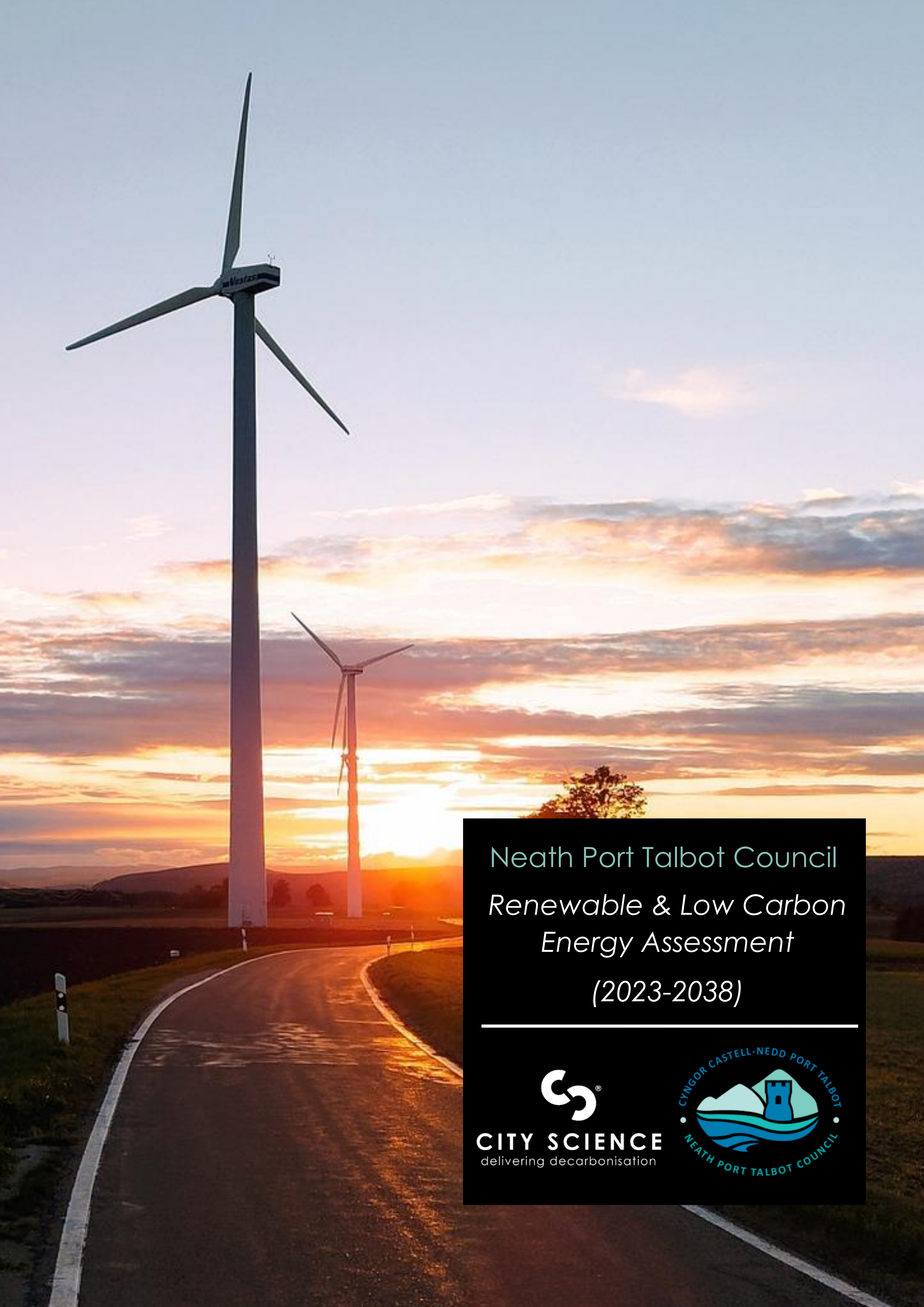

Neath Port Talbot Council

Renewable & Low Carbon Energy Assessment

(2023-2038)

CITY SCIENCE
delivering decarbonisation

CYNGOR CASTELL-NEDD PORT TALBOT
NEATH PORT TALBOT COUNCIL

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Contents

Glossary

Acronym	Meaning
ASHP	Air Source Heat Pump
GSHP	Ground Source Heat Pump
CfD	Contracts for Difference
CHP	Combined Heat & Power
COP	Coefficient of Performance
SCOP	Seasonal Coefficient of Performance (SCOP)
C&I	Commercial & Industrial
BEIS	Department of Business, Energy and Industrial Strategy
DESNZ	Department for Business, Energy Security and Net Zero
FES	Future Energy Scenarios
FLOW	Floating Offshore Wind
GHG	Greenhouse Gas
GW	Gigawatt
GWh	Gigawatt hours
LDO	Local Development Orders
LPA	Local Planning Authority
LPG	Liquefied Petroleum Gas
LSA	Local Search Area
MSW	Municipal Solid Waste
MW	Megawatt
MWh	Megawatt hours
NRW	Natural Resource Wales
NPT	Neath Port Talbot
NPTC	Neath Port Talbot Council
Ofgem	Office of Gas and Electricity Markets
REPD	Renewable Energy Planning Database
NGED	National Grid Electricity Distribution
PPW	Planning Policy Wales
SINC	Site of Importance for Nature Conservation

1 Introduction

Chapter in Brief

This chapter includes a summary review of UK Government, Welsh Government and key regional and local policy within Neath Port Talbot relevant to renewable and low carbon energy, including discussion of the specific relevance for this assessment.

1.1 Study Purpose & Content

1.1.1 Neath Port Talbot Council (NPTC) have commissioned City Science to undertake a Renewable and Low Carbon Energy Assessment (RLCEA) for their administrative area. The purpose of the study is to formulate robust renewable and low carbon energy evidence to inform the preparation of the NPT Replacement Local Development Plan (RLDP) 2023-2038, which is in the early stages of preparation. The work will also feed into the preparation of background evidence, policies, and proposals to be formulated for the first South West Wales Strategic Development Plan (SDP).

1.1.2 NPTC are undertaking a Renewable Energy Assessment which reflects the Practice Guidance – Planning for Renewable and Low Carbon Energy – A toolkit for Planners, Sept 2015 (Welsh Government, 2015) and other relevant subsequent national policy and guidance. This commission comprises the following tasks:

- A policy review (Section 1.2)
- An assessment of existing and potential future energy demand (Section 2)
- An assessment of existing and proposed renewable energy generation (Section 3)
- A county wide renewable energy assessment to quantify the county's potential renewable resource (Section 4)
- A building integrated renewables (BIR) assessment (Section 5)
- Heat opportunities mapping (Section 6)
- Identification of potential renewable and low carbon energy opportunities for site allocations (Section 7)
- Identification of areas suitable areas for stand-alone renewable energy development (Section 8)
- Viability appraisals for strategic sites (Section 9)
- Evidence and propose suitable targets and policies for inclusion in the RLDP (Section 10)

1.1.3 This evidence base aims to estimate the scale of resource within the study area that is available for use, to provide focus for setting local policy and targets; therefore, assisting NPTC in tackling key issues including climate change, fuel poverty and decarbonisation. It will also provide direction to the authority on how it can play its part in meeting the National and UK renewable energy targets.

1.1.4 The study provides details of existing and future demand, to provide context for resource-based targets.

1.2 Policy Context

1.2.1 There are various key plans, policies and guidance at both national and local level that provide important context to this study and will inform its outputs. The objective of this section is to outline key policies that are significant drivers of this study.

Policy Context Overview

1.2.2 There are numerous policies relevant to the development of renewable energy and low carbon energy in the Neath Port Talbot area, including policy set at a UK Government, Welsh Government, and at a local authority level. A summary of policies review is shown in Figure 1-1 below.

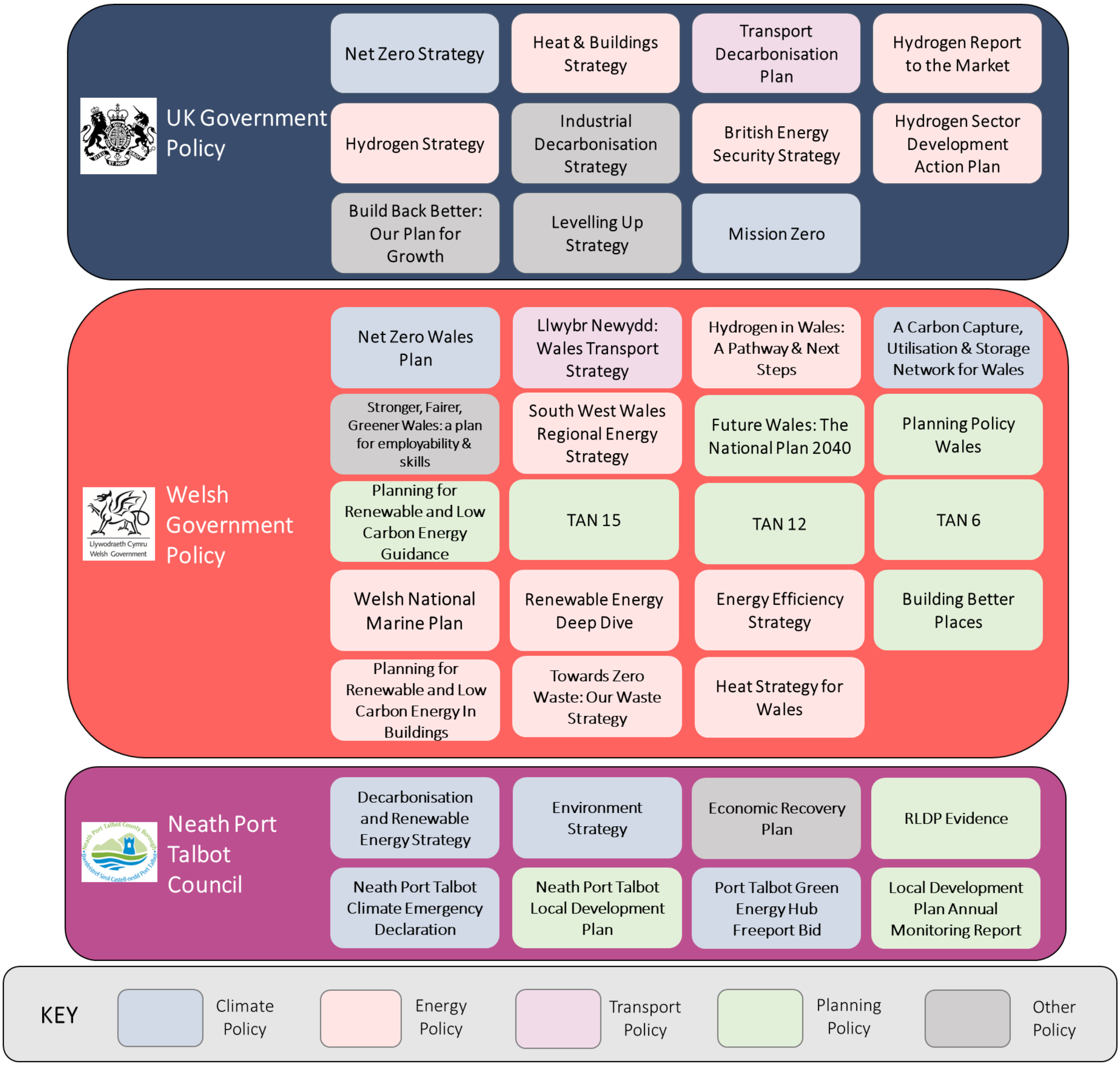


Figure 1-1: Summary of UK, Welsh, and Neath Port Talbot policy

1.3 Summary of UK Government Policy

Overarching Legal Framework

1.3.1 The UK was the first country to set legally binding carbon targets (an 80% reduction in carbon emissions by 2050 against a 1990 baseline) through the Climate Change Act (2008). These targets were later reflected in the Environment (Wales) Act (2016). Understanding of the urgency and importance of tackling climate change has grown since the Climate Change Act; more detailed and specific policy has therefore been enacted and is addressed in this section. After a wave of climate activism and recommendations from the Committee on Climate Change (CCC), the UK and Welsh Government declared a climate emergency and the UK committed to setting new net zero carbon (100% reduction in carbon emissions) targets for 2050.

UK Net Zero Strategy

1.3.2 The UK Net Zero Strategy introduced a 2035 target for the electricity grid to be decarbonised, new Internal Combustion Engine (ICE) vehicle phase-out dates, and a gas boiler phase-out date. Such measures will create increased electricity grid demand that should be met by increasing renewable deployment. Likewise, the strategy aims to reform the Contracts for Difference (CfD) auctions to deploy more solar and wind, which will increase funding available for renewable deployment.

British Energy Security Strategy

1.3.3 Similarly, the British Energy Security Strategy aims to make the UK the "Saudi Arabia of (offshore) wind power" and aims for a five-fold increase in solar deployment by 2035 aided by the inclusion of solar in CfD auctions. Neath Port Talbot's coastal location and port facilities means it is well-placed to facilitate the UK Government's 5 GW of floating offshore wind (FLOW) ambition.

Build Back Better

1.3.4 Regarding green investment, the Building Back Better strategy is very relevant to NPTC as it introduces the Swansea City Deal that will fund nine regional projects and create 9,000 new jobs. The Homes as Power Stations project, set to be complete by 2026, is based in Neath Port Talbot and will introduce retrofit and renewable energy measures to at least 10,300 properties.

Industrial Decarbonisation Strategy

1.3.5 The presence of the Port Talbot steelworks in the county makes the Industrial Decarbonisation Strategy highly relevant – the strategy aims for 50 TWh of fuel switching (such as electrification or hydrogen) by 2035 on industrial cluster sites. Large industrial demands for electricity or hydrogen could drive demand for renewable capacity to supply electricity direct to industry, or for hydrogen production via electrolysis.

National Planning Policy Framework

1.3.6 The UK National Planning Policy Framework is not applicable to renewable and low carbon energy planning in Wales since Planning Policy Wales (PPW) takes precedent. As a result, whilst UK policies have no direct impact on Neath Port Talbot as a Local Planning Authority (LPA), these policies do have an indirect impact via their effect on the development of the renewable energy industry.

1.4 Summary of Welsh Government Policy

National Net Zero Strategy

1.4.1 Under the Environment (Wales) Act (2016), Wales was originally required to reduce net greenhouse gas emissions by at least 80% by 2050 (against a baseline set in legislation). Further regulations since then have been put in place to make Wales net zero by 2050.

1.4.2 Net Zero Wales (2021) set a target to produce 70% of Wales' electricity via renewable resources by 2030, and to build an additional 1 GW by 2025. It also set a target for Welsh renewables to have an element of local ownership (owned by one or more organisations located in Wales) to bring wider benefits to the local area such as lowering local energy bills or using local installation services.

National Development Framework & Planning Policies

1.4.3 In Future Wales (2021), the national development framework for Wales, Policy 17 identified ten Pre-Assessed Areas for onshore wind in Wales where large-scale wind farms (defined as over 10 MW) are "acceptable in principle", of which, area number nine covers a large portion of Neath Port Talbot.

1.4.4 Planning Policy Wales (PPW 12) states that planning applications for larger scale (over 10 MW) renewable energy developments will be made directly to Welsh Ministers under the Developments of National Significance (DNS) process, and there will be preference for sites identified within the Policy 17 Pre-Assessed Areas.

1.4.5 NPTC is required by Planning Policy Wales (PPW 12) to "support and guide renewable and low carbon energy development to ensure their area's potential is maximised". Local planning authorities should seek to identify land for energy developments below 10 MW (i.e. not larger-scale developments which would go through the DNS process). This was later increased to any development below 50 MW in the Infrastructure (Wales) Bill (Welsh Parliament, 2023)

1.4.6 NPTC are to ensure that any sub-50 MW developments do not preclude the potential for larger developments within the areas identified in the Policy 17 Pre-Assessed Wind Areas. If the RLDP Local Search Areas are identified within the Pre-Assessed Wind Areas, development of sub-50 MW wind generation projects should only be permitted if they would not preclude or detrimentally impact the development of larger projects within these areas identified. These should therefore only be developed if a particular site is not suitable for a larger development due to access restrictions, grid capacity restrictions, ecology issues etc.

1.4.7 The potential in Neath Port Talbot for heat networks is highlighted in Policy 16 in Future Wales (2021), which identifies two Priority Heat Network Areas in Port Talbot and Neath. NPTC should explore heat networks in these areas as they have been deemed to have sufficiently high heat density and therefore potential for heat networks.

1.4.8 Technical Advice Note 15 (TAN 15) Development (Welsh Government, 2021), flooding and coastal erosion included renewable energy generation developments (excluding hydro generation) within the "Less Vulnerable Development" category, which is defined as "development where the ability of occupants to decide if risks and consequences are acceptable is greater than that in the highly vulnerable category.". Proposals for such developments within identified flood risk zones must satisfy the planning authority that its location is justified. Hydro energy generation was included in "Water Compatible Developments" which are defined as "required to be in a fluvial, tidal or coastal location by virtue of their nature, and developments which are resilient to the effects of occasional flooding". They are not subject to a justification test by the local planning authority. Preparation of the next edition of TAN 15 is underway; this may increase flexibility in the TAN to allow for appropriate regeneration and redevelopment in flood risk areas, and provide more detail on the issues for the plan-led system and the justification for development.

1.4.9 The potential of marine renewables in the Neath Port Talbot region is set out in the Welsh National Marine Plan (2019) and the Marine Energy Plan for Wales (2019). Both policies highlight the strong tidal energy potential in the wider Swansea Bay region, however projects to date such as the Swansea Bay Tidal Lagoon have not been successful to date due to cost, risk, lack of investment and ecological impacts. The Celtic Freeport project in Milford Haven and Port Talbot is hoping to accelerate the low-carbon economy in Wales by supporting new manufacturing facilities and major port infrastructure to support floating offshore wind (FLOW) rollout in the Celtic Sea.

1.4.10 In the Towards Zero Waste: Our Waste Strategy (Welsh Government, 2010), the Welsh Government introduced a moratorium on energy from waste by 2050, as they aim to maximise recycling and re-use to minimise residual waste. Waste sent to energy recovery will be progressively reduced from 2025 to 2050. By 2024/25 local authorities are restricted to a maximum of 30% of their waste going to energy recovery, with that being reduced to 0% by 2050. In the 2022/23 period, NPT sent 30.9% of their total municipal waste to incineration with energy recovery (Welsh Government, 2023), meaning they are on track to achieve the 2025 target.

1.4.11 The Energy Efficiency Strategy (2016-2026) aims to ensure that Wales is in the best possible position to realise its full energy efficiency potential and become a major exporter of energy efficiency technology and know-how. This aims to be achieved by establishing a well-educated and skilled workforce, developing a robust supply chain, and funding innovation in new energy efficiency measures.

1.4.12 In Building Better Places (2020), the key existing planning policies and tools that should be used for taking action in the recovery period after the Covid-19 pandemic are outlined, including Local Development Orders (LDOs), which grant planning permission without the need for planning applications. Details concerning the implementation of LDOs in Wales can be found in the 'Welsh Government Circular 003/2021 Guidance on Using a Local Development Order' and 'Local development orders: impacts and good practice'.

1.4.13 Welsh Government Practice Guidance: planning for renewable and low carbon energy in buildings (2012) sets out ways in which the built environment can identify reductions in the carbon footprint of new buildings and optimise the use of renewable and low carbon energy technologies in the design process. It is intended for architects, planners and developers to incorporate the optimal combination of these technologies in projects.

Regional Energy Strategy

1.4.14 Regarding energy storage and flexibility, the South West Wales Regional Energy Strategy (2022) places a key emphasis on battery storage, which Neath Port Talbot Council are in a strong position to capitalise on as the region hosts Wales' largest battery storage project (22 MW Pen y Cymoedd).

1.5 Summary of Local Policy

1.5.1 Neath Port Talbot Council declared a climate emergency in 2022, meaning the Council has officially committed to calling on the UK and Welsh Governments to provide the necessary powers to ensure they reach carbon neutrality by 2030. Consequently, Neath Port Talbot Council's LDP should reflect this level of climate ambition regarding renewable energy deployment targets and the Council's position on renewable energy planning consent.

Local Decarbonisation Strategy

1.5.2 The Council's flagship decarbonisation strategy, the Neath Port Talbot Decarbonisation and Renewable Energy (DARE) Strategy (2020), introduces the "energy trilemma" which is centred around energy security, energy equity, and environmental sustainability. Future policies and LDPs should meet this trilemma through renewable deployment. Additionally, the Strategy highlights that Neath Port Talbot is the base of the only Flexible Integrated Systems Project in Wales - this is a £24.5m operation aiming to develop renewable energy production integration through localised, smart and low carbon energy production. Consequently, the Council is in a strong position to expand on this project and make Neath Port Talbot a flagship low carbon region.

Renewable Energy Strategy

1.5.3 Local renewable energy planning criteria are further outlined in the 2017 Neath Port Talbot LDP, which aims to promote the development of wind, solar, Combined Heat & Power (CHP) and biomass, whilst minimising the impact on residents.

1.5.4 There are also potential upcoming projects of interest such as the Port Talbot Green Energy Hub Celtic Freeport Bid which aims to create a green investment corridor with renewable energy sites at Port Talbot and Milford Haven and will help boost the offshore wind industry in the region.

1.5.5 Neath Port Talbot has their own Renewable and Low Carbon Energy Supplementary Planning Guidance (2017), which is more specific to developments carried out in the county.

1.5.6 AECOM carried out a low & zero carbon technologies feasibility study for Neath Port Talbot in 2016, around the Sandfields Secondary School. Their recommendation was that solar PV should be prioritised as a means of carbon reduction. AECOM also carried out a heat network feasibility study in 2016 in Neath Port Talbot, which indicated that there is potential for a heat network around the future Baglan Bay Energy Park and new superschool (which has since been scrapped).

1.5.7 Further emerging information will be released from the Neath Port Talbot LAEP and Net Zero Carbon Action Delivery Plan.

Local Area Energy Plan

1.5.8 City Science has developed Neath Port Talbot's Local Area Energy Plan (LAEP), which is a data-driven spatial plan that identifies the changes needed for the local energy system to meet net zero by 2050.

1.5.9 The report is prepared through significant stakeholder engagement to provide a comprehensive view of the current and future energy system in Neath Port Talbot and sets out specific target uptake rates of technologies such as heat pumps and renewable generation technologies.

1.5.10 As there is an overlap between the LAEP and this RLCEA, any target setting is ensured to be consistent across both workstreams, such that the outcomes are consistent and align with each other.

1.6 Method & Scope

Scope of Assessment

1.6.1 The geographic scope of this assessment is that of the administrative boundaries of Neath Port Talbot Council (NPTC), as that is what is governed by the authority's planning policy.

1.6.2 The emerging Replacement Local Development Plan (RLDP) covers the period 2023-2038. This assessment therefore identifies renewable and low carbon targets for deployment by 2038.

1.6.3 The renewable energy technologies considered in this study include:

- **Onshore wind**: generating electricity.
- **Ground-mount solar PV**: generating electricity.
- **Biomass combustion**: in boilers generating heat, and Combined Heat & Power (CHP) generating heat and electricity simultaneously. Considering feedstocks of wood fuel from woodland management and 'woody' energy crops.
- **Waste incineration (Energy from Waste):** generating heat, or heat and electricity simultaneously.
- **Anaerobic Digestion (AD):** combustion of biogas generating heat and electricity simultaneously. Four waste feedstocks are considered: food waste, agricultural animal manure, agricultural poultry litter and sewage sludge.
- **Hydropower**: generation of electricity from wave, tidal and inland (non-coastal) water courses.
- **Building Integrated Renewables (BIR)**: generation of heat or electricity utilising small scale, building integrated renewables such as rooftop solar PV, heat pumps, small and micro wind power, and small biomass boilers.

1.6.4 Other low carbon opportunities considered include:

- **Waste heat**: e.g. from industrial processes or power stations.
- **District Heating Networks (DHN)**: serving residential and/or non-residential heating loads.
- **Geothermal energy** (mine water is currently being considered for its potential with DHN; the Seren Project in the South Wales coalfield is establishing a network to monitor mine water temperatures to estimate its heating potential (Seren Energy, 2015). This geological area encompasses all of NPT).

1.6.5 Renewable and local carbon opportunities not explored in this study:

- Solar thermal hot water panels
- Liquid biofuels
- Offshore wind.

Overarching Method

1.6.6 This study largely follows the method set out in the Welsh Government's guidance "Planning for Renewable and Low Carbon Energy - A Toolkit for Planners, 2015", referred to henceforth as the "Toolkit" or "Planning Toolkit" (Welsh Government, 2015). In some instances, the methodologies set out in the Toolkit reference superseded policies or financial incentive schemes which are no longer active. It uses an assessment of Pembrokeshire as an example for the Toolkit, with future forecasts and targets for 2020, which does not align with the target year in this study of 2038. Furthermore, changes to national planning policy, the introduction of Future Wales and changes to the definition of large scale development previously set out as Nationally significant infrastructure projects to Developments of National significance have all been since the publication of the toolkit which is now outdated in some respects. It has therefore been deemed appropriate to deviate the Toolkit's suggested methodologies where they have been considered out of date, or where latest policy has superseded the proposed approaches. Where this has been done, it has been clearly stated in this report.

1.6.7 The overarching aim of this study is to identify potential renewable and low carbon energy resources and set targets for their deployment for the end of the RLDP period (2038). The results of this assessment are aimed at informing planning policy development for the RLDP. It is not meant as a tool for assessing planning applications.

1.6.8 The Toolkit outlines six potential policy objectives for local planning authorities to consider with respect to renewable and low carbon energy, along with four evidence bases which should inform each of the policies. These policy options are detailed in Table 1-1 below, along with the sections of this report that will inform those policies. The dark purple areas represent where an evidence base is critical in developing a particular policy option, the lighter purple area indicate where an evidence base may have some relevance in supporting a policy option.

Policy Options	Relevant report sections	E1. Area wide RE assessment	E2. BIR uptake assessment	E3. Heat opportunities mapping	E4. Detailed viability appraisal for strategic sites
P1. Develop area wide RE targets and monitor progress	4, 5 and 8				
P2. Inform site allocations for new development	7				
P3. Identify suitable areas for stand-alone renewable energy development	8				
P4. Identify opportunities and requirements for renewable or low-carbon energy generation linked to strategic new build development sites	7 and 9				
P5. Develop policy mechanisms to support District Heating Networks (DHN) for strategic sites	6 and 9				
P6. Identify further actions for LA, public sector and wider stakeholders	10				

Table 1-1: Relationship between policy options, evidence base and report sections

Notation Used

1.6.9 It is important to distinguish between energy generators that produce heat or electricity, or both (such as in CHP). Electrical capacity and electrical energy generation will be denoted with a suffix “e”, e.g. MW_e or MWh_e, and heat capacity and generation will be denoted with suffix “th”, e.g. MW_{th} and MWh_{th}.

2 Existing & Future Energy Demand Baseline

Chapter in Brief

This chapter provides a summary of the current energy use in Neath Port Talbot and makes a projection of energy demand to the end of RLDP period (2038). The energy demands shown here will be compared to the renewable energy potential in latter stages of this study.

2.1 Introduction

2.1.1 NPTC will wish to develop RLDP energy targets for a certain proportion of the county's energy demand being satisfied by renewable or low carbon energy. It is therefore useful to understand the current energy demands of the county and make a projection of what energy demands may be at the end of the RLDP period (in 2038).

2.1.2 The Toolkit refers to an old UK Government projection of energy demand to develop this projection: the UK Renewable Energy Strategy, 2008 (HM Government, 2008). The methodology set out used in this study has instead used the latest DESNZ's Energy and Emissions projection 2022 to 2040 (DESNZ, 2023).

2.1.3 BEIS publish the subnational final energy consumption dataset each year data for each local authority across Great Britain, accounting for various sectors and fuel types (BEIS, 2022). The latest year of data available at the time of drafting was 2020, which was significantly impacted by the Covid-19 pandemic. Most notably the road transport energy consumption dropped substantially in that year. This was not considered representative of current energy demands, therefore the data for 2019 has been used.

2.1.4 The forecast of energy consumption in 2038 was determined by taking the percentage change in energy demand between 2022 and 2038 in DESNZ's energy and emissions projections publication, under their "Reference case" scenario in Annex F (DESNZ, 2023). The Reference case represents the expected final energy demand based on current policies that have been implemented or are planned to be implemented. It is not representative of a net zero scenario.

2.1.5 The DESNZ Reference case projection is for the UK energy system. This analysis therefore assumes that the national projection of energy demand can be considered representative of the expected changes in the NPT energy system. The demand of the steelworks is not included in this projection.

2.1.6 The final energy demand categories in the DESNZ subnational dataset do not map exactly to that in the DESNZ energy projections. A mapping between these two datasets was therefore developed, which has been provided in Appendix A.

2.1.7 As per the Toolkit, the energy demands have been simplified into three categories:

- Electricity
- Heating fuels
- Transport fuels

2.1.8 Aviation and shipping fuels are not included in the analysis as it is difficult to attribute such demands to a local authority.

2.1.9 It was identified that the Port Talbot steelworks had a substantially larger demand than that shown in the industrial categories of the BEIS subnational final energy data. The BEIS final energy data for 2019 showed a 320 GWh demand for coal, and 4,645 GWh demand for manufactured solid fuels. It was known that the Port Talbot steelworks had a demand of circa 21,000 GWh, mostly for coal, with some natural gas, as Tata Steel publish an annual sustainability report including the energy intensity of the Port Talbot site (Tata Steel, 2021).

2.1.10 We suspect that the BEIS methodology used to disaggregate the coal and manufactured solid fuels data down to a local authority level has failed to properly represent the demands of the steelworks, which is a very large and unique energy consumer. It was assumed that the Port Talbot steelworks would be solely responsible for the industrial coal and solid fuels demand in NPTC, therefore this data was excluded from the analysis, and the demand for steelworks was determined separately using annual Tata Steel sustainability report.

2.1.11 No projection has been made on the 2038 energy demand for the Port Talbot steelworks as its future is highly uncertain. Recent government funding announcements suggest that it could transfer to a scrap steel electric arc furnace production route, which could reduce its overall energy demands dramatically (BBC News, 2023).

2.1.12 The result of this analysis is shown in Table 2-1 below. The energy demand for electricity, heating fuels and transport (road and rail) fuels in 2019, excluding the Port Talbot steelworks, has been estimated to be ~3,780 GWh.

2.1.13 The percentage change in final demand in the BEIS projections from 2019 to 2038 showed a 7% decrease in electricity consumption, an 8% decrease in heating fuels, and a 3% decrease for transport fuels (most likely due to the electrification of vehicles).

2.1.14 Applying the trajectories in the DESNZ UK projections to the NPT energy demands results in the overall 2038 demand being very close to that in 2019.

Category	Current 2019 demand (GWh)	BEIS Energy & Emissions Projection 2038 increase from 2019	2038 Estimation using BEIS Energy & Emissions Projection (GWh)
Electricity	1,305	-7%	1,220
Heating fuels	1,560	-8%	1,432
Transport fuels (road & rail)	1,162	-3%	1,128
*Steelworks fuel**	*21,333*	-	-
Total	**4,023**	**-6%**	**3,780**

*Table 2-1: Existing and future energy demand for Neath Port Talbot (*the Port Talbot steelworks demand has been excluded from the projection due to its unique nature and its future being highly uncertain.)*

3 Existing & Proposed Low Carbon Technologies

Chapter in Brief

This chapter outlines the current installed capacity of renewable and low carbon energy generation in Neath Port Talbot.

3.1 Introduction

3.1.1 Understanding Neath Port Talbot's existing and proposed renewable and low carbon technologies is a useful exercise in setting a baseline from which targets can be developed (Welsh Government, 2015).

3.2 Method

3.2.1 There is no single comprehensive source of renewable capacities, this exercise involves searching through multiple datasets and performing corroboration where possible. The below method searches through multiple public datasets, cross references against NPTC planning data, and then performs a final check against a Welsh Government publication which performed a comprehensive corroboration of renewable datasets.

Step 1: Review public renewables datasets: REPD, FiT, Ofgem Renewables and CHP Register.

Step 2: Cross reference schemes against renewable schemes in NPTC planning data.

Step 3 Compare the total capacity estimates against the Energy Generation in Wales 2021 report (Regen, 2021).

Step 4: Review REPD and NPTC planning data for proposed schemes which are not yet built.

Step 5: Estimate the energy generation from existing and proposed capacity using the recommended capacity factors in the Toolkit (Welsh Government, 2015).

Figure 3-1 Methodology for assessing existing and proposed low carbon technologies

Public Datasets Used

3.2.2 The following public data sources have been reviewed to produce an estimate of the existing renewable and low carbon technologies:

- Renewable Energy Planning Database (REPD) (BEIS, 2023)
- Ofgem Feed-in Tariff (FIT) register (Ofgem , 2023)
- Ofgem Renewables and CHP register (Ofgem, 2023): including registered stations under the Renewable Obligation (RO) and Renewable Guarantees of Origin (REGO).

3.2.3 The REPD began in 2014 (though it captures schemes developed prior to this year), capturing renewable schemes of 1 MW and above installed capacity, until 2021 when it began logging any schemes from 150 kW and above. Projects below 1 MW that went through the planning system before 2021 may therefore not be represented in the REPD.

3.2.4 The FiT register, published by Ofgem, provides details of any renewable schemes that applied for the FiT incentive between April 2010 and April 2019. Any schemes developed outside of that period, or did not claim for the FiT incentive within that period, would not be included in the register.

3.2.5 The RO scheme was designed to encourage generation of electricity from larger renewable sources in the UK. The RO scheme came into effect in 2002 in Great Britain and the scheme closed to all new generating capacity 1 April 2017.

3.2.6 The REGO scheme provides certificates that evidence that electricity sold has come from a renewable source. The scheme came into effect in 2003 and is running up to the present day.

Corroboration of Datasets

3.2.7 The schemes identified were then compared against all schemes listed in NPTC's planning application data. Naturally, there is overlap between the datasets, so where possible, renewable schemes were corroborated against each where a unique identifier could be found (e.g. a planning reference or a unique site name). However, such a unique identifier is not always available to perform this corroboration, so there is doubt in some instances.

3.2.8 Regen was commissioned by Welsh Government to produce a series of reports exploring the extent of renewable capacities across Wales, the latest of which is representative of the capacities in 2021 (Regen, 2021). In doing this, they performed a corroboration of all public renewable datasets, gaining access to some non-public datasets, and held engagements utilities, installers and industry organisations. This study is therefore considered a trustworthy source of renewable capacities, but it was published in 2021 and so therefore would not capture any schemes built since then.

Notes on the estimation of renewable energy capacity:

When determining the capacity and development status of the existing developments, planning application data from NPTC was cross referenced against the REPD, FiT register and Ofgem Renewables and CHP register. Care was taken to corroborate the datasets using the planning application reference and removal of any duplications. The cross referencing was not always possible and the capacities across the two datasets often conflicted, particularly in the case of onshore wind. The locations of the registered addresses in the REPD would sometimes conflict with the polygons provided in the NPTC planning data (see Figure 12-1 below). Our best professional judgment was used in determining operational capacities in instances of doubt.

In the case of heat pump capacity, there is no publicly available dataset, so the figures are taken directly from the Energy Generation in Wales Report (Regen, 2021).

The capacity estimates were compared with the Energy Generation in Wales report (Regen, 2021). The estimate provided in the Energy Generation in Wales report could be considered be more comprehensive, because Regen held engagements across industry and had access to additional data which is not publicly available such as:

- Western Power Distribution connections data.
- SP Energy Networks connections data.
- MCS data.

However, the report was produced in 2021, and so will be missing any renewable projects developed between the publication in 2021 and the time of writing this study (2023). To avoid underestimation the renewable capacity in NPTC, the highest installed capacity between our estimates and that of Energy Generation in Wales is used in the results.

The capacity factors provided by the Toolkit are used to estimate the energy generation for each technology.

3.2.9 The NPTC planning data had a total of 21 onshore wind schemes with a combined capacity of 512 MW, with 506 MW of this capacity listed as having “Approved” or “No objection” status. The REPD showed 23 schemes with a combined capacity of 530 MW; but only 10 were listed as operational with a combined capacity of 361 MW. Only 10 schemes were corroborated between the two datasets using the planning application reference.

3.2.10 Most notably the Pen Y Cymoedd wind farm was listed in the NPTC planning application data as having an installed capacity of 299 MW, but in the REPD it was 228 MW. This installation forms most of the large polygon in the North East of NPT which extends into neighbouring Rhondda Cynon Taf (see Figure 12-1). The capacity of this wind farm attributable to NPT based on land area could be reduced to that within the boundaries of the county (45% of its polygon falls within Rhondda Cynon Taf).

3.2.11 For simplicity and transparency, it was decided that the operational capacity of schemes in the REPD would be used as the installed capacity in this study (361 MW). This could be an underestimate given the schemes and capacities listed in the NPTC planning data; however, this RLCEA then aligns with the LAEP workstream, which also uses the REPD for its baseline.

3.2.12 It was also noted that this is larger than the installed capacity shown in Energy Generation in Wales 2021 of 330 MW. We had a preference to pick larger of the two capacities between our investigations and Energy Generation in Wales 2021 as that could be more comprehensive.

3.2.13 Rooftop PV installations are likely to fall under permitted development, and so would not be included in the NPTC planning data, nor the REPD. The REPD also only includes schemes above 150 kW and so will not include small rooftop installations (the average domestic installation is around 3.5 kW). An estimate of small-scale rooftop PV capacity was determined by assuming that anything 50 kW or below in the FiT register was a rooftop installation (the register does not explicitly state whether a scheme is rooftop or ground mounted). Out of the 1,694 schemes in the FiT Register, only seven had a capacity greater than 50 kW, and 1,612 had capacities less than 5 kW, which suggests that most schemes in this register are rooftop PV. The FiT register will not cover all rooftop installations in the county (for reasons sated in 3.2.4), but it provides a reasonable estimate. The sum of schemes below 50 kW in the FiT register amounted to 7.0 MW, with 5.8 MW of that being listed as domestic applications.

3.2.14 Assumed capacity factors represent the ratio of actual energy generation to the theoretical maximum energy output of the installed capacity. This accounts for periods of low wind speed for onshore wind, or cloudiness for PV, which result in the installed capacity being unable to output its maximum potential.

3.3 Existing Installed Capacity

3.3.1 Table 3-1 below shows the total installed capacity of identified existing renewable developments in NPT. A full breakdown of the identified sites is also provided in Appendix B.

3.3.2 Note that the installed capacity of hydropower, heat pumps and biomass (heat) were taken from Energy Generation in Wales (Welsh Government, 2022). The capacity of rooftop PV was calculated from the Feed-in-Tariff (Ofgem , 2023). As a result, these capacities do not have individual sites listed in Appendix B.

3.3.3 For biomass and AD generation that is marked as CHP enabled (as determined from REPD), the potential heat recovery (MWth) is estimated from the provided installed capacity (MWe). For AD, it is assumed that the generation has a 35% electrical efficiency and 40% heat recovery. For biomass, it is assumed that the heat capacity is double the electrical capacity, as per the Planning Toolkit (Welsh Government, 2015). Where it is unclear whether the generation is CHP and no additional information is available, it is assumed to be heat only generation.

Technology (power)	Installed capacity (MW_e)	Assumed capacity factor	Estimated annual power generation (MWh_e/yr)
Wind (onshore)	361.2	27%	854,310
Solar PV (ground mounted)	44.4	10%	38,868
Solar PV (roof mounted)	7.0	10%	6,095
Anaerobic Digestion (electricity)	6.0	42%	22,075
Hydro	1.0	50%	4,380
Biomass (electricity)	54.0	90%	425,736
Totals	**473.6**	-	**1,351,464**
Technology (heat)			
Biomass (CHP heat)	34.4	50%	150,672
Anaerobic Digestion (CHP heat)	6.9	50%	30,034
Heat Pumps	1.0	20%	1,752
Biomass (heat only)	19.0	30%	49,932
Totals	**61.3**	-	**232,390**

Table 3-1: Existing renewable generation capacity in NPTC

3.4 Proposed Installed Capacity

3.4.1 The Toolkit suggests that only large sites that have received planning permission, but not yet been constructed, should be included in the review of proposed technologies (Welsh Government, 2015).

3.4.2 Only schemes with a proposed installed capacity of greater than 2 MW are included (as we have deemed this to be a “larger” installation). If a planning application for a site has been submitted, but is yet to receive a decision, it will not be included. It is possible that some of the proposed sites included in the results will not be built.

3.4.3 Certain pipeline projects that are therefore not included are Fforch Dwm Wind Farm (35 MW), Hirfynydd Renewable Energy Park (100 MW), Y Bryn Wind Farm (130 MW) and Mynydd Margam Solar Farm (29 MW).

Technology type	Site Name	Proposed Installed Capacity MW	Assumed capacity factor	Estimated annual energy generation (MWh/yr)
Ground mounted PV	Mynydd y Gwrhyd Solar Farm	2.2	10%	1,953
Roof mounted PV	Ffordd Amazon, Crymlyn Burrows Solar Pannels	3.3	10%	2,891
Wind Onshore	Melin Court	18.0	27%	42,574
Wind Onshore	Foel Trawsnant	33.0	27%	78,052
Biomass (heat only)	Intertissue, Briton Ferry	8.0	30%	21,024
Total proposed power generation (MW_e)		**56.5**	-	**125,470**
Total proposed heat generation (MW_{th})		**8.0**	-	**3,072**

Table 3-2: Proposed renewable and low carbon energy projects in NPTC

3.5 Combined Existing & Proposed Installed Capacity

3.5.1 The combined capacity of the existing and proposed schemes is shown in Table 3-3 below.

Technology (power)	Existing and proposed Capacity (MW_e)	Estimated existing and proposed annual energy generation (MWh_e/yr)
Wind (onshore)	412.2	974,935
Solar PV (ground mounted)	46.6	40,821
Solar PV (roof mounted)	10.3	8,986
Anaerobic Digestion	6.0	22,075
Hydro	1.0	4,380
Biomass (electricity)	54.0	425,736
Total estimated power generation	**530.1**	**1,476,933**
Technology (heat)		
Biomass (CHP heat)	34.4	150.672
Anaerobic Digestion (CHP heat)	6.9	30,034
Heat Pumps	1.0	1,752
Biomass (heat only)	29.0	76,212
Total estimated heat generation	**71.3**	**258,670**

Table 3-3: Existing and proposed renewable generation capacity in NPTC

3.6 Comparison Against Energy Demands

3.6.1 Figure 3-2 below compares the current (2019) energy demand and the 2038 projection against the estimated existing renewable energy generation. The Port Talbot steelworks demand has been excluding for reasons detailed in Section 2.

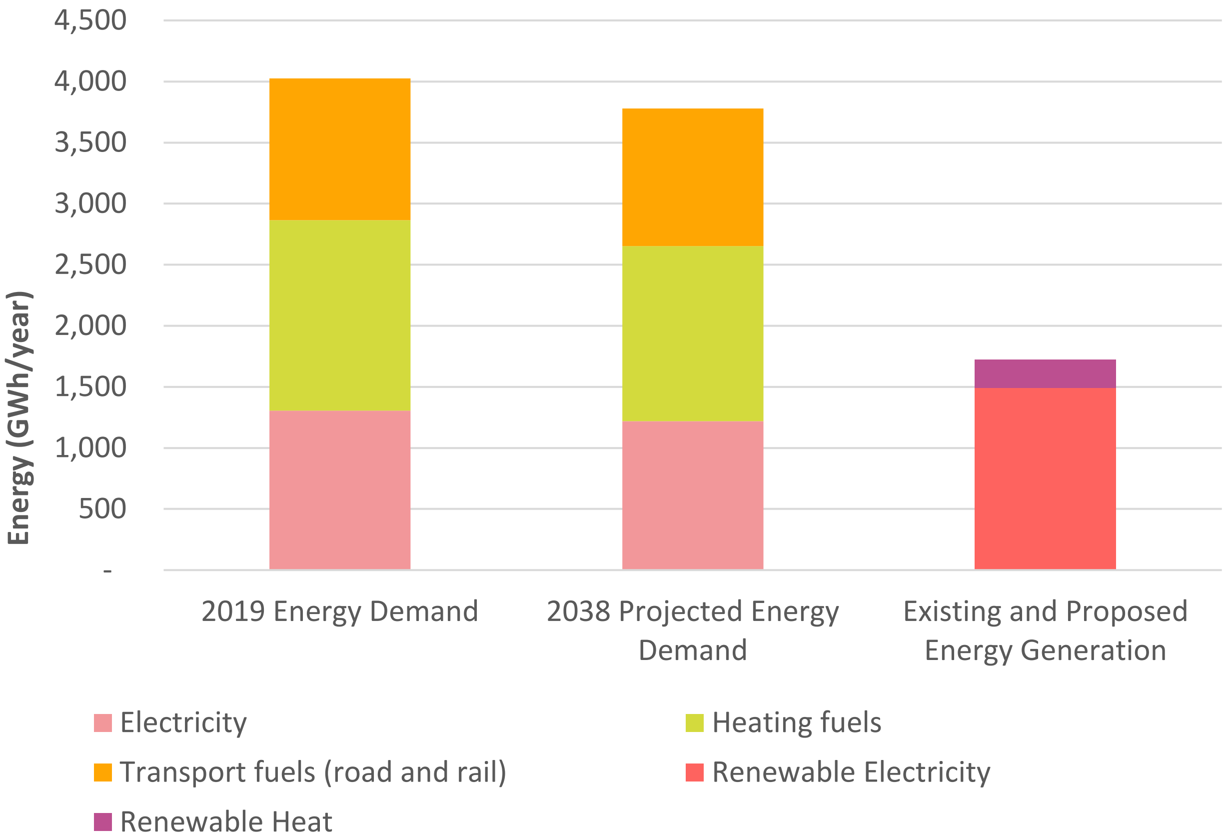


Figure 3-2: Comparison of energy demand (excluding the steelworks) and existing renewable energy generation

3.6.2 The estimated electricity generation from existing and proposed assets (1,493 GWh) is slightly greater than the 2019 electricity demand of 1,305 GWh, and the projected 2038 demand of 1,220 GWh.

3.6.3 The combined renewable energy generation (electricity and heat) from existing and proposed assets (1,723 GWh) is approximately 43 and 46% the total energy requirements (excluding the steelworks) in 2019 and the 2038 projections respectively.

3.6.4 In Figure 3-3 below, the estimated and proposed existing renewable energy generation has been compared against the 2019 energy demand with the Port Talbot steelworks demand included. The steelworks main source of fuel for the blast furnaces is coal. A projection to 2038 has not been shown due to the uncertainty on the steelwork's future, as outlined in Section 2.1.11.

3.6.5 The total energy demand with the steelworks included amounts to approximately 25,000 GWh. The combined energy generation (electricity and heat) from existing assets (1,723 GWh) is approximately 8% of the total energy requirements when including for the steelworks. However, the energy demands are expected to change significantly following the implementation of the steelworks decarbonisation plans. The figure below is provided for context as it is not possible to estimate the potential future energy demands at the current time.

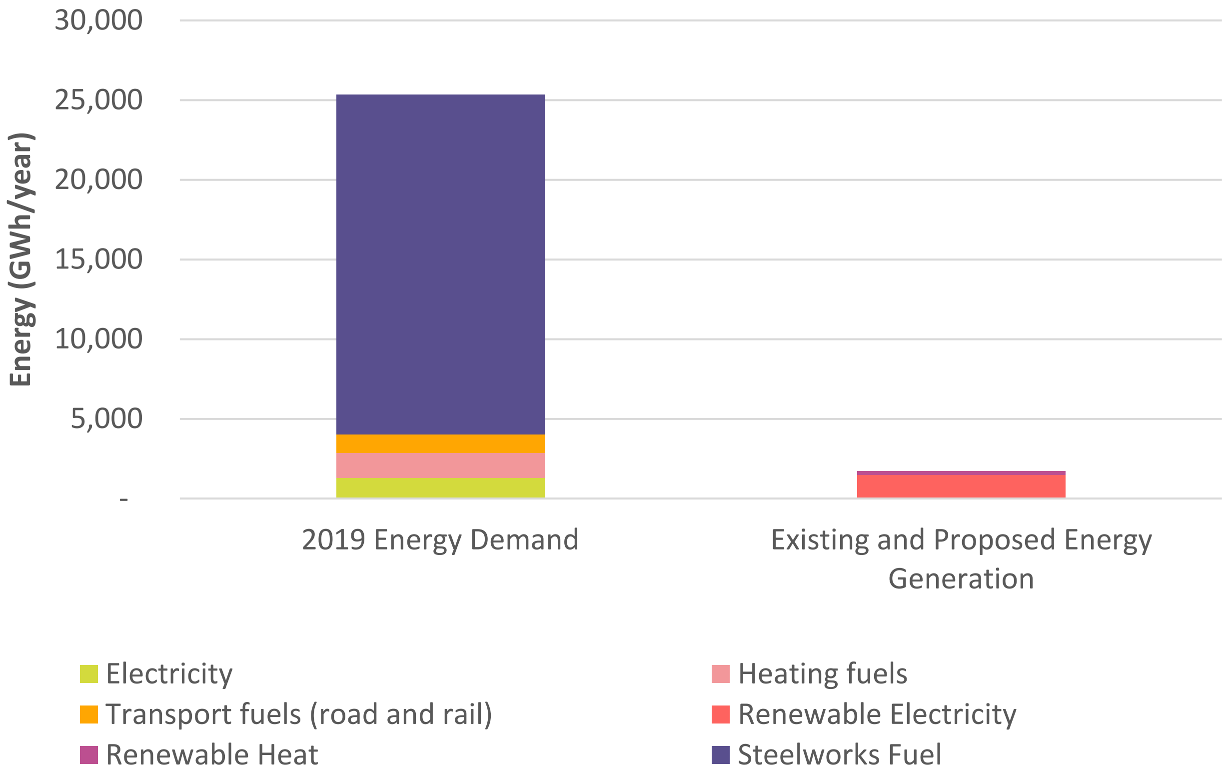


Figure 3-3: Comparison of energy demand (including the steelworks) and existing renewable energy generation

4 Renewable Energy Resource Potential

Chapter in Brief

This chapter determines the renewable energy potential for onshore wind, ground-mount PV, Anaerobic Digestion (AD), waste incineration and hydropower.

4.1 Onshore Wind

Introduction

4.1.1 This section assesses the potential to expand onshore wind deployment within NPT. A constraints mapping assessment has been carried out to provide a high-level estimate of the potential capacity across the local authority.

Method

4.1.2 The method for assessing onshore wind potential follows that outlined in the Planning Toolkit (Welsh Government, 2015). This is summarised in Figure 4-1.

Step 1: Decide on typology of wind turbine used for the assesement. For this analysis, a maximum turbine size of 2 MW is considered, which is typical for onshore wind as outlined by the Planning Toolkit.

Step 2: Map average annual wind speed; a minimum average annual wind speed of 6 m/s at 45m above ground level is suitable for onshore wind.

Step 3: Map environmental and heritage constraints, which includes Special Protection Areas (SPA), Special Areas of Conservantion (SAC), and other protected areas.

Step 4: Map transport infrastructure constraints such as roads and rail to minimise disruption due to "toppling".

Step 5: Map existing dwellings and a noise buffer; a minimum buffer of 500m should be used for a 2 MW turbine.

Step 6: Map existing aviation and radar constraints such as traffic zones and radio transmission areas that could otherwise cause disruptions. A full list of the restrictions and their buffer distances from Steps 2-6 are provided Appendix C.

Step 7: Map local development plan sites; these are already planned for developments and are therefore excluded from the search.

Step 8: Assess potential installed capacity and generation; based on a 2 MW turbine a potential installed capacity of 10 MW/km^2 is assumed, with a capacity factor of 27% based on the Planning Toolkit.

Figure 4-1: Methodology for Assessing Onshore Wind Resource (Welsh Government, 2015)

4.1.3 The Toolkit states that this method is suitable as a high-level assessment for the purpose of informing an area wide target. However, the following should be considered:

- An area of constraint may still be suitable for wind turbine deployment depending on the type and environmental designations of the constraint
- While the assessment can inform the potential of individual sites, it is not enough alone to determine technical viability

4.1.4 Areas marked for development in the Local Development Plan LDP were mapped as additional areas of constraint. The areas marked for renewable energy developments were however included as available land.

Results

4.1.5 The results of the constraint mapping exercise show 2.6% of the land area (11.5 km^2) passed through restrictions, with the 'woodland' restriction being the most impactful constraint. The full map of restrictions is shown on Figure 12-3 in the Appendix.

4.1.6 Following initial analysis and comparing the results to the Future Wales Policy 17 Pre-Assessed Areas for Wind (Welsh Government, 2020), it was found that the GIS constraints mapping was overly restrictive. Further analysis revealed that existing and approved NPTC wind developments overlapped with the restrictions map, as shown on Figure 12-14 in the Appendix.

4.1.7 Figure 4-2 below shows that much of the restriction that the existing NPT wind developments overlays is coniferous woodland.

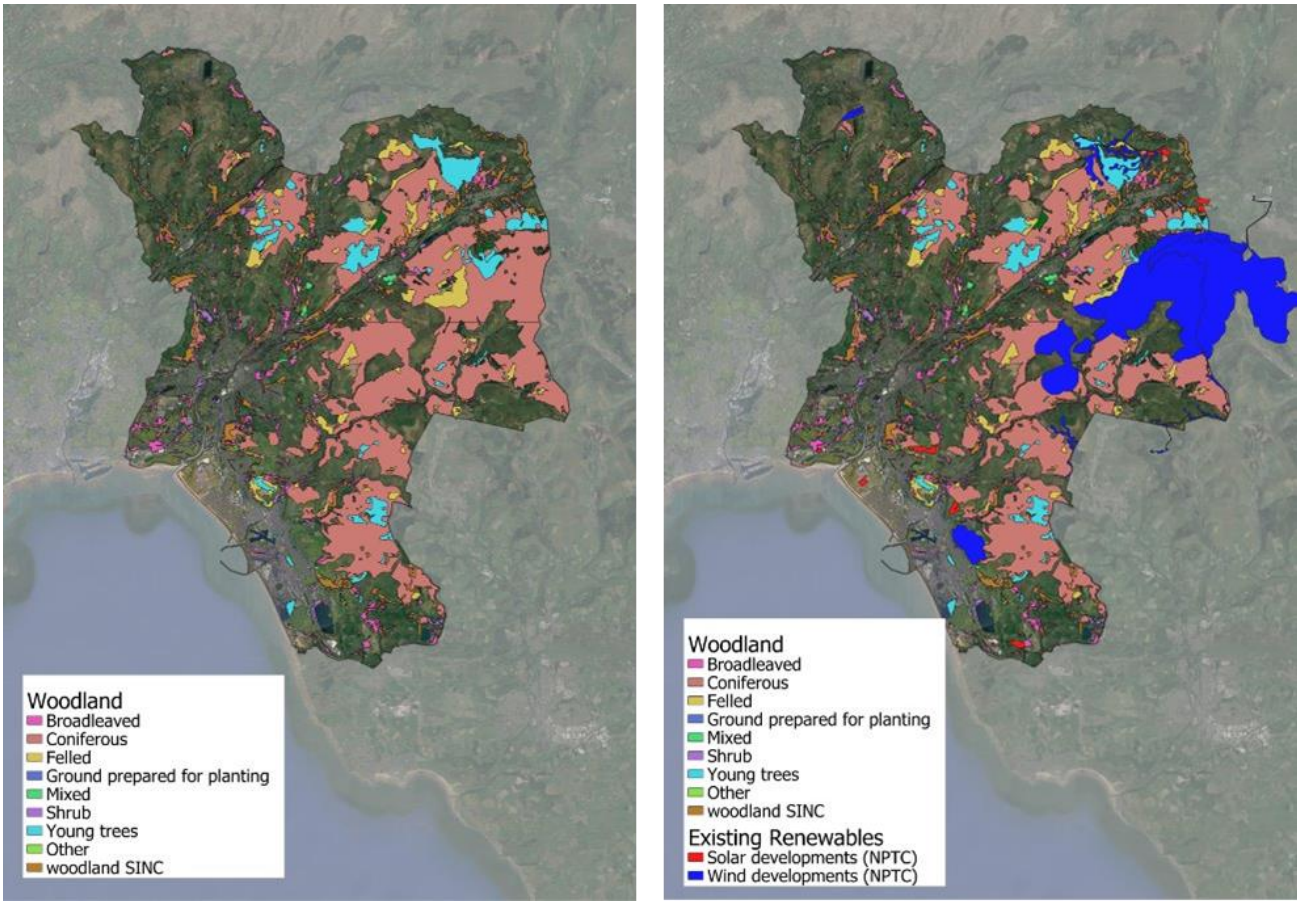


Figure 4-2: Onshore wind woodland restrictions and existing NPT wind developments

4.1.8 The existing onshore wind developments were investigated using Google Earth satellite view, which showed that onshore wind turbines are being constructed in areas of coniferous woodland in NPT. This is shown on Figure 4-3 below.

Figure 4-3: NPTC wind development in coniferous woodland satellite view

4.1.9 The National Forest Inventory (NFI) maps all forest and woodland areas over 0.5 hectares. However not all the area is covered with tree canopy (minimum of 20% canopy coverage), and areas designated 'coniferous woodland' show that there is space for wind turbines to be constructed between groupings of trees.

4.1.10 As highlighted by the toolkit, 'coniferous woodland' is a designation which may not restrict wind turbine development, and this was therefore removed as a constraint. This doubled the available land to 24.7 km^2, as shown on Figure 12-5 in the Appendix.

4.1.11 The areas with potential for onshore wind development are shown in Figure 12-6. The total capacity and generation potential is shown in Table 4-1.

4.1.12 Note that the areas and figures shown below do not include existing wind sites, and therefore this represents new potential capacity.

Area (km^2)	Potential Capacity (MW)	Potential Generation (GWh/year)
24.7	247	584

Table 4-1: Onshore wind potential in NPT

4.2 Ground-Mount Solar PV

Introduction

4.2.1 This section assesses the potential to expand solar PV deployment within NPT. A constraints mapping assessment was completed to provide a high-level estimate of the potential capacity across the local authority.

Method

4.2.2 The method for assessing Solar PV potential follows that outlined in the Planning Toolkit (Welsh Government, 2015). This is summarised in Figure 4-4.

Step 1: Map locations of built-up areas and infrastructure.

Step 2: Map further environmental and heritage constraints such as Special Protection Areas (SPAs), Special Areas of Conservation (SAC), and other protected areas. A full list of restrictions is provided in Appendix C.

Step 3: Map areas of suitable slope and topology; the performance of PV systems is directly related to orientation and slope gradient. Based on the Toolkit, for inclinations of 0-3°, all orientations can be considered suitable, while for inclinations between 3-15°, only south-west to south-east facing areas are suitable. Any inclincations above 15° are considered unsuitable.

Step 5: Assess potential installed capacity and energy output; according to the Toolkit, a 1 MW fixed-tilt PV array is approximately 6 acres (equivalent to an installed capacity density of 41.7 MW/km^2), and has a capacity factor of 10%.

Step 6: Map locations of suitable Agricultural Land Classification and apply further constraints as necessary; higher quality agricultural land is to be prioritised for agricultural activities.

Figure 4-4: Methodology for Assessing Solar PV Resource (Welsh Government, 2015)

4.2.3 The Toolkit states that this method is suitable as a high-level assessment for the purpose of informing an area wide target. However, the following should be considered:

- Areas deemed unsuitable through the high-level constraints mapping exercise, may in fact be deemed suitable after a more detailed site feasibility assessment
- Conversely an area identified as suitable through GIS mapping may prove to be technically or financially unviable.

Results

4.2.4 The results of the constraint mapping exercise show 13% of the land area (58.8 km^2) pass through the restrictions, with 'woodland' restriction being the most impactful constraint. Areas available for development are shown in Figure 12-7, categorised based on agricultural land classification. Table 4-2 shows the capacity of these areas, also based on agricultural land classification.

4.2.5 According to the Toolkit, large-scale solar PV farms are most appropriately sited on lower grade agricultural land (3b, 4 or 5), or non-agricultural land. This can also be further constrained to only grades 4 and 5, depending on the availability of PV potential. Given the large amount of potential in grades 4 and 5, it can therefore be assumed that grades 2, 3a, and 3b will not be considered for ground-mount PV. NPTs previous LDP (Neath Port Talbot Council, 2016) outlined that higher-grade land should be protected unless there is a compelling justification, and if no suitable alternative sites on lower-quality land is found.

Agricultural Land Grade	Area (km^2)	Potential Capacity (MW)	Potential Generation (GWh/year)
1	-	-	-
2	0.02	0.8	0.7
3a	58	2,418	2,118
3b	1	38	33
4	407	16,976	14,871
5	406	16,951	14,849
Other/Unclassified	59	2,468	2,162
Total	**932**	**38,851**	**34,034**

Table 4-2: Ground-mount PV potential in NPT by agricultural land classification

4.2.6 Up to 38,850 MW of maximum potential was identified in NPT, across 932 km^2 of land. This is a large area, and it would be unreasonable to think that it would be fully built out with ground-mount PV installations. There are a range of further land competition factors such as food production, energy crops and livestock grazing which need to be considered. Future work on target setting will consider reasonable proportions of this land used for ground-mount PV.

4.3 Biomass Resource

Introduction

4.3.1 Biomass can be a low carbon fuel provided the biomass is sourced sustainably. Biomass can be combusted in boilers for heat or in CHP configurations the heat (often in the form of steam) can be used to generate electricity.

4.3.2 If managed sustainably, biomass can also have other benefits (Welsh Government, 2015):

- Providing opportunities for agricultural diversification
- Encouraging increased management of woodland
- Positive effects on biodiversity
- Removing bio-degradable elements from the waste stream.

4.3.3 Two feedstocks have been considered in this study; both are forms of 'woody' biomass:

- Wood fuel from sustainable forestry and woodland management
- 'Woody' energy crops (miscanthus and short rotation coppice willow).

4.3.4 Liquid biofuels for transport are considered outside the scope of this assessment (Welsh Government, 2015).

Method

4.3.5 The method for assessing the potential energy yield from sustainable wood fuel and 'woody' energy crops follows that outlined in the Planning Toolkit (Welsh Government, 2015). This is summarised in Figure 4-5 and Figure 4-6.

Wood Fuel

4.3.6 The assessment considers resource from forestry residues and woodland management, it does not consider resource from: arboriculture residues or clean wood waste as they are out of the scope of the Toolkit (Welsh Government, 2015).

4.3.7 Wood fuel in the context of this assessment refers to virgin wood harvested from the sustainable management of forestry and woodland. This includes wood from thinning and so-called "lop and top" from timber (branches and twigs lopped of trees), meaning the ecological impact is minimized.

Step 1: Estimate the area of woodland practical for yielding wood fuel. Only coniferous plantations that are not ancient woodland or SINC are considered suitable.

Step 2: Establish the potential annual wood fuel yield from this land area. Assume 0.6 oven dry tonnes of available wood fuel per hectare of woodland, per annum as per Toolkit (Welsh Government, 2015).

Step 3: Establish the potential energy yield if the wood fuel is combusted for CHP or heat only, using capacity factors from the Planning Toolkit (Welsh Goverment, 2015).

Figure 4-5: Summary of the method for determining wood fuel resource potential.

Notes on wood fuel estimation

Determining the annually averaged sustainable yield of wood fuel, as instructed by the toolkit, requires an estimate of the area of woodland in NPTC that is practical for harvesting. The available dataset, National Forestry Inventory, shows the extent of different types of woodland in NPTC, but does not explicitly indicate where the forest is sustainably managed and suitable for yielding fuel. Therefore, through consultations with the local authority, we determined that it was best to only consider coniferous plantations, but with the exclusion of environmental conservation areas.

Energy Crops

4.3.8 Energy crops that are considered in this section are miscanthus and short rotation coppice willow. This section does not consider the potential for energy crops to provide liquid biofuels for transport.

4.3.9 These crops can only be grown on agricultural land grades 1 to 4, meaning grade 5 land is excluded from this search.

4.3.10 There is little guidance on the proportion of suitable land that can be planted with energy crops. The Toolkit suggests to assume that 10% of suitable land could be planted with energy crops (Welsh Government, 2015); this figure comes from the Bio-Energy Action Plan for Wales (Welsh Government, 2009).

Step 1: Establish the maximum theoretical area of land in NPT that could be used for growing energy crops. This includes all agricultural land that is grade 1 to 4 that is not subject to environmental and heritage constraints.

Step 2: Establish the land area that could be practically used for growing energy crops considering competing land uses and unsuitable topography. This is assumed to be 10% of the theoretical area, based on the Planning Toolkit (Welsh Government, 2015).

Step 3: Establish the potential annual fuel yield from this land area. We assume an average yield of 12 oven dry tonnes per year per hectare, based on the Planning Toolkit (Welsh Government, 2015).

Step 4: Establish the potential energy yield if the energy crops are combusted for CHP or heat only, using capacity factors from the Planning Toolkit (Welsh Goverment, 2015).

Figure 4-6: Summary of the method for determining energy crop resource potential.

Results

4.3.11 The estimated potential energy generation from wood fuel and energy crops in NPT is shown in Table 4-3. The theoretical maximum land area that could be used for growing energy crops is shown in Figure 12-9. As per the Planning Toolkit, we assume that only 10% of this is practically harvestable, as we must consider other competing land uses such as for food (Welsh Government, 2015). The area of forestry that is estimated to be appropriate for sustainably harvesting wood fuel is shown in Table 4-3.

4.3.12 The Toolkit states that energy crop fuel should be used for electricity generation or in CHP (i.e. not used for heat only generation), so no heat only generation potential has not been calculated (Welsh Government, 2015). Only the CHP results have been provided as the electricity only results would be the same, just with the heat generation removed.

Variable	Energy Crops	Wood fuel
Maximum theoretical land area that could be used for growing energy crops (hectares)	9,527	-
Practical land area available (hectares)	953	9,746
Assumed oven dry tonnes per hectare per annum	12	0.6
Tonnage of bioenergy, per annum	11,432	5,847
Assumed oven dry tonnes per 1 MW_e	6,000	6,000
Assumed heat to power ratio	2.0	2.0
CHP electrical capacity (MW_e)	2.0	1.0
CHP thermal capacity (MW_{th})	4.0	1.9
Assumed electrical capacity factor	90%	90%
Assumed thermal capacity factor	50%	50%
Annual electricity output (MWh_e)	**15,022**	**7,683**
Annual useful heat output (MWh_{th})	**16,691**	**8,537**

Table 4-3: Potential energy generation from wood fuel and energy crops in NPT

4.3.13 Though the practical woodland collection area available for wood fuel is significantly larger than that for energy crops, the yield density for crops is much greater (12 over dry tonne per hectare vs 0.6). The resulting energy potential from energy crops is approximately double that of the wood fuel resource.

4.3.14 It should be noted that both the woodland area for wood fuel and the land suitable for energy crops is disperse. Comprehensive collection of these energy sources may therefore by logistically challenging.

4.4 Anaerobic Digestion

4.4.1 In this section, the potential energy generation in NPT from the Anaerobic Digestion (AD) of organic waste is calculated. Four waste streams are considered:

- Food waste
- Agricultural animal manure
- Agricultural poultry litter
- Sewage sludge

4.4.2 The Toolkit states that it is unlikely that any AD facility would be used for heat only generation, and instead it would be used for electricity only or CHP. Our results are provided for simultaneous generation of heat and electricity via CHP.

Method

4.4.3 The method for assessing the potential energy yield from AD in NPT, follows that outlined in the Planning Toolkit (Welsh Government, 2015).This is summarised in Figure 4-7.

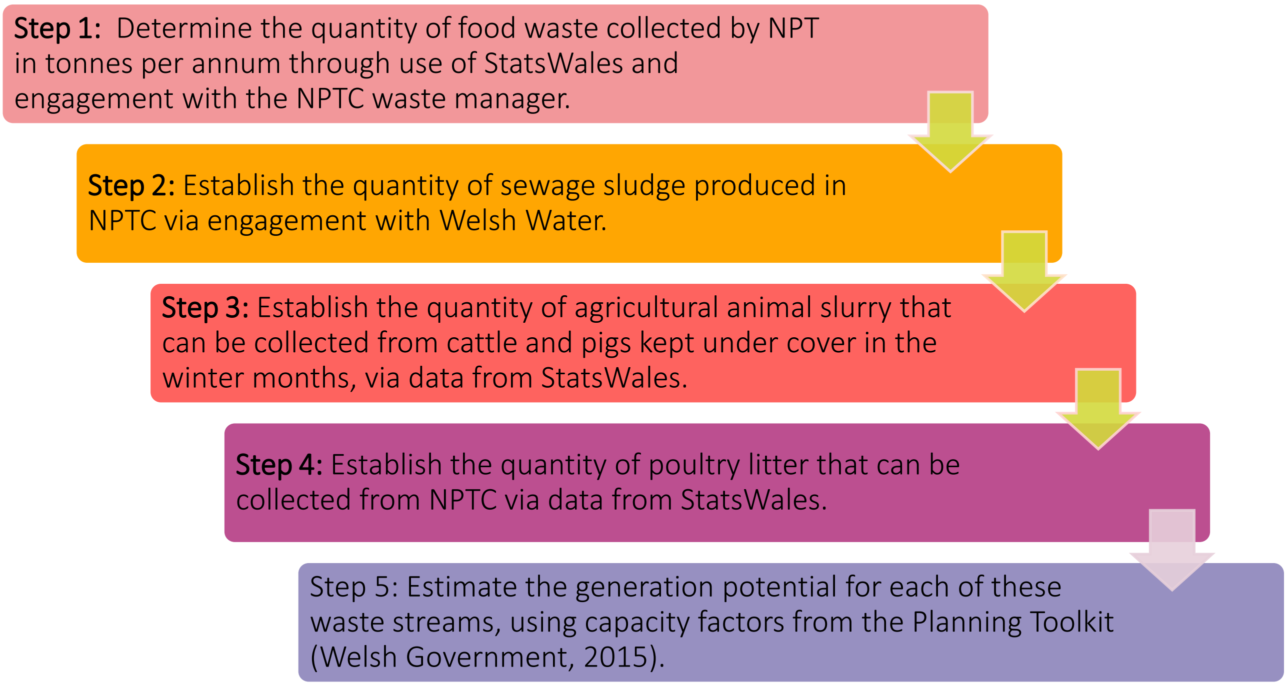


Figure 4-7: Method for determining the AD energy generation potential in NPT.

Food Waste

4.4.4 The NPTC waste officer confirmed that all food waste collected by the local authority currently goes to existing anaerobic digestion facilities in various locations, including the Biogen facility at Bryn Pica in the neighbouring local authority of Rhondda Cynon Taff. Further energy potential can therefore only be exploited, were the local authority to increase the amount of food waste collected.

4.4.5 We have provided a quantification of the AD energy generation potential, should the food waste feedstock be used within the county.

4.4.6 Food waste collected by local authorities is published by StatsWales (Welsh Government, 2023) for financial years FY2014/15 to FY2020/21, the quantity of food waste collected by NPTC varied from 4,500 to 6,600 tonnes per annum over this period.

4.4.7 The Toolkit states that an estimate of food waste not collected by the local authority should also be calculated. Through discussions with NPTC's waste officer, we learnt that there is no data on the uncollected waste streams; therefore, quantification has been provided on that which is collected only.

4.4.8 The following waste streams are outside of the local authority collected waste and so their potential has not been quantified:

- Food waste from businesses who use commercial waste companies (i.e. not the local authority collection service).
- Food waste not separated from the general waste (i.e. that which ends up in 'black bags' or wheeled bins); many councils estimate that up to 30% of black bin waste is food waste (Cambridge City Council, 2023) (Hull City Council, 2023) (West Berkshire Council, 2023).

4.4.9 The calculations will therefore be an underestimate of the theoretical energy potential of food waste produced in NPTC.

4.4.10 Projections for future quantities of food waste collected in NPTC are not available. Through discussions with the NPTC waste officer, it was agreed that it was best to assume a flat food waste projection to 2038 of 6,000 tonnes per annum.

Sewage Sludge

4.4.11 Dŵr Cymru Welsh Water were engaged to obtain data on wastewater treatment plants to understand the quantity of raw sludge produced in NPT each year. The most recent available data was for FY2021/22.

4.4.12 Several new wastewater treatment plants were built in NPT in recent years, which has increased the quantity of sludge available. In FY2018/19, the data states that 94 dry tonnes were available, this increased to 2,706 dry tonnes in FY2021/22. In this assessment, the data from FY2021/22 is used.

4.4.13 It is unclear whether any further wastewater treatment plants will be built in NPT before 2038; therefore, a flat projection of the 2021-2022 sewage sludge data to 2038 is assumed in the assessment calculations.

4.4.14 We understand Dŵr Cymru Welsh Water already send some sewage sludge to anaerobic digestion plants to power their wastewater treatment works, but we do not know the exact quantity. One of these AD plants is the Afan Wastewater Treatment Works in Port Talbot and has a 6 MWe installed capacity, with CHP enabled. This is an important consideration in contextualizing the potential resource; the plant may already have sufficient capacity to process all the identified sewage sludge in NPT.

Agricultural Animal Manure

4.4.15 The assessment of manure potential considers that from cattle and pigs. StatsWales provides the number of cattle and pigs by local authority in Wales (Welsh Government, 2017). Data is available from years 2007 to 2017, through which there is a significant change in the number of livestock. The number of cattle in NPT decreased by approximately 30%, from 7,721 to 5,544 over this period, while the number of pigs increased by approximately 250% from 80 to 196.

4.4.16 The data from the latest year available (2017) has been used in this assessment but should the trends from 2007 to 2017 be continued until 2038, the calculations would be an overestimation due to decreased livestock numbers.

4.4.17 The quantity of manure generated per head of cattle and per pig assumes that the livestock are housed for 6 months of the year, based on the Toolkit.

Poultry Litter

4.4.18 The Toolkit (Welsh Government, 2015) specifies that the minimum number of birds to make litter collection financially viable is 10,000. According to the 2017 data available from StatsWales (Welsh Government, 2017), there are only 2,000 birds in NPT.

4.4.19 Therefore, it was deemed there is an insufficient quantity of poultry litter in NPT to support an AD facility. No results table for poultry litter has therefore been provided below.

Results

Food Waste Variable	Value
Total food waste quantity (tonnes/yr)	6,000
Anticipated waste quantity in 2038 (tonnes/yr) (assumed constant, approved by NPTC)	6,000
Assumed thermal capacity factor (as per Toolkit)	50%
Assumed electrical capacity factor (as per Toolkit)	90%
Assumed quantity of waste required per $1MW_e$ (tonnes/yr) (as per Toolkit)	20,000
Assumed thermal energy generation per MW_e (MW_{th}) (as per Toolkit)	1.5
CHP electrical generation capacity (MW_e)	0.30
CHP thermal generation capacity (MW_{th})	0.45
Estimated annual useful heat yield (MWh_{th})	**1,971**
Estimated annual electricity yield (MWh_e)	**2,365**

Table 4-4: Estimated potential AD energy generation from food waste

Sewage Sludge Variable	Value
Amount of sludge produced in wastewater treatment works in NPTC 2021-2022 (tonnes of dry solids/yr)	2,706
Anticipated sludge quantity in 2038 (tonnes/yr) (assumed constant)	2,706
Assumed thermal capacity factor (as per Toolkit)	50%
Assumed electrical capacity factor (as per Toolkit)	90%
Assumed quantity of waste required per $1MW_e$ (tonnes/yr) (as per Toolkit)	13,000
Additional thermal energy generation per MW_e (MW_{th}) (as per Welsh Planning Toolkit 2015)	1.5
CHP electrical generation capacity (MW_e)	0.21
CHP thermal generation capacity (MW_{th})	0.31
Estimated annual useful heat yield (MWh_{th})	**1,368**
Estimated annual electricity yield (MWh_e)	**1,641**

Table 4-5 Estimated potential AD energy generation from sewage sludge

Cattle & Pig Manure	Value
Cattle	
Number of cattle in NPTC 2017	5,544
Number of cattle in NPTC 2038 (assumed constant)	5,544
Manure generated per cattle (wet tonnes/yr)	6
Total manure generated by cattle in NPT (wet tonnes/yr)	33,264
Pigs	
Number of pigs in NPTC 2017	196
Number of pigs in NPTC 2038 (assumed constant)	196
Manure generated per pig (wet tonnes/yr)	0.6
Total manure generated by pigs in NPT (wet tonnes/yr)	118
CHP Generation	
Assumed proportion of slurry that is feasible to capture (as per Toolkit)	25%
Total slurry feasible to capture (wet tonnes/yr)	8,345
Assumed thermal capacity factor (as per Toolkit)	50%
Assumed electrical capacity factor (as per Toolkit)	90%
Assumed quantity of waste required per 1MW$_e$ (tonnes/yr) (as per Toolkit)	225,000
Assumed thermal energy generation per MW$_e$ (MW$_{th}$) (as per Toolkit)	1.5
CHP electrical generation capacity (MW$_e$)	0.04
CHP thermal generation capacity (MW$_{th}$)	0.06
Estimated annual useful heat yield (MWh$_{th}$)	**244**
Estimated annual electricity yield (MWh$_e$)	**293**

Table 4-6 Estimated potential AD energy generation potential from agricultural animal manure

Conclusions

4.4.20 Food waste presents the best opportunity for AD potential in NPTC, but its capacity is still small at 0.3 MW$_e$.

4.4.21 The Afan Wastewater Treatment Works (WwTW) operation by Welsh Water has an installed capacity of 6 MW$_e$, which is much greater than the potential capacity identified here (0.2 MW$_e$). It is understood that the site takes in wastewater from outside the county. The capacity suggests that all the wastewater AD potential originating from within NPT is currently utilised.

4.4.22 There is only a small opportunity for agricultural manure, with just 0.04 MWe capacity identified (equivalent to 40 kW$_e$). This is unlikely to be a viable opportunity.

4.4.23 Poultry litter has been deemed an unviable opportunity as the number of poultry (approximately 2,000) falls below the recommended threshold set by the Planning Toolkit (10,000).

4.5 Energy from Waste (EfW) Incineration

Introduction

4.5.1 The Welsh Government has set out targets to achieve 70% waste recycling by 2025 and to reduce the impact of waste in Wales within their environmental limits by 2050 – aiming to completely phase out residual waste, via reuse or recycling of any waste that is produced. This means that no energy from waste incineration should be active in 2050. However, given the end date of this study is 2038, when 30% of waste is still permitted to go to waste incineration, its potential has still been considered here.

4.5.2 In the 2022-2023 period, up to 65% of waste in Neath Port Talbot was reused, recycled, or composted (Welsh Government, 2023). The average for Wales in 2022-2023 was up to 66%. The target for achieving 70% waste recycling by 2025 is therefore on track to be met.

4.5.3 Energy recovery from waste should be preferred over landfill, but only where measures to prevent, reuse or recycle waste are not applicable. This follows the waste hierarchy as set out in Article 4 of the revised Waste Framework (Directive 2008/98/EC), shown in Figure 4-8 below.

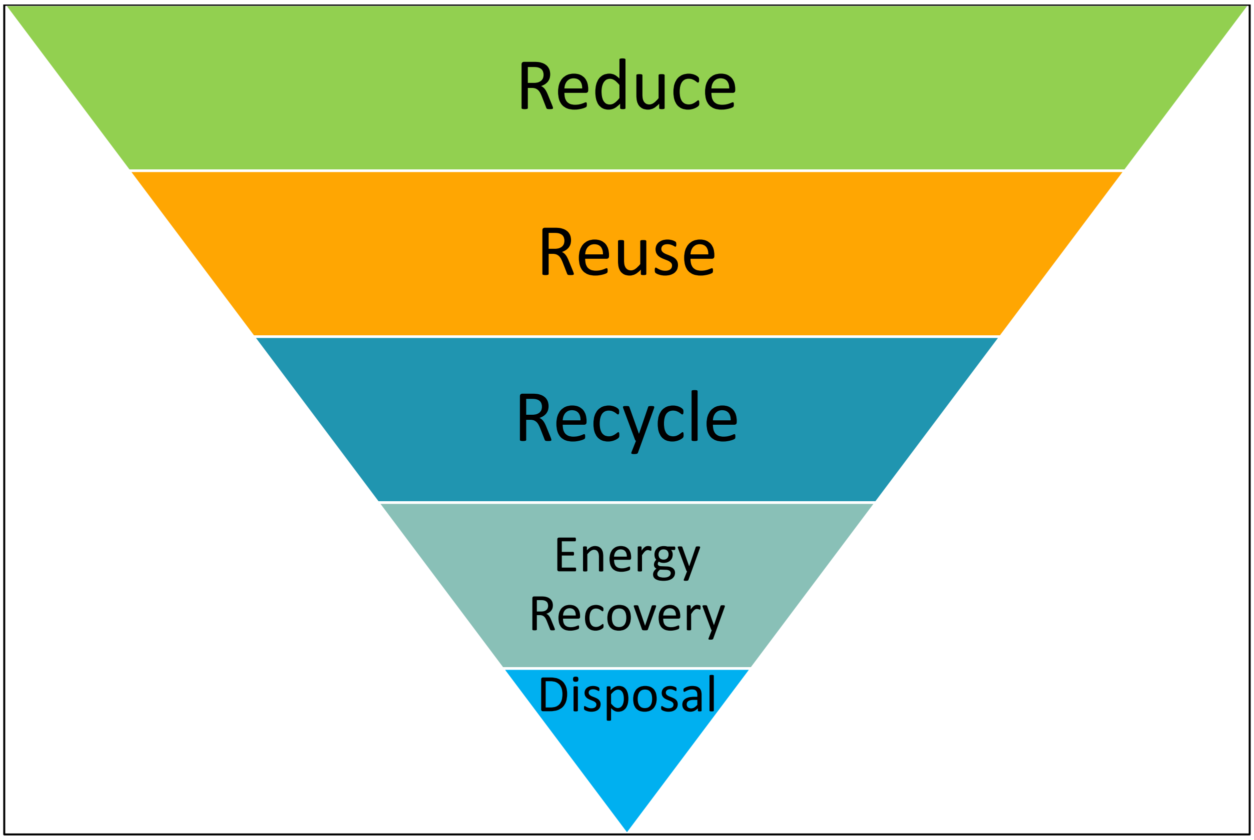


Figure 4-8: Waste hierarchy

Method

4.5.4 The methodology for calculating EfW potential as outlined in the Planning Toolkit (Welsh Government, 2015) is shown in Figure 4-9 below.

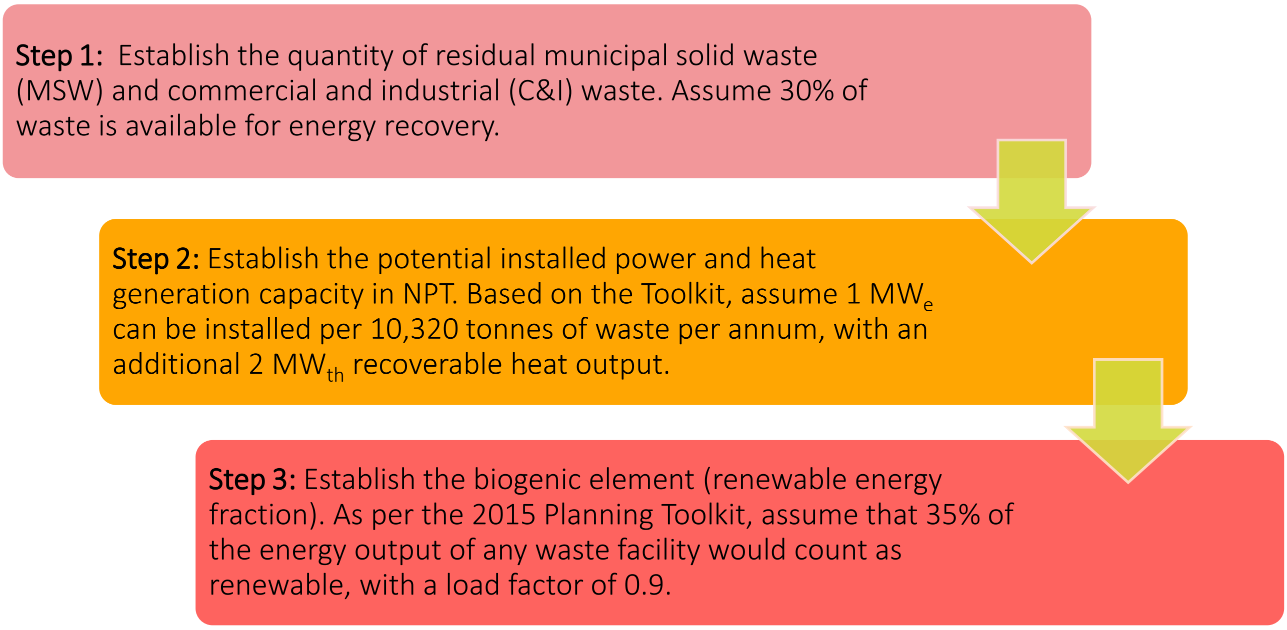


Figure 4-9 Method for determining the resource of EfW in NPTC

4.5.5 Data on waste was gathered from StatsWales which in turn collects data from 'WasteDataFlow' which is managed by Natural Resource Wales (NRW). The most recent figures for this are for FY2021/22; these are therefore used and projected to 2038 using an assumed annual waste reduction rate of 1.5%, as per the Planning Toolkit (Welsh Government, 2015).

4.5.6 The data provides the quantities of Municipal Solid Waste (MSW) and Commercial and Industrial (C&I) waste collected by the local authority. There are further waste collection streams outside of that collected by the local authority, but data on these streams is only published periodically at a regional level (Mid and South West Wales region) in NRW's Industrial and Commercial Waste Survey, the latest of which was in 2018 (NRW, 2018).

4.5.7 The 2018 study determined that 938,000 tonnes of C&I waste originates in the Mid and South West Wales region. Proportioning this down to the percentage of population in NPT in the region (16%) (according to the 2018 MYE) and applying the 30% limit on proportion available for energy recovery, reduces this figure down to 45,024 tonnes. The study also found that much of the C&I waste was metallic, which is not combustible, and therefore would not contribute to incineration energy potential.

4.5.8 The calculation below has only included for the local authority collected waste due to the uncertainty in the non-local authority collection stream's potential. StatsWales states that approximately 65,000 tonnes of local authority waste was collected in FY2021/22, so the potential from the non-local authority waste streams (which we estimate may be in the region of 45,000 tonnes) is not insignificant. The calculation below may therefore be an underestimation of waste incineration potential.

4.5.9 Some of the waste collected in Neath Port Talbot currently supplies energy from waste facilities outside of the county. The size of this waste stream is unknown, though the assumption that 30% of waste identified is available for energy recovery aims to account for this.

4.5.10 Waste is not considered completely renewable resource, only a proportion of it comes from organic matter. The Toolkit (Welsh Government, 2015) states to assume that 35% of the waste is biogenic. The renewable energy output in Table 4-7 therefore represents the energy derived from this proportion of the waste.

4.5.11 One existing EfW site is the NPTC waste facility at Crymlyn Burrows, which has planning permission for incineration with energy recovery. The permission for the site also includes Mechanical Biological Treatment (MBT). However, there has been no on-site incineration for over 10 years, and no MBT operation. NPTC have in sourced the facility and are currently remodelling the operation to focus on increasing volumes of source separated recycling delivered to the site. The decreasing volumes of residual waste delivered to the site will be bulked-up and transferred off-site for treatment and disposal. The Environmental Permit is being aligned accordingly and the site will no longer be permitted for MBT or incineration.

4.5.12 Another EfW facility is the Margam Green Energy Plant in NPT which deals specifically with wood waste. The waste stream is sourced from the UK and beyond, and only a small proportion of the overall feedstock is sourced from local authorities within the mid and southwest Wales region.

Results

4.5.13 Table 4-7 below shows the estimation of renewable energy generation potential from total MSW and C&I waste generated in NPTC. Results for CHP generation have been provided only, as large EfW plants must at a minimum demonstrate that they have fully considered the opportunities for CHP (NRW, 2014).

MSW & C&I Waste Incineration Variable	Value
Total waste 2021-2022 (tonnes/yr)	64,951
Total waste projected in 2038 (tonnes/yr)	52,565
Proportion of waste available for energy recovery	30%
Quantity of waste available for energy recovery in 2038 (tonnes/yr)	15,769
Assumed thermal capacity factor (as per Toolkit)	50%
Assumed electrical capacity factor (as per Toolkit)	90%
Assumed Quantity of waste required per 1MW_e (tonnes/yr) (as per Toolkit)	10,320
Assumed additional thermal energy generation (MW_{th}) (as per Toolkit)	2
CHP thermal generation capacity (MW_{th})	3.1
CHP electrical generation capacity (MW_e)	1.5
Estimated annual useful heat yield (MWh_{th})	13,386
Estimated annual electricity yield (MWh_e)	12,047
Biodegradable (renewable proportion)	35%
Estimated annual renewable heat yield (MWh_{th})	**4,685**
Estimated annual renewable yield (MWh_e)	**4,216**

Table 4-7 NPTC EfW CHP energy generation potential from MSW and C&I waste

Conclusions

4.5.14 A CHP EfW plant could generate 13,400 MWh of heat and 12,000 MWh of electricity from waste, with approximately 4,700 MWh_{th} and 4,200 MWh_e being considered renewable.

4.5.15 MSW contributes more significantly to these figures compared to C&I waste, with 91% of the energy derived from MSW, and only 9% coming from C&I waste. However, as outlined above, there could be significant potential from C&I waste streams not collected by the local authority which warrants further investigation.

4.5.16 Future Wales Policy 19 sets out the policies that Strategic Development Plans (SDP) should establish for the region (Welsh Government, 2020). Part of this is a coordinated framework for minerals extraction and the circular economy including waste treatment and disposal. It is most appropriate to consider EfW in the context of preventing landfill, as recycling targets should first be prioritised.

4.6 Hydropower

Introduction

4.6.1 Hydropower uses the kinetic energy of moving water to generate electricity. Hydro schemes are particularly site specific; the suitability of a particular site for hydropower development depends on the water resource complexity, economic viability and is subject to licensing and planning permissions (UK Government, 2022).

4.6.2 Significant changes in the renewable energy industry affected the hydropower sector over the past decade, mainly due to the increased costs of hydro scheme assessments and the competitive price reduction in wind and solar PV generation. Despite the competitive challenges, hydropower remains valuable in diversifying the UK's electrical generation portfolio (University of Birmingham, 2022).

Marine Hydropower (Wave & Tidal)

4.6.3 Marine hydropower encompasses various forms of technologies that harness energy from the sea and ocean to produce electricity, including ocean thermal gradients, salinity gradients, waves, tidal streams and tidal ranges. Compared to land-based hydropower, marine energy is still in its formative stage. However, marine, wave and tidal technologies are of strong interest to the government, particularly the Scottish and Welsh governments, providing major advantages in showcasing the UK innovation in the renewable sector and supporting with the energy transition to low-carbon electricity generation (UKRI, 2023).

4.6.4 Situated on the eastern periphery of Swansea Bay, within the Bristol Channel, Neath Port Talbot finds itself amidst a region often considered as an attractive place for marine energy. Regen conducted a study in 2012 which assessed the energy resource across the Bristol Channel (Regen, 2012). Whilst the study did not find resource immediately off the coast of NPT, it identified several GW of potential capacity for tidal range, tidal stream and wave power across the Bristol Channel.

4.6.5 A notable large-scale project development was the proposal for the Swansea Bay Tidal Lagoon, presented by Tidal Lagoon Power. The project aimed to harness a significant amount of tidal energy from the Bristol Channel through the construction of a tidal lagoon system. This project envisioned the construction of a breakwater surrounding Swansea Bay, equipped with 16 hydro turbines, 9.5 km breakwater and was expected to have an electricity generation capacity of 320 MW, offering substantial renewable electricity supply to the surrounding area (TETHYS, 2022).

4.6.6 Despite its ambitious objectives and promising prospects for marine hydropower generation, the Swansea Bay Tidal Lagoon project encountered challenges regarding its economic viability environmental implications, and due to work only commencing after five years of receiving approval, meaning the development consent order was no longer valid. This led to the government's decision to not provide the necessary subsidies for the project to proceed (UK Government, 2018). As result the development was suspended.

4.6.7 Despite the setback encountered by the Swansea Bay Tidal Lagoon project, a new scheme, known as Blue Eden, has emerged as a proposal for a tidal lagoon in the Swansea Bay area. Notably, Blue Eden differentiates itself from previous proposals as it is fully privately funded and led by the Bridgend-based DST Innovations consortium (Swansea Council, 2021).

4.6.8 The Blue Eden project encompasses the construction of a 9.5 km tidal lagoon within Swansea Bay, complemented by a floating solar farm. Additionally, the project includes the establishment of an electric battery manufacturing plant, a battery storage facility, a data storage centre, an oceanic and climate change research centre, and the development of waterfront homes and highly energy-efficient eco-homes integrated into the aquatic environment. This ambitious initiative aims to create approximately 2,500 permanent green jobs (Swansea Council, 2021).

4.6.9 Central to the Blue Eden project is the implementation of state-of-the-art underwater turbines capable of generating 320 MW_e of marine hydropower. The energy produced by the tidal lagoon and solar array will primarily be utilized on-site, while an estimated 32% holds the potential for exportation to the grid, benefiting local residents and businesses (Swansea Council, 2021).

4.6.10 The Blue Eden project is understood to fall under the remit of Swansea Council, and therefore has not been considered in scope of this assessment. No marine energy projects have therefore been identified within the scope of NPTC.

Land-Based Hydropower

4.6.11 As per the Planning Toolkit, there is currently no recognised methodology available for local authorities to determine the suitability of land-based hydropower. In determining land-based hydropower for NPT, we have used the results of a national Environment Agency (EA) study (Environmental Agency, 2010) and reviewed existing hydro schemes in the REPD, registered for the Feed-in-Tariff (FiT), or in NPTC planning data. The methodology is summarised in Figure 4-10.

Step 1: Analyses of "win-win" opportunities for hydro schemes provided by the Environmental Agency (2010) study, to estimate the potential for land-based hydropower within the study area.

Step 2: Identify any further capacity by comparing against existing operational sites in REPD, FiT and NPTC planning data.

Figure 4-10 Methodology for estimating hydropower potential in NPT

4.6.12 The EA study provides a dataset of locations with potential for hydro power. Potential sites were determined by utilising Synthetic Aperture RADAR (SAR) and Light Detection and Ranging (LIDAR) technologies to measure the head height and flow of inland running water. Following these measurements, filters were applied to identify opportunities that would yield both environmental sensitivity and a minimum potential power capacity of 10 kW; denoted as “win-win” sites (sites below 10 kW are considered a lesser opportunity). However, EA explicitly state there is low confidence in the results due to uncertainty in the measurements. The results are meant to be indicative only, and do not replace the need for individual site assessment.

4.6.13 Recent regulations on reservoir maintenance from Natural Resources Wales (NRW) following flood mapping has led to some being sold or drained, which would in practice reduce the number of hydro opportunities available.

Results

4.6.14 The EA study identified 97 sites within NPT with a total potential power capacity of 14 MW; these are shown in Table 4-8 below, broken down by the size of the opportunity. The capacity factor for hydro is assumed as 50% (International Renewable Energy Agency, 2014). Figure 12-10 maps out the identified "win-win" opportunities across Neath Port Talbot.

Opportunity Size	Number of Sites Identified	Cumulative Power Capacity (MW)	Cumulative Generation Capacity (MWh/yr)
Small hydro (1-10 MW)	5	6.8	29,969
Mini hydro (0.1-1 MW)	21	5.2	22,720
Micro hydro (10-100 kW)	71	2.1	9,050
Total	**97**	**14**	**61,739**

Table 4-8 Number and power of "win-win" hydropower opportunities in NPT

4.6.15 Some large water masses shown on Figure 12-10 are not identified as having potential for hydropower schemes. This is either due to their environmental sensitivity being too high, or their potential for power generation being too low. Given their size, it can be deduced that it is likely due to their environmental sensitivity.

4.6.16 There are no hydro power schemes in NPT listed in the REPD but there are schemes in the FiT register and NPTC planning data. Those in the NPTC planning data are shown below:

- Tan y Rhiw Farm (50 kW)
- Nant Creunant, Crynant (3 kW)
- Brynrhyg Farm, Crynant (5 kW)
- Nant yr Allow Farm, Glyncorrwg (100 kW)
- Land at Maesgwyn, Glyncorrwg (100 kW)
- Brynawel, Crynant (22 kW)
- Plas Farm (11 kW)
- Margam Country Park (12 kW)

4.6.17 There are six hydropower schemes listed in the FiT register, with a combined installed capacity of 283 kW. Four of them are commercial hydro schemes totalling 277 kW, the other two schemes are listed as domestic with a combined power capacity of 5.6 kW. Exact locations of the FiT schemes are not provided, but the post code is. Five out of the six schemes are in postcode SA10, and the other, which is 100 kW in capacity, is in postcode SA13.

4.6.18 NPTC planning data was reviewed for existing hydro power schemes which also listed six schemes with a combined capacity of 280 kW. The six schemes showed an almost identical make up of capacities compared to the six schemes registered in the FiT data, which would suggest that the planning data is referring to the same schemes. However, when mapping the data, the locations of the NPTC planning hydro power schemes showed very different locations to postcodes in the FiT data. Unfortunately, there is no unique identifier to corroborate these two datasets, but given the almost identical capacities, we assume that the datasets are referring to the same schemes.

4.6.19 In the Ofgem REGO and RO registers, there is a 230 kW scheme listed at Aberdulais Fall; this scheme is not listed in either the FiT or NPTC planning data, though appears to be the site owned by the National Trust Wales at Aberdulais which has a 20 kW and 200 kW waterwheel (The National Trust Wales, 2024).

4.6.20 The REGO dataset also lists a 50 kW and a 100 kW hydro scheme. The 50 kW scheme was corroborated to the 50 kW scheme in the NPTC planning data by the name of the site (Tan y Rhiw Farm). The 100 kW scheme was corroborated to the 100 kW in the NPTC planning data by the organisation "Jones and Jones Renewables Ltd", which is the site at Nant yr Allow Farm, Glyncorrwg.

4.6.21 Energy Generation in Wales 2021 stated that there was 1 MW of hydro power capacity in NPT. This is greater than the combined capacities we have identified the public renewable dataset sources. As discussed in section 3, the Energy Generation in Wales study had access to data which is not publicly available; therefore, in such instances where the study found greater capacity than in this study, it would be assumed that the Energy Generation in Wales capacity was more comprehensive, and therefore used as the existing capacity in this study.

4.6.22 As 1 MW of hydropower has been developed in NPT, this could suggest that there is a further 13 MW of potential capacity if all EA "win-win" opportunities are exploited. Further work is required to determine the feasibility of this.

5 Building Integrated Renewables

Chapter in Brief

This chapter determines the energy potential for renewables that can be "building integrated" across the building stock in Neath Port Talbot.

5.1 Introduction

5.1.1 Building Integrated Renewables (BIR) are often termed "microgeneration", having an electrical generation capacity of no more than 50 kW, or heat generation capacity of no more than 45 kW (UK Governement, 2004).

5.1.2 BIR refers to any generation asset that provides energy directly to a building; for example, a large industrial building may have an integrated wind turbine with a private wire. BIR are sized in relation to the energy demand and infrastructure associated with the building, in addition to the available area for the asset.

5.1.3 (National Grid ESO, 2019) identified 5% of the UK's 2018 generation capacity as microgeneration.

5.1.4 The Toolkit (Welsh Government, 2015) identifies the following technologies as BIR:

- Solar photovoltaic (PV) panels (excluding solar PV farms that are land mounted and covering an area >3 acres (or 0.5 MW) and providing <10% of a building's electricity demand via a private electricity wire)
- Solar thermal hot water panels
- Micro building-mounted wind turbines
- Small free standing, normally single wind turbines
- Micro scale biomass heating (i.e. wood chip or pellet boilers or stoves)
- Ground and air source heat pumps.

5.1.5 Due to low market share and historically low uptake and potential to compete for space with other technologies, this assessment excluded solar thermal hot water panels. Energy Generation in Wales 2021 identified ten solar thermal installations in NPT, the total capacity of these installations was stated as 0 MW (Regen, 2021). It is not known whether the total capacity was unknown, or it was not significant enough in the report to provide the actual capacity.

5.1.6 Future uptake of low or zero carbon (LZC) technologies in new buildings is likely to be influenced by building regulations and planning requirements. Uptake in existing buildings is at the discretion of the building owner, which may be related to financial viability and the desirability of LZC technologies to owners and occupiers of residential and non-residential properties.

5.1.7 The simplified method provided within the Toolkit (Welsh Government, 2015) is based on a future date of 2020 and on financial incentives that are no longer active (notably the FiT and RHI schemes). The target study date for Neath Port Talbot is 2038; therefore, an amended method is used in this assessment to estimate BIR potential. The potential is split into domestic and non-domestic sectors.

5.1.8 The current and projected number of properties in NPT is used throughout this section for the estimates of BIR capacities. The figures for this are shown below and will be referred to in each subsequent section.

Current Number of Properties & 2038 Forecast

5.1.9 The number of residential buildings currently in the Neath Port Talbot study area (66,793 units) was established from the OS Addressbase data. Draft RLDP projections of new domestic state an additional 4,081 units to be constructed between 2023 and 2038 (3,209 houses and 872 flats), taking the total number of dwellings to 70,874 at the end of the RLDP period (2038).

5.1.10 Data on existing non-domestic (commercial and industrial) buildings is also obtained from OS Addressbase data, which identifies 4,256 commercial buildings and 469 industrial buildings within the study area. The evolving RLDP projects new floorspace of non-domestic buildings, which amounted to 33,243, 74,218 and 34,025 m^2 of new office, industrial and warehouse floor space respectively. Some calculations below (such as roof space of industrial and warehouse buildings for rooftop PV) use the floor space calculations directly, whereas other calculations (such as heat pump capacity) use a number of buildings. Where a number of non-domestic buildings were required, the floorspace projections were converted into number of buildings by determining the average floorspace of office and industrial buildings in NPT using the Non-domestic National Energy Efficiency Data-Framework (ND-NEED) study (BEIS, 2020).

5.1.11 The average floor space of an office was determined to be 156 m^2 and the average factory floor space (factory was the closet sector to industrial and warehouse in the NEED study) was determined to be 768 m^2. This equated to an additional 213 commercial buildings and 141 industrial and warehouse buildings constructed between 2023 and 2038.

5.2 Roof-Mounted Solar PV

5.2.1 Roof-mounted solar PV has seen large-scale deployment over the last decade; it provides a good purpose for otherwise unused space and can generate electricity to offset the need to import from the grid. Though the diurnal generation profile may not match with a typical domestic demand profile, the potential growth in energy storage (electrical and thermal) and roll-out of electric vehicles and electric heat pumps can remedy this. Roof-mounted PV on buildings that are used during the day (e.g. offices) may be able to provide a closer match between demand and supply.

Method

5.2.2 The Toolkit (Welsh Government, 2015) describes a methodology to calculate solar PV uptake to 2020. This assessment period is to 2038; therefore, a different approach is required. The overall method followed is summarised in Figure 5-1.

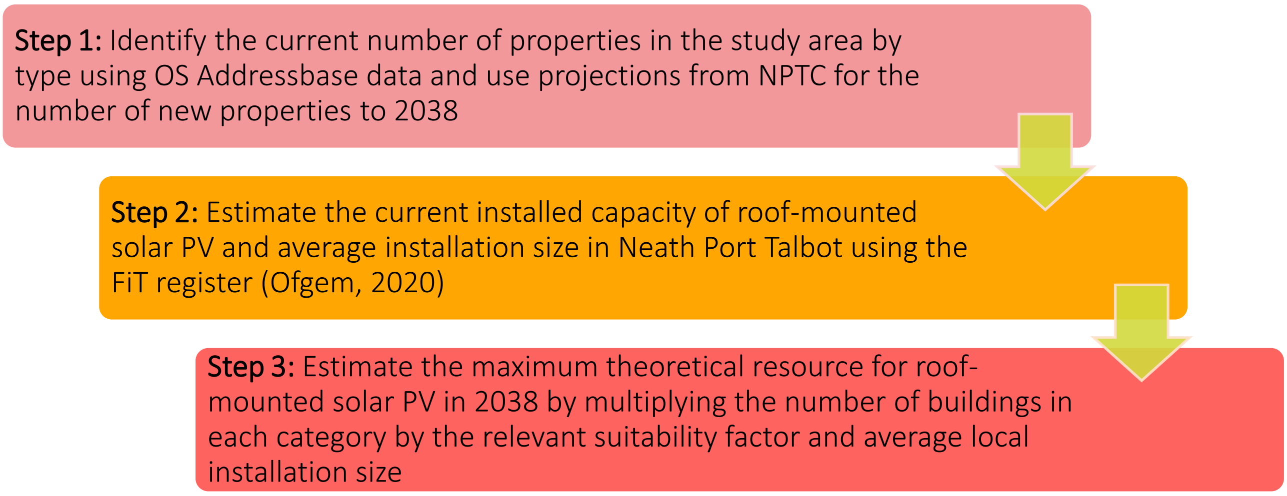


Figure 5-1 Method for estimating roof-mounted PV potential

5.2.3 DECC's Renewable and Low-carbon Energy Capacity Methodology (DECC, 2010) provides a method for estimating the maximum roof-top solar PV potential in an area based on estimates of roof-top solar PV suitability in new and existing buildings.

5.2.4 The number of existing installations and total average installed capacity (MW) are obtained from Ofgem's feed-in tariff register (Ofgem, 2019). The data allows the separation of domestic and non-domestic installations and serves as the starting point for the analysis. Note that this data does not distinguish between roof-top and ground-mounted solar PV.

5.2.5 The DECC's Renewable and Low-carbon Energy Capacity Methodology (DECC, 2010) provides Government assumptions on the number of roofs that are considered suitable for solar systems, for both existing roof space and new developments. The average generation capacity per individual system is also provided. The analysis in this assessment, however, uses data from the FiT register (Ofgem, 2019) for the average individual domestic system size as it is available by local authority.

5.2.6 While the DECC methodology suggests a 50% roof-top solar suitability for new developments, this assessment assumes a more optimistic 85% for new houses because:

- The DECC methodology has not been updated since 2010.
- It is likely that building regulations and planning requirements will encourage a wider uptake of LZC technologies.

A suitability of 25% is assumed for new build flats, in line with existing properties.

5.2.7 The roof-mounted suitability percentages for solar PV used in the assessment are summarised in Table 5-1 below.

Typology	Suitability – Existing Buildings	Suitability – New Developments
Household	25%	Households: 85%, Flats: 25%
Commercial	40%	40%
Industrial	80%	80%

Table 5-1: Summary of rooftop solar PV suitability assumptions

5.2.8 The maximum potential solar PV capacity is estimated by combining:

- The number of existing buildings (from OS Addressbase data) and new developments (from NPTC projections).
- The respective factors for roof-mounted suitability for existing buildings and new developments.
- An assumed individual capacity. The average capacity of a domestic rooftop PV installation in NPT was determined using data from existing installations in the Feed-in-Tariff register which was 3.6 kW (Ofgem, 2019). We use an assumed 5 kW average capacity for commercial installations (as per DECC methodology) and an assumed 0.2 kW/m^2 for industrial installations.

5.2.9 The above calculation identifies the total capacity that would be made available if all assumed suitable buildings installed a solar PV system with a capacity equal to the assumptions above. This is therefore considered a theoretical maximum.

Maximum Theoretical Capacity in 2038

5.2.10 The number of buildings shown in paragraph 5.1.9 and 5.1.11 are used to calculate the current and maximum theoretical capacity.

5.2.11 The maximum theoretical resource within the study area is provided in Table 5-2. New builds and existing properties are separated, as there is potential for the LPA to have a greater influence on rooftop PV deployment on new builds via planning processes.

5.2.12 Despite applying greater suitability assumptions on new builds between 2023 and 2038, there is still greater potential on existing building rooftops due to their greater number.

Variable	Domestic Existing	Domestic Newbuild	Commercial Existing	Commercial Newbuild	Industrial Existing	Industrial Newbuild	Total
Roof-mounted solar PV maximum theoretical capacity in 2038 (MW_e)	59.6	10.5	8.5	0.4	77.9	17.3	**174**
Roof-mounted solar PV maximum theoretical generation in 2038 (MWh_e/annum)	52,212	9,210	7,457	374	68,261	15,171	**152,684**

Table 5-2 Maximum theoretical resource of roof-mounted solar PV within Neath Port Talbot in 2038

Conclusions

5.2.13 As outlined in Section 3, we estimate from the FiT register that there is at least 7.0 MW of installed rooftop PV capacity already present in NPT, with 5.8 MW of that being listed as domestic and 1.2 MW being non-domestic. From the NPTC planning data we found that there is a 3.3 MW proposed rooftop scheme on the Amazon warehouse.

5.2.14 From the maximum theoretical potentials above, we therefore estimate that there may be a further 54 MW of potential capacity on existing domestic buildings, and a further 82 MW of existing non-domestic buildings (assumed the 3.3 MW Amazon warehouse scheme is built). Note that these are considered to be maximum theoretical potentials, meaning they are purposely ambitious, and a lower uptake may in reality be more appropriate.

5.3 Heat Pumps Uptake Assessment

5.3.1 Heat pumps can provide both heating and cooling and are commonly found in commercial settings. They can be both gas and electrically driven, but most commonly electricity. Heat pumps work transfer energy from a low temperature source such as ambient air, water, ground or waste heat and raise it to a higher temperature. This is done using a thermodynamic refrigeration cycle; it can therefore be reversed if cooling is required.

5.3.2 Heat pumps are highly efficient, as the amount of thermal energy transferred is often much greater than the energy required to drive the refrigeration cycle. This ratio is known as the Coefficient of Performance (COP). A standard Air Source Heat Pump (ASHP) with a COP of 3.0 will provide 3 kWh of heat for every 1 kWh of supplied electricity.

5.3.3 The electrical input is not considered renewable, but the heat transferred from the air, ground or water is. The "net thermal benefit" is the renewable portion of the heat moved; this has been calculated below along with the total heat pump capacity by assuming a Seasonal Coefficient of Performance (SCOP) of 3.0. The SCOP is the average COP achieved over the full course of a year; it is determined by dividing the annual heat output by the annual electrical energy input.

5.3.4 The financial case for heat pumps is improved if properties are not connected to the gas network, meaning they may currently be heated using a more expensive fuel such as oil or LPG. Most buildings are suitable for the deployment of at least one heat pump option; however, some potential limitations do exist such as a lack of space.

5.3.5 As stated by National Grid ESO (National Grid ESO, 2019) “all the main technologies available to decarbonise heating in [Great Britain] today involve some additional cost, consumer disruption and energy infrastructure development. As a result, decarbonising heating will require coordination at a national scale, with clear policy and resourcing”. The variety of technologies also means there is no leading pathway to decarbonise heat. The best choice is likely to vary across the country, depending on factors such as existing infrastructure, geography, and housing stock”. In the absence of effective policy or funding incentives, there is uncertainty regarding the pace at which heat will decarbonise during the RLDP period.

5.3.6 Notable policy drivers in the decarbonisation of building heating includes the ban on gas boilers installed in new build properties from 2025, and the ban on the sale of new gas boilers (for existing properties) from 2035. Note that there is still uncertainty on these bans; a change in government may induce a revision to these dates.

Method

5.3.7 The Toolkit (Welsh Government, 2015) describes a methodology to calculate heat pump uptake to 2020. The RLDP period is to 2038; therefore, as with the roof-mounted solar PV assessment, a different approach is required. The overall method followed is summarised in Figure 5-2 below.

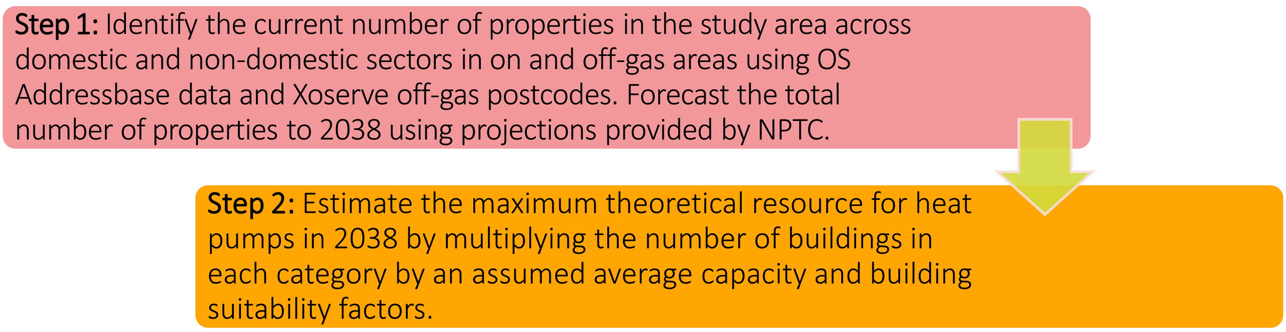


Figure 5-2 Method for estimating heat pump uptake

5.3.8 The DECC's Renewable and Low-carbon Energy Capacity Methodology (DECC, 2010) provides a range of estimates for heat pump suitability in new and existing buildings for buildings on and off the gas network.

5.3.9 This assessment looks to estimate maximum potential capacity. It is considered that electric heat pumps will be prioritised in new buildings; as such, the suitability factor used for new developments is 100%. This is considered an optimistic, albeit practical assumption, given the 2025 Future Homes Standard, which mandates low-carbon heating in new developments (UK Government, 2021). It should be noted that these are not deployment assumptions. The suitability factors used in the assessment for heat pump building suitability are summarised in Table 5-3 below.

Typology	Suitability – Existing Buildings	Suitability – New Developments
Residential (off-gas network)	100%	100%
Detached/Semi-detached	75%	100%
Terraced	50%	100%
Flats	25%	100%
Commercial & industrial buildings (off gas)	75%	100%
Commercial & industrial buildings (on gas)	75%	100%

Table 5-3 Summary of heat pump suitability assumptions

5.3.10 Typical thermal capacities for commercial buildings are obtained from the DECC methodology. Typical thermal capacities for residential buildings are split based on typology. A breakdown of these is shown in Table 5-4 below.

Typology	Typical Thermal Capacity (kW)
Residential - Flats	5
Residential - Terraced	8
Residential - Semi-detached	12
Residential - Detached	16
Commercial & industrial	100

Table 5-4 Summary of heat pump thermal capacities assumptions

5.3.11 The maximum theoretical capacity is estimated by multiplying each combination of suitability factors and average generation capacity by the number of existing buildings and new developments.

Maximum Theoretical Capacity in 2038

5.3.12 The number of buildings shown in paragraph 5.1.9 and 5.1.11 are used to calculate the current and maximum theoretical capacity.

5.3.13 Xoserve provide a database of all postcodes that are completely off-gas (Xoserve, 2022), i.e. there is no gas network at all within these postcodes. This dataset was joined with the OS Addressbase data to determine whether a building had a gas connection or not. Note that this will underestimate the number of off-gas buildings, as a postcode could be partially on-gas, and so it wouldn't show up within Xoserve's off-gas postcode dataset.

Typology	Average generation capacity (kWth)	Assumed existing building HP suitability	Number of existing buildings
Flats (off gas network)	5	100%	754
Flats (on gas network)	5	25%	8,976
Detached (off gas network)	16	100%	564
Detached (on gas network)	16	75%	11,958
Semi-detached (off gas network)	12	100%	594
Semi-detached (on gas network)	12	75%	26,070
Terraced (off gas network)	8	100%	293
Terraced (on gas network)	8	50%	19,722
Commercial (off gas network)	100	75%	608
Commercial (on gas network)	100	75%	3,648
Industrial (off gas network)	100	75%	71
Industrial (on gas network)	100	75%	398

Table 5-5 Number of building types and suitability factors for existing buildings

Typology	Average generation capacity (kWth)	Assumed new building HP suitability	Number of new buildings
Domestic (terraced)	8	100%	436
Domestic (semi-detached)	12	100%	2,266
Domestic (detached)	16	100%	507
Domestic (flats)	5	100%	872
Commercial	100	100%	213
Industrial	100	100%	141

Table 5-6: Number of building types and suitability factors for new buildings

5.3.14 The results of heat pump theoretical maximum capacity are shown in Table 5-7 for 2038. As the LPA could potentially have more control over the potential to install heat pumps into new developments the maximum theoretical potential in new developments is separated from the existing.

5.3.15 The capacity factor of a heat pump is assumed to be 20% based on the Toolkit (Welsh Government, 2015).

Variable	Domestic Existing	Domestic Newbuild	Commercial Existing	Commercial Newbuild	Industrial Existing	Industrial Newbuild	Total
Total heat pump capacity (MW_{th})	491	43	319	21	35	13	922
Net thermal benefit capacity (MW_{th})	327	29	213	14	24	8	615
Net thermal benefit (MWh/annum)	572,904	50,399	372,826	24,904	41,084	14,599	1,076,716

Table 5-7 Maximum theoretical heat pump capacity

Conclusions

5.3.16 As per Section 3, the current heat pump capacity in NPT was estimated to be 1 MW, as determined by Energy Generation in Wales 2021 (Regen, 2021).

5.3.17 The maximum theoretical potential calculations above suggest that 845 MW of total heat pump capacity could be installed in existing buildings, which is 845 times greater than the existing capacity. Note that this is a maximum theoretical potential resource in NPT, and does not represent the targeted uptake rate in 2038; in practice the target will be lower than this.

5.4 Micro Wind Turbines

5.4.1 Micro wind installations are defined as having a capacity of less than 100 kW, though individual micro turbines are typically under 10 kW. They can either be building integrated (on top of roofs), or ground based.

5.4.2 Micro wind turbines can generate electricity to offset the need to import from the grid.

Method

5.4.3 The Planning Toolkit (Welsh Government, 2015) describes a methodology for calculating micro wind capacity up to 2020. The assessment period for this project is up to 2038; therefore, a different approach is required. The 2010 DECC's Renewable and Low-carbon Energy Capacity methodology has been used to guide the development of this methodology. Note that the methodology does not include site specific considerations such as: building height, roof shape, neighbouring buildings, and high trees. This level of assessment would need to be conducted at a site level scale. The overall methodology is summarised in Figure 5-3 below.

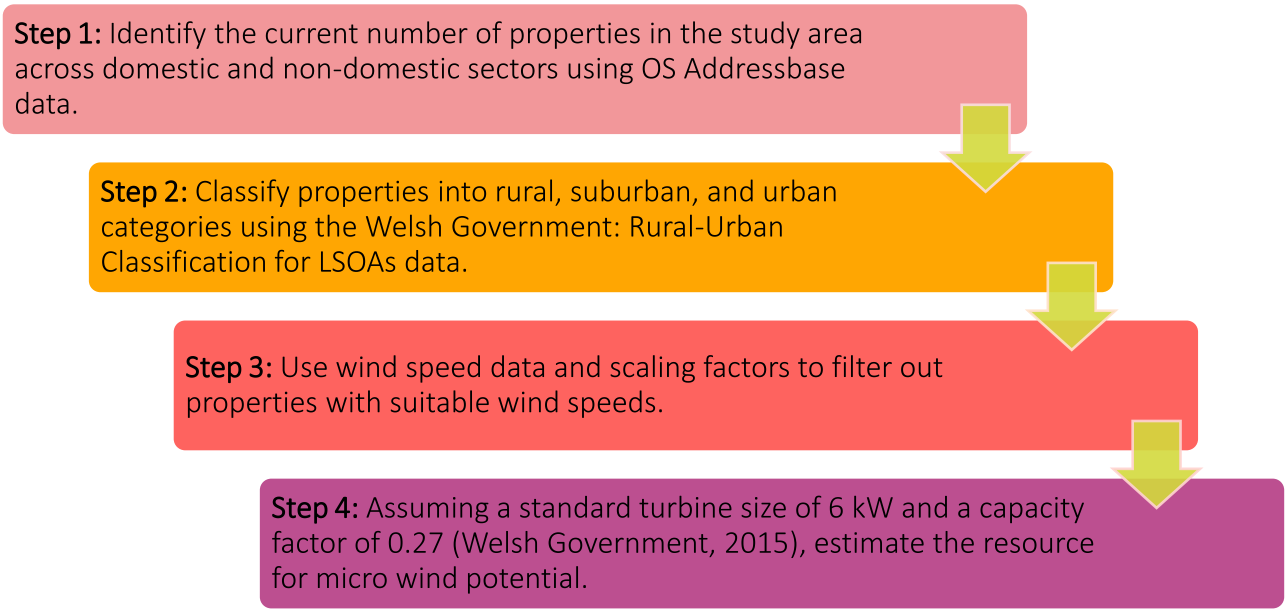


Figure 5-3 Method for estimating micro wind turbines

5.4.4 The DECC methodology specifies that micro wind turbines are only viable where wind speeds are greater than 4.5 m/s at a height of 10m. This wind speed is however subject to a correction factor based on the building terrain (urban/suburban/rural); this is outlined in Table 5-8 below, with the subsequent minimum viable wind speed for each terrain type.

Build Terrain Typology	Correction factor applied to building terrain	Minimum viable wind speed for micro turbines (m/s)
Urban	56%	8.0
Suburban	67%	6.7
Rural	100%	4.5

Table 5-8 Minimum viable wind speed for micro turbines for each building terrain typology

5.4.5 Global Wind Atlas data was used to determine the average wind speed for each address. The Rural-Urban Classification for LSOAs dataset from DataMapWales was used to scale the wind speeds for each address. Properties that did not meet the threshold for micro wind viability were subsequently filtered out.

5.4.6 The theoretical potential resource is then estimated using an average turbine rating of 6 kW as per the DECC methodology.

Maximum Theoretical Capacity in 2038

5.4.7 Table 5-9 below shows the breakdown of buildings by typology and terrain type that are suitable for micro wind turbines, in addition to the calculated energy generation potential.

5.4.8 It was found that no buildings in Urban or Suburban areas had suitable wind speeds to support micro wind turbines. Only 1.5% of all buildings identified in the OS Addressbase dataset were deemed suitable; all of these resided in Rural areas.

Building terrain	Number of buildings with suitable wind speed for micro wind potential	Micro wind potential capacity (MW_e) (assumes 6 kW_e average individual capacity)	Micro wind energy potential (MWh_e/yr)
Residential			
Urban	-	-	-
Suburban	-	-	-
Rural	945	5.7	13,411
Industrial			
Urban	-	-	-
Suburban	-	-	-
Rural	34	0.2	483
Commercial			
Urban	-	-	-
Suburban	-	-	-
Rural	118	0.7	1,675
Total	**1,097**	**6.6**	**15,568**

Table 5-9 Micro wind generation potential across different building typologies and terrain

Conclusions

5.4.9 The potential for micro-wind in Neath Port Talbot is significantly lower than other sources of building-integrated renewables, at only 6.6 MW_e across the entire county.

5.4.10 It is recognised that for industrial and commercial buildings, there may be availability for an increased number or size of turbines due to the buildings themselves being larger; an assumed turbine rating of 6 kW is likely conservative. The practicality of micro wind would therefore largely have to be determined on a case-by-case basis; nevertheless, solar PV appears to be the more suitable renewable for BIR; particularly in more urbanised areas where wind speeds are lower. Wind generation may be well-suited to open areas as outlined in Section 4.1, or as BIR for buildings in more rural areas that have lower spatial restrictions.

5.5 Biomass Heating

5.5.1 Biomass heating is best suited for off-gas, hard-to-insulate buildings where there is no access to relatively cheap gas and where electrification using heat pumps could be costly due to the level of building fabric upgrade required.

5.5.2 The UK government is proposing a "heat pump first" approach to decarbonising off-gas areas and believes that biomass for heating will serve only a niche role in decarbonisation (BEIS, 2022), in line with advice from the Climate Change Committee (CCC).

5.5.3 Biomass boilers are further complicated by their large spatial requirement compared to alternative off-gas solutions (electrification, oil, LPG). Air quality is also a consideration; biomass combustion may cause high levels of particulate and nitrous oxide emissions.

Method

5.5.4 The Toolkit (Welsh Government, 2015) does not provide a method for estimating biomass potential. The following methodology, which was developed by City Science, aims to determine the quantity of off-gas buildings that are hard-to-insulate and that might have the spatial requirements for a biomass system.

5.5.5 Energy Performance Certificate (EPC) data is used as the basis for this estimation. An EPC is not a necessary requirement for all buildings; therefore, only a proportion of the county's building will be covered by the available data. A key assumption in this methodology is that the available EPC datasets for domestic and non-domestic buildings are representative of all buildings in the county.

5.5.6 Uptake of biomass boilers for new buildings is not investigated, as it is expected that new developments would be built to a standard to accommodate electrification.

5.5.7 Figure 5-4 below shows the steps used in this methodology.

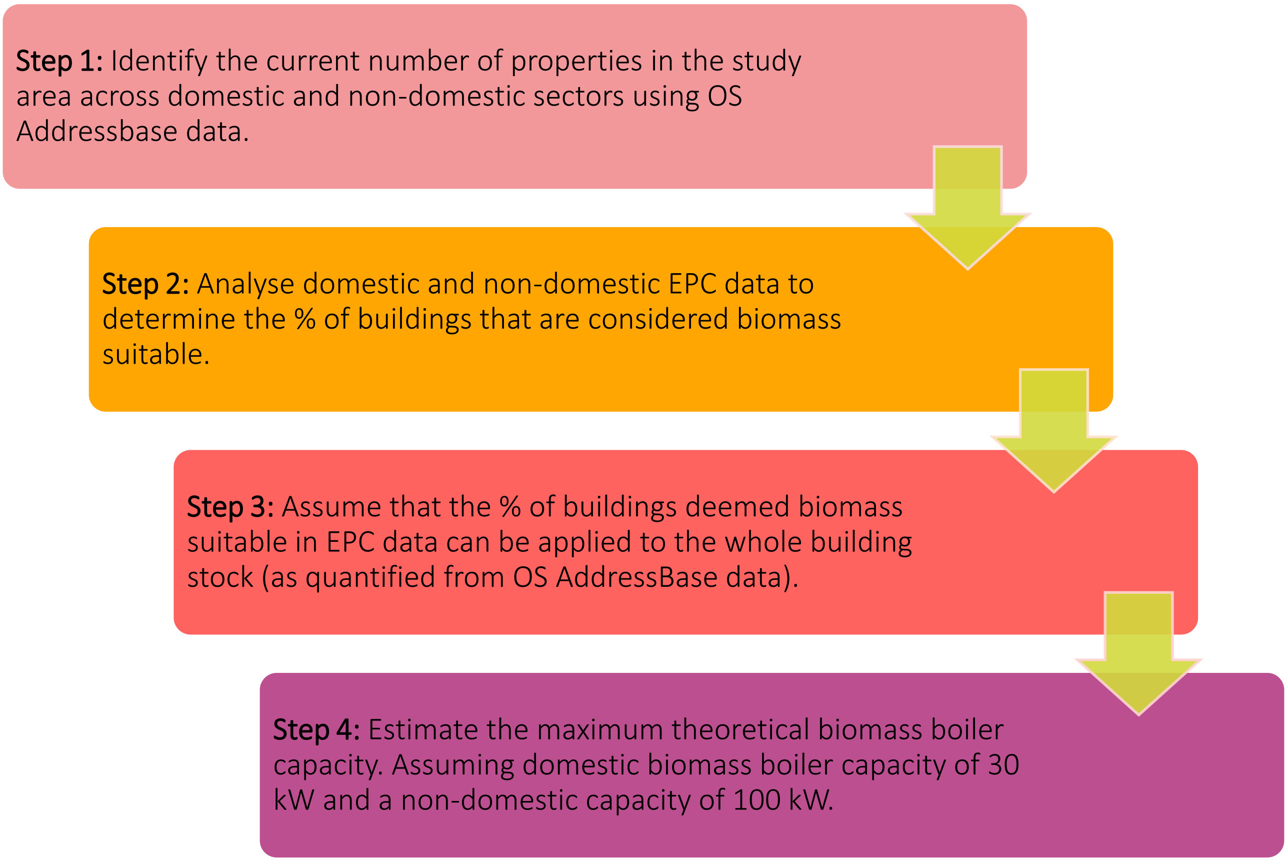


Figure 5-4 Method for estimating biomass boiler capacity

Maximum Theoretical Capacity in 2038

5.5.8 The number of buildings shown in paragraph 5.1.9 and 5.1.11 are used to calculate the current and maximum theoretical capacity.

5.5.9 Domestic buildings were considered suitable for a biomass boiler if:

- They are off-gas and did not have an existing electric heating system.
- They are detached or semi-detached (spatial availability).
- Their EPC rating is F or G (hard-to-insulate).

5.5.10 Non-domestic buildings were considered suitable for a biomass boiler if:

- Their current heating fuel is not electricity, natural gas, district heat or waste heat.
- Their EPC rating is F or G (hard-to-insulate).

5.5.11 The percentage of domestic and non-domestic buildings that were deemed suitable for biomass boilers was 1.04% and 0.84% respectively. This corresponds to 431 domestic and 16 non-domestic buildings.

5.5.12 Table 5-10 below shows the comparison of the total number of buildings in OS Addressbase and EPC datasets, split between domestic and non-domestic properties.

Typology	OS Addressbase number of buildings	EPC number of buildings	EPC data coverage	% of buildings in EPC datasets deemed suitable for biomass
Domestic	68,931	41,432	60%	1.04%
Non-domestic	4,725	1,910	40%	0.84%

Table 5-10 Comparison of OS Addressbase and EPC datasets for Neath Port Talbot County

5.5.13 The potential capacity is then calculated, assuming biomass boiler capacities of 30 kW_{th} for domestic installations and a capacity of 100 kW_{th} for non-domestic installations. The assumed domestic capacity is greater than that assumed for heat pumps (5-16 kW), as biomass boilers are often fitted to properties with higher peak space heating demands and are often oversized.

5.5.14 Table 5-11 below shows the projected number of biomass boiler-suitable buildings, with the total potential capacity and generation. A capacity factor of 20% is assumed for BIR biomass boilers, as per the Toolkit (Welsh Government, 2015)

Typology	Projected number of buildings with biomass boiler suitability across whole building stock	Biomass boiler potential capacity (MW_{th})	Biomass boiler potential heat generation (MWh_{th}/yr)
Domestic	718	21.5	37,668
Non-domestic	40	4.0	7,008
Total	**758**	**25.5**	**44,676**

Table 5-11 Domestic and non-domestic buildings with biomass suitability and potential capacity

Conclusions

5.5.15 The overall estimated capacity for biomass boilers across domestic and non-domestic buildings is 25.5 MW_{th}. This is significantly lower than the estimated uptake of heat pumps; but as outlined above, biomass is expected to serve only a niche role in decarbonisation.

6 Heat Network Opportunities

Chapter in Brief

This chapter maps out various datasets which could inform the identification of viable heat networks.

Method

6.1.1 The methodology followed during this assessment is set out in Section E3 of the Welsh Government's 2015 toolkit for planners, as shown in Figure 6-1 (Welsh Government, 2015). Through this methodology, existing and future energy demand and infrastructure is identified across the NPT area and discussed in further detail in the subsequent sections.

Step 1: Establish the location and types of property within study area. Identify potential key non-domestic properties that could be anchor loads for a heat network.

Step 2: Establish energy demands of loads and potential heat clusters that have potential for district heating.

Step 3: Identify off gas areas.

Step 4: Identify areas of fuel poverty.

Step 5: Identify any existing district heat networks and combined heat and power schemes as well as any sources of waste heat.

Step 6: Map new local development plan sites.

Step 7: Develop an energy opportunities plan for district heat networks.

Figure 6-1 Method for Assessing Heat Network Opportunities (Welsh Government, 2015)

6.1.2 Step two has previously been carried out as part of the NPT LAEP where four heat network focus zones were identified based on the heat density of the areas, these included: Neath, Swansea University Bay Campus, Baglan Energy Park, and Port Talbot. The remaining steps listed in Figure 6-1 were carried out to ensure consistency with the toolkit methodology. These four LAEP focus zones have been reviewed in more detail using the findings from steps 3 to 6.

6.1.3 Accompanying the modelling was a 'Heat Mapping Workshop' held by City Science and attended by representatives from NPT, Bridgend, Cardiff, and Swansea Councils, as well as employees from TATA Steel. The purpose of the workshop was to present the findings of the heat mapping exercise and utilise local knowledge and expertise to supplement our analysis. The findings of the workshop are included in the following section. The workshop was held on 04/07/2024.

Model Inputs

6.1.4 Anchor Loads are buildings with a significant energy demand which may make the connection of a network to other buildings possible, these include:

- Public sector buildings
- Private sector buildings with large heat loads
- Private sector buildings with heat demand profiles which diversify a heat network (e.g. care homes)
- Organisations with decarbonisation targets (e.g. universities)
- Planned developments
- Social housing clusters

6.1.5 Potential anchor heat loads are shown in Figure 12-11, anchor loads are primarily located in the urban areas of Neath, Port Talbot, Baglan Energy Park, and Swansea University Bay Campus.

6.1.6 Identifying residential heat demand allows the formation of clusters and positioning relative to anchor loads. Heat network opportunities can be assessed for their potential to reduce fuel poverty and service off-gas connections.

6.1.7 Areas not served by the gas network have been identified because the use of non-gas fuels for heating and domestic hot water often incurs additional cost to the user and can be more polluting. However, developing DHNs in off-gas areas is often difficult due to lower heat densities, which make any potential network less cost-effective. Where viable, rural housing may help diversify the heat demand profile of a network. Off gas areas have been identified and shown in Figure 12-12.

6.1.8 Areas with higher rates of fuel poverty have been identified as the development of a heat network has the potential to alleviate or push people further into fuel poverty depending on design factors such as heat source and cost of heat. By taking these areas into consideration in the earliest stage of the design process, the risk of a network exacerbating fuel poverty can be minimised. The areas with a high Welsh Index of Multiple Deprivation (WIMD) are shown in Figure 12-12.

6.1.9 A variety of potential heat sources were identified across Neath Port Talbot including:

- Existing heat/power generation facilities
- Planned biomass and CHP facilities
- Utilisation of waste heat from Industrial processes

6.1.10 The amount of potential heat available from each heat source is uncertain. As a result, an assessment of these sources is advised as part of any further feasibility studies. No existing heat networks were identified in the assessment area. Additional heat sources such as heat pumps could be incorporated into planned developments or installed on council-owned land. Identified heat sources are shown in Figure 12-13.

6.1.11 Planned new developments have been identified because these sites can be highly beneficial for a network, often having large heat demands and the potential to incorporate energy generation technologies into the designs. A DHN could be used to serve the development or to extend to additional external users. This may enable the connection of off-gas homes and buildings in the area to a low carbon alternative. Planned developments also use heating systems with lower operating temperatures due to their higher standards of fabric insulation, which are especially suitable for heat pump schemes.

6.1.12 The location and size of heat users were assessed using City Science's in-house heat mapping tool to create clusters where heat networks may be suitable. Clusters are formed by connecting smaller heat loads with a load greater than 72.5 MWh/yr, with a maximum separation distance proportional to their demand. A cluster must have at least 5 buildings and a minimum heat demand of 500 MWh/yr. These clusters alongside planned developments, heat sources, and areas with a high WIMD rank are shown in Figure 12-14 heat clusters and centred around the urban and industrial areas of Neath and Port Talbot where heat density and anchor loads were larger.

6.1.13 The four focus zones identified as part of the LAEP were reviewed using the findings of the remaining steps of the toolkit's methodology to create the energy opportunities plan shown in Figure 12-14.

6.1.14 These focus zones are located in areas of high WIMD rank and contain a significant number of biomass facilities and large industrial installations from which waste heat may be recovered and used as a heat source for networks. These zones also have numerous planned developments where an energy center could be incorporated into the design.

6.1.15 The four zones are the most suitable areas for district heating feasibility studies. Additional details regarding these four focus zones are outlined below.

Neath

6.1.16 Within the Neath area, several locations may be suitable anchor loads for a network including Neath Leisure Centre, Neath Civic Centre, Neath Police Station, Neath College, and Gwyn Hall. This is shown on Figure 12-15. Large RLDP Candidate Sites in the area include Ty Canol Farm (residential) and Land Southwest of Cimla (mixed-use). A high-level estimate of the annual heat demand across the Neath area came to 15 GWh. Existing heat sources in the area include The Metal Box biomass facility. Large scale heat pumps could be incorporated into planned developments or located council-owned land as an alternative to The Metal Box.

Feedback from the Heat Mapping Workshop

The workshop identified Neath College as an additional heat load which may be beneficial to a DHN. The workshop also identified the distance between heat sources located at either The Metal Box or planned developments and the town centre as a challenge to DHN development. The River Neath was also highlighted as a geographical constraint and any further assessment should consider the cost of crossing the river or the viability of developing several smaller networks.

Swansea University Bay Area

6.1.17 The Swansea University Bay Area consists of numerous large buildings which may act as anchor loads for a network including university buildings such as the College of Engineering, Bay Library and School of Management, and commercial buildings such as Bay Studios and Amazon UK. This is shown on Figure 12-16. The University of Swansea also has the goal of decarbonising by 2040, where the development of a DHN could form part of their strategy to decarbonise buildings. The heat demand of clusters in the surrounding area is estimated at 38 GWh, with the network expanding to residential clusters and other commercial buildings. There is substantial land around the University which could be used to develop an energy centre for the network. To the North of the area, the Coed Darcy planned development (mixed use) could also incorporate an energy centre into the design.

Feedback from the Heat Mapping Workshop

The workshop highlighted the close proximity between the University Bay Campus and Swansea City Centre and the opportunity for collaboration between local authorities. Any further DHN feasibility study should consider the benefits and risk of developing a network between the two areas.

Baglan Energy Park

6.1.18 Baglan Energy Park consists of numerous large buildings which may act as anchor loads for a network including Neath Port Talbot Hospital, Ysgol Bae Baglan, Ysgol Gymraeg Bro Dur and Rosedale Medical Centre. This is shown on Figure 12-17. The heat demand of clusters in the area is estimated at 11 GWh, with the network expanding to primarily residential clusters and industrial/commercial buildings. There are numerous biomass facilities in the area which could act as heat sources for the network, alongside the potential to incorporate an energy centre into the Baglan Energy Park (employment) or Baglan Way (employment) planned development

Feedback from the Heat Mapping Workshop

The workshop also highlighted that stakeholders including Neath Hospital and businesses within the Baglan Energy Cluster did not show a significant amount of interest in a DHN development but acknowledged previous engagements lacked resources and that a renewed engagement strategy and wider societal decarbonisation pressure may result in more positive engagement.

Port Talbot

6.1.19 In the Port Talbot area, large anchor loads include Neath Port Talbot Hospital, Ysgol Cwm Brombil and Afan College. This is shown on Figure 12-18. Heat loads are centred around three distinct areas, around Neath Port Talbot Hospital, around Aberavon seafront which includes schools and a Leisure Centre, Afan College and in the south around the Kenfig industrial estate. The total heat demand of these clusters is estimated at 12 GWh. There are numerous biomass facilities located in the area such as Margam Green Energy Plant, Western Bio-Energy, and Unit 3 Kenfig Industrial. The area includes a number of large developments such as Port Talbot Steelworks (employment space/renewable energy infrastructure) and the port of Port Talbot (employment/transport infrastructure).

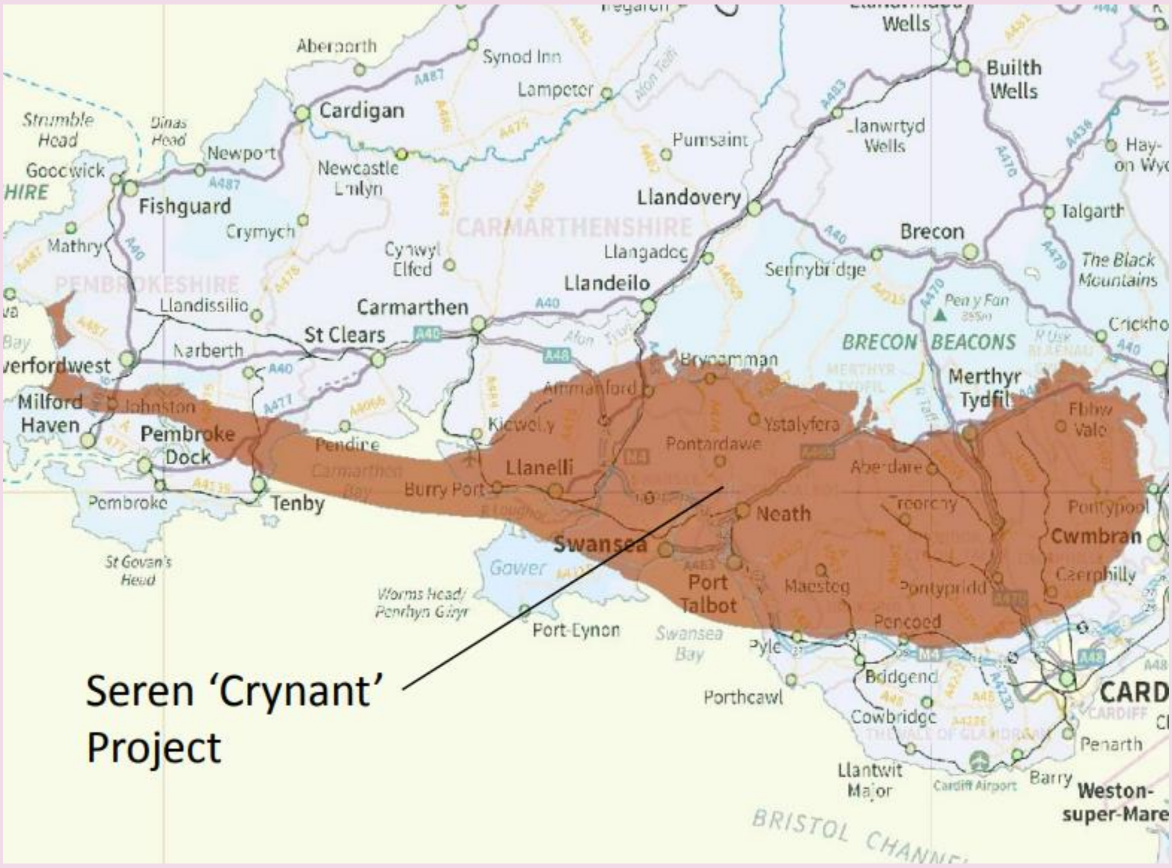
Feedback from the Heat Mapping Workshop

The workshop highlighted that the future of the Port Talbot Steelworks and the development of electric arc furnaces is uncertain and presents a risk to any DHN developed using this site as a heat source. A number of heat sources should be considered in any further assessment.

The workshop also identified that Afan College may move to an alternative location as part of the local plan development which may impact the size of the cluster.

Note on Mine Water Heat Opportunity

Mine water can be used as an energy source for heat pumps, dramatically increasing their COP by reducing the amount of energy input required to raise the water temperature to the required level. This is currently being considered for its potential with DHN; the Seren Project in the South Wales coalfield is establishing a network to monitor mine water temperatures to estimate its heating potential, and its geological area encompasses all of NPT as shown on the image below (Seren Energy, 2015).



7 Informing Site Allocations for New Development

Chapter in Brief

This chapter will make use of the results of the county wide renewable resource assessment for onshore wind and ground-mount PV, and the heat opportunities mapping, as a factor in assessing the RLDP's candidate sites for new building developments. The section maps out candidate sites, identifies renewable power supply opportunities, and identifies heat opportunities for new developments.

Section to be completed for report at deposit plan stage

8 Prioritisation of Areas Suitable for Standalone Renewables (Local Search Areas)

Chapter in Brief

This chapter will make use of and reviews the results of the county wide renewable resource assessment for onshore wind and ground-mount PV and applies prioritisation with respect to additional constraints, to aid in the identification of Local Search Areas (LSAs). Onshore wind is prioritised based on wind speed and air traffic infrastructure, while ground-mount PV uses agricultural land grades. Grid connection points are also considered as a limitation for both technologies.

Section to be completed for report at deposit plan stage

9 Viability Appraisals for Strategic Sites

Chapter in Brief

This chapter investigates the viability of renewable technologies and district heating networks for Neath Port Talbot's strategic sites outlined in the RLDP.

Section to be completed for report at deposit plan stage

10 Targets, Policies & Plans

Chapter in Brief

This chapter sets outs targets and policies suggested for inclusion into the RLDP.

Section to be completed for report for deposit plan stage

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12 Appendices

Appendix A – Energy Projections Mapping

Energy Category	BEIS Subnational Final Energy	BEIS Energy & Emission Projections
Electricity	Electricity: Domestic Electricity: Industrial, Commercial and other	Residential: Electricity Commercial Services: Electricity Public Services: Electricity Agriculture: Electricity Other Industry sectors: Electricity Transport: Electricity
Heating fuels	*Coal: Industrial – NOT INCLUDED* Coal: Commercial Coal: Domestic Coal: Public Sector Coal: Agriculture *Manufactured fuels: Industrial – NOT INCLUDED* Manufactured fuels: Domestic Petroleum: Industrial Petroleum: Commercial Petroleum: Domestic Petroleum: Public sector Petroleum: Agriculture Gas: Industrial, Commercial & other Gas: Domestic Bioenergy & wastes: Domestic Bioenergy & wastes: Industrial and Commercial	Residential: Natural gas Residential: Petroleum products Residential: Renewables Residential: Solid/manufactured fuels Commercial Services: Natural gas Commercial Services: Petroleum products Commercial Services: Renewables Commercial Services: Solid/manufactured fuels Public Services: Natural gas Public Services: Petroleum products Public Services: Renewables Public Services: Solid/manufactured fuels Agriculture: Natural gas Agriculture: Petroleum products Agriculture: Renewables Agriculture: Solid/manufactured fuels Other Industry sectors: Natural gas Other Industry sectors: Petroleum products Other Industry sectors: Renewables Other Industry sectors: Solid/manufactured fuels
Transport fuels (road and rail)	Coal: Rail Petroleum products: Road transport Petroleum products: Rail Bioenergy and wastes: Road transport	Transport: Natural gas Transport: Petroleum products (rail) Transport: Petroleum products (road transport) Transport: renewables Transport: Solid/manufactured fuels
Steelworks fuel	21,333 GWh*	N/A

*Table 12-1: Mapping of BEIS subnational energy data to energy projections (*The 2021 Tata Steel annual sustainability report states that the energy intensity of crude steel produced from Tata's UK Port Talbot operations has varied between 22.8 – 24 GJ/tonne crude steel over the past five years (Tata Steel, 2021). At an energy intensity of 24 GJ/tcs (6.667 MWh/tcs) and a production output of 3.2 Mt of crude steel, the steelworks consumes approximately 21,333 GWh per annum. This is mostly coal, with some use of natural gas, the exact split between to the two fuels is not made publicly available.)*

Appendix B – Existing Identified Renewable Sites

Name	Type	Capacity (MW)
Mynydd Y Gwrhyd Windfarm	Wind (onshore)	4.7
Llynfi Afan Renewable Energy Park	Wind (onshore)	6.0
Llynfi Renewable Energy Park, Land at Mynydd Caerau	Wind (onshore)	18.0
Pen Y Cymoedd	Wind (onshore)	228.0
Mynydd Brombil Wind Farm	Wind (onshore)	8.0
Maesgwyn Wind Farm - extension	Wind (onshore)	2.5
Longlands Lane	Wind (onshore)	1.5
Mynydd y Betws	Wind (onshore)	34.5
Maesgwyn	Wind (onshore)	26.0
Ffynnon Oer Wind Farm	Wind (onshore)	32.0
Total	Wind (onshore)	**361.2**
Caegarw Farm, Margam	Solar PV (ground mounted)	3.8
Hendre Fawr Farm, Rhigos	Solar PV (ground mounted)	11.6
Land at Maesgwyn	Solar PV (ground mounted)	7.5
Pantymoch Farm, Port Talbot	Solar PV (ground mounted)	11.5
Maesgwyn Opencast	Solar PV (ground mounted)	5.0
Seaway Parade	Solar PV (ground mounted)	5.0
Total	Solar PV (ground mounted)	**44.4**
Land at the Afan Dwr Cymru Welsh Water Treatment Works	Anaerobic Digestion	6.0
Total	Anaerobic Digestion	**6.0**
Longlands Lane, Margam	Biomass (CHP)	14.0
Margam Green Energy Plant, Longlands Lane, Margam	Biomass (CHP)	40.0
Total	Biomass (CHP)	**54.0**
Tan y Rhiw Farm	Hydro	0.05
Nant Creunant, Crynant	Hydro	0.003
Brynrhyg Farm, Crynant	Hydro	0.005
Nant yr Allow Farm, Glyncorrwg	Hydro	0.1
Land at Maesgwyn, Glyncorrwg	Hydro	0.1
Brynawel, Crynant	Hydro	0.022
Plas Farm	Hydro	0.011
Margam Country Park	Hydro	0.012
Total	Hydro	**0.303**
Total		**466***

*Table 12-2: NPT existing identified renewable sites (electricity) from REPD, FiT, CHP Register and checked against LA database (*Note this number is the total of identified renewable sites, which is lower than the total estimated installed capacity in Table 3-1, as not all sites are identified including rooftop PV and hydro.)*

Name	Type	Capacity (MW)
Longlands Lane, Margam	Biomass (CHP heat)	28.0
Unit 3 Kenfig Industrial Estate	Biomass (CHP heat)	6.4
Land at the Afan Dwr Cymru Welsh Water Treatment Works	Anaerobic Digestion (CHP heat)	6.9

Table 12-3: NPT existing identified renewable sites (heat)

Appendix C – GIS Constraints Mapping Restrictions

Restriction	Buffer (m)	Area (km^2)	% of NPT land area
Residential Addresses	500	219	49.48%
Woodland	50	210	47.41%
OS Local Roads	136	202	45.74%
Wind Speed <6m/s	0	179	40.55%
SLA	0	170	38.33%
LDP Settlements	500	156	35.38%
Residential Planning Sites	500	85	19.15%
Ancient Woodland	50	69	15.71%
OS Waterlines	20	64	14.56%
OS Regional Roads	178	60	13.57%
Sites of Importance for Nature Conservation (SINC)	0	42	9.59%
Green Wedges	0	34	7.69%
Watercourse SINC	0	32	7.22%
OS Rail	185	29	6.59%
Deep Peat	0	19	4.19%
Woodland SINC	0	18	4.06%
OS National Roads	190	18	3.97%
OS Surface Water	10	16	3.67%
Main Rivers	40	10	2.34%
Sites of Special Scientific Interest (SSSI)	0	8	1.87%
Historic Parks and Gardens	0	8	1.75%
Special Area of Conservation (SAC)	0	2	0.38%
Scheduled Monuments	0	1	0.27%
RAMSAR	0	1	0.24%
National Nature Reserves (NNR)	0	1	0.16%
Conservation Areas	0	1	0.13%
National Parks	0	0	0.00%

Restriction	Buffer (m)	Area (km^2)	% of NPT land area
Areas of Outstanding Natural Beauty (AONB)	0	0	0.00%
Marine Conservation Zones (MCZ)	0	0	0.00%
Special Protection Areas (SPA)	0	0	0.00%
UAS Airspace (danger)	0	0	0.00%
UAS Airspace (prohibited)	0	0	0.00%
UAS Airspace (restricted)	0	0	0.00%

Table 12-4: Onshore wind GIS constraints mapping restrictions

Restriction	Buffer (m)	Area (km^2)	% of NPT land area
SLA	0	169.52	38.33%
Woodland	0	163.98	37.07%
Urban Areas	0	73.34	16.58%
Sites of Importance for Nature Conservation (SINC)	0	42.40	9.59%
Ancient Woodland	10	40.35	9.12%
LDP Settlement Limits	0	38.15	8.62%
Green Wedges	0	34.01	7.69%
Flood Alert Areas	0	32.87	7.43%
Watercourse SINC	0	31.94	7.22%
OS Waterlines	10	31.68	7.16%
Deep Peat	0	18.54	4.19%
Woodland SINC	0	17.97	4.06%
OS Surface Water	10	16.22	3.67%
OS Local Roads	4	9.26	2.09%
Residential Planning Sites	0	8.45	1.91%
Sites of Special Scientific Interest (SSSI)	0	8.25	1.87%
Historical Parks and Gardens	0	7.73	1.75%
TAN 15 Flood Zones	0	5.66	1.28%
Main Rivers	20	5.09	1.15%

Restriction	Buffer (m)	Area (km^2)	% of NPT land area
OS Regional Roads	8	2.99	0.68%
OS Rail	15	2.52	0.57%
OS National Roads	20	2.10	0.47%
Special Area of Conservation (SAC)	0	1.67	0.38%
Scheduled Monuments	0	1.20	0.27%
RAMSAR	0	1.07	0.24%
National Nature Reserves (NNR)	0	0.71	0.16%
Conservation Areas	0	0.58	0.13%
National Parks	0	0.01	0.00%
Areas of Outstanding Natural Beauty (AONB)	0	0.00	0.00%
Marine Conservation Zones (MCZ)	0	0.00	0.00%
Special Protection Areas (SPA)	0	0.00	0.00%

Table 12-5: Ground-mount PV GIS constraints mapping restrictions

Appendix D – Mapping

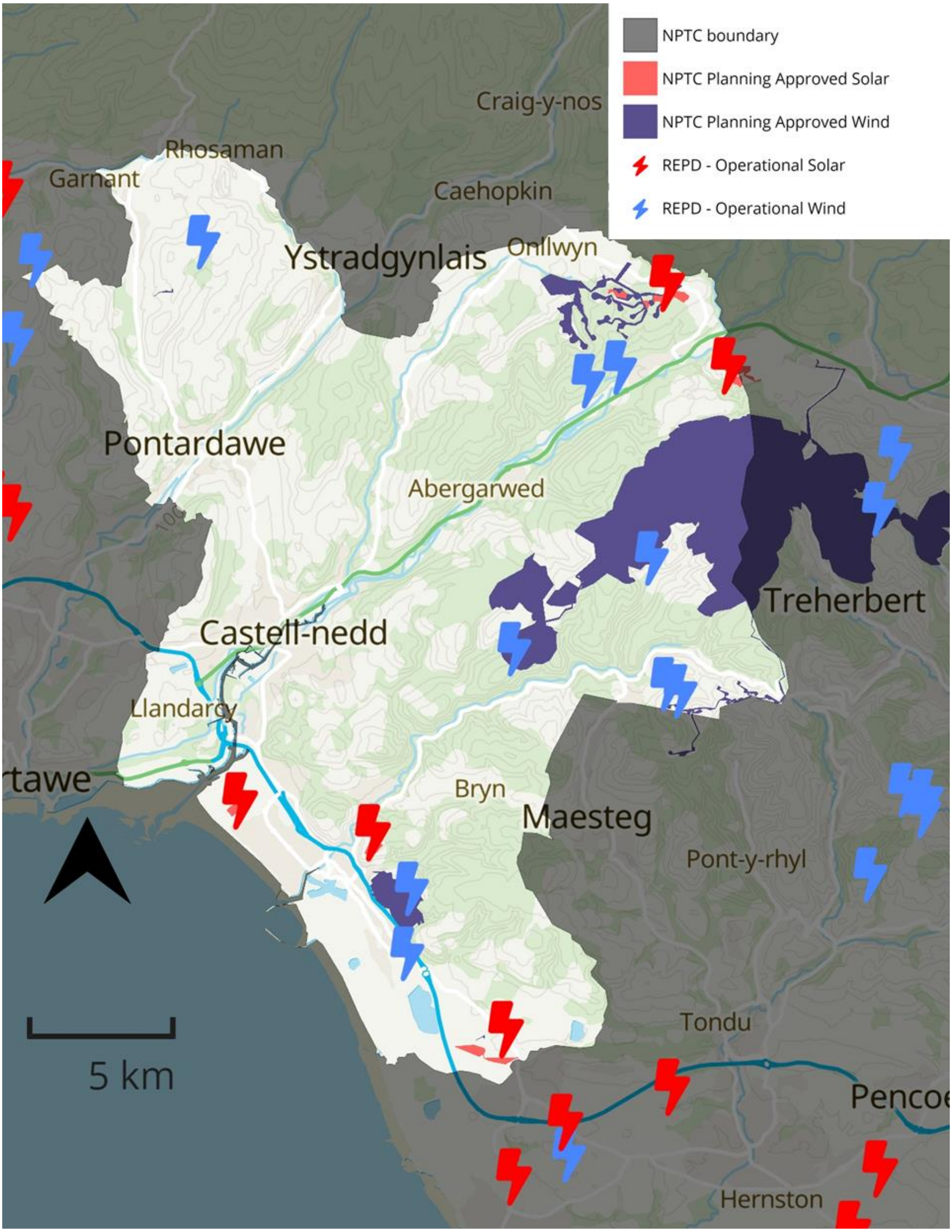

Figure 12-1: Operational onshore wind and solar from REPD and approved applications from NPTC planning data

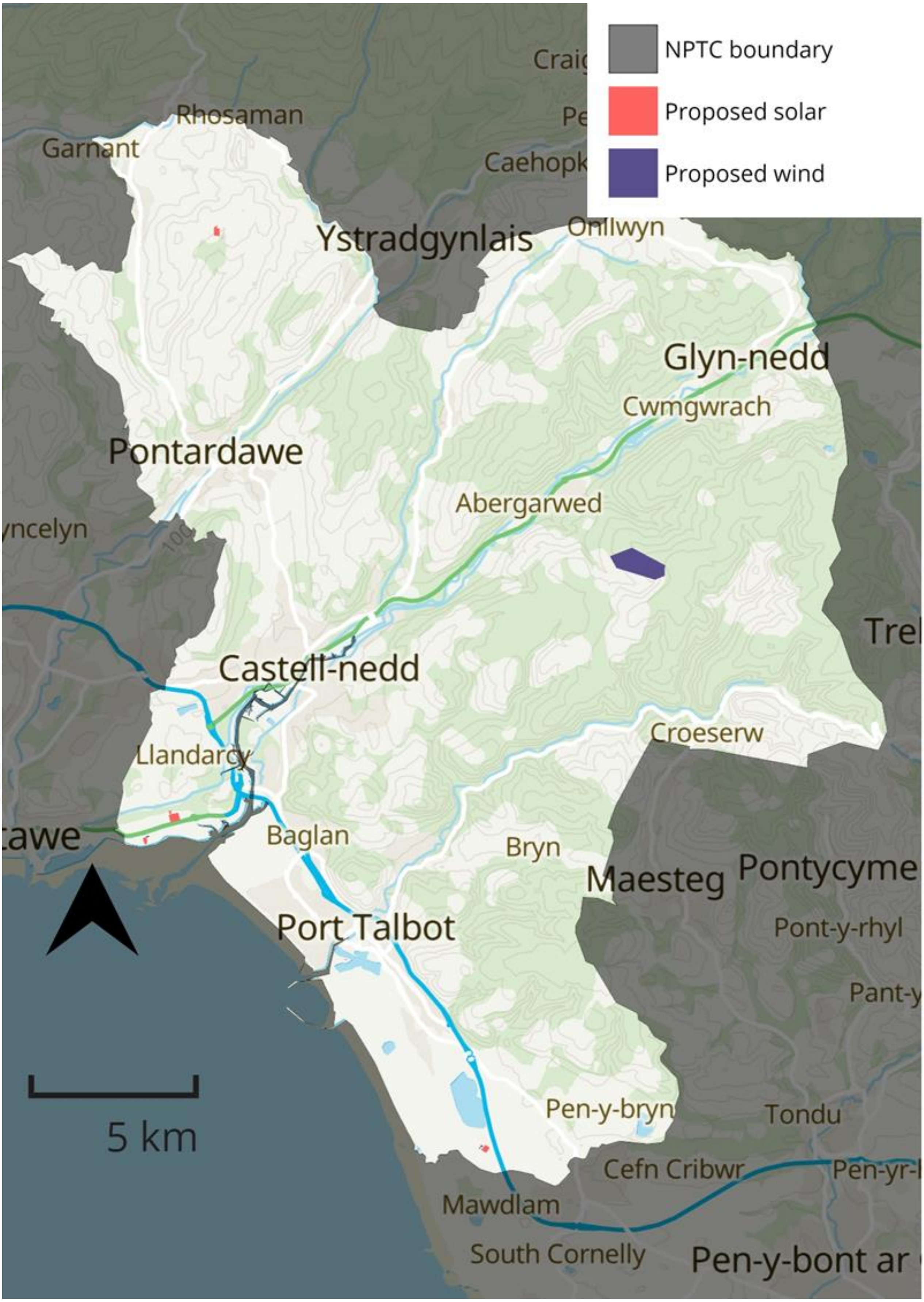

Figure 12-2: Map of proposed wind and solar generation in NPTC

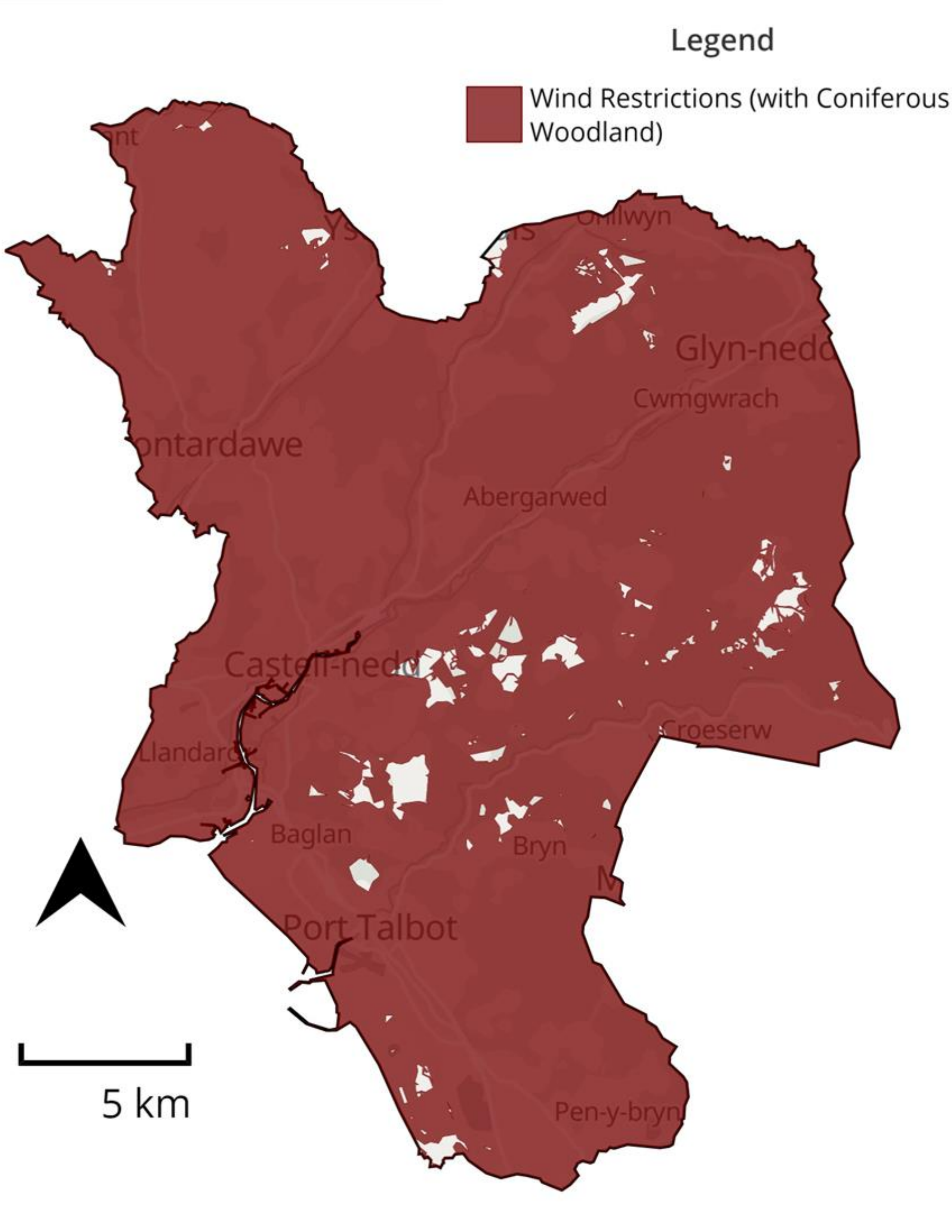

Figure 12-3: Onshore wind restrictions including coniferous woodland

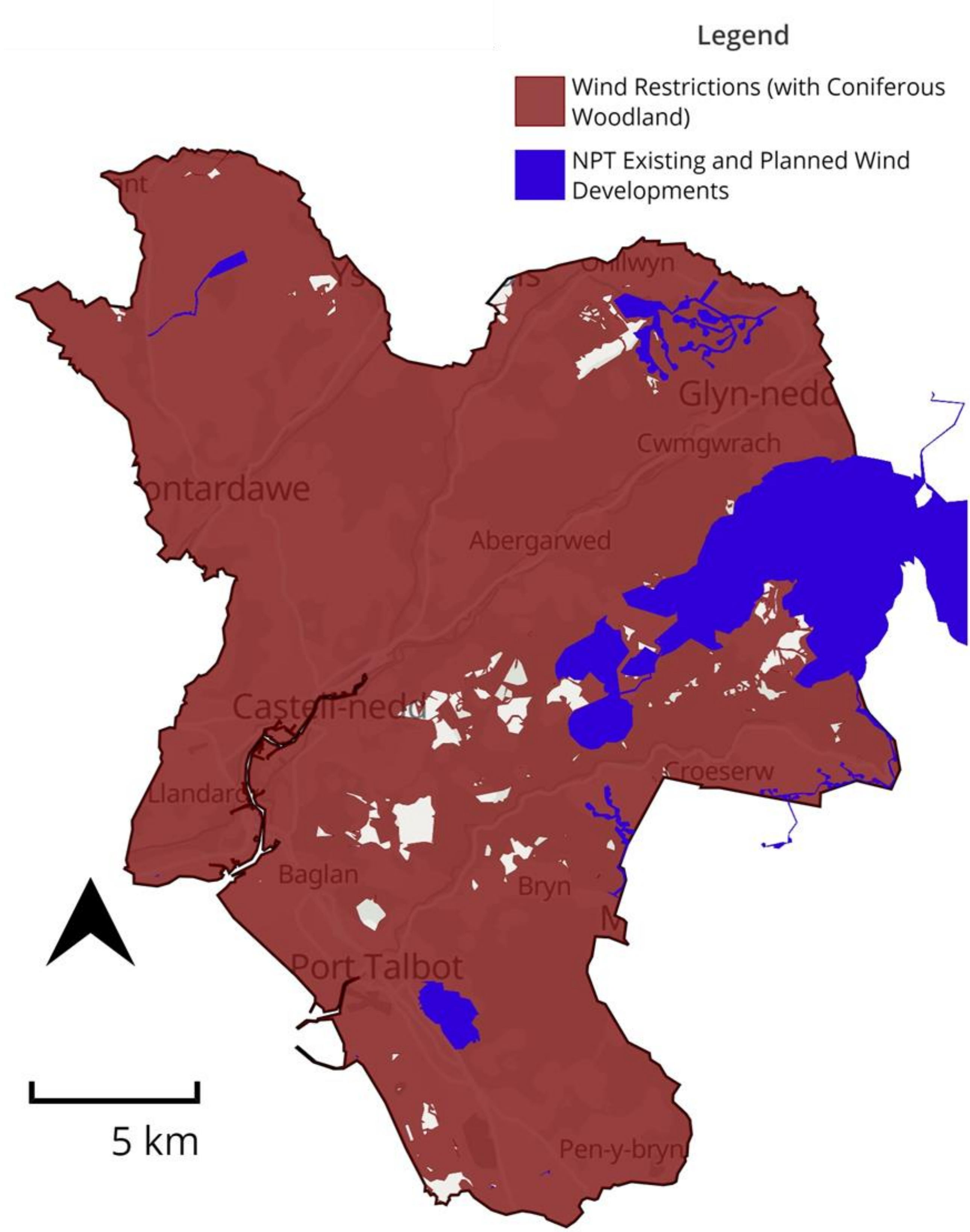

Figure 12-4: Onshore wind restrictions including coniferous woodland and existing NPT wind developments

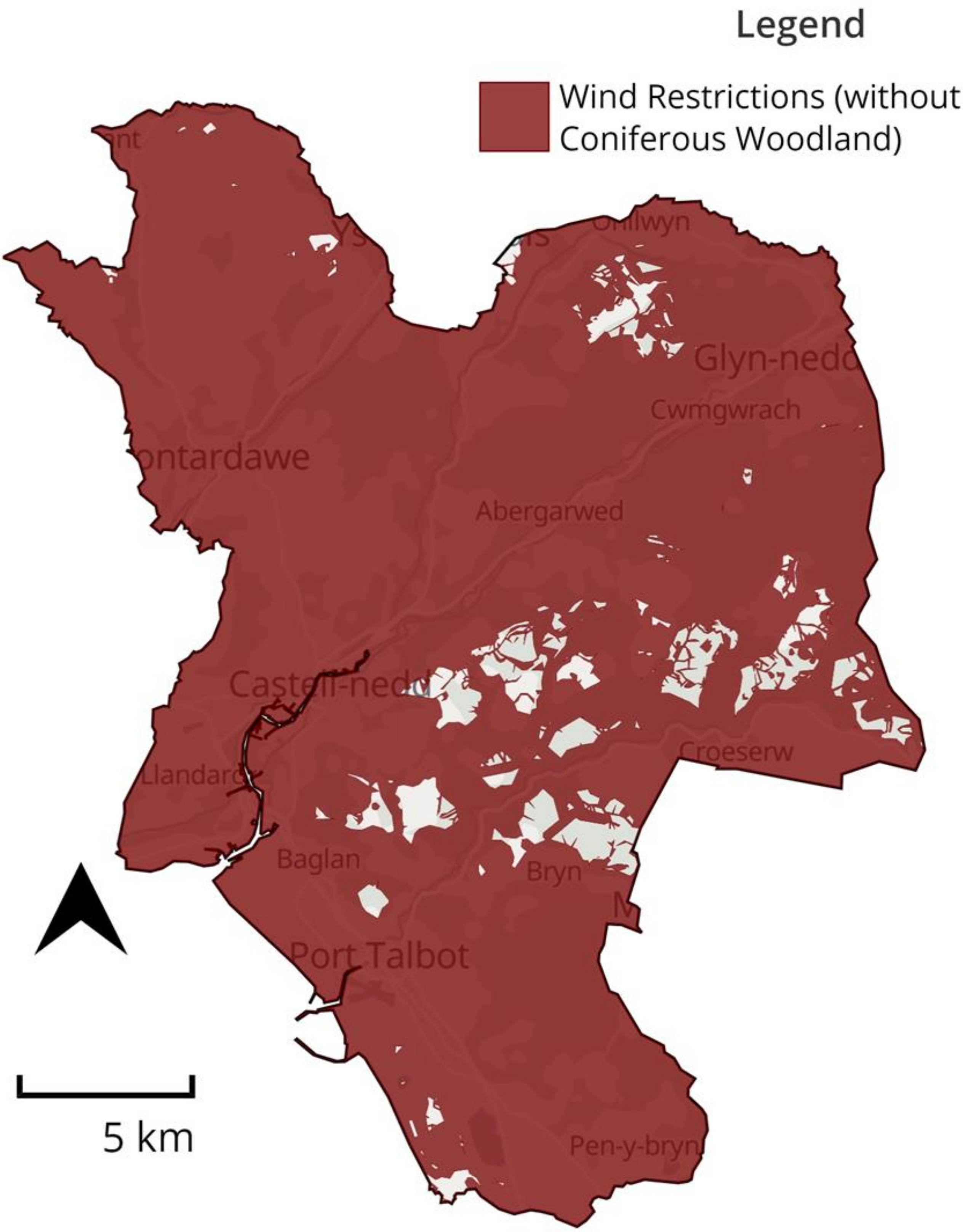

Figure 12-5: Onshore wind restrictions without coniferous woodland as a constraint

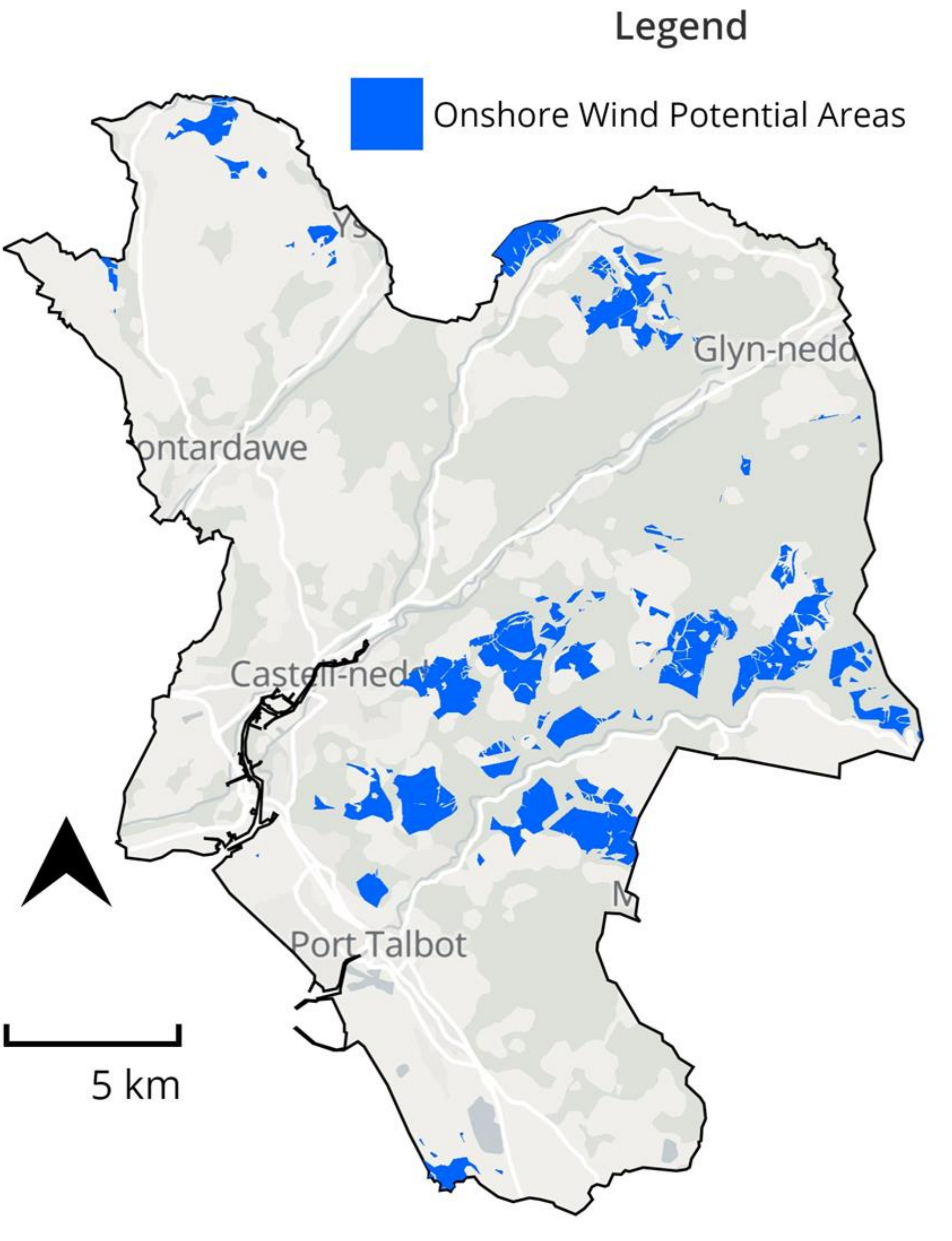

Figure 12-6: Potential onshore wind areas across NPT

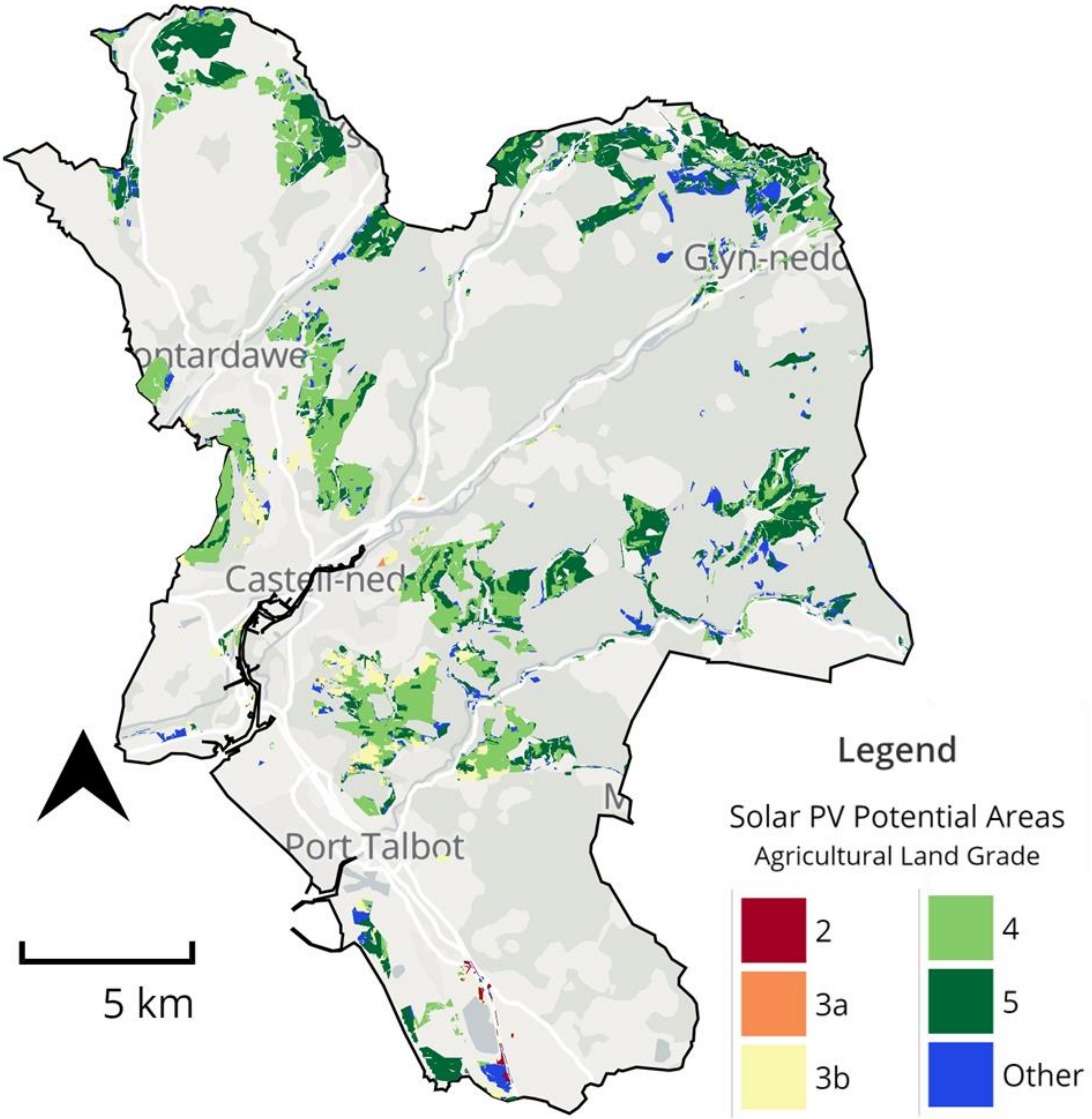

Figure 12-7: Ground-mount PV potential across NPT by agricultural land classification

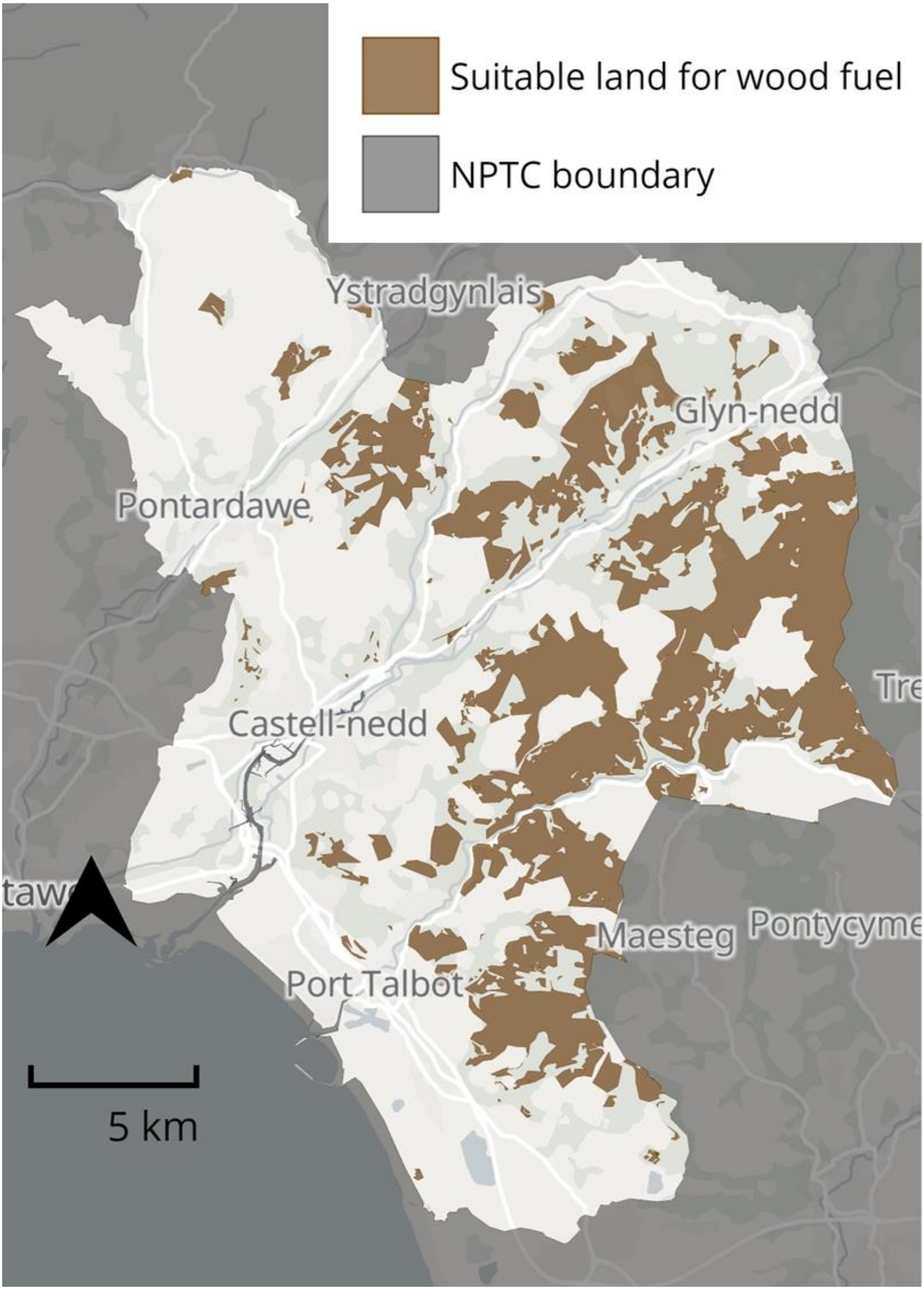

Figure 12-8: Woodland that could be used for sourcing wood fuel

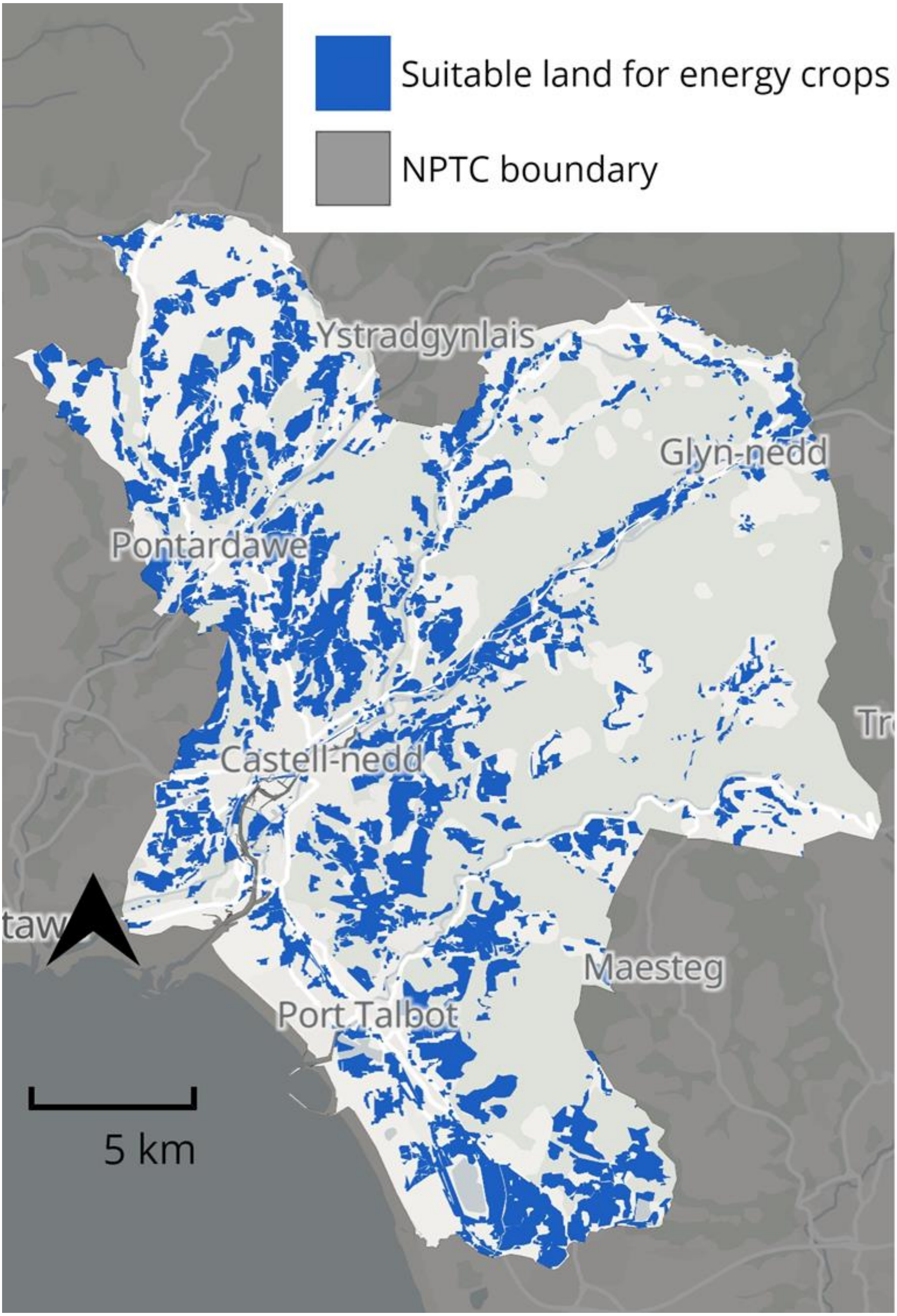

Figure 12-9: Maximum theoretical land area that could be used for growing energy crops

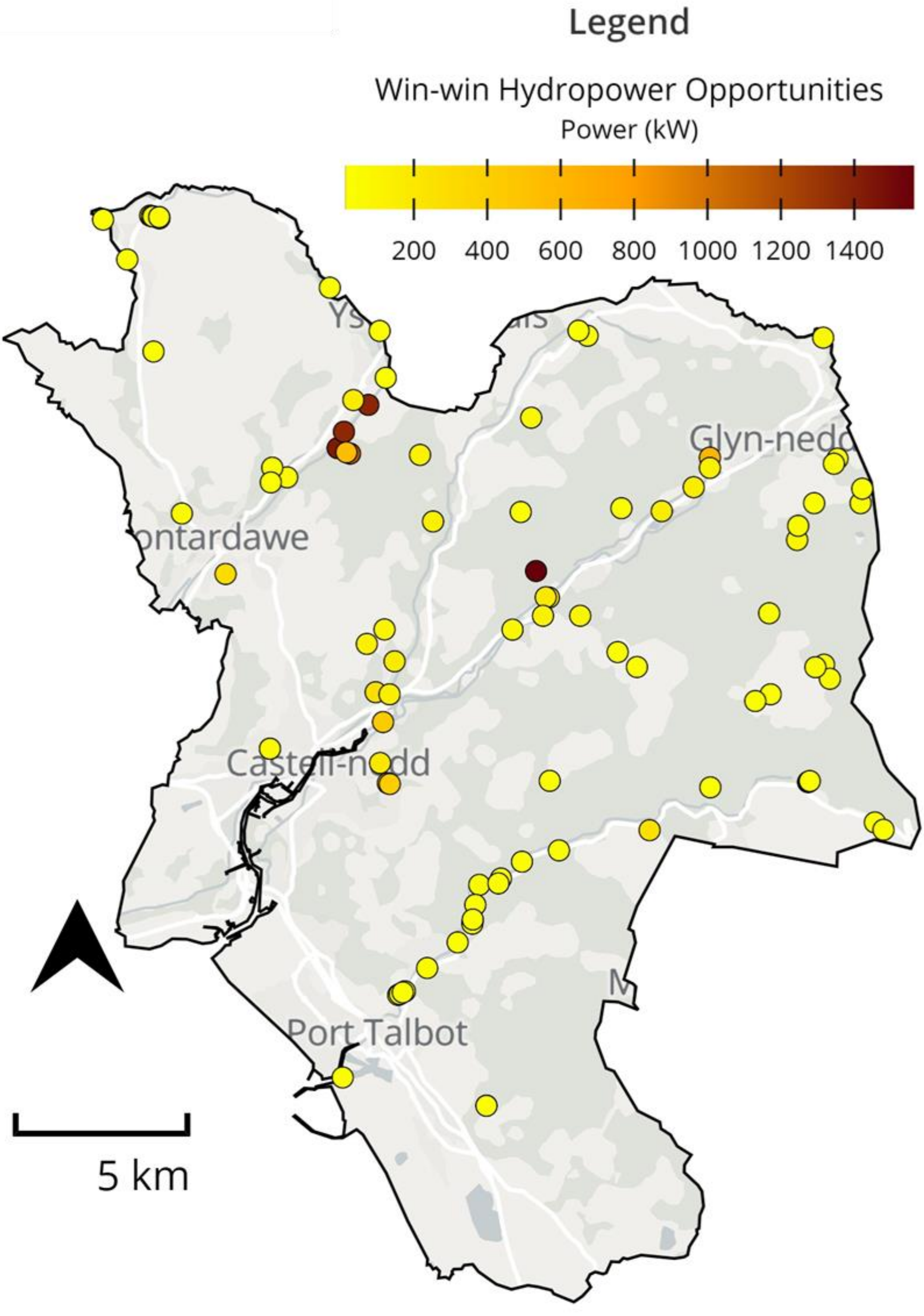

Figure 12-10: Map of Environment Agency "win-win" hydropower opportunities in NPT

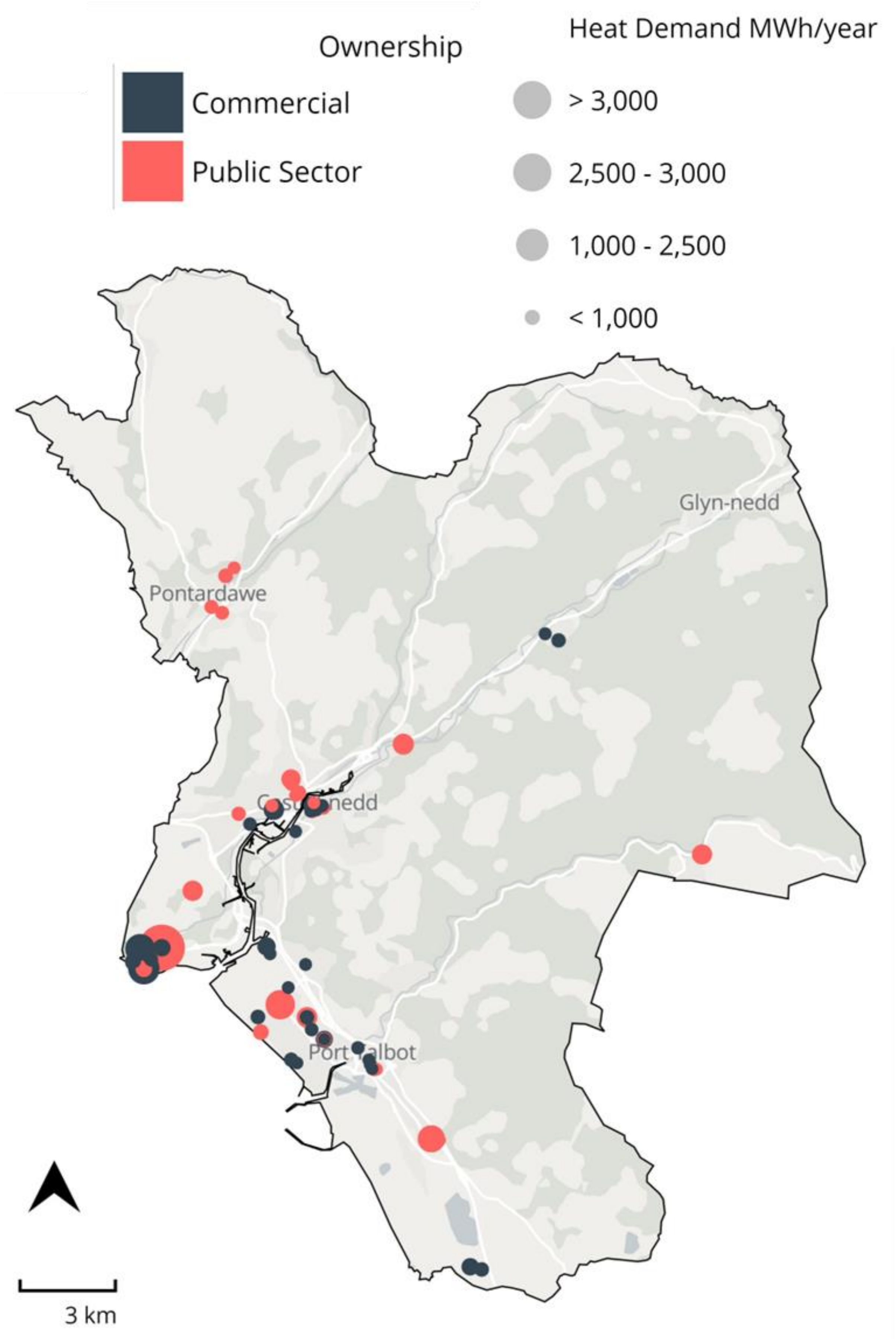

Figure 12-11: Potential Anchor Heat Loads across NPT

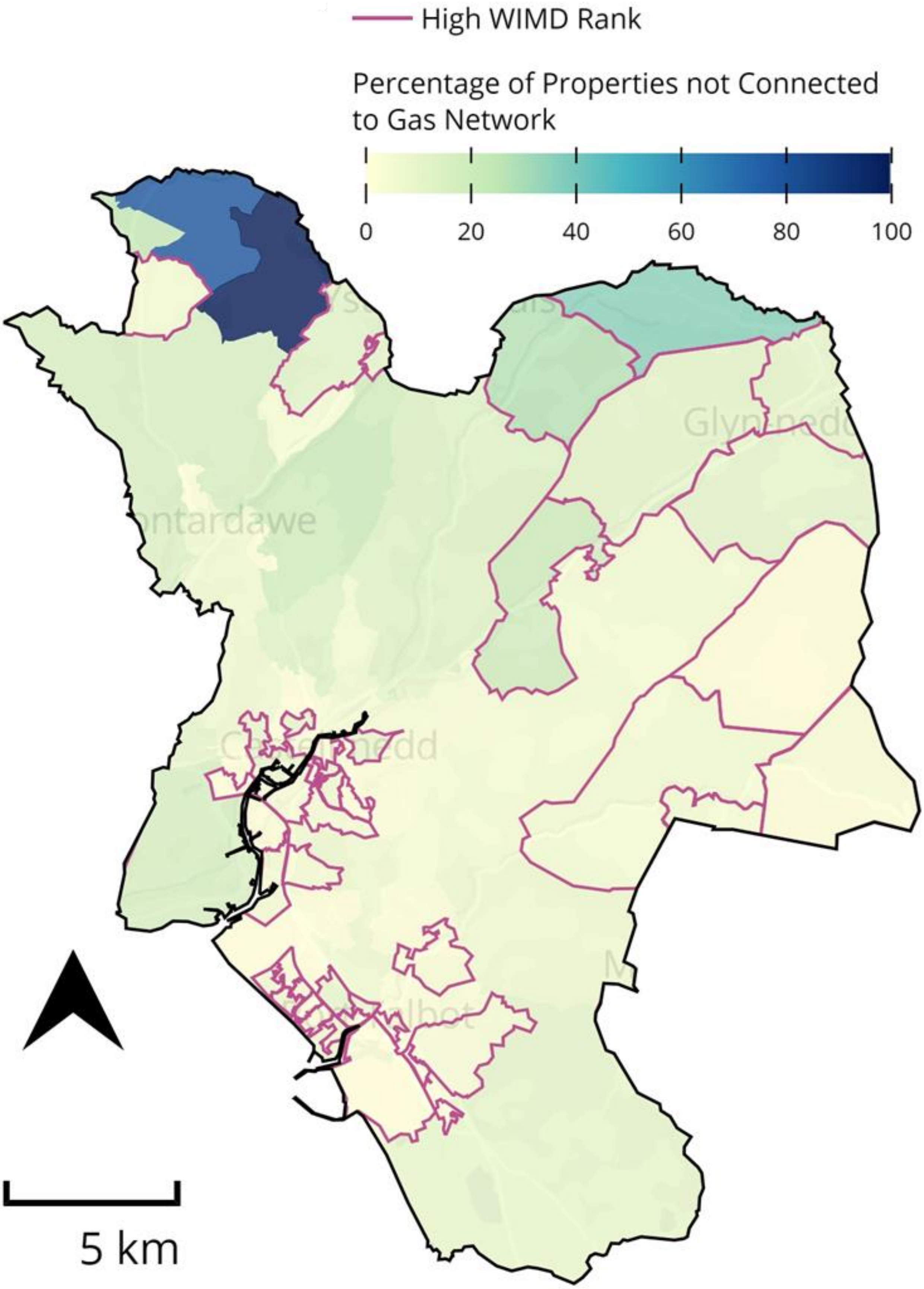

Figure 12-12: Areas of High WIMD Ranking and Proportion of Properties Not Connected to the Gas Network across NPT

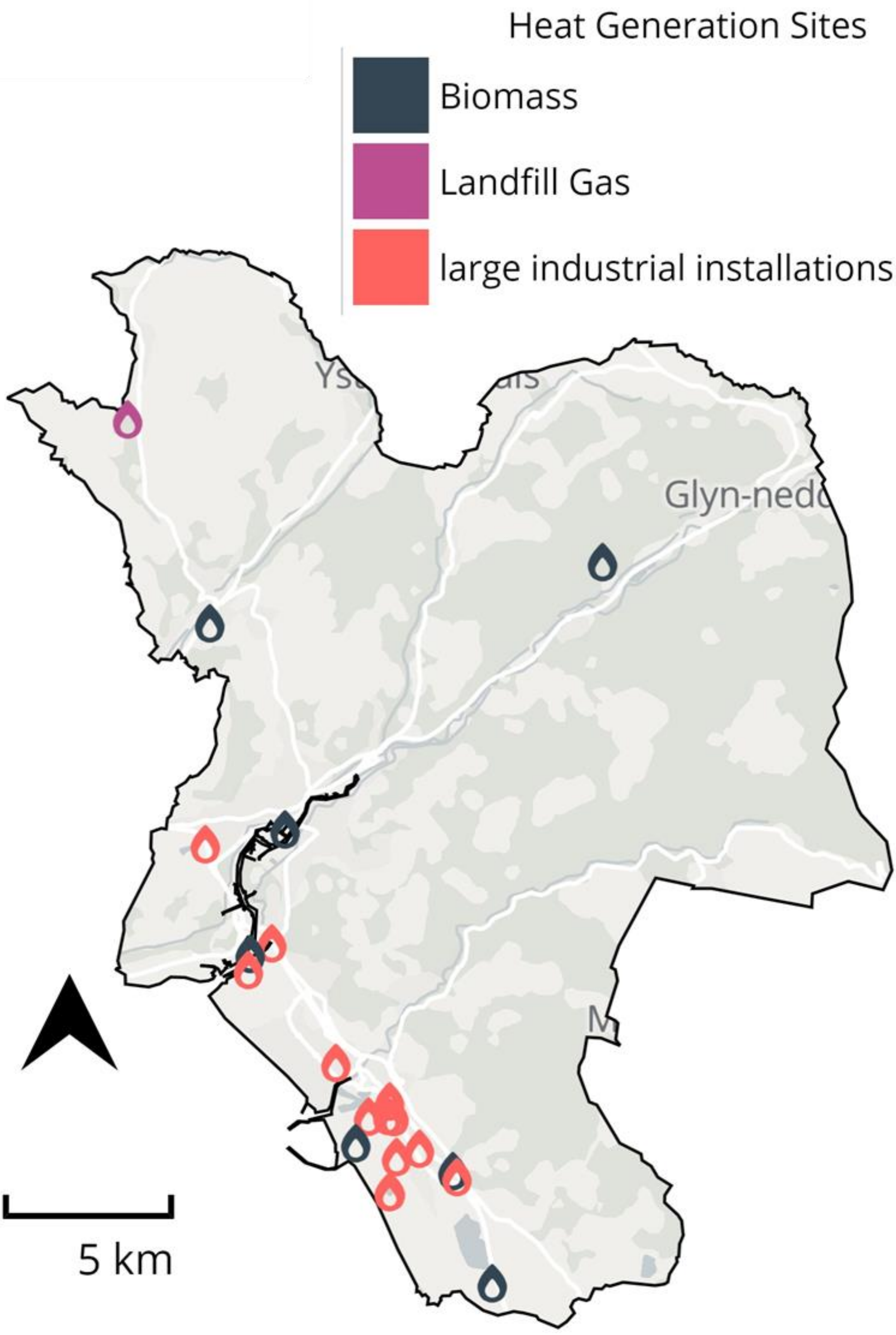

Figure 12-13: Potential Heat Sources across NPT

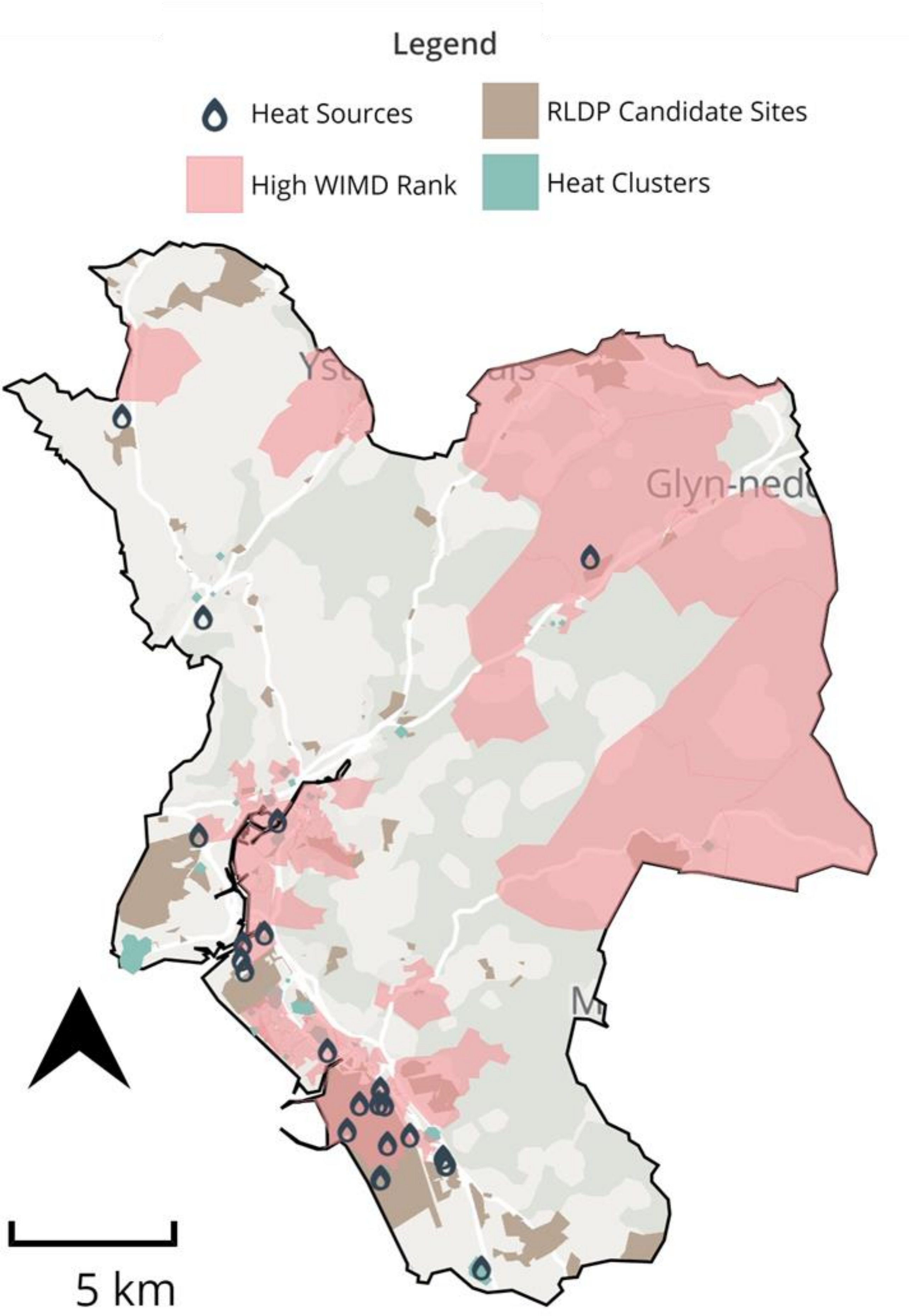

Figure 12-14: Energy Opportunities Plan of the NPT area

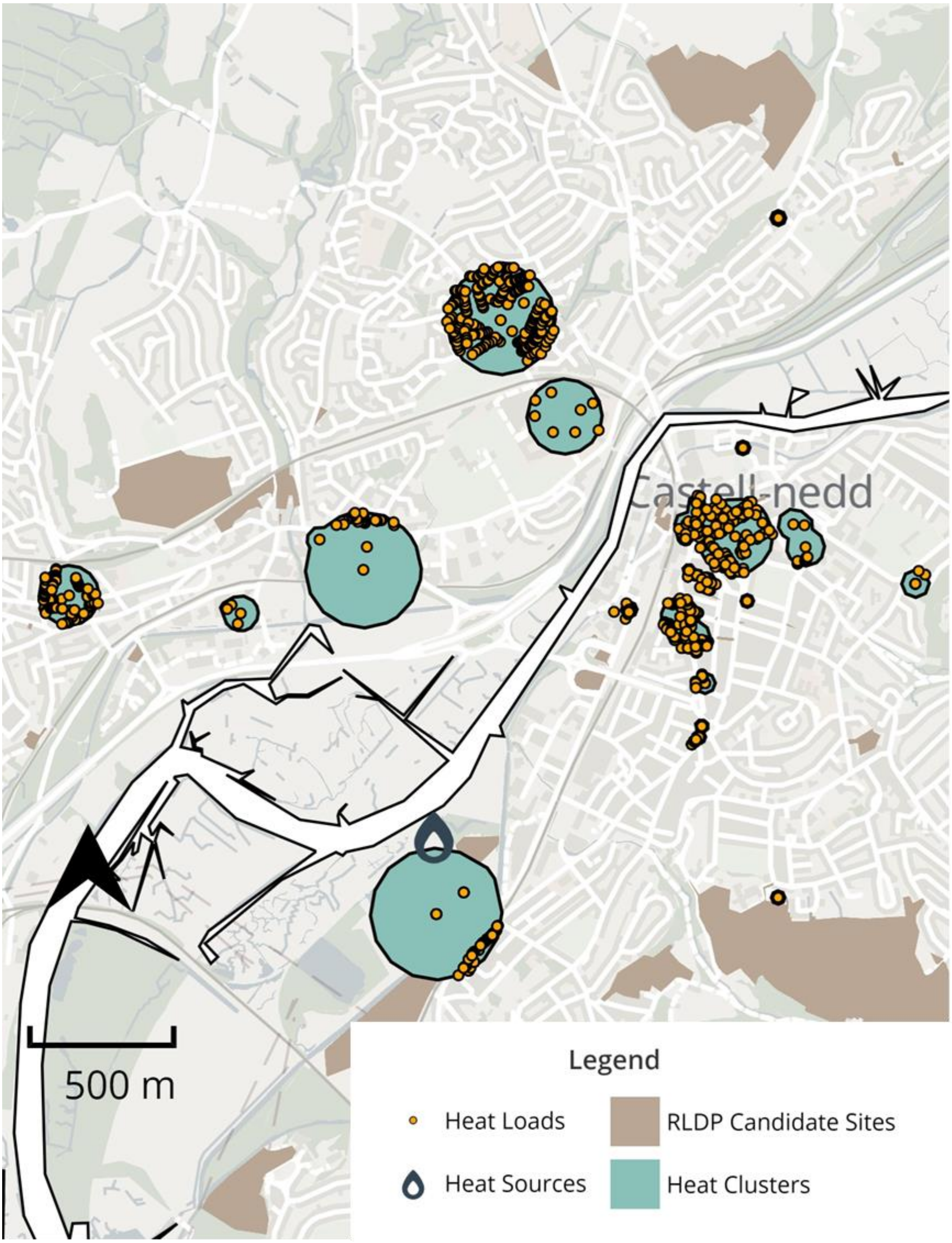

Figure 12-15: Neath Cluster Opportunities Plan

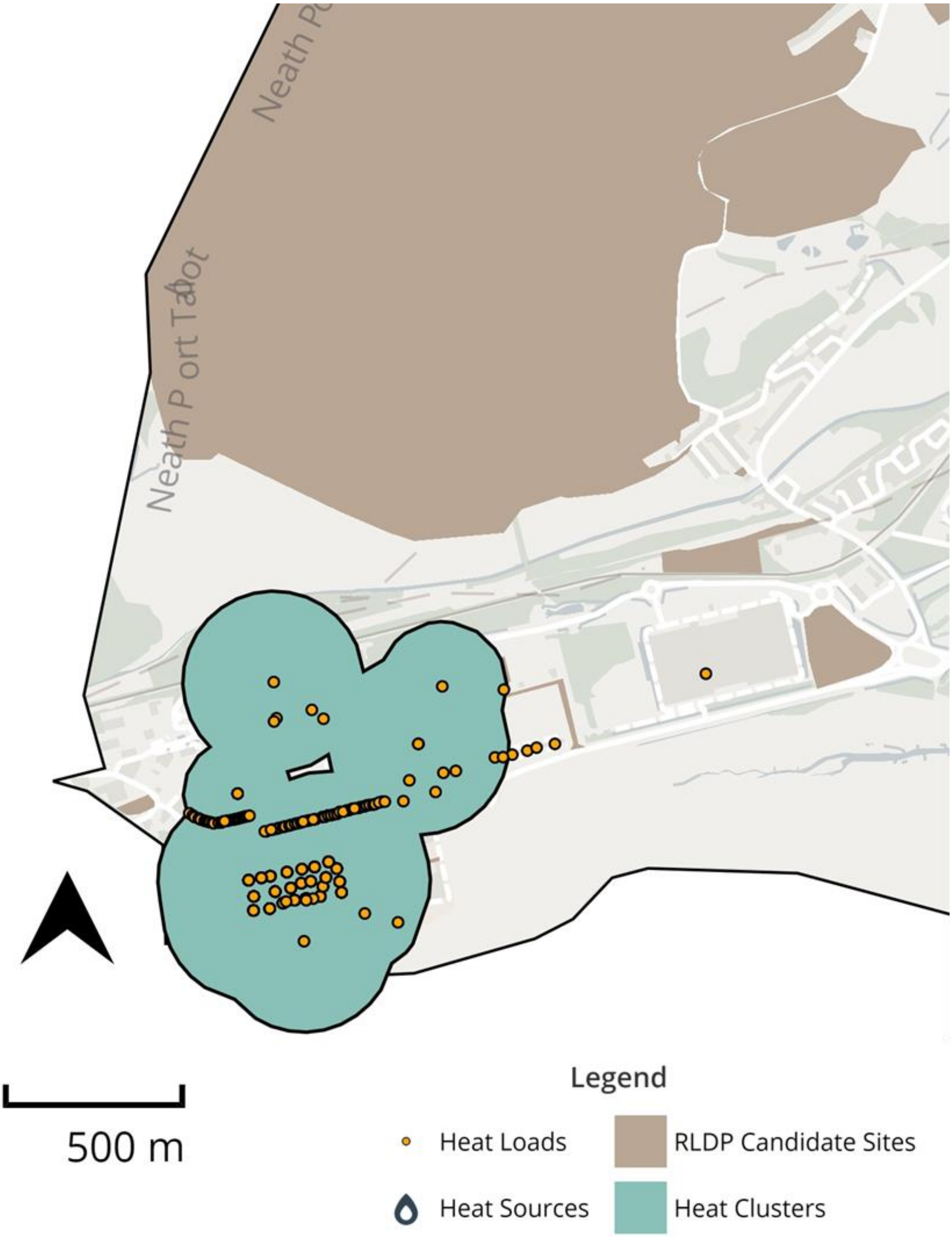

Figure 12-16: Swansea University Cluster Opportunities Plan

Figure 12-17: Baglan Energy Park Cluster Opportunities Plan

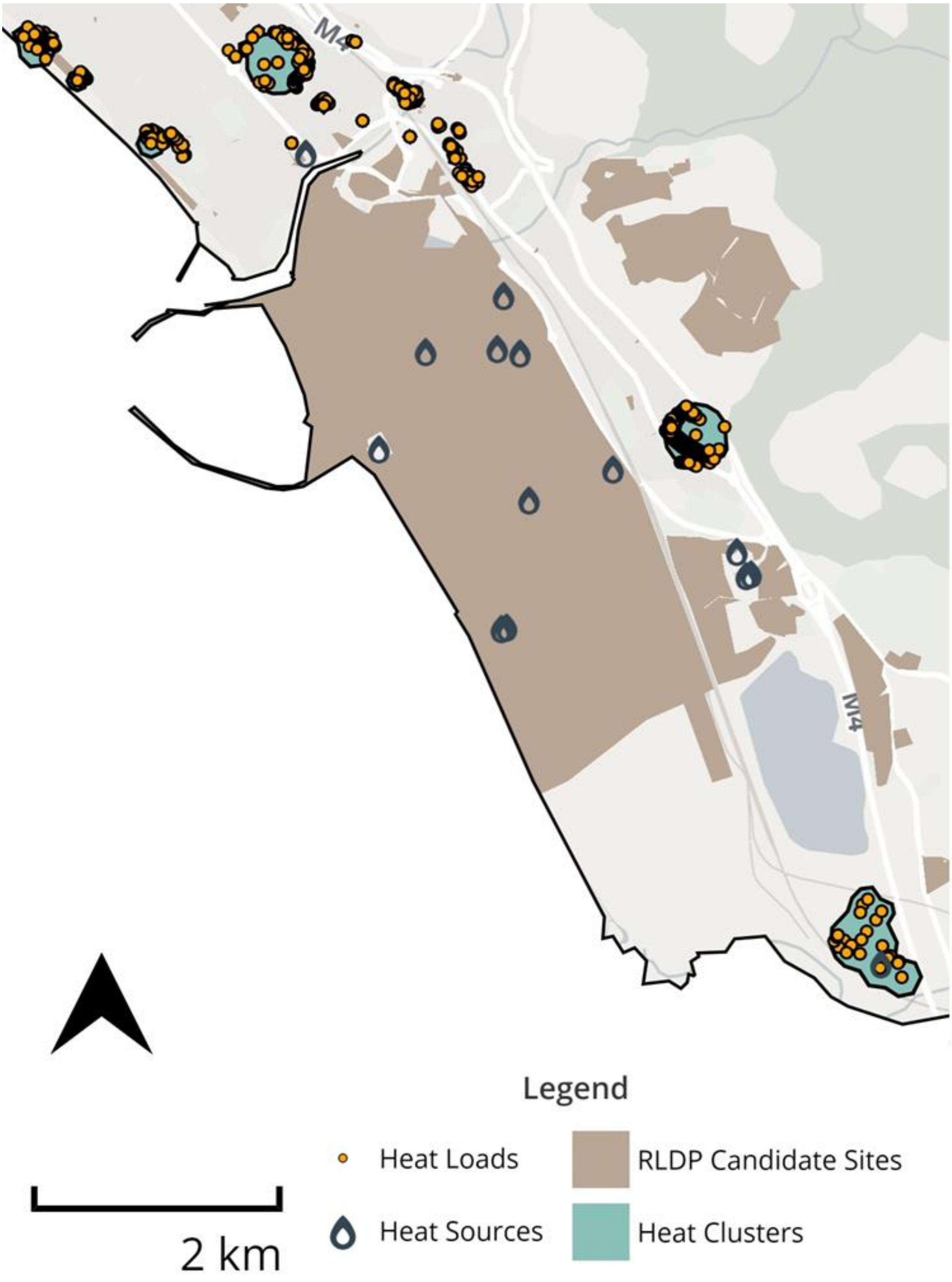

Figure 12-18: Port Talbot Cluster Opportunities Plan