5. ALTERNATIVES

5.1 DO-NOTHING SCENARIO

Climate change, security of electricity supply and price stability are amongst the factors supporting the main rationale underpinning the need for renewables. This need for renewables to play a significant role in the mix of fuels used in power generation is recognised internationally, with targets for renewable energy now being in place in more than 130 countries worldwide.

The case for renewables energy development in Ireland is heightened by the high dependency on fossil fuel sources for primary energy consumption. More than 95% of Ireland's total energy requirement energy is still supplied in the form of fossil fuel. This extremely high dependence on a finite supply of imported fuels raises questions over the security of supply in future years as reserves of fossils fuels are depleted. This brings the need for locally generated renewable energy sharply into focus. Additionally, Ireland is particularly vulnerable to future energy crises and fluctuations in supply given its location on the periphery of Europe

The need for Ireland to move to a low carbon economy through the use of their indigenous resources will benefit all Irish people by keeping more money in the Irish economy and creating more jobs. Ireland's energy security position sees the country spending approximately €6.5 billion each year on fuel imports and any steps to reduce dependence on imported fossil fuels will add to financial autonomy and stability in Ireland.

The Irish target for the renewable energy share of gross electricity consumption is 40% by 2020. In Ireland, wind energy, because of its developed technology and large resource available, represents by far the most significant viable option for electricity generation from renewables and is seen as making the most significant contribution to renewable energy developments. Achieving the Irish target for renewables is estimated as being equivalent to about 5,100 MW of installed wind energy capacity. In December 2014, that capacity stood at 2,211 MW, indicating that installation of significant further capacity is required to meet targets.

The need for renewables is established and underpinned by a number of critical national and local policy requirements, including Ireland's binding obligation to meet its 2020 renewable energy targets pursuant to EU law and as set out in the National Renewable Energy Action Plan and its international obligations regarding air emissions.

There are very significant financial penalties that will be incurred by Ireland by failing to meet those binding targets. In its overview of Ireland's greenhouse gas emission projections EPA has reported[8] that there continues to a significant risk that Ireland will not meet its 2020 EU targets even under the most ambitious emission reduction scenario.

European, national, regional and local policy all provide strong support to the development of renewable energy and in particular the most cost effective form of renewable electricity generation in Ireland – onshore wind energy.

The development of Grousemount Wind Farm is fully compatible with and supported by the above. The do-noting scenario is not a realistic one given the national circumstances.

8 Ireland's Greenhouse Gas Emission Projections 2013-2030, EPA (May 2014)

5.2 ALTERNATIVE ELECTRICITY GENERATION

5.2.1 Other Renewable Energy Sources

In the short - medium term at least, current and future demand for electricity generation capacity in Ireland will remain predominantly supplied by fossil fuel plants.

However, renewable and alternative sources of power will play an increasingly important role in meeting power needs in the future. The development of renewable sources of energy is in line with EU and Government policies, which have strong public support. Renewable energy resources other than wind include hydro, solar, biomass, tidal, wave and geothermal.

Hydro - There are no further suitable large and medium-sized impoundment hydro generation resources that could be developed in Ireland based on natural rivers and lakes. While a number of small such resources remain, it is not possible that their development could ever present anything other than a minor increase in power generation capacity.

Pumped storage schemes such as that operated by the ESB at Turlough Hill could offer storage capacity for both renewable and conventional energy during off peak periods but are not themselves primary power producers.

Solar - Solar power may be used in either direct heating applications or direct conversion of radiation to electricity by the use of photo-voltaic cells. However, for large applications, its costs remain very high. Feasibility studies continue in areas of high insolation and it would be reasonable to expect commercial development for significant energy outputs to occur first in such areas. This has not yet happened and at present solar power is not a serious option for electricity generation in Ireland.

Biomass - Biomass energy can be obtained from the combustion of any organic material that is grown and harvested on a regular basis. Suitable materials include forestry waste and specially grown short rotation forestry. Edenderry Power Station co-fires biomass with peat and is targeting having a 30% co-firing rate by 2015. Nonetheless, production of wood biomass on a large scale remains to be proven in practice. Large-scale electricity or heat generation from dedicated biomass crops is not a feasible option in Ireland at present.

Tidal - The generation of electricity from tidal power has been under assessment for more than 50 years and various schemes are proposed from time to time. ESB International, which is part of the ESB group of companies, is an investor in a pioneering energy project that installed the world's first commercial scale tidal power generating device in Strangford Lough, Northern Ireland. Locations with naturally high tidal ranges are required and those available in Ireland are generally 2 - 4m, which is considered modest. Such schemes are highly capital intensive and further developments at Irish locations will await successful operational data from this pilot installation. The Department of Communications Energy and Natural Resources Ocean Renewable Energy Development Plan (OREDP) identifies zones around Ireland suitable for ocean energy. The plan indicates that the tidal resource is very limited in contrast to wind and wave[9].

Wave - There has been considerable research on wave power and several wave energy test sites have been constructed internationally, e.g. the European Marine Energy Centre (EMEC) in the Orkneys. To obtain appreciable power outputs, installation in the most active and open sea areas is needed. These areas present very challenging environments

9 Draft Ocean Renewable Energy Development Plan

to structures and to mechanical and electrical equipment and significant testing of devices at differing scales is required before commercial scale developments can occur. Prototype wave energy converters have been deployed in Scotland, Spain, Portugal and Ireland (Pelamis, Oyster, Wavebob and Ocean Buoy for example) for short duration periods. However, to date, wave power has not been demonstrated to be technically feasible or commercially viable on a large scale. ESB has worked closely with the ocean energy team in the Sustainable Energy Authority of Ireland (SEAI) and the Marine Institute to develop a full scale wave energy test site off the west coast of Ireland at Belmullet in County Mayo. Termed the Atlantic Marine Energy Test Site (AMETS) it will provide a grid connected wave energy converter test facility for full scale devices. The ESBI Ocean Energy Group is also active in this field, through the Westwave Project - a proposal to develop a pilot wave energy array off the west coast of Ireland[10]. While test installations are being further deployed and wave energy converter testing continues, it is not expected to contribute significantly to power generation in the immediate future.

Geothermal - Geothermal power is exploited in many locations throughout the world, where reservoirs of hot or superheated water exist beneath the earth's surface. Most of these systems are installed at locations having reservoirs of water at temperatures in excess of 100 °C. Such high temperature reservoirs have only recently been identified in Ireland and commercial exploitation of these resources is still at the concept stage.

5.2.2 Role and Benefits of Wind Energy

Onshore wind power is recognised as one of the most promising renewable energy sources for electricity generation in Ireland. Wind energy currently represents by far the most significant viable option for electricity generation from renewables.

An independent study[11] of the Irish public's attitude towards the development of wind energy indicated a high level of support for developing more sources of renewable energy in Ireland, making it the preferred option among energy policies measured within the study

Both onshore and offshore wind farms will have roles to play in renewable energy developments. Onshore wind farms use field-proven technology, thus involving lower investment risks, while offshore wind farms remain considerably more expensive to construct than their onshore equivalents. Average capital costs of installation are greater by a factor of more than two and they have higher average operating costs by a factor of approximately 50%[12], due to the obvious difficulties of access for maintenance, etc. In time, problems associated with offshore wind will be solved. However, a need to develop wind farms at suitable onshore sites remains.

Wind is the world's fastest growing source of energy. In terms of available technology, it is the one viable renewable energy sources currently available in Ireland. This, rather than being a disadvantage, plays to the country's strengths, as it has some of the highest mean average wind speeds in western Europe.

Wind power provides more benefits than just affordable clean energy. The prices of wind-generated electricity are stable and not subject to the price volatility of fossil fuels. Additionally, since it is inexhaustible, wind offers long-term energy security that electricity derived from non-renewable fossil fuels cannot.

A frequent misunderstanding related to wind is the implication of its variability. In fact, with

10 http://www.westwave.ie/
11 Attitudes Towards the Development of Wind Farms in Ireland, SEI (now SEAI), 2003
12 Renewables 2012 Global Status Report; REN21 Renewable Energy Policy Network

modern meteorology, wind is very predictable over the time scales relevant for balancing the electricity system. Electricity demand and wind output in Ireland are not strongly correlated. Wind generation variability in 2012 was less than electricity demand variability. The variation in the output of wind farms has an almost equal chance of either offsetting the variation in demand or adding to the variation.

It is also important to distinguish between capacity and production. Capacity is the amount of installed power in a region and is measured in MW. Production is how much energy is produced by that capacity and is measured in MWh. While wind power does not replace an equal amount of fossil-fuel capacity, it does replace production – for every MWh that is produced by a wind turbine, one MWh is not produced by another generator.

The carbon penalty for having additional conventional plant on reserve duty to compensate for the variability of wind (which is in any case usually predictable) is very small.

5.2.3 Project Context

Wind power has become an important source of energy worldwide, mainly due to: environmental considerations (the search for energy alternatives and for a reduction in energy dependence), and the increasing costs of oil and other fossil fuels.

The evolution of modern wind turbines is a story of engineering and scientific skill, coupled with a strong entrepreneurial spirit. In the last 20 years, turbines have increased in size by a factor of 100 (from 25 kW to 2500 kW and beyond), the cost of energy has reduced by a factor of more than five and the industry has moved from an idealistic fringe activity to an acknowledged component of the power generation industry. At the same time, the engineering base and computational tools have developed to match machine size and volume.

Worldwide Scenario

Worldwide wind generating capacity stood at 318 Gigawatts (GW) in 2013, representing an eight-fold increase over the intervening decade. Worldwide growth is shown in Table 5.1 and is presented in Figure 5.1.

Table 5.1: Global Deployment of Wind Power (GW)

Year	2006	2007	2008	2009	2010	2011	2012	2013
Installed Capacity	74	94	120	159	198	238	282	318
Annual Growth	25.4%	26.7%	28.1%	31.9%	24.5%	20.2%	18.5%	12.8%

In 2013, a total of 25.4 GW of renewable power capacity installations was installed in the EU with more than 72% of all new installed capacity being renewable. It was, furthermore, the sixth year running that over 55% of all new power capacity in the EU was renewable.

Within the EU wind power’s share of total installed power capacity has increased five-fold since 2000; from 2.4% in 2000 to 13% in 2013. Over the same period, renewable capacity increased from 24.5% of total power capacity to 39.6% in 2013. In the EU Germany is the country with the most installed wind generating capacity at 34,250 MW, while Spain in second place with over 22,960 MW of capacity. In terms of electricity supply, Denmark’s wind capacity met almost 26% of its electricity needs in 2011, the largest share in any country.

Many of the largest operational onshore wind farms are located in the USA and China. The Alta Wind Energy Centre in California is the largest onshore wind farm outside of

China, with a capacity of 1,020 MW. Whitelee Wind Farm, located on Eaglesham Moor near Glasgow in Scotland, is Europe's largest with 215 wind turbines and an installed capacity of 539 MW.

In terms of size and rating, the largest turbines currently available commercially are the Enercon E126, which has a hub height of 135 m, a rotor blade diameter of 126m and an overall dimension of 198 m. Its rated power output is 7.58 MW.

Irish Scenario

Ireland's first commercial wind farm at Bellacorick, Co. Mayo is now more than 20 years old and there has been sustained growth since then in the deployment of wind power in Ireland. Growth over the past decade is shown in Figure 5.2.

EirGrid, the Irish transmission grid operator, has reported that the installed wind capacity in Ireland was 2,211 MW at end December 2014 with a further 614 MW installed in Northern Ireland (SONI), giving a total installed capacity of 2,825 MW on the island.[13]

The highest recorded wind power output peaked on 21st December 2014 with a total of 2,314 MW on an all island basis.

The fuel mix for electricity supplied to the All-Island electricity market is presented in Table 5.2. These represent the latest published figures from the CER[14]. The fuel-mix of suppliers in Ireland is calculated as required by Regulation 25 of EC (Internal Market in Electricity) Regulations 2005, which transposes Article 3.6 of EU Directive 2003/54/EC.

Table 5.2: Fuel Mix for All-Ireland Electricity Generation

Year	Coal	Gas	Oil	Peat	Other	Renewables
2010	16.0%	64.1%	1.6%	5.8%	0.5%	12.1%
2011	14.4%	56.2%	0.0%	5.9%	3.2%	17.2%
2012	19.9%	47.7%	0.0%	6.9%	1.8%	23.7%
2013	18.4%	44.1%	0.0%	6.5%	0.8%	30.2%

Ireland has an abundant wind energy resource and almost the entire country has either an excellent or very good wind energy resource, as indicated in Figure 5.3. Ireland has the potential to generate the cheapest wind energy in the whole of Europe.

Apart from a small area in the south of France, only Ireland, Denmark and Scotland have substantial areas of land where the wind speeds at 50 m above ground level, on open plains, are above 7.5 m/s. However, Denmark is relatively flat, and so derives minimal benefits from the enhanced wind speeds on hilltop sites. Wind farm capacity factors in the range 30-35%, or above, may be expected in Ireland.

5.3 PROCEED WITH PERMITTED DEVELOPMENTS

The proposed development comprises the amalgamation of two previously permitted wind energy projects, namely Barnastooka Wind Farm (14 wind turbines) and Grousemount Wind Farm (24 wind turbines). An alternative to the current proposal is to develop these projects as currently permitted.

The permitted development at Grousemount (24 turbines) has a maximum installed

13 EirGrid and SONI Operations 2014, All Island Wind and Fuel Mix Summary Report
14 Fuel Mix Disclosure and CO2 Emissions 2013, Commission for Energy Regulation, July 2014

capacity of 48 MW and the dimensional constraints in the permitted development at Barnastooka (14 turbines) restrict turbine selection to models with a turbine capacity of 3 MW. Thus, the limit the maximum overall rating of the combined development is currently 90 MW. Grousemount Wind Farm comprising the combined approved Barnastooka and Grousemount Wind Farms has received grid connection offers totalling approximately 115 MW. This means that 25 MW of capacity that is available would not be developed at this site and would require a separate greenfield development elsewhere to provide this incremental output.

Further to the above, there are obvious benefits to be derived from developing the combined scheme as a single development having the same wind turbine model. These include the economies of scale that would be derived in turbine procurement and supply, and in uniform methods of construction and subsequent maintenance during operations.

Removing the dimensional constraints on the allowable combination of tower heights and blade lengths while retaining the turbines' maximum overall dimension also allows for consideration of larger number of candidate turbines during tendering. Again, this offers commercial benefits and greater possibilities for selecting the turbine model most suited to the local conditions.

It is clear that the current proposal offers significant advantages over the separate permitted developments. The principal one is that it offers the opportunity to develop a project with additional electricity generating capacity and output, without associated additional adverse environmental impacts.

5.4 ALTERNATIVE SITES

5.4.1 Context

The criteria applied in determining site suitability for wind energy development include wind resource, established and future land use, environmental conservation designations, ease of access, proximity to national Electricity Network and ease of site development.

A number of siting criteria are applied. These are generic in nature but are intended to be flexible in relation to location of a proposed project, i.e. the acceptability of scale and type of development is dependent on location and land use characteristics of the area. The general criteria for sites considered suitable for wind farm development are as follows:

- Estimated wind speed of at least 7.5 - 8 m/s.
- Proximity to a connection point with the national Electricity Network.
- Reasonable road access.
- Terrain and ground conditions suitable for construction.
- No special designations that would significantly affect planning permission potential.
- Low potential for electromagnetic interference.
- Sufficient distance from residences to minimise amenity impacts.

In pursuit of ESB's policy on renewable sources of energy, its companies engaged in wind energy development have identified and evaluated many sites in different counties throughout Ireland for their suitability for wind energy development.

Some the wind energy projects for which planning applications have been made over the past number of years and which are additional to Grousemount are identified in Table 5.3.

Table 5.3: Planning Applications for Wind Farms

Location – Republic of Ireland	
• Ballinvully, Co. Mayo	• Grouselodge, Co. Limerick
• Boolynagleragh, Co. Clare	• High Street, Co. Clare
• Bradlieve, Co. Donegal	• Moneypoint, Co. Clare
• Bunkimalta, Co. Tipperary	• Oweninny, Co. Mayo
• Cappawhite, Co. Tipperary	• Raheenleagh, Co. Wicklow
• Castlepook, Co. Cork	• Rossacurra, Co. Carlow
• Coolberrin, Co. Monaghan	• Tullynahaw, Co. Roscommon
• Garvagh Glebe, Co. Leitrim	• Woodhouse, Co. Waterford
Location – Northern Ireland	
• Carrickatane, Co. Derry	• Eglish, Co. Derry
• Clunahill, Co. Tyrone	• Gortmonly, Co Derry
• Crockdun, Co. Tyrone	• Meenakeeran, Co. Tyrone

The sites listed above, whose locations are shown in Figure 5.4, are amongst more than 300 separate potential wind farm sites that have been assessed throughout Ireland. The development rate of the order of 5%, meaning that 95% of sites assessed are not proceeded with, is typical in the wind industry.

For ESB Wind Development, which is among the leading developers in the country, the extensive range of factors that arise in site selection would obviously not arise in the case of individuals, groups or companies not engaged in the wind development sector to the same extent.

These involve commercial decisions that are made in a portfolio context to identify the most commercially attractive combination of projects with which to proceed. These take account of such factors as strategic geographical spread, size profile, anticipated market movements in civil engineering and equipment costs, physical access, electricity prices, and the risk, prospects or potential impediments to planning approvals and connection to the electricity network.

5.4.2 Site Suitability

Wind Speed

Wind speed, on which the power achieved is highly dependent, is critical to the viability of wind farm developments. The power available from the wind is a function of the cube of the wind speed. All other things being equal, a turbine at a site with an average wind speed of 5 m/s will produce nearly twice as much power as a turbine at a location where the wind averages 4 m/s. Doubling the wind speed increases the power output eightfold, whereas doubling the turbine area only doubles the power. In this regard, the windiness of the site is a key development parameter.

Wind classes determine which turbine is suitable for the normal wind conditions of a particular site. These are mainly defined by the average annual wind speed (measured at the turbine's hub height), the speed of extreme gusts that could occur over 50 years, and how much turbulence there is at the wind site.

The three wind classes for wind turbines, are defined by an International Electrotechnical Commission (IEC) standard, and correspond to high, medium and low wind.

Table 5.4: Wind Classification

Turbine Class	IEC I	IEC II	IEC III
Annual average wind speed	10 m/s High Wind	8.5 m/s Medium Wind	7.5 m/s Low Wind
Extreme 50-year gust	70 m/s	59.5 m/s	52.5 m/s
Turbulence Classes	A 18%	A 18%	A 18%

There is a strong likelihood that long-term wind speeds at the site at Grousemount classify the site as an IEC Class I - Class II site and, thus, subject to adequate turbine height, an economically viable wind farm is feasible at this site.

Size and Topography of Site

The site must be of sufficient size to accommodate a wind energy development that is commercially viable to the developer. A large site is required for the siting of wind turbines and wind turbines require sufficient distance between each other to ensure that the blades of one operating turbine will not interfere aerodynamically with the wind take of adjacent turbines.

In addition, proximity of residences in the context of protection of residential amenities is a significant factor in site selection. At Grousemount there is a minimum separation of more than 500 m between the nearest turbine and all residences, other than those with a financial interest in the project.

The Grousemount site is suitable on grounds of its size and local topography.

Other Factors

The other favourable characteristics of this site in relation to wind energy generation include the following:

- Wind Farm Planning: The site is within the part of the county categorised as an Area Open to Consideration for wind energy development in accordance with the Kerry County Council's Renewable Energy Strategy 2012.
- Planning History: Grousemount Wind Farm is a combination of two previously permitted wind farms that were separately granted planning permission by Kerry County Council, indicating that from a planning perspective the site is suitable for wind energy development.
- Nature Conservation Designation: The development area is not subject to designation for nature conservation.
- Ground Conditions: The ground conditions are generally favourable for civil engineering construction and there are good conditions for foundations at the site.
- Ease of Construction: Access tracks within the site may be constructed with minimal requirement for excavation of overburden.
- Established and Future Land Use: Existing land uses will not be affected and the proposed development will not compromise alternative future land uses.
- Environmental Impacts: While some minor impacts are inevitable, the construction of a wind energy project is fully compatible with the existing

environment at the site.

Previous Assessments of Site Suitability

The planning permissions granted by Kerry County Council indicates that this site is suitable for wind energy development.

Barnastooka Wind Farm

Schedule (1) of Planning Permission Register Reference 10/197 noted as follows:

Having regard to:

(a) the national policy with regard to development of alternative and indigenous energy sources and the minimisation of emissions of greenhouse gases,

(b) the guidelines issued by the Dept. of Environment, Heritage and local Government in 2006 on Windfarm Development,

(c) the provisions of the Kerry County Development Plan 2009-2015,

(d) the nature of the landscape in the area and to any submissions received in relation to the application,

it is considered that, subject to compliance with the conditions set out below, that the proposed development of wind turbines and associated works at this location would not have a detrimental adverse impact on the landscape, would not adversely impact on flora and fauna, would not seriously injure the amenities of the area or of property in the vicinity and would be in accordance with the proper planning and sustainable development of the area.

Grousemount Wind Farm

Schedule (1) of Planning Permission Register Reference 10/1333 noted as follows:

Having regard to:

(a) the national policy with regard to development of alternative and indigenous energy sources and the minimisation of emissions of greenhouse gases,

(b) the guidelines issued by the Dept. of Environment, Heritage and local Government in 2006 on Windfarm Development,

(c) the provisions of the Kerry County Development Plan 2009-2015,

(d) the planning history of the site

(e) the nature of the landscape in the area and to any submissions received in relation to the application,

it is considered that, subject to compliance with the conditions set out below, that the proposed development of wind turbines and associated works at this location would not have a detrimental adverse impact on the landscape, would not adversely impact on flora and fauna, would not seriously injure the amenities of the area or of property in the vicinity and would be in accordance with the proper planning and sustainable development of the area.

Summary

The site at Grousemount is a suitable site for wind energy.

5.4.3 Grid Connection

The mechanism for delivering the installed wind farm capacity necessary to meet renewable energy targets in Ireland up to 2020 is the "Gate" process of grid connection offers. The acceptance of a grid connection allocation allows a wind farm to connect to the national Electricity Network. The grid connection capacity is non-transferable and the developer cannot reallocate it to another part of the country.

Thus, despite the fact that ESB Wind Development is developing wind farm projects nationally, the grid connection capacity of up to 115 MW that is currently available at Grousemount cannot be readily substituted by equivalent grid capacity elsewhere in Ireland, should it not be possible to deliver in this locality.

5.5 ALTERNATIVE CONFIGURATIONS AND LAYOUTS

There are three principle but separate criteria that form the basis for the proposed arrangement at Grousemount and these are site constraints, energy production and site infrastructure / operating costs.

An objective of the development is to maximise the sustainable wind energy capture at what is a very suitable site for wind energy development without causing significant adverse environmental impacts.

5.5.1 Turbine Size

The choice of turbine size at Grousemount was made primarily to ensure that no incremental visual impact arise relative to the approved developments at the site. The wind turbines will have a maximum overall dimension of 126 m. This is comparable to the turbine sizes in the permitted Barnastooka Wind Farm (Ref. 10/0197) and Grousemount Wind Farm (Ref. 10/1333) whose maximum overall dimension are 125 m and 126 m respectively.

The possibility of installing different numbers and sizes of wind turbines was examined.

While wind turbine technology still offers a range of power ratings from a few kilowatts (kW) up to several megawatts (MW or thousands of kW), wind turbines have generally grown taller and more powerful. See Figure 5.5. The first wind farm in Ireland at Bellacorick in Co. Mayo used 300 kW rated capacity turbines and wind farms commissioned in Northern Ireland in the mid-1990s used 500 kW rated capacity turbines.

Technological advances in turbine design mean that turbines with a rated capacity of 2.5 MW – 3.5 MW, as proposed, are now readily available and are offered by many manufacturers. This size of turbine is now generally in the median range of sizes of turbine considered for the latest proposals for wind farm projects.

As noted in Kerry County Council's Wind Energy Strategy 2012 (Section 7.4.5.3), the current trend internationally in wind development is for increasingly tall turbines laid out in large wind farms. Such wind developments benefit from economies of scale in both construction and operation. The technology is such that a small number of tall turbines in a given area can yield more output than a development with a multiplicity of smaller turbines in that same area.

It is believed that an arrangement of a greater number of smaller capacity machines offers no significant advantages in visual impact terms over the chosen option and that visual impact is minimised by installing larger but fewer wind turbines. Their key advantages are as follows:

- The minimum number of turbines are deployed to generate the highest energy output.
- The minimum development footprint is required as fewer turbines need to be deployed to fulfil grid connection capacity.

A development of lower capacity would be wasteful of resources at a site capable of sustaining a project of the proposed size with minimal increased impact on the local environment.

5.5.2 Proposed Arrangement

Turbines

The layout adopted for the arrangement of turbines on the site has taken on board the consented arrangements of the permitted Barnastooka Wind Farm (Ref. 10/0197) and Grousemount Wind Farm (Ref. 10/1333). The arrangement evolved initially by taking into account the constraints imposed by consideration of the following:

- Topography and ground conditions
- Operational efficiency
- Land ownership boundaries
- Critical spacing
- Accepted good design practice

Detailed baseline information to determine site constraints was collected for the site through, consultation, desk based studies and fieldwork.

Availability of lands for development is a key constraint and the size of the site at Grousemount was determined by a number of factors that include land ownership boundaries, the willingness or otherwise of landowners to enter land lease option agreements, site topography and orientation.

Proposed locations of turbines mirror almost exactly those in the approved developments at the site. Differences have arisen mainly in the context of ensuring adequate windtake protection to adjoining developments.

Windtake

With turbines T1-T6 having a maximum rotor blade diameter of 93 m, they are set back a minimum of 232.5 m from the site boundary, i.e. 2.5 x rotor blade diameter.

This complies with the guidance of the Kerry Wind Energy Strategy 2012, where Section 7.4.5.21 - Disposition of Turbines states as follows:

> *Turbines shall be located no closer than 2.5 times the blade diameter from the boundary of adjacent properties.*

The DoEHLG Windfarm Planning Guidelines (Section 5.13) note as follows regarding windtake:

> *Bearing in mind the requirements for optimal performance, a distance of not less than two rotor diameters from adjoining property boundaries will generally be acceptable, unless by written agreement of adjoining landowners to a lesser distance.*

Anemometer Masts

The anemometer masts have been positioned to provide adequate coverage of what constitutes a very extensive site, with each specific location being chosen to avoid wind turbulence effects from surrounding turbines.

5.5.3 Summary

There is a multiplicity of factors that supports the selection of the proposed layout, the primary one being that it is virtually identical the developments already permitted at the site.

The wind turbines, access tracks, Substation and anemometers will occupy a very small proportion of the overall lands at the site and the remainder will be available for existing or other uses.

Development of a wind farm layout requires reconciliation of a number of often conflicting factors and there is no perfect arrangement for a wind energy development on this or indeed any other site. Generally, the arrangement that prevails is the one that falls short of the ideal combination of features to the least extent.

It is believed that the proposed layout represents the optimum arrangement for the 38 turbine scheme at Grousemount taking account of the constraints applying.

5.6 WIND ENERGY GUIDELINES

The DoEHLG Windfarm Planning Guidelines (Section 6.9) notes that landscape character types provide a useful basis for practical application of siting and design guidelines in relation to wind energy development. In that context six landscape character types were selected to represent most situations, as follows:

- Mountain moorland
- Flat peatland
- Urban / industrial
- Hilly and flat farmland
- Transitional marginal land
- Coast

Mountain Moorland is the landscape character type that best describes the site at Grousemount.

The Guidelines note as follows regarding this landscape character type

1(a) Large wind energy development with random layout, irregular spacing and high turbines - this siting and design option is appropriate given the scale of this landscape

1(b) Wind energy development with many turbines of medium height – this can be inappropriate. The spatial extent of a wind energy development can be reduced by using taller turbines. This may be a preferable solution in some situations.

1(c) Wind energy development with relatively few and tall turbines.

It is believed that the characteristics of the proposal for Grousemount fully meet the Guidelines, being most closely fitting the characteristics of 1(c) above.

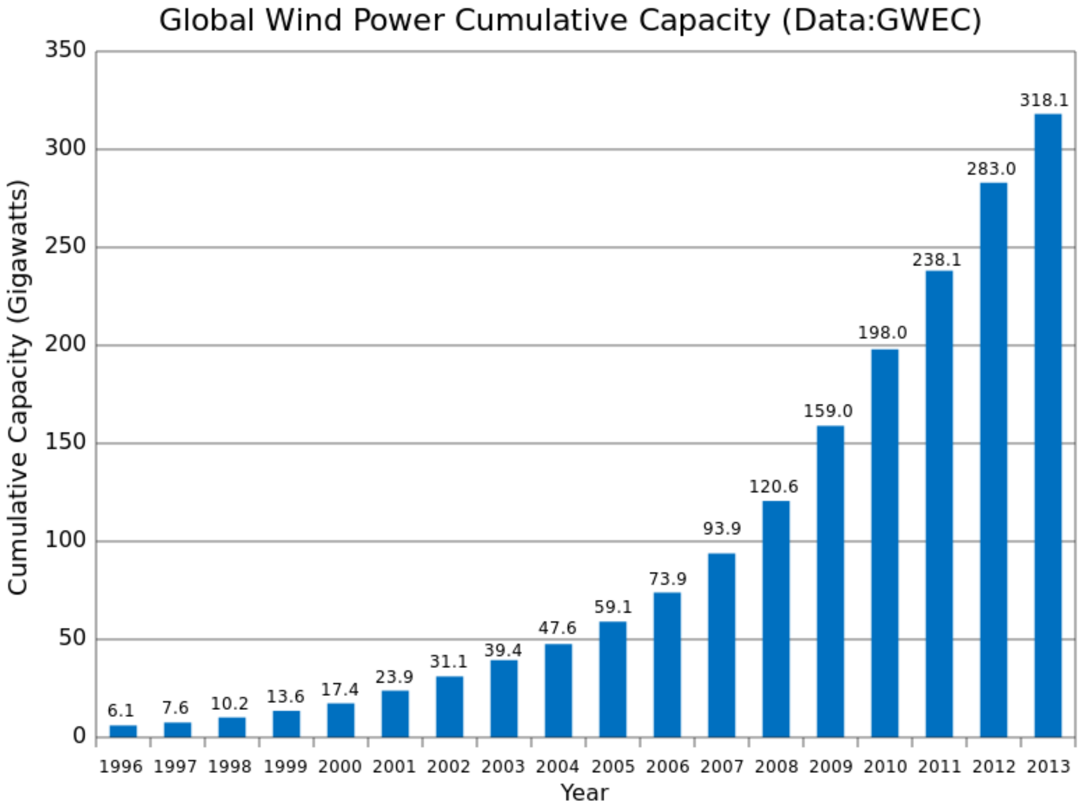

Figure 5.1: Global Wind Power Installation

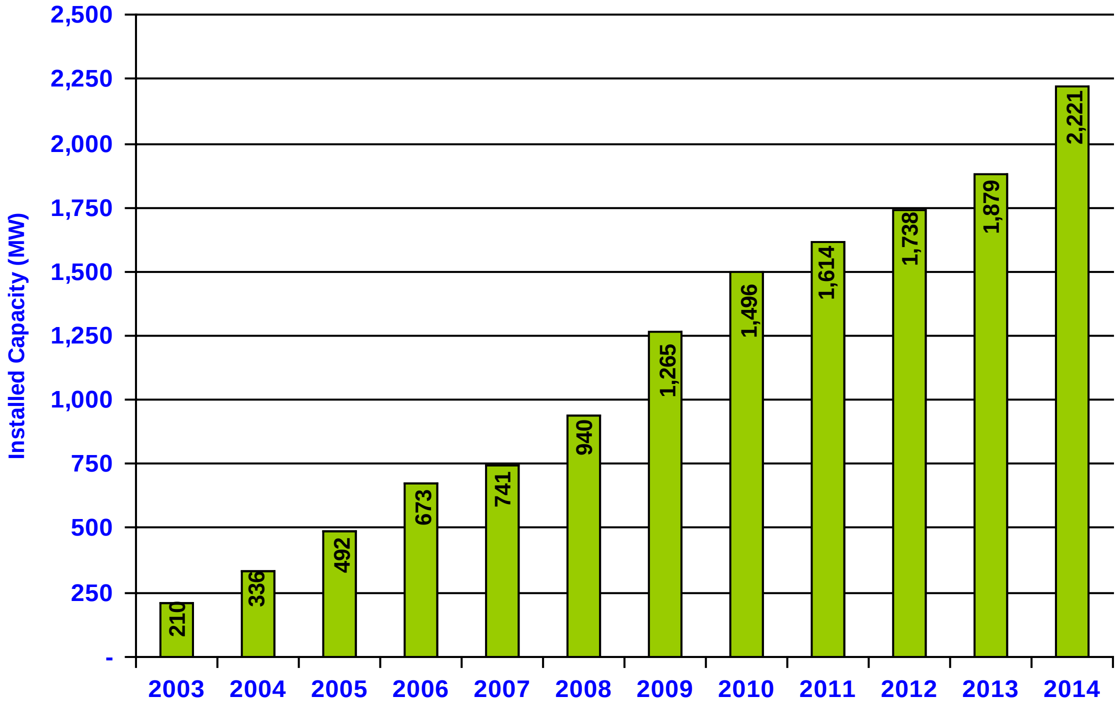

Figure 5.2: Growth in Wind Energy Generation in Ireland

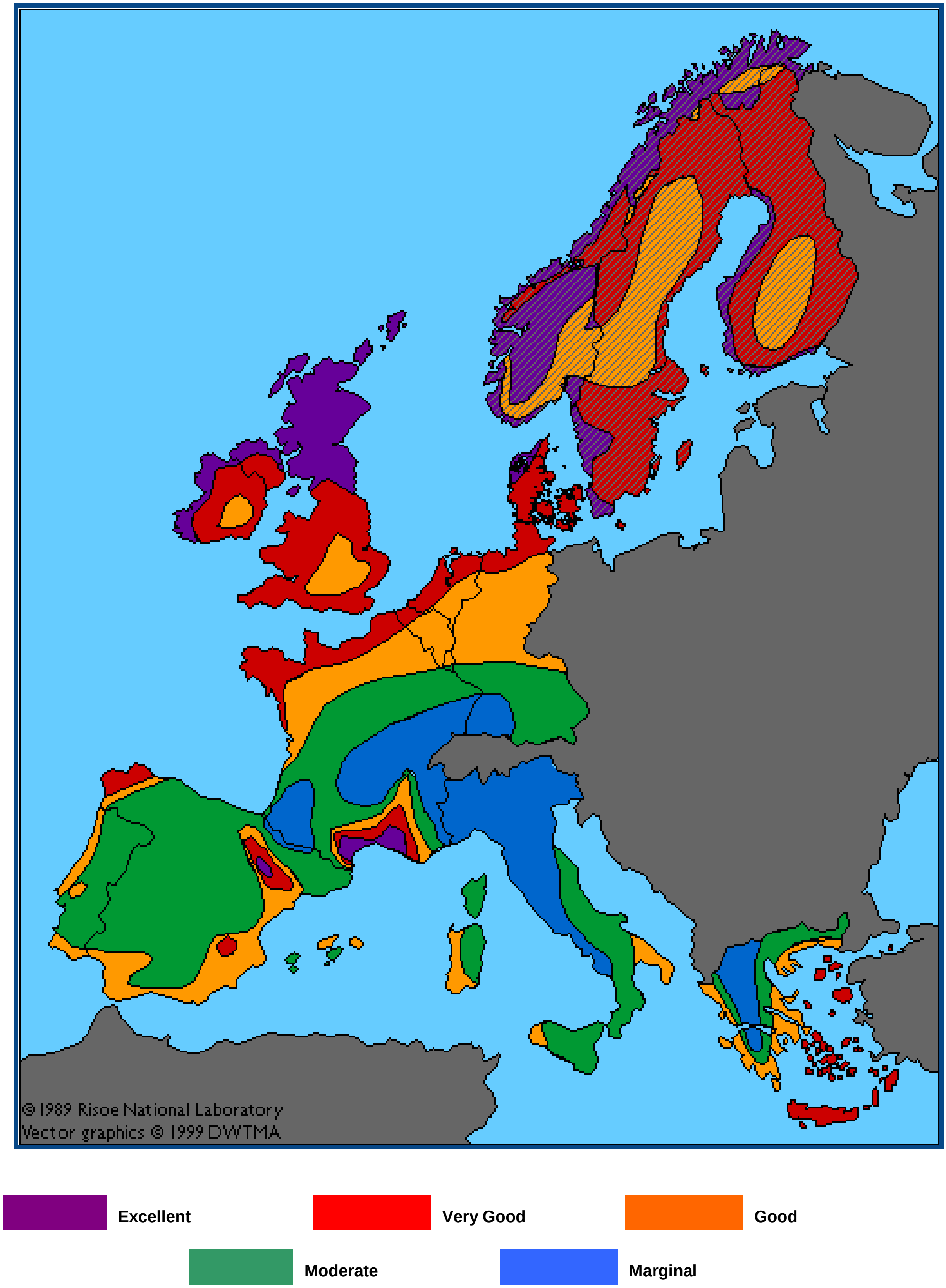

Figure 5.3: European Wind Resources

Figure 5.4 - Wind Farm Planning Applications

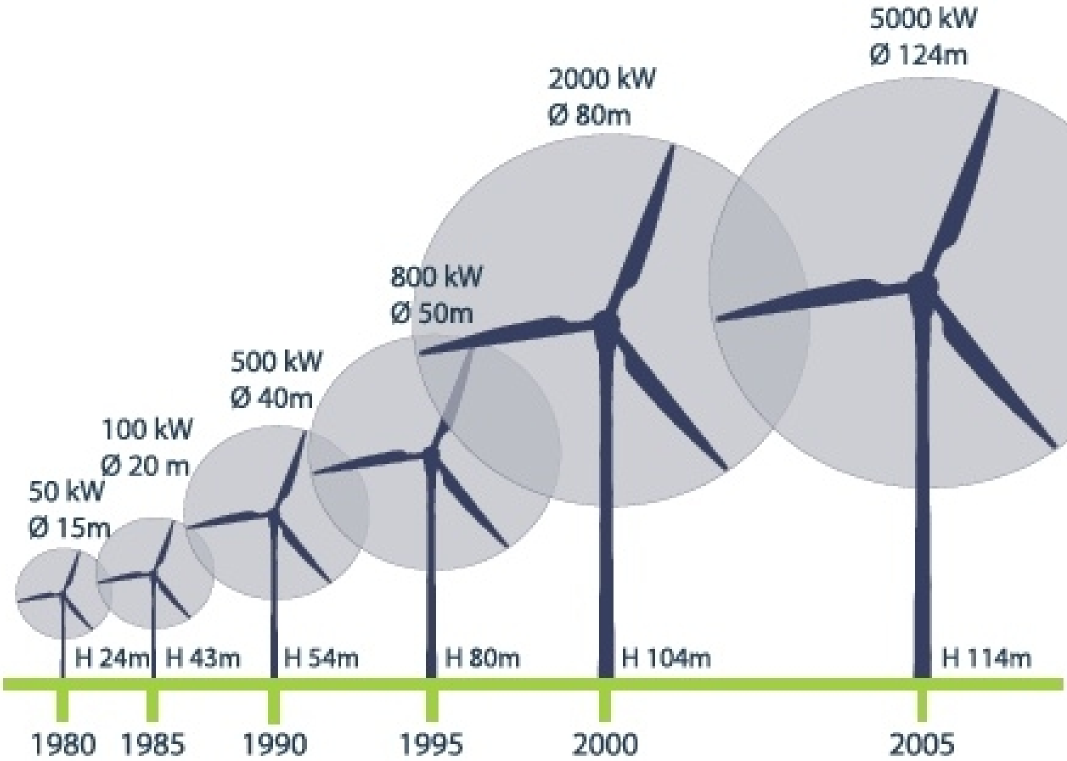

Figure 5.5: Trend in Wind Turbine Sizes