
ENERGY AUDIT ON THE ARAN ISLANDS



Energy audit on the Aran Islands

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1 Introduction

In 2014, the Aran Islands joined the SMILEGOV¹ project through its membership in the *Comhdháil Oileáin na hÉireann* (Irish Islands Association) and subsequently in the *European Small Islands Federation* (ESIN). The objectives of SMILEGOV, funded by the IEE at the European Commission, is to establish a clear picture of the island's energy consumption, its emissions and how it is supplied with energy, moving into an action plan for a more sustainable future, and to invite the island to join the Pact of Islands².

1.1 Process

The work has mainly been carried out by Senior Advisor Christian Pleijel, formerly at Sweco, now an independent consultant and the Vice President of ESIN (*European Small Islands Federation*), with the kind help of Mr Ronan MacGiolla-pharaic at the Fuinneamh Oileáin Árann (Aran Islands Energy), support from the Irish Islands Association and from the Cork County Council.

1.2 Methodology

The island has been observed from six different perspectives, a method described and used in Christian Pleijel's book on the small islands of Europe³: (1) Facts, (2) Identity and culture, (3) Optimism, (4) Pessimism, (5) Possibilities, and (6) Actions. The reason for not solely describing the energy is that issues such as energy and mobility are closely related to tourism, trade & industry, transports, healthcare, culture, schools and demography.

The impact of sea and air transports to and from the islands on total energy use and emissions have not been calculated.

Islands are miniatures of the world, solitary, clearly separated from the mainland by the sea. Being small, distant and vulnerable, an island needs to plan and develop itself in a cohesive and continuous manner, handling the complexity of local, regional and European politics, combining small scale and big scale. In my opinion, the *West Cork Islands Integrated Development Strategy* does this an excellent example of such integrated planning. However, this is an attempt to further elaborate the energy side of developing the island.

I am solely responsible for opinions, arguments, facts and faults in this report.

September 2015,

Christian Pleijel

¹ <http://www.sustainableislands.eu/>

² <http://www.islepact.eu/html/index.aspx>

³ <http://europeansmallislands.com/how-to-read-an-island/>

2 Summary

Baseline Year 2013
Population 1,200 / 2,392

ENERGY CONSUMPTION

Excluding transports to and from Aran Islands

Transport diesel	2,000 MWh
Coal import	6,000 MWh
Oil import	2,500 MWh
Kerosene import	3,000 MWh
Electricity by local RE	1,750 MWh
Electricity import	2,500 MWh

Sum of energy consumption **17,750 MWh**

Per capita 1,200 / 2,392 14,792 kWh / 7,421 kWh

Sea transports yet to be calculated

Air transports yet to be calculated

EMISSIONS

Transport diesel	466,690 kg CO ₂ e
Coal	438,828 kg CO ₂ e
Oil	10,856 kg CO ₂ e
Kerosene	196,160 kg CO ₂ e
Electricity by local RE	62,858 kg CO ₂ e
Electricity import	2,312 kg CO ₂ e

Sum of emissions **1,924,663 kg CO₂e**

Per capita 209 / 235 9,209 kg CO₂e / 8,332 kg CO₂e

Sea transports yet to be calculated

Air transports yet to be calculated

LOCAL ENERGY PRODUCTION

Electricity	1,750 MWh
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ACTION PLAN 2022

48% reduction in imported energy through electric vehicles and heat pumps

13% reduction in imported energy through increased wind generation

To be carbon neutral by 2022



3 Facts

The Aran islands

The Aran Islands – *Oileáin Árann* – consist of three islands: Inis Mór (Inishmore), Inis Meáin (Inishmaan) and Inis Oírr (Inisheer), situated on Ireland's west coast 5–12 nautical miles out in the Atlantic Ocean.

	Area	Pop
Inis Mór	31 km ²	750
Inis Meáin	9 km ²	185
Inis Oírr	8 km ²	265

The 1,200 inhabitants primarily speak Irish, which is the language used in naming their islands although the English names still are used on maps alongside the correct Irish.

Inis Mór

Inis Mór is the largest of the three Aran islands with a population of 750 (2013).

While a lot of island-income comes from the fishing industry, most islanders make their money from tourism and therefore the summer months are vital in terms of sustainable living throughout the rest of the year.

Annually, about 250,000 tourists visit the Aran Islands with a minimum of a 1,000 daily visitors during the months of June, July and August, rising to 3,000 on a busy sunny day.

Inis Mór is the most developed island in terms of tourist facilities. Key problems emanating from tourism

now facing Inis Mór and increasingly the smaller islands include:

Overcrowding / congestion during peak periods;

Perceptions that the island is a day trip destination –(during peak times, up to 63% of all visitors are day tours);

Seasonality is a significant problem for the island.

The number of tourists per head of population is 148 on Inishmore⁴.

275 jobs on the islands are supported by the tourism expenditure.

The population grows to about 1,000 becoming a mixture of islanders, mainland locals and holidaymakers.

Inis Meáinn

Inis Meáin is the middle of the three Aran islands. It is about 3 miles long and 2 miles across and had a permanent population of 185 2013.

There are some 42 in full time employment on the island and about 62 in part time employment. The largest employer would be Inis Meáin Knitwear, with 16 full time employees. Others are employed in the Co-Op, in tourist related activities and services. There is a primary school on the island with 12 pupils, and a secondary school with 11 pupils.

⁴ The other two Irish hislands in the Smilegov project are Oileán Chléire, 172 visitors per head of pop, and Bere Island, 13 visitors per head of pop (20 with army).

Tourism would be one of the largest sources of employment on the island. There is one ten room hotel, nine bed and breakfasts most of whom serve an evening meal, six people offer self catering accommodation, and a restaurant. There is also an airport, a craft shop, a diving centre, a pub, a library and a credit union. Fishing and farming are engaged in to varying degrees by most households on the island.

The island had three wind turbines to supplement the power supply from the mainland but had to take them down as they were causing too much risk. Fresh water is in short supply. Wells on the island used to be supplemented by a desalination plant that is no more in operation. In August 2014 Inis Meáinn and Inis Oírr ran dry and a cargo boat was converted to carry massive tankers. The daily requirement on Inis Meáinn, which has the smallest population of the Aran Islands, is 80 m³.

In summer the population can rise to 500.

Inis Oírr

Inis Oírr is the smallest of the three Aran islands, being about 3 km by 3 km, with a permanent population of 265 (2013).

The island lies just off the coast of Clare. It is similar to the other two islands in that it has a barren and rugged landscape and is of considerable cultural importance.

Tourism is the principal source of employment. There is one hotel, nine bed and breakfasts, a number of holiday cottages, two pubs, a campsite, two restaurants, bicycle hire, island tour, craft shop, and a number of historical walks. There is a cultural and arts centre containing: a museum, a folk theatre, an art gallery, craft units and a café. There are Irish language courses for adults and cultural holiday courses.

The summertime population is about 700.

Population

There are 1,200 inhabitants with 320 continuously occupied properties on the islands.

The figure rises in the holiday season to $1,500 + 500 + 700 = 2,700$.

The human pressure on the island's fresh water system, on energy supply, on sewage and waste handling, postal services, healthcare, rescue, roads and ferries should be calculated as follows:

Residents (365 days)	1,200	438,000
Summer resid's (90 days)	1,500	135,000
Visitors (2 days)	50,000	100,000
Visitors (1 day)	200,000	200,000
Sum		873,000

873,000 man-days divided by 365 gives 2,008. The number of people using the Aran Islands as a human

society is equivalent to a population of 2,392. That is the base or calculating the island's ecological footprint.

From an infrastructural and a sustainable perspective, the Aran Islands serves 2,392 people, not 1,200.

Governance

The Aran Islands are a part of County Galway.

Generally speaking, government agencies operate as individuals instead of cooperating when delivering infrastructure projects or services. Management of the constraints and opportunities of island environments is poorly understood by government departments.

National policy seems to be geared at large companies delivering services. There is little flexibility for small operators and there is little understanding for the unique and variable conditions of the islands.

Access and transport

On the island

Inis Mór has traffic congestion problems in mid summer (bikes, buses and cars). It is focused around the arrival times of the ferries and the good weather. A large majority of tourists take bikes the rest taking tour buses or hiring cars (horses). Personal motorised transport is limited to the locals as there is no easy accessible way for tourists to bring their own vehicles to the islands.

To and from the islands

There are three subsidised services between the mainland and Inis Mór:

A sea passenger/freight service from Galway provided by O'Brien Shipping Ltd;

A sea passenger service from Ros-saveal provided by Island Ferries Ltd;

An air service from Connemara Airport with Aer Árann which has provided air services to the Islands since 1970. This service was supported by funding from Údarás na Gaeltachta until 1999 when direct responsibility for the funding of the service passed to the Department of Community, Rural and Gaeltacht Affairs.

The service can be viewed from two perspectives:

The islanders' perspective of the service is in access terms i.e. quick access to and from the mainland and as a medical/emergency service to bring patients to hospital in emergencies.

People on the mainland tend to view the service more in business and social terms i.e. allowing business people and agencies providing services to the islanders easy and effective access to the island.

The duration of the flight is about 10 minutes. In addition, Aer Árann provides a shuttle bus service from a pick-up point in Galway city.

The air service is much used as can be seen in this table (2014):

38,473 total each way passengers 2014 (18,746 departing islands)						
	Árainn		Inis Meáin		Inis Oírr	
	Islander	Other	Islander	Other	Islander	Other
Jan	683	231	256	62	442	116
Feb	708	277	215	63	425	123
Mar	961	627	302	82	419	159
Apr	1044	1366	229	203	613	376
May	756	1290	217	301	494	400
Jun	784	1804	241	265	441	480
Jul	757	1858	170	275	551	642
Aug	782	2471	306	406	808	834
Sep	711	1585	171	343	472	338
Oct	997	937	235	155	608	276
Nov	941	440	230	154	402	246
Dec	692	280	195	120	498	132

Beginning in 2014 there has been a hard battle with the government to retain funding for the air service.

After announcing that a helicopter company had been selected as the "preferred tenderer" at the end of August 2015, residents of the Aran Islands expressed anger at the loss of fixed wing services and the proposed move of flights from Connemara to Galway.

It subsequently emerged that the Department had no clarity as to the availability of Galway Airport as an aviation hub for the duration of the four year contract.

September 2015 was a month of confusion that ended in a decision to abandon the ongoing tender process – a major climb down from the Government.

Summertime ferries

In summertime, other ferry services exist. A reduced service is offered between November and March incorporating two return journeys for four of the days and three return journeys for the other three days.

Doolin Ferries also operates ferry services from Doolin to the three Aran Islands during the summer months using the Happy Hooker, the Tranquility, the Queen of Aran and the Rose of Aran. These are 100 seat-er Class 2A vessels 65' – 70' long.

Aran Islands Fast Ferries Ltd started a summer passenger service from Doolin earlier this year.

For the last years, the Chateau Terry, a landing-craft vessel 29x10 metres, has carried heavy goods, machinery and large vehicles to the islands.

Energy

People on the Aran Islands use energy for heating, transport and common services (freshwater, sewage, waste handling).

The islands' electrical network is connected to the mainland by a 3MW submarine cable. Heating of public buildings and residential homes is primarily through the burning of heating oil or kerosene. Open fire-places are a common feature. Trans-ports for cars and small boats is with diesel primarily.

Transport diesel	201,000 litres
Coal import	780 tonnes
Oil import	247,000 litres
Kerosene import	25,500 litres
Electricity by local RE	1,750 MWh
Electricity import	2,500 MWh

This sums up to 9,040,500 MWh = 7,534 kWh per capita counting 1,200 inhabitants, 3,779 kWh counting

2,392 inhabitants. European average is 28,439 kWh per capita.

Why is it so low on the Aran Islands? One reason is the small number of cars and the short distances. The main reason is that the transports to and from the island

Sea transports – getting to and from the island – account for 25% of the total energy used.

Emissions

The emissions from the island consist of sewage, waste and greenhouse gas (CO₂-equivalents).

(a) Sewage

Wastewater on the islands is generally treated in individual on-site septic tanks or treatment systems.

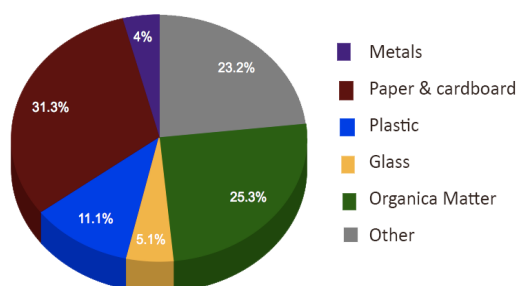
The sum of sewage on the island can be estimated to 180 litres per capita and day⁵ x 365 days x 2,392 people = 157 million litres. Most of it is grey water (from showers, bath, dish and washes) and a smaller part is black-water from toilets comprising bacteria, nutrients and medicine spill.

(b) Solid waste

There is no data on how much solid waste is produced on the Aran Islands a year. According the Waste Atlas⁶, generation of waste in Ireland was 586 kg per capita in 2013 whereof 34% was recycled.

⁵ <http://www.doeni.gov.uk/niea/ppg04.pdf>

⁶ <http://www.atlas.d-waste.com/>



Irish waste according to the Waste Atlas

For the Aran Islands as a whole, this would mean a generation of 1,400 tonnes of solid waste a year whereof 56 tonnes of metal (cans, tins), 439 tonnes of paper & cardboard, 156 tonnes of plastic, 71 tonnes of glass (bottles), 355 tonnes of organic matter (that doesn't leave the island) and 325 tonnes of other (could be electronics, metal scrap, building materials).

On the mainland, waste is an asset used for recycling and heating. Is waste an asset for the Aran Islands, or just a problem?

(c) Greenhouse gas⁷

⁷ Human emissions of CO₂ have augmented from 270 ppm to 380 ppm in 100 years. Parallel to this, the average temperature on Earth has increased with almost 1°C. We call this the 'greenhouse effect', gases contributing to this are carbon dioxide (CO₂), nitrogen oxide (NO_x), methane (CH₄), freones, water steam and ozone. Carbon dioxide is the most frequent by volume with 379,64 ppm (2015). Although the degree of methane is low, methane is 25 times more efficient than carbon dioxide in producing heat. This is why all gases should be included in discussions on temperature changes and possible actions on lowering their effects. In

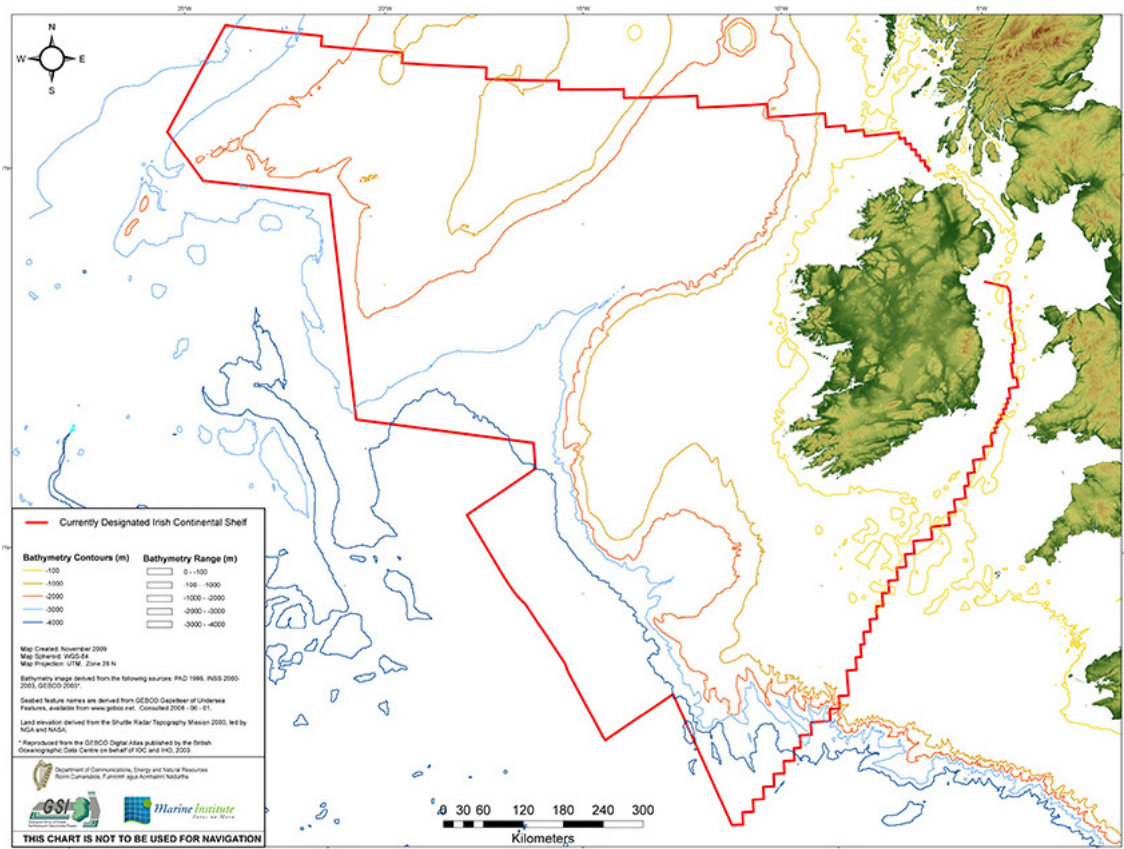
On the Aran Islands, the total yearly emissions of greenhouse gas are about 5,500 tonnes of CO₂e with coal and electricity import as the main sources.

An Aran resident emits 4,5 tonnes of CO₂e a year, 2,3 tonnes if the inhabitant number is considered to be 236.

On Ireland, the average emissions are 11,8 tonnes. The main reason for this low figure is that transports to and from the Aran Islands are not included in the calculation.

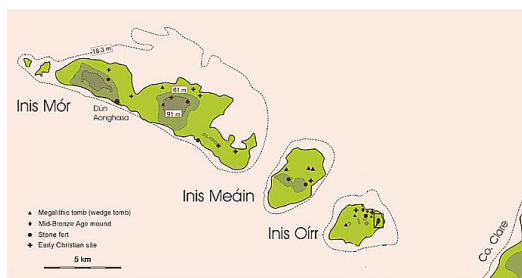
The emissions should be balanced against the islands' ability to store carbon (not calculated here). Since they are islands, part of the sea area surrounding the island should also be included in the calculation its of carbon storage ability (see map on page 11).

order to measure this, CO₂-equivalents (CO₂e) are used, which define the amount of any greenhouse gas needed to produce as much heat as CO₂. One kilo of methane gas has the same effect as 21 kg carbon dioxide.



The Real Map of Ireland, developed by the Marine Institute in Galway

4 The culture and identity of the Aran Islands



First inhabited around 3,000 BC, the Arans were occupied by Stone, Bronze and Iron Age man, and they contain many early Christian monuments. Persecution of Catholics in the mid 17th century brought many more people, who, finding the islands

rocky and inhospitable, devised brilliant method of producing topsoil needed for agriculture. Seaweed and sand spread on the rocks created fertile soil and grassland, and a totally self-sufficient way of life evolved.

If you google an island, the information you get will refer to the islands' land size - the dry area, not sea. Inis Mór will be described as having an area of 31 km². But an island is a piece of land surrounded by water and if the water doesn't count it could as well be a village in France,

a hill in England or a town in Germany.

As can be seen from the "Real map of Ireland" shown above an island located in the sea give rights to the sea. This would include the seabed, areas under the seabed, the airspace above the islands and their sea surface. The Azores, the Canary Islands, Madeira, Svalbard, England and Ireland give Europe the rights to sea areas of 3,813,155 km². These rights do not apply to the individual islands such as the Aran Islands that often lack legal, administrative, and political power over "their" sea or "their" water – as they are neither a state, nor a region or a municipality, but just three tiny small-island communities.

The Aran Islands have had an influence on Western culture that is disproportionate to their size, caused by

their unusual cultural and physical history.

They should have an influence on their surrounding waters too, on the dramatic decrease of biomass in the last hundred years; aquaculture and fish farming; refineries; ports; sea-going transport; cruise ships; submarine cables conveying pipes for electricity, telephony and data, oil and gas; tourism; energy production aided by wind, waves, tidal waters and streams; military interests; rubbish; pollution including ammunition and radioactive waste; and the fact that a third of all birds migrating between Africa and Europe are in ill health.

Aran Islands are three pieces of land surrounded by the sea – an integral part of their culture, their history, their economy and their living conditions.

5 Optimism

Tourism development

Galway County Council and the Community of the Island of Árann commissioned Tourism Development International to carry out a Study entitled *Creating a Sustainable Tourism Strategy* in 1999.

Their Report included the following relevant recommendations:

Improved management of Cill Ronain Harbour will be required to relieve congestion and allay safety concerns. Management will be overseen by a Harbour Master and will be facilitated through development of an off-pier mini-bus rank and a new visitor terminal

Improved access to the Island, from the mainland, should be facilitated through immediate investment in signposting

Proposed improvements to passenger transport services should use the *Draíocht na Farraige* vessel as a benchmark of quality in the standard of service required.

Electric Car Trials

Inspired from the Danish island Samsø, a trial with eight electric cars has been undertaken on the islands: six cars on Inis Mór, one car on Inis Meáin and one on Inis Oírr. Each car is on loan to one household for half a year, with the project spanning three years for a total of forty-eight test trials.

Each household paid a 400 euro one-time fee for a charging station at home, in addition paying a deposit of 400 euro for the car. The electricity cost was estimated at about 32 euro for a half year of driving if the car was charged night-time (when electricity is cheaper and produced locally with wind) and with a maximum mileage of 2,500 km for the half year.

The cars have a daily range of 60 kilometres at a speed of 65 km/h after a nights recharging. The fuel efficiency is 130 W/km, which is equivalent to 0.13 litre/mile.

A project report is soon to come.

6 Pessimism

The Aran Islands are faced with threats of depopulation, ageing population, an overusage of energy mainly due to their position in the sea and their heavy dependence on tourism business. In this, they are

very much alike the other 2,400 small island societies of Europe.

Aran Islands have been blessed from oil spills/catastrophes, the nearest catastrophe being the “Marée Noire” accident in the Shannon Estuary.

7 Possibilities

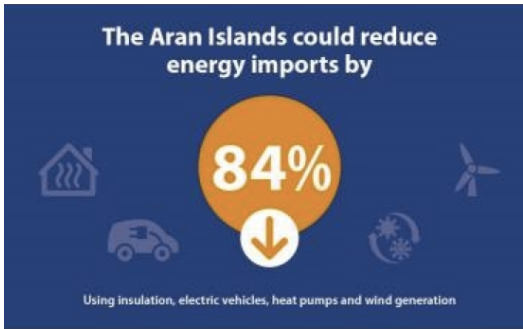
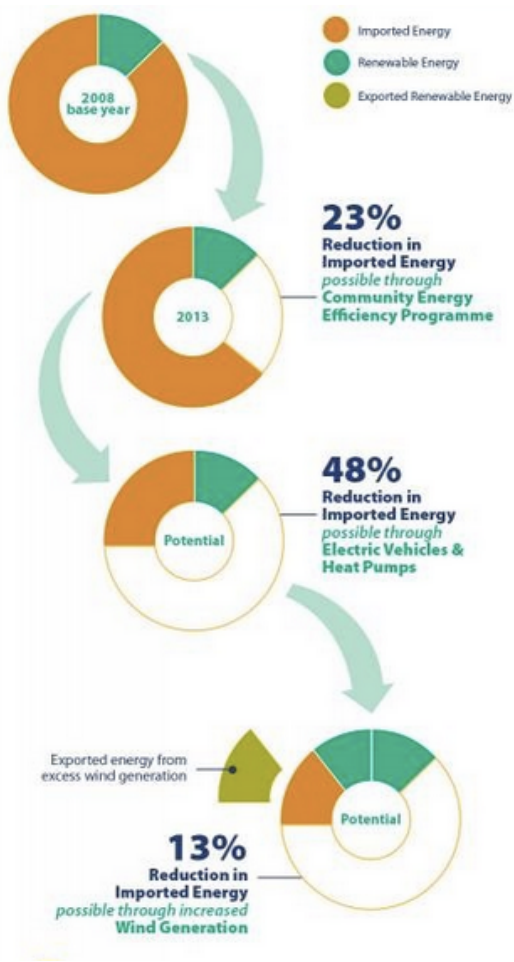
In September 2012, the Aran Islands Energy Co-operative with the assistance of the SEAI, Údras na Gaeltachta, sponsorship from private commercial companies and the local community, undertook a pilot demonstration project for energy efficiency and conservation measures for selected public buildings on the Aran islands.



Aran Islands: Sustainable Energy Concept

The Aran Islands were chosen as the ideal location for a study to determine how the reliance on imported energy could be reduced through energy efficiency and renewable energy. As well as studying the concept, pilot projects were carried out on the islands. These included a three year electric vehicles trial and a programme of building energy upgrades.

The project was successfully conducted in November 2012.





Inis Oír

8 Action Plan

Aran Islands are to be energy independent in 2022.

An energy independence road map

Building on the 2012 pilot demonstration project and on existing energy studies by the SEAI and other state and private bodies, the energy co-op and a small team of consultants prepared the energy independence 2022 road map which clearly identifies supporting the local economy by energy efficiency and conservation measures, followed by encouraging and improving local sources of electricity generation.

Working with the SEAI's Better Energy Communities Project to focus on public demonstrations of energy efficiency, generation and smart energy storage technologies, flexible demand and building innovative resilient, viable commercial and collaborative relationships with other communities, state academic and private companies as technology partners working in the energy sector in Ireland, with a defined overall focus of making the Aran Islands "Smart Grid ready" and achieving practical working smart microgrid within 2 to 3 years.

In 2014, the energy co-op commissioned a feasibility study for setting up a wind turbine on Inis Mór. It was focused on a direct link to a factory unit, as this is one of the ways to move faster through the Irish planning process. When presented to the public, it received much encouragement and backing but its location was not well received and the project was pushed back to the drawing board.

The Irish Government is working on a White Paper on energy, hopefully be supporting the local plans of the co-op when it is published. There was a ministerial visit to the Aran Islands and the community energy ownership agenda has been pushed through three workshops.

The Galway County development plan for 2015-2021 includes, as Objective ER 9 – Oileáin Árann an Energy Transition Community: "The Council shall continue to support Comhar-chumann Fuinnimh Oileáin Árann (Aran Islands Energy Cooperative), SEAI and Údarás na Gaeltachta in their objective to develop the islands as being energy independent by 2022 and becoming Ireland's first energy transition community."

An ideal test bed

The Aran Islands are an ideal test bed to measure the effectiveness of such measures as currently the islands are 100% dependent on imported energy. Every litre of fuel, cylinder and gas and tonne of coal is measurable as an import. Electricity is supplied via a

modern well maintained, 20kv local grid with a quantifiable single access point to the national grid. The islands also have an existing wind farm under refurbishment and as a part of the SEAI's trials the highest proportion of electric vehicles and a quantifiable benchmark for confirmation of the value of these measures both in energy and economic terms.

Come and see for yourself

The Aran Islands will also provide a working "come and see for yourself" how it can be done template for wider community acceptance and understanding of the forthcoming transition to a national and global sustainable energy and economic future.⁸

More details

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<https://www.facebook.com/AranIslandsenergy/?fref=nf>



⁸ <http://connemarajournal.ie/islands-lead-the-way-in-sustainable-energy/>