

EAST HERTS COUNCIL

ENVIRONMENT SCRUTINY COMMITTEE - 16 NOVEMBER 2010

REPORT BY EXECUTIVE MEMBER FOR COMMUNITY SAFETY
AND PROTECTION

6. CASTLE WEIR MICRO HYDRO SCHEME

WARD(S) AFFECTED: Hertford Castle.

Purpose/Summary of Report

- To present a capital investment proposal for the installation of a micro hydro generation scheme at Castle Weir, Hertford.

<u>RECOMMENDATION FOR ENVIRONMENT SCRUTINY COMMITTEE</u>	
(A)	The business case for the design and build of a micro hydro scheme at Castle Weir, Hertford be considered;
(B)	The comments of the Environment Scrutiny Committee be passed to the Executive for consideration at the 7 December 2010 meeting of the Executive.

1.0 Background

1.1 On the 11 May 2010, The Executive considered a report on the refurbishment of the former Castle Hall. Part of that report included reference to the development of a micro hydro scheme adjacent to the Hall at Castle Weir, funding for which is included in the capital programme. At that meeting it was agreed to refer the development of a business case for the Scheme to the Environmental Scrutiny Committee for comment, once the national picture on Feed in Tariff payments had become clear. The comments of the Environmental Scrutiny Committee will be passed to the next meeting of the Executive to be held on 7 December 2010 for their consideration.

1.2 The report below introduces the proposal for a micro hydro scheme at Castle Weir and sets out a business plan for the project along with a draft timetable for the works.

2.0 **Report**

2.1 Hydro power systems convert potential energy stored in water at height to kinetic energy through a turbine to produce electricity. Officers have undertaken a feasibility study for the River Lea in Hertford and specifically Castle Weir which is close to Hertford Theatre. This has indicated that through the installation of a small scale micro hydro system a significant element of the electricity demand for Hertford Theatre can be generated.

2.2 Castle Weir is on the site of an old mill which has long been demolished. However, the waterways and structures left behind provide a convenient opportunity for a new hydro electric power scheme. In addition an attractive option for directly utilizing the power generated is to connect the hydro plant to the phase switchboard at the rear of Hertford Theatre building at the south side of the weir.

2.3 A set of manually operated sluice gates, which can divert flows through a specific river channel, exist at the weir site. In practice these gates are never used, although the mechanisms have been refurbished in the last few years. This location offers an attractive site for a mini hydro system. There is good access to the sluices via the car park on the north bank.

2.4 The net head of water passing through the site is considered to be 1.3 m for design purposes. Some flow (known as the compensation flow) would be left to pass over the weir, for visual purposes and to allow fish to continue to move downstream.

2.5 There are two principal types of hydro system- Kaplan propeller and Archimedes screw. The modern type of turbine traditionally used for low head sites such as Castle Weir is a

Kaplan propeller type machine. The system employed will need to take account of variable flows whilst maintaining good efficiency, in order to maximize energy capture from the river in both the summer and winter months. There are various arrangements for installing a propeller turbine, but for heads below 2 metres a siphonic design is usually employed. This sucks water up above river level before dropping through the turbine. A trash screen, to prevent debris reaching the propeller, and which importantly will also keep out fish, is also required. To maintain efficiency the screen would be fitted with an automatic cleaner to ensure it remains clear of debris at all times.

- 2.6 An Archimedes screw system is considered less suitable at the current time due to its larger footprint, additional engineering works required, lack of variable flow and the potential for possible vandalism due to its more exposed nature, although it is inherently more fish friendly. However, technology for micro turbines is rapidly evolving and officers will continue to explore the various options through the tendering process.
- 2.7 The installation costs for a suitable Kaplan type system favoured for this site are estimated at approximately £130,000 plus basic construction works. At the current time certain renewable energy generation schemes attract what are known as 'Feed in Tariff payments'. In late August these were clarified by the Government, firstly in relation to the payments which a Hydro Scheme would attract (as they were originally set up with other renewable energy generation methods in mind). Secondly, the Government lifted the ban on Local Authorities generating their own electricity and selling it to the grid. It is believed that these tariffs will make the installation of a Hydro scheme at Castle Weir significantly more attractive. It is worth noting that Feed in Tariffs are not financed by the Government but through a levy on the cost of energy, which we all pay through our utility bills.
- 2.8 In summary Feed in Tariffs allow the generator, in this case East Herts Council, to be paid a set sum for every unit of energy generated for their own use (19.9p per kW), plus

receive an additional export payment of 3p per unit exported to the grid (i.e. not used on site), and of course benefit from the saving in actual electricity not purchased from the national grid. The payments are on a set basis for a full term of 20 years and are linked to the Retail Price Index (RPI). The full payback of this scenario is explained in Essential Reference Paper A, but is estimated to be between 7 and 7.5 years, based on an estimated capital cost of between £157,500 and £165,500 which principally depends on the aesthetic treatment given to the plant house.

- 2.9 A summary of the costs and income from the scheme is shown at **Essential Reference Paper 'B'**.
- 2.10 If the Executive, at its meeting of 7 December 2010 is minded to accept this business case then the tender, planning and consents programme would be able to start in December 2010, as initial preparatory work has already been undertaken by officers. It is the intention to start on site in June 2011 assuming all the necessary steps progress smoothly.

Activity	Indicative Date
Out to tender	December 2010
Planning Pre-application	December 2010
Seek Environment Agency Consents/ Planning Consent	December 2011
Planning Consent Granted	March/April 2011
Confirmation of Microgeneration Certification Scheme Contractor Status (required to achieve tariff payments)	March/April 2011
Tender Award (subject to Planning approval)	March/April 2011
Start on site –assuming 8 week average lead in for turbine	June 2011
Works period (during period of lowest flows)	June/July 2011
Commissioning	July/August 2011

- 2.11 Along with exploring potential payback from the project officers have been in discussion with the University of Hertfordshire; Renewables East; BRE; and the Environment Agency to discuss appropriate technology. The agreement of the Environment Agency (EA) is key to the success of the project as licences have to be obtained to undertake the works as in theory it interferes with the river flow. The EA's main concern with hydro schemes is one of safety to fish in the river and this is mainly resolved through the use of effective screens. The hydro plant should not be considered a flooding risk by the EA due to the minimal flows through the current sluice gates which is the proposed site for the turbine.
- 2.12 The visual aspect of the hydro plant is relatively minor and in many ways it is perhaps beneficial to have some visual presence in order to show case the project. Officers intend to investigate the potential for interpretative signage adjacent to the hydro scheme to explain the technology and some of the history of the site. In addition it is hoped that it may prove feasible to provide a publically visible meter display to demonstrate the electricity being produced at any one time by the turbine. It may be possible to achieve this either on site or via a web based system linked to the East Herts web site. As Castle Weir is in a conservation area planning approval for the hydro plant would be required. Informal discussions with Development Control are therefore underway.
- 2.12 Small scale Hydro is a very efficient, reliable, low maintenance technology with a long life expectancy (25 years+) with maintenance likely to be in the region of £800 per year. But the Council is already responsible for the maintenance of the weir and it is anticipated general maintenance (i.e. cleaning of the intake screens) should not increase from that which is currently carried out.
- 2.13 One of the main attractions for the installation of a hydro scheme at Castle Weir, in addition to the energy saving and significant carbon reduction that would be achieved is the

likely high level of public and media interest along with considerable kudos for the authority. Hydro power schemes are relatively rare in the UK and particularly so in a lowland area like Hertford. As well as this, it is believed that this would be one of the first examples of a community theatre in the UK to be powered directly and substantially by hydro electricity.

Background Papers

None.

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ESSENTIAL REFERENCE PAPER 'A'

<p>Contribution to the Council's Corporate Priorities/ Objectives <i>(delete as appropriate):</i></p>	<p>Pride in East Herts <i>Improving standards of the built neighbourhood and environmental management in our towns and villages.</i></p> <p>Shaping now, shaping the future <i>Safeguard and enhance our unique mix of rural and urban communities, ensuring sustainable, economic and social opportunities including the continuation of effective development control and other measures.</i></p> <p>Leading the way, working together <i>Deliver responsible community leadership that engages with our partners and the public.</i></p>
<p>Consultation:</p>	<p>Consultation with the Environment Agency is underway.</p> <p>Local residents will be consulted through the usual planning processes.</p>
<p>Legal:</p>	<p>No specific implications</p>
<p>Financial:</p>	<ul style="list-style-type: none"> • <i>Estimated costs are based on the installation of a 12kW Kaplan turbine system producing 80,000kW per year.</i> • <i>In 2009/10 Castle Hall had an annual electricity consumption of 318,000kWhr at a cost of £27,000.</i> • <i>Current unit rates for electricity are 7.895p day and 5.212p night.</i> • <i>Electricity consumption at the Hertford Theatre will vary significantly both seasonally and across the day. The Castle Weir hydro will generate electricity continuously (subject to river levels). At off-peak times the hydro may generate more electricity than Hertford Theatre can use, and this if this was the case this can be fed into the Grid. On average, it will deliver approximately 25% of the annual electricity demand of Hertford Theatre based on 2009/10 usage. This equates to a saving in carbon emissions of approximately 60 tonnes CO2</i>

equivalent per year (based on electricity from coal fired sources)

- The annual value of electricity produced by the turbine would be approximately **£22,400**, dependant on negotiation with the utility company partner through whom tariff payments are accessed, possibly an additional £1200 per export tariff payment. Note this additional payment has been excluded from the payback assumptions below.
- Total value of tariff plus estimated electricity saved over 20 years is £448,000
- Annual maintenance is currently estimated at £800, although this will be funded from existing budgets.
- Capital costs of the turbine and plant are estimated at £130,000. In addition an estimated £27,500 to £35,500 is required for civil works namely the plant house and associated infrastructure giving an estimated total capital cost of **£157,500 to £165,500**. This equates to an approximate payback of 7 to 7.4 years excluding any potential benefit from the export tariff.
- Other project costs include £320 for Environment Agency Licences plus local newspaper advertising and costs of the initial planning application. Licences may need to be required after 12 years, but officers intend to seek life time consent as a matter of course. A provision for these is included in the capital costs
- If the Executive is minded to approve the business case a sum of £157,500 will be submitted for inclusion in the Capital Programme for 2011/12
- Sensitivity Analysis
The table below details the impact upon the payback period in the event of a 10%, or 20% variation in costs in either direction.

	0%	-10%	+10%	+20%
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	<i>Basic Construction Works</i>	<i>£157,500 7 years</i>	<i>£141,750 6.3 years</i>	<i>£173,250 7.7 years</i>	<i>£189,000 8.4 years</i>
	<i>Enhanced</i>	<i>£165,500 7.4 years</i>	<i>£148,950 6.6 years</i>	<i>£182,050 8.1 years</i>	<i>£198,600 8.9 years</i>
	<ul style="list-style-type: none"> <i>Note if energy prices continue to rise, as would seem likely then clearly the value of electricity generated by the turbine and which is used to offset grid electricity will assist with reducing the payback period.</i> 				
Human Resources	None				
Risk Management:	No specific implications				

ESSENTIAL REFERENCE PAPER 'B'

Summary of Financial Implications and Payback Period

Capital

Cost of scheme	£157,500
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Revenue

Income from Feed In Tariff	£15,920
Electricity Generated	£6,480
Total Annual Income	<u>£22,400</u>

Payback Period

7 years

Additional income generated after payback over the 20 year tariff period = £290,500