Torfaen County Borough Council and Newport City Council

Renewable and Low Carbon Energy Assessment

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Executive Summary – Torfaen County Borough Council

This report has been produced by Verco as a joint study for Torfaen County Borough Council and Newport City Council on behalf of the Carbon Trust in Wales. This summary concerns the results for Torfaen County Borough Council (TBC).

The purpose of the study is to provide an evidence base for the potential development of renewable and low carbon energy within the two local authorities, to examine the low carbon potential for strategic development sites and explore strategic leadership opportunities. The study methodology has followed the Welsh Government Planning for Renewable and Low Carbon Energy – A Toolkit for Planners (July 2010).

Renewable electricity potential

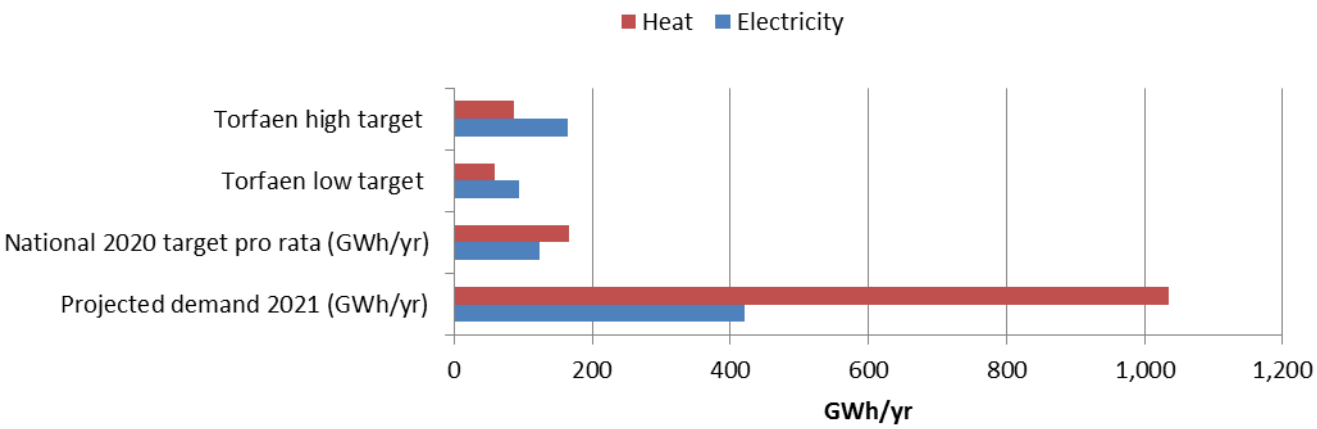
This study has identified a total renewable generation potential in Torfaen of 283GWh/yr equivalent to 67% of the projected electricity consumption of the authority area in 2021 of 420GWh/yr. The largest potential resource is wind power, followed by solar photovoltaics (PV). Only 3% of the total renewable energy resource is currently being exploited, excluding waste resources, the majority of which are currently exported outside of the county for treatment and disposal.

Renewable heat potential

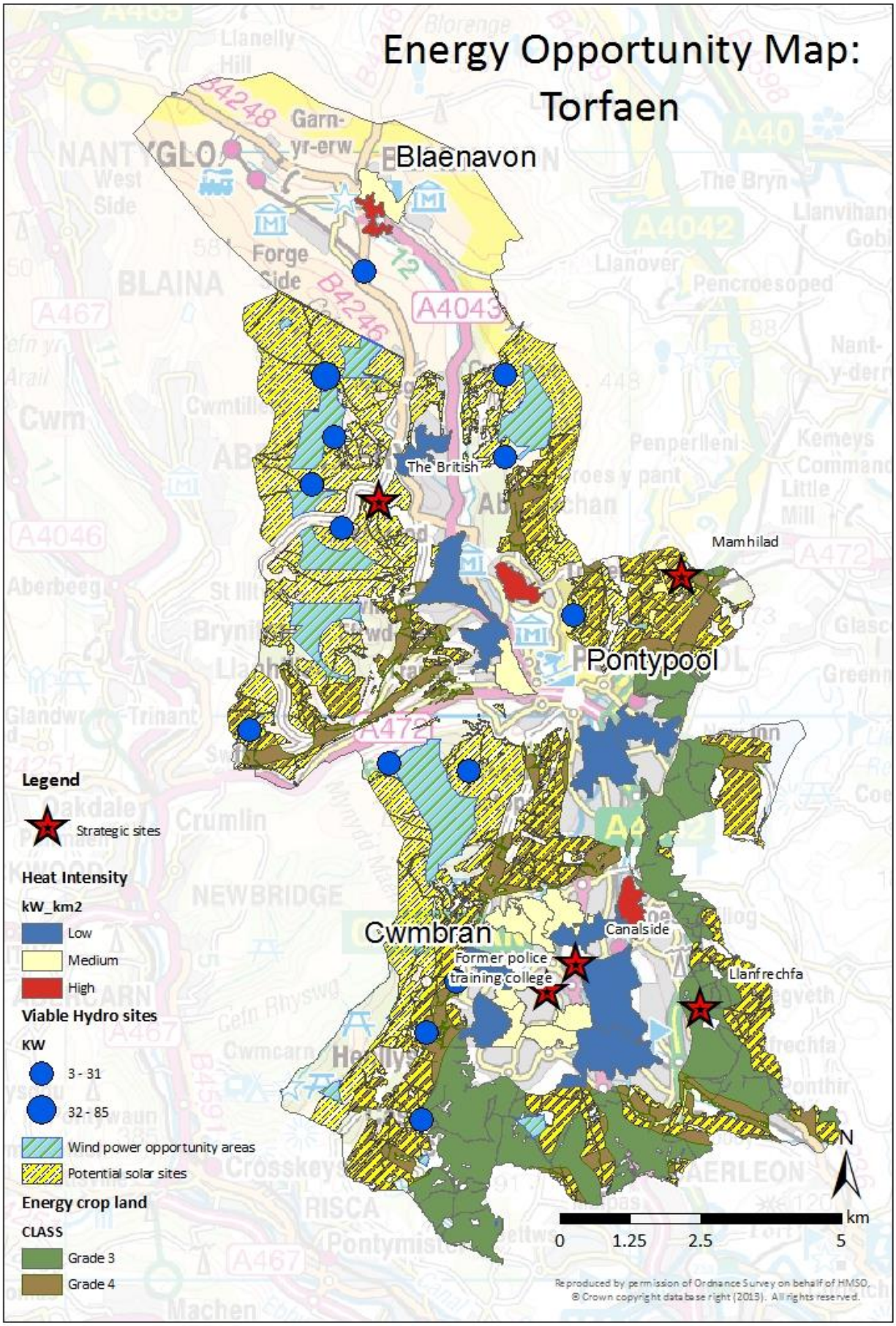
The potential for renewable heat is calculated to be of 116 GWh/yr, equivalent to 11% of the projected heat demand for the authority area in 2021. The largest potential heat generation resource is energy from waste, with a potential 77 GWh/yr, followed by energy crops and wood fuel.

Renewable energy targets

Renewable energy targets for the county are proposed based on high and low scenarios of resource exploitation. The high scenario is roughly equivalent to UK targets for 2020, albeit with over achievement of the 30% by 2020 renewable electricity target (39%) and underachievement of the 12% heat target (8%, or 3% excluding waste).



The energy opportunity map shown on the next page identifies, spatially, some of the key renewable energy resources available within the authority and areas of least constraint. An electronic version of the map with a higher resolution base layer is to be made available to accompany this report.


Energy Opportunity Map:
Torfaen
Blaenavon
Pontypool
Cwmbran
Mamhilad
The British
Canalside
Former police training college
Llanfrechfa
Legend
Strategic sites
Heat Intensity
kW_km2
Low
Medium
High
Viable Hydro sites
KW
3 - 31
32 - 85
Wind power opportunity areas
Potential solar sites
Energy crop land
CLASS
Grade 3
Grade 4
N
km
0
1.25
2.5
5
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We identify the following as potential opportunities within Torfaen:

- **Wind energy**, however cumulative visual impact is likely to limit the exploitation of this resource. Detailed feasibility work of specific sites would be required to confirm the viability of specific sites.
- **Solar PV,** both roof mounted and ground based. Further survey work would be required to identify viable projects.
- There are several potential **hydropower** sites, mostly in the north of the county. The combined generation capacity is however relatively small, <1% of the Torfaen's electricity demand.
- The southern and eastern sections of the authority offer good **energy crop potential**.
- There are potential opportunities for **heat networks** in the Cwmbran and Pontypool. These should be reviewed to identify potential amenable anchor loads prior to committing to further technical and economic viability analysis.

Strategic sites

Five strategic sites have been reviewed for their projected energy consumption and the potential to integrate low and zero carbon energy supply: Llanfrechfa Grange, The British, Mamhilad, the Former Police Training Village and the Canalside Action Area. Two of these sites, Mamhilad and Llanfrechfa Grange, account for majority (75%) the total projected energy demand of all five sites. Solar PV is an option for all sites. Opportunities exist for communal energy systems in three of them, Mamhilad, Llanfrechfa Grange, and to a lesser extent the Canalside mixed use development, although without linkage to surrounding areas. There are potential opportunities to link in with standalone projects at two of the sites: wind and hydro at The British; anaerobic digestion and solar at Mamhilad.

Strategic leadership

The renewable energy targets proposed in this study (and not yet considered by TBC) are estimated to provide the basis for investment in the region of up to £119m. This is turn could deliver up to ~3,000 jobs. These broad estimates of economic benefit clearly demonstrate that there is significant social and economic value to promoting and exploring low carbon energy solutions. There are barriers, but the Local Authority is well placed through coordination, investment support and the direct delivery to drive development and unlock the value that exists.

We recommend a strategic approach based upon a delivery framework that seeks to understand and provide support through the three development communities: the public sector, community sector and commercial sector. We recommend that the Council:

- Facilitate a workshop with key stakeholders to review result, establish priorities, delivery measures and strategic actions.
- develop and embed a delivery framework strategy and plan.
- establish supportive planning policy that provides direction for renewable energy development and for achieving higher development standards, considering development viability.
- consider setting up an investment fund to direct appropriate finance.
- provide development support for strategically important projects.
- consider setting up development vehicles, e.g. a public-led Energy Services Company (ESCO) that could lead key projects where the private sector is not actively driving development, such as district heating networks or smaller scale wind energy.
- be proactive about using its own assets, notably land and buildings, to implement replicable projects.

Executive Summary – Newport City Council

This report has been produced by Verco as a joint study for Torfaen County Borough Council and Newport City Council on behalf of the Carbon Trust in Wales. This summary concerns the results for Newport City Council (NCC).

The purpose of the study is to provide an evidence base for the potential development of renewable and low carbon energy within the two local authorities, to examine the low carbon potential for strategic development sites and explore strategic leadership opportunities. The study methodology has followed the Welsh Government Planning for Renewable and Low Carbon Energy – A Toolkit for Planners (July 2010).

Renewable electricity potential

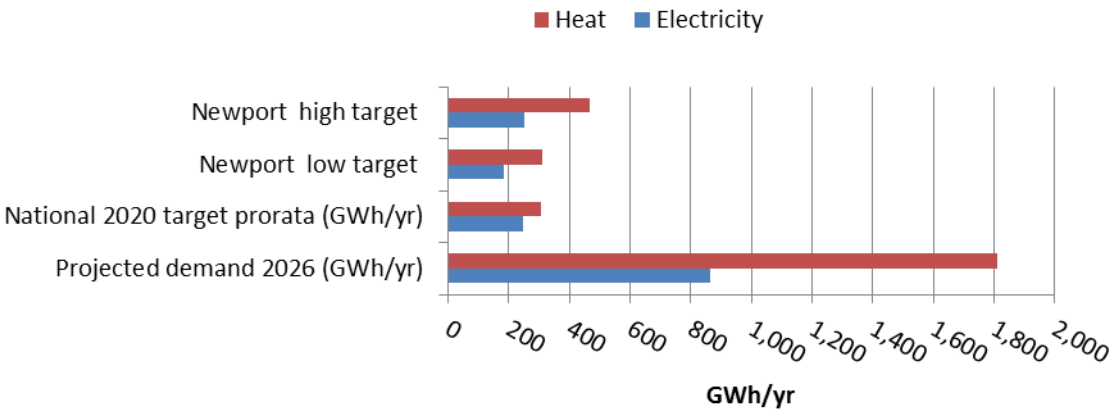
This study has identified a total renewable generation potential in Newport of 338GWh/yr equivalent to 39% of the projected electricity consumption of the authority area in 2026 of 863GWh/yr. The largest potential resource is wind power, followed by solar PV. Waste streams are a significant resource, although generation facilities are located outside of the county, notably Trident Park in Cardiff. Only 8% of the total renewable energy resource is being exploited at present, excluding waste resources which are currently exported outside of the county for treatment and disposal.

Renewable heat potential

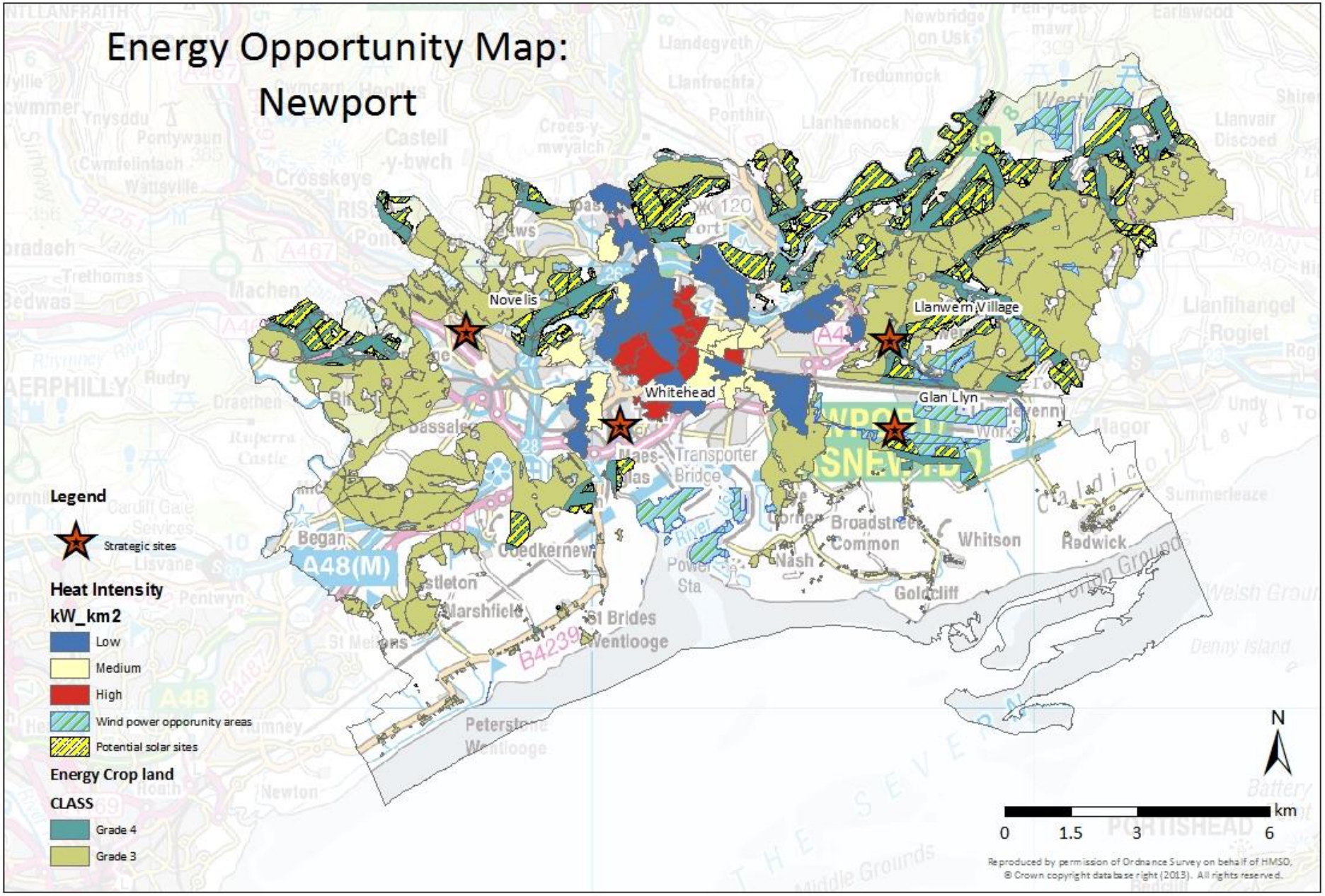
The potential for renewable heat is calculated to be 621GWh/yr, 34% of the projected heat demand for the authority in 2026 of 1,810GWh/yr. The largest potential heat generation resource is energy from waste, with a potential of 256GWh/yr although again energy recovery facilities are located outside of the county, followed by energy crops and wood fuel.

Renewable energy targets

Renewable energy targets for the county are proposed based on high and low scenarios of resource exploitation. The high scenario is roughly equivalent to UK targets of 30% by 2020 for electricity, but exceeds the 12% by 2020 UK renewable electricity target heat target (26%). If waste is excluded then the renewable heat potential is only 5%.



The energy opportunity map for Newport shown on the next page identifies, spatially, some of the key renewable energy resources available within the authority.


Energy Opportunity Map:
Newport
Novelis
Llanwern Village
Whitehead
Glan Llyn
Legend
Strategic sites
Heat Intensity
kW_km2
Low
Medium
High
Wind power opporunity areas
Potential solar sites
Energy Crop land
CLASS
Grade 4
Grade 3
N
km
0
1.5
3
6
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We identify the following as important opportunities within Newport:

- **Wind energy**, notably around the mouth of the Usk and in eastern areas of the county. Detailed feasibility work of specific sites would be required to confirm the viability of specific sites.
- **Solar PV,** both roof mounted and ground based. Further survey work would be required to identify viable projects.
- The authority generally offers good **energy crop potential**, although most land is of agricultural standard and landholders are likely to designate it for other purposes.
- There are potential opportunities for **heat networks** in the centre of Newport. The Uskmouth power stations are a huge potential source of waste heat that could potentially be distributed to the city. It would represent a major infrastructure project to harness this resource, but it is worth at least preliminary investigation given the scale of the opportunity.

Strategic sites

Four strategic sites have been reviewed for their projected energy consumption and the potential to integrate low and zero carbon energy supply: Glan Llyn, Llanwern Village, Whitehead Works site and Novelis. Glan Llyn is by far the largest site, with projected energy consumption greater than the other three sites put together. Development is underway on the Glan Llyn site, and outline planning permission has been granted on the Novelis site. There are opportunities to influence the latter stages of the Glan Llyn site and the Novelis site when reserved matters applications are submitted containing the detailed design for the proposals. Llanwern village is predominantly residential, and lends itself to a high fabric specification and microgeneration solution. Solar PV is an option for all sites. The Whitehead site holds potential for a gas CHP/biomass energy centre to supply the new hospital and adjacent buildings. There are potential opportunities to link standalone wind and solar projects to the employment areas of Glan Llyn.

Strategic leadership

The renewable energy targets proposed in this study (and not yet considered by NCC) are estimated to provide the basis for investment in the region of up to £144m. This is turn could deliver up to circa 3,500 jobs. These broad estimates of economic benefit clearly demonstrate that there is significant social and economic value to promoting and exploring low carbon energy solutions. There are barriers, but the Local Authority is well placed through coordination, investment support and the direct delivery to drive development and unlock the value that exists. We recommend a strategic approach based upon a delivery framework that seeks to understand and provide support through the three development communities: the public sector, community sector and commercial sector. We recommend that the Council:

- Facilitate a workshop with key stakeholders to review result, establish priorities, delivery measures and strategic actions.
- develop and embed a delivery framework strategy and plan.
- establish supportive planning policy that provides direction for renewable energy development and for achieving higher development standards, considering development viability.
- consider setting up an investment fund to direct appropriate finance.
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- consider setting up development vehicles, e.g. a public-led Energy Services Company (ESCO) that could lead key projects where the private sector is not actively driving development, such as district heating networks or smaller scale wind energy.
- be proactive about using its own assets, notably land and buildings, to implement replicable projects.

1. Introduction

This report has been produced by Verco as a joint study for Torfaen CBC and Newport CC on behalf of the Carbon Trust in Wales. The purpose of the study is to provide an evidence base for the potential development of renewable and low carbon energy within the two local authorities, to examine the low carbon potential for strategic development sites and explore strategic leadership opportunities.

1.1 Objectives

The project objectives were to:

- Develop an understanding of local renewable resources, constraints and opportunities and the local delivery context;
- Identify opportunities to include renewable energy schemes, district heating and combined heat and power into development proposals;
- The renewable opportunities identified will provide an evidence base to facilitate the delivery of renewable energy generation across the local authority areas;
- Assist in facilitating renewable and low carbon energy generation in development through the emerging policies of the Torfaen Deposit LDP (Policy S3) and Newport Deposit LDP (Policies GP1 and CE14).

The spatial elements of this study are not intended for use by development management officers to assess individual planning applications for either strategic new development sites that are incorporating renewable energy, or for stand-alone renewable energy generating systems. Further detailed survey work would need to be undertaken to assess development potential and viability. However, they may be used to inform an assessment of need for these renewable energy installations.

1.2 Methodology and scope

The study methodology has followed the Welsh Government Planning for Renewable and Low Carbon Energy – A Toolkit for Planners (July 2010). Given the advanced stages of the respective Torfaen and Newport LDP's the study has not addressed Policy Option 1: Developing area wide RE targets or Policy Option 2: Inform site allocations.

The study periods match those of the respective LDPs as follows:

- Torfaen CBC 2006 to 2021
- Newport CC 2011 to 2026

The majority of the strategic (land development) sites are to be built-out over a longer timeframe than the respective Plan Periods. The Energy Assessments for these strategic sites consider the sites fully built out.

The study covers all mainstream renewable energy technologies as per the Toolkit guidance. Verco have developed an additional assessment for ground mounted solar PV, which has been included in this study. This renewable energy assessment does not cover renewable transport fuels, offshore wind or marine energy. Other than the shore-line network connections, offshore renewable energy projects are not within the planning jurisdiction of local planning authorities, but are the responsibility of the Crown Estate.

The study also considers some energy options that are non-renewable, but can still produce less carbon than use of the conventional electricity grid or gas network, and are therefore considered to be important considerations. These options include:

- Waste heat, e.g. from power stations, or industrial processes;
- Gas engine or gas turbine Combined Heat and Power [CHP], or fuel cell CHP, where the heat is usefully used; and
- The non-biodegradable fraction of the output from energy from waste plants

Our recommendations for strategic leadership broadly cover all low carbon solutions including energy efficiency, rather than renewable energy alone.

1.3 Requirement for this study

The need for the study was driven by planning policy, notably the requirements for renewable energy and sustainable development as set out in Planning Policy Wales (PPW), supported by detailed policy guidance contained within Technical Advice Note (TAN) 8 Planning for Renewable Energy, TAN 22 Planning for Sustainable Buildings and supporting practice guidance contained within Welsh Government's (WG's) Planning for Renewable and Low Carbon Energy – A Toolkit for Planners (July 2010).

National policy requires local authorities to undertake Renewable Energy Assessments for their respective local authority areas. Paragraph 12.8.9 of PPW states that "*local planning authorities should facilitate the development of all forms of renewable and low carbon energy to move towards a low carbon economy to help to tackle the causes of climate change*" and can make a positive contributions towards this by "*considering the contribution that their area can make towards developing and facilitating renewable and low carbon energy … ensuring that development plan policies enable this contribution to be delivered*" and "*ensuring that development control decisions are consistent with national and international climate change obligations, including contributions to renewable energy targets and aspirations*".

Paragraph 12.9.2 of PPW provides further details into what is expected of local authorities in relation to renewable energy requirements, stating that "*Local planning authorities should guide appropriate renewable and low carbon energy development by undertaking an assessment of the potential of all renewable energy resources and renewable and low carbon energy opportunities within their area, and include appropriate policies in development plans. Local planning authorities are encouraged to work collaboratively in order to gather evidence on a sub-regional basis wherever possible*".

Paragraph 12.93 outlines that in undertaking such assessments authorities should establish an evidence base which:

- Takes into account the contribution that can be made by their local area towards carbon emission reduction and renewable and low carbon energy production;
- Recognises that approaches for the deployment of renewable and low carbon energy technologies will vary;
- Identifies the accessible deliverable renewable energy resource potential (including heat) for their area and considers the likely utilisation of this resource over the plan period;
- Takes into account the environmental, social and economic impacts and opportunities from renewable and low carbon energy development;

- Takes into account the cumulative effects of renewable and low carbon energy development;
- Takes into account the likely mechanisms for determining applications for sites based on their potential and actual output; and
- Takes into account issues associated with grid connection and the transportation network.

In addition to planning policy requirements the council's recognise the economic and environmental benefits that can be derived from low carbon technology and therefore have commissioned this work to help indicate how strategic actions by the authorities may unlock these benefits.

In order to respond to these requirements the study largely follows the WG Renewables Toolkit.

1.4 Report structure

The report has been structured to provide the necessary outputs for both Councils whilst minimising duplication, as follows:

Common introductory sections

- Section 1: Introduction
- Section 2: Policy context

Part I: Torfaen County Borough Council

- Section 3: Background facts and figures
- Section 4: Area wide renewable energy assessment
- Section 5: Strategic development sites
- Section 6: Summary of key opportunities

Part II: Newport City Council

- Section 7: Background facts and figures
- Section 8: Area wide renewable energy assessment
- Section 9: Heat and energy opportunity maps
- Section 10: Strategic Development sites
- Section 11: Summary of key opportunities

Part III: Recommendation for strategic leadership (common section)

Appendices

- Appendix A: Glossary and explanation of terms
- Appendix B: Analysis methodology additional notes:
  - B1: Baseline energy demand
  - B2: Existing and planned renewables
  - B3: Wind energy resource
  - B4: Energy crops and woodfuel resource
  - B5: Waste resources
  - B6: Solar photovoltaics
  - B7: Fuel Poverty

- B8: Off gas grid-connection
- B9: Heat mapping

- Appendix C: CO_2 emissions data table
- Appendix D: Torfaen data tables
- Appendix E: Newport data tables
- Appendix F: Economic impacts
- Appendix G: List of tables and figures

2. Policy context

This section summarises the current policy context for renewable energy, low carbon technologies and new developments across the UK and in Wales.

2.1 United Kingdom

- **The Climate Change Act 2008** sets a legally binding target for the UK of at least a 34% reduction in greenhouse gas emissions by 2020, and 80% by 2050, against a 1990 baseline through domestic and international action.

- **The Low Carbon Transition Plan** sets out the UK's plan for becoming a low carbon country, with a headline goal to cut emissions by 18% on 2008 levels by 2020 (112 MtCO2e). This strategy is framed by the Climate Change Act (2008). The plan to 2020 requires an emissions reduction from homes by 29% on 2008 levels (27 million tonnes of CO2e).

- **The UK Government Renewable Energy Strategy**, published July 2009, calls for 15% of the UK's electricity, heat and transport fuel to come from renewable sources by 2020. This comprises of a 30% target for electricity, 12% target for heat and 10% of transport fuels.

- **The Renewables Obligation (RO)** is currently the UK Government's main support scheme for achieving the UK's 2020 target for renewable electricity. The RO provides renewable generators with a per MWh payment for renewable generation in additional to the wholesale electricity price. The scheme will be closed to new generation from 2017.

- **Feed-in Tariffs (FiTs)** deliver financial rewards for small-scale low carbon electricity generation (<5MWe), and were introduced in April 2010. Payment for the electricity produced by small-scale generators is provided by electricity supply companies. The policy intends to result in a return on investment (ROI) of between 5-8% for renewable electricity generation below 5 MW. The return on investment can however vary widely from project to project, depending on factors such as technology type, scale, location and prevailing tariff rates.

- **The Renewable Heat Initiative (RHI)** provides payment for using heat from renewable sources. The RHI for non-domestic buildings was introduced in 2011 and offers varying p/kWh rates for heat from renewable heat technologies. The equivalent scheme for the domestic sector is due to be introduced in mid-2013, and has been preceded by the Renewable Heat Premium Payment voucher scheme, which offers capital grants to householders.

- **Electricity Market Reform 2014-2017**. The draft Energy Bill aims to ensure secure and sustainable energy supply to the UK over the coming decades. The UK Government has published a draft Energy Bill, of relevance to renewables is the proposal for the introduction of Feed-in Tariffs with Contracts for Difference (FiT CfD) to replace the Renewables Obligation for larger scale renewable generation (>5MWe). The long term aim is for CFDs to be a transitional policy towards all generation competing in the wholesale electricity market on equal terms. CFDs will also be applied to nuclear power and carbon capture and storage

generation plants. Between 2014 and 2017 renewable generators will be able to choose between the RO and a CfD.

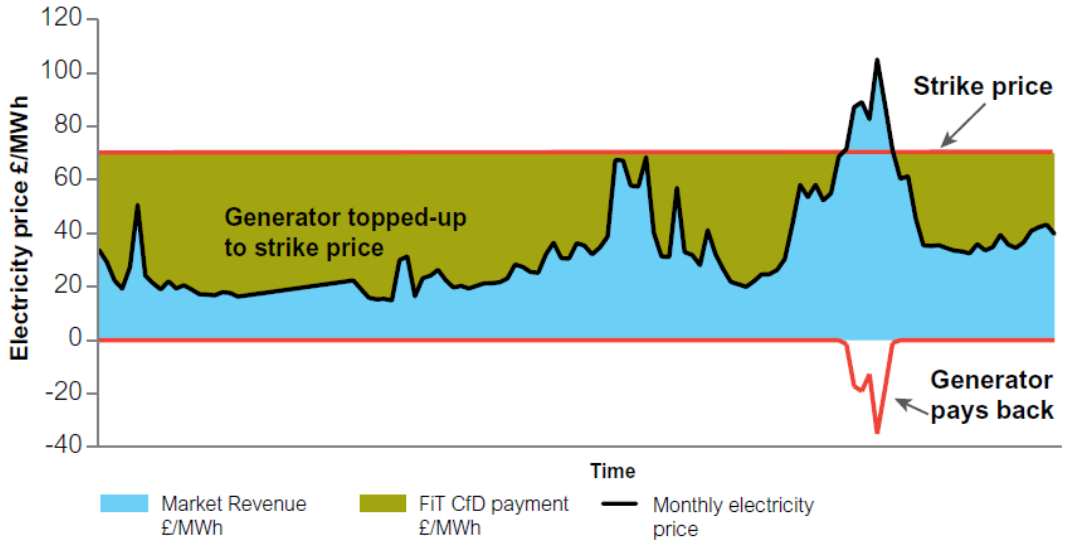


Figure 1: Operation of an intermittent feed in tariff with Contract for Difference

Source: Planning Our Electric Future: a White Paper for Secure, Affordable and Low-Carbon Electricity DECC, July 2011, reproduced under the Open Government License.

2.2 Policy context for new developments

Wales is aspiring to take a lead within the UK on energy standards for new developments. The original ambition stems from Carwyn Jones' 2007 announcement as Environment Minister of the Welsh Government for all new buildings in Wales to be zero carbon from 2011. Similar ambitions were stated by the UK government from 2016 on onwards. The detailed policy to support these ambitions is taking time to emerge due, mainly to concerns over the cost to developers and the desire to minimise barriers to new developments in the current economic situation.

- **Building a Greener Future Policy Statement, CLG, 2007.** UK government proposals for zero carbon homes by 2016.
- **The Consultation on the Definition of Zero Carbon, CLG December 2008.** This document introduced the concept of offsite emission reduction 'allowable solutions' as part of the proposed approach to meeting zero carbon aspirations.
- **The Code for Sustainable Homes** which includes minimum standards for carbon performance. The Welsh Government currently requires level 3 for all developments that it supports, with an aspiration for level 5 for strategic sites. For all other developments in line with PPW, applications for dwellings received on or after 1st September 2010 to meet with the Code for Sustainable Homes Level 3 and obtain 6 credits under issue *Ene1 – Dwelling Emission Rate*
- **BREEAM Excellent** is required of all public buildings supported by the Welsh Government. It includes minimum standards for carbon performance (CO_2 Index/EPC Rating of 40 or lower). For all other developments in line with PPW, applications received on or after 1st September 2009 for non-residential developments which will either have; a minimum floor space of 1,000m^2, or will be carried out on a site with an area of one hectare or more, to meet the

BREEAM 'Very Good' standard and achieve the mandatory credits for 'Excellent' under issue *Ene1 – Reduction of CO2 Emissions.*

- **Part L Building Regulations, CLG, 2010.** These are the Building Regulations currently in force in Wales.
- **Devolution of Building Regulations to Wales, December 2011.** The devolution of Building Regulations to Wales is part of Welsh Government's strategy for Wales to take a lead in Sustainable Development. The exact form of Welsh Building Regulations has yet to be announced, but has been subject to a consultation as explained in the next bullet point.
- **Building Regulations Part L Review, July 2012.** Welsh Government has yet to respond to the consultation, however the relevant proposals are:
    - For domestic buildings, an average 44 or 55% improvement over the 2006 Building Regulations from January 2015 (equivalent to a 25% or 40% improvement on 2010 standards) combined with elemental building specifications. The improvement target is disaggregated by property type, to reflect the differing potential for emission reduction as a result of building form e.g. detached properties vs. apartments. WG's preference is for an average 55% reduction. There will be a review in 2015/2016 to increase standards to zero carbon by 2020. Requirements for on-site reduction, known as 'Carbon Compliance' levels are not expected to exceed 55%, hence the review is to focus on offsite reduction through the Allowable Solutions mechanism proposed by the UK Government. The Planning Policy Wales requirements for the use of the Code for Sustainable Homes will be removed.
    - For non-residential buildings, the proposal is for a 20% aggregate improvement in CO_2 performance on 2010 standards from June 2014 (approximately equivalent to a 40% improvement on 2006 standards). An aggregate improvement is used to account for the variety of non-domestic buildings – the precise improvement factor depends on the building type. The carbon target will be combined with minimum energy efficiency standards, expressed in primary energy terms. In a similar fashion to domestic buildings, there will be a further review in 2015/16 with the intention of setting standards for zero net carbon standards by 2020.
- **Sustainable Development White Paper, Welsh Government 2012.** Welsh Government has recently consulted on the plans for legislation to place a Sustainable Development (SD) duty on some organisations in Wales and create a new independent SD body. The Bill is likely to require all public sector organisations in Wales to make Sustainable Development a 'central organising principle'.

The effect of these policy changes is a tightening of the standards required, but potentially greater flexibility over how the target is achieved compared to previous proposals for zero carbon buildings in Wales. It results in a greater emphasis on the intrinsic energy efficiency of buildings and possibility of off-site 'allowable solutions' to offset residual emissions that are uneconomic to abate on site. The future national policy requirements are summarised in the table below.

		2013	2014	2015	2016	2017	2018	2019	2020 onwards
Residential	CSH Level	Level 3		n.a.			n.a.		n.a.
	Regulated carbon emission reduction against 2006 Building Regulations	-31%		-55% (average)			Potential for early introduction of net zero carbon requirement		Zero net emissions with up to 55% to be achieved onsite
Non-domestic	BREEAM Rating	BREEAM Excellent (for WG supported buildings)							
	Regulated carbon emission reduction against 2006 Building Regulations	-25% (on average)		likely to be -40% (average)			Potential for early introduction of net zero carbon requirement		Zero net emissions with -40%- 63% on site

Table 1: The path to zero carbon - summary of anticipated energy requirements for new buildings in Wales

2.3 Format and structure of this report

The remainder of the report is structured as follows:

- **Part I: Torfaen County Borough Council** and **Part II: Newport City Council** contains the results of the renewable energy assessment for each council respectively.
- **Part III: Strategic recommendations**, is a common section applicable to both councils.
- The appendices contain various additional information and data tables. **Appendix B** is a key section which contains methodology information to supplement that of the Toolkit including GIS maps covering both Councils to avoid duplication.

PART I: TORFAEN COUNTY BOROUGH COUNCIL

3. Torfaen CBC - Energy demand and background information

This section presents background information on energy consumption, carbon emissions and current renewable energy projects within the County Borough.

3.1 Baseline energy demand (current and future)

Torfaen's energy consumption at the start of the Plan Period in 2006 was just under 2,400GWh/yr, with 58% used for heat, 23% for transport and 19% electricity. Based on national projections for energy demand, consumption is expected to fall by about a fifth to 1,952 GWh/yr by the end of the plan period (2021). This is to be achieved through a combination of greater end use efficiency, decarbonisation of the electrical grid and a transfer of some heat and transport loads to the electricity grid, as set out in the UK's Low Carbon Transition Plan.

	2006			2021			
Sector	**UK**	**Wales**	**Torfaen**	**UK**	**Wales**	**Torfaen**	**Predicted UK% change to 2021**
Electricity (GWh/yr)	317,834	17,394	445	299,947	16,415	420	-6%
Heat (GWh/yr)	890,503	65,659	1,393	661,220	48,753	1,034	-35%
Transport (GWh/yr)	491,892	24,399	538	431,743	21,415	472	-14%
Total Final Energy Consumption (GWh/yr)	**1,700,229**	**107,452**	**2,375**	**1,392,910**	**86,584**	**1,952**	**-18%**

Table 2: Annual final energy demand in 2006 and projected for 2021 in UK, Wales and Torfaen

3.2 Carbon emissions

The Department for Energy and Climate change have published figures of 2010 carbon emissions by end use at a local authority level across the UK[1]. The data set covers emissions sources within the scope of influence of Local Authorities, i.e. excludes power generation over 50MW. Torfaen's total emissions were 598 ktCO_2/yr. With a population of 90,500 this equates to 6.6 tCO_2/capita, which is equal to the UK average of 6.6 tCO_2/capita. The figure below shows the breakdown of emissions by different sectors and fuels in Torfaen.

[1] See Appendix C for data table and source.

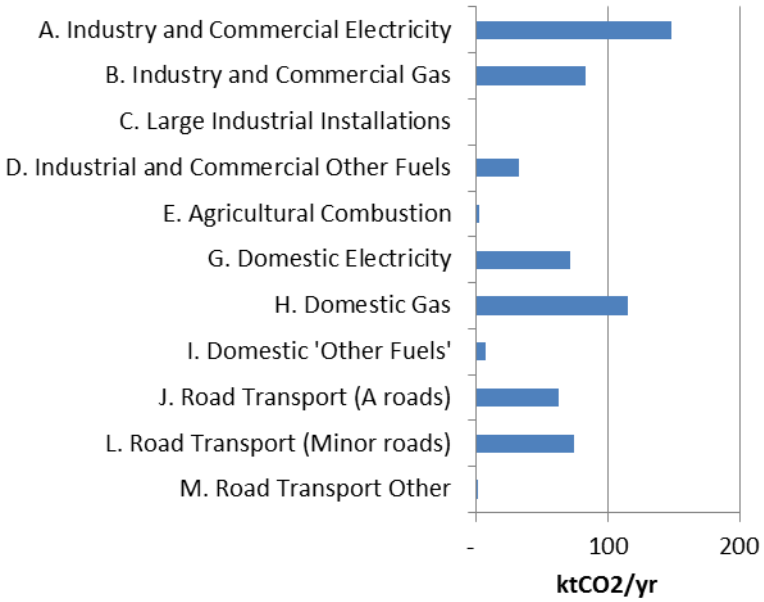


Figure 2: CO_2 emissions within the scope of influence of Torfaen CBC

3.3 Renewable energy targets

The table below shows the UK's 20% by 2020 renewable energy target applied to Torfaen's projected 2020 consumption. A longer term target to 2030 is under consideration by the UK government, but no announcement has been made yet.

A significant proportion of renewable electricity will be supplied from power stations outside of the authorities, such as off shore wind. Similarly, renewable transport will come through blending of biofuels at a national level. It is uneconomic to transport heat large distances therefore renewable heat generation equipment will normally be located within the county where it is consumed.

The pro-rata share of the national targets is used to inform the suggested renewable energy target for the county presented in section 0.

	RE target for 2020			
Sector	**RE UK**	**RE Wales**	**RE Torfaen**	**Renewable Energy share by 2020**
Electricity (GWh/yr)	85,962	3,781	123	30%
Heat (GWh/yr)	77,423	7,257	167	12%
Transport (GWh/yr)	45,306	2,440	54	10%
Total Final Energy Consumption (GWh/yr)	**208,691**	**13,478**	**344**	**-**

Table 3: Final renewable energy demand projected for 2020 in UK, Wales and Torfaen

3.4 Existing and proposed RE technology

Table 4 presents the existing renewable energy technologies that are currently operational within Torfaen CBC, with Table 5 shows those that are planned to be installed. From these tables, it can be seen that the majority of installed technology is solar photovoltaics with some proposed hydropower schemes planned.

Name/Location	Technology	Capacity [MWe]	Capacity [MWt]	Status	Source
Llanyravon Manor	ASHP	-	0.012	Operational	Torfaen Council
Life Station, Trevethin	Biomass	-	0.045	Operational	Torfaen Council
Padre Pio Primary School	Biomass	-	0.075	Operational	Torfaen Council
Sainsbury's, Llewellyn Rd, Cwmbran	Biomass	-	0.45	Operational	Torfaen Council
Crownbridge School	CHP	0.02	0.02	Operational	Ofgem
YG Gwynlliw	CHP	0.02	0.02	Operational	DECC Fit
Blaenavon Community Campus	CHP	0.02	0.04	Operational	Ofgem
Dwr Cymru Ponthir Sewage Treatment Plant	Ground mounted Solar PV	0.27	-	Operational	Torfaen Council
Log cabin Penygarn	GSHP	-	0.012	Operational	DECC Fit
Power Station, Bleheim Road	GSHP	-	0.06	Operational	Torfaen Council
Melin Homes	Heat Pump	-	0.165	Operational	Torfaen Council
Blaenavon World Heritage	Micro Hydro	0.029	-	Operational	Torfaen Council
Land adjoining Ty Ni, Sluvad Rd, New Inn	Solar PV	0.0028	-	Operational	Torfaen Council
Nr Pistyll-Gwynn Farm, Cwmavon	Solar PV	0.004	-	Operational	Torfaen Council
Padre Pio Primary School	Solar PV	0.0126	-	Operational	Torfaen Council

Name/Location	Technology	Capacity [MWe]	Capacity [MWt]	Status	Source
St David's RC Primary School, Cwmbran	Solar PV	0.019	-	Operational	Torfaen Council
St Albans RC High School, Pontypool	Solar PV	0.025	-	Operational	Torfaen Council
Greenmeadow Community Farm, Cwmbran	Solar PV	0.027	-	Operational	Torfaen Council
New Inn Primary School	Solar PV	0.027	-	Operational	Torfaen council
Trem y Ffynnon, Sluvad, Pontypool	Solar PV	0.03	--	Operational	Torfaen Council
Festive Productions, Llantarnam	Solar PV	0.05	-	Operational	Torfaen Council
Big Pit Museum, Blaenavon	Solar PV	0.05	-	Operational	Torfaen Council
Ty Blaen Torfaen Council Offices, Pontypool	Solar PV	0.05	-	Operational	Torfaen Council
Pontypool Active Living Centre	Solar PV	0.05	-	Operational	Torfaen Council
Cwmbran Stadium Sports Centre	Solar PV	0.05	-	Operational	Torfaen Council
Dwr Cymru Ponthir Sewage Treatment Plant	Solar PV	0.27	-	Operational	Torfaen Council
Melin Homes	Solar PV	0.788	-	Operational	Torfaen Council
Bron Afon	Solar PV	1.403	-	Operational	Torfaen Council
Total Domestic PV	Solar PV	3.403	-	Operational	DECC Fit
Life Station, Trevethin	Solar Thermal	-	0.002	Operational	Torfaen Council
Power Station	Solar Thermal	-	0.003	Operational	Ofgem
Melin Homes	Solar Thermal	-	0.5	Operational	Torfaen Council

Name/Location	Technology	Capacity [MWe]	Capacity [MWt]	Status	Source
Cartref, Castlewood, Talywain	Wind	0.001	-	Operational	Torfaen Council
Crowvalley Cattery, Pentovey Cottage, Cwmoody, Pontypool	Wind	0.004	-	Operational	Torfaen Council
Total		**6.63**	**1.4**		

Table 4: Existing renewable electricity capacity in Torfaen CBC

*The capacity installed represents the sum of domestic photovoltaic with a capacity inferior to 0.5 MW. It also refers to Building Integrated Renewables.

Name/Location	Technology	Capacity [MWe]	Capacity [MWt]	Status	Source
Festive Productions ltd, Llantarnam	Solar PV	0.2	-	Planned	Council
New Inn Business Centre, Panteg Way	Solar PV	0.05		Planned	Council
Ebenezer Church Hall, Pontypool	Solar Panels	0.007		Planned	Council
Ty Coch Stud Farms, Henllys	Wind	0.005	-	Planned	Council
Afon Llwyd / Pontymoile	Hydro	0.048	-	Planned	Council
Cwm Llanwenarth	Hydro	0.024	-	Planned	Council
Twyn Du	Hydro	0.024		Planned	Council
Shanks, Pont-y-felin Industrial Estate, Panteg, Pontypool	AD	2.4		Planned	Council
Total		**3.401**			

Table 5: Proposed renewable electricity capacity in Torfaen CBC

4. Torfaen CBC- Area wide renewable energy assessment

This section contains the results of the assessment of renewable energy potential within the County Borough. The assessment methodology is as per the WG Planning for Renewable and Low Carbon Energy – A Toolkit for Planners (July 2010) (see section 1.2 for further details). However additional commentary and GIS outputs maps associated with the assessment are presented in Appendix B.

4.1 Wind energy

The table below presents the potential capacity of wind power based on GIS mapping of the constraints listed in Table 47 of Appendix B. The potential is ranked by areas of least constraint (priority areas 1 to 4). The Priority Areas are outlined in Table 7; this table represents the upper limit of the potential wind resource, not taking into account cumulative visual impact issues.

The GIS wind constraints map for the county is shown in Figure 54 of Appendix B.

Wind Resource Priority	Annual average wind speed	Potential disruption to the NATS*	Area (km^2)	Potential energy generated (GWh/yr)	Potential Capacity (MWe)	Equivalent number of utility scale (2MWe) turbines
Priority 1	High (>6.5m/s)	Low	1.0	23.6	10	5
Priority 2	Moderate (6-6.5m/s)	Low	0.1	2.3	1	0
Priority 3	High (>6.5m/s)	High	4.7	111.1	47	23
Priority 4	Moderate (6-6.5m/s)	High	0.4	9.4	4	2
Total			**6.2**	**146.6**	**62**	**30**

Table 6: Unconstrained wind resource in Torfaen

**National Air Traffic Service*

The unconstrained areas in Torfaen are situated around the periphery of the study area, largely as a consequence of the ribbon of urban and suburban development that forms a spine through the County Borough. It is important to note that the unconstrained areas are in areas of relatively complex topography, and micro siting issues are likely to reduce the available land further. Grid connection and site access may also be a significant barrier to viability, particularly for projects with a small number of turbines.

Applying the 7km buffer zone around the largest area of potential as per the Toolkit methodology results in a single significant area of wind energy potential located on the high ground to south of the A472 west of Pontypool, labelled 'a' in Figure 3 below. Ignoring this buffer, which is arbitrary requirement, offers up various other small sites, labelled 'b' to 'f'. The vast majority of the land area within the sites are 'priority 3' areas, deemed to have high average wind speeds but also a high risk of objection by the National Air Traffic service. Note that area 'f' is adjacent to the World Heritage Site (WHS), thus could be affected if a buffer were placed around the WHS boundary.

In practice, there may be a case to reduce the size of this buffer zone, particularly when considering separation between single or small clusters of turbines.

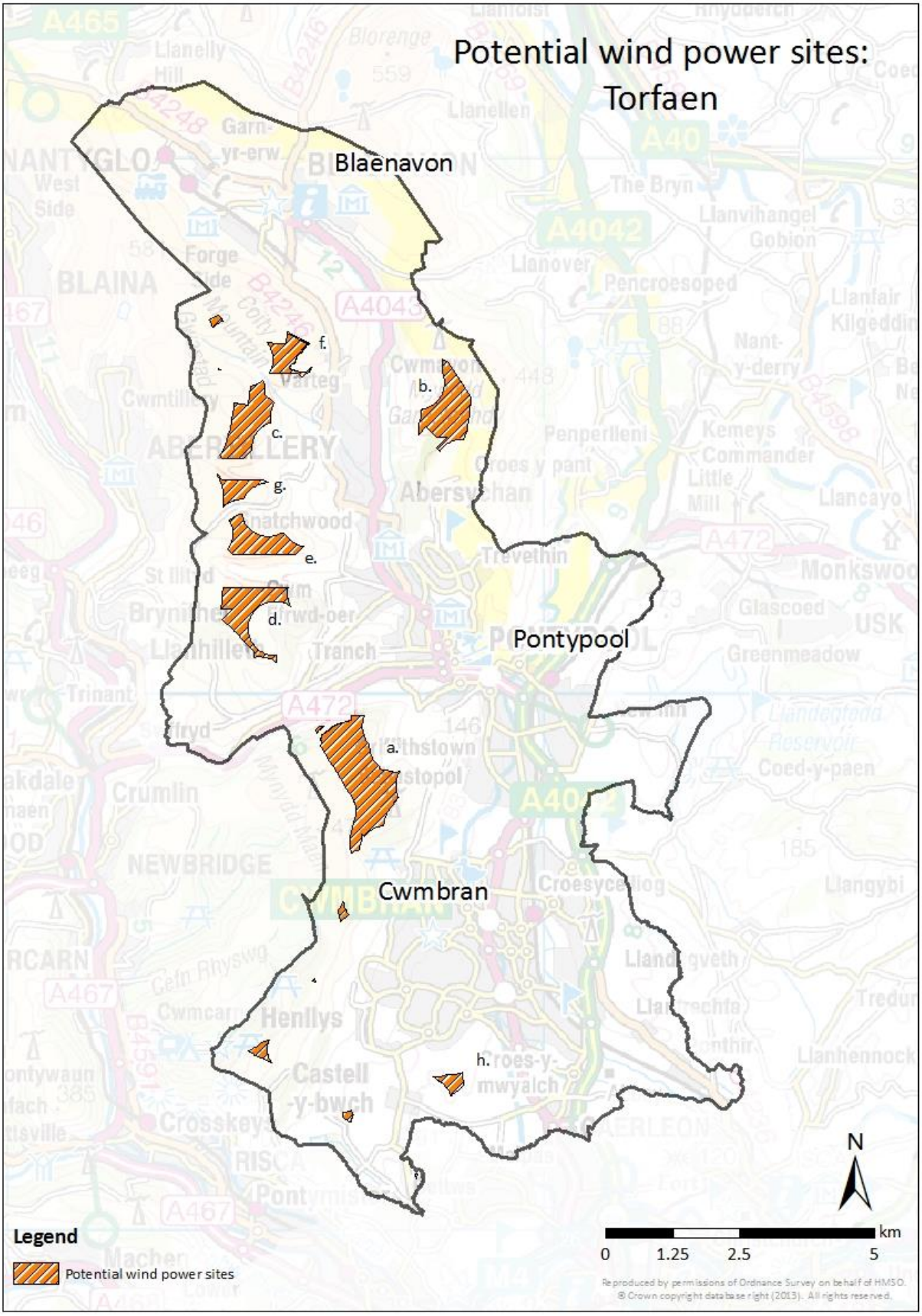


Figure 3: Wind energy opportunity areas in Torfaen

Potential Wind Farm – reference	Area (km^2)	Potential energy generated (GWh/yr)	Potential Capacity (MWe)	Equivalent number of 2MWe turbines
a.	1.7	42.3	18	9
b.	0.8	18.8	8	4
c.	0.7	18.8	8	4
d.	0.7	18.8	8	4
e.	0.6	14.1	6	3
f.	0.3	9.4	4	2
g.	0.2	4.7	2	1
h.	0.1	4.7	2	1
Total	**5.1**	**131.6**	**56**	**28**

Table 7: Potential wind opportunity areas in Torfaen

** These sites are all within 7km of each other so are likely to raise issues of cumulative visual impact.*

4.2 Energy crops and wood fuel resource

The results for the total available agricultural land by grade is available in Table 8 for harvesting sustainably potential energy crops for Torfaen. The areas for potential energy crop opportunities are located near the southern and eastern perimeter of Torfaen CBC. The GIS energy crop map for the county is shown in Figure 55 of Appendix B.

Output	Land Grade 3	Land Grade 4	Total
Available (Ha)	1,225	2,002	**3,227**
Percentage of area that can be used	10%	10%	**-**
Usable area (Ha)	122	200	**406**
Yield (odt)	1,470	3,400	**3,870**
Electricity			
Potential installed capacity (MWe)	0.25	0.57	**0.82**
Heat from CHP			
Potential installed capacity (MWe)	0.25	0.57	**0.82**
Potential installed capacity (MWt)	0.50	1.14	**1.64**

Table 8 Potential energy crop outputs for Torfaen

Table 9 provides the total available forestry and woodland resources available for Torfaen CBC, and of that the potential wood fuel yield within the area. The main area for potential wood fuel resources is located near to the southern perimeter of Torfaen CBC, with some potential also along the eastern boundary.

Output	Forest
Available (Ha)	2,023
Usable area (Ha)	2,023
Yield (odt)	1,231
Heat only option	
Potential installed capacity (MWt) from boilers	**1.8**

Table 9 Potential wood fuel resource for Torfaen

4.3 Waste resources

A joint Head of Valleys (Torfaen and Blaenau Gwent) residual waste contract was awarded to New Earth in February 2013. Under the new three year contract, which is extendable for up to eight years, waste will be treated and disposed of using Mechanical Biological Treatment (MBT) and landfill disposal. Around 75% of the waste will be sent for treatment at New Earth's MBT facility in Avonmouth. The remaining waste, not suitable for treatment, will be sent to landfill.

Table 10 provides the total amount of waste produced, and how much of that is biodegradable, and the potential amount of electricity and heat that can be produced from the waste.

The methodology used to calculate the total potential wastes resources is available in Appendix B.

Outputs	Municipal Solid Waste	Commercial & Industrial Waste	Total
Total Waste (tonnes)	48,054	77,101	**125,155**
Total Residual (30%)	14,416	23,130	**37,546**
Total Biodegradable (renewable) element (35%)	5,046	8,096	**13,141**
Electricity			
Required wet tonnes per MWe	10,320		**-**
Potential installed capacity (MWe)	0.5	0.8	**1.3**
CHP			
Potential installed capacity (MWth)	1.0	1.6	**2.5**
Heat			
Required wet tonnes per MWt	1,790		**-**
Potential installed capacity (MWth)	2.8	4.5	**7.3**

Table 10 Potential waste resources for Torfaen CBC

4.4 Anaerobic digestion

Additional potential energy sources derived from waste as reported on in the Bioenergy Action Plan for Wales include:

- Food waste
- Animal manure
- Poultry litter
- Sewage sludge

Because 100% of the waste resources within this section are biodegradable, it is classified as entirely renewable energy.

4.4.1 Food waste

Torfaen CBC working with two adjacent Councils (Caerphilly and Blaenau Gwent) to procure an anaerobic digestion plant which will process domestic food waste produced by all three Local Authorities. The location of the plant is not yet determined.

There is further potential for anaerobic digestion of commercial and industrial food wastes, although further analysis is needed to see how much of the waste produced is currently in long term contracts with waste companies.

The table below presents the theoretical energy potential of Torfaen's food waste resources based on 2010 figures for both domestic and commercial and industrial waste.

Food Waste	Municipal	Commercial & Industrial	Total
Total Waste	3,600	18,580	22,180
Electricity			
Required tonnes per MW	32,000		
Potential installed capacity (MW)	**0.1**	**0.6**	**0.7**
Heat			
Potential installed capacity (MW)	**0.2**	**0.9**	**1.1**

Table 11 Potential energy from food waste for Torfaen CBC

4.4.2 Animal Manure

Animal manure resources are calculated using agricultural statistics obtained from WG. The figures assume that 50 per cent of farms within the Torfaen CBC area use a slurry system, and that of those farms, it would be feasible to capture the slurry from 50 per cent. Table 12 shows the potential electricity and thermal potential.

Livestock	Number	Available resource per head/yr (t)
Cattle	1,615	1.5
Pigs	28	0.15
Electricity		
Required wet tonnes per MWe	225,000	
Potential installed capacity (MWe)	**0.011**	
Heat from CHP		
Required wet tonnes per MWth	47,000	
Potential installed capacity (MWth)	**0.052**	

Table 12 Potential livestock waste available for anaerobic digestion in Torfaen CBC

4.4.3 Poultry Litter

No farms in Torfaen CBC area accommodate birds exceeding 10,000 therefore it is considered that the resource generated would not be sufficient to support a dedicated litter energy plant. Therefore, Verco have not considered this source relevant to include in the assessment.

4.4.4 Sewage Sludge

Data from the sewage sludge resource is derived from data in the Bioenergy Action Plan for Wales (2009).

Sewage Sludge	Predicted tonnes per annum
Total sewage sludge	3,043
Electricity	
Required dry solid (tonnes) per MWe	13,000
Potential installed capacity (MWe)	**0.234**
Heat	
Potential installed capacity (MWt)	**0.351**

Table 13 Potential sewage sludge available for anaerobic digestion in Torfaen CBC

4.5 Solar photovoltaic (PV)

The potential for ground mounted PV is estimated from GIS mapping of land constraints, such as the quality of agricultural land and nature designations as set out in Appendix B. This analysis suggests that a relatively large area is potentially available for ground mounted solar. We have therefore made a further assumption that only a small proportion (1%) of the total land available could actually be used. This compares with 10% for energy crops. It is a somewhat arbitrary figure, but reflects the fact

that solar farms have to compete with other land uses and will require unshaded flat land or land inclined to the south with potential for an economic connection to the grid.

Even on this basis it is clear that solar PV has far fewer constraints than wind energy and this there is a higher degree of flexibility as to where the potential capacity could be located. Figure 57 in Appendix B shows the GIS map of potential for ground mounted solar. The main areas of opportunity within Torfaen lie on the perimeter of the county, on either side of the predominantly urban north-south spine.

The potential for roof mounted PV is similarly estimated from GIS mapping of roof areas of non-domestic and domestic property types. Further details of the methodology for both calculations are shown in Appendix B.

Solar PV	Ground-mounted	Roof-mounted industrial & commercial	Roof-mounted domestic	Total
Total area available for PV (m^2)	38,255,280	1,129,112	2,220,337	**52,199,708**
Total practical PV panel area (m^2)	382,553	141,139	222,034	**851,675**
Electricity				
Total potential installed PV capacity (MWp)	58	21	33	**128**
Potential generation (GWh_e/yr)	47	17	27	**102**

Table 14 Solar PV resource potential in Torfaen

4.6 Hydropower

The potential for hydropower resources in Torfaen is estimated from two sources. Firstly, the Environment Agency Study 2010 which identifies potential run of river schemes across the UK, and second, the series of feasibility studies commissioned by the Council for high head projects. The Environment Agency report simply identifies potential sites, but does not provide detail of viability. The feasibility studies are of varying degrees of detail but include high level business cases for sites deemed economic.

The key opportunities for hydropower in Torfaen are located along the southern area of the Monmouthshire Brecon canal, south of Cwmbran running parallel with the A4051. Further opportunities lie within the Garn-yr-erw area north of Blaenavon. The GIS hydropower potential map is shown in Figure 4.

Feature type	Estimated installed capacity (MW)	Indicative output (GWh/yr)
Lock	0.1	0.2
Waterfall	0.7	2.1
Weir	1.4	4.5

Total	**2.185**	**7**

Table 15: Environment Agency Study results for Torfaen CBC

Hydro power resource	Run of river (EA data)	Additional feasibility studies - viable	Additional feasibility studies – viablility unknown	Total
Number of potential hydropower projects	133	14	10	157
Electricity				
Total potential installed hydro capacity (MWe)	2.195	0.265	0.229	2.589
Potential generation (GWh_e/yr)	6.790	1.035	1.234	9.059

Table 16 Potential hydropower resources in Torfaen (EA and feasibility studies)

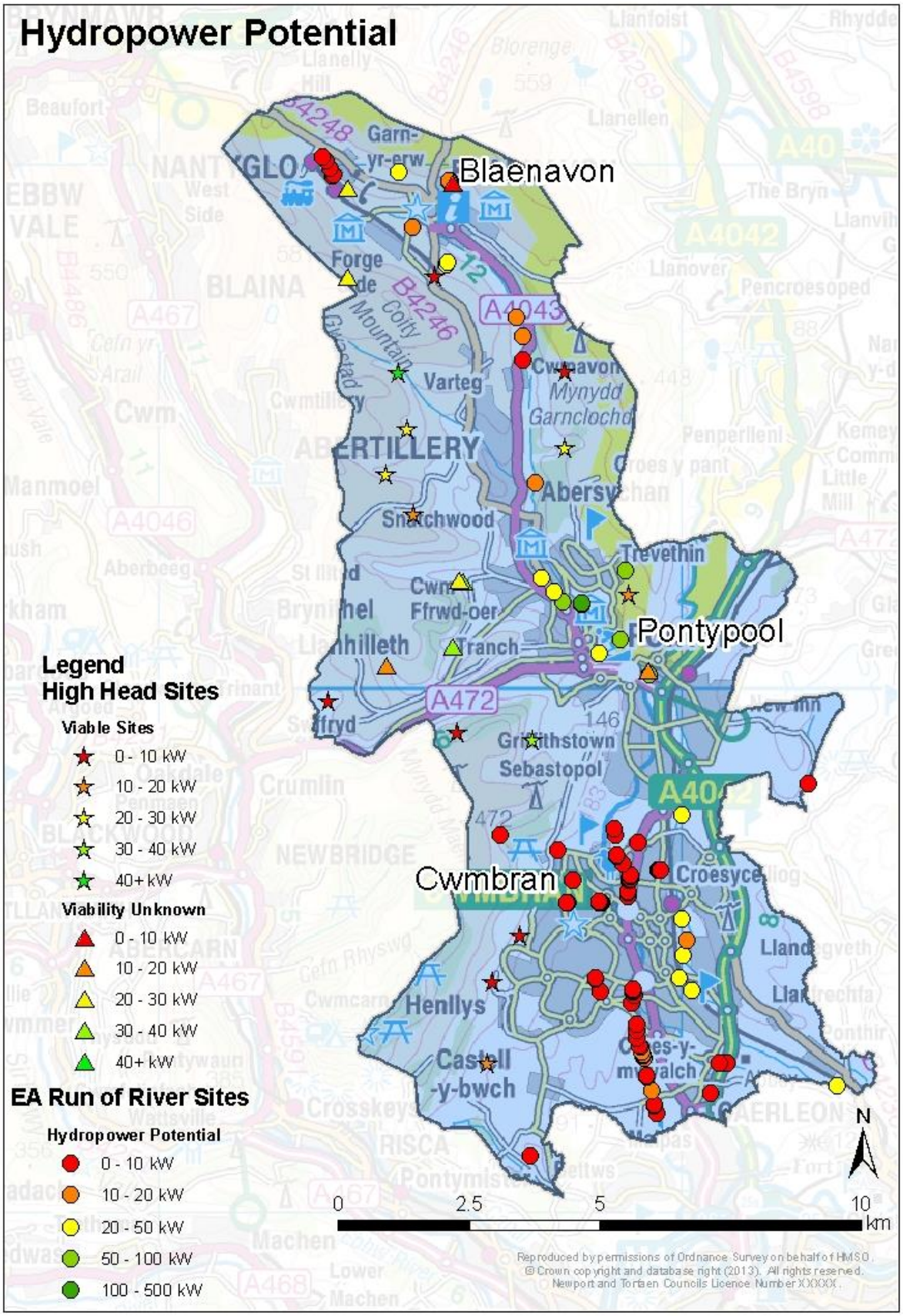


Figure 4 High head and run of river sites within Torfaen

4.7 Buildings integrated renewables uptake assessment

This analysis follows the simplified method contained in the Toolkit which is based on scaling the results of the Pembrokeshire by projected completions of new dwelling and floor area of non-domestic development (see section E2.3 of the Toolkit for further details). Table 17 presents the results obtained. The number of existing dwellings has been extracted from statswales.wales.gov.uk. The average number of future dwellings and annual average new floor area has been provided by Torfaen CBC.

This simplified methodology is undoubtedly very crude and thus the results need to be considered as indicative only.

#	Torfaen County Borough		Units
1	**Existing dwellings and non-residential buildings**		
2	No. of existing dwellings in Pembrokeshire	55,592	
3	No. of existing dwellings in Torfaen	39,711	
4	Calculate EDR	0.7	
5	Predicted RE electricity capacity for Pembrokeshire by 2020	2.2	MWe
6	**Predicted RE electricity capacity for Torfaen by 2021**	**1.6**	**MWe**
7	**Future dwellings**		
8	No. of average net annual completions assumed for Pembrokeshire	585	
9	No. of average net annual completions planned for Torfaen	430	
10	Calculate NDR	0.7	MWe
11	Predicted RE electricity capacity for Pembrokeshire by 2020	4.3	MWe
12	**Predicted RE electricity capacity for Torfaen by 2021**	**3.2**	**MWe**
13	**Future non-residential buildings**		
14	Future new non-resi ave. annual floor area assumed (Pembrokeshire) - 2020	56,000	m^2 GIFA
15	Future new non-resi ave annual new floor area est. (Torfaen)by 2021	20,000	m^2 GIFA
16	Calculate FNR	0.4	
17	Predicted RE electricity capacity for Pembrokeshire by 2020	6.3	MWe
18	**Predicted RE electricity capacity for Torfaen by 2021**	**1.4**	**MWe**
19	**Totals**		
20	**Total predicted new BIR RE electricity capacity by 2021**	**7**	**MWe**
21	Existing BIR RE electricity capacity in Torfaen	3	MWe
22	**Total predicted new & existing BIRRE electricity capacity (Torfaen) – 2021**	**10**	**MWe**

Table 17 Predicting level of BIR renewable electricity uptake by 2021 for Torfaen CBC

4.8 Torfaen – Summary of renewable energy potential

Torfaen CBC projected electricity demand for 2021 is 420 GWh/yr. This study has identified a total potential of 283 GWh/yr (67%). The largest area for potential is onshore wind, with a total potential of 147 GWh, followed by solar PV (both ground and roof mounted), and with a total combined potential of 91 GWh. Only 3% of the total renewable energy resource is being exploited at present (excluding waste).

Waste materials from Torfaen are currently exported out of the authority for treatment elsewhere and thus any energy recovery currently undertaken is not counted in the current installed capacity. As a small authority, waste contracts are always likely to be in partnership with neighbouring authorities to achieve economies of scale, as is the case currently. The council therefore has limited control over where any energy recovery activity actually takes place, it can however influence how it is done and the technology employed.

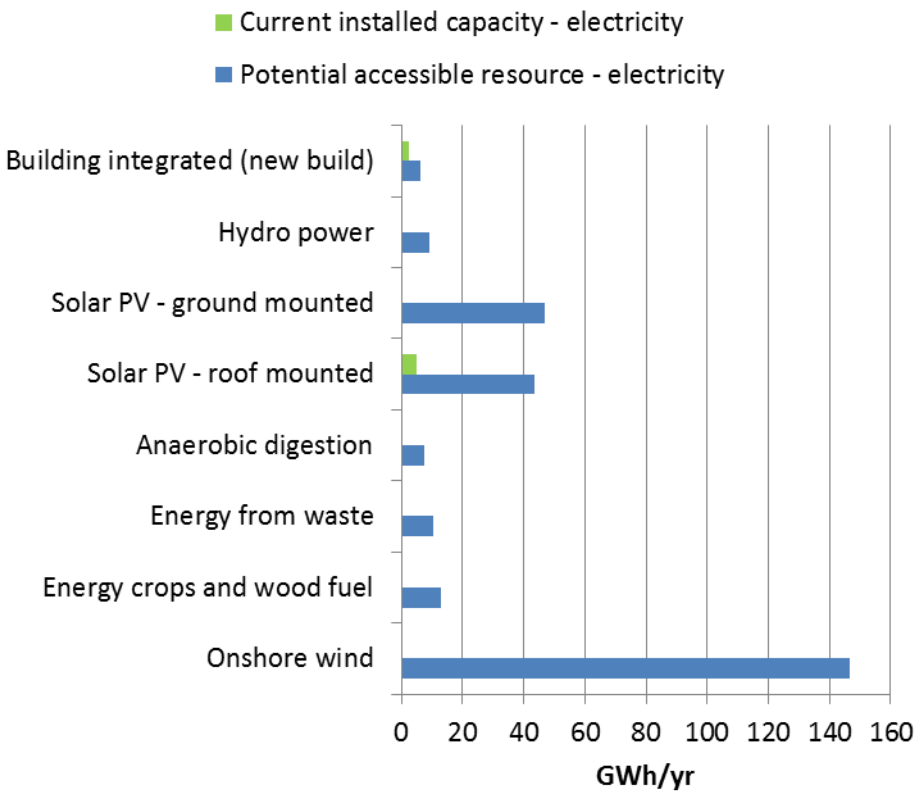


Figure 5: Torfaen summary of renewable electricity potential and current installed capacity

Energy Type	Capacity Factor*	Potential Accessible Resource		Current Installed Capacity		Target Scenarios for 2021			
		MWe	GWh	MWe	GWh	Low		High	
						MWe	GWh	MWe	GWh
Onshore wind	27%	62	147	0	0	15.5	37	31	73.3

Energy crops and wood fuel	90%	1.6	13	0	0	0.8	6.5	1.2	9.7
Energy from waste	90%	1.3	10	0	0	0.7	5.1	1.0	7.7
Anaerobic digestion	90%	0.9	7.5			0.5	3.7	0.7	5.6
Solar PV - roof mounted	9%	54	44	6.3	5.0	14	11	27	22
Solar PV - ground mounted	9%	58	47	0.3	0.2	29	23	44	35
Hydro power	40%	2.6	9.1	0.03	0.1	1.3	4.5	1.9	6.8
Building integrated (new build)	10%	7.0	6.1	3.0	2.6	3.5	3.1	5.3	4.6
Total		**188**	**283**	**9.6**	**8.0**	**65**	**94**	**112**	**164**
Torfaen electricity demand projected in 2021							420		420
Percentage electricity demand in 2021 potentially met be renewable energy sources							**22%**		**39%**

Table 18 Resource summary for renewable electricity for Torfaen CBC

** 'Capacity factor' refer to the typical annual energy output divided by the annual energy output if plant generated at full capacity for the entire year. Annual output can be calculated by multiplying its installed capacity by its capacity factor and the number of hours in a year. In practice the capacity factor will vary from project to project, and these are typical figures for viable installations.*

4.8.1 Renewable heat

This study has identified a total potential of renewable heat of 116 GWh/yr, equivalent to 11% of the projected heat demand for the authority in 2021 of 1,034 GWh/yr. The largest potential heat generation resource is energy from waste, with a potential 77 GWh/yr, followed by energy crops and wood fuel.

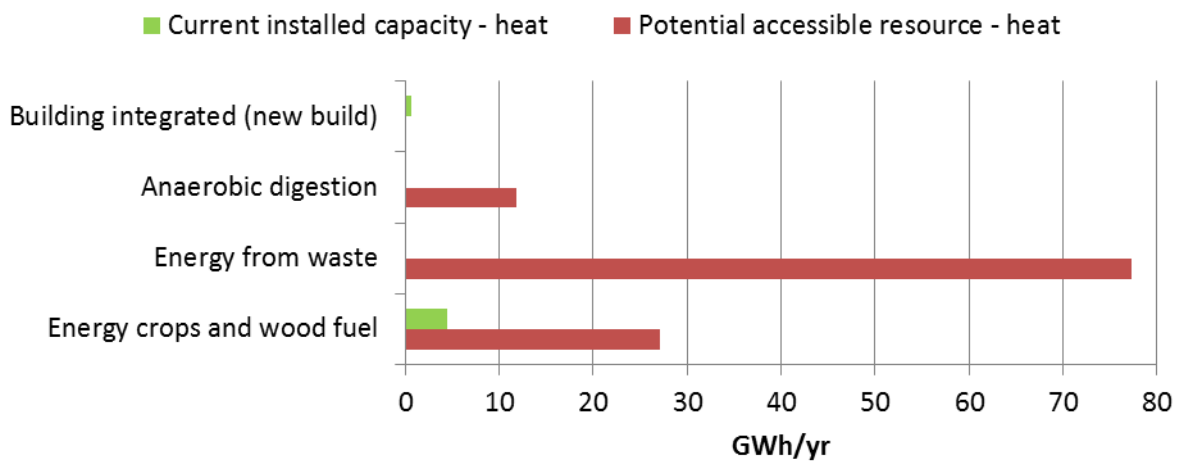


Figure 6: Torfaen summary of renewable heat potential and current installed capacity

Energy Type	Capacity Factor	Potential Accessible Resource		Current Installed Capacity		Target Scenarios for 2021			
						Low		High	
		MWth	GWh	MWth	GWh	MWth	GWh	MWth	GWh
Energy Crops	90%	3.4	27	0.6	4.5	1.7	14	2.6	20
Energy from Waste	90%	9.8	77	0	0	4.9	39	7.4	58
Anaerobic Digestion	90%	1.5	12	0	0	0.8	5.9	1.1	8.9
Building Integrated	10%	-	-	0.8	0.7	-	-	-	-
Total		**15**	**116**	**1.3**	**5.2**	**7.4**	**58**	**11**	**87**
Torfaen heat demand projected in 2021 (GWh/yr)						**1,034**			
Percentage heat demand in 2021 potentially met be renewable energy sources							**6%**		**8%**

Table 19: Torfaen - summary of renewable heat potential and current installed capacity

4.8.2 Renewable energy targets to 2021

The Toolkit recommends that 'High' and 'Low' target scenarios be calculated as 50% and 75% of the total potential. We have followed this guidance with the exception of two technologies – wind and roof-mounted solar PV - where we have assumed lower figures of 25% and 50% respectively. In the case of wind, this is to reflect the likely restriction of cumulative visual impact, due to the wind opportunity areas being in close proximity and in visible locations. For roof mounted solar PV, panels would be deployed principally on private roofs, requiring significant investment by building owners.

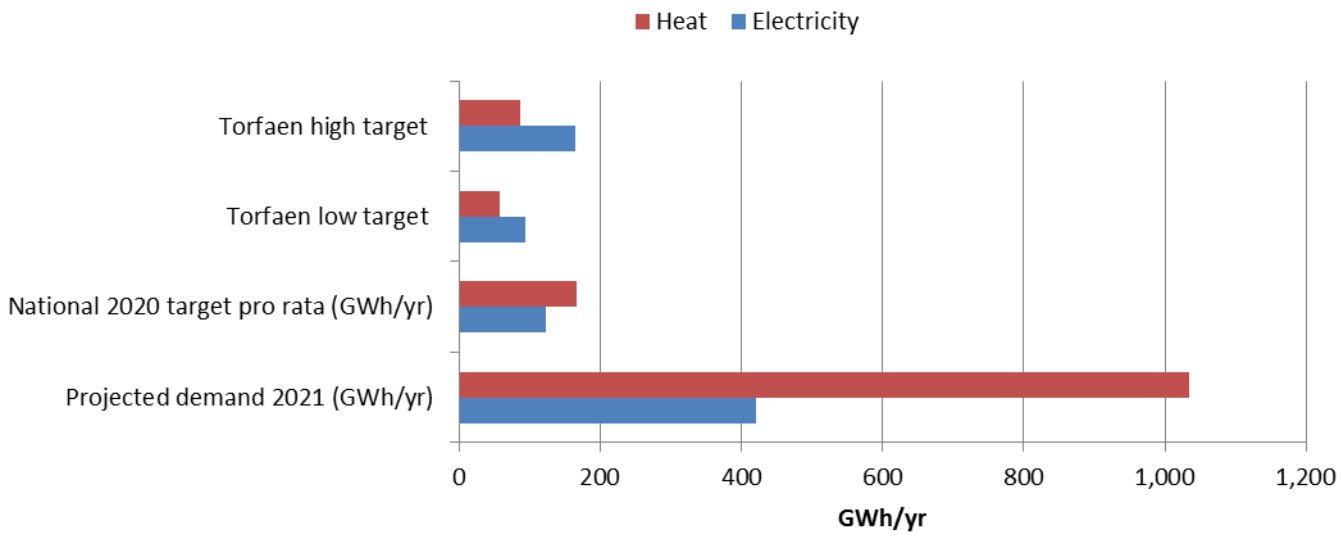


Figure 7: Torfaen– Renewable energy target scenarios comparisons

Figure 7 above compares the target scenarios against the UK renewable energy targets on a pro-rata basis (see section 3.3 for calculation) and also Torfaen's projected energy consumption in 2021. If Torfaen achieve the high target scenario presented, it will surpass the national target of 30% of electricity to be met by renewable sources, with 39%. As there is less potential in Torfaen CBC for renewable heat, at the high target scenario, only 8% of renewable sourced heat is available, compared with the national target of 12%.

Target summary	Projected demand 2026 (GWh/yr)	National 2020 target prorata (GWh/yr)	Torfaen low target	Torfaen high target
Electricity	420	123	94	164
Heat	1,034	167	58	87
Total	**1,454**	**290**	**152**	**251**

Figure 8: Torfaen– Renewable energy target scenarios comparisons

5. Torfaen CBC- Strategic development sites

This section contains high level analysis of five strategic development sites in Torfaen, allocated within the emerging Local Development Plan. The purpose is to assess the energy needs of the proposed development and consider opportunities for low carbon and renewable energy technologies to be incorporated as part of the future development of these sites.

5.1 Description and location of sites

The approximate locations of the five sites are denoted by the yellow stars in the figure below. The sites, have been chosen as all five sites are at relatively early stages of the development process, hence there is a potential opportunity to influence the schemes through their development phases. Development Frameworks produced for the sites have been used to inform this assessment where they have been available. A summary of the key parameters and findings for each site is shown in the table on the next page, and the assumed area schedules and phasing are presented in Appendix E.

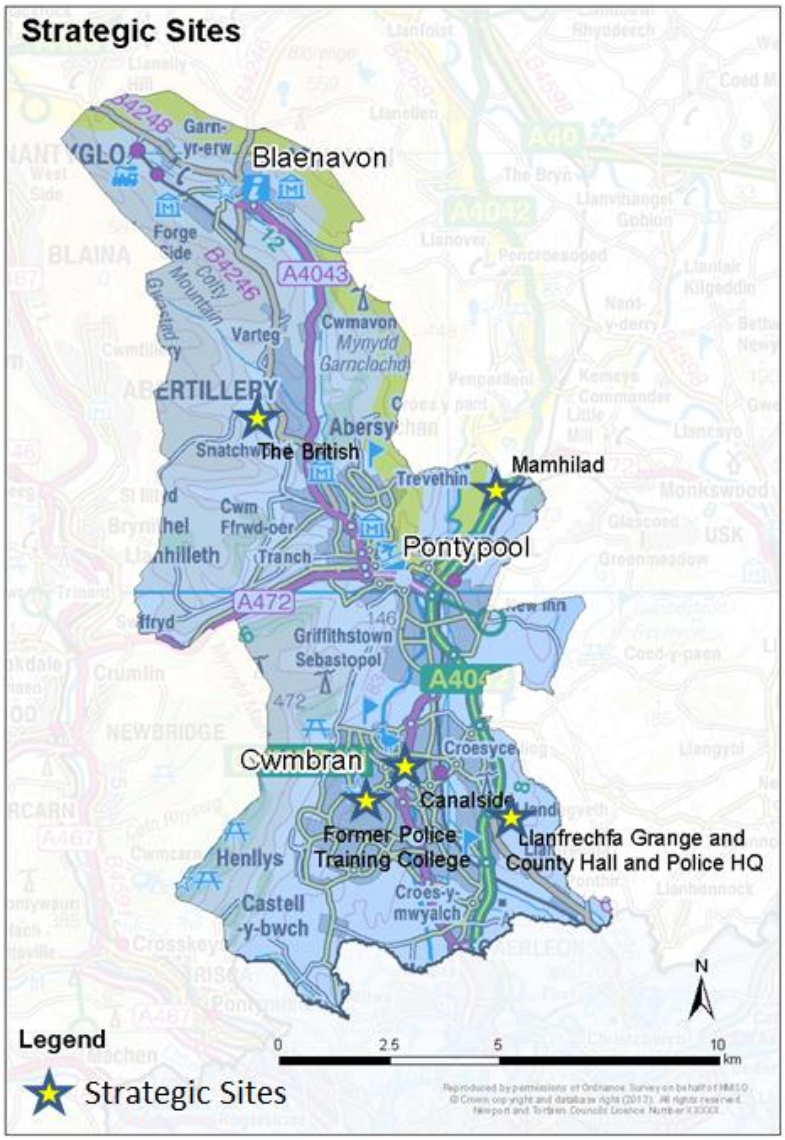


Figure 9 Strategic sites in Torfaen County Borough Council

Site name	Status	Projected energy demand and carbon emissions			Key opportunities
		Electricity (MWh/yr)	Heat (MWh/yr)	(tCO2/yr)*	
Llanfrechfa Grange, County Hall and Police HQ	Police HQ residential site due to start construction in 2014. Specialist and Critical Care Centre (SCCC) due to open 2017.	8,218	15,154	8,025	- SCCC energy centre 0.5kWe gas CHP and 1MWth Biomass heating, possible extension of communal system to employment areas and flats. - Roof mounted solar PV
The British	Due to start construction in 2017	4,272	3,650	3,130	- Possible sites for community wind and hydro projects nearby - Roof mounted solar PV - Heat pumps for residential heat of later phases.
Mamhilad	Due to start construction in 2015	15,879	18,289	9,557	- Roof mounted solar PV - Communal system (biomass/CHP) to supply Nylon Spinners building and higher density development. - Possible site for Anaerobic Digestion plant nearby. - Roof mounted solar PV - Ground mounted PV.
Former Police Training College	Due to start construction in 2015	3,706	3,334	2,215	- Roof mounted solar PV - Gas CHP/biomass heating to apartments
Canalside	Due to start construction in 2017	945	1,011	408	- Roof mounted solar PV - Heat pumps to serve mixed use area using canal as heat source/sink.
Total		**33,020**	**41,438**	**23,335**	

Table 20: Summary of Torfaen CBC strategic sites

**Carbon emissions are calculated using 2013 carbon factors assuming grid electricity and gas heating. In practice grid carbon intensity is projected to decrease significantly over the build out period.*

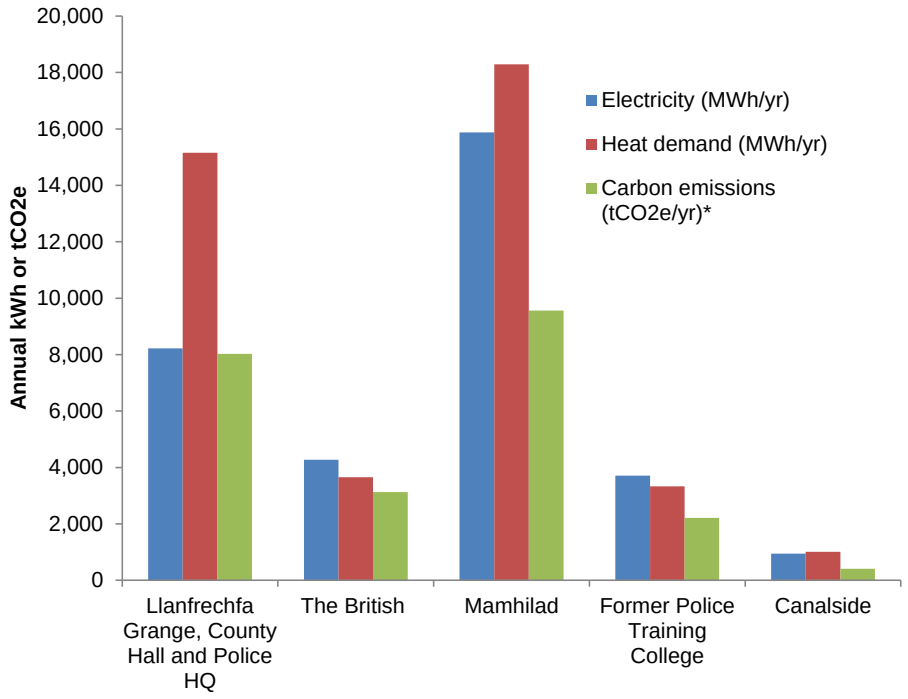


Figure 10 Projected energy consumption and carbon emissions associated with Torfaen's strategic sites

5.2 Site 1: Llanfrechfa Grange and County Hall and Police HQ

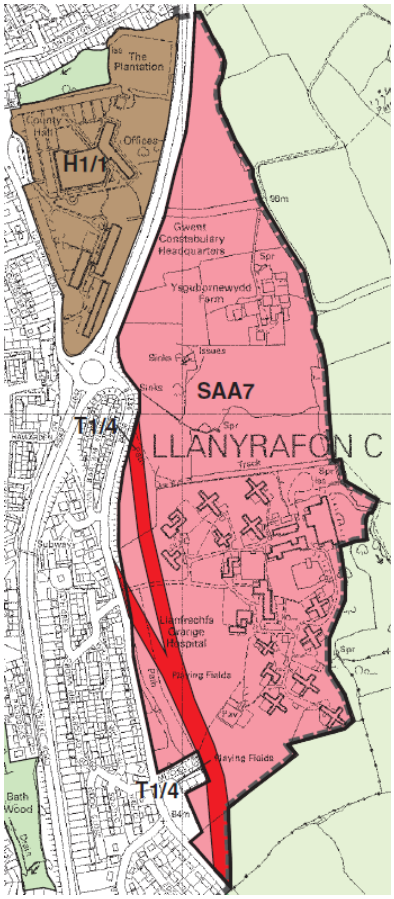
5.2.1 Site description

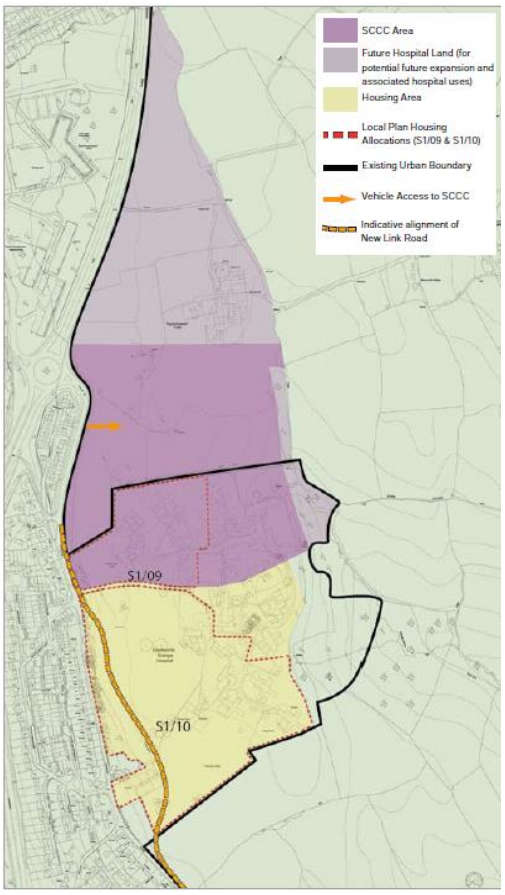
Llanfrechfa Grange (Allocation SAA7 of the LDP) is located on an existing hospital site, and includes associated agricultural land. A 50,000m^2 450 bed Specialist and Critical Care Centre (SCCC) is to be the primary land use. The SCCC was granted planning permission in January 2013 and is due to open in 2017. A BREEAM rating of excellent is targeted.

An energy strategy for the SCCC was prepared in July 2012 which envisages passive design and energy efficiency as core design principles. The design team's preferred approach to offsetting residual emissions at this stage is the installation of a circa 0.5 MWe gas fired CHP sized to meet the domestic hot water load of the building plus a circa 1 MWt biomass heating system to provide space heating during the autumn, winter and spring months. A gas fired boiler system would then provide both domestic hot water and space heating top up for remaining demand.

To the south of the hospital will be 300 dwellings built by 2021 and recreation facilities. There is planned to be a further 19,200m^2 of associated employment uses to the North of the hospital by 2021. The employment area will continue to be built after 2021 with potential for approximately a further 17,000m^2. Both these proposals are currently at allocation stage only with no detailed proposals for these uses on site at present.

In addition to SAA7 the former Police HQ and County Hall on the northern side of the dual carriageway (Allocation H1/1 of the LDP) is to be demolished to make way for approximately 200 dwellings with a density of 30-40 dph. Development is due to start in 2014 for completion in 2019.





2012 Deposit Plan image

Llanfrechfa Development Framework 2008

Figure 11: SAA7 Llanfrechfa Grange and H1/1 County Hall and Police HQ

5.2.2 Energy demand estimate

The SCCC will be by far the largest energy user on site. The bulk of the SCCC's energy demand will be for space heating and domestic hot water.

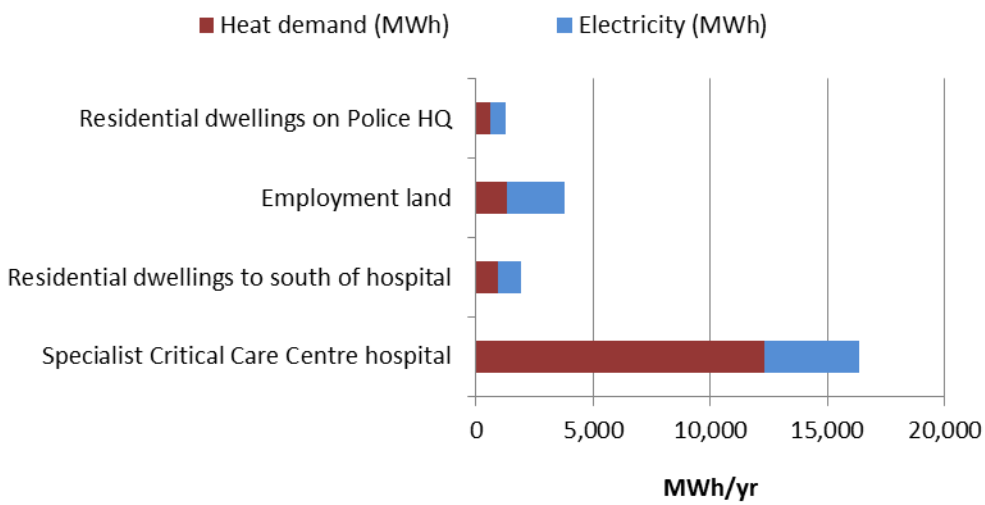


Figure 12: Llanfrechfa energy demand estimate

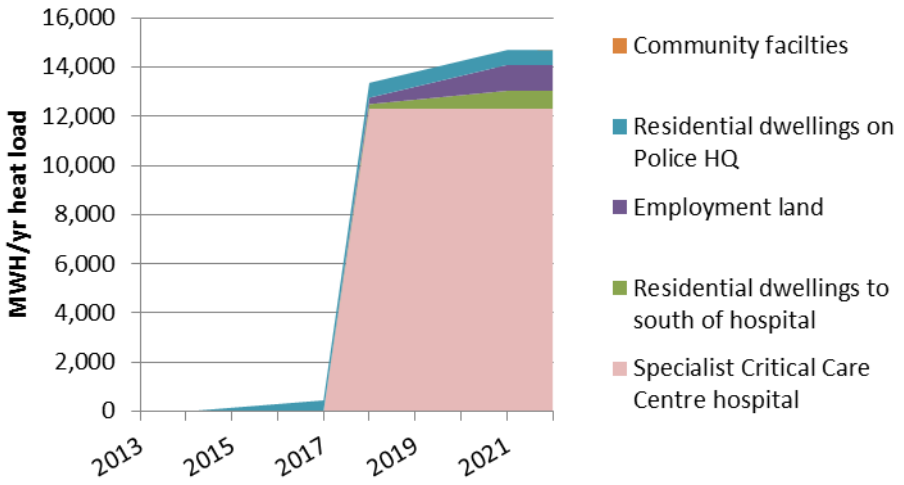


Figure 13: Llanfrechfa heat load growth estimate

5.2.3 Key opportunities

- The large space heating and hot water demands of the SCCC make it an ideal candidate for CHP and/or biomass heating, as already proposed by the design team. There may be opportunities to add additional heat loads to the SCCC, but it is unlikely to be practical for a purely commercial scheme for the following reasons:
    - Phasing and budget – the SCCC will precede other development on the site and the budget does not cover oversizing of the energy centre to supply other loads.
    - Security of supply – the hospital naturally demands very high levels of energy service and a communal system with others uses adds unwelcome complexity. The NHS is not set up or motivated to exploit commercial opportunities for energy supply to neighbouring development.
    - Heat loads – there are no obvious anchor loads for a DHN. The residential development is low density and the employment uses still speculative. An exception could be if any NHS-owned and operated residential flats were located close to the energy centre, thereby providing a combination of proximity, heat density and common ownership.
- The site has good solar access and there is a good opportunity for solar PV on all the roofs. The low density housing provides a large potential roof area relative to floor area. The employment area may have large units or other non-domestic buildings with substantial roof areas for commercial solar PV that achieve economies of scale and reduce capital cost through integration into building design at an early stage.
- Ground mounted solar systems are unlikely due to the ecological and grade 3 agricultural value of the surrounding land. There is however area of unconstrained land to the east of northern tip of the site.
- The housing at the former Police HQ and County Hall site is too distant and of insufficient density to warrant connection of a heat main across the dual carriage way. Also these houses are due to be completed before the SCCC becomes operational.

Technology	Suitability	Technical potential		Financial parameters		Comment
		(MW)	(MWh/yr)	Capex (£m)	Indicative IRR	
Domestic solar PV		0.75	600	1.5	10%	Average 1.5kW per unit
Non-domestic solar PV		0.6	516	1.3	10%	Assumption that PV area is on average 20% of the floor area.
Biomass heating (MWth)		1	2,628	0.4	10%	To serve SCCC only
CHP (MWe)		0.5	3,066	0.35	/	To serve SCCC only

Table 21 Llanfrechfa Grange LZC technology options

5.2.4 Design and layout implications

- Cluster any high heat users (if any) close to the SCCC energy centre. Even if not possible to connect building together from the outset, it may create possibilities for CHP or renewable heat in the future.
- Masterplan lay out to facilitate passive design techniques and optimise roof orientation (45° of South) and space for solar PV.
- Avoid overshadowing of roofs in areas of development with a mix of building heights.

5.2.5 Recommended actions

- Communicate this appraisal to the scheme design teams
- Consider the possibility adjacent development connecting into the hospital energy centre. This could be accompanied by the energy centre being owned and operated by an ESCo, which will have the commercial driver to maximise the commercial return of energy centre assets.
- Explore the possibility of the hospital using biomass feedstock from council wood waste streams.
- Log the scheme as a potential recipient of Allowable Solution funds to help fund energy infrastructure.

5.3 Site 2: The British

5.3.1 Site description

The British (Allocation SAA5 in the LDP) is a brownfield development site and the former location of the British Ironworks and Collieries. Discussions are on-going with the landowner regarding future development of the site. The LDP outlines a planning application for the site could potentially be submitted in 2013. The area is phased in the LDP to be ready for redevelopment from 2017 as a mixed use development comprising 200 dwellings by 2021, followed by a new primary school, supermarket and approximately 8,000m^2 of employment in the period 2021 – 2025.

From an examination of the previous planning application the site was assessed as potentially being able to accommodate up to 800 units in total. The exact numbers that could be accommodated on site will need to be determined through further work, however, for the purposes of this study it is assumed a further 600 units will be built at a rate of 50 per year from 2021- 2033. However, as detailed the number of units to be accommodated on the site would be in line with a Development Framework to be prepared and adopted for the site.

Figure 14: The British – Indicative masterplan (based on previous planning application)

The eastern development area shown in the figure above covers 20ha and is likely to contain residential, school, retail and employment areas. The Western development area is likely to be 5ha and would potentially comprise residential and amenity areas. These development areas are indicative and are based on information from the previous planning application and site analysis.

5.3.2 Energy demand estimate

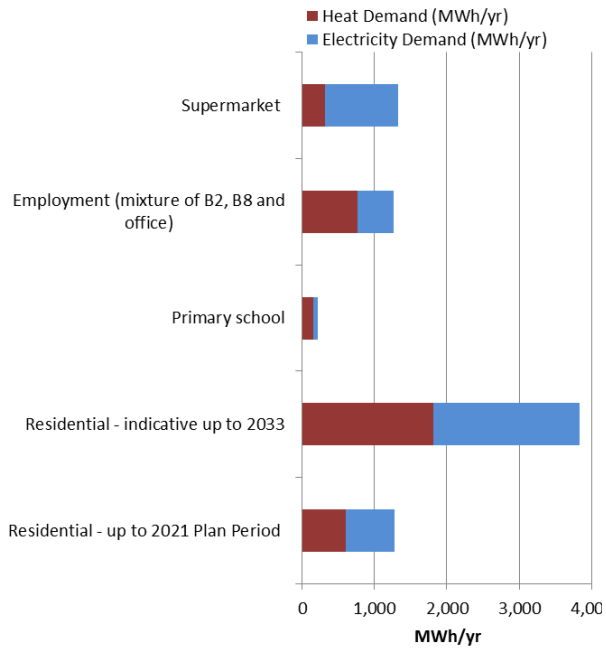


Figure 15 The British energy demand estimate

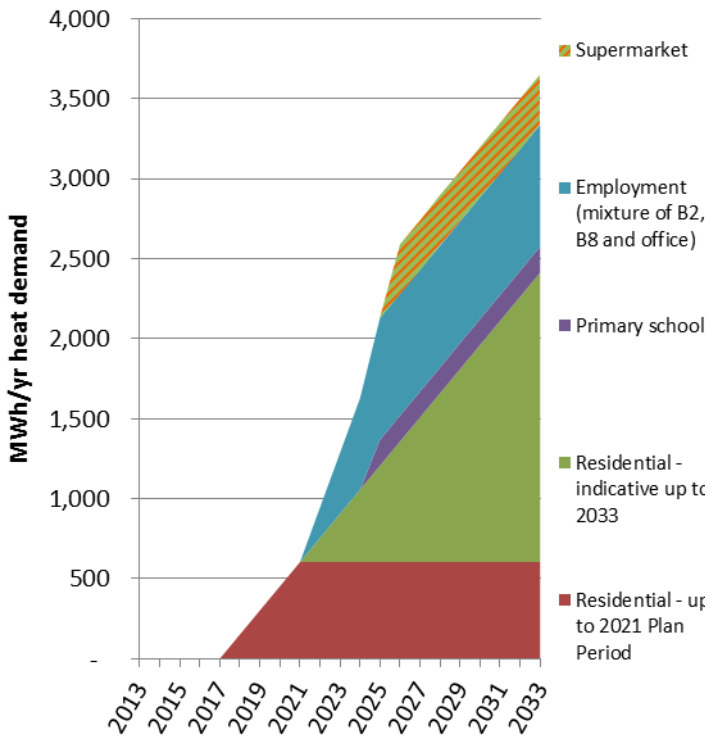


Figure 16 The British estimated heat demand and growth profiles

The bar chart above shows the expected electricity and heat demand of the development fully built out. The adjacent graphic shows how the heat demand is expected to grow over the build out period. The majority of the demand is from residential development. The next largest energy use area is employment, however, there is little certainty as to exactly what uses will come forward for this element.

5.3.3 Key opportunities and risks

- Wind opportunity area 2 identified in section 4.1 is located on the high ground to the west of The British site. There could conceivably be scope for a community wind turbine, or small cluster of turbines in this zone, in some way connected or associated to the British development, e.g. through a private-wire connection. The viability of the site is unknown and the likelihood is that access to the site and grid connection implies that the project needs to be of a certain scale to be economic, however, this may be at odds with the planning constraints of this visible location. A project with 3 x 2MWe turbines (6MWe total) would have an annual electrical output of approximately three times the annual consumption of the entire The British site.
- The 'Hydro opportunities in Torfaen', studies undertaken by TGV Hydro Ltd in 2011 identified three viable high head hydro projects in the valleys 1km to the west of The British. The three projects, are 28kW, 23kW and 12kW, thus beneath the 30kW size usually considered the

minimum to be economic. The largest site, Golynos has currently been ruled out due to landownership issues, the other two are being pursued by the Garnsychan Partnership community group. The combined output of all three would be 255MWh/yr, equivalent to approximately 75 dwellings, or 5% of site electricity consumption if fully built out. There could be an opportunity for the development of the British to support the development of these projects in some fashion.

- There are no major heat sources or loads likely to be present in a future masterplan for the site or in the vicinity of the site. The largest single energy user is likely to be the supermarket, the loads of which will be predominantly electrical. Some supermarket chains are experimenting with renewable energy / CHP energy centres, driven by corporate carbon targets. There could be a possibility to share heat with the primary school if the two are located adjacent to one another.
- Ground source heat pumps may not be suitable with ground conditions, given the industrial and mining heritage of the site. However, they could be an option worth investigation particularly for the western development area which presumably will require a new gas connection. By the time the development comes forward the grid carbon may decarbonised sufficiently to make it attractive from a carbon compliance perspective.

Technology	Suitability	Technical potential		Financial		Comment
		(MW)	(MWh/yr)	Capex (£m)	Indicative IRR (15 yr)	
Domestic solar PV		1.20	960	1.32	10%	Average 2kW per unit
Non-domestic solar PV		0.2	193	0.27	10%	Assumption that PV area is on average 10% of the floor area (mostly existing buildings).
Pen-twyn hydro		0.0123	49	0.10	7%	400m from Western development area. Being looked at by the Garnsychan Partnership community group.
Cwm Sychan (Abersychan) hydro		0.0232	92	0.14	12%	0.9km from Western development area. Being looked at by the Garnsychan Partnership community group.
Golynos hydro		0.0281	114	0.145	15%	1km from western development area. Project currently abandoned due to land ownership problems.
Wind		6	14191	9000	15%	Located on the high ground 1-3km from of the site Detailed feasibility required. Very visible location.
Biomass heating (MWth)		0.1	131	0.04	10%	Biomass to supply primary school
Heat Pumps		0.7	148	0.42	10%	5kW per unit for western development area.

Table 22 The British LZC technology options

5.3.4 Design and layout implications

- The residential development is likely to be relatively low density (35 dph), with a mixture of semi-detached, terraced and detached dwellings. This indicates a microgeneration approach to be most suitable. The site is mostly inclined to the east and has reasonable solar access, although it will become shaded in the afternoon outside of summer months due to the high ground to the west, particularly in the western development area.
- There is an opportunity to maximise roof area orientation to within 45 degrees of due south for solar renewables, and a SE-SSW orientation for panels would be most effective for those plots most affected by afternoon shading.

5.3.5 Recommended actions

- Work with the landowner/developer to establish low energy and low carbon design as one of the objectives of the updated masterplan. Take into account the findings of this appraisal within masterplan discussions.
- Require the developer to have a site wide energy strategy as part of their outline planning application.
- Explore the potential of the site to link with or otherwise support the potential community energy schemes (hydro and wind) in the vicinity. Allowable solution funds could potentially contribute some capital funding to the schemes.

5.4 Site 3: Mamhilad

5.4.1 Site description

Mamhilad (Allocation SAA4 of the LDP) is the largest of the five strategic development sites in Torfaen. The site comprises derelict and operational industrial and office buildings and large areas of farmland totalling an area of approximately 73 hectares. The Council's vision for this SAA is the transformation of a dated employment area and surrounding land to a mixed-use sustainable urban village with links to the nearby key settlement of Pontypool in order to provide employment and housing opportunities and bring wider regeneration benefits to the Pontypool area.

The Mamhilad Park site is being promoted by Johnsey Estates as a sustainable mixed use urban community. The current Draft Development Framework for the site proposes approximately 1,700 dwellings (690 within the Plan Period to 2021) and a variety of other uses including a primary school, retail, leisure, professional services and a hotel. A major element is the conversion of the 125,000m^2 Grade II* listed Nylon Spinners building.

Figure 17: Mamhilad Urban Village Development proposals, RPS Urban Design, December 2012

5.4.2 Energy demand estimate

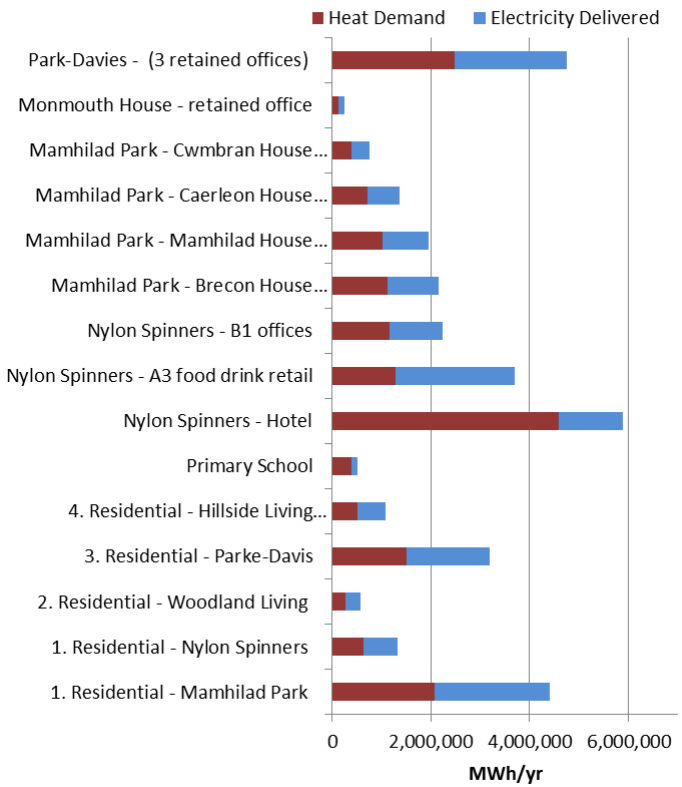


Figure 18 Mamhilad energy demand estimate

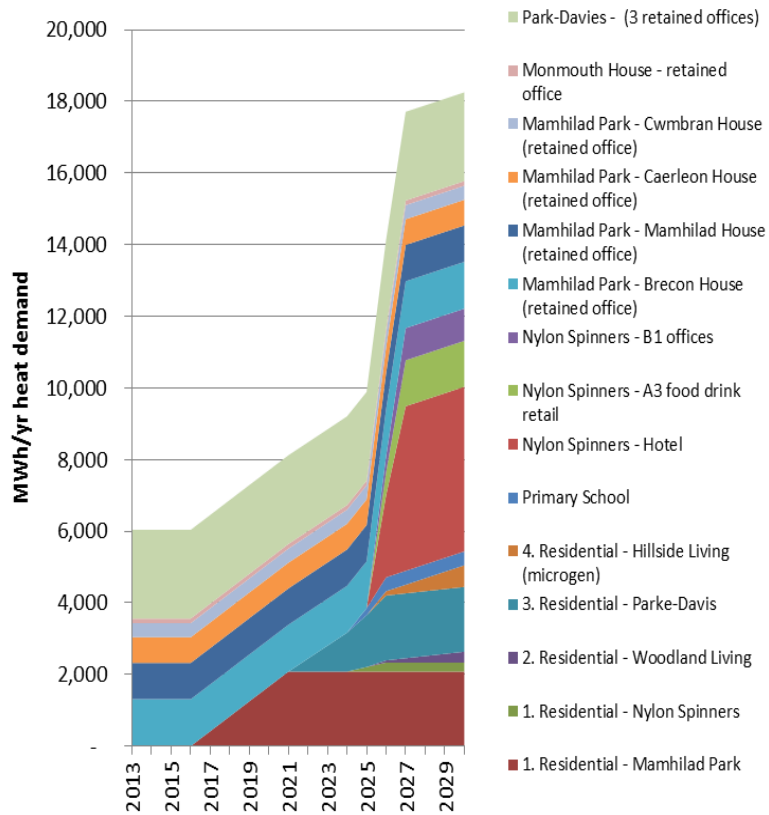


Figure 19 Mamhilad estimated heat demand and growth profiles

The bar chart above shows the expected electricity and heat demand of the development fully built out. The adjacent graphic shows how the heat demand is expected to grow over the build out period. The retained buildings are located at Mamhilad Park and the Park Davies 1 km to the south east. We have assumed that the offices are indeed occupied and that they have typical energy performance. If the buildings are to be heavily refurbished as part of the development, then their energy performance should improve. The refurbished Nylon Spinners building is set to be the largest energy user on site, and in particular the hotel. The remainder is residential development, which will grow gradually over time as the various plots and phases are completed.

5.4.3 Key opportunities

The sustainable energy options of this site have already been subject to some high-level study within the recent RPS Urban Design document dated, December 2012. The energy master plan envisaged a biomass-fuelled energy centre supplying the majority of the site, with the exemption of the lower density 'Hillside Living' residential. The upfront infrastructure costs for this approach will be substantial and may be difficult, if not impossible, to finance given the long build out period of a scheme of this scale. We estimate that the total cost of the network, energy centre and consumer connections to be in region of £11m, whilst conventional heating system would cost be in the region of £5m. Our views of the opportunities for this site are as follows:

- The Nylon Spinners building is a relatively dense mixed use development with a range of heating, cooling and power needs. This building and immediately adjacent buildings could be a feasible scope for a communal system, thereby leaving the majority of residential areas to take a high fabric efficiency and micro-generation approach to carbon compliance rather than district heating.
- There is an unoccupied plot of land on the opposite side of the roundabout on the eastern side of Usk Road of approximately 6.7 ha and 150m from the corner of the Nylon Spinners site. This could be a potential site for an Anaerobic Digestion (AD) plant, for example to treat the food waste of the county. This could potentially be a low carbon source of heat and power to supply at least the Nylon Spinners building. The site has excellent road access and there is a large substation on the Mamhilad side. A technical option could be to pipe biogas from the AD to a CHP unit located with the development itself and closer to heat and electricity loads. This could be more cost effective than the equivalent electrical and heat distribution infrastructure.
- The site has good solar access. There are opportunities for solar PV on domestic and non-domestic roofs. The solar PV would complement the proposed district heating system.
- The site is located in an area of potential for ground based solar PV (grade 4 agricultural land). A solar farm could be potentially be developed with private wire connection to the site.

•

Technology	Suitability	Technical potential		Financial parameters		Comment
		(MW)	(MWh/yr)	Capex (£m)	Indicative IRR	
Domestic solar PV		2.55	2,040	2.81	10%	Average 1.5kW per unit
Non-domestic solar PV		2.8	2,258	3.10	10%	Assumption that PV area is on average 10% of the floor area (mostly existing buildings).
Ground mounted solar PV		5	4,000	4.75	10%	Typical parameters for a 5MWe solar farm.
Heat Pumps		0.85	243	0.51	Further analysis needed	5kW per unit for 'Hillside Living' microgen houses only
Biomass heating (MWth)		2.2	5,782	1.35	n.a.	Biomass supplying 30% of annual heat load of DHN network.
CHP (MWe)		1.0	6,132	0.7	n.a.	CHP unit supplying 40% of annual heat load of DHN network.
Energy Centre, DHN network & consumer connections		/	/	6	n.a.	5km of network, 900m^2 energy centre, 20MW of consumer connections. The capital cost is additional cost to conventional gas heating system which would cost~£5m).
Anaerobic Digestion		1	7,884	7.7	Further analysis needed.	Assuming a 1MWe plant which would be minimum size. Not including heat distribution. Viability strongly depends on feedstock gate fees.

Table 23: Mamhilad LZC technology options

5.4.4 Design and layout implications

- Masterplan lay out to facilitate passive design techniques and optimise roof orientation (45° of South) and roof space for solar PV.
- If ground source heat pumps are pursued, then consideration of the housing layout and services planning to facilitate the installation of the ground loops. This could include early

consideration or borehole locations in areas of soft landscaping and routing of the ground loops back to the heat pumps.

- Avoid overshadowing of roofs in areas of development with a mix of building heights.

5.4.5 Recommended actions

- Share the results of this appraisal with Johnsey Estates.
- Encourage the developer to soft market test the communal energy aspect of the current Development Framework with potential ESCo partners, once the development has reached a greater level of certainty. This can be done be circulating a soft marking document which allows prospective ESCos to quantify the likely energy loads, the growth of those loads over time, the certainty with which those loads will be available, the consumer risk and the proposed location of the energy centre and indicative network routing. This document can by 10-15 pages long with data table and figures as appropriate.
- Soft market test the possible Anaerobic Digestion plant location. Factor in this location into discussions concerning the food waste contract and possible long term solutions.
- Require the developer to have a site wide energy strategy as part of their outline planning application.

5.5 Site 4 Former Police Training College

5.5.1 Site description

The site lies in an elevated position to the south - west of Cwmbran town centre, between the residential areas of Green Meadow and St Dials. The site comprises a former Police Training Centre in the west, an overgrown playing field in the north and small fields with open rough grassland to the east. The site occupies an area of 20.8 ha.

The site is owned by the Ministry of Justice, and Torfaen County Borough Council. Redrow homes currently have options on part of the site. The Ministry of Justice has the largest land holding and owns the land currently occupied by the former police training facility. The remainder of the site is occupied by rough grassland fields enclosed by hedgerows and fields that are leased for grazing.

The buildings on the former Police Training Centre comprise a main central block, together with a number of residential units to the north-west. In addition there is a range of buildings of varying ages to the rear of the main block, comprising accommodation, a boiler house, maintenance buildings, some demountable classrooms and a bar/club building. The sloping site has been terraced to form platforms for development. The site is screened on all sides by mature hedgerows.

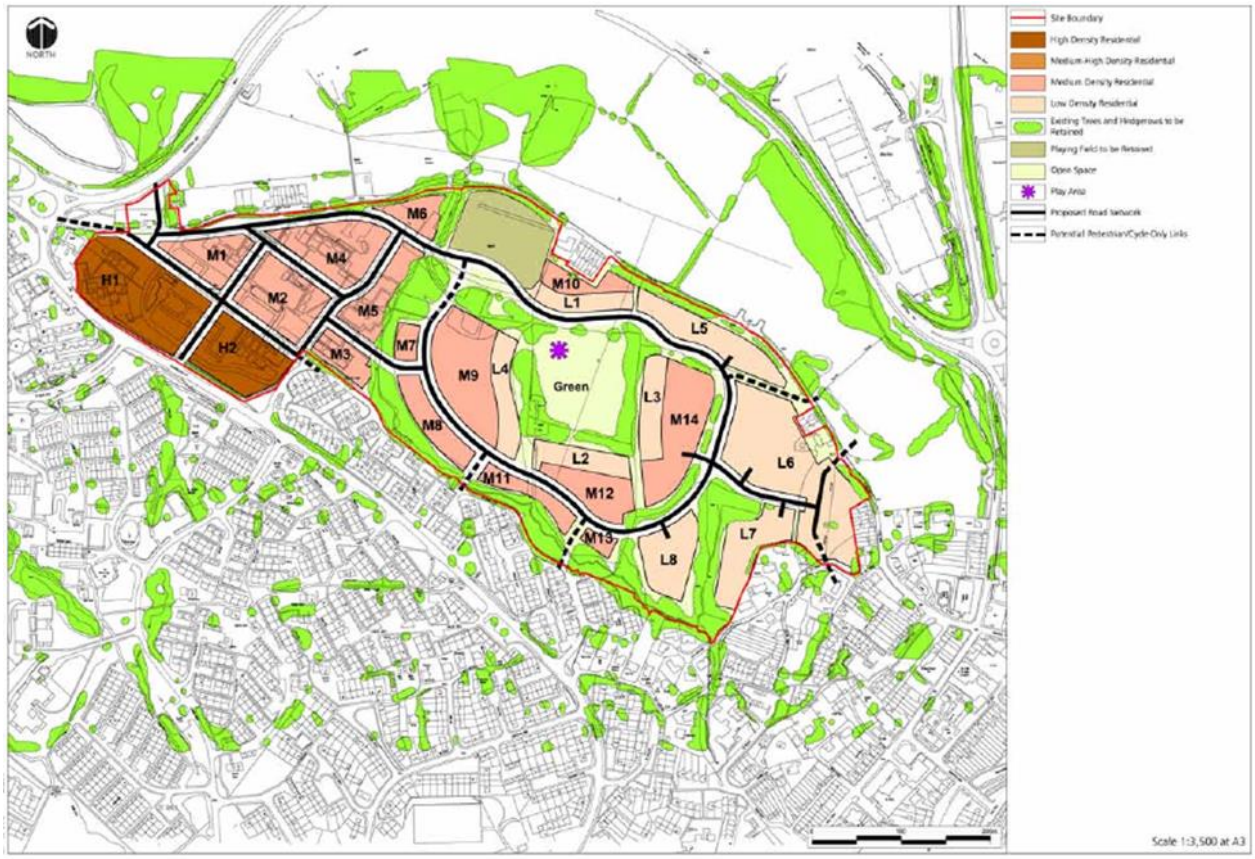
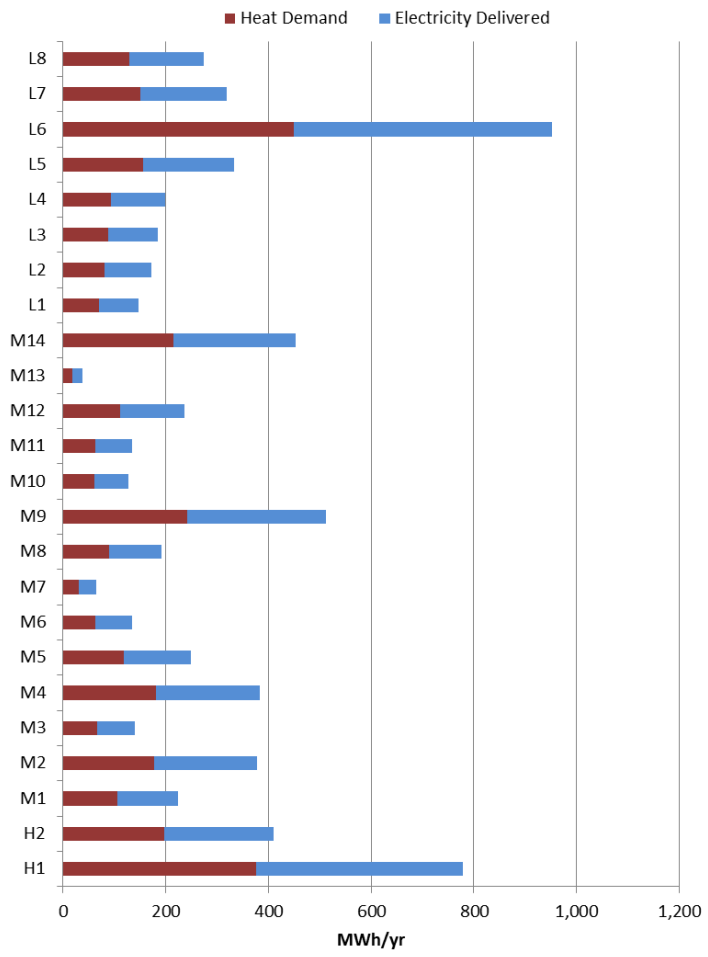


Figure 20 Former Police Training College and Adjacent Land

5.5.2 Energy demand estimate



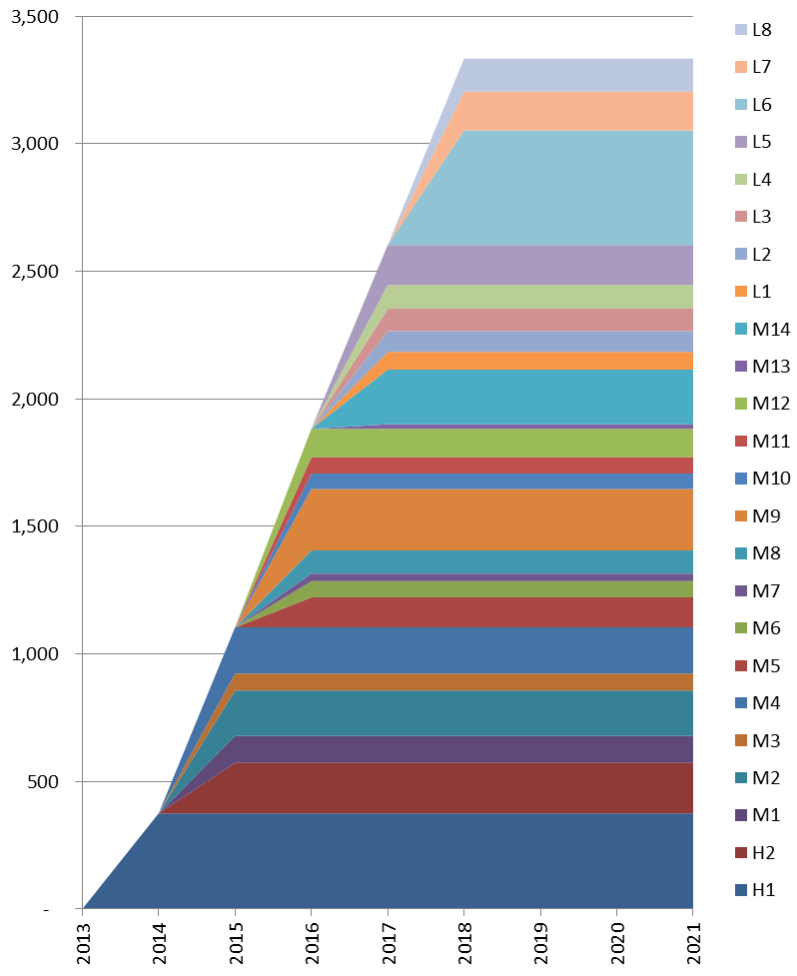


Figure 21 Former police training college energy demand estimate

Figure 22 Former police training college estimated heat demand

The bar chart above shows the expected electricity and heat demand of the development fully built out. The adjacent graphic shows how the heat demand is expected to grow over the build out period. Assuming that all plots achieve the anticipated thermal performance of new build residential units, rather than the existing buildings, then the high density plots (H1 and H2) are projected to account for 17% of the heat demand, medium density (M1 – M14) 46% and low density (L1-8)) 37%. .

5.5.3 Key opportunities

The proposed development for this site is purely residential. The majority is low and medium density although some apartment blocks are proposed in west of the site. There are no obvious heat sources or anchor loads in the vicinity of the site.

- The entire site has good solar access being located on an elevated position, gently sloping to the south. The existing police college buildings have a variety of pitched and mono-pitched roofs. If some of these are to be retained, then many appear suitable for retrofitting of solar PV, subject to further investigation. The site has many field boundaries and mature trees, if retained then these could cause shading to buildings situated immediate to their North. This will need to be assessed further as detailed development plans come forward.
- Biomass heating/mini gas CHP of the apartment blocks could be a possibility. A suitable boiler room and heat distribution network may already exist within the existing buildings if retained or could be part of the new build design. It is not envisaged that such a network would extend beyond plots H1 and H2 due the heat density of the remaining plots.
- Despite a reasonable wind resource, building integrated or standalone wind turbines are not recommended, for reasons effectiveness, available space and visual impact.
- Ground mounted solar arrays are unlikely to be appropriate given the high ecological and amenity value of the grass lands.
- The use of ground source heat pumps (boreholes) may be appropriate heating strategy particularly for the medium and low density plots. The fact that the site is largely green field grazing land should mean that there are no constraints for ground loops due to contamination.

Technology	Suitability	Technical potential		Financial		Comment
		(MW)	(MWh/yr)	Capex (£m)	Indicative IRR	
Domestic solar PV		0.81	646	0.89	10%	PV system size dependent on unit type. Assumed average 1.8kW
Apartment block biomass heating		0.2	526	0.12	/	Biomass boiler to supply high density H1 and H2 plots.
Heat Pumps to medium and low density areas.		1.67	1,308	1.002	/	5kW per unit for medium and low density houses only.

Table 24 Former police training college LZC technology options

5.5.4 Design and layout implications

- Consider grouping high density blocks to provide potential economies of scale for communal option (high density blocks H1 and H2)
- For all plots, consider a master plan lay out to facilitate passive design techniques and optimise roof orientation (45° of South) and space for solar PV. This should work relatively well with proposed road network, which has SE-NW as the primary axes.
- Care should be taken to avoid shading cast by the trees and to avoid overshadowing of roofs in areas of development with a mix of building heights.

5.5.5 Recommended Actions

- Require developers to produce a site wide energy strategy as part of a future master plans and any outline planning application.

5.6 Site 5: Canalside Action Area

5.6.1 Site description

The Canalside Action Area is a long term project beyond the LDP period to create a new canal quarter for the town. An indicative masterplan was produced in December 2012, but there are no developers on board as yet or planning applications submitted.

The objective is to create a new vibrant canal quarter in the centre of Cwmbran. The masterplan contains approximately 200 dwellings, comprising a mixture of flats, terraces, semidetached and detached houses with density ranging from 30 to 54 dwellings per hectare. The objective is for 100 dwellings to be built up by 2021 commencing on the west side of the canal. The regeneration aspiration for the site after 2021 is for the creation of a canal side quarter with retail and restaurants (A1 and A3) and construction of a canal basin. The site will accommodate 1,050m^2 retail floor space (A1-A3 uses), 2,100m^2 for hotel leisure uses (C1 and D2 uses) and 1,250m^2 public space and canal basin.

Figure 5.1 Indicative masterplan

5.6.2 Energy demand estimate

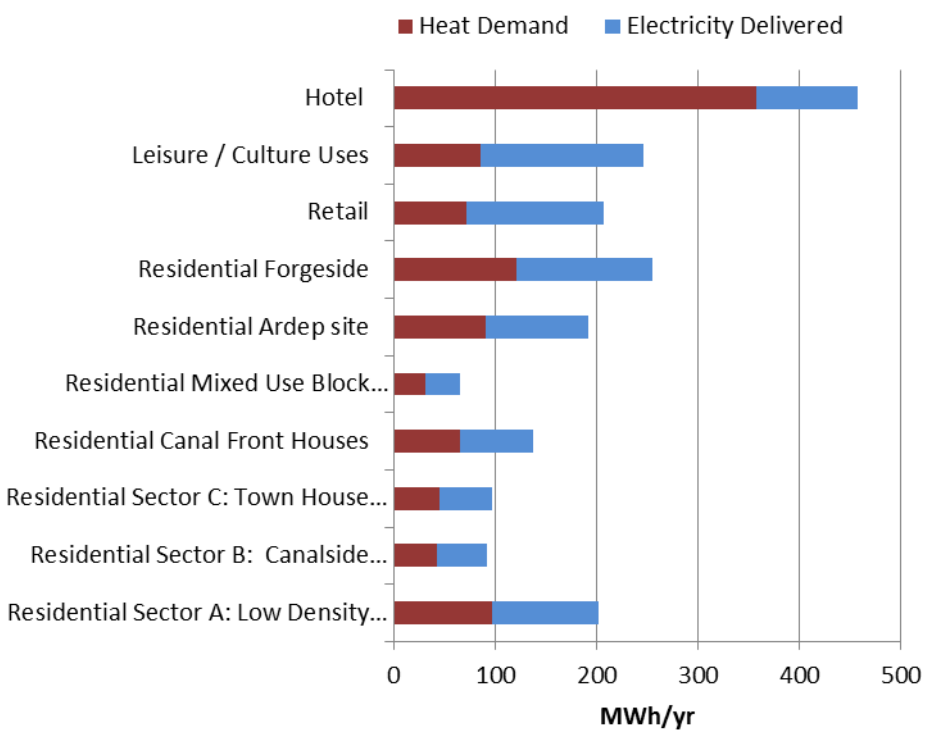


Figure 23 Canalside energy demand estimate

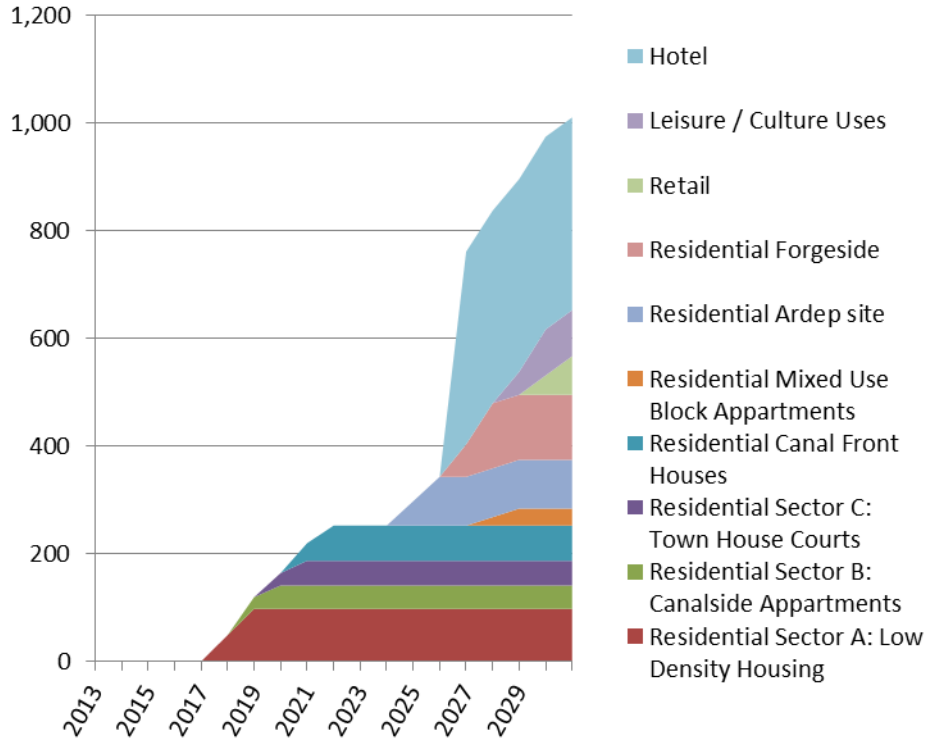


Figure 24 Canalside estimated heat demand and growth profiles

The bar chart above shows the expected electricity and heat demand of the development fully built out. The adjacent graphic shows how the heat demand is expected to grow over the build out period. The largest single heat user on site is likely to be the hotel, however this is likely to come forward only in the latter stages of the development, once the majority of the residential plots have been built.

5.6.3 Key opportunities

- Roof mounted solar PV on houses and non-domestic development. The site has good solar access.
- Consider the use of canal water as heat source for heat pumps. By the time that this development is built out the grid electricity factor should tend to favour heat pumps over natural gas heating options. The canal could also potentially act as a heat sink for cooling to the commercial areas.
- Alternatively, the hotel provides a potential anchor heating load for a communal heating system covering the mixed use area and any residential flats in close proximity. The site is adjacent to areas of heat demand > 3,000 kw/km^2 but further study would be required to establish whether there is potential for a network to extend out into existing development. The site is bounded by major roads and bisected by the canal, which could make network installation relatively expensive.

Technology	Suitability	Technical potential		Financial parameters		Comment
		(MW)	(MWh/yr)	Capex (£m)	Indicative IRR	
Domestic solar PV		0.29	232	0.32	10%	Average 1.5kW per unit
Non-domestic solar PV		0.1	118	0.16	10%	Assumption that PV area is on average 20% of the floor area.

Table 25: Canalside Action Area LZC technology options

5.6.4 Design and layout implications

- To maximise solar potential, the majority of pitched roofs should be oriented to between SE and SW (i.e. up to 45 degrees either side of due south). The majority of the roof pitches of the indicative masterplan are orientated E/W, in particular the low density housing in the north-west corner of the site, the canal front properties, the houses with internal courtyard parking and the Forgeside area.
  In some cases this is a result of north-south axis of several of the access roads and the orientation of the canal itself. There may however by opportunities to realign properties to have a more southerly aspect, or to employ mono-pitched roofs to maximise suitable roof areas. This aspect could also assist with passive design layout of houses, to allow summer shading and avoiding potential overheating due to large east and west facing windows which are hard to shade due to the low sun angle.
- Consider potential location for an energy centre to serve the higher density mixed use area. This should be centred on the hotel (note that this recommendation is irrelevant if the heat pump option is pursued)

5.6.5 Recommended actions

- Provide pre-planning advice to developers on the layout implications listed above, and the review individual planning applications accordingly.

- Undertake a study to review option for heating and cooling to the mixed use areas, once development proposals are firmed up.

6. Urban heat network opportunities

The heat map of both authorities is shown in Appendix B9. This section explores the three areas of potential interest in Cwmbran, Pontypool and Blaenavon where the density of heat demand exceeds the nominal threshold[2] of 3000kW/km^2. Further comment and high level conclusions, based upon a rapid desktop exercise for each area is shown below.

6.1 Cwmbran

The heat map of Cwmbran indicates dispersed areas of high heat density around the town. One LSOA area exceeds 5,000 kW/km^2, but is surrounded by much lower density areas.

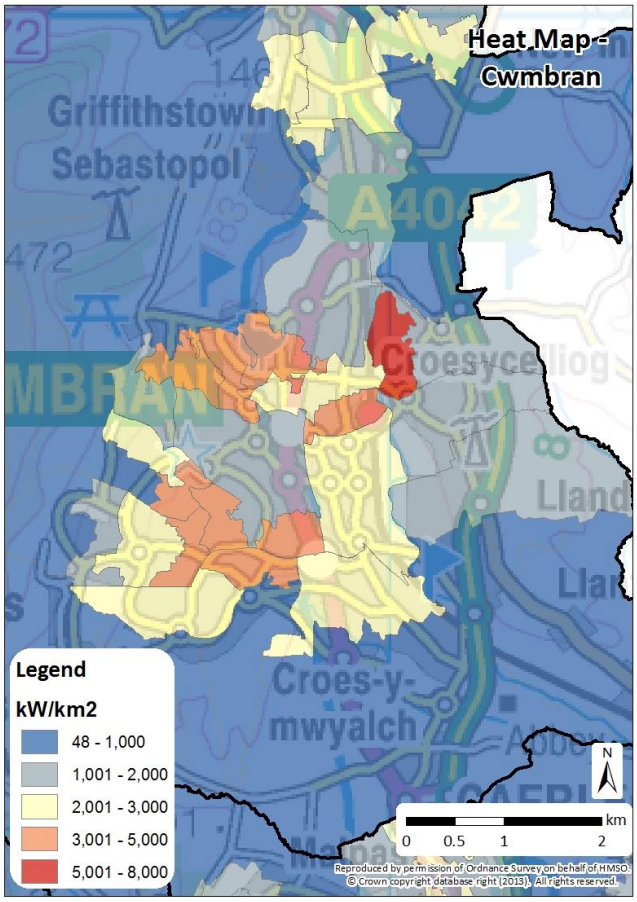


Figure 25: Heat map of Cwmbran

The built environment across Cwmbran incorporates large areas of low rise housing, much of it built in the latter half of last century. There are no immediately obvious anchor loads or sources, however this should be checked, which can be done rapidly by conducting a review of the principal buildings in the locality and identifying whether any are public buildings or are likely to have a high heat load. Whilst further investigation would be needed to confirm, we believe that the relatively high heat demand per km^2 may be due to the poor thermal performance of the extensive areas of housing.

Retrofitting district heating network to such large number of small consumers would be very expensive, even if source of cheap heat where locally available. It would also do nothing to tackle fuel poverty, indeed may worsen in due to the high standing charges generally required to finance and maintain a heat network. Assuming there are no public anchor loads in the locality and energy loads are dominated by the low rise housing than it is recommended to focus on retrofitting of existing housing stock, for example with external wall insulation and air tightness.

[2] 'Heat density' is a measure of the heat demand in a geographic area, and is calculated by dividing the aggregate heat demand (kW) by the area (km^2). Research carried out for DECC 'The Potential and Costs of District Heating Networks, by Poyry and Faber Maunsell (2009), indicated that areas with heat density of less than 3,000kW/m^2 were unlikely to be viable.

6.2 Pontypool

The heat map for Pontypool illustrates a heat density between 3 and 5,000 kW/km^2 within two LSOA areas north of the A472. All other LSOA areas, even in the urban centre are identified as having a low heat density between 2 and 3,000 kW/km^2.

The northern area identified in the map, Trevethin, is low rise predominantly residential and is not an attractive prospect for district heating.

The town centre may hold some potential with a mix of public and commercial buildings in relative proximity. The first step before committing further time and effort should be to undertake a rapid appraisal of potential anchor loads, such as the leisure centre, civic centre and police station.

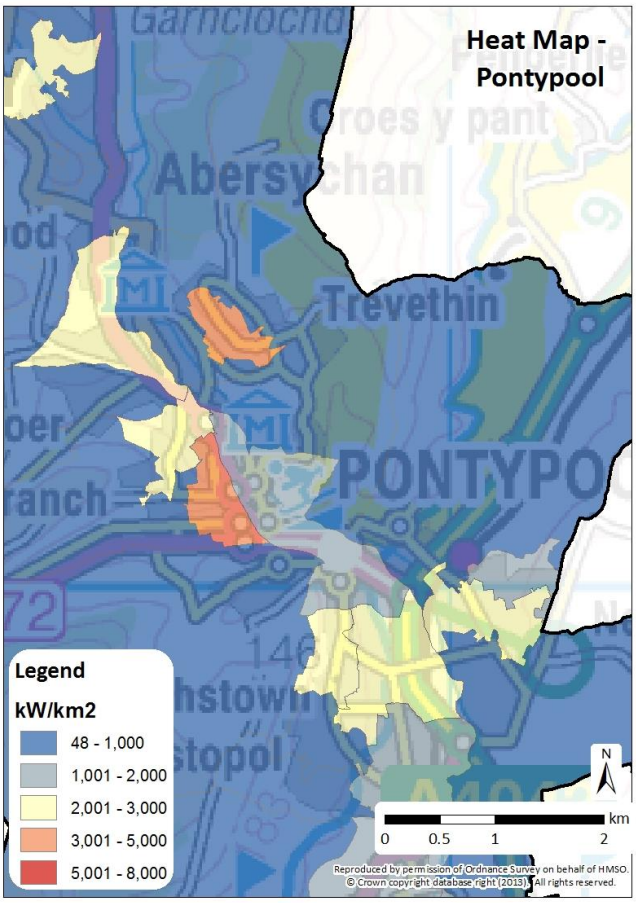


Figure 26: Heat map of Pontypool

6.3 Blaenavon

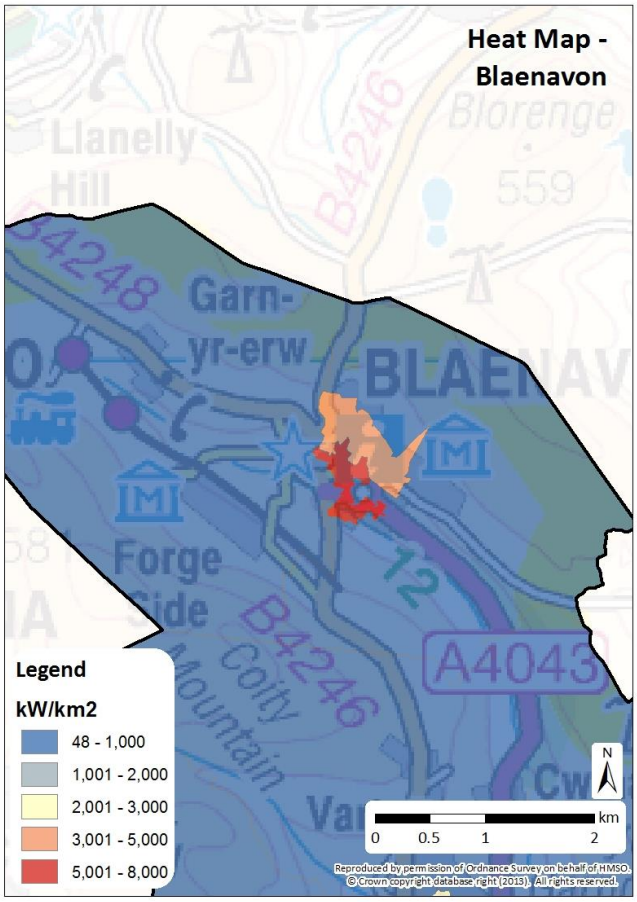


Figure 27: Heat map of Blaenavon and the surrounding area

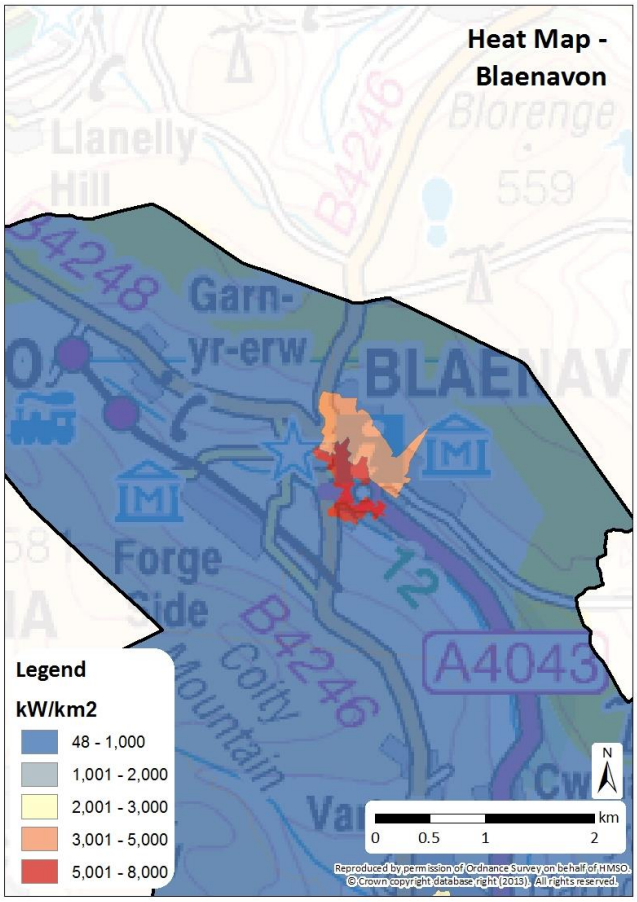


Figure **27** illustrates the portion of the heat map centred around Blaenavon area. This figure highlights that the highest heat density LSOA of 7,610 kW/km^2, which is very significant. However, a desktop review of this area highlights that the majority of the buildings situated in this zone are high density, low grade domestic properties. It is very rarely economically viable to retrofit these buildings for district heating. There are no large commercial or industrial heat loads evident, and so it is recommended that this location is not further considered for district heating, unless further evidence materialises.

Note that the Blaenavon and neighbouring Gilchrist Thomas and Kays and Kears Industrial Estates at Blaenavon were subject to a detailed carbon / energy vision and framework in 2009[3]. The study reviewed two district heating options, neither of which was found to be viable.

[3] Blaenavon Energy Strategy, AECOM for the Carbon Trust in Wales, 2009.

7. Torfaen - Energy Opportunity Map & Key Opportunities

The energy opportunity map for Torfaen on the next page identifies, spatially, some of the key renewable energy resources available within the authority. It does not cover all resources, because some are assessed without reference to spatial distribution, e.g. building integrated renewables. Some opportunities are identified as indications of indirect resource, e.g. land class from which to infer suitability for biomass crops, and others are identified more directly, such as land that may be suitable for wind, solar or hydro power development.

The energy opportunity map also locates the strategic development sites to help identify where connections could be made.

From the map, analysis of strategic sites and exploration of urban heat networks we identify the following as important opportunities within Torfaen:

- The potential for **wind energy**, which the largest potential renewable energy source, is situated around the periphery of the study area, largely as a consequence of the ribbon of urban and suburban development that forms a spine through the County Borough. Cumulative visual impact is likely to limit the exploitation of this resource.
- There is a large general resource potential for land based **solar PV** systems across the authority and particularly in the more rural locations. The areas in south of the county would have the best solar resource.
- There are several potential **hydropower** sites, mostly in the north of the county. The combined generation capacity is however relatively small.
- The southern and eastern sections of the authority offer good **energy crop potential**, although this is largely on Grade 3 land which might in practice prove more valuable for crops or other land uses.
- There are potential opportunities for **heat networks** in the Cwmbran and Pontypool and these should be rapidly reviewed to identify potential amenable anchor loads prior to committing to technical and economic viability analysis. There is limited linkage of high heat density areas with the strategic development sites and thus urban heat networks (discussed earlier) should be considered in isolation.

As regards strategic sites:

- There are potential linkages between potential hydro and wind energy developments and The British strategic development site. A private wire connection is unlikely to be feasible; however the British site may be able to somehow support the development of the projects, and thus provide a revenue stream for community benefit.
- The British and Mamhilad strategic sites are located in areas of potential for ground based solar PV. Solar farms could be potentially be developed with private wire connection to the sites. Mamhilad is the stronger candidate, due to topography and solar resource, although it would be displacing more valuable agricultural land.
- Land opposite the Mamhilad could be location for Anaerobic Digestion plant, which could contribute heat and power to the site and replace the proposed dedicated gas CHP/biomass energy centre.

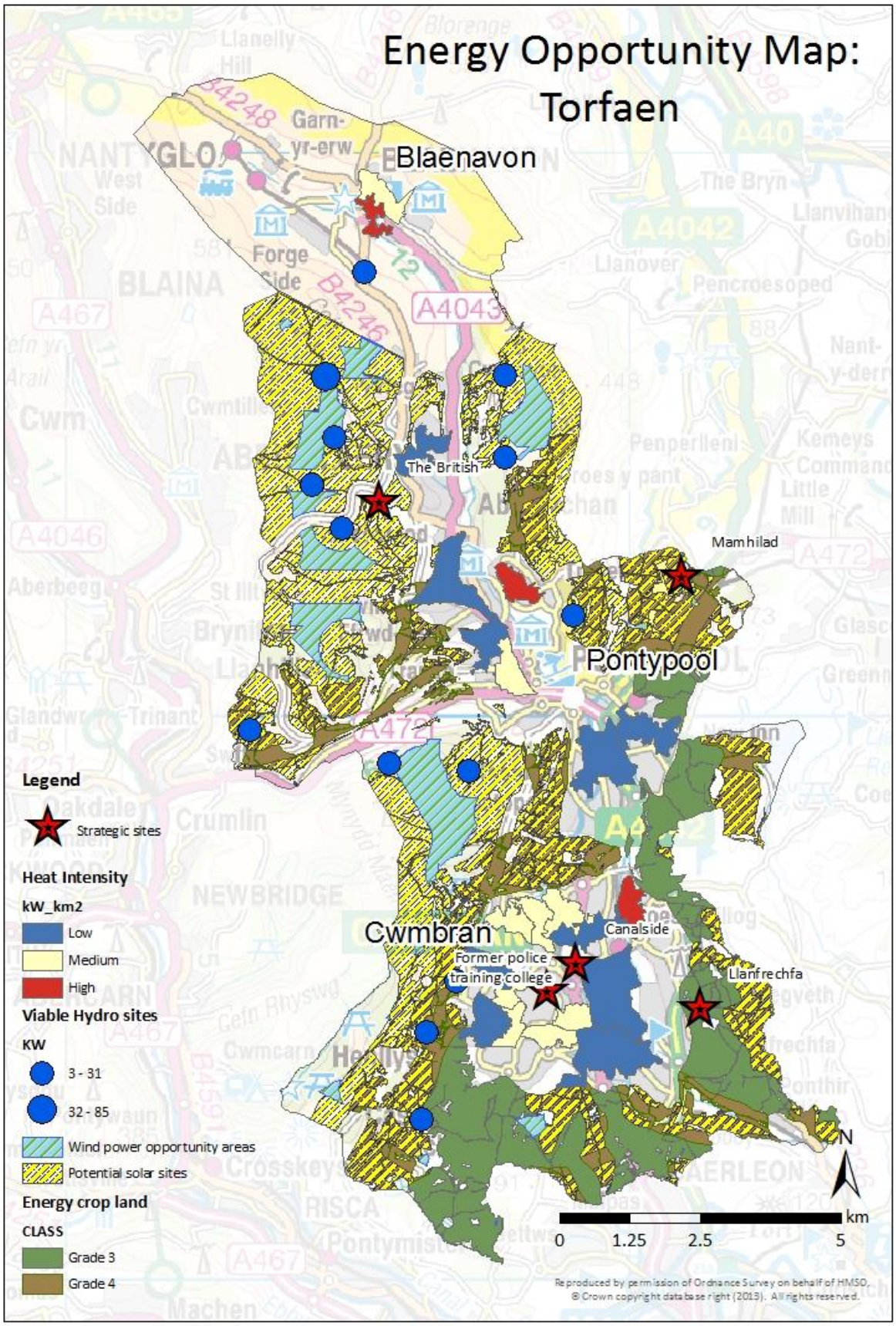


Figure 28 Energy Opportunity Map – Torfaen CBC

PART II: NEWPORT CITY COUNCIL

8. Newport - Energy demand and background information

This section presents background information on energy consumption, carbon emissions and current renewable energy projects within the county.

8.1 Energy demand and carbon emissions

Newport's energy consumption in 2011 was just under 5,000GWh/yr, with approximately half used for heat, a third for transport and the remainder electricity. Based on national projections for energy demand, consumption is expected to fall by about a fifth to 4000GWh/yr by the end of the plan period (2026). This is to be achieved through a combination of greater end use efficiency, decarbonisation of the electrical grid and a transfer of some heat and transport loads to the electricity grid, as set out in the UK's Low Carbon Transition Plan.

	2011			2026			
Sector	**UK**	**Wales**	**Newport**	**UK**	**Wales**	**Newport**	**Predicted UK % change to 2026**
Electricity (GWh/yr)	286,769	15,224	860	287,777	15,277	863	0.4%
Heat (GWh/yr)	742,132	54,867	2,467	544,465	40,253	1,810	-36%
Transport (GWh/yr)	457,087	22,725	1,643	381,417	18,963	1,371	-20%
Total Final Energy Consumption (GWh/yr)	**1,485,988**	**92,816**	**4,971**	**1,213,660**	**74,494**	**4,045**	**-22%**

Table 26: Annual final energy demand in 2011 and projected for 2026 in UK, Wales and Newport

8.2 Carbon emissions

The Department for Energy and Climate change have published figures of 2010 carbon emissions by end use at a county level across the UK[4]. The data set covers emissions sources within the scope of influence of Local Authorities, i.e. excludes power generation over 50MW. Newport's total emissions were 1,245 ktCO_2/yr. With a population of 141,300 this equates to 8.8 tCO_2/capita, compared to a UK average of 6.6 tCO_2/capita. The figure below shows the breakdown of emissions by different sectors and fuels in Newport.

[4] See Appendix C for data table and source.

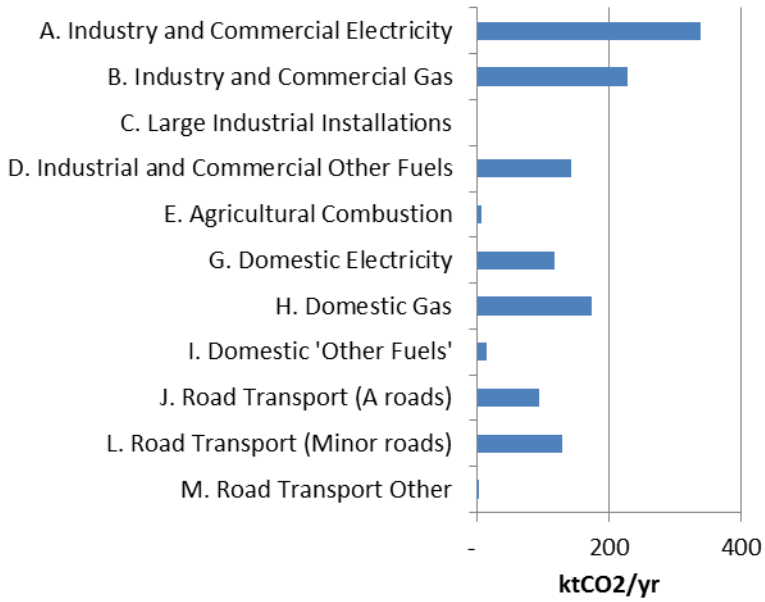


Figure 29: CO_2 emissions within the scope of influence of Newport CC

8.3 Renewable energy targets

The table below shows the UK's 20% by 2020 renewable energy target applied to Newport's projected 2020 consumption. A longer term target to 2030 is under consideration by the UK government, but no announcement has been made yet.

A significant proportion of renewable electricity will be supplied from power stations outside of the authorities, such as off shore wind. Similarly, renewable transport will come through blending of biofuels at a national level. It is uneconomic to transport heat large distances therefore renewable heat generation equipment will normally be located within the county where it is consumed.

The pro-rata share of the national targets is used to inform the suggested renewable energy target for the county presented in section 9.8.2.

	RE target for 2020			
Sector	**RE UK**	**RE Wales**	**RE Newport**	**Renewable Energy share by 2020**
Electricity (GWh/yr)	82,513	3,671	247	30%
Heat (GWh/yr)	71,577	6,301	308	12%
Transport (GWh/yr)	42,543	2,296	166	10%
Total Final Energy Consumption (GWh/yr)	**196,632**	**12,268**	**721**	**-**

Table 27: Final renewable energy demand projected for 2020 in UK, Wales and Newport

8.4 Existing and proposed RE technology

The tables below present the existing and planned renewable energy capacity in Newport CC. The majority of the existing technologies in Newport are wind turbines, contributing over 15MW of renewable electricity to the national grid, with further proposed winds turbines to be installed.

Name/Location	Technology	Capacity [MW]	Status	Source
Solutia	Wind	5	Operational	Newport City Council
Tesco Distribution Centre, Greenmoor	Wind	1.6	Operational	Newport City Council
New Park Farm, Bassaleg	Wind	0.5	Operational	Newport City Council
Hazel Farm, Llanwern	Solar farm	2.5	Operational	Newport City Council
Total Estimated Domestic PV	Solar[5]	3	Operational	DECC Fit
Docksway	Landfill gas	2	Operational	Ofgem
Total		**14.6**		

Table 28: Existing renewable electricity in Newport CC

Name/Location	Technology	Capacity [MWe]	Status	Source
Land to the South of Baldwins Crane Hire West Wau Road Alexandra Docks – (Development of a bulk drying and pelleting facility with onsite energy centre)	Biomass -	25	Approved but project appears dormant or abandoned	Newport City Council
Land South West And Adjacent To Timber Yard West Way Road Newport	Energy from Waste	12	Approved but project appears dormant or abandoned	Newport City Council
Clearwell Farm, Cardiff	Solar farm	2	Approved	Newport City Council
Sewage Treatment Works, Nash Welsh	Wind	2.5	Operational	Newport City Council
East Way Road, Alexandra Docks Newport	Wind	2.3	Approved	Newport City Council
RES Land To The North Of Little Longlands, Caldicot	Wind	1.5	Submitted	Newport City Council
Total		**42.8 (8.3 potentially in development)**		

Table 29: Proposed renewable electricity capacity in Newport CC

In 1994, Newport City Council made a planning application for a barrage across the River Usk for regeneration reasons in a similar fashion to Cardiff Bay. The tidal power dimension of the project is unknown, but the scheme was categorically refused by the secretary of state in 1995.

[5]The capacity installed represents the sum of domestic photovoltaic with a capacity inferior to 0.5 MW. It also refers to Building Integrated Renewables.

8.5 Existing fossil fuel generation

There are two large power stations in Newport:

- Uskmouth Power, a 360MW coal-fired power station owned by Scottish and Southern Energy (SSE), built in the early 1960s, refurbishment in 1998 extended the plant's life by around 25 years.
- Severn Power, a 850MW gas-fired power station commissioned in 2011 and owned by DONG Energy.

9. Newport CC - Area wide renewable energy assessment

This section contains the results of the assessment of renewable energy potential within the Local Authority. The assessment methodology used is as per the Toolkit (see section 1.2 for further details); however, additional commentary and GIS outputs maps associated with the assessment are presented in Appendix B.

9.1 Wind energy

The table below presents the potential capacity of wind power based on GIS mapping of the constraints listed in Table 47 of Appendix B. The potential is ranked by areas of least constraint (priority areas 1 to 4). This table represents the upper limit of the resource, not taking into account cumulative visual impact issues.

Wind Resource Priority	Annual average wind speed	Potential disruption to the NATS*	Area (km^2)	Potential energy generated (GWh/yr)	Potential Capacity (MWe)	Equivalent number of utility scale (2MWe) turbines
Priority 1	High (>6.5m/s)	Low	0.4	9.5	4	2
Priority 2	Moderate (6-6.5m/s)	Low	3.6	85.1	36	18
Priority 3	High (>6.5m/s)	High	0.8	18.9	8	4
Priority 4	Moderate (6-6.5m/s)	High	0	0	0	0
Total			**4.8**	**113.5**	**48**	**24**

Table 30 Unconstrained wind resource in Newport

**National Air Traffic Service*

The GIS wind constraints map for the county is shown in Figure 54 of Appendix B. Figure 30 below shows the location of existing turbines alongside the potential areas of opportunity for wind development, not taking into account the cumulative impact. The only area outside of the 7km buffer zone recommend in the Toolkit is found in the northeast corner of the county, which could accommodate approximately four turbines. It is noted that there is no statutory separation distances between wind farms in the UK, so the 7km is arbitrary number which in practice provides an overly pessimistic resource estimate.

Wind development in Newport to date has followed the model of dispersed turbines, mostly feeding into consumer sites via 'private wire' commercial arrangements. The remaining potential in the county is of similar nature. Subject to the constraints for cumulative impact and detailed feasibility, there is scope to increase the installed capacity by up to a factor of five.

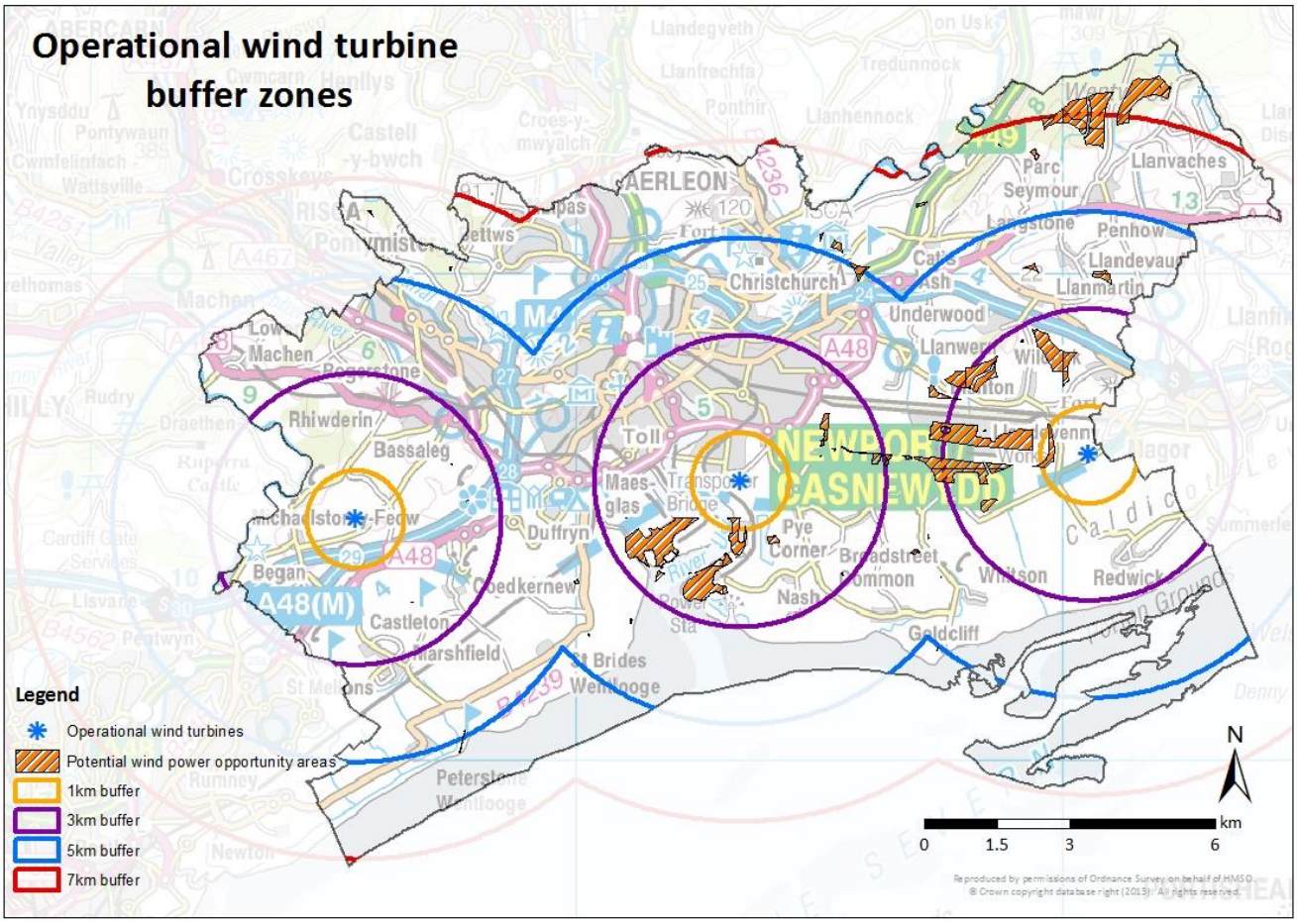


Figure 30: Wind opportunity areas in Newport and buffer zones around existing turbines.

Potential Wind Farm	Area (km^2)	Potential energy generated (GWh/yr)	Potential Capacity (MWe)	Equivalent number of 2MWe turbines
Wind opportunity area near north of Llanvaches – priority 3	0.4	9.4	4	2
Total	**0.4**	**9.4**	**4.02**	**2**

Table 31 Potential wind farms in Newport

9.2 Energy Crops and wood fuel resource

The results for the total available agricultural land by grade is available in Table 32 for potential energy crops, and Table 33 shows the total available land for potential woody biomass, and the subsequent potential for energy generation. The main areas for opportunity lie within the outer zones of the local authority, mainly on the eastern and western perimeters. Similarly, the areas for potential wood fuel also fall within the eastern and western perimeters of Newport CC.

Output	Land Grade 1	Land Grade 2	Land Grade 3	Land Grade 4	Total
Available (Ha)	120	829	4292	2,377	**7,620**
Percentage of area that can be used	10%	10%	10%	10%	**-**
Usable area (Ha)	12	82	429	237	**761**
Yield (odt)	144	994	5,151	2,852	**9,142**
Electricity					
Potential installed capacity (MWe)	0.02	0.17	0.86	0.48	**1.53**
Heat from CHP					
Potential installed capacity (MWe)	0.02	0.17	0.86	0.48	**1.53**
Potential installed capacity (MWt)	0.04	0.34	1.72	0.96	**3.1**

Table 32 Potential energy crop outputs for Newport

Output	Forest
Available (Ha)	2,053
Usable area (Ha)	2,053
Yield (odt)	1,232
Heat only option	
Potential installed capacity (MWt) from boilers	**1.9**

Table 33 Potential wood fuel resources for Newport

9.3 Waste resources

Newport CC is one of the five councils in South Wales collaborating in Prosiect Gwyrdd (Project Green). Prosiect Gwyrdd has recently let a 25 year contract to private sector partner Viridor to treat the combined waste of all partner Councils. Viridor is currently constructing a new waste to energy facility at Trident Park in Cardiff to treat the waste. Therefore, in interpreting the results below for Newport it is worth noting that:

- Only the electrical component of the project is certain at the time of writing. The utilisation of heat from the Viridor plant to provide district heating to consumers in Cardiff is currently under investigation by E.ON, but is not confirmed.
- Power (and potentially heat) will be generated and supplied to the grid in a neighbouring authority.

Outputs	Municipal Solid Waste	Commercial & Industrial Waste	Total
Total Waste (tonnes)	67,395	745,455	**812,850**
Total Residual (30%)	20,218	223,637	**243,855**
Total Biodegradable (renewable) element (35%)	7,076	78,273	**85,349**
Electricity			
Required wet tonnes per MWe	10,320	10,320	**-**
Potential installed capacity (MWe)	0.7	7.6	**8.3**
CHP			
Potential installed capacity (MWth)	1.4	15	**17**
Heat			
Required wet tonnes per MWth	1,790	1,790	**-**
Potential installed capacity (MWth)	4.0	44	**48**

Table 34 Potential energy from waste resource for Newport CC

9.4 Anaerobic digestion

Additional potential energy sources derived from waste as reported on in the Bioenergy Action Plan for Wales include:

- Food waste
- Animal manure
- Poultry litter
- Sewage sludge

Because 100% of the waste resources within this section are biodegradable, it is classified as entirely renewable energy.

9.4.1 Food Waste

The table below presents the theoretical energy potential of Newport's food waste resources based on 2010 figures.

Food Waste	Municipal	Commercial & Industrial	Total
Total Waste	4,000	170,936	174,936
Electricity			
Required tonnes per MW	32,000	32,000	
Potential installed capacity (MW)	**0.1**	**5.3**	**5.4**
Heat			
Potential installed capacity (MW)	**0.2**	**8.0**	**8.2**

Table 35 Potential energy from food waste for Newport CC

9.4.2 Animal Manure

Animal manure resources are calculated using agricultural statistics obtained from WG. The figures assume that 50 per cent of farms within Newport CC area use a slurry system, and that of those farms, it would be feasible to capture the slurry from 50 per cent. Table 36 shows the potential electricity and thermal potential.

Livestock	Number		Available resource per head/yr (t)
Cattle	4,087		1.5
Pigs	64		0.15
Electricity			
Required wet tonnes per MWe	225,000		
Potential installed capacity (MWe)	**0.03**		
Heat from CHP			
Required wet tonnes per MWth	47,000		
Potential installed capacity (MWth)	**0.1**		

Table 36 Potential energy from livestock manure for Newport CC

9.4.3 Poultry Litter

No farms in Newport City Council area accommodate birds exceeding 10,000 therefore it is considered that the resource generated would not be sufficient to support a dedicated litter energy plant. Therefore, Verco have not considered this source relevant to include the assessment.

9.4.4 Sewage Sludge

Data from the sewage sludge resource is derived from data in the Bioenergy Action Plan for Wales (2009).

Sewage Sludge	Predicted tonnes per annum
Total sewage sludge	4,700
Electricity	
Required dry solid (tonnes) per MWe	13,000
Potential installed capacity (MWe)	**0.361**
Heat	
Potential installed capacity (MWth)	**0.542**

Table 37 Potential energy from sewage sludge for Newport CC

9.5 Solar photovoltaics (PV)

The potential for ground mounted PV is estimated from GIS mapping of land constraints, such as the quality of agricultural land and nature designations and as detailed in Appendix B. This analysis suggests that a relatively large area is potentially available for ground mounted solar. We have therefore made a further assumption that only a small proportion (1%) of the total land available could actually be used. This compares with 10% for energy crops. It is a somewhat arbitrary figure, but reflects the fact that solar farms have to compete with other land uses and will require unshaded flat land or land inclined to the south with potential for an economic connection to the grid. Even on this basis it is clear that solar PV has far fewer constraints than wind energy and this there is a higher degree of flexibility as to where the potential capacity could be located. Figure 57 in Appendix B shows the GIS map of potential for ground mounted solar. Although the best solar resource is along the coast, this is also an area of high constraint for ground mounted PV due to high quality agricultural land, nature designations and urban areas. However, there are opportunities for ground mounted PV in the north eastern area within Newport CC.

The potential for roof mounted PV is similarly estimated from GIS mapping of roof areas of non-domestic and domestic property types. Further details of the methodology for both calculations are shown in Appendix B.

Solar PV	Ground-mounted	Roof-mounted industrial & commercial	Roof-mounted domestic	Total
Total area available for PV (m^2)	13,753,026	1,951,290	3,165,734	**18,870,050**
Total practical PV panel area (m^2)	137,530	243,911	316,573	**698,014**
Electricity				
Total potential installed PV capacity (MWp)	21	37	47	**105**
Potential generation (GWh_e/yr)	17	29	38	**84**

Table 38 Solar PV resource potential for Newport CC

9.6 Hydropower

The potential for hydropower resources is estimated from GIS mapping with data provided by the Environment Agency. There are no available additional feasibility studies available for Newport CC area. The main opportunities for hydropower within Newport lie to the east of Duffryn, and also to the east of Rogerstone.

Feature type	Estimated installed capacity (MW)	Indicative output (GWh/yr)
Lock	0.175	0.6
Waterfall	0.05	1.6
Weir	1.54	4.9
Unknown	0.04	0.1
Total	**1.8**	**5.8**

Table 39 Potential hydropower resources in Newport

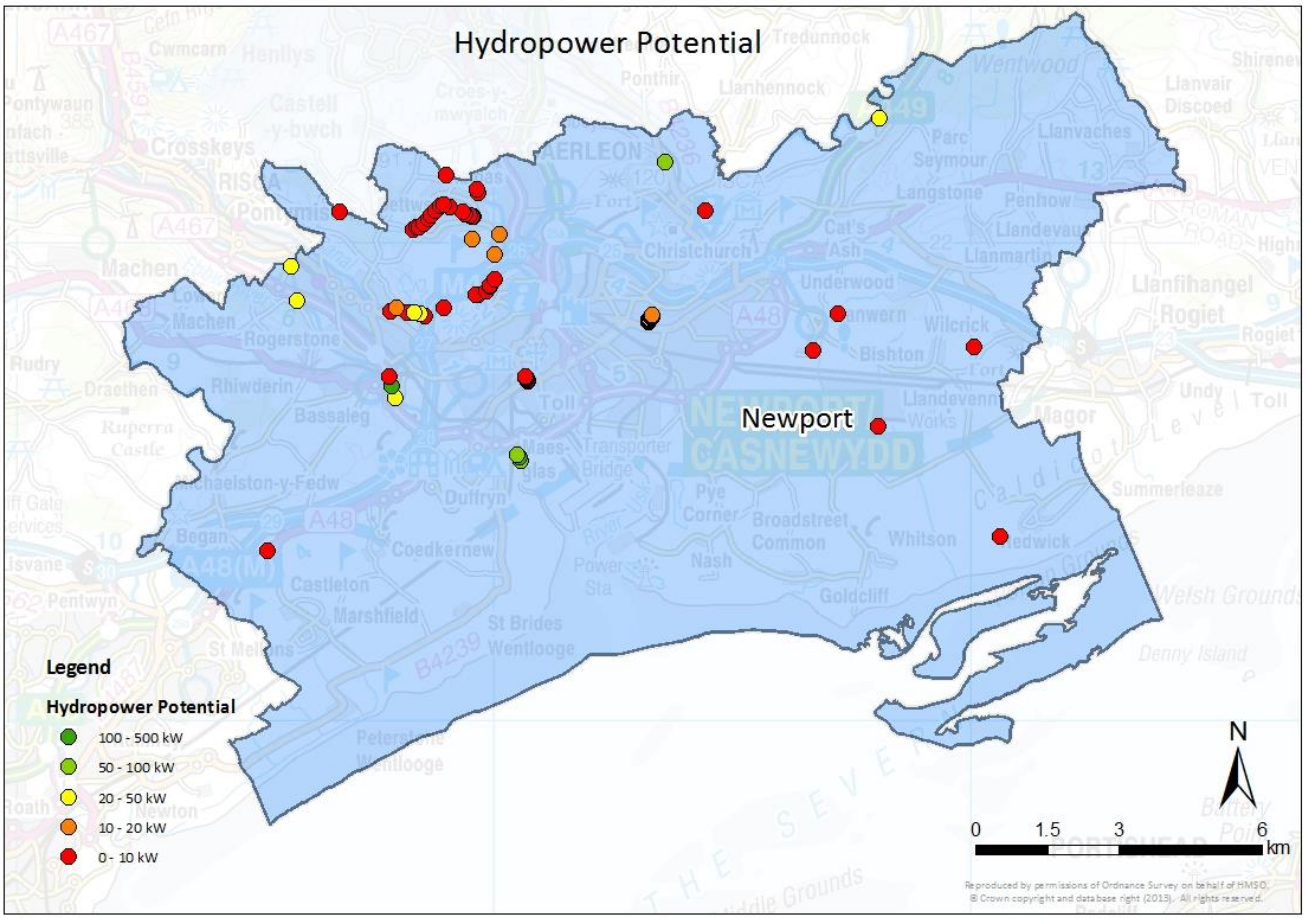


Figure 31: Potential hydropower sites in Newport

9.7 Newport - Buildings integrated renewable uptake assessment

For this section, the method is based on scaling the uptake results for Pembrokeshire, for renewable energy BIR for heat and electricity, on a pro-rata basis depending on the level of existing and projected new build development in the area compared to that assumed for Pembrokeshire. Table 40 presents the results obtained. The number of existing dwellings has been extracted from statswales.wales.gov.uk. The average number of future dwellings

This analysis follows the simplified method contained in the Toolkit which is based on scaling the results of the Pembrokeshire by projected completions of new dwelling and floor area of non-domestic development (see section E2.3 of the Toolkit for further details). Table 40 presents the results obtained. The number of existing dwellings has been extracted from statswales.wales.gov.uk. The average number of future dwellings and annual average new floor area has been provided by Newport City Council.

This simplified methodology is undoubtedly very crude and thus the results need to be considered as indicative only.

Row no.	Newport City Council		Units
1	**Existing dwellings and non-residential buildings**		
2	No. of existing dwellings in Pembrokeshire	55,592	
3	No. of existing dwellings in Newport	63,070	
4	Calculate EDR	1.1	
5	Predicted RE electricity capacity for Pembrokeshire by 2020	2.2	MWe
6	**Predicted RE electricity capacity for Newport by 2026**	**2.5**	**MWe**
7	**Future dwellings**		
8	No. of average net annual completions assumed for Pembrokeshire	585	
9	No. of average net annual completions planned for Newport	690	
10	Calculate NDR	1.2	MWe
11	Predicted RE electricity capacity for Pembrokeshire by 2020	4.3	MWe
12	**Predicted RE electricity capacity for Newport by 2026**	**5.1**	**MWe**
13	**Future non-residential buildings**		
14	Future new non-residential average annual new floor area assumed for Pembrokeshire by 2020	56,000	m^2 GIFA

15	Future new non-residential average annual new floor area estimated for Newport to 2020*	58,600	m^2 GIFA
16	Calculate FNR	1.0	
17	Predicted RE electricity capacity for Pembrokeshire by 2020	6.3	MWe
18	**Predicted RE electricity capacity for Newport by 2026**	**7**	**MWe**
19	**Totals**		
20	**Total predicted new BIR RE electricity capacity for Newport by 2026**	**14**	**MWe**
21	Existing BIR RE electricity capacity in Newport	3	MWe
22	**Total predicted new and existing BIRRE electricity capacity for Newport by 2026**	**17**	**MWe**

Table 40: Predicting level of BIR renewable electricity uptake by 2026 for Newport CC

9.8 Newport – Summary of renewable energy potential

Newport CC projected electricity demand for 2026 is 863 GWh/yr. The largest area for potential is onshore wind, with a total potential of 113 GWh/yr, followed by solar PV (both ground and roof mounted), and with a total combined potential of 79 GWh/yr. Approximately 8% of the total renewable resources are being exploited at present (excluding waste), with the largest contribution from wind energy.

Waste materials from Newport are currently exported out of the authority for treatment elsewhere and thus any energy recovery currently undertaken is not shown. As a small authority, waste contracts are always likely to be in partnership with other councils to achieve economies of scale, as is the case currently. Newport's MSW will soon be treated at the Trident Park waste to energy facility as part of the 25 year Prosiect Gwyrdd contract. Note that the energy for waste figure is largely driven by commercial and industrial waste, for which the data is approximate.

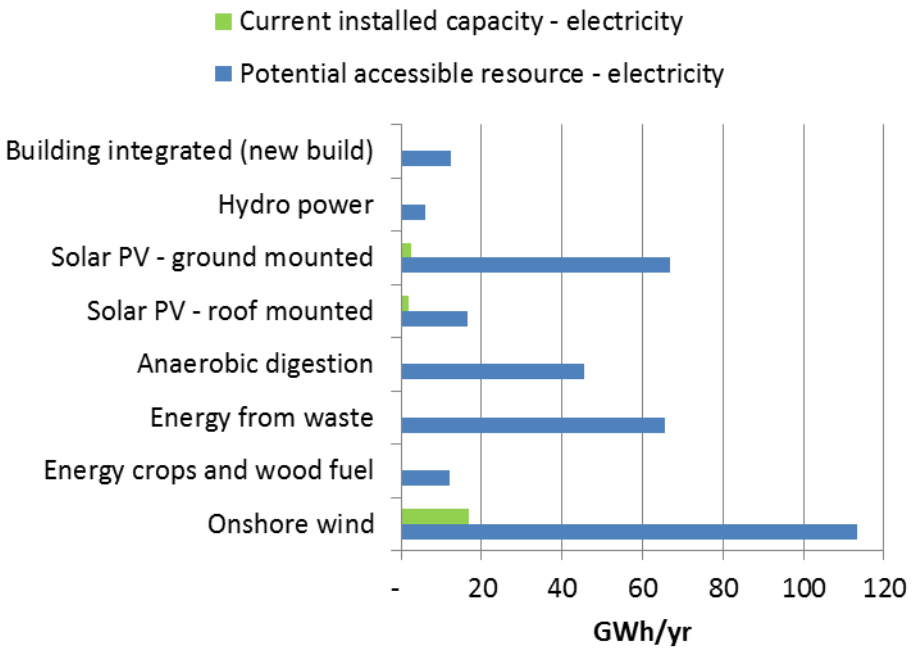


Figure 32: Newport – summary of renewable electricity potential and current installed capacity

Energy Type	Capacity Factor	Potential Accessible Resource		Current Installed Capacity		Target Scenarios for 2026			
						Low (50%)		High (75%)	
		MWe	GWh	MWe	GWh	MWe	GWh	MWe	GWh
Onshore Wind	27%	48	113	7.1	17	24	57	36	85
Energy Crops	90%	1.5	12			0.8	6.0	1.1	9.0
Energy from Waste	90%	8.3	65			4.2	33	6.2	49
Anaerobic Digestion	90%	5.8	46			2.9	23	4.3	34
Solar PV – ground mounted	9%	21	17	2.5	2.0	10	8.3	15	12
Solar PV – roof mounted	9%	84	67	3.0	2.4	21	17	42	34
Hydro Power	37%	1.8	5.9			0.9	2.9	1.4	4.4
Building Integrated	10%	14	12			7.0	6.1	11	9.2
Total		**184**	**338**	**13**	**21**	**71**	**152**	**117**	**237**
Newport electricity demand projected in 2026						**863**			
Percentage electricity demand in 2026 potentially met be renewable energy sources							**18%**		**27%**

Table 41 Resource summary for renewable electricity for Newport CC

** 'Capacity factor' refer to the typical annual energy output divided by the annual energy output if plant generated at full capacity for the entire year. Annual output can be calculated by multiplying its installed capacity by its capacity factor and the number of hours in a year. In practice the capacity factor will vary from project to project, and these are typical figures for viable installations.*

9.8.1 Renewable heat

This study has identified a total potential of renewable heat of 621 GWh/yr. The largest potential heat generation resource is energy from waste, with a potential 512 GWh/yr, followed by energy crops and wood fuel. This compares with a projected heat demand for the authority in 2026 of 1,810 GWh/yr. Note that the energy for waste figure is largely driven by commercial and industrial waste, for which the data is approximate.

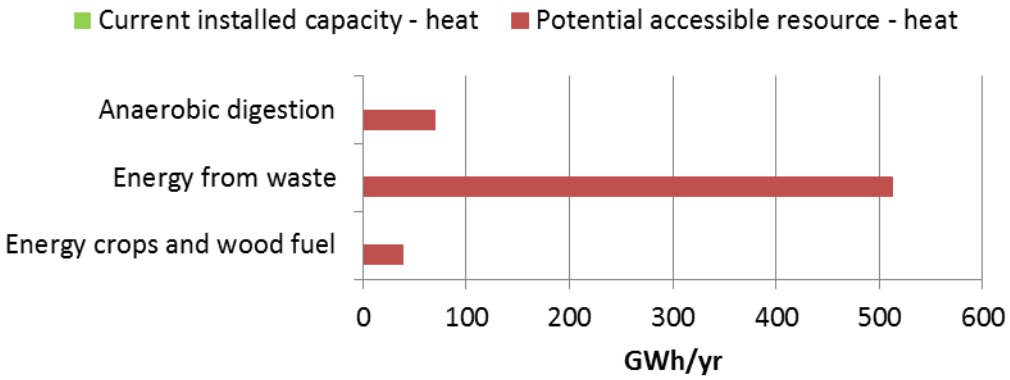


Figure 33: Newport – summary of renewable heat potential and current installed capacity

Energy Type	Capacity Factor	Potential Accessible Resource		Current Installed Capacity		Target Scenarios for 2026			
						Low (50%)		High (75%)	
		MWth	GWh	MWth	GWh	MWth	GWh	MWth	GWh
Energy Crops	90%	5.0	39	-	-	2.5	20	3.7	29
Energy from Waste	90%	65	512	-	-	33	256	49	384
Anaerobic Digestion	90%	8.8	70	-	-	4.4	35	6.6	52
Total		**79**	**621**	**0**	**0**	**39**	**311**	**59**	**466**
Newport heat demand projected in 2026						**1,810**			
Percentage heat demand in 2026 potentially met be renewable energy sources							**17%**		**26%**

Table 42: Newport - summary of renewable heat potential and current installed capacity

9.8.2 Renewable energy targets to 2026

The Toolkit recommends that 'High' and 'Low' target scenarios be calculated as 50% and 75% of the total potential. We have followed this guidance with the exception roof-mounted solar PV - where we have assumed lower figures of 25% and 50% respectively, panels would be deployed principally on private roofs, requiring significant investment by building owners.

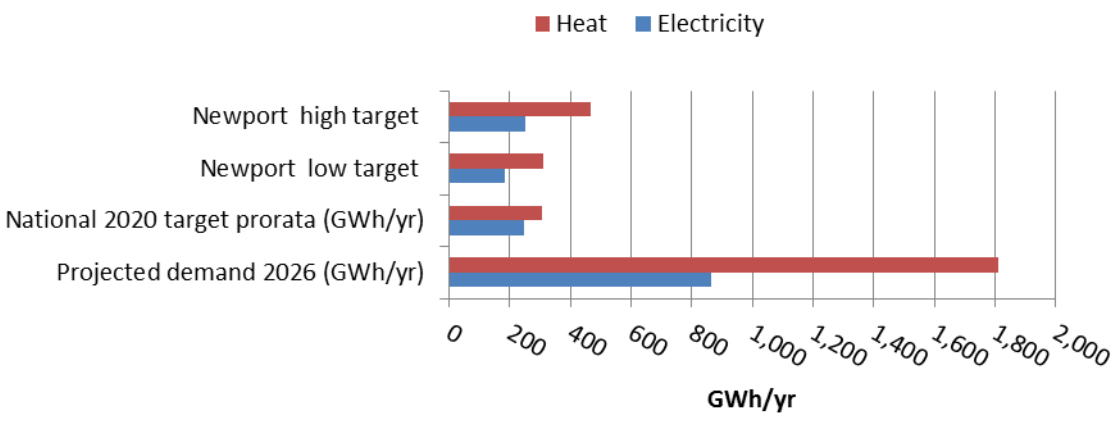


Figure 34: Newport renewable energy potential and proposed targets to 2026

Figure 34 above compares the target scenarios against the UK renewable energy targets on a pro-rata basis (see section 3.3 for calculation) and also Newport's projected energy consumption in 2026. The national target falls between the high and the low scenario targets, indicating that there is good potential for Newport to achieve its 'share'.

Note however that significant proportion of the renewable heat potential, and lesser extend electricity is founded on the energy from waste resource, itself largely based on commercial and industrial arises. Further work would be required to establish the extent to which this resource is exploitable.

Target summary	Projected demand 2026 (GWh/yr)	National 2020 target prorata (GWh/yr)	Newport low target	Newport high target
Electricity	863	247	182	250
Heat	1,810	308	311	466
Total	**2,673**	**555**	**493**	**716**

Figure 35: Newport– Renewable energy target scenarios comparisons

10. Newport - Strategic development sites

This section contains high level analysis of four strategic development sites in Newport, identified by the Council. The purpose is to assess the energy needs of the proposed development and consider opportunities for low carbon and renewable energy technologies.

10.1 Description and location of sites

The approximate locations of the four sites are denoted by the yellow stars in the figure below. The sites are at various stages of development, ranging from outline planning (Llanwern) through to construction in progress on the first phase (Glan Llyn).

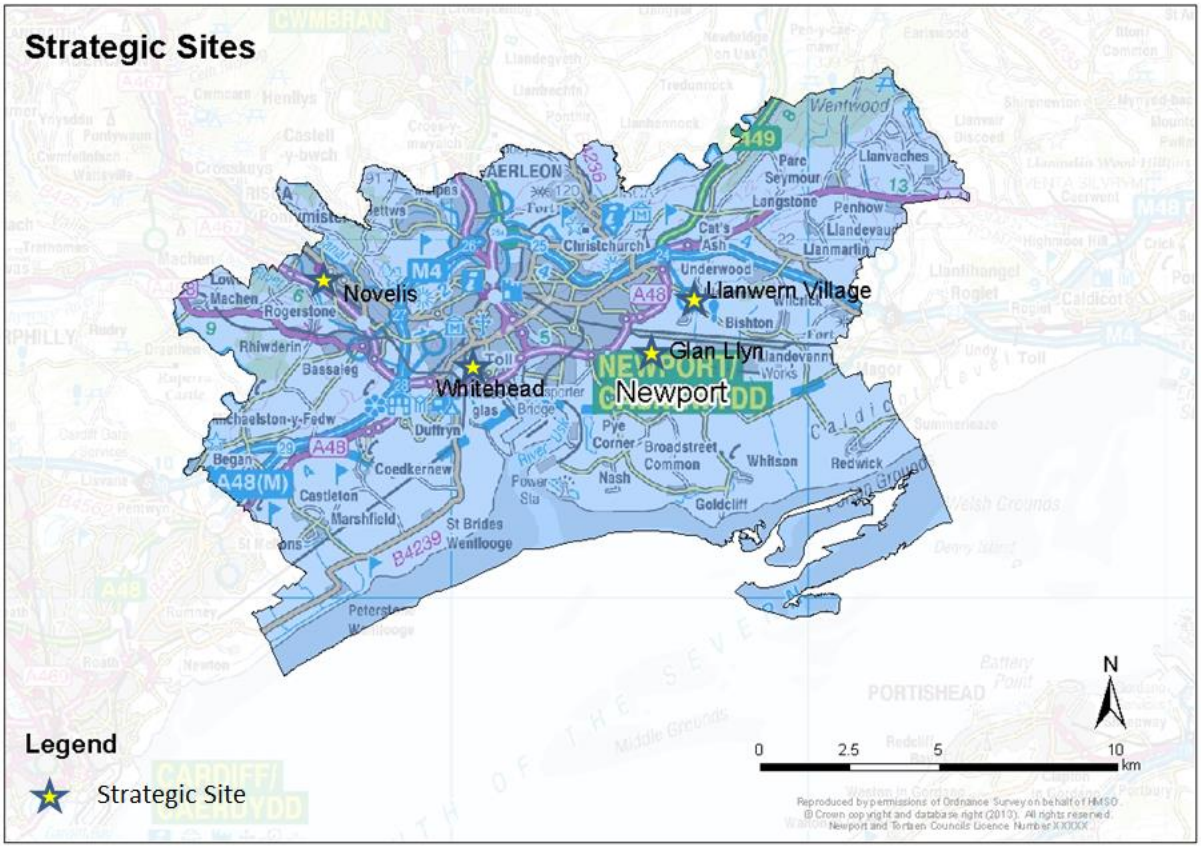


Figure 36 Strategic sites in Newport CC

A summary of the key parameters and findings for each site is shown on the table on the next page, and the assumed area schedules and phasing are presented in Appendix E. Glan Llyn is by far the largest site, with projected energy consumption greater than the other three sites put together.

Site name	Status	Projected energy demand and carbon emissions			Key opportunities
		Electricity (MWhe/yr)	Heat (MWht/yr)	(tCO2/yr)*	
Glan Llyn	First phase under construction	27,484	29,150	21,532	- Roof mounted solar PV - Ground mounted solar PV and wind near site - Biomass heating of public buildings - Heat pumps for later residential phases (~post 2020).
Llanwern Village	Outline planning application	3,754	3,501	2,823	- Roof mounted solar PV - Ground mounted solar PV near site. - Biomass heating of public buildings - Heat pumps for later residential phases (~post 2020).
Whitehead	Concept stage	6,476	12,994	6,584	- Roof mounted PV - CHP/biomass for new hospital, possible extension to cover employment areas and flats.
Novelis	Planning application	3,745	3,611	2,845	- Roof mounted solar PV - Biomass heating of public buildings - Heat pumps for later residential phases (~post 2020).
Total		**37,852**	**49,281**	**31,907**	

Table 43: Summary of Newport CC strategic sites

** Carbon emissions are calculated using 2013 carbon factors assuming grid electricity and gas heating. In practice grid carbon intensity is projected to decrease significantly over the build out period.*

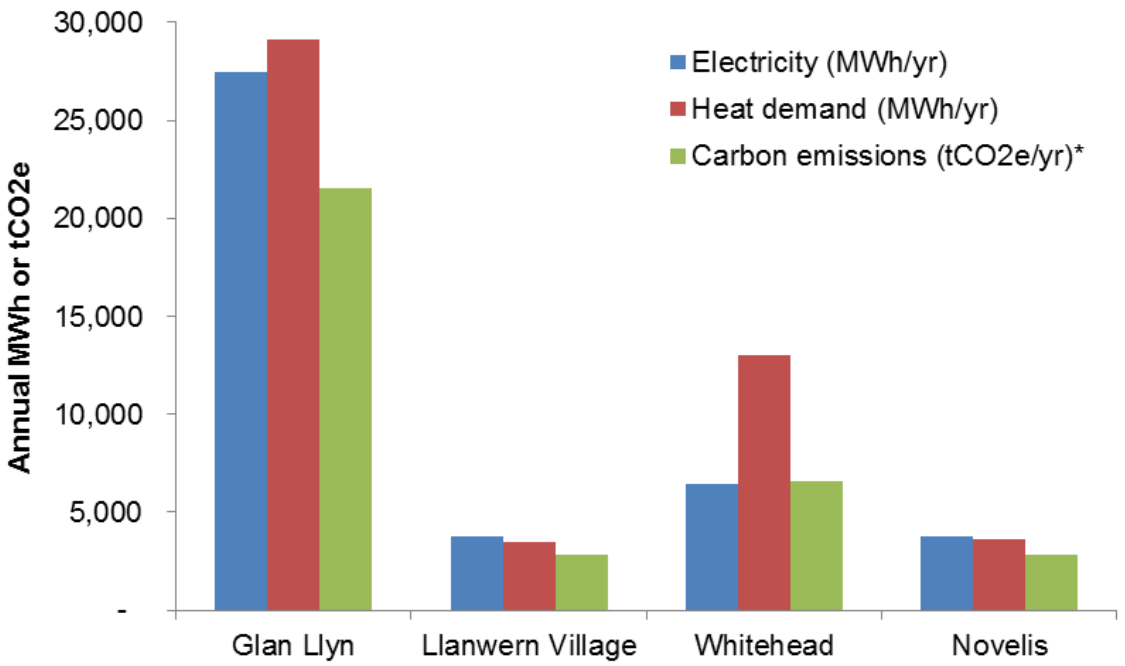


Figure 37: Projected energy demand and carbon emissions of Newport's strategic sites fully built out

10.2 Site 1: Glan Llyn

The Glan Llyn site is owned by St Modwen who have obtained planning consent for a mixed use development, which includes 4,000 new homes including a new local centre with schools, library, police station, district centre, doctor's surgery and extensive amenity and sports space.

The masterplan is divided into four phases, with the residential development commencing at the western end of the site, while the employment area forms a buffer to the existing steelworks at the eastern end.

The first residential plot of 311 units is under construction in partnership with house builder Persimmon. Full completion of the masterplan is anticipated by 2026-8.

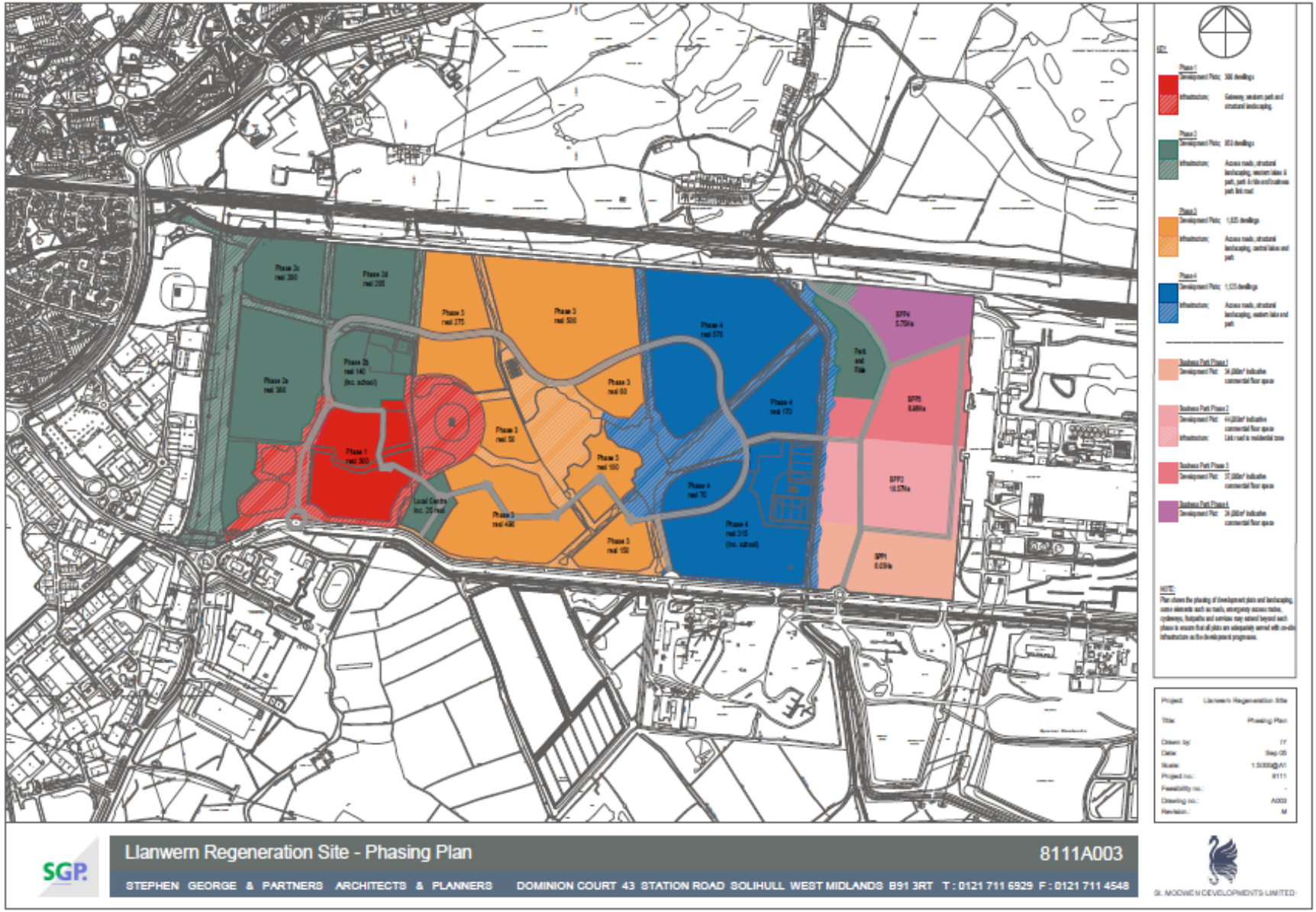


Figure 38 Glan LLyn master plan, Source: St Modwens.

10.2.1 Energy demand estimate

Left-hand Figure 39 below shows the breakdown of the estimate heat and electricity consumption of each plot when fully built out. It can be seen that residential and employment areas dominate, while the public buildings and civic amenities account for only a small proportion of the projected energy demand. The right-hand Figure 40 shows the expected growth in heat demand over the build out period.

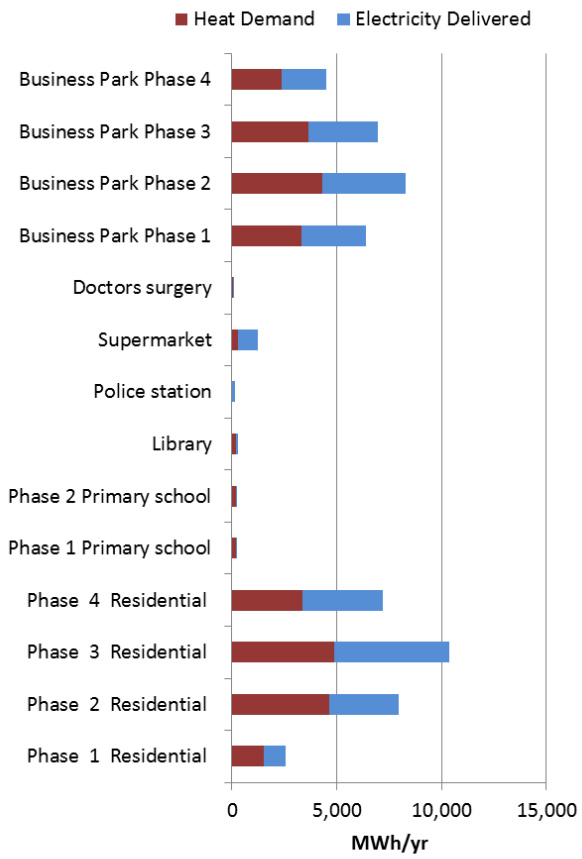


Figure 39 : Glan Llyn energy demand estimate – fully built out

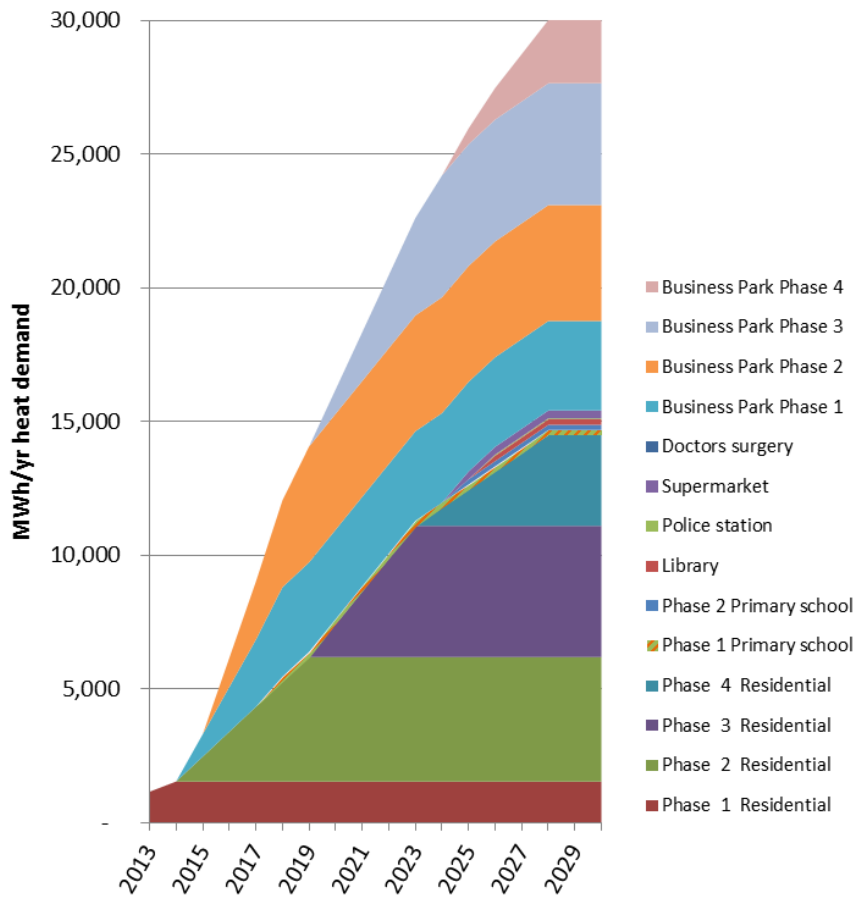


Figure 40: Glan Llyn estimated heat demand growth profile

10.2.2 Key opportunities

The Council has limited scope to influence Glan Llyn as the site is owned by St. Modwen and already has outline planning permission. However, the key energy opportunities are as follows:

- There are no major heat sources or loads within the emerging master plan or in the vicinity of the site, and the residential development is low density. This suggests that the most effective energy strategy to be based on 'high fabric specification/micro-generation' approach, which will also deliver low energy costs for the occupants.
- The site has good solar access, and being close to the coast, also particularly high levels of irradiation (see Figure 56 in Appendix B). Combined with large areas of low density residential development and commercial development, the site presents considerable opportunity for solar PV. There could also be an opportunity for a roof or ground mounted array with private wire connection to a commercial user in the employment area. The combined installed capacity of the three types of system could be in the region of 15 MW, the annual output of which would be approximately half the electrical consumption of the complete site.
- There are no obvious anchor loads within the development for a communal heating system. The proposed public buildings are relatively small and are not energy intensive. The density of heat demand is likely to be low in any case, due to the high fabric specification of buildings and relatively low density.
- Biomass heating for individual public buildings (or perhaps small clusters of buildings in close proximity) could be worth further consideration subject to review of heat densities.
- Heat pumps may be an attractive option for the later residential phases, owing to tight fabric specifications and the lower grid carbon factor by that time. If ground source heat pumps are to be used, ground conditions will have to be checked at an early stage, given the industrial heritage of the site.
- There are potential wind sites to the east of the development area. This could present opportunities for a private wire connection to power intensive employment activities.

Technology	Suitability	Technical potential		Financial parameters		Comment
		(MW)	(MWh/yr)	Capex (£m)	Indicative IRR	
Domestic solar PV		6.00	4,800	6.6	10%	Average 1.5kW per unit
Non-domestic solar PV		6.3	5,074	7	10%	Assumption that PV area is on average 25% of the floor area (all new buildings)
Ground mounted solar PV		5	4,000	4.75	10%	Typical parameters for a 5MWe solar farm.
Heat Pumps		14	3,930	8.3	/	5kW per unit for houses in phases 3 and 4.

Table 44: LZC opportunities for Glan Llyn

10.2.3 Design and layout implications

- Masterplan lay out to facilitate passive design techniques and optimise roof orientation (45° of south) and space for solar PV. Particular attention will need to be paid to the north-south streets, which will tend to lead to E-W facing houses.
- A predominantly southerly aspect can also assist with passive design layout of houses, to allow summer shading whilst avoiding potential overheating due to large east and west facing windows which are hard to shade due to the low angle of the sun.
- Avoid overshadowing of roofs in areas of development with a mix of building heights.

10.2.4 Recommended actions

- Share the findings of this analysis with St. Modwen.
- Require an energy strategy with in the planning applications of future phases.

10.3 Site 2: Llanwern Village

10.3.1 Site description

The Llanwern Village area is situated in the Northern part of the East Expansion Area. Gallagher Estates was granted outline planning permission in 2007 for an urban extension of 1,100 dwellings and a primary school set within landscaped public space. There is to be 23% affordable housing.

Two development phases are proposed, with 350 dwellings in phase 1 (up to 2016) and 750 in phase 2 (2017-2021). It is the smallest of the four strategic sites.

Figure 41 Llanwern village master plan

10.3.2 Energy demand

The site is almost entirely residential. Heat demands are therefore expected to be relatively small and dispersed, being predominantly domestic hot water loads. Space heating loads should be relatively modest owning to the high building fabric specification by the time the development proceeds.

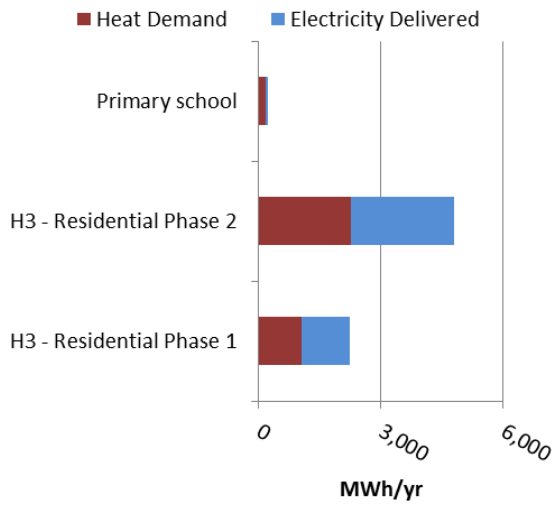


Figure 42: Llanwern Village energy demand fully built out

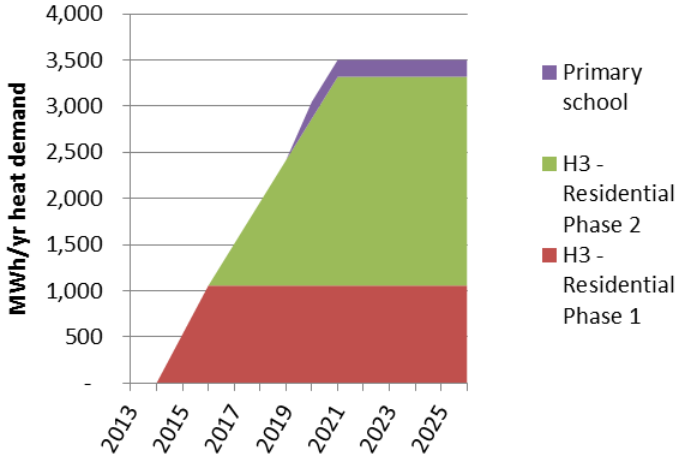


Figure 43: Llanwern Village heat demand growth

10.3.3 Key opportunities and conclusions

Llanwern Village has a similar development mix to the residential areas of Glan Llyn and the Novelis site. The energy opportunities are therefore of a similar nature.

- There are no major heat sources or loads within the emerging master plan or in the vicinity of the site, and the residential development is low density. This suggests that the most effective energy strategy to be based on 'high fabric specification/micro-generation' approach, which will also deliver low energy costs for the occupants.
- The site is to accommodate 23% affordable housing. If some of this is in apartment blocks there could conceivably be an opportunity for biomass heating/mini gas CHP, maintained by the housing associate.
- The site has good solar access and an excellent solar resource being close to the coast (see Figure 56 in Appendix B). There is already a 2.5MW solar farm nearby. Some of the plots on the southern extremity of the site are on a shallow north facing slope, which may restrict solar access for area and increase risk of over shading.
- Heat pumps may be an attractive option for the residential plots in the second phase, owing to tight fabric specifications and the lower grid carbon factor by that time. The site does not have the same industrial heritage as the other strategic sites, which should mean that there are no constraints for ground loops due to ground contamination.

Technology	Suitability	Technical potential		Financial parameters		Comment
		(MW)	(MWh/yr)	Capex (£m)	Indicative IRR	
Domestic solar PV		1.65	1,320	1.82	10%	Average 1.5kW per unit on both phases.
Biomass heating (MWth)		0.1	131	0.08	/	Biomass heating to school
Heat Pumps		3.75	1,659	2.25	/	5kW per unit for phase 2 houses only.

Table 45: Llanwern Village – LZC options

10.3.4 Design and layout implications

- Masterplan lay out to facilitate passive design techniques and optimise roof orientation (45° of south) and space for solar PV. Particular attention will need to be paid to the north-south streets, which will tend to lead to E-W facing houses.
- A predominantly southerly aspect can also assist with passive design layout of houses, to allow summer shading whilst avoiding potential overheating due to large east and west facing windows which are hard to shade due to the low angle of the sun.
- Avoid overshadowing of roofs in areas of development with a mix of building heights.

10.3.5 Recommended actions

- Share the findings of this analysis with Gallagher Estates.
- Require an energy strategy as part of the detailed planning application.

10.4 Site 3: Whitehead

10.4.1 Site description

The 21.4 Ha Whitehead site is owned by the Welsh Government and is allocated for residential and commercial uses. The adjacent 20.6Ha MonBank site is owned by Redrow. A masterplan for the MonBank site has been prepared with comprises 700 low-density residential units and commercial use.

The site is adjacent to Aneurin Bevan Health Board's Royal Gwent hospital and the Council is keen to safeguard land for its eventual replacement. The Specialist Care functions of the Royal Gwent Hospital are to be relocated to the Llanfrechfa site, thus the replacement hospital if built is likely to be smaller than the existing facility.

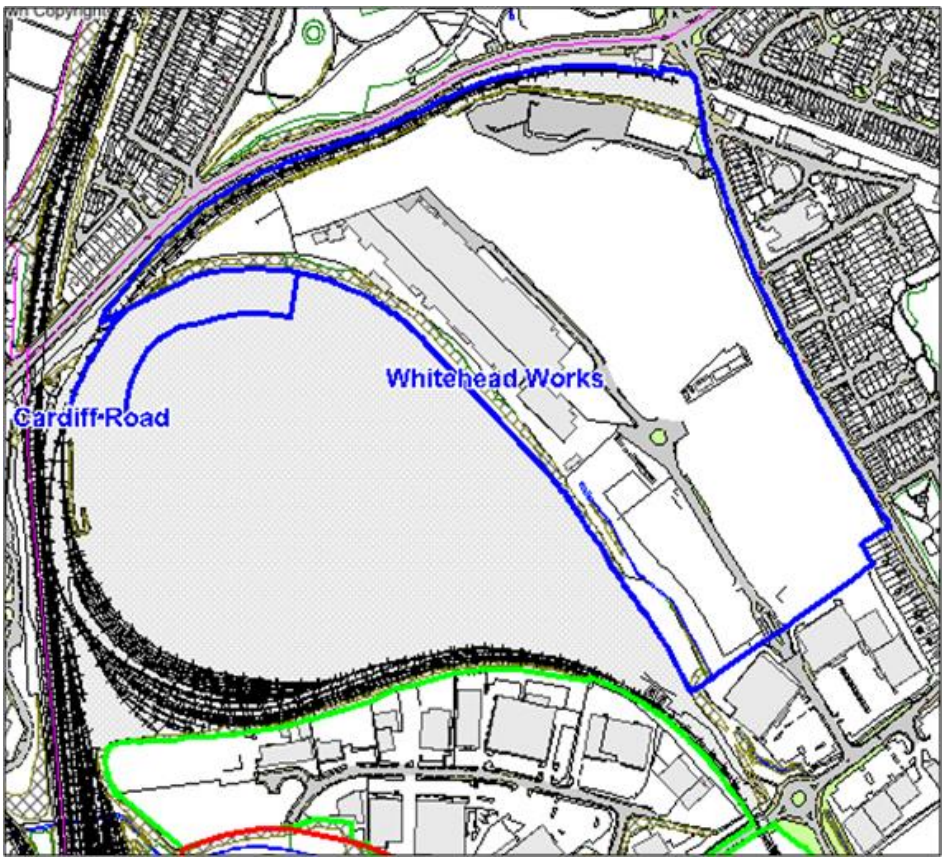
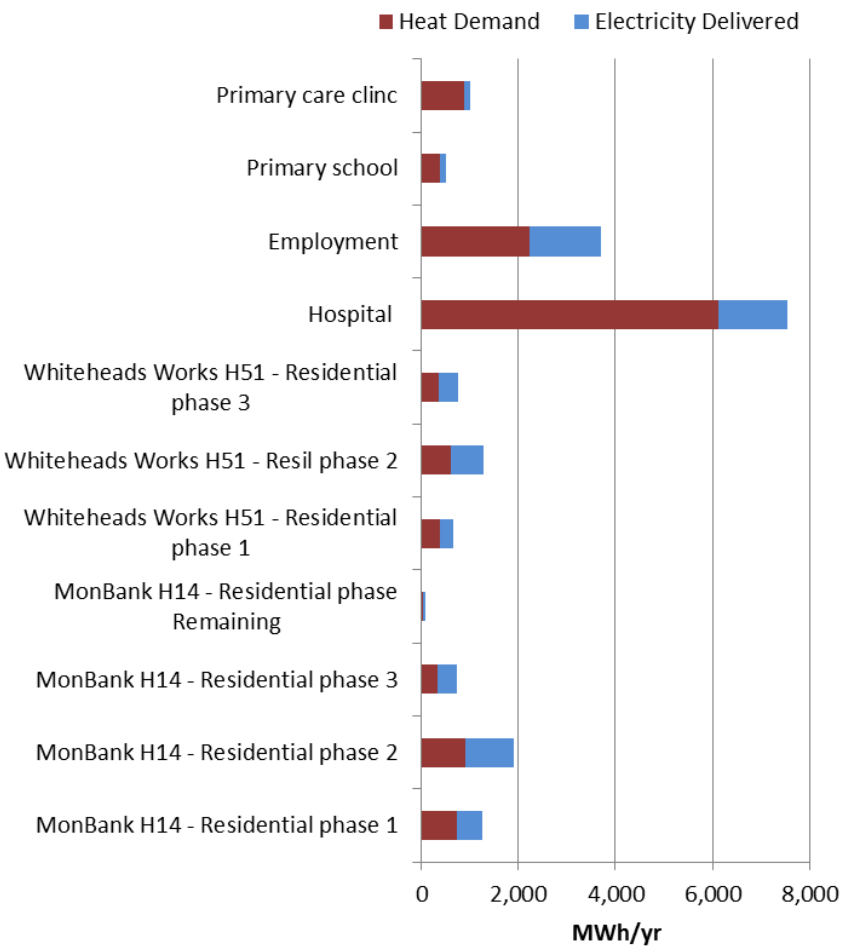


Figure 44 Site location plan

10.4.2 Energy demand estimate



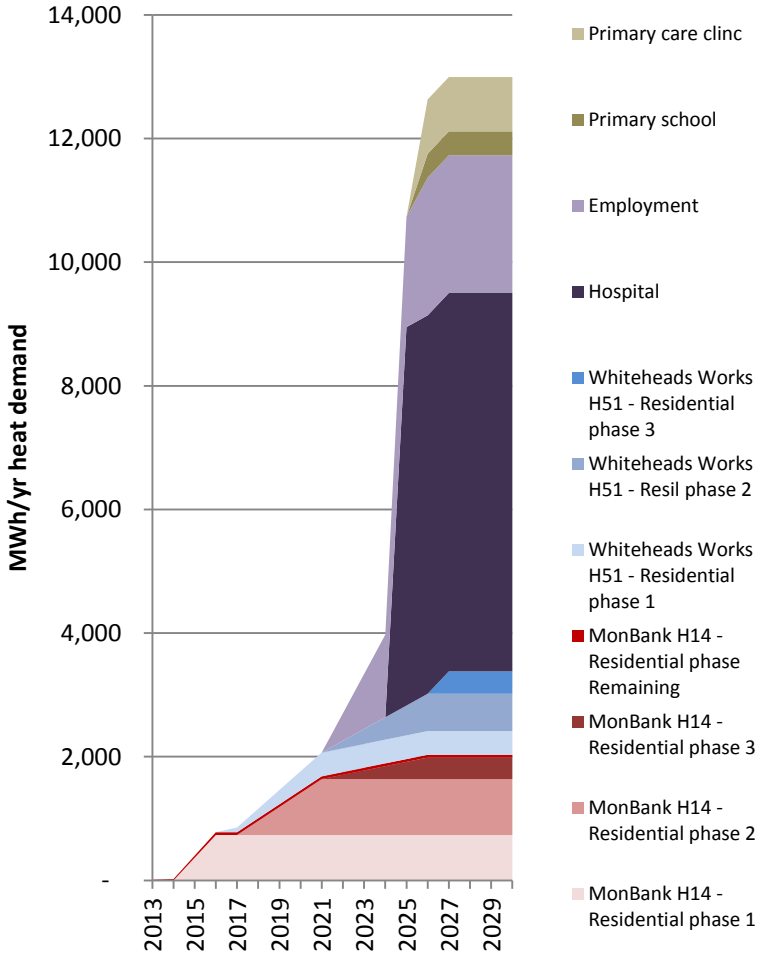


Figure 45 Whitehead energy demand estimate – fully built out

Figure 46 Whitehead estimated heat demand and growth profiles

The bar chart above shows the expected electricity and heat demand of the development fully built out. The adjacent graphic shows how the heat demand is expected to grow over the build out period. The hospital and related employment areas are likely to be two largest energy users on site.

10.4.3 Key opportunities

In contrast to the predominantly residential nature of the other three strategic sites, Whitehead is mixed use site in Newport city centre. Key opportunities are:

- Gas-fired CHP within the new hospital, with an approximate electrical capacity of 500kWe.
- Biomass heating may also be an option for the hospital, either operating alongside the CHP in the heating season or instead of the CHP. However the city centre location may make it problematic due to considerations of space, air quality and transport impacts of fuel delivery.
- The hospital energy centre could be an anchor scheme to serve other areas of the site. We estimate that a communal energy system based on a 750kWe CHP unit supplying all the non-domestic areas of the site would cost in the region of £3m. There may be a case for connecting residential apartments to such a system, if any are planned. This system would have to be managed by an ESCo, either one set up as part of the project or tendered to a private ESCo company.
- Options for expansion of such a system to supply other local loads appear limited. The site is located approximately 2km from the town centre, and is surrounded by out of town retail parks and low density residential areas. It is also bordered by railway lines and a B-road. The Royal Gwent hospital is of course a major energy user, however the new hospital (and the SCCC at Llanfrechfa) is to replace this.
- Roof mounted solar PV on all buildings. The site has good solar access and an excellent solar resource being close to the coast (see Figure 56 in Appendix B).

Technology	Suitability	Technical potential		Financial parameters		Comment
		(MW)	(MWh/yr)	Capex (£m)	Indicative IRR	
Domestic solar PV		1.47	1,176	1.62	10%	Average 1.5kW per unit
Non-domestic solar PV		0.9	739	1.02	10%	Assumption that PV area is on average 10% of the floor area (mostly existing buildings).
CHP (MWe)		0.5	3,066	0.35	/	Hospital CHP unit operating year round.
Hospital biomass heating (MWth)		0.5	1,314	0.31	/	Biomass heating to hospital in heating season. Space, air quality and fuel transport issues may make it unsuitable for this site.
Gas CHP and heat distribution to all non-domestic areas		0.75	4,500	2.9	/	1km of network serving all non-domestic loads on site, 750kWe CHP, 3.5MWe gas boilers, 900m2 energy

of site.						centre, 3.5MW of consumer connections

10.4.4 Design and layout implications

- For all plots, consider a master plan lay out to facilitate passive design techniques and optimise roof orientation (45° of South) and space for solar PV.
- If a communal system is to be pursued, group heat users together within the masterplan, consider infrastructure routing and allocate a location for the energy centre.

10.4.5 Recommended actions

- Undertake a feasibility study and costs and benefit analysis of the communal system, once the masterplan and phasing becomes more certain.
- If studies are positive, undertake a soft marketing exercise to gauge market interest in delivering the scheme.

10.5 Site 4: Novelis

10.5.1 Site description

The Novelis site covers the extensive area of the former Novelis/Alcan factory works site within Rogerstone, north-west of Newport. Most recently, the site was an aluminium factory operational for over 70 years before closing in April 2009. Prior to this it is understood the site formed iron and copper works. Most buildings and structures occupying the site have already been demolished and some work to remediate the site has been completed. The site covers an area of approximately 40 hectares.

A planning application has been submitted by Walters Land (Rogerstone) Limited in 2012, which includes the name 'Jubilee Park' for the site. When complete the proposed scheme will provide:

- Up to 925 new homes
- A new primary school
- A neighbourhood centre to include community/shopping facilities
- The re-use of Mandrake House for housing use
- The re-use of the existing 'Drill Hall' for community uses

Dwellings will be Code for Sustainable Homes level 3 compliant as a minimum. Further detail on this will be determined during the reserved matters planning applications, however, it is envisaged that renewable energy sources will be required to achieve this.

The development will be delivered in four phases. Phase 1 is from 2011 – 2016 and involves the northern parcel of the site; phase 2, from 2017 – 2021, is to the west; phase 3, from 2022 – 2026, runs west to east through the centre of the site, and phase 4 is the south east parcel of the site. The community facilities are currently excluded from the phasing plan in order that they may be delivered as appropriate during the course of the development.

Figure 47 Novelis Housing Phase plan

10.5.2 Energy demand estimates

The diagram below shows the indicative heat and electricity demand for this site. Residential development accounts for the vast majority of the energy demand, which is predicted to grow gradually over the build out period as homes are completed and occupied.

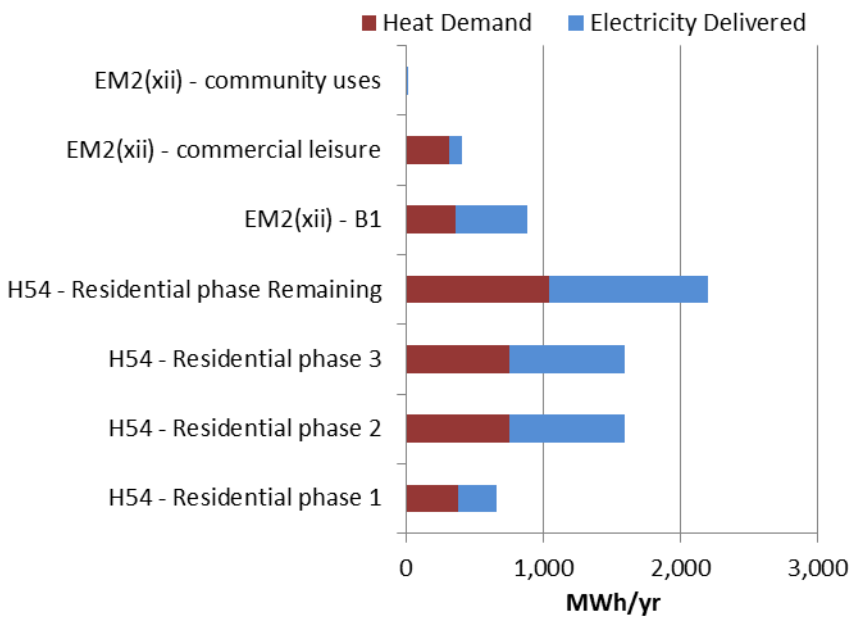


Figure 48 Novelis energy demand estimate

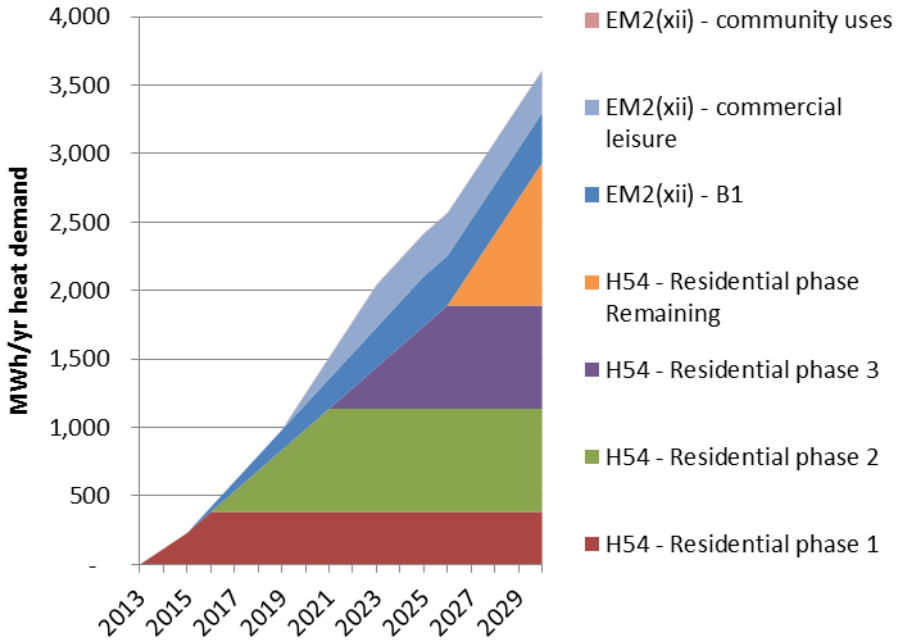


Figure 49 Novelis heat load growth estimates

10.5.3 Key opportunities and conclusions

- There are no major heat sources or loads within the emerging master plan or in the vicinity of the site, and the residential development is low density.
- Ground source heat pumps may not be suitable depending on the ground conditions, given the industrial heritage of the site, having previously been used as an aluminium works. However, they could still be worth investigation.
- The site has good solar access, with the land to the north east along Tregwilym Road elevate above the site, and there is a good opportunity for solar PV on the roofs of the non-domestic buildings, which is likely to achieve improved economies of scale over domestic installations.
- The Ebbw River flows along the SW boundary of the site. There is very little gradient to river, and hence energy generation potential. The Environment Agency hydropower study identifies one potential resource of 20-50kW at a small weir 800m upstream of the site (see section 9.6). This is very unlikely to be economic to develop at present and it too far for private wire connection to the site.

Technology	Suitability	Technical potential		Financial parameters		Comment
		(MW)	(MWh/yr)	Capex (£m)	Indicative IRR	
Domestic solar PV		1.05	840	1.16	10%	Average 1.5kW per unit
Non-domestic solar PV		0.5	397	0.55	10%	Assumption that PV area is on average 10% of the floor area.
Heat Pump		3.5	2,254	2.1	/	5kW per unit for houses only

Table 46 Novelis LZC technology options

10.5.4 Design and layout implications

- The residential component of the development is likely to be relatively low density, suggesting a microgeneration approach to be most suitable; in particular, solar PV as the site has reasonable solar access. There is an opportunity to maximise roof area and optimise orientation to ensure a SE-SW orientation for panels is provided. The predominantly SE-NW axis of the road network should allow this orientation.
- For the non-domestic buildings, similar principles apply, but careful attention should be given to avoiding overshadowing of roofs in areas of the development with a mix of building heights, and to minimising roof obstructions.
- Heat pumps may be an attractive option for the later phases, owing to tight fabric specifications and the lower grid carbon factor by that time. If ground source heat pumps are to be used, ground conditions will have to be checked at an early stage, given the industrial heritage of the site.

10.5.5 Recommended actions

- Share this analysis with the Walters Land (Rogerstone) Limited.
- Require an energy strategy for reserved matter applications. Review reserve matter applications for adherence to the above

11. Urban heat network opportunities

The heat map of both authorities is shown in Appendix B9. The figure below illustrates the findings of the heat mapping exercise around the Newport area. This figure highlights that the highest heat density of 6,932 kW/km^2. The three areas of high heat density are all located in the centre of town situated adjacent to the River Usk which would be a potential barrier to the installation of district heating infrastructure. This is no great surprise as the centre of Newport is a dense urban environment.

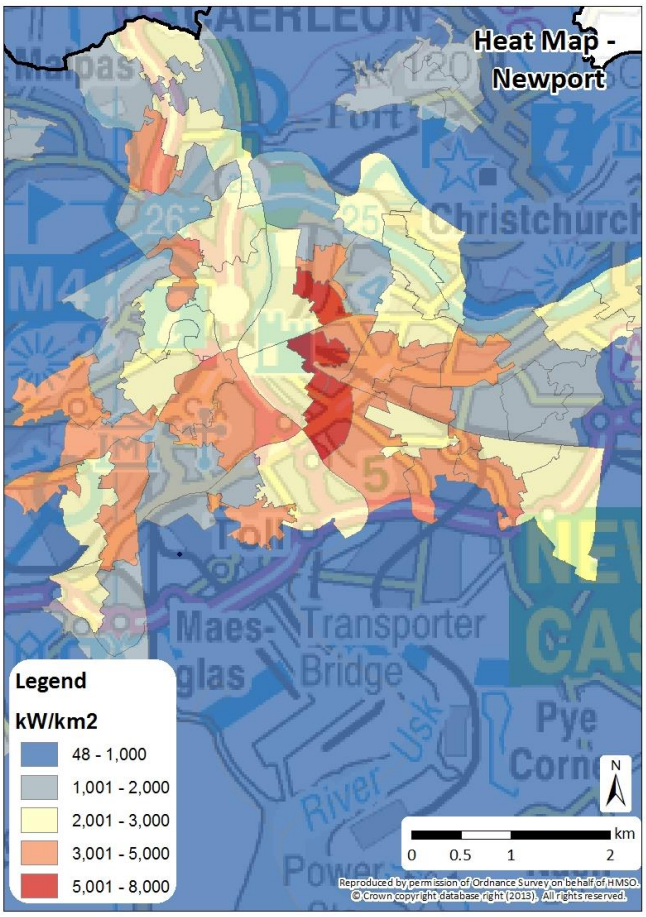


Figure 50: Heat map for Newport

There is one existing district heating system in Duffryn managed by Newport City Homes, which supplies heat to 100 dwellings.

There are two major power stations at Uskmouth, approximately 5km from the town centre. Severn Power was only commissioned in 2011 and thus this site will be a fossil fuel generation site for decades to come. With a combined electrical capacity of over 1.2GWe, these are a potentially very large source of waste heat, well in excess in the total heat demand of the authority. Reconfiguring the thermal power plants for district heating and installing the distribution infrastructure would be a major infrastructure project, but could be technically feasible.

The combination of a general high heat density, the existence of a large number of significant commercial and public buildings and also the existence of a large potential heat source means that it would be worth conducting a detailed heat network viability study for a scheme based in the centre of Newport, with consideration of the connection to one or other of the Uskmouth power stations.

12. Newport – Energy opportunity map and key opportunities

The energy opportunity map for Newport on the next page identifies, spatially, some of the key renewable energy resources available within the authority. It does not cover all resources, because some are assessed without reference to spatial distribution, e.g. building integrated renewables. Some opportunities are identified as indications of indirect resource, e.g. land class from which to infer suitability for biomass crops, and others are identified more directly, such as land that may be suitable for wind, solar or hydro power development.

The energy opportunity map also locates the strategic development sites to help identify where connections could be made.

From the map, analysis of strategic sites and exploration of urban heat networks we identify the following as important opportunities:

- The potential for **wind energy**, which is the largest potential renewable energy source, is located around the mouth of the Usk where there is precedent for development, in the north-eastern corner of the county, and also a number of plots of the land to the east of Glan Llyn and Llanwern Village.
- There is a significant resource potential for **land based solar PV** systems across the authority. The coastal areas have the best levels of irradiation, however all plots are 3km or more from the coast primarily due to ecological and agricultural constraints.
- The authority generally offers good **energy crop potential**, although most land is of agricultural standard which is unlikely to be economically viable, since landholders are likely to designate it for other purposes. Significant ribbons of Grade 4 land are identified alongside elements of the road network, which may offer interesting opportunities.
- There are potential opportunities for **heat networks** in the centre of Newport but should be reviewed at a high level to identify potential amenable anchor loads prior to committing to technical and economic viability analysis. The Uskmouth power stations are a huge potential source of waste heat that could be distributed to the city (approximately twice the total heat demand of the authority and seven times the total renewable heat potential). It would represent a major infrastructure project to harness this source, but it worth at least preliminary investigation given the scale of the opportunity.

As regards strategic sites:

- Glan Llyn and Llanwern Village are located near areas of potential for ground based solar PV and wind power. Solar farms could potentially be developed with private wire connection to the sites, particularly Glan Llyn which is may have large individual power consumers within the employment areas. Wind turbines would need to be ~ 1km or more from the new residential development, which reduces the scope for a similar connection, however again there could be possibilities for private wire connection to the employment area of Glan Llyn.
- There is no overlap between the areas of opportunity for heat networks and the strategic sites, however, if a viability study is conducted for central Newport this should give some consideration to the opportunity of connecting in the Whitehead development site, which is located approximately 2km from the city centre.

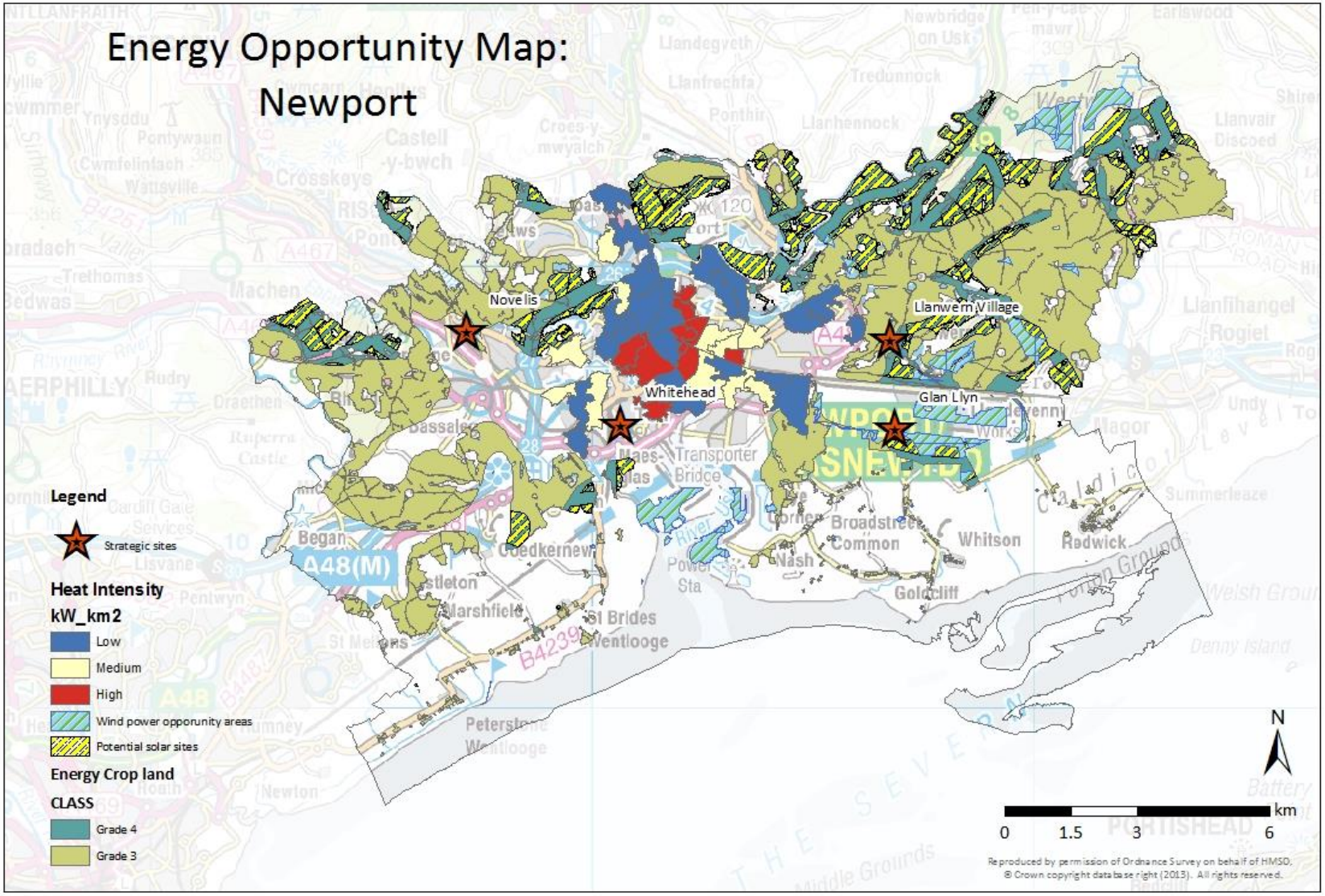


Figure 51

Energy Opportunity Map for Newport CC

PART III: RECOMMENDATIONS FOR STRATEGIC LEADERSHIP

13. Recommendations for strategic leadership

13.1 Rationale for supporting

There are a range of tangible drivers for supporting low carbon investment in addition to aims of reducing carbon emissions. Together these create significant incentives to invest in low carbon technologies, which will support delivery against the councils' economic growth and environmental objectives.

13.1.1 The high target scenario is valued at an investment opportunity of £264 million (excluding energy from waste) across the study area. Delivery of this is estimated to lead to job creation/retention of 7,000 job-years across the estimated lifetime of the projects[6]. The large majority (97%) of this employment would be associated with manufacture, construction and implementation of projects, but some long-term jobs would also be required for plant maintenance, operation and fuel supply activities. These employment numbers include those associated to manufacturing, a large proportion of which are unlikely to be located within the study area. A breakdown of the figures by authority and job types is shown in Appendix F.

13.1.2 Energy prices are set to rise substantially. Already, across the UK, one in four households is living in fuel poverty. This issue also affects business as continued increases directly affect profits and competitiveness. Energy security remains a critical issue for the UK economy with increasing volatility of energy prices. Local energy supply, particularly from renewable energy sources will mitigate volatility and increases the retention of benefits of energy expenditure within the local community.

13.1.3 There are policy drivers at national and international levels. The Climate Change Act places legally binding obligations on the UK to reduce its CO_2 emissions by 80% by 2050 over 1990 levels. The UK has also signed up to delivering 15% of its primary energy from renewable energy sources by 2020 in line with its commitments to the European Directive.

This is expanding the market for low carbon development across all technologies. A series of market mechanisms have been introduced to stimulate investment into clean energy to meet these targets. These include the Renewables Obligation (RO), the Feed in Tariff (FiT) and the Renewable Heat Incentive (RHI), Energy Company Obligation (replacing CESP and CERT) and Green Deal.

The Carbon Reduction Commitment Energy Efficiency Scheme (CRC-EES) continues to focus attention on energy efficiency in large non-energy-intensive users such as supermarkets and large office portfolios. The EU Emission Trading scheme and Climate Change Agreement (CCA) are key mechanisms driving investment in the industrial sector.

Building standards and the planning system continue to require new development to achieve lower carbon performance.

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[6] *Based on range of employment indices from the European Photovoltaic Industry Association, the National Non Food Crops Research Agency, the European Power Research Institute and the European Wind Energy Association. Energy from Waste figures have been excluded from the Newport estimate to account for the recent waste management decisions.*

13.2 Pathways to support delivery

Despite the drivers for investment there are numerous barriers and market failures that prevent development. This is includes policy uncertainty surrounding low carbon solutions which undermines investor confidence. Achieving planning consent can often be a contentious issue although this is often associated to specific technologies such as wind energy and energy from waste. Access to appropriate finance is also a key constraint.

The Councils need to adopt a strategic approach to support delivery of anything like the potential that has been identified. This should be designed to facilitate investment from both the public and private sector, provide dedicated project support for strategic opportunities, and use its 'convening' power to aggregate and deliver of smaller scale opportunities (thereby maximising their attractiveness to developers and funders). To reinforce the implementation of a broader strategy it will be important for councils and other public counterparties to actively support key opportunities such as district heating in the urban centres (e.g. Newport and Cwmbran), supporting low carbon development on strategic sites and delivering low carbon projects on their own land and buildings.

A strategic approach would need to be designed to distinguish support to the key delivery communities: Public, Commercial and Community. It should align to specific identified drivers, address delivery capability and capacity gaps and attempt to resolve the barriers that constrain it. These will be different for each delivery community, for example, communities will often have a lack of expertise and financial resource, private developers may have low confidence in project returns or scale and the public sector may be risk adverse and have limited delivery expertise.

The strategic approach will need to balance the desire for a broad approach (covering each of developer communities and the range of technologies) and being outcome focused. It should do a few things well in the first instance, promote tangible benefits, build capability and drive change over time. The diagram below illustrates features that could be included within a strategic delivery framework. This is shown in summary form for simplicity but could be the basis for building a more detailed schedule of drivers, barriers and implementation actions tailored to each development community and set in the context of the portfolio of opportunities that exist. Clear understanding of possible opportunities is critical to identify appropriate development and funding support. The work covered in this report helps to identify opportunities at a macro level. It will be important to complement this with some form of bottom-up assessment of generation and energy efficiency projects, particularly across the public estate, where the councils and council partners have the most direct influence.

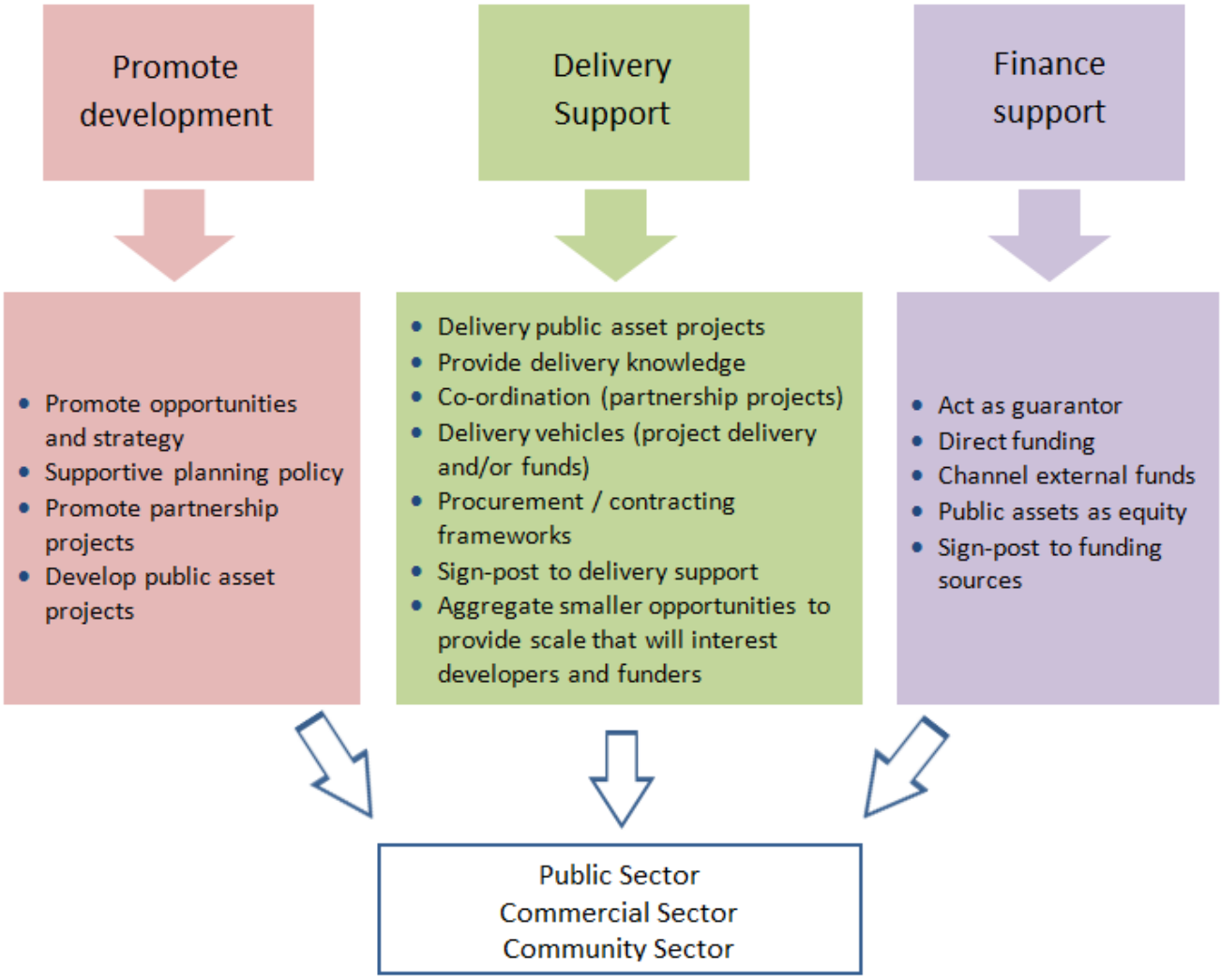

Figure 52: Strategic framework

The following sections discuss some of the key implementation actions that could be taken.

13.2.1 Finance support

Councils are in good position to support the provision of appropriate finance. They have a 'convening power' to 'crowd-in' external investment by supporting project development tasks, act as debt guarantor, administering funds, e.g. EU fund such as JESSICA, or providing funds directly as equity, debt or grant. Often councils are able to make available low cost funding available, e.g. from Public Works Loan Board (PWLB) borrowing although this may require the establishment of a delivery vehicle. One option is to establish a local energy fund. This could be designed to provide a range of targeted fiscal support and could also be linked with a development support function. Such a fund would aim to provide appropriate finance solutions for developer groups (which could include the council). It could bring in lower cost funds enabling to improve the financial performance of projects and improve their viability, it could seek to bundle projects together, reducing transaction costs and it could simply make finance available where it currently isn't. Developers in all sectors – community, public and private – could benefit from provision of financial support. Such a funding mechanism would typically have a defined focus, perhaps by asset case or by developer/sponsor group. Asset classes could include renewables, district heating, energy retrofit of domestic and non-domestic

properties. Examples include RE:FIT and Blue Skies Peterborough which are both a combined funding / delivery mechanisms focused on non-domestic energy retrofit in the Greater London area and Peterborough respectively.

Funds are being developed by the various councils/city-regions such as Greater Manchester (forming a joint venture with the Green Investment Bank), Leeds City Council and Cambridgeshire County Council.

There are numerous sources of finance which could be aggregated including PWLB, EU funding (including European Investment Bank), Green Investment Bank, locally derived revenue from Allowable Solutions (subject to this coming into force) and Community Infrastructure Levy tariffs, local pension funds, and so on. Each will have restrictions and will not be suitable for all opportunities and it will be important to clearly establish a pipeline of investable opportunities to establish the case for the bringing these together. Experience elsewhere shows that bridging the gap between opportunities and investable projects is a key role for public sector, where others are not currently fulfilling that role.

It is important to recognise that opportunities may not require investment particularly with the emergence of Energy Performance Contracting (EnPC) and similar developer-led approaches to renewables energy generation and CHP.

13.2.2 Development support

Where councils are looking at establishing investment funds they recognise the need to resource the development of projects and will typically establish a delivery function to operate in parallel. This will act to facilitate bringing forward a pipeline of investment opportunities. It is important to recognise that an investment fund will receive revenue from loan repayments which can be subsequently re-invested.

This would cover a range of roles:

- Direct delivery of public asset projects. Where significant individual (or portfolios) of opportunities exist within the asset base of the councils (or public partners) these should be managed as an end in itself but also to support the establishing of strategic infrastructure and to promote low carbon investment. Use of land assets for stand-alone generation such as wind energy and solar PV generation, development of district heating, building of low carbon buildings, energy management and energy retrofit of the council buildings, fuel switching, and domestic energy retrofit are all important opportunities and for which viable projects will exist. In addition, the councils should consider if they are in position to act as lead developer where market players are not active. If there is a genuine gap in the market then councils (under powers to promote sustainable development) should develop projects and benefits from the long term revenues generated.

- Providing delivery knowledge to project developers, sponsors or asset managers. This would entail offering technical and commercial advice to key individuals to facilitate the delivery of projects. This could involve meetings, workshops, training or support on a help-line basis.

- Co-ordination of projects particularly where multiple parties are involved (e.g. district heating schemes) or where parties do not have the capacity to progress, such as community groups with access to land or large scale domestic energy retrofit with social housing providers.

- Aggregation of opportunities. This particularly applies to smaller projects that may not attract developer or investor interest on their own. One example is energy efficiency / energy retrofit

within public buildings. Using existing data the councils could classify performance of properties that they intend to retain and define energy reduction targets for each. These can then be aggregated as a discrete portfolio of opportunities for which there would be numerous contracting pathways to delivery. Implementation via a delivery vehicle would enable other organisations to also put forward projects.

- Establishing Delivery Vehicles. This will often be linked to funding provision (see above) and will focus on specific asset classes (broad classification of project opportunities). The councils provide a range of technical and commercial support to take projects through viability and business planning stages, address development barriers and bring them to financial close. Delivery vehicles would aggregate projects and provide a centralised delivery focus.

- Establish procurement / contracting frameworks. This could be closely linked or part of a Delivery Vehicle providing the full suite of development services or it could simply be providing access to pre-approved contractors / suppliers providing the advantages of quicker implementation, consistency of approach and the ability to bundle smaller project together.

- Sign-post to delivery support. Where support already exist the councils could act to sign-post developers / sponsors.

13.2.3 Promoting Development

Promoting opportunities and their development needs to be tangible and the therefore rooted in the strategy and the specific support provide by the strategic delivery framework. There are number of tasks in could encompass:

- Promote opportunities and strategy. Publishing information from this study and highlighting parts which link to strategic goals for the councils would be of value. Where appropriate, we would recommend that the councils promote opportunities directly to key developer / sponsor organisations such as social housing providers, major land-owners, community groups and other public agencies.

- Supportive planning policy. There is a need to develop local planning policies that support the continued development of appropriately sized and appropriately located low carbon projects and associated infrastructure. There is also a need to address both areas with low exploitation of the resource and those where high levels of development have led or may lead to concerns about over-saturation. Any pressures on land requirements for, say, wind energy are likely to become more acute as time goes on as a result of the national drive to ramp up the installation of low carbon technologies.

  Planning policies other than the main strategic plans should be considered, e.g. to provide specific area-based guidance, technical guidance on specific technologies and infrastructure policies that could support district heating.

- Develop public asset projects and consider acting as lead-developer where the market is not actively pursuing opportunities. Councils have significant assets that can support the development of low carbon project, particularly land and the buildings. These should be fully exploited and the benefit promoted.

13.3 Recommended tasks

The key tasks are recommended for the councils to initiate and support a strategic delivery framework. Some task linked and some are mutually supportive, and so they should be considered in the round.

1. Conduct **analysis of key project opportunities** (drawing for this and other work) and identify a 'long-list' of strategic opportunities, dominant project asset-classes and potential bundles of smaller projects.
2. Conduct **gap analysis** of the finance and delivery capability required to deliver these key opportunities versus those presently available.
3. Produce a concept note or **'straw-man'** for a strategic delivery framework identifying the keys interventions for each of the developer communities (community, public sector and private sector). This should also highlight where interventions can be associated to specific drivers or address specific barriers.
4. Facilitate a **strategic framework planning workshop.** This should be focused on key actors to review the findings included in this report and the above tasks. Its focus would be to review the 'straw man' and enable co-design of the strategic framework. Attendees to this workshop could include the council, other public agencies (for example through the Local Strategic Board), major social housing providers, other public agencies, major land-owners, key decision-makers (e.g. politicians), key project sponsors (with live project and significant assets), community representatives and market providers active in the local area. It will be important to effectively plan this workshop and engage attendees prior to the event to maximise the value of discussions and the output.
5. **Revise 'straw-man'** based upon discussions at the workshop, such that this forms a statement of the objectives and underlying architecture of the strategic delivery framework.
6. Conduct **pipeline analysis** – strategic projects, partnership, bundling, technology clusters, key partners, e.g. RPs, LSB partners. This will provide an evidence base of project opportunities around which investment and delivery support can be designed. This stage of wok should take the key opportunities identified early, add other opportunities that may have been excluded for the first stage (which is assumed to be rapid exercise) and examine each of the opportunities in further detail to determine viability, deliverability and nature of support required to take them to financial close.
7. **Explore and develop finance and project development support**, exploring and testing available options, developing a business case and then implementing.

Appendix A: Glossary and explanation of terms

Power vs. Energy Output

In the context of this Renewable Energy Assessment, power is measured in either kiloWatts [kW], or MegaWatts [MW], which is a thousand kW, or gigaWatts [GW], which is a thousand MW. It is a measure of the electricity or heat output being generated [or used] at any given moment in time. The maximum output of a generator, when it is running at full power, is referred to as its installed capacity or rated power output.

Energy, on the other hand, is the product of power and time. It has the units of kWh [the h stands for "hour"] or MWh, or GWh. As an example, if a 2MW wind turbine ran at full power for 1 hour, it would have generated 2 x 1 = 2MWh of energy. If it ran at full power for one day [24 hours], it would have generated 2 x 24 = 48MWh.

This distinction is important, because in carrying out the renewable energy resource assessment, certain assumptions have been made to calculate both the potential installed capacity [or maximum power output] of different technologies, as well as the potential annual energy output.

Electricity vs. Heat Output

In terms of the units used, it can be important to distinguish between whether a generator is producing electricity or heat. This is because some renewable energy fuels [i.e. biomass] can be used to produce either heat only, or power and heat simultaneously when used in a Combined Heat & Power [CHP] plant.

It is also important to be able to distinguish between renewable electricity targets and renewable heat targets. To do this, the suffix "e" is added in this toolkit to denote electricity power or energy output, e.g. MWe, or MWhe, whilst for heat, the suffix "t" is used [for "thermal"], to denote heat output, e.g. MWt, or MWth.

See below for a full glossary of terms.

GLOSSARY	
AD	Anaerobic Digestion; process in which organic materials are broken down in the absence of oxygen producing biogas which can be burnt to produce electricity and/or heat
AMR	Annual Monitoring Report: One of a number of documents required to be included in the Local Development Framework Development Plan Documents, submitted to Government via the Regional Government office by a Local Planning Authority at the end of December each year to assess the progress and the effectiveness of a Local Development Framework
ASHP	Air Source Heat Pump A heat pump installation that uses the atmosphere as a source or dump of heat energy.
BERR	UK Department for Business, Enterprise & Regulatory Reform, superseded in June 2009 by the Department of Business, Innovation and Skills
CERT	The Carbon Emissions Reduction Target (CERT) (2008 – 2011) is the third

GLOSSARY	
	three-year phase of a domestic energy supplier obligation and obligates all domestic energy suppliers with a customer base in excess of 50,000 customers to make savings in the amount of CO_2 emitted by householders.
CHP	Combined Heat and Power; also known as cogeneration Generation of both heat and power from a single heat source by recovering waste heat from electricity generation
CHPA	Combined Heat and Power Association
CSH	Code for Sustainable Homes; also referred to as 'Code': The Code is the national standard in England for the sustainable design and construction of new homes. The Code aims to reduce carbon emissions and create homes that are more sustainable by measuring the sustainability of a new home against nine categories of sustainable design, rating the 'whole home' as a complete package. The Code uses a one to six star rating system to communicate the overall sustainability performance of a new home. From 1 May 2008 it is mandatory for all new homes to be rated against the Code and include a Code or nil-rated certificate within the Home Information Pack.
DECC	Department for Energy and Climate Change: Government department created in October 2008. It is responsible for all aspects of UK energy policy, and for tackling global climate change on behalf of the UK.
ESCO	Energy Service Company; This is a professional business providing a broad range of comprehensive energy solutions including designs and implementation of energy savings projects, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management. The ESCO performs an in-depth analysis of the property, designs an energy efficient solution, installs the required elements, and maintains the system to ensure energy savings during the payback period The savings in energy costs is often used to pay back the capital investment of the project over a five- to twenty-year period, or reinvested into the building to allow for capital upgrades that may otherwise be unfeasible. If the project does not provide returns on the investment, the ESCO is often responsible to pay the difference.
FIT	Feed-in-Tariff: A UK Government cashback scheme outlined in the Energy Act 2008 effective from 1 April 2010 guaranteeing payment to people who generate small scale low carbon electricity.
GHG	Greenhouse Gas: Any gas that absorbs infra-red radiation in the atmosphere. The current IPCC (Intergovernmental Panel on Climate Change) inventory includes six major greenhouse gases. These are Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF_6).
GIS analysis	Geographic Information System analysis; includes data that is referenced by spatial or geographic coordinates
GSHP	Ground Source Heat Pump: A heat pump installation that uses the earth as a heat sink to store heat or as a source of heat.

GLOSSARY	
GWh	Gigawatt hour – 1,000,000 kWh. A convenient unit of energy for power generation equipment.
IRR	Internal rate of return : A rate of return used in capital budgeting to measure and compare the profitability of an investment.
kW	Kilowatt – unit of power. Can be expressed as thermal power (kW_{th}) and electrical power (kW_e). The productive capacity of small scale renewable generation is usually measured in kW
kWh	kilowatt hour – unit of energy. Can be expressed as thermal energy (kWh_{th}) and electrical energy (kWh_e). A convenient unit for consumption at the household level.
kWp	kilowatt peak – maximum power output of a photovoltaic cell, occurring with intense sunlight.
Large wind	Large scale wind, for this study this is assumed as being above 1 MW in capacity (tip height typically greater than 100 m). Where appropriate, the default size of large scale wind turbines in 2.5 MW with a tip height of approximately 125 m.
LDP	Local Development Plan
LZC	Low and Zero Carbon
MLSOA	Middle Layer Super Output Area; Super Output Areas are a unit of geography used in the UK for statistical analysis. They are developed and released by Neighbourhood Statistics. Middle Layer SOAs have a minimum population 5000, and a mean population 7200. Built from Lower Layer SOAs. There are 7,193 MLSOAs in England and Wales
MOD	Ministry of Defence
MSW	Municipal Solid Waste: Waste type that includes predominantly household waste (domestic waste) with sometimes the addition of commercial wastes collected by a municipality within a given area.
$MTCO_2e$	Million Tonnes of Carbon Dioxide Equivalent
MW	Megawatts. The productive capacity of electrical generation plant is often measured in MWe.
MW_e	Megawatts of electrical capacity.
MW_{th}	Megawatts of thermal capacity.
MWh	Megawatt-hour, equal to 1,000 kWh.
MWhe	Megawatt hours of electrical energy
MWhth	Megawatt hours of thermal energy

GLOSSARY	
ODT	Oven Dried Ton; an amount of wood that weighs 2,000 pounds at zero per cent moisture content7[1]; common conversion unit for solid biomass fuel
PPW	Planning Policy Wales
PV	Photovoltaic cells that convert sunlight directly into electricity.
RHI	Renewable Heat Incentive – a proposed subsidy to support the use of renewable heat technologies, due to commence in April 2011.
SHLAA	Strategic Housing Land Allocation Assessment
SHW / STHW	Solar Hot Water; also known as Solar Thermal Hot Water
Small wind	Small scale wind, for this study this is assumed as being below 500 kW in capacity (tip height typically less than 60 m)
SPV	Special Purpose Vehicle; a legal entity set up for a specific purpose: to isolate financial risk from a lead organisation.
TAN 8	Technical Advice Note 8: Renewable Energy
tCO_2/yr	Tonnes (metric) of CO_2 per year
TCPA	Town and Country Planning Association
TWh	Terra Watt Hours ($1x10^{12}$ Watt Hours or $1x10^{9}$ Kilowatt Hours). A convenient unit of energy consumption for national statistics.

[7] *[1] http://www.encyclo.co.uk/define/oven%20dry%20ton*

Appendix B: Analysis methodology – additional notes and GIS results

The analysis contained in this report has followed the methodology of the WG Planning for Renewable and Low Carbon Energy – A Toolkit for Planners (July 2010). However additional notes on methodology, assumptions and GIS results are shown in the sections below, in the following order:

- B1: Baseline energy demand
- B2: Existing and planned renewables
- B3: Wind energy resource
- B4: Energy crops and woodfuel resource
- B5: Waste resources
- B6: Solar photovoltaics
- B7: Fuel Poverty
- B8: Off gas grid-connection
- B9: Heat mapping

B1. Baseline energy demand

The method used for establishing the baseline energy demand is based on the approach that was developed for the Bridgend County Borough 'Renewable energy: a toolkit for planners'. The method relies upon:

- Predicted future energy demand as indicated in the UK Renewable Energy Strategy
- WG derived data and statistics published by DECC.

The Plan Periods for both councils extends beyond 2020. Due to the lack of data for energy demand in 2011, the final energy demand is deduced using data from 2010[8], and expected growth between 2010 and 2011 is extracted from the 'Updated Energy and Emissions Projections 2012' report from DECC. The same process and data sources have been applied to project future energy demand for 2026. The results obtained are present in Table 26, alongside the predicted percentage change in the final energy demand during the agreed period. The decrease in demand is due to the increased energy efficiency of buildings, through a combination of public awareness, government incentive programmes, e.g. The Green Deal and increased efficiency of building fabrics.

The basis of the analysis undertaken for the REA analysis is the projected Final Energy Consumption (FEC) for 2020, to which the UK is held to a target set by the European Union. This target is based on the forecasted demand from the DECC energy model, across electricity, heat and transport. Table 27 indicates the intermediate targets of predicted energy demand by key energy sector for 2020. Due to the lack of official targets for post 2020, we have not projected renewable energy demand due to the lack of official targets.

B2. Existing and planned renewables

- Renewable energy statistics database for the UK
- Ofgem renewable and CHP register

[8] https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/sub-national-electricity-consumption-data

- Renewable tariff registers
- Torfaen County Borough Council
- Newport City Council

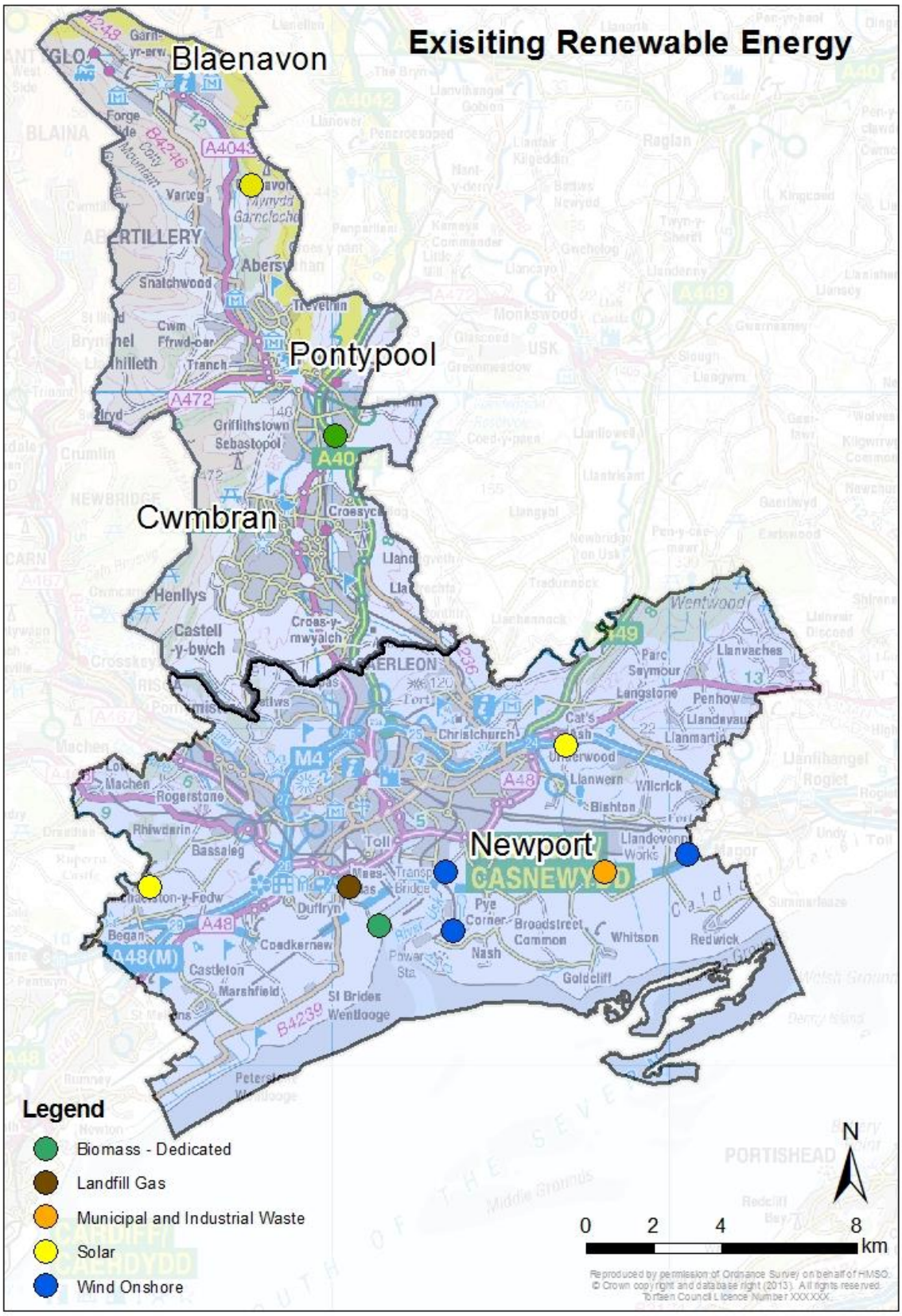

Figure 53: Existing renewable energy capacity

B3. Wind energy resource

A strategic high level assessment of the potential wind power within the area was undertaken using GIS to map different constraints. These have been overlaid to form composite maps of constrained and less constrained zones of potential. At least one large wind turbine could be installed at each of the identified sites, and some larger sites may allow for multiple turbines.

The identified sites provide a total technical potential that is, the wind generated that could be implemented if all of the available sites that were identified by the GIS are developed. We have assumed that a wind turbine capacity of 2MWe, however developers may well choose smaller or larger turbines. The generation potential is based on an assumed load factor of 27%, as suggested by the Toolkit.

A minimum of 7km separation between wind farms is assumed as a proxy constraint for cumulative visual impact. It is important to note that this is only used for high level strategic planning and each wind turbine must be considered by planning on an individual case by case, and the visual assessment and landscape taken into account.

With the GIS constraints mapping we have identified all the absolute constraints that are likely to rule out wind turbine developments but there are a number of additional local issues and preferences that could constrain any specific wind turbine location[9]. These include *local* landscape considerations such as access issues, contamination, private airstrips, economic issues and political decisions concerning the desirability of a wind turbine at any specific site. The identified sites for potential wind turbine developments would also need to be considered against the local landscape character assessments to ascertain their potential impact on character areas. Cumulative impact of multiple turbines would also be an important consideration for the character assessment. One issue which may cause a wind turbine development to prove uneconomic would be the proximity of the local power grid. Once wind developers have identified general sites, they analyse these further issues in greater detail before putting together an economic case and a subsequent planning application.

GIS Layers			
No	**Name**	**Buffer (m)**	**Type/Applicability**
Wind speed			
1	Average wind speed @ 45m agl <5.9m/s		Constrained
International, national and local designations for heritage			
2	World Heritage Sites		Constrained
3	Heritage Parks & Gardens		Constrained
International, national and local designations for landscape			
4	Areas of Outstanding Natural Beauty		Constrained

[9] See Appendix ii for a full list of constraints

5	Greenbelt		Less Constrained
6	National Parks		Constrained
7	Special Areas of Conservation		Constrained
8	Special Protected Areas		Less Constrained
9	Sites of Importance for Nature Conservation		Less Constrained
10	County Heritage Sites		Less Constrained
11	Environmentally Sensitive Areas		Less Constrained
International, national and local designations for ecology			
12	Sites of Special Scientific Interest		Constrained
13	Ramsar Sites		Constrained
14	RSPB Reserves		Less Constrained
15	Important Bird Areas		Less Constrained
16	National Nature Reserves		Less Constrained
17	Local Nature Reserves		Less Constrained
18	Ancient Woodland		Constrained
Designations for archaeology			
19	Scheduled Ancient Monuments		Constrained
Space Requirements			
20	Open water		Constrained
21	Woodland		Constrained
22	Dwellings	500	Constrained
23	Commercial Buildings	50	Constrained
24	Motorways, A roads & B roads	170	Constrained
25	Railways	170	Constrained
26	Bridleways		Constrained
27	Other Public Rights of Way		Constrained
Air safeguarding and radar constraints from MoD and civil aviation interests			

28	Civil airports		Less Constrained
29	MoD airbases		Less Constrained
30	Small civil airfields		Less Constrained
Electromagnetic interference to communications radar			
31	Primary TV transmission masts		Constrained
32	Secondary TV transmissions masts		Constrained
33	TV broadcast links		Constrained
34	Radio transmission masts		Constrained
35	Radio broadcast links		Constrained
36	Weather radar stations		Less Constrained
Cumulative impact			
37	Existing or consented wind farms		Constrained

Table 47: Wind energy analysis constraints layers

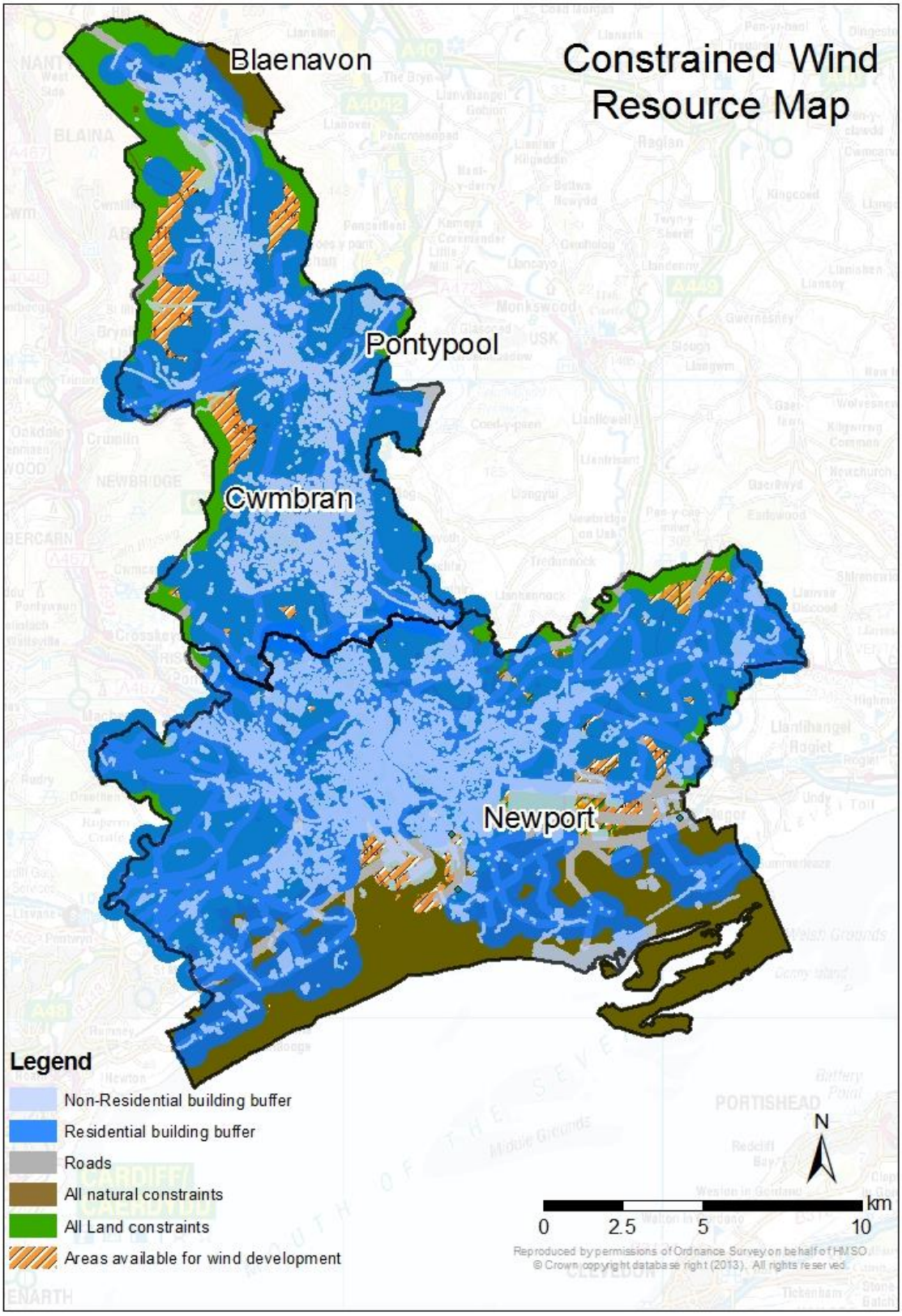

Figure 54: Wind energy constraints map

B4. Energy crops and woodfuel resource

Agricultural Land Classification and the National Forest Inventory data are used to map the land grades and produce a constraint map.

We have assumed that Sites of Scientific Interest and Scheduled Monuments are constrained. It has been assumed that only 10% of the agricultural land is suitable for energy crops. It is important to note that although agricultural graded land 1 to 3 has been included in this analysis, it is likely that these lands will have more value in use for crops and livestock, or may have unsuitable topography e.g. steep slopes. This assessment considered energy crops of both misccanthus (elephant grass) and short rotation coppice (SRC) willow.

Despite areas of land being indicated as having potential for growing of energy crops, further studies are required, as market demand is likely to play a key role in what, and how much is planted. It is also important to note that not all constraints have been considered in this REA, including the proximity of plant and technology and the practical access to sites required for preparation and delivery of fuel.

Biomass can be utilised for the generation of both electricity and heat. The use of energy crops, forestry residues and recycled wood waste for energy generation can have a number of advantages:

- Provide opportunities for agricultural diversification;
- Encourage increased management of woodland;
- Positive effects of biodiversity;
- Remove biodegradable elements from the waste stream;
- CO_2 savings if replanting occurs and long distance transportation is avoided.

There is no consideration of utilisation of straw as an energy source as Wales is a net importer. Furthermore, there is no consideration for the potential of growing energy crops to provide liquid biofuels for transport.

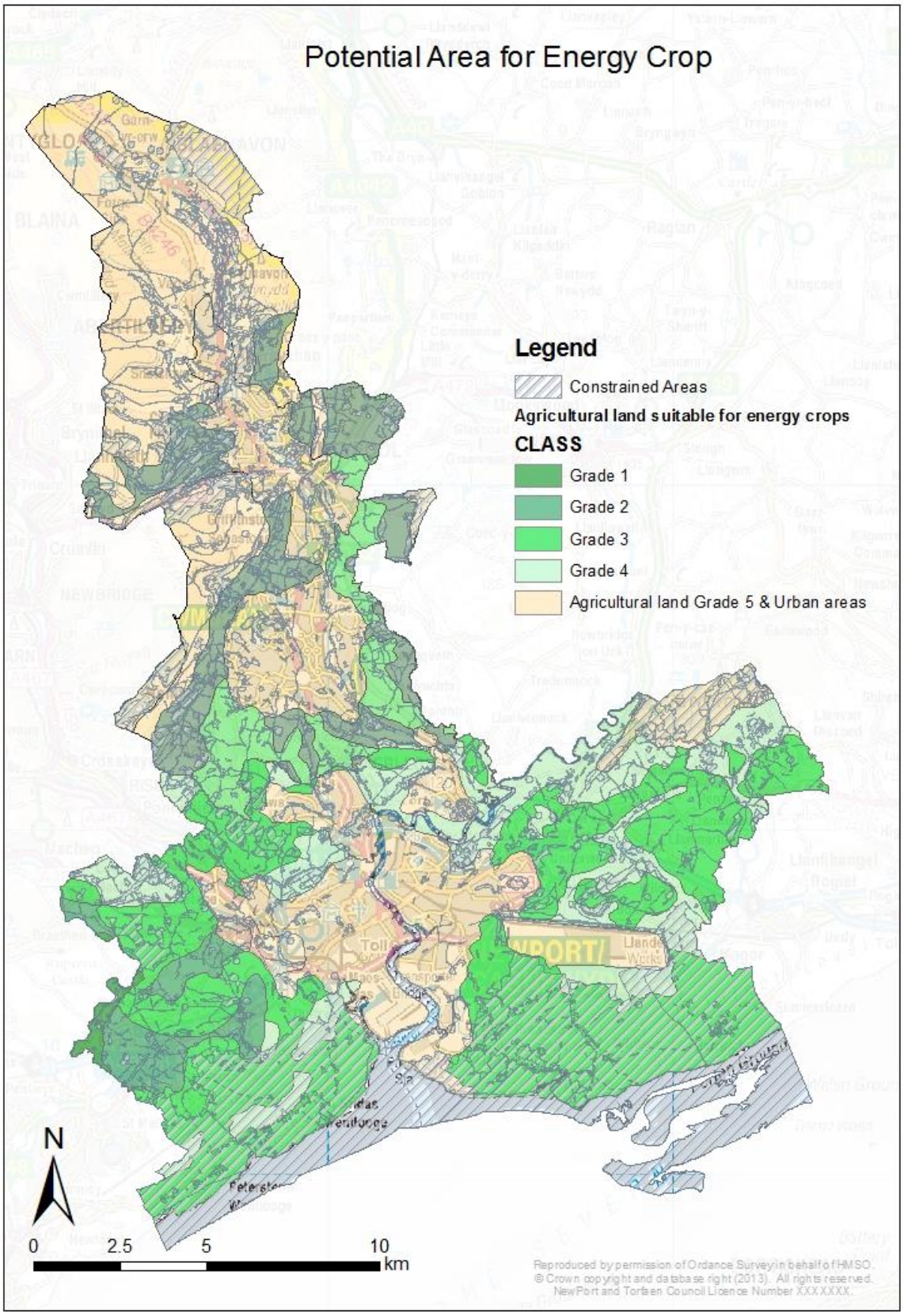

Figure 55: Potential area for energy crops within Newport and Torfaen

B5. Waste resources

Energy from waste considers potential sources that can be derived from both municipal and commercial and industrial waste. The Wales Waste Strategy has proposed a municipal waste target of 30 per cent that should be available for energy recovery. It is also assumed that 30 per cent of commercial and industrial waste is available for energy recovery.

There is currently no data for individual local authorities with regards to how much commercial and industrial waste is produced, however, it has been collated into regional waste areas. From previous waste studies[10] it was possible to determine that Newport accounted for 46 per cent of commercial and industrial waste in the South East region, and Torfaen 5 per cent, therefore these figures were applied to the most recent regional commercial and industrial waste data[11].

B6. Solar photovoltaics (PV)

There is no specific methodology for assessing the potential of solar PV within the Toolkit and a methodology has therefore been developed for this study, as detailed below. The technical potential for PV is considered in two parts: ground-mounted arrays ('solar farms') and building mounted installations:

Ground-mounted solar PV arrays

- Calculation of the available land area for PV. This is determined by mapping the constraints in a similar fashion to the wind and energy crop assessment. It is assumed that only grade 4 and 5 agricultural land is available for solar arrays and then the available area is further reduced by the constraints listed in Table 48 below.
- Assumption of the proportion of the total land available actually used. We have assumed that 1% of the unconstrained land area could be used for PV. This compares with 10% for energy crops. It is a somewhat arbitrary figure, but reflects various significant constraints, in particular the fact that solar farms will have to compete with other land uses, need an economic grid connection and will require unshaded flat land or land inclined to the south. This is a figure that has been used in other similar studies conducted by Verco.

Constraints
Areas of Outstanding natural beauty
Nature conservation designations, including: SSSIs, SPAs, SACs, Ramsar sites, NNRs, LNRs
Sites of Historic Interest, including: World Heritage Sites, Scheduled Ancient Monuments, Registered Parks and Gardens

[10] South East Wales Waste Plan, available from: http://sewales.stickywebdesign.co.uk/newpdfs/Agreeddocs/part2/1.RWAssesment_CHAP/06_RWA_D.PDF)
[11] Taken from StatsWales available here: https://statswales.wales.gov.uk/Catalogue/Environment-and-Countryside/Waste-Management/Industrial-and-Commercial-Waste/ThousandTonnesOfIndustrialAndCommercialWaste-by-Management-Sector).

Common land
Buffer zones around Rights of Way (5m)

Table 48: GIS Constraints for Ground-mounted Solar PV

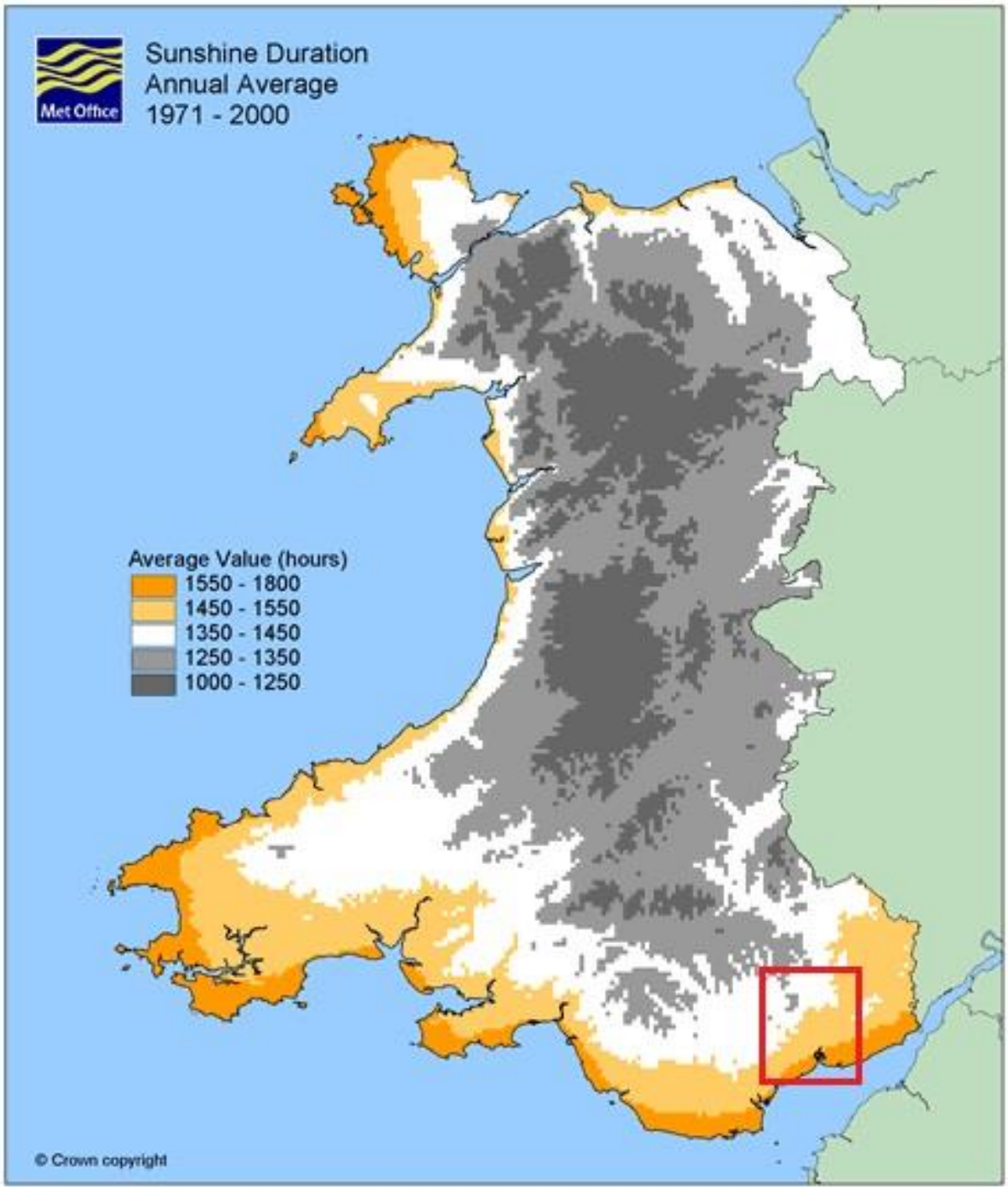

Figure 56: Sunshine duration annual average 1971-200 Met office.

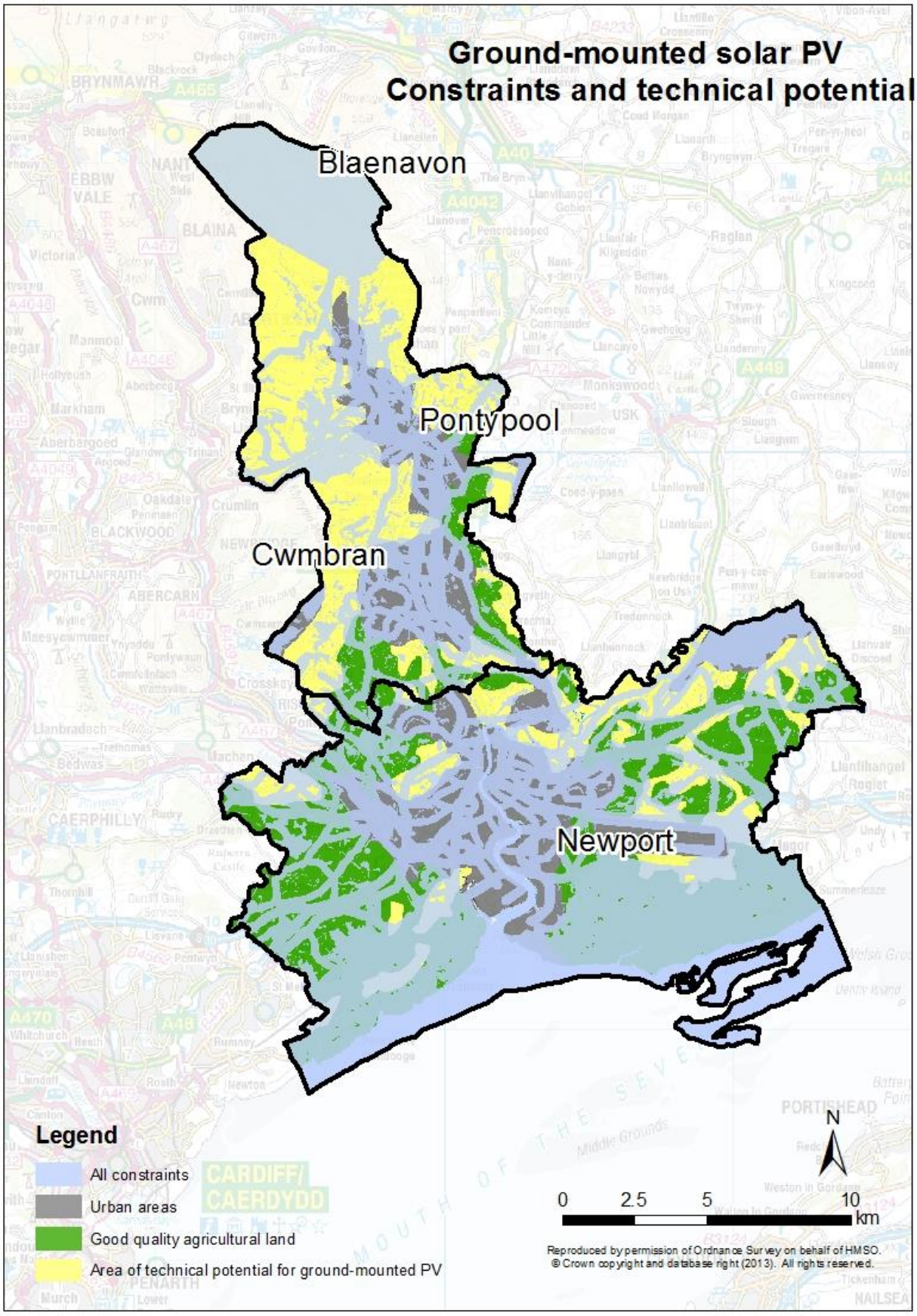

Figure 57: Potential Ground Mounted SolarPV

Building-mounted solar PV installations

- The total roof area is obtained from GIS data.
- Assumption of the typical proportion of roof area suitable for PV panels on an individual building to take into account factors such as structure and access.
- Assumption of the proportion of buildings suitable for PV panels to take into account location-specific factors such as roof aspect and shading.

The above methodology is applied to non-domestic and domestic buildings. The assumed parameters for the calculation are shown in the table below.

Parameter	Value	Reference
Percentage of roof area available to PV - non-domestic buildings	25%	Verco assumption
Percentage of non-domestic buildings suitable	50%	Renewable and Low Carbon Energy Capacity Methodology, Methodology for the English Regions, January 2010, SQW Energy for the Department for Energy and Climate Change.
Percentage of roof area available to PV - domestic buildings	40%	Same assumption as Zero Carbon Hub 'Carbon Compliance, Setting an appropriate limit for zero carbon new homes, February 2011
Percentage of domestic buildings suitable	25%	Renewable and Low Carbon Energy Capacity Methodology, Methodology for the English Regions, January 2010, SQW Energy for the Department for Energy and Climate Change.
Ground mounted PVs systems - ratio of ground area to PV panel area	50%	Verco assumption (to avoid self shading of PV panels in a ground mounted array)
PV panel output Wp/m2	150	Verco
PV Output kWh/kWp	800	Verco

Table 49: Parameters for solar PV calculations

B7. Fuel Poverty

Fuel poverty is currently defined as the need of a household to spend more than 10% of its income on energy to keep warm. Figure 58 below shows the fuel poverty map for the study area using the Toolkit methodology.

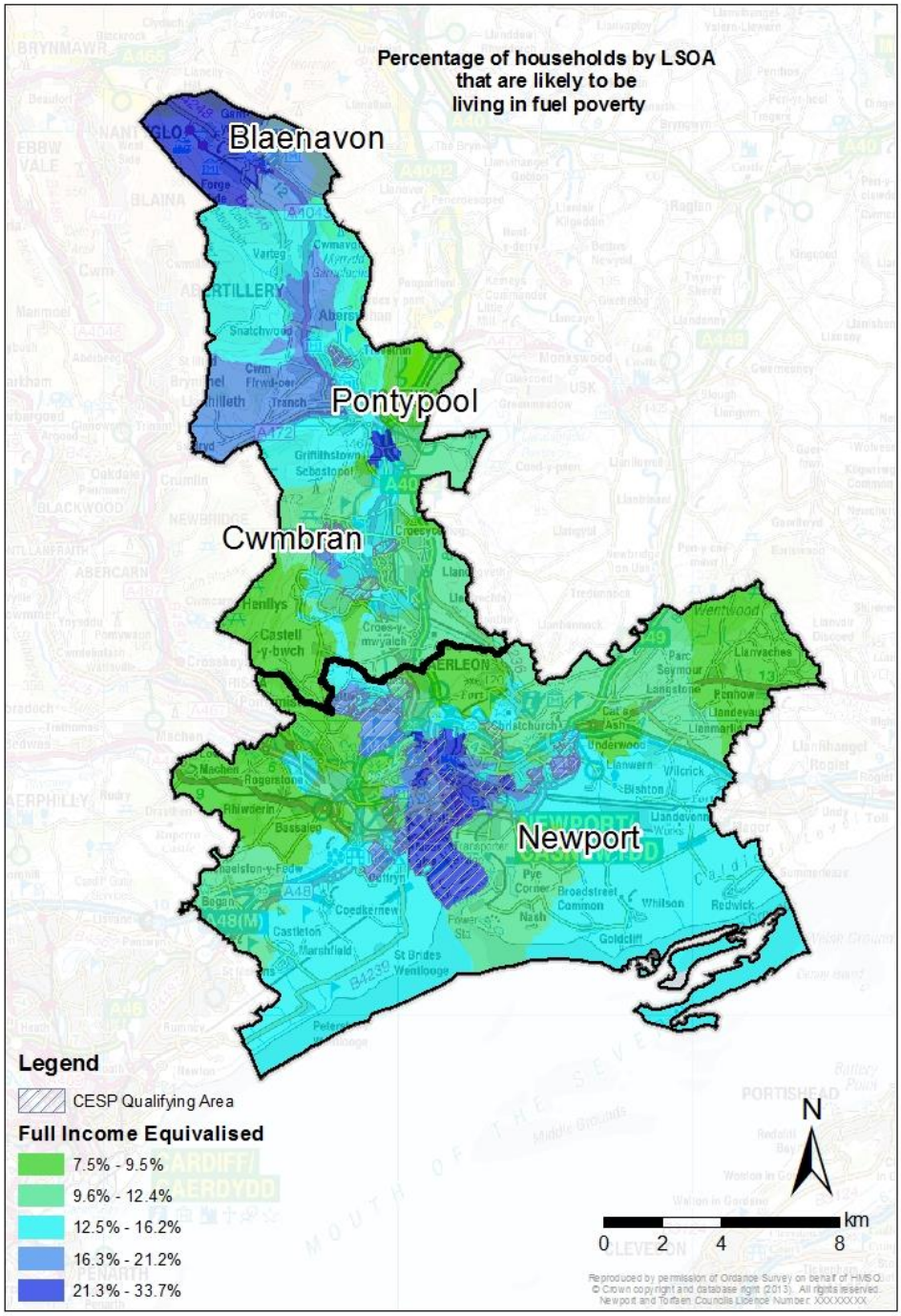

Figure 58 Percentage of households by LSOA that are likely to be living in fuel poverty within Newport and Torfaen

Note that the UK Government is currently consulting on a revised definition, referred to as the 'Low Income High Costs' indicator[12]. This is partially due to the affect that energy price volatility has on current definition of fuel poverty, which tend to understate the problem when prices are low and understate it when prices are high. The proposed an alternative indicator is believed to offer a more accurate measure of fuel poverty. This would mean a household was considered to be fuel poor where:

- It had required fuel costs that were above average; and
- Its income is below the average poverty line (once housing and fuel costs have been taken into account).

[12] Fuel Poverty: Changing the Framework for measurement, Department of Energy and Climate Change, September 2012 available here: www.gov.uk/government/uploads/system/uploads/attachment_data/file/66570/6406-fuel-poverty-changing-the-framework-for-measureme.pdf

B8. Off gas grid connection

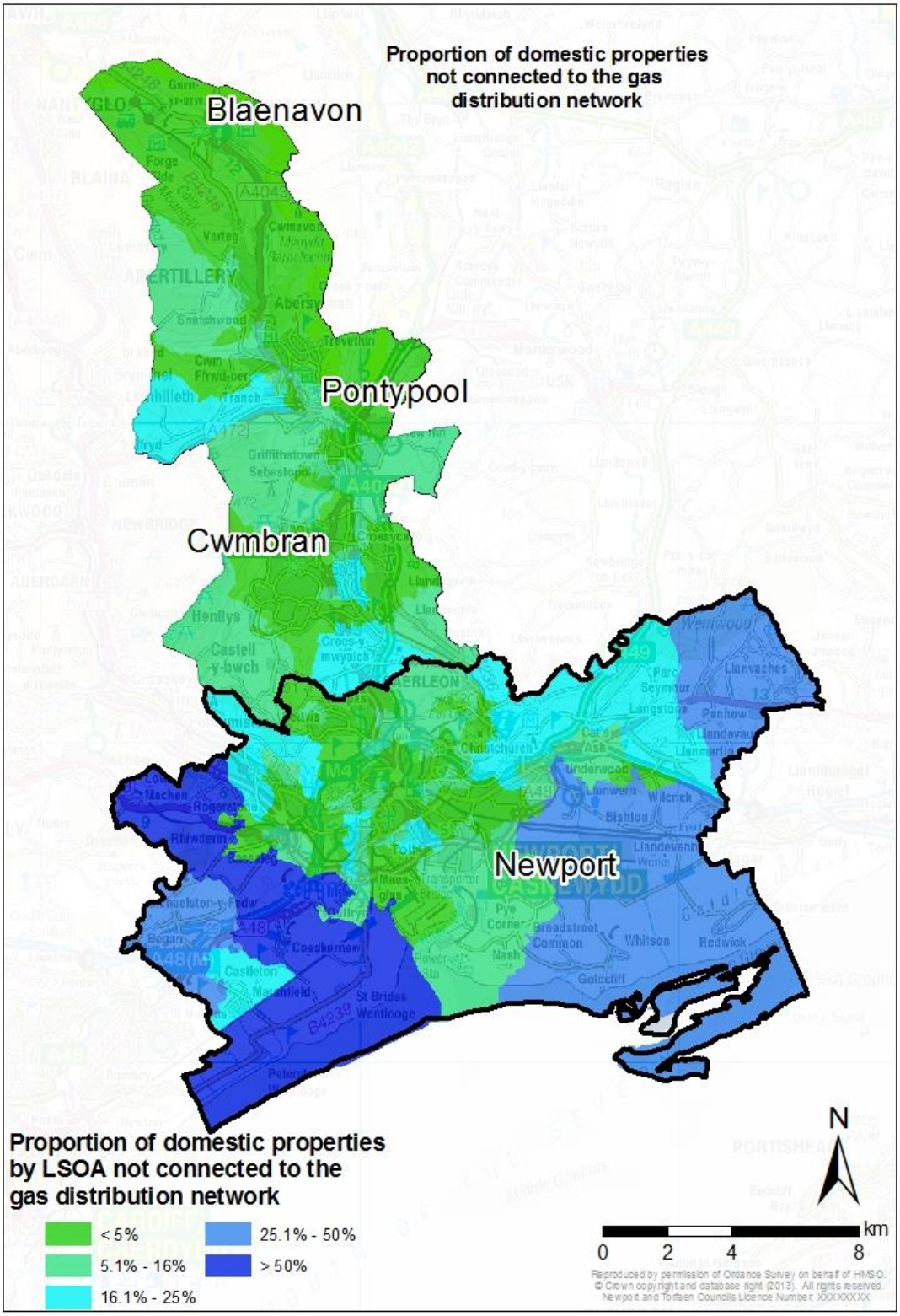

Figure 59: Proportion of domestic properties that are not connected to the gas distribution network in Torfaen and Newport

B9. Heat Mapping

The methodology seeks to assess the district heating potential within the two counties through the heat mapping exercise. The heat mapping has been carried out at a Lower Super Output Area (LSOA) resolution;

All individual buildings in Newport and Torfaen (both domestic and non-domestic) have been identified through the use of three different data sets and the energy consumption of houses in each LSOA area determined using national statistics data the Newport and Torfaen determined.

Heat demand for non-domestic buildings was determined from CIBSE benchmarks which are viewed as an industry standard, and VOA (Valuation Office Agency) data identifying the floor area and usage of non-domestic buildings.

Domestic building heat loads were determined from national statistics on the gas consumption of domestic properties in the Borough. Boiler efficiencies of 80 or 85% were assumed for converting fuel demand to heat demand when analysing building loads (80% was used for any those more dated benchmarks, using data from 1999).

Note: Industrial process heat demands cannot be quantified using this methodology, as the heat and power loads of industrial facilities are highly process-specific and are often not suitable for supply by district heating. Therefore only a basic allowance for space heating has been applied to industrial premises.

Figure 60 below shows the heat mapping results for both counties. Areas with 3,000kW/km^2 or more are considered as being of potential interest for district heating, but further analysis is required to validate this assumption. Local circumstances such as existence of specific buildings as anchor loads, ease of network routing and the aggregate load profile of buildings are all important feasibility factors.

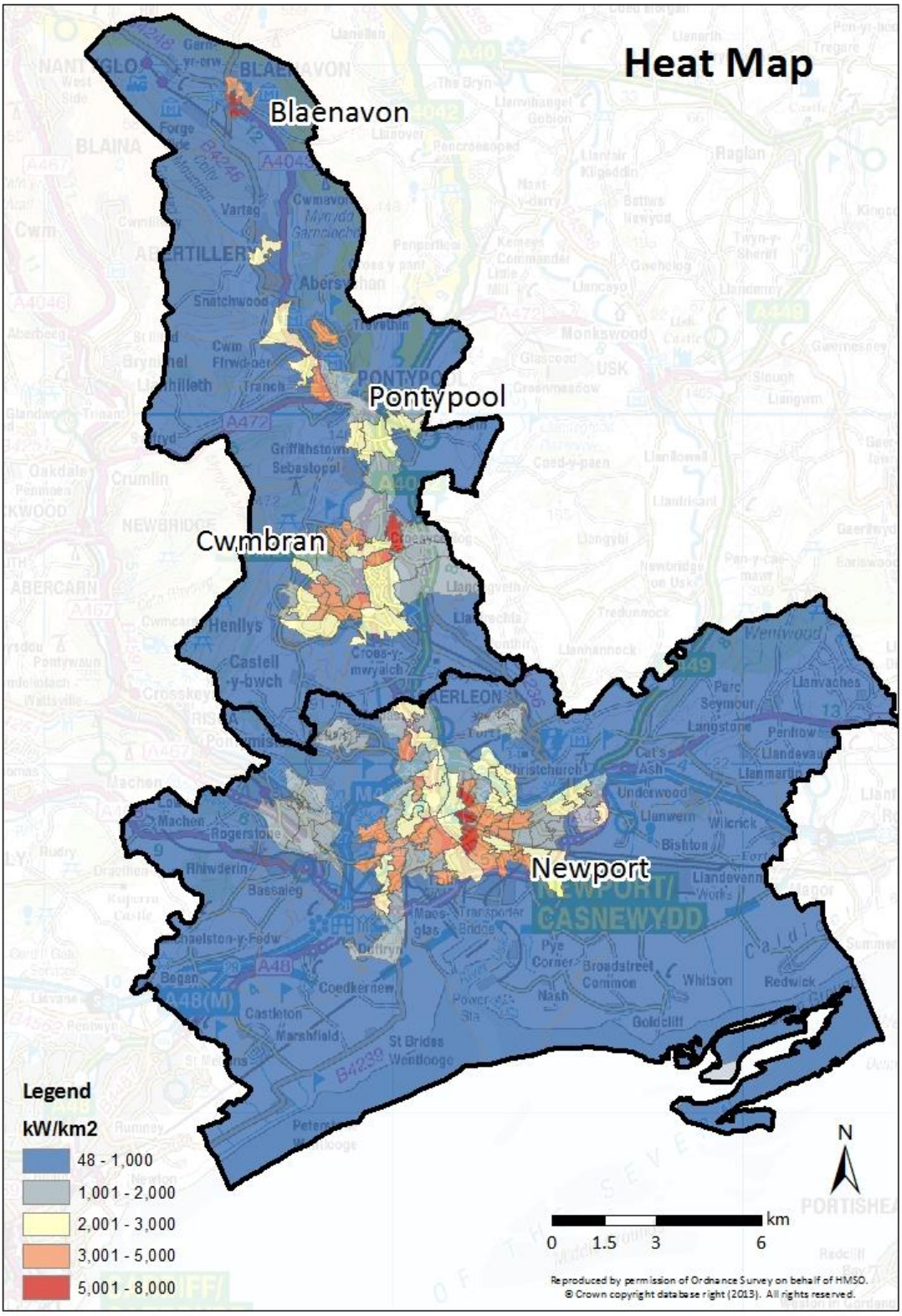

Figure 60 Heat density map of Torfaen CBC and Newport CC

Appendix C: Carbon emissions within the scope of influence of LAs

Units: $ktCO_2e/yr$

LA Region Name	Year	M. Road Transport Other	L. Road Transport (Minor roads)	J. Road Transport (A roads)	I. Domestic 'Other Fuels'	H. Domestic Gas	G. Domestic Electricity	E. Agricultural Combustion	D. Industrial and Commercial Other Fuels	C. Large Industrial Installations	B. Industry and Commercial Gas	A. Industry and Commercial Electricity	Grand Total	Population ('000s, mid-year estimate)	Per Capita Emissions (t)
Newport	2010	2	128	94	15	174	117	5	143	-	229	339	1,245.4	141.3	8.8
Torfaen	2010	1	75	63	7	116	71	2	33	-	83	149	597.6	90.5	6.6

Source: DECC Local Authority CO_2 emissions dataset 2010 (https://www.gov.uk/government/organisations/department-of-energy-climate-change/about/statistics)

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Appendix D: Torfaen strategic sites data and assumptions

Site 1: SAA7 Llanfrechfa Grange and H2/1 County Hall and Police HQ

Land use type	No. of units	Avg area of units (m2)	Area of units (m2)	Heat Demand (MWh/yr)	Electricity Demand (MWh/yr)	Phasing assumption
Specialist Critical Care Centre	1	50,000	50,000	12,312	4,049	Hospital opens in 2017
Residential dwellings to south of hospital	300	100	30,000	905	1,013	50 dwellings a year completing 2021
Hospital employment	1	19,200	19,200	1,313	2,477	Hospital employment build out mirrors that of the adjacent residential.
Residential dwellings on Police HQ	200	100	20,000	603	675	50 dwellings a year completing 2017
Community facilities	1	300	300	21	4	Complete 2021

Site 2: The British

Land use type	No. of units	Avg area of units (m2)	Area of units (m2)	Heat Demand (MWh/yr)	Electricity Demand (MWh/yr)	Phasing assumption
Residential - up to 2021 Plan Period	200	100	20,000	603	675	2017-2021
Residential - indicative up to 2033	600	100	60,000	1,810	2,026	2021-2033
Primary school	1	2,100	2,100	163	50	210 place school opening 2025
Employment	8	1,000	8,000	761	504	8000m2 2021-25
Supermarket	1	4,249	4,249	313	1,016	Assume plot ratio of 0.3 and opening 2026

Site 3: SAA4 Mamhilad

Land use type	No. of units	Avg area of units (m2)	Area of units (m2)	Heat Demand (MWh/yr)	Electricity Demand (MWh/yr)	Phasing assumption
1. Residential - Mamhilad Park	690	100	69,000	2,082	2,330	Pre-2021
1. Residential - Nylon Spinners	250	80	20,000	631	691	Completed post 2021
2. Residential - Woodland Living	90	100	9,000	272	304	Completed post 2021
3. Residential - Parke-Davis	500	100	50,000	1,508	1,688	Completed post 2021
4. Residential - Hillside Living (microgen)	170	100	17,000	513	574	Completed post 2021
Primary School	1	5,000	5,000	387	120	Completed post 2021
Nylon Spinners - Hotel	1	27,000	27,000	4,598	1,294	Completed post 2021
Nylon Spinners - A3 food drink retail	5	3,750	18,750	1,282	2,419	Existing - not EE retrofitted
Nylon Spinners - B1 offices	5	3,750	18,750	1,161	1,069	Existing - not EE retrofitted
Mamhilad Park - Brecon House (retained office)	1	10,894	10,894	1,124	1,035	Existing - not EE retrofitted
Mamhilad Park - Mamhilad House (retained office)	1	9,834	9,834	1,015	934	Existing - not EE retrofitted
Mamhilad Park - Caerleon House (retained office)	1	6,948	6,948	717	660	Existing - not EE retrofitted
Mamhilad Park - Cwmbran House (retained office)	1	3,816	3,816	394	363	Existing - not EE retrofitted
Monmouth House - retained office	1	1,250	1,250	129	119	Existing - not EE retrofitted
Park-Davies - (3 retained offices)	3	8,000	24,000	2,477	2,280	Existing - not EE retrofitted

Site 4 Former Police Training College

Land use type	No. of units	Avg area of units (m2)	Area of units (m2)	Heat Demand (MWh/yr)	Electricity Demand (MWh/yr)	Phasing assumption
H1	80	143	11,400	376	403	Completed by 2021
H2	42	143	6,000	198	212	Completed by 2021
M1	14	250	3,500	106	118	Completed by 2021
M2	24	246	5,900	178	199	Completed by 2021
M3	9	244	2,200	66	74	Completed by 2021
M4	24	250	6,000	181	203	Completed by 2021
M5	16	244	3,900	118	132	Completed by 2021
M6	8	263	2,100	63	71	Completed by 2021
M7	4	250	1,000	30	34	Completed by 2021
M8	12	250	3,000	91	101	Completed by 2021
M9	32	250	8,000	241	270	Completed by 2021
M10	8	250	2,000	60	68	Completed by 2021
M11	8	263	2,100	63	71	Completed by 2021
M12	15	247	3,700	112	125	Completed by 2021
M13	2	300	600	18	20	Completed by 2021
M14	28	254	7,100	214	240	Completed by 2021
L1	7	329	2,300	69	78	Completed by 2021
L2	9	300	2,700	81	91	Completed by 2021
L3	9	322	2,900	87	98	Completed by 2021
L4	10	310	3,100	94	105	Completed by 2021
L5	17	306	5,200	157	176	Completed by 2021
L6	48	310	14,900	450	503	Completed by 2021
L7	16	313	5,000	151	169	Completed by 2021
L8	14	307	4,300	130	145	Completed by 2021

Site 5: Canalside Action Area

Land use type	No. of units	Avg area of units (m2)	Area of units (m2)	Heat Demand (MWh/yr)	Electricity Demand (MWh/yr)	Phasing assumption
Residential Sector A: Low Density Housing	37	80	2,960	98	105	Completed by 2021
Residential Sector B: Canalside Appartments	24	60	1,440	43	49	Completed by 2021
Residential Sector C: Town House Courts	19	80	1,520	46	51	Completed by 2021
Residential Canal Front Houses	27	80	2,160	65	73	Completed by 2021
Residential Mixed Use Block Appartments	16	60	960	32	34	Completed by 2030
Residential Ardep site	30	100	3,000	91	101	Completed by 2030
Residential Forgeside	40	100	4,000	121	135	Completed by 2030
Retail	5	210	1,050	72	135	Completed by 2030
Leisure / Culture Uses	5	250	1,250	85	161	Completed by 2030
Hotel	1	2,100	2,100	358	101	Completed by 2030

Appendix E: Newport strategic site data and assumptions

Site 1: Glan Llyn

Land use type	No. of units	Avg area of units (m2)	Area of units (m2)	Heat Demand (MWh/yr)	Electricity Demand (MWh/yr)	Phasing assumption
Phase 1 Residential	300	100	30000	1,537	1,047	Under construction
Phase 2 Residential	950	100	95000	4,653	3,291	2015-2019
Phase 3 Residential	1625	100	162500	4,902	5,487	2020-2023
Phase 4 Residential	1125	100	112500	3,394	3,799	2024-2028
Phase 1 Primary school	1	2500	2500	194	60	Completed nr end of phase 2018
Phase 2 Primary school	1	2500	2500	194	60	Completed nr end of phase 2 (2025)
Library	1	2000	2000	206	84	Completed nr end of phase 2 (2026)
Police station	1	500	500	37	120	Completed nr end of phase 2 (2026)
Supermarket	1	4000	4000	295	956	Completed nr end of phase 2 (2025)
Doctors surgery	1	500	500	52	21	Completed nr end of phase 2 (2025)
Business Park Phase 1	1	34000	34000	3,348	3,072	2014-2018
Business Park Phase 2	1	44000	44000	4,333	3,976	2015-2019
Business Park Phase 3	1	37000	37000	3,643	3,343	2020-2023

Site 2: Llanwern Village

Land use type	No. of units	Avg area of units (m2)	Area of units (m2)	Heat Demand (MWh/yr)	Electricity Demand (MWh/yr)	Phasing assumption
H3 - Residential Phase 1	350	100	35,000	1,056	1182	Phase 1: 2014-2016
H3 - Residential Phase 2	750	100	75,000	2,263	2,532	Phase 2: 2017-2021
Primary school	1	2,500	25,000	183	40	x

Site 3: Whitehead

Land use type	No. of units	Avg area of units (m2)	Area of units (m2)	Heat Demand (MWh/yr)	Electricity Demand (MWh/yr)	Phasing assumption
MonBank H14 - Residential phase 1	150	100	15,000	735	520	Phase 1 (2011-2016)
MonBank H14 - Residential phase 2	300	100	30,000	905	1,013	Phase 2 (2017-2021)
MonBank H14 - Residential phase 3	115	100	11,500	347	388	Phase 3 (2022-2026)
MonBank H14 - Residential phase Remaining	15	100	1,500	45	51	Phase 1 (2011-2016)
Whiteheads Works H51 - Residential phase 1	80	100	8,000	384	276	Phase 2 (2017-2021)
Whiteheads Works H51 - Resil phase 2	200	100	20,000	603	675	Phase 3 (2022-2026)
Whiteheads Works H51 - Residential phase 3	120	100	12,000	362	405	2027
Hospital	1	23,400	23,400	6,120	1,411	Hospital opens 2025
Employment	1	23,400	23,400	2,227	1,474	Phase 3 (2022-2026)
Primary school	1	5,000	5,000	387	120	Opens 2026
Primary care clinic	1	3,200	3,200	878	142	Opens 2026

Site 4: Novelis

Land use type	No. of units	Avg area of units (m2)	Area of units (m2)	Heat Demand (MWh/yr)	Electricity Demand (MWh/yr)	Phasing assumption
H54 - Residential phase 1	80	100	8,000	384	276	Phase 1 (2011-2016)
H54 - Residential phase 2	250	100	25,000	754	844	Phase 2 (2017-2021)
H54 - Residential phase 3	250	100	25,000	754	844	Phase 3 (2022-2026)
H54 - Residential phase Remaining	345	100	34,500	1,041	1,165	Assume post 2026
EM2(xii) - B1	1	4,000	4,000	365	516	Assume phase 2
EM2(xii) - commercial leisure	1	4,000	4,000	310	96	Assume phase 2
EM2(xii) - community uses	1	100	100	4	4	Assume phase 2

Appendix F: Economic impacts

The table below shows the breakdown of estimated employment and investment in both councils under the 'Low' and 'High' renewable table scenarios presented in sections 4.8.2 (Torfaen) and 9.8.2 (Newport).

The large majority are in the 'development' phase, which would include activities such as construction, design, manufacture and professional services. Not all of these will be created locally. The employment is expressed in 'job years' i.e. one job for the period of a year, to reflect the temporary nature of the development jobs. The jobs would also be phased of the build out period to reach the target.

The figures are based on a range of employment indices from the European Photovoltaic Industry Association, the National Non Food Crops Research Agency, the European Power Research Institute and the European Wind Energy Association. Energy from Waste figures have been excluded from the estimate to account for the recent waste management decisions.

Torfaen	**Low target**	**High target**
Development	1,879	3,149
OPs/fuel	60	100
Total job years	1,939	3,248
Investment £m	68	119
Newport	**Low target**	**High target**
Development	3,071	3,536
OPs/fuel	115	133
Total job years	3,186	3,669
Investment £m	112	144

Table 50: Employment and investment estimates by target scenario

Appendix G: List of tables and figures

List of tables

Torfaen County Borough Council

Newport City Council

Appendices

List of figures