Molteic (DINGLE HUB)

ENERGY MASTER PLAN – SUPPORTING DETAIL

Baseline Energy Balance, Renewable Energy Potential and Register of Opportunities

Image: www.simonewalsh.net

Report prepared for Molteic (Dingle Hub) Sustainable Energy Community by:
Kevin Curtin, Survey and Design Services
Shay Kavanagh, Fuinniv Independent Consulting

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SURVEY&DESIGN SERVICES

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1 Introduction and Overview

Dingle Hub/Dingle Sustainable Energy Community (hereinafter referred to as "Dingle SEC"), a registered member of the Sustainable Energy Authority of Ireland's (SEAI) Sustainable Energy Communities (SEC) Network, has entered into a three-year Partnership Agreement with SEAI. The objectives of the SEC program are to:

- ~ Increase energy efficiency
- ~ Use renewable energy
- ~ Develop decentralized energy supplies

Step 2 of this 5-step process involves the preparation of an Energy Master Plan (EMP) for the particular SEC territory to establish the baseline energy consumption for an agreed year, and the formulation of a Register of Opportunities that will deliver specific % energy demand reductions and specific % contribution from renewable energy sources.

In this particular case, Dingle SEC has set the EMP baseline year at 2016. They have also committed to set ambitious energy demand reduction and renewable contribution targets by 2030: from the analysis detailed below, the projected achievable out-turns for these targets by 2030 are 34.96% and 36.34% respectively.

It should be borne in mind that deployment of onshore wind was not a feasible option for the study area due to landscape/archeological characteristics, and also due to the existing infrastructural deficit (see Resource Maps 5, 6 Appendix 1). Furthermore, the view was taken that offshore wind, wave and tidal power renewable technologies are not likely to be deployable on the western seaboard by 2030; this is due to the long lead-times involved, but it is also submitted that initial roll-out of such technologies in Ireland is likely to be located closer to the high electricity demand that exists adjacent to the Irish Sea.

Therefore, it is projected that renewable energy contribution will be accounted for by decentralized measures and also some deployment of some mid-sized solar photovoltaic (PV) and anaerobic digestion (AD) installations. The projected capital expenditure required to deploy the required energy demand reduction and renewable contribution measures amounts to €165.99M and €44.81M respectively (this latter amount does not include provisions for expenditure in relation to PV farm or AD plant installations).

The EMP Study Area (pop. 12,764), described as the Dingle Peninsula, is defined by the territory to the west of a line connecting Blennerville to Castlemaine – the Area consists of 26 no. Electoral Divisions and 1 no. Small Area (see GIS Map hereunder). The Study Area is further divided into Sub Study Area A (pop. 9,454, west of a line connecting Inch to Camp) and Sub Study Area B (pop. 3,310, east of a line connecting Inch to Camp).

The baseline energy balance is prepared on the basis of final energy usage (also called "delivered energy"), by fuel type (using the methodologies detailed in Section 3 hereunder) for each of the following sectors:

SECTORS	
1	Residential Buildings
2	Non-Residential - Commercial/industrial and public buildings (schools, health facilities, etc)
3	Municipal and Local Authority (this section includes local authority housing/buildings/transport, public lighting, water supply and wastewater services)
4	Fisheries and Agriculture
5	Transport (excl local authority transport)

Figure 1: GIS MAP – Dingle Peninsula showing Electoral Divisions

This EMP also includes supplementary case studies in respect of 2 no. residential and 5 no. non-residential buildings – these are presented in Appendix 2 and 3 respectively.

The Baseline Energy Balance and Register of Opportunities for the residential sector are prepared on the basis of standard occupancy, as per Dwelling Energy Assessment Procedure (DEAP) which is the official method for calculating and rating the energy performance of dwellings in Ireland. Projected energy savings from DEAP calculations are the basis for project evaluation by SEAI in the administration of Community Grants or other grant schemes for dwellings. Furthermore, energy retrofit targets such as those contained within CAP (see below) and also Building Regulations Part L are based on DEAP outputs. The Baseline Energy Balance and Register of Opportunities for the non-residential sector are also prepared on the basis of standard occupancy. This methodology approach for these sectors enables consistent periodic “like-for-like comparisons”, as energy demand and renewable technology interventions are implemented over time, using available assessment tools without the necessity for acquiring and weather-normalising occupancy levels.

However, due to the particularly high tourism element in the accommodation/hospitality sectors in this study area, an assessment of the impacts of seasonality on the Baseline Energy Balance has also been carried out. In particular, detailed analysis has shown that calculated 2016 energy demand in the Residential and Non-Residential Sectors can be reduced by 17.9% and 6.7% respectively from the calculated figures below (ref Sections 3.2 and 3.3) to take account of seasonality. On the assumption that Bord Failte visitor occupancy levels and gathered from a detailed survey in those sectors remain unchanged over the period to 2030, then targets for energy demand and renewable contribution measures may be adjusted downwards accordingly, for those sectors only.

In respect of the Register of Opportunities, the three main actions that will deliver the required energy demand reduction are:

1. Medium-depth energy retrofit of 75% of all dwellings (66.2% of overall energy demand reduction). Permanently occupied dwellings should be prioritized to maximise energy savings.
2. Energy retrofit across the non-residential buildings sector to achieve 40% energy demand reduction (15.33% of overall energy demand reduction)
3. Deployment of EV’s and CNG vehicles (cars, busses, trucks) (14.9% of overall energy demand reduction)

Given the enormity of the scale of interventions required to deliver change, it is submitted that the following barriers need to be addressed as a matter of urgency (nationally and locally):

1. CALLS TO ACTION: Current inertia must be overcome in order to accelerate activity and create a non-reversible momentum towards change in energy performance of buildings; creation of new and novel channels of communications (preferably bottom-up, rather than continuation of top-down channels), as well as positive market signals, will be crucial.

2. HUMAN CAPITAL: There are serious supply chain issues in terms of trained personnel (professional and trades-based) which are very significant impediments in the drive towards broad and deep retrofit.
3. HUMAN CAPITAL: Resources to monitor and maintain new technologies are currently noticeably scarce – this is a major barrier to deployment of new technologies.
4. FINANCIAL CAPITAL: It is apparent that mobilization of the necessary financial capital to fund the required sea-change in retrofit activity will be a major issue among property-owners. Innovative interventions by the energy supplier community, and energy technology suppliers, will be required to deploy performance-based solutions with appropriate distribution of risk. Also, investment in EV & CNG infrastructure by the appropriate bodies will be a critical enabler of the required changes in the transport sector.

Notwithstanding the foregoing, there are a number of very exciting energy-related initiatives underway in the Dingle Peninsula (see Appendix 4 below) which should act as positive enablers towards change in this study area:

1. Feasibility Study on the Development of Anaerobic Digestion in the Dingle Peninsula
2. ESB Networks Dingle Project
3. RegEnergy Interreg Project
4. Energy Efficiency Improvements in Dingle Fishery Harbour Centre
5. IERC STORENET Project

The involvement of key national research and technology players in such energy-related studies in this study area, as well as the positive supporting roles played by Dingle Hub and others, creates the very real possibility that Dingle Peninsula can become one of the most important test-beds for the energy transition in Ireland. It must be anticipated that this, in turn, will become the catalyst for the required investment in energy demand reduction and renewable generation measures through the Dingle SEC territory.

Furthermore, the following exciting initiatives are currently underway on the Dingle Peninsula which serve to overcome some of the challenges identified above:

Sustainable Public Transport on the Dingle Peninsula

Dingle Hub, in conjunction with Kerry County Council and North, East and West Kerry Development (NEWKD), has had ongoing discussions with Local Link Kerry (LLK) about introducing new bus routes on the Dingle Peninsula and moving towards operating only low carbon emission buses on the Dingle Peninsula. The aim would also to integrate the bus services with other transport services and provide an online booking engine, real-time passenger information and suitable bus shelters throughout the Peninsula. Discussions have taken place with ESB and GNI about sourcing suitable electric buses and CNG buses respectively.

Electric Vehicle charging and parking facilities on the Dingle Peninsula

In conjunction with Kerry County Council and ESB, work is progressing on examining how best to provide for suitable charging and parking for electric vehicles (EV's) on the Dingle

Peninsula. This is especially important in view of the significant number of tourists that pass through the Dingle Peninsula each year (approx. 1 million) and the need to ensure adequate charging and parking facilities will be available. Upgrading of the existing electricity infrastructure on the Dingle Peninsula may be required to support the roll-out of suitable EV chargers, particularly fast chargers.

Kerry Education and Training Board Course for Energy Coaches

In conjunction with Kerry Education and Training Board and ESB Networks, work is progressing in organising an accredited course for people who are interested in becoming energy coaches. This role has been deemed to be very important to help support efforts at advising, encouraging and supporting householders to undertake upgrading of the energy efficiency and switch to renewable energy in their homes. It is planned to commence the course in Quarter 3, 2019 and the course will run for two years, (for part-time participants).

Farm Ambassador programme on the Dingle Peninsula

The Farm Ambassador programme is based the on the model used in the very successful ESBN Ambassador programme, which is currently running on the Dingle Peninsula (See Appendices) and which deals with electricity and energy usage in homes and businesses. The aim of the Farm Ambassador programme is to install Internet of Things (IoT) technology on a number of farms, with sensors and a low-power wide-area network, connected to the cloud. The objective is to improve carbon and emissions efficiency and to measure the carbon and emissions' reduction (in a verifiable manner), as well as implementing cost and labour savings, on farms on the Dingle Peninsula.

Socio-economic profile and plan for the Dingle Peninsula

NEWKD, in conjunction with Dingle Hub, is developing a socio-economic profile and plan for the Dingle Peninsula, which should provide key information that can both support decision-making on the projects currently underway and also provide a baseline measure for measuring their impact in the future. The work will produce a geographically-appropriate, deliverable, multi-annual, cross-sectoral, integrated territorial development plan for the Corca Dhuibhne Peninsula that is driven by civil society, supported by the statutory sector and social partners, is complementary of other plans and contributes to sustainable territorial development, in line with best international practice.

2 Legislation and Policy Background

2.1 EU Level

Energy Performance of Buildings Directive

A revised Energy Performance of Buildings Directive was published by the EU in Summer 2018 and must be transposed into law in EU Member States by March 2020. The main changes will be:

- Targets: Member States must achieve decarbonized building stock by 2050 using a cost-effective combination of energy efficiency and decarbonized energy supply. This must be guided by national milestones for short-term (2030), mid-term (2040) and long-term (2050) objectives.
- ICT/Smart Technologies: Promotion of ICT/smart technologies, communications and building automation/control systems. The "smart readiness factor" will measure the building's ability to use ICT to adapt building operation to the needs of the grid. This should help occupants understand energy usage and savings achieved by installed smart technologies.
- E-Mobility: Promotion of electromobility (i.e. promotion of electric cars)
- Renovation Strategies: The reference to national long-term building renovation strategies has been moved to and strengthened in the EPBD (this originally resided in the Energy Efficiency Directive). "Each Member State shall set out a roadmap with measures and domestically established measurable progress indicators, with a view to the long-term 2050 goal of reducing greenhouse gas emissions in the Union by 80-95% compared to 1990".
- Financing: The EPBD seeks to mobilise financing/investment from public and private sources.

Energy Efficiency Directive (2012)

A 2016 update of this Directive establishes a set of binding measures towards helping the EU to reach a 30% energy efficiency target by 2030. National measures to be adopted include the following:

- Energy distributors/sales companies to drive 1.5% energy savings per year through energy efficiency measures
- Public sector to procure energy efficient buildings, products and services
- Governments to carry out energy efficient renovations to at least 3% of the buildings they own/occupy per year
- Easy and free access to energy data to be provided to energy consumers
- Incentivize energy audits for SME's
- Mandatory energy audits for large companies

Renewable Energy Directive

A 2016 update of this Directive requires the EU to fulfill at least 27% of its total energy needs with renewables by 2030.

EU Climate and Energy Framework

This Policy sets the following 2030 targets (from 1990 levels):

- At least 40% GHG emission reductions (binding)
- At least 27% share for renewable energy (binding)
- At least 27% improvement in energy efficiency (endorsed)

2.2 National Level

Climate Action and Low Carbon Development Act (2015)

This is the first ever climate legislation in Ireland and provides a statutory basis for the national objective of transitioning to a low carbon economy by 2050. It enshrines the commitment of the State to GHG mitigation and adaptation measures as well as providing approval for the plans underpinning this transition, namely the National Mitigation Plan and National Adaptation Framework.

Ireland's Transition to a Low Carbon Energy Future 2015-2030

This White Paper sets out the framework to guide energy policy to 2030, with the long-term vision of reducing GHG emissions by 80%-95% by 2050 (compared to 1990 levels). The Plan envisages the Citizen being at the center of the required energy transition: the change "from passive consumer to active citizen" and citizen engagement are key principles of this Plan.

National Energy Efficiency Action Plan (NEEAP4) 2017-2020

NEEAP4 sets a target of 20% improvement in energy efficiency by 2020 and a more ambitious target of 33% in respect of the public sector. It sets out the scale of energy and emission savings achieved per sector by 2016 and projects the levels of savings envisaged by 2020 under various scenarios. It also sets out details of measures and programs that will deliver towards the savings targets in each sector.

National Mitigation Plan 2017

This first whole-of-government plan sets out the multiple measures require across several Government Departments to enable the required transition "to a low carbon, climate resilient and environmentally sustainable economy by 2050". In particular, it sets out measures to facilitate the decarbonization of electricity generation, built environment, transports and agriculture/forestry/land use.

National Renewable Energy Action Plan 2010

This sets out national targets in respect of the share of energy from renewable sources to be consumed in transport, electricity and heating/cooling in 2020.

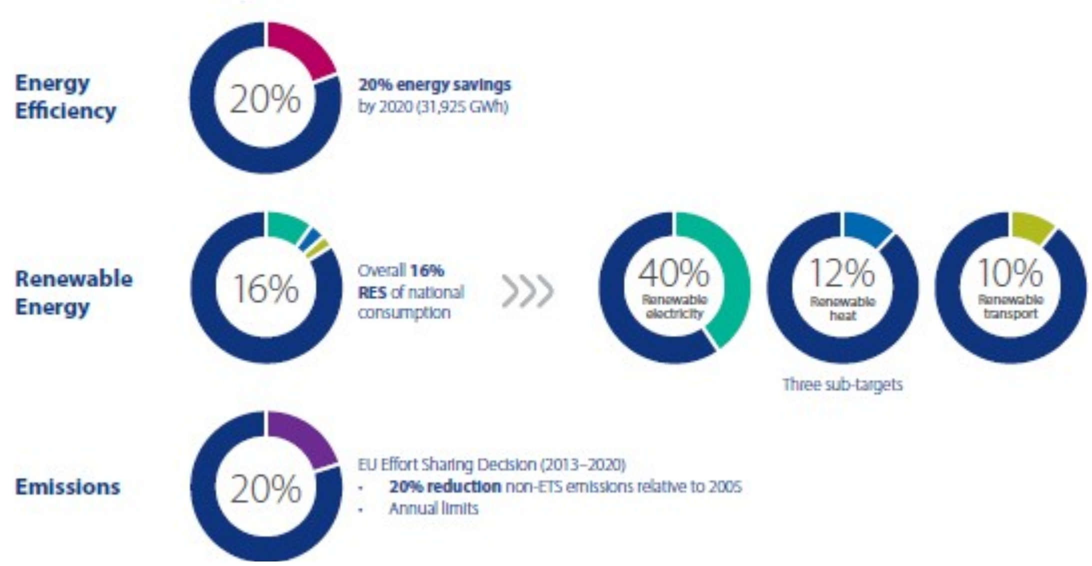


Figure 2: National Headline Energy and Emissions Targets
Source: Ireland's Energy Projections, 2017 (SEAI)

CLIMATE ACTION PLAN 2019

The Climate Action Plan openly acknowledges, at the very outset, that "Ireland is way off course" in respect of arresting it's GHG emissions. Furthermore, this gap-to-target is currently widening due to recent growth in emissions. This plan commits to detail the changes required to provide a pathway to 2030, which will be consistent with achieving a net zero emissions target by 2050. The following sets out a number of the objectives included in the Plan:

- Electricity
  - Increase share of renewable electricity from 30% to 70%, with peat and coal plants closing
  - Support scheme for micro-generation
- Buildings
  - Introduce stricter requirements for new buildings and substantial refurbishments
  - 500,000 homes to be upgraded to B2 (BER)
  - Heat pumps to be fitted to 400,000 existing homes
  - Increase attention to Energy and Carbon ratings in all aspects of managing property assets
- Transport
  - Target of 950,000 EV's on road by 2030
  - Make the economy less transport-intensive
  - Increase biofuel content for motor fuels
  - Conversion of public transport fleet to zero carbon alternatives
- Agriculture
  - Deliver verifiable GHG abatement through improved farming practices
  - Carbon abatement through increased forestry planting and soil management

- Enterprise and Services
    - Embed energy efficiency, replacement of fossil fuels, careful management of materials and waste across all enterprises and public service bodies.
    - Create centres of excellence for the adoption of low carbon technologies
- Waste and the Circular Economy
    - Reduction strategies for plastics, food waste and resource use
    - Increased levels and quality of recycling
    - Reduced reliance on landfill

2.3 <u>Local Level</u>

Kerry County Development Plan 2015 - 2021

Chapter 13 "Development Management – Standards and Guidelines" states that *wind energy, geothermal, biomass, combined heat and power and all other forms of renewable energy will be considered in accordance with the Renewable Energy Strategy adopted by Kerry County Council in 2012. The use of small wind turbines and solar panels shall be encouraged where appropriate.*

However, it is also evident from Chapter 11 "Built and Cultural Heritage" that certain barriers to large-scale renewable developments may exist in areas of linguistic, archaeological and cultural importance: *Building activity and natural resource extraction coupled with an increase in afforestation and changing farming methods has placed the archaeological heritage of the County under increasing threat. However, the main threat in the future may come from renewable energy developments, telecommunications infrastructure and visitor impact, as we strive to move away from fossil fuels, seek greater connectivity and adopt more active lifestyles. Unlike green energy, the archaeology of the County is not a renewable resource and it is the efforts of this generation that must ensure its protection and preservation for the future.*

Transition Kerry's Sustainable Energy Community Roadmap

This study commissioned by Transition Kerry, a community initiative, was completed in 2013 using 2008 as the baseline year. The objective of the study was to set out a road-map to plan the transition of the county towards 100% renewable energy by 2030, based on a 25% reduction in energy demand by the same year. This study envisaged that the primary drivers towards this change will involve:

- Urban areas: Use of district heating systems, supplied from wood-fired power stations (though this aspiration may not find favour any longer) and also large-scale solar arrays
- Rural areas: Provision of space and water heating from heat pumps and solar heating systems
- Electricity generation to be significantly supplied from wind energy (45%), with an important contribution from solar photovoltaic.

The Study highlighted that the required changes will demand an ambitious program of biomass supply chain development as well as a technological transformation to accommodate intermittent renewable energy supply. The projected capital cost of the long-term plan was estimated at €1.6 billion, with annual renewable energy costs projected at 15% higher than the baseline year. The Study further highlighted that the transition of the County's energy system "will require full-scale mobilization of human resources and capital, driven by a long-term multi-stakeholder' partnership.

Kerry County Council Renewable Strategy (2012 – 2015)
It is evident from the appraisals that were carried out as part of the preparation of this report that there is significant potential for the development of wind, bioenergy and, to a lesser extent, hydro power within the county. The document also concludes that there is capacity within the upgraded transmission grid to collect and transmit significant amounts of electricity generated from renewable sources. However, it is also evident that, due to landscape character and other constraints, little of no potential for developing wind energy projects lies within the Dingle Peninsula. In addition, there is currently no suitable transmission grid available for large scale power generation projects within the peninsula. The capacity to connect small to medium scale power generation plants, such as grid-scale photovoltaic, is a matter that needs to be investigated further.

The availability of forestry feedstock within the peninsula for bioenergy purposes is also extremely limited due to the geographical terrain.

For further details, see resource maps included in Appendices below.

3 Baseline Energy Usage (2016)

3.1 Introduction

The Baseline Energy Usage (BEU) for 2016 in the Dingle Peninsula Study Area includes the key sectors of the local economy i.e. residential, non-residential, municipal/local authority, agriculture/fisheries and transport. The energy usage profile of each sector was developed using bottom up data that reflect local conditions, wherever possible. Where localized data was insufficient, we leveraged sectorial national energy usage statistics published by SEAI and applied socio-economic multipliers reflecting the size of local sectorial activity.
Furthermore, an extensive program of bottom-up data gathering was undertaken:

- An online survey of both the residential and non-residential sectors was carried out in collaboration with Dingle SEC and SENSORPRO www.sensorpro.net .
- An extensive non-residential buildings inventory survey was carried out throughout the study area (in the absence of rates data) to identify building uses, types, ages, locations and approx floor areas.
- Detailed energy information was acquired from Kerry Co Council on their non-residential and street-lighting stock.

3.2 Methodology and Findings – Residential Sector

The approach to dwellings is based on use of the RetroKit www.retrokit.eu software analysis tool. RetroKit was developed by XD Sustainable Energy Consulting Ltd (XDC) www.xdconsulting.eu to make optimal energy retrofit investment decisions on a multi-unit dwelling stock basis, across a region or community. RetroKit extracts Building Energy Rating assessment data and carries out analysis to:

- Determine the baseline energy performance of housing stock in terms of energy use and expenditure, CO2 emissions and BER rating, at whole stock level and per relevant dwelling cohorts;
- Model and compare a range of energy retrofit scenarios, to establishing optimal energy retrofit packages for the stock, considering technical requirements as well as financial and environmental criteria.

RetroKit results can be used towards formulating an energy retrofit action plan, defining packages of energy conservation measures tailored to each element of the stock.

There are two types of RetroKit analysis carried out for the Dingle peninsula

- Analysis based on the entire peninsula housing stock broken down by electoral district. This uses CSO housing data for each ED, coupled with typical archetypes based on countywide BER data from SEAI BER database for County Kerry.
- Analysis for specific dwellings for which BER XML files have been sourced from SEAI with consent from dwelling owners (local authority and private).

RetroKit is then used to carry out baseline building energy calculation for each dwelling in each ED to derive the total delivered and primary energy, energy costs, CO2 emissions, and renewable energy contribution per dwelling.

For the purposes of the Register of Opportunities (see Section 6 below), RetroKit uses the baseline energy information to develop a set of retrofit scenarios (Shallow, Medium and Deep) in order to establish the optimum approach to meet the energy reduction target set out in the project brief. The following is a summary of the various scenarios:

- *Shallow*: Basic air tightness, insulate cavity and ceiling, cylinder lagging jacket, LEDs, wood stove
- *Medium*: Shallow, plus fully zoned controls, factory insulated cylinder, air source heat pump
- *Deep:* Medium, plus advanced air tightness, demand-controlled ventilation, EWI and floor and rafter insulation, triple glazing, external doors, insulated pipework, underfloor heating, PV system

In the case of this study area, the medium energy retrofit scenario outcome is closest to meeting the energy savings required in the project brief and is more cost effective than the deep retrofit scenario.

Calculations of the impacts of seasonality on energy usage and cost are based on the assumption that holiday home dwellings are open for all of summer months and only closed for months in the heating season. In this way, the varying impacts of seasonality on different energy end-uses are accounted for (lighting/water heating/auxiliary energy vs space heating). Seasonal occupancy level information per month is taken from Bord Fáilte data[1] for County Kerry. Further detailed information on the seasonality methodology:

<u>*Residential*</u>

First, RetroKit is used to determine usage of energy in all 6,986 dwellings in the peninsula. RetroKit is not designed to make non-standardised assumptions about occupancy so therefore must be done on a full occupancy basis. Then, Bord Fáilte figures show occupancy per month in paid accommodation nights in Kerry from 2016-2018, giving an average of 52% occupancy per month. This 52% is applied to energy uses needed all year round (hot water, lighting, pumps, fans, appliances). Space heating (standard occupation) is required for 8 months of the year from October to May, and therefore a lower percentage of the space heating standard demand is required (just under 30%). All of the demand from supplementary electric immersion heating in summer is assumed to be required (as summer is the busiest period). These factors area applied to each of the energy uses in the 1,926 holiday homes. The calculation is detailed in the Baseline Dwellings Summary tab of the baseline tool.

Findings (based on standard occupancy):

- Total Final Energy Consumption (Residential) = 181.87GWh (51.84% of Total Final Energy Consumption)
- Estimated Final Energy Consumption Cost (Residential) = €18.751M
- Total Emissions (Residential) = 57.99ktCO_2eq. (54.37% of Total Emissions)

Findings (based on seasonality):

- Total Final Energy Consumption (Residential) = 149.30GWh (Reduction of 17.9%)

[1] Bord Failte correspondence 13/3/19

3.3 Methodology and Findings – Non-Residential

Calculation of energy usage in this sector is based on the combination of several data sources:

- ~ Anonymised data from the non-domestic Building Energy Rating (NDBER) assessment database (a sample of over 1500 buildings/facilities in Kerry), from which were derived average figures for treated floor area, fuel and electricity usage for buildings/facilities belonging to a certain category (e.g. schools, warehouses, retail units, etc.).
- ~ An inventory of all the non-residential buildings/facilities within the study area was prepared by the project team identifying each building type, estimated floor area and building age. The buildings identified per electoral district, by use of a mapping tool by our appointed GIS specialist. The estimated seasonality of each building is also collated in this inventory based on information provided by Dingle SEC (i.e. the number of months in the year that each particular building is open).
- ~ TM46[2] benchmarks for different building types used to rationalise energy estimates derived from the countywide BER data. TM46 benchmarks delivered energy usage per m^2 for a range of building types. The BER data average specific energy per m^2, for each fuel type under each building type, is adjusted using the TM46 /m^2 benchmarks.
- ~ Cost data gathered from the online survey of non-domestic building owners on the peninsula.
- ~ Schools energy data from SEAI's public sector programme. Of the 23 schools in the study area, the energy used per fuel type was reported for 13 schools in this programme. The remaining schools' energy usage was estimated based on average energy/pupil from the 13 schools - pupil count is known in all of the schools. This is added to the energy usage per ED in ND buildings outlined above.

Calculations of the impacts of seasonality on energy usage and cost are based on the assumption that such seasonally operated buildings are open for all of summer months and are only closed for months in the heating season (or, in some cases, never closed). Therefore, the varying impacts of seasonality on different energy end uses are accounted for (lighting/water heating/auxiliary energy vs space heating vs cooling. The fuel cost estimates from survey data vs calculated (including seasonality) are generally within 13% on average - this appears reasonable given the range of assumptions made with respect to floor areas, use of TM46, estimates in BER data etc. Further detailed information on the seasonality methodology:

Non-Residential (only applied to buildings other than buildings for which metered data was available i.e. not including schools and Kerry Co Council buildings).

The full occupancy delivered energy for each energy usage (space heating, water heating, lighting etc) is calculated for each of the buildings catalogued during the survey of all non-residential buildings in the peninsula outlined above. For each building, the opening period is catalogued as being open for either 6 months per year, 9 months or 12 months. If a building is identified as being closed for part of the year, then that is taken to be during the 8-month space heating season (October to May). So, for example, a building closed for 3 months of the

[2] CIBSE TM46:2008 *Energy Benchmarks*

year would have 75% of the standardised energy uses required all year (hot water, lighting, auxiliary energy). The same building would only require space heating for 62.5% of the same building when open all year round with standard occupancy [(8-3)/8 = 62.5%]. If a building has a cooling load, then it is unadjusted as it would be needed during the summer during the high-occupancy season.

Findings (based on standard occupancy):

- Total Final Energy Consumption (Non-Residential) = 40.99GWh (11.68% of Total Final Energy Consumption)
- Estimated Final Energy Consumption Cost (Non-Residential) = €5.176M
- Total Emissions (Non-Residential) = 15.19ktCO_2eq. (14.24% of Total Emissions)

Findings (based on seasonality):

- Total Final Energy Consumption (Non-Residential) = 38.26GWh (Reduction of 6.7%)

3.4 Methodology and Findings – Municipal/Local Authority

3.4.1 Streetlighting

- Information on lights in the peninsula was provided by Kerry County Council, including the following key information for EACH streetlight
  - Billable wattage and burn hours (where burn hours blank, assume is average value of other burn hours)
  - Locational information (easting/northing etc)
- Identification of electoral districts and small areas for each lighting carried out by GIS specialist. Flags the ones located in the remit of this study.
- Lights per ED are summed to give streetlighting energy usage per ED and then total for the peninsula.
- Lighting energy is therefore calculated entirely from bottom up. Tallied by electoral district.

3.4.2 Other local authority uses

- Electricity in Non-Domestic buildings is bottom up based on data from Kerry County Council with precise locations, so is again tallied by electoral district. (Note: One of the ND buildings (Farrannakilla House) also uses non-electrical fuel, for which we don't have data - there is no published BER for this building).
- Transport: energy consumption was calculated using county wide figures from the most recent Kerry Sustainable Energy and Climate Action Plan (SECAP) and scaled down by population for Dingle and per ED.
- Wastewater / pumping: energy consumption was calculated using county wide figures from the most recent Kerry Sustainable Energy and Climate Action Plan (SECAP) and scaled down by the number of houses supplied with mains water (from SAPMAP[3] data); similarly scaled down to each ED based on houses supplied with mains water.

[3] CSO Small Area Population mapping tool

Findings:

- Total Final Energy Consumption (Municipal/Local Authority) = 2.95GWh (0.84% of Total Final Consumption)
- Estimated Final Energy Consumption Cost (Municipal/Local Authority) = €0.483M
- Total Emissions (Municipal buildings/Local Authority) = 1.212ktCO_2eq. (1.13% of Total Emissions)

3.5 Methodology and Findings– Fisheries and Agriculture

3.5.1 Fisheries

- Diesel consumption for national for fishing fleet sourced from SEAI *Energy in Ireland*
- Figures from Dept Ag, Fisheries and Marine (DAFM) provided registered addresses of all fishing boats nationally.
- From this information, it was possible to identify fishing vessels > 10tonnes registered on Dingle peninsula – it is assumed that they all refuel in the Dingle town electoral district.
- From the same information, it was also possible to identify the kW rating of all boats > 10 tonnes nationally and on Dingle peninsula, thus providing a basis for apportioning the ratio of energy usage of the fishing fleet in Dingle to the energy usage of the national fishing fleet.

3.5.2 Agriculture

- National electricity and diesel consumption for agriculture and fisheries sourced from SEAI *Energy in Ireland*
- Calculations based on Gross Value Added (GVA)[4] statistics for agriculture and fisheries, minus GVA from sea fishing landings, were carried out to give agriculture GVA only. The same exercise was carried out for the South West (SW – Cork/Kerry) region.
- This latter GVA information was used to scale energy to SW region, which in turn was scaled to Kerry alone based on CSO Number of farms classified by economic size.
- This energy data was further scaled based on CSO employment statistics in the agriculture sector, thus giving energy usage in the agriculture sector for diesel and electricity per ED and for the whole for the peninsula.

[4] CSO RAA01 (GVA by region, year and statistic

Findings:

- Total Final Energy Consumption (Fisheries) = 6.459GWh
- Estimated Final Energy Consumption Cost (Fisheries) = €0.402M
- Total Emissions (Fisheries) = 1.704ktCO_2.

- Total Final Energy Consumption (Agriculture) = 17.218GW
- Estimated Final Energy Consumption Cost (Agriculture)= €1.561M
- Total Energy Related Emissions (Agriculture) = 5.419ktCO_2.

- Total Final Energy Consumption (Fisheries and Agriculture combined) = 23.677GWh (6.75% of Total Final Consumption)
- Estimated Final Energy Consumption Cost (Fisheries and Agriculture combined) = €1.963M
- Total Emissions (Fisheries and Agriculture combined) = 7.123ktCO_2eq. (6.68% of Total Emissions)

3.6 Methodology and Findings – Transport

Transport energy consumption is calculated on the basis of "place of ownership". For example, if a large national bus company has high travel distances throughout the country, its energy consumption will be attributed to its place of ownership rather than to the various territories that it passes through. This avoids double counting. Similarly, if a bus company in Dingle has high travel distances throughout the country, its energy consumption will be attributed to Dingle SEC.

3.6.1 Private car

- Energy usage per year calculated based on average age of cars and diesel/petrol annual average car efficiencies in L/100km (similar approach to Kerry SECAP work)
- Electric car efficiencies derived from SEAI EV data.
- Car travel (in km) and the private car population obtained from the CSO transport omnibus
- The proportions of the national private car stock, by fuel type, obtained from CSO data
- RES-T biofuel value used to split petrol and diesel into unblended fossil fuel and biofuel
- The private car population per ED obtained from the CSO SAP Map is used to split each fuel type (for private cars) for each ED.

3.6.2 Small public service vehicles (PSVs)

- Travel by small PSVs (km) taken from the CSO transport omnibus for Kerry
- The split of fuel type is calculated based on national data from CSO
- RES-T biofuel value used to split petrol and diesel into unblended fossil fuel and biofuel
- Vehicle efficiencies etc assumed to be same as private cars to derive usage of each fuel

- This data is scaled to the Dingle peninsula, using the number of employees in transportation sector taken from SAPMAP data
- This data in turn is scaled to each ED, using the number of employees in transportation sector from SAPMAP data

3.6.3 Large PSVs

- Large PSVs efficiency data is based on fuel and travel (km) data collected from local transport operators.
- RES-T biofuel value used to split petrol and diesel into unblended fossil fuel and biofuel
- Distances travelled are scaled from Kerry data (in the CSO transport omnibus) based on number of employees in transport sector per ED.
- The resulting distances travelled (per ED) are multiplied by the efficiencies for large PSVs above, to provide estimated energy usage.

3.6.4 Freight (heavy and light goods vehicles)

- Distances travelled data from the CSO transport omnibus, scaled down from southwestern region to Kerry based on the number of hauliers in the county.
- RES-T biofuel value used to split petrol and diesel into unblended fossil fuel and biofuel
- National freight energy data used based on SEAI *Energy in Ireland,* scaled to Dingle peninsula and ED using the number of employees in sectors expected to use freight transportation from SAPMAP data.
- It is assumed that all freight vehicles use diesel (blended from pure diesel and biofuel component from RES-T for 2016)

Findings:

- Total Final Energy Consumption (Transport) = 101.33GWh (28.88% of Total Final Consumption)
- Consumption breakdown by transport category: private cars (59.3%), all other transport (excl municipal fleet) (40.7%)
- Estimated Final Energy Consumption Cost (Transport) = €12.083M
- Total Emissions (Transport) = 25.153ktCO_2eq. (23.58% of Total Emissions)

3.7 Summary of Final Energy Consumption and Related Emissions

Sector/User Group	Final Energy Consumption (GWh)	CO_2 Emissions (kt)
Residential	181.87	57.99
Non-Residential	40.99	15.19
Municipal and Local Authority	2.95	1.21
Fisheries and Agriculture	23.68	7.12
Transport	101.33	25.15
TOTALS	**350.82**	**106.66**

TABLE 1: Final Energy Consumption, per user group

Calculated figures for Final Energy Consumption for Sub-Areas A and B, as well as calculated figures accounting for seasonality, are presented in Sections 3.9 and 3.10 hereunder.

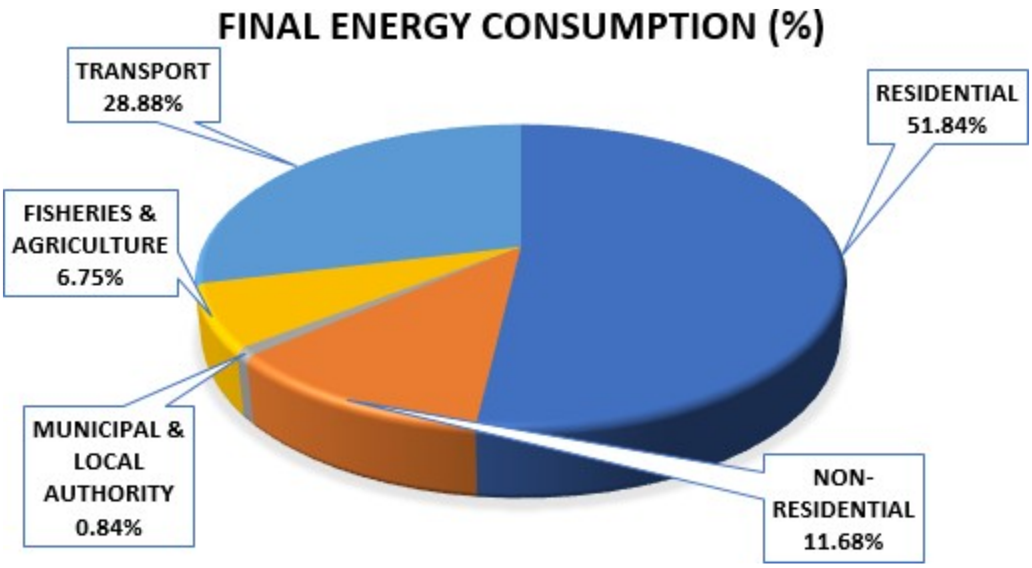


FIGURE 3: Final Energy Consumption, per user sector (%)

Energy consumption data in the residential sectors has been acquired predominantly on a bottom-up basis. As is evident from Figure 3 above, the proportion of final energy consumption attributable to the residential sector is particularly high in this study area, compared to a national residential share of 23.2% in 2016[5]. However, national comparisons for the Dingle Peninsula are unlikely to yield the same shares as national figures as there are a number of unique attributes:

[5] SEAI: ENERGY IN IRELAND – 1990 – 2016 REPORT

~ This is a predominantly rural territory with larger, with more detached dwellings and a somewhat older housing stock than average (there are 5% more dwellings in the pre-1970 category than the national average). Furthermore, the calculated solid fuel energy usage in dwellings in Dingle is 25%, compared to national (SEAI based) figure of 14%. As solid fuel heating is a less efficient means of turning fuel into useful heat, this will cause Dingle's usage per dwelling to be higher than national usage.

~ By way of illustration, the average dwelling in Ireland in 2016 consumed 13,885kWh of direct fuels and 4,638kWh of electricity, **18,524kWh in total**[6]. However, the corresponding calculated 2016 figures for the study area are 21,434kWh and 4,600kWh respectively, **26,034kWh in total**.

~ A comparison of the calculated average fuel cost per dwelling of €2,203 (after accounting for seasonal occupancy) proves to be quite close to the estimate of actual energy costs of €2,153/dwelling, as established from close to 200 survey responses submitted to our online survey in the study area.

~ The proportion of final energy consumption attributable to transport is particularly low in this study area at 28.8% - by way of comparison, the proportion of final energy consumption attributable to transport nationally in 2017 was 42.4%[7]. It should be noted that this area has below-average public transport services. Our projections are accurately in line with Kerry SECAP 2015.

~ Total Final Consumption per capita in the study area in 2016 is calculated at 27.48MWh approx., 4.4% lower than the national average Total Final Consumption per capita nationally in 2016 of 28.74MWh[8] approx. It should be noted that this area has below-average industrialisation.

~ High seasonality factor, as described above.

[6] SEAI: ENERGY IN THE RESIDENTIAL SECTOR – 2018 REPORT
[7] SEAI: ENERGY IN IRELAND – 1990 – 2016 REPORT
[8] SEAI: ENERGY IN IRELAND – 1990 – 2016 REPORT

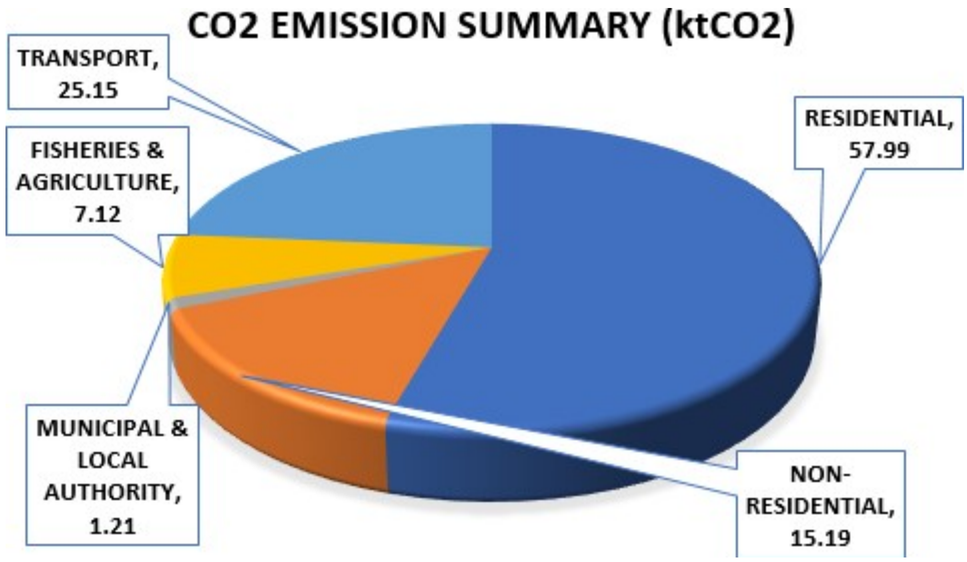


FIGURE 4: CO_2 Emissions, per user sector (%)

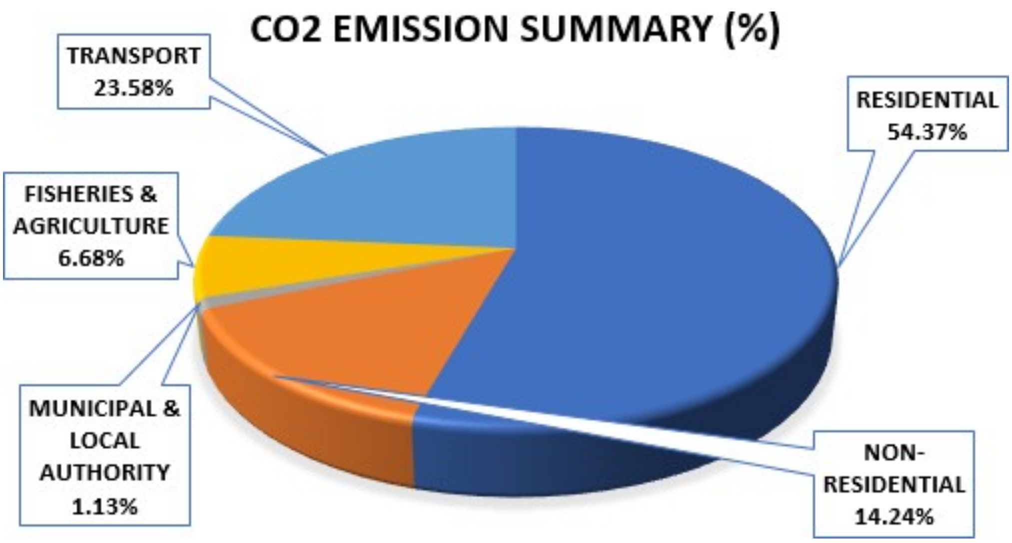


FIGURE 5: CO_2 Emissions, per user sector (%)

3.8 Summary of Final Energy Fuel Mix and Energy Costs

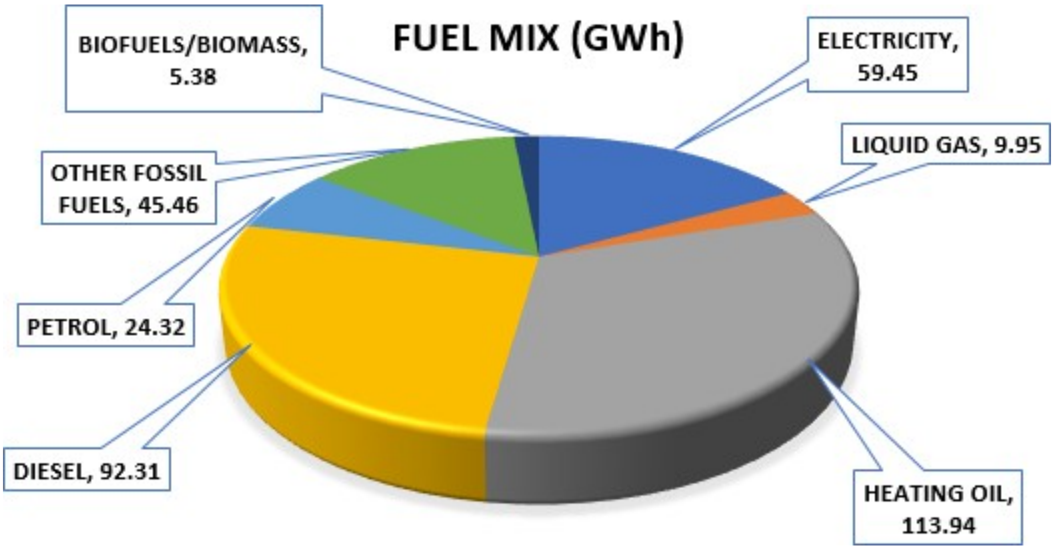


FIGURE 6: Final Energy Consumption (GWh), by energy carrier

The ratio of combustible fuels to electricity of 83.1%:16.9% is slightly higher than the national 2017 ratio of 80.7%:18.8%. Diesel is primarily used in the transport and agriculture sectors, while heating oil is primarily used in dwellings.

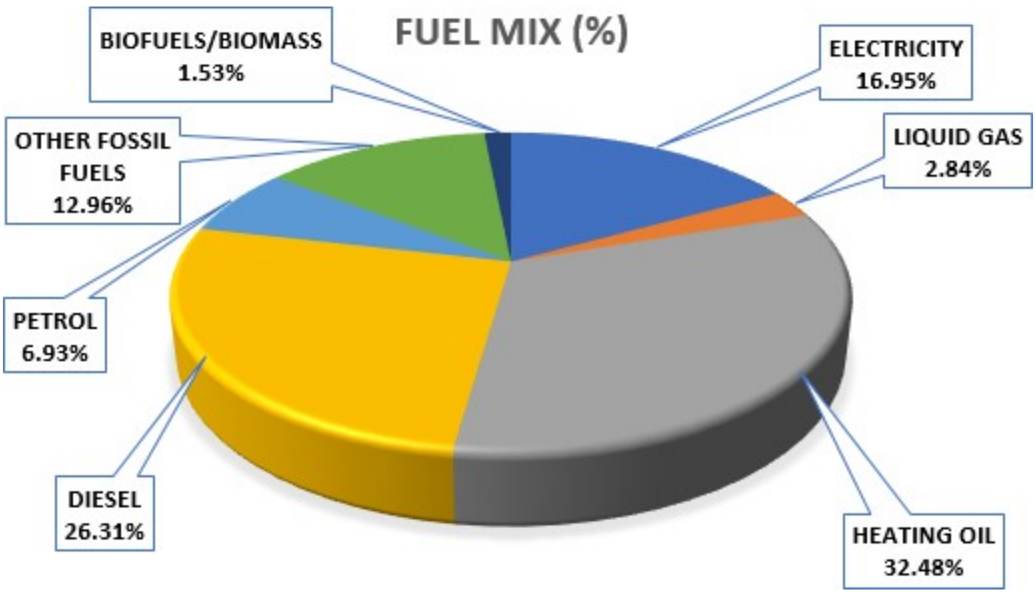


FIGURE 7: Final Energy Consumption (%), by energy carrier

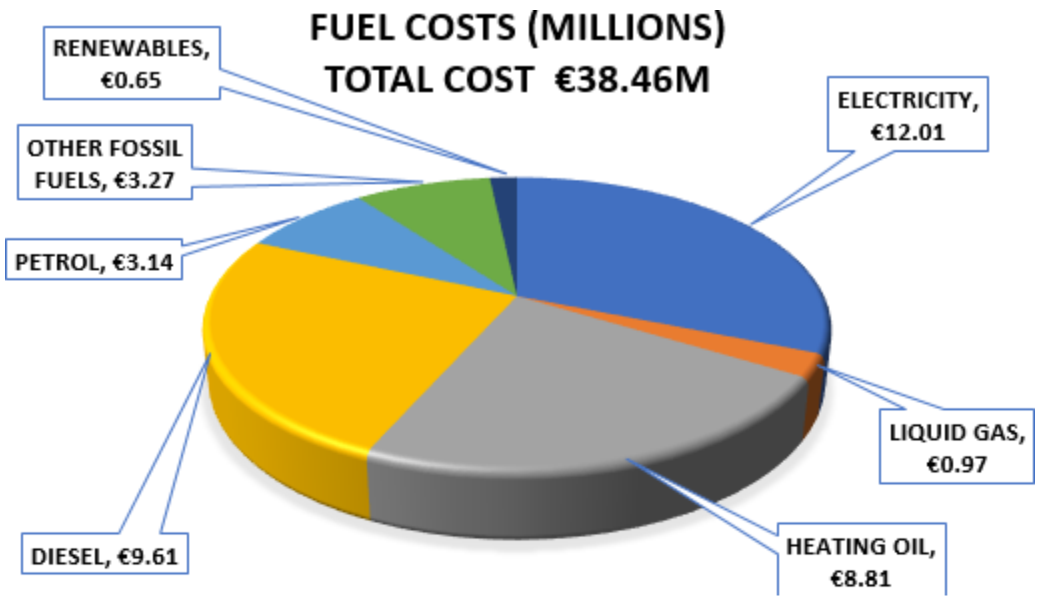


FIGURE 8: Fuel Cost, by energy carrier

As detailed in Sections 6 and 7 below, energy demand and renewable contribution measures have the potential to reduce energy costs by 24.8%, based on 2016 prices. This equates to a saving of €9.53M on a current (2016) energy spend of €38.46M. It is notable that the combined effect on energy costs of delivering improvements of 35% approx (in terms of both energy demand reduction and also renewable contribution) is less than might be expected at 24.8% - this is because of the significant change in fuel mix from oil to much more expensive electricity.

3.9 Summary of Final Energy Consumption, by Sub Study Area

Sector/User Group	**Final Energy Consumption – Study Area A (GWh)**	**Final Energy Consumption – Study Area B (GWh)**
Residential	144.19	37.68
Non-Residential	36.18	4.81
Municipal and Local Authority	2.32	0.63
Fisheries and Agriculture	20.89	2.79
Transport	74.01	27.32
TOTALS	**277.59 (79.1%)**	**73.23 (20.9%)**

TABLE 2: Final Energy Consumption, per user group, by Sub Study Area

3.10 Summary of Final Energy Consumption (Seasonality-adjusted for Residential and Non-Residential Sectors

Sector/User Group	Final Energy Consumption (GWh)
Residential	149.32
Non-Residential	38.24
Municipal and Local Authority	2.95
Fisheries and Agriculture	23.68
Transport	101.33
TOTALS	**315.52**

TABLE 3: Final Energy Consumption, per user group, adjusted for seasonality in Residential and Non-Residential Sectors

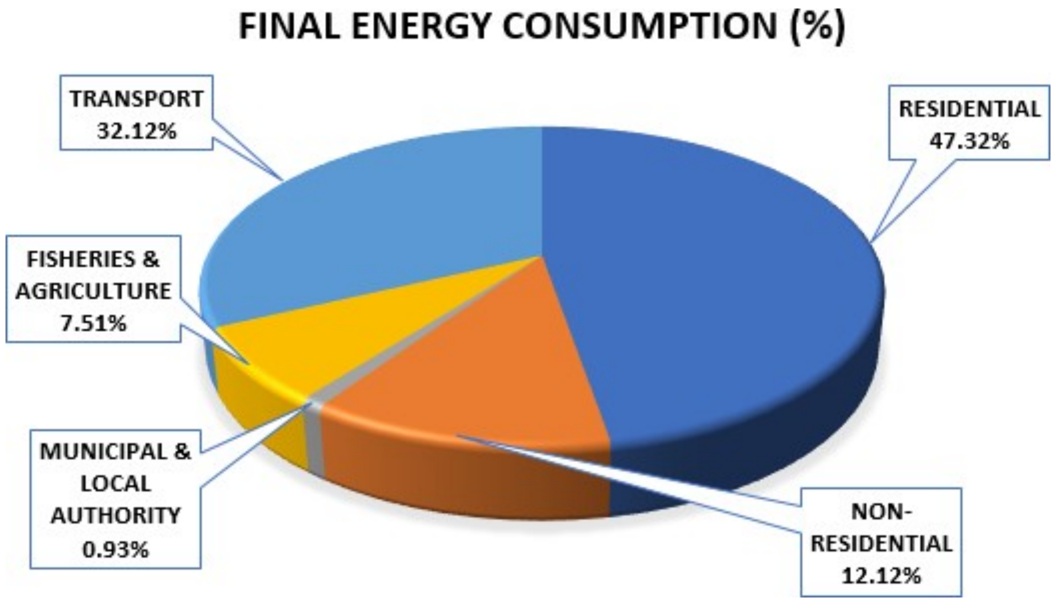
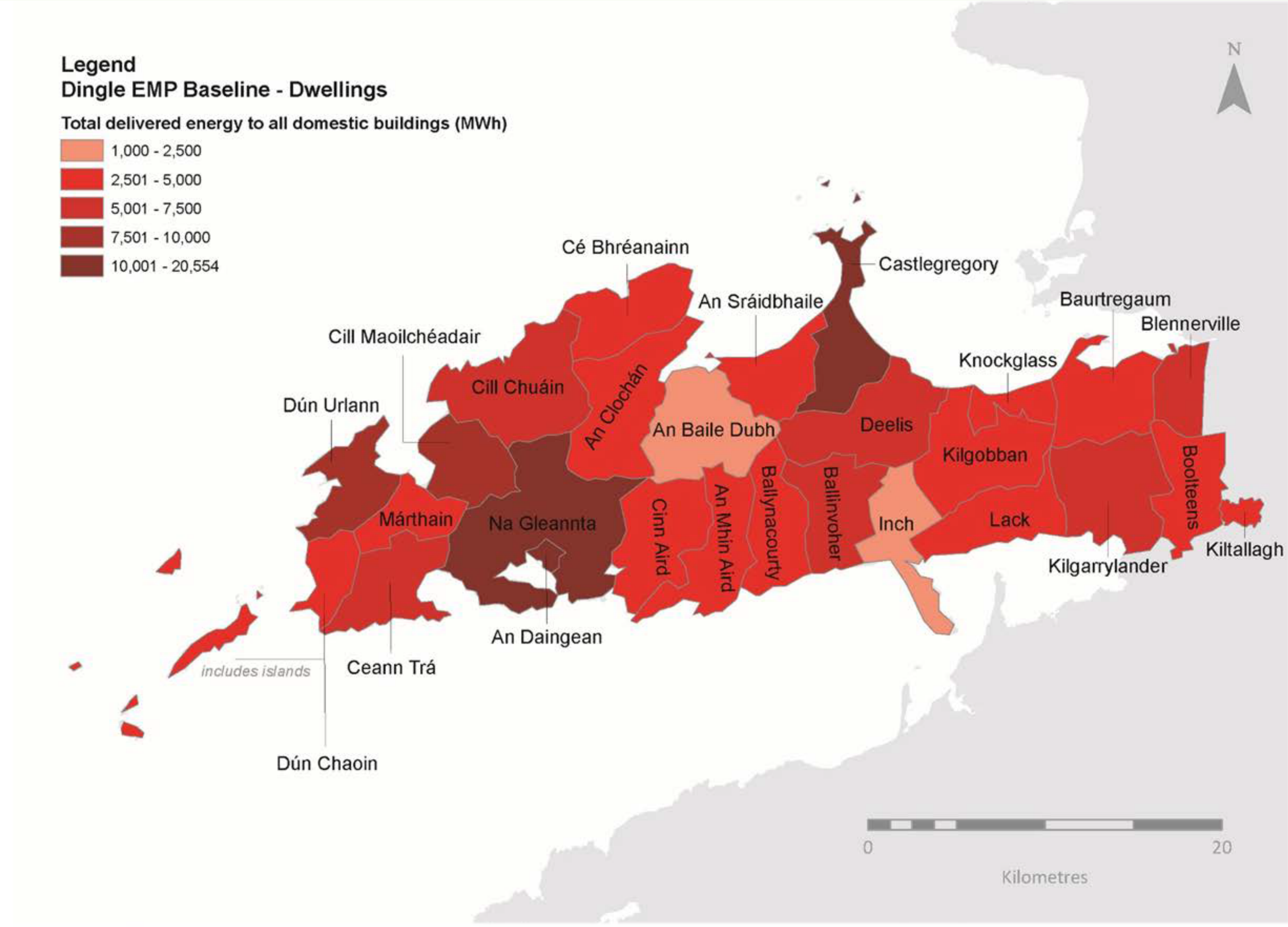


FIGURE 9: Final Energy Consumption, per user sector (%) - adjusted for seasonality in Residential and Non-Residential Sectors

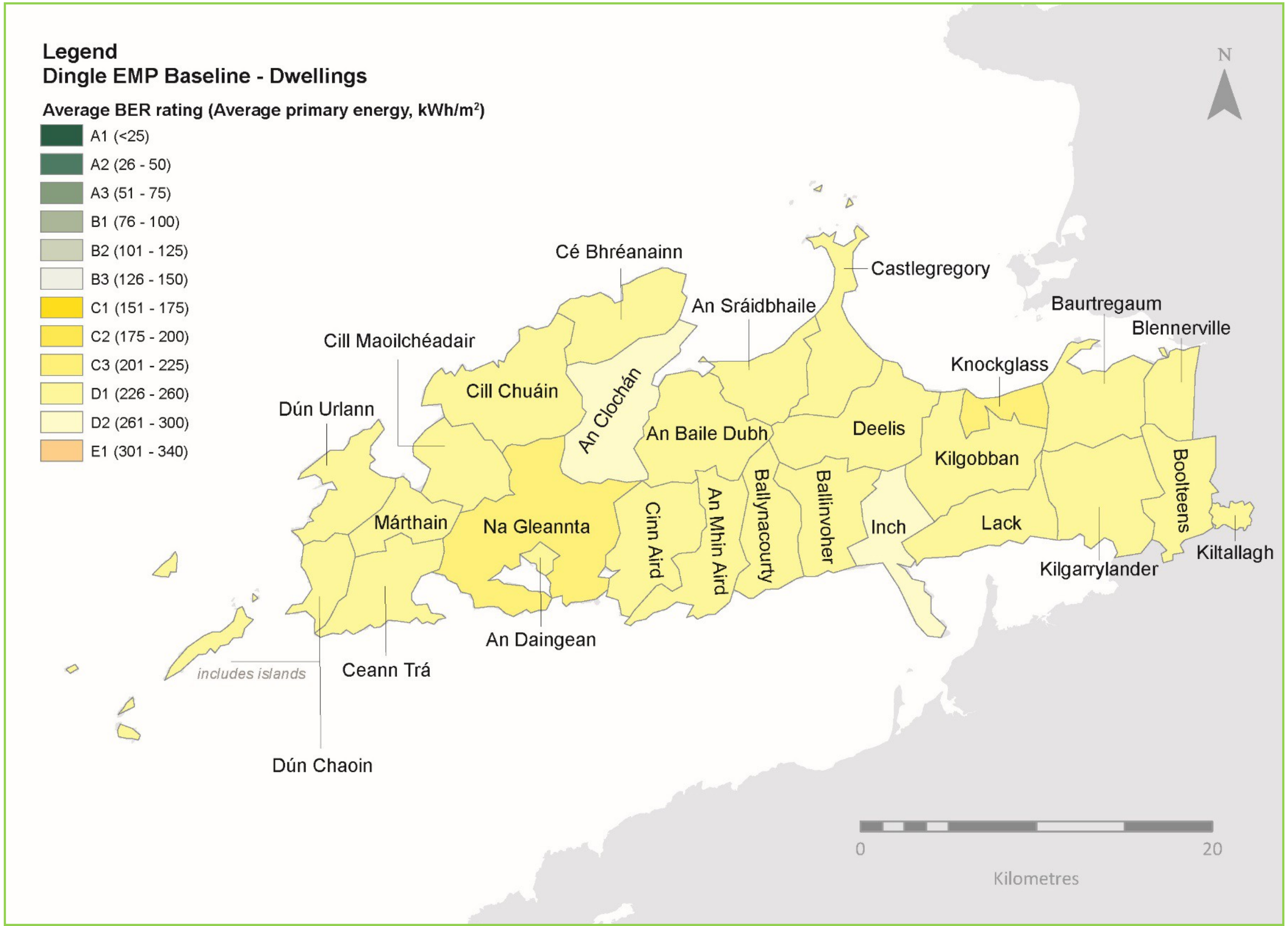
4 GIS MAPS

KMZ files (provided separately) - these are opened using Google Earth software as follows:

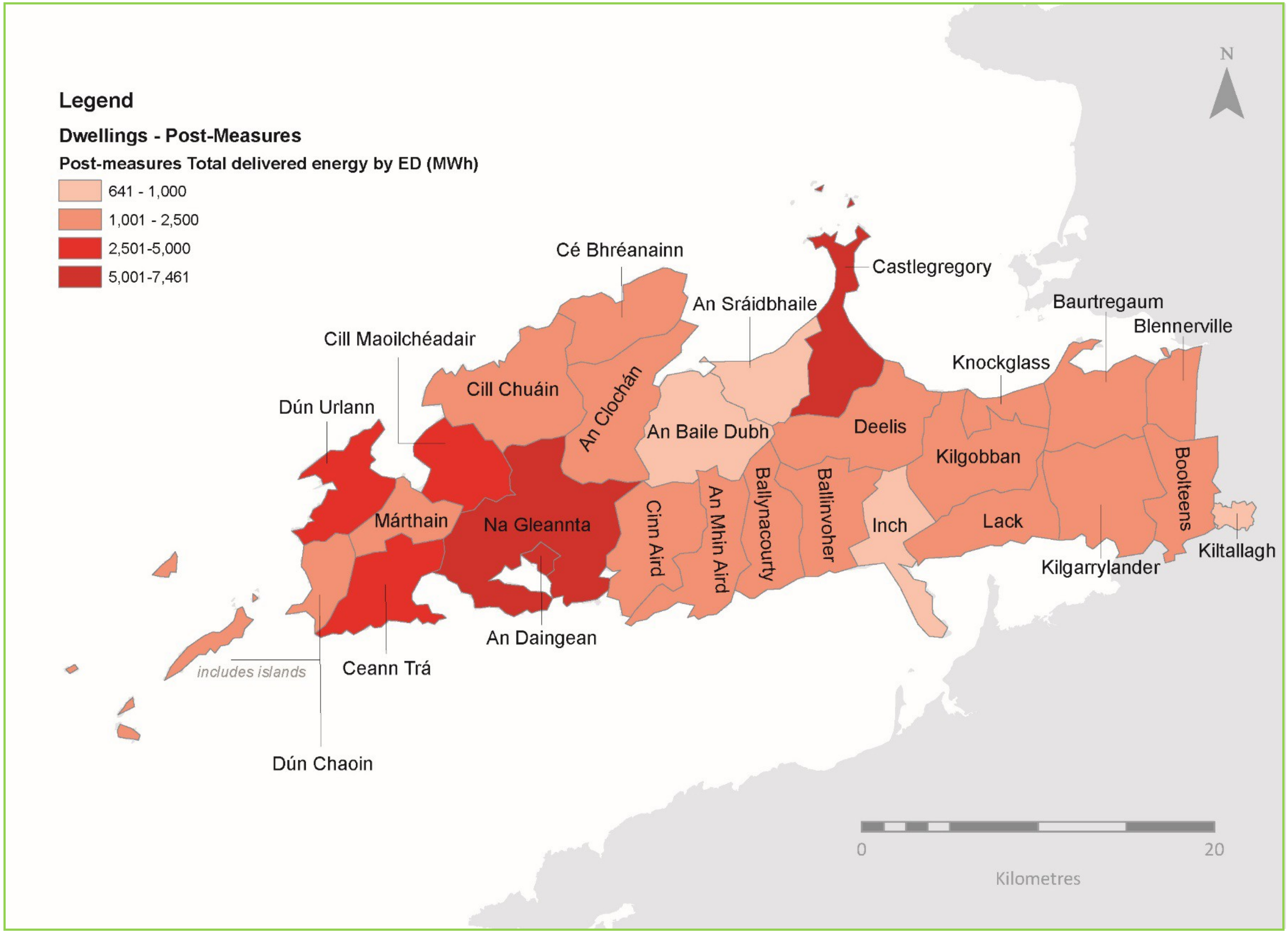
- Ensure that Google Earth is installed on the PC.
- Double-click on KMZ file saved to PC.
- Each map shows the area, broken into EDs, with colour shading for the metric on display.
- The key to explain the different colours is opened by selecting map on the "places" menu on the left-hand side and going to layers-> legend -> location of your choice. When working with more than one layer, you may wish to turn off previous maps and legends, to ensure you are looking at the intended layer and associated legend.
- Each map includes popups showing a range of other metrics per ED outlined below.



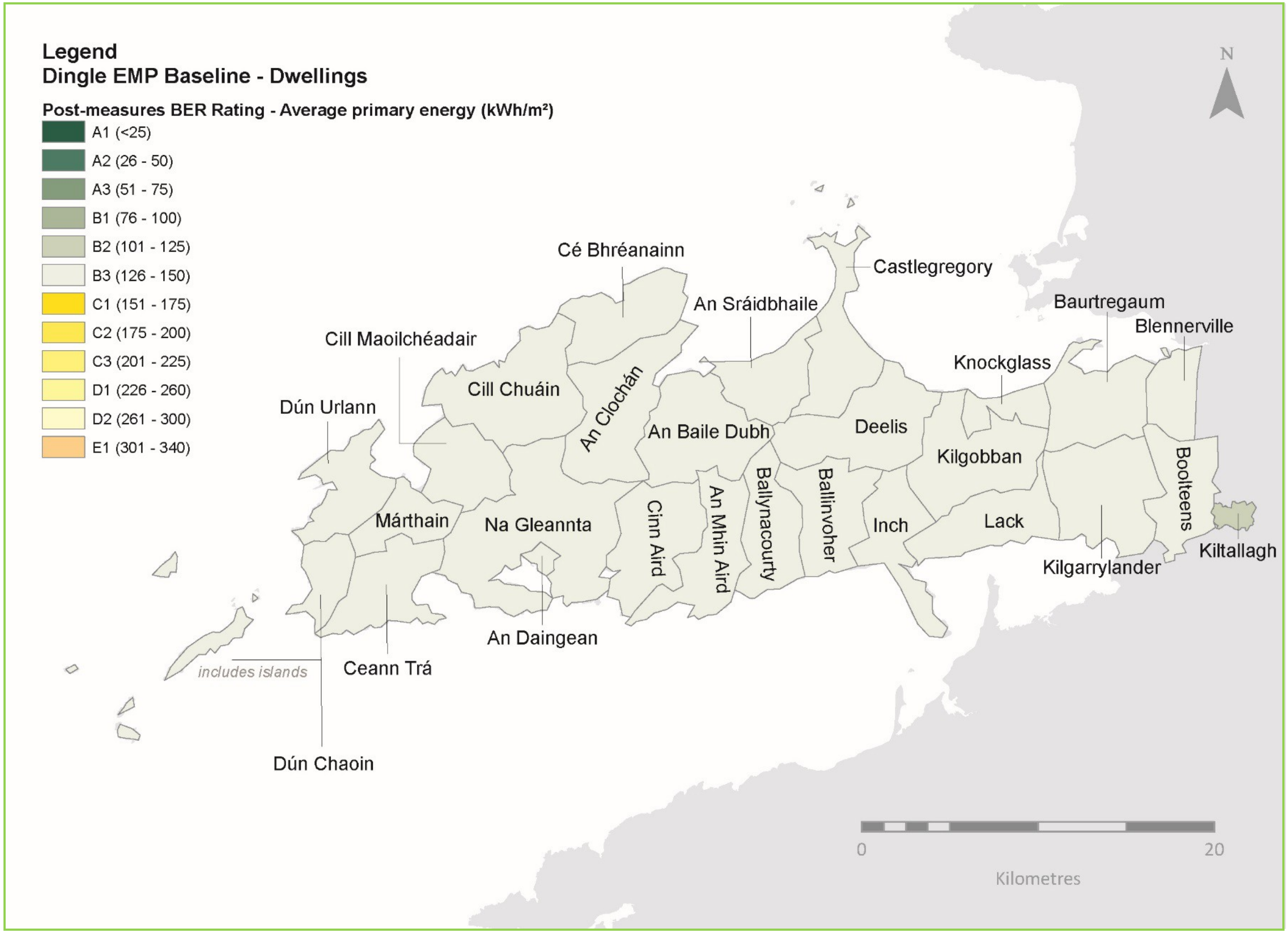
*GIS MAP 1 – TOTAL EXISTING DELIVERED ENERGY, BY ELECTORAL DIVISION (**DWELLINGS**)*



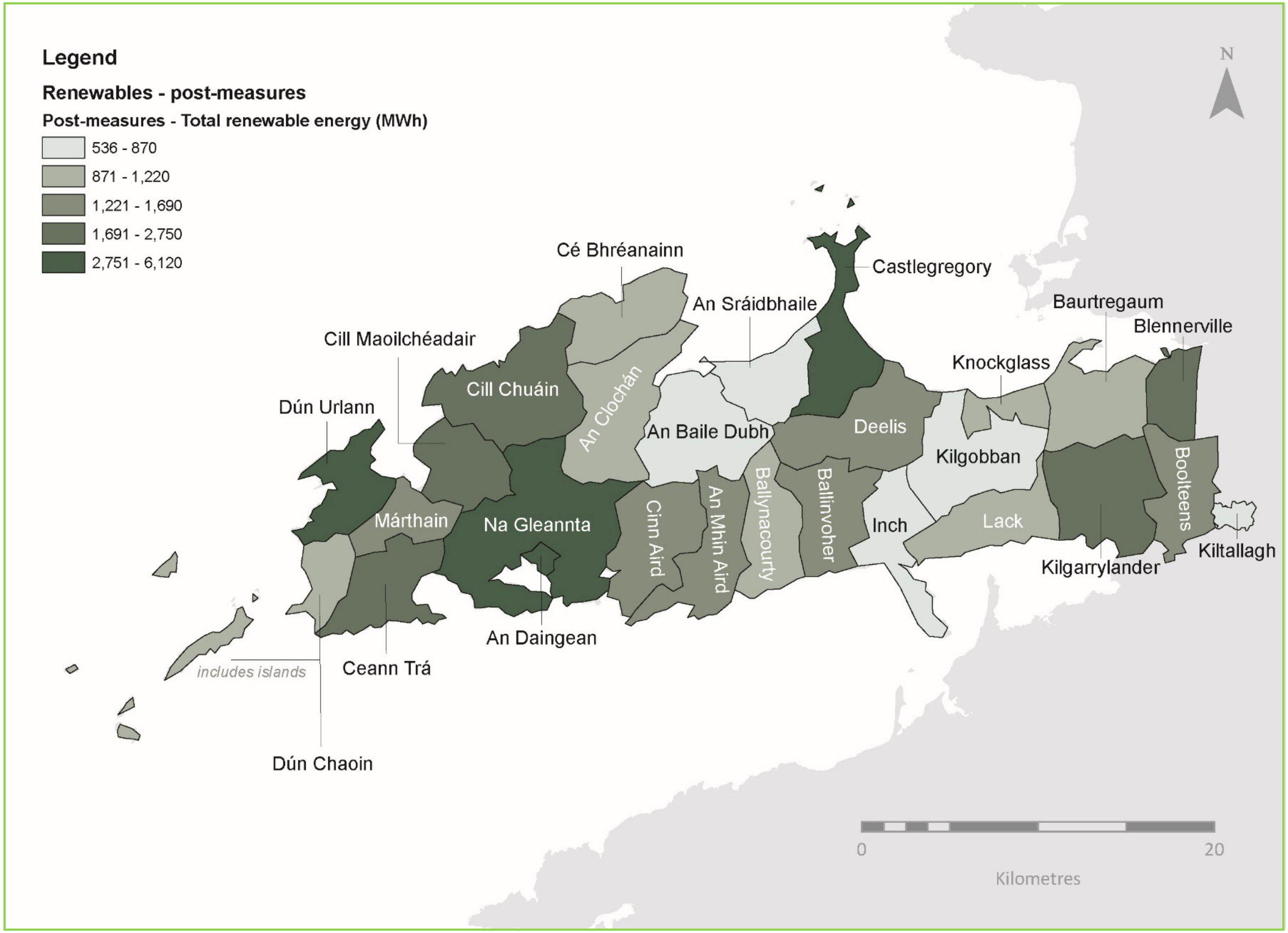
*GIS MAP 2 - AVERAGE EXISTING BER GRADE, BY ELECTORAL DIVISION (**DWELLINGS**)*



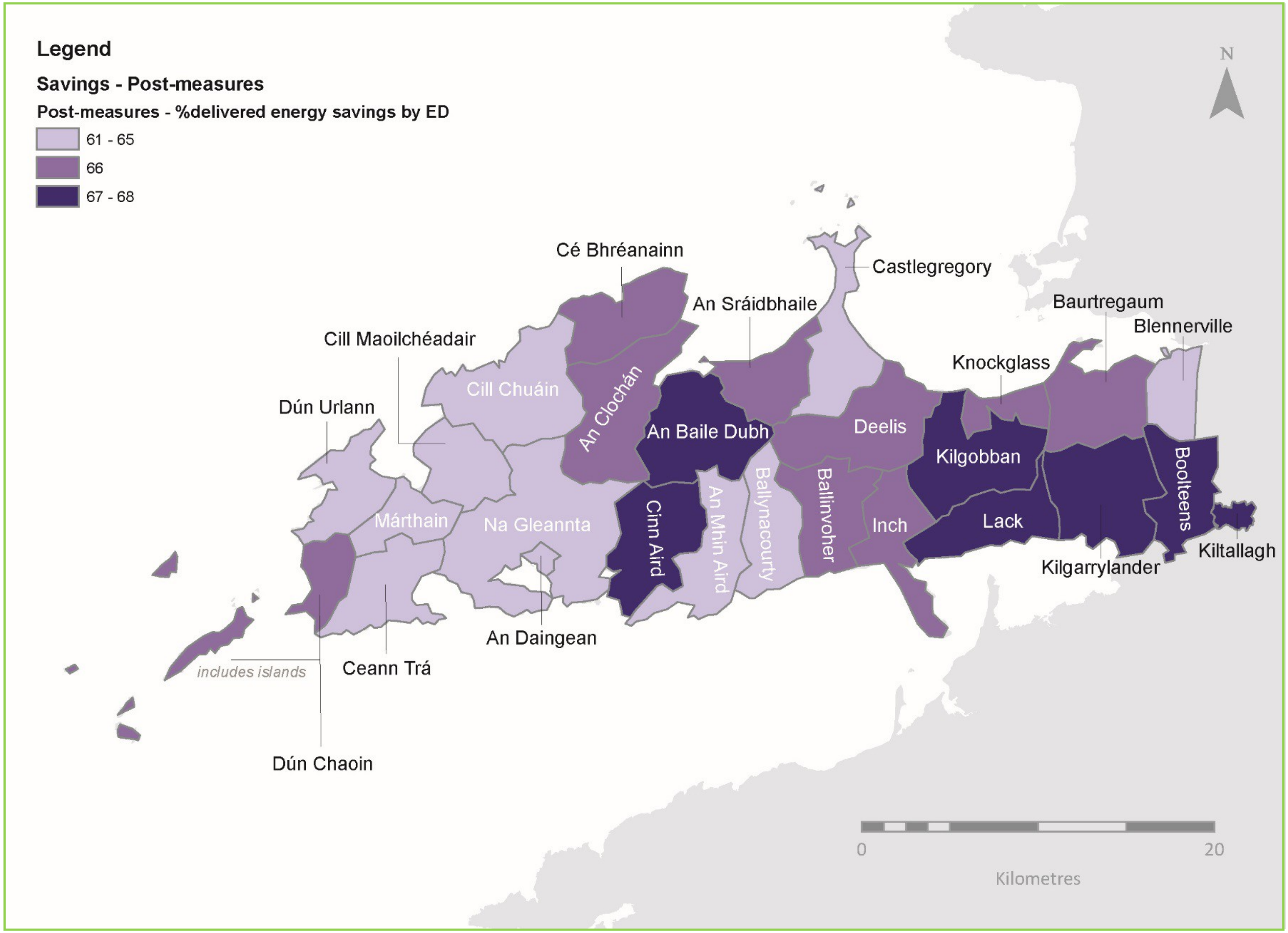
*GIS MAP 3 - TOTAL POST-RETROFIT DELIVERED ENERGY, BY ELECTORAL DIVISION **(DWELLINGS)***



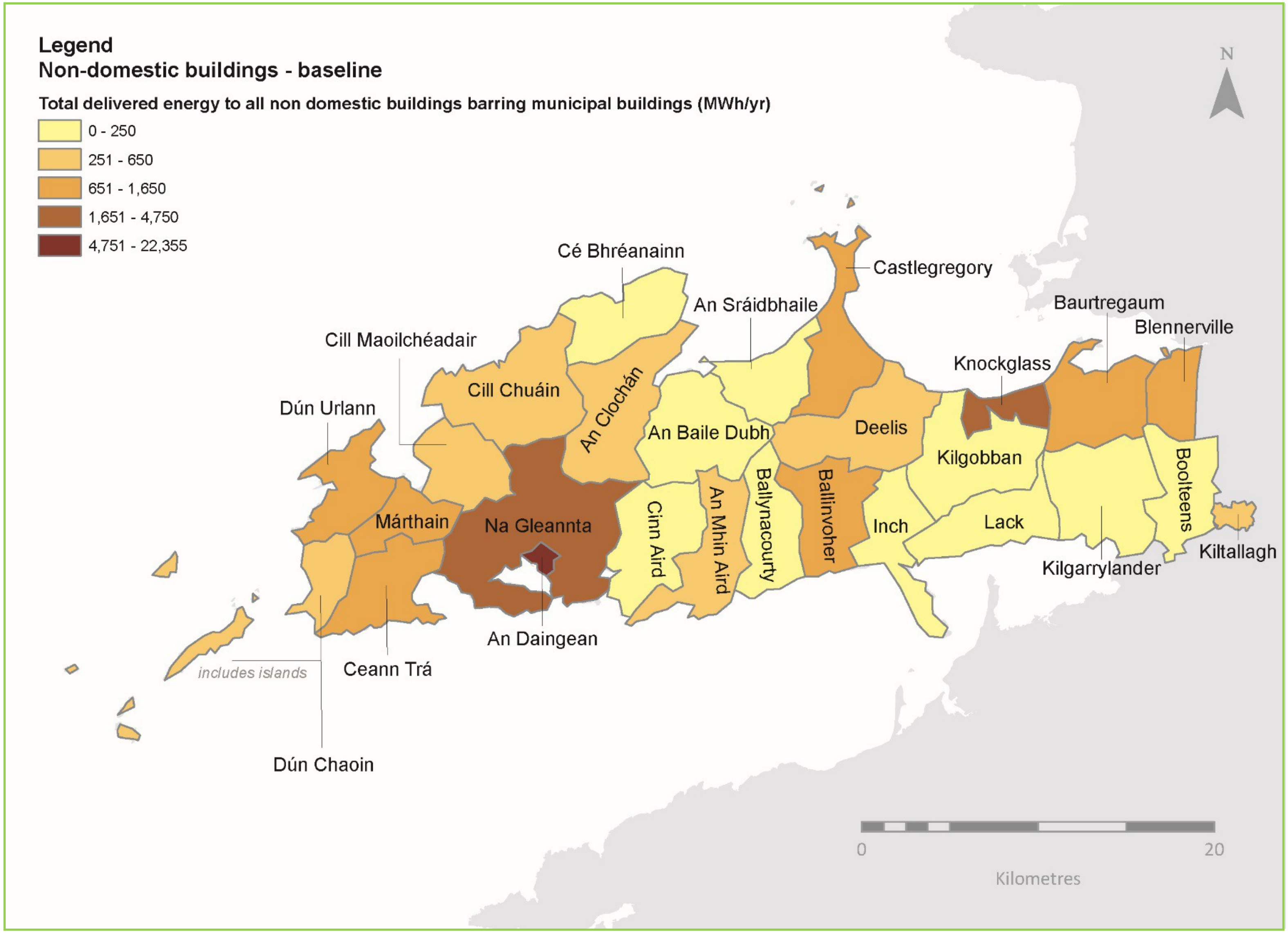
*GIS MAP 4 - AVERAGE POST-RETROFIT BER GRADE, BY ELECTORAL DIVISION (**DWELLINGS**)*



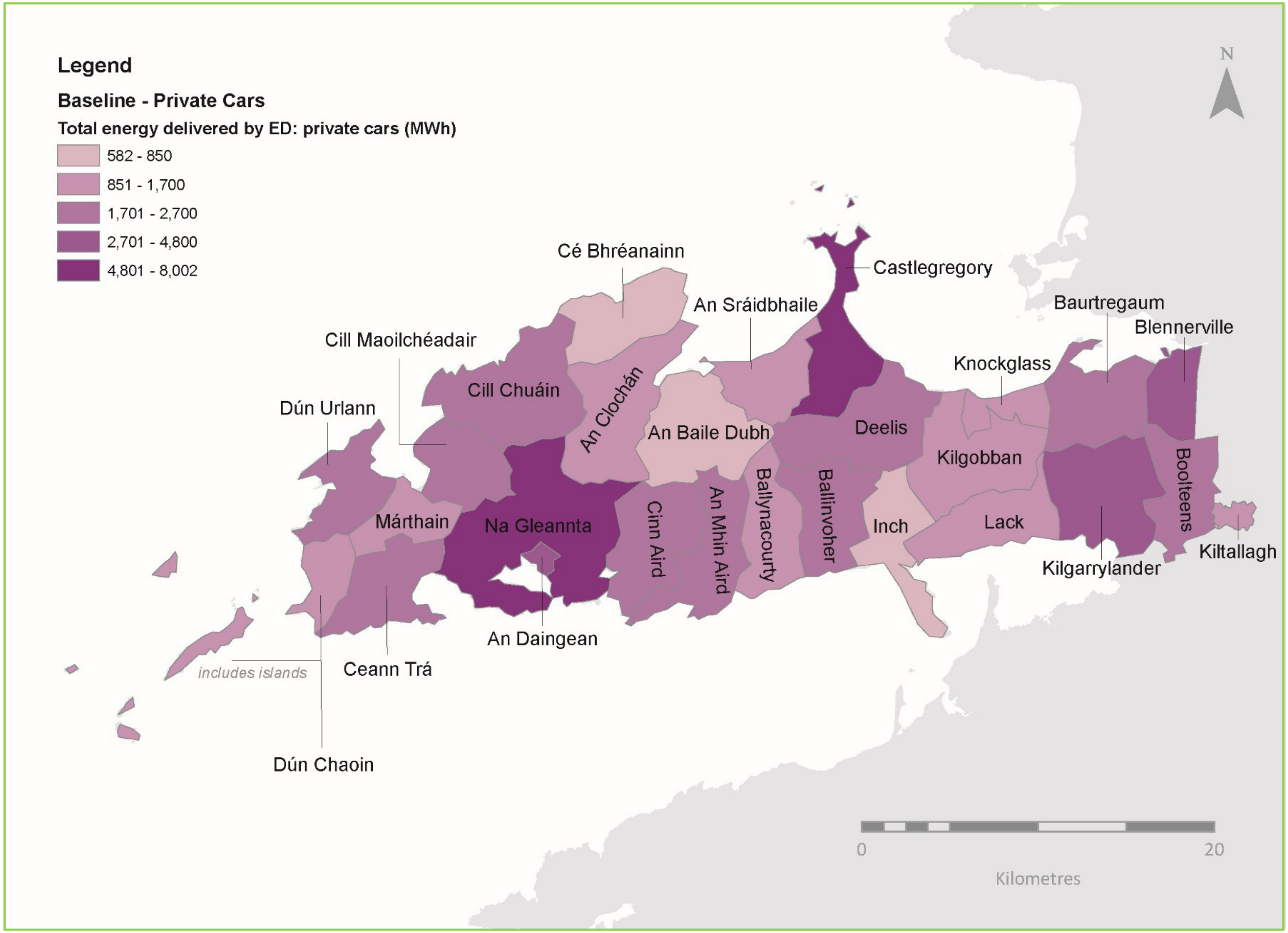
*GIS MAP 5– TOTAL POST-RETROFIT RENEWABLE ENERGY CONTRIBUTION, BY ELECTORAL DIVISION (**DWELLINGS**)*



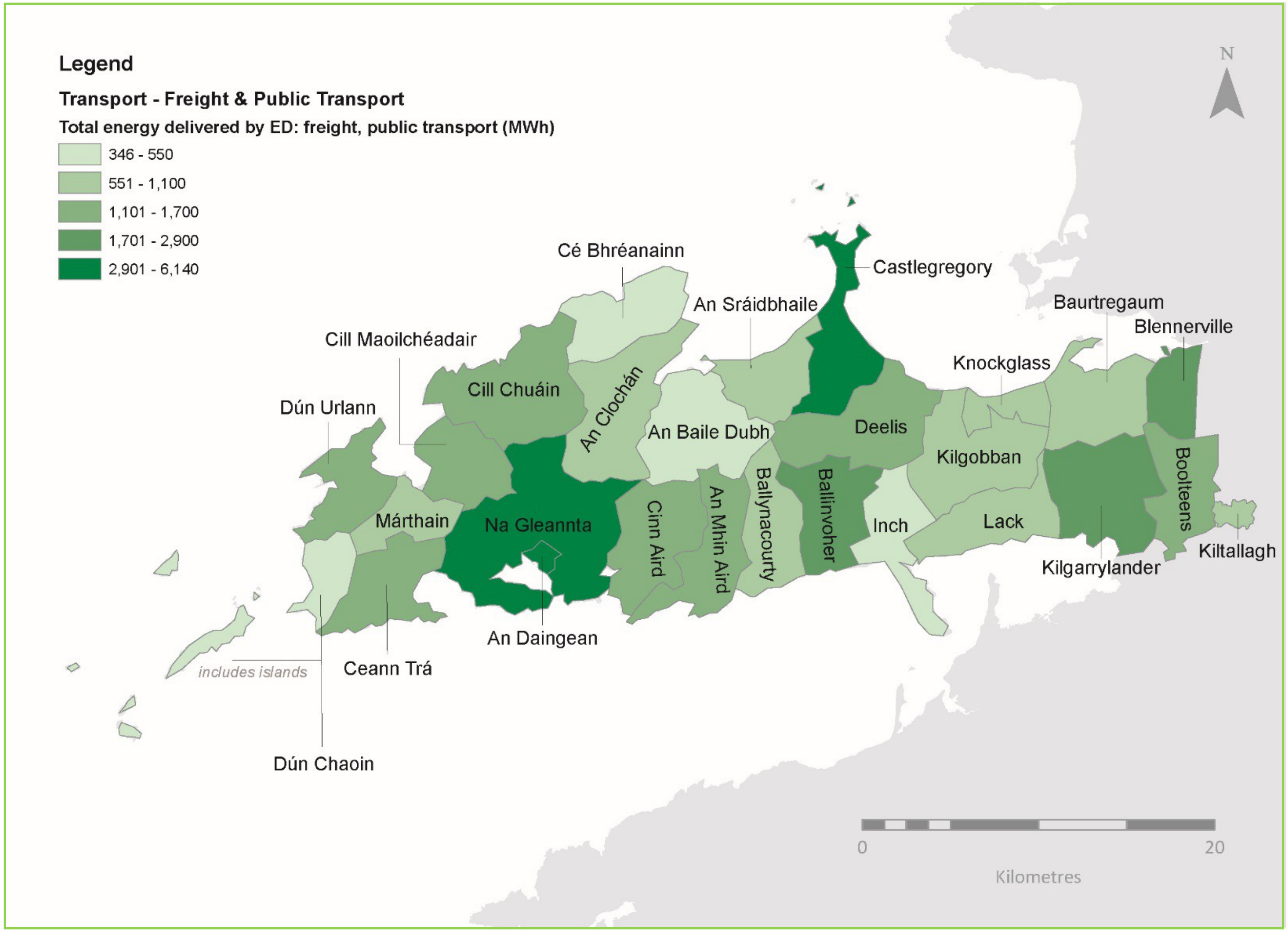
*GIS MAP 3 - POST-RETROFIT DELIVERED ENERGY SAVINGS (%), BY ELECTORAL DIVISION (**DWELLINGS**)*



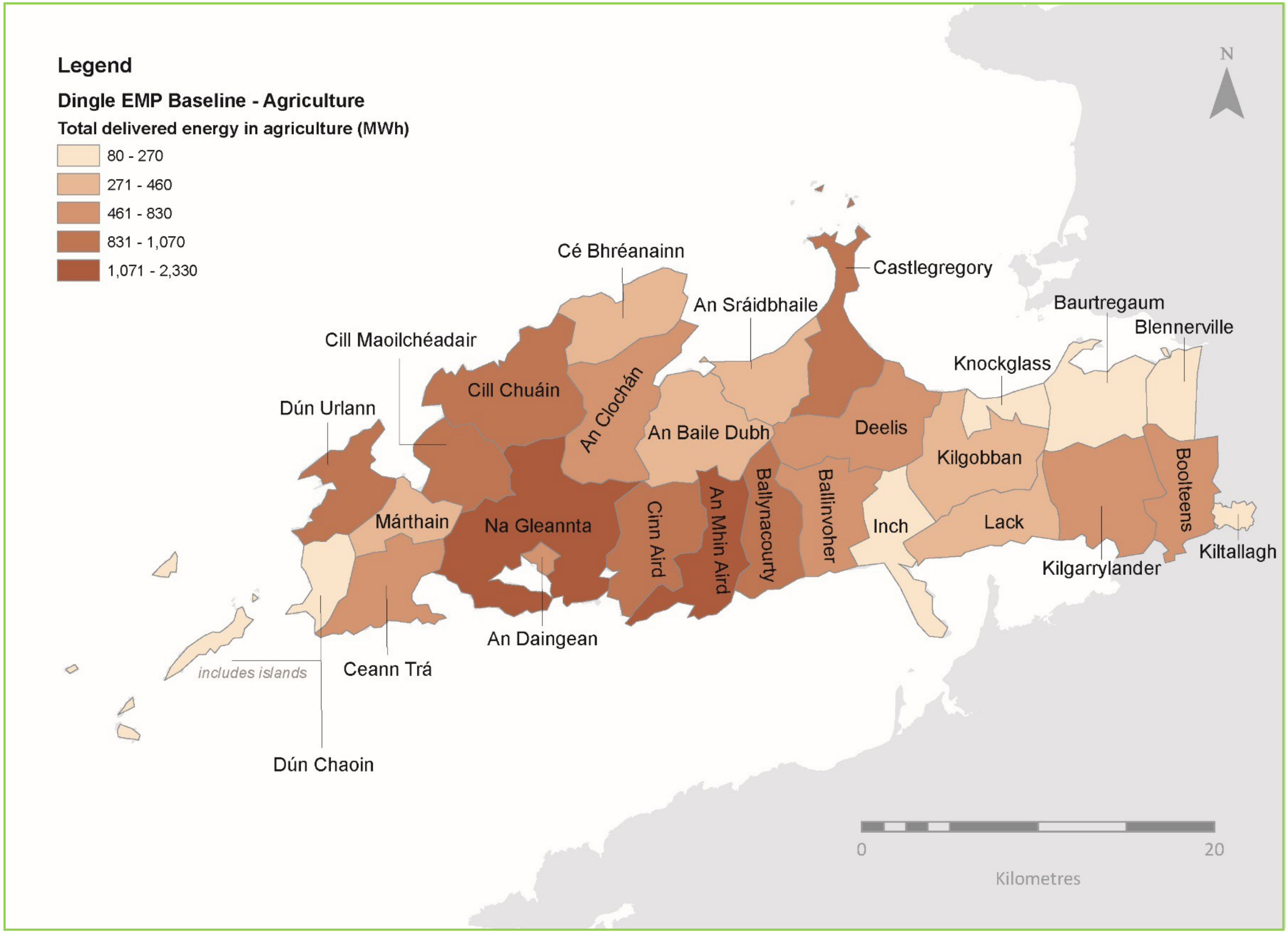
*GIS MAP 7 – TOTAL EXISTING DELIVERED ENERGY, BY ELECTORAL DIVISION (**NON-DOMESTIC BUILDINGS, EXCL MUNICIPAL BUILDINGS**)*



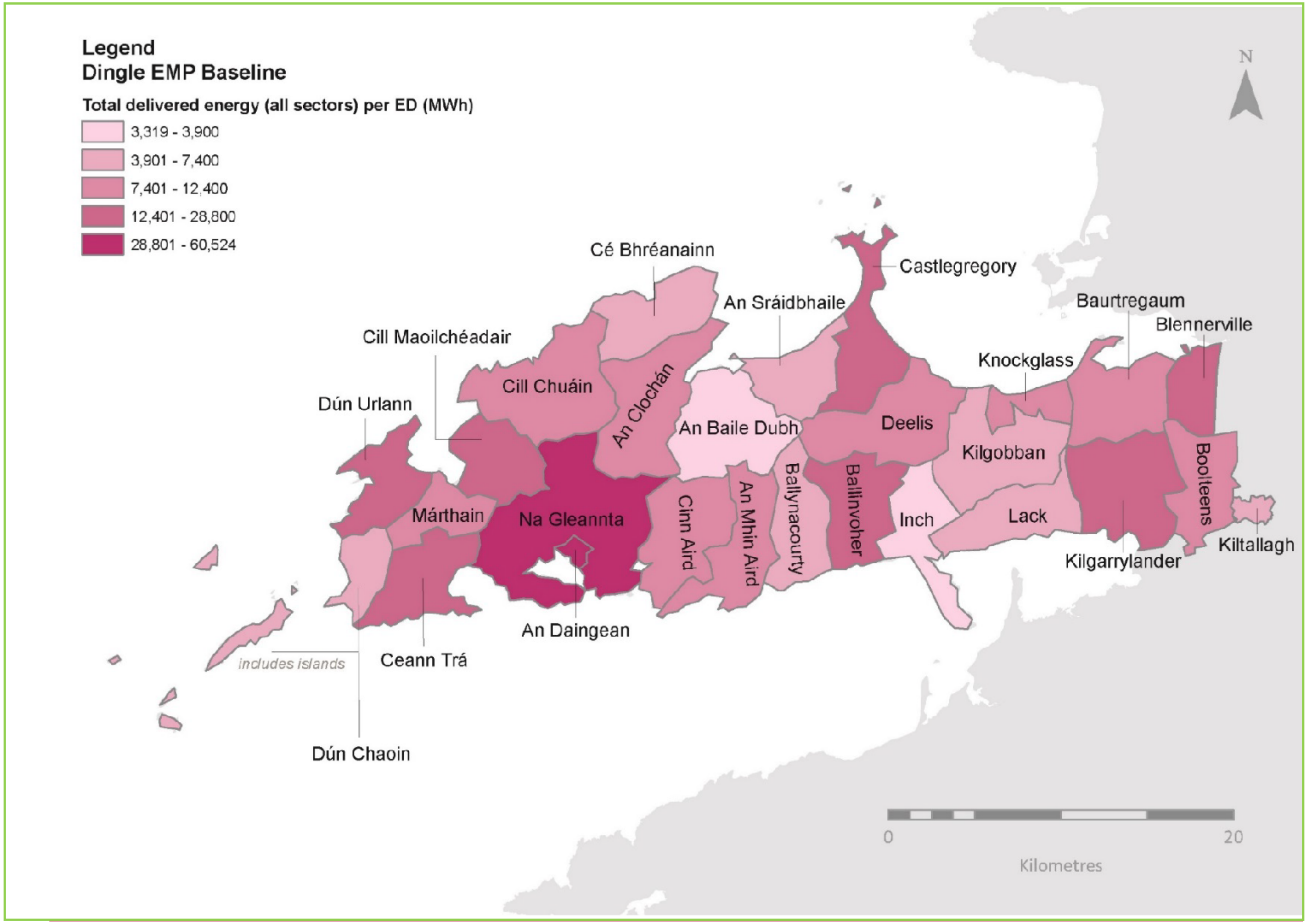
*GIS MAP 8 – TOTAL TRANSPORT DELIVERED ENERGY, BY ELECTORAL DIVISION (**PRIVATE CARS**)*



*GIS MAP 9 – TOTAL TRANSPORT DELIVERED ENERGY, BY ELECTORAL DIVISION (**FREIGHT, PUBLIC TRANSPORT**)*



*GIS MAP 10 – TOTAL DELIVERED ENERGY, BY ELECTORAL DIVISION (**AGRICULTURE**)*



GIS MAP 11 – TOTAL DELIVERED ENERGY, BY ELECTORAL DIVISION (**ALL SECTORS**)

5 Register of Opportunities

The following tables list the proposed actions under User Sector headings for the 2019-2030 period for Energy Demand Reduction and Renewable Energy Contribution respectively. In particular, we have set out a series of recommendations/proposals under the following sectors:

- ~ Residential
- ~ Non-Residential
- ~ Municipal and Local Authority
- ~ Fisheries and Agriculture
- ~ Transport

For further detail on the various sectoral measures, please refer to Sections 6 and 7.

ENERGY DEMAND REDUCTION ACTIONS	COST	PROJECTED ENERGY DEMAND REDUCTIONS (GWh/a)
RESIDENTIAL ACTIONS (2019-2030)		
1. Deployment of medium-depth energy retrofit of 75% of dwellings	€127.41M	81.2
NON-RESIDENTIAL ACTIONS (2019-2030)		
1. Deployment of energy retrofit measures to deliver 40% reduction in energy demand across entire non-residential sector	€25.73M	16..4
2. Deployment of solar thermal installations to meet 30% of domestic hot water needs	Incl	2.4
MUNICIPAL and LOCAL AUTHORITY ACTIONS (2019-2030)		
1. Replace all existing public lights (1,233 no.) with LED lighting (65% savings approx)	€0.658M	0.33
2. Reduce Co Council transport energy demand by 18% (see actions below)	€5.5k/yr	0.16
3. Reduce Co Council non-residential building energy demand by 40%	€63k	0.03
4. Reduce water services energy demand by 30%	€0.99M	0.43
FISHERIES and AGRICULTURE ACTIONS (2019-2030)		
1. 20% reduction in energy demand across entire sector	€3.55M	3.44
TRANSPORT ACTIONS (2019-2030)		
1. Deployment of EV's and CNG vehicles (cars, busses, trucks) (National Mitigation Plan, Tasks T3, T18, T19)	€605k/yr	8.77
2. Smart driving program across all transport sectors (National Mitigation Plan, Task T22)	€21.5k/yr	9.35

RENEWABLE ENERGY CONTRIBUTION ACTIONS	COST	PROJECTED RENEWABLE ENERGY CONTRIBUTON (GWh/a)
RESIDENTIAL ACTIONS (2019-2030)		
1. Deployment of heat pumps in 75% of dwellings (as part of medium energy retrofit)	Incl. in energy reduction measure above	36.34
2. Deployment of roof-top or ground-mounted PV and battery storage in 30% of dwellings (4.14kWp ea)	€25.23M	6.15
NON-RESIDENTIAL ACTIONS (2019-2030)		
1. Deployment of roof-top or ground-mounted PV to meet 30% of electricity needs (lighting, cooling, aux)	€7.07M	2.95
2. Deployment of solar thermal installations to meet 30% of domestic hot water needs	€8.92M	2.4
3. Deployment of biomass boilers to meet 20% of space heating needs	€0.29M	1.1
MUNICIPAL and LOCAL AUTHORITY ACTIONS (2019-2030)		
1. Deploy PV to meet 40% of reduced electricity demand	€1.32M	0.55
FISHERIES and AGRICULTURE ACTIONS (2019-2030)		
1. Deploy PV, battery storage to meet 20% of reduced electricity demand in agriculture sub-sector	€1.98M	0.64
TRANSPORT ACTIONS (2019-2030)		
1. Increase blending of biofuels in diesel and petrol from 5% (2016) to 11% (2030), per SEAI "National Energy Projections 2030). This is a State-led initiative – no intervention by Dingle SEC is required.	Cost Neutral	8.46
LARGE-SCALE ACTIONS (2019-2030)		
1. Deployment of 4 no. 4MW PV farms		16.34
2. Deployment of 4 MW AD facility		8

6 Commentary on Register of Energy Demand Reduction Opportunities

6.1 Residential

Energy Demand Reduction Action 1 – deployment of large-scale medium depth energy retrofit (as described in Section 3.2) of 75% of all residential stock.

Due to the fact that energy demand in this sector is particularly high, it offers by far the most potential for overall energy demand reduction in the study area. This sector is more conducive to the modelling of the impacts of energy retrofit measures on energy usage (as mentioned above, such impacts have been modelled using the RETROKIT software package); also, the availability of financial incentives (such as SEAI grants for pre-2006 dwellings and/or sale of energy credits) and mature market technologies facilitates ready roll-out of the required measures.

In particular, proposed medium-depth energy retrofits will include the following:

- ~ Wall insulation upgrade
- ~ Flat and sloping ceiling insulation upgrade
- ~ Air tightness measures, incl chimney draught limiter
- ~ Air-water heatpump, incl insulated DHW cylinder and full heating controls
- ~ Wood log stove (in lieu of open fire)
- ~ LED lighting

The retrofit analysis using RetroKit checks each individual dwelling measure-by-measure, within the medium depth retrofit scenario, to ensure that the measure is case-appropriate. The particular retrofit proposal does not apply individual measures unless they are appropriate. For example, it will not specify wall insulation for an already well insulated wall. As another example, if the dwelling already has low energy lighting, it will not be applied in the retrofit scenario for that dwelling. Therefore, if the same "medium retrofit" scenario is applied in RetroKit across all dwellings, an older dwelling would typically have more individual measures applied by RetroKit than a newer dwelling. This means that while baseline dwellings will start with varying BER grades, they will approach a similar BER grade as deeper retrofit measures are applied in the analysis carried out for this Energy Master Plan.

The estimated capital cost (at today's rates) of carrying out a medium-depth energy retrofit of 75% of all dwellings is €127.41M approx, without grant support (i.e.) €24,315 per dwelling approx. If grant funding is available for all of this retrofit work (at levels commensurate with current SEAI Community Grant levels available for pre-2006 dwellings[9]), the net energy retrofit cost would be €68.48M approx. This latter calculation is based on an assumed 75%:25% split between non-energy poor and energy-poor households.

[9] Significant SEAI grants are currently available for heat pump & PV installations for dwellings built up to 2010.

Whereas the CAP envisages a retrofit of 500,000 (25% approx) of the national dwellings stock to B2 BER grade (with heat pumps installed in 400,000 existing dwellings), this EMP proposes energy retrofit of 75% of dwellings within the study area to achieve the BER grades shown on the following table in those dwellings. This is more ambitious than achieving a B2 BER in only 25% of the dwelling stock.

Age Band	Average Projected Medium Retrofit BER Outcome (based on 75% of dwellings)
0 - 1970	C2
1971 - 1990	C1
1991 - 2000	C1
2001 - 2010	B3
2011 - 2017	B1

The foregoing measures have the potential to reduce 2016 energy demand in this sector by 44.6%.

While the 75% target is indeed challenging, the following should be kept in mind:

~ This level of ambition is required if the scale of energy savings ambition set out by Dingle SEC, and outlined in this report, are to be achieved.

~ The majority of the dwellings in the study area are currently heated by oil boilers. Oil boilers are no longer grant aided by SEAI, whereas heat pump grants are now in place alongside a robust set of installation standards and better insulation levels espoused by SEAI in their grant requirements.

~ Many of the boilers in the study area, even those installed in dwellings more recently, will need to be replaced during the period out to 2030. Boiler lifespan is estimated at 15 years according to CIBSE Guide M:2014 (Appendix 12A1). Further evidence of the 15-year lifespan of boilers is in the Technical Guidance Document to Part L from the Department of Housing, Planning and Local Government. Table 7 therein in respect of “major renovations” discusses replacing boilers that are more than 15 years old as being the cost optimal approach. Even if the lifespan is stretched out to 20 years, then houses constructed up to 2010 with boilers installed will be faced with updating their heating system by 2030, the target date detailed in this report. Heat pump installations, plus fabric upgrade where necessary, should be targeted in such cases rather than the BAU installation of fossil fuel boilers.

~ Consumer awareness and engagement initiatives to maximise the likelihood of low energy retrofit measures are essential.

(Please note that the modelled scenario, as shown on GIS Map 3 above, is prepared based on the longer-term ambition to retrofit all 100% of dwellings)

6.2 Non-Residential

Energy Demand Reduction Action 1 – deployment of large-scale energy retrofit measures to deliver 40% energy demand reduction in the non-residential stock. It is not possible to give a prescriptive quantitative proposal in respect of the number of buildings that require intervention, as there are aren't non-residential building archetypes or models to enable such an assessment. The required level of intervention will differ significantly from building to building. The non-residential case studies outlined in Appendix 8.3 below serve to illustrate the potential variations and considerations in bespoke retrofits.

A significant proportion of these properties are used in the hospitality/accommodation sector. Therefore, there is an opportunity to showcase exemplar projects, with a view to creating replicability. Unfortunately, this sector is less conducive than the residential sector to the modelling of the impacts of energy retrofit measures on energy usage. However, there is an availability of financial drivers to incentivize roll-out of the required measures such Accelerated Capital Allowances, Energy Efficiency Fund and SEAI Community Grants. Furthermore, the significant energy savings potential from this sector can induce additional financial incentives from energy suppliers through the Energy Efficiency Obligation Scheme. In addition, the upcoming implementation of Nearly Zero Energy Building (NZEB) Regulations for new-build and major renovations will act as a further strong driver towards increased mobilization of energy efficiency measures.

In particular, potential energy retrofit measures include the following:

- Wall and roof insulation upgrades
- Window, external door replacement
- Solar thermal domestic hot-water heating
- Air tightness measures
- Replacement of inefficient, end-of-life heat sources
- Low heat loss DHW storage cylinders
- Time and temperature heating controls
- LED lighting, with presence detectors where possible

The applicability of particular measures will be determined by factors such as building age/condition/use, opening hours, ratio between space-heating and DHW demands, potential for solar or internal heat gains and necessary illumination levels. As an example, deployment of solar panels for DHW purposes would not be an optimal intervention in the case of a school that typically has high winter opening hours and a relatively low DHW demand. However, deployment of solar panels for DHW purposes would be more likely to be a cost-effective intervention in the case of a hotel or guesthouse which has high summer DHW demand.

The total projected retrofit capital cost for the non-residential sector is €25.73M approx.

6.3 Municipal and Local Authority

Energy Demand Reduction Action 1 – Public Lighting: This action is based on the replacement of all existing 1,233 no. non-LED public lights, with LED public lighting. The projected energy savings and capex is deduced from TII/ARUP Report "Road Lighting – A New Era" Sept 2018. (It should be noted that the efficacy of LED lighting is currently an evolving discussion, with issues of concern being raised by in respect of possible adverse light pollution impacts on the environment, biodiversity and health).

Energy Demand Reduction Action 2 - Transport: Proposed 18% energy demand reductions, per Transport opportunity actions – see below.

Energy Demand Reduction Action 3 – Non-Residential Buildings: Proposed 40% energy demand reductions, per Non-Residential opportunity actions – see above.

Energy Demand Reduction Action 4 – Water Services: Irish Water have not published data on potential energy savings applicable to particular measures. However, it is submitted that the proposed 30% energy demand reductions can be achieved from the following potential actions:

~ Significant reduction in Unaccounted For Water (UFW) - networks and private-side
~ Significant reduction in consumer-driven service demand, by use of water conservation measures such as low-flow taps, rainwater harvesting, etc.
~ Water/Wastewater treatment: enhanced scheduling measures, appropriately designed plant capacities, upgrading of pumps and blowers with variable speed drives (VSD's), preventative maintenance schedules, review of plant power factors and control strategies, etc

The foregoing measures have the potential to reduce 2016 energy demand in this sector by 44%.

The total projected retrofit capital cost in the municipal and local authority sector is €1.85M approx.

6.4 Fisheries and Agriculture

Energy Demand Reduction Action 1: Proposed 20% energy demand reductions across the agriculture sub-sector, per the following possible actions:

~ Design and procurement of energy efficient equipment by the farming sector
~ Optimizing field operations, using task-appropriate machinery, discard unnecessary ballast, scheduling of equipment preventative maintenance, monitoring tyre pressures
~ Good grassland management practices (ref Farm Ambassador programme mentioned above)
~ Milk cooling: Use of pre-cooling using mains or well water
~ Water heating systems: Insulation of storage tanks and pipework; time/temperature controls; elimination of leaks and limescale coating; use of heat recovery from milk pre-cooling and cooling systems
~ Use of energy efficient lighting and controls
~ Use of high efficiency motors and variable speed drives, especially with vacuum pumps
~ Other measures specific to pig and poultry production farms

The total projected retrofit capital cost in the Agriculture Sub-Sector is €3.55M approx.

6.5 Transport

Energy Demand Reduction Action 1: This action is based on:

(i) The prediction that there will be 500,000 electric passenger cars in Ireland by 2030, per "SEAI National Energy Projections: 2030", scaled to project usage of electric and PHEV's in the study area, with EV efficiencies taken from SEAI published data. Whereas the CAP has been prepared on the basis of an upwardly revised stock projection of 840,000 passenger EV's by 2030, our projections are based on the more conservative estimate contained within the above recently published SEAI report.

(ii) The prediction that there will be 23,000 electric goods vehicles, 4,650 CNG freight vehicles, 450 electric buses and 1,500 CNG busses in Ireland by 2030, per "Alternative Fuels Infrastructure for Transport in Ireland: 2017 – 2030"", scaled to the study area. The calculations are based on assumptions that biofuels will be 11% of the diesel mix by 2030 and that CNG will be 20% renewable by 2030.

Energy Demand Reduction Action 2: This action is based on the prediction contained within the National Mitigation Plan, that eco-driving can reduce fuel usage by 5 – 10%. An average 10% reduction figure out to 2030 is assumed.

The foregoing measures have the potential to reduce 2016 energy demand in this sector by 18%.

The total projected capital cost in the Transport Sector is €7.52M approx.

No transport energy usage reductions based on modal shift are included for the study area given the rural setting of the territory. However, it is noted that Dingle Hub is at the forefront in endeavoring to create an enhanced public transport offering on the Dingle Peninsula (ref Sustainable Public Transport initiative mentioned above). If, in fact, a 10% modal shift can be achieved by 2030, we calculate that this will reduce the overall energy demand by a further 4.77GWh.

While fuel switching in transport will largely be market driven, it would be worth encouraging this at a local level by identifying and executing opportunities to increase take-up. For instance, focussing on the measures under "Electric Vehicle charging and parking facilities on the Dingle Peninsula" referenced in the "introduction and overview" section of this document.

It would also be useful to promote uptake of EVs locally by increasing awareness of SEAI EV grants, EV charger grants (e.g. through SEAI funded community projects), and help locals to avail of opportunities to test drive EVs at any upcoming energy awareness events to be hosted by the SEC.

<u>Summary – Energy Demand Reduction Measures</u>

The aggregated post-works energy demand across all sectors from the above measures amount to 228.18GWh, which represents a reduction of 34.96% on the 2016 energy demand of 350.82GWh.
The total projected capital cost = €165.99M

The above capital cost of €165.99M equates to a cost of €1.35 per annual kWh saved : this would be considered to be a better-than-average Value for Money (VfM) project proposition, as indicated from SEAI grant marking-scheme documentation[10].

[10] Community Grant Guidelines (metrics in terms of primary energy)

7 Commentary on Register of Renewable Energy Contribution Opportunities

7.1 Residential

Renewable Energy Contribution Action 1: This action is an intrinsic part of residential energy demand action no. 1 above (i.e.) deployment of heat pumps. The predicted % renewable energy contribution towards overall reduced energy demand based on standardized occupancy is 36.34%. Heating upgrades should be prioritized on permanently occupied dwellings to maximise earlier benefits.

Renewable Energy Contribution Action 2: This action is based on the proposal that 4.14 kW_p roof-top (or ground-mounted) PV panels and battery storage is deployed across 30% of all residences. PV installed in holiday homes should provide almost the same benefit as when installed in permanently occupied homes given that the yield is highest in summer, when occupancy is at its highest. This measure would provide 6.15GWh renewable contribution towards residential electricity demand (based on E/W orientation with modest over-shading).

The total projected capital cost for renewable energy installations in the Residential Sector is €25.23M approx. (Action 2 only)

7.2 Non-Residential

Renewable Energy Contribution Action 1: This action is based on the proposal that roof-top (or ground-mounted) PV panels be deployed to meet 30% of lighting, cooling and auxiliary electricity demand across this sector. Due to the extent of the measures required, it may be necessary for some large facilities to locate their PV off-site, as an individual or co-operative installation. This measure would provide 2.95GWh renewable contribution towards residential electricity demand.

Renewable Energy Contribution Action 2: This action is based on the proposal that roof-top solar thermal panels be deployed to meet 30% of domestic hot water (DHW) demand across this sector: solar thermal installations are particularly effective in the hospitality sector. This measure would provide 2.4GWh renewable contribution towards residential electricity demand. This solar thermal measure is also considered to be an energy efficiency measure and is included in energy demand reduction measures above.

Renewable Energy Contribution Action 3: This action is based on the proposal that existing fossil fuel heat sources be changed out and replaced by biomass-fueled boilers to meet 20% of space-heating demand across this sector. This measure would provide 1.1GWh renewable contribution towards renewable heat. (This measure has the potential to realise tariff payments, under the proposed Support Scheme for Renewable Heat (SSRH), of €38,620 pa to the property-owner). While biomass is considered to be a renewable fuel, it has to be sustainably sourced[11] as required in the SSRH.

[11] Ireland's Sustainable Energy Supply Chain Opportunity, SEAI 2014

The total projected capital cost for renewable energy installations in the Non-Residential Sector is €16.28M approx.

7.3 Municipal and Local Authority

Renewable Energy Contribution Action 1: This action is based on the proposal that Kerry Co Council and Irish Water meet 40% of their reduced electricity demand from deployment of photovoltaic panels.

Accordingly, the predicted % renewable energy contribution to the reduced municipal and local authority energy demand is 27.5%.

The total projected capital cost for renewable energy installations in the Municipal and Local Authority Sector is €1.32M approx.

7.4 Fisheries and Agriculture

Renewable Energy Contribution Action 1: This action is based on the proposal that the agriculture sub-sector deploys roof-top (or ground-mounted) photovoltaic panels and battery storage to meet 20% of their reduced electricity demand. Accordingly, the predicted % renewable energy contribution to the reduced fisheries and agriculture energy demand is 3.4%. Renewable energy is not considered relevant to the fisheries sub-sector to any significant extent.

The total projected capital cost for renewable energy installations in the Fisheries and Agriculture Sector is €1.98M approx.

7.5 Transport

Renewable Energy Contribution Action 1: This action is based on predictions, contained within "SEAI National Energy Projections: 2030", that biofuel share will increase to 11% by 2030. This is considered to be a cost-neutral measure, per Task T21 of the National Mitigation Plan.

The predicted renewable energy contribution to the reduced transport energy demand is 8.46GWh (10%).

7.6 Large-Scale Deployment

Renewable Energy Contribution Action 1: Deployment of 4 no. 4MW PV farms. According to SEAI[12], this would require 16-20 acres per PV farm. Initial assessments would indicate that one PV farm should be located adjacent to high electricity demand locations at Dingle Town and Castlegregory. Also, that the two other PV farms should be located close to the eastern boundary of the study area, near Blennerville and Castlemaine, to maximise potential for grid connectivity. This measure would provide 16.34GWh renewable contribution towards overall electricity demand in the study area. (This projected renewable contribution is calculated on

[12] SEAI: Frequently Asked Questions on Solar Photovoltaics

the basis of optimal orientation/inclination, no over-shading and annual solar radiation of 1074kWh/m^2). Projected capital cost of these measures will be dependent on site-specific civil and connectivity-related costs - these project costs cannot be confirmed until completion of feasibility studies in due course.

Renewable Energy Contribution Action 2: Deployment of 1 no. 4MW AD plant – a feasibility study on this proposal is currently underway (see Appendices below). This measure could potentially provide 8GWh renewable heat and electricity towards energy demand in the study area. Alternatively, the biogas can be upgraded to biomethane to provide transport fuel. The feasibility of this action very much depends on the availability of suitable feedstocks such as energy crops/grass silage, food wastes, animal slurries, etc. The projected capital cost of this measure will become apparent on completion of a feasibility study in due course (currently underway).

Summary – Renewable Contribution

The aggregated contribution from the above measures amount to 82.92GWh, which represents a contribution of 36.34% towards the reduced energy demand of 228.18 GWh.
The total projected capital cost = €44.81M

While the amount of proposed PV deployment outlined above is significant in scale, the potential to realise a virtual power plant (VPP) on the peninsula should be given serious consideration in due course. This technology is currently being trialed in an IERC STORENET project in the west of the peninsula (see Appendix 4 below).

This option should become technically feasible on completion of the roll-out of smart meters on the peninsula (it is projected that the national smart meter roll-out will be completed by end of 2024). VPP technologies will have the capability of opening up a number of positive tradable services to the network operator, as well as significantly reducing electricity costs for property-owners with no up-front costs for battery installation.

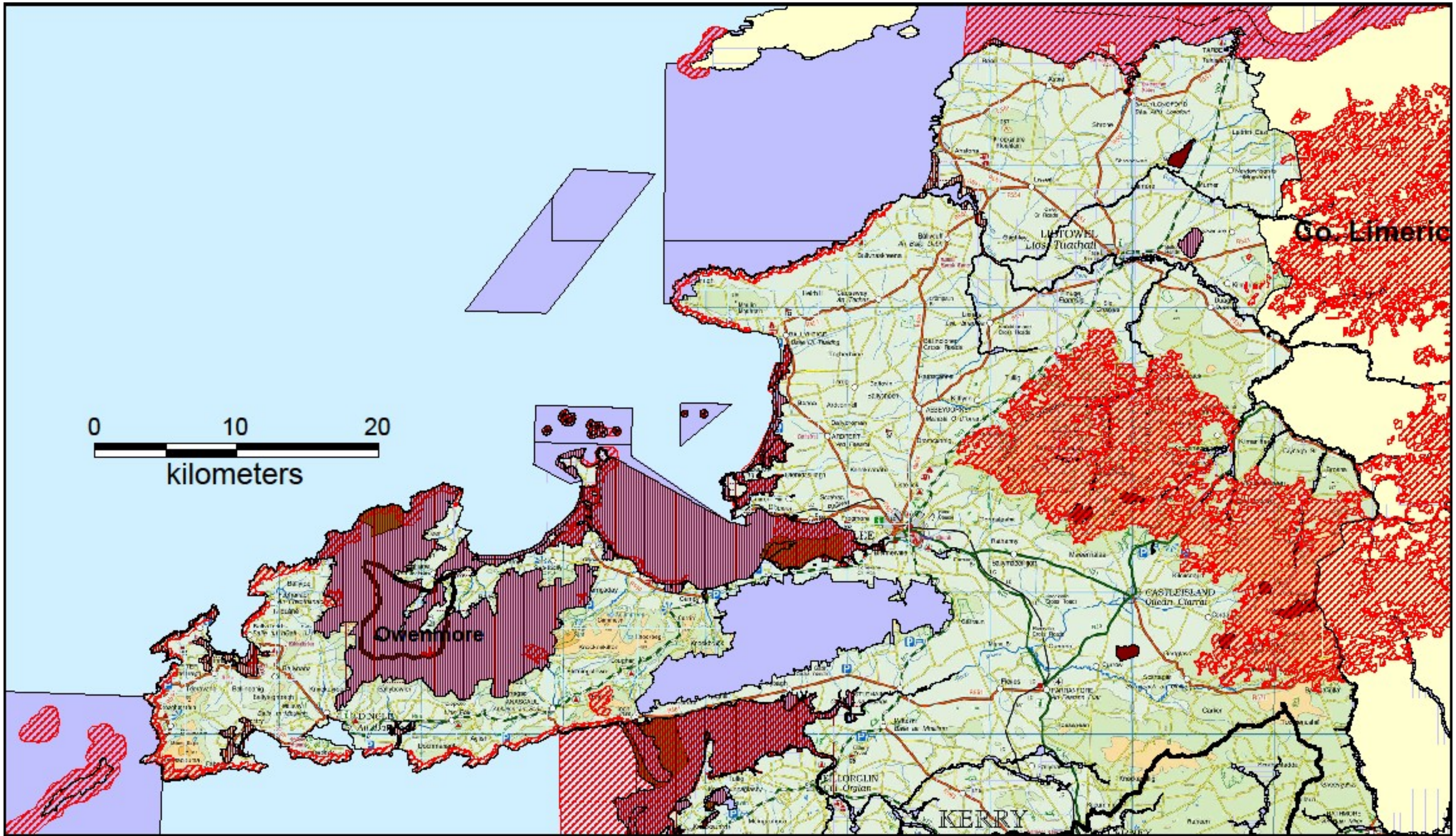
It is acknowledged that many of the proposed PV or other installations will not be exempt from planning permission. This is one of the several disruptive aspects of the required energy transition. While the land-take associated with PV farms is not inconsiderable, it must be borne in mind that the total projected renewable contribution to electricity in the study area by 2030 (excl AD) is only 33.1%, compared to the national ambition contained in CAP of 70%. This low level of RE-E penetration is due to the fact that there is currently little or no renewable generation capacity in the study area, and also the fact that the area is not suitable for deployment of grid-scale onshore wind power generation. The low RE-E penetration is further impacted by the high electrification of heat and transport going forward.

Summary – Energy Demand Reduction and Renewable Contribution Measures – Costs

The measures detailed above have the potential to reduce energy costs by 24.8%, based on 2016 prices (i.e.) a saving of €8.08M on a current (2016) energy spend of €38.46M. As stated above, it is notable that the combined effect on energy costs of delivering approx 35% in terms of both energy demand reduction and also renewable contribution is less than might be expected at 24.8%: this is because of the significant fuel source change from cheaper oil to much more expensive electricity

8 APPENDICES

8.1 APPENDIX 1: RESOURCE MAPS



Map 3a **Draft Renewable Energy Strategy**

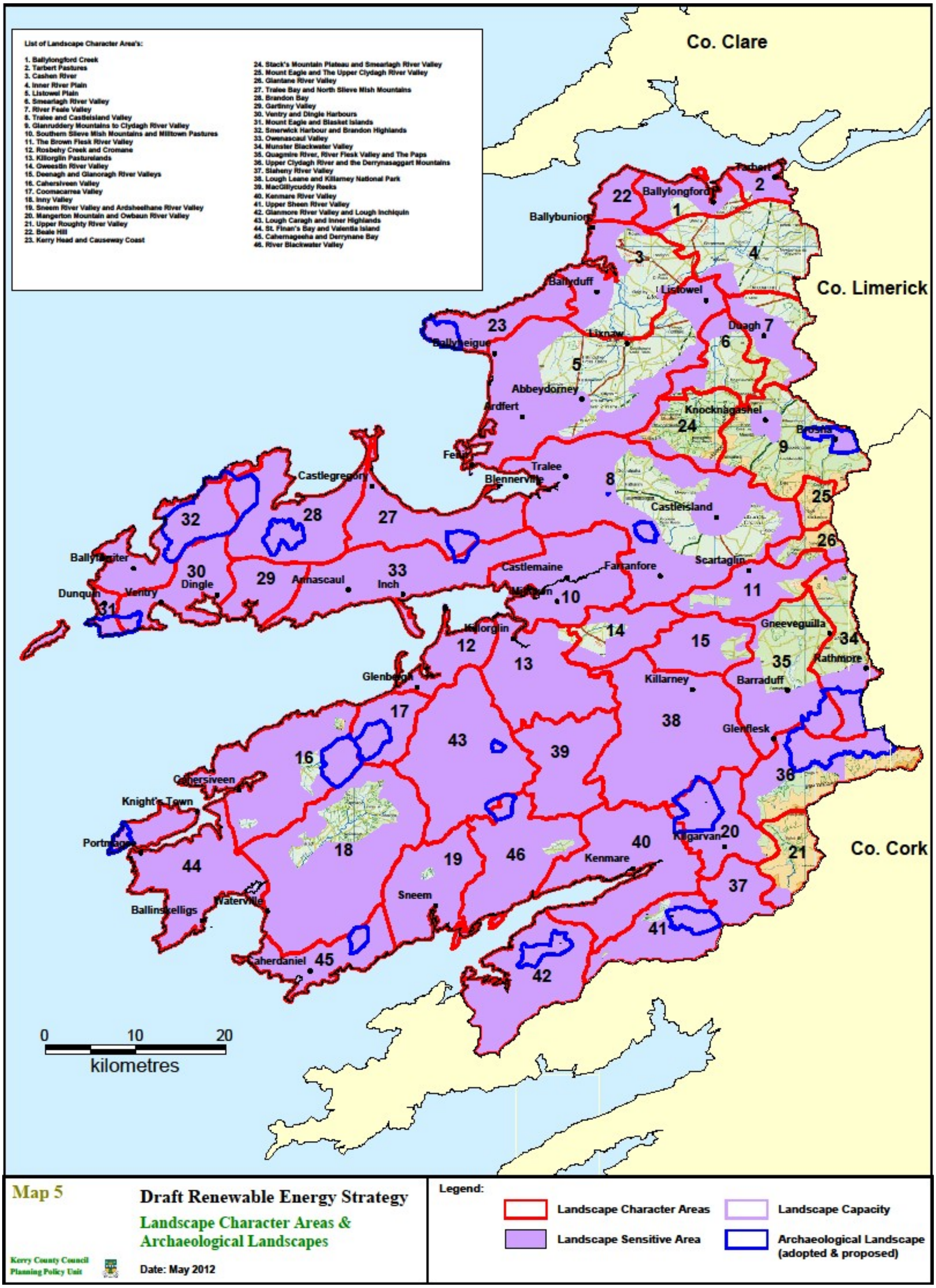
Ecologically Sensitive Areas

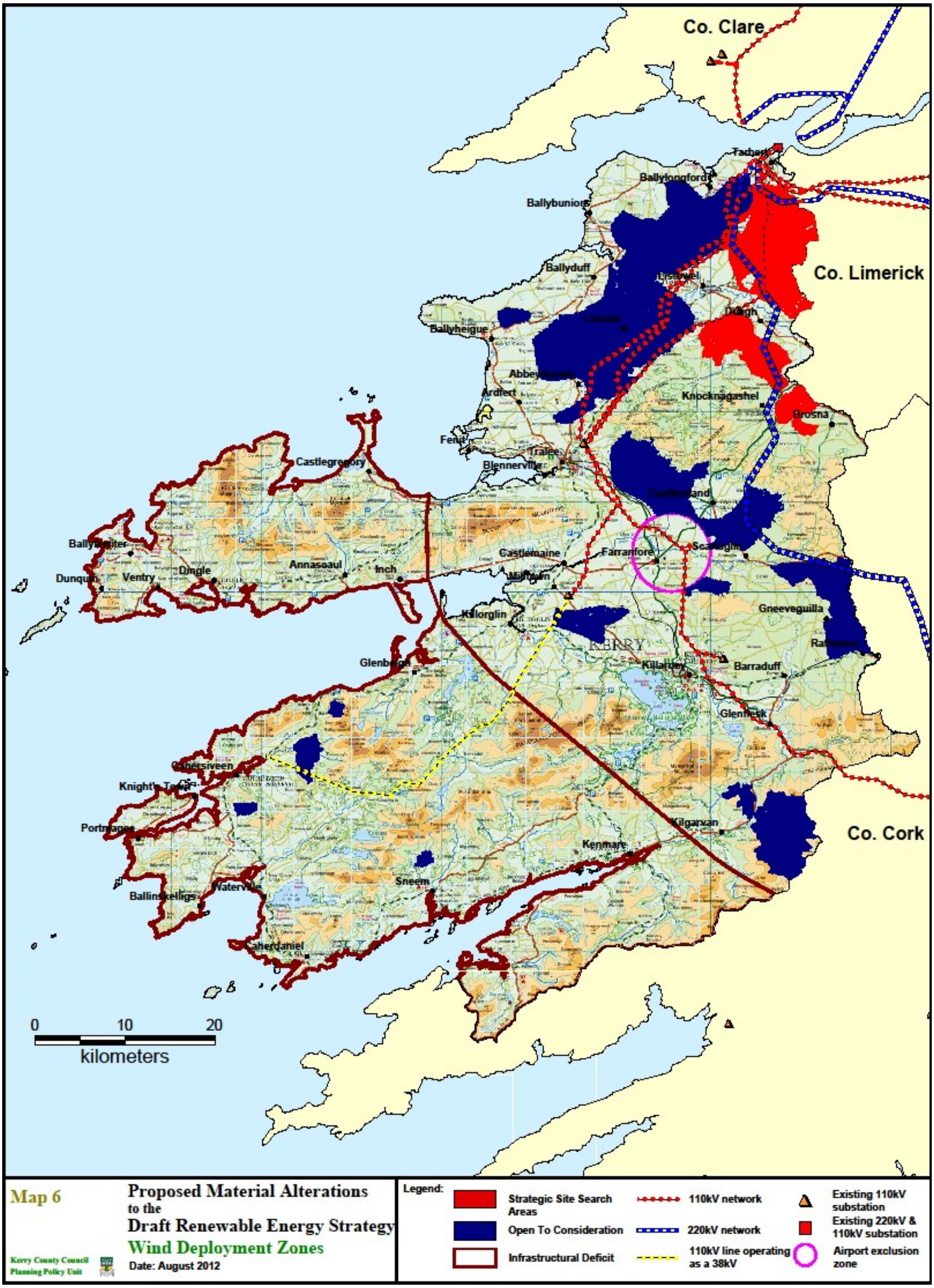
Kerry County Council
Planning Policy Unit

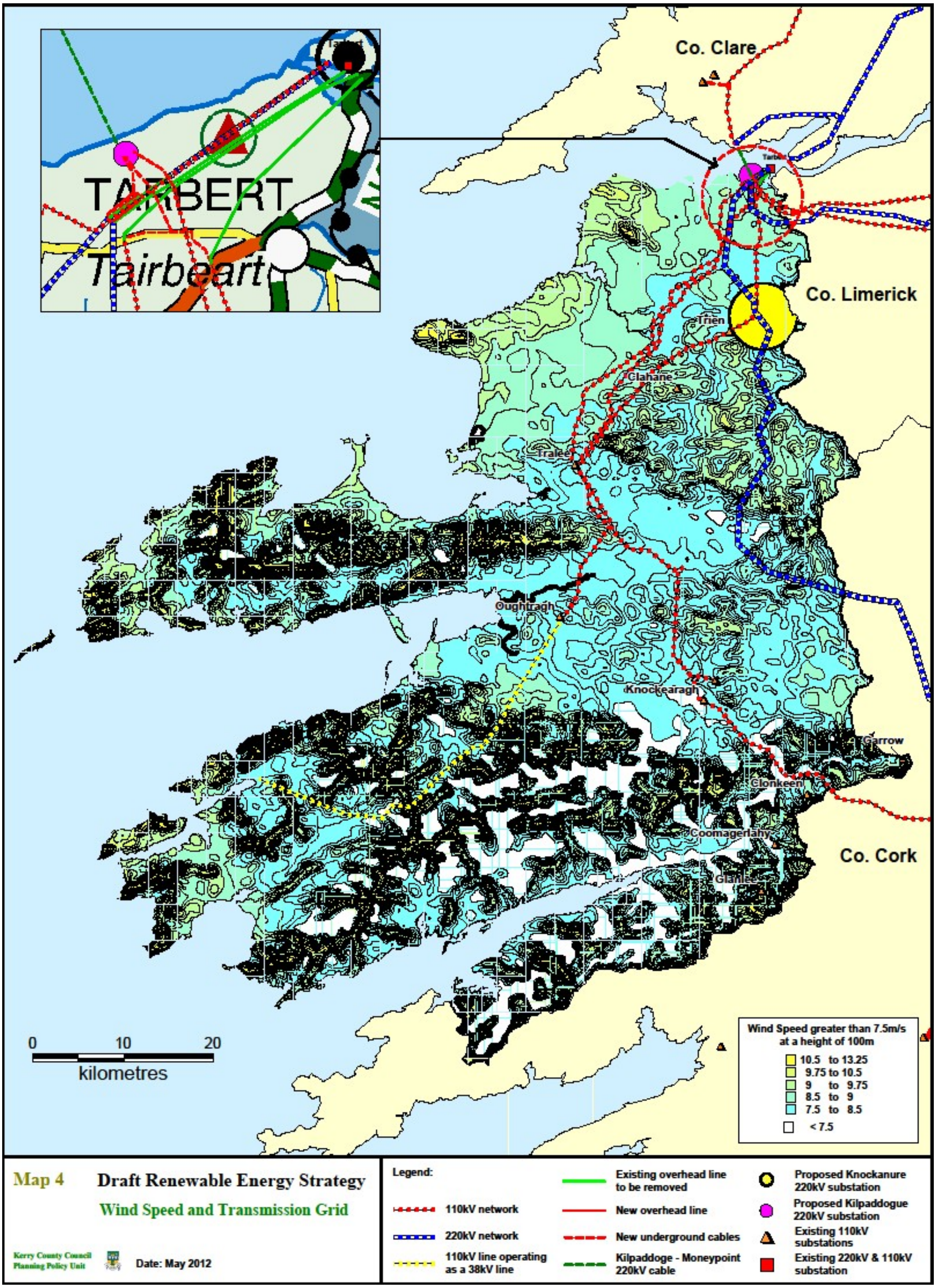
Date: May 2012

Legend:

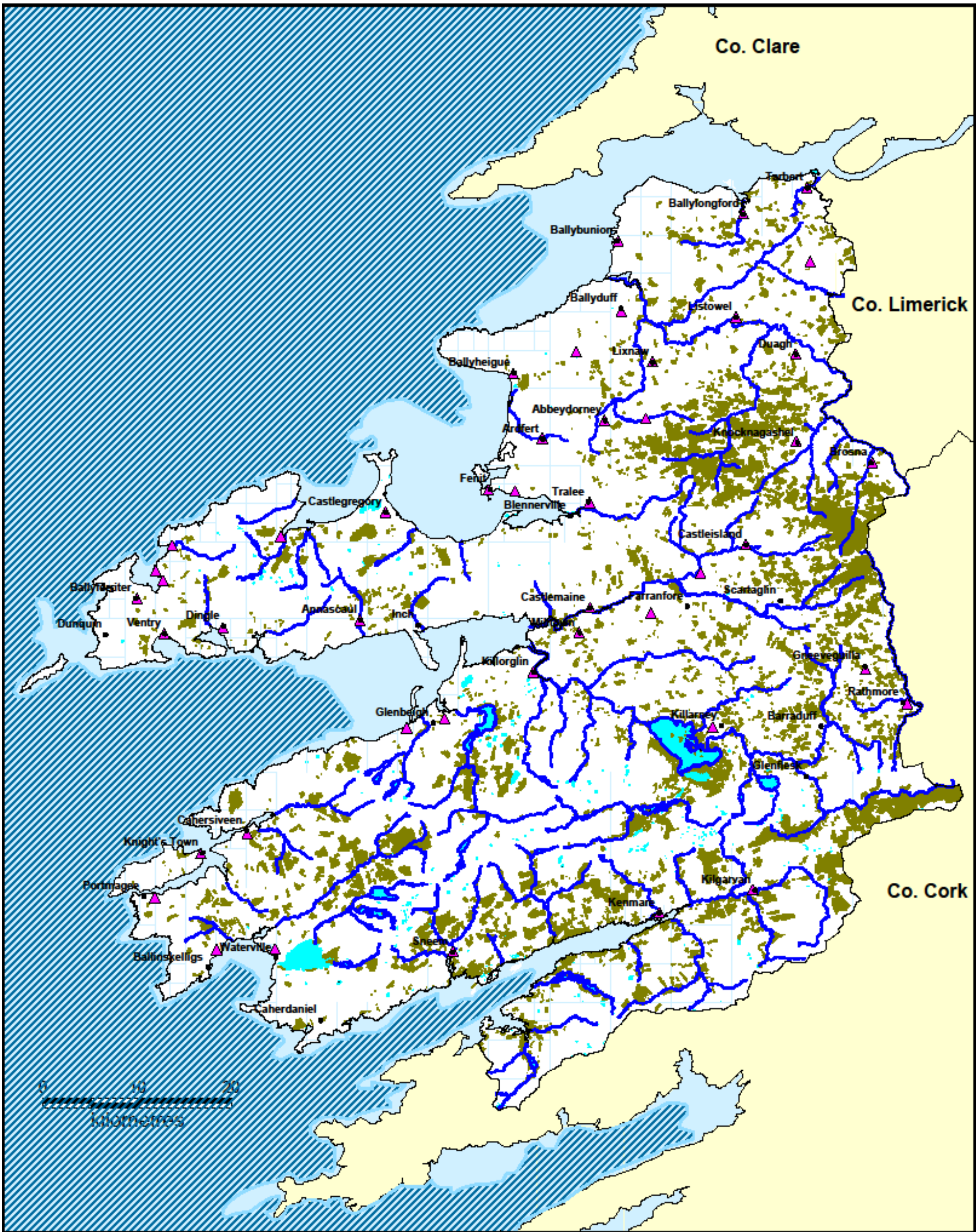
- Natural Heritage Area
- Special Area of Conservation
- Special Protected Area
- River/Lake Catchments
- Nature Reserves
- Proposed Natural Heritage Area


List of Landscape Character Area's:
1. Ballylongford Creek
2. Tarbert Pastures
3. Cashen River
4. Inner River Plain
5. Listowel Plain
6. Smearlagh River Valley
7. River Feale Valley
8. Tralee and Castleisland Valley
9. Glanruddery Mountains to Clydagh River Valley
10. Southern Slieve Mish Mountains and Milltown Pastures
11. The Brown Flesk River Valley
12. Rosbehy Creek and Cromane
13. Killorglin Pasturelands
14. Gweestin River Valley
15. Deenagh and Glanoragh River Valleys
16. Cahersiveen Valley
17. Coomacarrea Valley
18. Inny Valley
19. Sneem River Valley and Ardsheelhane River Valley
20. Mangerton Mountain and Owbaun River Valley
21. Upper Roughty River Valley
22. Beale Hill
23. Kerry Head and Causeway Coast
24. Stack's Mountain Plateau and Smearlagh River Valley
25. Mount Eagle and The Upper Clydagh River Valley
26. Glantane River Valley
27. Tralee Bay and North Slieve Mish Mountains
28. Brandon Bay
29. Gartinny Valley
30. Ventry and Dingle Harbours
31. Mount Eagle and Blasket Islands
32. Smerwick Harbour and Brandon Highlands
33. Owenascaul Valley
34. Munster Blackwater Valley
35. Quagmire River, River Flesk Valley and The Paps
36. Upper Clydagh River and the Derrynasaggart Mountains
37. Slaheny River Valley
38. Lough Leane and Killarney National Park
39. MacGillycuddy Reeks
40. Kenmare River Valley
41. Upper Sheen River Valley
42. Glanmore River Valley and Lough Inchiquin
43. Lough Caragh and Inner Highlands
44. St. Finan's Bay and Valentia Island
45. Cahernageeha and Derrynane Bay
46. River Blackwater Valley
Co. Clare
Co. Limerick
Co. Cork
Ballylongford
Tarbert
Ballybunion
Listowel
Ballyduff
Lixnaw
Duagh
Ballyheigue
Abbeydorney
Ardfert
Knocknagashel
Brosna
Fenit
Tralee
Blennerville
Castlegregory
Castleisland
Ballyferriter
Dunquin
Ventry
Dingle
Annascaul
Inch
Castlemaine
Farranfore
Scartaglin
Milltown
Killorglin
Gneeveguilla
Rathmore
Glenbeigh
Killarney
Barraduff
Glenflesk
Cahersiveen
Knight's Town
Portmagee
Kilgarvan
Kenmare
Sneem
Waterville
Ballinskelligs
Caherdaniel
0
10
20
kilometres
Map 5
Draft Renewable Energy Strategy
Landscape Character Areas &
Archaeological Landscapes
Kerry County Council
Planning Policy Unit
Date: May 2012
Legend:
Landscape Character Areas
Landscape Capacity
Landscape Sensitive Area
Archaeological Landscape
(adopted & proposed)


Co. Clare
Co. Limerick
Co. Cork
Tarbert
Ballylongford
Ballybunion
Ballyduff
Ballyheigue
Ardfert
Fenit
Knocknagashel
Brosna
Castlegregory
Tralee
Blennerville
Ventry
Dingle
Annascaul
Inch
Castlemaine
Farranfore
Killorglin
KERRY
Gneeveguilla
Killarney
Barraduff
Glenbeigh
Glenflesk
Knight's Town
Portmagee
Kilgarvan
Kenmare
Sneem
Ballinskelligs
Waterville
0
10
20
kilometers
Map 6
Proposed Material Alterations
to the
Draft Renewable Energy Strategy
Wind Deployment Zones
Kerry County Council
Planning Policy Unit
Date: August 2012
Legend:
Strategic Site Search Areas
Open To Consideration
Infrastructural Deficit
110kV network
220kV network
110kV line operating as a 38kV
Existing 110kV substation
Existing 220kV & 110kV substation
Airport exclusion zone



TARBERT
Tairbeart
Co. Clare
Co. Limerick
Co. Cork
Trien
Clahane
Tralee
Oughtragh
Knockearagh
Garrow
Clonkeen
Coomagerlahy
Glanlee
0
10
20
kilometres
Wind Speed greater than 7.5m/s at a height of 100m
10.5 to 13.25
9.75 to 10.5
9 to 9.75
8.5 to 9
7.5 to 8.5
< 7.5
Map 4
Draft Renewable Energy Strategy
Wind Speed and Transmission Grid
Kerry County Council Planning Policy Unit
Date: May 2012
Legend:
110kV network
220kV network
110kV line operating as a 38kV line
Existing overhead line to be removed
New overhead line
New underground cables
Kilpaddoge - Moneypoint 220kV cable
Proposed Knockanure 220kV substation
Proposed Kilpaddogue 220kV substation
Existing 110kV substations
Existing 220kV & 110kV substation



Map 2 **Draft Renewable Energy Strategy**

Natural, Waste Water & Ocean Resources

Kerry County Council
Planning Policy Unit

Date: May 2012

Legend:
- Wind speed >7m/s at 100m above mean sea level & Wave Power 20kW/mWC
- Wind speed >7m/s at 100m above mean sea level
- Forestry
- Lakes
- Rivers
- Waste water treatment plant

(Note: Wind speed & Wave Power based on the Draft Offshore Renewable Energy Development Plan 2010)

8.2 APPENDIX 2 – DOMESTIC CASE STUDIES

DINGLE SEC ENERGY MASTER PLAN DOMESTIC CASE STUDY 1

– DWELLING AT BALLYFERRITER, CO KERRY

Date of Survey: 22/5/19
Age of Original Dwelling: 100 years old approx; original dwelling extensively renovated in 2007 incl replacement floor (incl under-floor heating) and window replacement; original dwelling re-roofed in 2017; rear single storey extension constructed in 2007.
Brief Description of Dwelling: West-facing, traditional 2-storey house (95m2), with rear single storey extension (50m2)
Condition of Dwelling: Generally excellent
Main Walls: Original dwelling – 400mm mass concrete; extension – 300mm cavity
Roof Details: Flat ceiling, main roof (200mm insulation); flat ceiling, extension (100mm insulation); sloping ceiling, extension (insulation unknown)
External Joinery: PVC doors, PVC 12mm double-glazed windows, with 2 no. Velux roof lights to rear extension
Primary Heating: Oil-fired internal boiler central heating, underfloor heating on ground floor, radiators on first floor, time-clock, room stat on ground floor
Secondary Heating: Wood burning stove
DHW Heating: Same oil-fired boiler, with 245L thermal store

General Comment: It is would appear that a combination of oil boiler and underfloor heating is not appropriate in this case. The client also is not happy with current heating oil consumption and associated costs.

PRE-WORKS

Heat Loss Indicator = 3.65 W/Km^2
Estimated Primary Energy Consumption (excl appliances): 313.36 kWh/m^2/yr (E1 BER Rating)
Estimated Delivered Energy (Space/DHW Heating, Oil) (79% eff. boiler): 33,925 kWh/yr
Estimated Delivered Energy Cost (Space/DHW Heating, Oil) (ditto boiler, €0.1037/kwh): €3,518/yr
Actual Delivered Energy Cost 2018 (Space Heating/DHW, Oil) (ditto boiler, €0.864/L): €3,381/yr

PROPOSED BUILDING ENERGY RETROFIT WORKS

~ Internal wall insulation (114.22m^2) to original walls: improving wall U value from 2.20 W/m^{2}K to 0.32 W/m^{2}K (using 60mm PIR insulation, conductivity 0.022 W/mK)
~ Apply air-tightness measures (to deliver air-tightness test result of < 0.25 ac/h)
~ Install air-to-water heat pump, incl radiator replacement to first floor
~ Fit energy-savings bulbs throughout

POST-WORKS

Heat Loss Indicator = 1.97 W/Km²

Estimated Primary Energy Consumption (excl appliances): 84.51 kWh/m²/yr (B1 BER Rating)
Estimated Delivered Energy (Space/DHW Heating, electricity) (air-water heat pump): 4,007 kWh/yr
Estimated Delivered Energy Cost (Space/DHW Heating, electricity) (ditto heat pump, €0.2307/kwh): €924/yr
Estimated Reduction in Secondary Heating Delivered Energy Cost (wood log stove €0.06/kwh est): €132/yr
Estimated Reduction in Lighting Delivered Energy Cost (676kWh x €0.2307/kwh est): €156/yr
Estimated Post-Works Delivered Energy Cost Reduction: €2,638/yr

CAPITAL COST ANALYSIS

Estimated Capital Cost (incl VAT): €29,440 (No Grant)
Estimated Annual Energy Cost Savings: €2,638
Simple Payback Period: 11.2 years

Estimated Capital Cost (incl VAT): €19,136 (35% Grant)
Estimated Annual Energy Cost Savings: €2,638
Simple Payback Period: 7.3 years

NOTE 1: Capital costs above are estimated only; these figures need to be confirmed by competitive quotations before final consideration of the retrofit measures proposed.
NOTE 2: SEAI Community Grants of up to 35% max are available for residential, non energy-poor dwellings. Grant eligibility is considered on a case-by-case basis, and as part of an overall community SEC submission.
NOTE 3: Fuel prices are taken from SEAI Fuel Cost Comparison (Jan 2019).
NOTE 4: Above calculations are based on DEAP software, with associated standard occupancy and heating schedule assumptions.

DINGLE SEC ENERGY MASTER PLAN DOMESTIC CASE STUDY 2

– DWELLING AT CASTLEGREGORY, CO KERRY

Date of Survey: 22/5/19
Age of Original Dwelling: Constructed 2005.
Brief Description of Dwelling: North-facing, bungalow (176m2).
Condition of Dwelling: Generally excellent
Main Walls: Cavity walls, bonded-bead cavity-fill insulation
Roof Details: Flat ceiling, (300mm insulation); living room sloping ceiling (insulation unknown)
External Joinery: PVC 12mm double-glazed windows.
Primary Heating: Oil-fired internal condensing boiler central heating, radiators, no time and temperature controls
Secondary Heating: Solid fuel stove
DHW Heating: Same oil-fired boiler, with 114L thermal store

General Comment: This is a modern bungalow with an external envelope that appears to be performing reasonably well. Nonetheless, the form factor of the dwelling is sub-optimal which presents an opportunity to make a significant energy saving by changing the oil boiler to a highly efficient heat pump installation. Minimal interventions are required to make this dwelling “heat pump ready”.

There are some mould growth/ventilation/condensation issues evident on the kitchen ceiling which need to be addressed prior to undertaking any energy retrofit works.

PRE-WORKS

Heat Loss Indicator = 2.32 W/Km^2
Estimated Primary Energy Consumption (excl appliances): 204.47 kWh/m^2/yr (C3 BER Rating)
Estimated Delivered Energy (Space/DHW Heating, Oil) (85.5% eff. boiler): 23,934 kWh/yr
Estimated Delivered Energy Cost (Space/DHW Heating, Oil) (ditto boiler, €0.1037/kwh): €2,482/yr

PROPOSED BUILDING ENERGY RETROFIT WORKS

~ Fit insulated slab on underside of sloping ceiling (28.08m^2): improving sloping ceiling U value from 0.36 W/m^{2}K to 0.26 W/m^{2}K (using 38mm insulation, conductivity 0.034 W/mK). The primary objective of this measure is to reduce the heat loss indicator to below the threshold of 2.30 W/Km^2, which is a condition of SEAI grant support for heat pumps.
~ Apply air-tightness measures (to deliver air-tightness test result of < 0.25 ac/h)
~ Install air-to-water heat pump, incl radiator replacement
~ Fit energy-savings bulbs throughout

POST-WORKS

Heat Loss Indicator = 2.25 W/Km²

Estimated Primary Energy Consumption (excl appliances): 77.76 kWh/m²/yr (B1 BER Rating)

Estimated Delivered Energy (Space/DHW Heating, electricity) (air-water heat pump): 4,322 kWh/yr

Estimated Delivered Energy Cost (Space/DHW Heating, electricity) (ditto heat pump, €0.2307/kwh): €997/yr

Estimated Reduction in Secondary Heating Delivered Energy Cost (solid fuel stove, 472kWh x €0.06/kwh est):€28/yr

Estimated Reduction in Lighting Delivered Energy Cost (671kWh x €0.2307/kwh est): €155/yr

Estimated Post-Works Delivered Energy Cost Reduction: €1,668/yr

CAPITAL COST ANALYSIS

Estimated Capital Cost (incl VAT): €23,320 (No Grant)
Estimated Annual Energy Cost Savings: €1,668
Simple Payback Period: 13.9 years

Estimated Capital Cost (incl VAT): €15,158 (35% Grant)
Estimated Annual Energy Cost Savings: €1,668
Simple Payback Period: 9.1 years

NOTE 1: Capital costs above are estimated only; these figures need to be confirmed by competitive quotations before final consideration of the retrofit measures proposed.

NOTE 2: SEAI Community Grants of up to 35% max are available for residential, non energy-poor dwellings. Grant eligibility is considered on a case-by-case basis, and as part of an overall community SEC submission.

NOTE 3: Fuel prices are taken from SEAI Fuel Cost Comparison (Jan 2019).

NOTE 4: Above calculations are based on DEAP software, with associated standard occupancy and heating schedule assumptions.

8.3 APPENDIX 3 - NON-DOMESTIC CASE STUDIES

DINGLE SEC ENERGY MASTER PLAN NON-DOMESTIC CASE STUDY 1

– CLIENT: GAA CLUB PREMISES

BUILDING 1 – SPORTS HALL and MEETING ROOMS

Date of Survey: 21/5/19
Age of Building: Built 1980 approx
Brief Description of Building Type:

~ Split-level, high-ceiling sports hall, with stage to front and mezzanine floor to rear
~ Gynasium rooms under stage with separate external access
~ Single-storey annex to side (games-room, meeting room, kitchenette, store-rooms, etc)

Brief Description of Building Construction:

~ Concrete floors
~ 275mm cavity wall (uninsulated)
~ Torch-on felt flat roof (assumed uninsulated)
~ PVC double-glazed windows
~ Timber external doors

Brief Description of Building Services:

~ Space-heating:
4 no. wall-mounted gas-fired radiant heaters (to sports hall)
Electric heating to meeting room, store-room and gym
~ Domestic Hot Water:
None
~ Lighting:
20 x incandescent light bulbs (typically 77W)
21 x 1.5m T8 fluorescent tubes (assumed 58W)
1 x CFL (assumed 16W)

Current Energy Usage (based on copy invoices provided by Client**):**

~ Electricity (day rate – lighting, panel heaters in meeting room and storeroom)
  - 9,057 units over period 14/3/18 – 27/4/19 (annualised: 8,083 units)
  - Annualised costs (excl standing and other charges): €1,809 approx
  - Annualised costs (incl standing charges, excl other charges): €2,148 approx
~ Electricity (night rate – presumably storage heating in gym)
  - 617 units over period 14/3/18 – 27/4/19 (annualised: 551 units)
  - Annualised costs (excl standing and other charges): €65 approx
  - Annualised costs (incl standing charges, excl other charges): €79 approx

~ Bulk Propane (wall-mounted radiant heaters)
  - 1,733 litres over period 9/6/17 – 29/4/19 (annualised: 918 litres)
  - Annualised costs: €955 approx

<u>PROPOSED BUILDING ENERGY RETROFIT WORKS</u> (BUILDING 1)

1. <u>MEASURE 1</u> – IMPROVE INSULATION OF MAIN WALLS and ROOF
   a. Pump bonded bead to main wall cavity (improving U value from 1.60 W/m^{2}K to 0.35 W/m^{2}K). Capital cost = €8,700 approx
   b. Fit insulation to main roof (improving U value from 2.80 W/m2K to 0.25 W/m2K). Capital cost = €34,500 approx
   c. The net benefit of items 1 and 2 above amount to a potential reduction of 71% in overall fabric heat loss in the building (*see NOTE 1 below*), with a potential gas fuel cost saving of €678 pa

2. <u>MEASURE 2</u> – LIGHTING
   d. Replace all incandescent light bulbs/pendants, with CFL fittings (16W). Capital cost = €2,000 approx
   e. Replace all T8 light fittings/tubes with T5 light fittings/tubes(34W). Capital cost = €2,000 approx
   f. The net potential benefit of items 1 and 2 above amount to a reduction of 1,800 kWh/pa (based on 1,044 lighting hours/yr), with a potential electricity cost saving of€409pa

<u>CAPITAL COST ANALYSIS</u>

Estimated Capital Cost, Measures 1 and 2 (incl VAT): €47,200 (No Grant)
Estimated Energy Cost Saving, Measures 1 and 2 (incl VAT): €1,087
Simple Payback Period = 43.4 yrs

Estimated Capital Cost, Measures 1 and 2 (incl VAT): €23,600 (50% Community Grant)
Estimated Energy Cost Saving, Measures 1 and 2 (incl VAT): €1,087
Simple Payback Period = 21.7 yrs

BUILDING 2 – CHANGING ROOMS and BALL ALLEY

Date of Survey: 21/5/19
Age of Building: Built 1980 approx
Brief Description of Building Type:

~ Flat-roofed, high-ceiling ball alley, with adjoining pitched roof, standard ceiling changing room section

Brief Description of Building Construction:

~ Concrete floors
~ Main walls (insulation unknown)
~ Torch-on felt flat roof (assumed uninsulated)
~ PVC double-glazed windows
~ Timber external doors

Brief Description of Building Services:

~ Space-heating:
None
~ Domestic Hot Water:
2 x 300L approx DHW insulated storage tanks, heated by electric immersion
~ Lighting:
28 x incandescent light bulbs (typically 77W)
3 x CFL (assumed 16W)
Pitch lighting (spec's unknown)

Current Energy Usage (based on copy invoices provided by Client**):**

~ Electricity (day rate – water heating, lighting, pitch lighting)
  - 5,334 units over period 16/5/17 – 9/3/19 (annualised: 2,941 units)
  - Annualised costs (excl standing and other charges): €668 approx
  - Annualised costs (incl standing charges, excl other charges): €1,026 approx

PROPOSED BUILDING ENERGY RETROFIT WORKS (BUILDING 2)

1. MEASURE 1 – INSTALL PHOTOVOLTAIC PANELS ON ROOF TO GENERATE ELECTRICITY
   a. Install 3kW$_p$ PV panels, south-facing, 30deg tilt, with battery storage. Capital cost = €10,000 approx
   b. The net benefit of item 1 above amount to a reduction of imported electricity of 2,577kWh/pa, with a potential electricity cost saving of €584pa

2. MEASURE 2 – LIGHTING
   a. The lighting usage is too low for this building to consider changing out the current light fittings (building lights 4hr/wk, winter only and pitch lights 6hrs/wk, winter only)

CAPITAL COST ANALYSIS

Estimated Capital Cost, Measures 1 (incl VAT): €10,000 (No Grant)
Estimated Energy Cost Saving, Measures 1 (incl VAT): €584
Simple Payback Period = 17 yrs

Estimated Capital Cost, Measures 1 and 2 (incl VAT): €5,000 (50% Community Grant)
Estimated Energy Cost Saving, Measures 1 and 2 (incl VAT): €584
Simple Payback Period = 8.5 yrs

NOTE 1: Fabric heat loss calculations are based on planar losses only, and are calculated based on the following

1. *Heating degree hours (Shannon Airport), averaged over May 2016 – April 2018*
2. *Usage Factor of 0.16, based on occupancy information provided by the Client*

NOTE 2: Capital costs above are estimated only; these figures need to be confirmed by competitive quotations before final consideration of the retrofit measures proposed.

NOTE 3: SEAI Community Grants of up to 50% max are available for non-residential, community buildings. Grant eligibility is considered on a case-by-case basis, and as part of an overall community SEC submission.

NOTE 4: Fuel prices are taken from SEAI Fuel Cost Comparison (Jan 2019).

DINGLE SEC ENERGY MASTER PLAN NON-DOMESTIC CASE STUDY 2 – GUESTHOUSE, DINGLE

Date of Survey: 21/5/19
Age of Building: Built 1963, with side and rear extensions in early 1970's approx
Brief Description of Building Type:

- Rectangular 3-storey main building, with rear single-storey flat-roofed annex.
- Living rooms, dining room, kitchen and staff quarters on ground floor; 16 no. guest rooms on first and second floors

Brief Description of Building Construction:

- Concrete floors
- Cavity main walls (uninsulated, per client)
- Pitched main roof (re-roofed in 1990's), with 200mm insulation
- Torch-on felt rear flat roof (assumed uninsulated)
- PVC double-glazed windows and external doors

Brief Description of Building Services:

- Space-heating:
  - Gas-fired central heating (30-40 year old boiler)
- Domestic Hot Water:
  - Separate gas boiler (MHG ProCon 45 condensing boiler), with 316L cylinder storage (50mm insulation)
- Lighting:
  - Ground Floor: 53 x incandescent light bulbs (typically 77W), 1 x 1.5m T8 fluorescent tubes (assumed 58W) and 4 x CFL (assumed 16W)
  - Upper Floors: Room-by-room access not available

Current Energy Usage (based on copy invoices provided by Client**):**

- Electricity (lighting, pumps, plug loads, etc)
  - 27,355 units over period 11/4/17 – 10/4/19 (annualised: 13,678 units)
  - Annualised costs (excl standing and other charges): €3,335 approx
- Bulk Propane (space heating, water heating, cooking, clothes drying)
  - 21,583 litres over period 20/10/16 (est) – 28/3/19 (annualised: 8,837 litres)
  - Annualised costs: €6,720 approx (using most recent unit rate)
  - Annualised LPG usage in energy terms = 62,566 kWh
  - Distribution of LPG usage (based on information provided by Client – See Note 2 below):
    - Cooking 2,888 kWh
    - Clothes Drying 11,000 kWh
    - DHW 12,430 kWh (assume 90% condensing boiler eff.)
    - Space Heating 36,248 kWh (balance)

PROPOSED BUILDING ENERGY RETROFIT WORKS

1. MEASURE 1 – IMPROVE INSULATION OF MAIN WALLS
    a. Pump bonded bead to 50mm main wall cavity (improving U value from 1.60 W/m^2K to 0.48 W/m^2K). Capital cost = €9,310 approx
    b. The net benefit of this measure amounts to a potential 35% reduction in overall fabric heat loss in the building (*see NOTE 1 below*), with a potential gas fuel cost saving of €642 pa

2. MEASURE 2 – REPLACE EXISTING LPG SPACE-HEATING BOILER
    a. Replace existing boiler with new 94% efficient condensing LPG boiler. Capital cost = €4,000 approx (the current boiler is at end of serviceable life)
    b. Assuming the operating efficiency of the current LPG boiler is 65%, boiler replacement has the potential to deliver a space heating reduction of 11,183 kWh/pa, with a potential LPG cost saving of €1,039 pa.

3. MEASURE 3 – REPLACE LIGHTING
    a. Replace all incandescent lights bulbs on ground floor with CFL's (34W). Capital cost = €1,060 approx
    b. The net benefit of this measure potentially amounts to a reduction of 1,283 kWh/pa (based on 2 lighting hours/day, 275 days/yr), with a potential electricity cost saving of €313pa

CAPITAL COST ANALYSIS

Estimated Capital Cost, Measures 1, 2 and 3 (incl VAT): €14,370 (No Grant)
Estimated Energy Cost Saving, Measures 1 and 2 (incl VAT): €1,994
Simple Payback Period = 7.21 yrs

Estimated Capital Cost, Measures 1, 2 and 3 (incl VAT): €10,059 (30% Community Grant)
Estimated Energy Cost Saving, Measures 1 and 2 (incl VAT): €1,994
Simple Payback Period = 5 yrs

(Though clothes drying would be considered outside the scope of Community Grant funding eligibility, it is evident that this is a significant energy cost factor for this business. The feasibility of heat pump tumble dryers should be investigated.)

NOTE 1: Fabric heat loss calculations are based on planar losses only, and are calculated based on the following

3. *Heating degree hours (Shannon Airport), averaged over May 2016 – April 2018*
4. *Usage Factor of 0.0 (June-Sept, Jan, Feb) 0.5 (May/Dec/Mar) and 1.0 Oct/Nov/April) (based on occupancy information provided by the Client)*

5. Assumed occupancy rate of 60%

NOTE 2: 3 x gas cooker rings (assumed total 7kW) x 1.5hr/day; 20kW gas clothes dryer x 2hr/day; 20 showers/day (assumed 5 mins/shower and 7L/min.

NOTE 3: Capital costs above are estimated only; these figures need to be confirmed by competitive quotations before final consideration of the retrofit measures proposed.

NOTE 4: SEAI Community Grants of up to 30% max are available for non-residential, private sector buildings. Grant eligibility is considered on a case-by-case basis, and as part of an overall community SEC submission.

NOTE 5: Fuel prices are taken from SEAI Fuel Cost Comparison (Jan 2019).

DINGLE SEC ENERGY MASTER PLAN NON-DOMESTIC CASE STUDY 3

– CLIENT: MEDIUM-SIZED PRIMARY SCHOOL

Date of Survey: 21/5/19

Age of Building: Ground floor built 1830's, extended in 1920's, first floor constructed in 1950's.

Brief Description of Building Type:

- Rectangular 2-storey main building, with rear two-storey flat-roofed annex.
- Classrooms (3 no.), staffroom, hall and toilets on ground first floor; classrooms (6 no.) and toilets on first floor

Brief Description of Building Construction:

- Concrete floors
- Solid main walls (internally insulated in areas, per client)
- Pitched main roof, insulated in 2010, (access not possible, assumed 200mm insulation)
- Torch-on felt rear flat roof (assumed uninsulated)
- PVC 12mm double-glazed windows and PVC 6mm double-glazed windows,
- External timber doors

Brief Description of Building Services:

- Space-heating:
  - Oil-fired central heating (replaced in 2011); room stats and TRV's
- Domestic Hot Water:
  - Electric undersink water heaters
- Lighting:
  - Ground Floor: 72 x 1.5m T8 fluorescent tubes (assumed 58W) and 4 x CFL (assumed 16W)
  - Upper Floors: 67 x 1.5m T8 fluorescent tubes (assumed 58W) and 2 x CFL (assumed 16W)

Current Energy Usage (based on copy invoices provided by Client**):**

- Electricity (lighting, pumps, plug loads, water heating, etc)
  - 20,155 units over period 4/6/16 – 27/11/18 (annualised: 8,124 units)
  - Annualised costs (excl standing and other charges): €1,709 approx (based on recent unit rate)
- Heating Oil (space heating) – meter readings not available
  - 2.5 fills x 1,500L ea per annum, per client, copy invoices provided (annualised: 3,750 litres)
  - Annualised costs: €3,240 approx (SEAI Jan 2019)
  - Annualised Gas Oil usage in energy terms = 39,560 kWh

PROPOSED BUILDING ENERGY RETROFIT WORKS

1. MEASURE 1 – IMPROVE INSULATION OF UNINSULATED MAIN WALLS
    a. Fit internal wall insulation (improving U value from 2.1 W/m^{2}K to 0.34 W/m^{2}K). Capital cost = €242,000 approx
2. MEASURE 2 – IMPROVE INSULATION OF FLAT ROOFS
    a. Fit roof insulation (improving U value from 2.8 W/m^{2}K to 0.25 W/m^{2}K). Capital cost = €6,000 approx
3. MEASURE 3 – REPLACE WINDOWS
    a. Replace all existing 6mm double glazed windows (improving U value from 3.69 W/m^{2}K to 1.20 W/m^{2}K). Capital cost = €60,000 approx
4. The net benefit of measures 1, 2 and 3 above potentially amounts to a reduction of 54,298 kWh/pa, with a potential heating oil cost saving of €5,560pa – this figure exceeds the current annual spend on heating oil. For the purposes of the capital cost analysis below, it is assumed that an annual heating oil spend of €1,000 will be required to deal with extreme cold weather events.

CAPITAL COST ANALYSIS

Estimated Capital Cost, Measures 1, 2 and 3 (incl VAT): €308,000 (No Grant)
Estimated Energy Cost Saving, Measures 1 and 2 (incl VAT): €2,240
Simple Payback Period = 151 yrs

Estimated Capital Cost, Measures 1, 2 and 3 (incl VAT): €215,600 (30% Community Grant)
Estimated Energy Cost Saving, Measures 1 and 2 (incl VAT): €1,928
Simple Payback Period = 112 yrs

NOTE 1: Fabric heat loss calculations are based on planar losses only, and are calculated based on the following

1. *Heating degree hours (Shannon Airport), averaged over May 2016 – April 2018*
2. *Usage Factor of 0.0 (June-Aug) 0.25 (May/Sept-Nov, Feb/Mar), 0.19 (Dec/Jan) and 0.13 (April)*

(based on normal primary school occupancy

NOTE 2: Capital costs above are estimated only; these figures need to be confirmed by competitive quotations before final consideration of the retrofit measures proposed.

NOTE 3: SEAI Community Grants of up to 30% max are available for non-residential, public sector buildings. Grant eligibility is considered on a case-by-case basis, and as part of an overall community SEC submission.

NOTE 4: Fuel prices are taken from SEAI Fuel Cost Comparison (Jan 2019).

DINGLE SEC ENERGY MASTER PLAN NON-DOMESTIC CASE STUDY 4

– CLIENT: HISTORICAL CHURCH BUILDING

Date of Survey: 22/5/19

Age of Building: This historical building was originally constructed over 600 years old, with major reconstruction in the 1800's. Though still used for church services and as a performance venue, the fabric of the building has fallen into decay in a number of areas. A restoration group is currently looking at a significant restoration project involving repair of windows, repair of stone masonry rendering/pointing, removal of woodworm/wet rot and upgrading of the electrical installation. They also hope to install a heating system.

Brief Description of Building Type:

A five-bay rectangular main building, with side annex; also includes a truncated square-plan tower at the southwest gable.

Brief Description of Building Construction:

- Concrete floors
- Solid stone masonry main walls (uninsulated)
- Pitched main roof, (assumed uninsulated)
- Single-glazed timber windows
- Timber entrance doors

Brief Description of Building Services:

- Space-heating:
  - Electric storage heating
- Domestic Hot Water:
  - None
- Lighting:
  - 16 x recessed fittings (possibly 50W halogens), 2 x CFL's, 2 x incandescent lights

Current Energy Usage (based on copy invoices provided by Client**):**

- Electricity (day rate - lighting, plug loads)
  - 2,610 units over period 31/5/17 – 27/11/18 (annualised: 1,740 units)
  - Annualised costs (excl standing and other charges): €458 approx (based on recent unit rate)
- Electricity (night rate - space heating)
  - 18,480 units over period 31/5/17 – 3/4/19 (annualised: 10,010 units)
  - Annualised costs (excl standing and other charges): €1,215 approx (based on recent unit rate)
- Electricity (night rate - space heating) Dec 18 – March 19
  - 8,400 units over period 27/11/18 – 3/4/19)
  - Cost per 4-month winter period €1,019 (excl standing and other charges, based on recent unit rate)

PROPOSED BUILDING ENERGY RETROFIT WORKS

A quantitative measure-by-measure analysis in respect of potential energy retrofit works in this case is outside the scope of this study; such an analysis will require input from a multi-disciplinary project team involving significant input from heritage architects and mech/elect designers. A detailed hygrothermal analysis will also be required to assess movement of heat and moisture across the building fabric. It should be noted that the deployment of heat sources and/or fabric upgrades in advance of specialist treatment of rot-infected materials can lead to exacerbation of such problems.

However, the following commentary on potential measures to be considered is made on the basis of information provided by the client, that a stable temperature is to the maintained in the building post-restoration:

1. Provision of 300mm attic insulation. This is a standard cost-effective retrofit measure, improving the U value of the flat ceiling from the current value of 2.8 W/m^{2}K to 0.13 W/m^{2}K; attic ventilation measures will be required
2. Replacement of ground floor to U value of 0.16 W/m^{2}K min (from current estimated U value of 0.55 W/m^{2}K), incl installation of underfloor heating
3. Internal insulation of main walls. A diffusion-open insulating plaster system such as DIATHONITE EVOLUTION should be considered – this material is manufactured from a combination of cork, clay, lime and diatomaceous earth. Application of a 50mm layer of this material can improve the U value of the stone wall from the current estimated value of 2.1 W/m^{2}K to 0.63 W/m^{2}K
4. Preliminary calculations indicate a potential reduced planar fabric heat loss of 71% based on measures 1, 2 and 3 above (see NOTE 1 below).
5. Change the existing single glazing to PILKINGTON SPACIA glazing, or similar. It is not possible to accurately calculate the resultant improvement in window U value, as dimensions and condition of timber elements are central to same. However, a very significant improvement is likely.
6. The use of an air-source, or vertical-bore groundwater-source, heat pump has many attractions in this case. However, the applicability of a low temperature system in a sub-optimal fabric heat loss environment will required specialist design input to ensure that the system performs effectively, and that the building fabric is not negatively impacted.
7. In the event of deployment of a heat pump (electricity is the only input), the deployment of PV panels (roof or ground-mounted), with battery storage, will be critical to minimise running costs.

NOTE 1: Fabric heat loss calculations are based on planar losses only and are calculated based on heating degree hours (Shannon Airport), averaged over May 2016 – April 2018.

NOTE 2: SEAI Community Grants of up to 50% max are available for non-residential, community buildings. Grant eligibility is considered on a case-by-case basis, and as part of an overall community SEC submission.

DINGLE SEC ENERGY MASTER PLAN NON-DOMESTIC CASE STUDY 5

– CLIENT: MULTI-USE COMMUNITY BUILDING, PRE-SCHOOL AND SPORTS/PERFORMANCE FACILITY

Date of Survey: 22/5/19
Age of Building: The original building (schoolhouse, 145m^2 approx) is over 100 years old, with a number of extensions and a ball-alley constructed during the 1960's and 1970's (totalling 344m^2 approx). Total floor area = 489m^2 approx.
Brief Description of Building Type:
This is a multi-use building: play-school, sports hall/performance centre, health centre, enterprise centre, youth club base and administration hub.
The typical usage for this building, based on information provided by the client, is as follows:

- Play-school, admin: 9hr/day, Mon-Fri
- Hall: used by play-school and gymnastics classes (heating rarely used)
- Play Area (adjacent to ball alley): 2-3 hrs Friday nights
- Ball Alley: Sporadic use
- Dining Room: used for music sessions on Monday nights
- Enterprise centre: currently vacant

Brief Description of Building Construction:

- Concrete floors
- Stone original main walls, mass concrete and cavity main walls to extensions
- Pitched main roof, with flat roofs to a number of the extensins and ball-alley
- PVC double-glazed windows and aluminium external doors

Brief Description of Building Services:

- Space-heating:
    - Electric storage heaters: entrance lobbies 1 and 2, offices 1 and 2, dining room, play-school, youth club play areas, consultation room
    - Electric panel radiant heaters: Offices (enterprise centre), office 3
    - Electric VORTICE infrared 3 bar wall-mounted heaters (7 no. x 1,800W approx): Sports Hall/Performance Centre
- Domestic Hot Water:
    - 140L thermal store, heated by roof-mounted solar thermal panels, incorporating heat-pump (electric immersion standby)
- Lighting:
    - Ground Floor: 26 x incandescent light bulbs (typically 77W), 67 x 1.5m T8 fluorescent tubes (assumed 58W) and 13 x CFL (assumed 16W)

Current Energy Usage (based on copy invoices provided by Client**):**

- Electricity (space heating, lighting, plug loads, etc)

- Supplier 1
  - Day Rate 1,585 units over period 18/1/17 – 27/12/18 (est) (annualised: 816 units, €188)
  - Night Rate 10,389 units over period 18/1/17 – 27/12/18 (est) (annualised: 5,349 units, €628)
- Supplier 2
  - Day Rate 11,475 units over period 1/5/18 (est) – 30/4/19 (est) (annualised: 11,475 units, €1,981)
  - Night Rate 14,122 units over period 1/5/18 (est) – 30/4/19 (est) (annualised: 14,122 units, €1,045)

Annualised costs (excl standing and other charges): €3,842 approx. This equates to an annual energy spend of €7.85 approx per m^2 floor area, which is extremely low.

DISCUSSION ON POSSIBLE RETROFIT WORKS

The energy-saving opportunities (ESO's) are extremely limited given the current low annual energy costs, probably due to the *prebound effect*.

1. ENERGY MEASURE – INSTALL PHOTOVOLTAIC PANELS ON ROOF + BATTERY STORAGE
   a. Install 4.5kW$_p$ PV panels, southwest facing, 30deg tilt, with battery storage. Capital cost = €15,000 approx
   b. The net benefit of item 1 above amount to a reduction of imported electricity of 3,676kWh/pa, with a potential electricity cost saving of €635pa (displacing day rate utility consumption, at current rate)

CAPITAL COST ANALYSIS

Estimated Capital Cost, Measures 1 (incl VAT): €12,650 (No Grant)
Estimated Energy Cost Saving, Measures 1 (incl VAT): €635
Simple Payback Period = 19.9 yrs

Estimated Capital Cost, Measures 1 and 2 (incl VAT): €6,325 (50% Community Grant)
Estimated Energy Cost Saving, Measures 1 and 2 (incl VAT): €635
Simple Payback Period = 10 yrs

2. COMFORT MEASURE – INSTALL DRAUGHT LOBBIES OUTSIDE EMERGENCY EXITS OF PLAY-SCHOOL, SPORTS HALL and ENTERPRISE CENTRE
   Emergency doors, by their nature, provide extremely poor airtightness. In addition, the current aluminium emergency doors are being used for ongoing access to the spaces concerned, leading to very poor comfort levels, as well as enabling significant heat losses in the effected compartments. Draught lobbies should be considered for outside each of these exits.

NOTE 1: Capital costs above are estimated only; these figures need to be confirmed by competitive quotations before final consideration of the retrofit measures proposed.

NOTE 2: SEAI Community Grants of up to 50% max are available for non-residential, community buildings. Grant eligibility is considered on a case-by-case basis, and as part of an overall community SEC submission.

NOTE 3: Fuel prices are taken from SEAI Fuel Cost Comparison (Jan 2019).

8.4 APPENDIX 4: ONGOING ENERGY-RELATED STUDIES IN THE DINGLE PENINSULA

Gas Networks Ireland

Biogas – A renewable fuel for the sustainability energy transition of the Dingle Peninsula?

The Dingle Sustainable Energy Community, led by the Dingle Hub/Molteic an Daingean, has commissioned a feasibility study on the Development of Anaerobic Digestion in the Dingle Peninsula with the aim of becoming a leader in the development of the rural bio-economy in Ireland. The study, funded by the LECO project and Gas Network Ireland, is undertaken by XD Sustainable Energy Consulting Ltd with a team of experts in biogas system design and engineering, advanced renewable energy systems and spatial planning.

Anaerobic digestion breaks down biodegradable materials in the absence of oxygen to produce biogas, a renewable fuel which can be utilised to produce heat, electricity and for transport. Anaerobic digestion is used worldwide in domestic, agricultural, municipal and industrial applications. Our objective is to investigate the potential for biogas production on the peninsula to contribute to meeting the community's energy needs in an affordable, secure and sustainable manner. The study will apply circular economy thinking, considering organic wastes as a valuable resource which when combined with agricultural by-products and feedstocks, can be turned into a high-quality fuel – enabling new economic opportunities locally.

The study started in May 2019 with a comprehensive assessment of the biomass resource available in the peninsula to determine their practical potential for biogas, their spatial distribution and cost. This will provide a firm basis to engage with key stakeholders with a view to defining a vision for anaerobic digestion in the framework of Dingle's transition to sustainable energy and to identify the core principles which should govern its development. The next step will be to investigate and compare suitable technical biogas pathways, from feedstock to energy end-use, considering their environmental, social and economic impacts. This will lead to conducting the preliminary design and a lifecycle cost analysis of anaerobic digestion projects deemed as being most beneficial. In addition, a multi-criteria spatial analysis will be undertaken to identify optimal locations for anaerobic digestion plants.

The feasibility study, planned for completion by January 2020, will also recommend business and financing models appropriate for community participation, in consultation with key stakeholders. It will provide the community with a roadmap for the deployment of anaerobic digestion systems on the Peninsula and guide the next steps for project development.

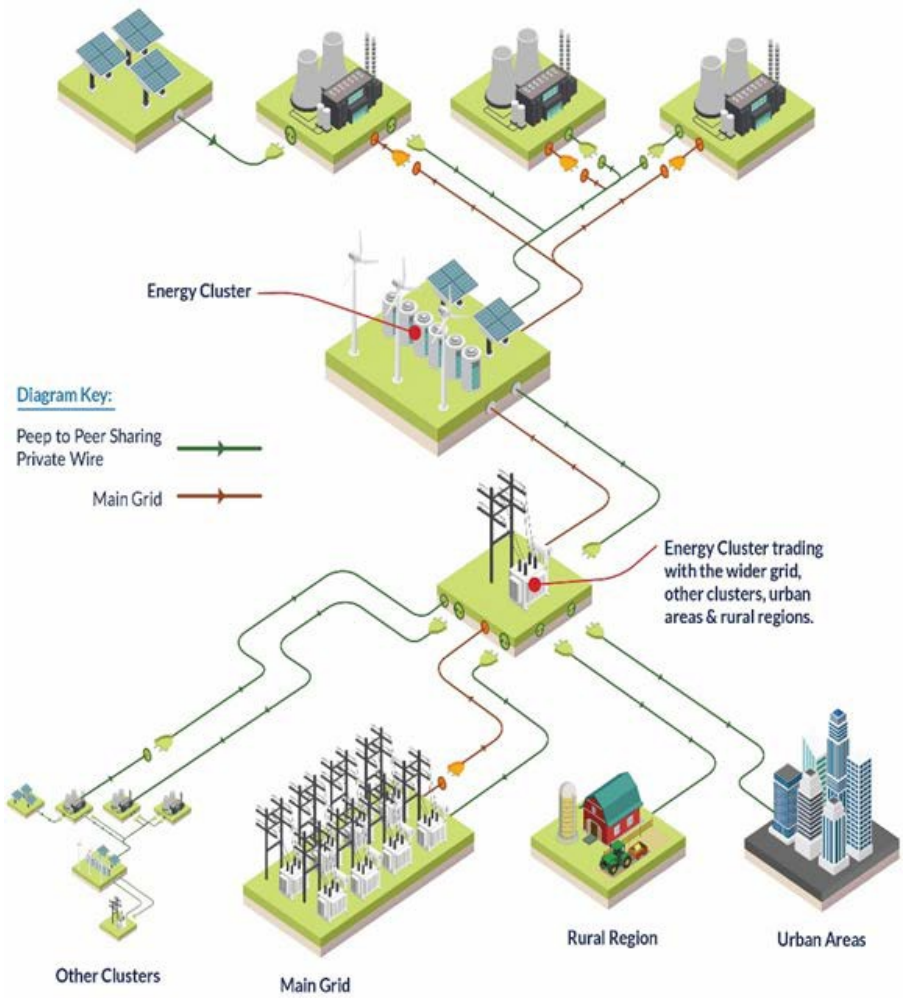
Údarás na Gaeltachta

Northern Periphery and Arctic Programme 2014–2020
An tAontas Eorpach Ciste Forbartha Réigiúnach na hEorpa
LECo Local Energy Communities

Renewable Energy Regions - RegEnergy

Waterford Institute of Technology (WIT) through its ICT research division, the TSSG, are partners in the Northwest Europe Interreg project RegEnergy. RegEnergy aims to increase the use of renewable energies (RE) using smart grid ideals and through creating demand–supply partnerships between urbanised and surrounding rural territories.

WIT will develop an Optimisation platform and will coordinate the implementation of smart grid technologies with the potential of being the hub of energy clusters. We will analyse groups of commercial energy users such that optimisation techniques can be employed where supply and demand profiles can be balanced in a local, distributed manner. This will facilitate industrial/innovation parks, that can serve as a hub for this low carbon cluster. Modelling these profiles and having an aggregated view of the networks load requirements will facilitate optimisation with local distributed generation resources such as solar, wind and battery storage. It will also facilitate peak shaving, time of use tariffs and ancillary services with the wider grid. These clusters can ultimately then trade with the surrounding rural region, urban areas and other clusters.



ESB Networks Dingle Project
A Smarter Network For a Brighter Future

ESB is leading Ireland's transition to a low carbon economy, powered by clean electricity. Electricity holds the key to a low carbon energy future. By removing carbon from electricity generation and electrifying heat and transport, Ireland can address over 50% of its carbon emissions. ESBN have chosen the Dingle Peninsula as the location for a highly innovative three-year test project which will see the deployment of a range of new innovative technologies to assist in the development of a smart, resilient, low-carbon energy network of the future. It's a 5 million euro project and involves working very closely with the community.

It includes the selection of 5 Ambassadors to work with us for the duration of the project. Ambassador homes/premises will be fully kitted out with Solar PVs/Air Source Heat Pumps/Battery Management Systems/Peer to Peer Trading devices and EV Chargers. The key objectives of the project are to help determine the following:

~ Electrification of heat and transport - do we build our way out of this with Cu/Al or IOT or what combination?
~ Network investment – controllable load (peak shaving) - understand how big a role flexibility will have.
~ Maximum use of renewable generation – immersions, batteries, EV's
~ Technology adoption – what are the key elements that incentive people to make the transition?
~ The market conditions required to incentivise people to adopt DER's.
~ Most advantageous IT and communications network.

An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

DINGLE FISHERY HARBOUR CENTRE

The Department of Agriculture, Fisheries and Marine, through the Sea Fisheries Administration Division, has a programme underway to monitor and manage the energy consumption and energy efficiency in the Fishery Harbour Centre. This is part of our obligations under the S.I. 416: 2014 for the Public Sector to make energy efficiency savings of 33% by 2020.

By the end of 2017 we have reached a value of 29.1%. *(The Public Sector Report for 2018 is currently underway).*

Our ongoing programme for making energy efficiency improvements in Dingle FHC includes

- Monitoring and assessing power usage in the harbour by DAFM, external agencies such as SFPA and power sold to harbour users.
- Replacement of all exterior lighting by energy efficient solutions such as LED's.
- Refurbishment of the Harbour Master's Offices – the refurbishment provides improvement in working facilities but at the same time it will result in energy efficiencies.
- Replacing PEL light with solar powered PEL Light

Future projects will include

- Any works to Lathair Building will be done on an Energy Efficient Design basis, with NZEB as the minimum standard, with a target of achieving SEAI EXEED Programme standards
- Assessing the feasibility of greater control of high mast lighting, with a view to reducing LUX levels when not required.
- An ongoing case by case assessment of replacing plant with EV vehicles where appropriate and justified.
- Assessing the feasibility of installing PV panels on buildings
- Assessing the feasibility of replacing fossil fuel boilers in Lathair Building.

IERC STORENET PROJECT, BALLYFERRITER

Extract from press release of 12 December 2017:

Twenty homes in Dingle, Co. Kerry, are to test the potential of a new storage technology to support the use of variable renewable energy supply resources and smart connection to the Irish electricity grid. The new €1.12m *StoreNet* project was officially launched at an International Energy Research Centre (IERC) industry workshop at Tyndall National Institute this morning. *StoreNet* will install residential battery storage systems to operate in the form of virtual power plant in Dingle to integrate with energy supply and demand management and operate at scale across a community. *StoreNet* is an industry-led collaborative research project that includes Electric Ireland, ESB Networks and Solo Energy and demonstrates battery-based energy storage within Irish homes on the Irish grid.

The project aims to reduce energy costs for residents, relieve pressure on the grid during peak times, and contribute to our transition to a sustainable energy future. Residents who generate electricity from renewable resources on their premises will store excess energy in the battery, and deploy their stored energy rather than energy from the Irish grid during peak times. Additional 'smart' charging of the batteries during off-peak times will not only relieve pressure on the grid but will also reduce the cost of supply to the residents. From a commercial perspective, the project will identify the energy services that can be delivered by a distributed energy storage network and assess the business model in terms of 100% renewable electricity, retail sales and grid services.

What is Hotmaps?

The Horizon 2020 funded project HotMaps aims at designing a toolbox to support public authorities, energy agencies and urban planners in strategic heating and cooling planning on local, regional and national levels, and in line with EU policies.

In addition to guidelines and handbooks on how to carry out strategic heating and cooling (H&C) planning, HotMaps will provide the first H&C planning software that is

- **User-driven**: developed in close collaboration with 7 European pilot areas
- **Open source**: the developed tool and all related modules will run without requiring any other commercial tool or software. No restrictions in use and access to the source code.

EU-28 compatible: the tool will be applicable for cities in all 28 EU Member States

Scientific partner

Pilot areas for developing and testing the tool

What can you do with HotMaps?

The Energy Efficiency Directive as well as the RED and EPBD require EU Member States to develop policies foreseeing systematic planning processes for efficient heating and cooling.

HotMaps will facilitate this task by allowing users to

- **Map** the heating and cooling energy situation including renewable and waste heat potentials in GIS layers in virtually any EU region up to a 250x250m level;
- **Model the energy system**, considering hourly matching of supply and demand, demand response etc. on local, regional and national level;
- **Simulate supply and demand options** of long-term scenarios **until 2050** regarding e.g. CO_2-emissions, energy costs, demographic changes, share of renewables.

An agile bottom-up development

The software tool will be developed in close cooperation with the target group, i.e. urban planners and strategic decision-makers as well as with members from the open source community. The pilot areas of Aalborg, Bistrita, Frankfurt, Geneva, Milton Keynes, Kerry County and San Sebastian will co-design, test and validate in order to guarantee a user-friendly software entirely based on user needs.

Who is behind HotMaps?

Coordinated by the TU Wien, HotMaps is developed by a consortium of leading experts in energy planning in Europe, modelling and tool development, energy policy and communication.

Experience from the ground is fed into the project by pilot areas from Denmark, Germany, Romania, Spain, Ireland, Switzerland and the UK as well as 20 further follower areas.

Kerry County Council Role in Hotmaps

KCC are a pilot region in the Hotmaps project. Essentially the role of the pilot area is to give input into the users requirements of the tool, test the tool and use the tool to analyse and develop a heat strategy for a chosen area.

As well as giving input into the tool development from the user perspective, demonstration of the use of the tool in the pilot regions is also required. This demonstration includes heat mapping in selected regions, engagement of stakeholders and development of a renewable heating strategy for the region. The Dingle peninsula has been proposed as the region of focus in Kerry as it will fit in well with the ESB's Dingle 2030 project and will serve to complement the Dingle Energy Master Plan.

It is hoped that the Hotmaps work would result in:

- The production of heat maps for Dingle
- Load curves for Dingle
- Comparison of various heating technologies as options for renewable heating in the region
- Presentation of findings at stakeholder meetings
- Training of relevant people in the use of the application

Acronyms

COM: Covenant of Mayors
SECAP: Sustainable Energy and Climate Action Plan
EU: European Union
SME: Small and Medium-Sized Business
GHG: Greenhouse Gas
NEEAP4: 4th National Energy Efficiency Action Plan
SEAI: Sustainable Energy Authority of Ireland
BEI: Baseline Emissions Inventory
CSO: Central Statistics Office
BER: Building Energy Rating
DBER: Domestic Building Energy Rating
NBER: Non-Domestic Building Energy Rating
EPPSU: Energy Policy Statistical Support Unit (of SEAI)
ICT: Information and Communication Technology
ETS: Emission Trading Scheme
CIBSE: Chartered Institute of Building Services Engineers
nZEB: Nearly Zero Energy Buildings
PPP: Public Private Partnership
EV: Electric Vehicles
CNG: Compressed Natural Gas
DTTAS: Department of Transport Tourism and Sport
DCCAE: Department of Communications Climate Action and Environment
ED: Electoral District
SA: Small Area
SAP MAP: CSO Small Area Population Map
PHEV: Plug-in hybrid electric vehicle
PV: Photovoltaic
AD: Anaerobic Digestion
GNI: Gas Networks Ireland
CIBSE: The Chartered Institute of Building Services Engineers
DHW: Domestic Hot Water
NZEB: Nearly Zero Energy Buildings
EWI: External Wall Insulation
NEWKD: North, East, West Kerry Development
CAP: Climate Action Plan
BAU: Business As Usual