Maximising Local Energy Generation, Storage and Use

Natural Heritage Designations

Renewable energy development has the potential to adversely impact the natural heritage, with protected species and local designations. The natural heritage of Iona is sensitive to development. Site specific survey will be required to accompany any planning application. The scope of this will vary depending on the nature of the proposal and its location, but as a minimum is likely to require a site walkover by a suitably qualified ecology professional, and in the case of wind energy development may require ornithological vantage point surveys at two times of year (likely to be winter and late spring). In the event that adverse effects are identified, mitigation to avoid, offset or reduce the effects will be developed and early engagement undertaken to ensure the scale and location of any proposed development is acceptable.

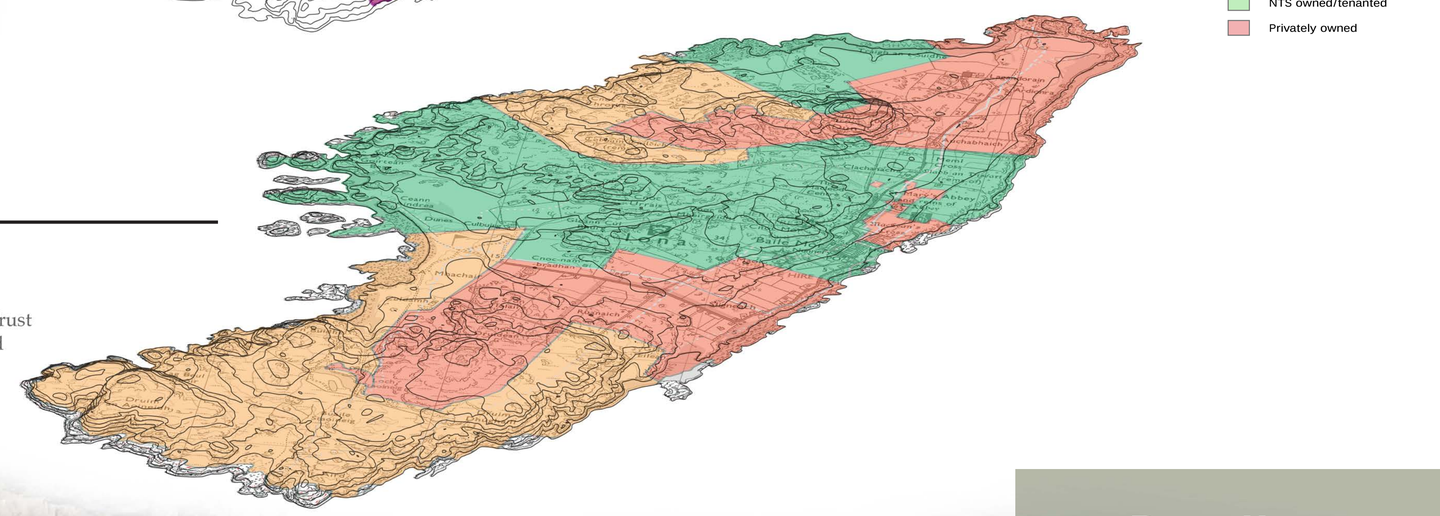
Cultural Heritage Designations

The Island of Iona is uniquely important in terms of its cultural heritage due to its association with St. Columba. It is important to recognise that cultural heritage considerations relate less to the visitor experience, but to the cultural heritage assets. Effects can be direct, or indirect, where they may affect the setting. Direct effects may arise in relation to ground disturbance associated with the construction and operation of development or ancillary infrastructure. The greater the area of ground disturbance, the higher the potential for direct effects to arise. While it may be possible to locate (or re-locate) new development to avoid direct effects, this may cause delay or expense. Indirect effects may arise in relation to the setting. This is assessed using similar materials to those used for landscape and visual impact (ZTVs, wirelines and photomontages), but the assessment methodology differs. There is also the potential for as-yet undiscovered cultural heritage, which could be directly or indirectly affected by new development. It is likely that a planning condition will be applied to any permission to undertake some form of archaeological fieldwork either in advance or during any ground disturbance works.

Land Ownership

The main land owner on Iona is the National Trust for Scotland. The land in its ownership is either tenanted (farming) or subject to common grazing rights. The presence of NTS on the Steering Group and previous relationships developed from the proposals for redeveloping the hall should assist the required negotiations. Other parts of the Island are in private ownership, with a variety of different land owners. The public road network is in Council ownership. In addition, Iona Abbey is a Scheduled Monument in the ownership of the Iona Cathedral Trustees, under the responsibility of Historic Environment Scotland, with the Iona Community as tenant, but with some responsibilities for the building.

The National Trust for Scotland



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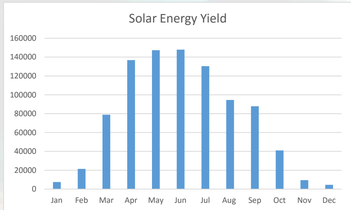
Solar

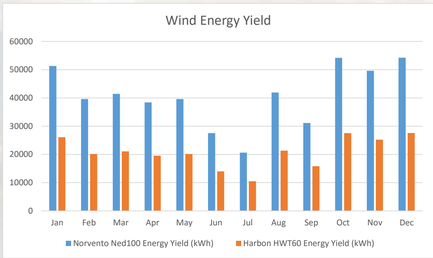
Energy yield modelling can be estimated with a strong degree of accuracy from solar irradiance mapping, based on co-ordinates for a specific location, performance data from candidate manufacturers, and calculated using specialist industry software. The modelling we have undertaken indicates solar irradiation levels are high (compared to installed sites across Scotland), with capacity factors above 10%. Around 350kW of solar capacity could form part of the renewable generation mix for Iona - requiring an area of ~0.6ha.

The combination of solar and wind is complementary, with the high levels and reliability of output from solar in summer compensating for the less reliable and lower outputs from wind over the same period, with roles reversed across the other seasons.



Wind

Wind data over an approximate two year period has been obtained from Tiree Community Development Trust to enable energy yield modelling to be undertaken. Like Tiree, Iona has an excellent wind resource, averaging >9m/s. Based on the constraints identified through the appraisal of the planning and environmental baseline, two candidate turbines are being considered, with overall height to turbine tip of 35m and 25m respectively. These turbines have rated generating capacities of 100kW and 60kW respectively (i.e. maximum output per turbine). Between 300 and 360kW in wind capacity could form part of the renewable generation mix for the island - either 3 taller, or 6 smaller turbines.



Heat-pump

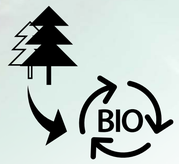
Heat Pumps are devices which can provide heating (or cooling). A heat pump uses some external power to transfer energy from the heat source to the heat sink – the ratio of energy used to energy output is termed the co-efficient of performance (COP). While heat pumps use external power, the energy source can be renewable, and they are also deemed to be 'renewable' in situations where significantly more energy is generated than consumed - typically at least 3 times more. They work most efficiently when integrated with energy efficiency measures. The COP increases as the temperature difference decreases between the heat source and the destination, which means a heat pump could be less efficient when outside temperatures are lower - which is often when there is a greater need for internal space heating.

The ground and large bodies of water are natural stores of thermal energy, and therefore are more consistent temperature sources than the air, but require a larger interface (in the form of a pipe network) to extract the heat, and can be more expensive to install. Ground source, air source and water source are all being considered, depending on location, for tIona.

Additional funding has been secured by Iona Renewables Group to investigate a heat pump supply for the Abbey, in collaboration with Historic Environment Scotland and Iona Community.

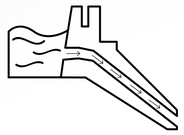
Non-viable options

Biomass



Although a community woodland with available resource is owned by SWMID at Tiroran, this is not considered a viable option due to the scale of demand on Iona relative to the long distances from the nearest drying and chipping facilities at Dervaig. Depending on the amount of heating required, based on number of buildings using biomass and the time of year, a delivery could be required between weekly and every 2.5 weeks, requiring a round trip every time of ~120 miles, significantly contributing to costs and carbon emissions, and prone to seasonal disruptions.

Hydro



The only potentially viable hydro option on Iona would be based around Loch Staoineig, and the limited catchment area for rainfall leads to a very low flow rate. Only a small proportion of the flow can be abstracted for hydro-power, to maintain consistent flow in the watercourse. This, combined with the low head height, limits generating potential to below 10kWp. The nearest electrical connection is over 1.31km, meaning the expense of connection would outweigh the income from the generation.

Generation

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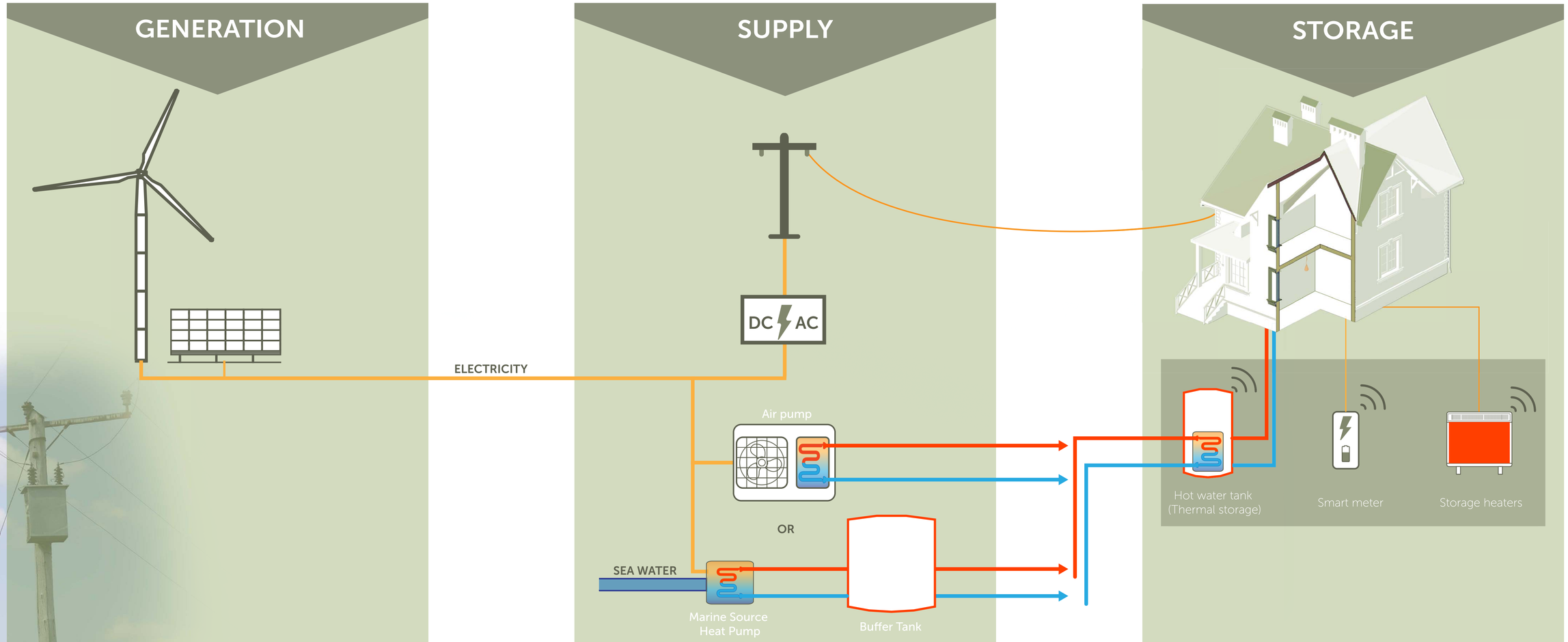

Renewable generation can be intermittent, dependent on when the wind is blowing or the sun is out. But the solution to energy systems is not just on installing more generation, just as building more lanes on roads is not the solution to traffic congestion. Managing flow on the supply side, and providing storage, are integral to creating an effective local energy system for Iona.

The electrical network on Iona is capable of transmitting all the energy required for the island, but it has very limited capacity to export energy from the island, and may require localised reinforcement to connect and transmit generators on the island. As the purpose of generating energy on the island is to meet the island's needs, a form of active network management, which avoids the need for costly distribution network upgrades across Mull, is needed. Discussions with SSE are still at an early stage, but in principle they are supportive of the community's proposals, and will help work towards developing a solution.

Opportunities for the direct supply of heat are also being investigated - either on a standalone basis, such as the Marine Source Heat Pump for the Abbey, or as part of a network. A district heat network is being considered for the village, where the proximity of homes and businesses means a network system could be viable.

Smart systems - integrating smart meters and smart heating controls using ICT connections to the generating equipment - can help match demand with supply and help balance the network. The ACCESS project is paving the way, automatically charging storage heaters in some homes on Mull and Iona when the Garmony Hydro on Mull is generating power. Similar systems can be developed to integrate with wind or solar generation on Iona, and can work equally well with hot water tanks - or with newly developed heat batteries, as well as with storage heaters. This flexibility means a smart heating system can be developed without the disruption of replacing existing heating systems.

Thermal storage is also cheaper than electrical storage - and the majority of energy required in the home is for heating. This reduces the need for more expensive electrical battery storage at this point. And costs for battery storage are coming down, so it makes sense to focus first on thermal storage. A network creates the potential for more storage than is possible within individual buildings.

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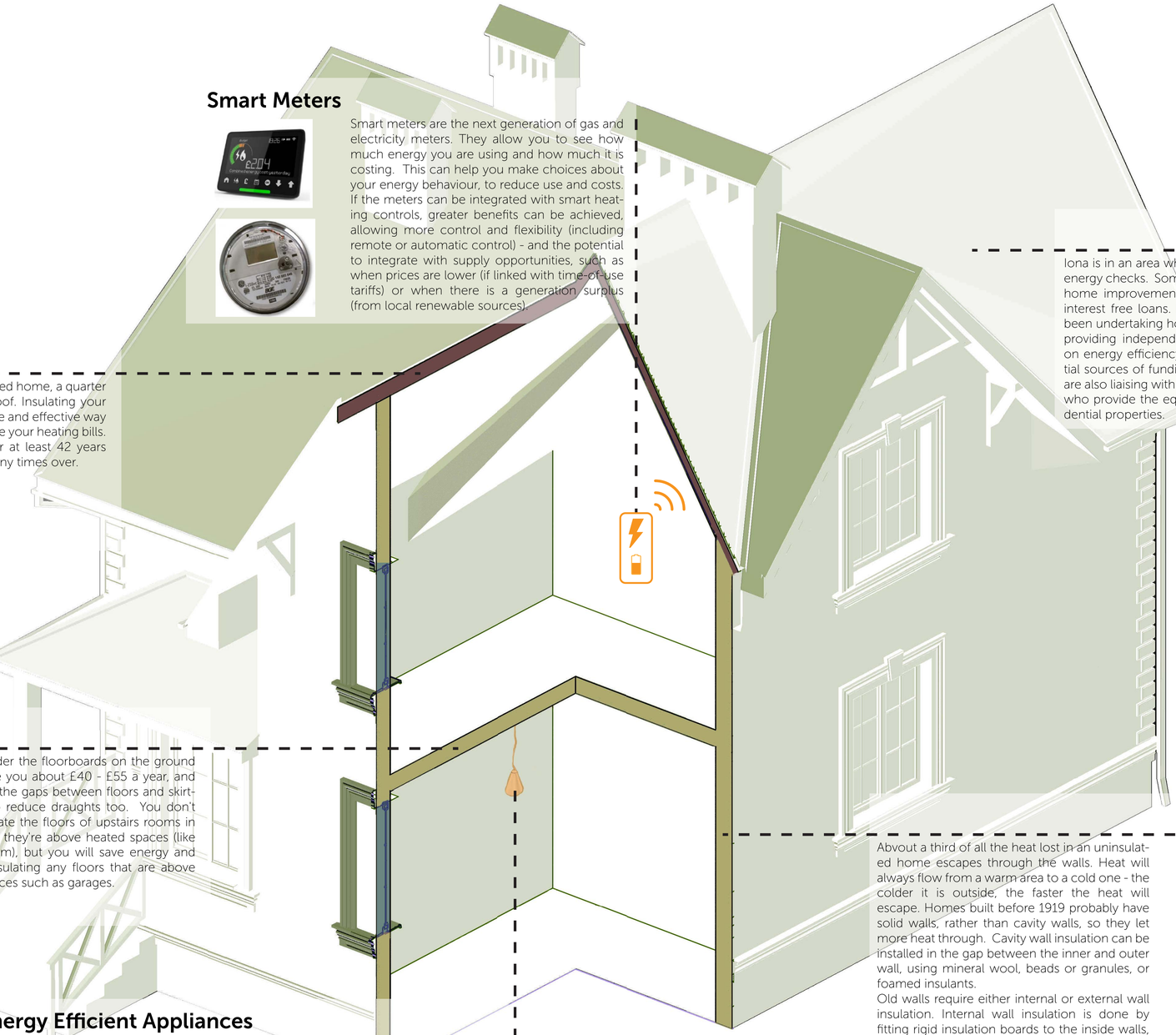

Smart Meters

Smart meters are the next generation of gas and electricity meters. They allow you to see how much energy you are using and how much it is costing. This can help you make choices about your energy behaviour, to reduce use and costs. If the meters can be integrated with smart heating controls, greater benefits can be achieved, allowing more control and flexibility (including remote or automatic control) - and the potential to integrate with supply opportunities, such as when prices are lower (if linked with time-of-use tariffs) or when there is a generation surplus (from local renewable sources).

Home Energy Checks

Iona is in an area which is eligible for free home energy checks. Some homes are eligible for free home improvement works, others can access interest free loans. Home Energy Scotland has been undertaking home energy checks on Iona, providing independent advice to homeowners on energy efficiency improvements and potential sources of funding. Home Energy Scotland are also liaising with Resource Efficient Scotland, who provide the equivalent service to non-residential properties.

HOME ENERGY SCOTLAND

Roof and Loft Insulation

Heat rises, and in an uninsulated home, a quarter of heat is lost through the roof. Insulating your loft, attic or flat roof is a simple and effective way to reduce heat loss and reduce your heating bills. Loft insulation is effective for at least 42 years and it should pay for itself many times over.

Floor insulation

Insulating under the floorboards on the ground floor will save you about £40 - £55 a year, and you can seal the gaps between floors and skirting boards to reduce draughts too. You don't need to insulate the floors of upstairs rooms in your house if they're above heated spaces (like the living room), but you will save energy and money by insulating any floors that are above unheated spaces such as garages.

Wall Insulation

Abvout a third of all the heat lost in an uninsulated home escapes through the walls. Heat will always flow from a warm area to a cold one - the colder it is outside, the faster the heat will escape. Homes built before 1919 probably have solid walls, rather than cavity walls, so they let more heat through. Cavity wall insulation can be installed in the gap between the inner and outer wall, using mineral wool, beads or granules, or foamed insulants.

Old walls require either internal or external wall insulation. Internal wall insulation is done by fitting rigid insulation boards to the inside walls, and needs to be done room by room. External wall insulation involved fixing a layer of insulation material to the wall, then covering it with special render or cladding. It is less disruptive to the interior, but is more expensive and may not be possible on listed buildings or in conservation areas.

internal wall insulation

cavity wall insulation

Energy Efficient Appliances

Lighting accounts for 18 per cent of a typical household's electricity bill. You can cut your lighting bill and energy use by changing which bulbs you use and how you use them. Houses typically use a mixture of standard light fittings and downlighters or spotlight fittings. Energy efficient bulbs are available for both types of fittings. All electrical appliances have to advertise their energy efficiency, and selecting energy efficient devices can help reduce your energy bills.

Energy efficiency measures

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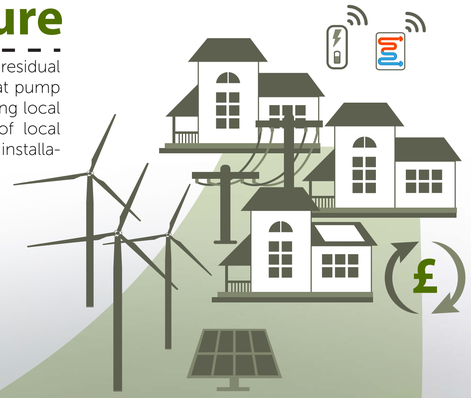
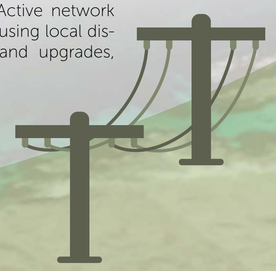
2022 - Future

Further wind and solar generation developed to meet residual energy demands after energy efficiency measures and heat pump deployment. Active network management system integrating local generation with local demand to maximise direct use of local power. Local ownership of renewable energy generating installations generates income for local community.



2020 - 2021

Planned reinforcements to transmission network. Active network management system developed with SSE to permit using local distribution network, with localised reinforcements and upgrades, matching local generation and demand.



2017 - 2020

Energy Efficiency measures implemented for homes on Iona. Development and deployment of smart meters, smart heating controls, local and network heat pumps, and thermal storage in the form of hot water tanks and storage heaters.

Abbey refurbishment. IRG and Historic Environment Scotland develop and operate a marine source heat pump to provide supplementary heat to the building's heating system, generating income for IRG and reducing carbon emissions and running costs for the Abbey.

2016

Feasibility study to maximise local energy generation, storage and use. Study undertaken in three stages: Preliminary feasibility, Options Appraisal, and Detailed Feasibility. The main outcomes for the study are to identify a roadmap to progress towards maximising local energy generation, storage and use from renewables, and to identify a first phase of development which is high impact but also deliverable and scaleable.

Funding secured to develop proposal for a heat pump for Iona Abbey.

Home Energy Checks undertaken to identify energy efficiency measures for homes on Iona.

2018 - 2019

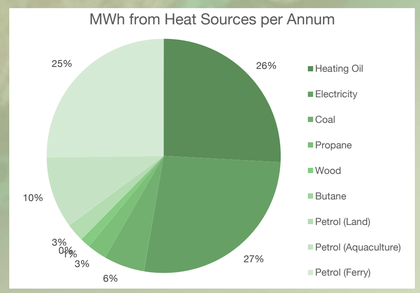
Single wind turbine developed, maximising renewable generation within the exporty capacity constraints imposed by the electricity distribution network.

2015

Iona Renewable Group established.

Energy Audit undertaken for island to establish annual energy demand. Excluding marine transport, around 4,419 MegaWatt hours (MWh) are used, mainly coming from heating oil and electricity.

Coal is used, mainly for secondary heating, and propane / butane (gas) for cooking. A relatively small amount is used for vehicles.



Roadmap