actuator.



Axial flow



Cross flow



Reciprocating hydrofoil

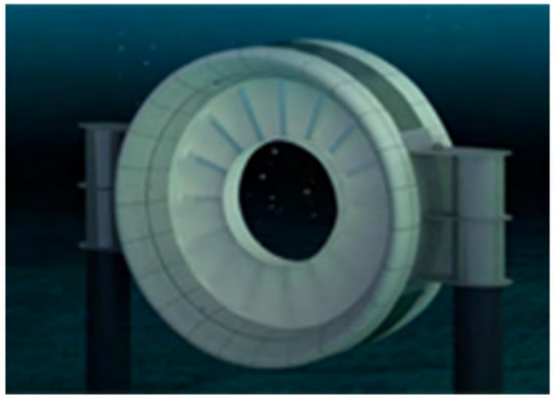
Tidal stream devices are all at prototype stage.

Entec

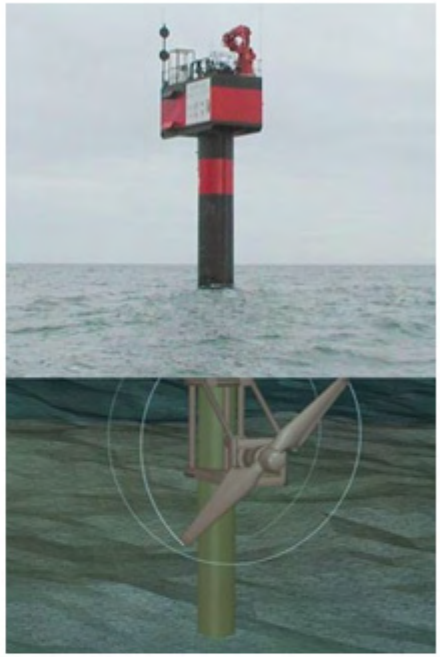
Creating the environment for business

Tidal stream technologies

Fixed



Gravity base



Monopile

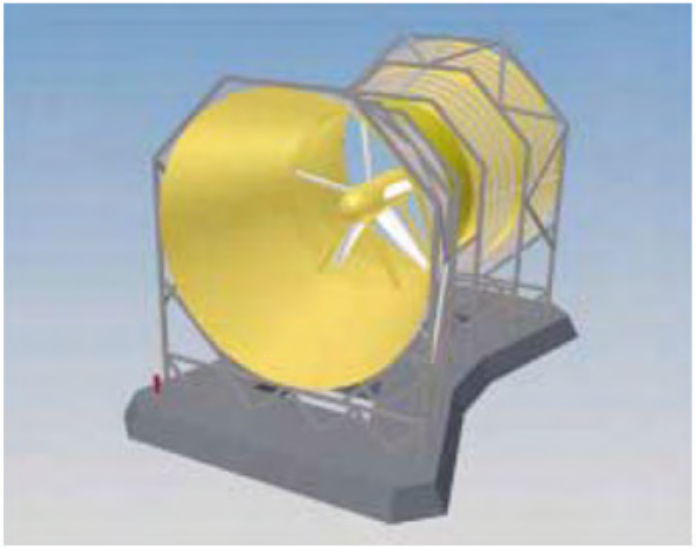
Floating

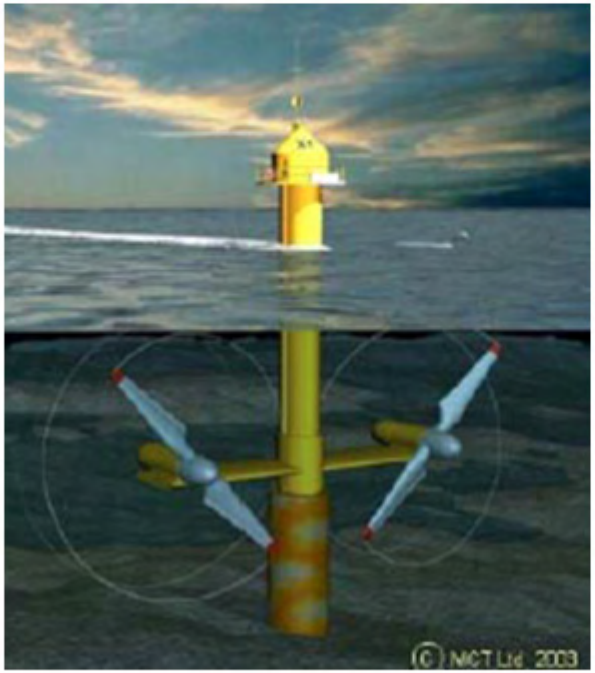
Entec

Creating the environment for business

Tidal stream technologies

Ducted



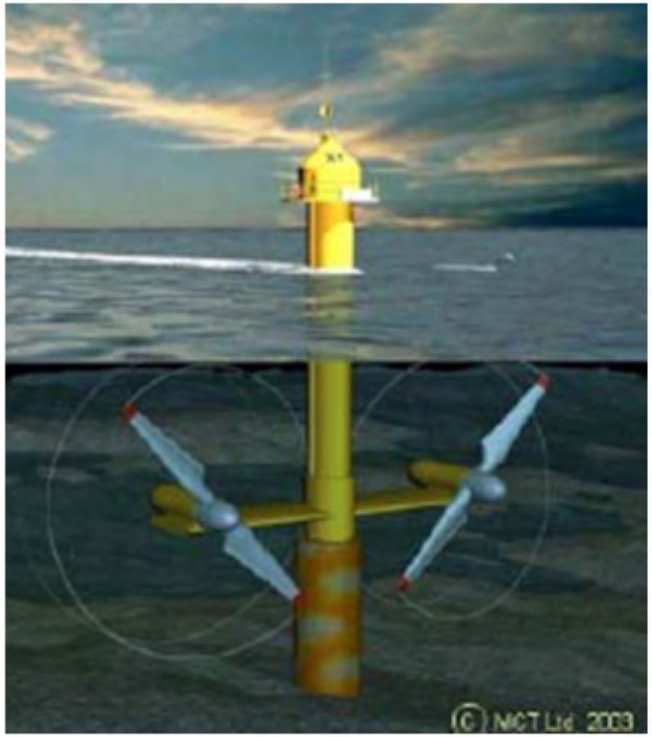


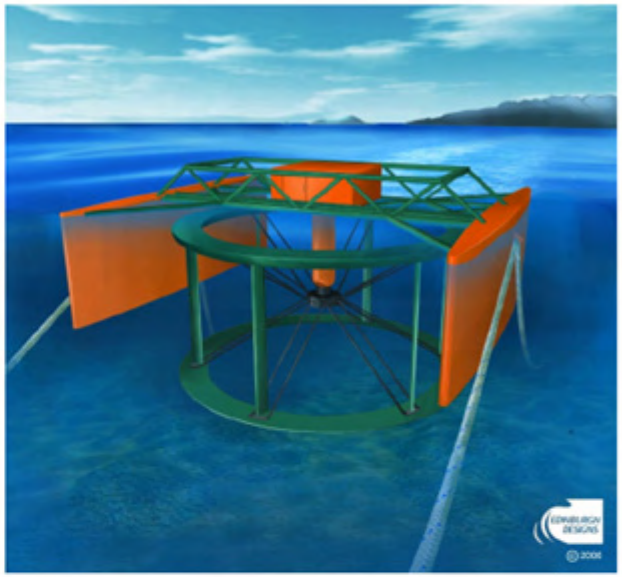
Free stream

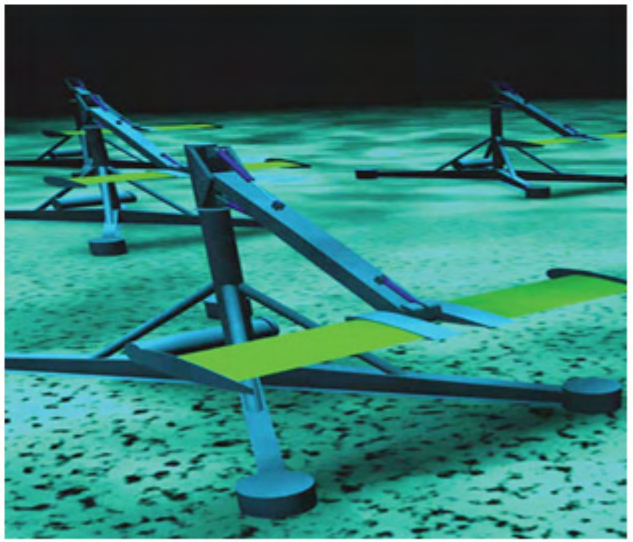
Entec

Creating the environment for business

Tidal stream technologies







Entec

Creating the environment for business

Tidal resource

World tidal range resource	UK tidal range resource
386 – 560 TWh/y	19 TWh/y (4.7% of UK energy demand)

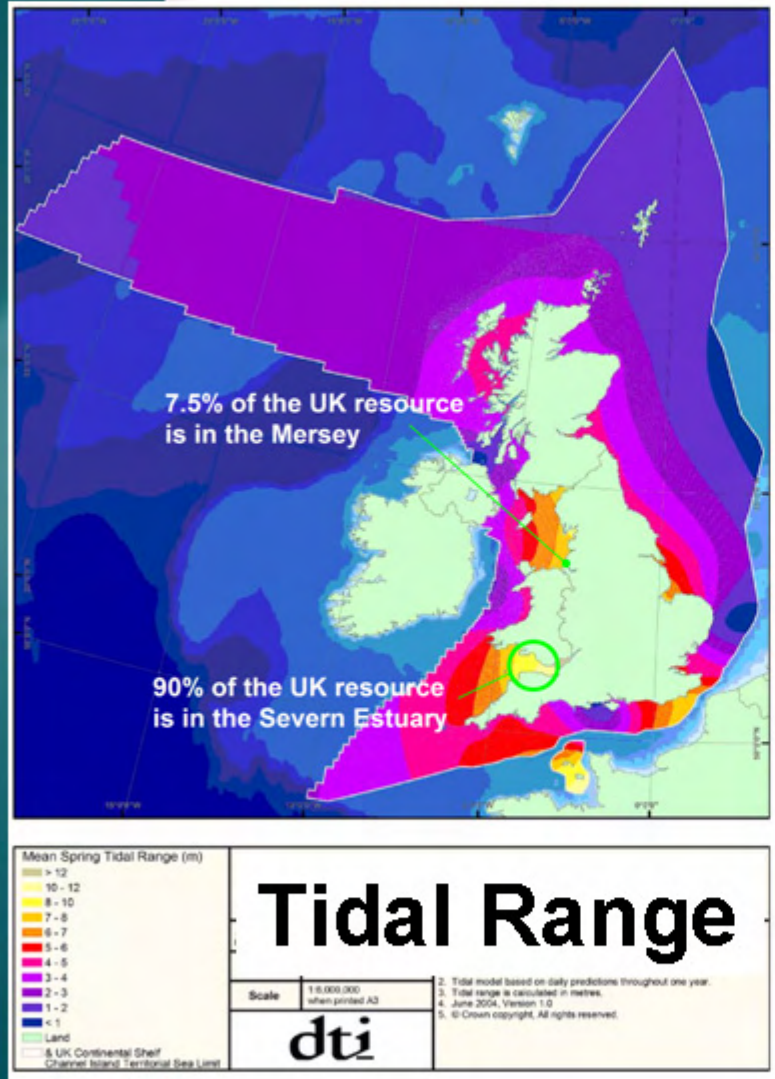
World tidal stream resource	UK tidal stream resource
approx 153 TWh/y*	18 TWh/y* (4.5% of UK energy demand)

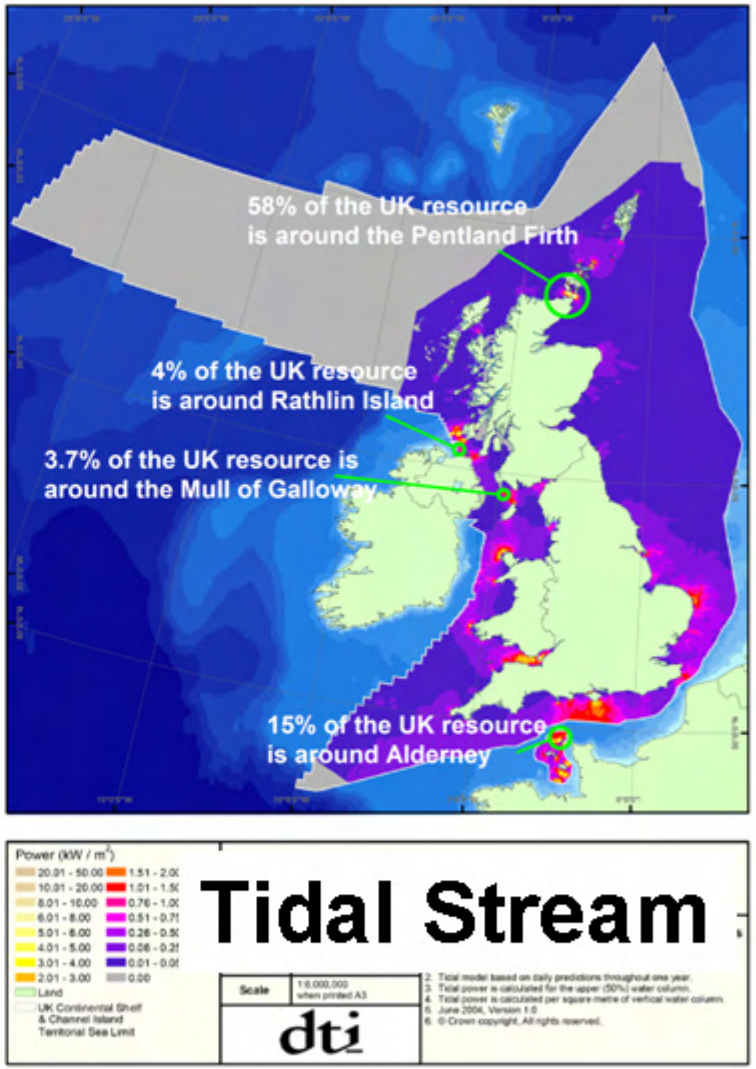
* This is an estimate of the extractable resource

Entec

Creating the environment for business

Tidal resource maps





Entec

Creating the environment for business

Location of tidal resource

Tidal range sites (TWh/y)		Tidal stream sites (TWh/y)	
Severn	(17)	Pentland Skerries	(3.9)
Mersey	(1.4)	Stroma	(2.8)
Duddon	(0.21)	Duncansby Head	(2.0)
Wyre	(0.13)	Casquets	(1.7)
Conwy	(0.06)	South Ronaldsay	(1.5)
		Hoy	(1.4)
		Race of Alderney	(1.4)
		South Ronaldsay, Pentland Skerries	(1.1)
		Rathlin Island	(0.9)
		Mull of Galloway	(0.8)

Entec

Creating the environment for business

Potential power

Severn Barrage	17 TWh/y
Swansea Lagoon	0.124 TWh/y (124 GWh per year)
One tidal stream device	0.002 – 0.004 TWh/y (1.75 – 3.90 GWh per year)
Farm of tidal stream devices (30 MW installed capacity)	0.052 - 0.117 TWh/y (52.5 – 117 GWh per year)

UK power demand 407.3 TWh per year*

* 2005 data, DTI

Entec

Creating the environment for business

Capital cost

	Technology	Capital Cost (£M)	£M/MW installed capacity
Tidal range	Barrage	12,500 – 17,400	1.4 - 2
	Lagoon	81.5 - 234	1.4 - 3.9
Tidal stream	First production model	1.4 - 3	1.4 - 3
	First 5 MW farm	8.2 - 15	1.6 - 3
	Commercial 30 MW farm	36.3	1.2

Entec

Creating the environment for business

Cost of energy

Tidal stream

- Technology is 'higher risk' for finance
- Cost of energy is high, but will fall
  - Learning
  - Economies of scale
- Cost of energy is linked to resource quality and availability

Tidal range

- Technology is 'lower risk' for finance
- Barrages – cost of energy is less likely to fall
- Lagoons – opportunities for learning

Entec

Creating the environment for business

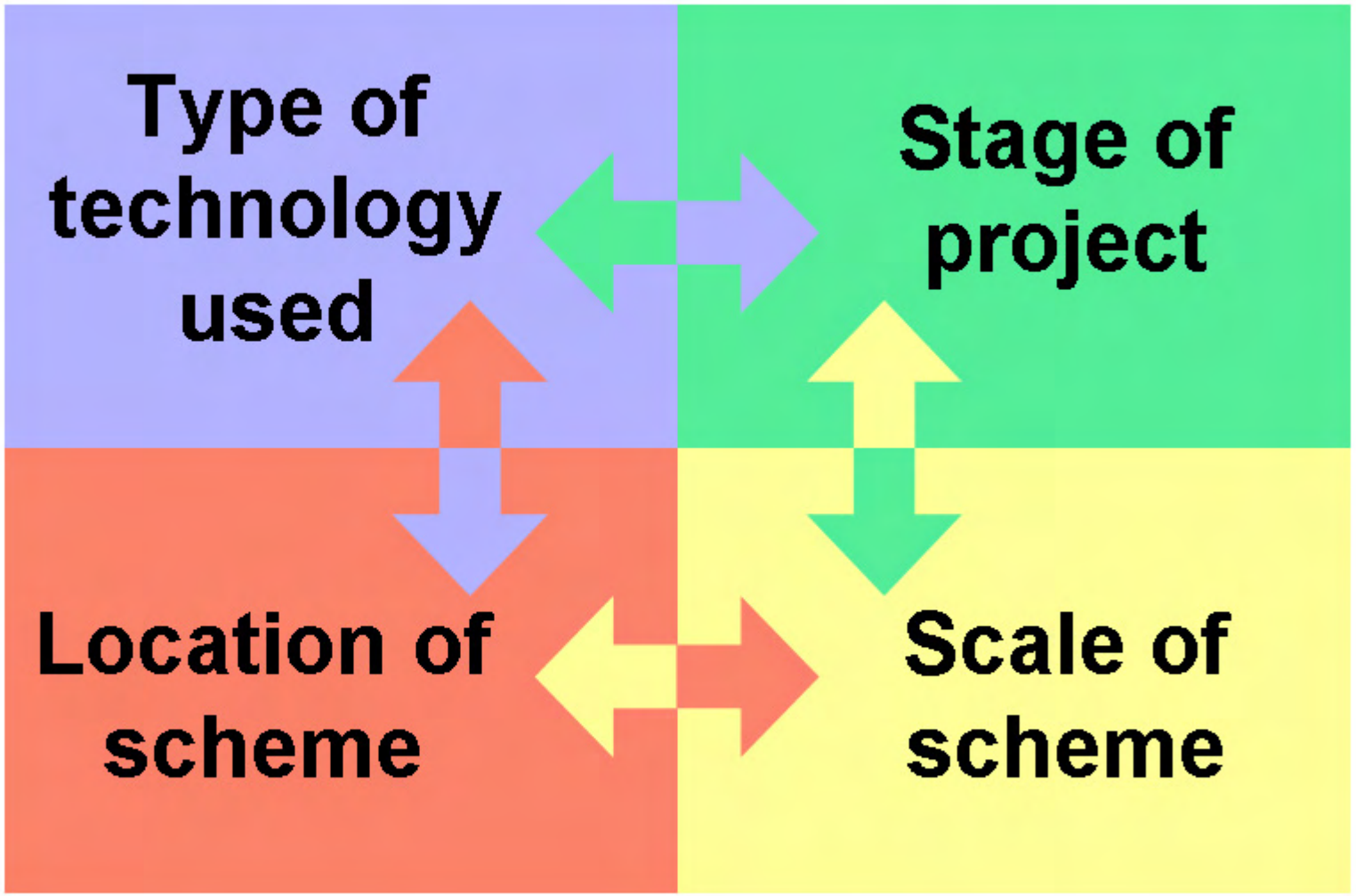
Financing

- **Currently funded through government grants**
  - capital grants from DTI and Scottish Executive
  - revenue support, i.e. ROCs, MSO
- **Commercial schemes will be funded with private equity**
  - need to reduce risks to secure financing
  - investors want guaranteed return on investment

Entec

Creating the environment for business

Factors to consider



Creating the environment for business

Potential environmental issues

CO_2

Lifecycle emissions

Savings

Ecology

Seabed

Water column

Intertidal

Sediments & currents

Erosion, scour

Deposition

Water quality

Clarity

Toxic substances

Algal blooms

Noise

Air-borne

Underwater

Legislation

Protected sites

Protected species

Entec

Creating the environment for business

Potential economic issues

Job creation
Construction
Infrastructure development

Infrastructure
Ports, harbours
Housing, amenities

Grid connection
Location
Upgrades

Fishing industry
Safety zones
Fish stocks

Commercial shipping
Navigational safety
Safety zones

Flooding
Flood risk
Flood defence

Entec

Creating the environment for business

Potential social issues

Recreation

Safety zones, navigation

New areas

Tourism

Visiting tidal scheme

New jobs

Transport

Improved infrastructure

New transport links

Seascape

Visual effect

Amenity value of coast

Community development

Housing, shops, industry

Job creation

Entec

Creating the environment for business

Sustainable Development Commission

Sarah Graham
sarah.graham@entecuk.co.uk

Anne Savage
anne.savage@entecuk.co.uk

Entec

Creating the environment for business

Sustainable Development Commission Tidal Power Stakeholder Workshop

27th March 2007 - Aberdeen

Transcript

Date of issue: 23rd April 2007

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 – Aberdeen, 27/03/2007

Please sign in

Name	Organisation
Kenny MacInnes	Sustainable Scotland Network
Andrew Prior	JNCC
Bill Edgar	EMEC
Jon Wilson	Defence Estates
Archie Johnstone	Northern Lighthouse Board
James Simpson	Scottish Executive
Morag McCorkinaale	Aberdeen Renewable Energy Group
Catriona Prebble	Scottish Renewables
Simon Robertson	NPUWER Renewables
Melanie Hay	Scottish Enterprise
Bill Band	Scottish Natural Heritage
Min Zhu	OFGEM
Maeve O'Keeffe	The Environment Council
Elizabeth Marshall	The Highland Council
Tom Woolley	The Environment Council
June Graham	Scottish Environment Protection Agency
John Thouless	SSE Generation Ltd
Peter Fraser	Royal Institute of Navigation
Peter G Dow	Salmon & Trout Association
Chris Grieve	The Environment Council
Roger Morris	Natural England
Steve Hill	The Environment Council
Paul Neilson	SSE

Outline agenda

- Welcome & introduction
- Presentation from SDC
- Overview for the day
- Presentation on tidal technologies
- SD aspects of technologies
- Government roles
- Acceptability
- Overview of day & evaluation
- Closing remarks from SDC

©The Environment Council

Working agreements

- One person speaking at a time
- Respect the views of others
- Mobiles etc. switched off
- Chatham House rules i.e. non-attribution

Welcome and introduction – 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	
Environmental impacts/benefits and potential constraints	Knowledge & aims of technology and possible future impact
- Broad perspective on marine & renewable energy industry - Promotion of renewable energy	View of other stakeholders' issues and concerns
Neutral viewpoint – hope to make all those aware of potential impact on marine environment users both commercial & pleasure	Improved understanding of socio-economic aspects
Common sense & not to specific in detail	Learn more of individual projects & technologies
Assess impact on migratory fish species	Potential of tidal power development in short, medium & long term
Local impact people & anglers	Impact on need for network capacity & operation
An understanding of the technical aspects of tidal energy technologies	More info to assess & discuss
Network regulation & efficient transmission capacity	The views of other stakeholders regarding the potential impacts of tidal technology
Reducing barriers for renewable energy to access network & markets	Report on process of SDC studies
Coastal management specialist – geomorphology & top down interpretation of impacts	Hope that Developers are aware of potential impact on marine users – both commercial & pleasure
Energy policy priorities	Better knowledge of stakeholders' views
Background to the project	An understanding of the differing priorities of the public vs. stakeholders
Green	
Preliminary understanding of environmental impacts	Appreciation of stakeholder views on tidal

©The Environment Council

Gives	Gets
Policy context for renewables	An appreciation for the key concerns of other stakeholders & how it affects what I do
Experience of developing other forms of renewable energy in Scotland	Awareness of the ambitions/needs of tidal energy developments
Pentland Firth concerns	Policy drivers- for marine wave & tidal energy development
Knowledge of tidal sites	Greater understanding of the environment within which tidal power must evolve
Knowledge of NE Scotland industry view & aspirations for tidal power	Understanding of likely environmental monitoring
Renewable energy development experience!	Other stakeholder views
Knowledge of modern marine interests	Agreement to expedite structures development at Pentland Firth
Interest of local communities to attract development/investment at Pentland Firth	Knowledge: How do we best exploit tidal power & overcome constraints?
Ideas for structuring parallel development activities	
Understanding that there is a tidal resource in the Highlands/Scotland – how do we exploit it?	
Red	
Process & engagement understanding	Different stakeholder views vs public concerns
Cables & connections	Stakeholder expectations
Government position	Likelihood & timing of large scale development
Overview information	Wider view of issues
Knowledge of annual migration & human navigation needs. Curiosity regarding technology	Understanding of how information will be presented by SDC
Marine navigation requirements; methodology groups; consultation process	Information to feed back to RIN. Understanding of structures involved and their influence on navigation for animals and humans
Understanding of consenting and potential environmental impacts	Central views of a wide range of stakeholders
Knowledge of companies/general issues	Understanding of how information will be presented by SDC
Broad knowledge of technology & economics of tidal stream devices	Better understanding of wider issues

Points of clarification following presentation by Entec

- Benefits for fish stocks
  - Via habitat creation
  - Restrictions on fishing allows stocks to recuperate

©The Environment Council

  - Have found that shell fisheries build up around stable structures
- Transport downsides have been included in navigation
- Tidal stream technologies can also take a solid form, similar to a barrage

Points of clarification following presentation by Entec continued

- Funding – some may come from Europe in the future. EU concentrates on research funding, not policy creation
- Area for tidal stream units (e.g. 30 units = 5 km2) depends on type of device. Further research is required.
- Consideration given to animals in tidal streams (e.g. impacts on migration extrapolating from other experience needs further research)

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	
Benefits	**Disbenefits**
* Carbon savings (assuming not cancelled out by growth in electricity demand) – potential benefits for people & wildlife	* Significant visual impact
Carbon saving	* Visual
	Visitor impacts on environmental factors including secondary
Transport diversion	
	Inter-tidal erosion and morphological change – long term decline
Design sensitive (e.g. fence not solid vs solid)	Scouring estuary systems; macro change to ecosystems
* Resource availability close to centres of population	* Large area impacts on protected species and sites (birds, Natura 2000)
Concentrated energy production	* Major effect on habitats
	* Presumed dis-benefit to large inter-tidal ecosystem
Combining heat pumps with possible power generating 'marine' CHP	Smothering exposed hard surface communities
Multiple technology benefits	Macro-ecosystem change
Potential technology benefits-caissons	Disrupts tidal transport mechanisms – fish, birds
	Disruption of migratory fish & multiple mortalities

©The Environment Council

TIDAL BARRAGES - ENVIRONMENTAL	
Benefits	**Disbenefits**
Large number of MWs relative to footprint	* Marine migration routes; Flushing action in estuary removed
* Benefit breeding grounds and marine parks	* We don't know what dis-benefits might be – research needed
	Additional journey time – marine
	Displaced infrastructure – impact elsewhere on natural environment
	Resources aggregate demand
	Could become a toxic collection point – "Nitrogen" bird farms
	Water quality – eutrophication
	* Carbon footprint during construction
	CO2 payback – carbon footprint long-term

TIDAL BARRAGES - SOCIAL	
Benefits	**Disbenefits**
* Improved infrastructure potential	Disruption to community – construction
Improved transport links	Long-term disruption/displacement
* Job creation during construction	Health toxic blooms
Flood management from sea - Agricultural/community benefit - Urban (property)	Impact on SAR (Search & Rescue Operations) – submerged structure at certain states of tide
Flood management facility	Negative tourism impacts – reduce opportunities for leisure
Civic amenity - People	Attracting investment & jobs - short-term, not sustainable
Could act as observation point, congregation point, tourism focus	
Tourism opportunities	Impact on local ports large & small – job losses
Watersport centres	
	Structural failure (unlikely)
Reduce fuel poverty - local	Long term decline in flood protection – potential collapse of structures
Improved health from reduction in fuel poverty	
Direct Community Benefit Fund	

©The Environment Council

TIDAL BARRAGES - SOCIAL	
Benefits	**Disbenefits**
Reducing climate change - Pride - Community buy-in	

TIDAL BARRAGES - ECONOMIC	
Benefits	**Disbenefits**
More manageable maintenance (downtime)	* Longer term economic development benefits not as significant as other technologies
	* Significant capital costs/unlikely economies of scale
* The main resource at broadly the right end of the British Isles with respect to electrical demand therefore potentially less costly transmissions reinforcements than for more distant renewables	Initial cost high and no guarantee of reduction
On-site transmission – connectivity	
Reliable source of energy – power easily accessed	Publicity disbenefits
Proven technology	Need to relocate ports – new infrastructure and increased transport costs
Long term full life costing	Secondary impacts – transport etc
Publicity benefits	All or nothing
Economic activity	Decommissioning liability
Big business opportunity	
	Environmental impact assessment and other regulatory costs
Uncertainty about costs – fishing	
	Uncertainty about costs to fishing closures – nursery, spawning
* Funding gap to be funded from public purse	Loss of sport fishing and income
Community Benefit Fund	Salmon is supermarket for seals
Employment opportunity - Maintenance - Construction	
Bulk of investment will be with indigenous suppliers	
Security of supply	
Improve storage & efficiency	

©The Environment Council

TIDAL BARRAGES - ECONOMIC	
Benefits	**Disbenefits**
Coastal protection – leading to tax reduction	

Tidal stream

TIDAL STREAM - ENVIRONMENTAL	
Benefits	**Disbenefits**
* Greater flexibility in locations than barrages	Impact on living species – it would be easy to go for maximum economic benefits and loose sight of the environment and social benefits
	Heavy disturbance in high impact areas
* Less permanent impact – quick/easy to decommission	* Concentrated resource – greater disturbance
	* Ecological impacts from tidal and wave energy
Small scale potential	
* Concentrated resource (less area disturbed)	Impact of cables
Minimal energy loss from this technology – lower thresholds (smaller devices)	Unknown impacts
Lower silting risk	* Changes in coastal processes – erosion impacts/risks
* Early projects can be carefully monitored for future expansion	Decommissioning options – end of life effects. 20 year life may be extended by replacement technology
Structural potential for monitoring stations	* Noise impacts on marine mammals
	* Possible levels of fish and mammal mortality especially collision
* Key means of replacing fossil fuel energy – CO2 savings & climate change mitigation	
	Lack of environmental knowledge – precautionary approach by regulators hinders/prevents development
	More susceptible to fowling – not yet known?

©The Environment Council

TIDAL STREAM – SOCIAL	
Benefits	**Disbenefits**
* Potential for jobs especially rural in remote areas – regeneration. Vessel maintenance	Negative impact on local community
* Jobs – not always skilled locals	
	* No benefit for 'saving the grid'
Cash for local community	
	Depends how streams structured – continuity of supply
Local pride – local project self-sufficient. Buy-in from local community needed	
	Loss/impediment of surface and sub-surface marine navigation
Potential for small scale application	
	Impact on/loss of coastal exercise & firing areas
Minimal visual and noise impacts	
Submerged projects have no visual impact	Impact on search & rescue operations
Small scale devices less likely to constrain & obstruct surface & sub-surface navigation	More devices, more inhibitive on navigation than larger solid projects
	Potential loss of landscape aesthetics
	* Projects don't always use local labour

TIDAL STREAM – ECONOMIC	
Benefits	**Disbenefits**
* Generally technologies with low visibility therefore not intruding on tourism in rural areas	Cost of environmental studies to fill information gap. Who will pay? – small projects will struggle
	Large capital cost for research development
Near shore – easy access, cheaper	Costs on small developers to R&D
	* Remote locations – costs of linkage & losses within the grid
* Quicker results than other technologies	* Less mature technology. Technologies may not be ready for commerciality for 5 years
Potential for multiple, smaller scale and cheaper devices	Maintaining tidal stream more complicated
* Modular construction provides more flexibility and less risk	Costs/difficulties of maintaining devices. Greater risk of downtime
	More cabling/mooring and infrastructure requirements compared to other technologies

©The Environment Council

TIDAL STREAM – ECONOMIC	
Benefits	**Disbenefits**
* First projects must be allowed to progress quickly to gain experience	
	Requirement for government support
* One of a number of tricks in tool box	
	* Grid will be the key constraint on deployment. Action needed from NGC/OFGEM
CHP potential	
	* Commercial fishing restrictions
Security of supply	
Won't run out or 'peak'	* Commercial navigation restrictions
Free 'fuel' sources – renewables	
Aberdeen UK leader in sub-sea technology – massive potential for industry leaders – ship and employment	
Scottish lead in tidal technology – massive UK opportunity	
Potential for revitalising marine engineering sector - Develop new skills - R&D implications	
Indigenous capability – new business & employment opportunities	
Substantial export opportunities – knowledge and licensing. May need to import if we don't develop in UK	
Global business opportunities based on strong market here	

Tidal lagoons

TIDAL LAGOONS - ENVIRONMENTAL	
Benefits	**Disbenefits**
* Site specific in Scotland (e.g. Solway Orkney)	* Site specific not suitable for all environments
* Avoids habitat change associated with tidal barrages	* Loss of bird feeding areas
CHP possibility	* Impacts on coastal processes, sediment, transport etc
* Green power	
Combine wave & tidal!	Unknown impacts – not tested
* Concentrated energy source – small footprint relative to MWs	* Visual impact at low tide

©The Environment Council

TIDAL LAGOONS - ENVIRONMENTAL	
Benefits	**Disbenefits**
Not such a large impact on mainland rivers coast line	
Contained impact that can be managed	* Large structure – high embodies energy, visual impact
Baseline environmental & other data	Low efficiency when compared to area impacted – 5km2 for similar output to 30 tidal flow devices
Location flexibility	* Risk of navigational hazards following decommissioning
Post decommissioning – artificial reef/habitat	Loss of less intrusive environmentally damaging micro generation as a result of macro energy high impact developments
	* Extensive civil infrastructure - Raw materials (quarries) - Transport impacts
	Energy balance from concrete manufacture
	Large amount of concrete used - acid by-product
	Increased demand for aggregates – more landward & marine aggregate extraction
	Carbon footprint during construction
	* Long-term impacts of decommissioning of large engineered schemes (compared to micro tidal stream devices)
	* Lifecycle environmental costs – impact vs payback

TIDAL LAGOONS – SOCIAL	
Benefits	**Disbenefits**
* Medium/micro scale of development – potentially less of an impact on surface/sub-surface navigation	* Obstruction of marine navigation routes – loss of navigable waters
	Navigational hazard for commercial & pleasure marine users
Leisure & amenity feature (i.e. wind surfing) – visitor attraction	Navigation – disrupt established routes
Flood defence	Removal of fishing grounds – loss of local employment

©The Environment Council

TIDAL LAGOONS – SOCIAL	
Benefits	**Disbenefits**
Bridge over transport advantage	* Possible loss/constraint of defence training, tests, procurement and research areas
Community opportunities	Construction impacts
* Local employment	* Large visual impact
	Increase flood risk
	Leisure exclusions
	Removal of leisure opportunities

TIDAL LAGOONS – ECONOMIC	
Benefits	**Disbenefits**
Depending on future sea bed ownership negotiation, local ownership	Poorer efficiency than tidal streaming
Possible use of compartments to extend generation times	Very high capital cost
Controllability of output	Higher material & capital cost vs barrage
Compared with tidal stream. Less cable/connection distance therefore less transmission loss	Major decommissioning liability
Sites closed to demand centres/grid	
	* Impact on important economic activities (e.g. tourism, agriculture)
* Uses proven hydro technology	
	Removal of leisure opportunities
* Could combine heat energy – have CHPs with adding heat pumps	
	* Sites often not accessible to large population centres
Calming storm surge – flood prevention	
	Loss of inshore fishing opportunity
Infrastructure improvements	Impact on fishing limited area
* Business opportunity	Impact on fishing gear caught on u/w objects
* New business potential	
	Impact on tourism
Aqua-culture possibilities	
	Impact on coastal views
* Local construction	
	Cost of changing navigational charts

©The Environment Council

TIDAL LAGOONS – ECONOMIC	
Benefits	**Disbenefits**
* Local employment – labour intensive	
	Obstruction of marine navigation routes
	Impact of macro generation developments on micro generation potential/capacity
	Marine installation effects (e.g. silting of harbours & shipping lanes, displacement of sediment)
	Expect scour in places

Notes on SD aspects of different technologies exercise

- Hard to split economic, environment and social
- Hard to judge knock on benefits/disbenefits from other benefits
- What do we mean by environment?
    - Natural or built
    - Macro or micro levels
- Social benefits
    - Local
    - National

Government roles in supporting tidal power

Groups of participants took part in a facilitated discussion at their tables using the structure set out below.

What roles do you think the government should be taking in tidal power?

1. Roles in decision making
2. Roles in financing
    - Research & development
    - Capital investment
    - Ongoing support

Blue

1) Decision-making

Policy

The Government needs "absolute clarity" about its policy line on tidal power. This should be more than a vague section in a white paper.

There needs to be greater clarity between the EU, UK Government, and the devolved administration policy lines.

©The Environment Council

Environmental issues should be given greater consideration when setting up the policy line.

A main policy should be set by the Government, with less reliance on the regulators to set their own improvised policies (e.g. individual SWOT assessments on each application).

Legislation could be put into place to join up the market. Legislation could also help to tilt the market towards renewables, away from fossil fuels. This is currently illegal.

Consents process

These should be simplified to a one-stop process, and have increased flexibility in terms of access and communications.

There should be a level of certainty in arising at the end-point, and lower the levels of risk involved.

Consultation/Dialogue

Consultation and involvement from all stakeholders should take place at the earliest possible stage.

The Government needs to examine the energy mix in terms of national strategy and local impacts (e.g. local planning rules can allow local energy generation, but selling this electricity to the grid can come up against statutory boundaries). This needs dialogue with regional and national government, and facilitation of local energy generation (consents). The priority should be tilted towards energy solutions.

Government roles in supporting tidal power continued

Planning

The grid cannot be updated/upgraded unless planning legislation is changed at a central Government level. The planning allowances in relation to grid connections need to be reassessed. There is currently a long-term enquiry into this.

2) Finances

Overall role

The Government needs to be transparent about its role and intentions in terms of funding support – i.e. will it be a main player (public system) or the underwriter (private system).

Subsidies

Fossil fuels should be made more expensive, or tidal power subsidised to balance the grid issues faced by renewable power that fossils don't have.

©The Environment Council

The Scottish Executive has already put in place a market support scheme that not only provides capital support, but also enhances tidal payments for one-year certainty. The group felt this should be extended across the whole of the UK.

R&D

Tidal technologies are very expensive with high funding requirements. Since the Government pays large sums to other non-tidal energy technologies, the Government should pay some money into the large pot for funding tidal research.

Green

- The governments geographically based strategic approach may be a mistake because it assumes the generic availability of options for various locations based on experience at one site. Although any strategy needs guidance from central government, there seems to be a vacuum in direction so it would seem more appropriate for local and regional government bodies to take the lead.

- With Orkney being the primary site for testing of tidal power devices, there may be inconsistencies with the variety of environment types at sites chosen for generation.

- However, Orkney provides a strong focus for industry, which is attractive for developers with Government encouraging people to visit the site.

- There is a need for central government to inject more money into the development of tidal power.

Government roles in supporting tidal power continued

- The role of the Scottish executive is seen as important. A suggested relationship between levels of government could be that central government set a framework for tidal power across the UK with the role of the Scottish Executive (SE) being to implement it. However, there should be strong stakeholder and public feedback mechanisms in this process to make it adaptable and inclusive.

- To an extent there is an argument that the SE does not have enough powers to implement tidal power as an energy option. However, there are powers in place including section 36 of the electricity act. The role of Ofgem in this is influential but it is understood that it is a regulatory body and not one with legislative powers.

- A concept that should be examined in energy policy is that heat and electricity have been viewed separately but both constitute forms of energy and should be considered together.

- Energy companies want targets for tidal power and government bodies should be set up to deliver incentives to meet these targets.

- It is recognised that Scotland is rich in potential energy to be harnessed by renewable power generation technology but at the same time, it is recognised that much of the demand is in the South of the UK.

- The Crown Estates are seen as a block to progress in developing tidal power.

- The Marine Bill requires 5 years of Environmental Impact Assessment (EIA) before any tidal power is installed which is very restrictive to leading industries.

©The Environment Council

- In any overarching plan, the government needs to look beyond location and any targets driving tidal power development and consider the environment as well as expectations related to the technology; e.g. is it truly a clean technology? How does it fit with future predicted tide levels? It is important to consider local lives.

- Increased investment from central government is needed for development. This should be available from central government at a level that matches the wider interests of the UK with an option for funds to be topped up by devolved administrations.

Government roles in supporting tidal power continued

- Developers do have a current level of finance to work with but there is a funding gap between research and commercial level generation. The government must be willing to accept that some technologies will fail.

- The marine renewables development fund (MRDF) could help this but it doesn't as; (1) it doesn't fill the identified gap (2) industries are not ready to fulfil the criteria – this fund is only available to commercially generating installations.

- The locational drive behind funding is limiting. In addition, money is needed not only for engineering and it should be recognised that funding should also be available to cover both any environmental assessment activity required and legal activities including engaging local people in development of sites.

- ROCs are helpful, but again only once technology is generating commercially.

- It is unfair to expect tidal power to compete with mature renewables for the same funding. The MRDF came too late but it is a welcome additional funding stream.

- A possible funding mechanism is that of a revolving credit scheme to allow cash flow gaps to be plugged, funded by central government.

- ROCs are seen as a good way of ensuring that the consumer pays for renewable energy, which is considered correct.

- Financial bridging facilities need to be in place to plug the identified funding gap.

- Central government could be the guarantor for any credit scheme that would allow technologies to become commercially viable, retaining shares and returning to the public gains on investment. However, the government must pay money to further the national interest, NOT make money, as it is also the regulator. The government's role should be to create a climate for business with private companies making money as a result.

- The ROCs system provides ongoing support but once commercially viable, this support should be withdrawn.

- Public-private partnerships are a good idea initially but these should be reviewed and adapted once the industry is mature.

Government roles in supporting tidal power continued

©The Environment Council

- The next 5 years is essential as possible funding for tidal power may be diverted into the 2012 Olympics and investment in nuclear power.

Red

- Tidal power / energy generation is a new industry which needs steering/leadership by central government.
- Joined up, integrated framework through one authority.
- The proposed Marine Bill offers such a framework.
- Important to separate government as the consenting body from government as the promoting body.
- Strategic Environmental Assessment an important mechanism to enable more joined up decision-making.

- Industry wary of the risks of shifting ground that results from the variety of authorities/agencies involved in the current decision-making arrangements – the industry wants stability in the mechanisms provided in order to plan, invest and develop with more certainty.
- Industry wants regulators to have the 'right' brief in order to facilitate development of renewables technology and the industry. Ensuring a balance between the current requirement to 'prove the need' and the potential for licensing developments or projects.

- Some suggested that planning decisions should be made at more local levels or at Devolved Administration level so long as criteria set out in a strategic, integrated framework are met.
- Others disagreed, in order to effect such a suggestion; primary legislation would have to be changed. Any project greater than 1MW is not currently a local decision. There are no plans to change this.

- Central government should have a role in educating stakeholders – providing information about the technologies, their potential impacts and how stakeholders can engage with development proposals.
- Strategic Environmental Assessment could be the mechanism to educate and inform stakeholders.
- SEA could also be the mechanism to determine who are the important stakeholders.

- Environmental Impact Assessment is an important mechanism for consultation on individual project proposals; however, central government should provide guidelines on best practice for developers and other government agencies on the most effective ways to conduct EIA.

Government roles in supporting tidal power continued

Financing

- A view was expressed that government should fund R&D, capital investment and provide ongoing support – as the technology needs to be proven, because the industry needs stability and certainty and because there are connectivity issues.
- Others did not agree.

R&D

- Government should have a role in financing environmental impact monitoring.

©The Environment Council

- Government should have a role in financing the development of tidal power devices.
- Government commitments on renewables targets suggests there is a role in financing R&D of tidal technologies.
- Strategic Environmental Assessment should be well resourced and funded by government.

Capital Investment

- PFI
- Wires provision – regulator should be providing clear Terms of Reference, clear priorities and include incentives.
- Investors and industry should be responsible for financing capital investment, but government targets on renewables suggest financial assistance from government should be available.

Ongoing support

- Price support from government will engender certainty for industry and investors.
- The renewables obligation and marine supply obligation will help in Scotland until 2010 and 2027 respectively, perhaps these should be extended.

Acceptability

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. The stations were set in the context of the exercise on the sustainability of different tidal power options.

What key things need to change to make tidal power more acceptable?

Tidal power (generic)

Tidal power (generic) - Changes	
Benefits	**Disbenefits**
Maximise economic benefits (indigenous industry creation)	Increase knowledge base
Integrate devices into proposed structures	Streamlined planning process to allow timely decision-making
Commitment to well resourced E.I.A.	Better information on acoustic outputs from tidal farms/large scale

©The Environment Council

Tidal power (generic) - Changes	
Benefits	**Disbenefits**
	developments
Make full use of Scottish SEA (due end Mar07)	Consent marine projects quickly – planning
Long term funding and incentives	Spatial planning can be wrong – needs quality input and flexibility
Exploit Scottish lead in tidal stream and wave development	A more joined up licensing & consultation system
National awareness in Scotland of potential to develop	2-3 years to get a S36 consent will kill tidal before it starts
Greater information/awareness to ensure informed debate	Certainty on the scale/size of tidal energy devices
"Uptake" forecasts to indicate likely spatial impacts	Consideration of cabling & potential to fund under-grounding
Accelerate indigenous technology development	Need shift towards local generators for local consumption
Research into environment impacts funded by central government	
Better understanding of environmental impacts	
Grid investment in underground & undersea cables	
Exploit Aberdeen's capability as a global sub-sea development/management culture	
Strategic approach to tidal – both types and within whole energy supply/source	
Location strategy to guide infrastructure and grid	
A spatial planning/allocation system	
Need clear government policy	
Consistency in approach to assessing environmental impact	
Siting/design guidance to facilitate the selection of technologies	

Tidal barrages

Tidal barrages - Changes	
Benefits	**Disbenefits**
Fully exploit the benefit of output controllability	Nothing will make barrages acceptable. It is "make your mind up time for government"
Simultaneous development of barrage & any grid upgrades required	Assurance of no adverse impacts on estuarine sites designated for wildlife. Research needed to increase knowledge base
	Further research required
	More potential for IP generation
	Proper and full consultation with marine users

©The Environment Council

	Greater understanding of environmental impact
	Require a better understanding of the dynamics of flow – bredding and developing organisms. Potential impact on marine plankton etc

Tidal stream

Tidal Stream - Changes	
Benefits	**Disbenefits**
Revolving credit guarantee scheme needed	Avoid sensitive or unusual tidal habitats
Maximum benefit to UK supply chain	Much better understanding of tidal stream interactions with biological. Systems are required before action. Uncertainty
Build on Scottish lead in tidal technology	Research/monitoring is needed to confirm that collision risks are acceptably small
Extend financial support across UK	Improve knowledge on environmental impacts – should simplify planning
Maximise existing skills and develop new ones	Underwater/monitoring is needed to confirm that collision risks are acceptably small
Support indigenous technology & suppliers	Underwater noise levels to be kept at levels which do not displace wildlife
Exploit Aberdeen's global energy network & sub-sea expertise	Fear of failure has been greatest/most costly dis-benefit
Essential change needed to deliver some projects	Requirement for improved govt support particularly at R&D stage
Project management/development teams for specific locations needed	Site specific (energy) resource assessments
Maximise potential for multiple energy source utilisation	Improved efficiency and reliability of technology
Funding to assist developers in environmental impact assessment	More "relaxed" approach to environmental impact for demonstrator projects
Make grid capacity available - regulation	Reduce development and investment risk
Align grid upgrades/new build with resource locations	Need for proving technology – funding required
Convince business and the public that this is the way forward	Resolve potential conflicts with other users of the area
Believe in benefits and fully fund a site specific generation type	Solve grid issues
Statutory renewable energy targets for planning consultants	Potential to fund undergrounding & cables
Once projects are delivered capability will be proved and wealth	Regulatory framework to facilitate appropriate grid provision

©The Environment Council

Tidal Stream - Changes	
Benefits	**Disbenefits**
created more will follow	
Prove the technology – get experience	Ensure adequate monitoring at early stage
Accurate quantification of cost to government of meeting ministerial targets for renewable energy	Greater understanding of environmental impact
Better coordination of funding agencies	Strategic Environmental Assessment (England & Wales)
Public & private partnership structure needed	Identification of mitigation opportunities to minimise environmental impacts
Expedite developments to prove benefits value	Fast consent process
Proper & full consultation with marine users	
Tidal stream will only become more acceptable when real projects are delivered	
Using marine heat with power CHP will give greatest efficiency	
Agreement over level of energy extraction which can be taken without change to hydrology/sedimentation	
Mechanism to fast track most promising designs/technologies	
Accelerated programs for proving 20 year design life	
Using structures as communication/transport links between islands	
Incentives for application of proven oil and gas sub-sea technology to renewables	

Tidal lagoons

TIDAL LAGOONS – Changes	
Benefits	**Dis-benefits**
Greater awareness of tidal lagoons	Viability of concept needs to be proven
Local community benefit	Environmental research
Proper & full consultation with marine users	Greater understanding of environmental impact
Fully exploit the benefit of controllability of output	Pilot study required
	DTI report on feasibility of tidal lagoons was highly dismissive. Industry believes this may not be the case

©The Environment Council

	Not convinced this is viable in UK – Barrage option would!?
	There will be dis-benefits so government must make its mind up

Overview of day - Final discussion

Marine S.E.A.

- UK wide documentation will take on board work being done in all regions
- SDC final report will look at generic issues & impacts; second part of report will look at the Severn
- Important to have project management team for Pentland Firth (not headed by an academic)
  - Need someone with a lot of project management experience
- Perception that if localised too much it won't be effective
- Why is study not looking at wave?
  - Focus on Severn wouldn't take account of variety of marine resource
  - Report aims to look at differences between tidal technologies

Overview of day - Final discussion continued

- Engagement with commercial & leisure users of marine environment is a challenge because of disinterest – more of the groups attending
- Cardiff workshop because of Severn
- Pentland Firth is also of importance & disappointment was expressed as to lack of these groups attendance – however, they were invited
- Heat is greater than 50% of energy use in UK but has apparently been forgotten (references to 'CHP' on carousel output actually refers to the 'heat pump' concept)
- Speculative provision of grid capacity would require change to regulatory framework (existing framework doesn't allow for this)

Action points

Action	Who	Completed
Email invitee list to attendees of this workshop	TEC	Sent with joining instructions on or after the 16th of March 2007
Email SDC presentation (including links to other processes) to this group	TEC	Circulated 3rd of April 2007
Email ENTEC presentation to this group	TEC	Circulated 3rd of April 2007

Messages to the SDC

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

©The Environment Council

- Carbon footprint - The carbon lifecycle has been frequently referred to as (in this workshop) a justification for tidal power. However, there will need to be clear guidance and protocols on how this is done – this is not simple & could be a large burden for developers if required.

- Tidal lagoons - DTI report on feasibility of lagoons was dismissive – "can't be done economically". Energy utilities believe this may not be the case, such opportunities should be facilitated/left open and not closed as this report has the danger of doing.

- Climate change - #1 priority -> Tell regulators! - The overriding importance of talking climate change should be filtered to all institutions involved in consenting to ensure they receive the timely attention and likelihood of success which they should receive if this is truly a top priority.

Messages to the SDC continued

- Financing - Support is focused on leading generation of technologies but there is a danger that some as yet little developed technologies may in fact be an even better solution. We don't want to miss these opportunities. Funding should support all stages of device developments.

- Urgent need for accelerated development program - Run in parallel 3 expert development groups with a coordinator for each site
  - Academic – environmental impct analysis
  - Engineering – bespoke designs and testing in specific sites
  - Legal & financial – how to structure projects for finance

- It is not clear how the project will differentiate between 'views' obtained from the workshop and 'evidence' provided by consultants. There is a lot of information/knowledge available that is not being collected by consultants (whose consultation process seems limited).

- Spatial planning - Is only as good as those who write it – it could be wrong or not fully informed therefore needs to be flexible and preclude developments outside of preferred areas.

- Knowledge gaps need to be addressed – much of what has been captured today is informed opinion rather than evidence. Research is required if these projects are to be promoted.

- Who will own these structures – private or public?

©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

©The Environment Council

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

©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

©The Environment Council

Name	Organisation
Peter Hall	Bristol Port Company
Adrian Jowitt	Natural England
Mervyn Bramley	University of West of England / RSA
Mike Johnson	Goucester Harbour Trustees
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

©The Environment Council

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
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

©The Environment Council

Gives	Gets
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
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

©The Environment Council

Gives	Gets
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
- 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

©The Environment Council

Gives	Gets
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
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)

©The Environment Council

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
* 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

©The Environment Council

TIDAL BARRAGES – ENVIRONMENTAL (1 of 2)	
Benefits	**Disbenefits**
* 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
	* 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 - ?)

©The Environment Council

TIDAL BARRAGES – ENVIRONMENTAL (2 of 2)	
Benefits	**Disbenefits**
* 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	
	* 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.

©The Environment Council

TIDAL BARRAGES – ENVIRONMENTAL (2 of 2)	
Benefits	**Disbenefits**
	* 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?
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)

©The Environment Council

TIDAL BARRAGES – SOCIAL (1 of 2)	
Benefits	**Disbenefits**
* 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	
* 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	

©The Environment Council

TIDAL BARRAGES – SOCIAL (2 of 2)	
Benefits	**Disbenefits**
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	
	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	

©The Environment Council

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
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

©The Environment Council

TIDAL BARRAGES – ECONOMIC (1 of 2)	
Benefits	**Disbenefits**
* 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
* 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'?

©The Environment Council

TIDAL BARRAGES – ECONOMIC (2 of 2)	
Benefits	**Disbenefits**
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	
	Scour sediment movement
Low visual impact	
	Viable resource areas tend to be in environmental designated areas (high energy = biodiversity = design)

©The Environment Council

TIDAL STREAM – ENVIRONMENTAL (1 of 2)	
Benefits	**Disbenefits**
* 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
Less pressure for on land windfarms	May disrupt sharks & rays due to EMF etc.
	Under-water electrical cable

©The Environment Council

TIDAL STREAM – ENVIRONMENTAL (2 of 2)	
Benefits	**Disbenefits**
* 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

©The Environment Council

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	

©The Environment Council

TIDAL STREAM – SOCIAL (2 of 2)	
Benefits	**Disbenefits**
* 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
* 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

©The Environment Council

TIDAL STREAM – ECONOMIC (1 of 2)	
Benefits	**Disbenefits**
* '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
* 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	

©The Environment Council

TIDAL STREAM – ECONOMIC (2 of 2)	
Benefits	**Disbenefits**
	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!)
	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

©The Environment Council

TIDAL LAGOONS – ENVIRONMENTAL (1 of 2)	
Benefits	**Disbenefits**
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
	* 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

©The Environment Council

TIDAL LAGOONS – ENVIRONMENTAL (2 of 2)	
Benefits	**Disbenefits**
* 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
* 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

©The Environment Council

TIDAL LAGOONS – ENVIRONMENTAL (2 of 2)	
Benefits	**Disbenefits**
	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
	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

©The Environment Council

TIDAL LAGOONS – SOCIAL (2 of 2)	
Benefits	**Disbenefits**
* 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	

©The Environment Council

TIDAL LAGOONS – ECONOMIC (1 of 2)	
Benefits	**Disbenefits**
	* 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+ ?
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

©The Environment Council

TIDAL LAGOONS – ECONOMIC (2 of 2)	
Benefits	**Disbenefits**
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

©The Environment Council

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 Environment Council

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 Environment Council

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:

©The Environment Council

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 Environment Council

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.

©The Environment Council

- 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 Environment Council

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.

<u>Government roles in supporting tidal power continued</u>

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.

©The Environment Council

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

©The Environment Council

- *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

©The Environment Council

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
Good grid connections	Can work in tandem with other technologies

©The Environment Council

Tidal barrages	Alternative 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

©The Environment Council

Tidal barrages	Alternative technologies
Traffic relief from 2 bridges if a transport link over barrage	
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

©The Environment Council

Tidal barrages	Alternative technologies
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
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

©The Environment Council

Tidal barrages	Alternative technologies
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	
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	

©The Environment Council

Tidal barrages	Alternative technologies
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
	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)	

©The Environment Council

Tidal barrages	Alternative technologies
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?
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	

©The Environment Council

Tidal barrages	Alternative technologies
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)
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	

©The Environment Council

Tidal barrages	Alternative technologies
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)	
Beyond UK contractors/construction capability	
Loss of jobs in angling economy in South Wales & indirect impact	

©The Environment Council

Tidal barrages	Alternative technologies
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	
Could be configured for continuous power generation	

©The Environment Council

Tidal barrages	Alternative technologies
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	

©The Environment Council

Tidal barrages	Alternative technologies
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	

©The Environment Council

Tidal barrages	Alternative technologies
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	
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

©The Environment Council

Tidal barrages	Alternative technologies
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
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.

©The Environment Council

Tidal barrages	Alternative technologies
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	
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

©The Environment Council

Tidal barrages	Alternative technologies
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	
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

©The Environment Council

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)
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)

©The Environment Council

Tidal barrages	Alternative technologies
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)	
Major threat to ports with potential knock-on to increased carbon (cargo going to SE resulting in more road miles)	

©The Environment Council

Tidal barrages	Alternative technologies
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

©The Environment Council

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

©The Environment Council

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

©The Environment Council

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

©The Environment Council

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

©The Environment Council

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

©The Environment Council

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)

©The Environment Council

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**?

©The Environment Council

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.

©The Environment Council

- 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.

©The Environment Council

- 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.

©The Environment Council

5.9 Stakeholder invitee list

Aberdeen event

Convention of Scottish Local Authorities (COSLA)
Department for Environment, Food and Rural Affairs (Defra)
Department for Transport (Dft)
Department of trade and industry (Dti)
North Sea Regional Advisory Council (NSRAC)
Environment and Heritage Services, Department of the Environment NI
Fisheries and Angling Conservation Trust (FACT)
Fisheries Research Services Aberdeen
Friends of the Earth Scotland
Greenpeace
Highlands and Islands Enterprise
Historic Scotland
HM Treasury
Invest Northern Ireland
Joint Nature Conservation Committee (JNCC)
JWG Consulting (Woodshed's Tidal Delay tidal power)
Local Government Association (LGA)
Lunar Energy
Marine Conservation Society (MCS)
Marine Current Turbines
Maritime & Coastguard Agency
Ministry of Defence (MoD)
National Federation of Sea Anglers
National Grid
Natural England
Northern Ireland Local Government Association (NILGA)
Northwest Development Agency
Npower
Ofgem
Ofreg (NI)
Open Hydro
Proudman Oceanographic Laboratory, Liverpool
Royal Commission on Ancient and Historic Monuments of Scotland
Royal Institute of Navigation
Royal Society for the Protection of Birds (RSPB)
Royal Town Planning Institute

©The Environment Council

Scottish & Southern Energy
Scottish Association for Marine Science (SAMS)
Scottish Coastal Forum
Scottish Enterprise
Scottish Environment Link
Scottish Environment Protection Agency (SEPA)
Scottish Executive
Scottish Fisheries Protection Agency
Scottish Natural Heritage
Scottish Power
Scottish Renewables
Surfers against Sewage
Sustainable Scotland Network
Systems Operator for Northern Ireland
The Carbon Trust
The Crown Estate
The Department of Enterprise, Trade and Investment Northern Ireland (DETINI)
The Environment Agency (EA)
The Highland Council
The Morecambe Bay Partnership
The Scottish Fishermen's Federation
The Shellfish Association of Great Britain
Trinity House
UK Association of National Park Authorities
University of Edinburgh
Wales & Northern Ireland Office, UK Government
WWF

©The Environment Council

Association of Sea Fisheries
Committees of England and Wales
British Ports Association
British Trust for Ornithology (BTO)
Cadw
Cefas
Cemare, University of Portsmouth
Centre for Sustainable Energy
Countryside Council for Wales
Cynnal Cymru
Dawson Construction
Defra
Department for Transport (Dft)
Dti
North-West Waters Regional Advisory
Council (NWWRAC)
English Heritage
Fisheries and Angling Conservation Trust (FACT)
Friends of the Earth Wales
Greenpeace
HM Treasury
Joint Nature Conservation Committee
(JNCC)
Local Government Association (LGA)
Local Government Association (LGA)
Marine Biological Association (MBA)
Marine Conservation Society (MCS)
Maritime & Coastguard Agency
Ministry of Defence
National Federation of Sea Anglers
National Grid
Natural England
Ofgem
Parsons Brinkerhoff
Regen SW
Royal Commission on Ancient and Historic Monuments of Wales
Royal Institute of Navigation
Royal National Lifeboat Institute
(RNLI)
Royal Society for the Protection of
Birds (RSPB)
Severn Estuary Partnership
Severn Lake Project
Severn Tidal Power Group (STPG)
Southwest Regional Assembly
Southwest Regional Development
Agency (SWRDA)
Surfers against Sewage
The Carbon Trust
The Crown Estate
The Environment Agency (EA)

©The Environment Council

The Shellfish Association of Great Britain
Tidal Electric
UK Association of National Park Authorities
University of Cardiff, BRASS group
University of Southampton National Oceanographic Centre
University of Wales / Swan Turbines
University of West England
WAG Enterprise, Innovation and Networks Department
WAG Environment, Planning and Countryside Department
Wales and Northern Ireland Government Office
Welsh Federation of Fisherman's Associations
Welsh Local Government Association (WLGA)
Welsh National Assembly Sustainable Energy Group (NASEG)
WWF

©The Environment Council

Freedom of Information Act 2000
This document contains commercially sensitive and confidential information. The contents of this document should not be copied, reproduced or disclosed to any third party without prior written permission from a Director at Opinion Leader Research.