PiSCES - Executive Summary

The Smart Cluster Energy System for the fish processing industry (piSCES) operation will ultimately reduce the costs and carbon footprint of Energy Networks in the fish processing industry by implementing smart grid technologies. This will be done through modelling the usage profile of their energy networks and optimising that against the wholesale energy market and any available onsite generation. It addresses the Cross-border Innovation Theme of the Ireland Wales Programme of strengthening research, technological development and innovation. In particular it will focus on the Specific Objective of – 'To increase the intensity of knowledge transfer collaborations involving research organisations and SMEs in line with the shared priorities of the smart specialisation strategies'.

The operation will consist of 4 partners – 2 of which will research and develop the technology and 2 implementation partners (one of each in Ireland and Wales). Waterford Institute of Technology through its ICT research division TSSG, who will lead the operation, and Cardiff University (CU) plan to research, design and develop microgrid networks in conjunction with production centres in Ireland and in Wales. The implementation partners, Bord Iascaigh Mhara (BIM) in Ireland and the Milford Haven Port Authority (MHPA) in Wales, will work with fish processors and related industry to provide live data and test sites. As well as these joint beneficiaries, other stakeholders from the fish processing industry, smart grid technology industry and related government bodies will be included as stakeholders to steer the operation to achieve its objectives. A full list of operation stakeholders is included in Section 1.7 and includes Bord Bia, the Irish Food Board who run the 'Origin Green' programme, SeaFish UK, global technology providers Siemens and renewable energy experts Lightsource.

The fish processing industry, by definition, is generally centred around coastal fishing ports which are remote and isolated by their nature. This imposes inherent competitive disadvantages in the market compared with other similar food producers who are located close to large urban centres. To survive, they must be innovative in their business practises improving efficiencies and controlling their cost base. Due to the nature of their business, energy costs represent a significant portion of this cost base through freezing, chilling and production processes. The energy industry is going through a paradigm shift from a unidirectional, demand driven model with large centralised power generation to a market driven by smart grid ideals where supply and demand will be balanced with variable and intermittent renewable energies in a more localised manner. This will require intelligent systems to enable the scenarios, particularly at end user level, to satisfy demand within the peaks and troughs of the market.

Some of the disadvantages outlined for the fish processing can be turned into an advantage – their energy usage tends to have a degree of flexibility as to its consumption, for example in the control of their thermal loads and their rural location make it more feasible to install on-site renewable technologies. These are major elements for implementing smart grid technologies at consumer sites which will allow the end user to take control of their energy and become a 'prosumer' with the ability to trade in the market. These smart energy clusters fit within both governments Smart Specialisation Strategies and bring inclusive growth to remote locations.

Figure 1 below shows a cluster of companies typical of a fishing port. Currently, each is connected to the national grid individually with no control over pricing and supply. Incorporating renewable

energy within individual sites can bring many advantages including cost reduction, security of supply, reducing carbon footprint and improving corporate and social responsibility and 'green marketing' potential. By forming these into an energy cluster and linking them to other energy sources within the local community brings further advantages – energy that is generated locally can be consumed locally and by leveraging the flexibility of the entire cluster, advantage can be taken of the market price troughs through dynamic tariffs while minimising exposure to the price peaks.

Figure 1 – piSCES Schematic

The cluster would require an Energy Supply Company (ESCO) which through the Modelling module would have visibility of the energy requirements of each of the constituent cluster members and the system via algorithms and decision and rules engines would optimise the energy profiles with variable market pricing and available local generation. This system will form the technology core of the piSCES operation with a master and slave relationship between the ESCO and the cluster members.

By incorporating smart grid technologies, renewable energy and optimisation techniques, large scale efficiencies can be achieved. Also, by virtue of the fact that fishing clusters exist throughout both jurisdictions means that, by solving efficiency problems at a research and test bed level can facilitate a roll up where the scaling of the technology can have a significant impact on decarbonising our future economies. It is envisaged that on successful completion of these energy microgrids, they can begin to trade with other clusters which will facilitate their roll up regionally and then nationally to create a real smart grid.

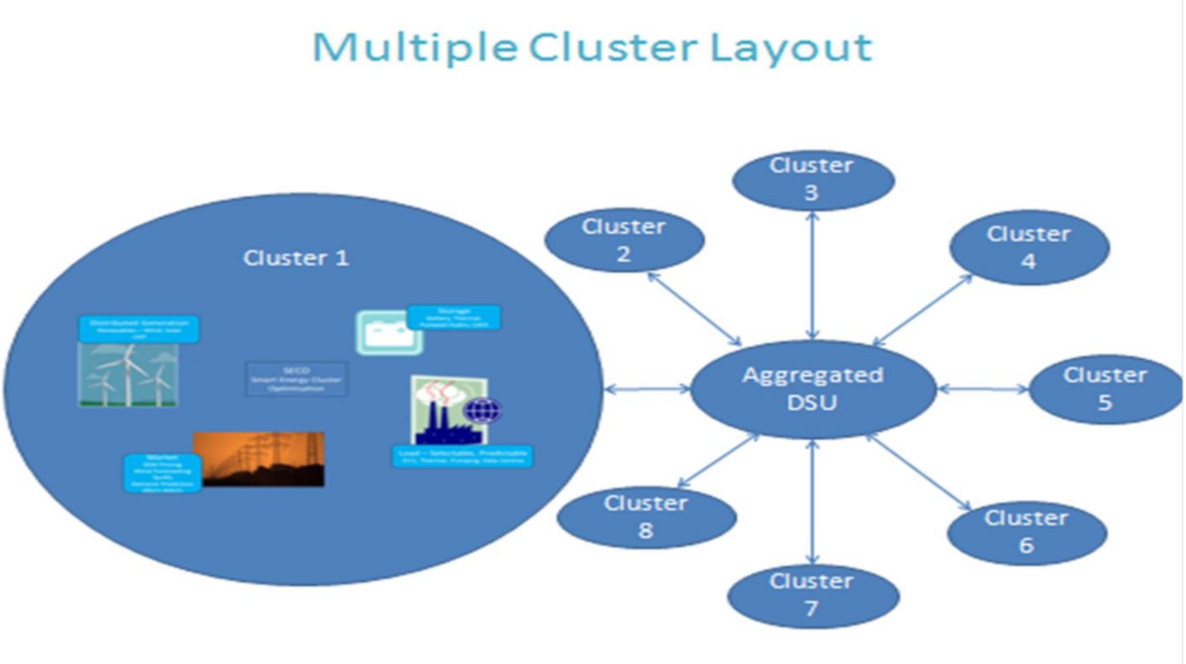

Figure 2 – Multiple Cluster Layout

The piSCES operation objectives include;

- To model and implement a microgrid on a single high energy site in both Ireland and Wales to examine and improve the efficiency by availing of smart grid technologies and in doing so, encourage the take up of new products and processes by partners and associated SMEs across both regions.

- Compare and contrast the outputs in relation to the energy markets, economic returns and local legislative conditions thereby promoting the exchange and transfer of knowledge via cross-border research collaboration between SMEs and HEIs;.

- To realise the inherent flexible capacity within these networks and to leverage this asset to realise economic returns for participating partners and the region including the possibility of additional investments.

- To investigate future trends in relation to EU directives, which aim to remove obstacles in the energy market, through linking and leveraging a sites dispersed network and aggregating them into a microgrid, resulting in wider economic impacts within the sector and internationally.

- To investigate a model integrating renewable energy technologies into these networks resulting in take-up of new products and processes by SMEs.

The objectives of this operation have specific relevance with the Territorial Co-operation agenda in the following areas;

- "Ensuring global competitiveness of the regions based on strong local economies" by facilitating new technologies to strengthen local industry. Industrial clusters that produce and consume energy with intelligent optimisation are known as microgrids. This will reduce their costs and allow them to take control of their energy use.

- "Energy challenges threaten regional competitiveness" – rural industries must reduce their cost base to overcome challenges posed by remoteness, distance to markets, etc.

- "Climate Change and environmental risks" – need to embrace the low carbon economy and become price makers rather than price takers while reducing your carbon footprint.

- "Promote polycentric and balanced territorial development" by supporting rural and coastal community employment – this technology will facilitate transfer of knowledge to rural SMEs, previously with little exposure to R&D.

Transferring this knowledge to SME's in this sector will facilitate the following result indicators;

- Number of enterprises cooperating with research institutions - 4.

- Number of enterprises participating in cross-border, transnational or interregional research projects - 4.

- Number of research institutions participating in cross-border, transnational or interregional research projects - 2.

It is globally recognised that for our planet to have a sustainable future, we must take action to alter climate change and its environmental effects. A major component of this is to take steps in decarbonising our energy systems. At the recent historic COP 21 (Conference of Parties) negotiations in Paris, an agreement was adopted by consensus by all of the 195 UN Framework on Climate Change (UNFCCC) participating member states and the European Union to reduce emissions as part of the method for reducing greenhouse gas. This will be achieved by members reducing their carbon output and to aim to keep global warming to well below 2 degrees C. This is a global endorsement of the paradigm shift that was mentioned earlier in relation to energy networks of which the smart grid is a central tenant.

A Smart Grid is defined as "an electricity network that can cost efficiently integrate the behaviour and actions of all users connected to it – generators, consumers and those that do both – in order to ensure an economically efficient, sustainable power system with low losses and high levels of quality and security of supply and safety." The Sustainable Authority of Ireland (SEAI) recognise that to decarbonise our energy future, we need to implement a smart grid on the demand side of the equation to match the capacity of increasing the share of renewable energies on the system. The following graphic shows how, by implementing smart grid techniques, the capacity of the system can be improved and be made more efficient while increasing the penetration of renewables. Effectively, with a smart grid, we can achieve more with fewer resources – we can integrate more renewable energy on to the system by intelligently optimising existing infrastructure. Microgrid clusters who effectively balance their supply and demand to a degree at a local level before tapping in to the grid facilitate this shift. Providing control at the end user level will enable cluster members to be central to this new market and be drivers in its adoption. The piSCES technology will supply the intelligence to integrate with the market and apply arbitrage to drive revenues.

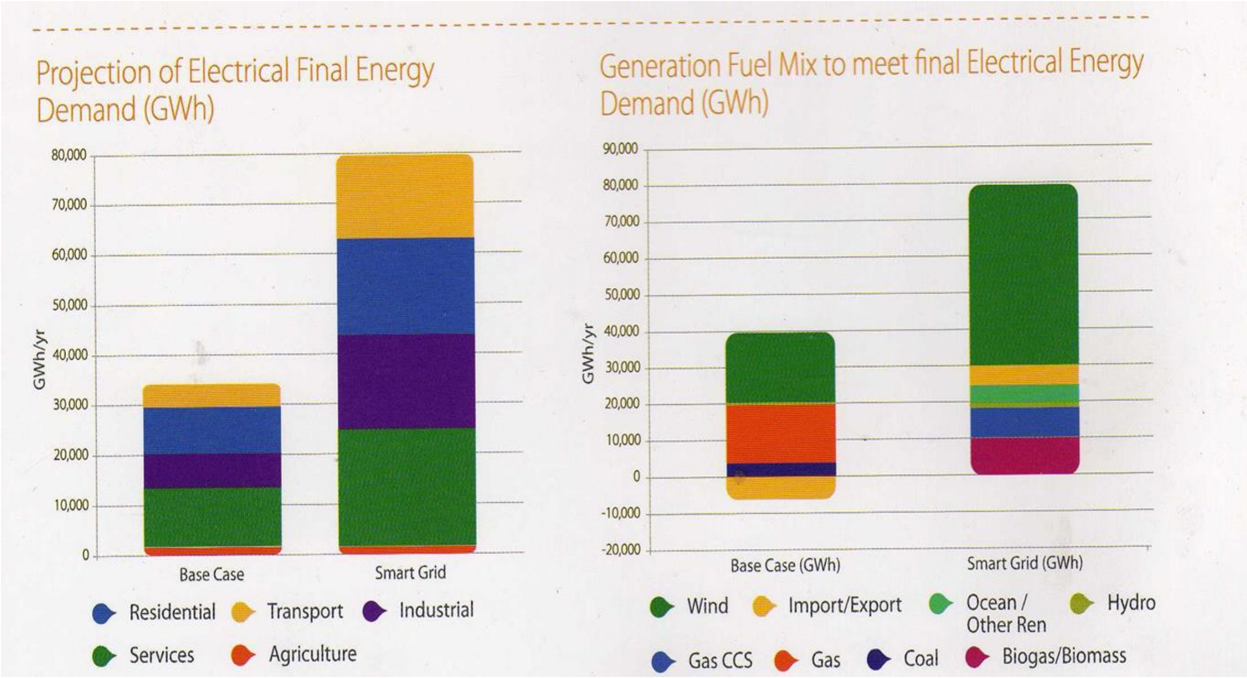

Figure 3 – Smart Grid Attributes

SME's, particularly in remote locations, face many barriers including access to markets, availability of R&D and higher logistical costs. To sustain rural industries and the employment they supply, new technologies are critical to improve efficiencies to offset these disadvantages. By incorporating intelligence at the end user level to create coastal microgrids, it allows them to take control of their energy and become price makers rather than price takers. Smart grid technologies are being developed which can have a significant impact on the energy profiles and generation mix of energy networks. As factors such as renewable generation, optimisation techniques for supply and demand and demand side management techniques become more pervasive in the energy mix, rural clusters have the potential to be at the forefront of the new smart grid economies. By combining the skillsets of leading R&D institutions in this space, these technologies can be defined and further developed to suit their specific requirements. By including the processing sites in the partnership ensures their specific requirements will be catered for, ensuring buy in. This will ensure operation outputs will be market specific and will be focussed on real and tangible results on completion. Also, as energy is intimately linked with user behaviour and environmental awareness, there is a need for adapted user-oriented interfaces to improve business societal awareness about energy consumption to induce changes in consumer behaviour and to enable the introduction of innovative resource and demand management schemes. This will overcome the 'human' barrier to technology adoption.

The resources to realise the objectives are included in Section 2 and the finances required in Section 3. Table 1 below highlights the overall figures by partner.

Partner	Requirement	Overhead	Total	Match Funding
WIT	€938,496.60	€234,624.10	€1,173,120.70	€187,699.30
CU	€511,811.44	€127,952.86	€639,764.30	€102,362.29

MHPA	€202,132.00	€50,533.00	€252,655.00	€40,426.40
BIM	€134,235.53	€33,558.88	€167,794.41	€26,847.11
Total	€1,786,675.56	€446,668.89	€2,233,344.45	€357,335.11

Table 1 – Partner Financials (€)