2006-2 Carbon Emissions Trajectories

Portsmouth Water

Commercial in Confidence

Final report

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Optopia
Optimising your net zero future

Contents

Acronyms

Acronym	Meaning
BAU	Business As Usual
CAW	Carbon Accounting Workbook
CPPA	Corporate Power Purchase Agreement
DI	Distribution Input
DYAA	Dry Year Annual Average
EV	Electric Vehicle
GAC	Granular Activated Carbon
LTDS	Long Term Delivery Strategy
PC	Performance Commitment
PIC	Public Interest Commitment
REGO	Renewable Energy Guarantee of Origin
WRMP	Water Resources Management Plan
WTT	Well to tank

Executive summary

This report evaluates Portsmouth Water's (PW) future emissions under 2 scenarios: business as usual, and mid case. We highlight some key takeaways from the modelling below.

Public interest commitment (PIC)

- PW has previously committed to net zero operational emissions by 2030.
- The carbon footprint for the PIC is on a relatively narrow boundary: Scope 1 and 2 emissions and Scope 3 where a core activity is outsourced.
- It is also reported on a market basis, so measures like the procurement of green energy tariffs/ and or purchase of carbon offset certificates can be used to reduce reported emissions.
- As a result, in a best case, PW can meet its 2030 commitment, but only through offsetting. The trajectories in this report would involve work beyond business as usual: to reduce energy use, reduce mileage, decarbonise vehicles, work with supply chain partners to reduce their footprint, onsite renewables.
- While some of these measures pay back for themselves relatively quickly (in five years or less for the mid case in this report); others would need to be justified on carbon reduction (rather than necessarily cost saving) grounds.

Projected net footprint under different assumptions	Metric	2021	2022	2030
Trajectory 1a: BAU with no interventions (PIC)				
	tCO2e	1,094	1,410*	873
	% change on 2021		29%	-20%
Trajectory 3: Mid case (PIC)				
	tCO2e	1,094	1,410*	838
	% change on 2021		29%	-23%

*emissions increase in 2022 as compared to 2021 in 3 main areas:

Increased 3rd party emissions (vehicles), Increased refrigerant reporting (1 to 4 categories)

Increased fuel oil use (generators), Increased gas usage (office buildings)

New Performance Commitment (PC)

- Ofwat has introduced a new operational greenhouse gas reporting commitment for PR24.
- It has a wider footprint boundary than the PIC e.g. it includes chemicals and well to tank emissions for energy.
- It is also calculated on a location basis, which means that key market measures possible under the PIC (e.g. low carbon energy tariffs and carbon offsets) would not be eligible.
- Lastly, emissions factors will not reduce over time and are fixed at 22/23 assumptions. This means that decarbonisation of the grid and other external activities, impacting emission factors, will not affect emissions under the PC.

- These differences mean that PW's absolute footprint is higher under the PC than the PIC i.e. the two footprints cannot be compared like for like.
- In terms of the trajectories, the rate of reduction for the PC is slower than for the PIC, due to the differences above. Even though the actions PW is assumed to take are very similar for both reporting boundaries, the results are necessarily less impactful than for the PIC.

Projected net footprint under different assumptions	Metric	2021	2022	2030
Trajectory 1b: BAU with no interventions (PC new)				
	tCO2e	7,551	8,439	7,270
	% change on 2021		12%	-4%
Trajectory 2: Mid case (PC)				
	tCO2e	7,551	8,439	6,435
	% change on 2021		12%	-15%

Projected PC under different assumptions	Metric	2021	2022	2030
Trajectory 1b: BAU with no interventions (PC new)	kgCO2e/Ml	115	128	123
	% change on 2021		11%	7%
Trajectory 2: Mid case (PC)	kgCO2e/Ml	115	128	109
	% change on 2021		11%	-5%

We note that the results are contingent on a range of assumptions which given they look to the future are inherently uncertain. Key uncertainties include:

- Delivery of the WRMP – the scenarios are contingent on reducing electricity and chemical use in line with reduced supply
- Engaging suppliers – outsourced emissions (e.g. from third party vehicles) are included in both footprints and delivering the trajectories requires their emissions to be reduced too
- Fleet decarbonisation – all scenarios assume switching all vehicles to EV commencing in 2026, in line with the fleet strategy; if this takes longer than anticipated to achieve, the rate of footprint reduction will be slower.
- Energy reduction measures – all scenarios assume a reduction in energy use through energy savings and these projects will need to deliver to the levels expected to achieve the trajectories
- Reporting guidance – reporting guidance is subject to update and change which can affect the footprint reported and the emissions abatement options available
- Costs of abatement – this report makes simple assumptions about the costs of market measures like REGOs and carbon offsets. Their price can fluctuate materially driven by international markets.
- Electricity emissions factors – particularly for the PIC, if the grid decarbonises more slowly than anticipated, the trajectories will reduce more slowly.

- Head office and network building upgrade: all scenarios assume that these will progress as planned and achieve the estimated energy reductions, including moving away from gas heating in both buildings.
- HTWSR: emissions associated with HTWSR operation have not been included in any of the trajectories, this will have a material difference if included.
- GAC: it has been assumed that GAC is no longer required as part of the treatment process, zero emissions were reported in 22/23 associated with virgin or regeneration of GAC and this has been projected froward in the models.

1. Introduction

In May 2023, Ofwat published the final definition PR24 operational greenhouse gas emissions performance commitment (PC) for water companies like PW. PW asked Optopia LTD (Optopia) to help assess the trajectory its emissions could follow, in line with the scope of the PC.

This follows PW's publication of its own Net Zero Routemap, which set out how it plans to deliver the sector-wide public interest commitment (PIC) for net-zero emissions by 2030. PW also asked Optopia to update its view of future emissions based on the PIC scope, to establish how it is progressing to date and the activities needed to meet the PIC.

To do this, Optopia modelled three different trajectories:

- Trajectory 1: Business as Usual (BAU) or baseline emissions, with no net-zero specific interventions (reported both on a PC and PIC basis). This includes expected reductions in emissions from the WRMP, growth in emissions from the LTDS and firm changes to emissions through energy management.
- Trajectory 2: Mid case based on Ofwat's new PC criteria for PR24. This includes assumptions regarding the most cost effective emissions reductions (which payback capex investment through opex savings within 5 years, any reductions not meeting this criteria are delayed to AMP9).
- Trajectory 3: Mid case based on the original WaterUK PIC criteria. This includes the same assumptions as Trajectory 2 where they are in the scope of the PIC.

This document is the final report; it presents our final results based on data provided by PW and feedback on the draft results.

It is structured as follows: Section 1.1 provides an overview of current reporting rules. Section 1.2 summarises our approach. Section 2 presents key assumptions that the results rely on. Section 3 presents historic emissions and compares the scope of the PIC to the scope of the PC. Section 4 presents the two pathways for the PIC and explains the differences. Section 5 does the same for the PC trajectories. Section 6 compares all of the trajectories. Section 7 sets out key risks, challenges and recommended areas for action.

We have also provided a spreadsheet alongside the report, which sets out annual projected emissions for each trajectory (tCO2e), % change on 21/22 emissions. For the PC trajectories, it also reports those emissions on a kgCO2e/Ml basis.

1.1. Carbon reporting boundaries

This section describes the different sources of emissions included in the trajectories.

The report uses the following terminology, in line with the Greenhouse Gas (GHG) Protocol[1]:

- Scope 1 direct emissions from company's own activities. For a water company these can include: refrigerants and fuels including gas oil, diesel and natural gas
- Scope 2 indirect emissions from fuels. For a water company these can include: emissions from imported electricity or heat
- Scope 3 other indirect emissions. For a water company these can include: transmission and distribution losses from grid imports, well-to-tank emissions of fuels, outsourced activities, chemical use, business travel

The project covers operational (rather than embedded) emissions only. The modelled emissions trajectories are based on one of two reporting boundaries:

- PIC: In 2019, the United Kingdom set a target of net zero emissions by 2050. The water sector agreed a more ambitious target, to achieve net zero by 2030 as set out in the net zero routemap[2]. PW has also committed to achieve net zero by 2030 and set out how it plans to do this in its own net zero routemap[3]. This footprint is based on a relatively narrow boundary: Scope 1 and 2 emissions and Scope 3 where a core activity is outsourced. It is also reported on a market basis, meaning that measures like the procurement of green energy tariffs/ and or purchase of carbon offset certificates can be used to reduce reported emissions.
- PC: In December 2022, Ofwat announced[4] that it will introduce a performance commitment for operational emissions at PR24. It confirmed its final guidance for this in May 2023[5]. Key differences to the PIC are:
    - Location based – market methods to reduce emissions e.g. green tariffs or offsetting do not count as a reduction (1% of gross location-based emissions may be offset from projects that PW invests in and are part of its value chain ('insets')).
    - Fixed emissions factors – emissions factors are fixed at V17 of the Carbon Accounting Workbook (CAW) i.e. 22/23 factors. This means that future reductions in emission from e.g. electricity grid decarbonisation does not count as a reduction
    - Chemicals – the PC includes the carbon impact of chemicals usage which has a material impact on PW's reported Scope 3 emissions compared to the PIC.
    - Well to tank (WTT) emissions – emissions from the extraction, production, transmission and distribution of electricity, heat and purchased fuels. Given the volume of electricity

[1] https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf
[2] https://www.water.org.uk/routemap2030/wp-content/uploads/2020/11/Water-UK-Net-Zero-2030-Routemap.pdf
[3] https://www.portsmouthwater.co.uk/wp-content/uploads/2021/07/2030-NET-ZERO-CARBON-ROADMAP_28-JULY-2021-v1.pdf
[4] https://www.ofwat.gov.uk/wp-content/uploads/2022/12/PR24_final_methodology_Appendix_7_Performance_commitments.pdf
[5] https://www.ofwat.gov.uk/publication/pr24-operational-greenhouse-gas-emissions-performance-commitment-water/

used, this has a material impact on PW's reported Scope 3 emissions compared to the PIC.

1.2. Approach

This section provides an overview of our approach to quantifying the projections.

- Calculate baseline emissions: we used 22/23 actual activity data assumed constant, then modified it for known changes, e.g. as a result of the Water Resources Management Plan (WRMP), to estimate what activity levels would be in the absence of a net zero programme
- Establish a long list of abatement options: together with PW, we then constructed a pragmatic list of the way that carbon emissions at PW could be reduced.
- Scenario development: this list was then refined and the timing of each measure's implementation assigned to the baseline, a mid-case or a best-case.
    - Mid-case: carbon reduction and efficiencies measures where capex investment results in a payback of < 5years in Opex savings
- Emissions projection: we then used these assumptions regarding activity data, combined with future emissions factors to calculate future emissions
- Results review: we then summarised the findings of our analysis for presentation in this report and the templates that accompany this document.

2. Key data and assumptions

2.1. Abatement options for PW

We took the 22/23 activity data as a starting point and projected it forward assuming:

- the WRMP is delivered (reducing water demand, volume supplied and so reducing electricity and chemicals consumption).
- LTDS activities that may increase emissions go ahead.
- Some energy management measures already underway are assumed to be complete

In order to determine trajectories for future emissions, we then quantified a range of different ways that PW could reduce its carbon footprint:

- Impact of energy management measures on emissions, from energy efficiency to fuel switching
- Impact of fleet management on emissions, specifically mileage reduction and switching to electric vehicles
- Impact of planned onsite solar developments (assuming that PW retains the REGOs)

For PIC (i.e. market-based) trajectories only, we also quantified:

- Impact of green electricity procurement (assuming that this is of a quality aligned to carbon reporting guidance at the time)
- Impact of in/setting or offsetting on the footprint (assuming that this is the final step undertaken and uses good quality offsets, to be in line with net zero reporting guidance)

2.2. Key assumptions

This section sets out key data and assumptions on which the results rely (Figure 2.1). The assumptions reflect that this was a short, high-level project, designed to produce top-level outputs to inform the PC process. We are happy to provide further detailed information or answer questions as necessary.

Figure 2.1 Overview of key assumptions

Ref	Area	Data/ assumption	Source
1	Historic emissions	Historic data for all emissions sources taken from the input sheet to the Carbon Accounting Workbook	PW Water (22/23 activity data, checked against the APR)
2	Historic emissions factors	Historic emissions factors for most emissions sources taken from DESNZ emissions factors for company reporting (for the relevant year for the PIC or fixed at 22/23 for the PC)	DESNZ https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting
		Emissions factors for purchased Chemicals and Granular Activated Carbon (GAC) are taken from the CAW v17	CAW v17

Ref	Area	Data/ assumption	Source
		Well to tank (WTT) emissions factors are taken from DESNZ for: electricity, electricity losses, fuels (including fuels used in buildings and vehicles)	DESNZ
3	WRMP	Impact of WRMP on electricity and chemicals use is based on Table 3c: DYAA - Final plan.	Portsmouth Water WRMP24 Table-V6 2. Level Data 5NY Distributed Input
4	Projected grid emissions factor	Projected carbon emissions factor from Cornwall Insight (central for all trajectories except 4 which uses the high case).	Projected carbon emissions factor from HMT Green Book (December 2022)
5	Projected emissions factors for other activities	Assumed constant. Given the expected increase in biofuels e.g. for transport fuels, this should be conservative i.e. avoid underestimating the scale of the challenge.	Assumption
6	Abatement measures: energy efficiency and fuel switching	These assumptions have been taken from data held by PW (e.g. ESOS reports, the LTDS) supplemented with PW's knowledge and Optopia's experience to fill gaps and produce estimates A generic asset lifetime of 30 years is assumed, so that all measures installed in a scenario last until at least 2050.	PW & Optopia
7	Abatement measures: fleet management	PW's fleet has been modelled as part of the fleet strategy work. This includes a transition to an all electric fleet commencing in 2026. Vehicles will be transitioned to EV in line with the standard vehicle replacement cycle, unless suitable EV options are not available. In which case a more efficient diesel vehicle will be procured, and then replaced with an EV alternative at its next renewal time. It has been assumed that third party fleet, associated with outsourced activities, will transition at a similar rate to the PW fleet.	PW PW Fleet strategy Optopia
8	Abatement measures: renewable generation (onsite solar)	Existing renewable assets are assumed to continue at 22/23 levels for the remainder of the period. Solar sites coming on line in 23/24 have been included in the plan, as have the planned future sites. All solar developments have been assumed to be owned and operated by other group companies and not by PW (therefore do not count under the location based measure).	PW (Solar update 7/9/23)

Ref	Area	Data/ assumption	Source
9	Abatement measures: green electricity procurement	These assumptions have been taken from the net zero routemap and conversations with PW, supplemented with Optopia's own experience, data analysis and estimates. A REGO prices of £8/MWh is based on information from PW[6].	PW Optopia
10	Abatement measures: offsets	£15/5CO2e assumption has been used in the models. An indicative carbon removal offset price of £10-20 per tonne is based on publicly available information[7].	Optopia Renewable Exchange Woodland Carbon Code
11	Supply volumes to calculate the PC	Absolute emissions are divided by supply volumes to give kgCO2e/ Ml as well as tCO2e for PC reporting.	Portsmouth Water WRMP24 Table-V6 2. Level Data 5NY Distributed Input Multiplied by 365 days
12	HTWSR not included	HTWSR operational emissions have not been included in the trajectories, as advised by PW, chemicals or electricity. These are to be reported separately, no detailed information available on this provided.	PW

2.3. Comparison of trajectory assumptions

An overview of each trajectory is provided in Figure 2.2 below.

Figure 2.2 Overview of trajectory assumptions

	PIC		PC	
	Trajectory 1a	Trajectory 3	Trajectory 1b	Trajectory 2
	BAU with no interventions (PIC)	Mid case (PIC)	BAU with no interventions (PC)	Mid case (PC)
Location or market based	Market		Location	
Reporting boundary	PIC		PC	
Emissions factors	In year		Fixed at 2022	
Electricity factors	Treasury Green Book		Treasury Green Book	
Impact of WRMP	Portsmouth Water WRMP24 Table-V6 2			
Impact of LTDS	Baseline	Mid case	Baseline	Mid case
Measures scenario	Baseline	Mid case	Baseline	Mid case

[6] No attempt has been made to project REGO prices as part of this project. We have used in an assumption of £8/MWh, but outturn prices could be higher or lower.

[7] As in the case of REGOs, we have not undertaken any modelling of future carbon credit (offset) prices. A report by the Committee on Climate Change (see here figure 1.5) found a wide range in current costs hence there is even more uncertainty looking ahead. For the purposes of illustration, we have used an indicative cost of £15/tCO2e based on the midpoint of a statement by the Woodland Carbon Code that current prices for pending credits are between £10-20/tCO2 (see here).

Onsite renewables (known)	Baseline	Mid case	Baseline	Mid case
Fleet mileage reductions (own and outsourced)	No change	No change	No change	No change
EV switching (own and outsourced)	Commence 2026	Commence 2026	Commence 2026	Commence 2026
Low carbon energy procurement	No change (i.e. 100% electricity from recognised green tariff)		n/a (location based)	
Offsetting	No change (i.e. no offsets)		n/a (location based)	

2.4. Costs

Figure 2.3 summarises the treatment of Opex and Capex under all trajectories. Capex costs are assumed to be incurred once in the start year for the measure. Opex costs are assumed to be incurred annually (including in the first year), for the lifetime of the measure.

Figure 2.3 Overview of cost assumptions

Emissions driver	Treatment of Opex/ Capex
WRMP	Funded elsewhere so we have not accounted for any Capex or Opex resulting from these changes
LTDS	Funded elsewhere so we have not accounted for any Capex or Opex resulting from these changes
Energy management	Both Capex and Opex included from ESOS, PW and Optopia energy efficiency project
Fleet mileage	Mileage reductions not currently included in the plan
Vehicle switching	Funded elsewhere so we have not accounted for any Capex or Opex resulting from these changes
Onsite renewables	Vales provided by Portsmouth Water
Energy procurement	Assume no Capex and Opex indicative cost of REGOs only (£8/MWh). Using a different mechanism e.g. a CPPA would incur additional set up costs e.g. legal fees.
In/offsets	Assume no Capex; assumed indicative cost of certificates. Prices could be higher or lower than this. If chose to use insets, they would incur additional internal/ supply chain costs to implement projects.

All costs are assumed flat real, in 2023 money i.e. no adjustment is made for inflation and future costs are not discounted.

Note, in the spreadsheet accompanying this report, we have provided emissions data to two decimal places as required by Ofwat. This is not intended to give the impression of more accuracy than the high level assumptions for this project allow (ideally we would be reporting in ktCO2e).

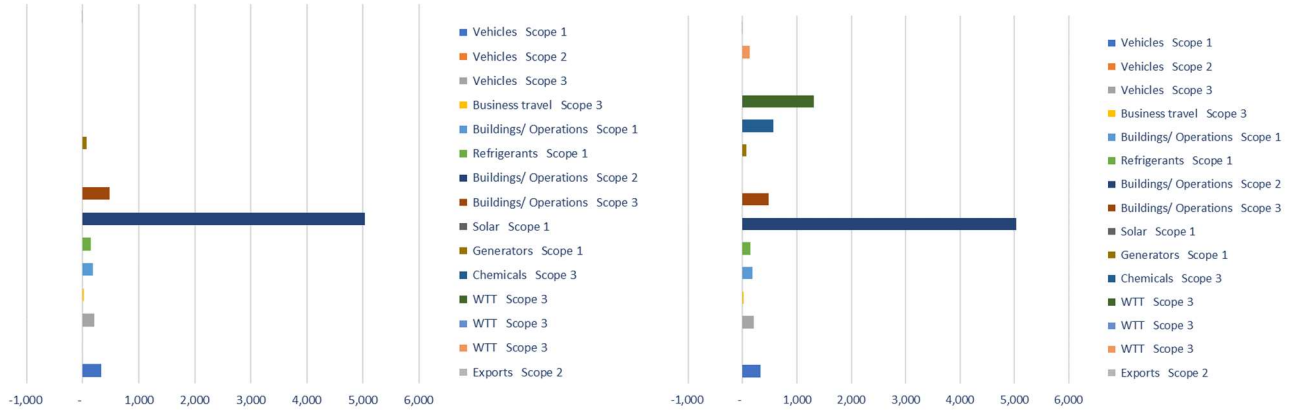
3. Historic emissions

We used the most recent year's data (2022/23) as the starting point from which to project the level of each activity that generates carbon emissions to 2050.

The breakdown of historic carbon emissions under each reporting boundary is shown in the chart below (Figure 3.1).

The table summarises the gross footprint (i.e. before any green tariff) under both reporting boundaries for 22/23. It shows that the scope of the PC is much broader than the PIC, so the reported footprint is also materially higher (due primarily to the inclusion of chemicals and WTT emissions from electricity in the PC).

Figure 3.1 Historic emissions by activity (2022/23) (PIC on left, PC on right)



tCO2e	PIC	PC
Gross footprint 22/23	6,444	8,446
Net footprint 22/23	1,393	8,446
		The PC is location based and does not allow low carbon energy procurement or offsets to be netted off.

Source: PW, Optopia analysis

The charts in the chapters that follow illustrate the emissions pathway under each set of assumptions. To help make trajectories easier to compare, we have separated emissions projections into two chapters, the first focussed on the PIC, the second on the PC. This means that Trajectory 3 appears before Trajectory 2.

4. Public Interest Commitment (PIC)

4.1. Trajectory 1a: BAU using the PIC methodology

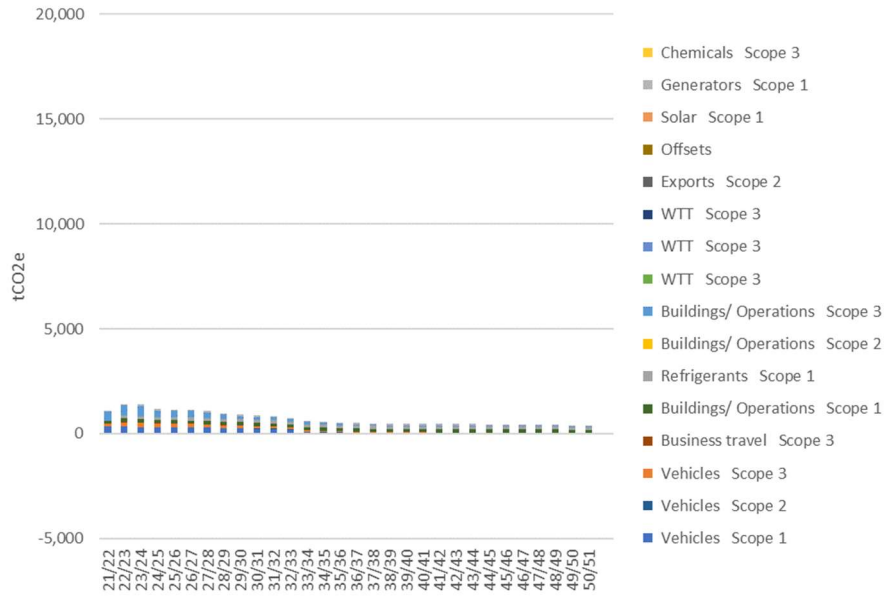
Trajectory 1a is the business as usual (BAU) trajectory using the public interest commitment (PIC) methodology. Other assumptions are summarised in Figure 4.1.

Figure 4.1 Trajectory 1a: assumptions

Assumptions:	Trajectory 1a
Location or market based	Market
Reporting boundary	PIC
Emissions factors	In year
Electricity factors	Treasury Green Book
Impact of WRMP	WRMP24 Table-V6 2
Impact of LTDS	Baseline
Measures scenario	Baseline
Onsite renewables (known)	Baseline
Onsite renewables (additional)	n/a
Fleet mileage reductions (own and outsourced)	No change
EV switching (own and outsourced)	No change
Low carbon energy procurement	No change (i.e. 100% electricity from recognised green tariff)
Offsetting	No change (i.e. no offsets)

The BAU trajectory in emissions is illustrated in Figure 4.2 using a PIC reporting boundary and related assumptions (i.e. market based, in-year emissions factors).

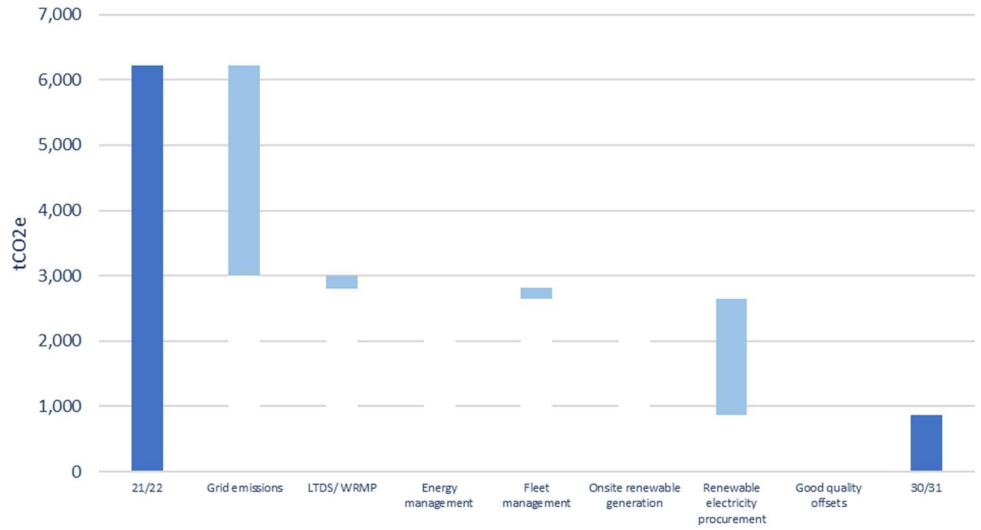
Figure 4.2 Trajectory 1a: BAU emissions to 2050 (PIC)



Source: PW, Optopia analysis.

Trajectory 1a (tCO2e)	21/22	22/23	30/31	40/41	50/51
Net footprint	**1,094**	**1,410**	873	470	395

Figure 4.3 Trajectory 1a: Contribution of different activities (PIC)



Source: PW, Optopia analysis

Based on the assumptions above and the current reporting methodology, the emissions that PW reports under the PIC could reduce materially, without further action. This is for two key reasons:

- the PIC allows net emissions reporting i.e. PW can report its green electricity tariff as zero emissions
- the PIC allows the use of in-year emissions factors, which are projected to fall over the period, in line with Cornwall Insight's projections

Low carbon energy procurement

We note that the guidance on reporting electricity tariffs is expected to tighten in future:

- In particular, a green tariff of the kind currently used by PW may no longer be judged sufficiently additional[8]. However, no firm decisions have been made yet.
- In parallel , newer market-based mechanisms to source renewable electricity (corporate power purchase agreements, or CPPAs, for instance) are being used by a larger number of companies.
- It is on this basis that all PIC trajectories assume that PW continues to procure 100% of its electricity from a route it is allowed to report as zero emissions on a market-based reporting methodology[9].

[8] Green tariffs have come under criticism (in the UK and internationally) for failing to meet test of additionality and being insufficient to zero rate emissions. The UK opened a call for evidence on recognising the carbon content of energy products but has not yet produced proposals for updating its corporate GHG reporting guidance. If it does change, the rules for reporting the PIC may be updated in line with best practise or stay the same. Given this uncertainty, we have taken a simple approach for this report.

[9] Noting that because the Cornwall Emissions grid emissions factors are negative towards the end of the period, a zero-rated tariff would increase reported emissions. We therefore assume that if the emissions factor is less than zero, SES Water would take advantage of that, rather than continue to procure a green tariff.

Grid decarbonisation

The extent and rate of grid decarbonisation also materially affects PW's reported emissions under the PIC. This is particularly true as the vehicle fleet electrifies, since it affects the emissions saving from the switch to EVs. The assumptions (Cornwall Insight central scenario) result in negative emissions from electricity consumption towards the end of the period modelled.

Carbon offsets

The PIC also allows the use of good quality carbon offsets. In line with good practice, offsets are the last option in an emissions reduction hierarchy and should only be used once a company is already taking steps to reduce its own emissions. By definition, that is not the case with a BAU trajectory and so we have not included offsets here. In addition, PW is not currently buying offsets, so it is not a BAU assumption. Offsets are included in Trajectory 4a (see below).

Costs

The table below sets out an estimate of the capital and operational costs under this trajectory. Please refer to Figure 2.3 for an explanation of which categories of costs were included for this project.

Figure 4.4 Estimated Capex and Opex: Trajectory 1a (PIC) (£m)

Capex £m	2022-50	2023-24	2024-25	2025-30	2030-35	2035-40	2040-45	2045-50
Baseline energy management	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scenario energy management	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onsite generation	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Opex £m	**2022-50**	**2023-24**	**2024-25**	**2025-30**	**2030-35**	**2035-40**	**2040-45**	**2045-50**
Baseline energy management	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scenario energy management	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onsite generation	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Energy procurement (REGO)	**3.5**	0.1	0.1	0.7	0.6	0.6	0.6	0.6
Offsetting	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	**3.5**	**0.1**	**0.1**	**0.7**	**0.6**	**0.6**	**0.6**	**0.6**

*Source: PW and Optopia analysis. Totals may not sum due to rounding . *Relates to the solar project included in BAU from the Measures sheet.*

4.2. Trajectory 3: Mid case using the PIC methodology

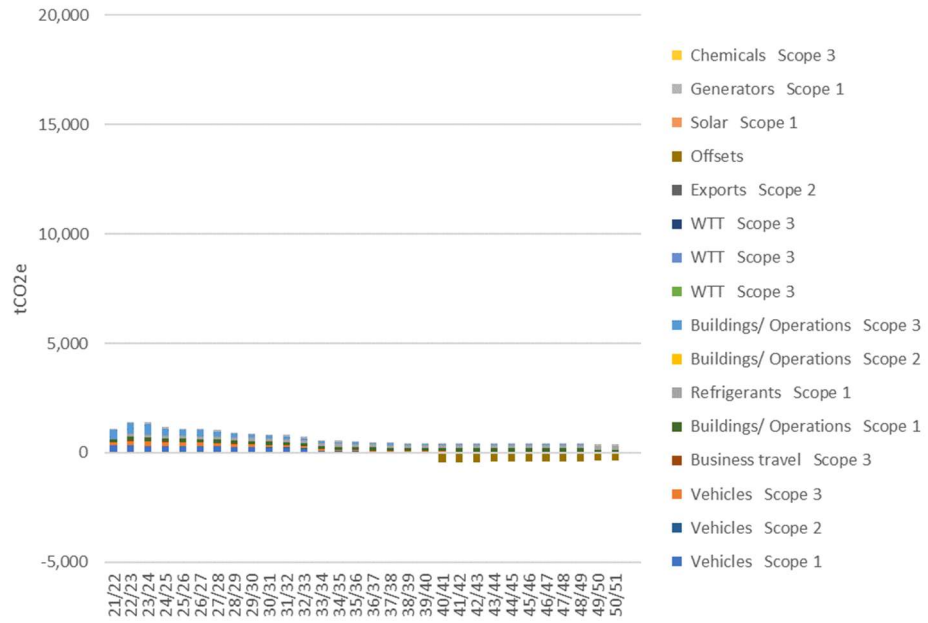
Trajectory 3 is the mid case based on the PIC methodology. It takes the BAU scenario as a starting point and then adds in additional reductions, for energy management, fleet and onsite generation. The assumptions are summarised in Figure 4.5.

Figure 4.5 Trajectory 3: assumptions

Assumptions:	Trajectory 3
Location or market based	Market
Reporting boundary	PIC
Emissions factors	In year
Electricity factors	Treasury Green Book
Impact of WRMP	WRMP24 Table-V6 2
Impact of LTDS	Mid case
Measures scenario	Mid case
Onsite renewables (known)	Mid case
Onsite renewables (additional)	Mid case (climbing to 20% by 2040)
Fleet mileage reductions (own and outsourced)	Mid case (20% reduction by 2030 the constant)
EV switching (own and outsourced)	Mid case (50% EV switching by 2030 and 100% by 2050)
Low carbon energy procurement	No change (i.e. 100% electricity from recognised green tariff)
Offsetting	No change (i.e. no offsets)

The mid case trajectory in emissions is illustrated in Figure 4.6 using a PIC reporting boundary and related assumptions (i.e. market based, in-year emissions factors).

Figure 4.6 Trajectory 3: Mid case to 2050 (PIC)

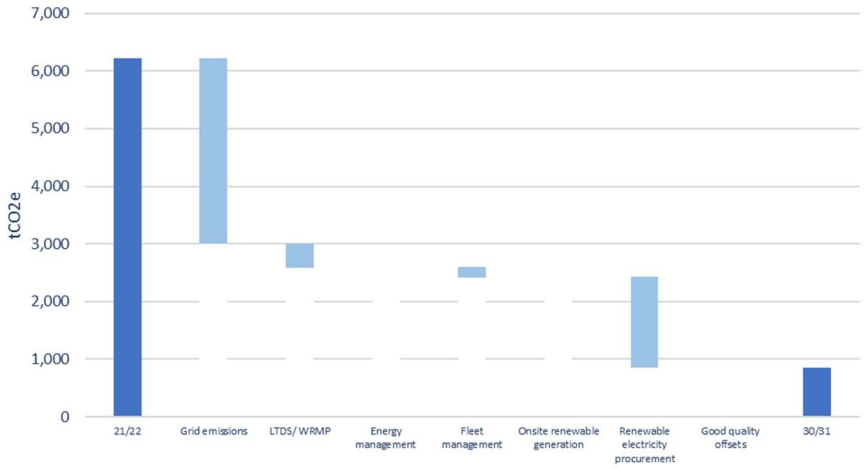


Source: PW, Optopia analysis.

Trajectory 3 (tCO2e)	21/22	22/23	30/31	40/41	50/51
Net footprint	1,094	1,410	838	-	-

We note the negative emissions towards the end of the period modelled. This is a direct result of the electricity emissions factor projection being negative in the later years. It remains to be seen whether, even if generation delivering carbon removal is implemented, a negative factor would be allowed for carbon reporting. For instance, it means that other options e.g. onsite renewables or low carbon energy procurement result in a higher footprint, which arguably goes against the emissions hierarchy used for this project.

Figure 4.7 Trajectory 3: Contribution of different activities (PIC)



Source: PW, Optopia analysis

Costs

The table below sets out an estimate of the capital and operational costs under this trajectory. Please refer to Figure 2.3 for an explanation of which categories of costs were included for this project.

Figure 4.8 Estimated Capex and Opex: Trajectory 3 (PIC) (£m)

Capex £m	2022-50	2023-24	2024-25	2025-30	2030-35	2035-40	2040-45	2045-50
Baseline energy management	**1.9**	0.0	0.0	0.6	1.3	0.0	0.0	0.0
Scenario energy management	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onsite generation	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	**1.9**	**0.0**	**0.0**	**0.6**	**1.3**	**0.0**	**0.0**	**0.0**
Opex £m	**2022-50**	**2023-24**	**2024-25**	**2025-30**	**2030-35**	**2035-40**	**2040-45**	**2045-50**
Baseline energy management	**-20.2**	0.0	0.0	-2.8	-4.1	-4.1	-4.1	-4.1
Scenario energy management	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onsite generation	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Energy procurement (REGO)	**3.1**	0.1	0.1	0.6	0.6	0.5	0.5	0.5
Offsetting	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	**-17.0**	**0.1**	**0.1**	**-2.2**	**-3.6**	**-3.6**	**-3.6**	**-3.6**

Source: PW and Optopia analysis. Totals may not sum due to rounding .

5. New Ofwat Performance Commitment (PC)

5.1. Trajectory 1b: BAU using the PC methodology

Trajectory 1b is the business as usual (BAU) trajectory based on the performance commitment (PC) methodology. Although it uses the same assumptions as the BAU for the PIC, the results are materially different because:

- the scope of the footprint is much broader, as discussed in Section 3
- the reporting rules are stricter, meaning market-based emissions reductions cannot be used
- emissions factors are fixed and do not allow for grid decarbonisation

The assumptions are summarised in Figure 5.1.

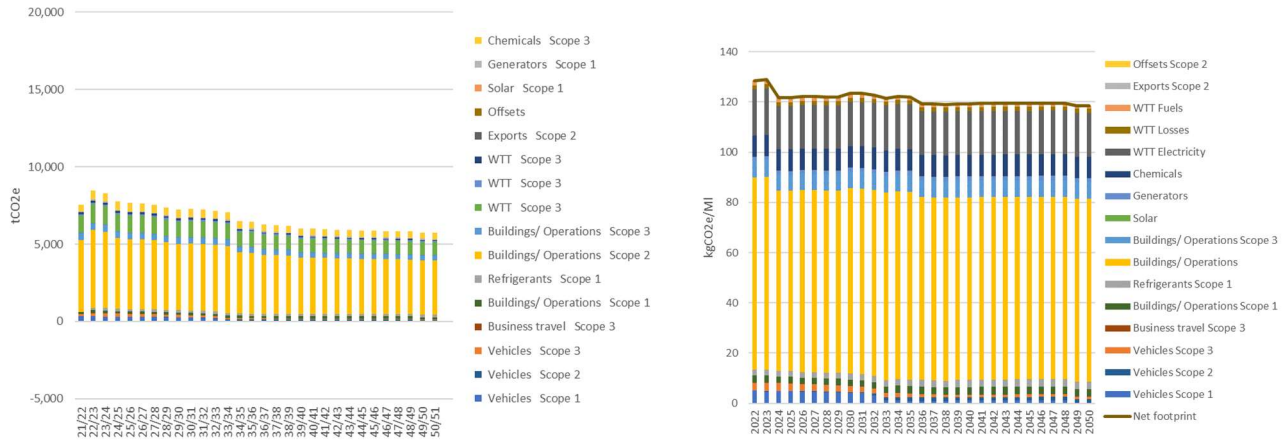
Figure 5.1 Trajectory 1b: assumptions

Assumptions:	Trajectory 1b
Location or market based	Location
Reporting boundary	PC
Emissions factors	Fixed at 2022
Electricity factors	Treasury Green Book
Impact of WRMP	WRMP24 Table-V6 2
Impact of LTDS	Baseline
Measures scenario	Baseline
Onsite renewables (known)	Baseline
Onsite renewables (additional)	n/a
Fleet mileage reductions (own and outsourced)	No change
EV switching (own and outsourced)	No change
Low carbon energy procurement	n/a (location based)
Offsetting	n/a (location based)

The BAU trajectory in emissions is illustrated in Figure 5.2 using a PC reporting boundary and related assumptions (i.e. location based, fixed emissions factors).

It shows that the footprint under the PC is much larger than under the PIC. In addition, because most of the change in absolute emissions in the baseline (left hand chart) is driven by the rate of reduction in water supply, the footprint remains relatively constant in relative terms (right hand chart).

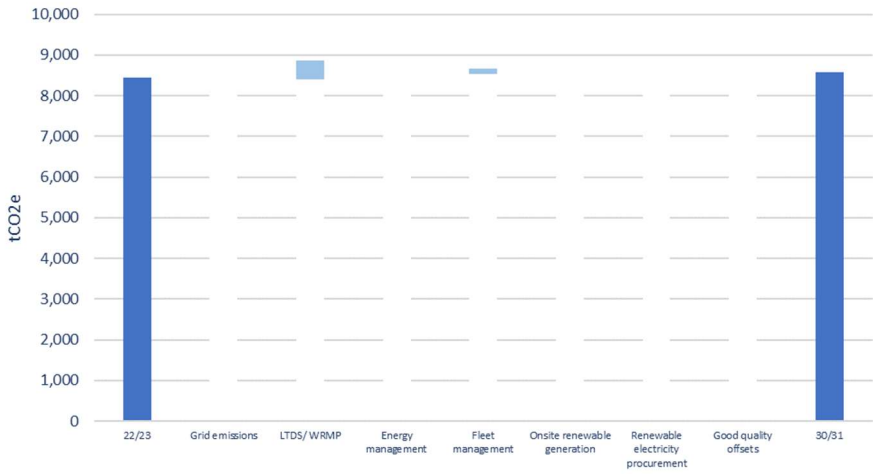
Figure 5.2 Trajectory 1b: BAU to 2050 (PC) (tCO2e on the left)



Source: PW, Optopia analysis.

Trajectory 1b	21/22	22/23	30/31	40/41	50/51
Net footprint (tCO2e)	7,551	8,439	7,270	5,991	5,738
Net footprint (kgCO2e/Ml)	115	128	123	119	118

Figure 5.3 Trajectory 1b: Contribution of different activities (PC)



Source: PW, Optopia analysis Note the reduction in grid emissions relates to the fact that Ofwat has fixed factors based on CAW17 i.e. 22/23 rather than 21/22.

Key determinants of the footprint under all three PC trajectories are:

- Electricity use (because the grid factors stays constant and green tariffs cannot be used). Although the WRMP is expected to reduce electricity use, switching to EVs is expected to increase it.
- Well to tank emissions. These make a material contribution to the footprint. On the plus side, the inclusion of these factors means that where electricity and fuel use can be reduced it, it makes a bigger difference to the footprint.
- Chemicals. These are also assumed to reduce at the rate of the WRMP, however they are carbon intensive and remain a large proportion of the footprint in 2050 in the absence of other abatement options.

It is these areas that PW will need to target for energy reduction if it is to affect its emissions as reported under the PC.

Costs

The table below sets out an estimate of the capital and operational costs under this trajectory. Please refer to Figure 2.3 for an explanation of which categories of costs were included for this project.

Figure 5.4 Estimated Capex and Opex: Trajectory 1b (PC) (£m)

Capex £m	2022-50	2023-24	2024-25	2025-30	2030-35	2035-40	2040-45	2045-50
Baseline energy management	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Scenario energy management	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onsite generation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Opex £m	2022-50	2023-24	2024-25	2025-30	2030-35	2035-40	2040-45	2045-50
Baseline energy management	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scenario energy management	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onsite generation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Energy procurement (REGO)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Offsetting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: PW and Optopia analysis.

5.2. Trajectory 2: Mid case using the PC methodology

Trajectory 2 builds on the business as usual (BAU) trajectory based on the performance commitment (PC) methodology. It uses the same abatement assumptions as Trajectory 3 (mid case based on the PIC methodology). However, it follows the performance commitment reporting requirements.

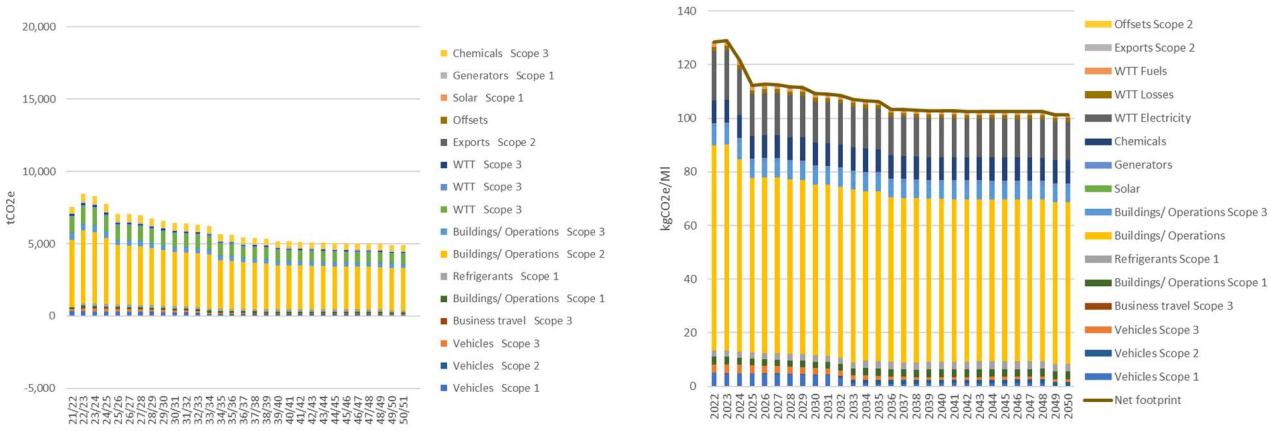
The assumptions are summarised in Figure 5.5.

Figure 5.5 Trajectory 2: assumptions

Assumptions:	Trajectory 2
Location or market based	Location
Reporting boundary	PC
Emissions factors	Fixed at 2022
Electricity factors	Treasury Green Book
Impact of WRMP	WRMP24 Table-V6 2
Impact of LTDS	Mid case
Measures scenario	Mid case
Onsite renewables (known)	Mid case
Onsite renewables (additional)	Mid case (climbing to 20% by 2040)
Fleet mileage reductions (own and outsourced)	Mid case (20% reduction by 2030 the constant)
EV switching (own and outsourced)	Mid case (50% EV switching by 2030 and 100% by 2050)
Low carbon energy procurement	n/a (location based)
Offsetting	n/a (location based)

The mid case trajectory in emissions is illustrated in Figure 5.6 using a PC reporting boundary and related assumptions (i.e. location based, fixed emissions factors).

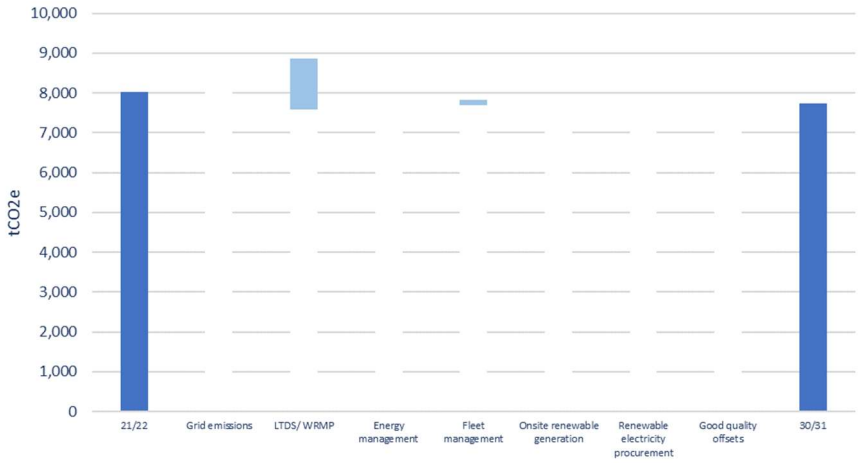
Figure 5.6 Trajectory 2: BAU to 2050 (PC) (tCO2e on the left, kgCO2e/Ml on the right)



Source: PW, Optopia analysis.

Trajectory 2	21/22	22/23	30/31	40/41	50/51
Net footprint (tCO2e)	7,551	8,439	6,435	5,156	4,904
Net footprint (kgCO2e/Ml)	115	128	109	103	101

Figure 5.7 Trajectory 2: Contribution of different activities (PC)



Source: PW, Optopia analysis

Costs

The table below sets out an estimate of the capital and operational costs under this trajectory. Please refer to Figure 2.3 for an explanation of which categories of costs were included for this project.

Figure 5.8 Estimated Capex and Opex: Trajectory 2 (PC) (£m)

Capex £m	2022-50	2023-24	2024-25	2025-30	2030-35	2035-40	2040-45	2045-50
Baseline energy management	**0.9**	0.0	0.0	0.4	0.5	0.0	0.0	0.0
Scenario energy management	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onsite generation	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	**0.9**	**0.0**	**0.0**	**0.4**	**0.5**	**0.0**	**0.0**	**0.0**
Opex £m	**2022-50**	**2023-24**	**2024-25**	**2025-30**	**2030-35**	**2035-40**	**2040-45**	**2045-50**
Baseline energy management	**-17.3**	0.0	0.0	-2.6	-3.5	-3.5	-3.5	-3.5
Scenario energy management	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onsite generation	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Energy procurement (REGO)	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Offsetting	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	**-17.3**	**0.0**	**0.0**	**-2.6**	**-3.5**	**-3.5**	**-3.5**	**-3.5**

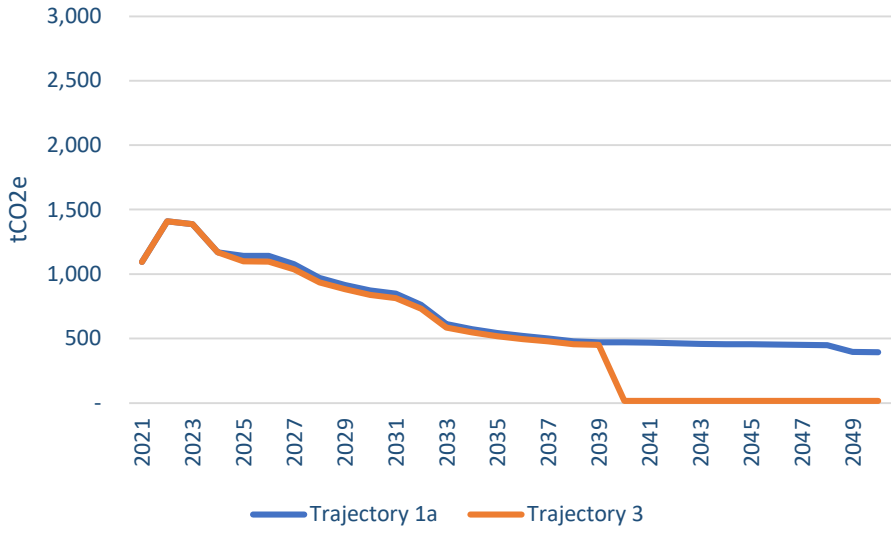
Source: PW and Optopia analysis.

6. Comparison of trajectories

The scenarios in this report demonstrate how the reporting boundary directly affects both the scale of the footprint reported and the range of abatement options available.

The PIC carbon footprint is much smaller than the PC footprint. There are also a wide range of options to reduce it. As a result, it starts smaller and, if grid emissions reduce at the rate expected, PW can achieve its net zero commitment in a best case.

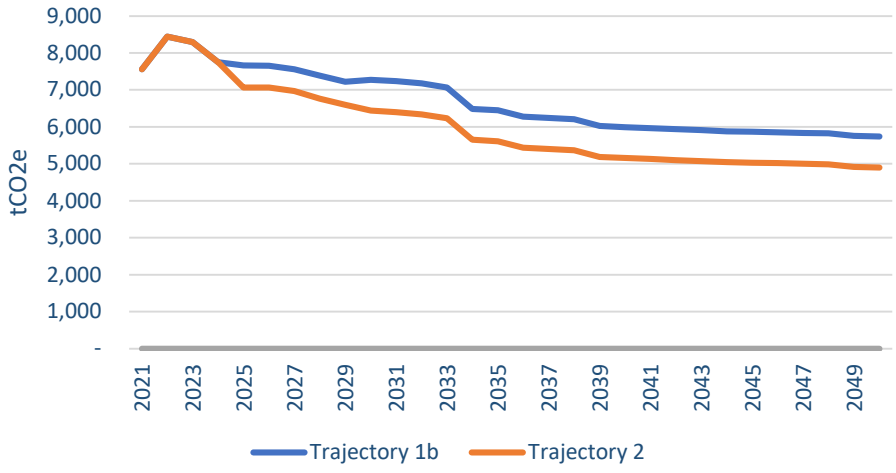
Figure 9 Public interest commitment trajectories (tCO2e)

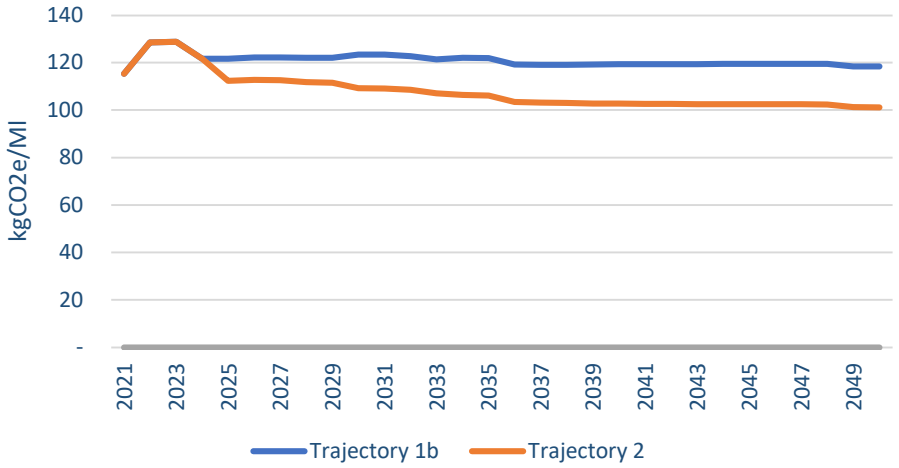


Source: PW and Optopia analysis.

In absolute terms, the PC trajectories rely on emissions reductions through reduced energy and chemicals use, as DI reduces. However, in relative terms, energy management, fleet management and onsite (behind the meter) renewables can all help reduce relative emissions as reported under the PC. Although the resulting footprint reductions are considerably higher under the PIC, a best case could deliver a material difference.

Figure 10 Performance commitment trajectories (tCO2e and kgCOe/Ml)





Source: PW and Optopia analysis

7. Risks and challenges

This report contains projections, which by definition are uncertain. They set out one view of the future based on a series of assumptions; actual outturn may be different than expected. This section sets out some key reasons why actual outturn may differ from the projections in this report.

7.1. Risks for delivery of the PIC and the PC trajectories

New reporting guidance

We have followed the written guidance but are aware that this is the first time PW has calculated its emissions on this reporting boundary. As a result, it is possible that the final PC agreed with Ofwat may reflect some differences in emissions included/ excluded and/or that its reporting guidance may develop over time (so affecting how easy it is to demonstrate a reduction in relative emissions).

PW's delivery of the WRMP

If demand for water is not reduced as planned, it could increase the absolute carbon footprint. The absolute projections in this report assume the delivery of the WRMP. Both electricity use and chemicals use are assumed to reduce materially over the period modelled, as a direct result of the delivery of the WRMP. Since this would also increase DI, its impact on PW's PC may be muted. It would make the 2030 net zero target more costly to deliver.

Outsourced activities

In this report we assume that outsourced activities, specifically vehicle mileage and EV switching, achieve the same ambitious profiles as for PW's own fleet. Achieving this will require a clear fleet strategy that is embedded in PW's procurement requirements of third parties.

Home vehicle charging

It is still early to judge the impact of the electric vehicle roll out on PW's footprint, which introduces uncertainty. For instance, the assumptions rely on diesel and petrol consumption reducing due to the uptake of EVs (not that EVs become additional mileage). In addition, colleagues charging vehicles away from work may result in apparent reduction in emissions, if this isn't correctly recorded, which may increase again as reporting improves. The source of charging away from site is also currently outside PW's control to ensure is low carbon (i.e. it is not on its corporate green tariff).

7.2. Risks for delivery of the PIC trajectories

PW's delivery of the WRMP

If demand for water is not reduced as planned, it could increase the absolute carbon footprint. The absolute projections in this report assume the delivery of the WRMP. Since this would also increase DI, it may not impact directly on PW's PC but it would make the 2030 net zero target more costly to deliver.

Grid emissions

If the grid decarbonises to a lesser extent (or more slowly) than assumed, it would increase the absolute carbon footprint. The decarbonisation of the national electricity grid is outside PW's control. As this market-based approach does not count towards the PIC, a slower rate of decarbonisation will most affect the cost of delivering the PIC.

Treatment of energy procurement

We assume in the baseline, mid and best cases that PW is allowed to demonstrate a material reduction in its market based footprint by procuring green electricity. The GHG Protocol recently consulted on updates to its guidance to corporate carbon footprints (changes which could feed into UK reporting). This could mean that PW would need to pursue other avenues to procure electricity that meets a zero emissions reporting requirement and these may be more expensive than the cost of REGOs assumed.

PW's delivery of the net zero programme

If PW does not implement the energy savings measures assumed (or if they do not deliver the savings expected), the trajectories will not be achieved. While for the purposes of illustration the results in this report are grouped into a small series of categories, in reality, each chunk of emissions reductions breaks down into a large number of smaller actions. These must be proactively managed if they are to deliver effectively, to the cost expected and on time.

Market movements

The cost of abatement could move materially in the timescales covered by this study. While in some cases this may make the costs of abatement less expensive than assumed, it could push the costs up too. For instance, in recent years we have seen material changes in the cost of carbon offsets and renewable energy certificates (REGOs) as well as in the cost of materials (e.g. PV panels).

Reporting/ regulation

Changes to the reporting rules may affect the options available to PW. For instance, the carbon insetting and offsetting markets are relatively immature and the accepted view of a 'quality' certificate is developing rapidly.

Disclaimer

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The report contains projections that are based on assumptions that are subject to uncertainties and contingencies. Because of the subjective judgements and inherent uncertainties of projections and because events frequently do not occur as expected, there can be no assurance that the projections contained herein will be realised and actual results may be different from projected results. The projections contained in this document are not firm predictions of the future but illustrations of what might happen. Parties should base their actions on an awareness of the uncertainties around such projections and that they result in a wide range of possible outcomes.