ICE INTELLIGENT COMMUNITY ENERGY

EUROPEAN UNION

Interreg France (Channel Manche) England

EUROPEAN UNION

ICE REPORT D4.1.1: REVISED METHODOLOGY

28/02/2020

BRETAGNE DÉVELOPPEMENT INNOVATION

EXETER PLYMOUTH UNIVERSITY UEA marine

Task T4.1:

Refinement of ICE Methodology

Lead: Marine South East

Contents

1 Introduction

1.1 The ICE project

Supported by Interreg VA France (Channel) England, the Intelligent Community Energy (ICE) project aims to facilitate the design and the implementation of innovative smart energy solutions for isolated territories that face unique energy challenges, and test these in the Channel area.

Many islands have no connection to wider electricity distribution systems and are dependent on imported energy supplies, typically both expensive and fossil fuel driven. The energy systems on which isolated communities are dependent tend to be less reliable, have high unit cost and produce more greenhouse gas (GHG) emissions per unit energy than mainland grid systems.

In response to these problems, the ICE project considers the entire energy cycle, specifically for our test sites, but also generally in terms of applying a general approach to other isolated communities. This assessment covers production to consumption and integrates new and established technologies in order to deliver innovative energy system solutions. These solutions will be implemented and tested at our unique pilot demonstration sites (Ushant island and the University of East Anglia's campus), to demonstrate their feasibility and to develop a general model for isolated smart energy systems elsewhere.

The ICE consortium brings together research and business support organisations in France and the United Kingdom. Commitment from SMEs will support the project rollout and promote European cooperation.

1.2 Purpose of this document

An important output from the ICE project is a general methodology for implementing an integrated, community energy scheme, reported in deliverable D2.1.1 and D2.1.2. This outlines a methodology comprising a sequence of steps:

1. Assess energy demand outlook and identifying options
2. Assess energy supply outlook and options
3. Assess the overall system and its reliability
4. Identify credible scenarios and select preferred plan
5. Implement, monitor and revise
6. Outline a model for business engagement

The audience for D2.1.1 and D2.1.2 is primarily the public authority or utility company that is committing to the adoption of the new approach, informed by the needs of the wider stakeholder group. However, much of the technology and expertise needed to implement the scheme will be coming from private sector companies. Such schemes therefore represent a business opportunity for suppliers, offering the potential to expand into a new sector try out new technologies or new approaches to system management. Taking a wider view, there is an opportunity for projects to catalyse sectoral business investment and growth to meet the coming challenges of shifting from fossil fuel imports to potentially cheaper in situ renewable energy and other relevant technologies such as energy storage and smart energy management.

For this to happen, it is essential to engage an ecosystem of suppliers that possesses the breadth of expertise needed to implement a community energy scheme. Accordingly, the objective of this document is to provide a basis for firms to become part of this ecosystem. The material needed to enable this participation has been developed within the project and is presented here as two steps. First, we define the breadth of capability that is likely to be required during the life cycle of a community energy scheme, and secondly, we present the value potential to firms that could offer relevant capabilities.

This document also takes account of lessons learned in recruiting smaller suppliers into the pilot procurement, reported in D2.2.1. These suggest that it is not easy for SMEs to identify business opportunities in large public sector-led projects, with the result that the ecosystem of suppliers lacks sufficient breadth. This document aims to address this difficulty.

1.3 Content of this Document

The document creates two additional chapters that are annexed to the original D2.1.1 general methodology, namely:

- A value chain map that highlights the breadth of capabilities needed to implement a typical community energy scheme. This is intended to set out the breadth of expertise that could potentially be involved in the planning, implementation and operation of a community energy scheme;
- A set of value propositions setting out the commercial rationale for suppliers to sell into the community energy market. This is intended to clarify the business potential for a wide range of suppliers, in a way which is convincing for an SME that might have limited prior experience in the community energy market, as well as larger businesses playing a systems integration role.

These chapters form the main part of this deliverable.

2 General Methodology for Smart Energy Transitions

2.1 Summary – T2.1

The summary section from ICE deliverable T2.1.2 sets out the justification for accelerating the roll-out of smart energy transitions for isolated communities, and the systems-wide factors to be considered. The text from this report are reproduced below:

This document describes a proposed methodological approach to the design and implementation of smart energy island systems. It is informed by a desk review of the available literature on smart energy islands (see T2.1.1 ICE deliverable report), current thinking in electricity system planning, and the particular challenges facing isolated systems (eg. Ushant). The approach consists of a series of sequential steps and iterations between steps that aim to guide communities through the process of creating a smart energy system. Unique to this approach is the emphasis of fostering local skills, businesses and industry in the delivery of the program with the aim of retaining these long-term benefits within the community.

The document lays out the specific considerations of the proposed generic methodology for the isolated system smart energy transition. The conceptual overview of the methodology is presented and the rationale behind this choice of framework is supported. The framework comprises a set of guidelines based on the understanding of the best practices in ongoing smart energy transition projects and the approaches to electricity system planning. Within the scope of the ICE methodological approach the role of the different key players in the implementation of the methodology and the rationale behind the choices made regarding technologies, policies and so on are detailed. These includes stakeholder engagement, assessing energy demand and supply outlook and issues around balancing. Options, system reliability, scenarios and the implementation, monitoring and revision of the energy transition aspects are then considered.

The ultimate goal of the document is to provide a blueprint for smart energy transitions in isolated and peripheral territories and to allow transferability of the methodology. The result here is that the specificities including business models related to issues featuring isolated territories are all covered by this generic approach. In turn, the document aims to empower policymakers and stakeholders with the outlook, circumstantial evidence, and innovation on how to develop smart energy transition strategies for isolated and peripheral territories.

2.2 Implications for the Supply Chain

One of the key goals of ICE is to expand the range of SMEs available to help deliver smart energy transitions. Access to this market is the prime motivation for SMEs to want the ICE certification which is being offered.

To achieve this goal, it is necessary to understand how such SMEs could be assisted to win business in the supply chain for smart energy transition, how their growth in this sector can most effectively be supported, and equally how the barriers to such participation could be overcome. These barriers are significant, owing to the complexities of regulation in the energy sector and also the different ownership and governance arrangements for electricity generation and distribution in different countries. As a result, the scope for scaleability of solutions internationally is likely to be limited in some parts of the value chain.

2.3 Securing Commitment and Investment

This wider participation of companies along an extended supply chain offers potential socio-economic benefits which can make the smart energy transition more compelling as a proposition. For public authorities responsible for economic growth, championing a smart energy transition can make good sense, to exploit:

- A more resilient and cost-effective energy supply network reducing costs for the economy and stimulating investment;
- Building capacity and track-record of local firms involved in the project, to help them win business elsewhere;
- Creating an infrastructure that can readily integrate additional generating and storage capacity at low marginal cost, to enhance network performance in future.

These diverse benefits can help to justify co-investment with public funds and also attract private investment by fund holders seeking long-term income from infrastructure assets.

3 Value Chain Map for Community Energy Systems

In order to implement a community energy system, it is essential to understand the motivation and roles of all parties in the system's implementation and operation. Although value chain analysis has been extensively demonstrated in community energy schemes, the level of detail relevant to SME suppliers has been lacking. ICE report D2.1.2 (ICE deliverable) outlined numerous domains of commercial engagement summarised in the figure below.

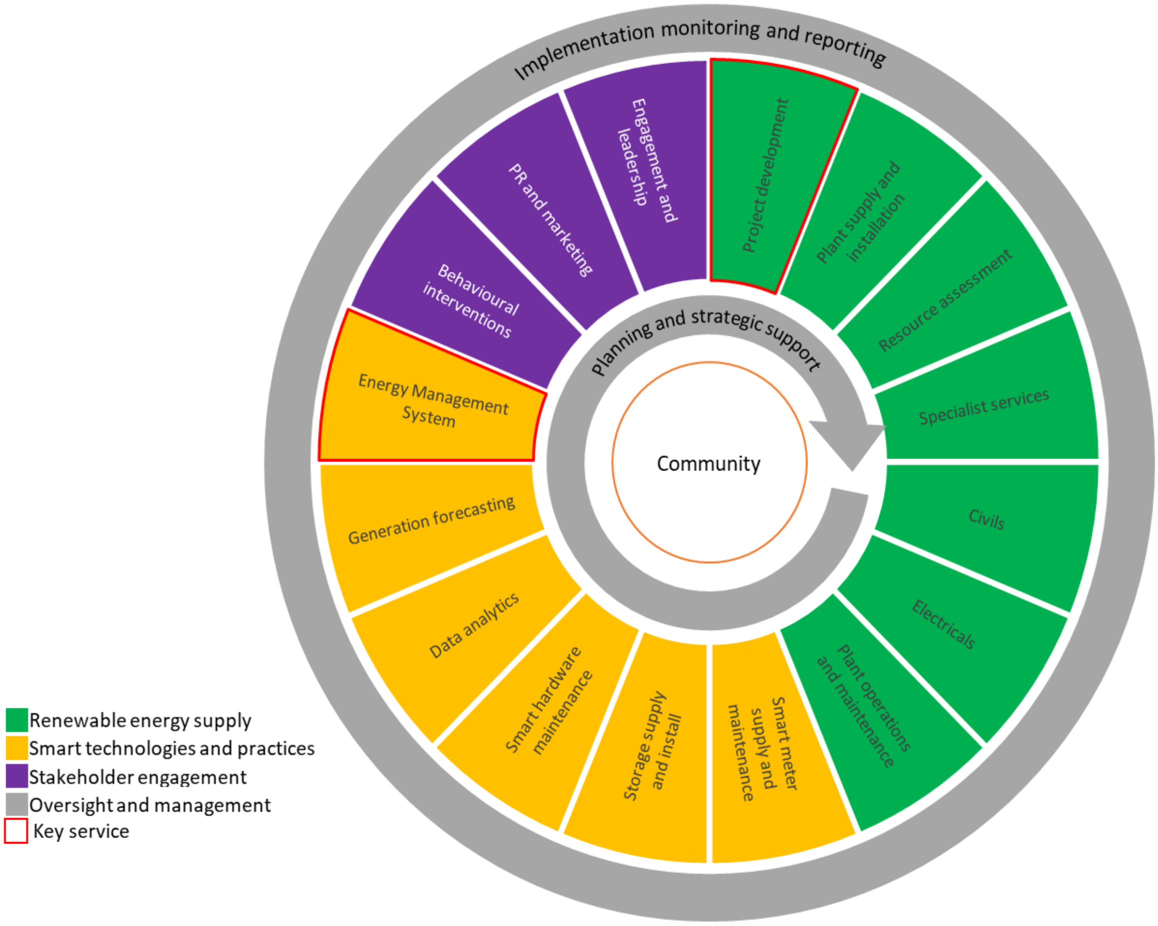


Figure 1 Domains of opportunity and the likely types of product and service for the transition (from report D2.1)

Additionally, a more detailed value chain map has been defined for this revision to the ICE approach in order to address this gap, and is shown at high level below, in which the same colour scheme for the value chain links is used as is shown in figure 1 above:

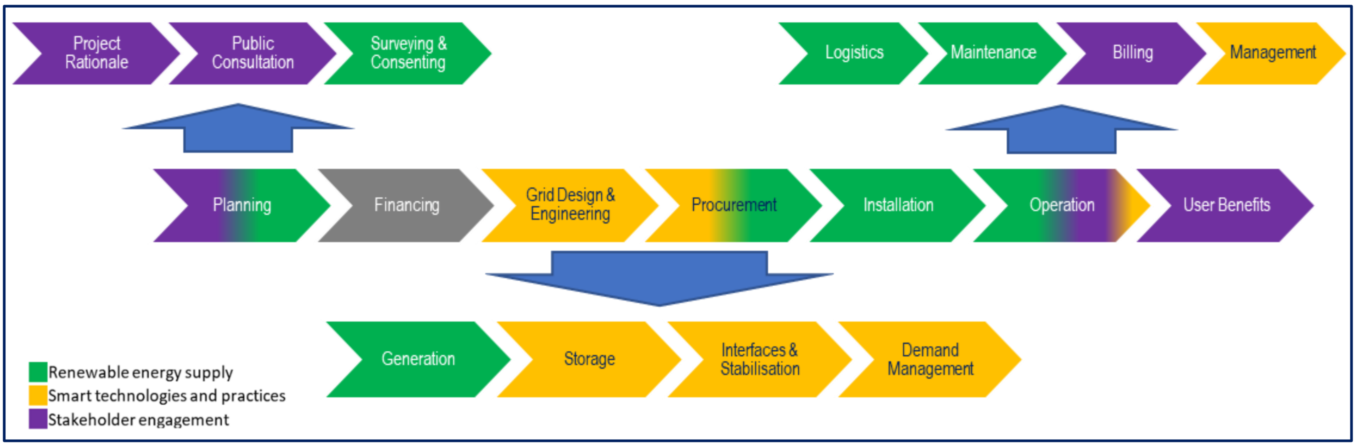


Figure 2 Value chain highlighting supplier opportunities as the project advances

The main strand of the value chain runs from the initial planning stages of the project, through project implementation, and leading to planned user benefits. In sub-sections 3.1 to 3.7 below, each link of the value chain is summarised, highlighting the main activities and challenges (including the need to meet multiple stakeholders requirements in a consistent and cost-effective way). Some of these value chain links are particularly well-suited to present opportunities relevant to specialist suppliers, namely:

- Planning, which includes multiple sub-contractor tasks such as surveying (as required by consenting procedures) and public consultation, as well as assessment of options for balancing supply and demand and its optimisation;
- Grid design and engineering, and its subsequent procurement, which needs to deliver the planned benefits and which will need to embrace a range of specialist expertise in smart energy systems;
- Operation, including maintenance, which also needs to support interfaces with the community and customer base.

3.1 Planning

After identifying and quantifying the available renewable energy resource, the planning and consenting issues can be assessed against the types, size and location of new generation plant and other technological interventions. Once a clear plan is established for the technical characteristics, the planning process involves a range of activities including obtaining appropriate permits for the necessary works.

3.1.1 Project Rationale

Before the project planning even starts there has to be a defined rationale for the project, with buy-in from key political and financial stakeholders. In many cases, the project will form an element of a larger strategic plan focused on decarbonisation and sustainable development goals. This will typically include a number of complementary sub-projects, such as energy efficiency improvement programmes, which would run alongside ICE best practice and be integrated with it.

3.1.2 Resource Assessment

Some understanding of the available renewable energy resource will already be known to underpin the project rationale. This understanding now has to be quantified in greater detail, deploying appropriate sensors for on-site resource measurement, and performing relevant analysis to determine the accessible resource and its variability (including seasonality, diurnal/tidal cycles etc).

New renewable energy resources, and/or improved technologies for accessing them, are likely to be identified during the lifetime of the community energy infrastructure. Future-proofing this infrastructure is therefore important to allow future resources to be integrated into the system.

3.1.3 Public Consultation

Island communities, and the individuals within them, will have their own priorities concerning energy, its generation, consumption and associated finances, but potentially also regarding environmental impact, visual impact, impact on local economy and other factors specific to that community. It is essential to seek out the views of the community and to integrate these into decisions that will impact on them. This may need to be a multi-stage process, first seeking out general opinion, then narrowing options as planning informed by user opinion becomes more specific.

This consultation should investigate diverse factors including acceptability of different pricing regimes, impacts on reliability of supply in changing generation modes, acceptability of new technology on the environment, as well as willingness to use new technologies which may require behaviour change. The significance of these will vary from community to community. (See T2.1 but also some deliverables in WP1.) It can be observed that consultation often begins too late in the process, when projects are already well developed with limited remaining flexibility, thereby undermining effective consultation [REF]

3.1.4 Surveying & Consenting

Deployment of additional generating capacity (wind turbines, marine current turbines etc) will generally require specific consents which can take a considerable time. Some technologies may be ruled out as the result of the specifics of the location (for example, a protected marine or land environment). Ecological surveys and environmental impact assessments will often be required. A wide range of specialist consultancies will be needed to carry out these studies and assessments.

3.2 Financing

The community energy scheme requires up-front capital investment which can be justified against cost savings and other benefits once the scheme is operating. A business plan is typically developed to quantify these costs and savings over time, and to determine the return on investment needed to justify the up-front investment. Accessing the level of finance needed may be difficult, but there are options for addressing this (see ICE report D2.3).

In many cases, where wide-ranging development is being undertaken at the direction of public or community organisations, it may be useful to create a vehicle such as an energy service company (ESCO) which will capture the costs and savings; this could be constituted as a legal entity (e.g. a Community Interest Company) or a construct within a public body such as a nationalised utility. The way in which cost savings and other benefits (such as improved environmental quality, enhanced economic development and improved system performance) will be shared between the ESCO/utility, the energy user and wider public (locally and nationally) is crucial to the success of the scheme. Any approach needs to ensure that consumers are protected in terms of energy costs and overall system performance.

A range of specialist financing companies is now available, ranging from banks offering asset-backed finance through to companies offering a more turnkey service to ESCOs.

In addition, many potential smart energy solutions will require energy consumers (domestic or commercial) to invest in upgraded equipment. In some instances, it will be appropriate to fund such changes (such as new metering equipment) through the ESCO or through public subsidy. Some investment, however, may require investment by householders or businesses in generation or storage plant, new e-mobility solutions or upgraded electrical appliances such as heat pumps. In these circumstances specialist consumer finance options may be required. For some interventions, public support for such lending can be implemented through, for example, the underwriting of commercial loans by development banks to reduce lenders' risk and therefore the rates paid by consumers.

3.3 Grid Design & Engineering

Micro-grid performance requires careful optimisation to ensure that intermittent energy resources are utilised as fully as possible, whilst also meeting the requirements of energy users, at least cost. The scale and locations of electricity generation facilities and energy storage facilities are key elements of this optimisation. The optimal location of storage is inter-dependent with the capacity distribution of the grid, and additional generation facility locations, so the most cost-effective solution depends partly on the existing grid infrastructure and a detailed analysis thereof (see ICE report D1.2). Furthermore, the amount of (costly) energy storage may be able to be minimised by judicious application of demand-side management. This in turn depends on the type of domestic energy management systems to be installed, and the willingness of consumers to use these.

Given the complexity of these inter-dependencies, grid performance modelling has a critical role to play. Different scenarios can be explored both for the initial system and for its future expansion potential. There is, therefore, a diverse requirement for expertise, services and equipment supply. Such suppliers will be involved in the design and optimisation process, and subsequently may be involved in the procurement of equipment (see below).

3.4 Procurement

Once the design of the technical part of the programme has been finalised (including specification of generation and storage plant and grid modifications), the required equipment and services can be procured. Access to an extensive supply chain capability is important, to tap all available technologies and to minimise costs.

This supply chain capability can be represented in greater detail by a subsidiary value chain that lists the range of sub-systems involved, focusing specifically on the equipment needed to build the system. This includes the following:

3.4.1 Generation

Additional renewable energy devices are needed that can generate electricity to supply the community energy scheme. This will increasingly be renewable energy devices that will displace traditional fossil-fuelled generators. Although some renewable energy facilities will have significant MW-scale capacity, and will be implemented by large companies, there is also a need to exploit fully the potential for smaller-scale renewable facilities (e.g. roof-top and land based solar and sub-MW onshore wind) that could be supplied and installed by smaller firms. The community grid business model will have to be designed to motivate investment in additional renewable generation, including after the initial community energy system has been commissioned. This might require changes such as allowing new generation owners access to the grid to pass on, and ideally compensated, for their excess generation. Efforts might also be made to encourage consumers to invest via incentives to offset capital costs or to encourage investment in specific generation technology which demonstrate a better fit with island demand.

3.4.2 Storage

Some facility for electricity or heat storage will be needed (now or at a later date, as the technology matures) in order to optimise the performance required of the scheme. Energy storage may be installed in large grid-scale (MWh scale) units or small-scale batteries (10s of kWh scale) designed for household applications. As with additional generation capacity, the business model must incentivise further investment in storage to enhance grid stability as the proportion of renewables increases.

3.4.3 Interfaces & Stabilisation

In some cases, community energy schemes will be tied to a larger grid infrastructure. Optimising this grid interface is important and becomes more so as expected demand on the grid (e.g. for EV charging or heat pumps) intensifies. In cases which are independent from the larger grid (e.g. on islands too far from a mainland to support a cable) some additional reinforcement in the local distribution network will nonetheless be required to accommodate the new generation devices and other sub-systems. In addition to storage facilities, equipment is needed to provide the voltage and frequency stabilisation that a grid requires.

3.4.4 Demand Management

In order to balance electricity demand on the grid, against a fluctuating level of generation (particularly from renewable sources), some kind of demand management may increasingly be needed. This can have a number of systemic benefits, for example, including reducing peak consumption, shifting consumption to flatten overall demand or to move demand to better fiit with times when renewable generating capacity. This can help to minimise costs relating to use of reserve generators (typically fossil-fuelled) or minimising reserve or energy storage capacity and attendant costs. This approach can reduce the amount of storage required in a cost-effective way.

There is a wide range of equipment and systems offering demand-side management, and the technology is advancing continuously. Some demand side approaches may also require buy in from consumers, and it is important to identify and replicate best practice in approaching this in different territories. The community of ICE-labelled companies clearly has an important role to play in capturing the range of companies that is able to meet these supplier requirements.

3.5 Installation

A significant programme of installation is required, potentially including offshore or nearshore installation of marine energy devices. Deployment of demand-management facilities, and potentially generation (e.g. roof-top solar) and storage, in individual households that volunteer, will require a substantial resource to manage consumer interaction and to install equipment on a house-by-house basis. This may usefully be integrated with a programme for energy efficiency surveying and improvement recommendations, in order to reduce overall energy demand as far as possible.

3.6 Operation

The operational phase of the scheme life cycle is of particular relevance to the equipment and service supplier community, since it will continue for several decades. Tasks to be supported during this period include inspection, maintenance, repair, upgrading and expansion, along with associated management of the complete system operation.

Even though the annual spend on such activities will be small in comparison with the capital spend, the long-term nature of the revenue stream is attractive to suppliers.

3.6.1 Logistics

A logistics infrastructure is needed to ensure that equipment and personnel needed to operate the system are available at the right place and at the right time. In addition, remote communities will require management of a spares inventory so that failures can be resolved as quickly as possible.

3.6.2 Maintenance

On the back of the logistics infrastructure, a programme of preventative maintenance will be needed to ensure reliability of supply. Condition monitoring of distributed generation capacity has a key role to play, to identify plant degradation early on, and schedule replacement of equipment before failure occurs. A diverse range of condition monitoring solutions are now commercially available. Further, optimisaiton of O&M around usage to minimise loss in generation and best fit with periods of high demand can help to keep down costs, This form of system optimisation is also commercially available.

3.6.3 Billing

Given that householders are part of the community energy system, a support infrastructure of billing and customer services will usually be needed. Equally in systems where householders are contributing energy or balancing services (via time-delayed consumption), the system must allow payments or credits to customers.

3.6.4 Management

The overall system will require a facilities management provider to take responsibility for the system, and to manage suppliers and contractors as required.

3.7 User Benefits

Although user benefits are not an activity as such, they do motivate activity all the way back up the value chain. Particularly, an understanding of how different categories of user will consume energy should shape the demand management approach, and similarly impact on the overall smart grid design.

Implementation, consenting and justification of public funds will require societal buy-in to the whole concept of community energy. Therefore, detailing the benefits to domestic users will be crucial to the project.

4 Value Propositions for Participants in Value Chain

It is clear that all the entities involved in this value chain need to have motivation to participate. Identifying and validating these motivations is a key part of the ICE methodology, to ensure that the impact of the project is maintained after the project itself is completed. The value proposition forms a critical part of the investment case for each of the companies involved in the value chain.

A common methodology is being employed to define the value propositions targeting three typical companies occupying different positions in the value chain. To help ensure consistency of approach across the three, a widely-respected methodology has been used called the Value Proposition Canvas, which is part of the same thinking behind the Business Model Canvas[1].

This methodology aims to achieve a fit between:

1. **The customer priorities that could be satisfied by the company**
   - What essential customer needs need to be met
   - What customer fears would need to be overcome
   - What wider stakeholder benefits would be realised

and

2. **The product/service to be provided by the company**
   - What it does and how the customer would pay for it
   - What features it would provide to the customer
   - Whether those features are likely to offer value for money.

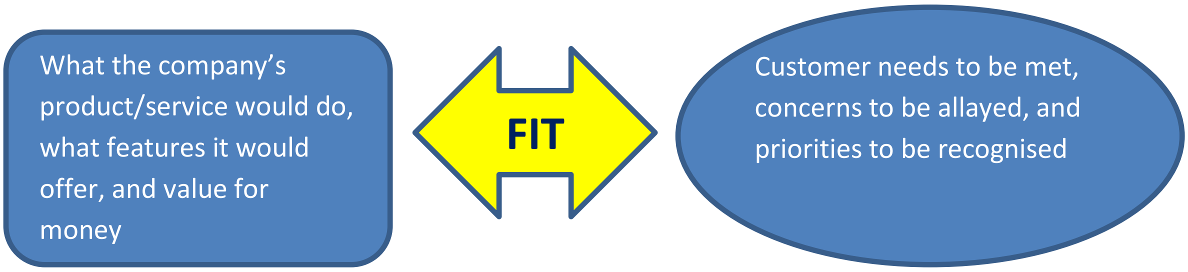


Figure 3 – approach applied to defining the value propositions

For each of the three value propositions, the following key tasks will be addressed:

- Task 1 – define the position that the company occupies in the value chain
- Task 2 – identify this company's end user and target customers (households, businesses, public authorities) with some examples
- Task 3 – analyse needs and concerns of these end user and target customers, and their stakeholder priorities
- Task 4 – describe the product/service that the company is bringing, or is proposing to bring, into the community energy market to meet these requirements

[1] Business Model Canvas by Alexander Osterwalder

- Task 5 – demonstrate how the characteristics and features of the product/service would satisfy the end beneficiary and target user priorities.

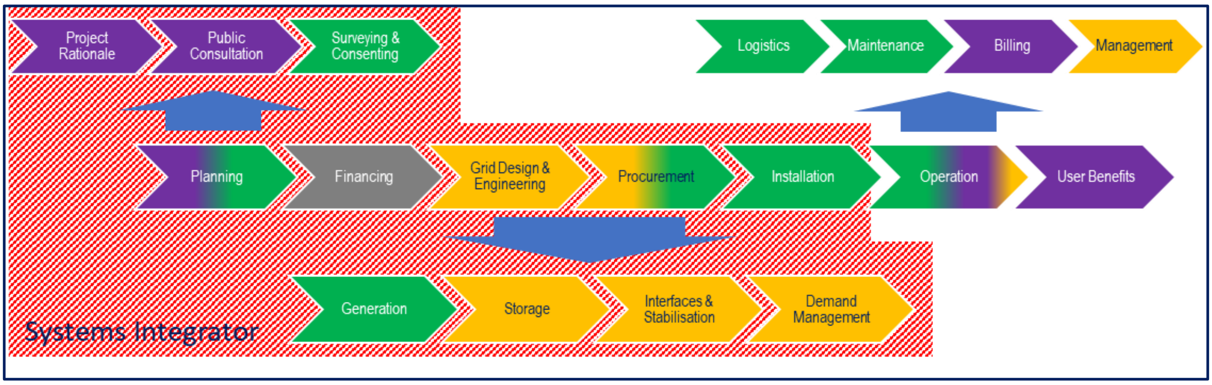
This approach has been applied to three key types of company occupying part of the value chain, as reported below.

4.1 Systems Integrator

4.1.1 Position in Value Chain

The systems integrator takes overall responsibility for implementing the project and must be of a necessary scale to take on the financial risk involved, against the likely return. It must also have the technical expertise to lead the overall system design, and to quantify/remediate any residual technical or societal risks. In exchange for taking on these risks, the systems integrator must see a significant financial incentive: typically, a combination of a financial instrument (that reflects the true costs of conventional generation in remote locations) and revenue from energy sales. It can sell directly to end users (in which case it may also be the operator) or it can sell to an intermediary (which could be the operator or aggregator). This is a well-used business model based on asset-backed financing.

Within the value chain, the systems integrator's oversight role extends across all value chain functions up to and including installation. In some cases, the same organisation will also operate the system. In other cases, the systems integrator might begin their role after the project planning phase has been completed, at a stage where consenting risks have been mitigated.



Although the systems integrator will design to integrate multiple electricity generators, some of these generating facilities will be owned and operated by others. This provides flexibility for third parties to stimulate investment in future renewable resource exploitation, provided that a suitable regulatory framework exists to ensure that small generators can sell power into the system at acceptable rates.

4.1.2 End User & Target Customers

The end user for the systems integrator is the energy consumer: households, businesses, public authorities and others. These customers may contract directly with the systems integrator in cases where the systems integrator is also operating the community energy network. In other cases, these end users will contract with a third party that is operating the network and its associated back-office functions.

There are three critical target customers for the systems integrator:

- Large energy consumers, especially in situations where the network is servicing the needs of a single organisation (e.g. a university, estate or a port) in which case the systems integrator is contracted by a single customer;
- Public authorities or utilities, where the public authority represents the interests of all energy consumers, and/or where the community network forms part of the wider distribution network which might have existing customer service functions;
- A new organisation (for example, a community interest company) which might be set up specifically to operate the community network in the interests of its members.

4.1.3 Customer Needs, Concerns & Stakeholder Priorities

The customer needs include:

- Provision of electricity to the end user(s) with at least minimum standards of reliability, and to statutory levels of stability (voltage and frequency);
- Any demand management facility offers flexibility to end user(s) to ensure adequate convenience and equally to ensure that loss of convenience (eg timing of electricity demand to avoid peak demand periods) is offset by improved reliability and/or lower price tariffs;
- Provision of a customer support service that is responsive to evolving requirements such as setting up new supply;
- Pricing of energy to the end user that is no worse than that offered by traditional electricity suppliers before the community energy network was established.

Customer concerns may include:

- increased volatility in pricing which is difficult to manage financially, and which is not adequately offset by other benefits;
- Committing long-term to a solution which is subsequently over-taken by more attractive options and/or changing regulatory measures;
- Poor alignment of the interests of the supplier with community interests.

Ideally the following stakeholder priorities would be reflected in the solution:

- Be best-in-class in driving down carbon footprint
- Achieve community empowerment in evolution of their energy supply infrastructure.

4.1.4 Product & Service Offered

The core services to be offered by the systems integrator include:

1. Design and Engineering – integrate a range of equipment and sub-systems to take advantage of best available technologies, configured to suit each specific community requirement. Integrate multiple energy resources, with flexibility to accommodate future expansion and advancement of

generating facilities. Model the performance of the proposed system to optimise configurations and ensure stability of operation and availability of supply;

2. Build and Install – manage the total implementation including a procurement process that optimises levels of local supply and encourages SME participation. Ensure that the logistics of construction works minimise environmental impact and ensure that end-user equipment is installed with minimum disruption. Commission the system and perform hand-over to the organisation responsible for operations;

3. Financing – raise the necessary finance, either on an asset-backed basis for a commercial provider, or using public funding through a relationship with a local authority or public sector utility. The cost of finance will depend on minimising technical and commercial risk. A strong track record and a strong partnership with local authorities will both be important factors.

Other services which may be offered depending on the specific community situation include:

4. Planning – undertake due diligence work to assess the attractiveness of the project and how it fits with other programmes (e.g. on energy efficiency), and initiate a process of public consultation to identify concerns to be addressed and to secure public buy-in. Undertake all necessary surveys required for formal planning consent;

5. Operation – set up the appropriate facilities for maintenance of the network and for customer servicing and billing. Manage operations under an entity that can be held accountable to stakeholders.

4.1.5 Customer Benefits Achieved

Where the systems integrator is also operating the network and supplying services directly to end-users, it should be able to offer the following benefits:

- Secure supply that makes optimal use of all available renewable energy and storage resources;
- Rapid response to network outages and a preventative maintenance capacity;
- Scalability to allow the network to expand if required;
- Pricing arrangements that compare favourably (or not unfavourably) with conventional supply arrangements, and which allow customers to exploit cheaper but less flexible tariffs. This may require some level of regulatory control to provide confidence that consumers (and especially domestic power generators selling back to the operator) are not unfairly treated by a monopoly utility;
- Accountability to the local community and local authorities.

Where the systems integrator is not responsible for operation of the network, it would be contracting with a separate operational service provider (see below). It should be able to offer to this customer the first three benefits above, and:

- Delivery of community energy supplies in accordance with the commercial terms agreed with the operational service provider.

4.2 Equipment Supplier

One of the objectives of ICE is to enable increased participation of such firms in the community energy market. At a systems level, this offers three main benefits:

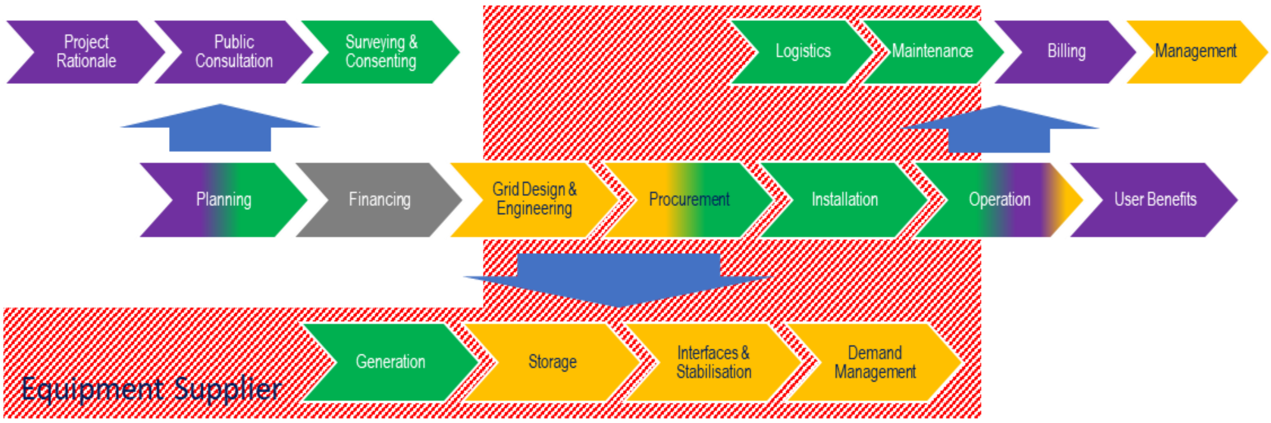
- Performance of the system is enhanced by drawing upon the latest knowledge and technology
- Pace of innovation can be accelerated by bringing small firms into collaboration with larger ones
- Socio-economic gains can be realised by introducing small, local firms into the project, and providing them with track record to win business in the wider market.

However, for small firms to be interested in ICE it needs to be clear how they will realise these benefits, which is spelled out in this value proposition.

4.2.1 Position in Value Chain

Equipment suppliers have a prominent place in the value chain as they represent the foundation upon which system integrators can rely to implement a grid.

Equipment suppliers are present at various stages of the value chain as they must be consulted upstream so that system integrators can design the grid.



Obviously, if they are responsible for operation of the equipment downstream they must provide what their customer expects, in terms of maintenance and intervention in case of breakdown.

4.2.2 End User & Target Customers

Although end users are energy consumers just as for system integrators, target customers of equipment suppliers are the organisations procuring the equipment that forms part of the system. Integrators may often be the client if they are seeking a specific technology.

4.2.3 Customer Needs, Concerns & Stakeholder Priorities

The end-user need is simple: bring a more reliable, cheaper and cleaner energy into houses to eliminate power cuts, expensive bills and use of fossil energies. It is then crucial that the technology deployed by the equipment suppliers be sufficiently effective to meet these needs or at least could be integrated in a grid that will be. Responsibility for assuring the performance of the complete system is placed on the integrator and/or the body accountable to consumers.

Expanding the national grid to an isolated territory such as an island is extremely costly and technically challenging: access, installation, regulations and extreme environments are major barriers to grid connection. On the contrary, off-grid systems are flexible, easy to use, cost-effective and adaptable to local needs and conditions. These systems can also incorporate local renewable energy sources to provide electricity.

The main concerns regarding to the implementation of a technology on isolated territory are:

- **Technical:**
  The equipment supplier as to provide a "green" solution that can be implemented in a smart grid
- **Logistical:**
  The solution must be implementable on isolated territories, considering the more difficult access conditions that generally induce logistics issues and higher costs
- **Commercial**:
  The solution provided by a supplier has to be integrated in a grid jointly with technologies from other companies
- **Social:**
  The solution proposed by the equipment supplier has to fit the territories' actors concerns by improving the energy transition with a high level of society implication and acceptance.
- **Territorial:**
  The solution provided must be replicable and adaptable to different isolated territories.

4.2.4 Product & Service Offered

The procurement necessary to install and operate the system will involve a wide range of equipment and service providers bringing the necessary mix of products needed to implement the system. There is a large population of specialist firms developing and offering products and services relating to micro-grid and smart-grid systems.

The specific technological characteristics of smart energy transitions within isolated territories tend to be unique to these systems, but some of the key technical differences between an isolated/island system and one which is not, are :

- the comparatively small electricity grid size,
- the shape of the electricity load due to daily and seasonal demand variability,
- the centralised and heavily diesel fuel dependent characteristics of existing electricity

Three main kind of services could then be implemented to improve the service to these territories.

- Onshore Renewable Energy (i.e. generation of electricity from solar, water and wind power under, upon, or above the land surface);
- Offshore Renewable Energy (i.e. generation of electricity from solar and wind power that do not take place onshore);
- Marine Renewables (i.e. generation of electricity from tidal and/or wave power).

Guinard Energies (ICE certified company) provides solution for hybrid electricity generation including storage composed with marine turbines and solar panels

The ICE certified company, SWANBARTON provides IoT for mini-grid monitoring and control.

Other kind of equipment may be needed to complete a grid such as:

- Network and Internet of things (e.g. house automation systems)
- Machine to Machine
- Security and safety

4.2.5 Customer Benefits Achieved

The establishment of local production assets improves access to cheaper, low carbon and more reliable energy for local economic development. Track record of local firms in supplying equipment may be valuable in tendering successfully for supply into other community energy projects.

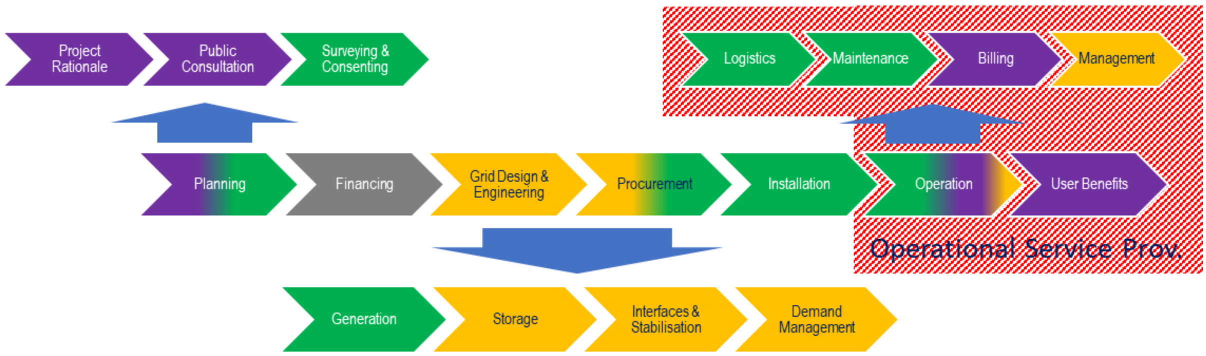
The involvement of inhabitants and local authorities in the process from the beginning make it easier to solve problems when they appear as their needs are well known by the energy suppliers as well as the territory and its specificities.

4.3 Operational Service Provider

The operational service provider is the consumer-facing body within the value chain, taking ultimate responsibility for the safe and reliable operation of the network. In some cases, they may be the same body as the system integrator, but in other cases the company responsible for building the system will hand over to the operator once the system is fully commissioned.

4.3.1 Position in Value Chain

The extent of the service provider role within the complete life cycle is illustrated below:



The exact nature of the service provider depends on the level of deregulation permitted in the national energy market. The UK has a highly deregulated system in which community interest companies can become energy suppliers, and contract directly with one of the Distribution Network Operators (DNOs). A more centralised electricity distribution network exists in France.

4.3.2 End User & Target Customers

The end users of the operating company are energy consumers. These could be private householders, businesses or public authorities.

However, target customers may include energy storage providers (eg household battery owners or EV owners) who are seeking to sell storage independently for use by the local micro-grid.

4.3.3 Customer Needs, Concerns & Stakeholder Priorities

The customer needs include:

- For energy consumers, provision of reliable power at a tariff rate that is at least as attractive as the tariff before installation of the system;
- For some energy consumers who can offer flexible loading on the grid (eg large users of power whose timing is not very critical, such as for agricultural drying or refrigeration), a lower tariff would be expected;
- For energy storage providers, the operating company would be expected to reward access to storage which can be valuable for balancing services. This would provide a return for investment in additional storage capacity.

With a relatively small operating company serving an island energy market, there would be concerns about limitation in network repair capabilities in the event of outage. Outsourcing of the maintenance function to a third party with repair infrastructure assets could alleviate this risk.

4.3.4 Product & Service Offered

The core services to be offered by the operational services provider include:

Customer Services

Provision of customer services by an energy supplier depends on back-office functions which are unlikely to be commercially attractive at a small island scale. Having personnel available for responding to billing queries and faults reported by customers is expensive and requires a certain scale (at least several thousand accounts) to be economic. In some cases, these costs could be borne by a local public body, as part of its public service, but in others it is likely that out-sourcing of the customer service function to a larger energy supply company would be more economically attractive.

Micro-Grid Operational Management

Effective operations management of the community energy system is critical to reliability and quality of service to customers. This will have been carefully considered at the design and engineering stage (see above), but once the system is operational some resource is needed to manage the system.

Considerable effort has been directed towards development of micro-grid operation facilities, mainly driven by the rapid growth in distributed generation and the need for local grid management to minimise requirements for grid reinforcement. As a result, there are many management systems available that maintain micro-grid stability autonomously, optimising the use of energy storage to maintain that stability.

However, there remains a need for resources to take care of system start-up and shut-down. It is likely that diesel generators will be required to provide some redundancy in case of a major failure in the system, and also to achieve stability of operation when starting up the system from cold.

Maintenance and Repair

Condition monitoring of the system will be vital to minimise the risk of failure, particularly in a situation where operations are largely autonomous. Status of the system can be monitored and potential points of failure due to degradation can be highlighted. This allows condition-based maintenance to be implemented. However, some physical inspection and intervention will still be required.

Inspection and maintenance of the system, particularly on a remote island location, is likely to be attractive to a smaller firm with local presence and interested in a relatively small geographic scope.

4.3.5 Customer Benefits Achieved

In order to secure public support for the project, the system must offer some tangible benefits to consumers. Typically, this would be a more advantageous tariff arrangement and/or improved reliability of supply etc. In some cases, the momentum for the project could be initiated by consumers, acting through a community interest company, which represents their interests and provides a point of communication with developers. In other situations, the service provider could be a private utility or a public authority.

5 Conclusions

The report has developed a more detailed characterisation of the value chain involved in implementing a community energy system, building on the work reported in D2.1.1 and D2.1.2. This more detailed picture is important to identify the range of opportunities for smaller equipment and service suppliers.

The decision to invest in a community energy system will be taken by larger organisations having the influence and financial strength needed to be seen as credible in championing investment of this scale. Three key categories of decision-maker have been identified: the system integrator who would understand the many steps needed to implement the system including the consenting stages involving public authority buy-in; the operator who would be the main public-facing body during the life of the system; and the contractor who would be responsible for equipment procurement and for delivering a complete system to the operator.

It is clear that the type of organisations taking on these roles, and the interaction between them, will be very dependent upon the existing electricity network companies: notably whether these are public sector service providers or private sector operators and investors. The justification of the investment needed will therefore vary widely.

A generic value proposition approach has been developed to respect this diversity. This approach uses a standardised methodology related to the Business Model Canvas. This has identified a wide range of potential benefits and dis-benefits across a wide range of stakeholders. Understanding these potential benefits to multiple stakeholders is critical to securing the necessary public, political and investor support for a community energy project.

The ICE methodology can usefully apply this understanding in formulating an offer that will appeal to stakeholders across many different communities ranging from small off-grid islands to energy systems operating with restricted grid connectivity, with a requirement to integrate renewable generation cost-effectively.

6 References

D2.1.1, 2019: ICE Project Deliverable 2.1.1

D2.1.2, 2019: ICE Project Deliverable 2.1.2

IRENA, 2018: Transforming Small Island Power Systems

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