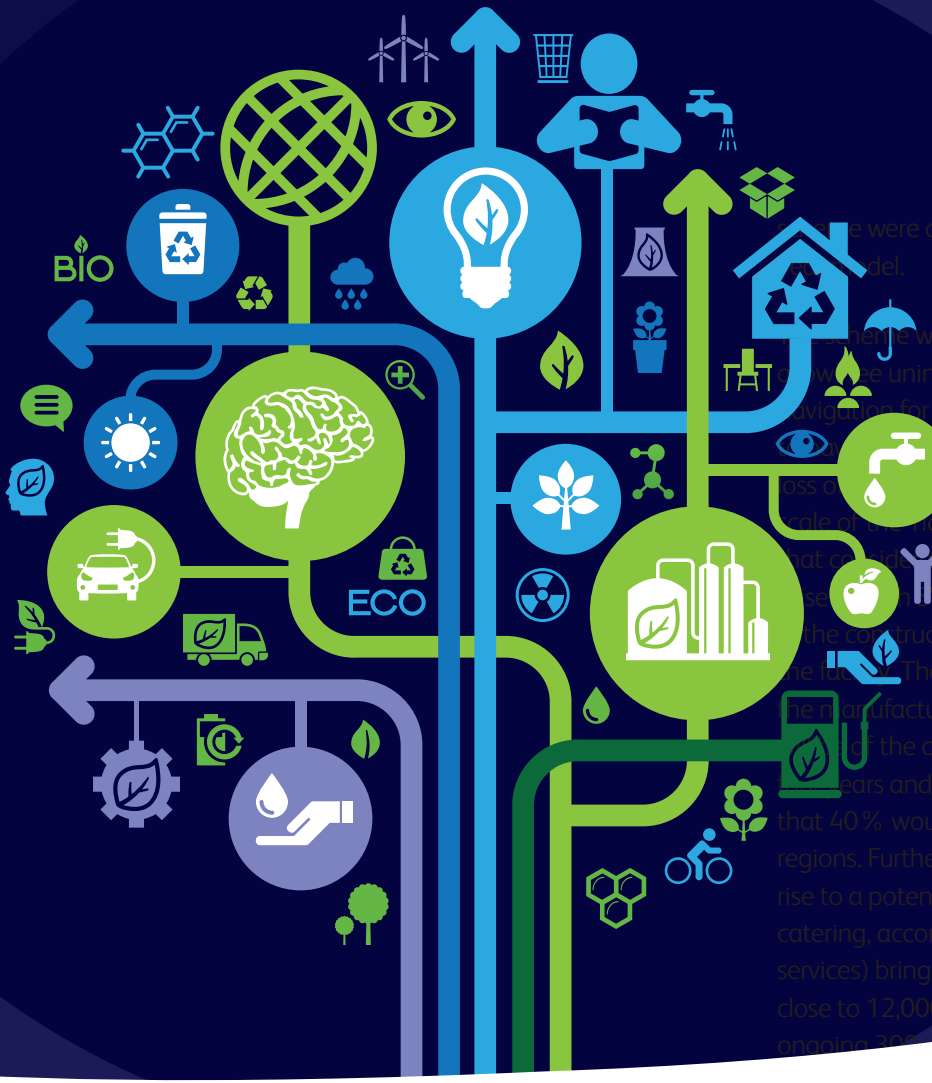
ENERGY PROSPECTUS 2014



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ENERGY PROSPECTUS TABLE

	Project Name	"Maximum Power (MW)"	"Annual Energy Generation / Saving (MWh)"	"Annual Energy Generation / Saving (MWh)"	"Construction Jobs (Approx FTE)"	"Operational Jobs (Approx FTE)"	Capex (£m)	"ROI (where relevant) (%)"	"Annual secure energy value (£m)"	"Annual green energy value (£m)"	Annual energy cost saved value	Project Stage	Time to deliver	"Complexity (H/M/L)"	"Project Maturity Delivery by 2020 (R/A/G)"	"Council Obligation (Y/N)"	Potential role to bring project to market
1	"Trident Park Energy from Waste Electricity Generation"	30	220,000	220,000	360	36	200	N/A	11.000	9.244		Construction	Apr-15	High	G	Y	Procuring authority
2	Trident Park Energy from Waste District Heating Network"	20	70,000 - 150,000	70,000 - 150,000	?	?	16		1.120			Feasibility	2016	High	A	N	"Facilitation and ESCo Partner
3	"Anaerobic Digestion in Cardiff"	1.5	12,200	12,200	? Pat	? Pat		N/A	0.566	1.127		Procurement	2016	High	R	Y	Procuring authority
4	"Anaerobic Digestion in Cardiff"	1.5	12,000	12,000				N/A	0.096			Procurement	2016	Low	R	N	Procuring authority
5	"Landfill Gas Electricity"	5	26,280	26,280	? Pat	? Pat						Operational		Low	G	Y	Owner
6	"Landfill Gas Heat"	4	21,024	21,024								Pre-feasibility		Low	A	N	"Owner
7	Lamby Way Landfill Solar Farm	5	4,500	4,500	?	?	3		0.209	0.297		Feasibility	Mar-15	Medium	G	N	Heat user"
8	Lamby Way Buildings Solar	0.25	215	215	?	?	0.405		0.010	0.014		Feasibility	Mar-15	Low	G	N	Funding and developer
9	Radyr Weir Hydro	0.4	1,800	1,800	?	?	2.5		0.090	0.270		Feasibility	Mar-15	Medium	G	N	Funding and developer
10	Llandaff Hydro	0.2	900	900	?	?	?		0.045	0.135		Pre-feasibility	2020	Medium	R	N	Funding and developer
11	Blackweir Hydro	0.1	450	450	?	?	?		0.023	0.068		Pre-feasibility	2020	Medium	R	N	Funding and developer
12	Other Hydropower	6.27	19,440	19,440					0.902	2.916		Pre-feasibility	2020	Medium	R	N	Funding and developer
13	"Energy Efficiency Council Buildings (RE:FIT)"	N/A	12,000	12,000	?	?	3.3		N/A	N/A	0.5	Pre-procurement	2015	Medium	G	Y	Facilitator
14	"Energy Efficiency Retrofit 2050"	N/A	100,000	100,000			58					Pre-feasibility	2022				Funding and developer
15	"Tidal Range Stepping Stones Tidal Lagoon"	600	1,200,000	1,200,000	4000	80	1,700					Pre-feasibility	2025	High	R	N	Facilitator
16	"Tidal Range Severn Tidal Fence"	400	880,000	880,000	10,000	300	2,300					Pre-feasibility	2025	High	R	N	Facilitator and SPV partner
17	Electricity ESCO	N/A	N/A	N/A					N/A	N/A	XXX	Pre-feasibility					Facilitator and SPV partner

PROJECT 1

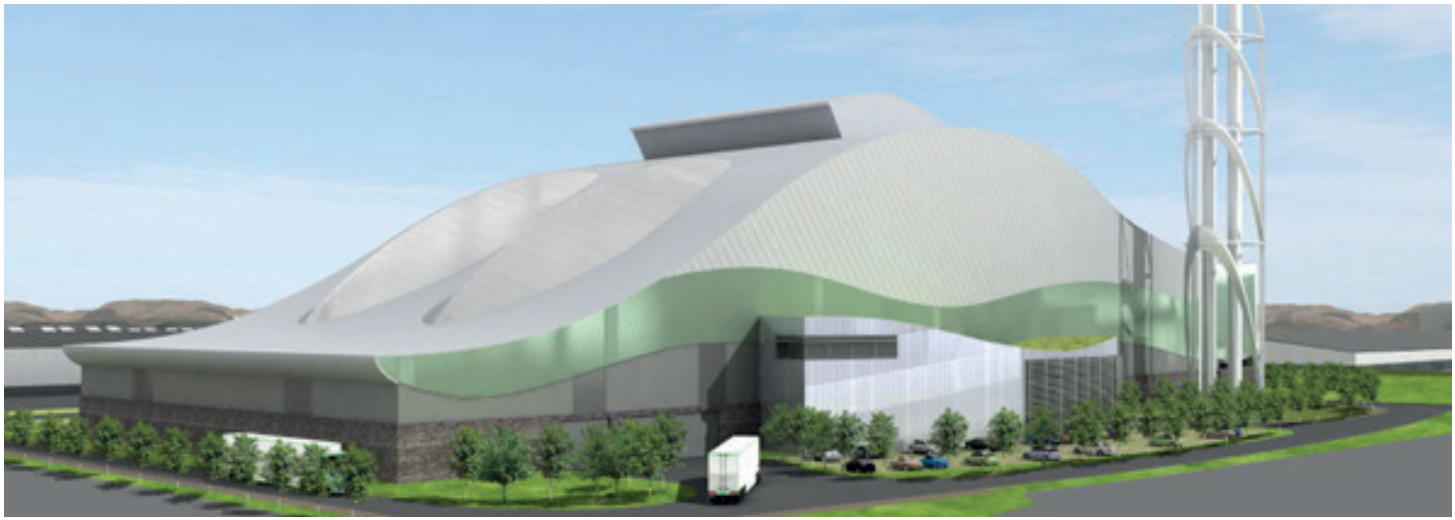
TRIDENT PARK ENERGY FROM WASTE FACILITY

CATEGORY

› ELECTRICITY GENERATION
› 30 MW
› 220,000 MWH/ANNUM

INVESTMENT OPPORTUNITY

› FULFILLED
› POST-PROCUREMENT
› CONSTRUCTION STAGE



DESCRIPTION

Prosiect Gwyrdd, the Cardiff Council lead residual waste treatment partnership, has provided the anchor contract (waste provider) to facilitate funding of 50% of the 350,000 tonnes per annum Energy from Waste (EfW) facility at Trident Park in Cardiff Bay.

The partnership (Cardiff, Newport, Caerphilly, Monmouthshire, Vale of Glamorgan) has a contractual obligation to supply residual waste to the facility. The benchmarked gate fee shows this is very good value for money. On average 172,000 tonnes per annum of residual waste will be supplied by the partnership each year for the 25 year contract duration.

With a capital value of £200m, 360 jobs have been created during the facility's construction and 36 operational jobs are due to be created when the facility becomes operational in 2015.

The EfW facility will produce electricity and has the potential to produce heat via combined heat and power (CHP). Utilisation of the heat is described in Project 2.

PROJECT 2

TRIDENT PARK ENERGY FROM WASTE FACILITY

CATEGORY

› CARDIFF HEAT NETWORK
› 20 MW
› 150,000 MWH/ANNUM

INVESTMENT OPPORTUNITY

› ACTIVE
› PRE-PROCUREMENT
› FEASIBILITY STAGE

DESCRIPTION

Cardiff Council is working with the owner of the EfW facility (Viridor) and E.ON to deliver a 12km district heating network which, during phase 1 of the project, will enable the utilisation of 70,000 MWh/annum heat (less than half of the total heat) produced by the Trident Park Energy from Waste Facility (see also Project 1). The Cardiff Heat Network project is expected to involve:

- Creation of a single purpose vehicle (SPV) for a Pipe Holding Company made up of a public-private partnership as the commercial model.
- Utilisation of the lower costs of finance available to local authorities and longer term infrastructure mind-set of a pension fund.
- Retrofitting district heating to existing homes to broaden the customer base, whilst also reducing the installation costs through utilisation of existing central government energy efficiency and renewable energy support schemes.

The estimated capital investment for the base case District Heating Network in Cardiff is £16m. This is driven by the length of the network and the proposed route from Trident Park to the City Centre to connect the identified 'anchor' customers.

PROJECT 3

ANAEROBIC DIGESTION IN CARDIFF

CATEGORY

› ELECTRICITY GENERATION
› 1.5 MW
› 12,200 MWh/annum

INVESTMENT OPPORTUNITY

› IN PROCUREMENT (NB: AT THIS STAGE THE CONTRACT COULD BE AWARDED TO EITHER SHANKS OR KELDA).E

DESCRIPTION

Cardiff Council and the Vale of Glamorgan Council are working together on their Organic Waste Treatment Project to procure treatment capacity for approximately 35,000 tonnes per annum of source-separated food waste collected from households and businesses.

In July 2013 Kelda and Shanks were shortlisted to develop proposals for the most sustainable and value for money solutions for Cardiff Council to assess. Both bidders plan to use the Anaerobic Digestion (AD) technology to process the organic waste produced by Cardiff and the Vale with Kelda Organic Energy potentially basing their facility in Tremorfa, Cardiff and Shanks Waste Management proposing their plant in Pontypool. AD is a biological process that produces methane gas that is used to generate electricity. Waste heat form the process can be put to beneficial use. Planning permission has been granted for Kelda to build an anaerobic digestion (AD) facility at the Dŵr Cymru Welsh Water Waste Water Treatment Works, Tremorfa, Cardiff.

The proposed AD facility would produce electricity and heat via combined heat and power (CHP). Potential utilisation of the heat is described in Project 4.

PROJECT 4

ANAEROBIC DIGESTION IN CARDIFF

CATEGORY

› HEAT UTILISATION
› 1.5 MW
› 12,200 MWH/ANNUM

INVESTMENT OPPORTUNITY

› IN PROCUREMENT

DESCRIPTION

The anaerobic digestion and combined heat and power proposed in Cardiff (see Project 3) would be expected to produce approximately equivalent proportions of heat and power1 Potential beneficial uses for this heat will be explored during the procurement process.

PROJECT 5

LANDFILL GAS

CATEGORY

› ELECTRICITY GENERATION
› 5 MW
› 26,000 MWH/ANNUM

INVESTMENT OPPORTUNITY

› FULFILLED
› POST-PROCUREMENT
› OPERATIONAL STAGE

DESCRIPTION

Cardiff's Lamby Way and Ferry Road landfill sites have landfill gas collection systems in place and utilise the collected landfill gas to generate electricity using landfill gas engines. These engines have a maximum installed electrical generation capacity of 4 MW and 1 MW respectively, with the generated electricity being fed into the national grid.

Landfill gas engines have the potential to produce heat via combined heat and power (CHP), a proposal to beneficially use this heat at Lamby Way is described in Project 6.

PROJECT 6

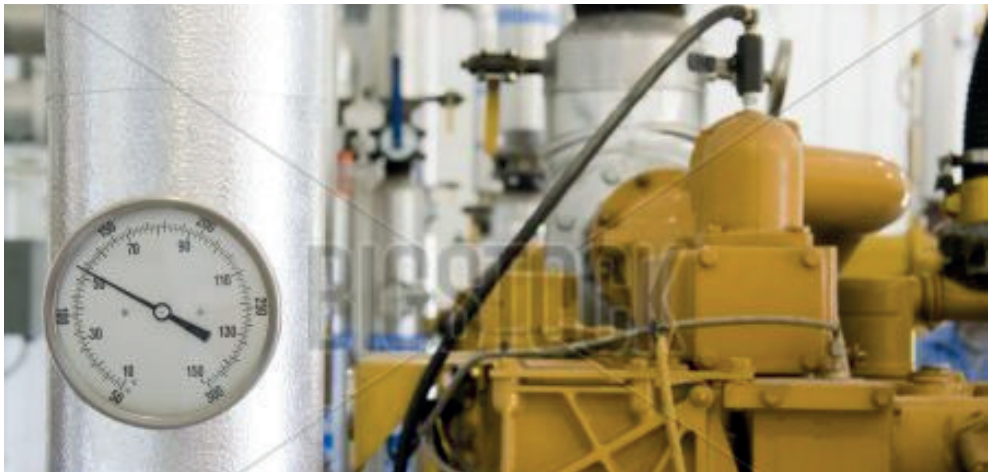
LANDFILL GAS

CATEGORY

› HEAT UTILISATION
› 4 MW
› 20,000 MWH/ANNUM

INVESTMENT OPPORTUNITY

› ACTIVE
› PRE-PROCUREMENT
› PRE-FEASIBILITY STAGE



DESCRIPTION

Whilst currently only producing electricity, the 4 MW landfill gas engines at Lamby Way could potentially produce approximately equivalent proportions of heat and power1.

There is an opportunity for this heat to be beneficially used to provide heating and cooling for the council buildings at Lamby Way.

PROJECT 7

LAMBY WAY LANDFILL - SOLAR FARM

CATEGORY

› ELECTRICITY GENERATION
› 5 MW
› 4,500 MWH/ANNUM

INVESTMENT OPPORTUNITY

› FULFILLED
› PRE-PROCUREMENT
› FEASIBILITY STAGE

DESCRIPTION

There is an opportunity to install a solar farm on Cardiff Council's landfill site at Lamby Way.

The landfill site is planned to cease landfill operations in the Autumn of 2014, capping and restoration activities are due to be completed in 2015.
The circa 69 hectare site could in theory provide sufficient space for up to 15 MW of photovoltaic generating capacity although 5 MW may be more deliverable.

As a landfill site, waste settlement and protection of the engineered cap will be major factors to be taken into account on the overall design, installation and maintenance.

The scale of the farm would be dependent on the following:

- Site ground conditions
- Grid connection capacity
- Capital costs
- Future planned use of the land
- Planning constraints
- Renewable electricity subsidies

Cardiff Council is planning to use public sector capital to finance the scheme and to start procurement for the solar farm in 2014.

PROJECT 8

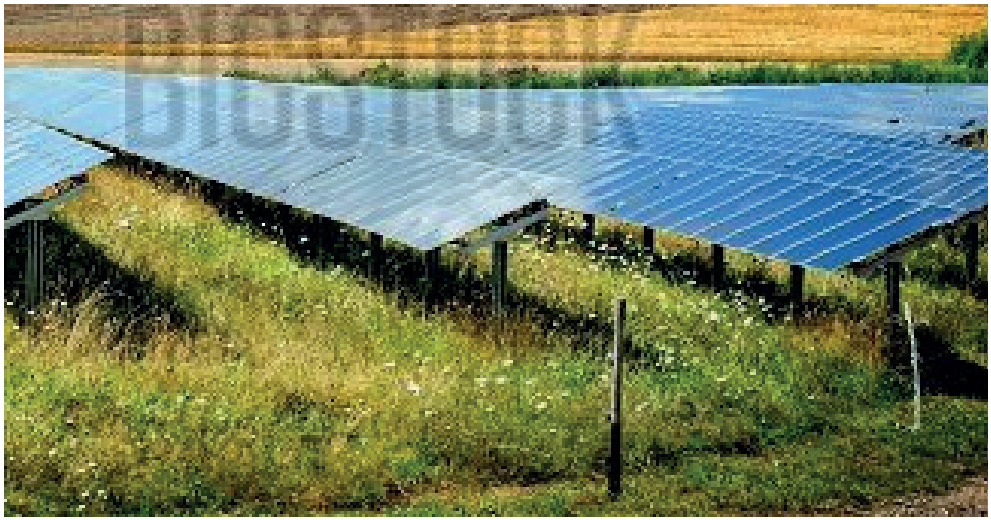
LAMBY WAY - BUILDINGS SOLAR PV

CATEGORY

› ELECTRICITY GENERATION
› 0.25 MW
› 215 MWH/ANNUM

INVESTMENT OPPORTUNITY

› FULFILLED
› PRE-PROCUREMENT
› FEASIBILITY STAGE



DESCRIPTION

There is an opportunity to install a solar photovoltaic system on the large roofs of the Lamby Way Recycling Centre. It is estimated that there is suitable space for approximately 0.25 MW of photovoltaic generating capacity. Cardiff Council is planning to use public sector capital to finance the scheme and to start procurement for the solar pv system in 2014.

PROJECT 9

RADYR WEIR HYDRO

CATEGORY

› ELECTRICITY GENERATION
› 0.4 MW
› 1,800 MWh/annum

INVESTMENT OPPORTUNITY

› FULFILLED
› PRE-PROCUREMENT
› FEASIBILITY STAGE

DESCRIPTION

The River Taff, along with many other river areas in Cardiff, provides opportunities to create constant renewable, clean sources of energy. The Council has immediate opportunity to exploit those areas that are within the council's direct control such as the structure and adjacent land at Radyr Weir.

The scheme proposed would be the largest of its kind in the UK (2x turbines with a 391kW total capacity) and would produce enough electricity to power 550 homes or the equivalent of five of the Authority's leisure centres (1,820,700kWh / annum). The proposed hydropower technology (Archimedean screw turbine) is considered "fish friendly" compared to other hydropower alternatives.

The scheme currently proposed would be funded on an Invest to Save basis; with a payback period estimated at of 7 years and assumes a 20 year guaranteed Feed in Tariff (FiT). This will however be the subject of a final business case assessment that will also consider all options for use of the income and length of the payback period. Cardiff Council is planning to start procurement of Radyr Weir Hydro scheme in 2014.

PROJECT 10

LLANDAFF HYDRO

CATEGORY

› ELECTRICITY GENERATION
› 0.2 MW
› 900 MWH/ANNUM

INVESTMENT OPPORTUNITY

› PRE-PROCUREMENT
› PRE-FEASIBILITY STAGE

DESCRIPTION

PROJECT 10

BLACKWEIR HYDRO

CATEGORY

› ELECTRICITY GENERATION
› 0.1 MW
› 450 MWH/ANNUM

INVESTMENT OPPORTUNITY

› PRE-PROCUREMENT
› PRE-FEASIBILITY STAGE

DESCRIPTION

PROJECT 12

OTHER HYDROPOWER

CATEGORY

› ELECTRICITY GENERATION
› 6.27 MW
› 19,440 MWH/ANNUM

INVESTMENT OPPORTUNITY

› ACTIVE
› PRE-PROCUREMENT
› PRE-FEASIBILITY STAGE

DESCRIPTION

In 2009, the Environment Agency published: "Opportunity and Environmental Mapping Sensitivity Mapping for Hydropower in England and Wales". This project assessed and mapped opportunities for hydropower and estimated the flow available, the maximum power potential, and the basic environmental sensitivity associated with exploiting them. It is the first phase of a wider programme of work that aims to make information available to developers and stakeholders, and to develop a more strategic approach to the sustainable deployment of hydropower.

A total of twenty-six sites, where there is sufficient height in river level to provide a hydropower opportunity and a power potential greater than 10 kW, are identified within the Cardiff administrative boundary. These sites are mostly weirs but could be other man-made structures, or natural features such as waterfalls.

PROJECT 13

ENERGY EFFICIENCY COUNCIL BUILDINGS (RE:FIT)

CATEGORY

› ENERGY SAVING
› 12,000 MWH/ANNUM

INVESTMENT OPPORTUNITY

› FULFILLED
› PRE-PROCUREMENT STAGE

DESCRIPTION

RE:FIT is a ready-to-use, cost neutral procurement initiative that allows the public sector to retrofit buildings with energy savings measures, reduce carbon emissions and achieve substantial guaranteed annual cost savings.

Energy Services Companies (ESCos) will install energy conservation measures in identified buildings and guarantee annual energy savings over an agreed payback period. This Energy Performance Contracting (EPC) model transfers the risk of performance to the ESCos as they must guarantee the energy savings to be made over the agreed payback period. Cardiff Council intends to procure its first phase RE:FIT project encompassing 18 buildings during 2014. The scheme would be funded by the Council on an Invest to Save basis.

PROJECT 14

ENERGY EFFICIENCY RETROFIT 2050

CATEGORY

› ENERGY SAVING
› 100,000 MWH/ANNUM

INVESTMENT OPPORTUNITY

› ACTIVE
› PRE-PROCUREMENT STAGE

DESCRIPTION

There are currently approximately 140,000 homes in Cardiff, many of which are energy inefficient, hard to treat and may have people living in fuel poverty. Even with the LDP's level of growth by 2050 the vast majority of the cities homes will have been built in the 20th, not the 21st Century. Retrofitting of these homes is essential to create an energy resilient city.

The Retrofit 2050 project estimates that there may be 98,000 cost effective retrofit measure opportunities for existing housing stock within Cardiff. This includes measures such as improved glazing; loft, cavity wall, solid wall and DIY floor insulation; improved air tightness; and insulation of pipe work and un-insulated hot water tanks. The project suggests that over £57.5m of investment would be required to implement these cost effective measures.

PROJECT 15

TIDAL RANGE - STEPPING STONES TIDAL LAGOON

CATEGORY

› ELECTRICITY GENERATION
› 600 MW
› 1,200,000 MWH/ANNUM

INVESTMENT OPPORTUNITY

› ACTIVE
› PRE-FEASIBILITY STAGE

DESCRIPTION

The Severn Tidal Power Feasibility Study highlighted many issues and uncertainties. This alternative proposal has been developed and informed by the STPFS outputs. It has been developed by Parsons Brinckerhoff with assistance from Black & Veatch.

The proposal is based on a tidal lagoon located west of Barry. It would not inhibit access to commercial ports in the Severn. It would be situated on a rock formation in a less protected environmental area (but still impacts on the East Aberthaw SSSI). It is significantly reduced in scale (600MW) but would still be the largest tidal power plant in the world. It is close to a grid connection at Aberthaw Power Station.

The construction cost is estimated to be £1.7bn, returning cost of energy at £193/MWh over a 30 year financing period. Over the 4 year construction period 4,000 jobs would be created (of which 2,000 would be local construction jobs) with a further 1,800 of associated indirect jobs in the local community. 80 permanent jobs would be created to operate the new power station. A key objective of the proposal is to be financeable in the private sector but developed in partnership with the public sector.

PROJECT 16

TIDAL RANGE - SEVERN TIDAL FENCE

CATEGORY

› ELECTRICITY GENERATION
› 400 MW
› 880,000 MWH/ANNUM

INVESTMENT OPPORTUNITY

› ACTIVE
› PRE-FEASIBILITY STAGE

DESCRIPTION

As part of the Severn Embryonic Technology Scheme (SETS) proposal, the Severn Tidal Fence Consortium (STFC) has studied the technical feasibility of an innovative approach to extracting energy from the tides. The STFC have proposed the use of a 'tidal fence system' as a method of extracting tidal power from the Severn Estuary whilst minimizing impact to the natural environment and shipping and importantly not impeding future commercial shipping developments.

The key findings from this initial analysis of the 'tidal fence system' are a 19km scheme located between Aberthaw and Minehead, utilising between 680 and 780 turbine units in a twin fence arrangement, delivered at a cost of £2.3bn returning cost of energy at £226/MWh. The economics of the