CARES Toolkit: Wind

LOCAL ENERGY SCOTLAND

Module structure

The CARES Toolkit is intended to be used as a reference by CARES clients of all kinds, including community groups, community-based businesses, and rural businesses. This module is one part of a series of documents forming the CARES Toolkit and is designed to cover all sizes of project, although the scale and complexity of multi-MW projects may require more detailed evaluation than smaller projects.

Other modules that may also be of particular interest to those reading this module are as follows:

- establishing a community group
- project finance
- procurement
- securing the site
- planning
- grid connection
- investment ready process
- shared ownership
- sources of finance.

This module is structured in four parts to act as a guide and reference document for CARES clients in the development of a wind energy project in Scotland.

Making projects economic in a changed market
Overview of options to make projects viable.

Project overview
A brief introduction to the typical ways to develop a wind project and step by step summary.

Project Steps, phases and breakpoints
A more detailed look at each stage of a project, showing a logical progression with defined break points.

Alternative wind energy options
An overview of the refurbished or remanufactured options available.

Further information
Appropriate links, definitions and references to other information, collated for quick reference.

Making projects economic in a changed market

Since 2015 the renewable energy market has changed with a new focus on more innovative grid solutions, new electricity sale options, and second-hand machines to make projects cost effective now support from Feed-in-Tariffs has ended.

The Distribution Network Operator (DNO) is a body licenced to distribute electricity through the national grid. In Scotland, there are two DNOs, Scottish and Southern Energy Power Distribution (SHEPD) covering the area north of Perth, and Scottish Power Energy Networks (SPEN) covering the area south of Perth. Both SHEPD and SPEN have large areas of constrained grid, which can lead to an expensive connection cost or a wait of several years for a connection date. There are a range of options which can be used to overcome grid connection constraints.

To overcome the potential issues with grid connections and financial viability, based on reducing or removed tariffs, there is a new focus on local energy supply. Different approaches can be taken to Local Energy Supply, as described in the toolkit module, these provide community groups with new options for supplying energy locally or selling electricity produced on a contract basis. This new focus on local energy supply provides the community group with a wider range of development options and the potential for increased revenue.

Options for second-hand, re-manufactured or refurbished machines are also worth exploring.

Project overview

Wind energy development options

There are a variety of development models that involve CARES clients to a greater or lesser degree and generally, as the level of involvement and control increases, so too do the risks and rewards. The range of involvement extends from taking on the full development of a project, to simply receiving benefit payments from another developer.

Allowing a wind developer to lead the project and drive it through to completion offers the CARES client less risk, no cost and little work, however, the financial reward is relatively low compared to the same project being led by the CARES client.

As the benefits of engaging and sharing with the local community have been shown to create more successful projects, commercial developers are also creating different development models. Many of these are based on some form of partnership with the community, possibly in a Shared Ownership or Joint Venture arrangement.

The CARES shared ownership portal is designed to allow organisations and community groups across Scotland to collaboratively progress renewable energy projects and is a useful place to start for those wishing to invest. The shared ownership module provides guidance on investing in projects being developed by a commercial developer.

Table 1 below sets out through 5 models the main options open to a CARES client wishing to be involved in a wind energy project. It identifies the role of parties involved, where the main risks lie and the potential benefits.

Overview of activities

Although the level of involvement in a project will depend on the role chosen by the CARES client, or indeed that offered to them, projects will generally move through a logical progression. It is valuable, in whichever role a CARES client undertakes, to understand the overall process.

In this module we have illustrated this progression of activities through a series of phases, up to defined break points. These break points are designed to review progress against a number of key challenges and confirm that a project has the potential to be viable and thus worth progressing to the next phase. These challenges include:

- local opposition to wind energy which can delay or prevent planning consent
- connection of an intermittent generation technology to the grid and grid access issues
- securing rights to use the land and gaining suitable access to the land
- finding sources of funding at each stage of the development

Local Energy Scotland provides free support, through their local development officers, to help CARES clients overcome these challenges and may also be able to provide financial support though the CARES loan and grant schemes.

Table 2 below outlines the steps in developing a wind energy project irrespective of scale and who is leading the development.

Table 1 - Wind energy development options. The table below gives general descriptions of five approaches to project development that may be applicable to CARES clients.

Model	Option	Description	CARES client Role	Third party Role	CARES client Risks	CARES client Benefits	Comments
1	**CARES client leads and owns the project throughout**	The CARES client identifies, develops and operates the project	As full developer	None	CARES client bears all of the technical, commercial and financial risks	The CARES client gains all income from the project and remains in total control of the process and outcome	For the CARES client to retain all financial and other benefits it must act as developer and take responsibility for all project risks. The CARES client may also become responsible for making community benefit payments to others.
2	**CARES client in partnership with another party (Joint Venture)**	CARES client identifies the project but shares further costs & risks	To undertake agreed tasks within the project development process	To undertake agreed tasks within the project development process	Risks are shared between partners & are usually limited to project costs	The CARES client gains a share of income & control, which remain in the proportions agreed with the other party	Depending on the detail and legal options taken, this can give the CARES client control of the project and can make the process of development easier. The transfer of benefits from the project will be agreed as part of the Joint Venture partnership agreement.
3	**CARES client Initiates then hands over to a developer**	CARES client identifies the project, gains rights to the site & seeks a developer to take the project forward	Site selection and initial viability then support for the project to make it a success	To confirm viability and take the project forward to operation	Work to identify an appropriate site usually involves more time than money, minimising risk	With rights to use the site the CARES client can negotiate more favourable outcomes in terms of ownership of the project	CARES client controlling the development site should generate higher benefits than those without control, however the bulk of income will reside with the developer
4	**Developer leads & offers sale to CARES client (Shared Ownership)**	Wind developer leads the project and sells a percentage or the entire project to the CARES client	Initial support for the project to make it a success then raises funds for purchase	Provides development skills and sources initial project finance	Reduced risk as CARES client would take ownership of an asset or project shown to be viable	Low risk route to long term asset ownership of a project	Potentially an attractive option where the project has been initiated by a developer. Purchasing generally increases the capital cost and may also impact on the income period. CARES clients considering this option should focus on obtaining legal and financial support
5	**Wind developer leads and owns the project throughout**	Wind developer leads the project & offers the CARES client an annual payment	Initial support for the project to make it a success	As full developer	None	Community Benefit payments vary between projects, but £5,000 / MW installed is considered good practice	Community Benefit payments to CARES clients will generally be a fraction of the income available from a project See the Community Benefits Register for payments provided on similar projects

Table 2 - Overview of activities This table summarises a logical progression for developing a wind energy project.

Phase 1	**Developing the idea**	
Step 1 **Develop the Vision**	A key initial step in wind energy development is to define why you want to undertake the project	1 to 4 months
Step 2 **Seek Advice**	Wind energy developments have already been undertaken by groups or businesses like yours	
Step 3 **Communicate**	Wind energy has the potential to be highly contentious, so it is important to undertake early consultation with local residents & the wider community	
Step 4 **Find a site**	Sites can be assessed against key factors to identify if there is potential for a viable wind project. Ability to secure use for 25 years is also vital	
Step 5 **Initial Scoping**	Very roughly gauge site potential. There are a number of web-based tools which allow you to quickly review the potential viability of a given site	
Break Point 1	**Is there a reason to develop?**	
Phase 2	**Assess potential sites**	
Step 6 **Establish a legal entity**	A community may need to be established as a formally constituted body or legal entity. A business may choose to operate under the business name	1 to 4 months
Step 7 **Secure initial funds**	Identify funding options to support pre-feasibility work. Appropriately constituted community groups can apply for a CARES enablement grant	
Step 8 **Pre-feasibility study**	A more detailed scoping study, usually by a paid consultant, to assess the site(s) identified and the technology options suitable	
Step 9 **Financial viability check**	More detailed accounting of estimated expenditure and income should be carried out. There is a CARES financial model that can be used for this purpose	
Break Point 2	**Does the project have potential?**	
Phase 3	**Evaluate the project**	
Step 10 **Secure the site**	The site is the key to viability, so it is important to secure it by a legally binding agreement (an options agreement) before incurring further development costs	6 to 12 months
Step 11 **Full feasibility study**	Building on the scoping study this more detailed study is carried out to identify all the site constraints and confirm potential turbines models appropriate for the site	
Step 12 **Confirm grid available**	Based on feasibility study information, check grid availability at the preferred locations. CARES development officers can support enquiries to the DNO	
Step 13 **Pre-planning consultation**	Meet with the local planning representatives and discuss your project, their relevant policies and any requirements they may place on an application	
Step 14 **Neighbour notification**	Notify all properties within 1km of the site about the proposed project and where possible ask for views and feedback	
Break Point 3	**Can the challenges be overcome?**	

Phase 4	Develop the project	
Step 15 **Fix the project size**	You should now have a scale of development in mind and the feasibility study, planning consultation and grid enquiry should have helped to fix this	6 to 18 months
Step 16 **Financial viability check**	Confirm the project remains financially viable. The CARES financial model can be populated with more detailed figures and various scenarios tested.	
Step 17 **Secure pre-planning funds**	Identify funding options to support ongoing development of the project through to a planning decision. CARES clients can apply for a CARES funding	
Step 18 **Planning application**	Usually through paid consultants and including a variety of reports, surveys & visualisations, prepare and submit a Planning Application for the project	
Step 19 **Grid application**	Make a formal grid application to the appropriate DNO	
Step 20 **Identify funding sources**	Investigate routes to achieve capital funding. The most appropriate should be selected at this point as this will influence some future activities	
Step 21 **Develop full financial model**	Complete a business plan and detailed financial appraisal with full project costs and projected project lifetime incomes to take to potential funders	
Break Point 4	**Confirm consents, grid and financial viability**	
Phase 5	**Getting Financial Close**	
Step 22 **Identify & contact suppliers**	With consents and agreements in place the turbine supply, construction, operations and maintenance contracts can be formalised and programmed	1 to 4 months
Step 23 **Secure bridge funds**	Identify if further funding is required (usually for deposits) prior to financial close. Well managed projects may be able to apply for a CARES loan	
Step 24 **Financial Close**	This is the point at which the funder assesses the project through a due diligence process and, if acceptable, agrees to release funds for construction	
Break Point 5	**Is the project ready to construct?**	
Phase 6	**Completing the Project**	
Step 25 **Repay other funds**	Secure any additional capital funding and repay development loans where required. CARES loans should be paid in full on reaching financial close	1 to 12 months
Step 26 **Construction**	Post Financial Close, confirm all orders and contracts and the process of wind turbine delivery, erection and connection can take place	
Step 27 **Community benefit**	Where appropriate enter into a community benefit agreement to secure index linked community benefit payments for the life of the project	20 to 25 years
Step 28 **Operation**	Ensure management is in place for the life of the project for collecting and distributing income and meeting operating, financial and other liabilities	
Step 29 **Decommissioning**	Wind projects must plan for removal of the construction at the end of the productive life (generally 20 to 25 years).	

Project steps, phases and breakpoints

Phase 1 – Developing the idea

Step 1 – Develop the vision

It is important you are clear about the reason for undertaking, or participating in, a wind development project. For example, this may be to gain income for use within the community or to enable local businesses or farms become more energy self sufficient to offset rising energy prices. You may have environmental drivers to reduce carbon emissions. It is important that you fully understand and define your own drivers so that project viability and outcomes can be tested against your objectives.

For communities, an excellent way to identify needs can be through the development of a Community Action Plan, the production of which will allow the development of a strategic plan and allow local democracy to define and respond to local community objectives and opportunities. It also provides a robust mandate for the distribution of funds when a community related venture begins to provide revenue. A strategic plan provides overall direction on the long path from where things are now to where we hope they will be. Community work can be greatly enhanced by a clear vision, a mission statement, objectives, strategies, and an action plan.

Businesses can also benefit from the development of their own action plan, as this helps link business needs and objectives with the potential to develop a wind energy project.

The main points to consider in an action plan are:

1. What are the needs in your community/business and what evidence of these needs is there?
2. What potential, realistic changes can you envisage?
3. What actions & activities need to be undertaken to meet the needs and implement the changes?
4. What are the costs of the actions?
5. What are the short and long-term priorities?

Eligible community groups can apply for a CARES enablement grant to support developing a community action plan. A number of examples of action plans produced by community groups have been referenced in Further Information.

Step 2 – Seek advice

It is sensible to seek the advice and experience of those that have started from a similar position and are well placed to offer help and guidance. By seeking this input from the outset, you will be able to build on the success of others when taking your project forward. Early liaison with your local CARES Development Officer (DO) can highlight opportunities for knowledge transfer between organisations and potential meetings or project visits.

Local Energy Scotland and other organisations such as Community Energy Scotland, the Development Trust Association Scotland and Energy Saving Trust also maintain case studies to facilitate the identification of suitable projects to approach and to gain their insight.

Consider completing a skills assessment of those persons that can be involved in the project during the development stages as the need to buy in consultancy support will clearly add to the cost of the project. The establishing a community group module describes the range of skills that could be beneficial.

Importantly, look for advice in relation to an appropriate scale of wind project to suit the project objectives.

Step 3 – Communicate

To ensure the best outcome for the project, establish clear communication within the local community, neighbouring communities, and other stakeholders early in the project, even before a site is identified.

Experience shows that this communication must be open and honest about what is being planned and must include good opportunities to receive and respond to feedback. This also avoids any misinformation being generated and to allow the vision for the project and the benefits from it to be fully explained. Eligible community groups can apply for a CARES enablement grant to support communication of this nature.

If strong opposition remains after this process it may make it harder and more costly to obtain planning permission and may cause lasting social impacts within your community.

It is equally important for a rural business planning wind energy projects to ensure that it has local support for its plans. A rural business receiving CARES financial support will pay an annual sum to the local community, but it is important to understand the relative significance of this against any perceived impacts such as visual intrusion.

There are a range of guidance documents available for engaging with the community referenced later in this module.

Step 4 – Find a site

The CARES Renewable Handbook highlights a number of key factors to consider when determining the suitability of a particular location for siting a wind turbine and can be referenced in addition to this module. There are a number of important points to consider when identifying a suitable site.

- Wind resource
- Planning constraints
- Grid connection
- Available customers
- Lease agreement
- Radar interference

- Access to site

Wind Resource

Appropriate wind turbine location is essential for project viability and a major determinant of this is wind speed. For a rule-of-thumb guide for MW scale turbines communityplanning.net suggest a wind speed of 6.4m/second (measured 45m above the ground) can lead to a financially viable project & for smaller turbines on lower towers, 5m/second or more at a hub height of 10 m may be needed. However, sites with lower wind speeds can still be viable for a given circumstance or for smaller wind turbines and conversely, if a site has these wind speeds, it is not certain to be viable.

In these initial stages of project development wind monitoring is not practical so other 'virtual' means of wind speed assessment are available that do not require masts to be erected.

Planning constraints

Most planning authorities have published Planning Policy Guidance covering wind energy projects and this should be your first port of call for background information. In addition, many Planning Departments welcome early informal discussions with wind energy developers about their plans. If turbines have been proposed, or built in the area, the Local Authority web site will contain details of the planning application, the objections, and any restrictions on the development of wind. This can be a valuable source of local information. While results from this background research can never guarantee that planning consent will be granted on any given site, it may help to identify where there may be serious barriers and the basis for this. The planning module provides additional guidance.

Clearly, designated areas such as Sites of Special Scientific Interest (SSSI), Areas of National Outstanding Beauty (ANOB) and National Parks have significant planning restrictions associated with them and will require additional consultation and a more detailed Environmental Impact Assessment (EIA) for wind energy development than in other locations. Scottish Natural Heritage (SNH) have a web-based mapping tool that will show some of the relevant land designations and constraints and is referenced later.

Grid Connection

A grid connection will be required for most projects and can be available at an early date in some areas whilst restricted in capacity for a long period of time in others. Grid connection can be a significant issue across parts of Scotland, especially if large amounts of electricity are being generated (>50kW export capacity). If a connection point is available then the further from the wind turbine this is, the higher the cost of connection will be. Early discussion with the DNO may give broad cost of connection, subject to detailed connection studies. This is covered in more detail in the grid connection module.

Lease agreement

To develop a wind project on a site will require a lease for the lifetime of the project (usually 25 years). Identify site owners through the land registry and make an initial approach to confirm their willingness in general terms to make the site available. The securing the site module contains further guidance on this which can be reviewed when you have identified a site.

Radar Interference

Wind turbines can potentially interfere with aviation radar and are a particular concern for military installations. While civil aviation radar locations are known, the military does not publish this information. Renewable UK provides guidance on how to check that a proposed site will not be objected to at the planning stage (see Further Information). Clearly, small, low turbines are less likely to be a problem unless they are close to and in line of sight with aviation radar. It is sometimes possible to 'blank' the impact of wind turbines that are being used if your identified site is in a restricted area.

Access to site

Larger scale turbines have blades and tower sections that can be many meters long requiring long vehicles to deliver them. This can be a problem if roads have acute bends or have narrow sections. The turbine nacelle can also be many tonnes in weight, so roads and bridges on route to the site must be capable of bearing this weight. If the turbine site is away from a suitable road or track, then consideration must be given as to how delivery to the erection site is to be achieved. If this is an issue it must be identified, especially if the cost of making a temporary track must be included in the project development cost. Local council transport officers and local transport contractors can be good sources of information about access. Full access surveys will be completed as part of the detailed project development later in the process.

Step 5 – Initial scoping

Having identified a potential site (or sites) consideration of the commercial viability of the project should begin. In the first instance web tools can be used to provide an initial assessment of viability. There are many different tools available to do this, some of which are referenced in Further Information later in this module.

As a general rule of thumb, at this point in the development of the project a site generating an estimated payback of 6years or less has the potential to make a viable project. Your Local Energy Scotland DO can provide support at this stage to help determine if the project seems viable.

Break point 1 – is there a reason to develop?

The development process in Phase 1 is intended to identify the need for a project, helps gauge local support and looks to find potential sites. If there are clear benefits to developing a project and a site can be found that is all of the following:

- Likely to have a good wind regime (subject to confirmation)
- Available to purchase, or where access can be secured on a long lease (25yrs)

- Accessible for turbine installation and maintenance
- Close to a point of grid connection
- Unlikely to cause unacceptable impacts on local people
- Potentially able to gain planning permission

Then there is good reason to develop a wind energy project and no reason for it to be stopped at this stage.

There are two actions that are useful throughout the entire ongoing project development, which you may choose to start now. Both are provided free by Local Energy Scotland.

1. Investment Ready preparation – Local Energy Scotland have developed a tool for recording the progress in developing your project and storing all the supporting documentation in a secure, online site. The local CARES Development Officer will assist in setting this up.
2. Project Development plan – a project development plan detailing key tasks, responsibilities and schedule for completion can help you meet the important deadlines that influence the success of your project. Local Energy Scotland has produced a template plan which can be downloaded.

Phase 2 – Assess potential sites

Step 6 – Establish a legal entity

In order to make funding applications, establish banking facilities, secure a site, and enter into contracts or joint venture arrangements, to pay bills and to receive income there should be a recognised legal entity taking the project forward.

For rural businesses, it is important that any liability insurance or the conditions of existing bank finance allow diversification into renewable energy generation so that this activity is covered. In the case of larger projects, it may also be prudent to isolate the liabilities of the wind energy project from the core business.

For community groups that are not already constituted, this means an appropriate formally constituted body or legal framework, usually where the constitution provides some protection against personal liabilities and potentially including appropriate insurance. The establishing a community group module contains more information on establishing a legal entity.

The form of legal entity taking on the project can influence the range of finance options available and could be critical in securing the finance option most suited to the project objectives. Further information on finance options can be found in the sources of finance module, and a review at this stage may support consideration of the appropriate legal entity to progress the potential wind project.

It is important that legal advice from a solicitor who has experience of completing this type of work is obtained at this stage.

Step 7 – Secure initial funding

If project funding has not been identified already, then it will almost certainly be required from this stage on.

There are many ways to source funding, however CARES clients have generally fallen into two categories. Communities, third sector organisations and charities that are eligible to apply to CARES for an enablement grant usually find this the most appropriate, whilst businesses often manage initial funds internally.

Step 8 – Pre-feasibility study

This is a scoping study that is intended to identify suitable sites for development and is commonly outsourced to a professional. For small scale developments (<50kW), a turbine supplier may provide some level of this professional support for free.

The study may look at several sites, and for each site investigate the potential scale and cost of the development. It will also look at each of the key constraints and identify which would be critical to enable the project to be developed on that site. The client or professional can also use the CARES DNO enquiry form to obtain initial grid information local to each site.

The subsequent report at the end of the study should indicate for each site:

a. Annual energy yield and estimated income.
b. Environmental constraints.
c. Initial estimates of capital, operations and maintenance cost.
d. Screening and scoping opinion from local planning authority which will detail key constraints that need to be addressed.

Procuring this study in a competitive process ensures value for money and allows for a review of the consultant's experience and skills prior to engagement. A template Invitation to Tender (ITT) for procuring these services is available on the Local Energy Scotland website and provides an outline of all the tasks that a professional consultant should complete. Further details on the process for procuring these services can be found in the procurement module.

Step 9 – Financial viability check

Some financial information will normally be provided as part of the pre-feasibility study. However, a slightly more detailed review of project viability is recommended. There are wind resource tools that can be utilised to compare potential generation and therefore help verify potential income and the project financial model can be populated with initial information on potential sites to compare overall benefit.

This viability check should be considered along with any other key constraints noted in the pre-feasibility study against the question in break point 2.

Break point 2 – does the project have potential?

If it is considered possible to overcome the identified constraints and the project still seem financially viable on one or more sites, the project can continue to Phase 3.

As looking at more than one site in detail can be costly, it is recommended to review site ownership and pursue one preferred site in the first instance.

Phase 3 – Evaluate the project

Step 10 – Secure the site

Securing the site requires you to enter into a legal agreement with the site owner that guarantees you tenure over the site for the full life of the project (usually 25 years). It is likely that this will involve some kind of payment to be made to the owner. Whilst this is not an essential step to complete before continuing the development of the site, until an agreement is in place any development that takes place and costs that are incurred are at risk of the site owner refusing permission to continue work.

The securing the site module has more details and for a set of example draft agreements. If parties do not want to enter an options agreement at this stage, an exclusivity agreement should be considered.

Step 11 – Full feasibility study

Building on the pre-feasibility work, a detailed feasibility study is now required to assess a number of factors in developing a wind project on the selected site, including:

- availability of wind resource, direction, speed, and turbulence
- local electricity grid connection point options on 11/33kV network
- potential electricity grid connection constraints
- designated sites (eg SSSIs), protected species and any locally valued habitats and species
- archaeology concerns
- communication links (such as radar, telecoms, impact on MOD radar and low flying, civil aviation, mobile phone masts, radio communication links)
- turbine selection
- visual impact, including cumulative impact, and landscape impact
- construction issues

Some of these factors are binary go/no go factors, and others are issues that can be managed and finessed in how a scheme is implemented. Potential lenders will want to see a professional and detailed assessment of each of these factors to understand the risks to project delivery and economics and it is most common to engage with specialist consultants to complete the necessary studies.

Local Energy Scotland has a template ITT that can be used to procure these services which includes a detailed scope of work for all activities that should be completed. The procurement module has further guidance.

Scoping Opinion

The aim of a scoping exercise is to assist the community and local authority in identifying the key environmental issues surrounding their proposal. To obtain the most relevant and valuable responses to a scoping report it is recommended that developers engage with the statutory consultees and the local community as soon as possible. This will include Scottish Natural Heritage (SNH), Scottish Environment Protection Agency (SEPA) and the relevant planning authority.

The Scottish Government has a list of expectations related to the scoping process and although this is more relevant for larger developments, the principles apply to all scales of project.

Step 12 – Confirm grid availability

Ensure the information already obtained on connecting to the grid is still up to date. Feasibility studies can take extended periods of time and any grid information gathered at the beginning of the process may change. CARES development officers can support grid enquiries to the local DNO. Many parts of the national grid in Scotland are constrained making it increasingly difficult to connect large generators. Solutions to overcoming grid constraints should be investigated early if needed, usually by marrying a local load with the local generation, or by accepting a connection offer with constraints or including Active Network Management or storage, and in some cases other funding can be applied to support this.

In general, however, having sufficient grid capacity and a suitable connection date to suit the predicted construction of the wind project remain the most favourable conditions in which to develop.

Step 13 – Pre-planning consultation

Early engagement with the local planning department is essential to minimise planning risk and wasted costs. If a meeting has not already taken place through the feasibility work to discuss the scale and nature of the project, on the preferred site, then this must be undertaken now. The feasibility study should have indicated the main issues related to the site, however an open discussion with the planning authority will give a clearer picture as to the potential to gain consent. There are no guarantees, but projects taken through to the next phase of development should be reasonably confident that there is a prospect of planning consent for the project, at the scale intended.

Step 14 – Neighbour notification

As a separate notification to that required when making a planning application, it is good practice to contact all residents within 1km of the proposed site. Local Energy Scotland has template letters for this notification which allow for feedback. This allows the views of those most affected to be taken into consideration in the next stages of development. If a rural business or community group wish to apply to CARES to fund the next stages of development, it should be noted that the CARES application for seeks confirmation that this neighbour notification has been undertaken.

Break point 3 – Can the challenges be overcome?

Frank and impartial assessment of the project should be carried out against the main challenges:

- Is the site tenure secure?
- Does the feasibility study show a viable project?
- Are the local residents aware and supportive of the development?
- Is there potential to get planning consent at the scale anticipated?
- Is it likely a suitable grid connection can be made?

If the potential remains, then the project can be taken to the next phase.

Phase 4 – Develop the project

Step 15 – Fix the project size

The size of the project should now be determined for taking through the subsequent process of final appraisal. The pre-feasibility study will have identified a number of options. The detailed feasibility study will have evaluated each option and identified the most appropriate. You will be able to make an informed decision as to the most appropriate scale of project in line with the restrictions of planning policy, guidance on suitable turbines to suit the wind resource and local consultation.

Step 16 – Financial viability check

Carry out a further financial modelling exercise with the detail provided through the feasibility study. The project finance model can be populated with these more accurate figures and a series of scenarios tested. Testing against income or expenditure changes, against lending rates and terms can determine financial viability in varying circumstances. A potential lender will expect to see a number of scenarios modelled. CARES development officers can support testing the financial viability of a project with this model and can also support engaging with financial advisors through the CARES framework.

Step 17 – Secure pre-planning funds

Funding will now need to be sought for taking the project through the next stages of development. Eligible clients can apply for CARES funding. Applicants should contact their local CARES development officer to discuss their project and get support with the application.

This is normally a short-term loan, paid back on securing funds for construction at a later step in this process, Financial Close. Although every effort should be made to ensure the project can progress to repay this loan, should a project meet with an insurmountable challenge, an application to write off the loan can be made. Although there is no guarantee that a write off will be granted, this provision is made to support projects where the risks are perceived to be too great or that are not be able to secure funding elsewhere.

Step 18 – Planning application

There are a number of applications to be made to secure the appropriate permissions and (in some instances) confirm project development costs. Given the time involved (often 6 to 12 months), a planning application is often the first step, as no project can secure finance without this consent.

Most planning authorities have developed local Planning Policy Guidance which describes what they expect developers of wind projects at all scales to deliver as part of the planning process. This will identify what is required as part of the planning application and the costs of submitting a planning application. This planning application can be submitted by the community group itself, or for more complex applications through the use of a planning consultant. Further information is available in the planning module.

Step 19 – Grid application

Although earlier enquiries should have indicated that a grid connection was possible, securing a grid connection will require a formal application and, within a set timeframe, a deposit to be paid to your DNO. The grid connection module provides guidance on obtaining a grid connection.

Step 20 – Identify funding sources

Some work should by now have been put into finding a suitable route and funder to support the capital costs of the project. Local Energy Scotland has a list of finance providers that offer finance to community renewable projects and the DOs can support discussion with funders and share further knowledge through contact with the Energy Investment Fund (EIF).

There are many finance options available including traditional loan finance, partnership with a developer, establishment of a co-operative (facilitating the sales of shares) and more. Each of these has different attributes and requirements (interest rates, target investment types, loan conditions).

The project finance module gives guidance on the types of finance, whether for development, construction or bridging loans that may be available to a project and potential sources of that finance.

Advice from an Independent Financial Adviser is essential to ensure all the options are evaluated as there are many potential sources of funding each with their own advantages and disadvantages. The framework of contractors is a good place to start to identify a suitable advisor.

As with all commercial processes, obtaining a number of different quotes for services will enable a comparison to be made and the most appropriate provider can be selected for the community needs.

Step 21 – Develop full financial model

The financial viability of any project depends on the cost of borrowing the money required to buy the turbine, civil works, balance of plant and the cost of installation, relative to the income after operating costs. The schedule of incurred costs and the length of time to install and commission the project all influence the financial viability of the project. The project finance model is available to download and use to complete a financial appraisal of your project and the CARES Financial Model example (linked to from the project finance model page) provides indicative costs taken from a number of different market studies.

In order to complete the financial appraisal as accurately as possible, the capital costs of the turbine, installation, connection, and other capital works such as grid connection, civil works and installation should be defined as accurately as possible. The detailed feasibility study should outline all the potential costs associated with your project and provide an indication of the scale of these costs, however, quotes will need to be obtained to confirm the final costs. Operational costs such as maintenance, ground rent and insurance must be determined and other ongoing expenditure such as community benefit payments must be accounted for.

An energy yield assessment will translate into potential income. However, this is subject to probability. The output from an energy assessment will be the predicted long-term energy yield, also called the central estimate or the P50 estimate. This estimate has a 50% chance the result will be lower and a 50% chance the result will be higher than the predicted long-term energy yield. Further detailed energy yield analysis can provide a P90 estimate (a 90% likelihood that the energy yield will be exceeded, and thus with a low risk) and it is this estimate that funders prefer to use.

A potential lender will also want to see a full business plan for the duration of operation of the wind turbine with a detailed cash flow and balance sheet that includes repayment of loans provided. The CARES Project Finance Model provides this facility and more detail on this is covered in the project finance module.

Break point 4 – Confirm consents, grid, and financial viability

The outcome from Phase 4 of the development process should show that all the following are in place:

- Planning consent granted
- Grid connection secure
- Energy yield predicted
- Income predicted
- Financial viability confirmed
- Funding options investigated.

If consents are in place and the project appears financially viable, then the project can progress. If at this stage the scheme looks unviable it should be stopped, or re-designed.

Phase 5 – Getting financial close

Step 22 – Identify and contact suppliers

The process of finalising suppliers of equipment and services will need to be completed. It is good practice to seek competitive tenders for all services, and it is recommended a construction phase project manager be appointed in the same way if not already in place.

For schemes under 50kW, the wind turbine and installers must be approved under the Microgeneration Certification Scheme (MCS).

There are a number of contracts that need to be agreed with suppliers:

- Construction phase project management
- Wind turbine Installation (Engineering Procurement and Commissioning)
- Operation and maintenance
- Power Purchase Agreements
- Financial and legal advice (financial advice, lease and contract advice)

Step 23 – Secure bridge funds

The timing, process and completion of the procurement process will be dictated by the route to capital drawdown which in turn is linked to the means by which the project will be funded. Suppliers of key pieces of equipment such as transformers and turbines may require deposits to secure delivery of these items. The long lead time on these items needs to be considered, and often requires further funds to be secured, prior to Financial Close. It is important to develop a programme, with cash flow, to anticipate the need for funding in advance. The CARES project plan is a good place to start.

CARES clients demonstrating a well-managed project can apply for a CARES bridging loan. This is designed for projects that will be progressing to Financial Close, as there is no potential for write off, but can provide a further £100,000 towards essential project costs at this stage.

Step 24 – Financial close

Using the detailed financial appraisal previously completed with the Project Finance Model, or another finance model, which has been verified by an accountant, it should be possible to secure finance through your chosen route.

Your finance providers will complete a full due diligence of the project, which includes a detailed analysis of potential project performance, all associated costs, warranties, and liabilities. If you have completed the CARES Investment Ready Tool you will have collated a large proportion of the information required by the lender and identified any gaps in the information that the lender may require. The lender may also require a significant financial floating bond be set up to pay the banks costs irrespective of the result, positive or otherwise of the due diligence process.

Financial close is the point at which all contracts are signed simultaneously, and funds are transferred between your lender and all your suppliers. Prior to this point your suppliers are likely to have requested deposits for all materials and services. At financial close the balance of payment is made.

The run-up to financial close is a busy period, so it is important to ensure that the relevant people with delegated responsibility are available to sign off any legal agreements.

Break point 5 – Is the project ready to construct?

Provided all consents, grid connection, contracts and funding is in place the project should be ready to construct.

A professional team of managers and suppliers should be responsible for taking the project through to commissioning. If any member of this team is not yet in place, they should be appointed prior to moving into phase 6.

Phase 6 – Completing the project

Step 25 – Repay other funds

Any debt that is due for repayment should be paid back (with appropriate interest) at this point. The CARES loans (where applicable) are set up to be repaid at financial close. The debt provided by the funders should include provision for this repayment.

Step 26 – Construction

Once all of the permits and permissions are in place and all relevant planning constraints have been addressed, construction can commence and the wind turbine(s) installed and grid connected. The construction module outlines the community group's obligations as a developer, the construction process and the additional roles in the construction process, including the community group's duty of care as a developer for the site workers, environment and general public, including legal responsibilities. The module includes links to guidance and regulatory documents.

Step 27 – Community benefit

CARES clients providing or receiving community benefit should enter into a binding agreement with the appropriate party, stating the terms and conditions of payments. CARES has template agreements to facilitate this, which also confirm a process for indexing payments over 20 years.

Step 28 – Operation

Income from the project will need to be managed carefully. The funder will expect cash to be held to cover fixed costs such as interest and loan repayments, O&M contracts and land rent. In addition, the funder will expect additional cash to be held to cover loan payments during periods when the wind turbine has not generated as much electricity as expected, for example if there are any faults with the wind turbine or the energy produced is lower than average. There are example financial covenants included within the project finance model, however different lenders are likely to have different requirements.

Only after these costs have been met can the project distribute the remaining income.

Proper management will need to be in place for the life of the project to oversee the process of collecting and distributing income and managing liabilities. It is also important that the performance of the wind turbine(s) are regularly monitored in relation to wind speeds, as large fluctuations in output, or differences with background windspeed might indicate a technical problem and this in turn will reduce income, leading to reduced financial returns.

The establishing a community group module provides further guidance on dispersing any income generated for the community group.

Step 29 – Decommissioning

Decommissioning bonds in Scotland can operate in three ways; the local planning authority can require the money to be set aside, the lender can require a fund to be set up or the community can choose to build a reserve.

The planning consent will state the date and requirements for decommissioning the turbine. The costs for removing the wind turbine and the requirements to remove foundations or other equipment need to be estimated.

There may be some scrap value in the equipment, but this is unlikely to cover the entire cost of decommissioning. Regardless of decommissioning mechanism the project should set aside income to build up a fund to cover decommissioning costs.

Alternative wind energy options

In line with the changing renewable energy market, wind turbines have got bigger and older existing commercial wind farms can be re-turbined with a smaller number of larger machines. Used wind turbines are widely available for purchase across Europe.

This provides an opportunity for community groups to acquire an older, smaller turbine at lower cost. This option is worth considering alongside alternative grid connection options and additional electricity revenues.

Refurbished/remanufactured wind turbines are less expensive than new models and can provide considerable savings in the construction phase of the development, but with increased risk about when the turbine might reach the end of its useful life. This can be relatively sudden, and for reasons external to the project. For example, a turbine hit by lightning might have its controllers burnt out, and if a replacement cannot be sourced because manufacturer has been discontinued, the turbine is difficult to restart. Choosing a widely available turbine, will ensure a more reliable supply chain for spare parts.

As always, projects costs and benefits will need to be assessed carefully.

What is a refurbished/ remanufactured wind turbine?

A refurbished wind turbine is a used wind turbine where failed or worn components are refurbished or replaced to the point that the wind turbine is able to operate. Refurbished wind turbines are often sold at a fraction of the cost of new turbines yet may still be capable of achieving design performance for many years. The expectation is that components which have not been refurbished or replaced will fail at some point during operation. As such, O&M contracts, downtime cover / response time is key to financial success.

A remanufactured wind turbine is a used wind turbine which has been restored to original manufacturer specifications which is achieved by replacing all key components of the turbine system with quality parts via an approved company. Remanufactured wind turbines are often more expensive than equivalent (ie same make/model) refurbished wind turbines but are often more reliable (ie low potential for failure).

Why procure a refurbished / remanufactured turbine?

- Procurement of a refurbished / remanufactured turbine may provide higher return on investment – refurbished / remanufactured wind turbines are often sold at a fraction of the cost of new wind turbines.
- Refurbished / remanufactured wind turbines can offer similar performance as new turbines at least for some years.
- Warranty and insurance packages are available for some refurbished / remanufactured turbines.
- Financing options are available for refurbished / remanufactured turbines – though options are limited and not as straightforward as for new turbines.
- Use of refurbished / remanufactured turbines supports the circular economy.

Who refurbishes / remanufactures wind turbines?

Used wind turbines are purchased by a variety of companies including traders, operators, developers, and engineering companies. Those who purchase used wind turbines may wish to sell the used wind turbine, use it, refurbish it, or remanufacture it. Trading websites give an indication of who buys and sells used wind turbines.

There are numerous companies who specialise in the refurbishment and/or remanufacturing of used wind turbines across the UK (see list in Appendix). Refurbishment / remanufacturing companies will often specialise in a particular turbine make (eg Vestas).

There are more than 100 refurbished wind turbines installed across the UK on farms and estates and by community groups.

What happens during refurbishment?

Turbines can be restored to operational capacity but without changing all components other than those that are obviously worn. There is no industry wide standard for what work must be done on a used turbine to qualify as refurbishment. As such, it is especially important to understand what checks, repairs and replacements have been carried out on the refurbished turbine.

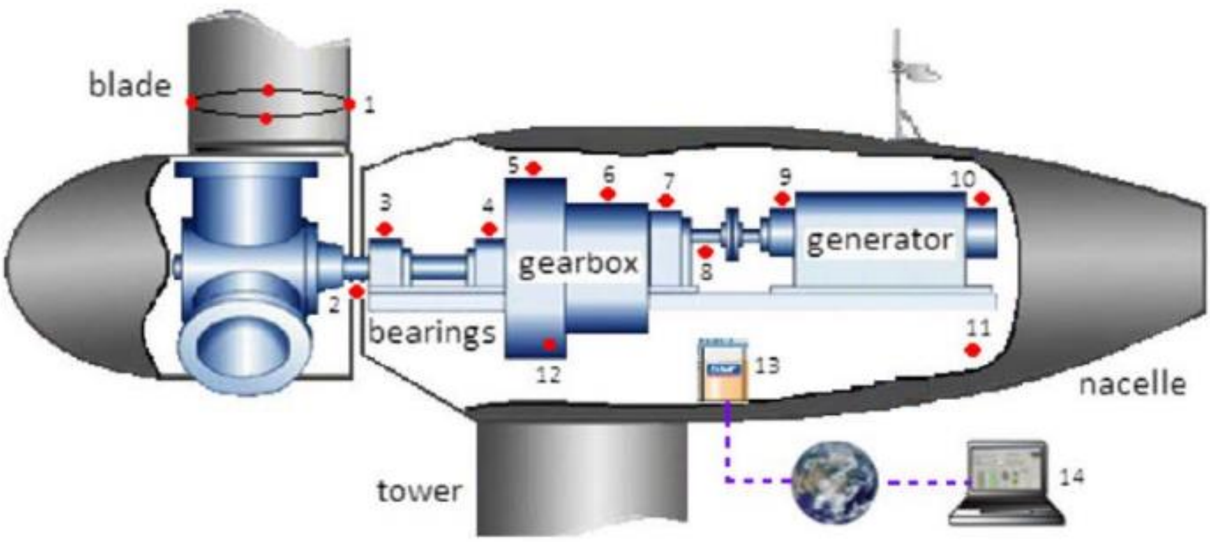
Companies who refurbish wind turbines should be, at the very least, paying special attention to the condition of critical components that could result in catastrophic failure eg tower, tower bed frame and blades. Various testing equipment is available to check for component flaws or fatigue (eg ultrasonic NDC, tap test, infrared thermography, etc). Some key components are listed in Table 3 below.

All other components, if failure occurs, will result in downtime but are repairable or replaceable (as long as parts are available). Nevertheless, downtime may result in loss of revenue and additional costs depending on the warranty and insurance package. Note that even with extensive warranty and insurance coverage, downtime due to failure may have implications on cash flow. Figure 1 illustrates main components of one type of wind turbine.

What happens during remanufacturing?

Turbines can also be remanufactured - fully restore the turbine to original manufacturer specification - which can increase cost of the turbine to around 80-90% of the original purchase price. This is typically more expensive option than the refurbishment. The advantage over refurbished turbines being that the wind turbine in fitted with nearly all new components reducing the likelihood of component failure and associated downtime. In addition, re-manufacturing implies a significant market in spare components – a good sign for future availability of spare parts.

Figure 1: Main components of wind turbine (source: National Renewable Energy Laboratory)



3: List of key components (source: National Renewable Energy Laboratory)

Key Components	Considerations
Tower	Towers are often over designed - high safety factor.
Tower Bed Frame	This is a large cost item and often the last item to wear out.
Blades	Blade cracking and the pitting of blade leading edge.
Gearbox - Bearings	Rate of failure depends on type of shaft i.e. high-speed shaft (HSS) systems are the often the most problematic.
Gear box - Gears	Rate of failure depends on type of gear system ie helical gears are often the most problematic.
Generators	Failure modes include magnetic wedge loss, contamination, and electric arc damage.

Key factors to consider

Price and return on investment

Refurbished / remanufactured turbines are often significantly cheaper than new wind turbines (of similar make and model) ranging between 50-90% of the new wind turbine price.

Not all key components of the refurbished turbine system will be refurbished or replaced and therefore fault occurrence for a refurbished wind turbine will likely be higher than for a remanufactured or new wind turbine. This will have implications on financial performance, maintenance requirements and should be understood and modelled.

The price of refurbished / remanufactured, second-hand turbines will vary based on a number of factors:

- Wind turbine design ie make and model
- Original date of manufacture – duration of previous operation and age of components.
- Previous operating conditions ie environment
- Maintenance history.
- Supply and demand – the market for second-hand wind turbines in volatile and prices are often negotiable. Some refurbishment companies may be more willing than others to negotiate on price.

An advantage of procuring refurbished / remanufactured wind turbines is the flexibility of price (often negotiable). This allows purchasers to determine their maximum turbine price that would result in project financial viability and negotiate accordingly.

Financial modelling for a refurbished wind turbine has been carried out using indicative costs to demonstrate the financial attractiveness of some refurbished wind turbines (available on the market) (see Table 4). A similar scheme with a new turbine (costing approximately £1.5 million) would have an IRR considerably lower at 7.86% with total dividends of less than the cost of the turbine (£1,473,317).

Table 4: Indicative cost / performance figures for refurbished wind turbine.

Refurbished Nordtank 1.5MW wind turbine	
Costs	
Project Development costs	£100,000**
Refurbished turbine	£300,000*
Other construction costs	£687,000**
Operating costs	£20,000** per year
Key parameters	
Export tariff	4.91 p/kWh
Duration of operation	20 years
Capacity factor	25%
Plant availability	95%
Senior loan rate	7%
Financial outputs	
Project IRR %:	18.97%
Total dividends	£3,499,103
Net present value	£1,137,709

Source: *Provided by wind turbine refurbishment company in the UK **Based on Ricardo's analysis of multiple wind turbine project costs in UK.

Performance

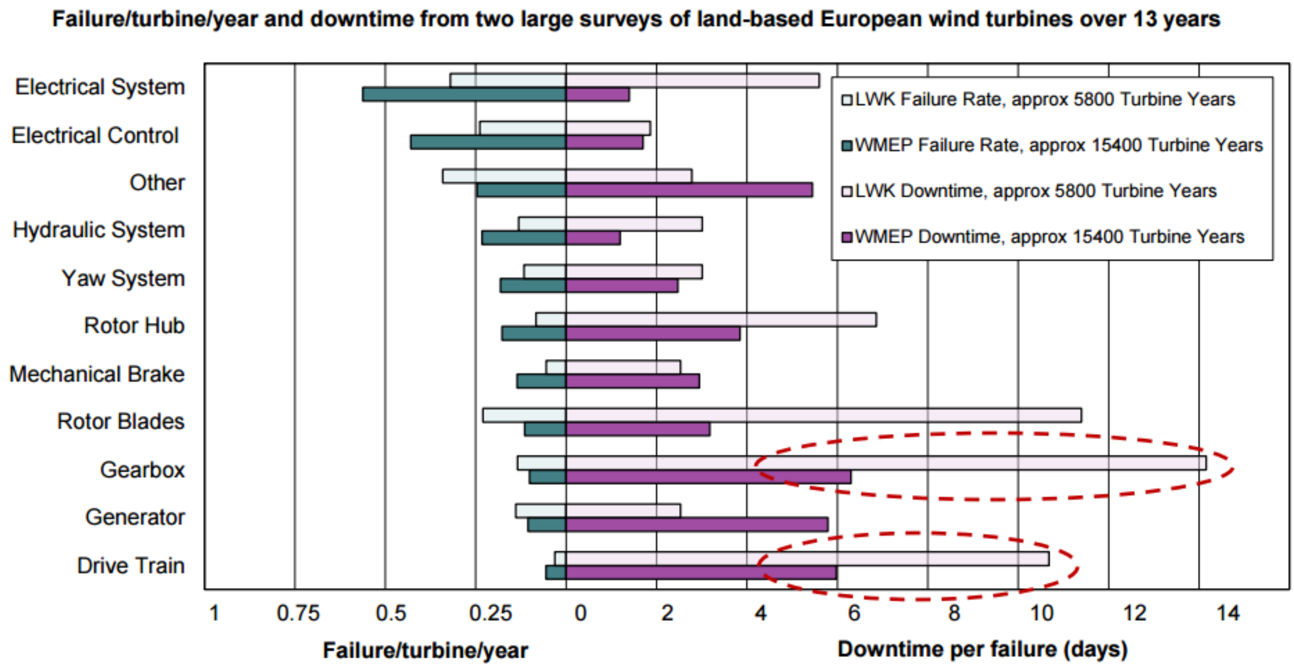
Refurbishment companies state that refurbished / remanufactured wind turbines are capable of operating in line with the manufacturer's original power curve. As such, the manufacturer's performance specifications and wind turbine performance logs should give a strong indication of the refurbished / remanufactured wind turbines potential performance.

Operators of refurbished / remanufactured wind turbines have reported performance against manufacturer power curves of over 98% availability and with outputs higher than P90 predictions. Some will warrant the performance of the turbine.

Operational life

A component which has been refurbished or replaced should be capable of functioning as if it was new. Frequency of wind turbine failure and the associated down time for repair varies by component. Figure 2 gives an indication wind turbine component "failure rate", the Mean Time Between Failure (MTBF) and the Mean Time To Repair (MTTR). For example, based on the WMEP data set MTBF, or the average failure rate of a wind turbine generator is every 8 years (ie 0.125 failures per turbine per year). MTTR, or the amount of time to repair the turbine is out of operation is just under 6 days.

Figure 2 Rate of failure and associated downtime by wind turbine component (Source: NREL[1])



Operation and maintenance

There are numerous companies who are qualified to carry out servicing and maintenance of refurbished / remanufactured wind turbines.

Servicing and maintenance requirements tend to be the same for all wind turbines, new, refurbished and remanufactured. It should be kept in mind that fine tuning of refurbished / remanufactured wind turbines after commissioning may take a few months requiring a qualified technician to ensure optimal operation of the machine (eg aligning voltage and frequency with the grid, adjustment of sensors, etc). This can take more time than with a new turbine as the turbine parameters are tweaked to perform optimally when connected to the UK grid. This may have implications on the wind turbines availability for generation and capacity factor directly after commissioning and should be kept in mind when carrying out financial forecasting.

Warranty

Refurbished wind turbine suppliers may provide warranties on the parts that have been refurbished or replaced. Standard 1-2 year warranties and extended warranties may also be awarded depending on the supplier’s experience and confidence with the machine that they have refurbished. As a comparison, new wind turbines warranty periods will depend on the

[1] Note that WMEP (Wissenschaftliches Mess-und Evaluierungsprogramm) and LWK (Landwirtschaftskammer Schleswig-Holstein) are the sources of data used by NREL to create the figure.

type of wind turbine and the business model of the company offering the warranty and can be anywhere from 2 to 10 years[2] . The level of turbine refurbishment specification and cost will define the warranty being offered.

Note that in some instances manufacture warranties may become void after refurbishment works. On the other hand, some refurbishment / remanufacturer companies work with manufacturers' who are able to provide manufacturer warranties for the refurbished wind turbines based on agreed refurbishment standards. As a result, some refurbishment / remanufacturing companies are able to provide 5-year O&M warranties, directly from the manufacture, which guarantee performance against the original power curve.

Furthermore, the higher specification achieved during remanufacturing will include a better warranty (when compared to a refurbished turbine) and normally involves a recommended refurbishment company providing response time to faults with 48 hours. This is more attractive for investors, but costs rise accordingly.

It is important to understand what the warranty covers:

- What happens if the supplier (refurbishment / remanufacturing company) goes out of business?
- Who is responsible for each component? Is it just one company or are there several?
- Does the warranty cover the removal, replacement and shipping of faulty parts?
- Are there any additional costs involved, such as a renewal fee?
- What is the duration of the warranty?
- Will there be a performance warranty against predicted power curve?

Insurance

Typically, insurance provided for refurbished / remanufactured wind turbines is similar to that which would be provided for wind turbines. However, this will likely be considered by insurers on a case-by-case basis. Insurance range of coverage can extend beyond normal accidental damage to include employer and public liability, material damage, mechanical breakdown and loss of revenue. Northern Alliance Insurance (UK) has provided insurance for refurbished / remanufactured wind turbines in the past[3].

Not all insurance companies with experience insuring new wind turbines are comfortable insuring refurbished / remanufactured wind turbines. However, there are some who will base their decision to insure (and associated fees and rates) on the reputability of the manufacturer, regardless of whether the wind turbine is new, refurbished or remanufactured.

Securing finance

In general, securing finance for refurbished/remanufactured wind turbines is more difficult than for new turbines.

[2] The Renewable Energy Hub
[3] Marsh Commercial

There are a few key differences between securing finance for a refurbished / remanufactured wind turbine compared to a new wind turbine:

Firstly, refurbished / remanufactured wind turbines are bespoke generating plants with unique histories and prices will vary accordingly. Prices may also be negotiable and subject to market demand. This means that it may not be possible to secure a refurbished / remanufacture wind turbine without making a deposit. Furthermore, sellers often require a statement confirming project finance is in place before they will sell a turbine. This could have implications on the financing process where some financers want to know the exact cost and turbine make/model that financing is sought for.

Secondly, financing of refurbished / remanufactured wind turbines will not be supported by all private and institutional debt providers. However, some financers who are uncomfortable with financing the supply and installation of refurbished / remanufactured wind turbine may consider refinancing, after the wind turbine has proven its successful installation and operation.

Crowd funding is one way to obtain unsecured debt finance to cover supply and installation costs of a refurbished / remanufactured wind turbines. ThinCats, FundingKnights, and CoAssets are some examples of crowd funding platforms providing peer to business lending. Crowd funding may provide more flexibility with repayment terms (ie not fees for early payback).

Some examples of other financers who may be willing to finance refurbished/remanufacture wind turbines include RMFunds, Social Investment Scotland, Assetz Capital and CO2Sense.

Due diligence costs may be higher for a refurbished / remanufactured turbine as the commercial and technical checks required may be more comprehensive.

Planning permission

Refurbished/remanufactured wind turbines will need to meet any given planning consent or conditions which may be placed on project size, noise, shadow flicker etc. Planning considerations are generally concerned with the development's (ie wind turbine(s), electrical room, etc) physical presence and corresponding potential impact on the environment, air traffic, surrounding communities (eg noise and visual), etc. As such, it is not expected that there would be any additional complications due to the selection of a refurbished/remanufactured wind turbine. Nevertheless, as for any proposed wind turbine development, it is advisable to contact relevant Local Authority to discuss the details of your proposed development.

Transporting turbine

Transportation of a refurbished wind turbine may be included in the cost of wind turbine supply and installation. This should be agreed with the refurbished turbine supplier to verify who is responsible for route access survey, dismantling, delay warranty, etc. Sellers may require contingency amount to cover unforeseen issues with transportation that result in delays and extra costs being incurred. Note that the buyer may choose to arrange all transportation logistics.

What to look for in a second-hand turbine

Experience

There are numerous companies who are able to carry out the sourcing of used wind turbines, refurbishment, installation and operation and maintenance.

Purchasers should look for refurbishment / remanufacturing companies that:

- Have a proven track record for the services that they intend to provide (eg experience with the turbine brand being refurbished / remanufactured).
- Are experienced at refurbishing / remanufacturing the turbine in question.
- Have a robust and transparent methodology for refurbishment / remanufacturing.
- Ideally, have a proven track record for securing finance for refurbished / remanufactured wind turbines.

Liability

It is important to determine who takes on responsibility for the performance and safe operation of the refurbished/remanufactured wind turbine, as well as the duration of this responsibility. Suppliers may have standard terms and conditions that should be understood. It may be possible to negotiate.

Turbine history

The history of a used wind turbine should be understood by the refurbishment/remanufacturing company and the purchaser of the refurbished/remanufactured wind turbine – this impacts the work that should be carried out as part of the refurbishment / remanufacturing process and the overall value of the wind turbine. Refurbishment / remanufacturing companies will likely have their own criteria for procuring used wind turbines.

The following details about the history of a used turbine are important:

- Country of previous operation: requirements for servicing and maintenance vary by country eg Sweden, Denmark and Germany have higher standards/requirements for servicing and maintenance.
- Location of operation: operating conditions will give an indication of past environmental stresses on the turbine. Turbines which have operated in coastal regions (eg exposure to saline environment) and regions of significant turbulence should be avoided.
- Generation records: has the turbine been operating as per the manufacturer performance curve?
- Down rating: wind turbines which have been down rated (eg due to grid restrictions) will have been subjected to less stress due to alteration of the max power output.
- Service records: records of servicing carried out on the used turbine should be available and inspected to ensure that routine servicing has been carried out as per

the manufacturer guidance and that any previous component failures (refurbishment/replacement) are understood.
- Detailed assessment of turbine: indicate component wear and necessary refurbishment schedule.

Certain companies offering 2nd hand turbines will complete a detailed assessment of the turbine prior to purchase to indicate component wear and necessary refurb schedule etc. Price per turbine in region of £5,000 including site visit to turbine location

It is important to understand whether sufficient refurbishment has been carried out on the used turbine. Ideally, refurbished / remanufactured wind turbine suppliers should provide a checklist (and supporting evidence if possible) to show that each component has been checked/tested and that repairs and replacements have been carried in line with robust criteria (eg scale of acceptability) based on knowledge of the turbine and/or manufacturer tolerances and specifications (e.g. through collaboration with manufacturers, based on own experience, with warranty providers).

As with new turbines, selecting a refurbished / remanufactured turbine with easily accessible replacement parts may reduce the downtime due to full or partial component failure.

Further information

Wind energy context

- The National Farmers' Union (NFU) provides specific guidance for farmers interested in wind energy generation
- The Scottish Government's Register of Community Benefits provides information to support local communities through the community benefit process. The register publishes the benefits that local communities have received through renewable energy projects.
- The shared ownership portal is designed to allow organisations and community groups across Scotland to collaboratively progress renewable energy projects
- Local Energy Scotland has produced a range of resources about shared ownership
- Highlands and Islands Enterprise (HIE) has information and support about shared ownership

Project Overview

Step 1 - Develop the Vision

You can find community group actions plans at:

- CARES funded community action plans
- CARES community benefits toolkit
- Development Trust Association Scotland
- Foundation Scotland

- Cairngorms National Park's Community Action Planning Toolkit

Step 2 - Seek Advice

The following organisations publish case studies to help others identify suitable groups to approach to gain their insight.

- Local Energy Scotland
- Community Energy Scotland
- Development Trust Association Scotland

Step 3 - Communicate

There are a range of resources available for engaging with the community including:

- The Scottish Community Development Centre (SCDC) has resources to support community development and communication
- National Standards for Community Engagement

Step 4 - Find a site

The CARES Renewable Energy Handbook outlines the technologies that have been employed by community groups across Scotland, the principles of how each technology works and the key issues regarding installation and operation as well as environmental impacts.

Wind resource "rule of thumb" guidance:

- MW scale – Local United: Community-led wind power
- Smaller scale – Good Energy: how do wind turbines work

To determine the wind speed at different locations, the following tools may be useful.

- Vortex has virtual mast assessments of wind speeds are available that do not require masts to be erected. These can be cheaper than completing an onsite assessment and completed in less time, although will be less accurate.
- The UK government has a UK wind speed database which provides wind speeds and can be used determine the wind speed within 100k square.
- There will several possible constraints on your project which you will need to identify:
    - Scottish Natural Heritage (SNH) has a mapping tool that will show some of the relevant land designations and constraints.
    - Renewable UK provides guidance on how to identify areas where radar may be a constraint.
- It is possible to 'blank' the impact of wind turbines are being used if your identified site is in a restricted area (see https://web.archive.org/web/20130204113605/http://www.scotland.gov.uk/Resource/Doc/917/0094738.pdf)

Step 5 - Initial scoping

There are several web tools available for determining the viability of a project which would be appropriate to use at this stage of the project development. Different tools use different data sources for wind speed data and estimated energy yield.

- Renewables First looks at the return on investment from a farm wind turbine

Step 6 - Establish a legal entity

The establishing a community group module contains more information on establishing the legal entity. It is important that legal advice from a solicitor who has experience of completing this work is obtained at this stage. This solicitor will be required at various stages throughout the project to support all legal and contractual activities, of which there will be many.

Step 7 - Secure initial funding

- Project finance module
- Source of finance module

Step 8 - Pre-feasibility Study

A pre-feasibility study will help identify sites that have the potential to be viable. CARES enablement grants provide grant funding to help towards the start-up costs of feasibility studies, community consultation and other preparatory costs. Up to £10,000 is available for community groups to fund non-capital aspects of a project.

The scope of work outlined in the pre-feasibility Invitation to Tender is comprehensive, however the information is unlikely to account for all project types and variations. It is therefore, the responsibility of those using the forms to ensure the template is tailored to be accurate and representative of the project – see http://www.localenergyscotland.org/funding-resources/resources-advice/cares-toolkit/downloadable-tools/invitation-to-tender-templates/

A number of difference sources can be used to obtain indicative project costs. These include:

- The project finance model provides indicative costs taken from a number of different market studies
- The Local Government Association which provides sample costs for a range of turbines – see https://www.local.gov.uk/sites/default/files/documents/download-potential-energy-9f8.pdf

Step 9 - Financial viability check

- Project finance module

Step 10- Secure the site

The securing the site module has example draft agreements. If parties do not want to enter an options agreement at this stage, an exclusivity agreement should be considered.

Step 11 - Full Feasibility Study

- Parliament UK – Overcoming barriers to local energy projects

Feasibility, design and development invitation to tender. The scope of work outlined in the ITT is comprehensive, however the information is unlikely to account for all project types and variations. It is, therefore, the responsibility of those using the forms to ensure the template is tailored to be accurate and representative of the project. Local Energy Scotland has Invitation to Tender templates.

Once it is clear that there is a viable project, it may be prudent to employ a project manager dedicated to developing the project. To support community groups in the delivery of their community projects, Local Energy Scotland has a framework of suppliers to provide a number of professional services including project managers.

For larger sites, the detailed feasibility study should include a scoping study to determine whether an Environmental Impact Assessment is required. The Scottish Government has a list of expectations related to the scoping process. The details are related to Formal Applications under Section 36 of The Electricity Act 1989 (see https://www.gov.scot/policies/energy-infrastructure/energy-consents/)

Step 12 - Confirm grid availability

- Grid connection module

Step 15 - Fix the project size

The outputs from your Detailed Feasibility and Design Study will have identified the optimum size of project. This will align with the planning application and grid connection applications that have been submitted.

Step 16 - Financial viability check

- Project finance module

Step 17- Secure pre-planning funds

- Project finance module

Step 18 - Planning application

The key applications to complete when developing your project are:

- Planning – see the planning module
- Grid connection – see the grid connection module

If you have employed a project manager, they will be able to complete this for you.

Step 19 - Grid application

- Grid connection module

Step 20 - Identify funding sources

- Sources of finance module
- Project finance module

Step 21 - Develop full financial model

When finalising the costs and income of the project, it is important to ensure they are completely accurate with enough detail for a bank to make a lending decision. Indicative costs will no longer be accurate enough.

This may require professional financial support. To support community groups in the delivery of their community projects, Local Energy Scotland has a framework of contractors to provide a number of professional services including financial advisors.

Step 22 - Identify and contact suppliers

For schemes under 50kW, the wind turbine and installers must be approved under the Microgeneration Certification Scheme (MCS). It provides a searchable list of approved wind turbine installers, as does Energy Saving Trust's Renewables Installer Finder.

Larger wind turbine suppliers are listed on many websites including:

- The Construction Centre

Step 23 - Financial Close

This is a very busy time for the project, and it is important to have the right support in place. To support community groups in the delivery of their community projects, Local Energy Scotland has a framework of contractors to provide a number of professional services including lawyers, financial advisors and project managers.

You should also refer to the project finance module.

Step 24 - Construction

The Health and Safety Executive has information on construction, design and management regulations.

Step 25 - Operation

You may wish to consider employing a project manager at initial stages, whose commitment will taper off as technical professionals are able to care for the operation and maintenance of the project.

Alternative Wind Energy Options - wind turbine refurbishment companies:

- MPG Wind
- Boythorpe Wind Energy
- Dutchwind

More details

Marsh Commercial, an insurance provider, offers insurance on reconditioned wind turbines.

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