ICE REPORT D4.4.1: IMPACT OF COMMERCIAL OFFER

03/12/2021

Task T4.4:

Promotion of commercial offer to isolated territories

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 refined methodology for implementing an integrated community energy scheme and the commercial offer to territories where the methodology could be deployed, as reported in deliverable D4.2.1. This outlines a value proposition addressing a sequence of steps performed along the timeline of the scheme implementation, including:

1. Planning and surveying, to assess both the resources available and the consenting needed;
2. Financing to build a viable case for investment and associated business model
3. Grid design and engineering, including modelling of the planned system for optimisation of overall performance
4. Procurement of the required equipment and services, including a main contractor to oversee the whole implementation
5. Installation of facilities including renewable energy assets, storage, network reinforcement
6. Operation of the new energy scheme.

In parallel with the methodology development and refinement, the ICE project has also engaged a wide community of territories where the ICE methodology could be applied. These territories are highly diverse, in terms of their energy needs, the maturity of their plans for decarbonisation and their political structures. In order to assess the value of promoting the ICE methodology to such territories, some pilot studies have been conducted. These have focused on a limited number of the priority territories identified in deliverable D4.3.1.

The results of these studies form a useful review of the potential impact of ICE methology on promotion and deployment, and are presented in this report.

1.3 Content of this Document

The document presents the results of the above approach for four territories, comprising two UK islands, one French island and a port. Based on these results, some conclusions have been derived to indicate how the methodology could be effectively promoted in future.

2 Methodology

The overall approach is to assess how the ICE methodology could be applied and promoted to the situation in selected territories. To do this, the work will make use of:

- The value proposition developed in deliverable D4.2.1
- The information on priority territories gathered and collated in D4.3.1 and other ICE work packages.

A template has been developed to capture relevant information in a consistent way. This template includes the headings defined within the ICE methodology, under the following headings.

2.1 Planning

Early stage planning is crucial to assessing the viability of the project and its potential impacts. This section is designed to determine where the project is currently in its planning timeline, in order to highlight key steps that need to happen next. It includes:

- Project Rationale: Are the main local or regional drivers for decarbonisation understood, clearly or partly?
- Resource Assessment: Does data on the accessible renewable resource exist or is it planned?
- Public Consultation: Is there evidence of public support for the project, or is engagement planned?
- Surveying & Consenting: What is the status of the consenting process, and of the required surveying?

2.2 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. The source of this capital could be private or public, depending on the ownership of the existing distribution network. Hybrid models (eg involving grant support) are also possible. This section seeks to understand the current thinking on capital investment options. It includes:

- Status of Financial Plan: Has the project identified a source of capital investment? What kind of business models have been considered, if any?

2.3 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. This section captures the current position in terms of preparation and/or delivery of the necessary assessment and optimisation. It includes:

- Design & Engineering: Has any analysis of the energy system been performed, either at high level or detailed modelling? Is a contractor identified to do this work?

2.4 Procurement

This section aims to capture the extent to which the project has considered the supply chain expertise required for implementation. A lot of experience is available from key suppliers so the project can benefit from pre-procurement dialogue leading on to a tendering procedure. Gaps in activity in the area can be usefully addressed within the ICE methodology. It includes:

- Generation Assets: What range of renewable energy assets are being targeted? Are they commercial scale (eg wind, tidal) or domestic scale (eg roof-top solar)?
- Storage Assets: Has any consideration been given to energy storage (eg batteries, hydro). If so, has optimal storage capacity been analysed?
- Network & Interfaces: Has integration with the existing distribution network been explored? Is the network owner supportive? What further network investment is needed?
- Control & Monitoring: Is there potential for smart grid functions (eg demand-side response, peer-to-peer trading)? Have these options been considered?

2.5 Facility Installation

A significant programme of installation is required, potentially including offshore or nearshore installation of marine energy devices. Although a major contractor is likely to lead, some of this work could involve local sub-contractors. Understanding this can support community engagement and this section is intended to capture the current status. It includes:

- Installation: Is the project engaging with any large contractors who would be interested to bid? Has dialogue been promoted with the local supply chain?

2.6 Operation

This section captures the level of understanding of activities needed during the life of the new facilities. This operational phase of the scheme life cycle is of particular relevance to local service providers, since it will provide business potential for several decades. It includes:

- Logistics: Do the existing project stakeholders have access to resources needed to operate the major assets reliably?
- Maintenance: Distribution and monitoring equipment is highly dispersed and requires 'white van' resources. Do these exist?
- Billing: How will the proposed system operation mesh with existing customer services? Have new support facilities been considered?
- Management: Will these customer services be part of a wider management oversight? Has this been considered?

3 Alderney

Territory Details *Name of territory and the region*	Island of Alderney within the Channel Islands, UK

The information is collected under the headings defined within the ICE methodology, using the tables below.

3.1 Planning

Project Rationale *Are the main local or regional drivers for decarbonisation understood, clearly or partly?*	Alderney's average electricity demand is ~0.76 MW, with a peak of less than 1.5 MW. Alderney residents pay ~45 p/kWh, of which ~15 p/kWh covers the cost of the diesel. If the levelized cost of energy from renewable sources is lower than 15 p/kWh, there is scope to reduce diesel generation utilisation, reducing costs and emissions. Deploying renewable generation also diversifies the energy mix, reducing consumers exposure to volatile fossil fuel prices. Analysis indicates that it is viable to deploy PV and wind turbine generation on Alderney for less than 15 p/kWh. With no renewable generation within the total electricity demand of ~6 GWh/annum, the carbon emissions from the diesel gensets is around 1,600 T CO2e/annum. Around 20 GWh/annum of heating energy is also consumed, supplied by various fossil fuels.
Resource Assessment *Does data on the accessible renewable resource exist or is it planned?*	Yes, a significant amount of resource assessment has been performed, covering onshore wind, solar and marine current. There is sufficient renewable resource to supply the island's electricity generation needs. Less than 100% renewable generation will be optimal, given the existence of the diesel gensets which have recently been upgraded. Deployment of renewable generation at household level is likely to be a problem on Alderney, since the relatively high fixed costs of the network would have to be met from an ever-smaller base of customers. Community schemes which contribute to overall network resilience and stability are likely to be preferrable.
Public Consultation *Is there evidence of public support for the project, or is engagement planned?*	Public engagement on the potential investment projects is fragmented. The State of Alderney has been exploring the prospect of a major tidal stream investment for some years, but has not yet succeeded in getting underway. The civic community meanwhile is keen to advance in a more incremental way, with a succession of smaller projects. External facilitation under ICE could usefully integrate these initiatives under a single plan, rolled out over a range of time-scales. The level of interest suggests a significant amount of public support for action. However, strong controversy has been generated by publication of outline plans for a large French-led tidal energy project without clear benefits to Alderney.
Surveying & Consenting *What is the status of the consenting process, and of the required surveying?*	There has not yet been any significant survey work done to address consenting requirements for tidal stream, wind or solar deployments. It is likely that any future tidal stream array would piggy-back on a potential project in French territorial waters, for

	which surveying has been completed. Small scale solar deployments are unlikely to incur significant consenting barriers. However, onshore wind turbines would require careful siting and planning approvals. Minute-by-minute electricity demand profiles are not available on Alderney and this greatly limits the assessment of cost-effectiveness of decarbonisation measures. It is likely that short-term peaks require more capacity than would otherwise be recognised, while short-term dips are likely to result in reduced generator efficiency. Access to real-time demand data is a key requirement for future optimisation of the system.

3.2 Financing

Status of Financial Plan *Has the project identified a source of capital investment? What kind of business models have been considered, if any?*	Recent investments in the electricity network have been funded with support from the States of Alderney: a finance and lease-back arrangement, or a commercial load guaranteed by the States of Alderney. Either way, the operating company (AEL) has been able to benefit from public sector lending rates. In both cases, it is essential that the project is able to generate returns that can support the case for investment. In the case of the large tidal array proposal (under a French contractor) a Power Purchase Agreement is envisaged which specifies an annual energy draw-down by Alderney at a fixed cost per kWh. Similar financing models should be available for future renewable generation and storage developments, provided robust financial projections can be defined.

3.3 Grid Design & Engineering

Design & Engineering *Has any analysis of the energy system been performed, either at high level or detailed modelling? Is a contractor identified to do this work?*	The ICE project has demonstrated the vital importance of modelling to ensure that the dynamic nature of both demand and renewable generation can be accommodated cost-effectively. A specific study on Alderney has been performed. This was able to utilise a significant amount of previous analysis of the dynamic electricity demand on Alderney. As a result, there is a good understanding of the likely levels of renewable energy penetration and of the associated electricity storage requirements on Alderney. An initial estimate of system optimisation indicates: 250kW of PV solar + 750kW of onshore wind, with a 1.5MW battery (6MWh capacity) could support 50% renewables penetration. Without the battery, renewables penetration would likely be limited to around 30% before curtailment losses become onerous. Further analysis will be needed for detailed engineering optimisation, but the current state of knowledge will allow selection from a wide range of competent contractors.

3.4 Procurement

Generation Assets *What range of renewable energy assets are being targeted? Are they commercial scale (eg wind, tidal) or domestic scale (eg roof-top solar)?*	In the short term, modest onshore community-scale RE deployments are most likely. These would need to be integrated within AEL's existing network and business model. Wind and PV solar are the most likely assets to be investable, in the 1oo's kW power range. In the longer term, it is likely that larger tidal energy projects will be implemented, probably as part of (or linked to) the proposed French tidal scheme, FABlink. Some export potential of an Alderney-only tidal energy scheme will probably be essential to economic viability.
Storage Assets *Has any consideration been given to energy storage (eg batteries, hydro). If so, has optimal storage capacity been analysed?*	There are no existing plans to install energy storage on Alderney. The 8 diesel generators are sufficient to meet peak load, so the business case for using the battery to meet peak load (and running the generators nearer to optimal design speed) no longer exists. A good case for energy storage would be created, however, when the island starts to install renewable generating assets. Modelling suggests a battery rating of 1.5MW (with 4 hour duration) would be the approx. size, but more detailed modelling would be helpful to refine the complete system operation.
Network & Interfaces *Has integration with the existing distribution network been explored? Is the network owner supportive? What further network investment is needed?*	AEL has been shown to be receptive to proposals that could reduce dependency on imported diesel fuel. They are keen to avoid residents going 'off-grid' as this would increase network fixed costs for other customers. A community scheme could be attractive, with a Power Purchase Agreement by AEL to attract low-cost financing. Such a project is likely to include some network reinforcement in order to maintain or enhance the resilience of the system.
Control & Monitoring *Is there potential for smart grid functions (eg demand-side response, peer-to-peer trading)? Have these options been considered?*	AEL already offers tariffs that incentivise consumption during periods of low demand, but there is significant further potential, especially as domestic and EV energy storage becomes available. Such systems will require controls that optimise the use of such storage. With a battery storage facility included within future renewable energy generation projects, the need for further control and monitoring will be essential to manage the state of charge of the battery. Demand monitoring in real time will be an important element of this system, and will also generate useful datasets for optimising the system design.

3.5 Facility Installation

Installation *Is the project engaging with any large contractors who would be interested to bid? Has dialogue been promoted with the local supply chain?*	No contractors have been approached directly. However, a contractor is in place for the proposed French-led tidal stream development project. A dedicated contractor is likely to be preferred for the onshore development scenarios, specialist in deployment of onshore wind and PV solar farms. There are many suitable contractors in the UK.

3.6 Operation

Logistics *Do the existing project stakeholders have access to resources needed to operate the major assets reliably?*	AEL have capacity in operating the existing network and diesel generators. This could potentially be extended to include logistics services for new assets such as battery storage. Spares inventory for wind turbine maintenance is specialist and is likely to use an external contractor.
Maintenance *Distribution and monitoring equipment is highly dispersed and requires 'white van' resources. Do these exist?*	AEL have capacity for maintenance of their existing network, and this could be expanded to cover the network extensions. Additional specialist expertise is likely to be needed for planned maintenance of turbines, solar PV and batteries.
Billing *How will the proposed system operation mesh with existing customer services? Have new support facilities been considered?*	It is anticipated that AEL's existing billing system would be adapted where necessary.
Management *Will these customer services be part of a wider management oversight? Has this been considered?*	No major additions to customer services beyond those already provided by AEL are envisaged.

4 Isles of Scilly

Territory Details *Name of territory and the region*	Isles of Scilly, UK

The information is collected under the headings defined within the ICE methodology, using the tables below.

4.1 Planning

Early stage planning is crucial to assessing the viability of the project and its potential impacts. This section is designed to determine where the project is currently in its planning timeline, in order to highlight key steps that need to happen next.

Project Rationale *Are the main local or regional drivers for decarbonisation understood, clearly or partly?*	The Isles of Scilly (IoS) is archipelago of 140 small islands off the coast of Cornwall, around 45km west of Land's End, Cornwall. The five main inhabited islands are St Mary's, Tresco, Bryher, St Martin's and St Agnes [1]. The largest inhabited island is St Mary's which is the main settlement of the islands. The small scale of demand, large seasonal variations in demand, lack of available energy resources and heritage restrictions on development, are common for small island communities. Further, IoS has a high share of fuel poverty (22.4%, against the UK national average of 10.4%).
Resource Assessment *Does data on the accessible renewable resource exist or is it planned?*	The IoS is almost entirely reliant on electricity imported from the mainland, with 457 kWp of solar PV installed on the islands which is likely to generate around 2.6% of the total electricity demand (485,791 kWh/year). The IoS are connected to the mainland electricity via a single 33kV cable with a capacity of 7.5MW (installed in 1989 by Western Power Distribution, WPD). We carried out an assessment of potential as part of the ICE project. Concerning solar, The direct normal irradiation (DNI) received is expected to be 1062 KWh/m^2/year, the global horizontal irradiation (GHI) is 1145 KWh/m^2/year and on a plane of 37° 1326 KWh/m^2/year. However, there are land constraints on exploiting this. We estimate that there are 1,182 domestic rooftops and we identified 54 warehouses and barns with roofs potentially suitable for solar PV as well as ground mounted opportunities. Opportunities for wind energy are likely to be limited by the classification of much if the islands as protected zones and due to visual impact. We modelled the use of smaller scale turbines (100kW & 250kW). The available wind resource is good, with modelling suggest consistent impacts across the year. It is impossible to suggest a meaningful figure for achievable wind energy exploitation given the current unlikelihood of achieving planning permission in the UK. Moixa, a private company, began to install battery storage on the islands in 2018, and there is considerable potential for more DSR improvements on the island.

Public Consultation *Is there evidence of public support for the project, or is engagement planned?*	Full stakeholder engagement was not possible within this study due to time and resource constraints and severely complicated by the Covid-19 pandemic from February 2020. In this study, we were able to integrate some IoS Council objectives based on a review of publicly available strategies and plans. The Council has been involved in an islands wide initiative to make energy smarter.
Surveying & Consenting *What is the status of the consenting process, and of the required surveying?*	There has not yet been any significant survey work done to address consenting requirements for wind or solar deployments. Total energy consumption on the IoS is approximately 18.732GWh and the average power demand for a year is 2.14MW. The maximum recorded power demand is 4.92MW, occurring at around 7 pm in mid-April. Peak power demand is typically from 6 pm to 7 pm. Despite the IoS being connected to the UK national grid, there were seven total power blackouts during 2019 for at least 30 minutes (April, July, August, September and October). This due to the faults on the islands grid cable [11].

4.2 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. The source of this capital could be private or public, depending on the ownership of the existing distribution network. Hybrid models (eg involving grant support) are also possible. This section seeks to understand the current thinking on capital investment options.

Status of Financial Plan *Has the project identified a source of capital investment? What kind of business models have been considered, if any?*	No, we did not see this as within the purview for our assessment. Some consideration was given to options within the UK funding structures, but these are limited and would require further investigation as to relevance.

4.3 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. This section captures the current position in terms of preparation and/or delivery of the necessary assessment and optimisation.

Design & Engineering *Has any analysis of the energy system been performed, either at high level or detailed modelling? Is a contractor identified to do this work?*	An assessment was carried out of the network capacity and limitations of the IoS electrical network. Western Power Distribution (WPD) is the electrical power provider to IoS through a 33kV subsea cable with a capacity of 7.5MW. There is a diesel-fuelled power station consisting of seven individual generation sets on Hospital Lane on St Mary's. They are used for less than 200hours/year. The sub-sea cable is fed from Cornwall and terminated at St Mary's power station, 33 kV. There are four 11kV feeders which supply power to the islands. The island network voltage is 11kV is the network voltage. The network is a mix of overhead and underground lines on the land and sub-sea cables. The 11kV is converted to a nominal 230V and 415V for

consumption via a mixture of ground and sub-sea cables. The 33kV cable is a single cable and has historically been reliable. WPD is considering installing a second cable from 2023 which will cost tens of millions GBP.

The ICE study of IoS includes an assessment of system reliability, though also recommends some scenario analysis, preferably with better data access.

IoS consists of five islands where St Mary's is the biggest island and it is the only power connection point to the Cornwall mainland. The maximum power demand is 4.92MW. Table 10 summarises all the results for the power flow and reliability assessment for the four islands. St Martin's has the highest voltage drops (2.06%), cable capacity (19.34%) and failure rate (0.2442/year). This because it supplies a part of Tresco Island and it has only one supply feeder from St Martin's, at the worst scenario. Tresco has the highest power demand, 3951 kW. The lowest voltage drops and able capacity are in Bryher. The main IoS report goes into more depth in Appendix 1.

Table 10 - Power flow and reliability assessments

Island	Load node						
	Total Power [10]	Voltage drop[kV]		Cable capacity [%]		Failure rate per year	
		Max	Min	Max	Min	Max	Min
Bryher	198.78	0.17%	0.15%	7.76%	0.34%	0.2436	0.2254
St Agnes	185	0.39%	0.35%	7.12%	1.2%	0.2385	0.2111
St Martin's	322.8	1.06%	0.87%	19.34%	2.67%	0.2442	0.1337
Tresco	395.1	0.88%	0.21%	17.96%	0.62%	0.14131	0.09287

The detailed workings behind this can be found in Appendix 1.

4.4 Procurement

This section aims to capture the extent to which the project has considered the supply chain expertise required for implementation. A lot of experience is available from key suppliers so the project can benefit from pre-procurement dialogue leading on to a tendering procedure. Gaps in activity in the area can be usefully addressed within the ICE methodology.

Generation Assets *What range of renewable energy assets are being targeted? Are they commercial scale (eg wind, tidal) or domestic scale (eg roof-top solar)?*	The overall picture which emerged from our capacity mapping was that capacity on the IoS is limited to a small number of generalised skills (e.g., construction) with increasing evidence of more specialist capacities in West Cornwall, and more again when including all of Cornwall or the Southwest UK. Some notable exceptions were the Isles of Scilly Wildlife Trust who provide specialist environmental consultancy on the islands whilst, on the other hand, there was no evidence of electricians based on the islands, though there were

	plenty in accessible Penzance and nearby West Cornwall. For more detail on the local capacity mapping see Appendix 1.
Storage Assets *Has any consideration been given to energy storage (eg batteries, hydro). If so, has optimal storage capacity been analysed?*	Moixa, a smart system company, began installing 43.8kWh of battery storage to help optimise the energy system in 2018.
Network & Interfaces *Has integration with the existing distribution network been explored? Is the network owner supportive? What further network investment is needed?*	We did not seek an opinion from WPD. Any change in behaviour would have to come from a position where WPD could see a return on investment and where spend as allowable.
Control & Monitoring *Is there potential for smart grid functions (eg demand-side response, peer-to-peer trading)? Have these options been considered?*	There is some discussion of the early stages of the switch from DNO to DSO functionality but at time of writing it was too early to add detail of what this might mean in practical terms.

4.5 Facility Installation

A significant programme of installation is required, potentially including offshore or nearshore installation of marine energy devices. Although a major contractor is likely to lead, some of this work could involve local sub-contractors. Understanding this can support community engagement and this section is intended to capture the current status.

Installation *Is the project engaging with any large contractors who would be interested to bid? Has dialogue been promoted with the local supply chain?*	No. However, the IoS has a smart grid programme that sees the island work with Hitachi.

4.6 Operation

This section captures the level of understanding of activities needed during the life of the new facilities. This operational phase of the scheme life cycle is of particular relevance to local service providers, since it will provide business potential for several decades.

Logistics *Do the existing project stakeholders have access to resources needed to operate the major assets reliably?*	
Maintenance *Distribution and monitoring equipment is highly dispersed*	This level of detail was not considered.

and requires 'white van' resources. Do these exist?	
<u>Billing</u> *How will the proposed system operation mesh with existing customer services? Have new support facilities been considered?*	This level of detail was not considered.
<u>Management</u> *Will these customer services be part of a wider management oversight? Has this been considered?*	This level of detail was not considered.

5 Molène

Territory Details *Name of territory and the region*	Isle of Molène Island located off the west coast of Finistère, in Brittany, France. Surface area of 72ha. 131 inhabitants. Non interconnected island.

The information is collected under the headings defined within the ICE methodology, using the tables below.

5.1 Planning

Early stage planning is crucial to assessing the viability of the project and its potential impacts. This section is designed to determine where the project is currently in its planning timeline, in order to highlight key steps that need to happen next.

Project Rationale *Are the main local or regional drivers for decarbonisation understood, clearly or partly?*	The island of Molène is part of the Ponant Islands which have been involved for many years with local and regional partners in the energy transition of their territories and are involved in discussions to this effect through notably the Ponant Islands Association.
Resource Assessment *Does data on the accessible renewable resource exist or is it planned?*	Yes, some data is available following the links below: Data about current energy production mix : https://opendata-iles-ponant.edf.fr/pages/home/ Data about objectives of Energy transition : https://www.ecologie.gouv.fr/sites/default/files/20200422%20Programmation%20pluriannuelle%20de%20l%27e%CC%81nergie.pdf page 384
Public Consultation *Is there evidence of public support for the project, or is engagement planned?*	Yes, meetings have been done (latest on 24th April 2022), and communication in Association des Iles du Ponant's yearly journal (https://www.iles-du-ponant.com/wp-content/uploads/2021/06/JOURNAL-DES-ILES-2021.pdf)

5.2 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. The source of this capital could be private or public, depending ownership of the existing distribution network. Hybrid models (eg involving grant support) are also possible. This section seeks to understand the current thinking on capital investment options.

Status of Financial Plan *Has the project identified a source of capital investment? What kind of business models have been considered, if any?*	There is no concrete project planned for now.

5.3 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. This section captures the current position in terms of preparation and/or delivery of the necessary assessment and optimisation.

Design & Engineering *Has any analysis of the energy system been performed, either at high level or detailed modelling? Is a contractor identified to do this work?*	EDF SEI is the only authorized operator for energy production, transport and distribution. It is working on implementing an Energy Management System, plus Li-Ion Battery to ensure good addition of Renewable Energy facilities. They have detailed data about energy consumption of the island. French regulation do not allow EDF SEI to transmit all the data, but only small fraction of it (for example, for a 1h time scale, data for only 30 days can be communicate)

5.4 Procurement

This section aims to capture the extent to which the project has considered the supply chain expertise required for implementation. A lot of experience is available from key suppliers so the project can benefit from pre-procurement dialogue leading on to a tendering procedure. Gaps in activity in the area can be usefully addressed within the ICE methodology.

Generation Assets *What range of renewable energy assets are being targeted? Are they commercial scale (eg wind, tidal) or domestic scale (eg roof-top solar)?*	Data about objectives of Energy transition : https://www.ecologie.gouv.fr/sites/default/files/20200422%20Programmation%20pluriannuelle%20de%20l%27énergie.pdf page 384 No precision is currently available about type of assets. It can be commercial scale or domestic. Actions have been done on both these scales so far.
Storage Assets *Has any consideration been given to energy storage (eg batteries, hydro). If so, has optimal storage capacity been analysed?*	EDF SEI is working on implementing an Energy Management System, plus Li-Ion Battery to ensure good addition of Renewable Energy facilities, based on forecasted Ren. Energy project on study (for example the 700kWp SDEF project + 36 kWp SDEF project) SDEF has launched a study about H2 storage, for the electricity surplus that cannot be stored by the Li-Ion Battery.
Network & Interfaces *Has integration with the existing distribution network been explored? Is the network owner supportive? What further network investment is needed?*	Network owner is SDEF (since Molène transferred to SDEF the role of network maintenance and developpement). EDF SEI has a 30 year contract with SDEF to operate the Molene Network. Investment are made for Ren Energy project for new line or upgraded line. No big investment planned since the grid is already existing, and that the evolution of consumption is limited (only replacement of production, not an increase or decrease in electricity consumption)

	Also, network burying has long be done, since it is well developed in France, and moreover Molene was known for wind and storm, so it is already done.
Control & Monitoring *Is there potential for smart grid functions (eg demand-side response, peer-to-peer trading)? Have these options been considered?*	EDF SEI is the only authorized operator for energy production, transport and distribution. EDF SEI perform the role of monitoring. Any energy producer has to sell it's electricity to EDF (and EDF has to buy it), only after the national energy commission (CRE) has stated a feed-in tariff. Usually, the increase of cost for small project and on the remote area of the island doesn't make profitable such a project. The grid is not "open" like European grid, so there is not (yet) a competitive tariff between two sites or within the day.

5.5 Facility Installation

A significant programme of installation is required, potentially including offshore or nearshore installation of marine energy devices. Although a major contractor is likely to lead, some of this work could involve local sub-contractors. Understanding this can support community engagement and this section is intended to capture the current status.

Installation *Is the project engaging with any large contractors who would be interested to bid? Has dialogue been promoted with the local supply chain?*	No concrete project of marine energy for Molene so far. One study has been done regarding potential (based on current), but cost is high. The cost of electricity has been estimated twice the current cost with fuel genset.

5.6 Operation

This section captures the level of understanding of activities needed during the life of the new facilities. This operational phase of the scheme life cycle is of particular relevance to local service providers, since it will provide business potential for several decades.

Logistics *Do the existing project stakeholders have access to resources needed to operate the major assets reliably?*	Skilled workers come from the continent to install the PV for example. There is no company on Molene able to be part of an Ren. Project (not even an electrician for inhabitants).
Maintenance *Distribution and monitoring equipment is highly dispersed and requires 'white van' resources. Do these exist?*	Maintenance is made by people from the continent. With the example of Ushant, maintenance was nearly similar for 1 or 5 PV plants, since the workers have to come for the whole day on the island.
Billing *How will the proposed system operation mesh with existing*	No billing for now.

customer services? Have new support facilities been considered?	
Management *Will these customer services be part of a wider management oversight? Has this been considered?*	Molene is part of the Ponant Island and activities linked to energy transition are managed in association with Association des Iles du Ponant and coherently with what is done for Ushant and Sein.

6 Portsmouth International Port

Territory Details *Name of territory and the region*	Port area within the city of Portsmouth, UK

The information is collected under the headings defined within the ICE methodology, using the tables below.

6.1 Planning

Project Rationale *Are the main local or regional drivers for decarbonisation understood, clearly or partly?*	The port's existing energy system is facing severe challenges that need to be addressed with urgency. These are: • Port emissions are having a large impact on poor air quality in the city, primarily due to particulate and NOx emissions from ships and port machinery; • Ships are starting to require large amounts of power when at berth, and this demand exceeds the level of power available in the port. The problems are clearly understood, but it is unclear what solutions the port should invest in.
Resource Assessment *Does data on the accessible renewable resource exist or is it planned?*	There is quite extensive data available on the solar power potential within the port. A survey has been conducted by Custom Solar and approx. 1.2 MWp of new generating capacity is currently being installed. This is additional to around 600 kWp of existing PV solar. There is probably more potential PV solar generating capacity to be exploited in future. Some assessment of wind turbine deployment options has also been performed, but this is not so attractive due to the height limitations imposed in this location.
Public Consultation *Is there evidence of public support for the project, or is engagement planned?*	A considerable amount of public communication has been performed, but mainly at a high level, proposing generic goals rather than specific investments. A strategic port master-plan has been published that includes some sustainability targets, but also at a high level.
Surveying & Consenting *What is the status of the consenting process, and of the required surveying?*	Survey data is available at fine resolution, and a great deal is known about environmental status and renewable resource availability. Planning consent for deployment of PV solar in the port is not required. However, planning consent for wind turbines or current turbines (attached to the quayside) would be required and has not yet been requested as there are no plans being actively developed for such installations. Port facilities that could export power to the grid require an additional G99 consent which has been obtained.

6.2 Financing

Status of Financial Plan	At present, the port is not seeking external investment. The port is wholly owned by Portsmouth City Council which can secure capital

Has the project identified a source of capital investment? What kind of business models have been considered, if any?	(in principle) at Treasury rates. This is cheaper money than any kind of commercial debt finance. Notwithstanding this, the port has already accessed third-party investment for assets such as EV charging points. The business model is that the port leases small areas of real estate to external service providers who finance any facilities that they deploy. It is possible the other energy generation or management assets would be similarly financed. The port has no wish to become an energy supply company so contracting with specialist suppliers is likely to be a future option.

6.3 Grid Design & Engineering

Design & Engineering *Has any analysis of the energy system been performed, either at high level or detailed modelling? Is a contractor identified to do this work?*	A significant amount of power consumption monitoring has been performed, and investment has been directed at reducing demand (eg by using all LED lighting and using a seawater heat pump for space heating). However, the power demand of visiting vessels is unknown since even the vessel operator is often unaware of the ship's consumption at berth. Electrification of port assets (eg cranes, freight tugs, link spans etc) will also create additional demand which is current not known accurately.

6.4 Procurement

Generation Assets *What range of renewable energy assets are being targeted? Are they commercial scale (eg wind, tidal) or domestic scale (eg roof-top solar)?*	As stated above, some solar PV facilities are already being installed at commercial scale. The scope for wind and current turbines is limited: both by planning constraints (wind) and the lack of much tidal stream or river current at the port.
Storage Assets *Has any consideration been given to energy storage (eg batteries, hydro). If so, has optimal storage capacity been analysed?*	Two storage facilities have already been installed: two dumb batteries (1 WMh Li-ion); and an intelligent PESO battery (150kWh lead-acid + Li-ion) with an AI-based controller for optimising the battery operation. These assets are principally for storing solar power and potentially for selling balancing services to the grid. It is recognised that much more storage will be needed to meet vessel power requirements.
Network & Interfaces *Has integration with the existing distribution network been explored? Is the network owner supportive? What further network investment is needed?*	Extensive discussions have been held with the local DNO (SSE). These have mainly concerned increasing the connection capacity for the port to meet vessel power requirements. However, it is unclear what connection rating will be required. Furthermore, the likely scale of additional capacity will exceed the power available and HV grid reinforcement will be needed. This will be very expensive. Although the DNO has been supportive, they have limited scope to deliver what the port will need. The port is also considering a private wire to a HV sub-station to bypass the DNO constraints.
Control & Monitoring	Yes, these options have been considered. The PESO AI-based controller can help to optimise provision of these services. It is

Is there potential for smart grid functions (eg demand-side response, peer-to-peer trading)? Have these options been considered?	likely that more asset consumption monitoring will be needed to provide inputs to the controller. This work has not yet been scoped and no contractor approached.

6.5 Facility Installation

Installation *Is the project engaging with any large contractors who would be interested to bid? Has dialogue been promoted with the local supply chain?*	The PV solar installation contractor is already in place. However, selection of the wider system installation contractor has not yet been considered. At present, it is not clear what kind of operating business model will be applied to the ports growing energy grid system. EV charging points are being supplied and installed by a contractor who will finance the investment against charging revenues. Other local suppliers are involved in related works, such as an air quality monitoring network.

6.6 Operation

Logistics *Do the existing project stakeholders have access to resources needed to operate the major assets reliably?*	Probably not. It is likely that external maintenance providers will be needed, alongside internal port engineering expertise.
Maintenance *Distribution and monitoring equipment is highly dispersed and requires 'white van' resources. Do these exist?*	This is less applicable to the port since it is in a more compact area.
Billing *How will the proposed system operation mesh with existing customer services? Have new support facilities been considered?*	The billing model for visiting ships is not yet defined. Both a charge per MWh and a fixed price model are options. These will be integrated into port fees.
Management *Will these customer services be part of a wider management oversight? Has this been considered?*	Yes, the port is in active discussion with its customers, to agree the power provision services that could be made available. The port will continue to provide management oversight.

7 Conclusions

These results make it clear that the possible deployment territories are very diverse in terms of their needs and their maturity along the decarbonisation journey. Application of the ICE methodology will be varied, to reflect these differing requirements.

All of the territories have needs that are currently unmet. This is encouraging and suggests that ICE methodology has a role, even in relatively mature territories.

The port-type territories are potentially more easily managed than islands because there is already a unified port management structure in place. The port can also evaluate investment options in decarbonisation more easily as future revenue streams are more easily predicted (based on numbers of visiting ships and other factors where the port has good quality information).

- Most ports have existing supply chains already in place so suitable expertise can be accessed. Socio-economic benefits of building supply chain growth based on decarbonisation can also be analysed reasonably easily.
- Although the Port of Portsmouth (being publicly owned) has achieved good levels of public engagement, it is likely that privately owned ports will need much more assistance in this area. ICE can help point the way in the area.

The island territories range from those having well-developed strategies in place, backed up by significant monitoring data, and those only just starting on the road to decarbonisation. The larger islands are generally more advanced.

Smaller islands are often at an early stage, with much more limited resources to work with. ICE methodology has a more clearly defined role here as small island communities will be able to benefit significantly from the experience embedded in ICE. On small islands, a group of committed citizens can achieve a disproportionate amount of progress, using the island community networks. However, this progress needs careful guidance to overcome the lack of technical expertise that exists in most small island communities.