Cyd Ynni

Project Assessment and Feasibility Report

Confidential

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1. Introduction

1.1. Overview of project

Cyd Ynni is a group 5 community energy projects in North Wales. Cyd Ynni has appointed Juno to identify options, assess costs and practicalities associated with supplying local electricity users with locally generated and community-owned electricity.

The organisation financing the work is Menter Môn. It is a rural economic development agency, delivering the LEADER programme in Gwynedd under the name of Arloesi Gwynedd Wledig.

There are three parts to the work (Lots 1 to 3 below) which are distinct and considered separately.

1.2. Juno Energy Background

Juno Energy has been operating in renewable energy since 1999 including development of a portfolio of community renewables projects. It has a depth of experience with innovative community projects that it is very well suited to supporting community energy organisations with the progression of these schemes.

In summary Juno Energy offers:

Development Services – Juno comprehensive experience in feasibility and development from initial assessments through business planning, to formal leasing, planning and licence applications and EIA. We have gained this in our 5 previous tidal site development projects, over 60MW ground mounted solar sites and three local energy projects. Our multidisciplinary team is able to help with:

- Site feasibility – Engineering, financial estimates, stakeholder consultation, environmental considerations
- Innovative business model development and community energy projects including local supply models and detailed consideration of matching generation to demand over the public networks.
- PPA procurement and negotiation for renewable energy projects
- Contract negotiation and achieving commercial agreements in multidisciplinary teams
- Surveys – Bathymetry, spacial flow surveys, ADCP deployment, species specific method development and definition, Ecology, Topology and ground investigations
- Planning applications – Managing the planning process and producing all necessary documentation.
- EIA Management – Scoping, EIA, ES, NRA, multidisciplinary team building and management
- EIA specialisms – Modelling, LVIA, EMF, CFD, Collision assessments, Glint and Glare, Montages.
- Lease and Legal – Negotiation of Option and Lease documentation from simple wayleaves through to Crown Estate leasing round bids.
- Procurement - From surveys to full EPC construction contracts for MW scale renewables projects.
- Project Management – on behalf of a variety of public and private sector clients, with financial management and change management controls.

Engineering Services – The Juno team have 18 years experience in renewable energy engineering and electrical connections with the primary focus on tidal and solar and fundamentals of hydro and wind.

The team have experience in all areas of renewable energy engineering development from initial project sizing to array planning and grid connection. In electrical connectivity, tidal, solar and storage we have the capacity to undertake outline scheme design and sizing. Our services include:

- Concept design – site configuration and optimisation
- Outline costing and feasibility of electricity connections
- Storage specification - sizing and market analysis
- Grid connection – Optioneering, subsea/land – based connection and grid connection applications, equipment specification and cost estimation
- Cost and performance analysis – Full end to end business case development

Local Energy Projects - Juno is currently working towards a combined 1MW solar storage and local supply project in Swansea with support from WEFO as announced by Mark Drakeford on 5th December 2018. This project is being delivered in partnership by Juno, Gower Power, Bristol Energy, Origami and RedT. The project is currently in the feasibility and development phase, with Juno leading and undertaking a project management role. This has identified a series of direct electricity sales models, sized the storage system, assessed grid revenues and the activities required for development, alongside the legislative requirements such as the Balancing System Code. The project has been invited to apply for the current Ofgem sandbox for innovative electricity supply arrangements and will use Smart Meters to balance supply and demand locally.

Also, in Bridgend, a desktop study was undertaken to identify possible community energy projects in the rural wards of Bridgend County Borough Council. These could help BCBC meet its obligations under the Well Being and Future Generations Act. The study undertook opportunity mapping, screening and feasibility, centred around identifying potential renewable energy generation sites and matching with public sector and private sector energy demand. This considered different methods of physically supplying energy to the sites and also the local supply mechanism and structure required for the energy sale. link (note this was £7,500 + VAT)

Juno has also undertaking a feasibility study to examine extending the scope and benefit of an existing 50kW solar array and 150kWe woodchip CHP system in East Lothian by developing an appropriate direct electricity supply model for local residential and business consumers. If feasible, this would be achieved by installing a battery storage system on site, with the aim of balancing export to key periods of consumer demand. In addition, this may be able to be used in the network balancing markets to further improve the revenue stream. The intention is that a direct supply model, at times of peak demand, can be used to improve generation income for the renewable generator whilst also improving the energy offering for the cooperative of consumers. Members of the community could invest and/or consume electricity from the project. The new system will not make use of any subsidy such as FIT or RHI and will be able to be delivered in 2019.

Other notable projects

Gower Regeneration

Juno delivered the 1MW community solar farm at Killan that has received an award of Best Community Project 2017 link in part for the recognition of the successful delivery under very tight timescales and site complexities. This 1MW array is the first solar farm in wales that will be owned by a public share offering. Business planning and financial modelling has been undertaken in support of the community share offer. Financed by the Welsh Government, the site is in South Wales is located on the boundary of an Area of Outstanding Natural Beauty on

historic coal minings. It required detailed design to accommodate complex topology and maintain visibility screens without compromising on panel shading. Procurement for EPC was undertaken and the project then successfully delivered on time prior to the subsidy reduction deadline.

Morlais Demonstration Zone

This 100MW community owned tidal stream project link is being developed to accommodate some of the first commercial tidal stream projects in the UK. Juno's role supporting the Project Board has included production of detailed financial models, business plans, securing seabed lease, procurement of design and consenting teams and design and site planning. Juno also undertaken resource modelling, stakeholder engagement, landowner approaches, risk assessment and contract negotiation. Juno was responsible for all documentation with respect to the sub-leasing process and assisted with the £18m Welsh European Funding Office grant application.

Locogen Solar Portfolio

Delivering a portfolio of ground mounted solar array sites for award winning Renewables specialist Locogen, Juno's role was to drive the projects from inception to completion. This included setting up circa 100MW of projects including site finding, landowner agreements, site design and financial performance analysis, securing grid connection, managing the planning applications with EIA, project sale agreements, construction point of contact and clearance of conditions precedent to the sale.

GSK Montrose

Juno delivered and Environmental Impact Assessment for GSK Montrose link which was a complex consent project. This 1MW tidal stream site on the east of Scotland was proposed as an iconic site for GSK, located adjacent to their Montrose manufacturing facility. The proximity of the site to the Ramsar, SPA and SAC in the Montrose basin gave rise to significant consenting challenges which required highly innovative environmental assessment methodologies. Juno was responsible for developing the project proposals including site design, budget, phasing and offshore operations.

Financial modelling and planning experience

In consultation with project partners and aggregators, Juno has developed a novel financial model to assess local storage and supply. This brings together technical aspects and market drivers to provide a platform for optimisation of local network demand matching systems.

Juno has developed the innovative Morlais business financial model in collaboration with the CEO. Juno also ran a portfolio of solar projects for Locogen Ltd, which involved financial modelling including multivariable forecasting. Juno has undertaken numerous feasibility studies in tidal stream including a financial assessment, including in accordance with GSK processes.

Juno also established a Business Plan with the primary goal of building an integrated, UK, end to end, tidal power company, undertaking a £5bn roll out of 820 tidal power turbines around the UK.. The team disaggregated the core activities required to successfully develop the tidal power sector, splitting the corporate structure into five key modular corporate entities and financial modelling for each.

1.3. Cyd Ynni Background

Cyd Ynni is a collaboration project between 5 community-owned renewable energy companies. The individual companies have a successful track record in terms of delivering renewable energy projects and energy-efficiency projects. There is currently an installed capacity of approximately

400kW. Each of these have plans in place to improve and expand in terms of generation capacity, reducing fuel poverty and exploring new and innovative opportunities. Over the next 3 years, the installed capacity will increase to approximately 950kW.

The 5 member groups are Ynni Anafon, Ynni Ogwen, Coetir Mynydd, Moelyci and Ynni Padarn Peris, all in northern Gwynedd. The collaborative Cyd Ynni project, established in March 2018, is administered by Datblygiadau Egni Gwledig (DEG) on behalf of these community-owned companies. There are 2 members of staff working on the Cyd Ynni project, supported by the Big Lottery Fund, with the purpose of increasing the capabilities of the 5 individual groups and fostering increased collaboration and co-operation.

Recent accomplishments include renewable electricity generation from a 270 kW hydro turbine at Abergwyngregyn (Ynni Anafon), a 100 kW hydro turbine at Bethesda (Ynni Ogwen), a 55 kW hydro turbine at Llanberis (Ynni Padarn Peris). The area also saw the establishment of an 'Energy Local Club' in Bethesda to supply local domestic properties directly from the community-owned hydro. Plans are in place for further developments including a network of electric vehicle charge points, a 200kW Solar PV installation paired with an on-farm AD plant, a 240 kW hydro, a new 100kW wind turbine, as well as exploring options regarding heat networks.

1.4. Project Background

Lot 1 - Afon Goch Hydro, Llanberis

An assessment is undertaken for the potential for a private wire between the Afon Goch Hydro scheme (owned by Ynni Padarn Peris) and the Youth Hostel Association premises in Llanberis.

Ynni Padarn Peris have installed a 55 kW hydro turbine on the Afon Goch in Llanberis (Google map coordinates = 53.116558, -4.132016), which has been operational since mid-2017. The first 10 months of operation produced 205 MW of clean electricity.

Near the turbine house, and immediately adjacent to the grid connection point, is the Youth Hostel ("YHA Snowdon Llanberis").

All planning documents, including scheme layout, for this Hydro can be viewed on the local planning authority's website-

https://diogel.gwynedd.llyw.cymru/swiftlg/apas/run/WPHAPPDETAIL.DisplayUrl?theApnID=C15/0801/15/LL&theTabNo=3

This project aims to scope and cost a private wire and metering arrangement to link the Afon Goch Hydro scheme and the Llanberis Youth Hostel and develop a Power Purchase Agreement to facilitate the local supply arrangement.

Lot 2 - Afon Galedffrwd Hydro, Mynydd Llandygai

An options appraisal and business case is undertaken for the sale of electricity from the proposed 240 kWp hydro turbine. This relates to the type of connections between the generator and potential commercial/industrial customers nearby.

The Afon Galedffrwd hydro is being developed by Coetir Mynydd. It will be powered by 3 x 80 kWp turbines which will all be part of a single system. The proposed location of the turbine house (Google Maps: 53.175493, -4.074089) provides several options in terms of connections. A

substation is located within 250m of the turbine house for grid connection. Bradite Paint/Little Greene, a large paint factory, has already expressed an interest in purchasing directly and is situated between the turbine site and the above-mentioned substation. Two other small industrial estates are close to the turbine house and have held discussions with the community group developing the hydro scheme - some interest has been shown but no agreement in principle. Another potential option is to supply domestic properties via the Energy Local model, as there is an existing scheme in the area.

This scheme will be funded by a community share offer. Construction should commence in mid/late 2019.

This project undertakes an options appraisal for the sale of electricity from the proposed Afon Galedffrwd Hydro turbine to potential commercial/industrial customers nearby then develops the business case and structure and makes recommendations on how best to progress and develop the scheme with the required partners and legal structures.

Lot 3 - Energy Local Club for Commercial Customers, Bethesda

The brief is to explore viability of creating a commercial/industrial equivalent (or similar) of the Energy Local Club in the Bethesda area.

The area of Bethesda has a successful Energy Local Club in existence, based on the model created by the Energy Local organisation. This allows domestic properties within the grid connection area to purchase their energy from a local generating source - in this case a 2 x 100 kW hydro turbines located in the area. For that scheme, the administration and billing is done by Co-operative Energy. Co-operative Energy do not supply to commercial/industrial customers. There are a number of micro, small and medium sized enterprises within the area which could potentially benefit from a supply of clean electricity.

The work in this project assesses the viability of creating a local industrial supply model in the Bethesda area to enable the local consumption of the output from 2 x 100kW hydro turbines. This includes identifying partnership opportunities with electricity suppliers that may be needed to establish such a scheme.

2. Afon Goch Hydro / YHA Llanberis (LOT 1)

Padarn Peris, the owner of the Afon Goch hydro scheme wishes to install a private wire supply to YHA Llanberis to facilitate energy price certainty savings to YHA and enhanced revenues for Padarn Peris.

Two options are considered; **Option A** proposes that YHA Llanberis transfers its electricity connection from the SPEN network to the LV circuit in the Metering Cubicle owned by Padarn Peris at the rear of the property. **Option B** proposed that YHA Llanberis adopts a dual supply with an automatic switch that would operate when the hydro was generating. Note that having researched Option B, it appears that it is not compliant with SPEN requirements for a single point of supply to a property and hence is not viable. The assessment of the concept is included in the report for completeness.

A Power Purchase Agreement is required to govern the supply of electricity to YHA (the Offtaker) by Padarn Peris (the Generator). The exact form of this depends on the Option used as above.

An example PPA agreement has been provided which envisages a situation in some ways similar to Option B, however it will require significant re-working and legal sign off prior to being adopted. A Heads of Terms is provided for a PPA for Option A at Appendix 1.

2.1. Option A – Transfer of supply to Padarn Peris

This arrangement is proposed as follows:

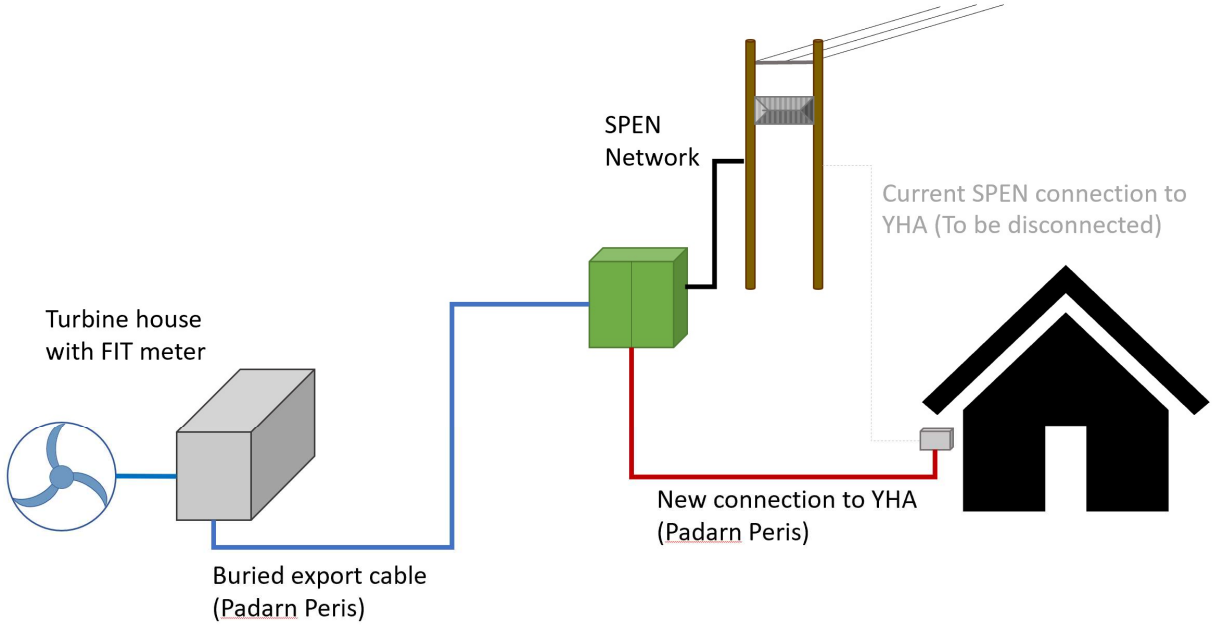


Figure 1 - Option A Concept Drawing

Resulting in the following energy flows:

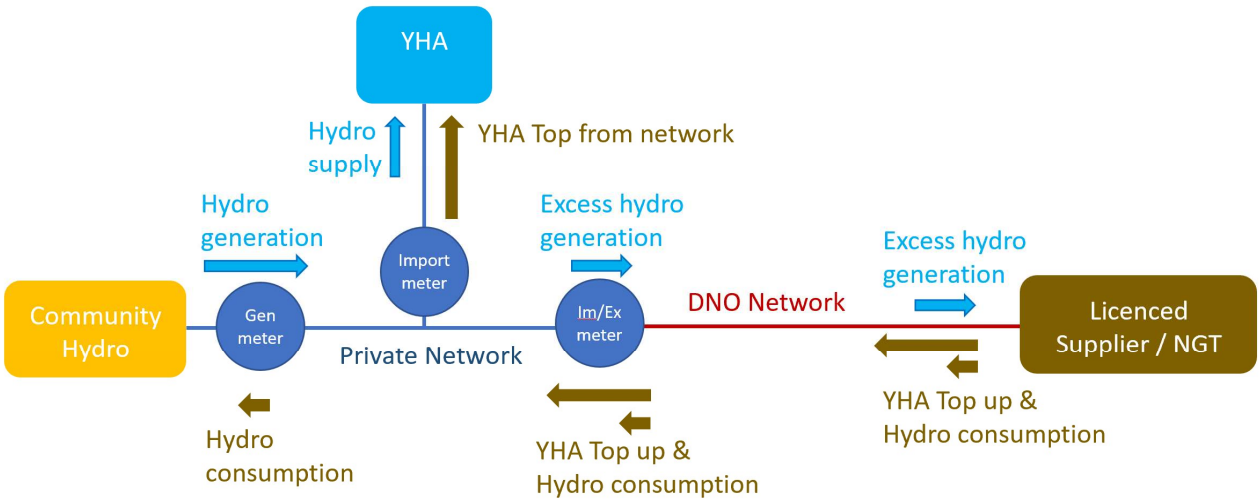


Figure 2 - Option A Energy Flows

Assessment of Option A

Option A offers the advantage that YHA would nolonger pay standing charges in respect of their SPEN connection. However YHA would then be reliant upon the grid connection of Padarn Peris and whilst it is technically possible to reduce this to an insignificant additional risk of outage

(using independent isolators direct from the SPEN supply), there would still be a commercial risk in that Padarn Peris would effectively be able to disconnect YHA. This can be addressed in the PPA and given the low level of costs involved in re-connecting the supply in the event of termination, it maybe that this risk can be successfully mitigated by making an allowance to share any re-connection costs with Padarn Peris.

There is additional complexity in the PPA, as the full volume of YHA supply must be addressed with back to back terms with a third party licenced supplier. Also, whilst a minor consideration, it is not possible to accurately measure the Hydro imported electricity with the current (FIT accredited) metering arrangement. It would add a reasonably significant cost and risk to change the generation meter to an import/export version given the need for re-accreditation, so would be simpler to base the calculation of imported power on an estimate. This is likely to be acceptable given the small volumes involved.

The draft Heads of Terms for a PPA for Option A is at Appendix 1.

2.2. Option B – Dual supply to YHA with ATS switch

NOTE THIS ARRANGEMENT MAY NOT BE COMPLIANT WITH UK NETWORK REQUIREMENTS. THE BELOW DESCRIBES BUT DOES NOT RECOMMEND THIS SET UP.

This arrangement is proposed as follows:

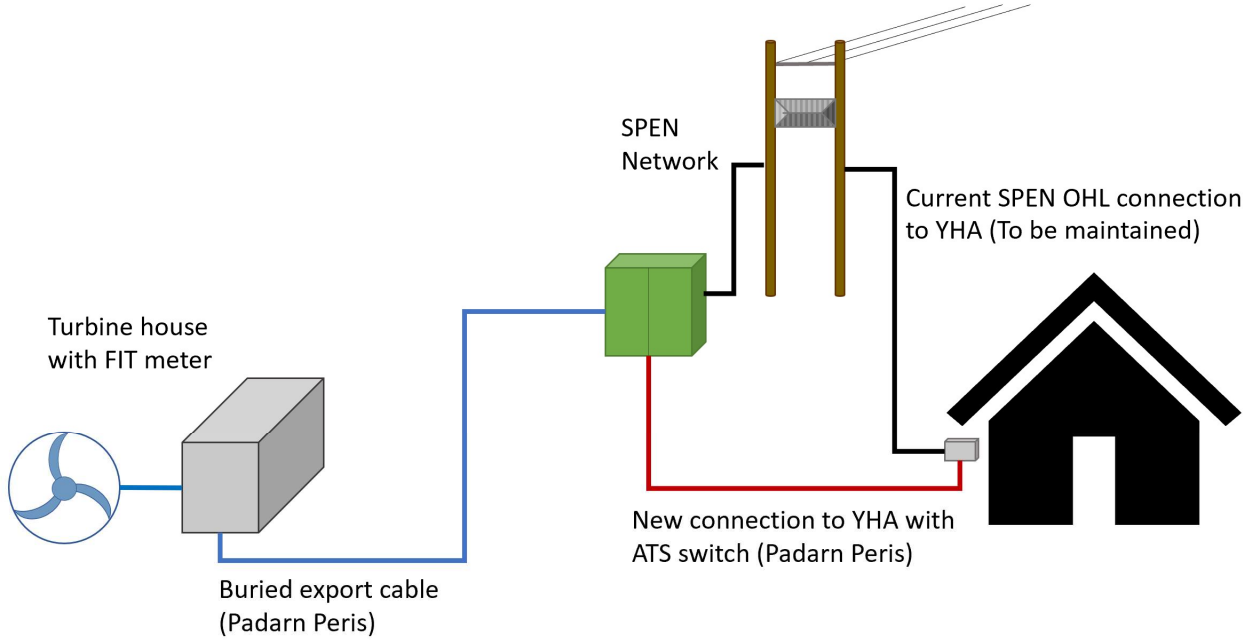


Figure 3 - Option B Concept Drawing

Resulting in the following energy flows:

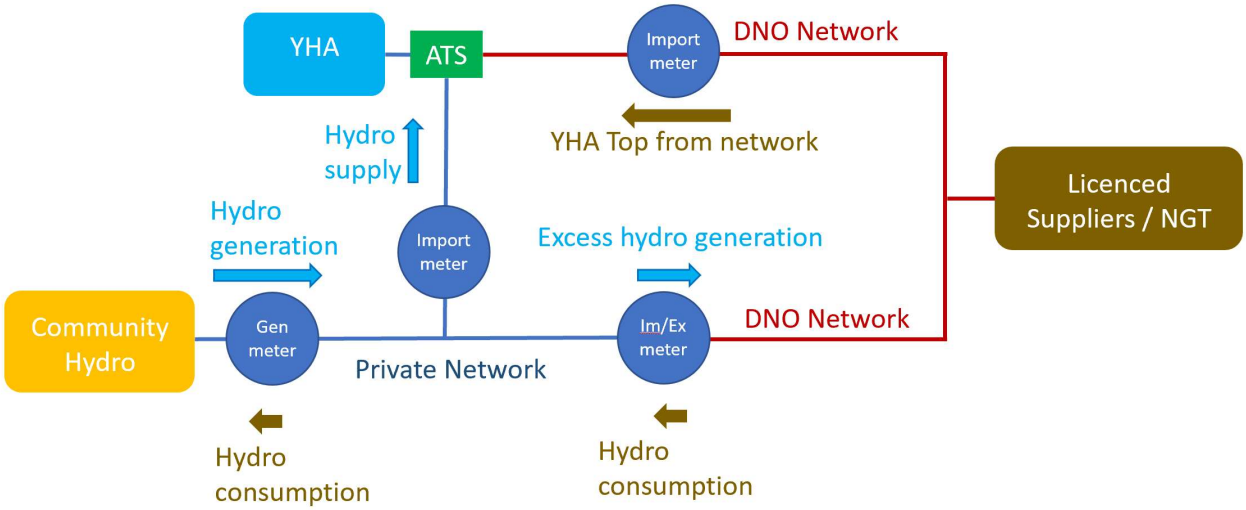


Figure 4 - Option B Energy Flows

Assessment of Option B

Whilst Option B would require YHA to continue to pay standing charges in respect of their SPEN connection, this is off set against the removal of disconnection and re-connection costs to SPEN. Also, there is an increase in capital cost owing to the requirement for an ATS switch to allow switching between the hydro and SPEN supplies when the hydro was not operating.

The primary advantages of this Option are that YHA are not dependent on Padarn Peris for their electricity supply which takes some of the complexity out of the PPA, and that the need for Padarn Peris to arrange a back to back PPA with a licenced supplier is eliminated. Further to this, the Hydro consumption nolonger features in the PPA equation.

SPEN have indicated that there are a number of potentially serious issues with Option B and that it would be considered an 'interconnector' and would not comply with the principle of a single point of supply to a customer's premises. This is because of the need to be able to isolate the system in an emergency and to avoid the customer inadvertently interfering with the SPEN network and metering and fault protection.

Lastly, the 'template' PPA as provided by the client envisages a situation very similar to this Option B and hence would require a potentially significant lower level of legal re-working. This is included at Appendix 2.

2.3. Metering and billing

The objectives are to optimise capital and operating costs to offer the most economically advantageous metering solution without introduce additional project risks. Given that the generation profile of small hydro is typically fairly consistent over a 24 hour period (See figure 5 showing Afon Goch data) it is not considered that a time of use tariff offers a benefit that is worthy of the additional complexity it would cause.

However, given the very close proximity of the YHA to the hydro plant, the energy users would be aware that power would be cheaper if there was a lot of precipitation in the area.

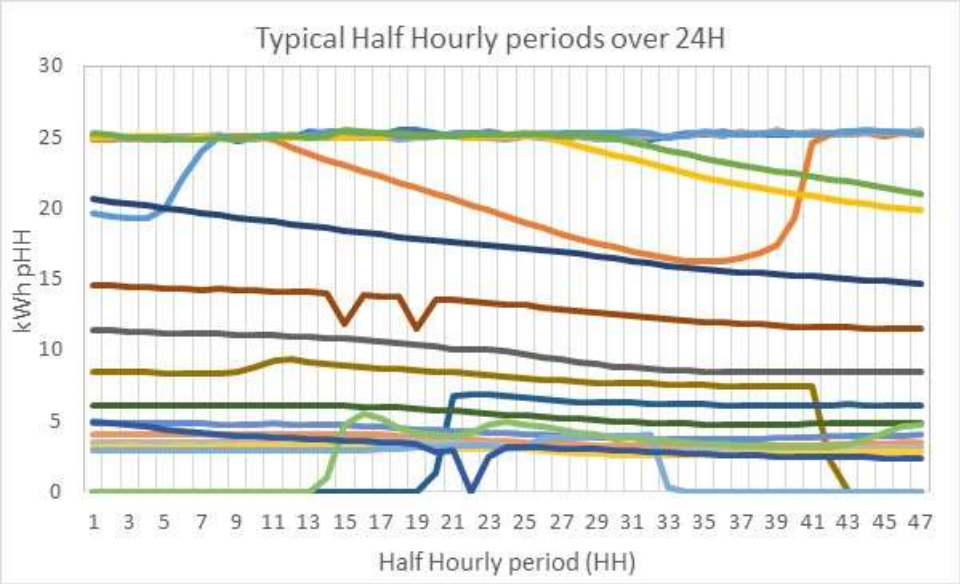


Figure 5 - Typical daily generation profiles for Afon Goch

For this reason, it is not considered of significant benefit to meter on a half hourly basis, nor to install a smart meter at YHA. It is therefore expected to be possible to use the existing YHA import meter.

In terms of other constraints, the Total Generation meter in the turbine house, is accredited for FITs so to avoid complication it is proposed to leave this unchanged.

Metering will be undertaken monthly by the Offtaker and read jointly by the Offtaker and Generator on a quarterly basis (with a representative present). An invoice would then be sent by the Generator to the Offtaker.

Specifics for Option A

- The Offtaker metering will be undertaken using the existing meter installed in the property [Offtaker meter]. This will be used to provide a total delivered volume (Offtaker Supply)
- The Offtaker Supply comprises supply from the hydro (Hydro Supply) and top up supply from the network (Top up supply)
- Such that Offtaker Supply = Hydro Supply + Top Up Supply
- The total Hydro Generation will be metered using the existing meter in the turbine house [Total Generation Meter]
- The Total Import from the SPEN network will be metering using the existing meter in the Metering Cubicle (Import / Export Meter)
- As the Hydro plant does not currently meter import at the turbine house, and it is expected to be minimal, the Hydro self usage will be calculated by using the average quarterly import for the 12 months prior to installing the private wire (Hydro consumption)
- The Top Up Supply will be calculated using the following equation on a quarterly basis:
- Top Up Supply = Total Import – Hydro consumption
- Hydro Supply = Offtaker Supply – Top Up Supply

Specifics for Option B

- The Offtaker metering would be undertaken using the new meter installed in the property [Offtaker meter]. This will be used to provide the volume of supply from the hydro (Hydro Supply).

2.4. Outline financial assessment

2.4.1. Cost comparison of Options

Option A		**Option B**	
Capex		**Capex**	
Disconnect SPEN supply	£ 250	Disconnect SPEN supply	N/A
Electrical connection works	£ 2,500	Electrical connection works	£ 2,500
Civil / Building works	£ 500	Civil / Building works	£ 500
ATS switch	N/A	ATS switch / protection	£ 1,000
Re-connection SPEN supply	£ 500	Re-connection SPEN supply	N/A
PPA	£ 3,500	PPA	£ 3,500
Opex differentiators		**Opex**	
None (base case)	N/A	Standing charge for existing supply	£ 68
Total 5 year cost	**£ 7,250**		**£ 7,838**

Table 6 - Comparison of option costs

2.4.2. Comparison of benefits and payback

The primary variable which controls the potential benefit of the project is the quantity and price of power that YHA would consume from the hydro scheme. Monthly data has been received from YHA and a years worth of generation data from Padarn Peris (Note this was potentially an unusual year in terms of lack of rainfall).

Using assumptions about the timing of use and seasonality, the model estimates that YHA would consume 16.1MWh of hydro per year. This could vary depending on rainfall and usage patterns. The Redotec report considers 20.6MWh per year as the local supply potential however this considered to be because total energy use at YHA was higher. The anticipated monthly generation and consumption are shown below in Figure 7.

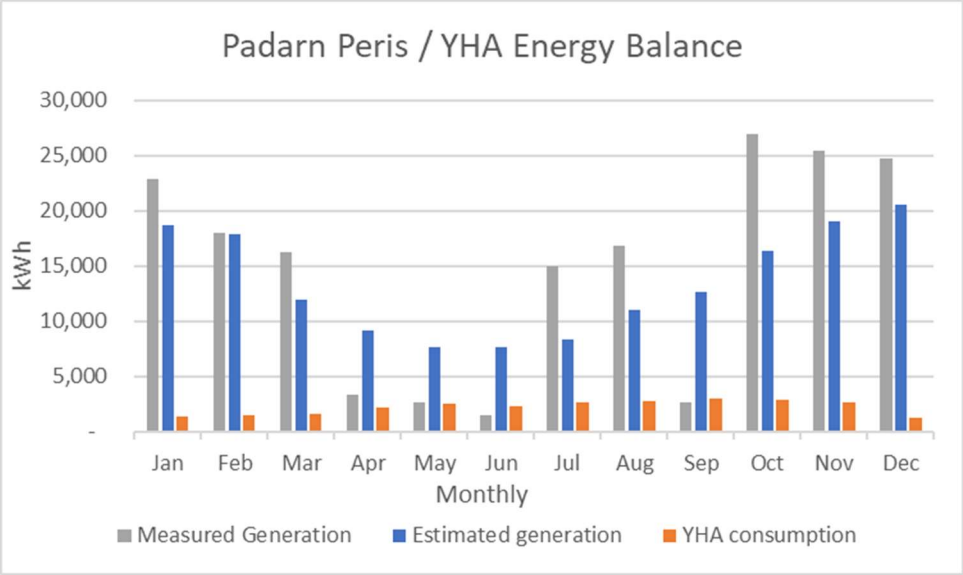


Figure 8 - Annual indicative energy balance

Once a local usage volume is determined, the annual benefit to Padarn Peris is most dependent on the energy price to YHA. The below table gives an indication of how there is a direct inverse relationship between the saving to YHA and the benefit to Padarn Peris. In concept, the saving and reputational benefit to YHA needs to be great enough for them to wish to proceed with the effort required in setting it up, and also to accept that they are tied to the scheme for a relatively long period.

On the other side, the benefit to Padarn Peris has to be substantial enough that it is worth spending capital reserves to set up the project.

Estimated annual YHA bill (existing tariff)	£ 4,174	£ 4,174	£ 4,174	£ 4,174	£ 4,174	per annum
YHA existing tariff (estimated)	0.154	0.154	0.154	0.154	0.154	£/kWh
Price reduction factor for local tariff	90%	80%	70%	60%	50%	%
Local supply tariff	**0.139**	**0.123**	**0.108**	**0.093**	**0.077**	**£/kWh**
Proportion of supply to be local tariff	61%	61%	61%	61%	61%	%
Potential YHA saving per year	**£ 253**	**£ 507**	**£ 760**	**£ 1,013**	**£ 1,267**	**per annum**
% saving for YHA	6.1%	12.1%	18.2%	24.3%	30.4%	
Additional revenue to Padarn Peris	**£ 1,543**	**£ 1,293**	**£ 1,044**	**£ 795**	**£ 546**	**per annum**
Construction cost	£ 3,250	£ 3,250	£ 3,250	£ 3,250	£ 3,250	
Legal	£ 3,500	£ 3,500	£ 3,500	£ 3,500	£ 3,500	
Land cost (assumed)	£ -	£ -	£ -	£ -	£ -	
Total cost	£ 6,750	£ 6,750	£ 6,750	£ 6,750	£ 6,750	
Simple Estimated Payback	**4.4**	**5.2**	**6.5**	**8.5**	**12.4**	**Years**

Table 9 - Annual benefit study

Fluctuations in energy price

Whilst energy prices are generally increasing faster than inflation, fluctuations do occur. These are generally managed by the licenced energy supplier who either sells to consumers and gradually increases prices on an annual basis, or buys power from generators on a year ahead basis reflecting market prices.

With a private wire arrangement, this offers both the generator and consumer an opportunity to reduce their exposure to fluctuations, if they so wish, by fixing a price for the locally supplied volume. Alternatively, given the general upward trend in electricity prices, the local supply price can be set to track market prices which may confer a benefit on Padarn Peris. This is a decision for the Padarn Peris management based on their attitude toward risk and reward.

2.5. Progress towards PPA

Juno has reviewed the 'Template PPA' at Appendix 2 as provided by Cyd Ynni which appears to facilitate Option B and has also developed a draft Heads of Terms for Option A at Appendix 1.

A number of key staff changes at YHA, and organisational bureaucratic processes have resulted in substantial delays in coming to agreement. We made initial contact with YHA head office in early September, and now having found the right person to talk to (Eleanor Butterfield), she was on holiday in September. We are still awaiting price and usage data for the YHA since the original contact on 27th September. Whilst Juno can follow this up, the response time is largely outside of our control so we are limited in our ability to accelerate this. The Head of SHEQ at YHA is in charge of making this decision and has stated that he will not be looking at it again until 2019.

In anticipation of the discussions ahead with YHA, we have contacted our solicitors to obtain an estimate for the negotiation of any points on a legal basis. They estimate that to arrange a PPA would cost in the region of £3,500. It is hoped that this could be reduced by agreement of Heads of Terms prior to involving legal support.

2.6. Land rights

The Hydro project land lease has also reviewed on a commercial basis to consider whether the proposed private wire may be possible. It appears that the Tenant does have the right to modify and add to the service media, although the route to the YHA is not shown on the plan. This would be subject to legal review and conversation with the Landlord. Legls revisions can be expensive and have the potential to significantly impact the benefit of the project economics.

2.7. Recommendation

It is recommended that

Awaiting feedback from YHA on proposed saving

3. Afon Galedffrwd Hydro, Mynydd Llandygai (Lot 2)

The Afon Galedffrwd hydro is being developed by Coetir Mynydd. It will be powered by 3 x 80 kWp turbines which will all be part of a single system. The proposed location of the turbine house (Google Maps: 53.175493, -4.074089) provides several options in terms of connections. Options are being considered to enhance the value of the electricity produced by the proposed system.

3.1. Project location and context

Located directly west of Bethesda, Bangor, the proposed 232kW system is situated on the Afon Galedffrwd river 100m from the B4409. The proposed turbine house is shown by the red dot on the Bing Maps image below. It is in very close proximity to the Bradite Paint Factory (1), Gwaithfeyedd Felin Fawr workshops (2) Coed y Parc Industrial Estate (3), the 33/11kV Bethesda Substation (4) and close proximity to the Penryhn Quarry (5).

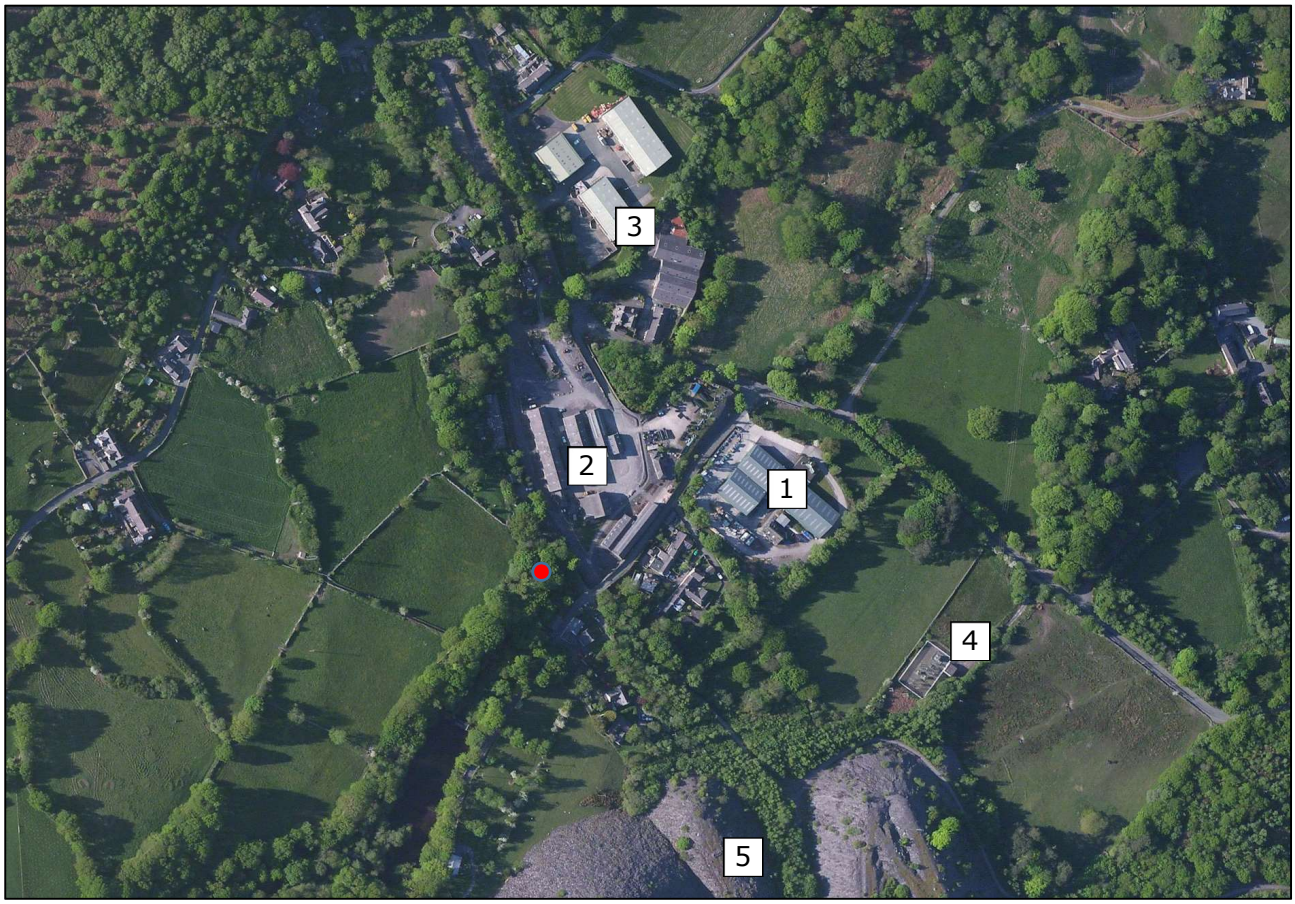


Figure 10 - Afon Galedffrwd Hydro Location and Context

3.2. Information provided

To undertake an options appraisal for the sale of electricity from the proposed Afon Galedffrwd Hydro turbine to potential commercial/industrial customers nearby key parameters need to be understood to allow a meaningful consideration of the possibilities.

The following information has been provided by the client and also helpfully by EllerGreen Hydro and Bradite.

- Estimated annual output by EGH 1,276MWh – by email 18/09/18
- Estimated annual output by EGH 758MWh – by email 26/09/18
- Budget offers from two suppliers - by EGH email 02/10/18
- Bradite data and connection information - by email 15/08/18 & 03/10/18
- Penrhyn data and connection information - by email GH 27/09/18
- Potential energy users – by email GH 10/10/18

Additional local businesses have been contacted but at the time of writing no usage data has been received. This includes Aquaroots, Blizzard and also Cygnet Fabrications who provided an annual estimate of energy usage and were keen to become involved.

3.3. Potential consumers

Figure # below shows a SPEN map of the network in the area of the proposed turbine and consumers. Green lines are 33kV cables, Red lines indicate 11kV cables, Brown lines are 400V. Dooted lines are overhead, solid lines are buried cable.

Figure 11 - Afon Galedffrwd Hydro potential consumers

	Consumer	Estimated Annual usage kWh	Notes	Estimated private wire distance
1	Bradite Paint Factory	135,770	Long standing factory with regular week day time use.	200m
2	Gwaithfeyedd Felin Fawr workshops	estimated 50,000	Small manufacturing. Pipes and other workshop.	50m
3	Coed y Parc Industrial Estate	estimated 250,000	Numerous individual business consumers, some office, some small manufacturing (10+)	400m + distribution
4	The 33/11kV Bethesda Substation	N/A	Potentially good link to DNO network	300m
5	Penryhn Quarry	3,545,695	18h weekday shifts, 6am - 12pm	750m

3.4. Outline options for consideration

Given the location of the proposed turbine house and the proximity to a number of business users and the DNO network, 7 primary options for local supply are considered.

A. DNO connection at HV, no local supply (Base Case)
B. DNO connection at HV, contract based local supply mechanism
C. DNO connection at LV, contract based local supply mechanism
D. Private wire to multiple local businesses
E. DNO connection at HV with LV private wire to Bradite
F. LV Private wire to Bradite, shared LV connection to DNO
G. HV Private wire to Penryhn quarry

3.4.1. DNO connection and contract based revenues (Options A, B, C)

These three proposed options connect to the DNO network as close as possible to the Hydro plant shown in Figure 12. They then use an administrative method of forming a contract between the generator and the consumer via a licenced electricity supplier and then use the existing DNO network to transport the power to consumers.

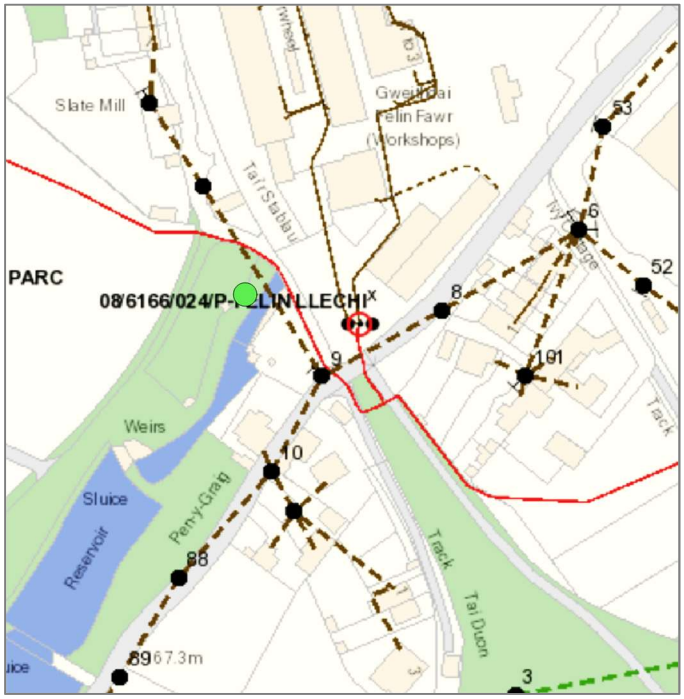


Figure 12 - Options A, B and C - DNO connection next to the turbine house

Option A – Base Case – DNO Connection Only

A DNO connection with a Utililty PPA, this is the standard or traditional route for renewable projects. A licenced electricity supplier purchases the power from the Generator and there is no commitment or ability to sell it locally. Whilst the power itself can be considered to be supplied locally down the cables, in practice there is very little or no additional benefit to the local consumers or the generator. This is the Base Case for the analysis below.

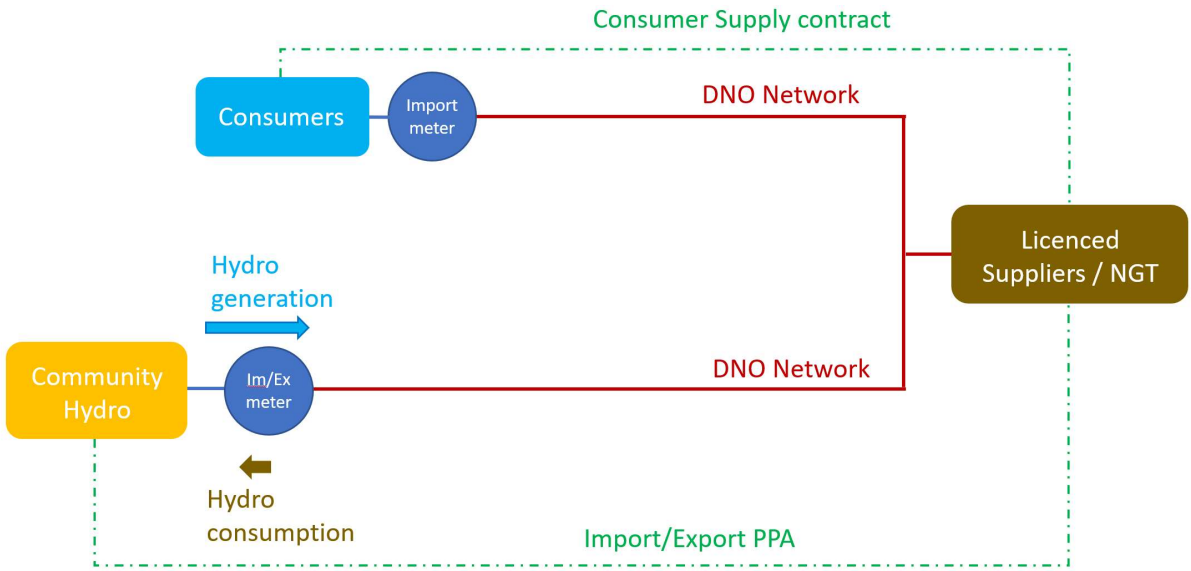


Figure 13 - Option A - DNO Connection Only

Options B&C - DNO connection with contract based local supply mechanism

The generator would be connected to the DNO network at HV or LV under a standard connection agreement. In some locations LV can offer enhanced value to the generator, however note that having consulted with SPManweb, an LV connection is unlikely to be possible here.

A contract based supply mechanism is used to link the generator to the local consumers. This generally requires a licenced electricity supplier to facilitate a purchase and sale of the energy locally.

This can take a number of forms including a Corporate PPA, Synthetic PPA or a Local Tariff. Essentially in each case the licenced supplier undertakes the various requirements in the electricity and balancing markets meaning that the risk to the generator and consumer are minimised. This is often called a 'Synthetic PPA' and allows the generator and consumer to hedge the electricity price in a way that they can both benefit over time.

Whilst there is no physical connection between the parties, other than the DNO network, the energy is still, in essence, locally supplied from one to the other.

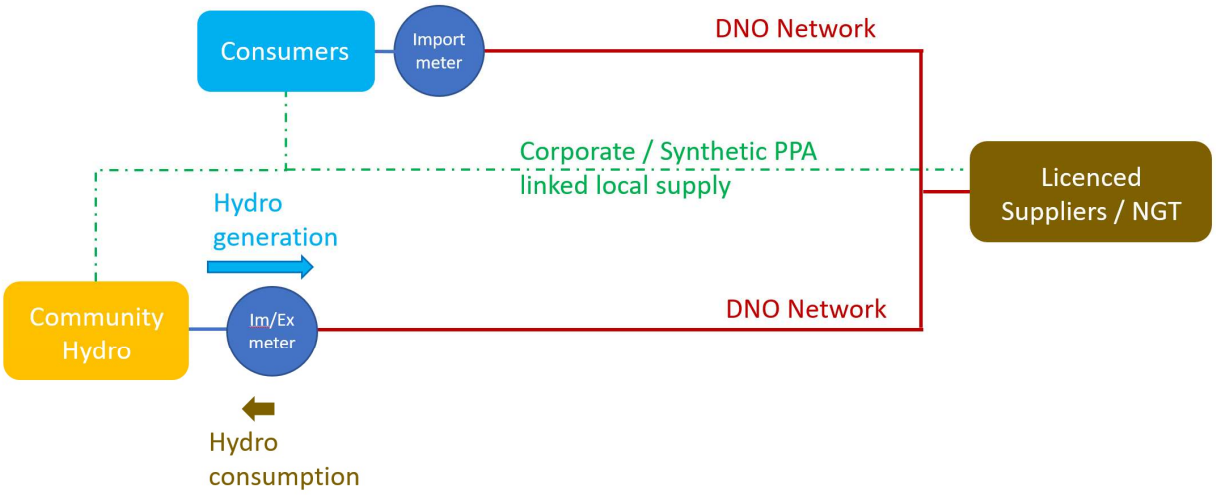


Figure 14 - Options B&C - DNO connection with contract based local supply mechanism

Option D – DNO connection and private wire to multiple businesses

The generator is connected to the DNO as per Option A but also installs a private wire that connects directly to circa 10 of the biggest business users in the immediate vicinity, resulting in approximately 600m of buried LV cable in the public road. It is assumed that all highways consents can be achieved without great complexity and that ground conditions allow for adequate trenching depth.

Each consumer is connected directly to the private wire, but retains a backup connection to the DNO network, each would require an Automatic Transfer Switch (ATS) or similar to switch to and from the hydro network and an individual meter to quantify the hydro power used by each consumer. Alternatively, through agreement of all parties, the hydro power could be divided up in a proportion commensurate to their overall energy usage. This would save on metering and ongoing admin costs however would not motivate consumers to use power when the hydro is generating.

There are likely to be technical challenges with the multiple party private wire approach with multiple loads being switched in and out and the effect on other connected consumers. SPManweb consent would also be required and appropriate circuit protection installed.

An outline map of the cable route and the consumers being served is shown in Figure #.

The generator would contract with each of the parties individually, but presumably would need to offer the same price to all. There is an administrative cost of reading meters and invoicing, expected to be in the region of 1-2days per quarter for a project of this scale. It is also hard to quantify the cost associated with operation and maintenance of a private network in the road, insurances would certainly be required.

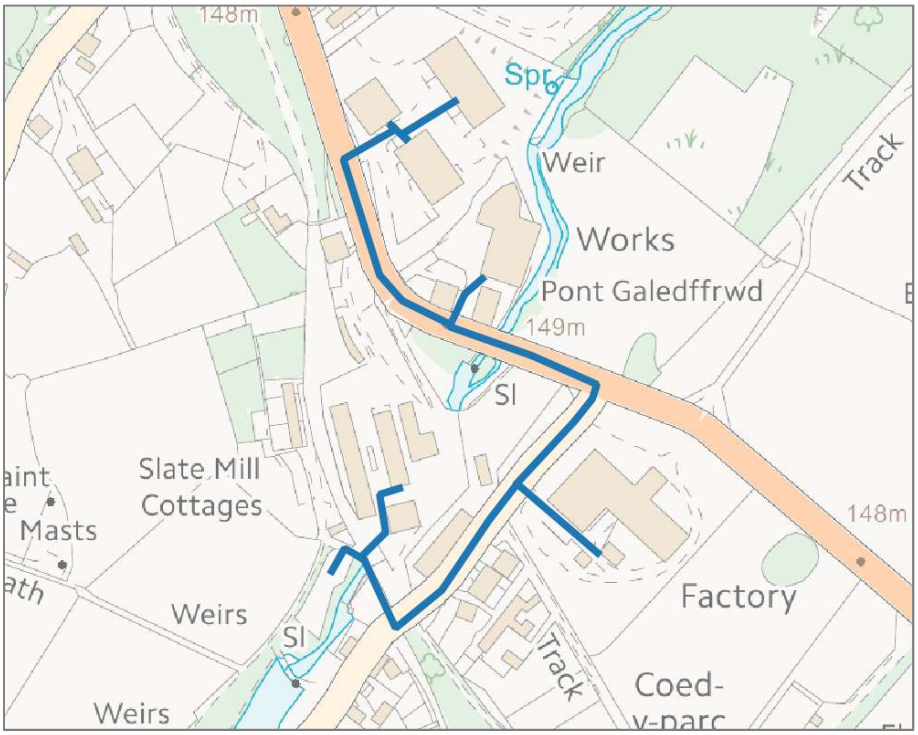


Figure 15 - Option D - Multi-Business LV private wire road route (solid blue)

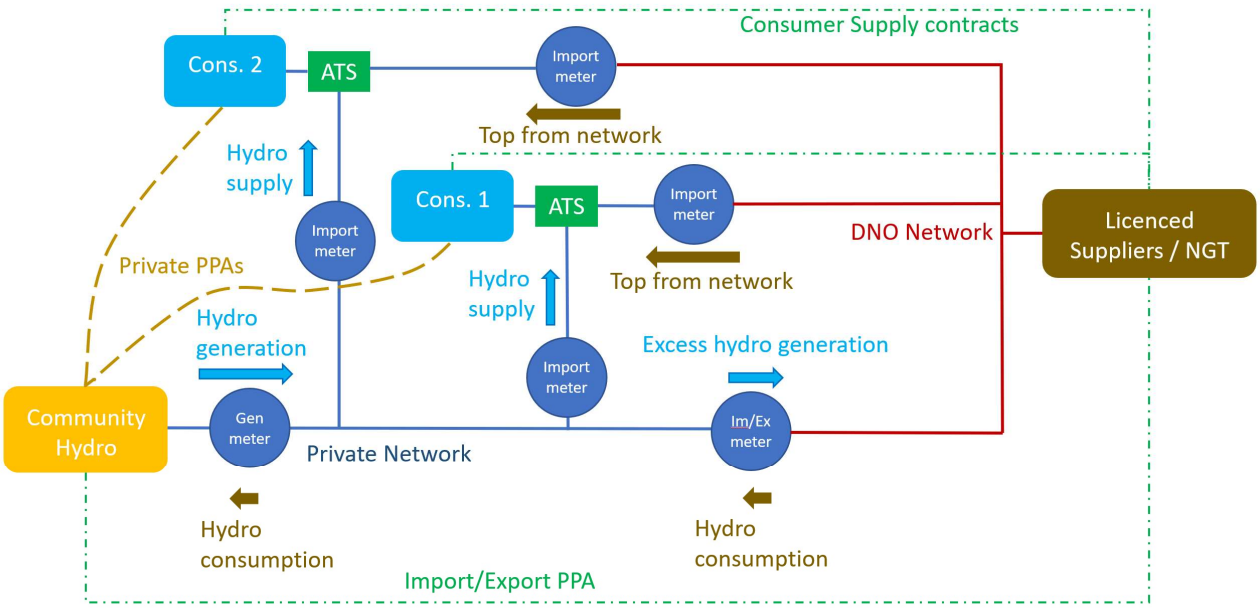


Figure 16 - Option D - Energy Flows and Contracts

Options E - DNO connection plus private wire to Bradite

In Option E the generator is connected to the DNO as per Option A but also installs a private wire that connects directly to the Bradite paint factory, resulting in approximately 180m of buried LV cable in the public road. This would also require SPManweb consent as it creates a link between two points on the network. At the time of writing SPManweb has expressed some concern how this would be achieved technically. This option also requires an 11kV transformer at the Turbine house site.

It is assumed that all highways consents can be achieved without great complexity and that ground conditions allow for adequate trenching depth. Alternatively a route of circa 270m exists through fields. This would require the necessary wayleaves, but would largely avoid the public road.

The generator is connected directly to the existing Bradite LV system and would also be likely to have a local LV auxiliary supply from SPManweb. An ATS would be required at Bradite to facilitate the changeover from Hydro to Mains power. It is not clear if the supplies can be 'mixed' at the same time.

An outline map of the cable route is shown in Figure #.

Option E would require a Private PPA between the Generator and Bradite with a metering point as the private wire meets the Bradite LV system. Whilst this is a relatively simple private PPA arrangement, there are key issues to be discussed and resolved. The first is contract duration, in that the PPA must last long enough to allow the cost of the private wire to recouped by the Generator, an early termination penalty would need to be agreed to protect the Generator's return. Given that the Generator holds an independent connection route to market via SPManweb, this removes the need for a Grid Sharing Agreement at Bradite.

There is an administrative cost of reading meters and invoicing, expected to be in the region of 0.5 days per quarter for a project of this scale. It is also hard to quantify the cost associated with operation and maintenance of a private network in the road, insurances would certainly be required. It has been suggested that Bradite could undertake O&M of the system including the Hydro plant, given their skills set and proximity.

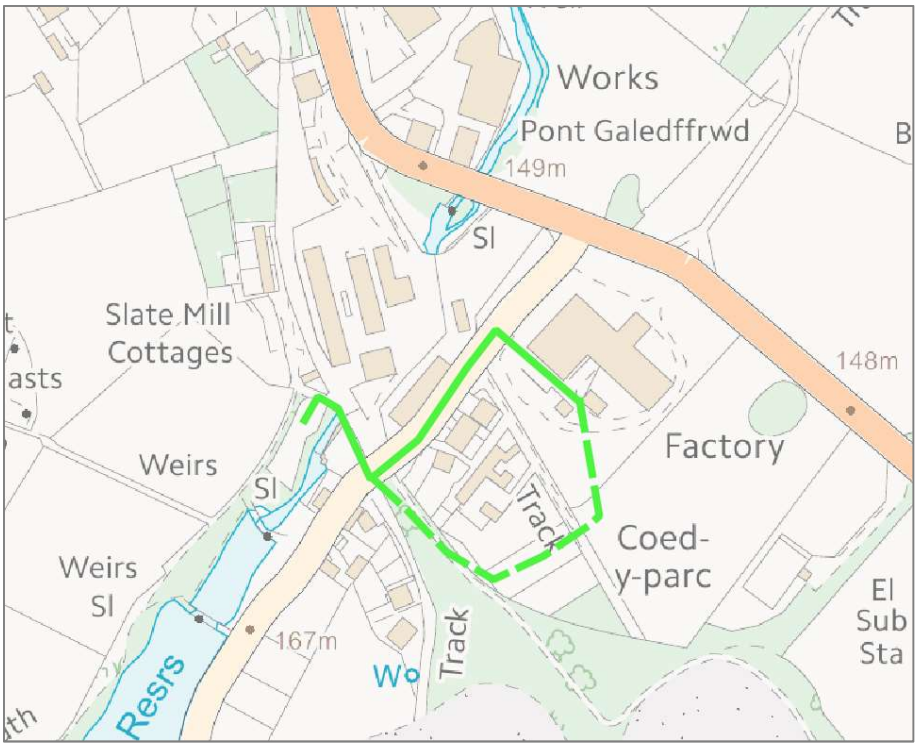


Figure 17 - Options E & F - Bradite LV private wire road route (solid) and agricultural route (dotted)

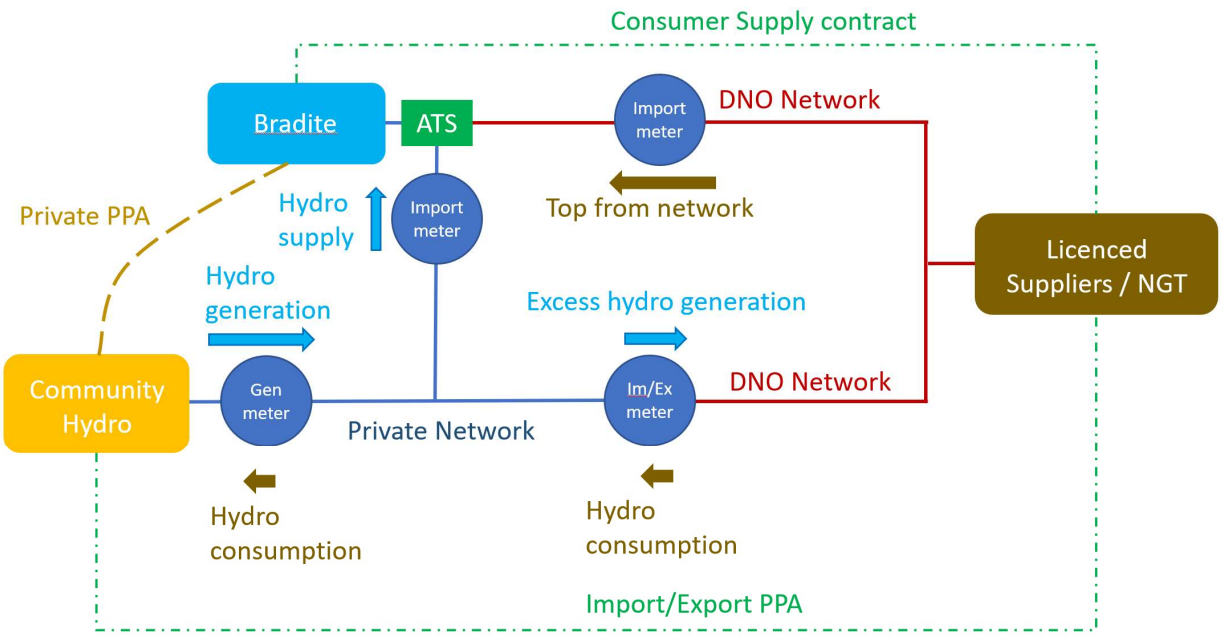


Figure 18 - Option E - Energy Flows and Contracts

Option F – Standalone private wire to Bradite

In Option F the generator is connected to the Bradite paint factory, resulting in approximately 180m of buried LV cable in the public road as per Option E but without the DNO connection at the turbine house. This removes the cost of a second transformer as the existing SPManweb transformer at Bradite can facilitate the export on to the network. A new Ring Main Unit is required at Bradite and associated works. An ATS would not be required as from SPManweb's perspective, the generator would be considered as embedded generation within the Bradite site.

It is assumed that all highways consents can be achieved without great complexity and that ground conditions allow for adequate trenching depth. Alternatively a route of circa 270m exists through fields. This would require the necessary wayleaves, but would largely avoid the public road.

An outline map of the cable route is shown in Figure 17.

Option F would require a Private PPA between the Generator and Bradite with a metering point as the private wire meets the Bradite LV system. The hydro station import power (self use) would also need to be measured at this point. Whilst this is a relatively simple private PPA arrangement, there are key issues to be discussed and resolved. The first is contract duration, in that the PPA must last long enough to allow the cost of the private wire to recouped by the Generator, an early termination penalty would need to be agreed to protect the Generator's return. Crucially, the Generator would be relying wholly upon the Bradite connection route to market via SPManweb so it would be critical to ensure that the Generator would be able to continue to use the connection in the event that Bradite was not operating, or was sold, or was insolvent. This could be achieved through the Grid Sharing Agreement and the associated property agreements. Inevitably there are also risks which would need to be quantified and mitigated, such as the risk of fire at the factory and how this could impact the generator's ability to export.

That said, there are potentially significant benefits to this route and given the substation on site belongs to SP Manweb there is likely to be a solution. As with Option E, there is an administrative cost of reading meters and invoicing, expected to be in the region of 0.5 days per quarter for a project of this scale. It is also hard to quantify the cost associated with operation and maintenance of a private network in the road, insurances would certainly be required. It has been suggested that Bradite could undertake O&M of the system including the Hydro plant, given their skills set and proximity.

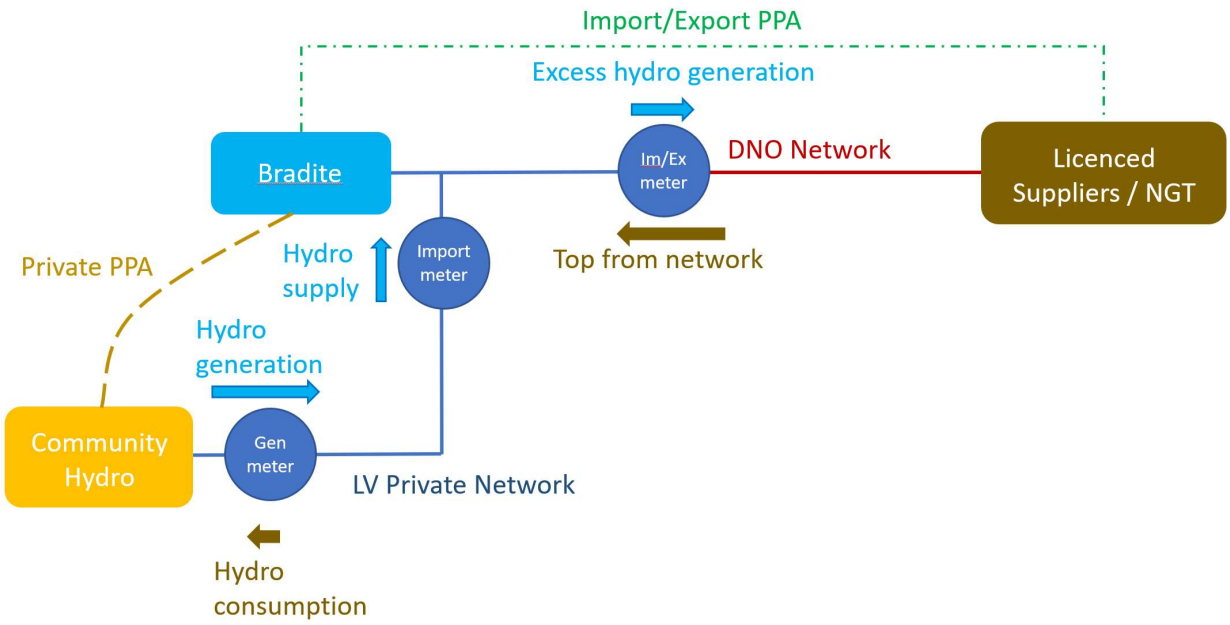


Figure 19 - Option F - Energy Flows and Contracts

Option G – Standalone private wire to Penryhn Quarry

In Option G the generator is connected to the Penryn Quarry, resulting in approximately 800m of buried or racked cable across public land or across the quarry site. The proposed route follows the existing 11kV line as far as possible. The distance is such that transforming to 11KV is likely to be more cost effecting that an LV circuit at that distance. Once the route is on the quarry site, it could be substantially cheaper and safer to route the cable in racks above the surface as it is then visible to workers operating on the site. This is TBC. The necessary consents and property agreements would be required for the public elements of the route.

Depending on the existing HV connection detail at Penrhyn Quarry, the private wire could be fed in to the existing system behind the meter at 11kV. This would result in the Generator being considered embedded generation from SPManweb's perspective.

An outline map of the cable route is shown in Figure 20.

Option G would require a Private PPA between the Generator and the Quarry with a metering point as the private wire meets the Quarry HV system. The hydro station import power (self use) would also need to be measured at this point. Whilst this is a relatively simple private PPA arrangement, there are key issues to be discussed and resolved. The first is contract duration, in that the PPA must last long enough to allow the cost of the private wire to recouped by the Generator, an early termination penalty would need to be agreed to protect the Generator's return. Crucially, the Generator would be relying wholly upon the Quarry connection route to market via SPManweb so it would be critical to ensure that the Generator would be able to continue to use the connection in the event that the Quarry was not operating, or was sold, or was insolvent. This could be achieved through the Grid Sharing Agreement and the associated property agreements. Inevitably there are also risks which would need to be quantified and mitigated, such as the risk of fire at the Quarry and how this could impact the generator's ability to export.

That said, there are potentially significant benefits to this route and given the substation on site belongs to SP Manweb there is likely to be a solution. As with Options E and F, there is an administrative cost of reading meters and invoicing, expected to be in the region of 0.5 days per quarter for a project of this scale. It is also hard to quantify the cost associated with operation and maintenance of a private network, insurances would certainly be required. It has been suggested that the Quarry could undertake O&M of the system including the Hydro plant, given their skills set and proximity to the project.

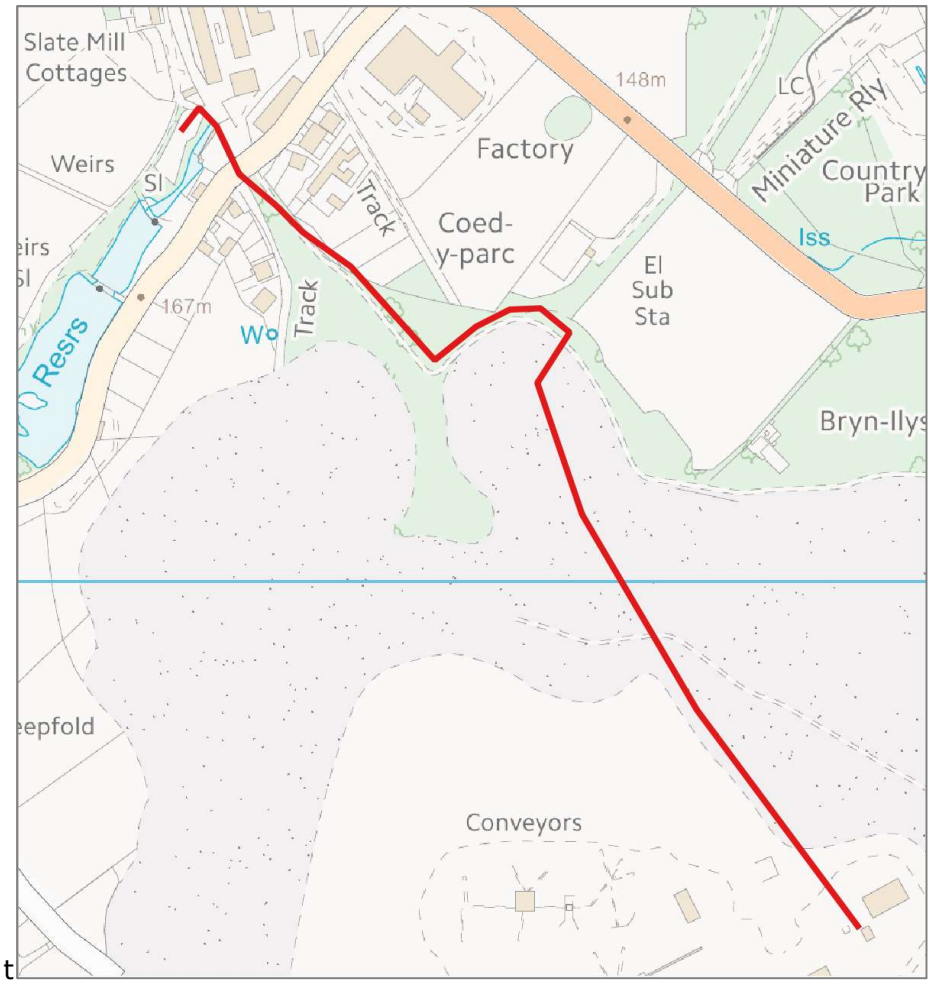


Figure 20 - Option G - Penrhyn Quarry LV private wire route (red line)

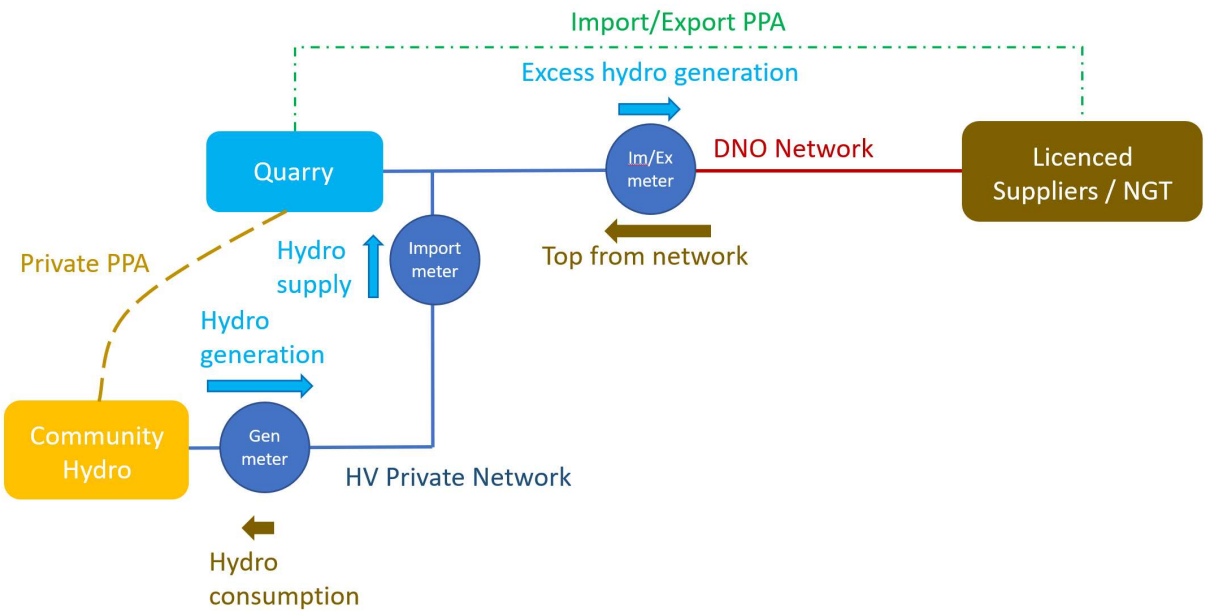


Figure 21 - Option F - Energy Flows and Contracts

3.5. Cost benefit analysis

3.5.1. Methodology

Each of the possible options identified above are considered with respect to the base case (Option A) whereby any change in the capital cost and revenue are used to calculate a simple payback and theoretical Net Present Value for each option to allow a comparison.

Capital cost values have been considered in consultation with an ICP and also SPEN. Inevitably without having undertaken a detailed site survey, there is a significant level of unknown with respect to ground conditions and electrical connection requirements. However the initial values provided are intended to provide a method of comparing each of the Options.

The annual possible project benefit is calculated on the basis of the benefit to the Hydro project plus the benefit to the consumers. A half hourly profile of generation and demand has been estimated for each consumer and the generator and the total amount of local supply then calculated. The consumers are shown in Section 3.3.

It is worth noting that different consumers will currently be paying different prices for energy and this should be the subject of negotiation of the next phase to determine an appropriate local supply price. For the purpose of this study it is assumed that the standard price currently received by the generator would be 5.8p/kWh. The standard price paid by business consumers is 13p/kWh and the price currently paid by the Quarry is assumed to be 10p/kWh. The local supply tariff is then set at 10p/kWh for the business customers and 9p/kWh for the quarry. Spill pricing received from a licenced electricity supplier is used to calculate the value of the power not used locally.

3.5.2. Results

Table 22 below shows the results of the study and aims to demonstrate the relative merits of each scheme. The expected additional capital costs are estimated and then compared with the potential benefit to the generator and consumers.

The cost of setting up the contract based mechanism is expected to be very small and this is expected to be absorbed by the licenced supplier. In contrast, once engineer and land issues are considered the cost of a private wire can be substantial, even with the potential reduction in the cost of connection to SPEN.

In summary, it is clear that the local contract based supply mechanism (Sleeved PPA) has the potential to offer the best return in current market conditions. It does not require additional capital investment, nor the additional risk of the construction and operation of a private wire. It also does not require an exclusive long term contract with a consumer which inevitably runs the risk of a major reduction in energy demand by factors outside the project control (such as fire). However unlike a private wire the contract based mechanism does not offer a true long term hedge of energy prices and there is a risk that a licenced supplier would not be offering the same arrangement in a few years time and hence the benefit could be curtailed.

iv

	Option	Notes	Capex variation from base case	Possible annual project benefit	Possible annual benefit to consumer(s)	Simple max payback of local scheme (years)	Max 10 year NPV @8%
A	DNO connection at HV, no local supply (Base Case)	NB no wiring or transformer included	£0	£0	£0	£0	£0
B	DNO connection at HV, contract based local supply	As above	£0	£8,646	£5,527	< 1.0	£ 88,060
C	DNO connection at LV, contract based local supply	DNO does not consider technically viable	N/A	N/A	N/A	N/A	N/A
D	DNO connection at HV with LV private wire to multiple businesses	LV cabling (600m) providing alternate/dual supply to 10 businesses, DNO does not consider technically viable	£ 110,000	£ 5,715	£ 4,082	11.2	-£ 66,343
E	DNO connection at HV with LV private wire to Bradite	As (A) with additional LV connection to Bradite 180m DNO does not consider technically viable	£ 31,500	£ 2,587	£ 1,848	7.1	-£ 13,096
F	LV Private wire to Bradite, shared LV connection to DNO	Replaces connection cost at turbine house with connection to SPEN at Bradite via LV private wire, new RMU required. No transformer cost.	£ 20,000	£ 2,587	£ 1,848	4.5	-£ 2,448
G	HV Private wire to Penryhn quarry	Replaces connection cost at turbine house with connection to SPEN at Quarry via HV private wire, new RMU required.	£ 70,200	£ 13,582	£ 4,244	3.9	£ 19,388

Table 22 – Cost Benefit Analysis Summary

3.6. Recommendation and next steps

Whilst it is worth mentioning that the maximum potential benefit is likely to come from private wire solution, the additional cost and risks associated with these options is likely to conclude that a contract based PPA is the preferred approach. In addition, adopting a sleeved PPA or similar at this stage would not preclude the development of a private wire in future if the market changed in favour of this.

The timescale associated with the build of the system is yet to be confirmed, however it is expected that an investment decision would be made early in 2019. If enhanced revenue, above and beyond the expected FIT tariff is required to enable the investment decision, then a contract based local supply arrangement could be agreed in principle with Bradite and the Quarry (assuming this is acceptable to them). This would require the agreement of a licenced energy supplier. Bristol Energy, Good Energy and Ecotricity have provided indicative pricing as part of this study.

The most critical next step is to agree the local supply price with Bradite and the Quarry. This would enable the hydro scheme financial model to be updated to include any enhanced revenues available. After this is agreed in principle, the licenced suppliers can be approached for terms for the PPA including the local supply element as a sleeved PPA.

4. Local Supply Model for Commercial Customers, Bethesda (Lot 3)

The area of Bethesda has a successful Energy Local Club in existence, based on the model created by the Energy Local organisation. This allows domestic properties within the grid connection area to purchase their energy from a local generating source - in this case a 2 x 100 kW hydro turbines located in the area. For that scheme, the administration and billing is done by Co-operative Energy, but is not currently able to include business customers in the scheme.

The primary reason for this appears to be that Co-operative Energy do not supply to commercial/industrial customers. There are a number of micro, small and medium sized enterprises within the area which could potentially benefit from a supply of clean electricity, so an alternative approach is being explored.

The work in this project assesses the viability of creating a local industrial supply model in the Bethesda area to enable the local consumption of the output from 2 x 100kW hydro turbines. This includes identifying partnership opportunities with electricity suppliers that may be needed to establish such a scheme.

4.1. The Energy Local Model

By way of introduction, the Energy Local Model uses a not for profit organisation called an Energy Local Club (ELC) formed with households and small scale renewable generators as members.

Households have smart energy meters installed to show when and how much power they are using.

Members (households and generators) agree a price ("match tariff") that will be paid to the generator when they match their electricity use to when electricity is generated locally, for example, turning their washing machine on when they know the local Hydro scheme is working a maximum capacity.

The club chooses a partner energy supplier (such as Co-operative Energy) that sells the extra power they need when there is not enough local electricity generated. The supplier sends each household the bill for their total power use.

The basics of the consumer tariff is that it is based around a Time of Use tariff which varies depending on the time of day. This is intended to encourage energy use when supply is plentiful Then, in addition to the 'Hydro tariff' comes in to play when hydro power is plentiful.

Indicative prices are given below:

- Morning price 12p 6-11am
- Midday price 10p, 11am-4pm
- Evening price 14p, 4pm-8pm
- Overnight price 7.25p 8pm-6am

Then hydro tariff 7p comes into play when hydro is running – its cheaper and then the hydro scheme gets all of that money (ie none is deducted by Coop)/

If not enough hydro is being generated then energy is shared between households. Some households may only use hydro, some who are using more, would have a mixed tariff at that time.

Standing charge Currently 17.8p/day or £65/year. This is apparently due to be revised. In addition consumers are not charged for smart meter.

The project uses a website interface (https://cydynni.org.uk/bethesda?lang=en) which provides a forecast of local hydro energy going to be available. It also advises on what the consumer should do, ie wait for a few hours till more is available or use heavy energy appliances immediately.

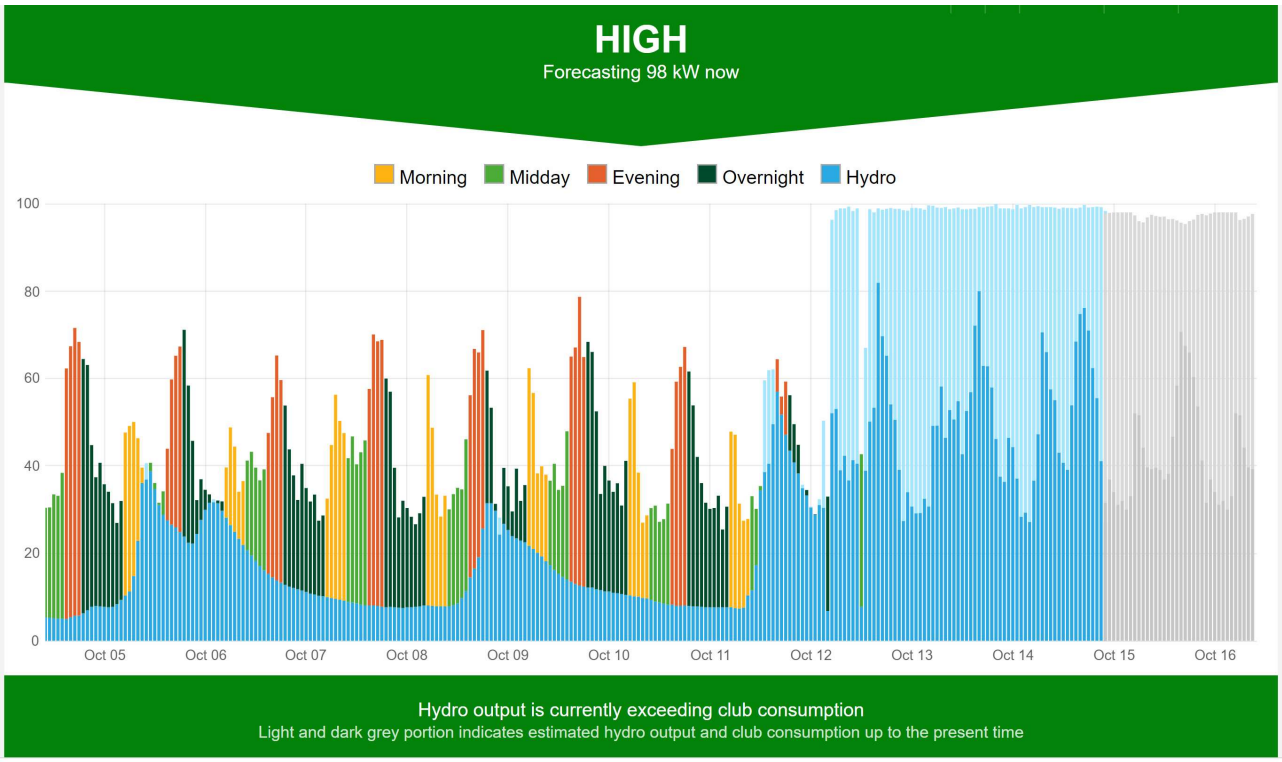


Figure 23 – Energy Local consumer interface

The trial secured a 90k grant from WG and involved the following partners:

- Cyd Ogwen,
- the National Trust,
- Development Trust Association Wales,
- Community Energy Wales (CEW),
- Scottish Power Energy Networks (SPEN),
- Co-operative Energy.

The trial has secured approval from Ofgem and Elexon.

4.2. Alternatives to the Energy Club

The energy market is constantly changing and there are rapid innovations in all areas of the sector, including local energy supply. In particular with the reduction and removal of subsidies available for renewable energy projects, new systems are being developed with the intention of increasing the value of energy for local renewable generators.

Sleeved PPA / Corporate PPAs

Sleeving or Corporate PPA is a variant of a standard Power Purchase Agreement (PPA) between a licensed supplier and generator and serves the purpose of linking generation to a particular customer, such as linking a hydro to a local energy consumer. Typically this tends to be used for larger energy users as it requires an agreement between the generator and supplier on price, however it is increasingly being used for more diverse and community energy projects.

The arrangement allows the customer to purchase energy directly from the generating facility via a licensed supplier, who manages the imbalance risk and covers back up supply and spill export.

This is a well established method and provides large consumers with price security and benefit and supplementing incomes for renewable generators. Many examples of 'Sleeving' case studies exist between large energy consumers and renewable generators, often as part of Corporate Social Responsibility schemes. For example, Google has entered into long-term Sleeved PPAs with renewable generators via a utility that provides balanced backup power.

A key aspect of this arrangement is the long term nature of the PPAs, it is this in part that allows the beneficial pricing. This is likely to be harder to arrange with a multitude of smaller business customers as expected in the Bethesda project and the administrative costs proportionally higher, hence eroding the pricing benefit.

Local Tariff

In a local tariff system a licenced supplier creates and administrative construct within its own systems to allow the 'matching' of generation to local demand. This tariff can be geographically restricted to consumers in a particular location, but care must be taken to comply with the Ofgem rules on tariffs and advertising of such.

Good Energy has acquired several generation sites and implemented local tariff projects in the South of England. As part of the company's community benefit focus, the tariffs are offered to consumers within 2 – 4km of generation sites. Eligible customers have received up to 20% reduction on their previous tariffs through the scheme.

White Label

A White Label arrangement is essentially one in which a white label provider, being an organisation that does not hold a supply licence, partners with a licensed supplier to offer electricity using a separate brand, particular to the white label provider. However white labelling offers a broad spectrum of opportunity which can be used to offer local supply organisations the opportunity to gain a measure of control of local tariffs while forgoing much of the risk and legal burden associated with becoming a full-fledged supplier.

In general, potential revenue to the white label provider increases with the responsibility, risk and customer acquisition numbers which the white label provider can bring to the partnership.

The licensed supplier provides the back-office functions and meets the majority of the requirements and industry codes. The white label party can handle some, or much, of the customer facing activity and builds the customer base. The white label organisation can negotiate its own tariff, in agreement with a Third Party Licensed Supplier (TPLS), to meet its own objectives. It is worth noting, however, that white labelled tariffs are bound to the tariffs of

the TPLS, where both partners must advertise the cheapest offered tariff. This can limit the autonomy of the white label provider and reduce local economic or social benefit.be

At one extreme, a white label can be a simple method of a licenced supplier reaching more customers through the use of an established brand. 'Sainsburys Energy' white labelling British Gas is a good example, where Sainsbury's sells British Gas electricity to its own customer base.

The licenced supplier pays the white labeller a fee for every customer that switches to the newly offered tariff. The rationale for doing this could be that the white labeller has identified an opportunity in the market, and wants to offer this in their area. Alternatively, the white labeller might want to support green tariffs, which may be financially beneficial to their customer base. However it is worth noting that licenced suppliers now have to inform their own customers if a partnered white labeller is offering a cheaper tariff which may limit the reduction in tariff the licenced supplier is willing to facilitate.

An alternate, more integrated white label partnership can be created, wherein the white labeller takes some of the customer service tasks in-house, away from the licenced supplier. These tasks can include those that can be performed from a service centre and in the community, such as sales, customer support, marketing, billing, debt collection and metering. The licenced supplier is likely to request an administration fee for their role in the partnership, though this will reduce if more of the functions are taken on by the white labeller. In this scenario, the more functions taken on by the white labeller, the more value is expected to be available to it.

Some fully licensed energy suppliers offer a 'white label in a box' route, enabling partnerships for Local Authorities, housing associations and community groups to quickly and efficiently set up as white label suppliers. For example, OVO Energy has a 5-step process for becoming a white label partner[1]:

(1) Set up of the entity and provision of information on possible development options;

(2) Modelling of the project finances and identification of the target customers;

(3) Design of tariff offerings, including pricing, where to buy power from, and management of energy trading;

(4) Marketing design, in order to sign up customers;

(5) Support in running the company, providing regular performance updates and contribution to operation.

The pros and cons of a white label model include:

Pros	**Cons**
• The ability to structure tariffs to meet local objectives.	• When creating tariffs the white label is constrained on one side by the Retail Market Review (RMR) tariff regulations and on the other by the licensed supplier who sets the Power Purchase Price and the retail pricing.

[1] https://www.ovoenergy.com/binaries/content/assets/documents/pdfs/ovo-communities-brochure.pdf

• Reduced cost to the white label party through reduced regulatory burdens, which are handled by the licensed supplier.	• It has been criticised as providing free marketing for licensed suppliers.
• The ability to combine with 'sleeving' options.	

Piclo – Selectricity

Piclo is an online platform that performs peer-to-peer energy matching for businesses and generators. It shows which renewable generators a consumer can match with and how local they are. It also enables suppliers to tailor their energy mix by choosing which generators they buy from.

Both businesses and generators sign contracts with the electricity retailer supplying the Piclo service. The retailer then sends meter data to Piclo, which does the energy matching. The consumers' Piclo account shows the matched energy data and allows the business to customise its energy mix. The business continues to get bills and invoices from the electricity retailer as usual.

Piclo is not intended to offer savings to the consumer or enhanced revenue for the generator. It appears to be set up primarily to facilitate a corporate responsibility element to business procurement of energy. The system has been criticised by renewable generators as it offers no certainty of consumers, in that consumers can choose to change supplier at any time. It also acts an auction for generators, pushing prices downward, so perhaps is not expected to be a force for improving revenues for community energy projects.

4.3. Potential Energy Generators

Bethesda Business Supply	**Energy generator type**	**Estimated annual generation kWh**	**Location**
Existing generators			
Ynni Ogwen (Bethesda) - Afon Ogwen 100kW hydro; Nearing the end of their current PPA (3 month or so), so could be timely.	Hydro	303,200	LL57 3LQ
Ynni Anafon (Abergwyngregyn) - Afon Anafon 270kW hydro (not been within scope of your recent commissioned work)	Hydro	818,640	LL330LP
Ynni Padarn Peris (Llanberis) - Afon Goch 50kW hydro	Hydro	161,000	LL55 4SR
Coming on line in 2019 and 2020:			
Afon Galedffrwd ~250kW hydro (2020)	Hydro	758,000	LL574YP
Ynni Padarn Peris (Llanrug) - new low-head hydro, potentially 100-	Hydro	303,200	LL554AB (?)
Ynni Anafon (Abergwyngregyn) - new project with 3 generating sources including >150kW Solar PV, 15-20kW AD and 50-75kW refurbished wind turbine, Solar element likely to be in 2019, other 2 in 2020	PV / AD / Hydro	351,480	LL330LP
TOTAL		**2,695,520**	**kWh pa**

Table 24 - Potential energy generators for the Business Community Energy project

4.4. Potential Business Users

Bethesda Business Supply	Energy user type	Estimated annual use kWh	Location
Properties in the care of Ogwen Partnership on High Street - these are likely to be part of the ECCO project that will install solar panels on the roof.			
Ogwen Partnership Office	Small office	5,500	LL57 3AE
Egin Ogwen Office	Small office	5,500	LL57 3AE
The Annie's Orphans Charity Shop plus two studios above.	Small shop	5,500	LL571YA
Siop Antiques O Law to Law	Small shop	5,500	LL57 3AN
Store 57 High Street	Small shop	5,500	LL57 3AN
Cwrw Ogwen - micro farmhouse * High Use	Residential + Small Manufacturing	50,000	LL57 3AY
Abstinence - elderly center	Community centre	7,500	LL57 3AR
Businesses and Other Institutions on the High Street which would be open to use:			
Shop Ogwen - craft shop	Small shop	5,500	LL57 3AN
Coed y Brenin Cafe	Café	10,000	LL57 3AJ
Pottery Bethesda Crochendy * High Use	Small manufacturing	50,000	LL57 3AN
Neuadd Ogwen * High Use (also likely to be part of ECCO)	Community centre / Venue	7,500	LL57 3AN
Hardware Shop	Small shop	5,500	LL57 3AR
Barbwr Ogwen	Small shop	5,500	LL57 3AR
Star Café	Café	10,000	LL57 3AY
Caffi Fitzpatricks	Café	10,000	LL57 3AY
Dairy Cosyn Cymru - * High Use	Small manufacturing	50,000	TBC
CL Jones Merchants	Small shop	5,500	LL57 3BX
Pub and Bunkhouse The Fic	Pub and hotel	12,000	LL56 4PJ
Eglwys Glanogwen	Community centre	7,500	LL57 3BG
Not on the high street -			
ZipWorld / Quarry - * High Use	Large manufacturing	TBC	LL57 4YG
Ogwen Bank Caravan Park - * High Use	Large residential	137,500	LL57 3LQ
Community buildings are not on the high street but are part of the ECCO project			
Bunkhouse Cabin Sleeping Gerlan	Hotel	12,000	LL57 3TG
Bethesda Cricket Club	Community centre	7,500	LL57 3DT
Mynydd Llandygai Community Center	Community centre	7,500	LL57 4LQ
TOTAL		**428,500**	**kWh pa**

Table 25 – Potential consumers for the Business Community Energy Project

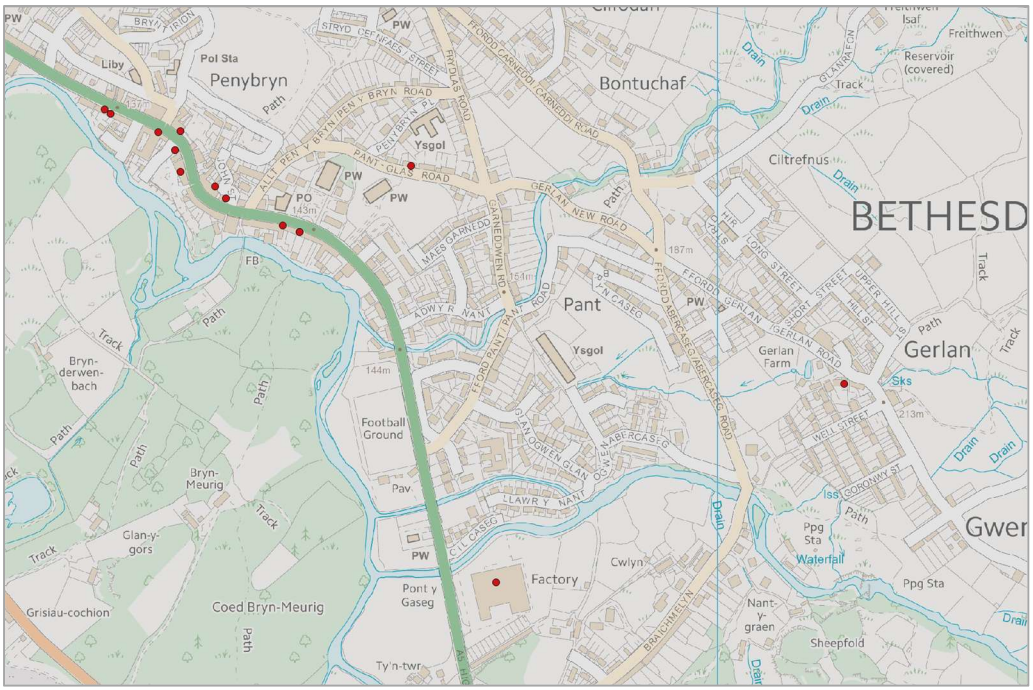


Figure 26 - Location of potential consumers in the centre of Bethesda

4.5. Routemap to a Business Community Energy project

4.5.1. Bristol Energy

Bristol Energy has done some initial investigations for this project with respect to what would be required and how long it would take to get a local energy system up and running.

They have confirmed that they are already considering similar concepts and projects elsewhere however there is a significant amount of work remaining to bring it to fruition.

At a high level, they estimate that it would require circa £50k in development costs and take 6-9 months to implement.

The biggest barriers for a sustainable/replicable model are considered to be the metering and control costs. The next step would be to allocate some time internally to consider this in detail.

4.5.2. Ecotricity

Ecotricity is an energy company based in Stroud, Gloucestershire, England specialising in selling green energy to consumers that it primarily generates from its 90MW wind power portfolio. It is built on the principle of heavily reinvesting its profit in building more of its own green energy generation.

With a long history of innovation, Ecotricity was one of the first companies to supply green electricity in the UK. Its mission was and remains to change the way electricity is made and used in Britain. Ecotricity regularly partners with community organisations whos priorities are aligned including Friends of the Earth and RSPB. One of the unique metrics Ecotricity report is the carbon cost per customer of their entire operation. This means they know the carbon emissions of

literally everything that goes into supplying their energy to their customers, from the planning, building and running of energy generation to the complete operation of our offices.

As an electricity supplier licenced to supply to business customers, Ecotricity can facilitate and administer the creation of the local energy tariff. Consumers and Generators will be contracted to Ecotricity to buy and sell electricity respectively.

Juno and Ecotricity have developed a project proposal to develop a Community Energy to Business Supply project that could be developed over a period of a few months comprising the following elements:

Project set up and delivery
- Identification of licenced supplier partner
- Set up suitable community entity (CBS or similar)
- Grant application
- Definition of responsibilities
- Partnership agreement
- Project management
- Initial report on project set up
- Monitoring and evaluation
- Final report on project performance

Community engagement
- Consultation and securing customers
- Development of web interface
- Data sources and interpretation

Determination of tariffs
- Analysis of supply and demand
- Time of day tariff
- Generator tariff

LES internal systems implementation
- Customer subgroup flagging and isolation
- Metering and calculation of time of day / local tariff
- Ofgem compliance
- Realtime data to web interface

Implementation
- Generator contracting
- Customer contracting
- Smart meter installation
- Project operation

The total expected budget is circa £27,000.

4.6. Conclusions and next steps

Despite a number of technical hurdles, recent advances indicate that there is no reason why a local supply model cannot be rolled out to business customers. A licenced energy supplier (LES) who is licenced to sell to business customers is required to facilitate this.

Whilst there are a number of internal systems and processes required within the LES, there are increasing numbers of ethically motivated companies who would be interested in taking on this roll.

Juno does not have an objective of in any way competing with the existing Energy Local project which has achieved a great deal of success, however it would appear that there is adequate market size for two projects to co-exist and Energy Local are not able to operate with Coop Energy for business customers. Hence a project is proposed in partnership with Ecotricity to achieve this objective.

The first step is to seek funding for the development phase. At the time of writing an expression of interest has been submitted.

Appendix 1

Afon Goch / YHA Llanberis

Heads of Terms for Power Purchase Agreement

V1 – 24/09/18

1. Context

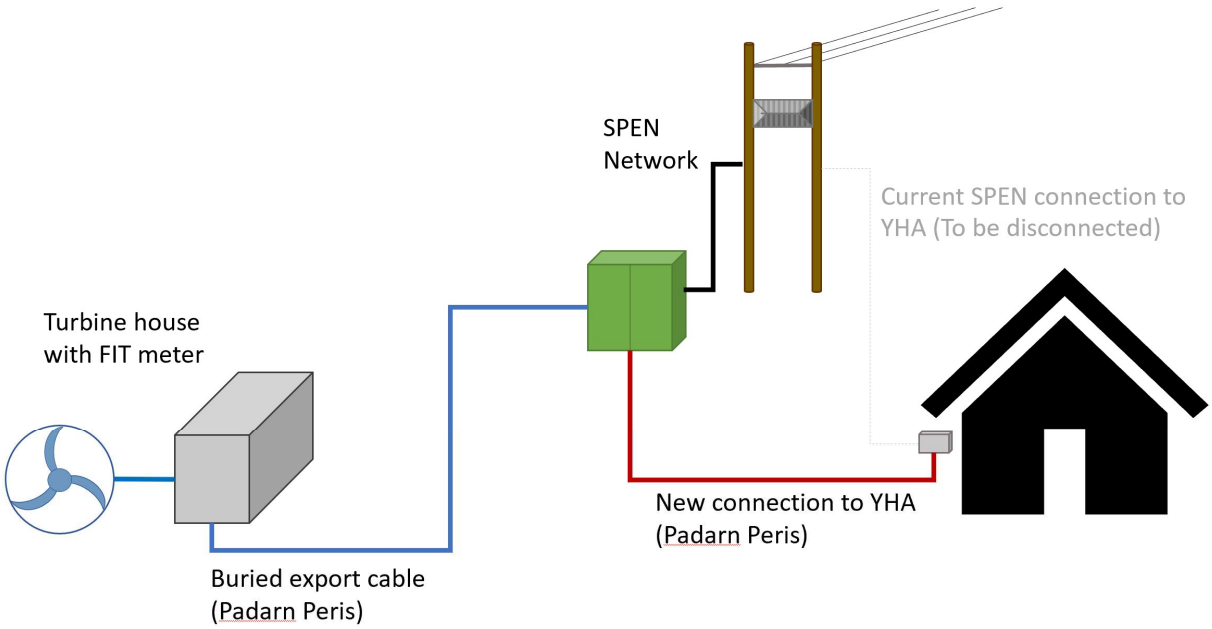
Padarn Peris, the owner of the Afon Goch hydro scheme wishes to install a private wire supply to YHA Llanberis to facilitate energy price certainty savings to YHA and enhanced revenues for Padarn Peris.

It is proposed that YHA Llanberis transfers its electricity connection from the SPEN network to the LV circuit in the Metering Cubicle owned by Padarn Peris at the rear of the property.

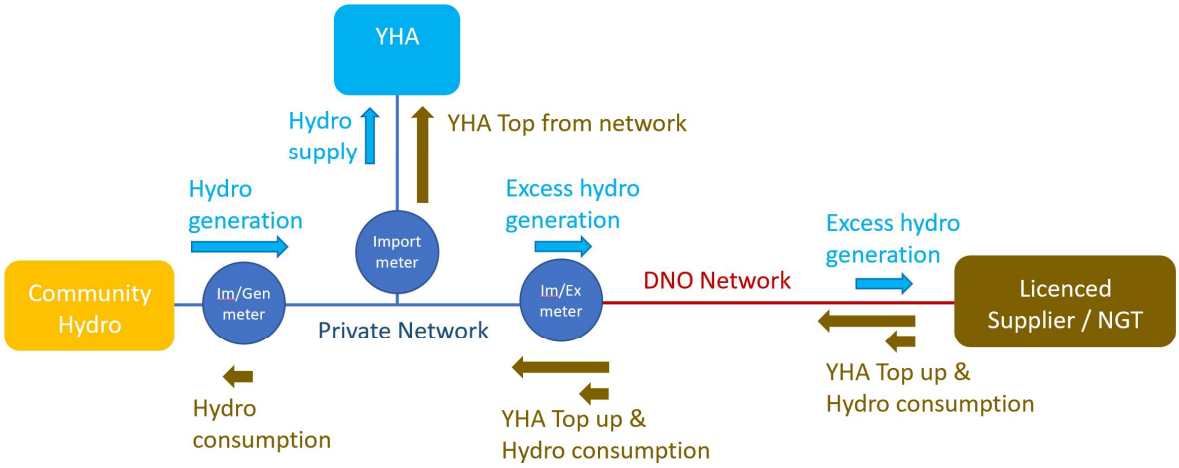
The entire of the YHA electricity supply would therefore be provided via Padarn Peris.

A Power Purchase Agreement is required to govern the supply of electricity to YHA (the Offtaker) by Padarn Peris (the Generator).

This arrangement is proposed as follows:



Resulting in the following energy flows:



2. Key terms

1.1 Price

1.1.1 Electricity supplied from the Hydro generation (Hydro Supply) will be supplied at Market Rate less 20%.

Market Rate to be determined using DECC's average data (average for the last 12 months using electricity prices in the non-domestic sector), which at the date of this agreement is available at the following link:

https://www.gov.uk/government/collections/energy-price-statistics

1.1.2 Electricity supplied from the SPEN network (Top Up Supply) will be supplied to the Offtaker at the cost to the Generator as paid to a third party licenced supplier in p/kWh.

1.1.3 Standing Charges – The Offtaker will pay a standing charge to the Generator based on the cost of administering the supply by the Generator for the benefit of the Offtaker. Expected to be half a day per billing period (quarterly) c.£200 per annum. The Standing charge paid by the Generator to the third party licenced supplier will be borne by the Generator.

1.1.4 VAT – VAT billing will be undertaken by the Generator and VAT will be charged at standard rate unless the Offtaker qualifies for relief and provides the Generator with evidence that they are a charity and a written declaration or 'certificate' confirming that they are eligible for the relief to the satisfaction of HMRC in which case the appropriate rate will apply and be charged.

1.2 Term and Termination

1.2.1 The term of this agreement is a minimum of [5] years and then will automatically renew on an annual basis.

1.2.2 The agreement can be terminated immediately in the following circumstances:

- the insolvency of either party
- material breach of the agreement which cannot be remedied within 28 days

1.2.3 The agreement can be terminated by 30 days written notice:

- on the expiry of the minimum term
- if payments have not been made for two consecutive periods

1.2.4 In the event that the Offtaker wishes to terminate the agreement prior to the expiry of the minimum term, the Offtaker will have to pay an exit payment equal to the value of the revenue that will be lost by the Generator for the remainder of the minimum period as a result of the early termination.

1.2.5 On termination of the agreement after the expiry of the minimum term the Generator will reimburse the Offtaker 50% of the cost of reconnection to the DNO network. Both parties will act to minimise this cost.

1.3 Point of connection / ownership

1.3.1 The Generator will fund, install, own and maintain the private wire connection to the Offtaker metering point. The point of connection and transfer of ownership is the same point that is currently the change of ownership to the SPEN network which is [The meter cable tails on the consumer side].

1.4 Metering and determination of supplied volumes

1.4.1 The Offtaker metering will be undertaken using the existing meter installed in the property [Offtaker meter]. This will be used to provide a total delivered volume (Offtaker Supply)

1.4.2 The Offtaker Supply comprises supply from the hydro (Hydro Supply) and top up supply from the network (Top up supply)

1.4.3 Such that Offtaker Supply = Hydro Supply + Top Up Supply

1.4.4 The total Hydro Generation will be metered using the existing meter in the turbine house [Total Generation Meter]

1.4.5 The Total Import from the SPEN network will be metering using the existing meter in the Metering Cubicle (Import / Export Meter)

1.4.6 As the Hydro plant does not currently meter import at the turbine house, and it is expected to be minimal, the Hydro self usage will be calculated by using the average quarterly import for the 12 months prior to installing the private wire (Hydro consumption)

1.4.7 The Top Up Supply will be calculated using the following equation on a quarterly basis:

1.4.8 Top Up Supply = Total Import – Hydro consumption

1.4.9 Hydro Supply = Offtaker Supply – Top Up Supply

1.4.10 Metering will be undertaken monthly by the Offtaker and read jointly by the Offtaker and Generator on a quarterly basis (with a representative present).

1.5 Generators obligations

The Generator will ensure that the electrical system allows for the hydro plant to be maintained and operated under all normal circumstances without interrupting the electricity supply to the Offtaker.

3. Additional terms

1.5.1 Confidentiality – The parties agree to keep the commercial details of this agreement confidential

1.5.2 No guarantee of renewable supply – By the nature of the project the Offtaker will use the Hydro generation if it is available, however the Generator does not guarantee hydro generation.

1.5.3 Invoicing frequency – The Generator will invoice the Offtaker on a minimum of a quarterly basis or other term as agreed between the parties.