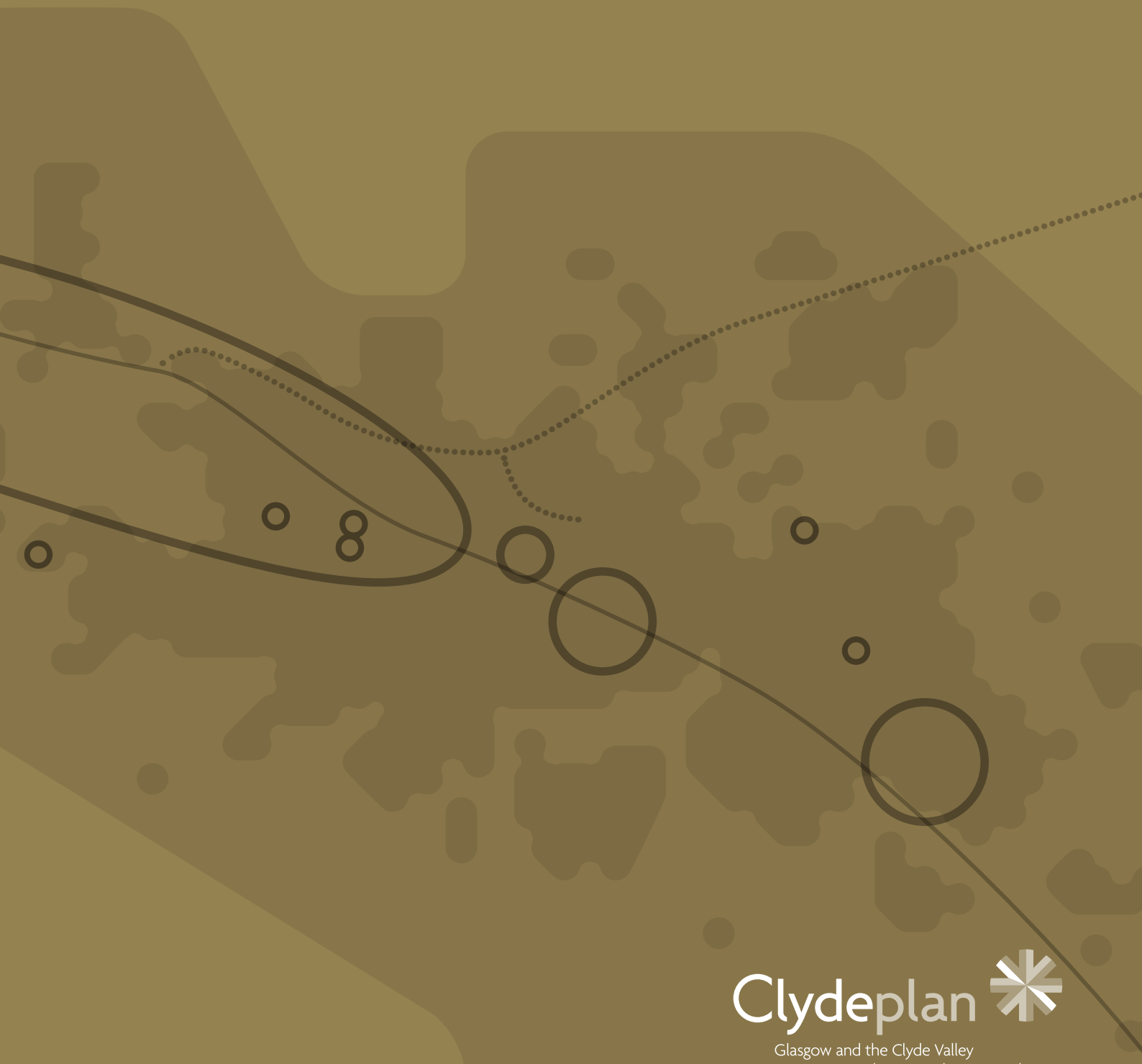
Strategic Development Plan

Proposed Plan - Background Report

January 2015

Low and Zero Carbon Generating Technologies



Clydeplan

Glasgow and the Clyde Valley
Strategic Development Planning Authority

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STRATEGIC DEVELOPMENT PLAN

BACKGROUND REPORT 10

LOW AND ZERO CARBON GENERATING TECHNOLOGIES

January 2016

East Dunbartonshire Council · East Renfrewshire · Glasgow · Inverclyde council · North Lanarkshire Council · Renfrewshire Council · South Lanarkshire Council · West Dunbartonshire Council

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PART ONE

Low and Zero Carbon Generating Technologies

in Glasgow and the Clyde Valley

1.0 Introduction

1.1 The purpose of Part One of this Background Report is to provide the context for the Renewable Energy policy contained in the Clydeplan SDP, identifying the reasons for the need to deliver heat and electricity and the continuing emphasis on onshore wind. It will establish the key opportunities for alternative renewable energy technologies and identify the level of policy support required for these technologies in the short to medium term.

1.2 A diverse mix of renewable sources is required in the Glasgow and Clyde Valley city region if climate change targets are to be met. This report provides information in relation to the types of technology and the cross boundary issues that may emerge in the next few years.

1.3 The research methodology is set out below alongside locational guidance on how strategic issues should be considered throughout the city region. Local Development Plans will be important to frame the local context, however, the strategic focus of Clydeplan SDP will allow for greater understanding of the renewables agenda and a more consistent policy approach across the city region.

2.0 Research Methodology

2.1 A four stage research and report preparation process has been undertaken:

Stage 1: Search and analysis of policy documents and renewables info including Scottish Government, Scottish Renewables, industry publications, online/traditional media.

Stage 2: Sieve information gathered, consider structure and detail for the background report.

Stage 3: Prepare draft version of background report, focusing on data and identifying trends in the renewables industry.

Stage 4: Conclude background report with detailed views on direction of travel over short to medium term

3.0 Renewables – General

3.1 There are three key factors driving the renewable energy industry namely, security of supply, sustainability and affordability. If the city region is to be successful in helping achieve Scottish and UK government targets, a supportive policy framework must be in place, helping to provide clarity to the industry.

3.2 A range of renewable energy technologies is needed to support the delivery of climate change targets, security of supply and a wide range of the potential benefits.

3.3 Renewables are a major part of Scotland's energy mix and technologies such as wind, hydro and biomass provide around half of Scotland's electricity needs[1]. Since the publication of SDP1, onshore wind has grown steadily, supported by some of the best wind resources in Europe.

3.4 The Scottish Government aims to derive the equivalent of 100% of electricity demand from renewable resources by 2020[2] and onshore wind energy development is a major contributor to reaching these targets.

3.5 The Scottish Government aims to reduce greenhouse gas emissions and in 2014 Scotland's renewable energy sector displaced more carbon emissions than ever before, with renewable energy projects including wind farms, hydro power and solar saving more than one million tonnes of CO2 per month from entering the atmosphere.

3.6 The reduction is the highest ever recorded in Scotland, with 12.3 million tonnes being displaced (an increase of 119% compared to 2010, when 5.61 million tonnes were displaced). The figure is equivalent to more CO2 than is emitted from every single car, bus and train journey taken over the course of a year in Scotland.

3.7 In 2014, a report by Scottish Renewables showed that 11,695 people are in full-time employment in the renewable energy field, an increase of 5% from the previous year and onshore wind was the biggest employer[3]. This demonstrates the significant impact of the renewable energy industry on the city region economy.

3.8 Additionally, investment in the renewables sector has increased substantially over the past decade, largely as a result of the subsidy levels supporting the industry, however, recent changes to subsidies announced by the UK government have left the industry in an uncertain position. Nonetheless, the Scottish Government remains fully supportive of the renewable energy sector and the significant contribution it can make to the diversification of energy supplies, demonstrated through NPF3 and SPP (2014).

3.9 SPP (2014) sets out policy principles for the planning system including:

- supporting transformational change to a low carbon economy;
- supporting a diverse range of electricity generation from renewable technologies; and
- guiding development to appropriate locations and advise on issues that will be taken into account when specific proposals are being assessed.

3.10 SPP states that development plans should seek to ensure an area's full potential for electricity and heat from renewables is reached giving due regard to relevant environmental, community and cumulative impact considerations.

3.11 Taking cogniscance of the Scottish Government's objectives, Clydeplan supports national priorities for the construction or improvement of strategic energy infrastructure including generation, storage, transmission and distribution networks, as illustrated in

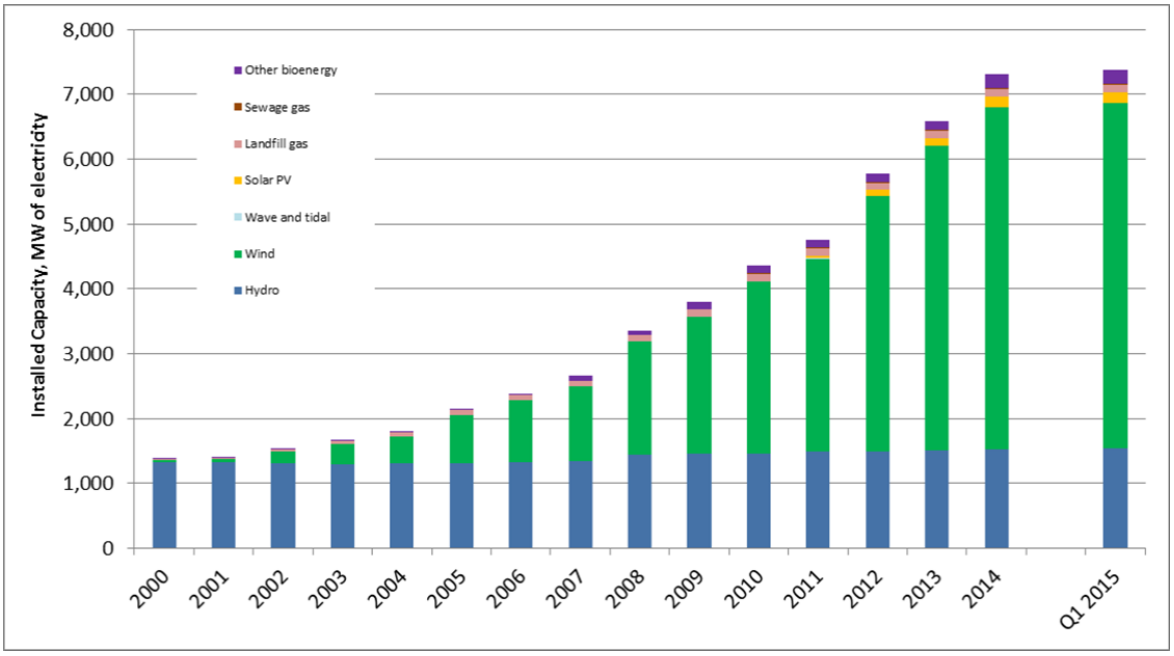
[1] http://www.scotland.gov.uk/Resource/0044/00444530.pdf
[2] http://www.scotland.gov.uk/Topics/Business-Industry/Energy/RoutemapUpdate2013
[3] http://www.scottishrenewables.com/publications/onshore-wind-what-you-need-know/

Policy 10 Delivering Heat and Electricity and this Background Report on low and zero carbon generating technologies.

3.12 By supporting a resilient heat system throughout Glasgow and the Clyde Valley, this SDP can facilitate the transition to affordable low carbon heat for households, organisations and industry. It is anticipated that this transformation will help capitalise on the economic opportunities this sector can provide and, in turn, increase sustainable economic growth throughout the region.

3.13 Figure 1 illustrates the development of renewable energy in Scotland since 2000 across a range of technologies including hydro, wind, wave and tidal, solar PV, landfill gas, sewage gas and other bioenergy. Onshore wind is the biggest contributor throughout Scotland, a trend that is repeated throughout the city region. Notwithstanding the success of onshore wind energy generation, a broader mix of energy sources will ensure levels of demand are met by a reliable supply. Bioenergy, Geothermal, Solar PV, Hydro and Marine (Wave/Tidal) all have potential throughout Glasgow and the Clyde Valley and must be considered as part of the Energy Network.

Figure 1: Renewables Installed Capacity to Q1 2015



Source: 2020 Routemap for Renewable Energy in Scotland – Update, Scottish Government, 2015

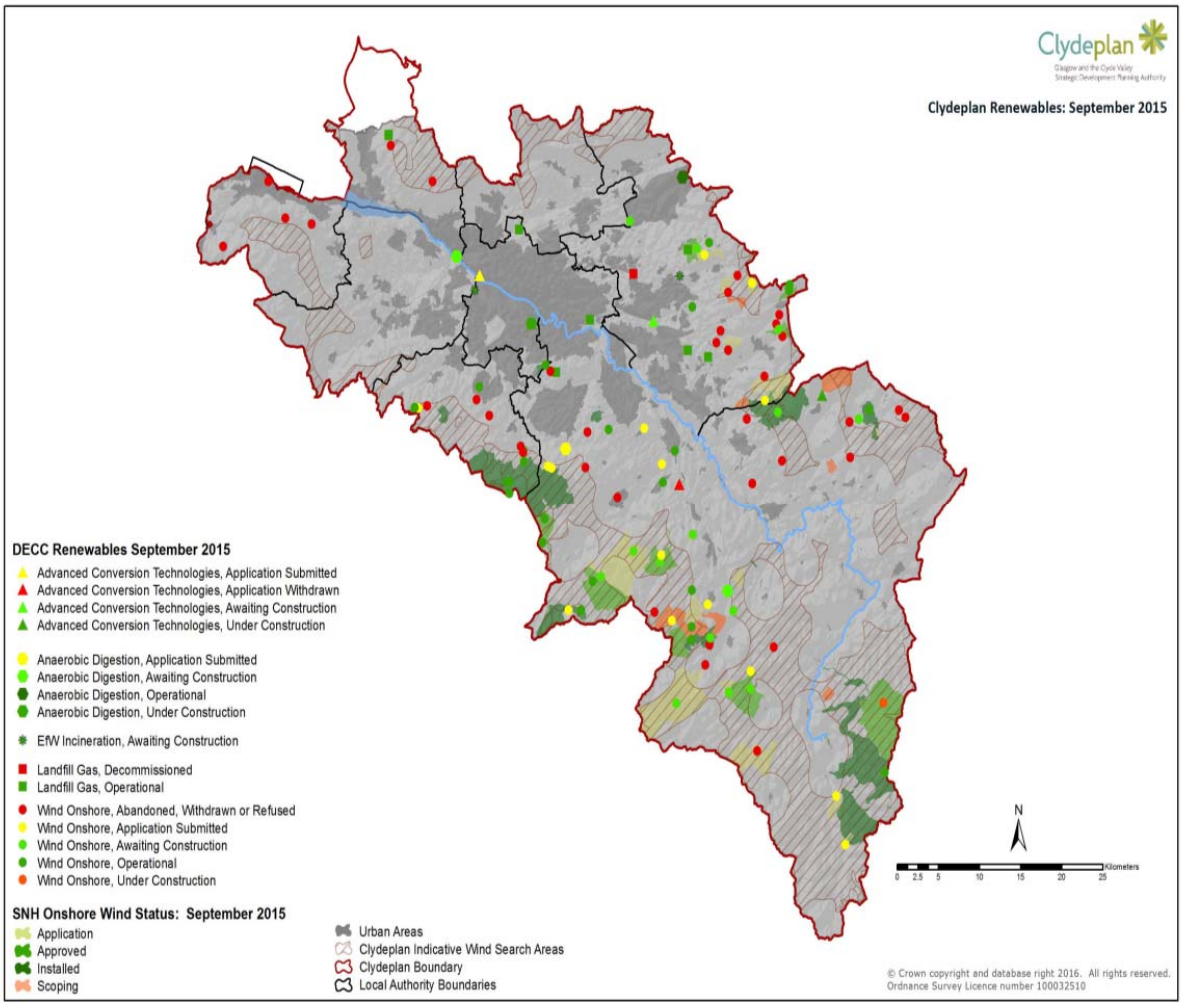
4.0 Energy Network

4.1 As the Energy Network Map below shows (Figure 2), renewable energy developments are dispersed throughout the Clydeplan area.

4.2 Onshore wind developments have been operational throughout the area with particular prevalence in East Renfrewshire and North and South Lanarkshire.

4.3 This Energy Network Map identifies the spatial impact of existing renewable energy technologies across the city region and it has potential to be developed further, ultimately identifying where further energy might best be delivered.. This Energy Network Map will be regularly updated to provide an overview and context for further patterns of development.

Figure 2: Energy Network Map



Source: DECC

5.0 Renewable Heat

5.1 The Scottish Government estimates that heat accounts for over half of all the energy we use for our homes, offices, hospitals, businesses, schools, other buildings and industries.

5.2 By supporting the shift from fossil fuel to renewable sources of heat, there is the potential to reduce greenhouse gas emissions, support delivery of climate change

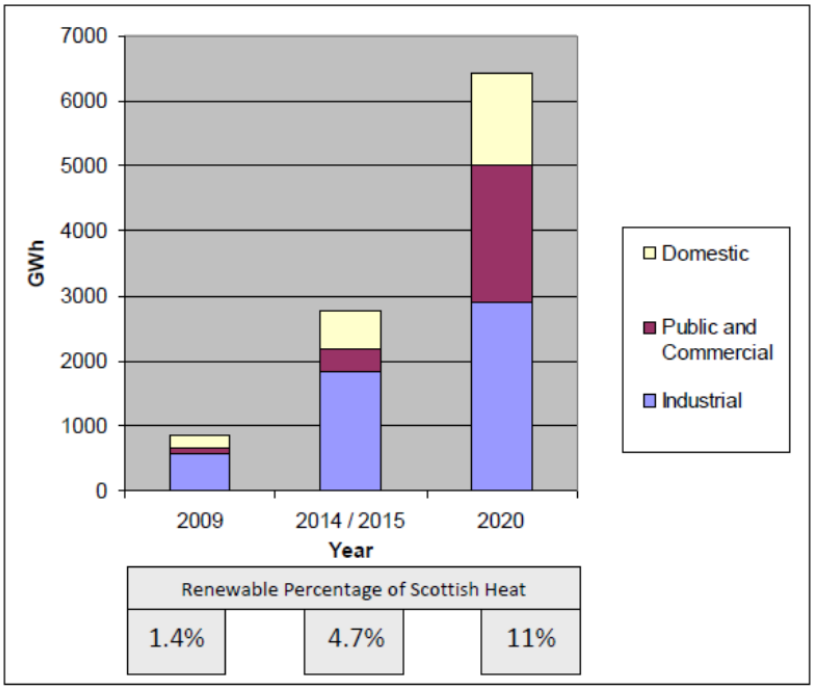
targets and make a significant contribution to Scotland's overall renewable energy target.

5.3 The Energy in Scotland (2014) document defines renewable heat as:

"*… heat produced from low carbon renewable sources such as biomass, heat pumps (ground source, air source and/or water source), heat from waste biomass and anaerobic digestion including biogas, solar heating, wind to heat and geothermal heat. It can be produced as either heat only or Combined Heat and Power*."

5.4 The Scottish Government has a target of 11% of the heat consumed in 2020 to come from renewable sources. Scotland is currently producing around 3% of total heat use from renewable sources. Around 70% of this is used in the industrial sector, with the public/commercial and domestic sectors having significant scope for expansion over the next few years. (Figure 3)

Figure 3: Indicative Level of Heat Usage by Market Sector



Source: Renewable Heat Action Plan for Scotland, Scottish Government, 2009

5.4 SDP2 provides a clear message that a low carbon future is supported alongside measures to ensure that renewable heat technologies are deployed on a wholesale basis. There are a large number of renewable heat technologies at varying stages of market development. These include biomass boilers, deep geothermal, solar thermal collectors, heat pumps (including ground source, water source and air to water heat pumps), and combined heat and power generating heat from biomass, biogas or waste.

6.0 Biomass

6.1 Apart from traditional fossil fuels such as coal and oil, biomass is the only other naturally-occurring, energy-containing carbon resource known that is large enough to be used as a reliable source of energy.

6.2 Biomass includes plant matter, vegetation and trees, as well as waste biomass such as municipal biosolids (sewage) and animal wastes (manures), forestry and agricultural residues, and certain types of industrial wastes.

6.3 Unlike fossil fuels, woody biomass (in the form of trees and plants) is renewable in the sense that only a short period of time is needed to replace what is used as an energy resource. This type of biomass is also considered to be "carbon neutral", in that the amount of carbon trees and plants absorb while growing is the same as the amount they produce when burned.

6.4 Over 90% of renewable heat is generated from woody biomass. There is significant availability of woody biomass in the Glasgow and Clyde Valley and surrounding areas. This energy source should be embraced and a full range of technologies deployed to ensure renewable heat targets are met.

6.5 The use of biogas, produced from bio-waste and other biomass sources, is a developing sector. However, there are challenges relating to how this can be supported by the existing gas network. Nevertheless, biogas should be considered at a strategic scale, in particular the creation of a network of biogas plants (combined heat and power plants/anaerobic digestors).

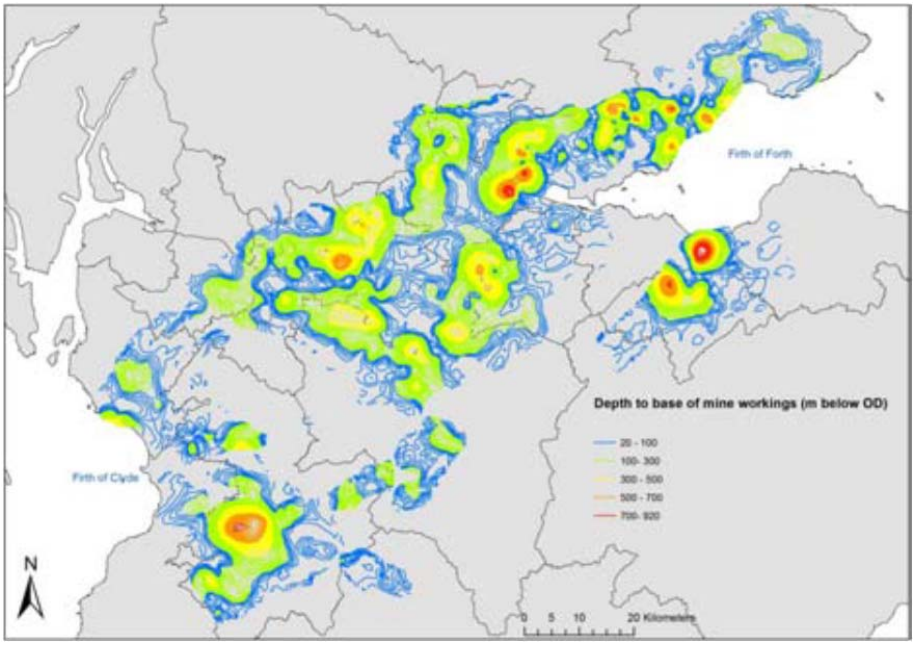
7.0 Geothermal

7.1 Geothermal energy involves making use of natural heat that exists within the structure of the planet. Geothermal energy is a renewable, sustainable, carbon free form of energy that can provide an uninterrupted supply of heat to be used continuously to heat commercial buildings and homes and to generate electricity.

7.2 The geothermal heat resource beneath Scotland can be considered in terms of three main headings: abandoned mine workings (low temperature), hot sedimentary aquifers (low and possibly relatively high temperature), and hot dry rocks / petrothermal sources (relatively high temperature).

7.3 Deep geothermal (defined by the Scottish Government as any geothermal source below 100m in depth) has some potential within the Clydeplan area, such as the former mining areas in North and South Lanarkshire, however the cost of implementing the technology may inhibit deployment of commercial scale developments in the short to medium term.

Figure 4: Depth of mine workings in Central Scotland (Source: Study into the Potential for Deep Geothermal Energy in Scotland: Volume 2, Scottish Government, 2013)



8.0 Onshore Wind

8.1 Onshore wind remains the cheapest way of producing large scale renewable electricity in the UK, however recent changes to the subsidy system have destabilised the sector and introduced uncertainty to the market.

8.2 SPP (2014) supports further wind farm development, particularly in the large swathe of Group 3 areas that exist in the Clydeplan area. Clydeplan's onshore wind spatial framework is presented in Policy 10 Delivering Heat and Electricity and Diagram 7 Onshore Wind spatial Framework. The methodolody and analysis for this spatial framework is set out in Part 2 of this Background Report.

8.3 The progress towards meeting the Scottish Government's 2020 target of 100% electricity demand has been mostly down to the significant deployment of wind farms throughout the country and this is likely to continue in the short term, albeit with reduced subsidies and perhaps a less favourable public appetite for wind farms.

8.4 The Clydeplan area benefits from a large rural periphery which provides scope for further wind farm developments, as evidenced by the recent GCV Landscape Capacity Study (2014).

8.5 As such, the policy for renewable heat and electricity continues to support onshore wind through the Spatial Framework as set out in in SDP2 Diagram 7, whereby the remaining opportunities for the location of wind farms are balanced against protecting environmental interest and residential amenity.

8.6 **Repowering** of existing wind energy development is likely to become a feature of planning applications in years to come. Repowering can refer to a single wind turbine or to a whole wind farm replacing part or all of the turbines before the end of their lifetime with new more efficient and more powerful machines.

8.7 In relation to infrastructure provision and landscape protection, repowering could be a better option than building new sites at new different locations. In fact, many higher yield sites are already developed and existing sites could have less visual impacts. Repowering offers the opportunity to rearrange the location of the turbines in order to better integrate them into the existing landscape. The ability to re-use part of the infrastructure already developed on site such as roads and grid connection also means less capital investment than is required for a new site.

8.8 However, the potential benefits of repowering need to be balanced against the appropriateness of a likely increase in turbine size and height and whether such a change can be comfortably accommodated within the original setting.

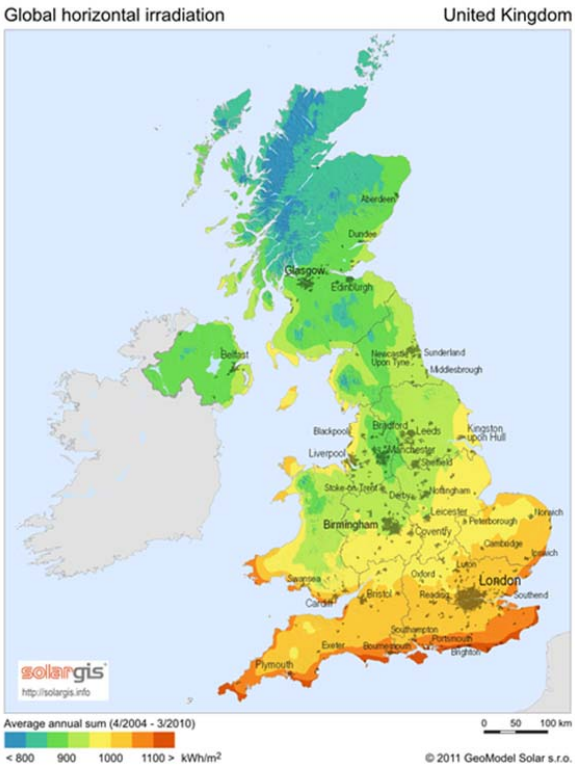
9.0 Solar PV

9.1 The deployment of Solar PV in Scotland has lagged significantly behind the rest of the UK. Although this can partially be explained by real differences in climate and weather, there are many perceived barriers that are inconsistent with the evidence.

9.2 As can be seen from Figure 5 below, apart from the southern most regions of England, there is minimal variation in levels of irradiation between the Glasgow and Clyde Valley region and much of the rest of the UK. Combined with the longer hours of daylight experienced in Scotland, compared to more southern areas of the UK, the capacity of solar energy could provide a significiant development opportunity, albeit one that may require government support from initial site investigation through to deployment.

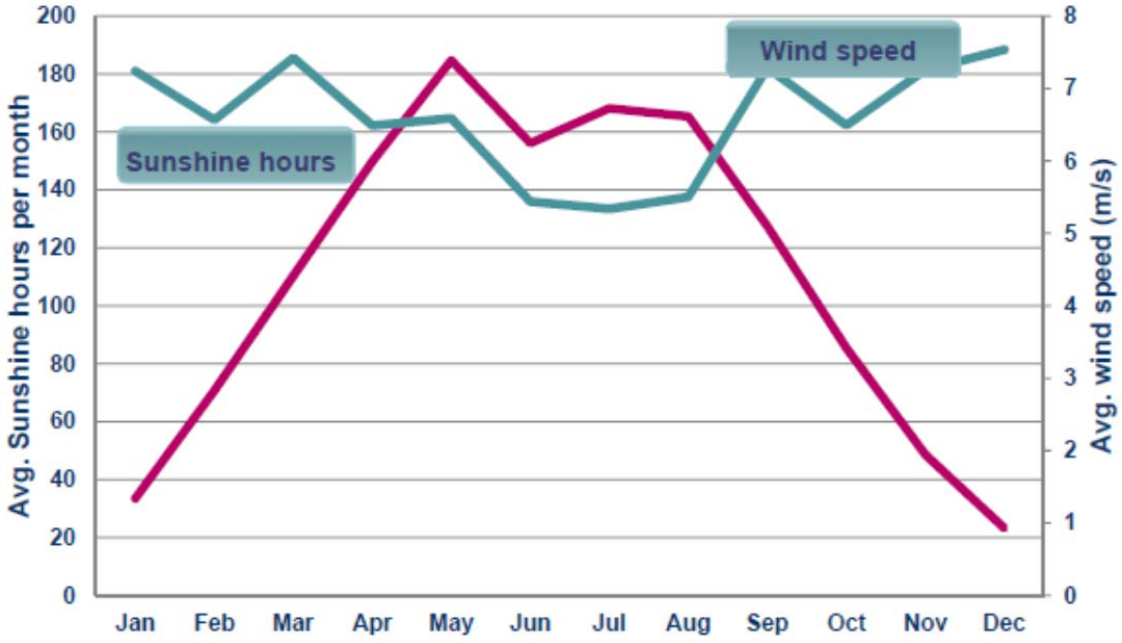
9.3 Due to the longer hours of daylight in the summer and the increased demand for power during this period of the year, Scotland as a whole should be considered suitable for the development of solar energy technologies, As Figure 6 highlights, this period coincides with lower wind speeds and subsequent fall in the production of electricity from wind turbines making the issue of co-locating wind turbine and solar panels an attractive option. In the absence of relevant data for the city region, the purpose of the Glenrothes data is to illustrate how the peak summer months of sunshine hours coincide with generally lower wind speeds. This pattern can be replicated throughout Scotland. As such, large scale solar farms should be worthy of further investigation within the context of the city region.

Figure 5: UK Global Horizontal Irradiation



Source: SolarGIS © 2015 GeoModel Solar

Figure 6: Average sunshine hours and wind speed for Glenrothes



Source: Combining solar and wind to maximise project returns, Amec Foster Wheeler

9.4 As can be seen from the Energy Network Map, there is potential for solar farm development within the city region. It could be appropriate to co-locate solar pv with suitable existing wind farms, or within a wider rural setting.

9.5 There is also potential to develop this technology in urban areas using existing Vacant and Derelict or underused land. Larger scale deployment of Solar PV would enable a more diverse supply of renewable energy, moving from an over reliance on wind energy, particularly in the summer months.

9.6 The opportunity to locate solar panels on domestic and commercial rooftops is supported at the strategic scale, where appropirate and subject to local considerations.

9.7 **Co-locating** solar and wind farms offers developers greater flexibility and maximisation of site energy yield. It is worth noting there is more demand for heat in the winter but overall demand for power is higher in the summer. Therefore, solar energy would help boost overall power supply at this time of the year. Losses due to turbine shading are low and the technologies complement the seasonal variability, as shown in Figure 6 above.

9.6 The disadvantages associated with solar energy in the city region, such as reduced efficiency/power output on cloudy and short days, could potentially be mitigated by the reducing cost of solar panels, the availability of inexpensive land to site them and the co-location of solar panels with existing electirity infrastructure, for example existing wind turbines.

9.7 Signs of a potential significant solar PV industry in Scotland have started to emerge, with a number of large scale pre-applications and screening opinions being received by local authorities, including some in the Clydeplan area. It is noted however, that infrastructure restrictions such as grid capacity and connections may limit the immediate growth of the solar PV industry.

9.8 It is unclear whether recent subsidy cuts will limit the potential for these solar farms to be deployed. If the cost of solar technology continues to fall then it may be that solar PV emerges as a realistic source of additional capacity and demand for large scale solar farms will emerge in the Clydeplan region. If so, strategic understanding of the location of these developments will be addressed through the Energy Network Map and will help to guide policy and decision makers.

10.0 Hydro

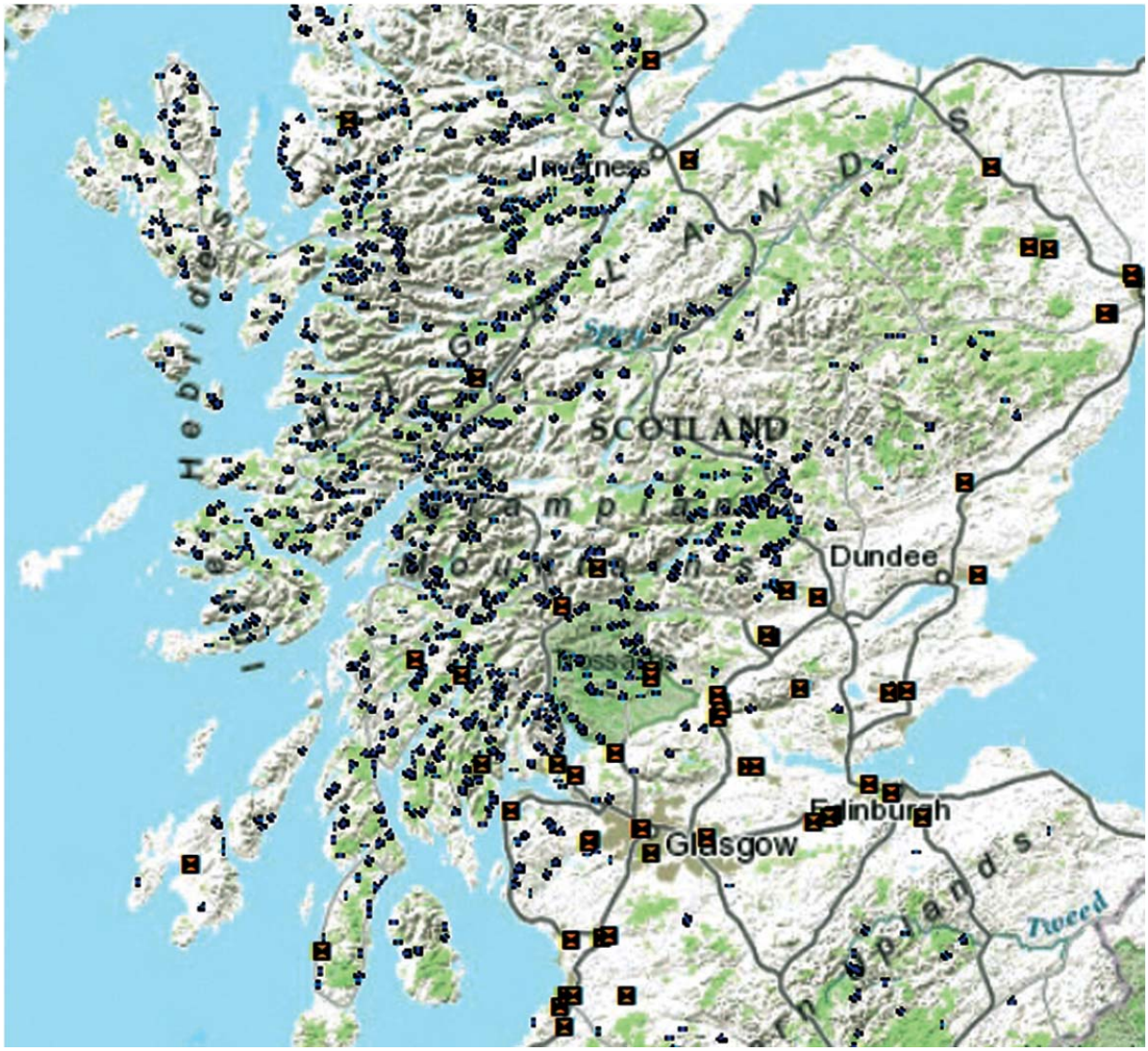
10.1 Hydro power produces about 12% of Scotland's electricity, with considerable potential remaining to introduce new hydro schemes and expand or improve the efficiency of existing facilities. Total hydro generation capacity in Scotland is about 1,500 megawatts (MW), a figure that was overtaken by wind power capacity in 2009.

10.2 A report to the Scottish Government, published in January 2010, showed a substantial range of viably developable small hydro schemes with a combined potential capacity of 1, 204MW, sufficient to supply around 1million homes. The study describes considerable untapped potential amongst more than 7,000 possible schemes, almost all of them smaller than 5MW capacity.

10.3 The Clydeplan area contains significant areas of undeveloped land, many of which are environmentally sensitive. Although the impacts of potential small scale hydropower schemes could be reduced, the development of hydro power still poses risks, particularly to sensitive species such as salmonids and crayfish.

10.4 Small-scale hydropower schemes have significant potential to address Scotland's sustainable power aims and contribute to local community development needs. Local environmental concerns have to be taken into consideration when determining the viability of a project and the potential effects on the natural heritage have to be managed through the application of relevant local development plan policies.

Figure 7: Installed hydropower in Scotland



Source: Scotland's Hydropower Resource, James Hutton Institute, 2014

11.0 Marine (Wave/Tidal)

11.1 Wave and tidal stream energy is electricity generated from the movement of wave and tidal flows. Wave power is more predictable than wind power, and it increases during the winter when electricity demand is at its highest. Tidal stream energy is also predictable and consistent.

11.2 With the marine resource and expertise in oil and gas exploration throughout Scotland, there is an opportunity to benefit from this type of renewable energy and to develop related wave and tidal stream services in the Clydeplan area, most notably the Inverclyde coastline and along the River Clyde.

11.3 Wave and tidal energy can make an important contribution towards meeting the demand for electricity. The industry is still in its early stages and further research and policy support is needed to determine how best to exploit these assets. Although the marine energy resource within the city region area is limited, Clydeplan supports the development of wave and tidal stream technologies.

11.4 A tidal barrier at the mouth of the River Clyde, located between Greenock and the Ardmore Point, would generate multi-benefits including renewable energy generation and improving flood defences. The estimated generation capacity of approximately 200GWH per year would be enough to power every home in Glasgow and would add to the renewable energy mix in the GCV area. Further exploration of generating electricity from tidal flows through a barrage on the river is welcomed by Clydeplan. Impacts on extensive Clyde Estuary designations, in particular SEPA regulations, would have to be addressed in any such proposal.

12.0 Energy Storage

12.1 Energy can be stored at variable scales, for both electricity and heat, in a number of ways, through technologies such as hydro pumped storage, hydrogen and fuel cells, compressed air and cryogen.

12.2 A clear case has been made that if the energy sector is to maximise environmental, economic and social benefits, renewable energy will need to be linked to energy storage.

12.3 Energy storage technologies can counteract intermittency associated with certain energy supplies, can ensure excess power is not lost at times of high production, can provide energy on demand off-grid in a variety of ways.

12.4 Advancements in storage technology are leading to new areas of consideration for planning policy makers with the full effects still to become clear. At the strategic scale, it may be that a network of storage sites will be required, with the potential scale of building having significant localised and cross boundary impacts.

12.5 An increasing range of energy storage technologies are being developed with the benefits in increasing the efficiency of intermittent energy sources such wind and solar becoming more apparent.

13.0 Direction of travel / Action

Renewable heat

13.1 It is clear that sustained efforts to increase the use of renewable heat is required if the 11% target is to be met by 2020. The use of biomass as an energy source is encouraged in appropriate locations throughout the city region. Clydeplan constituent local authorities have the opportunity to collaboratively plan, implement and deliver at various scales to ensure the use of district heating and combined heat and power plants. To achieve the 2020 target will require a strong focus on the domestic sector, particularly existing properties. This will require retrofitting of micro-renewables and the development of district heating.

13.2 Consideration will be given to undertaking further research in order to consider ways in which low and zero carbon heat generating technologies might be applied across the city region.

Onshore wind

13.3 Onshore wind remains the most widely deployed renewable energy source and, despite cuts to subsidies, will be expected to provide significant additional capacity within Scotland over the short-medium term, with the Clydeplan area having some capacity remaining. Proposals to repower existing wind farms are likely to come forward over the next few years. Where any potential negative impacts can be overcome, this will result in increased installed capacity with minimal strategic consequences.

13.4 Clydeplan will continue to monitor wind energy developments in the city region and engage wtih relevant stakeholders to evolve and revise onshore wind guidance, policy and spatial frameworks.

Solar PV

13.3 The capability of Solar PV to deliver additional installed capacity throughout Scotland is clear. If the cost of developing solar farms can overcome subsidy cuts and there is policy support at all levels then the strategic capacity of solar energy could be realised. Further research will determine whether co-location with wind farms could provide mitigation against potential environmental impacts. Policy intervention to demand that new residential/commercial developments include solar tiles/roofs (and other energy saving measures) in their design at the outset would be a positive step and would be supported by the SDP, provided other relevant local considerations could be satisfied.

Energy storage

13.4 Energy storage is key to balancing the grid and increasing the efficiency of intermittent sources. Support for research and design and resultant technological advancements may lead to energy storage methods that can be delivered at a large scale. This would have a strategic impact in relation to location and how the energy network functions.

Other energy technologies

13.5 Other renewable technologies such as hydro, wave/tidal and geothermal will continue to be supported although it is recognised that cost and locational issues may limit the immediate or further deployment of these sources within the city region.

13.6 Overall, Clydeplan is supportive of the advancement and deployment of renewable technologies as part of the Scottish Government's objective to transition to a low carbon economy. Through continued collaborative working, Clydeplan, its constituent local

authorities and other stakeholders will undertake research that will shape and inform the city region policy content and spatial frameworks of future SDPs.

PART TWO

Onshore Wind Spatial Framework for Glasgow and the Clyde Valley

14.0 Introduction

Background

14.1 The purpose of Part Two of the Background Report is to establish a spatial framework for wind energy that supports the Clydeplan SDP. This provides strategic background information, including a strategic landscape capacity study and will help inform decision making in relation to future wind turbine development proposals.

14.2 The main aim of this report is to identify areas with potential for wind farm development. It sets out the methodology undertaken and provides locational guidance on how strategic wind energy issues should be considered throughout the Glasgow and the Clyde Valley city region. It provides a strategic baseline which will be developed in more detail through Local Development Plans. This report is accompanied by '*Glasgow and the Clyde Valley Strategic Landscape Capacity for Wind Turbine Development Study'* (LUC, 2014)[4]. Please note that the Landscape Capacity Study (2014) is for information purposes only. It does not inform the strategic spatial strategy

Current Pattern of Wind Turbine Development

14.3 The city region is already a focus for onshore renewable energy developments. The locations of all operational, consented and proposed turbines in October 2013 are shown in Figure 7. Developments at scoping stage are not included. The total numbers of wind turbines in the city region are summarised in Figure 8. Based on October 2013 figures, there are 524 operational wind turbines, of which four fifths are in the large (80-120m) or very large (120-150m) categories[5]. These include a number of large wind farms (including Whitelee, Blacklaw and Clyde), several smaller wind farms/clusters and numerous single turbine developments.

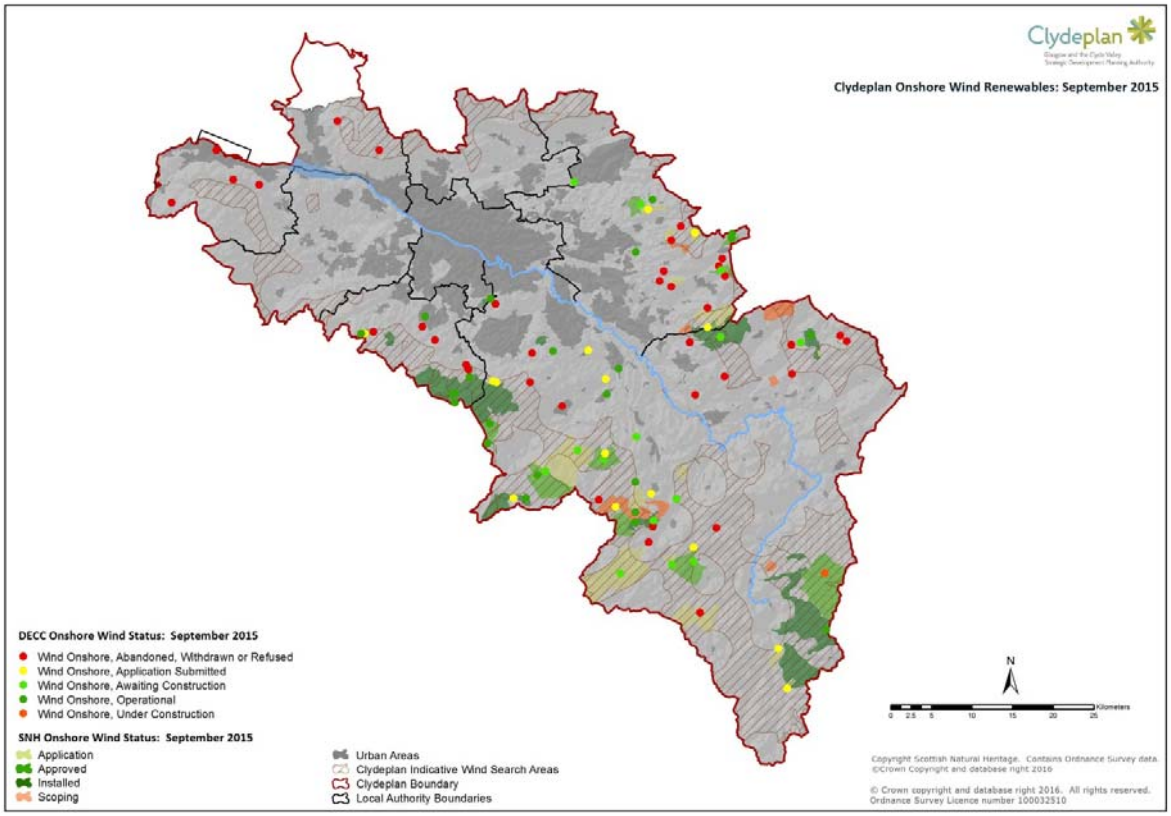
Figure 8: Wind turbines in the Glasgow and the Clyde Valley city region

	Operational and under construction	Consented	Proposed (valid planning application or appeal)	Total
Small (15-30 m)	45	78	3	126
Small-medium (31-50 m)	12	28	20	60
Medium (51-80 m)	62	30	25	117
Large (81-120 m)	225	42	24	291
Very large (over 120 m)	186	64	252	502
Total	**530**	**242**	**324**	**1096**

[4] http://www.clydeplan-sdpa.gov.uk/files/GCVLandscapeCapacityStudy2014.pdf
[5] Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley, LUC, October 2014, p.36

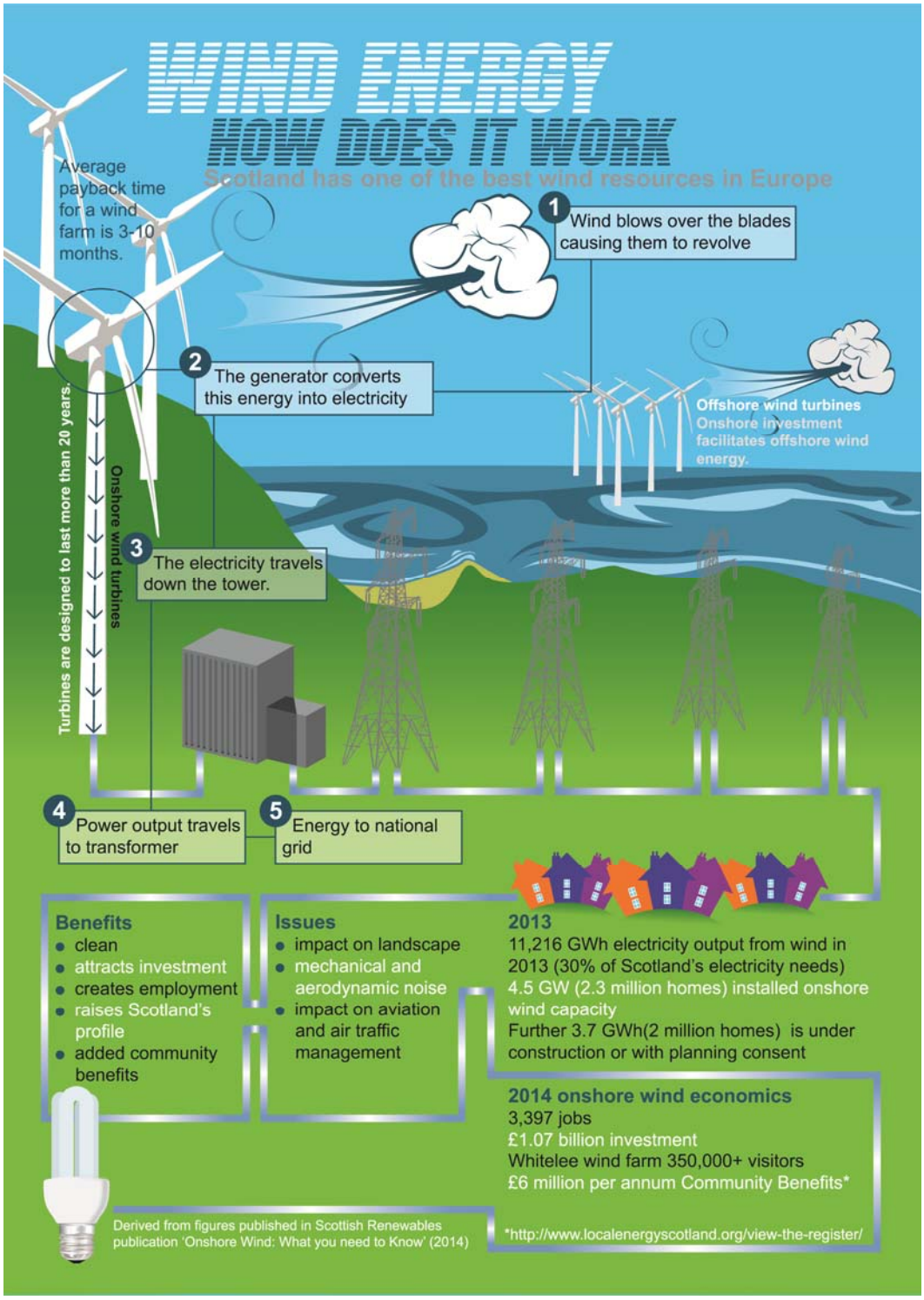
14.4 Public opinion on wind energy is divided. Since the emergence of wind power, there are concerns relating to the scale, proximity and impacts of proposed wind energy developments. At the same time, it is recognised as an opportunity to improve the long-term resilience of rural communities, particularly from locally-owned schemes, and where benefits from commercial developments are secured.

Figure 9: Wind Energy Development in Clydeplan (September 2015)



14.5 Figure 9 illustrates the overall pattern of development. At the broadest scale, existing and proposed wind turbines are most concentrated along the flanks of the upper Clyde Valley, to the south and east of Glasgow, within East Renfrewshire, North Lanarkshire and South Lanarkshire. Within these clusters, set either side of the Clyde itself, the larger wind farms are set on the highest ground at the edge of the study area, while smaller single turbines tend to be located on farmland closer to the river. For information purposes, these patterns of development are discussed further in Chapter 6 of the *Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley* (LUC, October 2014).

Figure 10: Wind Energy Issues



14.6 NPF3 states that onshore wind will continue to make a significant contribution to diversification of energy supplies. Clydeplan supports national priorities for the construction or improvement of strategic energy infrastructure including generation, storage, transmission and distribution networks. Scottish Planning Policy 2014[6] (SPP) sets out policy principles for the planning system including:

- Support transformational change to a low carbon economy;
- support a diverse range of electricity generation from renewable technologies; and
- guide development to appropriate locations and advise on issues that will be taken into account when specific proposals are being assessed.

14.7 SPP states that development plans should seek to ensure an area's full potential for electricity and heat from renewables is reached giving due regard to relevant environmental, community and cumulative impact considerations. SPP outlines the approach planning authorities should use to prepare a spatial framework for identifying those areas that are likely to be most appropriate for onshore wind farms, and states that development plans should indicate the minimum scale of onshore wind developments that the framework is intended to apply to. The Strategic Development Plan does not indicate a minimum scale, instead it will be for each planning authority to determine what is relevant within their boundary.

Planning

14.8 Development plans guide development to appropriate locations and advise on the issues that will be taken into account when specific proposals are being assessed. These include environmental, community and cumulative impact considerations. The level of interaction between Scotland's natural heritage and wind farms varies from site to site. Guidance has been developed by Scottish Natural Heritage (SNH) to promote responsible siting and design of wind farms and consideration of environmental impacts is part of the planning system[7]. Consideration of impacts on settlements and communities is a key role of the planning system. SPP requires spatial frameworks to identify community separation distances for settlements identified in the Local Development Plan and advises that plans should contain policy criteria to safeguard other settlements and individual properties.

14.9 SPP states that planning authorities should be clear about likely cumulative impacts recognising that in some areas the cumulative impact of existing and consented energy development may limit the capacity for further development.

[6] http://www.scotland.gov.uk/Topics/Built-Environment/planning/Policy
[7] http://www.snh.gov.uk/planning-and-development/renewable-energy/onshore-wind/

Tourism

14.10 Wind farms can present an opportunity for increasing tourism and establishing new access paths for recreational use. The visitor centre at Whitelee Wind Farm has had more than 350,000 visitors since it opened in 2009, with tens of thousands more estimated to have used the extensive path and cycle network built throughout the site.

15.0 Framework Methodology

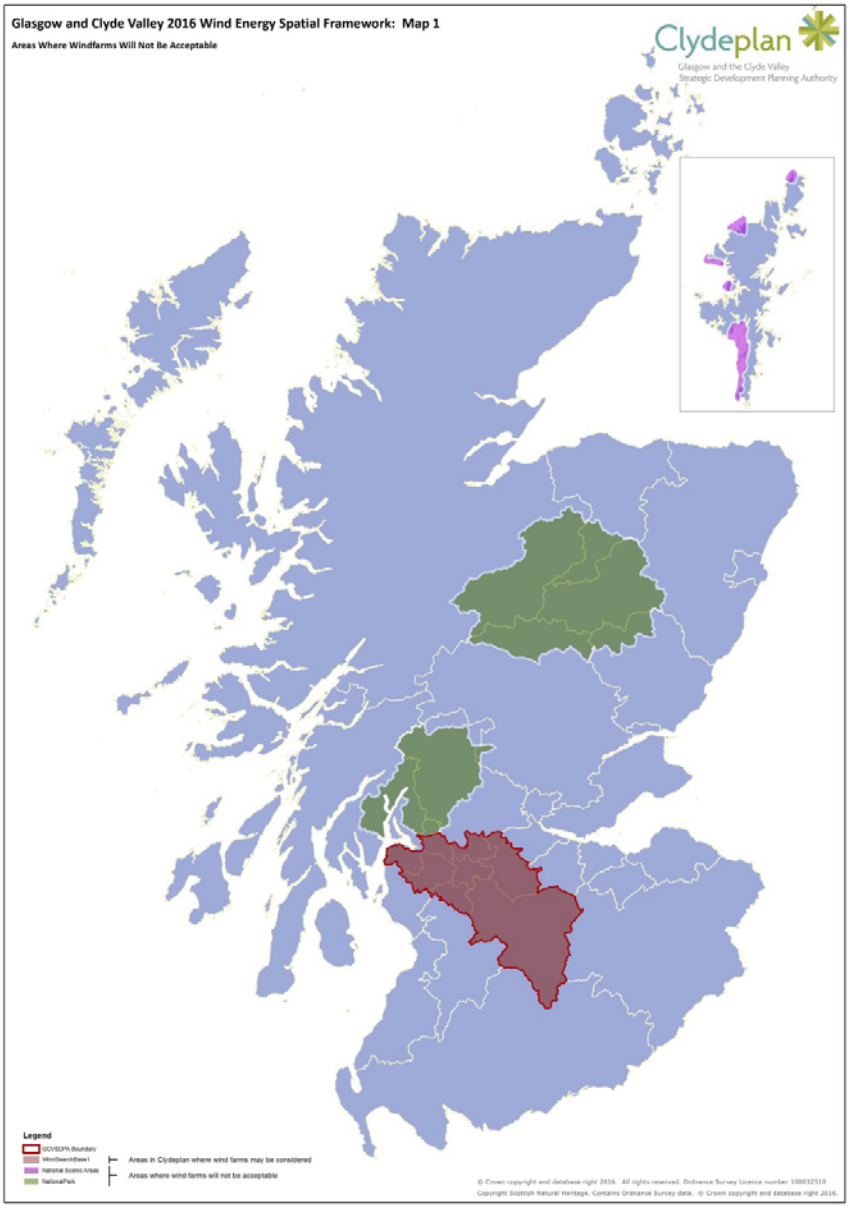
Clydeplan Spatial Framework

15.1 In order to deliver consistency, this Background Report follows the approach to spatial framework preparation set out in SPP, setting out Group 1, Group 2 and Group 3 considerations as they apply across the city region.

15.2 The maps included in this part of the Background Report show the city region and the relevant resources as the main image while an insert to the right of the main image shows the distribution of these resources across Scotland thus illustrating the city region's position in relation to the Scotland-wide context for that resource.

Group 1: Areas where wind farms will not be acceptable

15.3 Map 1 illustrates that there are no National Parks or National Scenic areas within the city region.



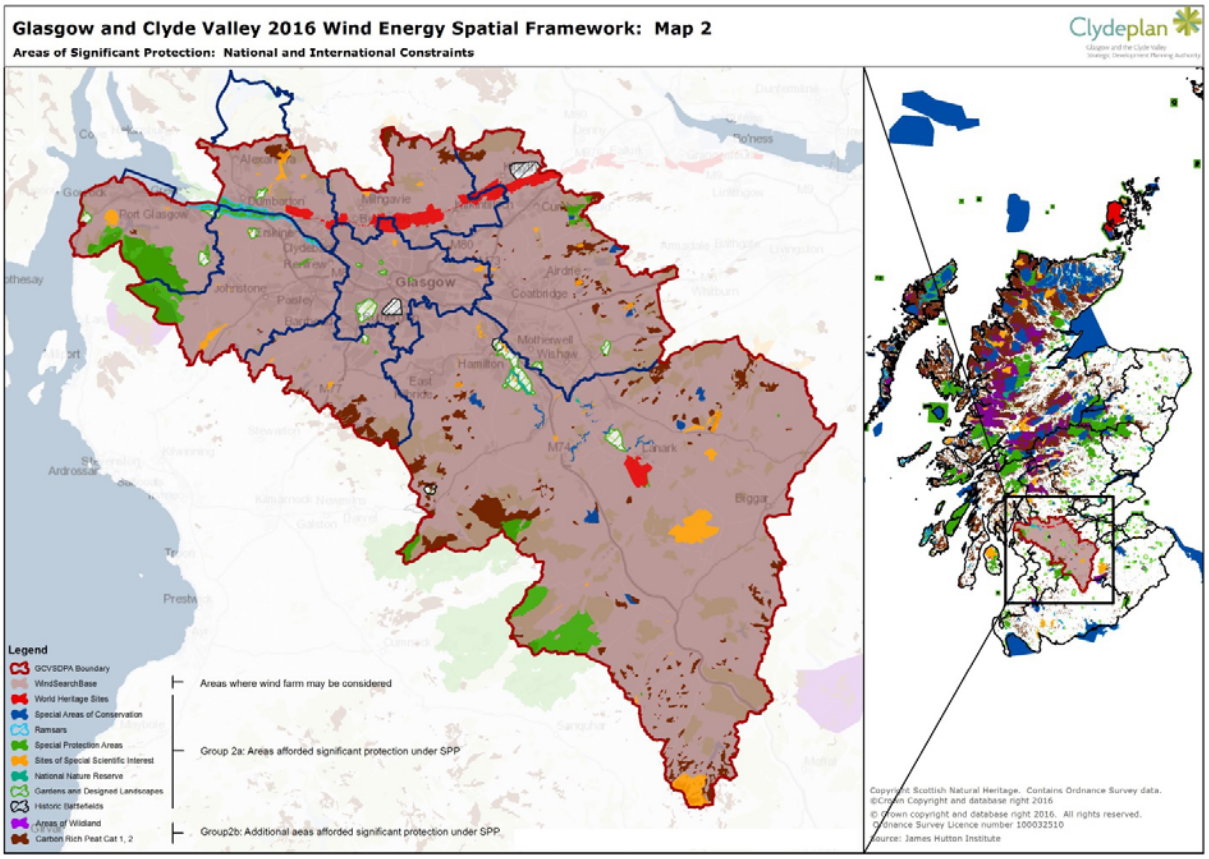
Group 2: Areas of significant protection

15.4 This Group relates to national and international designations, other national important mapped environmental interests and community separation for consideration of visual impact. These are areas where the need for significant protection is recognised and wind farms may only be appropriate in some circumstances. Within these areas, further

consideration will be required to demonstrate that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation.

National and international designations

15.5 Map 2 shows the national and international designations referred to in SPP.



15.6 Figure 11 outlines the relevant international and national designations that are relevant to this spatial framework.

Figure 11: International and National

Designation	Number of sites in Clydeplan
World Heritage Sites	2
Natura 2000 and Ramsar sites	16
Sites of Special Scientific Interest;	102

National Nature Reserves	1
Sites identified in the Inventory of Gardens and Designed Landscapes	21
Sites identified in the Inventory of Historic Battlefields.	5

Other nationally important mapped environmental interests

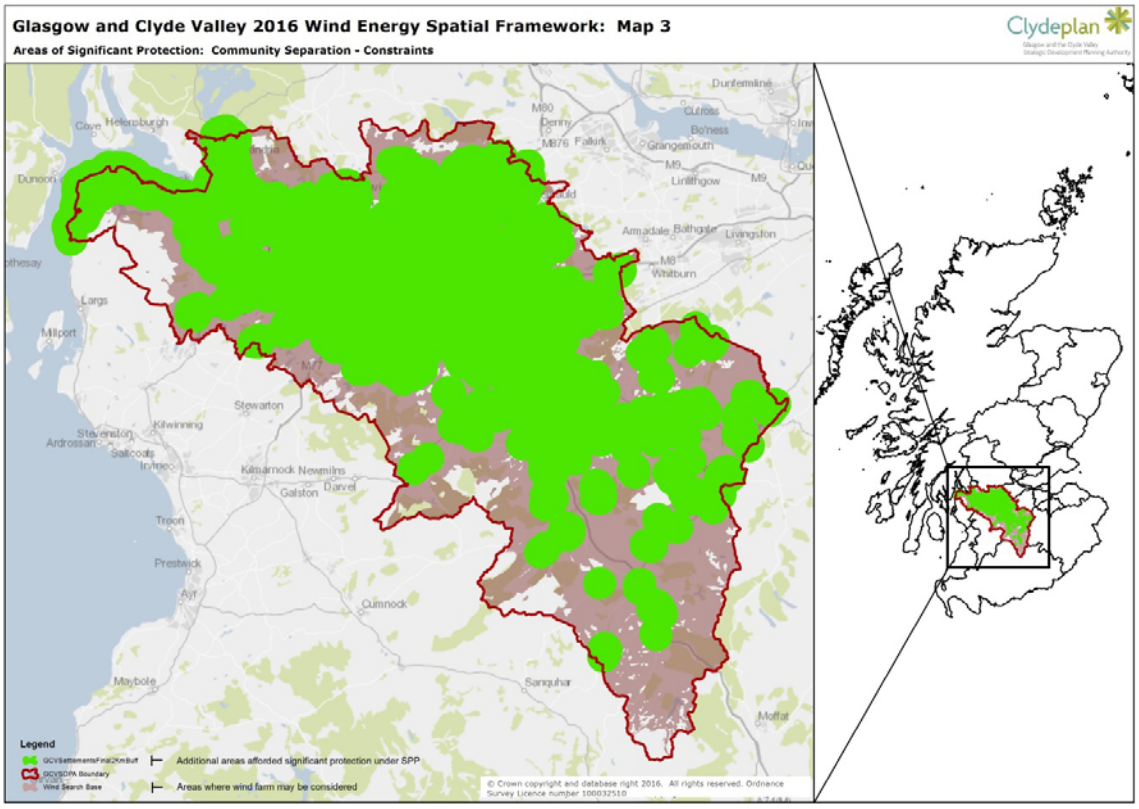
15.7 Map 2 outlines areas within the city region identified as wild land, as shown on the 2014 SNH map of wild land areas. It also shows classes 1 and 2 from the carbon rich soils, deep peat and priority peatland habitat consultation by SNH[8].

15.8 SPP requires that wild land is safeguarded in development plans and in spatial frameworks for onshore wind farms. Wind turbine proposals will need to "demonstrate that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation" (SPP, paragraph 215). The area of wild land identified in Clydeplan is Waterhead Moor in Clyde Muirshiel Regional Park which covers an area of 5,016 ha[9].

Community separation for consideration of visual impact

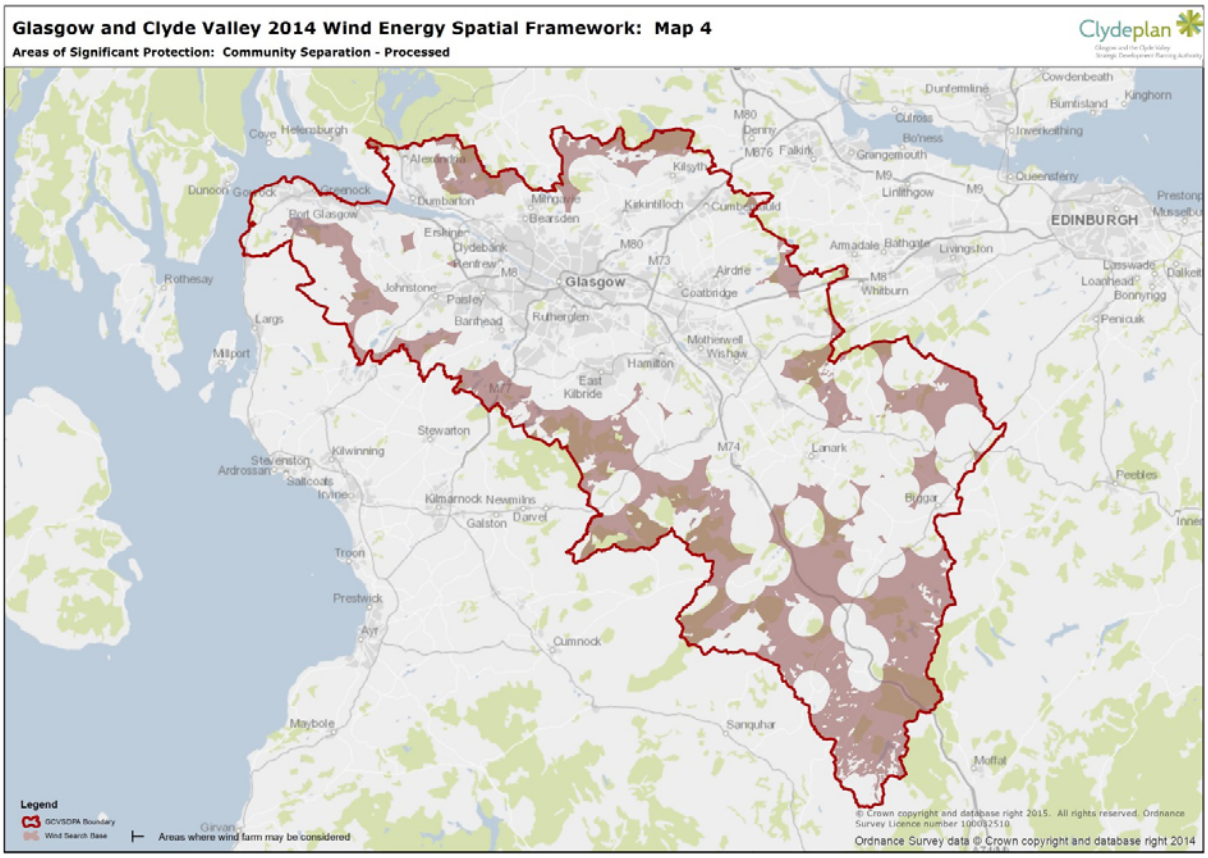
15.9 SPP advises that an area for community separation not exceeding 2 kilometres around cities, towns and villages that are identified in local development plans with identified settlement envelopes or edges should be defined. The extent of this area is indicative and alternative separation distances may be determined by the local planning authority in local wind energy spatial frameworks and to reflect local circumstances of individual planning applications.. However for strategic planning purposes a 2km ‘buffer’ is identified. Map 2c illustrates the urban nature of the city region reflecting the number and density of settlements as defined by settlement envelopes or edges in local development plans.

[8] http://www.snh.gov.uk/planning-and-development/advice-for-planners-and-developers/soils-and-development/cpp/
[9] http://www.snh.gov.uk/protecting-scotlands-nature/looking-after-landscapes/landscape-policy-and-guidance/wild-land/mapping/



Group 3: Areas with potential for wind farm development

15.10 At a city region scale areas that remain once the constraints outlined above in Groups 1 and 2 are excluded and illustrated in Map 3. SPP advises that in such areas wind turbine development is likely to be acceptable, subject to detailed consideration against local policy criteria. Areas with potential for wind farm development should not be viewed in isolation. Given the strategic scale of Map 3, developers and interested parties must refer to any local guidance made available by the local planning authority including local development plans and supplementary guidance, and landscape capacity studies.



16.0 Additional considerations for wind turbine proposals

Introduction

16.1 The identification of detailed policies and criteria for the assessment of wind energy proposals will primarily be a matter for Local Development Plans. However, there is a role for the SDP in relation to strategic landscape capacity and cumulative impact considerations. SPP notes that strategic and local development planning authorities should identify where there is strategic capacity for wind farms and areas with the greatest potential for wind development, considering cross boundary constraints and opportunities.

16.2 SPP states that development plans should set out the criteria that will be considered in deciding all applications for wind farms of different scales. The following section of this background report provides some insight into a key criteria, landscape impact, that will be relevant to wind turbine development proposals.

Clydeplan Landscape Capacity Study 2014

16.3 In partnership with Scottish Natural Heritage and the eight constituent local authorities, Clydeplan commissioned a strategic Landscape Capacity Study, undertaken by Land Use Consultants. The study examines cumulative development within the landscape to provide a picture of current residual capacity for further development. This establishes

that there is residual capacity in some lower sensitivity landscapes, but that the capacity threshold is being approached in others.

16.4 Turbine development over 50m is concentrated, broadly in the south and north-east of the study area, within East Renfrewshire, South Lanarkshire and North Lanarkshire. Considering operational development, there are essentially three main clusters of development which are almost wholly within the Plateau Moorland, Plateau Farmland and Southern Uplands landscape character types:

- One group is centred on Whitelee, and extends to Neilston and Middleton in the north-east, Cathkin Braes and Blantyre Muir in the north, and Hagshaw Hill in the south;
- The second group is somewhat looser, centred on Black Law and including Muirhall, Pates Law, and Greendykeside; and
- Clyde wind farm forms a group of its own in the south, with Glenkerie to the east.

16.5 The pattern of consented development will consolidate these three areas rather than significantly expand them. The main change is the number of consented single turbines over 50m, mainly in the Plateau Farmland landscape character type.

16.6 Proposed development is also largely within these three groups, though the locations of some consented and proposed wind farms may begin to close the present gap between Hagshaw Hill and Clyde. A new separate cluster of development is emerging to the south, around New Cumnock and Sanquhar in the 15km buffer around the SDP boundary.

16.7 The strategic cumulative assessment indicates that a distinct pattern of development has emerged within Clydeplan, largely following the distribution of lower sensitivity landscapes. This also corresponds with the SDP1 broad areas of search.

16.8 For very large turbines (120-150+ m), lower sensitivity occurs in the Plateau Farmland, Plateau Moorland and Southern Upland areas. Large turbines (81-120 m) lower sensitivity occurs in Rolling Farmland, Fragmented Farmland and Alluvial Plain areas. For medium turbines (51-80 m) the lowest sensitivity is found in the urban fringe landscapes of the Alluvial Plain and the Fragmented Farmland areas and for small-medium (31-50m) a similar pattern is identified. The Study found there is residual capacity in some of these lower sensitivity landscapes. A summary table is provided in the LUC Landscape Capacity Study[10]. Please note, this table is for comparison purposes only and should not be consulted without reference to the detailed statements for capacity in relation to each landscape character type.

16.9 The study also notes that some landscapes character types, particularly areas of the Plateau Moorland, Plateau Farmland and Southern Uplands LCTs, are reaching the point at which cumulative effects are likely to limit the potential for further development. The Landscape Capacity study is available to view here.

[10] LUC, Landscape Capacity Study for Wind Turbine Development in Glasgow and the Clyde Valley, June 2014, Table 5.42, p125

16.10 The Study has highlighted the importance of the undeveloped landscape of Tinto, Black Mount and the western Pentlands as strategic gaps. The Campsie Fells, Kilsyth Hills and Kilpatrick Hills to the north provide an important backdrop to the landscapes of the Clyde basin and serve as a strategic gap between the wind farm developments in North Lanarkshire and those on the north side of the Campsie Fells and Kilsyth Hills, visible from Stirling. It could be appropriate for these to remain gaps. This will be determined at local development plan and application stage.

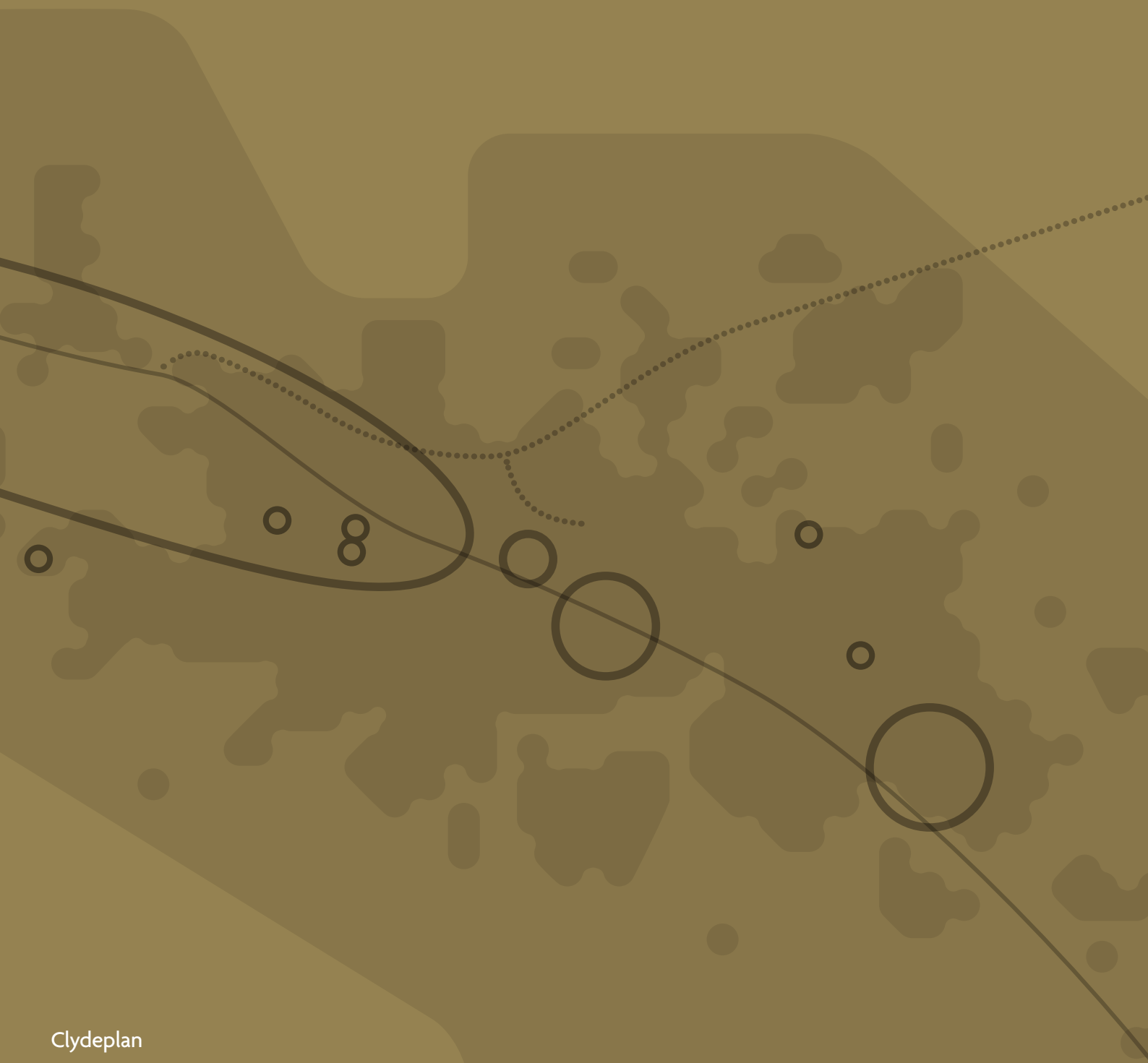
SEA Findings

16.11 The proposed strategy for onshore wind could include potential negative impacts on landscape, particularly if installations are clustered in areas where development is already concentrated. Further monitoring of impacts is therefore recommended. Additional, potentially less significant effects are also predicted for a range of environmental receptors, including biodiversity, soil, water, cultural heritage and landscape. Land use planning and management should ensure that any new turbine development is considered in more detail in relation to these receptors. Impacts on wider areas will need to be considered carefully in the preparation of each local development plan and specifically spatial frameworks for wind. The specific individual and cumulative impacts of development on biodiversity, soil, water, cultural heritage and landscape will be identified and assessed at this level, reflecting the wider requirements proposed in SPP and SDP2. Impacts are not therefore expected to be significant, given the availability of mitigation at the plan and project level and the national level capacity to accommodate this type of development.

Aviation

16.12 In relation to aviation issues, BAA work with Planning Authorities and developers to ensure that proposed developments in appropriate locations can proceed without compromising aerodrome safeguarding. It is therefore important that any local development plan policy relating to aerodrome safeguarding such as renewable energy policies include relevant criteria related to aviation issues including:

- radar visibility;
- obstacle limitation surfaces; and
- the cumulative impact of the above.



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