Initial report on renewable energy potential for Blane Valley Carbon Neutral Group

September 2010
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INTRODUCTION

As a first step toward sustainability in the Strathblanefield area, Blane Valley Carbon Neutral Group (BVCNG) aims to generate from renewable sources enough electricity to offset the total electricity consumption within the area. Other issues such as heating, transport, waste etc have been opted out for now.

For the purposes of this report the total local electricity consumption has been estimated at 19,000MWh/year. This estimate is derived from the total estimated electricity consumption and population in Scotland:

Total consumption (C) = 40,922 GWh/year = 40,922,000 MWh/year (Scotland’s electricity consumption 2008)\(^1\)

Population (P) = 5,168,500 (Scotland’s population mid-2008)\(^2\)

Per Capita consumption (C÷P) = 7.918 MWh/year

Population of Strathblane (SBFP) = 2,400 (estimated from 2001 census figures)\(^3\)

Total estimated electricity consumption in Strathblane (SBFP x per capita C) = \textbf{19,002 MWh/year}

This report summarises the desktop study which has been undertaken following a brief tour of the area and an initial meeting with the Group. At this meeting, the scale of the project was discussed, along with various sites with potential for renewable energy generation at different scales and by different means. Each site is indicative only and further work will be completed to establish best position, detailed economics etc once a decision on the way forward has been made. In summary, these included wind (in various locations at various scales), hydro, solar and biomass. This report sets out the potential for these technologies given local constraints.

1.1 Feed-in tariffs and Renewable Heat Incentive

The UK renewable energy market was transformed on 15th July 2009 with the release of the consultation document for the new Feed-In Tariff (FIT) regime. The consultation is now closed and the regime has been in place since 1st April 2010. Among the changes that the new regime will introduce are:

- an increase in the upper limit for generation capacity from 50kW to 5MW
- a fixed price per kWh of electricity generated, guaranteed for 20 years
- an additional, fixed price per kWh of electricity exported to the national grid

(see the Department of Energy and Climate Change’s final document ‘Feed-In Tariffs. Government’s Response to the summer 2009 Consultation’ for full details)

These changes mean that it is easier to calculate with confidence the return on investment for a renewable energy installation project, using the known FIT values and the performance of each installation. All these data are readily available.

To match the FIT regime, the government is currently consulting on the Renewable Heat Incentive, which will operate in a similar way for biomass, solar thermal and heat pump installations. As this scheme has not been finalised, the consultation document should only be considered as a guide to how it may be implemented, however it appears that it will make these technologies highly attractive as well.

The relevant figures and conditions from each scheme have been applied throughout the report to give a best estimate of payback from the options considered.

2 HYDRO

2.1 Introduction

Hydroelectric systems generate electricity from running water - usually a small stream, by turning a small turbine. Small or “micro” hydroelectric systems can produce enough electricity for lighting and electrical appliances in an average home. The faster the water flows and the more water there is, the more electricity
can be generated. The first stage in developing a hydro-power project is assessing the available energy using a desk-top study. This usually consists of:

- A computer generated flow prediction of the type used by SEPA to assess abstraction permissions
- Suggested system layout based on map data
- Estimated energy yield and income calculations
- Estimated costs
- Identification of potential barriers to development

From this information the client can decide if the scheme is financially viable and whether to proceed to the next stage involving:

- Detailed review of the flow
- Site Layout
- System Design
- Environmental Report
- Applying for an abstraction licence
- Applying for planning permission

2.2 Site Suitability

The suitability of a site depends on the amount of power that can be generated. To achieve a reasonable power output either the head or the flow needs to be of a significant value. High head is preferred as it is more likely to offer a shorter payback period, however low head sites can still offer a good return if a large enough flow is present. If the site has no stored water potential, i.e. dam, the design should be based on the lowest flow parameters. The potential for energy generation from a given site is found using the formula:

\[
\text{Generation (MWh/yr)} = \text{Head (m)} \times \text{Flow (m}^3/\text{s}) \times \text{Gravitational Constant (m/s}^2\text{)} \times \text{Capacity Factor (\%)} \times 8760 \text{ (hrs per year)} \div 1,000 \text{ (kWh per MWh)}.
\]

This equation has been used to estimate generation potential from the sites discussed, however in order to assess accurately the generation potential from the proposed hydro schemes, a minimum of 12 months of flow data are required.

For a desk-based analysis, head estimations can be made from contour map data and estimations of mean flow can be carried out from estimations of catchment area and rainfall data. Meteorological Office information on precipitation shows that the majority of Strathblane has an annual rainfall of between 1,600mm and 1,800 mm per year, with some small areas of reduced rainfall and increased rainfall over high altitude areas. Therefore a figure of 1,700 mm has been used for the purpose of this study.

Average annual flow calculations do not take into account porosity or evaporation. For the low head installations (Mill Dam and Blanefield) this should not make a significant difference to the estimated annual flow, however it may lead to an over-estimate for Ballagan Burn. The British Geological Survey 1:625,000 scale geological map of the area suggests that the Ballagan Spout itself, together with a section of the Burn’s catchment, is underlain by sandstone, siltstone and mudstone of the Inverclyde Group. Coupled with the topography, it may well be that a significant proportion of the rain falling on the catchment is not drained by the Burn.

2.2.1 Costs

Initial costs of installing hydro can be quite high but they are site specific and, in particular, depend on the amount of civil engineering required. Costs tend to vary between £4,000-£5,000 per installed kW for schemes to be used for domestic purposes. As hydro has the potential to run indefinitely they represent a medium to long-term investment that can prove cost-effective.

Following the publication of the new Feed-In Tariff regime for electricity all generated power will, if the product and installer comply with the standards outlined as part of the regime, give a return of 19.9p/kWh for installations up to 15kW and 17.8p/kWh from 15-100kW. In addition, any electricity used will offset the cost of
buying in electrical power. The amount of electricity that is offset will vary depending on the site and its generation capacity. Furthermore, depending on scale, 3p/kWh is offered for any electricity exported to the grid.

There are other licence and consent charges associated with hydro. In particular, hydro schemes are subject to an Impoundment Licence from the Scottish Environment Protection Agency (SEPA). These, typically, have an associated registration fee of £873 and a subsequent annual subsistence charge of £0-£1,920, depending on size.

The following sections describe the potential hydro sites considered:

2.3 Mill Dam NS 56161 78727

During the site visit the hydro potential at the Mill Dam was investigated. The Mill Dam is located to the south of Milndavie and feeds a tributary to the main river flowing through the village, the Blane Water. The Dam has historically been used for hydroelectric purposes (there is an old disused Mill at the base of the outflow) and appears to offer some potential for a hydro scheme. Following the desk based study, the head of the outflow has been estimated to about 10m and the catchment area to 0.5 km². Therefore, the mean flow is estimated at approximately 26 l/s, or 0.026 m³/s.

Based on these figures and using the formula above, it is estimated that the Mill Dam may provide an approximate scheme rating of 1.8 kW, with an annual production of around 6,300 kWh. This does not represent a significant generation capacity in terms of domestic electricity consumption (average 15,830 kWh/household/year in Strathblane based on figures in section 1), and would only offset the electricity consumption of 0.4 households.

It is estimated a hydro scheme at this site would cost about £6,000 and generate around £1,433 per annum. This is based on the assumption that all electricity will be exported to the grid.

2.4 Ballagan Burn NS 57266 79522

The Ballagan Burn site appears to offer a more favourable hydro potential. Located on the outskirts of Strathblane village, the burn acts as the source for the main river flowing through the village, the Blane Water. The burn follows a reasonably steep course to the river with a significant drop at the Spout of Ballagan (waterfall). Owing to this Spout the burn has a very high head and following a review of topographic maps of the area this has been estimated at around 100m. The catchment area is estimated at 2.6 km², giving an estimated mean flow in the burn of 0.14 m³/s.

Based on these figures, and using the formula above, it is estimated that the Ballagan Burn may provide an approximate scheme rating of 100 kW, with an annual production of around 337,000 kWh. This presents a reasonably positive option, providing enough energy to offset the electricity consumption of around 21 households, and could potentially offset a significant proportion of the electricity requirements of the Ballagan estate.

In order to optimise the power potential from this site, by implementing methods to control the flow, it is expected a significant amount of engineering works is required. When taking account of access, connection and engineering works it is estimated that this hydro scheme would cost around £600,000. The potential income from this facility would be about £70,000.

There are two options for the Group to utilise electricity generated from this potential scheme.

- Directly supplying the households within the Ballagan estate. This option may be very interesting to the Group as it would mean this area of the community’s catchment would be fairly self-sufficient in terms of electricity. However, this would require the supply from the turbine to be split between the households, adding both cost and transmission losses.

- Connecting the turbine directly into the grid. Although this does not offer the Group the opportunity of directly offsetting electricity consumption within the community’s catchment it will indirectly offset a percentage (1.77%) of the community’s total consumption. In addition, it will generate up to an additional
£16,800/annum. There is a substation within the estate and using this would significantly reduce any connection costs.

One very real potential problem with the idea of installing a hydro scheme in the Ballagan Spout is that it is one of the country’s original Sites of Special Scientific Interest. To quote from the SSSI citation for the site:

The site is a classic section for rocks of the Carboniferous Cementstone Group. It is the type locality for the Ballagan Beds, a sequence dominated by cementstone-shale rhythms (‘regular lithological alternations’). The cyclical nature of the sedimentary sequence is well-displayed and many features of sedimentological interest occur. This is a key locality for studies of stratigraphy and sedimentation in the Dinantian rocks of Scotland.

The underlying geology and soils have given rise to ancient deciduous gorge woodland with base-rich soils. The tree canopy is dominated by ash with frequent to occasional hazel, alder, bird cherry, birch, rowan and beech. The ground flora is characterised by species associated with these soil conditions and includes enchanter’s nightshade Circaea lutetiana, dog’s mercury Mercurialis perennis, sweet woodruff Galium odoratum, yellow pimpernel Lysimachia nemorum, and moschatel Adoxa moschatellina. The pendulous sedge Carex pendula occurs here at one of its few locations in the area.

Given this designation and the associated restrictions on activities within or affecting the site, we would consider it extremely unlikely that development of this nature would be permitted here.

2.5 Blanefield NS 55325 79517

The small waterfall located in the southern part of Blanefield, by Netherblane, was highlighted by the Group as another potential site for establishing small scale hydro. This burn acts as yet another tributary to the Blane Water and is fed by a small reservoir. Following the desk based study the head of the outflow has been estimated to about 5m and the catchment area to 0.1km². Therefore, the mean flow is approximately 5.4 l/s, or 0.0054m³/s.

Based on these figures, and using the formula above, it is estimated that the Blanefield burn may provide an approximate scheme rating of 0.2kW, with an annual production of around 650Wh. This power output is extremely low and would only be suitable for demonstration purposes.

The Group are in the process of developing the land adjacent to the small reservoir into allotments. One of the desires of the project is to utilise the hydroelectricity generated from this installation to supply lighting and heating for the planned allotments, as well as possibly using this facility for educational purposes. The estimated power generation from the proposed hydro scheme is not really sufficient to make any significant contribution toward these power requirements. However, although it may not generate a significant power output, nor income, its small size would allow community and school groups to get a clear understanding of how hydroelectric power works, and its potential uses. One idea would be to have a display stall with a poster template, or similar, within the turbine house outlining simple diagrams of the operation of the turbine and how the electricity is used.

Due to the small size of the scheme the best approach would be to connect the installation and the allotments to the grid, so that excess power generated can be exported and the allotments are also not dependent on hydro generation.

2.6 Conclusion

The Ballagan Burn is the only site with any real potential for effective hydro development and it seems highly unlikely that such development would be permitted by SNH or, for that matter, supported by the local community, given the environmental impact involved. There is potential for the Mill Dam site to pay for itself but it does not have the capacity to generate meaningful amounts of electricity. The Blanefield site is probably not worth developing, even if only for educational purposes.
3 SOLAR

3.1 Photovoltaics (PV)

Solar PV cells generate electricity from the sun’s energy which can be used for household purposes. They do not require direct sunlight to operate, they can do so under cloudy circumstances as well, although electricity production is directly related to the strength of sunlight. Therefore in order to optimise energy production, PV cells should only be placed on south-facing roofs that are not overshadowed by trees or buildings.

The Group has expressed interest in the possibility of integrating solar PV cells as part of their move to offset the village’s energy consumption. Although this is a good idea, it may not represent the most favourable economic choice. PV has a very high Feed-In Tariff (FIT) rate associated with it, 29.3p/kWh to 41.3p/kWh depending on size, which appears positive but the reason it is set so high is that the FIT is set up to provide an expected rate of return across all technologies. Good quality PV cells convert power to electricity at an efficiency of only 15%. When considering the lack of sunshine in the UK this does not represent a large output per square meter of cell, and therefore they need a high tariff rate in order to try to meet the set rate of return (8%).

The average yearly global radiation in the Blane Valley region is about 900-950kWh/m². When taking this into account it is expected that a typical 2.2kW system with an area of around 16m² would generate perhaps 1,600kWh/year, enough to offset 10% of the electricity consumption of a standard household in the Strathblane area. Such an installation would cost about £13,000 to install and pay around £800 a year, giving a simple payback of around 16 years.

The lifetime carbon footprint of PV in Scotland is around 50gCO₂/kWh, which is about one tenth of current grid carbon intensity but about ten times that of wind.

3.2 Solar thermal

Solar thermal panels have always been a robust and cost-effective way to harness the power of the sun and from April 2011 they will also benefit from annual payments under the Renewable Heat Incentive (http://www.rhincentive.co.uk/). This is currently still out for consultation but in the draft version, a “tariff” of 18p/kWh will be paid for solar thermal installations. A typical UK household uses around 3,700 kWh of energy per year to heat water for hot taps. A solar water heating system that produces 60% of the total hot water thus saves around 2,200 kWh in energy bills. (Source: Centre for Alternative Technology)

There were significant changes between the consultation document for the Feed-In Tariffs and the final government response, so it is advisable to wait until the final response to the RHI consultation is published but on these figures, this looks like an attractive technology, both practically and financially. The trick would be in finding a way for BVCNG to deploy it across the area.

4 BIOMASS

During the initial meeting with the Group, an ambition to investigate future development opportunities regarding renewable heat initiatives was outlined. In particular this related to investigating the potential for improving the energy efficiency of the local school, including the possibility of integrating a biomass heating system. Ideally the material supplying this system should be sourced from within the Community boundary to promote self-sufficiency and sustainability.

UK softwood planting in 2009 amounted to some 1,628,000 hectares, from which around 8.5 million wet tonnes of timber were produced. Forest cover in the UK is currently increasing, so for want of better data, we will take 5 wet tonnes per hectare per year as a benchmark for sustainable coniferous forest yield. Seasoned pine has a density of around 350kg/m³ so this equates to about 1.75 tonnes of seasoned timber per hectare.

Following the desk based study it has been established that there is at least 300 hectares of woodland within the Community boundary. If the benchmark figure of 1.75 tonnes is used, an estimated 525 dry tonnes of timber can be sustainably harvested from the area. The energy content of wood fuel at 20% moisture (this figure is consistently used in this report as it represents the average moisture content of wood fuel for sale) is
around 15GJ/t, or 4,167kWh/t, suggesting the total energy content that can be sustainably harvested from the area equals 2,187 MWh. Modern log gasification boilers can operate consistently at around 90% efficiency, so this source of energy is theoretically capable of delivering almost 2,000MWh of heat energy.

This would clearly be more than enough to supply the school, assuming that all that 300Ha of timber is actually available, however it is more likely that only a fraction may be so. Nonetheless, it appears that it would be worthwhile pursuing this option, particularly as there is a desire to update the school’s energy systems which could open up an opportunity to install a local, sustainably harvested biomass-fired combined heat and power system. Development of local timber management, drying facilities and pelletising infrastructure would generate local jobs and skills, while also providing a resource which could be used in other local installations, such as domestic-scale timber pellet boilers.

Should this option be highlighted as a preferred option further assessment of the practicalities, costs and a forward plan will be produced.

5 WIND

5.1 Introduction

Wind power is an established and robust technology which, with the introduction of the Feed-In Tariffs, is now attractive financially, as well as environmentally. At a community scale, the only significant negative environmental impacts of wind installations are visual, or aesthetic. This is really a qualitative judgement and whether the Group chooses to support wind power at any of the scales discussed in this section or not, it should be emphasised most strongly that local opinion is the key.

Following the initial discussion, we have looked at three different scales for wind installations. The smallest is in the region of 30kW, which implies a turbine on a 24m tower, with 6.5m blades, giving a height to tip of around 30m (for reference, a standard high voltage pylon ranges in height of between 30m and 50m). The next step up in scale is to the 300kW range, which needs a 37m tower and 16.5m blades, giving a total of around 54m. Finally, at the higher power end, full size 2.3MW turbines of the type seen at Whitelee and Fintry, which have a blade length of around 35m, on a hub at least 60m high, giving a height to tip in the region of 100m.

For the purposes of this exercise and because they generally have the most favourable cost and performance figures, we have used the Hannevind 30kW, Vergnet 275kW and Enercon 2.3MW turbines. For the two smaller installations, FIT rates have been used but the larger installations propose three 2.3MW turbines, making a total of 6.9MW, which would put the installation over even the new microgeneration threshold, so a reasonable average for ROC payments has been used.

The power available from a wind turbine depends on the swept area, so a turbine with twice the blade length can (all else being equal) generate four times as much energy. It also depends, of course, on the windspeed, which varies with height, both above sea level and above ground level (i.e. you get more wind through a turbine on a 30m mast than one on a 15m mast, and you also get more if you put it at the top of a hill, rather than the bottom). Available power also varies with wind-speed, however this time it varies as the cube of the speed, so windier sites have the potential to generate very much more electricity.

For each of the options below we have based the number of turbines on preliminary assessments of the area using topography maps, wind speed data, as well as the standard guidance on the minimum distance between turbines (6 times the rotor diameter up and down wind of the turbine, and 4 times the rotor diameter to the site). These are only an indication of the potential productivity of each site and will be addressed in greater detail following the Group’s decision on the way forward.

The following is a summary of the sites considered:

5.2 Ballagan NS 56991 79682

This site has good access and good potential for connection to the grid. As with the Ballagan hydro installation discussed above, there is potential to connect direct to the houses on the Ballagan estate but this would require considerable design and installation effort, as well as close co-operation with Scottish Power, so the
easier option would be to wire the turbine straight to the large transformer already on site. The site appears to have good wind resource, although it may be sheltered from the north. Overall, this site has excellent potential. Initial discussions with the Group suggested a 30kW turbine could be installed at this location. Such an installation would generate approximately 117MWh per year, enough to offset the electricity consumption of approximately 7.4 households.

5.3 Boards NS 54330 79207
This site has been considered for a larger, 275kW turbine. The site itself appears fine, although the wind resource is limited and connection is likely to be an issue for a turbine of this size. However, overall the site still has potential with a turbine of this size could generate up to 620MWh per year, enough to offset the electricity consumption of approximately 39 households. A reasonable site.

5.4 Braehead NS 54255 79752
Another site considered for the larger 275kW range turbine. Site wind conditions (the best conditions can be obtained at NS 53975 79722) and access are very similar to Boards, above, but connection is likely to be easier and cheaper as the site is right next to an 11kV line. A turbine of this size could generate up to 641MWh/year, enough to offset the electricity consumption of about 40 households. A reasonable site.

5.5 Campsie Dene NS 55200 80667
Connection costs are again likely to be significant at this site, although access is reasonable. The wind regime appears to be more favourable than on the south side of the valley, so these additional costs are overcome by the increased projected income. For this site a single 275kW turbine has been suggested, which has the capacity to generate up to 763MWh/year, enough to offset the electricity consumption of about 48 households. A reasonable site.

5.6 Campsie Fells NS 56195 81987
This site has the biggest wind resource we have ever seen and, technically, would make an excellent site for a wind farm. It has been considered for a larger scale installation of three 2.3MW turbines, which would be sufficient to meet the requirements of the Group’s aims (28,349MWh) and offset the electricity consumption of about 1,790 households. The site would require significant expenditure on connection and access and would no doubt cause a furore in terms of visual impact. However, the tremendous wind resource available means that, from a purely technical standpoint, it is well worth considering further. It would also be worth considering it as a site for a larger installation. However, there would be huge political implications in attempting to develop this site. Technically, it appears to be a good, or possibly excellent site.

If, due to local objection, a slightly smaller installation would be opted for, i.e. three 275kW turbines, the site would potentially generate 3,440MWh/year, enough to offset the electricity consumption of about 217 households.

5.7 Craigend Muir NS 57566 77627
Of the sites considered for the larger scale installation, Craigend Muir is perhaps the least contentious. The Campsie Fells site (above) would be highly visible (from elsewhere, if not so much from the town) and the Dumbrock Muir site(s), below, are understood to be politically sensitive. However, it is adjacent to the Loch Ardinning nature reserve, which could be difficult. Access and connection costs would be moderate and the wind resource appears reasonable, so overall the site is worth considering. The suggested installation of 3 2.3MW turbines at this site would generate up to 16,566MWh/year, enough to offset the electricity consumption of over 1,045 households. A good site.

If, due to local objection, a slightly smaller installation would be opted for, i.e. three 275kW turbines, the site would potentially generate 2,496MWh/year, enough to offset the electricity consumption of about 157 households.

5.8 Dumbrock Muir 1 NS 55385 78252
This site is understood to be politically sensitive in a local context, however from a purely technical point of view, it has reasonable access and excellent potential for connection to the high voltage grid which runs along
one side of the site. The wind resource is reasonable, so overall this would be a good site for consideration for this scale (3 x 2.3MW turbines) of installation, with the potential generation capacity of 15,674MWh/year, enough to offset the electricity consumption of around 990 households.

If, due to local objection, a slightly smaller installation would be opted for, i.e. three 275kW turbines, the site would potentially generate 2,385MWh/year, enough to offset the electricity consumption of about 150 households.

5.9 Dumbrock Muir 2 NS 54940 78592

We have added in a second site to the north north-west of Dumbrock Loch (OS ref NS 549 785), which appears on the map to be worth consideration, although this opinion is made in complete ignorance of local opinion or land ownership. From a technical perspective, the site has all the advantages of the first Dumbrock Muir site, with a slightly better wind regime, although it is also adjacent to the Dumbrock Loch Meadows SSSI, so any development would have to be undertaken with great care. This would be a good site with a generation capacity of 18,000MWh/year (based on three 2.3MW turbines), enough to potentially offset the electricity consumption of around 1,137 households.

If, due to local objection, a slightly smaller installation would be opted for, i.e. three 275kW turbines, the site would potentially generate 2,655MWh/year, enough to offset the electricity consumption of about 167 households.

5.10 Mugdock Country Park NS 54995 77772

This site was proposed for development of a single 30kW turbine in collaboration with the Park. Access and connection are likely to be relatively straightforward and the wind regime is reasonable. Overall, this is a good site with a generation capacity of 97MWh/year, enough to offset the electricity consumption of around 6 households.

Unfortunately the Park is within a Site of Special Scientific Interest, which may cause restrictions. However, following the desk based study it appears the two most suitable sites within the area of the Park are actually outwith the SSSI. This means any major works would not affect the SSSI (location of roads ensures access would not be across the SSSI), nor would the turbine itself as the SSSI features relates to vegetation and not birds. As a result the installation of one 30kW turbine will not affect the SSSI.

SNH have clearly outlined the types of operations, within the SSSI, that would require consent. Although this installation would be out with the SSSI it is recommended the Group liaises with SNH from the outset, should this option be progressed.

6 INTERIM CONCLUSIONS

For the purposes of this exercise, we have assumed that the electricity requirements of the area come to around 19,000MWh per year. This is based on a per capita average taken across the whole of Scotland and may be an under-estimate. A similar exercise in Stenton, East Lothian was compared with their own survey of every household in the village, with the result that they actually use twice the national average of electricity. However, for want of better data right now, this is the benchmark that we have chosen to meet the Group’s aim of generating the area’s electricity requirements from local, renewable resources. It should also be kept in mind that, although this may seem like a daunting target, it is the least ambitious of those originally discussed, such as carbon neutrality for the area, or the provision of all local energy from renewable resources. With increasing costs for fossil fuels and the introduction of electric vehicles, it is also possible that electricity consumption will rise, rather than fall, even with the implementation of efficiency measures.

Using this benchmark, it is immediately clear that only the larger scale wind installations will come close to fulfilling the Group’s stated objective. Although an installation of three large-scale wind turbines may seem excessive, this is what is required. In fact, this is probably a third or a quarter of what is actually required if the Group really wants to become carbon neutral. The same generation capacity could be achieved with smaller turbines but it would require around 200 of the smaller 30kW units, or 25 of the 275kW turbines. There simply are not enough sites within the area to achieve this with 30kW turbines and it is doubtful whether it could be
achieved even with 275kW units. It is also highly questionable whether to do so would represent less of an environmental impact.

Of the other technologies, a hydro installation in the Ballagan Burn could be worthwhile but would be highly unlikely to get planning permission. It would be worth asking SNH about this, rather than just abandoning the idea but it would also be a very good idea to canvass local opinion, as it may be that the detrimental environmental impact of damming the Spout outweigh the modest advantages. The Mill Dam hydro installation has potential and would be interesting from an educational perspective but would not be able to make a significant contribution to local electricity generation.

Local biomass resources may be worth pursuing further, particularly if this can be combined with a beneficial local project such as the installation of a biomass combined heat and power installation in the school.

Solar installations have some potential, although this is still better for solar thermal than for photovoltaics. The issue here would be not so much physically how to install solar but financially and organisationally how to make it work.

Overall, the only way to make a significant impression on the sustainability of Strathblanefield is through development of a relatively large-scale wind installation. This need not exclude development of other opportunities and other technologies but it is essential if the Group is to make any real difference. It is therefore recommended the Group compile a list of what options they prefer and how they wish to proceed. This could be a strict focus on large-scale wind, or a combination of technologies including wind (this would probably initially focus on wind to generate income for the development of other technologies and initiatives).

If the Group decides to pursue any of the above options, it would require a more thorough feasibility study to establish where best to site the installation(s), complete detailed economic modelling, and to determine any restrictions after liaising with SEPA and SNH. Following the outcome(s) of this an open discussion must be held with the community to gauge their views. Ultimately, any planning application would have to be supported by a full Environmental Impact Assessment, which would cost hundreds of thousands of pounds. However, funding of this scale for this purpose is available from organisations such as Community Energy Scotland and the Climate Challenge Fund (if it is extended; currently it is due to finish in April 2011 and is not accepting new applications).

This report is an initial overview of renewable energy generation potential in the Strathblane area. Once the group has decided which options it wishes to pursue, a more detailed feasibility study can be carried out into the practical implications of these.
Figure 1: Draft map of locations discussed in text.
<table>
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<th>Site</th>
<th>Installation (kW)</th>
<th>Equipment</th>
<th>Access</th>
<th>Connection</th>
<th>Total</th>
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<th>Annual generation (MWh)</th>
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<td>£1,000</td>
<td>£11,000</td>
<td></td>
<td>0.65</td>
<td>149</td>
<td>0.003%</td>
<td>£149</td>
<td>1%</td>
<td>74</td>
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<tr>
<td>Boards</td>
<td>275</td>
<td>£500,000</td>
<td>£10,000</td>
<td>£100,000</td>
<td>£610,000</td>
<td>5.8</td>
<td>620</td>
<td>3.3%</td>
<td>£135,000</td>
<td>22%</td>
<td>4.5</td>
</tr>
<tr>
<td>Braehead</td>
<td>275</td>
<td>£500,000</td>
<td>£5,000</td>
<td>£20,000</td>
<td>£525,000</td>
<td>5.9</td>
<td>641</td>
<td>3.4%</td>
<td>£139,000</td>
<td>26%</td>
<td>3.8</td>
</tr>
<tr>
<td>Campsie Dene</td>
<td>275</td>
<td>£500,000</td>
<td>£10,000</td>
<td>£100,000</td>
<td>£610,000</td>
<td>6.5</td>
<td>763</td>
<td>4.0%</td>
<td>£166,000</td>
<td>27%</td>
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<tr>
<td>Campsie Falls</td>
<td>6900</td>
<td>£10,000,000</td>
<td>£3,000,000</td>
<td>£2,000,000</td>
<td>£15,000,000</td>
<td>10.6</td>
<td>28,349</td>
<td>149.2%</td>
<td>£2,126,175</td>
<td>14%</td>
<td>7.1</td>
</tr>
<tr>
<td>Craigend</td>
<td>6900</td>
<td>£10,000,000</td>
<td>£1,000,000</td>
<td>£1,500,000</td>
<td>£12,500,000</td>
<td>6.8</td>
<td>16,566</td>
<td>87.2%</td>
<td>£1,242,450</td>
<td>10%</td>
<td>10.1</td>
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<tr>
<td>Dumbrock Muir 1</td>
<td>6900</td>
<td>£10,000,000</td>
<td>£500,000</td>
<td>£1,000,000</td>
<td>£11,500,000</td>
<td>6.6</td>
<td>15,674</td>
<td>82.5%</td>
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<td>9.8</td>
</tr>
<tr>
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<td>6900</td>
<td>£10,000,000</td>
<td>£500,000</td>
<td>£1,000,000</td>
<td>£11,500,000</td>
<td>7.1</td>
<td>17,955</td>
<td>94.5%</td>
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<td>12%</td>
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<td>£1,000</td>
<td>£6,000</td>
<td></td>
<td>6.3</td>
<td>1433</td>
<td>0.03%</td>
<td>£1,433</td>
<td>24%</td>
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<td>Mugdock Country Park</td>
<td>30</td>
<td>£70,000</td>
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<td>£10,000</td>
<td>£81,000</td>
<td>6.5</td>
<td>97</td>
<td>0.5%</td>
<td>£26,000</td>
<td>32%</td>
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</tr>
<tr>
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<td>2.2</td>
<td>£12,600</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>0.008%</td>
<td>£805</td>
<td>6%</td>
<td>15.7</td>
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<tr>
<td>Typical solar thermal</td>
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<td>£4,000</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td>0.042%</td>
<td>£1,440</td>
<td>36%</td>
<td>2.8</td>
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<tr>
<td>Biomass</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>2,000</td>
<td>10.5%</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Generation target has been set at 19,000MWh/yr, based on per capita electricity consumption in Scotland in 2008 (latest data).
NB biomass “generation” is not really applicable to this target but the calculation has been included to give an impression of the potential scale of this resource.

Figure 2: Summary table.
REFERENCES

1 Gross electricity consumed in Scotland during 2008 (total generated – exports + imports), representing domestic use plus electricity consumed in factories, etc, which must be shared among the population. [http://www.culturalcommission.co.uk/Topics/Statistics/Browse/Environment/seso/sesoSubSearch/Q/SID/132](http://www.culturalcommission.co.uk/Topics/Statistics/Browse/Environment/seso/sesoSubSearch/Q/SID/132)


3 According to Scotland’s census results online (SCRO), the total resident population of “Strathblane locality Scotland” was 1,811 [in 2001, when the last census was performed]. [http://www.scrol.gov.uk/scrol/browser/profile.jsp?profile=Population&mainArea=Strathblane&mainLevel=Locality](http://www.scrol.gov.uk/scrol/browser/profile.jsp?profile=Population&mainArea=Strathblane&mainLevel=Locality). This figure covers the village community and not the outlying regions included in the BVCNG’s boundary. For a more accurate estimate, the population of the Strathblane Community Council has been used (also derived from 2001 census data), [http://www.stirling.gov.uk/strathblane-5.pdf](http://www.stirling.gov.uk/strathblane-5.pdf)