Cabinet Prifddinas Ranbarth Caerdydd | Cardiff Capital Region Cabinet

**7 DECEMBER 2020**

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# TOWARDS AN ENERGY STRATEGY & IMPLEMENTATION PLAN FOR THE CARDIFF CAPITAL REGION

## REPORT OF CARDIFF CAPITAL REGION DIRECTOR

## AGENDA ITEM 8

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### Reason for this Report

1. To provide Regional Cabinet with details of the proposed CCR Energy Strategy for consideration and approval, along with details of the proposed next steps and associated timescales.

### Background

2. There is consensus across the Cardiff Capital Region (CCR) that a huge transformation is needed in the way in which energy is generated, transported and utilised. This shift is needed in order to meet UK net zero carbon targets by 2050, enhance health and wellbeing of our citizens; support a just transition to a clean growth economy and protect the environment for future generations.

3. The Welsh Government Energy Service (WGES) is working with each region across Wales, with a support package up until March 2022. This partnership has created a CCR Energy Vision and Strategy with the assistance of over 100 key stakeholders across the region. The strategy has considered the 'business as usual' decarbonisation pathway alongside a detailed future scenario to put the region on a pathway to achieve net zero by 2050. The options and choices are stark and there are no neutral decisions.

### Issues

<u>Energy Challenges and Opportunities in CCR</u>

4. The purpose of this report is to present the emergent Energy Strategy for the region. Whilst the urgency around the agenda is recognised, by March 2021, there is some important work to do to:

   - co-ordinate and align the regional approach to local strategies of the ten Councils and scope of individual climate crisis pledges so that a co-ordinated implementation plan can be developed;

- commence development of said implementation plan, in partnership with stakeholders and the WGES as a means of informing both City Deal and City Region opportunities. The latter will be particularly relevant given the evolution to a Corporate Joint Committee model and the wider funding streams and investment opportunities that can be secured through an expanded remit and focus;
- as part of the implementation plan, to scope the first 'Energy Mission' or challenge for the region – recognising the interlinked characteristics of climate crisis, historic low growth/ productivity in the region and the post COVID-19 recovery;
- embed a core set of energy 'asks and offers' within the investment prospectus for levelling-up, that showcase the potential for transformative programmes of activity; and,
- agree the strategy and implementation plan in readiness for the new financial year and the commencement of the new JWA Strategic Business Plan which will commence in 2021 and highlights the need for an amplified emphasis on decarbonisation as part of 'Build Back Better'.

5. Many scientists and commentators believe that the next 15 years will be the most consequential period in the history of humanity, demanding from us our best endeavours in dealing with a global pandemic and a climate and extinction emergency. As a result of COVID-19 and the huge scarring effects on global and local economies alike, all of this will play out against the backdrop of what certain experts are calling 'a systemic economic crisis'.

6. The interlinked challenges of climate, historic UK low growth-productivity and the post-COVID economic recovery, make for a real opportunity for CCR to play a distinctive role in the radical shifts and transformations required. This must build upon the region's unique natural energy generating assets and using the strength of our existing manufacturing base as a springboard for a transition to a hydrogen economy, with the creation of multiple Clean Growth hubs.

7. The recent '10 Point Plan for a Green Industrial Revolution' by UK Government provides important context. Coupled with continued commitments to increased R&D and infrastructure spending, there is an opportunity to align CCR's work to this and ensure the flow of public investment to catalyse such developments and 'level-up' the UK economy.

8. Our vision for Cardiff Capital Region was approved by Regional Cabinet 19/12/19 is:

   *To create the conditions for a transition to a carbon neutral economy and society in the CCR, using low carbon energy as an enabler of economic regeneration, growing our regional income whilst maintaining guardianship of our environment through a laser-focus on clean growth*

9. The strategy and forthcoming implementation plan must build upon this quickly and together with key developments such as the Levelling-up Prospectus, present a place-based proposal for a clean growth economy.

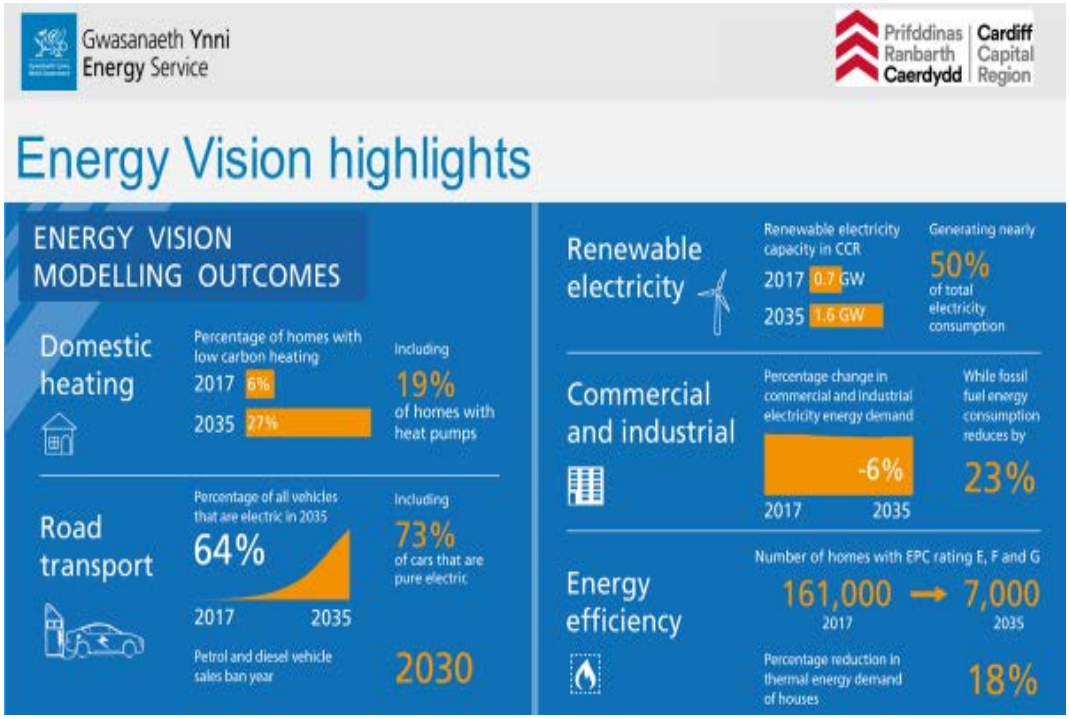
Data and Insights

10. Analysis shows that within all sectors in the region, energy use is 33 terawatt hours each year across heat, electricity, transport and fuel. This is significant and compared to Mid Wales which uses 5 terawatt hours – demonstrates the hive of industrial and consumer activity in CCR. Currently only about one sixth of this comes from renewable sources, predominantly electricity. The challenge of decarbonising the remaining five sixths is significant. The analysis pertaining to this is captured in the draft CCR Energy Strategy (Appendix 1).

11. To meet the targets Cardiff Capital Region needs to reduce emissions from its energy system by 55% by 2035, split by sector as follows:

- 51% reduction in domestic heat and power emissions;
- 54% reduction in commercial and industrial emissions;
- 60% reduction in road transport emissions.

12. The indicative requirements of the transformation, modelled to achieve the future vision are shown below:



Making it real – Implementation

13. The draft Strategy, whilst containing key data, evidence and early thinking and concepts, must now quickly translate to an implementation plan. This will comprise an actionable plan in its own right, key pillars of which are likely to mirror the following:

Levelling-up

14. Off the back of work undertaken to prepare the draft strategy, there are a set of draft proposals currently being developed to inform the Levelling-up Prospectus. Levelling-up is a significant area of policy focus at this time, key to making UK Government investment work for the whole of the UK and ensuring the benefits of both infrastructure and R&D investment extend beyond the 'golden triangle'. These emergent proposals are set out for information only at Appendix 3, with the proviso that they the full Levelling-up Prospectus containing a whole set of asks and offers, will be brought to Regional Cabinet for consideration early in the New Year. At this stage, it provides insight into objectives around domestic and commercial retrofit, hydrogen demonstration and harnessing tidal power. The Levelling-up Prospectus proposal is predicted to give a GVA of £1.2bn and 12,414 jobs, reflecting the specific job qualities of energy efficiency and renewable technologies.

Energy Mission

15. The characteristics and challenges of climate crisis, low growth-productivity and the COVID-19 economic recovery are interlinked. The scale of the problems and their sheer complexity means they cannot be solved through 'same old' approaches. There is a growing body of work in the UK principally driven by the UCL Institute of Innovation and Public Purpose, which demonstrates how challenge or mission-driven thinking can offer a more effective way of solving problems since it is data, R&D and knowledge -intensive. It also provides a focus on societal factors such as behavioural-change and gives a structure to public investments that respond to the problem posed, rather than the unsatisfactory answers that already exist. This means a stronger influence on the rate and direction of innovation.

16. Such an approach has already been applied to UN SDG goals and in CCR, the Local Wealth Building Challenge Fund is a strong example of such a challenge-driven approach. Given the commitment to replicate challenge funds in CCR, development of an Energy Mission spawning a myriad of energy challenges and demonstrators, will form a key pillar of the implementation process.

Next 5 Years and Beyond for CCR

17. The new JWA Strategic Business Plan is a transition document that seeks to transition the CCR City Deal into the CCR – offering opportunities for regional public investment at scale and outside of the parameters of one funding programme. One of the key areas of this plan 'Five for Five' is Build Back Better which places an emphasis on embedding energy objectives into economic objectives – in order that the societal and economic impacts are maximised. Not only will this help development of specific programmes and projects, it will assist

the mind-set change needed in showing wealth and wellbeing objectives, as closely aligned.

18. In addition, the JWA 5-year Business Plan is about moving into an environment broader and more diverse than City Deal and pioneering regional economic governance through the CCR Cabinet as the Corporate Joint Committee. This will open up opportunities for regional public investment on a wider scale. With the prospect of more place based funding for R&D, infrastructure, the new Shared Prosperity Fund, Green Industrial Revolution Fund (£12BN) and a revised Industrial Strategy, this will position CCR to bring together all of the public funding investment opportunities that can be used to lever in additional private money and partnerships to deliver on ambitions.

Transport work

19. Metro Plus and other local transport worked commissioned under the Local Transport Fund, all contain an element of carbon reduction. The LEV Taxi Strategy and plans to acquire a fleet of EVs in the region, as well as the £1.3M ULEV procurement, are all now underway. In addition the regional electric bus feasibility study is underway alongside feasibility for the introduction of 140 7kw for car-parking facilities across the region. Whilst all this is being reported into the Regional Transport Authority, it will be important to see this aligned and combined into core energy development work ongoing.

Engagement

20. The implementation process will also be informed and shaped by further engagement. Extensive engagement has already taken place via the regional energy officers group, via all Council Economic Development Leads, open-workshop events run by CCR and WGES and the Regional Business Council and the Regional Economic Growth Partnership. Wales and West Utilities has bene close to this work and this must be built upon to align with stated ambitions to decarbonise the gas grid in South Wales. All this continued work will be critical in ensuring ownership, buy-in and complementary connections across LA strategies and climate crisis pledges.

21. Engagement will be continue to driven by a continued focus on developing the evidence base and data – not just in relation to the scale of the challenge – but the scale of opportunity. High-level investments and the resulting GVA outputs and net job figures are shown below, which were produced as part of the Regional Energy Planning work by Welsh Government Energy Service specialist advisors. Investing to achieve the Vision produces more GVA and net jobs than a Business as Usual scenario.

22. The techno-economic analysis from the REP work shows that the investment needed between now and 2035, in order to meet the energy system transformation, totals £8.6bn, with investments required from a range of stakeholders. This investment would result in 47,330 (mostly net) jobs and a £7.2bn uplift in GVA.

Key issues

23. The WGES package of support will continue until March 2022, however, this is on the understanding that CCR defines responsibilities to continue what has been started. Prioritisation of this support can be discussed and prioritised but the proposed areas are to:

- maintain the current momentum;
- develop the implementation process as described (para 12-21 above);
- embed wherever possible into CCR City Deal activity;
- continued engagement to synch with work begun by Councils in the region (bus charging infrastructure, e-bikes, public charging points, feasibility studies, hydrogen storage, smart-grids, community heat networks and fleet review);
- undertake detailed analysis of grid constraints and opportunities working with Western Power;
- align the project proposals to work streams on energy efficiency, renewable electricity, fleet decarbonisation and hydrogen (working with Wales and West Utilities).

24. In addition CCR have implemented the Cardiff Capital Region Ultra Low Emission Vehicle Strategy and One Planet Framework and are currently procuring services for taxi charging infrastructure and concession contract. This will have a region-wide impact and therefore the opportunities for alignment and development complementary interventions are strong.

25. All of the above projects represent a step in the right direction, however a significant increase in scale and volume of interventions and investment is required to deliver these aspirations.

Resources

26. Scaling up of the current progress will require a commitment to shared purpose, cross-sector engagement and a focus on outcomes detailed in the CCR Regional Strategy. Currently, there is no dedicated resource within CCR for Energy work. It is therefore suggested that to match the investment being made by WGES, a sum of £50,000 from the top-sliced WIF Project Development Fund is made available to develop this work.

27. In addition, resource requirements to be set out in the Joint Committee Revenue budget in February 2021, will make the case for a further 3 permanent roles to the CCR establishment with the remainder of the team continuing to comprise secondments and fixed term posts. One of these posts is the proposed Transport and Energy Co-ordinator.

Governance

28. The proposed Transport and Energy Co-ordinator working to the Infrastructure head will be responsible for holding this programme together and convening the regional groups and stakeholders. All decisions and approvals required in line with the implementation process above will be brought before Regional Cabinet for consideration and approval. The Regional Transport Authority, Regional

Economic Growth Partnership and Business Council will remain as major stakeholder groups to this work, bringing together the necessary public, private, HEI and community sector expertise required.

**Reasons for Recommendations**

29. To seek Regional Cabinet approval of the draft strategy with the detailed work on implementation as set out in this to follow in March 2021.

**Financial Implications**

30. The report requests £50,000 is allocated from the Wider Investment Fund of CCR in order to match fund work with the WGES in order to develop a detailed implementation plan. Staff resources required to support this work will be managed from existing CCR budgets in order to inform a further report to Regional Cabinet. This report will aim to highlight a programme and ask for future investment and interventions in regional decarbonisation programmes.

31. Appendix 3 sets out indications of the costs and scale of potential revenue and capital investment which would need to come from Public, Private and Domestic sectors. These potential financial implications will need to be detailed further as part of any implementation plan and funding strategy, highlighting specifically any commitments being made using CCR Wider Investment Funding. Any future report will need to also consider the costs of establishing and operating any regional agency mechanism or relevant structures to support the delivery of any approved implementation plan.

**Legal Implications**

32. CCR will note that they are being asked to approve a draft energy strategy. All decisions and approvals required in line with the implementation of that strategy will be brought before Regional Cabinet for relevant consideration and approvals in due course. Therefore, there are no specific legal implications at this stage.

33. However, in considering its endorsement of this report the Regional Cabinet must have regard to, amongst other matters:

    (a) the obligations set out in the Welsh Language (Wales) Measure 2011 and the Welsh Language Standards;

    (b) the public sector duties under the Equality Act 2010 (including specific Welsh public sector duties). Pursuant to these legal duties, when making decisions, public bodies must have due regard to the need to (1) eliminate unlawful discrimination, (2) advance equality of opportunity and (3) foster good relations on the basis of protected characteristics, which are set out in section 4 of the Equality Act 2010;

**Well-Being of Future Generations (Wales) Act 2015**

34. In developing the Plan and in considering its endorsement regard should be had, amongst other matters, to:

a) the Welsh Language (Wales) Measure 2011 and the Welsh Language Standards;

b) public sector duties under the Equalities Act 2010 (including specific Welsh public sector duties). Pursuant to these legal duties Councils must in making decisions have due regard to the need to (1) eliminate unlawful discrimination, (2) advance equality of opportunity and (3) foster good relations on the basis of protected characteristics. Protected characteristics are: a. age; b. gender reassignment; c. sex; d. race – including ethnic or national origin, colour or nationality; e. disability; f. pregnancy and maternity; g. marriage and civil partnership; h. sexual orientation; I. religion or belief – including lack of belief, and;

c) the Well-being of Future Generations (Wales) Act 2015. The Well-being of Future Generations (Wales) Act 2015 ('the Act') is about improving the social, economic, environmental and cultural well-being of Wales. The Act places a 'well-being duty' on public bodies aimed at achieving 7 national well-being goals for Wales - a Wales that is prosperous, resilient, healthier, more equal, has cohesive communities, a vibrant culture and thriving Welsh language and is globally responsible. In discharging their respective duties under the Act, each public body listed in the Act (which includes the Councils comprising the CCRCD) must set and published wellbeing objectives. These objectives will show how each public body will work to achieve the vision for Wales set out in the national wellbeing goals. When exercising its functions, the Regional Cabinet should consider how the proposed decision will contribute towards meeting the wellbeing objectives set by each Council and in so doing achieve the national wellbeing goals. The wellbeing duty also requires the Councils to act in accordance with a 'sustainable development principle'. This principle requires the Councils to act in a way which seeks to ensure that the needs of the present are met without compromising the ability of future generations to meet their own needs.

   Put simply, this means that Regional Cabinet must take account of the impact of their decisions on people living their lives in Wales in the future. In doing so, Regional Cabinet must:

   - look to the long term;
   - focus on prevention by understanding the root causes of problems;
   - deliver an integrated approach to achieving the 7 national well-being goals;
   - work in collaboration with others to find shared sustainable solutions;
   - involve people from all sections of the community in the decisions which affect them.

35. Regional Cabinet must be satisfied that the proposed decision accords with the principles above. To assist Regional Cabinet to consider the duties under the Act in respect of the decision sought, an assessment has been undertaken, which is attached at Appendix 2.

**Equality Act 2010**

36. In considering this matter, regard should be had, amongst other matters, to the Councils' duties under the Equality Act 2010. Pursuant to these legal duties the Regional Cabinet must in making decisions have due regard to the need to (1) eliminate unlawful discrimination (2) advance equality of opportunity and (3) foster good relations on the basis of protected characteristics. Protected characteristics are:

- age;
- gender reassignment;
- sex;
- race – including ethnic or national origin, colour or nationality;
- disability;
- pregnancy and maternity;
- marriage and civil partnership;
- sexual orientation;
- religion or belief – including lack of belief.

**RECOMMENDATIONS**

37. It is recommended that the Cardiff Capital Region Regional Cabinet:

a) approves the draft CCR Energy Strategy as set out in in Appendix 1;

b) notes the next steps around the Implementation Process as set out in the report above and will receive the full Implementation Plan in March 2021;

c) approves a £50,000 match revenue budget for the development of the Implementation Plan process.

**Kellie Beirne**
**Director, Cardiff Capital Region City Deal**
**7 December 2020**

**Appendices**
Appendix 1 Draft Regional Energy Strategy
Appendix 2 Regional Energy Plan Summary (one page slide)
Appendix 3 Levelling Up for Energy – Emergent Ideas
Appendix 4 Well–being of Future Generations Assessment

Item 8 Appendix 1

Prifddinas Ranbarth Caerdydd | Cardiff Capital Region

# Cardiff Capital Region Energy Strategy

Funded & supported by:

Llywodraeth Cymru Welsh Government

Gwasanaeth Ynni Energy Service

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# Executive Summary

# Executive summary

This regional energy strategy for the Cardiff Capital Region was commissioned by the Welsh Government and supported by the Welsh Government Energy Service. It has been developed by Cardiff Capital Region City Deal with additional support from regional stakeholders. In this report the use of "We" refers to this collective group of stakeholders.

The overall objective of the strategy is to develop a strategic pathway identifying key interventions to deliver on the region's ambitions for decarbonising its energy system. An Energy Vision scenario has been modelled to set out a potential decarbonisation route that will put the region on track to achieve a net zero energy system by 2050.

**Our vision** for Cardiff Capital Region (CCR) is:

*To create the conditions for a transition to a carbon neutral economy and society in the CCR, using low carbon energy as an enabler of economic regeneration, growing our regional income whilst maintaining guardianship of our environment through a laser-focus on clean growth.*

**Our priorities** for achieving this vision are:

1. Energy efficiency and heat
2. Electricity and flexibility
3. Decarbonise transport
4. Grow business and jobs
5. Coordination, planning, regional support and ownership of the plan

**The baseline energy assessment** sets out the current energy use and generation in the region:

- Cardiff Capital Region currently consumes around 36% of all energy consumed in Wales, less than its 49% share of the population;
- Between 2005 and 2013, total energy consumption fell by 22% and since 2013, energy consumption in the region has remained relatively stable. The associated greenhouse gas emissions have fallen by 35% from 2005 to 2017;
- The region's total energy demand is split roughly into thirds across transport, domestic heat and power, and commercial/industrial heat, power and processes.
- Commercial and industrial electricity consumption constitutes 55% of all electricity consumption in the region, approximately 10% less than the Great Britain average;

- Renewable assets located in the Cardiff Capital Region currently generate the equivalent of 25% of the region's electricity consumption;
- Cardiff Capital Region currently hosts 22% of Wales' renewable energy capacity, with 311MW of solar PV and 299MW of onshore wind;
- Of the 709MW of renewable energy installed capacity in the region, 221MW (31%) is locally owned;
- 50% of renewable generation in CCR is from onshore wind projects and 18% is from solar PV;
- CCR has the lowest number of renewable heat installations with just 0.2% of homes having a heat pump or biomass boiler;
- 90% of homes are connected to the gas network, the highest of any Welsh region and above the GB average.
- Approximately 27,000 homes (~4%) are currently fuelled by oil, LPG, coal or other solid fuels;
- The average EPC rating is D and the region has the highest average energy efficiency ratings in Wales, with 75% of homes rated as EPC band D or above.
- Transport in the region is dominated by private car use with ~0.3% of cars pure electric, compared with an average of 0.6% of vehicles across Great Britain.
- CCR currently hosts 173 public charging devices, including 31 rapid public chargers.

**Note on scope:** the baseline assessment and strategy is focussed on the energy system only, covering power, heat and transport. Very large industry is excluded due to a lack of data availability, and it does not include greenhouse gas emissions or sequestration from non-energy related activity such as land use. The large industrial users should be included in the Zero2050: South Wales project led by National Grid.

**Achieving our energy vision for Cardiff Capital Region:** to meet Welsh Government targets, and to be on track for net zero by 2050, Cardiff Capital Region needs to reduce emissions from its energy system by 55% by 2035, split by sector as follows:

- 51% reduction in domestic heat and power emissions;
- 54% reduction in commercial and industrial emissions;
- 60% reduction in road transport emissions.

*Figure 1: Summary of the Energy Vision's emission reductions by sector. Source: WGES analysis*

**The energy vision scenario modelling** assumes a significant shift away from business as usual across these three sectors by 2035. The assumptions of the modelled future vision include:

**Domestic:**

- 154,000 homes improved from EPC band G, F and E to D, C and B;
- Over 140,000 heat pumps installed;
- 42,000 suitable houses accurately fitted with internal or external wall insulation;
- Over 185,000 other insulation measures in homes;
- 112,000 homes currently heated by fossil fuels to move to low carbon heating;
- Replacing heating systems in oil, LPG and solid fuel heated homes prioritised;
- No new gas connections for homes from 2025.

**Commercial and industrial:**

- A significant energy efficiency programme to reduce energy demand by 13%;
- A switch to alternative fuels, including hydrogen and electrification of heating;
- Decarbonising the electricity network through renewables and behind the meter renewable generation.

**Road transport:**

- 64% of vehicles driven in Cardiff Capital Region in 2035 are electric, equivalent to 15,000 more electric vehicles per year by the mid-2020s, peaking at 70,000 per year in the 2030s. This is to be facilitated by the deployment of 10,000 public and on-street EV chargers;
- 3,300 gas and hydrogen HGVs and 1,000 hydrogen vehicles;
- A 20% reduction in private vehicle mileage by 2035;
- A slowing of the growth in total number of vehicles on the road, facilitated by increased use of public transport and active travel.

**Renewable electricity generation:**

- 532MW of onshore wind installed (233MW of new capacity);

- 830 MW of solar PV installed (520 MW of new capacity of which 190 MW is roof-mounted and 325 MW from solar farms.);
- Sufficient flexibility, including storage, and network infrastructure upgrades to enable low carbon generation and demand technologies to connect;
- The region to generate the equivalent of ~50% of its total energy consumption in 2035 from regional renewable sources.

These assumptions summarise the level of action required between 2020 and 2035 to be on track to achieve net zero by 2050. The energy modelling focuses on known decarbonisation technologies and actions that could be implemented by 2035 in order to demonstrate a potential decarbonisation route.

The scenario is not intended to be prescriptive. There are a number of potential pathways to achieve energy system transformation, including new opportunities from technology innovation that will certainly emerge as the transformation takes place. The rapid evolution of technologies and pathways means that there are some major uncertainties and varying opinions about the precise route forward. One such alternative which has been developed is the Energy Network Association's "Pathways to Net Zero". The Pathways to Net Zero report focuses on a hybrid heat pump first approach. Wales and West Utilities has completed extensive research into its 2021-26 business plan which builds on this approach, the details of which are described in later chapters. What is clear is that different pathways all must achieve significant decarbonisation; should less action be achieved in any of the areas summarised above, other sectors will need to compensate with higher action to achieve the same results. The level of transformation described by the energy modelling actions is significant. More importantly, the modelling demonstrates the potential to be on a net zero pathway by using known and proven technologies and underscores the critical role of short- and medium-term action. Innovation will be essential to compliment this action and to develop technologies, skills, and practices that continue to achieve decarbonisation beyond 2035

**The economic impacts** of achieving the energy system vision have been assessed in terms of job creation, gross value added (GVA) and the investment (or spending) required for the energy transition, in comparison to business as usual. The economic analysis demonstrates that almost £3.4 billion of additional investment/spending is needed to achieve the energy efficiency, electricity generation, and heat aspirations described in the energy vision between now and 2035. This represents approximately £227 million per year and will need to be financed from a range of sources including the private sector, households, and national and local government. This investment is 65% more than is expected to be spent in the corresponding sectors under a business as usual scenario.

The energy system vision (ESV) scenario is estimated to result in an additional 16,700 net jobs, with an associated increase in GVA of nearly £1.7 billion, associated with the delivery of accelerated deployment of renewable electricity generation technologies and enhanced levels of energy efficiency. In addition, it is estimated that there will be over 3,000 more gross jobs associated with the provision of low-carbon heating

technologies in the ESV scenario than the BAU scenario, associated with £361 million of GVA.

When considering the job figures presented its important to reflect on where these jobs will be located. The methodology focuses on direct jobs, a greater proportion of which are considered likely to be located in the region than indirect or induced jobs[1]. However, we are unable to comment on the specific location of the jobs estimated; a portion of the jobs are likely to be located in the Cardiff Capital Region and a portion may be held by persons residing outside of the region. The experience of Wales to date has been that many electricity generation jobs are held by those living outside of the region. This contrasts with energy efficiency jobs which are often held by local residents who provide services to the surrounding area. In order to help Cardiff Capital Region benefit from jobs associated with future local electricity generation it will be important to first understand the reasons for any lack in local jobs and then to develop a policy response.

**Note:** please refer to the economic modelling chapter and technical annex for details on data sources, limitations and methodology.

*Table 1. Estimated difference in jobs, GVA and investment between the energy vision scenario and business as usual, from 2020 to 2035*

| Energy vision scenario for: | Jobs** | **GVA** | **Investment required** |
|---|---|---|---|
| Electricity generation* | 7,400(net) **(+23%)** | £853m **(+21%)** | £748m **(+204%)** |
| Domestic heat | 3,000 (gross) **(+311%)** | £361m **(+320%)** | £701m **(+277%)** |
| Domestic energy efficiency*** | 9,300 (net) (**+43%**) | £555m (**+43%**) | £1.9b **(+43%)** |
| **Total additional investment required to achieve the energy vision scenario** | | | **£3,405,554,659** |

** Electricity generation jobs figures were calculated using direct job intensity indicators. Direct jobs are typically more likely to be held by residents local to an energy site. However, jobs related to manufacturing may be located outside of the region. Likewise, some jobs may be held by persons residing outside of the region who travel into the region to undertake these jobs. As such, it is not possible to comment on the geographic location of these jobs. The perceived experience of Wales to date is that many of the long term operational and maintenance jobs associated with these technologies are held by persons outside of the region who travel into Wales to perform their duties. In order to help the region benefit from jobs associated with future local electricity generation it will be important to first understand the reasons for any lack in local jobs and then to develop a policy response.*
***Impact on jobs is presented as either net or gross jobs depending on the available data.*
****Data on the percentage change in jobs and GVA for domestic energy efficiency is unavailable.*
****Data on the percentage change across all indicators for commercial and industrial energy efficiency is unavailable.*

[1] Direct jobs are typically associated with the manufacture, construction, and installation of equipment. Indirect jobs arise in the supply chain of the energy technology. Induced jobs related to jobs generated as a result of spending incomes earned from direct employment.

**Green recovery from the Covid-19 pandemic:** this strategy has been finalised in the midst of the COVID-19 pandemic. At the time of writing, the true economic and societal costs of the pandemic for Cardiff Capital Region are not fully clear.

As we move from the immediate emergency response to considering our options for economic recovery, this energy strategy has the potential to play a significant role in helping Cardiff Capital Region to recover and rebuild sustainably. It sets out a pathway for accelerating the shift to a decarbonised energy system in the region and demonstrates the potential for achieving far greater local economic benefits than could be achieved by returning to business as usual.

**Next steps:** Achieving a net zero energy system in Cardiff Capital Region presents many challenges including, but not limited to, tackling deep retrofit in a large number of homes, reducing private car miles and enabling the low carbon vehicle roll-out including electric and hydrogen vehicles. There is an urgent need for action, using the growth deal and more broadly engaging stakeholders from across the region to deliver transformational projects. However, decarbonisation also faces many potential benefits for the region, from enacting significant energy efficiency programmes to creating investment opportunities for local people and organisations. The transition to a decarbonised economy will also provide exciting opportunities in engineering, the digital and retrofit markets as well as local skills and employment.

There are three key next steps to help this strategy come to life and to create action: developing the governance structure, socialising the strategy throughout the region and developing an action plan.

**Acknowledgements:** We would like to thank all of the stakeholders who made valuable contributions to this work through their participation in workshops, completing surveys, providing data, and additional communication on the phone and by e-mail.

# Acronyms and abbreviations

| ASHP | Air Source Heat Pump |
|---|---|
| **BEIS** | The Department for Business, Energy, and Industrial Strategy |
| **CCC** | Committee on Climate Change |
| **CHP** | Combined Heat and Power |
| **$CO_2$** | Carbon dioxide |
| **$CO_2e$** | Carbon dioxide equivalent |
| **CITB** | Construction Industry Training Board |
| **DNO** | District Network Operator |
| **DEFRA** | Department for Environment, Food & Rural Affairs |
| **DNS** | Development of National Significance |
| **ECO3** | The Energy Company Obligation phase 3 |
| **EPC** | Energy Performance Certificate |
| **EV** | Electric Vehicle |
| **GSHP** | Ground Source Heat Pump |
| **GW** | Gigawatt |
| **GWh** | Gigawatt hour |
| **HGV** | Heavy Goods Vehicle |
| **HHP** | Hybrid Heat Pump |
| **kt** | kiloton |
| **kWh** | Kilowatt hour |
| **LPG** | Liquid petroleum gas |
| **MCS** | Micro-generation Certification Scheme |
| **MW** | Megawatt |
| **NAEI** | National Atmospheric Emissions Inventory |
| **NRW** | Natural Resource Wales |
| **PV** | Photovoltaic |
| **RHI** | Renewable Heat Incentive |
| **SME** | Small and medium-sized enterprises |
| **TWh** | Terawatt hour |
| **ULEV** | Ultra Low Emissions Vehicle |
| **WGES** | Welsh Government Energy Service |
| **WHQS** | Welsh Housing Quality Standard |
| **WPD** | Western Power Distribution |
| **ZILF** | Zero Interest Loan Finance |

# Introduction

# Introduction and Background

## Regional energy strategy overview

In 2018, the Welsh Government commissioned the Welsh Government Energy Service to provide support to the Cardiff Capital Region City Deal and a number of regional partners and stakeholders such as the Economic Growth Partnership, the Business Council, Skills Partnership and Transport Authority to develop an energy strategy for the Cardiff Capital Region.[2] Similar regional energy strategies have also been developed with the remaining three economic regions of Wales.

The Welsh Government Energy Service (WGES) supports the public sector and communities to generate benefit for Wales from the transition to a low carbon economy. Support is provided to develop and implement large scale energy efficiency and renewable energy projects as well as wider advice to achieve targets for decarbonisation.

The Welsh Government declared a climate emergency in 2019 and accepted the recommendation from the Committee on Climate Change (CCC) to target a 95% reduction in greenhouse gas emissions by 2050 relative to 1990. After the Welsh Government accepted the CCC's recommended target, it presented in parallel an ambitious plan to go further and reach "net zero" by 2050. Wales had already announced in 2017 their ambitions for the Welsh public sector to be carbon neutral by 2030. The desire of the Welsh Government to aim for a more ambitious pathway than the one advised by the CCC is partly due to the unique legislative framework for climate policy that applies to Wales. The Well-being of Futures Generations (Wales) Act 2015 provides a ground-breaking legal framework for improving the social, economic, environmental and cultural well-being of Wales embracing the idea of a prosperous nation rather than an economic rich one. It mandates that all policy must contribute to sustainability and not undermine long-term goals.

Achieving this climate change target will require substantial transformation of our energy system and will result in radical changes in the technologies we use to heat our homes, to travel and to generate electricity. Transitioning to a modern, decarbonised energy system fit for the twenty-first century poses plenty of challenges, but it also has the potential to bring great benefit, both for the environment and for the economic and social wellbeing of our communities.

This work seeks to provide a strategic direction for the future of a decarbonised energy system including heat, power and transport within Cardiff Capital Region. It will define steps to begin to overcome the challenges we face. Furthermore, while the energy transition has the potential to bring benefits to our communities, maximising this benefit requires reflection on past experiences and would also benefit from an increased strategic focus.

The work has coincided with tremendous efforts that are underway to develop a City Deal for the region. Desired outcomes for the work include the identification of strategic projects that can be considered by the City Deal. More broadly, the plan provides a

[2] Full list will be in the Appendix.

considered approach and an evidence base for the region to move forward collaboratively towards a future decarbonised energy system through more tailored, detailed Local Area Energy Planning. This strategy is presented in five chapters.

**Chapter 1: Vision -** The energy system vision that is presented in this strategy was developed with stakeholder contributions through the project's first workshop, survey feedback, and targeted stakeholder conversations. The vision describes the region's aspiration for what a future energy system will achieve and how it will function. Five core values have been defined that should be at the heart of future energy projects and decisions.

**Chapter 2: Priorities -** A literature review was undertaken combining key policy and evidence documents with expert interviews and workshop consultation to build a more comprehensive picture of the challenges and opportunities in the Cardiff Capital Region. This includes available levers, barriers to development and key technologies. This research, and in particular the thoughts and ideas shared by stakeholders, informed the development of strategic priority areas. These priorities are central to achieving the region's decarbonisation goals and are important to its stakeholders.

**Chapter 3: Energy system, energy use & emissions -** A baseline study provides a portrait of the Cardiff Capital Region energy economy and landscape today. This chapter also summarises energy modelling that evaluates potential options for a pathway to a net zero energy system in the region.

**Chapter 4: The future of energy and the economy -** The fourth chapter considers the energy system pathways modelled and the economic impact of those pathways in terms of jobs, gross valued added (GVA), and the investment required to make those pathways a reality.

**Chapter 5: Next Steps** – Outlining the three key next steps that we will take to translate the Cardiff Capital Region energy system vision into reality.

**Impact of the COVID-19 pandemic**

This strategy has been finalised in the midst of the COVID-19 pandemic, which is having a profound effect on the lives of millions of people around the world, bringing unprecedented challenges for our economy, our society and our communities. At the time of writing, the true economic and societal costs of the pandemic for Wales and the Cardiff Capital Region are not fully clear, but the severity of the impacts on the global economy are forecast by many commentators to exceed that of the 2008 financial crisis.

The pandemic is also taking place against the backdrop of the ongoing climate emergency. And whilst the economic damage caused will undoubtedly result in a short-term reduction in greenhouse gas emissions, it is possible that emissions could rebound if climate positive solutions are not included as central elements in our economic stimulus packages.

As we move from the immediate emergency response to save lives, support the health sector, retain jobs and support our society and economy, we must recognise that our approach to the economic recovery that will follow provides us with a unique

opportunity to sustainably rebuild our economy and make greener investments and climate positive decisions that set us on a pathway that aligns with the Welsh, UK and international climate targets.

CCR have recently reconsidered and endorsed revised programme priorities in terms of reaction to COVID-19 and future economic adaptation. In this context, it is hoped that with the commitment to decarbonisation that CCR is making, that there will be acknowledgement that our economic recovery and growth plans need to be developed as part of driving down greenhouse gas emissions. We need to recognise the significant economic potential that a green recovery can contribute to rebuilding a sustainable economy in CCR.

The Committee for Climate Change (CCC)[3] has identified 6 key principles for a resilient recovery from the pandemic, and we must ensure that our strategy is underpinned by these cross-cutting principles to help put CCR in a position to capitalise on opportunities that may arise from the recovery:

1. Use climate investments to support economic recovery and jobs
2. Lead a shift towards positive, long-term behaviors
3. Tackle the wider 'resilience deficit' on climate change
4. Embed fairness as a core principle
5. Ensure the recovery does not lock-in greenhouse gas emissions or increased risk
6. Strengthen incentives to reduce emissions when considering tax changes.

We must also learn from the pandemic, taking the lessons from our response and apply them to the climate emergency. This may include for example:

- the need for openness and transparency;
- the importance of good data;
- the speed with which people can change behaviours and industry re-purpose;
- the need to support individuals and businesses through economic transition; and
- the importance of global collaboration.

Other lessons will undoubtedly emerge. But perhaps the biggest lesson from the COVID-19 pandemic is about the need for anticipation and preparedness in dealing with major societal issues, and the population's capacity and willingness to accept significant lifestyle changes if it is deemed necessary for the good of society. If it teaches us anything it is that we cannot afford to ignore science or expert judgement about the risks faced by our societies, or wait for problems to arrive before taking action. Learning lessons from the response to a global health emergency, and applying this to that of the global climate emergency could pave the way for the accelerated and sustained change that is so critical in solving the problem of climate change.

[3] https://www.theccc.org.uk/2020/05/06/take-urgent-action-on-six-key-principles-for-a-resilient-recovery/

As the COVID-19 crisis is still ongoing at the time of writing, it is still somewhat unclear when and how Wales will emerge fully from the current restrictions, and the process and timeframe through which the social distancing will be eased; or, indeed, whether we will encounter a subsequent lockdown in the future, whether at national or local levels. We must therefore acknowledge the significant uncertainties that exist around how the CCR economy will emerge from the crisis as well as the uncertainties associated with the shape of the future economic growth and decarbonisation trajectories modelled in this strategy. As such, the economic and climate modelling that underpins this strategy will need to be kept under review and updated when, and how, our emergence from the COVID-19 crisis becomes clearer. Certain elements of the strategy, such as our understanding of what it means to make 'futureproof decisions', may also need to be revisited.

In addition, CCR may be able to capitalise on the opportunity to sustain behaviours observed throughout the pandemic that have had a positive effect on reducing emissions, such as the increase in active travel, reduction in travel by private car, increased working from home practices and willingness to invest in domestic property improvements. Directing resources towards infrastructure that will support the embedding of such behaviours into business as usual for communities and businesses has the potential to drive lasting emissions reduction as we recover from the COVID-19 crisis.

However, the fundamental principles of this strategy remain firmly relevant. With its focus on cleaner, fairer economic growth, this energy strategy has the potential to play a significant role in helping CCR to recover and rebuild sustainably. It sets out a pathway for accelerating the shift to a decarbonised energy system in the region and demonstrates the potential for achieving far greater local economic benefits than could be achieved by returning to business as usual.

# Our Energy Vision

# Our Energy Vision

**Our 2035 Energy Vision statement**

*To create the conditions for a transition to a carbon neutral economy and society in the CCR, using low carbon energy as an enabler of economic regeneration, growing our regional income whilst maintaining guardianship of our environment through a laser-focus on clean growth.*

## The principles behind the vision

### Our vision is guided by three core principles:

### Core Principles

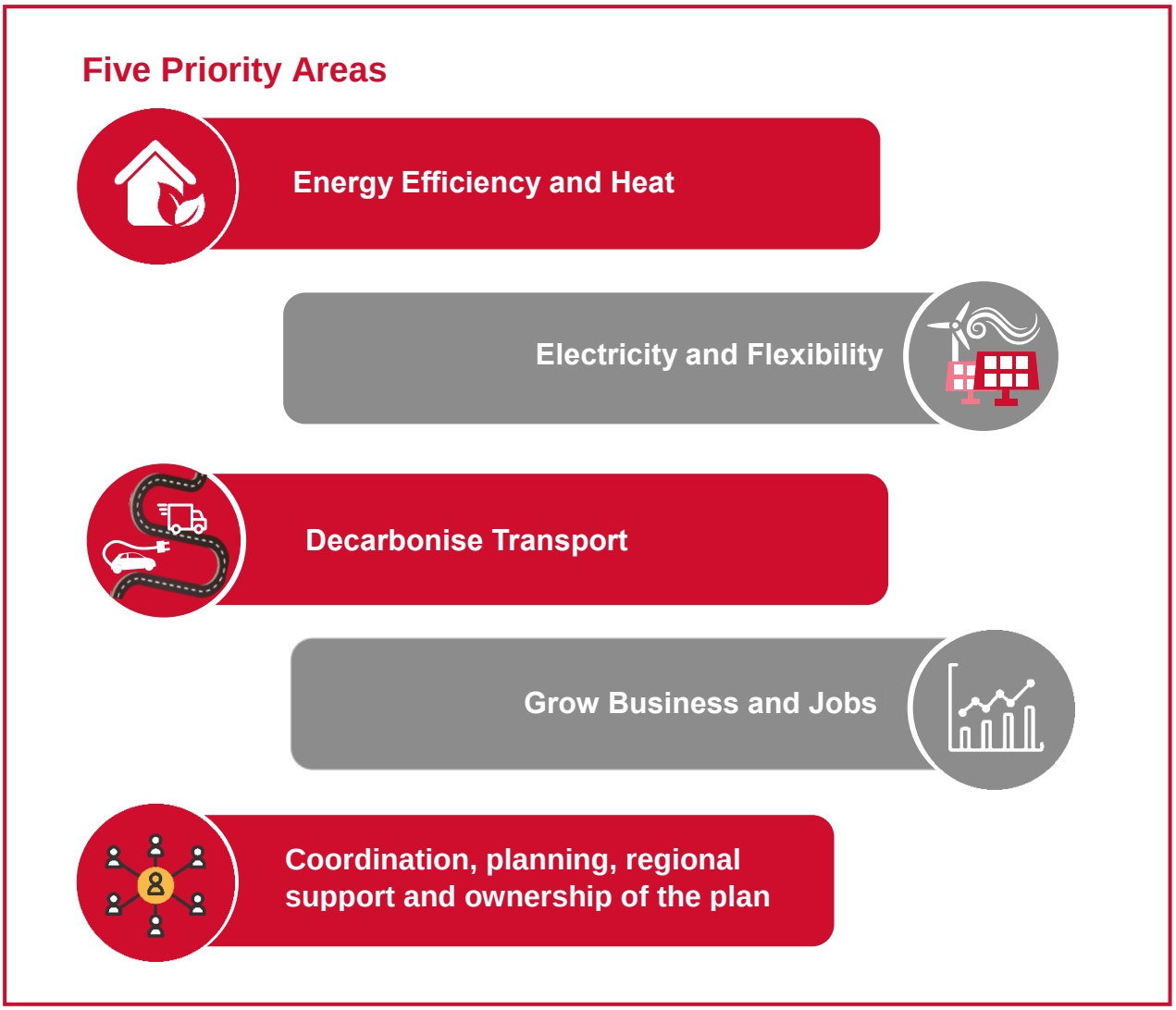
- **Act as an enabler to a sustainable regional economy:** deliver inclusive employment, profits and skills, lower costs and open up markets, and stimulate public and private investment in capital projects that deliver low carbon improvements across the region.

- **Contribute wider benefits to the region:** including alleviating fuel poverty, sparking innovation and developing local training and skills for people and businesses.

- **Decarbonise the energy system to meet national targets as a minimum**: make significant carbon reductions across all sectors, to have energy efficiency as a core focus, and to have a multi-vector system, that includes a range of low carbon technologies, that meets needs affordably and balances the best use of existing assets and resources.

## Our priorities

To achieve our vision, we have defined the following five priority areas.



## Energy Efficiency and Heat

- Deliver fabric improvements (e.g. window glazing, internal wall and roof insulation) to the region's existing and new builds including delivering a whole house retrofit approach to the existing housing stock, to improve energy efficiency and deliver cost savings.
- Build new homes to align with evolving 'Part L building regulations' including developments currently with planning permission.
- Help homeowners understand the benefits of energy efficient housing including cost savings, improved comfort and health.
- Utilise alternative fuels for heat including hydrogen, bio-methane and solar thermal.
- Develop flexible and hybrid heating solutions e.g. hybrid heat pumps, building on the learnings from the Freedom project based in Bridgend.

## Electricity and Flexibility

- Ensure there is a mix of generating technologies across the region to provide resilience and flexibility.
- Encourage local development of renewable energy projects by public bodies on publicly owned land to increase revenue generating potential for public bodies and to increase public ownership.
- Map renewable energy potential against upcoming developments, particularly developments of regional level scale.
- Pilot energy/battery storage projects to maximise renewable energy potential and build on previous trials in Cardiff and Bridgend.
- Encourage uptake of smart meters, ensuring the public sector has smart meters installed across its estate, to open up the potential of load shifting and access to balancing/flexibility markets.
- Adopt generation technologies, demand patterns and battery storage technologies which reduce loads on the distribution network and work with the DNO to maximise the capacity of the existing network.
- Encourage low carbon technologies e.g. LED lighting, and invest in behaviour change programmes to reduce consumption
- Encourage smart digital integration and support wider local innovative grid flexibility pilots for roll out across the region.

## Decarbonise Transport

- Prioritise investment in public transportation.
- Make public transport services more affordable and convenient to encourage a modal shift from private transport.
- Enable changes in people's travel methods capitalising on changing behavioural patterns as a result of the Covid-19 crisis.
- Promote electrification of public transport and build on trials including electric buses in Caerphilly and Cardiff, and the decarbonisation of the South Wales Metro.
- Encourage use of active travel modes e.g. walking and cycling.
- Develop an electric vehicle charging infrastructure, in collaboration with Transport for Wales and OLEV, taking a coordinated approach across the region e.g. the Gwent study, and encourage public sector fleet transitions to EVs.
- Lobby for additional Metro nodes to increase rural accessibility and connectivity.
- Ensure metro stations are integrated with other economic priorities and housing.
- Work with Welsh Government to identify a solution to the Newport/Cardiff trunk road bottleneck and consider addition of a dedicated bus lane.
- Consider hydrogen as an alternative fuel source where electrification is less suitable e.g. HGVs.
- Encourage the shift towards home-working created by Covid-19 especially in rural areas.

## Grow Business and Jobs

- Create a commercial property strategy which incorporates access to renewable energy sources and access to public transport links
- Promote continued research into battery and hydrogen technologies, and continue to develop academic excellence in this field
- Develop supply chain opportunities for energy efficiency retrofit and renewable energy manufacturing
- Evaluate the region's capacity and capabilities in retrofit and renewable energy deployment and develop training opportunities/incentives as necessary.

- Build on the region's strong reputation for research and innovation through engagement with Higher Education Institutes, including developing digital and "smart" solutions to energy transitions, as well as future proofing ongoing developments.
- Upskill and retrain the workforce to ensure the industrial sector needs are balances with local needs, and that it delivers support to those people and places that are most likely to lose out from economic and technical change.

## Coordination, planning, regional support and ownership of the plan

- Deliver against a shared vision and approach.
- Demonstrate aligned ambition and leadership across the region with plans agreed and championed by Chief Executives and leaders.
- Maximise economies of scale potential through the facilitating role of the region and through collaboration with other regions.
- Governance to use the framework for the City Deal Investment operations and will consult with the Regional Economic Partnership, Regional Business Council and Regional Skills Partnership. This will provide an enduring organizational structure which will secure the long-term delivery objectives of the plan.

# Our energy system, energy use & emissions

# Our energy system, energy use and emissions

## Modelling an Energy Vision scenario

### Aims of undertaking scenario modelling

Scenario modelling has been undertaken to create a 2035 Cardiff Capital Region Energy Vision scenario that could deliver against the level of ambition set out in the Energy Vision statement. The modelling outcomes are unique to the region, taking advantage of local resources and opportunities, and input from local stakeholders.

The overall aim of the scenario is to describe a potential decarbonisation pathway that will put the region on track to achieve a net zero energy system by 2050. The scenario is not intended to be prescriptive; there are a number of potential pathways to achieve energy system transformation, including new opportunities from technological innovation and changes to energy demand that will certainly emerge as the transformation takes place. The rapid evolution of technologies and pathways means there are uncertainties and varying opinions about the precise route forward. One such alternative is the Energy Network Association's "Pathways to Net Zero" which proposes pathways for decarbonising heat. Wales and West Utilities has completed extensive research into its 2021-26 business plan which builds on this alternative, the details of which are described in more detail in the chapter below. What is clear from research is that different pathways all must achieve significant decarbonisation.

The energy system vision pathway modelled demonstrates the potential to be on a net zero pathway by using known and proven technologies and underscores the critical role of short- and medium-term action. Innovation will be essential to compliment this action and to develop technologies, skills, and practices that continue to achieve decarbonisation beyond 2035.

The modelling presents a potential development scenario that is intended to:

- Highlight the scale of the challenge
- Identify existing opportunities and barriers
- Point to new opportunities and key decisions
- Provoke discussion and inspire action planning

The scenario focuses on known decarbonisation solutions that could be implemented by 2035, which would put CCR on a pathway consistent with achieving net zero emissions by 2050. However, this does not mean that activity around innovative new technologies should not also be pursued. The modelling takes a whole system approach to energy, considering the interactions between heat, transport and electricity demand. For example, the impact of decarbonising heat through electrification is reflected through an increase in electricity demand.

### Why does the scenario look to achieve zero emissions from energy in 2050 and not 95% decarbonisation?

The Committee on Climate Change recommended in its 2019 report, 'Net Zero: The UK's contribution to stopping global warming', that Wales adopt an overall

decarbonisation target reduction of 95%, against a 1990 baseline, by 2050[4]. This target, which is lower than the equivalent UK 2050 net zero decarbonisation target, recognises that Wales faces several additional challenges including higher greenhouse gas emissions from its agriculture and parts of its heavy industry. However, Welsh Government has expressed an ambition to exceed this target and aim for 100% decarbonisation. Non-energy agriculture emissions are out of scope of this energy system study. Both a Welsh 95% and a 100% emissions reduction target require the energy system to maximise its decarbonisation, reserving any residual emissions for more difficult to decarbonise sectors such as agriculture and heavy industry. It is worth noting that during the course of our engagement, stakeholders in the region and across Wales have expressed very strong support for ambitious energy system decarbonisation.

## Methodology in brief

The modelling sets an indicative decarbonisation trajectory to 2035. It has been created using a methodology that reflects the high-level methodology used by the Committee on Climate Change in its 2019 Progress Report to Parliament[5]. This absolute contraction method assumes a constant rate of decarbonisation is achieved between now and achieving net zero by 2050. This is used as a preliminary benchmark, pending 2020's more detailed assessment by the Committee on Climate Change, which will set out more detailed carbon budgets consistent with the new net zero target.

The CCR energy baseline has been established by gathering and analysing national and local datasets of energy consumption, energy efficiency and generation. The Energy Vision scenario has been created through a bottom-up analysis of the level of uptake of measures and technologies that is possible by 2035. Assumptions have been drawn from a range of sources, including:

- Committee on Climate Change reports[6,7]
- National Grid's Future Energy Scenarios[8]
- The project team's past work on future energy scenarios for Wales & West Utilities and for Western Power Distribution[9]
- Engagement and workshops with local, regional and national stakeholders.

[4] Committee on Climate Change (2019) Net Zero, The UK's contribution to stopping global warming. May 2019 https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf
[5] Committee on Climate Change (2019) 2019 Progress Report to Parliament https://www.theccc.org.uk/publication/reducing-uk-emissions-2019-progress-report-to-parliament/
[6] Ibid
[7] Committee on Climate Change (2018) Hydrogen in a low-carbon economy https://www.theccc.org.uk/publication/hydrogen-in-a-low-carbon-economy/
[8] National Grid (2019) *Future Energy Scenarios*, http://fes.nationalgrid.com/media/1409/fes-2019.pdf
[9] Regen (2019) Wales and West Utilities – Regional Growth Scenarios for Gas https://www.regen.co.uk/project/wales-and-west-utilities-regional-growth-scenarios-for-gas/
Regen (2019) Future Energy Scenarios. https://www.regen.co.uk/area/local-future-energy-scenarios/

## The methodology results in a bottom-up, stakeholder-informed Energy Vision for CCR

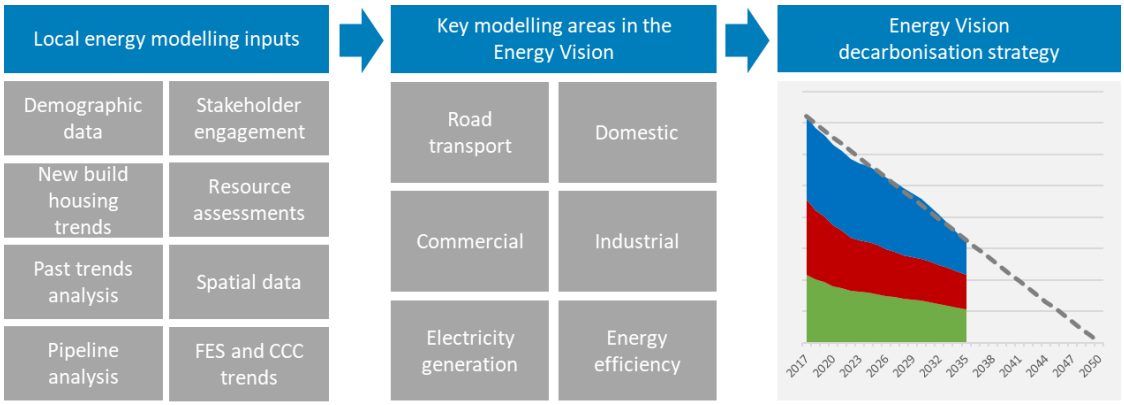



*Figure 2: Outline modelling methodology*

## Worked example: The modelling approach for domestic heat

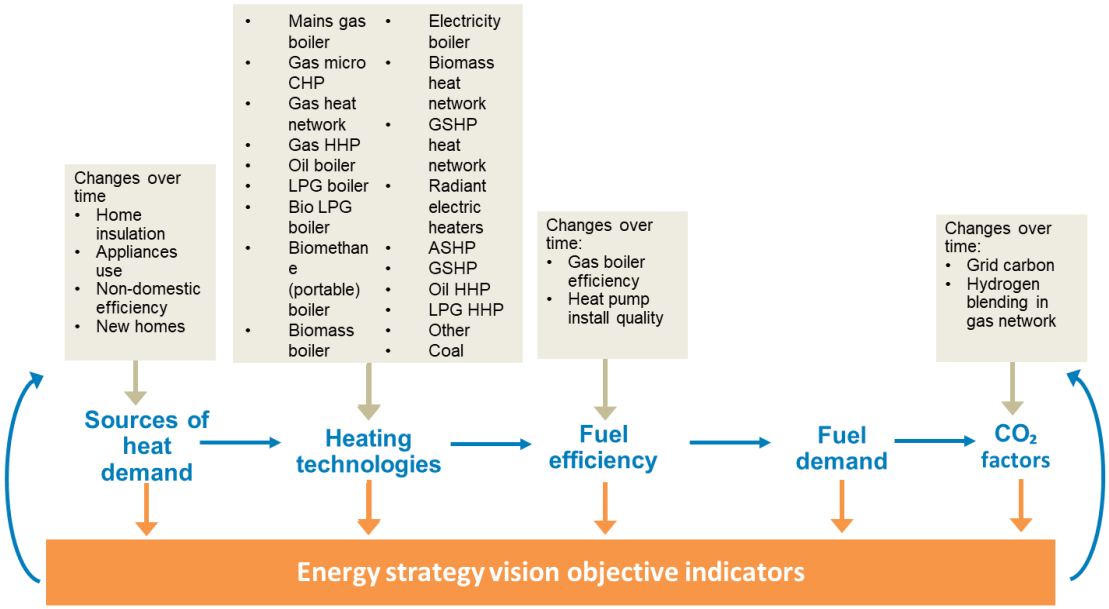



*Figure 3: Diagram of the modelling approach for domestic heat*

## A note on scope

The strategy is focused on emissions associated with the energy system in CCR. As a result, the scope of the modelling is limited to the energy system, which includes transport, power and heat use. Emissions or sequestration from non-energy activity such as agriculture and land use are not considered in the model. Data limitations and issues around whether emissions are considered locally or nationally mean that some other emissions that are within the energy system are also not considered by the model. These include aviation, shipping and some very large industrial energy users such as the SWIC, as expanded on in the introduction.

# Baseline and modelling results: by sector

## Our Energy consumption

### Baseline: energy consumption by sector

CCR currently uses around 32 TWh of energy[10]. The region accounts for around 36% of all energy consumed in Wales[10], which is less, on a pro-rata basis, than its 49% share of the Welsh population[11]. Fuels used to generate electricity are not included in this analysis, which is focussed on final consumption.

The region's total energy demand is split roughly into thirds across transportation, domestic heat and power, and commercial/industrial heat, power and processes[7].

CCR is the most urban region of Wales with the highest proportion of buildings connected to the gas network and so is the Welsh region with the highest consumption of gas, but also the lowest emissions per household due to the low number of homes heated by other, high carbon fossil fuels.

Energy consumption in CCR by sector and fuel

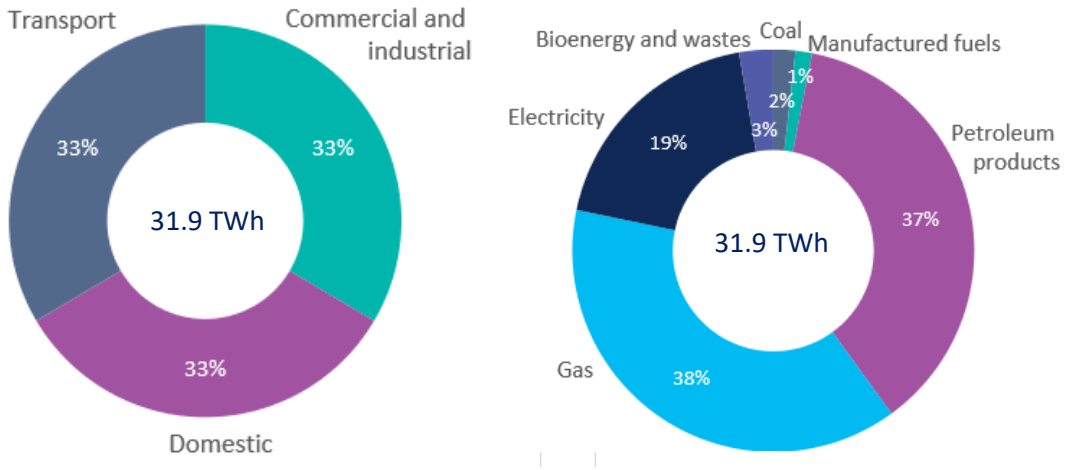



*Figure 4: Breakdown of energy consumption in Cardiff Capital Region. Source: BEIS sub-national total final energy consumption, 2019.*

[10] BEIS (2019) Regional and local authority electricity consumption statistics 2005 to 2018, https://www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics

[11] StatsWales (2019) Population estimates by local authority and year https://statswales.gov.wales/Catalogue/Population-and-Migration/Population/Estimates/Local-Authority/populationestimates-by-localauthority-year

CCR's trend for decreasing energy consumption has plateaued in recent years

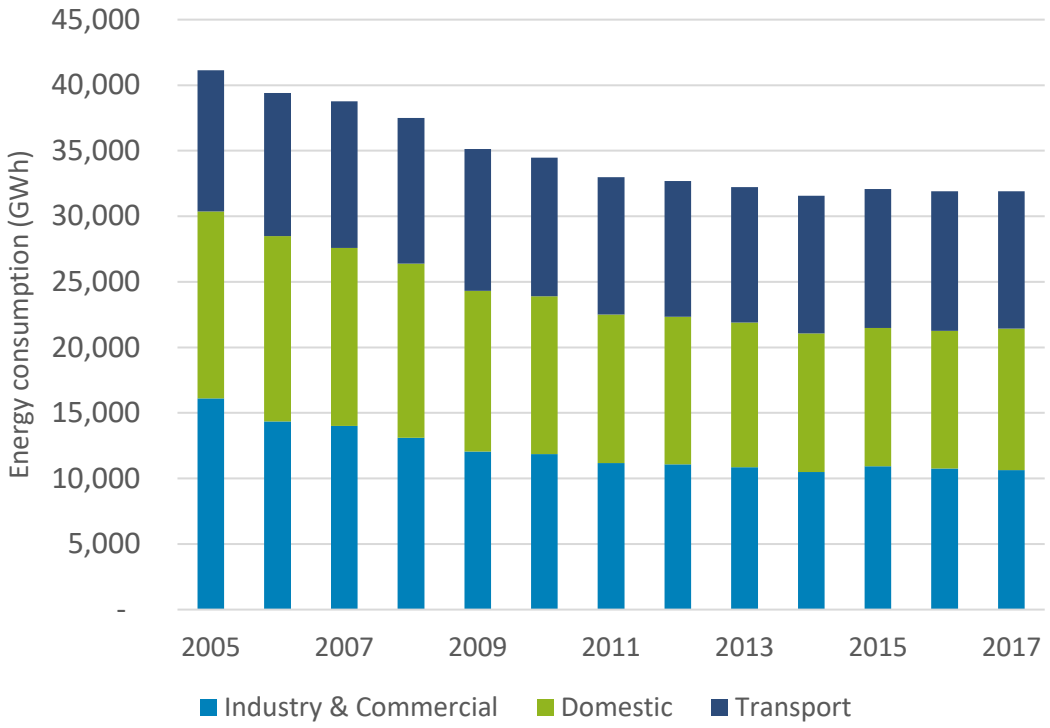



*Figure 5: Trend of energy consumption in the Cardiff Capital Region, by sector. Source: BEIS sub-national total final energy consumption, 2019. (Excludes bioenergy and wastes)*

Analysis of BEIS sub-regional data[12] shows that total energy consumption fell by 22% between 2005 and 2013, an average rate of about 2.4% per year. This is slightly greater than the 18% reduction in energy demand experienced across Great Britain over the same period. This is predominantly due to a significantly greater reduction in commercial and industrial energy consumption in CCR compared to Great Britain.

The 22% reduction in CCR's energy demand is predominantly due to the commercial and industrial sector's energy consumption reducing by 34%, while the domestic sector's energy consumption reduced by 24%. This is likely to be the result of deindustrialisation and behavioural change/energy efficiency measures in each sector respectively. Since 2013, energy consumption in the region has been relatively stable.

[12] BEIS (2019) Regional and local authority electricity consumption statistics 2005 to 2018, https://www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics

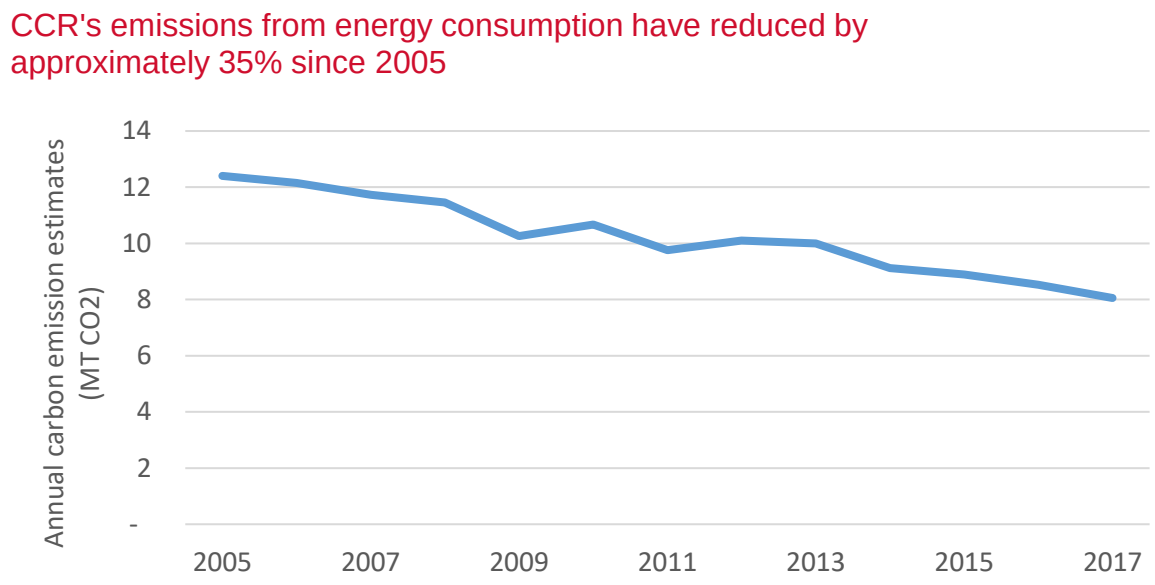



*Figure 6: Estimated historic emissions in CCR. Source: BEIS sub-national emissions*

Emissions from energy consumption reduced by around 35% from 2005 to 2017[13] as a result of falling demand and decarbonisation of the national electricity grid.

## Energy system vision: energy consumption by sector

To be on track for net zero by 2050, CCR needs to achieve 55% decarbonisation of its energy system by 2035.

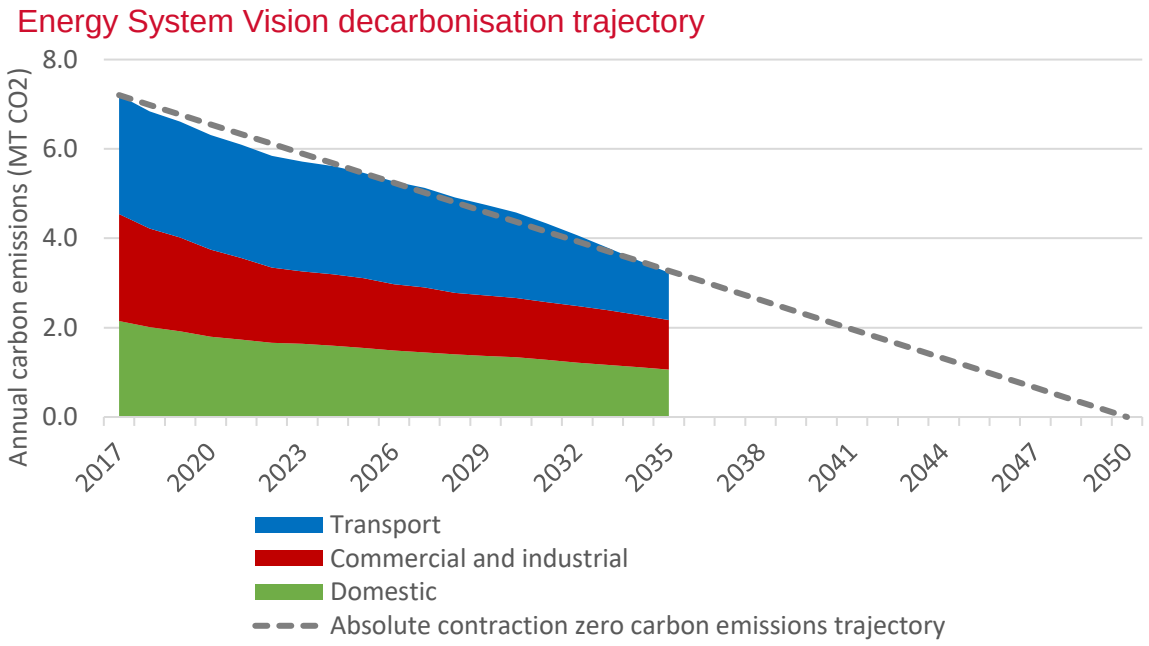



*Figure 7: CCR's Energy Vision decarbonisation trajectory by sector to meet net zero 2050 under an absolute contraction methodology. Source: WGES analysis*

[13] BEIS (2019) UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2017 https://www.gov.uk/government/collections/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics

- By reviewing the measures that could be implemented in CCR between the baseline year (2017) and 2035, this 55% decarbonisation target can be split by sector into:
    - 51% reduction in domestic heat and power emissions
    - 54% reduction in commercial and industrial emissions
    - 60% reduction in transport emissions.

The industrial decarbonisation will be addressed from decarbonising electricity, transferring heating from fossil fuel to electricity and rely on a small uptake of hydrogen.

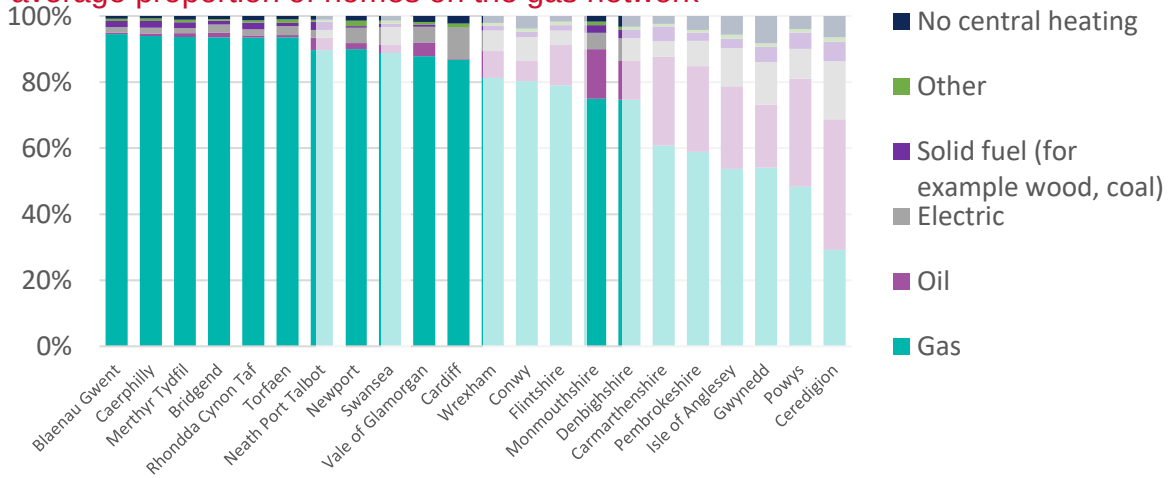
*Figure 8: Summary of the Energy Vision's emission reductions by sector. Source: WGES analysis*

# Our domestic energy consumption

## Baseline: domestic heating

Around 50,000 new homes have been built in the region[14] since 2005, but despite this, domestic heating demand has fallen by 31% since then, reflecting the national trend resulting from more efficient homes, appliances and lighting, and behavioural change.

Cardiff Capital Region's local authority areas have an above average proportion of homes on the gas network




[14] Welsh government, Household estimates for Wales - households by type by local authority, 1991 to 2017

*Figure 9: Proportion of homes heated by each heating fuel type, by local authority. Source: Census, 2011. MHCLG, Energy Performance Certificates.*[15]

## Cardiff Capital Region is the Welsh region with the lowest number of renewable heat installations

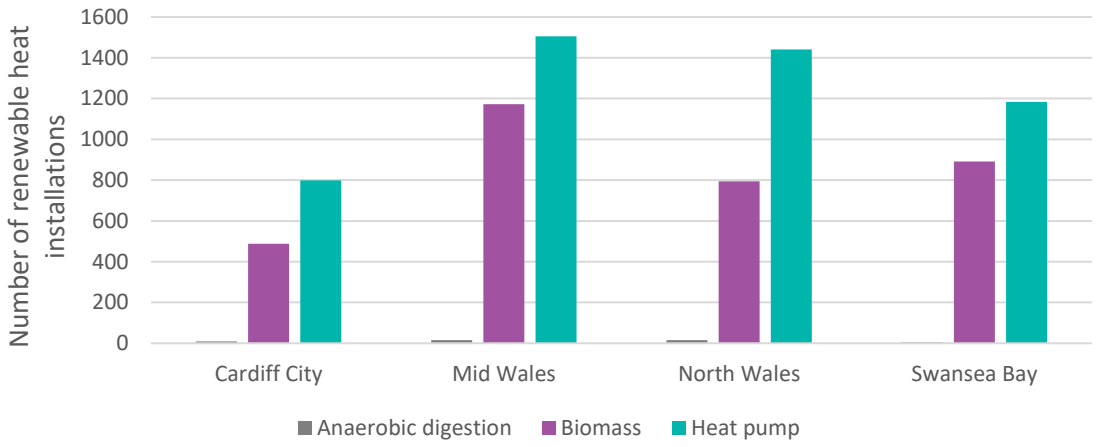



*Figure 10: Renewable heat installations in Wales. Source: Energy Generation in Wales 2018*

Despite hosting nearly half of all homes in Wales, CCR has the lowest number of renewable heat installations; it can be assumed this is due to the high proportion of on gas properties, meaning it is difficult for renewable heat technologies to compete against the low cost of natural gas. Just 0.2% of homes have a heat pump or biomass boiler.

## Cardiff Capital Region's domestic properties have an average EPC rating of D

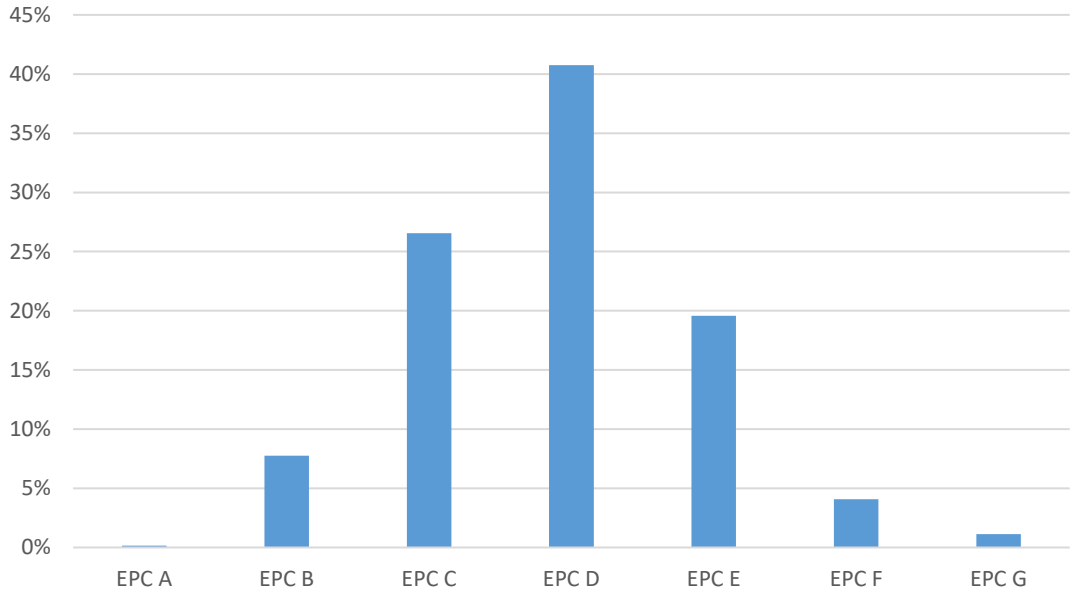



*Figure 11: Proportion of homes in CCR in each EPC band. Source: MHCLG, Energy Performance Certificates*

[15] To note, the Census data is now nearly 10 years old but EPC data and data on renewable heat shows little shift in heating types over that time.

CCR has the highest average energy efficiency ratings in Wales, with 75% of homes rated as EPC band D or above. This is, however, still below the Great Britain figure of 77% band D and above. The average rating (mean, median and mode) is a D, and there are virtually no A-rated properties; there is a significant need to improve energy efficiency to decarbonise the energy system.

## Energy Vision scenario: domestic heating

### Box 1: Assumptions regarding the decarbonisation of domestic heating in CCR[16]

The Cardiff Capital Region energy strategy modelling assumptions for domestic heating are based on input from regional stakeholders and the 2019 Wales & West Utilities Distribution Future Energy Scenario (DFES) project which explored potential future scenarios for the gas network in Cardiff Capital Region in 2035. Some of the key scenario highlights from the 2019 DFES included:

- Around 20% of homes could be heated by a heat pump by 2035, predominantly air source or ground source heat pumps replacing more expensive oil, LPG or solid fuel heating.
- Hydrogen offers a number of significant opportunities for Wales, particularly through the development of industrial clusters in North Wales and extending into the Wirral, and in South Wales in Pembrokeshire, Port Talbot and industrial zones around Cardiff and Newport. A number of hydrogen projects are planned and there is a high likelihood that hydrogen for industrial and transport applications will be become an important fuel over the next decade. There is the potential that some hydrogen from these trial projects could be used to supply heat to adjacent homes and commercial buildings, however hydrogen is not expected to become economically viable or widely available for network distribution as a heating fuel before 2035.
- Biomethane from food waste and sewage in populous areas, alongside farm waste in more rural areas, could provide up to 4% of energy supplied by the gas distribution network in Cardiff Capital Region by 2035. The proportion of biomethane that is injected into the mains gas network will depend on the availability of feedstocks and level of demand from other biomethane uses such as power generation.
- Consumption of natural gas energy in Wales could fall by over 20% between now and 2035.
- Projections on the uptake of heat pumps, including the proportion of hybrid heat pumps, were based on FES 2019 scenarios. Since then, the FES 2020 study has been published and includes a higher proportion of hybrid gas heat pumps, particularly under the Leading the Way scenario.

These findings have been built on in developing the Cardiff Capital Region Energy Vision scenario.

Wales and West Utilities' outlook regarding the potential for biomethane and hydrogen has evolved since the modelling was undertaken following the UK government evolution to a net zero target last year. Net zero scenario shows higher potential for biomethane and hydrogen. For example biomethane levels can exceed in some parts of the WWU network will reach over 20% by 2021. This would facilitate the decarbonisation of homes using smart hybrid heating systems.

[16] Regen (2019) Regional Growth Scenarios for Gas and Heat for Wales & West Utilities https://www.regen.co.uk/regional-future-energy-scenarios-for-heat-and-gas/

*Table 2. Regional Growth Scenarios for Gas and Heat compared with energy modelling*

| Key assumptions for domestic heating fuels | | 2019 WWU DFES Study | | | WGES Energy Strategy Study |
|---|---|---|---|---|---|
| | | Two Degrees Scenario | Community Renewables Scenario | Hybrid Accelerator scenario | |
| **Heat pump deployment (% of houses with a HP by 2035)** | | 12% | 19% | 17% (including significantly higher proportion of hybrid heat pumps) | 19% |
| **Biomethane and bioSNG energy** | **Biomethane and bioSNG heat energy for domestic and C&I heating in 2035** | 324 GWh | 436 GWh | 380 GWh | 362 GWh (note the scope excludes some large industrial sites) |
| | **Biomethane and bioSNG percentage of heat delivered by the gas network** | 3% of gas network energy | 4% of gas network energy | 3% of gas network energy | 4% of gas network energy |
| **Hydrogen use for domestic and commercial heating**<br><br>**(Hydrogen for industrial processes and transport is modelled separately)** | | 1% of gas network energy | None modelled before 2035 | 2% of gas network energy | None modelled before 2035 although there is potential for some domestic heating associated with industrial clusters |

## Existing homes

Achieving a 51% reduction in domestic carbon emissions by 2035 requires a significant shift in the way homes are heated and their level of energy efficiency. This is recognised in Prosperity for All: a low carbon Wales, Proposal 10, which looks at the challenges and opportunities around low carbon heat, and Proposal 11, which considers increasing the use of waste heat and low carbon heat.

One pathway to achieve this would be to focus on improving the worst performing homes, eliminating all E, F and G ratings through improvements, as well as some improvements to homes with higher ratings. For example, a 51% reduction could be achieved if 154,000 homes were improved from G, F and E to D, C and B, leaving just 1% of properties with an EPC rated E or worse. This should take account of the balance between the cost of building fabric improvements against the cost of gas and electricity grid decarbonisation

Upgrades to nearly all homes rated E, F and G required to deliver Cardiff Capital Region's Energy Vision

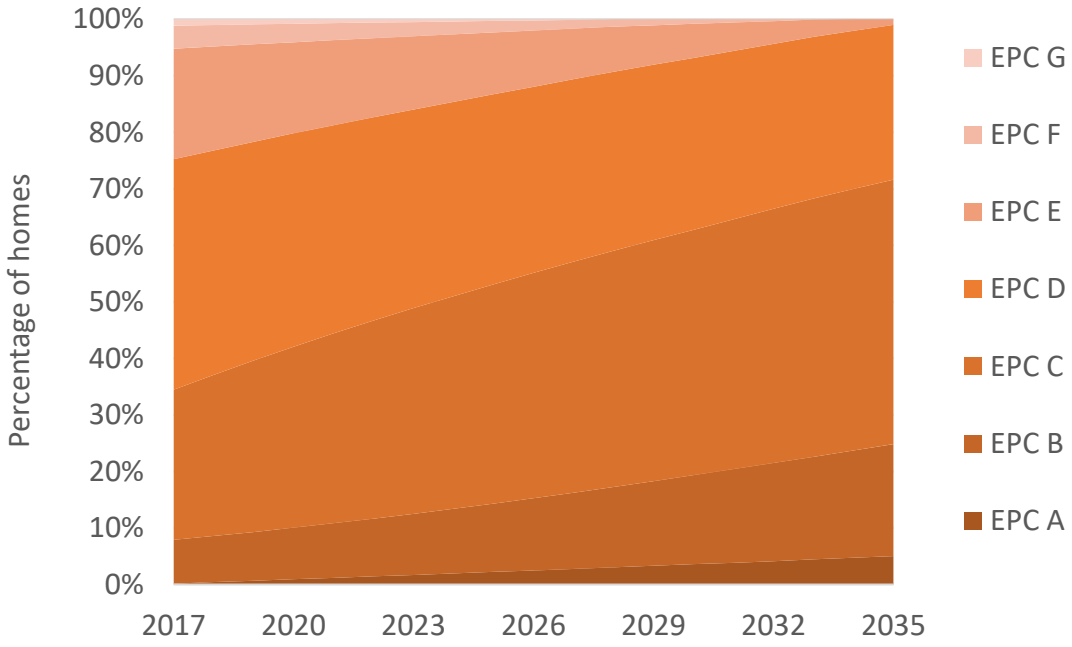



*Figure 12: Estimated domestic EPC band changes to deliver the Energy Vision scenario. Source: WGES analysis*

Around 112,000 homes, 17% of existing homes, need to move from using fossil fuel heating to low carbon heating by 2035, looking at cost effective solutions which consider fuel poverty, as heat pumps may not be affordable for all. Of these, approximately 27,000 (~4%) are currently fuelled by oil, LPG, coal or other solid fuels, with the remainder currently on mains gas.

The Energy Vision scenario assumes that the transition to low carbon heating will be dominated by a shift to air source heat pumps, with a supporting role for individual ground source heat pumps and shared ground loops. By 2035, over 140,000 heat pumps are assumed to have been installed in CCR, including over 28,000 heat pumps

in new homes and around 8,000 homes connected to heat pump-fuelled heat networks. The Vision includes a smaller role for biomass and bio-LPG heating options.

Air source heat pumps are the dominant new low carbon heating source introduced by 2035 under the Cardiff Capital Region's Energy Vision scenario

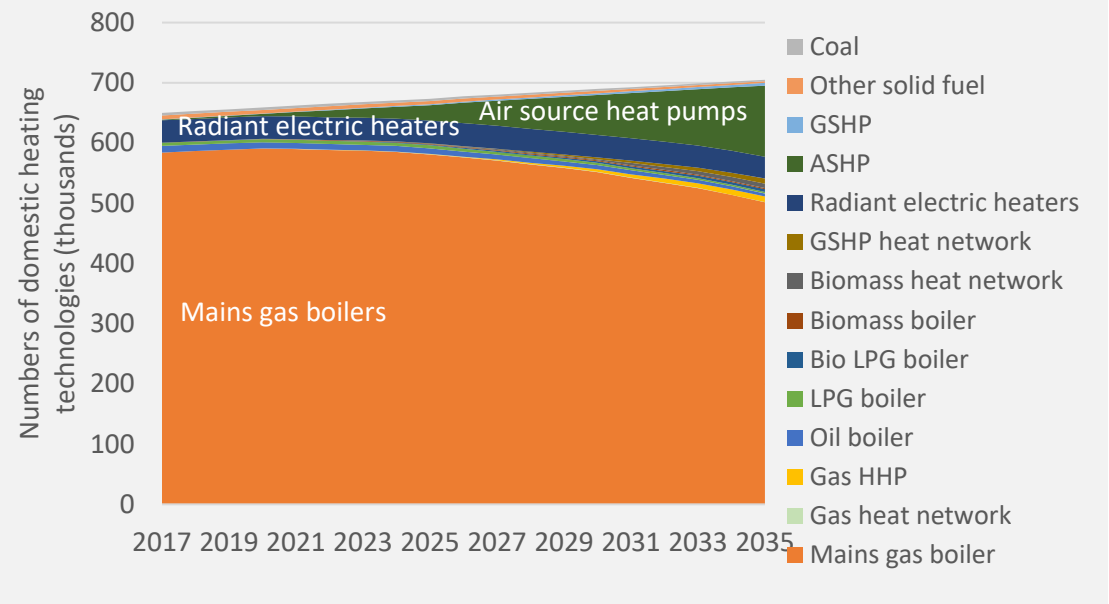



*Figure 13: Breakdown of domestic heating technologies in the CCR Energy Vision scenario, including existing and new build houses. Source: WGES analysis*

Despite these significant shifts to low carbon heat sources, gas boilers remain the dominant technology in existing homes in 2035; post 2035, there will need to be a focus on fully decarbonising these remaining on-gas homes.

## Box 2. Alternative Domestic energy and heat Pathway – 'balanced' scenario

The Energy Networks Association's 'Pathways to Net Zero' report explores the role of gas networks in a future Net Zero energy system, producing cost-optimised scenarios out to 2050. The Pathways to Net Zero report presents an alternative pathway called the 'balanced scenario' for a decarbonized heating system that can also be applied to the Cardiff Capital Region.

The "balanced scenario" describes a future where low carbon and renewable gases are used in a *balanced* combination with low carbon electricity, where electrification plays a less dominant role and renewable gas grid conversion is prioritized. It highlights the significant role of renewable gas in meeting net zero by 2050, especially in cases where existing homes can't be renovated or all-electric heat pumps are not an appropriate solution. However, it also identifies current barriers to achievement, for example, a significant reliance on timely Carbon Capture Use and Storage implementation and accompanying policies to support this.

WWU have considered these principles into its 2021-26 business plan, consulting over 20,000 stakeholders and consumers in the process.

<u>'Balanced scenario' overview for domestic energy and heat:</u>

- Deployment of hybrid heat systems becomes main heat source in buildings not suitable for all-electric heat pumps and where connecting to a district heating network is not an option
- Heat supply is mostly hydrogen and biomethane
- Moderate renovation in existing buildings

The key difference between the balanced scenario and the energy system vision scenario modelled for this report concerns the level and timing of the installation of heat pumps versus hybrid heat pumps. The balanced scenario, when applied to the Cardiff Capital Region would focus on hybrid heat pump installation first. Another key difference between the balanced scenario and the energy system vision scenario are timelines. The balanced scenario models out to 2050, whereas the energy system vision modelling has modelled out to 2035.

Detailed energy planning is required to provide certainty on the pathway and short term actions required in CCR to decarbonise not just heating, but the wider energy system. The gas and electricity DNOs, and the local authorities in the region, are vital to this process. Electrification is currently one of the few proven scalable options for decarbonising heat, with heat pumps playing a substantial role in any Net Zero scenario. Local area energy planning will identify the preferred combination of technological and system changes needed to the local energy system, to decarbonise heat, and local transport, and realise opportunities for local renewable energy production.

### Box 3: The Freedom Project

The Freedom Project, a joint innovation project between Western Power Distribution and Wales & West Utilities, installed and ran 75 gas hybrid heat pumps in Bridgend between 2016 and 2019. The project investigated the carbon and cost impacts of using an air source heat pump for the majority of heat demand, with a gas boiler providing heat during the coldest months of the year.

Hybrid heat pumps could provide significant reductions in emissions from domestic heating in the near-term and the project found the potential for lower system costs from a hybrid approach rather than through electrification alone.

In a net zero scenario, homes heated by a hybrid heat pump with a fossil gas backup would either have to transition to a fully electrified heat pump or be supplied by a low carbon gas such as hydrogen or biomethane.

## New homes

The recent consultation from Welsh Government on Building Regulations Part L (responses from which are currently being reviewing) is looking to establish the standards for housing construction for 2020 to 2025 and give industry notice by exploring the expected standards that will be in place from 2025. The current proposals for 2020 are to improve the target emission rate for new build homes by raising the fabric standards, and introducing renewable energy technology into the notional building that sets the target emission rate. To meet the new target, developers may, for example, choose to install low carbon heating but if not, will be required to future proof so that low carbon heating can be easily retrofitted in the future. The target outcome is that homes built in 2025 will emit 75% to 80% less carbon than those built to the 2014 Part L requirements[17]. The challenge will be to close the remaining gap to true zero carbon development.

The Energy Vision scenario relies on new homes being built with low carbon heating and high standards of energy efficiency from 2025, rather than building properties that will need retrofitting at a later date. If Welsh Government or the local authorities in CCR choose to bring this date forward, there will be a direct benefit in that the number of homes needing to be retrofitted by 2050 would be reduced.

*Table 3: Scenario summary: domestic*

| Sector | Example outcomes Energy Vision scenario | Energy prize | Carbon saving potential |
|---|---|---|---|
| Domestic heat and energy efficiency | 42,000 suitable houses accurately fitted with internal or | 18% reduction in gross thermal energy demand | 666 kt $CO_2$ (51% reduction) |

[17] Welsh Government (2019) Welsh Government Consultation Document: Building Regulations Part L and F Review https://gov.wales/sites/default/files/consultations/2019-12/consultation-document-building-regulations-part-l-review.pdf

| | | | |
|---|---|---|---|
| | external wall insulation.<br>Over 185,000 other insulation measures in homes<br>Over 140,000 heat pumps installed.<br>Replacing heating systems in oil, LPG and solid fuel heated homes prioritised<br>No gas in new homes from 2025, to avoid retrofitting at a later date | 30% net decrease in domestic heating energy consumption, taking into account demand reduction and improved heat technology efficiencies, including the impact of heat pump performance. | |

## Our commercial and industrial energy consumption

### Baseline: commercial and industrial

Industrial energy demand has decreased by 34% since 2005 and emissions have decreased by 49%. The greater reduction in emissions, compared to the reduction in energy demand, is largely due to the decarbonisation of the UK's electricity grid. This has been achieved through the increase of low carbon and renewable electricity generation, such as wind and solar PV, and the decrease of traditional fossil fuel plants, such as coal and gas. As noted above, due to data limitations some very large industrial energy users are not included in this analysis.

Cardiff Capital Region's commercial and industrial energy demand declined rapidly between 2005 and 2011, before levelling out

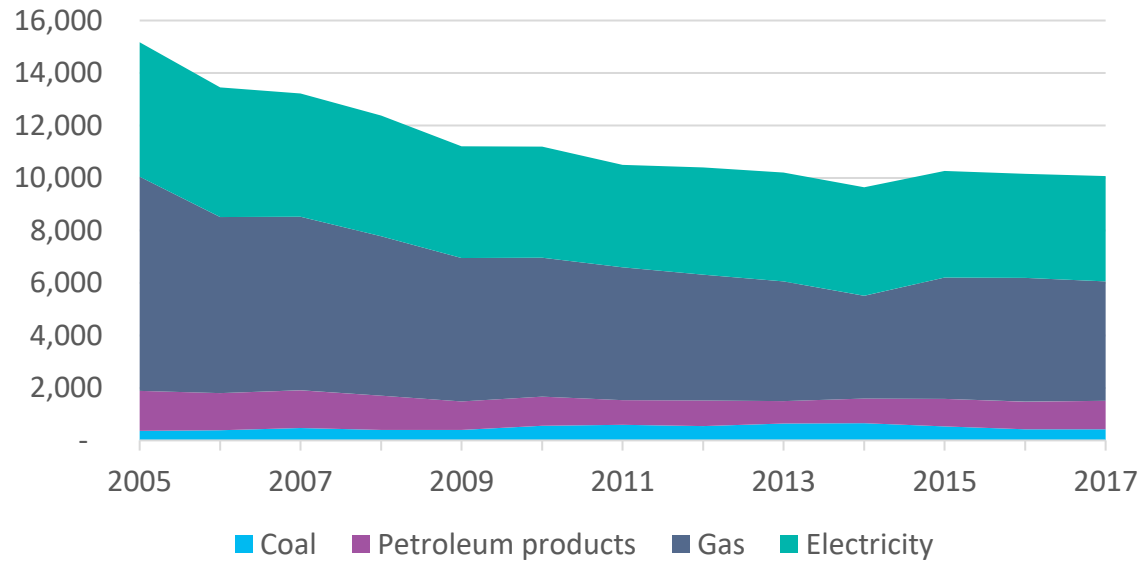



*Figure 14: Cardiff Capital Region's historic commercial and industrial energy consumption, by fuel. Source: BEIS total final energy consumption (2019)*

## Energy Vision scenario: commercial and industrial

The Energy Vision scenario sets out a pathway to achieve a further 54% reduction in commercial and industrial emissions by 2035 through:

- A 13% decrease in energy demand through energy efficiency measures and electrification of heat and process demand
- Switching to low carbon fuels and heating, including electrification and some use of low carbon hydrogen in industrial processes
- Significant further decarbonisation of the electricity grid through renewable generation.

CCR's Energy Vision scenario includes a 13% decrease in commercial and industrial energy consumption by 2035

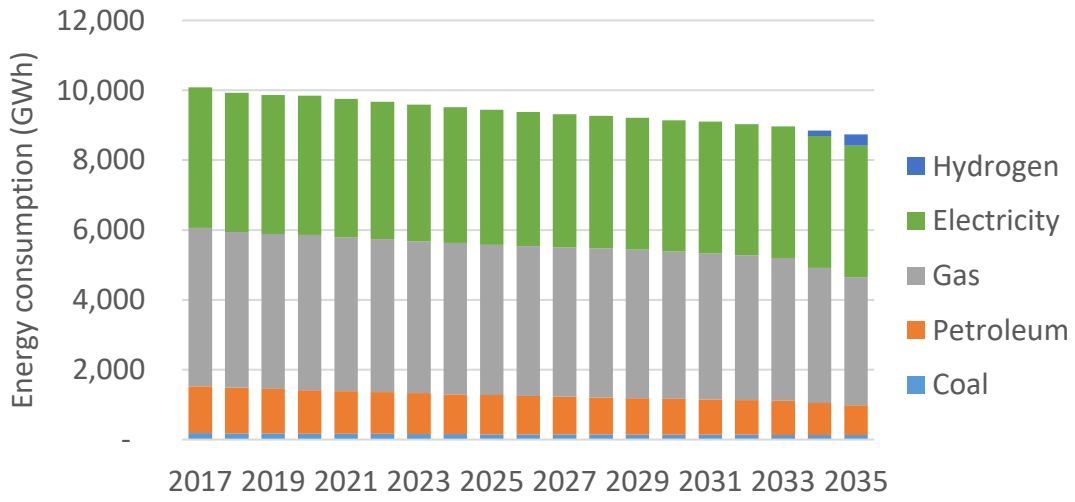



*Figure 15: Energy Vision scenario commercial and industrial energy consumption, by fuel. Source: WGES analysis*

Existing effort in this area can be built on, through the work of the South Wales Industrial Cluster (SWIC), which brings together a group of major industrial companies in CCR and other parts of South Wales to share knowledge, co-ordinate funding and collaborate on decarbonisation projects. It's focus areas include energy efficiency, carbon dioxide avoidance, the hydrogen economy, carbon capture, utilisation and storage (CCUS) and low carbon power generation.

Reaching a grid electricity average carbon intensity of 30g$CO_2$ per kWh[18] would in itself (with no additional demand reductions) achieve a 40% reduction in all commercial and industrial emissions in CCR, as shown in Figure 15. This very low electricity carbon factor would depend on significant installation of new low carbon generation capacity both in CCR and across the UK.

[18] Assumption based on Community Renewables and Two Degrees scenarios in National Grid (2019) *Future Energy Scenarios*, http://fes.nationalgrid.com/media/1409/fes-2019.pdf

Cardiff Capital Region's Energy Vision scenario results in a 51% decrease in commercial and industrial energy emissions by 2035, dependent in large part on decarbonisation of the electricity network.

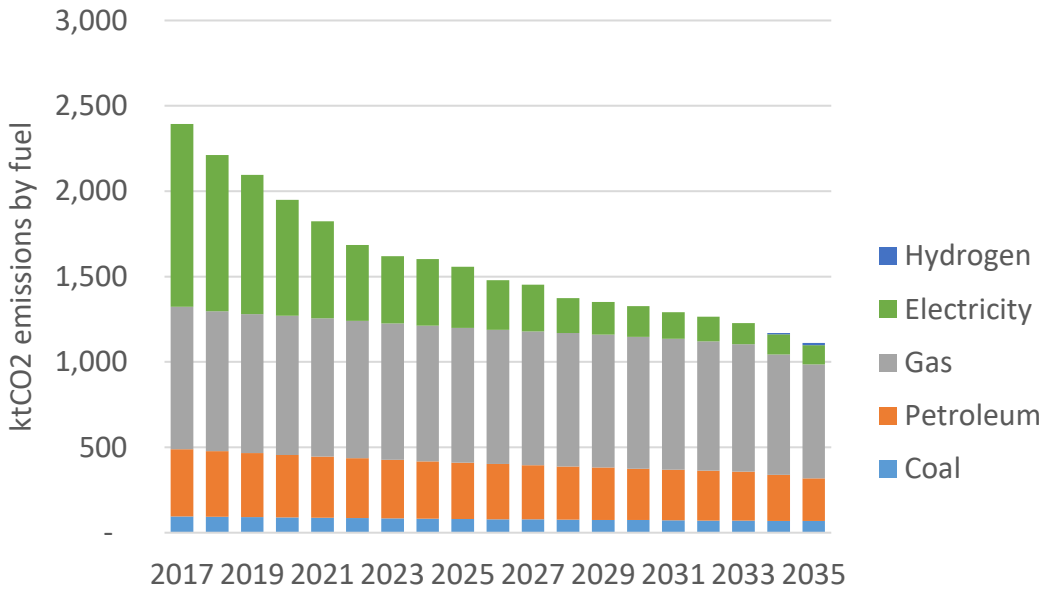



*Figure 16: Energy Vision scenario commercial and industrial emissions estimates, by fuel. Source: WGES analysis*

The future impact on energy utilities' networks and whole system decarbonisation in the CCR and beyond are beginning to be addressed through the Zero2050: South Wales initiative led by National Grid.

## Use and production of hydrogen

Feedback from CCR stakeholders was that there is strong support for the region to lead the way on the development of hydrogen production, storage and use technologies. It is key to prioritise the use of hydrogen based on regional cost-effectiveness in the industrial sector before transport and then heating. Regen's (see **Box 1**) found that before 2035, under some scenarios, there could be some use of hydrogen in the region in industrial clusters. Based on stakeholder interest and detailed scenario analysis, the Energy Vision scenario assumes early hydrogen adoption, beginning with its use in industrial processes in a CCR cluster around 2033.

To achieve the region's net zero carbon ambitions, hydrogen should be produced either using excess renewable energy to power electrolysis or through other methods such as steam methane reformation with effective carbon capture and storage. To be viable for widespread hydrogen use, further pilots will be required to help with realising cost reduction and further technology development.

Research has already begun in this area in the region with the collaboration between the University of South Wales, Cardiff University and Swansea University for the FLEXIS project. The FLEXIS project, which has a demonstration area in Neath Port Talbot, includes work packages on hydrogen, syngas, BIOH2 and BIOH4, on subjects such as storage, sustainable production, efficient use and purification.

*Table 4: Scenario summary: commercial and industrial*

| Sector | Example outcomes Energy Vision scenario | Energy prize | Carbon saving potential |
|---|---|---|---|
| **Commercial and industrial energy demand** | Significant energy efficiency programme<br>A switch to alternative fuels, including hydrogen and electrification of heating<br>Decarbonisation of electricity network through renewables and behind-the-meter low carbon generation | 35% reduction in coal and petroleum energy consumption<br>19% reduction in gas consumption<br>4% of demand supplied by hydrogen through industrial clusters<br>6% reduction in electricity demand | 1,284 kt $CO_2$ (51% reduction) |

# Our energy demand from transport

## Baseline: transport

CCR has a high dependence on private cars for transport. Average annual vehicle miles in CCR are similar to those in other Welsh regions at 9,330 miles per car, 17% higher than the UK average[19]. Less than 1% of road miles are driven by buses and coaches in CCR[19].

The £738 million Metro project – the cornerstone of the £1.2billion City Deal - will create a credible mass transport infrastructure that is likely to drive a modal shift from private vehicle use to public transport.

To date, CCR has seen a slow uptake of electric vehicles. Approximately 0.3% of cars registered in the region are pure electric, compared with an average of 0.6% of vehicles across Great Britain. Similarly, despite a surge in charger installations in 2019, CCR currently hosts 173 public charging devices, including 31 rapid public chargers[20]. This is relatively low, as is the case across Wales, where there are half the number of public EV chargers per capita compared to Scotland.

Wales has significantly lower bus utilisation rates than England or Scotland

[19] DFT (2019) Road traffic statistics (TRA) https://www.gov.uk/government/collections/road-traffic-statistics and Regen transport model

[20] DFT (2019) Electric Vehicle Charging Device Statistics https://www.gov.uk/government/statistics/electric-vehicle-charging-device-statistics-october-2019

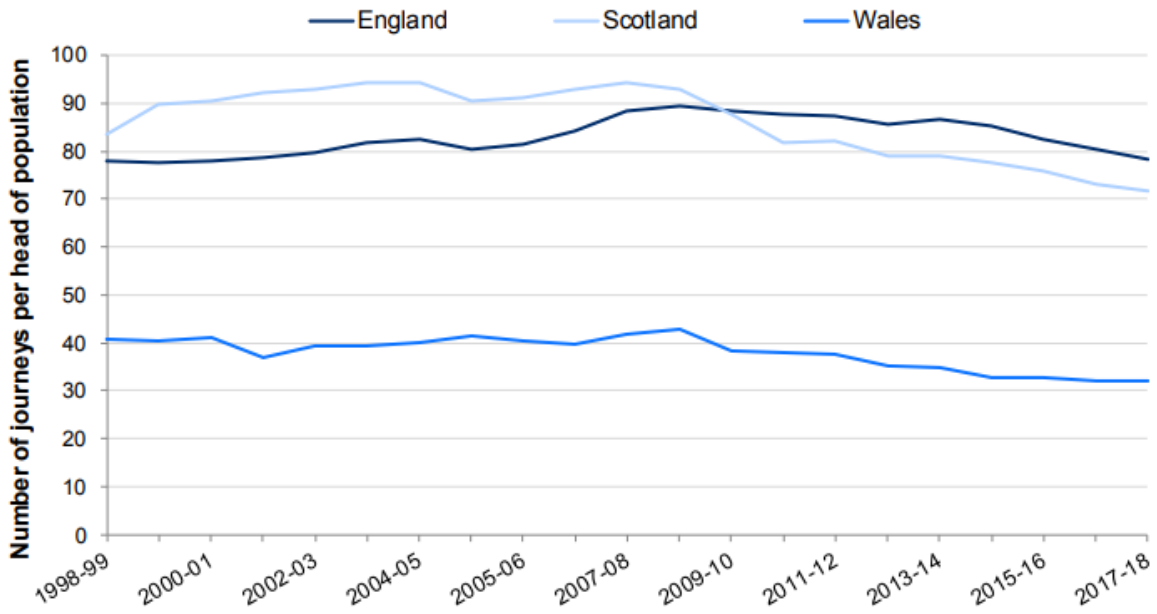



*Figure 17: Passenger journeys per head on local bus services by country, 1998-2018. Source: Public service vehicles statistical bulletin, 2019*

## Energy Vision scenario: transport

Achieving a 60% reduction in transport emissions by 2035 is a significant challenge for Cardiff Capital Region with its high dependence on private vehicles. The Energy Vision scenario assumes:

- 64% of vehicles driven in Cardiff Capital Region in 2035 are electric, with the ban on fossil fuel vehicle sales brought forward to 2030.
- A 20% reduction in private vehicle mileage in 2035 facilitated by significantly increased use of public transport and active travel.
- A slowing of the growth in total number of vehicles on the road, facilitated by increased use of public transport and active travel.

The reduction in private vehicle mileage was originally set at 15%. However, feedback from stakeholders in the region was that the urban environment and projects such as the current Metro and Metro Plus projects should inspire the region to aim for a greater percentage reduction. The reduction in transport-related emissions due to the changing way businesses have operated during the lockdown caused by COVID-19 provides a tremendous opportunity to permanently reduce travel emissions if these new working practices are sustained post COVID-19. It should also be noted however that forecasts undertaken over the last couple of years (pre-COVID-19) by Transport for Wales (TfW) using their SE Wales Transport Model indicates that even sizeable percentage uplifts in public transport usage results in only minor percentage reductions in private car mileage due to the sheer number of car journeys that already take place. The effects of making all public transport in SE Wales free to use were modelled and it was found that by 2026 this would more than double bus use, triple rail use, but have only a 6% reduction in private car use. Thus, a reduction in private car mileage is not only dependent on increases in public transport facilities and usage, but will also requires significant behavioural change.

## Cardiff Capital Region's Energy Vision scenario requires a significant decrease in the number of petrol and diesel vehicles

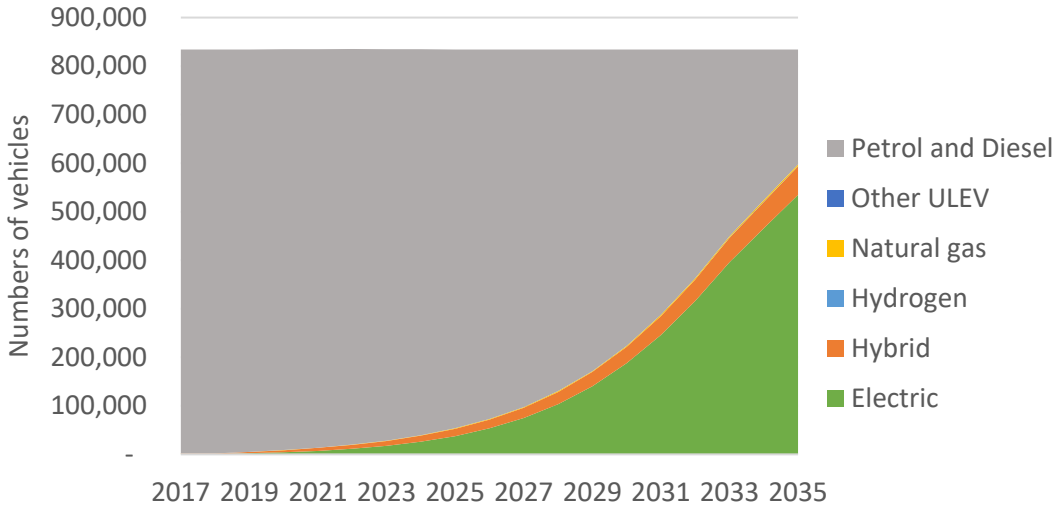



*Figure 18: Cardiff Capital Region's Energy System Vision road vehicle numbers, by vehicle fuel. Source: WGES analysis*

## Cardiff Capital Region's Energy Vision scenario results in road transport emissions reducing by around 60%

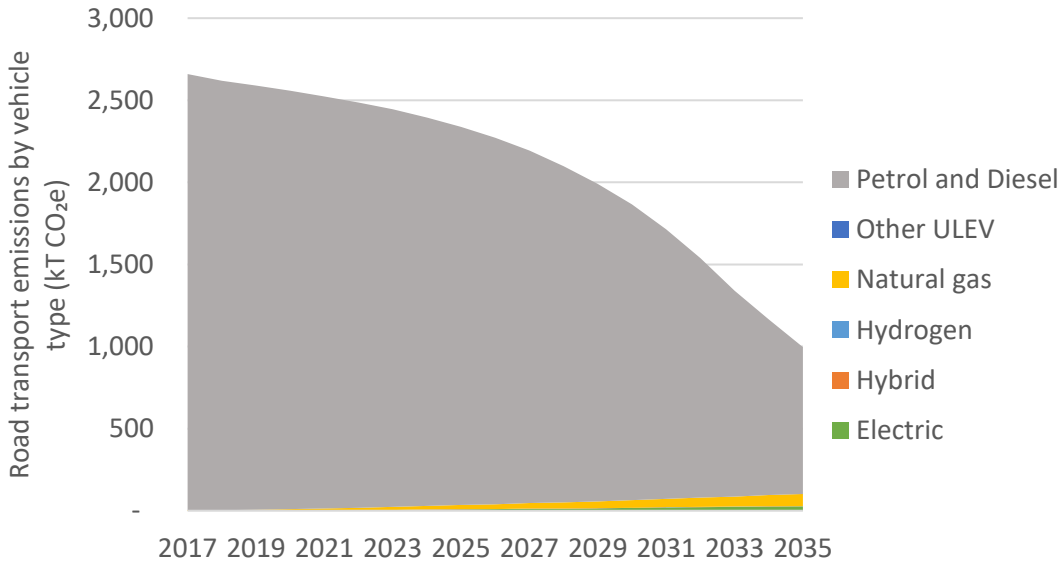



*Figure 19: Energy System Vision road vehicle emissions, by vehicle fuel. Source: WGES analysis*

*Table 5: Summary: Transport*

| Sector | Example outcomes Energy Vision scenario | Energy prize | Carbon saving potential |
|---|---|---|---|
| **Road transport** | 516,000 electric cars<br>3,300 gas and hydrogen HGVs<br>1,000 hydrogen vehicles<br>10,000 public and on-street EV chargers<br>20% reduction in private vehicle mileage | 6.7 TWh reduction in petrol and diesel energy consumption<br>1.4 TWh increase in electricity consumption | 1,606 kt $CO_2$ (60% reduction) |

Achieving these outcomes requires 15,000 EV sales per year by the mid-2020s, peaking at 70,000 per year in the 2030s before reducing to 60,000 per year. Peak sales of fossil-fuelled cars in Cardiff Capital Region have historically reached 70,000 per annum[21]. Additional support, such as a scrappage scheme alongside a 2030 ban on new fossil-fuelled car sales[22], would be needed to retire some fossil-fuelled vehicles earlier than their average lifespan, in order to achieve a peak of 70,000 EV sales per year in the 2030s.

This level of EV sales will also require a supportive, area-wide EV charging network. Similarly, the switch to gas and hydrogen heavy goods vehicles and buses is reliant on the fuelling infrastructure being in place.

# Baseline and modelling results: Electricity

## Our annual electricity demand

### Baseline: annual electricity demand

Annual electricity demand in CCR is currently approximately 6.2 TWh[23]. It has fallen steadily since at least 2005, when electricity demand was nearly 7.6 TWh[23], as a result of efficiency improvements and deindustrialisation.

Commercial and industrial electricity consumption constitutes 55% of all electricity consumption, approximately 10 percentage points less than the Welsh and GB average. Almost all of the remaining electricity demand is used in domestic buildings

[21] DFT (2019) Road traffic statistics (TRA) https://www.gov.uk/government/collections/road-traffic-statistics and Regen analysis

[22] The UK Government is due to consult on bringing forward the fossil-fueled vehicles ban to 2035 or earlier. The analysis assumes this is brought forward to around 2030.

[23] BEIS (2019) Regional and local authority electricity consumption statistics 2005 to 2018, https://www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics

and appliances. The Energy Vision includes ambitious uptake of renewable energy, including on-site generation, in order to contribute to the UK's decarbonised electricity supply.

### Energy Vision scenario: annual electricity demand

The scenario projection shows an overall net increase in annual electricity demand in CCR of 10% by 2035, compared to 2017. Increased energy efficiency measures and appliance efficiency lead to a continued decrease in the base electricity demand; however, by 2025 this is overtaken by the increased demand resulting from the electrification of heating and transport. Peak demand increases may be higher depending on whether time of use tariffs and other smart methods are successful in shifting demand across each 24-hour period.

In the Cardiff Capital Region Energy Vision scenario, decreasing base annual electricity demand is outweighed by increasing demand from electrified heat and transport

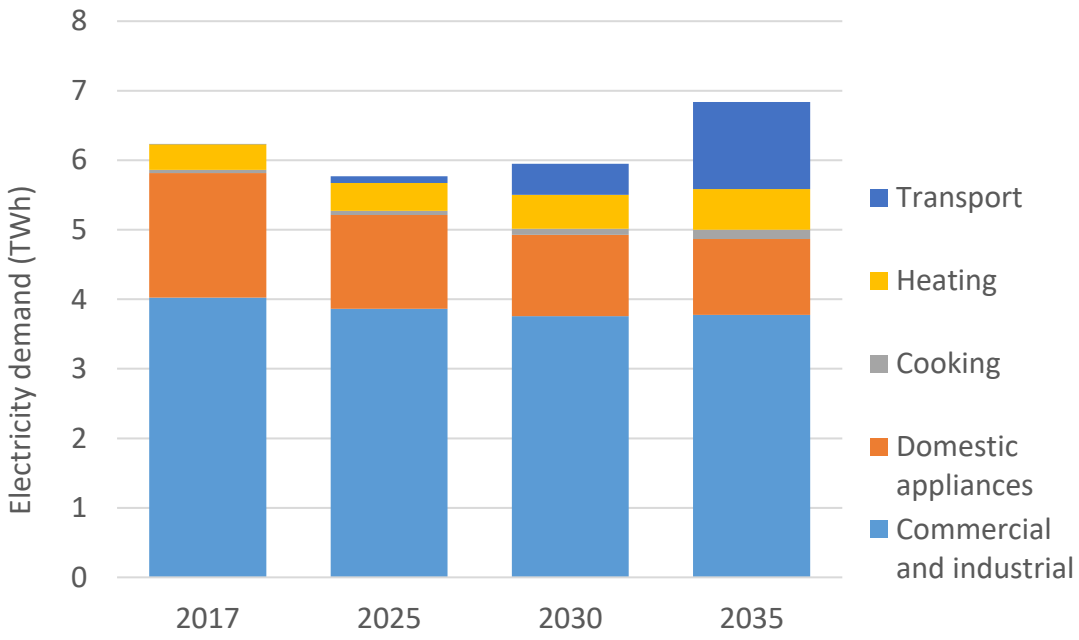



*Figure 20: Cardiff Capital Region's Energy Vision scenario demand by sector. Source: WGES analysis*

# Our electricity generation

## Baseline: electricity generation

### Cardiff Capital Region hosts 311 MW of solar PV and 299 MW of onshore wind

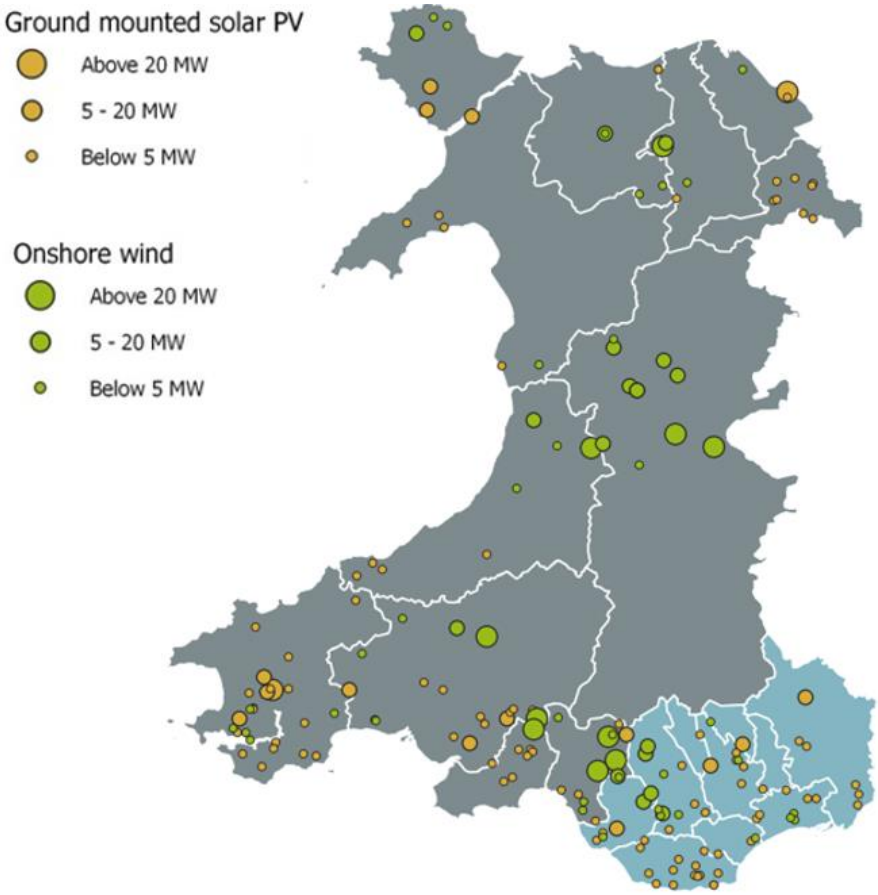



*Figure 21: Solar PV and onshore wind projects (>1MW) currently generating in Wales. Source: BEIS Renewable Energy Planning Database, 2019*

In 2019 there was a total of 709 MW of installed renewable electricity capacity in the region, with 221 MW of this locally owned[24].

Renewable electricity generation in CCR is mainly from onshore wind and solar PV. Solar PV has a relatively high installed capacity with 311 MW, but, due to a lower capacity factor, provides around 18% of renewable electricity generation in the region.

Cardiff Capital Region hosts approximately 40% of the Pen y Cymoedd wind farm, the largest wind farm in England and Wales. This project and nearly 90 others contribute to onshore wind currently generating 50% of the Cardiff Capital Region's renewable electricity generation.

[24] See Welsh Government (2019) Energy Generation in Wales, 2018 https://gov.wales/sites/default/files/publications/2019-10/energy-generation-in-wales-2018.pdf for definition of locally ownership.

The majority of the remaining renewable electricity generation in the region is made up of energy from waste, anaerobic digestion and biomass electricity/CHP projects.

*Table 6: Current renewable energy generation in the region*

| Technology type | 2018 Number of projects | 2018 installed capacity (MW) | 2018 Estimated annual generation (GWh) |
|---|---|---|---|
| Anaerobic digestion | 10 | 9 | 48 |
| Biomass electricity and CHP | 13 | 42 | 245 |
| Energy from Waste | 1 | 30 | 125 |
| Hydropower | 25 | 1 | 2 |
| Landfill gas | 9 | 13 | 47 |
| Onshore wind | 91 | 299 | 770 |
| Sewage gas | 2 | 4 | 16 |
| Solar PV | 22,063 | 311 | 294 |
| Total | 22,214 | 709 | 1,549 |

50% of renewable generation in CCR is from onshore wind projects

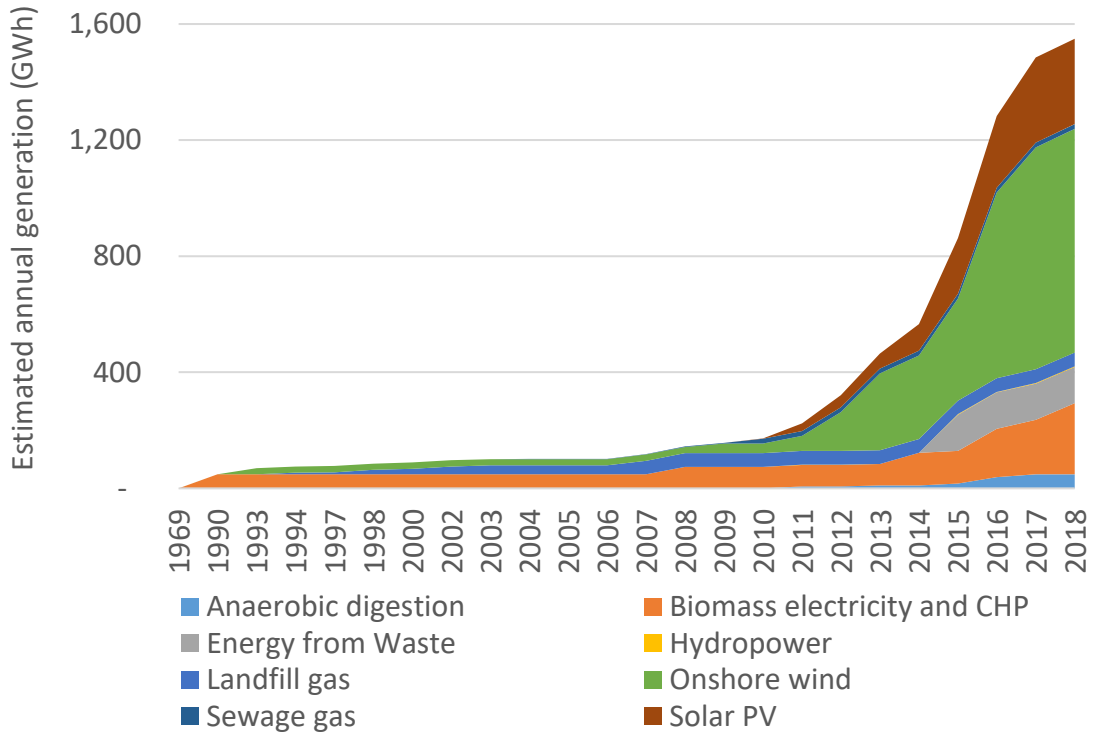



*Figure 22: Cardiff Capital Region's renewable electricity generation trends 2008-2018. Source: WGES analysis, Energy Generation in Wales 2018*

CCR hosts around a quarter of Wales' onshore wind capacity and a third of solar PV capacity.

## Cardiff Capital Region hosts 22% of current Welsh renewable electricity capacity

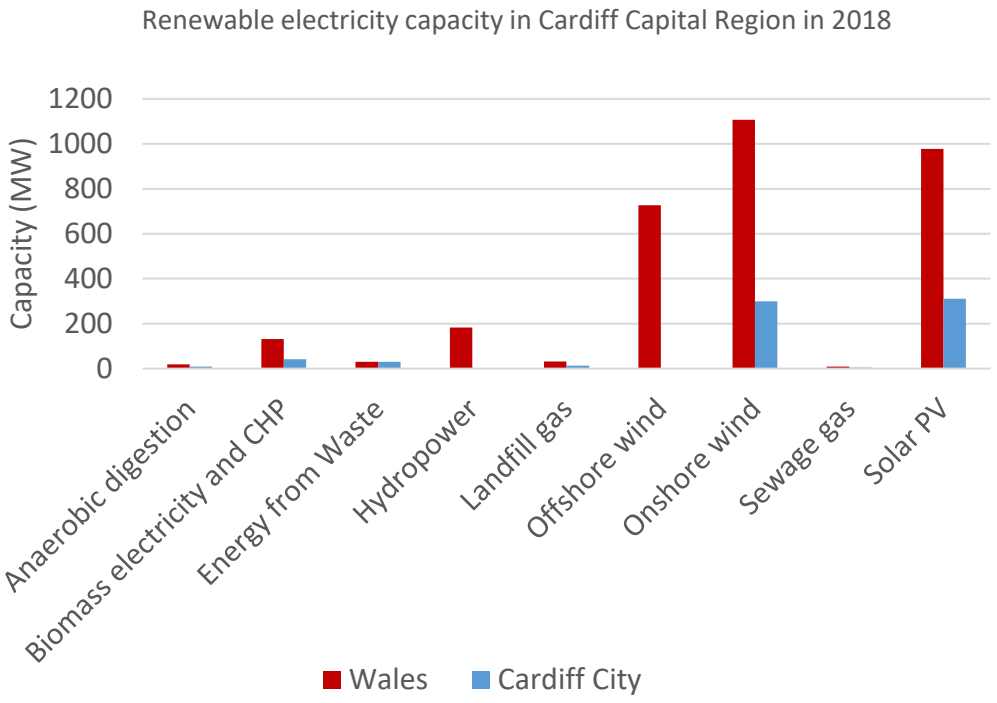



*Figure 23: Renewable electricity capacity in Cardiff Capital Region, 2018. Source: WGES analysis, Energy Generation in Wales 2018*

## Cardiff Capital Region currently generates the equivalent of 25% of its electricity consumption from local renewable sources

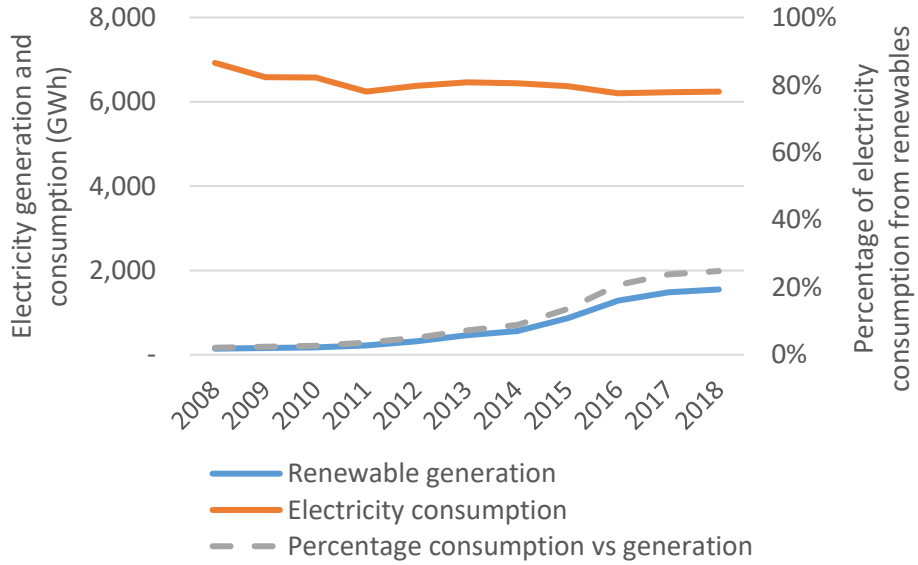



*Figure 24: Percentage of electricity consumption from renewables in Cardiff Capital Region. Source: WGES analysis, Energy Generation in Wales 2018*

## Energy Vision scenario: electricity generation

Stakeholders engaged through the workshops for CCR were keen for the region to increase the amount of renewable electricity that is generated in the region. Compared to the other regions of Wales, it will be more challenging to exceed the equivalent regional annual consumption, with renewable electricity generation, due to the higher population base and lower availability of renewable resources.

As a result, the Energy Vision scenario includes the ambition that the region generates the equivalent of approximately 50% of its total energy consumption in 2035 from regional renewable sources. This figure is less ambitious than other parts of Wales but has been arrived at by balancing the region's ambition against the available resources, investment requirement and potential grid capacity[25]. Potential benefits to the region in addition to supporting decarbonisation would include investment opportunities, job creation, supply chain stimulation and community benefit funds. If projects are developed by or invested in by the public and community sector there are additional potential economic and social benefits that could result, enabling the region to retain a higher proportion of the value created. This would also support Welsh Government's target to have 1GW of renewable electricity and heat capacity in Wales to be locally owned by 2030, and for all new energy projects to have at least an element of local ownership from 2020[26]

### Box 4: A note on grid carbon factors

Achieving net zero carbon emissions across the UK requires the decarbonisation of the electricity grid. In line with industry best practice, the modelling for the Energy Vision scenario applies the UK grid carbon factor to electricity consumed in the region, rather than creating a regional factor based on electricity generated locally.

To be on track for net zero, the Energy Vision scenario assumes that an average UK grid carbon factor of 30 $gCO_2$/kWh has been achieved by 2035, in line with the assumptions used by National Grid's 2019 Future Energy Scenarios[1]. In order to achieve this level of grid decarbonisation, National Grid's Community Renewables and Two Degrees scenarios require a net increase of 68 and 74 GW of low carbon electricity capacity respectively, across the UK by 2035. Cardiff Capital Region has the natural resources and the ambition to play an increased role in delivering renewable energy deployment.

[25] This Energy Vision projection does not include a Cardiff or Newport Tidal Lagoon project.

[26] https://gov.wales/sites/default/files/publications/2020-02/policy-statement-local-ownership-of-energy-generation-in-wales.pdf

To enable Cardiff Capital Region to meet the equivalent of 50% of its 2035 electricity consumption from local renewables requires a significant increase in generation and efficiency savings to offset new sources of electricity demand

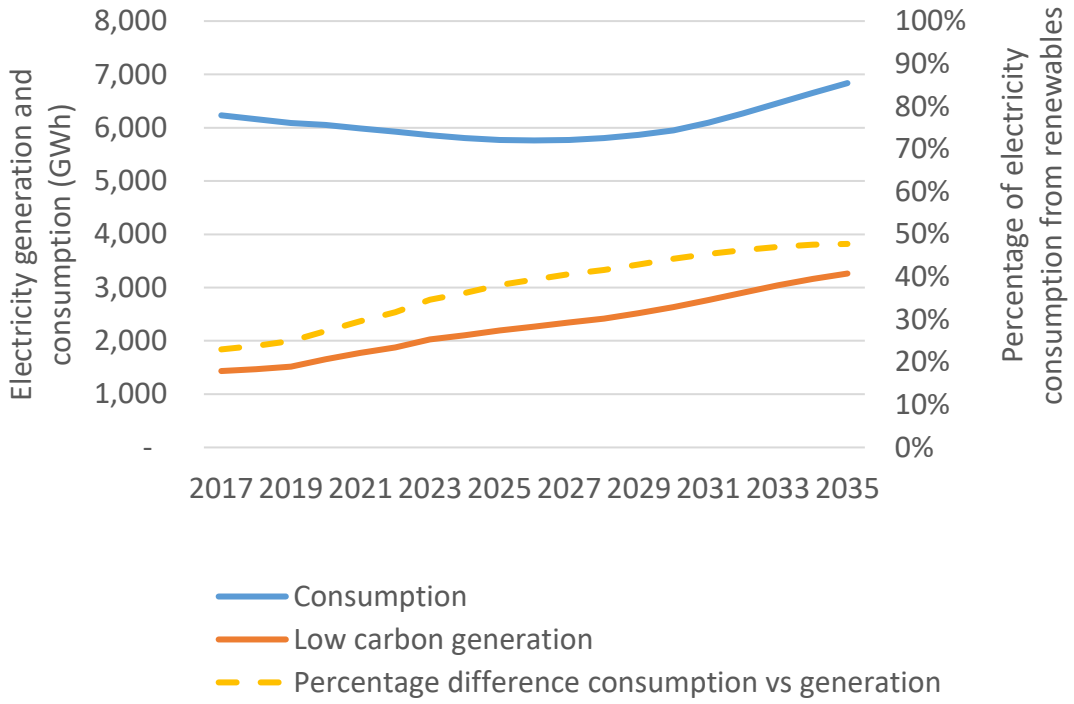



*Figure 25: CCR's Energy Vision scenario electricity consumption vs low carbon generation. Source: WGES analysis*

Figure 25 shows one pathway to achieving this level of electricity generation in the region.

Onshore wind and solar PV are the main electricity generating technologies focussed on in Cardiff Capital Region's Energy Vision scenario

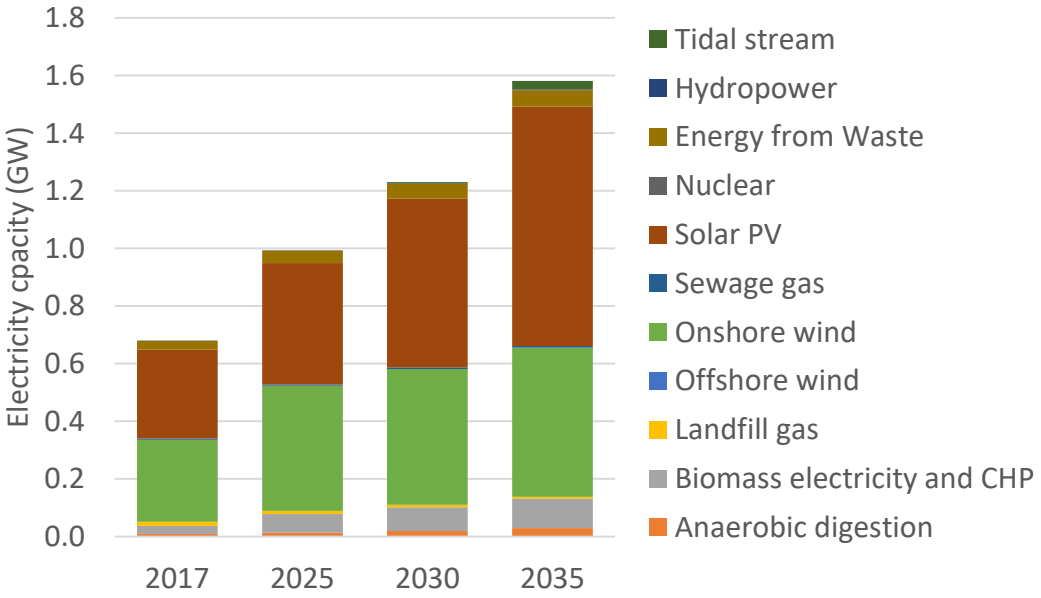



*Figure 26: Renewable energy capacity increases under Cardiff Capital Region's Energy Vision scenario. Source: WGES analysis*

## Onshore wind

The Energy Vision scenario includes an increase in onshore wind capacity of 233 MW. This is a relatively small proportional increase, due to a lack of available sites, primarily due to the urban nature of the region. The capacity increase is made up of:

- a small number of projects currently in development
- new projects in the existing Strategic Search Area F (SSA)
- new projects in Priority Areas as designated in the National Development Framework (NDF) consultation
- new projects (made up of small numbers of large turbines) outside of areas designated by the NDF and SSAs
- and a number of small to medium-scale farm or community projects.

CCR's Energy Vision includes an increase in onshore wind capacity of over 70%

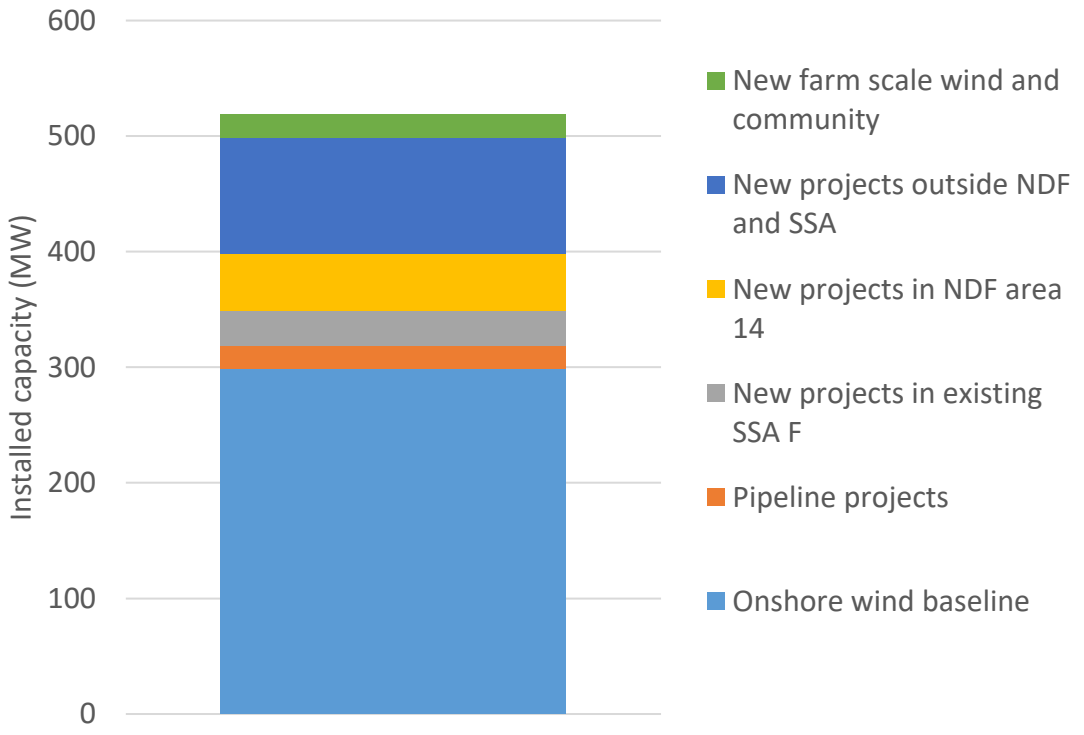



*Figure 27: CCR's Energy Vision scenario for onshore wind. Source: WGES analysis*

## Solar PV

The Energy Vision scenario includes 0.5 GW of new solar PV, with 190 MW on rooftops and 325 MW from solar farms. Roof-mounted solar PV has an important role to play in the urban environment, particularly in engaging households and businesses in understanding the energy they consume as well as what they can generate.

## Other renewables

The Energy Vision scenario also includes small increases in the deployment of anaerobic digestion (including biomethane-producing sites), and biomass electricity/CHP. Each of these technologies could have a small but significant impact on local renewable energy generation with associated economic benefits.

## Marine

Stakeholder input and additional expert research suggested that, despite support and interest, a tidal lagoon project would be unlikely to be developed in the region by 2035 and its inclusion in the Energy Vision could mask the need to focus on other technologies.

Tidal power in the form of a barrage, lagoons or tidal stream continues to receive support in South Wales, with the potential Swansea Bay project (in the neighbouring region) and similar related projects investigated off Newport and Cardiff. Support for a tidal lagoon project is also highlighted within the CCR strategic business plan.

The Swansea tidal lagoon received significant commercial and public interest and was granted a development consent order in 2015[27]. But despite the interest in the area, to date there has been limited progress.

The Newport and Cardiff tidal lagoons are both potential projects in the pre-application stage of the National Infrastructure Planning register; however, no progress has been recorded on the register for either site since 2017[28]. Innovation is still required in this sector to reach a level of economic viability seen by other renewable energy technologies.

For tidal stream, the resource in the CCR area is limited and there are no projects in development in the public domain. Better tidal stream resource has been identified in Pembrokeshire and around Anglesey. The highest velocity tidal stream resource in the CCR region is near to Aberthaw in the Vale of Glamorgan. However, there are issues with the velocity at these sites being both marginal and/or unidirectional, meaning there is a better flood or ebb flows but not both. In addition, the best resource is in the main shipping lane, with limited options to divert shipping due to shallow waters either side[29].

## Network infrastructure

At present there are significant network constraints on the transmission network in the licence area that supplies CCR. As a result, there is an embargo on controllable generators that run at peak times connecting to the Western Power Distribution (WPD)

[27] Planning Inspectorate (2020) National Infrastructure Planning https://infrastructure.planninginspectorate.gov.uk/projects/wales/

[28] National Infrastructure Planning register https://infrastructure.planninginspectorate.gov.uk/

[29] Welsh Assembly Government (2011) Marine renewable Energy Strategic Framework https://gov.wales/sites/default/files/publications/2019-09/marine-renewable-energy-strategic-framework-technical-addendum.pdf

network in the South Wales licence area. This doesn't affect onshore wind, solar or generators under 1 MW, but does affect the deployment of battery storage, gas generation, energy from waste and bio-energy that generates electricity.

It is possible that a system of Active Network Management on the distribution system could manage the constraint with a non-investment solution or equally the constraint may worsen and the embargo would continue. WPD are exploring whether exemptions to this embargo can be made for storage projects.

WPD's network capacity map shows significant further constraints for generation and demand customers across the region[30]. One method of working around network constraints would be through local flexibility and alternative connection agreements. The current embargo on connecting battery storage over 1 MW presents a barrier to some aspects of flexibility.

### Storage and flexibility

Cardiff Capital Region hosts one of Wales' first large scale batteries, The Parc Stormy 4 MW/4.8 MWh storage project that came online in February 2018 and provides Firm Frequency Response (FFR) to the National Grid. Smaller-scale commercial behind the meter projects are known to be hosted in the region, in addition to tens of domestic battery projects[31].

Further deployment of electricity storage, alongside flexibility such as demand side response provision or the creation of local energy markets, could support the decarbonisation of energy generation in Cardiff Capital Region by enabling more renewables to connect to the network in constrained areas and supporting the business case for investing in renewables. These will be explored further through the delivery plan.

*Table 7: Summary: electricity generation*

| Sector | Example outcomes Energy Vision scenario | Energy prize | Carbon saving potential |
|---|---|---|---|
| **Renewable generation** | Sufficient flexibility, including storage, and network infrastructure upgrades to enable low carbon generation and demand technologies to connect<br>532 MW of onshore wind (233 MW of new capacity) | Generating the equivalent of over 50% of electricity consumption in 2035 | Contribution towards reduction in UK grid carbon factor |

[3030] WPD (2020) *Network capacity map* https://www.westernpower.co.uk/our-network/network-capacity-map/

[31] Welsh Government (2019) *Energy Generation in Wales*

| | | | |
|---|---|---|---|
| | 830 MW solar PV (520 MW of new capacity) | | |

## Summary

Under a Business as Usual scenario, CCR is expected to achieve only 26% decarbonisation by 2035, approximately half of the 55% needed to be on track for net zero. Delivering the Energy System Vision scenario represents a very significant step up from a Business as Usual scenario and will only happen with significant local, regional and national commitment.

Potential Business as Usual and Energy Vision decarbonisation trajectories in CCR

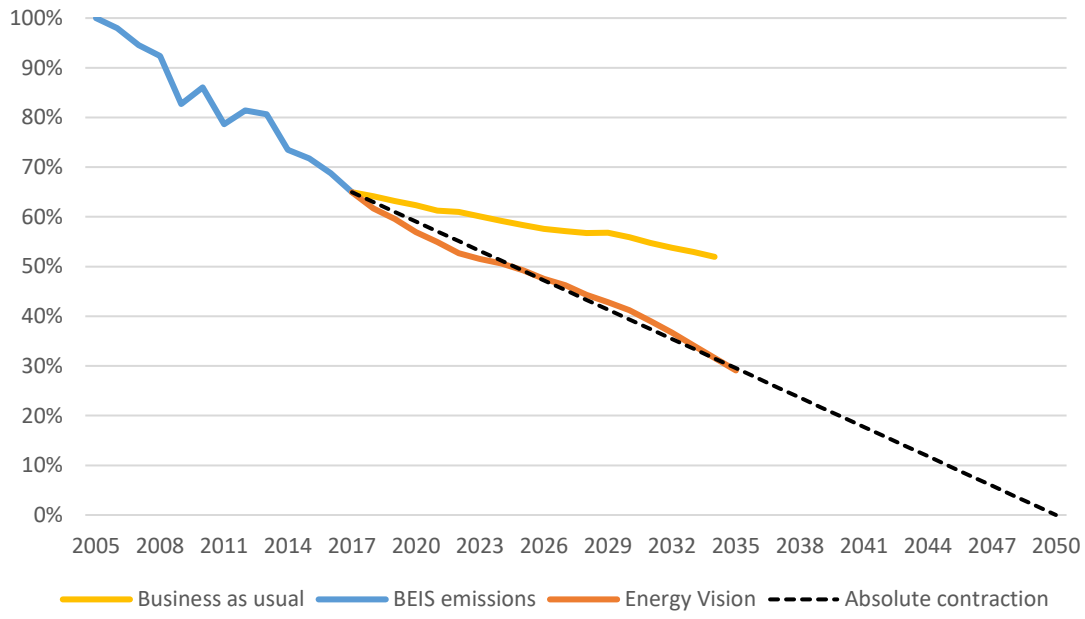



*Figure 28: Decarbonisation trajectories in Cardiff Capital Region. Source: WGES analysis*

The Energy Vision scenario focuses on known, deployable technology and behavioural change to 2035. Based on National Grid's 2019 Future Energy Scenarios[32] and the Committee on Climate Change[33], the scenario prioritises "clear, urgent, no regrets" actions. Table 1 summarises the results of the modelling, setting out key example outcomes to be achieved by 2035. Potential initial actions to set the region on course to achieve these outcomes are explored in the CCR delivery plan.

Beyond 2035, and to achieve net zero, further decarbonisation of all aspects of the energy system will be required. In some cases, this further decarbonisation is dependent on innovation, national policy and/or overcoming significant challenges. The delivery plan includes consideration for some of the longer-term issues raised,

[32] National Grid (2019) *Future Energy Scenarios*, http://fes.nationalgrid.com/media/1409/fes-2019.pdf
[33] Committee on Climate Change (2019) 2019 Progress Report to Parliament https://www.theccc.org.uk/publication/reducing-uk-emissions-2019-progress-report-to-parliament/

such as supporting research and development on hydrogen generation and use through the region's universities and heavy industries.

*Table 8: Summary of Energy Vision scenario modelling results*

| Sector | Example outcomes Energy Vision scenario | Energy prize | Carbon saving potential |
|---|---|---|---|
| **Domestic heat and energy efficiency** | • 42,000 houses fitted with internal or external wall insulation<br>• Over 185,000 other insulation measures in homes<br>• Over 140,000 heat pumps<br>• Replacing heating systems in oil, LPG and solid fuel heated homes prioritised<br>• No gas in new homes from 2025, to avoid retrofitting at a later date | • 18% reduction in gross thermal energy demand<br>• 30% net decrease in domestic heating energy consumption, taking into account demand reduction and improved heat technology efficiencies, including the impact of heat pump performance. | 666 kt $CO_2$ (51% reduction) |
| **Commercial and industrial energy demand** | • Significant energy efficiency programme<br>• A switch to alternative fuels, including hydrogen and electrification of heating<br>• Decarbonisation of electricity network through renewables and behind-the-meter low carbon generation | • 35% reduction in coal and petroleum energy consumption<br>• 19% reduction in gas consumption<br>• 4% of demand supplied by hydrogen through industrial clusters<br>• 6% reduction in electricity demand | 1,284 kt $CO_2$ (51% reduction) |
| **Road transport** | • 260,000 electric cars<br>• 2,600 gas HGVs<br>• 1,000 hydrogen vehicles<br>• 2,000 public EV chargers<br>• 20% reduction in private vehicle mileage | • 3.2 TWh reduction in petrol and diesel energy consumption<br>• 0.6 TWh increase in electricity consumption | 660 kt $CO_2$ (55% reduction) |
| **Flexibility and renewable generation** | • Sufficient flexibility, including storage, and network infrastructure upgrades to enable low carbon generation and | • Generating the equivalent of over 50% of electricity consumption in 2035 | Contribution towards reduction in UK grid carbon factor |

| | | | |
|---|---|---|---|
| | demand technologies to connect<br>• 532 MW of onshore wind (233 MW of new capacity)<br>• 830 MW solar PV (520 MW of new capacity) | | |

# The future of energy and our economy

# Economic Assessment

## Introduction

The changes required to develop a decarbonised future energy system have impacts that reach beyond reducing carbon emissions. Changing the technologies that we use to heat our homes, generate our electricity, and produce our energy will also affect the economic landscape. Examples of these effects include:

- changes in the geographic distribution of jobs as energy becomes less centralised,
- in the job intensity required to produce electricity because this is unique to each generation technology,
- in how expensive new technologies are to install, construct, and operate, and
- how cash circulates around local economies as a result of these changes.

We have built on the scenario modelling described in the previous chapter to try to better understand the impact on net job creation and gross value added. Additionally, we have estimated the level of investment required to achieve the scenarios. The impacts that we consider; job creation, gross value added, and investment required, are just some of the economic impacts related to the energy transition. Other impacts, such as the impact on the cost of energy prices are not included in analysis. Where possible, we have sought to estimate the specific changes to the Cardiff Capital Region economy.

## Approach

We have used an indicator-based approach to estimate job creation, gross value added, and investment. This involves using literature reviews to identify the most appropriate estimates such as jobs/MW, or GVA/employee. Subsequently, these indicators are applied to the results of the energy modelling and allow us to estimate the economic impact of changes in electricity generation, energy efficiency, and domestic heating. A technical annex that accompanies this report provides additional detail on the calculations and sources used in our analysis.

In practice, this approach has an important limitation in relation to low carbon heating. There is significantly less data available to assess the number of jobs associated with the transition to low carbon heating than electricity generation or energy efficiency. This means that the low carbon heating jobs are not comparable with the electricity generation or energy efficiency jobs. We discuss this in more detail in the low carbon heating section below.

In terms of scope, the economic impact in terms of jobs, GVA and investment has not been calculated in relation to two sectors in the energy modelling: 1) transport and 2) commercial and industrial energy efficiency. The transport sector was excluded because the production and employment benefits associated with EV manufacture will not be strongly influenced by the speed of customer switching to EVs in the same region. It is also frequently assumed that there will be no net change in jobs from the transition to EV manufacturing and assembly. Commercial and industrial energy

efficiency has not been assessed because the energy modelling inputs do not allow us to identify energy efficiency impacts from other factors influencing energy demand change, such as the macroeconomic assumptions underpinning the future energy scenarios.

Finally, it is important to provide clarity on the definition of the term “jobs” within the context of this analysis and how this applies to each technology area. Political and media commentary on “jobs” often refers to gross jobs, which are the direct jobs related to a specific project or intervention. In examining the economic impact of the energy transition the accepted standard is to calculate net jobs – this considers the net impact of the job gains alongside the job losses associated with transitioning from one technology to another. Where data sources have made this possible, we have sought to present jobs estimates in net terms, in line with this best practice. We also define jobs in terms of Full Time Equivalents (FTE) wherever data allows.

Additionally, there is a difference between direct, indirect and induced jobs. In an energy context, direct jobs are typically associated with the manufacture, construction and installation of equipment. Indirect jobs arise in the supply chain of the energy technology. Induced jobs related to jobs generated as a result of spending incomes earned from direct employment. Figure 29 below visualises these concepts.

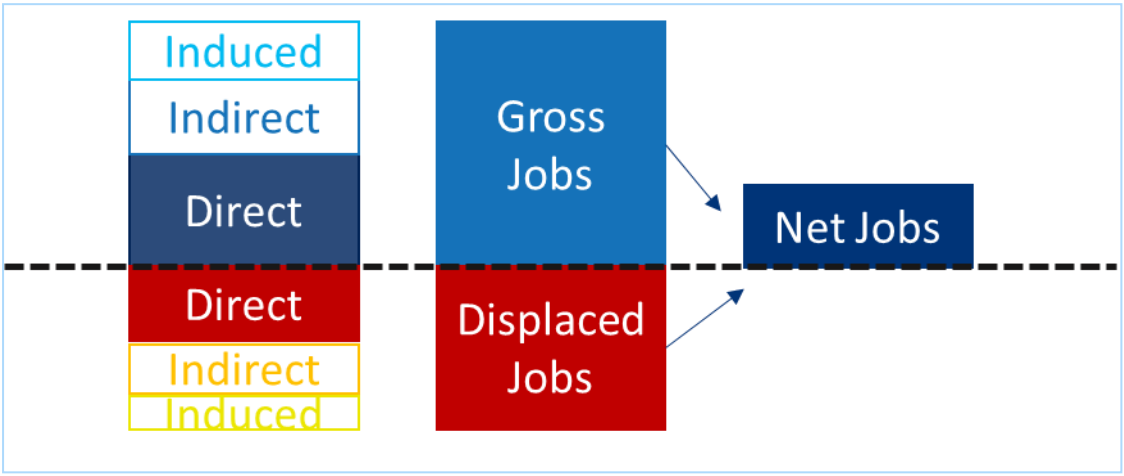



*Figure 29. Shows the relationship between gross, displaced, and net jobs. Indirect direct and induced jobs are also shown. Indirect and induced jobs have not been filled with colour because these jobs are not taken into account in this analysis.* [34]

Throughout this analysis we only calculate direct jobs, as depending on the area of decarbonisation, these are more likely to be local jobs than indirect or induced jobs. However, the analysis does not allow us to comment on the exact location of the job estimates. Some jobs are likely to be held by residents of the Cardiff Capital Region; other jobs may be held by those who travel into the region to perform their roles.

[34] Adapted from UKERC. 2014. Low carbon jobs: The evidence from net job creation from policy support for energy efficiency and renewable energy.

## Electricity generation

The results from assessing the economic impact related to the change in energy generation technologies estimate that achieving the energy system vision scenario will require nearly £750 million of additional investment, equivalent to approximately £50 million per year, compared against the business as usual scenario. This spending will be made by a wide range of parties included businesses (and their investors), households as well as local and national government. The energy system vision scenario will also create an estimated 7,400 additional annual jobs and contribute nearly £850 million more in GVA than the business as usual scenario between 2020 and 2035. The location of these additional jobs is an important question and a difficult one to answer with a precise number. Construction, operation and maintenance jobs will occur locally – however manufacturing jobs may occur inside of outside of the region. Likewise, persons could travel into the region to provide operational support while being based elsewhere. Ultimately, a portion of the jobs figures presented are likely to be located within the Cardiff Capital Region however other jobs will be held by persons resident outside of the region. In order help the region benefit from jobs associated with future local electricity generation it will be important to fist understand the reason why operation and maintenance jobs may be located outside of the region in order to develop a policy response.

Table 9 summarises the estimated economic impact of the business as usual and the energy system vision scenarios. The figures shown in the table represent the total value from all years from 2020 through to 2035. Similarly,Table 10 summarises the additional investment, jobs, and GVA associated with the Energy System Vision (ESV) scenario.

*Table 9 BAU and ESV economic impact2020- 2035*[35]

| Scenario | Gross Jobs including losses* | Average annual jobs including losses* | Discounted GVA | Discounted Investment |
|---|---|---|---|---|
| Business as usual (BAU) | 32,737 | 2,182 | 4,110,777,412 | £366,128,354 |
| Energy system vision (ESV) | 40,166 | 2,678 | 4,964,582,623 | £1,114,348,193 |
| **Gross and annual job figures have been calculated based on UK or international direct job intensity indicators per technology. These full time equivalent indicators include both short term (construction) and long term (operations and maintenance) jobs. However, short term jobs are weighted against the lifetime of the plant. Non-manufacturing direct electricity generation jobs are typically more likely to be held by residents local to an energy site. The experience of Wales to date is that many of the long term operational and maintenance jobs associated with these technologies are held my persons outside of the region who travel into Wales to perform their duties.* | | | | |

[35] A discount rate of 3.5% is applied to calculate investment and GVA over the 2020 – 2035 time period.

*Table 10. Difference between the ESV and BAU scenarios 2020-2035[36]*

| Scenario | Net Jobs | Discounted GVA | Discounted Investment |
|---|---|---|---|
| Difference between ESV and BAU | 7,429 | 853,805,211 | £748,219,839 |
| Difference between ESV and BAU (percentage) | 23% | 21% | 204% |

## Investment

In terms of investment, the energy system vision scenario requires additional investment associated with the amount of new electricity generation included in the scenario, as well as the specific technologies involved. Onshore wind, solar PV, energy from waste, and biomass electricity and CHP each are related with approcimately 1/5$^{th}$ of the additional investment required to achieve the energy system vision. Figure 30 shows the breakdown of the additional estimated investment required by technology area to achieve the energy system vision scenario compared with the business as ususal scenario.

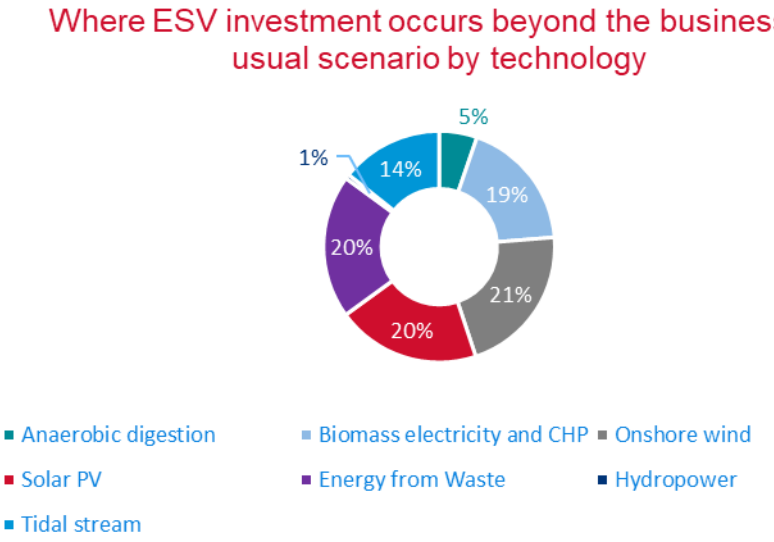



*Figure 30 Where ESV Investment occurs beyond the BAU scenario by technology*

## Jobs

The jobs figures presented in table 6 include both the jobs associated with increases in capacity and output from some generation technologies (for example solar PV) as well as the fact that some jobs will be lost as the capacity and output from fossil-fuel

[36] A discount rate of 3.5% is applied to calculate investment and GVA over the 2020 – 2035 time period.

based generation technologies falls. The breakdown of jobs required in the energy system vision scenario is visualised on an annual basis in Figure 31 below.

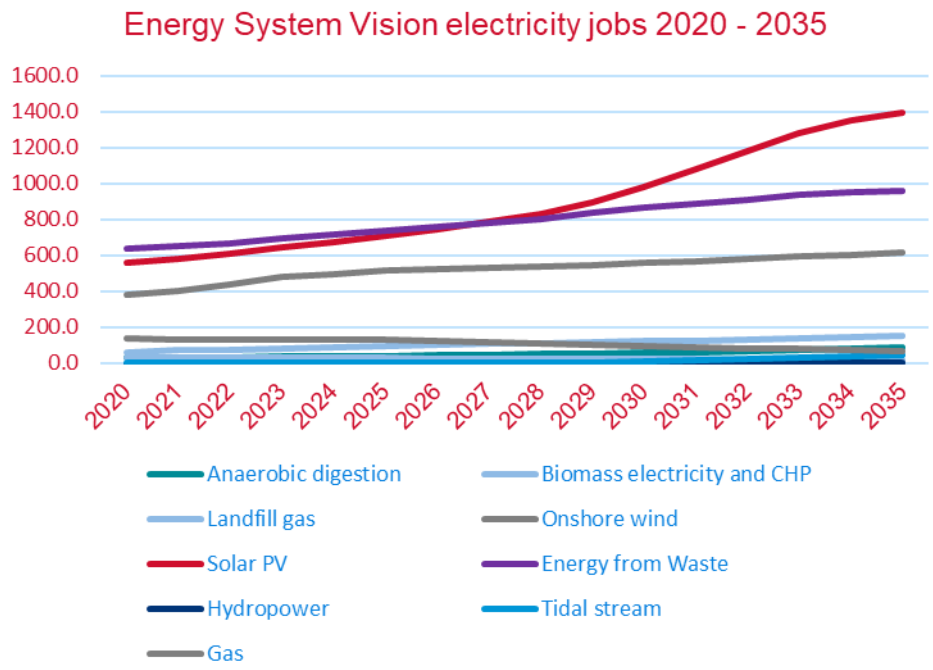



*Figure 31. ESV Gross Jobs including job losses*

It is estimated that in the energy system vision scenario electricity generation is responsible for 40,166 direct gross jobs from 2020 to 2035. This represents an average of 2,678 jobs per year. The number of annual jobs related to this scenario changes over the 2020 - 2035 as the deployment of technologies change. For example, in 2020 the energy system is estimated to support 1,821 jobs of which 133 are related to gas powered generation. Of renewable jobs in 2020, energy from waste is related to the largest number of jobs at approximately 634. By 2035, we estimate that the energy system vision scenario will support 3,323 jobs of which only 66 relate to gas generation. By 2035, solar PV requires the largest number of renewable jobs with 1,393 jobs or ~42% of the total jobs in that year.

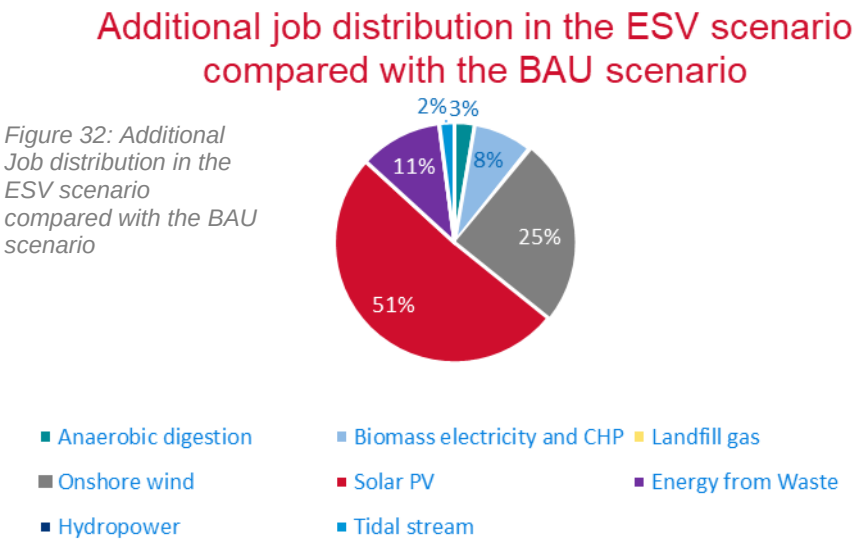



*Figure 32: Additional Job distribution in the ESV scenario compared with the BAU scenario*

Figure 32 looks at which technologies in the energy vision scenario supports additional jobs in comparison with the business as usual scenario. The difference between the two scenarios (known as net jobs) represents the net additional jobs supported by the energy system vision in comparison with the business as usual. Solar PV represents that largest difference in jobs between the two scenarios, followed by onshore wind and energy from waste.

## Domestic energy efficiency

As with electricity generation, the increases in domestic energy efficiency associated with the Energy System Vision scenario relative to the BAU scenario require more investment, support more jobs, and lead to an enhanced contribution to GVA. This reflects that the energy system vision sees a more dramatic shift in the number of homes achieving higher EPC ratings and the larger number of energy efficiency improvements needed to achieve this outcome. These figures are presented in Table 11.

Table 12 shows that the energy system vision requires approximately 1.6 times the investment and jobs compared with the business as usual scenario. Additionally, it supports approximately 1.6 times the GVA associated with the business as usual scenario.

*Table 11. Domestic Energy Efficiency additional economic impact of the ESV scenario compared with the BAU scenario from 2020 -2035[37]*

| Scenario | Net jobs | Discounted GVA | Discounted Investment |
|---|---|---|---|
| Business as usual (BAU) | 21,900 | £1.3b | £4.6b |
| Energy system vision (ESV) | 31,300 | £1.9b | £6.5b |
| Difference between ESV and BAU | 9,300 | £600m | £2b |
| Difference between ESV and BAU (percentage) | 43% | 43% | 43% |

[37] A 3.5% discount rate was applied to calculate the GVA and Investment over the 2020 – 2035 time period.

* Figures are rounded.
** Net jobs figures do not include estimations of operation and maintenance jobs associated with the energy efficiency improvements.

## Investment

The majority of investment required to install the energy efficiency measures described by the BAU and ESV scenarios is related to insulation measures. The investment requirements can be seen in Figure 33.

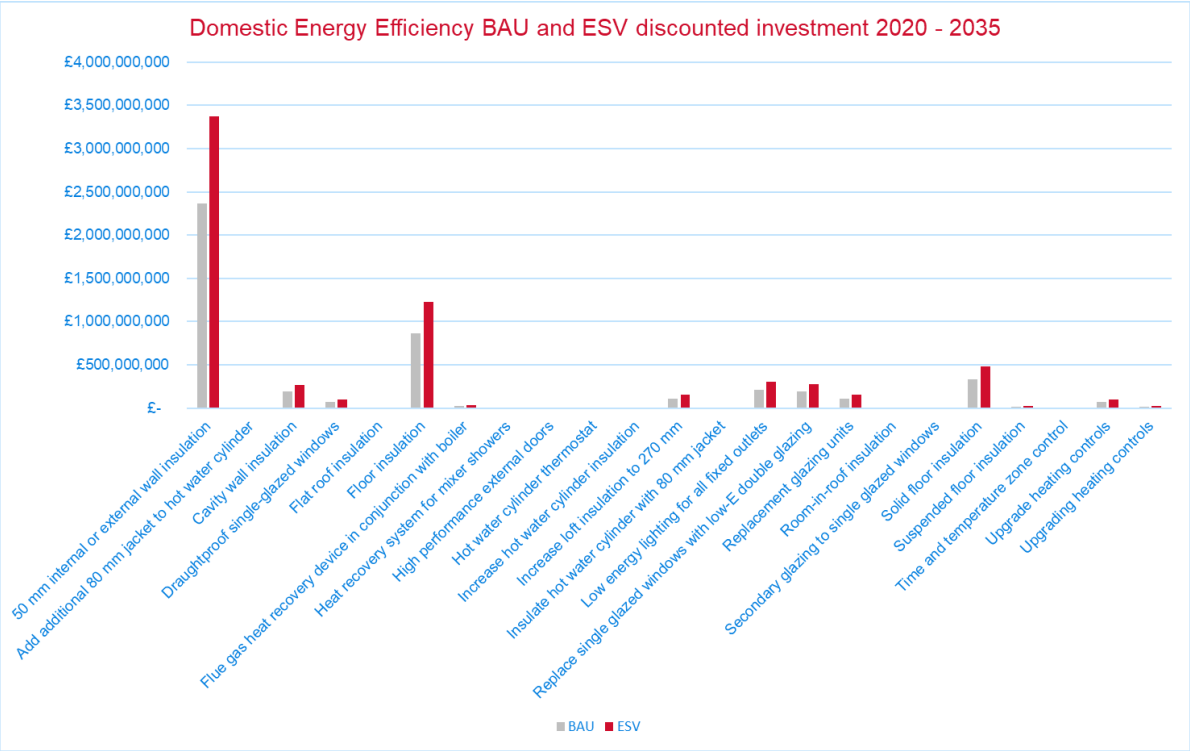



*Figure 33. BAU and energy efficiency Investment requirements 2020- 2035*

## Jobs

9,300 additional net jobs are related to the energy system vision scenario in comparison with the business as usual scenario between 2020 and 2035. These are net direct jobs and take account of the fact that energy efficiency requires additional jobs to deliver and install the relevant technologies, but could also reduce jobs associated with the reduced need for energy production and supply. Like electricity generation, some energy efficiency jobs may be held by those residing in the region and other jobs may be held by people who travel into the region to perform these jobs.

The majority (52%) of the additional jobs in the ESV scenario relate to installation of 50 mm internal or external wall insulation and 20% of jobs relating to floor insulation. Figure 34 below show the estimated jobs required to implement the energy efficiency measures that relate to the EPC shift in the BAU and ESV scenarios.

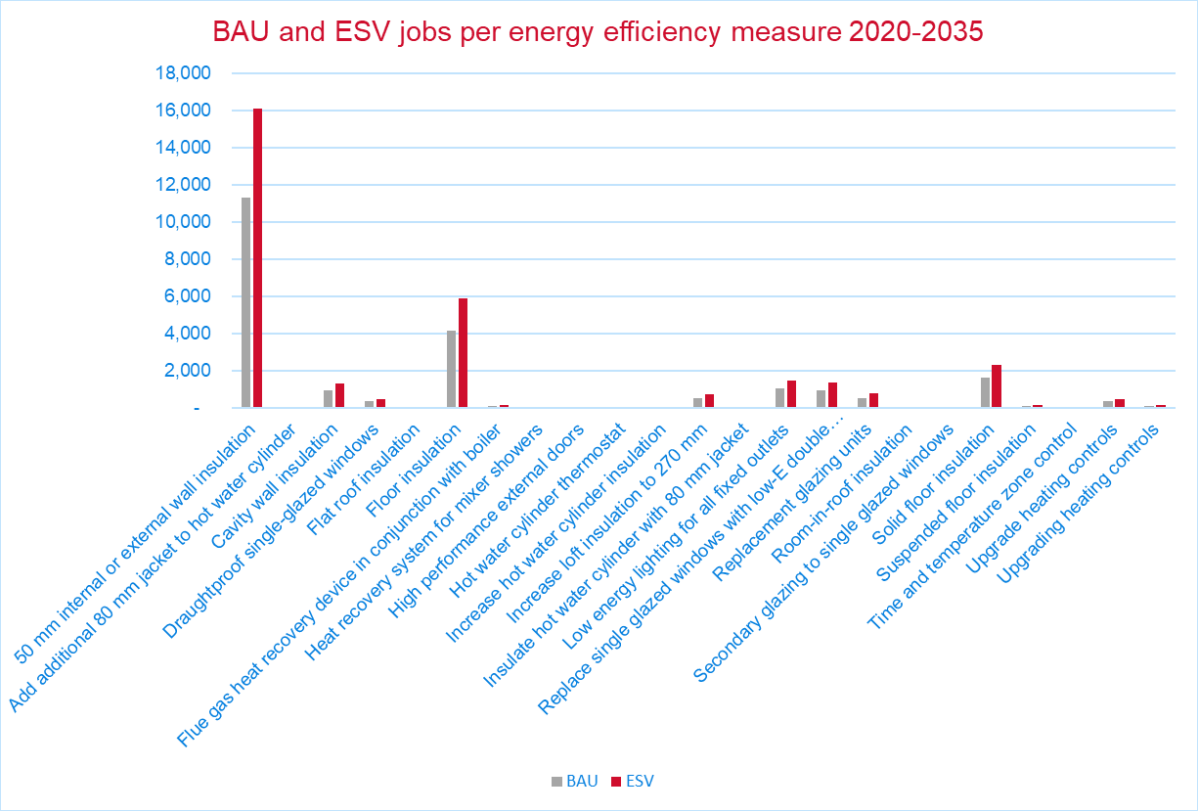



*Figure 34. Net BAU and ESV jobs per energy efficiency measure 2020 – 2035.*

## Domestic heat

For domestic heat, we estimate that the energy system vision scenario has a larger economic impact than the business as usual scenario when it comes to investment and GVA. For example, the GVA related to the energy system vision scenario is 320 percent greater than the BAU. Similarly, the energy system vision scenario requires nearly triple the level of investment compared with the business as usual scenario. The ESV scenario also requires more jobs related to low carbon heating. However, a lack of data on jobs associated with traditional heating technologies means a comprehensive comparison in the jobs impacts from the switch to low-carbon heating technologies is not possible. Table 12 below summarises the economic impact of both scenarios and also shows the difference between the scenarios. A comparison of the investment required in the BAU scenario and the ESV scenario is presented in Figure 35.

*Table 12. BAU and ESV economic impact as well the difference between ESV and BAU economic impact 2020-2035*[38]

| Scenario | Gross jobs associated with low carbon heating* | Discounted GVA associated with all heating technologies | Discounted Investment associated with all heating technologies |
|---|---|---|---|

[38] A 3.5% rate is applied to GVA and investment to calculate these figures over the 2020-2035 time period.

| | | | |
|---|---|---|---|
| Business as usual (BAU) | 966 | 112,904,278 | £253,448,346 |
| Energy system vision (ESV) | 3,971 | 474,208,575 | £954,916,917 |
| Difference between ESV and BAU | 3,005 | 361,304,297 | £701,468,570 |
| Difference between ESV and BAU (percentage) | 311% | 320% | 277% |
| *For domestic heat it is more difficult to link jobs to the local economy. This is because energy efficiency jobs are related to the manufacturing of energy efficiency technologies and products as well as their installation. A portion of these jobs is likely to be located within the Cardiff Capital Region however other jobs will be held by persons resident outside of the region. | | | |

## Investment

Figure 35 reflects that the shift to low carbon heating in the ESV scenario happens faster and at largest scale than the BAU scenario. For example, between 2020 and 2025, the ESV see less investment in gas boilers reflecting a faster shift away from this technology. The most predominant trend is across all year is that a substantial amount of additional investment is required in air source heat pumps. Investment particularly increases from 2025 in relation to air source heat pumps.

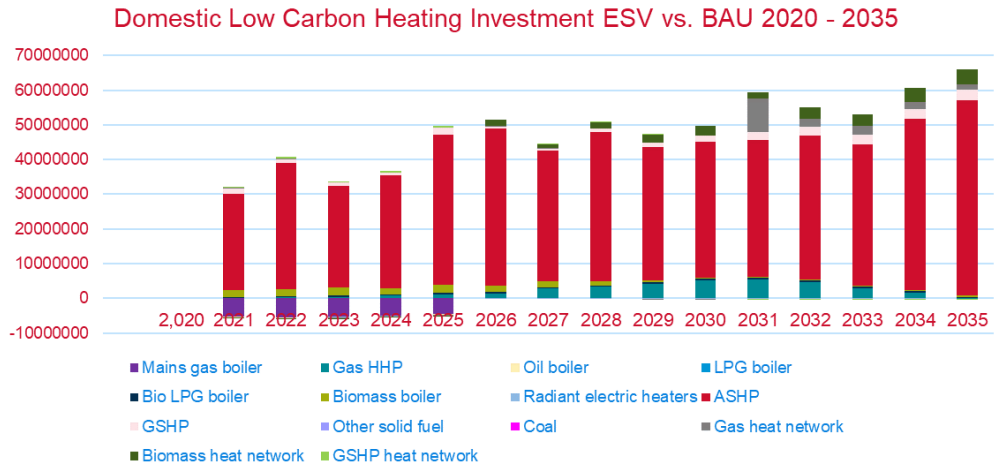



*Figure 35. ESV vs. BAU discounted heat investment 2020 – 2035. Discounted at a rate of 3.5%.*

## Jobs

The job figures estimated for domestic heat differ from those calculated for electricity generation. Fewer studies have been undertaken to quantify the jobs related to the installation of heating technologies than electricity generation technologies. Specifically, indicators of FTEs/ £m turnover in non-heat network low carbon heating technologies were available. For heat networks the indicators used were permanent jobs per annual GWh heat generated.

However, our estimate of jobs related to heating technologies only relates to low carbon heating and does not include jobs related to the installation of more traditional heating technologies such as gas boilers, due to a lack of available high-quality data.

Figure 36 below shows the difference in low carbon heating jobs between the ESV scenario and the BAU scenario. Like investment, the majority of jobs related to air source heat pumps. It's worth emphasizing that these figures relate to low carbon heating only and don't include jobs related to traditional heating technologies such as gas or oil boilers (either within the BAU or ESV scenarios). Additionally, as stated at the beginning of this section on domestic heating, it is difficult to comment on the location of these jobs; some jobs will be held by Cardiff Capital Region residents while others will be held by those outside of the region.

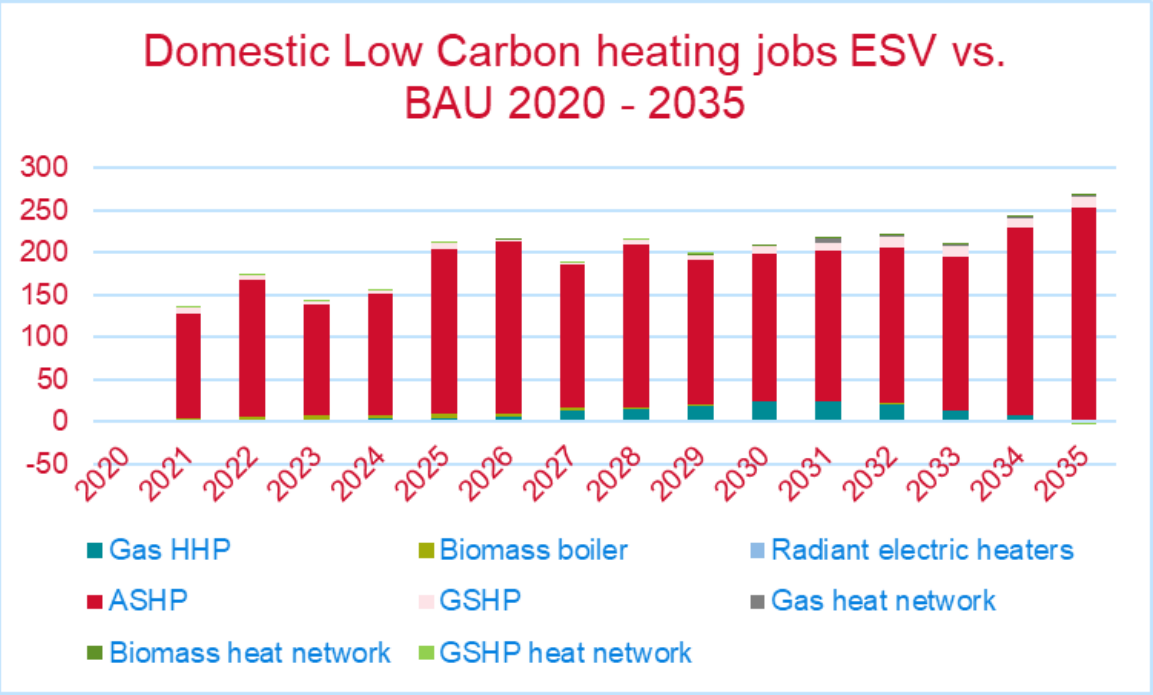



*Figure 36. Domestic Low Carbon heating jobs ESV vs. BAU 2020-2035*

## Summary

Across all technologies, the substantially higher level of effort related to decarbonisation and the energy transition in the energy system vision scenario requires more investment when compared against the business as usual scenario. Likewise, achieving the ESV scenario delivers more jobs and additional GVA. In total the ESV scenario requires £3.4 billion of additional investment which is a 65% increase against business as usual. In terms of jobs, the ESV scenario is estimated to require an additional 16,700 net jobs to deliver the accelerated deployment of renewable electricity generation technologies and the enhanced levels of energy efficiency. These additional jobs are associated with nearly £1.7 billion more GVA (discounted at 3.5% over the period 2020-2035). In addition, it is estimated that there will be over 3,000 more gross jobs associated with the provision of low-carbon heating technologies in the ESV scenario than the BAU scenario, associated with £361 million of GVA.

# Next Steps

# Next Steps

The Cardiff Capital Region Energy Strategy has undertaken several important first steps towards addressing the climate emergency in CCR. We have developed a collaborative vision for the future energy system in CCR and defined key priority areas that are essential to achieving that vision. The assessment of current energy sector emissions has enabled a deeper understanding of the progress that has been made in decarbonisation to date as well as the gap between our current activities and a net zero energy system.

Building on this, the energy modelling demonstrates a potential pathway to 2035 that is consistent with the long term aim of achieving net zero by 2050. This is coupled with an assessment of the economic benefits associated with transforming our energy system in alignment with this trajectory. This will be critical in communicating the benefits of action and demonstrating the potential for far greater local economic benefits than could be achieved by return to business as usual, particularly in the context of a green, economic recovery from the COVID-19 pandemic.

There are three crucial next steps that we will now take to transition from a strategy to real world action in the delivery of our CCR energy system vision:

1) **Defining the strategy governance.** We will establish a robust and formal governance structure for the CCR Strategy. This will include defining a structure of cross-sectoral governance, powers, roles and responsibilities for overseeing the implementation of the strategy, and the monitoring and evaluation of its progress. This is essential to coordinate and unlock action, and to ensure momentum going forwards.

2) **Communicating and socialising the strategy.** We will undertake a series of engagement activities to communicate, socialise and build support for the final strategy amongst key political, corporate and community stakeholders throughout the region. This activity will help to align a diverse stakeholder group to the CCR energy vision and raise awareness of insights arising from the analysis and engagement undertaken as part of the strategy development.

3) **Establishing a delivery plan.** We will create a delivery plan for addressing the challenges identified in the energy modelling work, and for defining the processes and actions that could be taken forward to realise the energy system vision. We anticipate that the delivery plan will be a living document that is regularly reviewed and updated, and may be influenced by future local area energy planning or other relevant developments and research.

The energy modelling presented has shown that significant action is required for the Cardiff Capital Region to be on track for a net zero future and that we have the tools and technologies to make progress now. The economic assessment confirms that the challenge is large and will require investment from households, businesses, investors, and the public sector. This challenge is matched with a vision that reflects the values demonstrated by stakeholders throughout the development of this strategy.

The economic assessment also illustrates that the energy system transition may bring benefits to the Cardiff Capital Region in the form of jobs, however additional investigation is required to maximise these benefits. Likewise, the energy vision clearly sets out the intention that the future energy system should support the wellbeing of communities wherever possible. These next steps will help to scale up the existing decarbonisation and energy transition efforts in the region and turn the vision into action.

# Cardiff Capital Region Energy Strategy

## DRAFT v.1

### Our vision for 2035

*"To create the conditions for a transition to a carbon neutral economy and society in the CCR, using low carbon energy as an enabler of economic regeneration, growing our regional income whilst maintaining guardianship of our environment through a laser-focus on clean growth"*

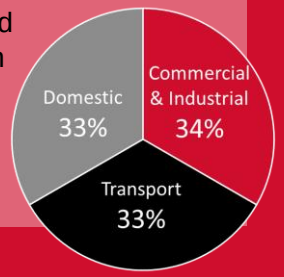
Prifddinas Ranbarth Caerdydd | Cardiff Capital Region

## Our priorities

- **Energy efficiency and heat**
- **Electricity and flexibility**
- **Decarbonise transport**
- **Grow business and jobs**
- **Coordination, planning, regional support and ownership of the plan**

## Our baseline energy assessment

- We consume **36%** of total energy consumed in Wales
- We host **22%** of Wales' renewable energy capacity
- **90%** of homes are connected to the gas network and **0.2%** use a biomass boiler or heat pump
- We have **709 MW** of renewable energy installed in the region, of which **31%** is locally owned
- Our total energy consumption fell by **22%** between 2005 and 2013 and greenhouse gas emissions from our energy system fell by **35%** between 2005 and 2017
- Commercial and industrial electricity consumption constitutes **55%** of all electricity consumption
- Transport is dominated by private car use with **0.3%** of cars pure electric
- Our sectoral energy demand split:




## Energy vision modelling assumptions

**Domestic**
- 42,000 homes insulated
- 140,000 heat pumps installed
- 154,000 homes improved to EPC band D, C and B
- 112,000 homes moved from fossil fuelled to low carbon heating
- No new gas connections from 2025

**Commercial & industrial**
- Decarbonisation of the electricity network through renewables and behind the meter generation
- Switch to alternative fuels and electrification of heating
- 13% energy demand reduction

**Renewable electricity**
- Sufficient flexibility, storage and network infrastructure upgrades
- Equivalent of 50% of total energy consumption generated from regional renewables
- 532MW onshore wind
- 830MW solar PV

**Road transport**
- 64% of vehicles electric by 2035
- 20% reduction in private vehicle mileage
- 3,300 gas and hydrogen HGVs and 1,000 hydrogen vehicles
- Increased public transport and active travel

## Achieving our energy vision

To meet Welsh Government targets, and to be on track for net zero by 2050, we need to reduce emissions from our energy system by **55% by 2035** split by sector as follows:

- **- 60%** Transport
- **- 51%** Domestic heat & power
- **- 54%** Commercial & industrial

## Estimated additional economic impacts of achieving our energy vision compared to business as usual:

| | Net Jobs | GVA |
|---|---|---|
| Electricity generation | +7,429 | +£853m |
| Domestic heat | Gross Jobs +3,005 | +£361m |
| Domestic energy efficiency | +413 | +£19m |
| Commercial energy efficiency | +269 | +£12m |

**£3.5 billion additional investment** required to achieve our energy vision

* all figures shown are approximate values

**Levelling Up Prospectus**

**Decarbonisation Work Programme**

Cardiff Capital Region, with support from Welsh Government, has an Energy Vision which has been modelled to set out a potential decarbonisation route that will put the region on track to achieve a net zero energy system by 2050, in line with UK Government objectives. Investment in the modelled outputs will produce a greater GVA and increase in jobs than business as usual.

**The energy vision scenario modelling** assumes a significant shift above and beyond business as usual across these three sectors by 2035, in order to be on track by 2050, in other words relying on business as usual means that we will fail our 2050 targets.

We are determined to play our part in delivering this radical transformation. We see the next 15 years as the most consequential period in the history of humanity, demanding from us our best endeavours in dealing with a global pandemic and a climate and extinction emergency. Succeeding with this Levelling Up request will allow us to fully participate in responding to these unprecedented and unparalleled challenges.

We have the necessary ambition and a stubborn, gritty optimism. We see huge potential for positive change, for instance utilising the region's natural energy generating assets, and using the strength of our existing manufacturing base as a springboard for a transition to a hydrogen economy with the creation of multiple Clean Growth hubs.

In order to deliver this transformation described here, we propose establishing the Cardiff City Region Energy Agency. The aim of the agency would be to link the decarbonisation agenda to economic growth through delivery of programmes and innovation initiatives. The Agency would be a lead, working with the 10 CCR Local Authorities, in the acceleration of emissions reduction, increased implementation of technological innovations and in setting an enhanced forward thinking policy agenda.

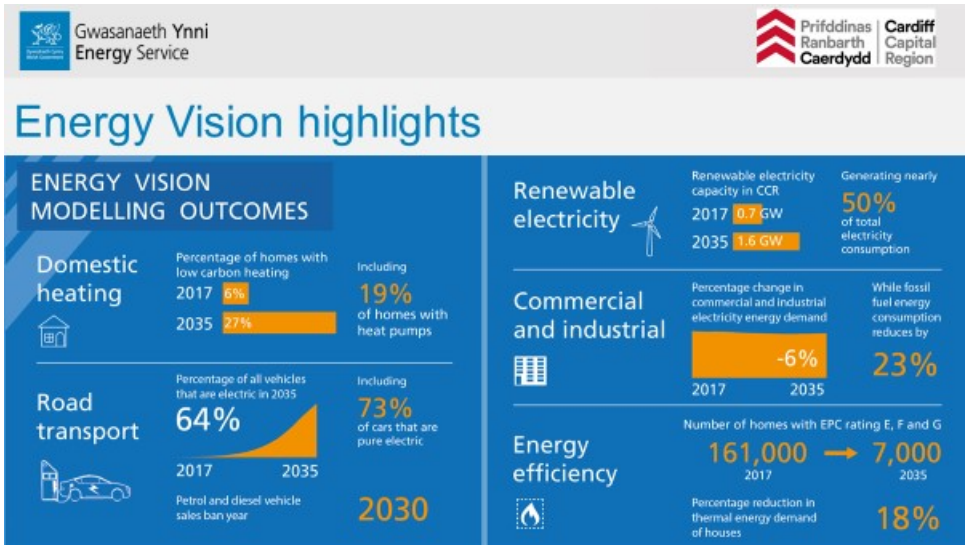
**Our vision** for Cardiff Capital Region is:

*To create the conditions for a transition to a carbon neutral economy and society in the CCR, using low carbon energy as an enabler of economic regeneration, growing our regional income whilst maintaining guardianship of our environment through a laser-focus on clean growth.*

To meet the targets Cardiff Capital Region needs to reduce emissions from its energy system by 55% by 2035, split by sector as follows, with visualisation below:

- 51% reduction in domestic heat and power emissions;
- 54% reduction in commercial and industrial emissions;
- 60% reduction in road transport emissions.

The indicative requirements of the transformation, modelled to achieve the future vision are shown diagrammatically below:




To turn to each of these areas in more detail :-

**Domestic:**

In terms of context the region has a high level of fuel poverty at 12% and below average levels of energy performance in its EPC bandings.

To be on track to achieve the 2050 targets, we need by 2035 to have achieved the following :-

- 154,000 homes need to be improved from EPC band G, F and moved to E to D, C and B;

- Working with Wales and West Utilities we want to build on Project Flexis to deliver hybrid heating systems and achieve over 140,000 installations of heat pumps;
- 42,000 suitable houses accurately fitted with internal or external wall insulation;
- Over 185,000 other insulation measures in homes;
- 112,000 homes currently heated by fossil fuels to move to low carbon heating;
- Replacing heating systems in oil, LPG and solid fuel heated homes prioritised;
- No new gas connections for homes from 2025.

**Our proposition**

There are currently insufficient mechanisms to incentivise householders to tackle the harder to deliver domestic retrofits. The region also has above average fuel poverty at 12%.

Recent Local Partnerships research suggests that there are four main barriers to private sector investment in domestic and commercial building retrofit:

- Availability of funds and suitable payback periods
- The knowledge of what to do
- Trusted contractors to undertake the work
- The level of disruption whilst the work is undertaken

In order to increase take up of measures we propose the following:

a) A review of potential funding mechanisms. Some of the measures have payback suitable for a ‘revolving door’ type loan arrangement. This could be secured on the property (as opposed to the individual) with regular payments being made alongside Council Tax or Business Rates. The savings would need to offset the loan payments for this to be attractive. Attaching the loan to the property as opposed to the individual simplifies the lending arrangements, especially as this investment mechanism does not touch the mortgage.

b) For measures required which do not offer a suitable payback consideration needs to be given to an element of grant funding to make this more attractive.

c) A wrap around survey and specification offer to enable properties to be rapidly assessed and projects developed at scale and pace. Ideally this would work on a neighbourhood scale to bring economies of scale.

d) A trusted contractor scheme to deliver the works. This should also include providing additional training for local companies and individuals.

**Our Ask**

1) A derogation or ability to flex the system of Council Tax (perhaps through the addition of a sundry debt) to establish a repayment mechanism.

2) Revenue of £4m to set up, manage and promote the scheme to homeowners and landlords and establish a retrofit framework of local contractors

3) Capital Pot of £400m (part repayable in over 20 years and part grant) to incentivise customer take up and offer grant to the fuel poor and grant towards measures without an economic payback.

**Our Outcomes**

Gwasanaeth Ynni
Energy Service

CCR energy efficiency jobs and investment

| | BAU | ESV | ESV vs. BAU |
|---|---|---|---|
| Jobs | 21,970 | 31,318 | 9,348 |
| Investment | £4.6b | £6.6b | £2b |
| Number of measures | 3.7m | 5.3m | 1.6m |
| GVA | £1.3b | £1.9b | £555m |

Gwasanaeth Ynni
Energy Service

CCR low carbon heating

| | BAU | ESV |
|---|---|---|
| Jobs | 966 | 3,971 |
| Investment | £254m | £955M |
| GVA | £361m | £474m |

## Commercial and industrial:

The CCR region has areas of commercial and industrial strength that are capable of competing at a UK and international level. Building on our competitive advantage and opportunity within the economy we are strategically targeting sectors for support, enabling them to grow and flourish. The region is also well skilled with a high proportion of the population with qualifications of degree level or equivalent. This makes CCR one of the most investable regions in the UK and an ideal environment for innovation led growth.

One such sector to benefit from CCR investment is the Compound Semi-Conductor Sector. In 2017 Cardiff Capital Region City Deal committed to a £38.5M project in acquiring and equipping the Compound Semiconductor Foundry in Newport, which is leased to IQE. This will help leverage up to £400m of private investment over the life of the project, to drive forward expansion and anchor the sector in the region.

The investment in the Foundry sits alongside £270m of strategically significant CS investments and assets already made in the region, which include:

- the Institute of Compound Semiconductors – which focuses on early stage R&D and is a partnership between IQE, Welsh Government and Cardiff University;
- the CSC Centre for Excellence – focusing on prototyping and a partnership with IQE and Cardiff University;
- applications-based Catapult Centre – led by Innovate UK and located at IQE's mega foundry in Newport;
- Centre for Integrative Semiconductor Materials – a materials foundry at Swansea University.

Investment in this sector will shortly be increase with UKRI funded CSConnected project. The project is based around integrating research excellence from the region's universities with the region's unique supply chains in advanced semiconductor manufacturing.

It is believed that the region has all the ingredients to develop similar growth and opportunity in the energy and environment sector. In line with UK ambition on hydrogen, the Welsh Government has commissioned a pathway strategy document for hydrogen in Wales, and this together with a baseline hydrogen activity assessment will be completed this year and will inform the low carbon transition plan moving forward, and also align activity to support the creation of a hydrogen market in Wales.

The region has a large number of significant manufacturers who use large volumes of process gas, including Celsa, Rockwool, Dow Corning, Tarmac and Tata in Newport.

In the first instance, working with the South Wales Industrial Cluster and IUK, CCR is expecting a bid into its newly created Local Welfare and Challenge Fund, which will resource a 6 month period of optioneering on up to 8 Clean Growth Hubs in South East Wales.

## Our Proposition

We wish to see a pioneering transition to hydrogen as an industrial fuel source.

Within the Commercial and Industrial sector we also wish to deliver a significant energy efficiency programme, with building integrated renewables to reduce energy demand by 13% and secure electrification of heating.

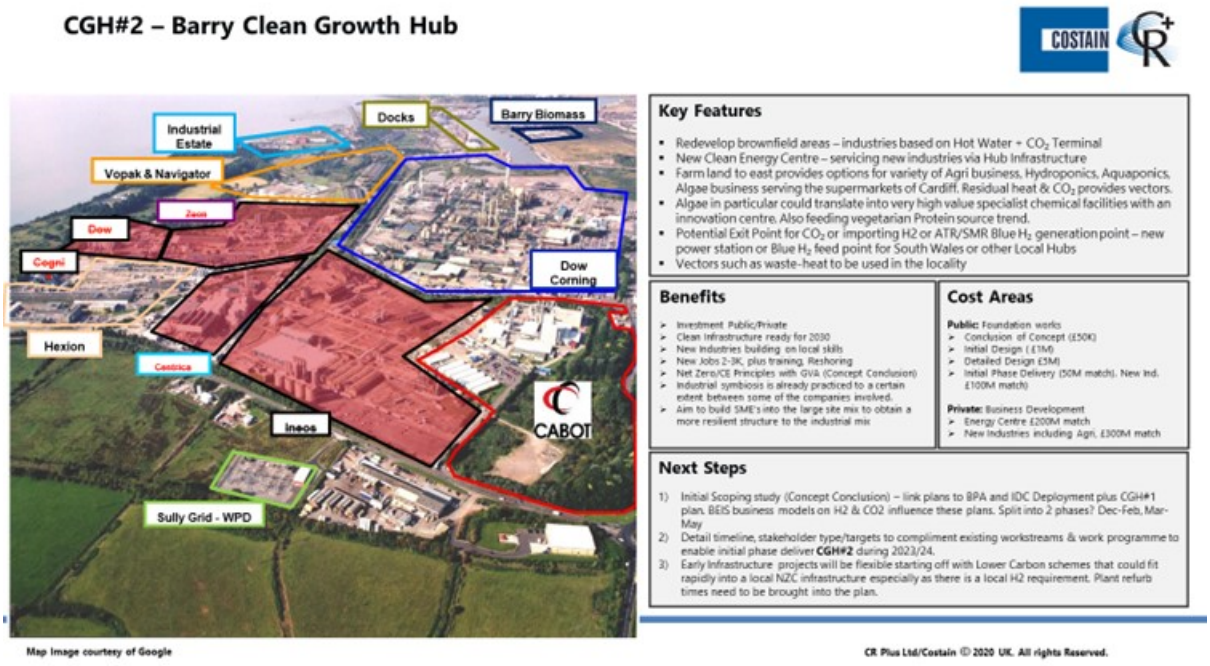
**Our Ask**

4) In order to be investment ready, with engineering and business requirements on an anchor site we require kick-start funding of £3m. This would enable the optimum industrial combinations and stakeholder buy in. The expected match from the first industrial adopters would be in the region of £50m.

This funding would achieve the following:-

- 15 potential sites for Clean growth hubs have been identified – an example of the clean growth hub at Barry Docks is shown below. Scoping of all 8 is required, with risk and opportunity profiling, to select 2 initial preferred locations.
- Undertake two feasibility studies on preferred locations to map process flows to select optimum industry combination and gain stakeholder buying
- Deliver Front End engineering reports for the two sites to establish the inward and outward connections and process flows, and determine an entity which is viable with financial constraints.

Initial work undertaken by the South Wales Industrial Cluster shows that there is potential opportunity in Wales for 25 clean growth hubs which they estimate as requiring £12.5 billion investment up to 2040, but with the creation of 62,000 jobs, plus the retention of existing manufacturing.




We would work with Wales and West Utilities and Welsh Water as both organisations have an appetite, appropriate infrastructure and access to funding for this transition.

We anticipate that if we can grow the demand for hydrogen then we would support further expansion customer base and supply chain into target areas such as domestic heating and transport fuels.

5) The Cardiff economy is also strong in the commercial and finance sector. Whilst asset rationalisation will be ongoing as part of the response to the pandemic we would like to offer Green Deal type energy efficiency retrofit proposal to the Commercial market uses the mechanism of Business rates to recover the investment. We seek a derogation on arrangements for charging and collecting Business Rates to finance what would be in large part a revolving fund for retrofit.

6) Revenue of £2m to set up and manage a scheme for a retrofit framework of local contractors for commercial premises

7) Capital Pot of £500m (repayable in large part over 20 years) to incentivise business customer take up.

## Road transport:

CCR has a high dependence on private cars for transport. Average annual vehicle miles in CCR are 17% higher than the UK average.[1] Less than 1% of road miles are driven by buses and coaches in CCR.[1]

The £738 million Metro project – the cornerstone of our original £1.2billion City Deal - will create a credible mass transport infrastructure that is likely to drive a modal shift from private vehicle use to public transport. This modal shift alone will not be enough to decarbonise transport in the region; a shift to electric and hydrogen vehicles will also be needed.

To date, CCR has seen a slow uptake of electric vehicles. Approximately 0.3% of cars registered in the region are pure electric, compared with an average of 0.6% of vehicles across Great Britain. Similarly, despite a surge in charger installations in 2019, CCR currently hosts 173 public charging devices, including 31 rapid public chargers[2]. This is relatively low, as is the case across Wales, where there are half the number of public EV chargers per capita compared to Scotland.

### Proposition

To achieve our targets we need 516,000 EV cars (equivalent to 64%) and small vans to be in use by 2035 which will require an estimated network of 10,000 charge points. High-level estimates suggest that this EV charging infrastructure will cost between £33m and £108m excluding grid connection costs. We believe that poor access to

[1] DFT (2019) Road traffic statistics (TRA) https://www.gov.uk/government/collections/road-traffic-statistics and Regen transport model

[2] DFT (2019) Electric Vehicle Charging Device Statistics https://www.gov.uk/government/statistics/electric-vehicle-charging-device-statistics-october-2019

charge points is a significant part of the slow transition to EV. Accelerating the deployment of EV charge points will provide the infrastructure needed to support the EV transition. Likewise, EV charging infrastructure may also support local EV business by providing the right eco-system. For example, the Cardiff Capital Region also aims to host the UK's first Giga Factory, producing EV batteries. If we can accelerate the transition to EV then we can help underpin the business start-up with BristishVolt.

Power electronics are at the heart of vehicle electrification, managing and optimising the power transfer between the battery (or fuel cell) and the electric motor. Incorporating compound semiconductors into power electronics can deliver significant performance and cost advantages – delivering vehicles that are lighter, more powerful and have greater range.

CSA Catapult, has created a state-of-the-art innovation centre within the compound semiconductor campus at Imperial Park, in South Wales and is already accelerating the UK towards its Net Zero goal. It is working with over 60 partners on projects worth in excess of £70m which will directly impact our ability to use more renewable energy and further electrify vehicles.

### Our Ask

8) To overcome the criticism of range anxiety and improve confidence we would like to launch a £75m competitive fund (similar in principle to the OLEV EV charging fund) to incentivise and underwrite the installation of EV charge points. This would improve investor confidence given the long payback periods for this infrastructure.

## Renewable electricity generation:

The Energy Vision modelling has assessed the land within the CCR region in terms of areas zoned for renewables from planning policy Strategic Search Areas and the Welsh Government's National Development Framework (due to be launched Feb 21). This analysis showed that it is possible to install 1.6GW of renewable electricity in the CCR region (which includes 532MW of wind and 820MW of solar).

The region will also work with the local DNO Western Power to jointly ensure sufficient flexibility, including storage, and network infrastructure upgrades to enable low carbon generation and demand technologies to connect.

The ambition is that the region will generate the equivalent of ~50% of its total energy consumption in 2035 from regional renewable sources.

### Our Proposition

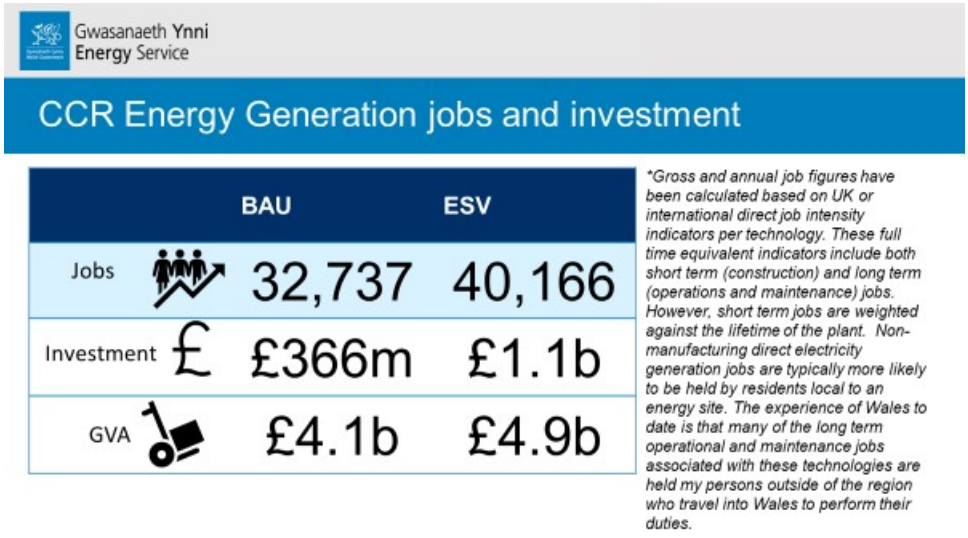
New Welsh Government policy requires local ownership of new energy assets. We have evidence that whilst this requirement is popular with private sector developers and local stakeholders there is a concern that developments are slowing and stalling as the practical arrangements to make this happen are not yet fully understood.

Additional opportunities exist directly on the public sector estate with approximately 95MW of wind projects identified on the public sector estate, with favourable grid and planning prospects. Progress is however slow, as each of the 4 public bodies involved do not have the necessary expertise or capacity to progress these projects at pace and scale.

**Our Ask**

9) Creation of a repayable stimulus pot of £200m, which is the equivalent of delivering a 20% public sector ownership in the 1.6GW pipeline. This will galvanise the construction of renewable projects by derisking the local ownership requirement and bringing investor confidence. We would anticipate around that the investment programme would perform at around 10% IRR for the public sector.

10) In respect of the public sector 90MW wind programme fund a Programme Manager and £1m development fees to coordinate the projects and steer the projects into and through planning, procure developers and oversee the construction contracts form the clients' perspective.




## Summary of Asks

| Initiative and ask | Levelling Up Ask | Repayable | Private sector match | Public sector match |
|---|---|---|---|---|
| Domestic retrofit | | | | |

| | | | | |
|---|---|---|---|---|
| 1)derogation | Flexibility | n/a | n/a | n/a |
| 2)retrofit arrangements | £4m revenue | no | no | no |
| 3) capital pot | £400m capital | 75% yes within 15 years | no | £10m |
| Commercial & Industrial | | | | |
| 4) Hydrogen feasibility and kick start | £3m revenue | no | £50m in 10 years | no |
| 5) derogation | Flexibility | n/a | n/a | n/a |
| 6) retrofit arrangements | £2m revenue | no | no | no |
| 7) capital pot | £500m capital | 75% yes within 15 years | £7.5m | no |
| Transport | | | | |
| 8) EV charging | £ 110m capital | 50% yes within 15 years | 55m over 15 years | no |
| Renewable energy | | | | |
| 9) Programme team | £1m revenue | no | no | In kind |
| 10) Local ownership pot | £200m capital | 100% within 15 years | no | no |
| TOTALS | Revenue £10m<br><br>Capital £1.2bn | | £112m | |

**The economic impacts** of achieving the **totality** of the energy vision have been assessed in terms of job creation, gross value added (GVA) and the investment required for the energy transition, in comparison to business as usual. Investing to achieve the Vision produces more GVA and net jobs than allowing BAU. A detailed annex of the full techno-economic analysis is available.

This techno-economic analysis from the REP work shows that the investment needed between now and 2035, in order to meet the energy system transformation for 2050, totals £8.6bn, with investments required from a range of stakeholders. This investment would result in 75,500 (mostly net) jobs and a £7.2bn uplift in GVA.

**Evidently, with our Levelling up Prospectus we anticipate contributing significantly, to kick starting and delivering these economic outputs.**

The Prospectus, in respect of decarbonisation is asking for £1.2bn capital as a chunk of this investment, to deliver outputs as a stimulus boost to this transition and to establish delivery mechanisms and programmes of work. This approach is predicted to give us a GVA of £1.2bn and 12,414 jobs, reflecting the specific job qualities of energy efficiency and renewable technologies, which we are proposing for the Prospectus. The prospectus also promotes a boost for hydrogen, in line with the recent UK Green Industrial Revolution announcements. There is currently some uncertainty on the hydrogen economic impact.

# Future Generations Assessment Evaluation
## (includes Equalities and Sustainability Impact Assessments)

| **Name of the Officer completing the evaluation:**<br><br>Kellie Beirne<br><br>**Phone no:** 07826 919286<br>**E-mail:** kellie.beirne@cardiff.gov.uk | **Please give a brief description of the aims of the proposal**<br><br>Cardiff Capital Region Energy Strategy |
|---|---|
| **Proposal:** Cardiff Capital Region Energy Strategy | **Date Future Generations Evaluation form completed:** 7 December 2020 |

1. **Does your proposal deliver any of the well-being goals below?** Please explain the impact (positive and negative) you expect, together with suggestions of how to mitigate negative impacts or better contribute to the goal.

| **Well Being Goal** | **Does the proposal contribute to this goal? Describe the positive and negative impacts.** | **What actions have been/will be taken to mitigate any negative impacts or better contribute to positive impacts?** |
|---|---|---|
| **A prosperous Wales**<br>Efficient use of resources, skilled, educated people, generates wealth, provides jobs | The energy vision work sets out a clean growth agenda – the potential to safeguard planetary life support systems whilst growing regional income. | The vision has bene stakeholder informed and analysis of issues independently informed by data, evidence and insights.<br><br>To optimize potential for impact this will be incorporated into a full action plan with a resultant 'energy mission'. |
| **A resilient Wales**<br>Maintain and enhance biodiversity and ecosystems that support resilience and can adapt to change (e.g. climate change) | The report goes to the heart of the sustainability and resilience mandate. | More work needs to be done to show sustainability and economic growth are not mutually exclusive and CCR has the opportunity to demonstrate this. |

| Well Being Goal | Does the proposal contribute to this goal? Describe the positive and negative impacts. | What actions have been/will be taken to mitigate any negative impacts or better contribute to positive impacts? |
|---|---|---|
| **A healthier Wales**<br>People's physical and mental wellbeing is maximized and health impacts are understood | Direct impact in terms of health, wellbeing and environmental benefits. | Climate crisis is causing worry and concern. More work will be needed in future to understand the link between anxiety and mental health and the state of the environment. |
| **A Wales of cohesive communities**<br>Communities are attractive, viable, safe and well connected | Safeguarding environment and world key to ensuring communities can thrive | ROI assessments need social and environmental dimension and 'clean growth' aims to be more clearly understood. Work ongoing with Prof Max Munday to draw this out as part of wider approach to alternative economic intelligence. |
| **A globally responsible Wales**<br>Taking account of impact on global well-being when considering local social, economic and environmental wellbeing | The report is a demonstration of CCR-wide responsibility to the planet | |
| **A Wales of vibrant culture and thriving Welsh language**<br>Culture, heritage and Welsh language are promoted and protected. People are encouraged to do sport, art and recreation | Our City Deal is uniquely Welsh – but pitches towards being world leading in areas of competitive strength. This enables a strong reflection on our rich culture and heritage which is drawn from our natural environment and resources. | |
| **A more equal Wales**<br>People can fulfil their potential no matter what their background or circumstances | The environment and climate crisis is a leveler – we are all responsible – we can all make a difference. | |

**2. How has your proposal embedded and prioritized the sustainable governance principles in its development?**

| Sustainable Development Principle | Does your proposal demonstrate you have met this principle? If yes, describe how. If not explain why. | Are there any additional actions to be taken to mitigate any negative impacts or better contribute to positive impacts? |
|---|---|---|
| Balancing short term need with long term and planning for the future | This is both a short, medium and long term goal and a golden thread running through all projects and programmes. | Continued work on data/ evidence and generating in equal measure, insight and foresight. |
| Working together with other partners to deliver objectives | The report sets out the different partners and sectors engaged in this work and the challenge process is about collective endeavor- civil society, business, HE, public services and community sectors. | More work to develop, align and promote shared purpose on this agenda. |
| Involving those with an interest and seeking their views | The report sets out the different partners and sectors engaged in this work | |
| Putting resources into preventing problems occurring or getting worse | Report and resultant action plan should create conditions for this to happen – at scale. | |
| Considering impact on all wellbeing goals together and on other bodies | This will be undertaken on a case by case basis through the new assessment process. | |

**3. Are your proposals going to affect any people or groups of people with protected characteristics?** Please explain the impact, the evidence you have used and any action you are taking below.

| Protected Characteristics | Describe any positive impacts your proposal has on the protected characteristic | Describe any negative impacts your proposal has on the protected characteristic | What has been/will be done to mitigate any negative impacts or better contribute to positive impacts? |
|---|---|---|---|
| Age | As with all those categories below – the impacts will relate to specific delivery that underpins the execution and operation of this Plan | None arising at this time. | |
| Disability | As above | As above | |
| Gender reassignment | As above | As above | |
| Marriage or civil partnership | As above | As above | |
| Pregnancy or maternity | As above | | |
| Race | As above | | |
| Religion or Belief | As above | | |
| Sex | As above | | . |
| Sexual Orientation | As above | | |
| Welsh Language | As above | | |

**4. Safeguarding & Corporate Parenting. Are your proposals going to affect either of these responsibilities?**

| | **Describe any positive impacts your proposal has on safeguarding and corporate parenting** | **Describe any negative impacts your proposal has on safeguarding and corporate parenting** | **What will you do/ have you done to mitigate any negative impacts or better contribute to positive impacts?** |
|---|---|---|---|
| Safeguarding | Not directly relevant –however, building the future economy in a sustainable way should have a profoundly positive impact on ability to safeguard the future of our residents | | |
| Corporate Parenting | Not directly relevant – however building strength in the economy should create opportunities for all of the young people entrusted in our care – in particular in safeguarding the environment for their futures. | | |

**5. What evidence and data has informed the development of your proposal?**

- Analysis of energy consumption
- Mazzucato work on energy mission for GMA and UN
- Collaboration with Energy Services catapult
- Collaboration with GMA CA

**6. SUMMARY: As a result of completing this form, what are the main positive and negative impacts of your proposal, how have they informed/changed the development of the proposal so far and what will you be doing in future?**

As above, the main implications will be in the delivery of this work.

**7. MONITORING: The impacts of this proposal will need to be monitored and reviewed. Please specify the date at which you will evaluate the impact, and where you will report the results of the review.**

| | |
|---|---|
| **The impacts of this proposal will be evaluated on:** | Quarterly 2020/21 and beyond |