

Design and Access Statement

We own an off-grid cottage, Hafod y Rhedrwydd^{1,2}, which we run as a holiday let. Over 600 families have enjoyed holidays there in the past 16 years; they appreciate the unspoilt wilderness, wildlife and views. Heating and cooking are provided by an oil-fired Rayburn, water is from a nearby spring and electricity is by petrol generator. The generator is run only when necessary since it consumes petrol even when idling. It is also noisy and unreliable if mistreated.

A steady electricity supply would be a great convenience for our guests. It would run the satellite broadband system and VOIP phone (useful in the absence of any mobile coverage), lights, a refrigerator, save several litres of petrol per day and avoid the need to handle petrol cans. Most importantly, it would enable us to run a UV steriliser instead of providing bottled drinking water. The petrol generator will be retained as back-up and to cater for high-power loads in dry weather.

A grid connection is not an option since the cottage is 2 km from the nearest power lines. A line of poles would also be visually unacceptable. Solar and wind-powered electricity sources would be similarly unacceptable and are too weather-dependent for a reliable off-grid supply.

A micro-hydro system is ideally suited to the location: the stream behind the cottage provides a head of 150 m so that even a modest flow will generate useful power. In dry weather (the 95th annual centile, 10% of the time in summer) a turbine flow of 0.6 litre/second will generate 350 Watts. This corresponds to 15% of stream flow at the Q95 point, rising to a maximum of 24% in the driest conditions. Wetter weather will allow higher powers up to a net output of 9 kW: this will assist with heating as well as reducing CO₂ emissions from burning oil and petrol.

The system has been designed to be highly reliable and need no interaction from guests. The provision of two turbine-alternator sets (a main one plus a small one for very dry conditions) will allow continued operation while one set is dismantled and serviced.

The Rayburn is currently used only when guests are due or present and it can take several days for the cottage to warm up. The provision of some background heating via electric radiators in each room will significantly improve thermal comfort, as will the more generous hot water provided by an immersion heater.

The penstock as it runs down past the cottage will tee-off to deliver an improved domestic water supply. This will overcome reliability issues with the existing spring in very dry weather and provide the pressure needed for a filter in front of the steriliser.

The water extraction system has been carefully designed to restrict the maximum flow rate, thus avoiding any significant adverse effect on the stream's ecology and facilitating the passage of fish up and downstream. Access for servicing will involve a 380 m walk up behind the cottage. Construction equipment will pass over the knoll behind the cottage to avoid steep side-slopes.

The pipe and cables will be buried to make them invisible. There will be no change to the appearance of the cottage. The risk of any environmental damage during construction will be minimised by only using light-weight equipment (e.g. 1.5 ton mini-digger and power barrow). Turf and top soil will be separated during trench-digging to allow replacement afterwards.

The turbine hut will have traditional slate walls and a turf roof. The hut is no larger than necessary: with a floor area of 7.6 m² and internal height of 1.5 m, maintenance of the equipment will involve sitting on a stool. The hut will be built into the foot of the hillside with any spare soil building up the

ground level on the uphill side. Together with the turf roof, this will ensure it is essentially invisible from the road (170 - 280 m away) and practically silent in operation. Access is via an existing track down from the cattle grid at the edge of the forest; this is steep (1 in 3.2) but within the capabilities of (for instance) a Freelander or any serious 4x4.

Notes:

1. There are a variety of historical spellings including Rhedrwydd, Rhedwydd and Hafodyredwydd. "Rhedrwydd" was the name when we purchased it.
2. [Photographs](#) of the cottage and surroundings, [website](#).