



WIND & SOLAR TECHNICAL EXPERT

Country Overview | Ireland Renewable Energy 2020-2030

Market Outlook | Regulatory Framework



Demographics.



Population & Demographics.

Ireland has a population of approximately 4.93 million people [1]. The Central Statistics Office's (CSO) latest Population and Migration Estimates report shows Ireland's population increasing by 64,500 , totalling 4.92 at the end of April 2019 [2]. This is the highest the population has been since the census of 1851, when it was recorded at 5.1m.

The CSO report also shows the number of people who immigrated to Ireland in the year ending April 2019 was 88,600. If this figure is compared to the previous 12 months when the figure was 90,300 , it demonstrates a slight decline of 1,700 people. Additionally, 12.7% (622, 700) of the population are non-Irish nationals, as there was a net increase of 35,800 non-Irish nations in the year ending April 2019. Furthermore, the Population Estimates show a population growth of 1.3% which is 6 times the 0.2% increase in the EU 28. This makes Ireland's population growth the third fastest in the EU [3].

Demographics	Ireland	United Kingdom
Population	4.93 million	67.89 million
Population Density	72 per Km ² (186 per mi ²).	255 per Km ² (660 per mi ²)
Life Expectancy	82.8 years	81 years
Median Age	38.2	40.5 years

Ireland Population by Year (Historical)

Year	Population	Growth Rate	Density (km ²)	Population Rank	Density Rank
2020	4, 937, 786	1.13%	71.68	124	139
2019	4, 882, 495	1.32%	70.87	124	139
2018	4, 818, 690	1.38%	69.95	124	139
2017	4, 753, 279	1.22%	69.00	121	140
2016	4, 695, 779	0.93%	68.16	121	140
2015	4, 652,425	0.43%	67.53	121	140
2010	4, 554, 321	1.92%	66.11	120	138
2005	4, 141, 223	1.83%	60.11	123	140
2005	3, 783, 103	1.04%	54.92	123	140

Source: World Population Prospects (2019 Revision)



GEOGRAPHY.



Geography & Climate.

- Ireland is situated on the north-eastern fringe of the Atlantic and on the north-western edge of Europe. It occupies a **total area** of approximately 84,409 square km/ 32,599 square miles.
- The **total length** of the island's coastline is 3,172 km (1,970 miles) [4].
- The island of Ireland has an oceanic climate,. Therefore it is cool and damp, cloudy and rainy throughout the year
- Temperatures do not vary much; however, the western coasts are milder in winter and cooler in summer and the southwest coast is particularly mild in winter [5].
- The gulf stream surround Ireland, therefore, it is much warmer than other countries that share its latitude, with average winter temperatures of 5°C - 8°C and average summer temperatures of 15-20 °C [6].
- Ireland consists of mostly flat low-lying area in the midlands, surrounded by a ring of coastal mountains. The highest peak is Carrauntuohill, which is 1041m (3414 ft) [7].



Source: [8]

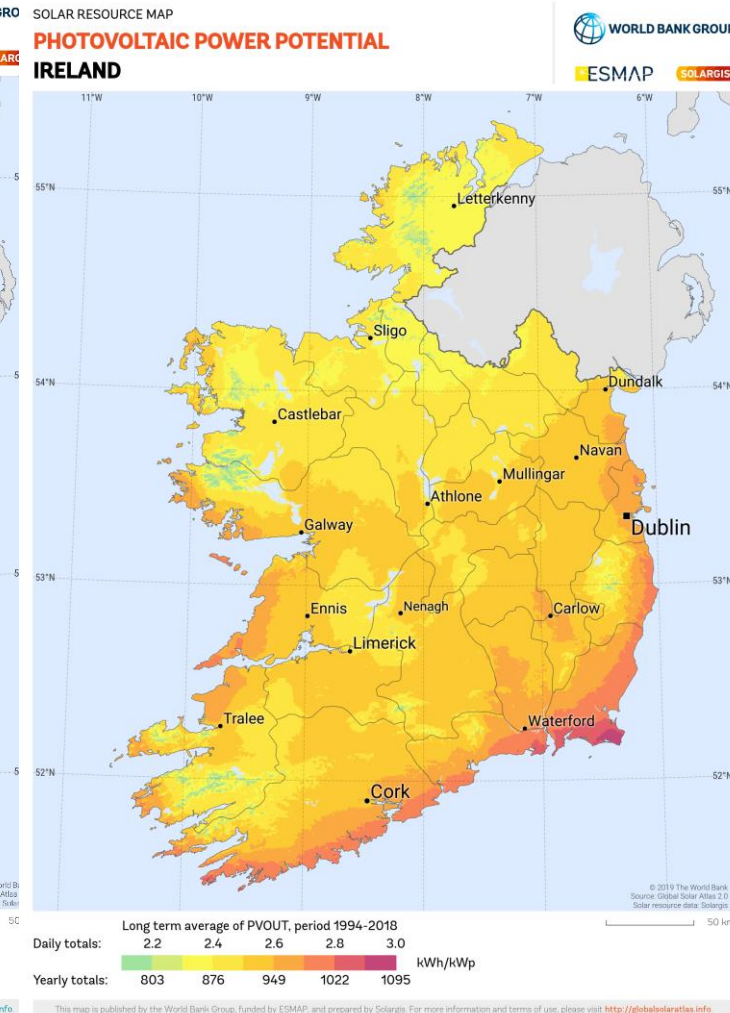
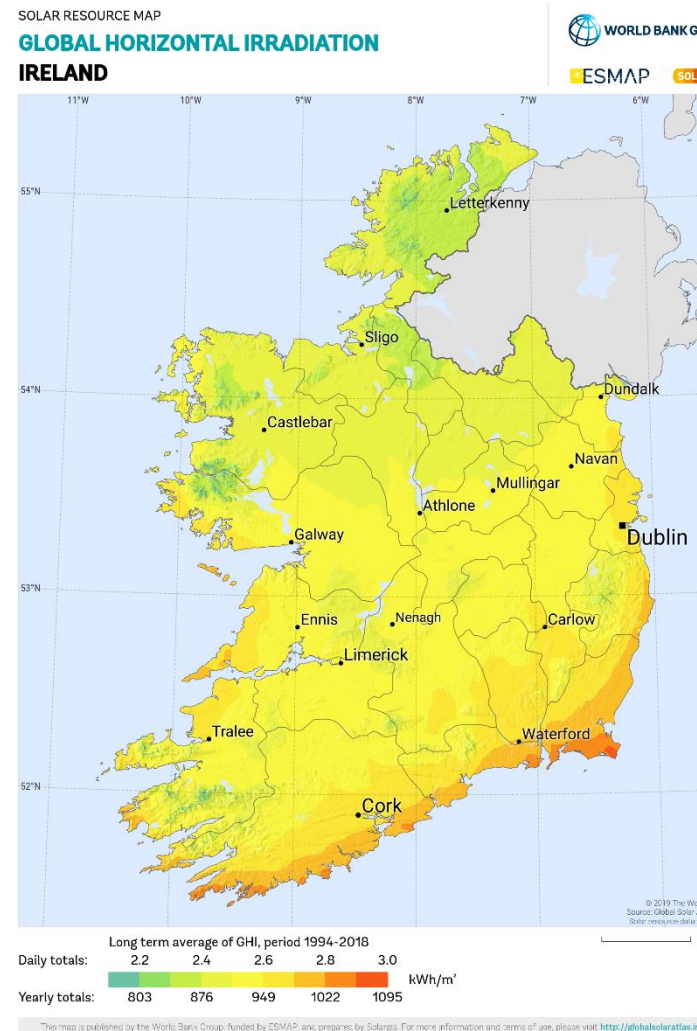
Geography & Climate.

The **Global Horizontal Irradiation** (GHI) map represents the daily and annual long-term averages of Global Horizontal Irradiation (kWh/m²). The **Global Photovoltaic Power Potential** map represents the daily and annual long-term averages of Global Tilted Irradiation (kWh/kWp) available for selected or optimum tilt and azimuth. These two maps correlate as the regions with the highest horizontal irradiation are more likely to generate higher photovoltaic power potential.

As the map demonstrates, the Northern parts of the country experience the least GHI with yearly totals averaging 803 kWh/m². This is similar to the PV power potential map as these areas also experience the least yearly PV power potential, between 803 and 976 kWh/kWp.

The central region of Ireland experiences yearly GHI averages of 949 kWh/m² and yearly PV power potential of 949 kWh/kWp, with some regions to the West and East of the island experiencing yearly averages of 1022 kWh/kWp.

The southern, and particularly the southern-eastline, coastline experiences the most GHI, with yearly totals of 1022 kWh/m² and the greatest PV electricity potential with areas reaching 1095 kWh/kWp.



Source: [9]

Geography & Climate.

The maps [10] show the mean annual wind speed (m/s) in Ireland and the maximum gust speed (m/s), which is likely to be exceeded once in 50 years.

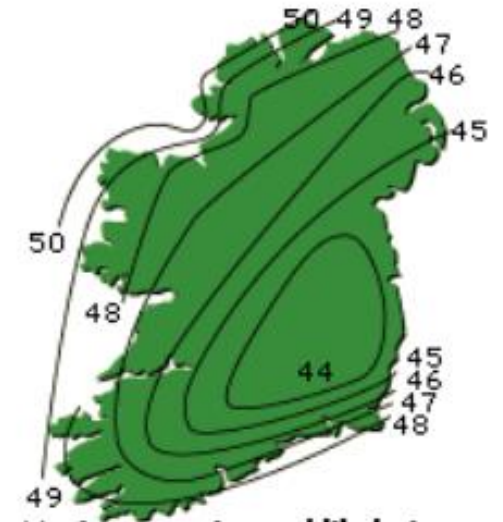
A number of factors can influence wind in a particular location, including obstruction by buildings or trees, the nature of the terrain and deflection by nearby mountains or hills.

The prevailing wind direction is between south and west. Average annual wind speeds range from 3m/s in parts of south Leinster to over 8 m/s in the extreme north, with maximum gust speeds reaching 50m/s.

During the course of a typical day, the range of mean hourly wind speed is considerable. At Belmullet, a western coastal station, the mean diurnal range is 11.5 m/s in January and is still as high as 8.4 m/s in July. At Clones, a typical inland station the mean diurnal range is 8.4 m/s in January and 6.2 m/s in July. The diurnal variation is much more pronounced in summer than in winter. This is a result of surface heating, which involves mixing of the faster-moving air at higher levels with the air near the surface. As the effect of surface heating diminishes, the wind speed decreases [11].



Mean annual wind speed
(units in m/s)



Maximum gust speed likely to be exceeded once in 50 years
(units in m/s)



THE ENERGY MIX.

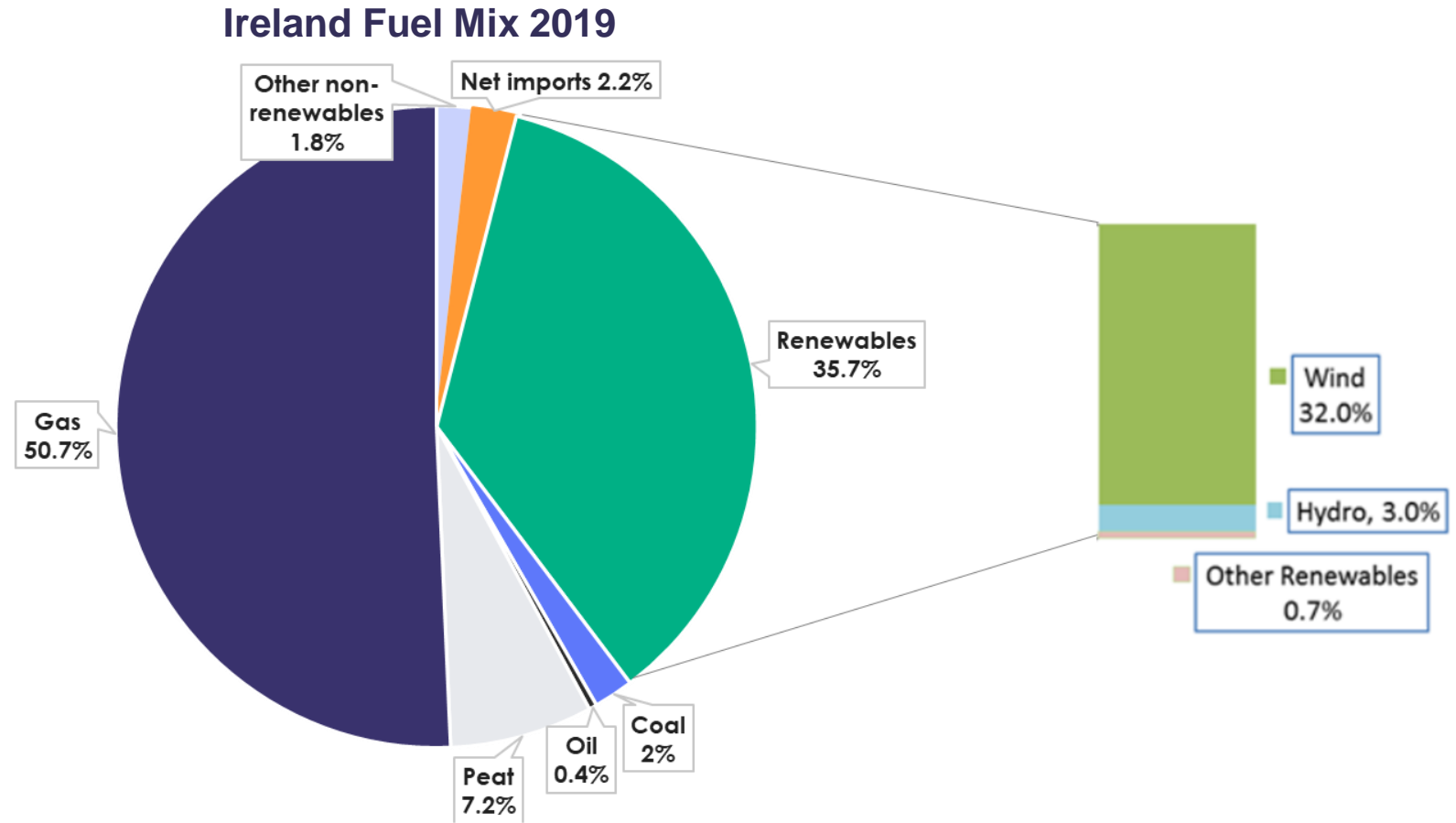
Current Conditions and Growth Outlook



FUEL MIX.

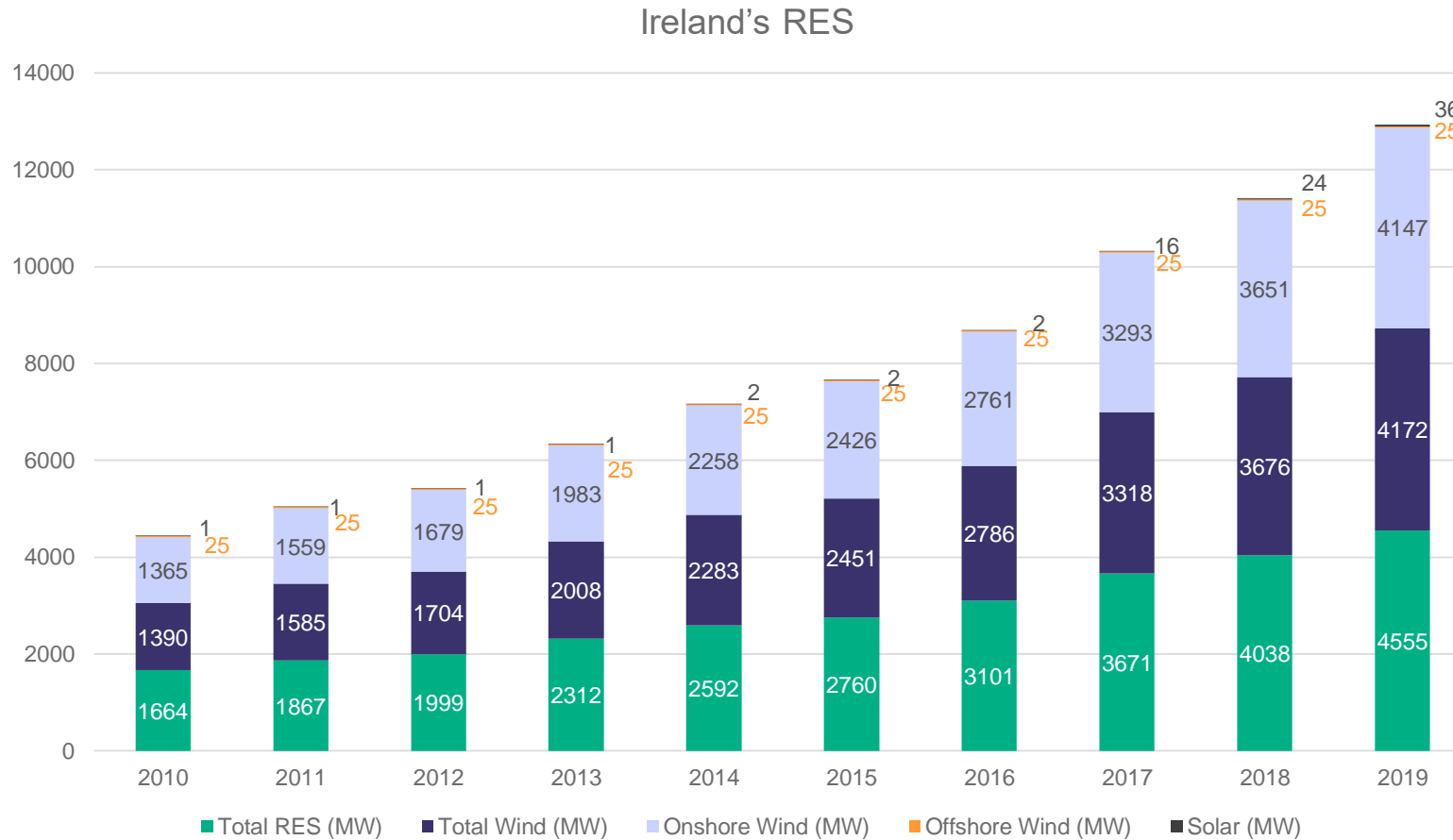
In 2019, gas dominated Ireland's fuel mix with a total of 50.7% of the entire energy mix.

The next greatest sector was renewables, amounting to 35.7% of Ireland's total energy mix. As the graph demonstrates, wind leads the renewable sector with 32%.



Growth.

Up to date



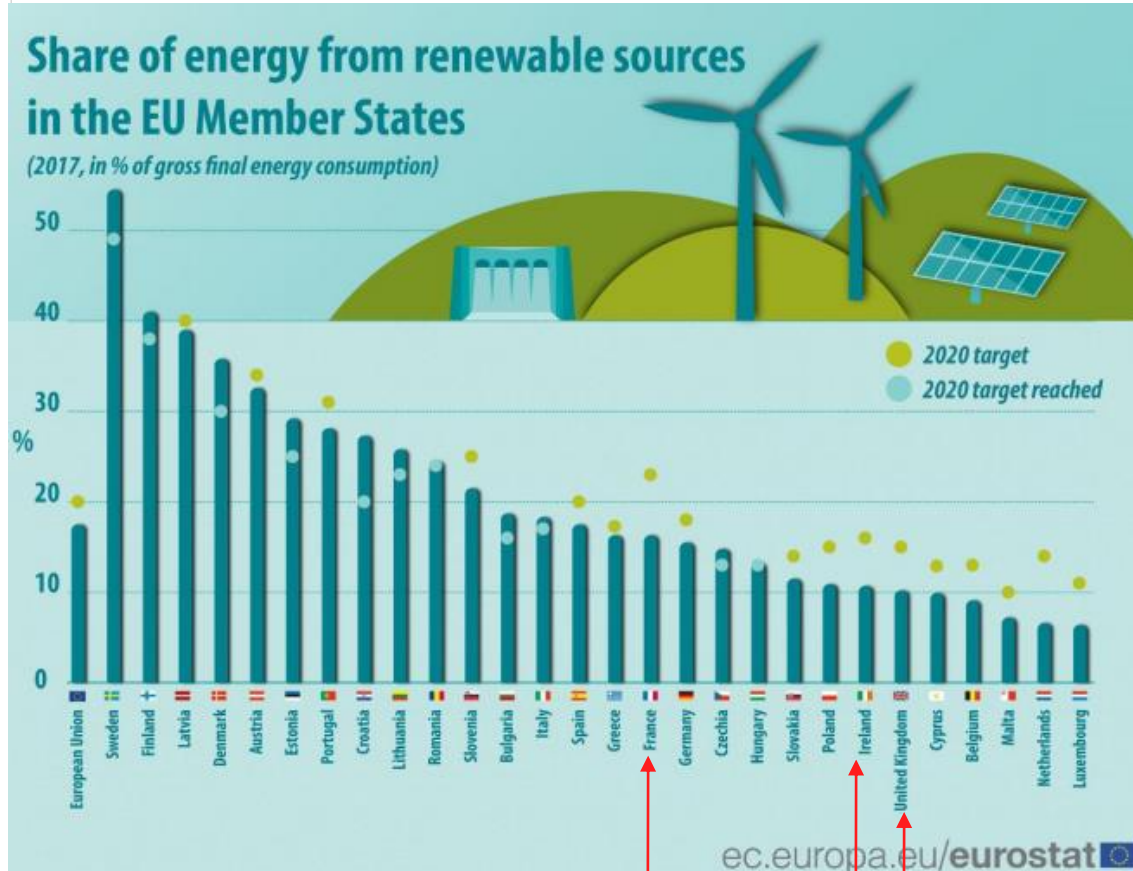
Wind benefited from previous two support mechanisms: Alternative Energy Requirement auctions in the 90s and REFiT from 2006 till 2015.

Climate Action Plan 2019 Target: 70% of electricity in Ireland to be generated from renewables. In order to achieve it, up to 30TWh of renewable generation will be required by the end of the decade. Competitive auctions could deliver up to 8.2 GW increase in onshore wind, at least 3.5 GW offshore wind and 1.5 GW of solar.

Source: [13]

2020 EU Targets.

National Targets



The national targets for 2020 for RES, are set as follows:

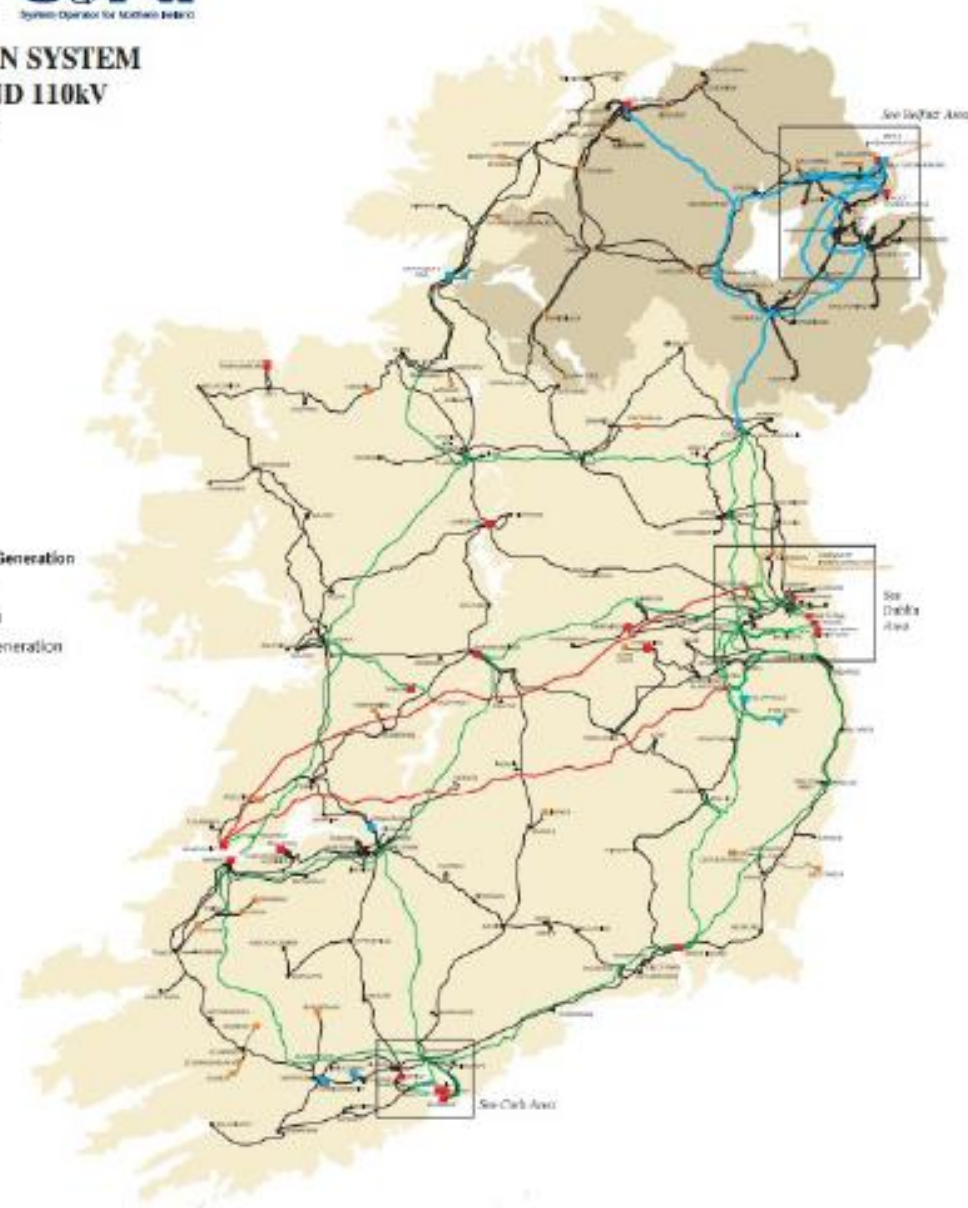
1. Contribution of the energy produced by RES to the gross final energy consumption: 20%
2. Contribution of the electrical energy produced by RES to the gross electrical energy consumption: at least 40%
3. Contribution of the energy produced by RES to the final energy consumption for heating and cooling: at least 20%
4. Contribution of the electrical energy produced by RES to the gross electrical energy consumption in transportation: at least 10%.

GRID.

- Ireland currently has a maximum System Non-Synchronous Penetration (SNSP) level of 65% (Q1 2018)
- The Climate Action Plan recognises the need to facilitate a high penetration of over 90% SNSP and Eirgrid, Irish Transmission System Operator is planning to achieve this through system services, market arrangements and additional flexibility.



TRANSMISSION SYSTEM 400, 275, 220 AND 110kV JANUARY 2014





THE AUCTIONS.

A CFD Like system...



AUCTIONS.

In 2019 Ireland announced its plans to procure renewable capacity through auction system under the Renewable Electricity Support Scheme. The scheme plans for up to 5 auctions over the next ten years and the government believes the auctions could deliver up to 8.2 GW increase in onshore wind, at least 3.5 GW offshore wind and 1.5 GW of solar. The qualifying stage of RESS 1 is underway with the auction results expected in August 2020.

	Auction Capacity (GW/hrs)	Auction Year	Delivery Year (end of)	Single Technology Cap
RESS 1	1,000	2019	2020	No
RESS 2	3,000	2020	2022	Yes
RESS 3	3,000	2021	2025	Tbc
RESS 4	4,000	2023	2027	Tbc
RESS 5 (possible)	2,500	2025	2030	Tbc

Ireland's new scheme is framed within the context of the Climate Action Plan and the European Union's Clean Energy Package (EU Clean Energy Package), in particular the Renewable Energy Directive and the development of Ireland's National Energy and Climate Plan. The RESS will be consistent with the EU Clean Energy Package and the EU Guidelines on State Aid for Environmental Protection and Energy 2014-2020.

AUCTION DETAILS.

- Contract for Differences type auction
- Projects can compete in three categories:

RESS 1



Community
(0.5MW – 5MW)



Solar
(0.5MW – 125MW)



All
(0.5MW – equivalent of
600GWh/year)

- Eligible technology: onshore and offshore wind, solar, hydro, waste to energy, biomass, biogas
- Duration of the scheme – 14-16.5 years
- Obligatory contribution to Community Benefit Fund – min €2 per MWh

AUCTION DETAILS.

Characteristics of the RESS auctions:

Eligibility rules: grid connection contracted, planning application, secured land	Bid bonds €2,000/MW	Project milestones	Financial Structure
Max Offer Price Considered RESS 1 €120/MW; RESS 1 Support I spay-as-bid	Cap on single technology	Market reference price	Floating Feed in Premiums

- RESS 1 Support will commence on Commercial Operation date or on 1 July 2021 (whoever is later)
- Project successful in the auction will have to submit Performance Bond in the amount of €25,000 per MW of offered quantity

Representative Maximum and Minimum Quantities:

	p = c (community)	p = s (solar)	P = a (all projects)
RMin	N/A	N/A	1,000 GWh
RMax _p	30 GWh	300 GWh	3, 000 GWh



THE MARKET CHANGES.

Simplifying and clearing the system from
speculative investments...



Market Drivers.

Ireland's main market drivers involve various government incentives and policies to fill the void left by the phasing out of coal in 2025 [14].

1. Huge investments in grid infrastructure to increase the renewable capacity, along with the introduction of energy storage systems to enable a steady supply of power when renewable energy is unavailable
2. Introduction of the Renewable Electricity Support Scheme with its auction system. The auctions are expected to bring up to 8.2 GW increase in onshore wind, at least 3.5 GW offshore wind and 1.5 GW of solar.
3. Delivering a Secure, Sustainable Electricity System (DS3) which allows system operator to procure ancillary services (including frequency response and reserve services). This programme is a key driver behind the high interest and growth in battery storage in Ireland (current pipeline 2.1 GW). First auction under this scheme was completed in 2019.
4. Corporate Power Purchase Agreements: first Corporate PPA to fund a new wind farm in Ireland was signed in 2019. Climate Action Plan 2019 expects that 15% of new renewable capacity will be contracted under PPAs [15].



GREENSOLVER ABOUT US.

What do we currently do and what are we going to do in Greece...



About us.

Greensolver was created in 2008, by technical experts, for investors and asset owners. We felt there was a real need in the market for an experienced and independent service provider catering to the infrastructure investors to deliver professional, world class services.

Experienced service provider

Greensolver has an extensive experience of Technical and Commercial Management (TCM), Construction Supervision (AMO) and Advisory, being on the market since 2008.

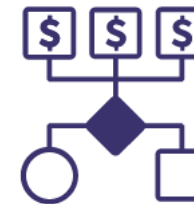
Our experience relies on:



Construction
1.68 GW+



Operation
1.4 GW+



Consulting & Advisory
15.0GW+

We are proud to be amongst the market leaders in France and the largest Asset Management company (in total operational asset capacity MWp) in the Netherlands.

About us.

Quality

Greensolver understands the requirements of the financial community. Our number one objective is to help you achieve your financial goal, whilst taking away the burden of daily operations. Our job is to be your technical arm so you can focus on other issues that occur.

Greensolver is certified **ISO 9001, ISO 14001 and OSHAS 18001** standards equipped with state of the art analysis tools and processes developed from its experience, that each of our customers benefit from. Greensolver is also the first asset manager in France to be certified with **ISO 55001** standard dedicated to asset management.

Greensolver has been certified as RRM (Registered Reporting Mechanism). That means that under the REMIT regulation, we are officially in a position to act as your representative and are allowed to send records of Wholesale Energy market transactions to the ACER (Agency for the Cooperation of Energy Regulators).

About us.

Innovative Tools

We launched **Greensolver Index** in early 2014, an innovative operation benchmarking tool enabling independent asset owners to compare themselves across a set of more than 45 KPI's.

In September 2015, we also launched **GreenBoost**, in cooperation with Newgreen. GreenBoost® is a unique service on the market which guarantees both the wind resource and the availability of a wind farm.

In 2016, we launched **Bladesolver**, an offer that enable the project owner to avoid risk and underperformance link to a damaged blade.

International services

We currently manage assets in nine European countries (Cyprus, France, Italy, Ireland, The Netherlands, Portugal, Spain, Sweden & United Kingdom), from our three European offices (Paris, London & Groningen).

We have been active in most parts of the world since the beginning, performing technical due diligences or construction assignments from Australia to Mexico, Poland, USA ...

Our team is multi-national and speaks 9 languages.



OUR SERVICES.



Project Origination & Structuring

Being one of the pioneer investors in renewables gives us access to high quality assets, allowing you to benefit from our unique network of developers, investors and off-takers to close bilateral deals and deploy your capital. The Greensolver team will support you throughout the process to de-risk your investment and maximise your return.

Our wind & solar experts assess the project sellers capabilities and track-records and we tailor our offers to your investment strategy and your technical capabilities where our technical and financial experts support you during the acquisition, pre-construction, construction and operation phases.

Experience

- Certified by Climate Bond Initiative as Approved Verifier
- Management of Eolfi, the first investment fund specialized in renewables in France
- Acquisition of 30 operational or RTB wind and PV projects totalling 288MW in France and Greece
- Acquisition of Ridgeline, a US based development company with 6 GW of projects under development
- Structuring of co-development agreement in Poland for 100 MW of wind project
- Sale of 15 wind and PV projects totalling 134 MW
- Sale of Ridgeline and Eolfi development platform
- Involvement in the acquisition or sale process of 12.7 GW as technical advisor



Greenbond: Certifying your Greenbonds to raise more capital	Origination: Deploying your capital	Structuring: Negotiating the best conditions for your contacts
Pre-Issuance certification	Market study	Co-development agreement structuring
Post-Issuance certification	Land Selection	PPA structuring
Greenbond report framework design	Project Pipeline	Project feasibility
	Development Platform	Risk assessment
	Ready to build or turnkey project	Suppliers selection
	Operational asset suitable for repowering	EPC and O&M contract negotiation

Advisory & Consulting

We have been managing assets on a daily basis for the past 12 years, which gives us a unique understanding of potential issues that can happen with an asset. This intimate knowledge is not a standard in the industry, and something you benefit from as a Greensolver customer.

We adapt our offer to your needs, especially concerning deliverables expected and our audits are made step by step (red flags, midterm report, final report) to give you clear, and simple indications.

Additionally, our team is experienced & multi-skilled as we have 10+ years of expertise with 12.7GW of technical advisory performed, where only experienced engineers work on due diligence (5+ years).

Technical Due Diligence: Negotiating the best conditions for your contracts	Performance Optimisation: Enhancing your asset performance	Contract Negotiation: Negotiating the best conditions for your contracts	Cash-flow Assumption Review: Providing expert feedback on key assumptions
H&S: Compliance, Audits & Management	Lifetime optimisation	Equipment Supply Agreement	Revenues
Cybers ecurity			
Plant design (optimisation & HSE requirements)	Bladesolver	Balance of Plant	OPEX
Feasibility studies	Yaw alignment	Operation & Maintenance	CAPEX
Permits	Maintenance optimisation	Electricity contracts	Financing
Contracts			
Construction & commissioning schedule			
Grid connection issues			
Acoustic studies (if wind)			
Yield Assessment			

Operation

We deliver under time pressure and can adapt our deliverables to your needs; format, data to be included, and periodicity: monthly, quarterly, annually. We have multiple control rooms, based in Paris/UK/Groningen for localised rapid handling of alarm messages (10 minutes prompt). We run 24/7, 365, and we handle issues as soon as they are identified, dealing with them either remotely or through our local site managers and the site's O&M providers.



Technical Management: Supervising & controlling asset's production & performance	Commercial Management: Managing your SPV's
On a daily basis, our experts work with WIS & Breeze software. Each software allows them to have access from one single platform to monitor every wind & solar asset, enhancing our productivity.	We manage more than 80 SPV (including 880MW under operation) for our customers.
One of our experts has also developed a unique software which connects to assets' telecommunication networks and which sends alerts when communication is lost.	Greensolver Finance is a successful joint venture between Greensolver and Premier Monde, chartered accounting firm.
24/7 operation & monitoring	Greensolver Finance allows investors, developers and asset owners to benefit from an in-house commercial & administrative management service.
Monthly reporting	In-house accountants
Site visits	Tax declarations
Site access monitoring	Payment processing
Maintenance management & optimisation	Debt management
Asset performance optimisation	Land lease management
HSE Compliance	Cash flow management
RRM declaration	Electricity sales invoicing

Development & Construction Management

Being in the market since 2008 allows us to have various processes, methodologies and tools, regularly improved and enriched. Through those processes we ensure your wind or solar assets are built in-time and on budget. We are a team of engineers that have a deep understanding of investor and lenders expectations and constraints. We have seen projects develop; we have done financial closings. We talk the same language even though our focus is technical. With 12+ years' experience, 1662MW of wind & assets have been built and 250MW were built between 2016-2018 alone.



Pre-financing technical Due Diligence: Reviewing the project bankability	Pre-construction: Planning and preparing the construction stage	Construction supervision: Acting as your main point of contact for the construction of your asset	Commissioning review Managing taking over & commissioning
Yield assessment	Technical Due Diligence	Coordination of suppliers & subcontractors	Technical documentation
Plant design (optimisation & HSE requirements)	Technical solutions evaluation	Quality review	Equipment / EPC
Feasibility studies	OPEX & CAPEX determination	Transport management	Balance of Plant
Permits	Call for tenders management	Costs & budget management	Grid substation
Contracts	Suppliers selection	Schedule monitoring	
Construction & commissioning schedule	HSE plan elaboration	HSE compliance review	
Grid connection issues		Procedure compliance review	
Acoustic studies (if wind)			



Sources.



Sources.

Reference	Sources	Page
1	https://www.worldometers.info/world-population/ireland-population/	3
2,3	https://www.irishexaminer.com/breakingnews/ireland/irish-population-rises-by-64500-bringing-it-to-almost-5m-946672.html	3
4	https://www.irish-genealogy-toolkit.com/Ireland-geography.html	5
5	https://www.climatestotravel.com/climate/ireland	5
6	https://www.educationinireland.com/en/Living-in-Ireland/Before-Arrival/Climate/	5
7	https://www.cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/g/Geography_of_Ireland.htm	5
8	https://www.climatestotravel.com/climate/ireland	5
9	https://solargis.com/maps-and-gis-data/download/ireland	6
10, 11	https://www.met.ie/climate/what-we-measure/wind	7
12	http://www.eirgridgroup.com/site-files/library/EirGrid/Fuel20Mix.jpg	9
13	IRENA (2020), Renewable capacity statistics 2020 International Renewable Energy Agency (IRENA), Abu Dhabi	10
14	https://www.renewableenergyworld.com/2019/08/22/ireland-s-renewables-expansion-to-attract-massive-investment-says-report/#gref	18
15	https://www.iwea.com/latest-news/2422-blog-explaining-corporate-ppas	18
	http://www.eirgridgroup.com/	

Disclaimer.

The content of this document have been produced based on primary and secondary research from Greensolver. It is intended as informational material only and in no means provide investment advice. Any reproduction, copying, modification and or publication of, or forwarding to third parties without the written consent of Greensolver is strictly forbidden.

This document and the information contained in it are the copyright of Greensolver, All Rights Reserved. The information in this document is provided “as is” without any representations or warranties, express or implied Greensolver makes no representations or warranties in relation to the information in this document.

Greensolver, cannot be held responsible in the event of errors or omission contained in the report as long as they are based on information or statements provided by third parties. The veracity of these data has not been verified, in that it was assumed to be accurate, complete, reliable, and up to date at the time of the study.

© Copyright Greensolver

**Project origination &
Structuring**

Advisory & Consulting

Operations

**Development & Construction
Management**



greensolver.net

contact@greensolver.net



Paris

28 Boulevard Haussmann
75009 Paris
France
+33 (0)1 80 87 85 60

London

51 Eastcheap
EC3M 1JP London
United Kingdom
+44 (0)20 3966 1380

Groningen

Leonard Springerlaan 35
9727 KB Groningen
The Netherlands
+31 (0)854 019 650

Dublin

40 Mount Street
D06X5K0 Dublin
Ireland
+35319036210

www.greensolver.net

contact@greensolver.net

