Fair Isle Energy Project

Fair Isle
Electricity Company

Lessons Learned

Overview

The Fair Isle Energy Project was officially opened on Friday 12th October and consists of the following:

3 x 60kW wind turbines
50kW solar array
Battery storage to allow 50 hours of energy to be stored
New HV system across the island

This report looks at the lessons learned from this project and during the course of its production has consulted with the following:

Steering Group
Project Manager
Technical Advisor
Contractors
Stakeholders

European Union gov.scot
EUROPE & SCOTLAND
European Regional Development Fund
Investing in a Smart, Sustainable and Inclusive Future

HIE
Highlands and Islands Enterprise
Iomairt na Gàidhealtachd 's nan Eilean

BIG LOTTERY FUND
LOTTERY FUNDED

Background

Fair Isle is the most remote island community in the UK and lies between Shetland (39km) & Orkney (43km). There are currently 57 people who live on the island which is 5km long and 3km wide. The island is owned primarily by the National Trust for Scotland with the vast majority of the land being under crofting tenure. It is renowned for Fair Isle knitting and the Fair Isle Bird Observatory which attract visitors (birds and spotters) from far and wide. FICA initiated work on a Community Development Plan in summer 2014 in response to a range of issues that had come to the fore including a recent decline in population to around 55 residents and associated changes in the age structure of the island. This decline in population means it is increasingly difficult to maintain essential services on the island which include a school, district nurse, shop & post office, ferry service, airstrip, BT, Scottish Water, refuse collection, fire fighting and first responders.

For a community of its size the community is extremely active with a number of formal and informal groups. Social activities and traditions are a significant part of the islands culture with regular activities taking place around the hall, school, museum, two churches and observatory.
The provision of a new energy system was identified as a key priority in the Community Development Plan through the community consultation carried out on the island. Fair Isle is not connected to the national grid and so must generate its own electricity. In 1983 the community installed the first commercial wind turbine in the UK and have managed the combined wind/diesel power system ever since.

Fair Isle Electricity Company was formed in and registered in May 1999. Its registration no is 196676. It is a private limited company limited by guarantee. Every resident of Fair Isle is invited to become a member and that allows them to purchase energy from the company. Every household and commercial property is a member.

Following a number of years of recording and analysing local meteorological conditions – particularly the wind regime – Dave Wheeler who manages the Met Office site on Fair Isle established that Fair Isle was probably the windiest low-level place in the British Isles. At a time of rising fuel costs and transport difficulties in getting the fuel in for the isles generator system Dave was able to show to the community the benefits of our generating electricity from the wind. Dave gave a paper describing the then current generating system on Fair Isle and how we wanted to move to generating power from the wind to a meeting in Inverness in 1980 ‘Energy for Rural and Island

Communities'

As a result of this meeting the Isle gained the interest of Northern Engineering Industries (later taken over by Rolls Royce). As the most remote inhabited island in the UK and with no connection to the National Grid the Fair Isle situation was unique, and set many challenges. These were overcome as they appeared with the successful installation and operation of a 60kw turbine soon followed. A few years later a 100kw turbine was installed, making Fair Isle's the first commercially operated wind farm in Europe.

However, by 2014 the system was becoming obsolete with the original turbine being beyond repair and the more recent turbine experiencing significant periods of down time resulting in reliance on the diesel generators for power on the island. At the same time, Scottish Water was investigating ways to improve the water quality on Fair Isle which would require more power and power over a 24 hour period. They commissioned a feasibility study on the options available.

As a result of this the Low Carbon Infrastructure Transition Project and Scottish Water provided further funding to develop the project further with the following objectives:

1. An innovative and collaborative local energy business model replicable across other island communities across the Highlands and Islands and beyond – Fair Isle requires a Class 1 turbine due to the high wind speeds. The combination of technologies is innovative – Class 1 turbine (required for the wind speeds on Fair Isle, storage system, fly wheel and solar has not been used before.
2. A dependable, 24 hour, stable, low carbon based electricity supply which is suitable for power quality sensitive equipment and every-day items taken for granted on the mainland, such as computers, monitoring equipment, washing machines etc.
3. Energy for Scottish Water Treatment works, airport (lighting to allow an extension of the available flight hours in a day) and harbour, bird observatory and additional domestic load – increasing the customer base and providing a sustainable income from electricity sales
4. Significant reduction of CO2 emissions on the island by displacing the diesel generation used by Fair Isle Bird Observatory and potentially other stakeholder

5. Enable the use of renewable energy that is currently not able to be utilised due to lack of energy storage equipment and provide a more robust and reliable system.
6. Ability to increase employment opportunities through the provision of a reliable and 24 hour power supply to generate employment but also employ someone to look after the system.
7. Increase in population by making Fair Isle a more attractive place to live and bring up children

We will revert to these objectives at the end of this report.

Team

Project Management	:	Great Glen Consulting
Technical Advisors	:	Arcus with Russet Engineering
Legal	:	Harper McLeod
Financial	:	Scott Moncrieff
Insurance	:	Bruce Stevenson
Turbines	:	Harbon Wind Turbines
BOP	:	Chap as main contractor with SSE Contracting as the main sub-contractor
Funders	:	Low Carbon Infrastructure Transition Project (Scottish Government) Big Lottery Scotland National Trust for Scotland Scottish Water Highland & Islands Enterprise Shetland Island Council Fair Isle Bird Observatory Fair Isle Electricity Company Shetland Charitable Trust (loan to assist cashflow for VAT reclaims)

Development Stage

Great Glen Consulting got involved in the project in May 2016 following a competitive tender process for the appointment of project management for the Fair Isle Energy Project. From that point it has taken just 2.5 years to put

in place the professional services team, develop, design, obtain planning, procure the main contractors and construct, test & commission the project.

At that point, Scottish Water had funded an initial feasibility study to look at energy options associated with their water treatment improvement works on the island. This had suggested more wind and a small hydro project.

The first ask for the project manager was to procure the technical advisor, legal advisor and the financial advisor to the project and this was done immediately following appointment.

The creation of a Steering Group for the project was undertaken as a priority task and this included representatives from LCITP, HIE, Scottish Water, NTS and SIC. This group met roughly every 3 months to check that the project was on target and delivering the scope of the funders requirements.

The Development of the project was funded by LCITP, Scottish Water and Shetland Island Council and the aim was to :

- get the feasibility refined with an agreed set of technologies scoped, agreed with the community and the Steering Group
- Get a lease agreed with NTS and any crofter consent issues identified and managed
- Create a business plan and financial model for the project
- Put in place the core project management tools for the project – change control, risk register. Programme etc
- Submit the planning application(s)
- and to get the point of being able to go out to competitive tender for the construction phase of the project
- Identify funding streams for the potential construction phase of the project

It is fair to say that these aims were delivered and that the project moved in the construction phase of the project by late 2017. This is a relatively short timescale to undertake the tasks identified and it is probably due to the project being driven by available funding streams at that time – namely the LCITP programme. Within few months of appointing the technical advisors the Steering Group agreed that a submission should be made to the LCITP fund, even at that early stage of project development. The risk of not doing this was that future funding may not have been available at a later stage.

The Development stage identified the set of technologies to be implemented and this was agreed by the Steering Group and this allowed the project design to proceed.

Key Development Stage Lessons :

- project management was important and the client team had the foresight to put this in place at an early stage of the project.
- The opportunity to apply for LCITP funding at this early stage accelerated the timescales for the project and so lad to durations for some tasks being less than optimal later on

Governance

At the outset of the Development Stage a Steering Group was set up. This consisted of the main Stakeholders for the project and original funders.

It was agreed that the Client for the project would be FIEC but that the Steering Group would be involved in the decisions on the options to be adopted and for ensuring efficient delivery for he project. A remit was produced to identify the role of the Steering Group.

The benefit of this Steering Group was that it established relationships at an early stage and the people involved were able to act as a conduit in their organisations to assist with issues to be resolved later such as funding, lease agreements etc.

Identification of FIEC as the Client was also important, particularly in the construction stage as all the funding flowed through FIEC and they were responsible for endorsing changes etc to the project. This gave FIEC a high level of ownership of the project.

During the development stage, weekly telephone conferences were held with the client, the Project Manager and the technical Advisor. This ensured that we kept the project on track and dealt with issues as they emerged to find solutions.

During the construction phase, monthly progress meetings were held involving the project manager, the technical advisor, the balance of plant contractor and the turbine suppler. This meant that not only was progress tracked, issues of integration of the system were also dealt with between the

different suppliers. This also assisted with the logistics of getting plant and materials to site as all the suppliers ended up using the same company.

Key Governance Lessons :

- Steering Group allowed relationships to be established which could be used to resolve issues during the course of the project
- Establishing the client for the project early on meant that roles and responsibilities were clear from the outset
- Regular progress meetings during the development and construction phases was instrumental in ensuring issues were dealt with immediately and that design integration issues were resolved.

Finances/Business Plan

Scott Moncrieff were appointed to produce the business plan and financial model for the project. Compared to other community renewable projects this project was slightly different. As the project would not be grid connected it would not export energy to the national grid nor be eligible for FITs payments. Therefore the revenue streams for the project would be based on the income generated from selling energy directly and standing charges on the island. This meant that grant funding was an option as FITS payments would not be applicable anyway.

At the time that funding applications were being made, the capital costs of the project were in their infancy and based on a design which wasn't well developed. As a result, the Initial cost estimates were low and probably did not consider the cost of logistics adequately. In hindsight, the project might have revisited these costs before going out to tender but this was not done.

Key finance Lessons :

- Because funding was sought at an early stage of the project, the costs were based on early capital cost estimates. These should have been revisited before the contracts went out to tender and then perhaps time wouldn't have been lost obtaining the additional funding required.

Legal

Whilst on the face of it the issues with leases and crofter consents seemed to go smoothly, this is due to the fact that there was one main landowner, NTS, who was supportive of the project, and that the crofters were in supportive as well.

We were fortunate that the landowner here the NTS was generally supportive of the project and didn't demand anything too excessive, for example rental payments or other conditions and most importantly all of the crofters bought into the project. Although there was one crofter who asked for a fairly small sum in respect of using his land there was never a sense that that was ever going to cause much of risk to the project.

The funding timescales were tight and actually completely unrealistic. This caused I think a little bit of tension whereby a large amount of funds had to be drawn down prior to the project being "ready" and prior to the project having the necessary consents for the wind turbines. There was a little bit of a difficulty in drawing down funds from the Big Lottery Fund as we didn't have the consents for the wind turbines. The lack of planning consent for the wind turbines also meant that we couldn't execute the crofting consents albeit we had the written agreement of all the crofters.

At this point in time though we had already entered into the lease with the National Trust for Scotland because we needed to commence construction early to meet the funding timescales of the LCITP fund. The whole funding package wasn't particularly joined up as a result of this.

The way we were able to get through it however was to be able to satisfy the Big Lottery Fund that because all the crofters had consented to the project there was no risk in respect of the crofting resumptions. Had we not had the agreement of all the crofters I think this would have caused great difficulty and would have delayed the funding from the Big Lottery.

The structure that we had did ultimately work with an early access lease being signed in advance and in advance of planning consent being obtained for the wind turbines but not one normally used.

The very good thing about this project was the excellent support and "buy in" that the community had and which actually made the project seem very smooth. If circumstances had been different however the project would have been difficult to execute due to these funding deadlines.

Funding

The LCITP funding drove the timescales for the project. The timescales for making the application were tight and the subsequent delivery timescales (to be commissioned by 30th September 2018) were aggressive and this lead to impacts which will be described in the following section of the paper.

However, the fact that LCITP bought into the project early on meant that other funders were willing to consider making a contribution to the project.

The funding model was fairly complex for the project with eventually 8 funders contributing. All these needed to be finalised before a contract could be awarded for the construction contracts could be awarded. This resulted in a delay to the construction start.

Part of the delay in finalising the funding package resulted from the original costs being under-estimated. As explained previously, the timescales for making the LCITP application didn't align with the overall development of the project and so costs were based on a very early iteration of design. This resulted in the project having to seek additional funding at the point we had tendered prices back from contractors.

Each funder had a different set of terms and conditions for the project and different criteria for release of funding. Whilst funders may have their own set processes for funding, this is perhaps something which could be considered for other projects when multiple funders come together to simplify the drawdown processes for the clients.

Key Funding lessons :

- This was a complex funding structure with a total of 8 funders. Getting them all committed in time to award contracts was a challenge.
- Perhaps getting Funders speaking to each other to join up their requirements might be something to consider in the future

Planning

This was split into 2 stages (1) Balance of plant including civils, control building, cable routes etc, and 2) turbines. This was because we were required to carry out breeding bird surveys before the turbine application could be made. Had we held all the planning submissions for this it would have delayed the overall programme. This appeared to work well.

Key Planning Lesson

- Splitting planning into 2 de-risked the programme

Design

Arcus, the technical advisors had produced quite a lot of design information as part of their development phase. This was included in the tender documents which gave the main contractors lots of information upon which to base their detailed design which they found helpful. The design of this system was complex as it had wind, solar, batteries, generators and then heating controllers all to be integrated. The fly wheel system was moved during the but the owner of this is now considering whether integration into the new system is feasible or sensible.

Arcus reflected that if they had considered the modular control building at the development stage this might simplified the planning process and reduced costs at an earlier stage of the project.

SSE and Harbon advise that their designs were done in a shorter timescale than they would have liked due to the time pressures on the project.

Several workshops were held with the turbine supplier and the technical advisors and they stated that this helped them with their design process.

Key Design Lessons

- Design workshops and working between the design teams to understand interfaces helped resolve issues before they became issues.

Procurement

The procurement of the development phase of the project was fairly straightforward and delivered according to programme. Costs were more or less contained within the budget which had been set at the outset of the

project. The technical advisor costs went up slightly due to information which emerged during the project and desire to carry out some geo-technical investigations and bird surveys etc as part of the planning and development process.

The turbines were eventually procured on a single source basis as there were few suppliers who could supply a Class 1 turbine which could cope with the wind conditions experienced on Fair Isle. We are sad to learn that the wind turbine manufacturer has just gone into administration. This leaves some issues for the project to deal with in terms of ongoing warranties, maintenance etc. If there is going to be a need for more turbines on islands with extreme weather, a lesson could be that the Scottish Government should look at creating a supply chain who provide and support them.

Early on in the project, one of the design sub-contractor organisations also went into administration. This was mitigated by the technical advisor using the member of the team who had been providing this input directly. However, it demonstrates that the industry is fragile.

Due to the deadline for commissioning, the procurement exercise was shorter than would normally have been expected and indeed was run through summer holidays which added pressure to the programme.

The project should think about how the system will be maintained afterwards. This was considered but the full costs of training weren't included to start.

Key Procurement Lessons

- There is a small pool of suppliers for the type of turbine required for Fair Isle. Supporting manufacturers to supply and maintain these is required if more are to be rolled out.
- Fragility of the supply chain was apparent and perhaps supporting the supply chain is an area to be investigated, particularly with the end of FITS.

<u>Environmental</u>

The project was required to employ both an archaeological clerk of works and an ecological clerk of works. These costs were not included in the original cost estimates and this is a point for future projects.

Fair Isle has significant archaeology and whilst nothing was found during the watching brief, the time take to agree any potential mitigation measures with SIC was protracted.

We utilised an archaeologist from Shetland and the ecologist lived on Fair Isle. This reduced the overall costs for the projects. The Ecological clerk of works worked closely with the contractors going in advance to identify anything they should avoid and coaching them in restoration. The standard of work done by the contractors was commended.

During the course of the works, several new native juniper plants were found which the ecologist was unaware of. These can now be monitored

There was one incident of damage to the native junipers. However, rather than carry out restoration, the ecologist determined that this should be left and would form the basis of research to monitor the regrowth and recovery of the species on the island.

There was a planning condition attached to the potential for rare birds to land on the island close to the turbines. If this happened monitoring would need to establish if work on the turbines should cease. We have 2 red throated phalaropes landed on the island – 2 pair of about only 50 breeding pairs in the UK. The Fair Isle Bird Observatory monitored and concluded that the works were not upsetting the breeding pair at all and so work continued and they bred successfully.

The bird survey data has been given to FIBO who didn't have this data for that part of the island previously and so this enhances their understanding of the bird movements in this area.

Key Environmental Lessons

- Cost in the requirement for an ECOW and ACOW – they will probably be required
- The planning conditions can provide unexpected benefits and need not be detrimental to the project

Construction

The main issues associated with the construction phase of the project have been related to the location of Fair Isle and the logistics of getting people and plant and materials over to the island.

SSE have been working on a similar project on Canna who have a roll-on roll off ferry. This has provided to be much more useful for transporting the materials than using a specialist supplier and using the existing boat – the Good shepherd.

The ability of the good Shepherd and other boats to get to and from the island in bad weather has been an issue and this has affected the transportation of people using the existing planes as well. This has meant that people have been stuck on Fair Isle or unable to get there when required.

The capacity of planes to get people there and back has not helped with the commissioning stage – see next section.

Key Construction Lesson

- **Logistics – if Fair Isle had a roll on/roll off ferry this would have made logistics much easier.**

Insurance

The initial fee quote for the system came in at over £10k. This is beyond the means of the FIEC in terms of insuring the system on an annual basis out of the revenues generated and so a basic insurance package has been put in place. This is potentially something that the Scottish Government could explore in terms of an insurance package for small community renewable generating schemes?

Key insurance lesson

- **Standard packages offered by insurers make them unaffordable for smaller communities.**

Testing & Commissioning

The testing & commissioning process was frustrated by a number of issues as follows:

- Logistics of getting everyone required on the island at the same time and into accommodation – this wasn't always possible which meant the overall process took longer than expected.

- If something didn't work then there was the issue of getting spares to site – we did discuss this as part of the planning process but the generators did cause problems with new kit having to be manufactured and then delivered
- Bad weather hampered the delivery of equipment to the island and the transport of people.
- The project decided not to replace all the heat cables which were already in place. During the testing and commissioning period one of these failed. This meant that it needs to be replaced an until this is done the full testing of the turbine interface with full heat loads cannot be done. Harbon can do this remotely but it remains on the snagging list.
- The flow of Testing & Commissioning information from the contractor has been slow, due partly to the issues with completing all testing and commissioning.

Key Testing & Commissioning Lessons

- **Logistics – travel & accommodation preventing getting everyone required to the island at the same time and so the programme was extended beyond what was originally intended**

Close out

Close out of the project has been slower than hoped due to a number of issues as follows:

- Testing & commissioning slower than anticipated
- Final account process held up by main contractor staffing issues and illness.
- Removal of all kit from the island slow due to bad weather

This is probably similar for other projects as once the main works have been complete the team tends to move onto other jobs. It takes the project manager to continually remind everyone of the requirements. This is where contract retention can assist.

Stakeholders

NTS - Invoicing to be more timely (without chasing) and to come with clear evidence of spend. The timing of invoices was dictated by the overall

progress of the project and so may have fallen out of alignment with the original funding agreement. Stronger supporting information to support the drawdown requests - given the nature of the block funding it may have been helpful, in hindsight to agree what evidence of progress was required by NTS to allow them to make payment as the invoices being paid did not match the block funding being provided by NTS. This is something to consider for other projects funded by NTS.

Community/ Collaboration & Other benefits

It is fair to say that the collaboration between the community, stakeholders and contractors has greatly assisted with this project.

In the early stages, setting up the Steering Group brought all the key stakeholders together and created a forum where we could discuss and resolve issues which might hold the project up.

NTS worked with the project to release accommodation, as did Shetland Islands Council.

However, the greatest collaboration came from the residents of Fair Isle and the way they welcomed those working on the project onto the island. 2 local people provide the food for the contractors in the Puffin hostel and this was complemented all the time.

The contractors were made to feel welcome and invited to island events such as darts night in the hall.

When there was something that needed done, the community and contractors all mucked in to get it done – even to the point of getting up at 3am to take deliveries form a boat coming in with materials for the project.

The people who undertook the catering and cleaning for contractors gained experience and confidence from this project. They have since been asked to do catering for other jobs on the island and will now look to do this for other visiting contractors.

The wind records from the turbines are now being used for correlating with the other wind recorders on the island and used at the airstrip for flight information.

The Northern Lighthouse Board are looking to purchase energy from FIEC which they didn't previously and also looking to potentially run a cable to the north lighthouse and supply that sometime in the future.

There are lots of requests from PHD students for information and it has raised awareness of the island generally.

The process of naming the turbines has raised awareness of Fair Isle folklore and this has been recorded. It created an intergenerational project between the school pupils and the older members of the community.

The project has facilitated other projects such as the Scottish Water improvement to water quality & housing project which are now either underway or being investigated.

Fuel poverty – there are 3 tariffs to ensure a differentiation between domestic and residential to try and avoid fuel poverty on the island.

Significant reduction in use of diesel on the island and so already making significant CO2 reductions.

Key Collaboration Lessons

- Creating an atmosphere where everyone worked together is key
- Collaboration between contractor and community was a key success factor in the project.
- It can provide development opportunities for the community and result in them starting up new business
- Projects like this can stimulate and act as a catalyst for other projects

Conclusions

The objectives set at the start of the project appear to have been delivered as shown in the table below.

Objective	Delivered
A dependable, 24 hour, stable, low carbon based electricity supply which is suitable for power quality sensitive equipment and every-day items taken for granted on the mainland, such as computers, monitoring equipment, washing machines etc.	Infrastructure delivered and system appears to be holding up.
Energy for Scottish Water Treatment works, airport (lighting to allow an extension of the available flight hours in a day) and harbour, bird observatory and additional domestic load – increasing the customer base and providing a sustainable income from electricity sales	System to allow power to Scottish Water , airstrip, observatory, harbour – all delivered. The Scottish Water treatment works project to improve water quality is now going ahead as extra power is available
Significant reduction of CO2 emissions on the island by displacing the diesel generation used by Fair Isle Bird Observatory and potentially other stakeholder	Will be measured over time
Enable the use of renewable energy that is currently not able to be utilised due to lack of energy storage equipment and provide a more robust and reliable system.	Battery storage implemented to provide 50hours of energy.
Ability to increase employment opportunities through the provision of a reliable and 24 hour power supply to generate employment but also employ someone to look after the system.	Delivered – 1 new resident to the island to be trained.
Increase in population by making Fair Isle a more attractive place to live and bring up children	This will be measured overtime.

Whilst the project went well, there are lessons to be learned across the project lifecycle which are listed below.

Key Development Stage Lessons :

- project management was important and the client team had the foresight to put this in place at an early stage of the project.
- The opportunity to apply for LCITP funding at this early stage accelerated the timescales for the project and so lad to durations for some tasks being less than optimal later on

Key Governance Lessons :

- Steering Group allowed relationships to be established which could be used to resolve issues during the course of the project
- Establishing the client for the project early on meant that roles and responsibilities were clear from the outset
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Key finance Lessons :

- Because funding was sought at an early stage of the project, the costs were based on early capital cost estimates. These should have been revisited before the contracts went out to tender and then perhaps time wouldn't have been lost obtaining the additional funding required.

Key Funding lessons :

- This was a complex funding structure with a total of 8 funders. Getting them all committed in time to award contracts was a challenge.
- Perhaps getting Funders speaking to each other to join up their requirements might be something to consider in the future

Key Planning Lesson

- Splitting planning into 2 de-risked the programme

Key Procurement Lessons

- There is a small pool of suppliers for the type of turbine required for Fair Isle. Supporting manufacturers to supply and maintain these is required if more are to be rolled out.
- Fragility of the supply chain was apparent and perhaps supporting the supply chain is an area to be investigated, particularly with the end of FITS.

Key Environmental Lessons

- Cost in the requirement for an ECOW and ACOW – they will probably be required
- The planning conditions can provide unexpected benefits and need not be detrimental to the project and indeed provide information not previously available.

Key insurance lesson

- Standard packages offered by insurers make them unaffordable for smaller communities.

Key Testing & Commissioning Lessons

- Logistics – travel & accommodation preventing getting everyone required to the island at the same time and so the programme was extended beyond what was originally intended

Key Community/Collaboration/Other Lessons

- Creating an atmosphere where everyone worked together is key
- Collaboration between contractor and community was a key success factor in the project.
- It can provide development opportunities for the community and result in them starting up new business
- Projects like this can stimulate and act as a catalyst for other projects