APPENDIX SES027

COST ADJUSTMENT CLAIM: PUMPING COSTS

Contents

1. Introduction

This appendix presents an updated cost adjustment claim for the additional, non-controllable costs associated with SES Water's greater pumping requirement due to our network topography. These are not fully reflected in the base cost models being proposed by Ofwat.

As indicated in our early claim, we have reviewed some of the underlying assumptions that went into estimating the size of our claim. We have also reviewed the approaches taken in other similar claims. Following this review, we are submitting a revised claim.

This section provides a brief overview of our claim, its rationale and relevant context. It also highlights where in the claim the reader can find information relevant to each of the cost adjustment claim assessment criteria.

A. Claim structure

1. This cost adjustment claim is structured in line with Ofwat's assessment criteria:
   - This section provides a brief summary of our claim.
   - Section 2 sets out the need for an adjustment, including: the unique circumstances leading to the requirement; the degree to which management has controlled the need for an adjustment; and our estimate of the required adjustment and its materiality.
   - Section 3 sets out our work to demonstrate that the costs we incur in this area are efficient.
   - Section 4 summarises the arrangements in place to protect customers.
   - Two annexes provide supporting material as referenced in the rest of the document.

B. Summary of our claim

The size of our claim.

2. In this revised claim, we estimate that SES Water will need an allowance of £42 million over AMP8 (£8.4 million per annum), in 2022/23 prices, in addition to what is implied within Ofwat's proposed base cost models and reflecting mitigating actions our management have taken to reduce our exposure. This is an increase on our early cost adjustment claim, where we estimated that SES Water will need an allowance of £31 million (£6.2 million per annum), in 2022/23 prices.
3. This increase is due to a number of factors.
   (a) We have re-estimated the proportion of our claim that is implicitly captured within our softening claim. We have estimated this on a bottom-up basis, replacing the broad but conservative assumption applied previously.

(b) We have updated our estimates of the energy price increase to 2022/23 in line with the most recent statistics from DESNZ1.

(c) We have made a number of smaller updates to align our assumptions with those used elsewhere in our business plan submission.

4. We note that the scale of this claim is substantially higher than we had submitted in our PR19 DD representation, even after accounting for headline inflation. We consider this is down to the following factors:

   (a) A change in our approach to calculating our claim to align it with Ofwat's consulted on base cost modelling for PR24.

   (b) Real price increases in power costs, particularly over the past 12-18 months that are not captured in Ofwat's base cost models.

   (c) The inclusion within the claim for investment and maintenance costs, which were excluded from our previous submission.

Our unique circumstances.

5. Our cost adjustment claim reflects the additional costs we are exposed to due to our network topography. The adjustment would account for additional power costs associated with significantly higher pumping requirements relative to the industry average, as well as associated investment and maintenance costs.

6. The topography of the area we serve and the nature of our ground water sources, mean that we have a much greater pumping requirement for abstraction and raw water transport than a typical company within the England and Wales water sector. This higher pumping requirement relative to others in the industry means that we are required to consume higher volumes of power and are exposed to additional investment and maintenance costs associated with pumping assets.

7. The associated costs are material to us. In the first two years of AMP7 our average annual expenditure on power alone was £6.5m (in 2017/18 prices excluding softening costs which are modelled separately). Recent trends in energy costs are expected to increase this figure. Whilst we do not separately monitor expenditure on pumping energy usage specifically, given the energy-intensive nature of pumping water for abstraction in particular, pumping will account for a high proportion of our total power expenditure in the forthcoming AMP. For example, for the industry as a whole, our analysis suggests that variation in average pumping head (APH) can account for around 55% of variation in wholesale water power costs per distribution input.[2]

Why Ofwat's base cost models do not fully capture our pumping costs.

8. The implicit allowance for pumping captured within Ofwat's published base cost models vary significantly from model to model, based on the following features of the explanatory variables used:

   - Where APH is included as an explanatory variable, it has been used in the Treated Water Distribution (TWD) models. This omits an important component of our cost

1 Department for Energy Security and Net Zero
2 See Figure 1 in Section 2 of this Cost Adjustment Claim.

base, i.e. the pumping requirement for abstraction, that form part of the Water Resources Plus (WRP) models.

- Ofwat's alternative explanatory variable in TWD and Wholesale Water (WW) models is the number of booster pumping stations:
  - This has a very weak negative correlation with power costs, and SES has a low number of booster pumping stations. Although intended to account for pumping energy costs, it actually serves to reduce SES' base cost allowances.
  - As a result, we consider it likely that implicit allowances in some models are negative.
- Although Ofwat considers treatment complexity to be a candidate proxy variable for pumping energy costs in the WRP models, the two treatment complexity variables used show very weak correlations with APH and relevant power costs. While there may be an engineering rationale for treatment complexity acting as a proxy variable for the pumping costs associated with water treatment, there is no logical link between network topography for abstraction and treatment complexity. Given the primary effect of these variables is to control for variation in treatment costs, we expect little to no implicit allowance is made in the WRP models.

9. In the PR19 final determination, APH was not included within the base econometric cost models. While there was agreement that the inclusion of APH in the cost models had a clear engineering rationale, concerns about data quality prevented its inclusion. As a result, Ofwat agreed with the need for a cost adjustment and provided the allowance we claimed for at Draft Determination representations in full. We note that since then, the inclusion of APH as a variable has been reconsidered and in Ofwat's recent PR24 base costs consultation, APH has been included in a subset of the models.
10. In our claim, we provide detail on how the inclusion of APH within the cost models reduces the scope of our required cost adjustment claim for PR24. But we also provide detail on why this is unlikely to fully reflect our cost exposure, particularly as APH, as discussed above, is missing as an explanatory variable for the WRP models and is only included in a subset of the TWD models.

2. Need for adjustment

This section presents why we need an adjustment to the base costs estimated through Ofwat's modelling.

SES Water's network topography exhibits some unique characteristics that mean we have a higher normalised pumping requirement, both to abstract water and to distribute it to our customers. 85% of the water we supply to our customers is abstracted from groundwater sources in greensand and chalk aquifers located deep underground.

Due to this, our APH is 185m on average for the historical data period, which is among the highest within the industry. In turn, our power consumption, when normalised by the distribution input and by the number of connected properties, is also necessarily high relative to the rest of the industry. While we continue to take action to mitigate our exposure to these costs, our network topography and associated pumping requirements are largely outside management control. As such, we require a cost adjustment to ensure our base cost allowance properly reflects our efficient costs.

A. SES Water's unique circumstances

SES Water has relatively unique network topography which necessitates higher pumping.

11. Due to the topography of the area that SES Water abstract water from, we need to pump more than would otherwise be required, to both:
    (a) Transport ground water from its location deep in underground aquifers to the level required for treatment, and
    (b) Distribute treated water from treatment plants to connected properties.
12. This makes our electricity consumption per megalitre of distribution input among the highest in the industry. It also leads to greater investment and maintenance costs due to the greater rate of wear and tear on our pumping assets.
13. The topography of the area we serve means that all of our water abstraction requires some degree of pumping, and often substantial pumping. This is unique to SES Water.
14. We abstract almost 85% of the water we supply from groundwater sources in greensand and chalk aquifers located deep below ground. This is the second highest in the industry and compares with a water company average of 37%. Our remaining abstractions are from a pumped storage reservoir, which also requires significant pumping. Once abstracted and treated, this water is distributed across our region and pumped across the North Downs to customers' homes and businesses.

15. In Table 1 below, we show power costs normalised by megalitres per day of distribution input averaged over the period 2011-12 to 2021-22, and we show the average of APH for our wholesale water business.

Table 1. Power cost per megalitre of distribution input and average pumping head over the period 2011-12 to 2021-22 (2017/18 prices)

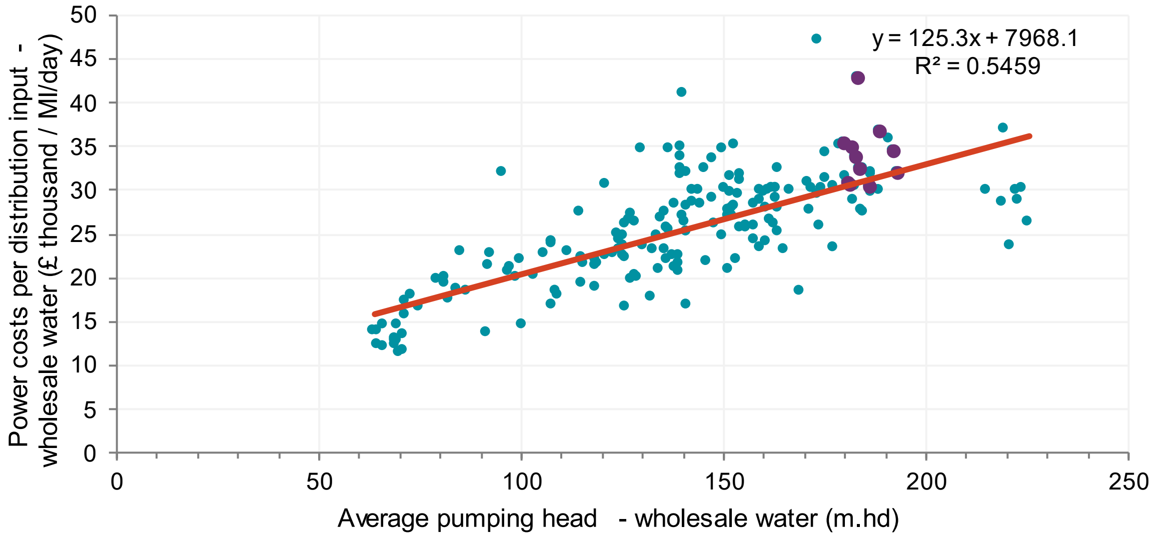
	Wholesale Water – Average Annual			
Company code	Power Costs / DI (£ / Ml / day)	APH (m.hd)	Cost Rank	APH rank
AFW	24,613	128	14	15
ANH	28,236	161	9	7
BRL	30,621	183	4	3
DVW	29,089	222	6	1
HDD	36,816	148	1	10
NES	20,257	103	17	17
NWT	17,138	78	19	19
PRT	12,971	67	20	20
SES	**33,932**	**185**	**2**	**2**
SEW	30,723	153	3	8
SRN	26,750	162	11	6
SSC	29,141	179	5	4
SVE	28,793	169	8	5
SVT	25,078	153	12	9
SWB	26,842	134	10	13
SWT	18,178	131	18	14
TMS	22,325	102	15	18
WSH	28,855	141	7	11
WSX	24,942	139	13	12
YKY	22,125	121	16	16

Source: SES Water analysis

16. We can see from the table that over the period 2011-12 to 2021-22, SES Water's APH is the highest within the industry, which translates to the second highest power cost per Ml of distribution input. APH is one of the two variables that determine the power consumption associated with pumping water, the other being the volume of water pumped, and the power consumption associated with pumping water makes up the majority of electricity consumption within the industry. For example, at SES Water, consumption associated with abstraction, transport and distribution, makes up an average of 75% of our total energy consumption. This is despite there being significant power consumption associated with our requirement to soften water.

17. Looking specifically at water abstraction, Figure 1 shows the correlation between power cost in water resources versus APH in water resources, both are normalised by distribution input in megalitre. This shows that SES Water sits at the far upper right end of the distribution, as highlighted by the data points in purple.

Figure 1. Correlation between APH and power costs over period 2011-12 to 2021-22



Source: SES Water analysis

18. While we recognise that electricity consumption is to some degree controllable by management, SES Water's high consumption is primarily due to our higher pumping requirements for abstraction and raw water distribution.[3] As a result, SES Water needs to use 46% more energy than the industry average and 91% more than the company with the lowest energy consumption. The table below shows energy consumption normalised by megalitres per day of distribution input averaged over the period 2011-12 to 2021-2 and highlights SES Water's high consumption on a company ranking basis.

Table 2. Energy consumption normalised by distribution input over the period 2011-12 to 2021-12, annual averages, MWh / Ml / day

Company	Energy Consumption per Distribution Input (MWh / Ml / day)			Ranking		
	Water Resources	Network Plus	Wholesale Water	Water Resources	Network Plus	Wholesale Water
AFW	33	216	249	15	14	14
ANH	73	248	321	3	7	5
BRL	63	262	325	7	4	4
DVW	42	232	274	13	10	12
HDD	55	294	350	8	2	3
NES	54	149	203	9	19	17
NWT	20	156	176	18	18	19
PRT	72	83	133	4	20	20
SES	**86**	**284**	**370**	**1**	**3**	**1**

3 Part of this high electricity consumption is explained by SES Water's additional electricity use for water softening, which is another unique requirement due to our statutory duty. We have submitted a separate cost adjustment claim for softening related costs, including the additional costs we incur for power. See Appendix SES029.

Company	Energy Consumption per Distribution Input (MWh / Ml / day)			Ranking		
	Water Resources	Network Plus	Wholesale Water	Water Resources	Network Plus	Wholesale Water
SEW	75	225	299	2	12	6
SRN	66	220	285	5	13	7
SSC	65	297	362	6	1	2
SVE	37	239	276	14	9	11
SVT	25	253	278	17	5	9
SWB	14	247	266	19	8	13
SWT	9	187	197	20	16	18
TMS	53	156	209	10	17	16
WSH	52	232	283	11	11	8
WSX	28	249	277	16	6	10
YKY	48	192	241	12	15	15

Source: SES Water analysis

19. This finding is replicated when looking at energy consumption per connected property, where SES Water continues to have the highest normalised energy consumption. SES Water needs to use 47% more electricity per connected property than the industry average and 81% more than the company with the lowest electricity consumption.

Table 3. Energy consumption normalised by number of properties over the period 2011-12 to 2021-12, annual averages, MWh/1,000 properties

Company	Energy consumption per 1000 properties (MWh)			Ranking		
	Water Resources	Network Plus	Wholesale Water	Water Resources	Network Plus	Wholesale Water
AFW	21	132	153	14	8	8
ANH	38	129	166	4	11	5
BRL	32	133	165	9	7	6
DVW	21	117	138	13	14	16
HDD	32	171	203	7	1	2
NES	30	83	113	10	18	18
NWT	11	83	94	18	19	19
PRT	39	46	73	3	20	20
SES	**48**	**157**	**205**	**1**	**2**	**1**
SEW	43	128	171	2	12	4
SRN	32	108	140	8	15	14
SSC	34	156	191	6	3	3
SVE	20	126	146	15	13	11
SVT	13	131	144	17	10	12
SWB	8	141	152	19	4	9
SWT	6	132	139	20	9	15

Company	Energy consumption per 1000 properties (MWh)			Ranking		
	Water Resources	Network Plus	Wholesale Water	Water Resources	Network Plus	Wholesale Water
TMS	36	106	143	5	16	13
WSH	30	134	164	11	6	7
WSX	16	136	152	16	5	10
YKY	26	105	132	12	17	17

Source: SES Water analysis

20. It can be seen from the table above that our power consumption, when normalised by the number of properties we serve, has been the highest across the industry over the period 2011-12 to 2021-22.

The costs associated with higher pumping requirements are only partially accounted for in Ofwat's proposed top-down cost models.

21. We note that a subset of Ofwat's proposed top-down wholesale water models include treated water distribution APH as a variable. However, we consider that this does not fully account for our exposure to higher pumping costs due to the topography of the area we operate in. The effect of including an APH variable on our efficiency score is visible in the treated water distribution model estimation results, as shown in the table below.

Table 4. Efficiency ranking under the treated water distribution models (rank out of 17)

Company code	Company	TWD1	TWD2	TWD3	TWD4	TWD5	TWD6
AFW	Affinity Water	11	14	8	15	17	14
ANH	Anglian Water	17	16	17	13	14	13
BRL	Bristol Water	16	12	15	15	12	17
HDD	Hafren Dyfrdwy	5	6	5	11	13	8
NES	Northumbrian Water	7	5	6	8	9	10
NWT	United Utilities	3	4	2	3	6	5
PRT	Portsmouth Water	2	1	1	6	3	2
SES	**SES Water**	**14**	**15**	**16**	**2**	**3**	**4**
SEW	South East Water	15	12	14	10	6	8
SRN	Southern Water	4	3	4	12	5	11
SSC	South Staffs Water	12	17	13	5	10	3
SVE	Severn Trent Water	6	10	7	3	8	7
SWB	South West Water	1	2	2	1	1	1
TMS	Thames Water	9	8	9	6	2	6
WSH	Dŵr Cymru	10	11	12	14	16	16
WSX	Wessex Water	8	6	11	9	11	12
YKY	Yorkshire Water	13	9	10	17	15	15

Source: Ofwat

22. We can see from Table 4 that including the APH variable in place of the number of booster pumping stations improves our efficiency ranking by 12 places across all three variants of the treated water distribution model.

23. This shows that excluding the APH variable from the base cost models will lead to an allowance that does not fully reflect our costs. We also demonstrated earlier that power costs are highly correlated with APH (but, as Figure 3 below will show, not with the number of booster pumping stations).

APH is excluded from Ofwat's WRP models.

24. While APH is captured in some of the TWD models, we note that APH is excluded as a variable in all of the WRP models. This is the part of the value chain where we are most exposed to higher power costs relative to the rest of the industry, as noted previously.

25. The nature of our water sources means that we have much higher water abstraction APH than others in the industry. As a result, the inclusion of treated water distribution APH within the treated water distribution cost model does not tackle the issue of higher pumping associated with the abstraction and transport of raw water.

26. We note that Ofwat did test the inclusion of APH in the WRP models and found that it was not a significant driver of costs. However, we consider that assuming WRP APH is not a relevant and important cost driver for electricity consumption, would be the incorrect conclusion to draw. This is due to several reasons:

    (a) While on average treated water distribution APH is the largest contributor to wholesale water APH, the other factors also make a significant contribution, particularly at SES Water.[4]

    (b) Our analysis shows that, when normalised by distribution input, there is a strong and significant correlation between APH and power costs. We present this analysis in Figure 6 in Annex A to this cost adjustment claim.

    (c) There remains a strong engineering rationale for APH being a driver of WRP costs, regardless of whether this is APH related to water abstraction, water treatment, or water transport.[5]

27. Ofwat has also stated it has some remaining concerns about the quality of APH data across the industry, specifically within the WRP price controls, which has in part driven its decision to exclude APH as a variable in its WRP models. This is not a justification for not accounting for the impact of APH on WRP base costs:

    - It is important to note that we have taken very active steps to improve the quality of our APH data, including ensuring a higher proportion of our APH estimate is derived from measured data. Our 2022/23 APH estimate is associated with a B2 confidence grading, with 34% of the estimate being derived from measured data.
    - We are confident we have improved the accuracy of our data. It would be wholly inappropriate for Ofwat not to account for the impact of APH on WRP base costs for this reason, given there is a strong engineering rationale for APH being a driver of WRP costs and strong statistical evidence (see above).

4 For example, water resources plus APH contributed 45% of wholesale water APH in 2020-21, compared with an industry average of 40%.
5 More broadly, there remains a strong engineering rationale for the topography of an area and the source of ground water being a driver of costs associated with water abstraction and raw water transport.

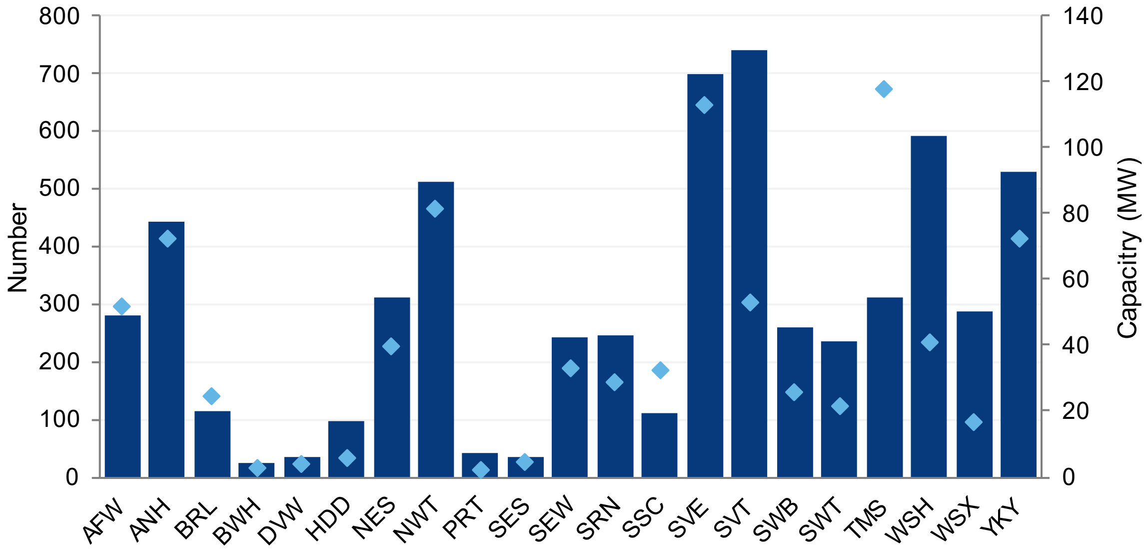
- If there are concerns with the quality of APH data of other companies, this is likely to explain the lack of significance found in Ofwat's econometric analysis, as the estimated coefficients are likely to have been subject to attenuation bias.

28. Given the importance of pumping within our water resources cost base, the exclusion of APH from the WRP models has a material effect on the gap between the allowance implied within the base cost models and our actual cost exposure and so requires a cost adjustment.

The inclusion of the number of booster pumping stations in the base models artificially deflates our cost allowances.

29. In the past, Ofwat has claimed that the inclusion of the number of booster pumping stations within the base cost models adequately captures the power costs associated with pumping. We do not consider this can be supported from an engineering or technical perspective, or indeed from statistical analysis. Figure 2 below shows the number and capacity of booster pumping stations by water company, averaged over the period 2011-12 to 2021-22.

Figure 2. Number and capacity of booster pumping stations over the period 2011-12 to 2021-22, annual averages

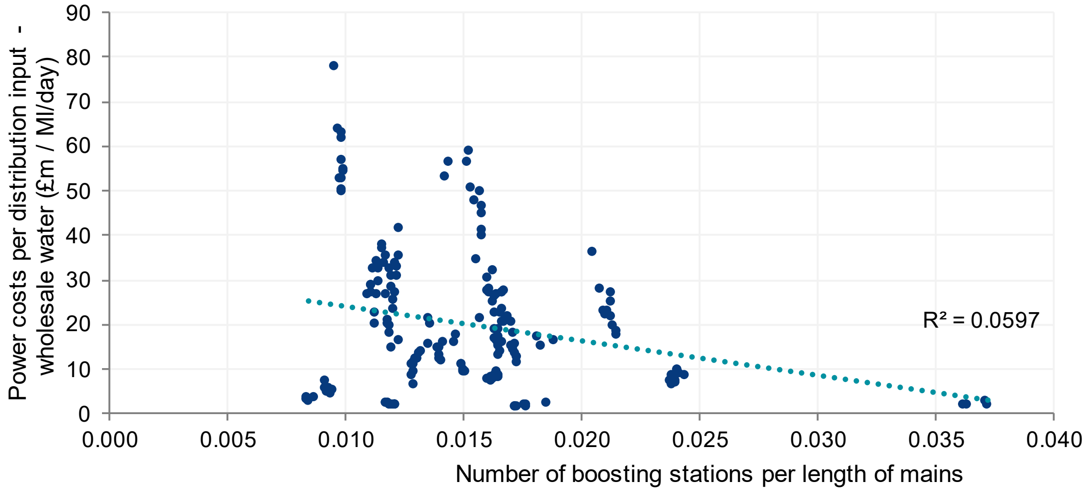


Source: SES Water analysis

30. We can see from the figure that there is a relatively random pattern of the relationship between number and capacity of booster pumping stations. Booster stations come in a wide variety of sizes and capacities. Including the number of stations as an explanatory variable provides no indication of whether they are in use or not, or how much of the capacity is actually put in use, and how much is kept there as reserve (and not consuming energy).

31. In Figure 3 below, we show the correlation between the number of booster pumping stations per km of mains and power costs.

Figure 3. Correlation between number of boosters/km and power cost over the period 2011-12 to 2022-23 (2017/18 prices)

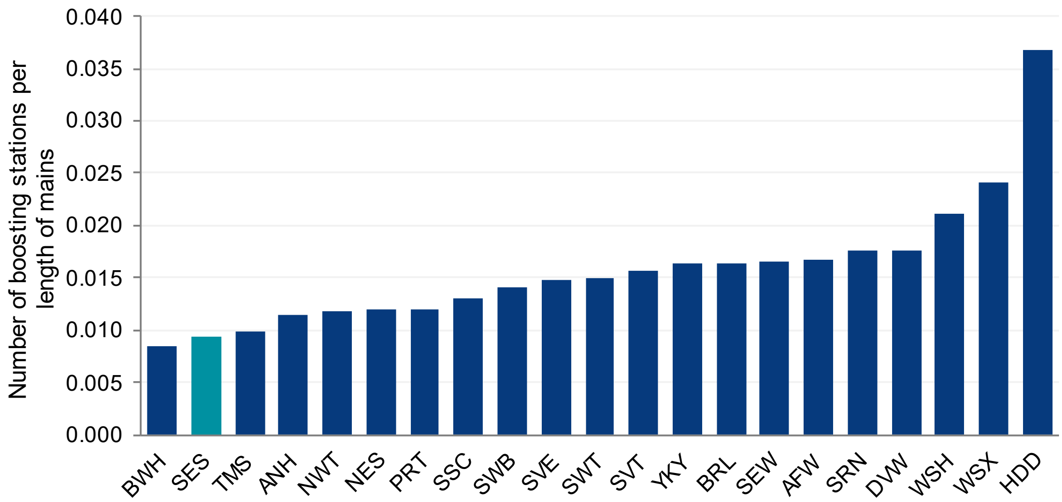


Source: SES Water analysis

32. We can see from the figure that the number of boosting stations per km is in fact *negatively* correlated with power costs. This makes it an even less convincing driver of power cost related expenditure.

33. For SES Water in particular, the presence of number of boosters per km acts as a *negative* factor to predict power costs, as we have far fewer booster stations than other water companies. This is shown in Figure 4 below and as a result, the variable's inclusion in Ofwat's base cost models creates an even larger gap between our actual exposure to uncontrollable power costs and Ofwat's modelled power costs.

Figure 4. Average number of booster pumping stations per length of mains over the period 2011-12 to 2022-23



Source: SES Water analysis

B. Controllability

The impact of the topography of the area we serve is largely outside management control. Nevertheless, we have undertaken a set of measures to mitigate the impact on our power costs.

34. In the table below, we summarise the main reasons why our greater exposure to power costs is largely outside of management control. We also summarise the main mitigations we have undertaken where there are factors within management control, that could be used to manage our exposure.

Table 5: Summary of drivers of energy costs and mitigations

Driver of energy costs	Ability of management to control costs / mitigation actions
Type of raw water sources	Our raw water sources are dictated by topography of the area we serve and our historic investment decisions. These have been made by balancing the need for a sustainable supply of raw water with raw water quality, environmental impact, and resilience to extremes of weather. Until our multi-AMP resilience programme, which will enable us to supply all regions of our area from more than one works, is complete, the ability to choose which sources (and hence which works) are utilised is limited.
Volume of water moved	Reducing the volume of water moved is one of the ways we are aiming to control costs. Our leakage performance measured in Ml/d is industry leading, and we have set ourselves an ambitious target of reducing leakage by 26.6% (from 2019/20 levels) by 2029/30. Through investment in our network (smart meters and pressure management) and customer engagement, we will help customers reduce consumption. By the end of the PR24 period, we plan to have achieved a reduction in per capital consumption of 11% from 2019/20 levels. For business demand, by the end of the PR24 period, we plan to have achieved a reduction in non-household water consumption of 5.1% from 2019/20 levels via our smart metering and water efficiency programmes. We will also work with retailers who own the relationship with business customers to continue to encourage water efficiency.
Efficiency of equipment	Our robust operation and maintenance of pumps is essential to their reliability as well as cost of operation. While our power consumption can vary from year to year, we have delivered an approximately 8% improvement in energy efficiency over the past decade, and we propose to deliver further efficiency improvements over AMP8.
Management of unit	Electricity costs form a material element of our overall operating expenditure. We run an Energy Strategy Committee (a

Driver of energy costs	Ability of management to control costs / mitigation actions
electricity costs	subcommittee of our main Board) to agree and oversee our electricity procurement activity throughout each AMP. Energy is procured up to – and sometimes in excess of – a year in advance. So far, our exposure to recent increases in power costs has been limited, due to our hedged position up to the end of AMP7. We are carefully considering how to procure electricity over the upcoming AMP, to make sure we (and our customers) are protected from volatile electricity prices while avoiding getting locked into long contracts at inflated prices. Nevertheless, we must recognise that it will not be possible for us to consistently 'beat the market'

Source: SES Water

35. In Table 6 below, we show that SES Water ranks 6 out of 17 companies in terms of power cost per MWh of consumption in 2021/22. Our unit costs are 13% lower than the industry average, despite our limited bargaining power relative to larger water companies. As a result, we consider we have taken reasonable steps to mitigate our exposure to high power costs by ensuring effective procurement of electricity.

Table 6. Power cost per unit of consumption in 2021-22, £/MWh 2017/18 prices

Company	Power unit cost (£/MWh)	Rank
AFW	136	13
ANH	89	4
BRL	88	3
HDD	147	15
NES	153	17
NWT	119	11
PRT	72	2
SES	**97**	**6**
SEW	113	10
SRN	98	7
SSC	58	1
SVE	112	9
SWB	121	12
TMS	148	16
WSH	143	14
WSX	91	5
YKY	109	8

Source: SES Water analysis

C. Calculation of required adjustment

36. To calculate the required adjustment, we have taken the following approach:

(a) We have developed a select number of econometric models to estimate the gross impact of APH on our power costs. Some of these models relate to specific price controls, whereas other models have been estimated at an aggregate level.

We apportion our estimates of the gross impact of APH on power costs into WRP and TWD price controls, in line with the base cost models, and project forwards using the number of properties as the scale variable.[6]

(b) We adjust these estimates to account for increases in electricity prices in real terms over the period to 2022/23. For this we use the Department for Energy Security and Net Zero (DESNZ) non-domestic electricity price index.[7]

(c) We include an allowance for additional investment and maintenance costs. These are based on our own estimates of the relationship between power costs and associated investment and maintenance costs for pumping assets. We assume an 80:20 relationship between power costs and non-power costs associated with pumping. Given recent increases in power costs may have distorted this relationship, we apply the ratio to our estimate of power costs before adjusting for real price increases between 2017/18 and 2022/23.

(d) For the treated water distribution model, we include an estimate for the implicit allowance based on the inclusion of the APH variable. We provide further detail on the assumptions underpinning this estimate in the following section.

(e) We have included an ambitious 1% ongoing efficiency challenge across our AMP8 plan, which will also account for further mitigations we propose to undertake to manage our cost exposure. This mainly accounts for actions we propose to undertake to limit the volume of water we have to abstract, by reducing per capita consumption and further reducing leakage. As we have been requested to present our claim pre-RPE and pre-ongoing efficiency, it is not captured in our net claim below. However, we present another table showing the size of our claim once this 1% ongoing efficiency assumption is included.

(f) Finally, we subtract the power costs associated with water treatment, which are partially captured within our cost adjustment claim for water softening.

(i) In our early cost adjustment claim, we assumed 42% of our claim was captured within our cost adjustment claim for softening. This was based on the assumption that all power costs associated with Water Treatment (WT) relate to softening. Over the period 2011-12 to 2021-22, WT power costs made up 42% of WRP power costs.

(ii) However, in practice, only a proportion of our WT power costs relate to softening. Consistent with our bottom-up estimate of softening-related power costs in our softening claim, we have worked out the proportion of WRP power costs that relate solely to softening and estimate it closer to 19%.

37. In the table below, we summarise our calculation steps and the total cost adjustment claim. Our total claim in 2017/18 prices over the full AMP is £35.61 million, or £42.04

[6] This forecast has been updated slightly from our early Cost Adjustment Claim so that it is in line with our WRMP assumption and consistent with the remainder of our business plan submission.

[7] DESNZ (2023) Gas and electricity prices in the non-domestic sector. Available at: https://www.gov.uk/government/statistical-data-sets/gas-and-electricity-prices-in-the-non-domestic-sector

million in 2022/23 prices. The breakdown in 2022/23 prices is £22.30m for water resources plus and £19.74m for treated water distribution.

Table 7: Summary of cost adjustment calculation (AMP8), £m, 2017/18 prices

	Water resources plus	Treated water distribution
(a) APH impact on power costs	11.47	9.18
(b) RPE adjustment for power costs [8]	8.90	7.12
(c) Impact on maintenance and investment costs	2.87	2.30
(d) Further management mitigations	Captured in OE assumption	
(e) Exclusion of water treatment costs including water softening	4.34	0.00
Gross claim: (a) + (b) + (c) - (d) - (e)	**18.89**	**18.60**
(f) Implicit allowance for APH in base cost models	0.00	1.88
Net claim: (a) + (b) + (c) - (d) - (e) – (f)	**18.89**	**16.72**
Net claim per annum	3.78	3.34
Claim uplifted to 2022-23 prices		
Gross claim	22.30	21.96
Net claim	22.30	19.74
Net claim per annum	4.46	3.95

Source: SES Water analysis

38. We have not adjusted the amounts in Table 7 for catch-up efficiency. There are three reasons.

(a) First, given our small size and the significance of this CAC, our overall allowances are particularly sensitive to model selection and the application of this CAC.

(b) Second, important elements of this claim are outside our immediate control (in particular electricity unit rates) and so may be less amenable to an efficiency challenge based on aggregate benchmarking.

(c) Finally, in the subset of three cost models in which APH is included in a form consistent with the part of the value chain being modelled, our efficiency score is in line with the upper quartile benchmark. Taken together, we do not find convincing evidence that a catch-up efficiency challenge would be warranted.

39. In line with the guidance provided by Ofwat, we have also not adjusted the amounts in the table below for future RPEs (beyond 2022/23) and ongoing efficiency. In the table below, we summarise our claim once RPEs and ongoing efficiency are included:

[8] This adjusts for real price increases to 2022/23, while accounting for any real price increases already implicit within the base cost models.

Table 8: Cost adjustment claim including RPEs and ongoing efficiency (AMP8), 2017/18 prices

	Water resources plus	Treated water distribution
Net claim before RPEs and OE	18.89	16.72
Real Price Effects adjustment	2.48	2.18
Ongoing Efficiency adjustment	-0.64	-0.46
Net claim after RPEs and OE	**20.73**	**18.34**
Net claim after RPEs and OE (2022/23 prices)	24.47	21.66

Source: SES Water analysis

D. Materiality

40. Looking at the period 2011/12 to 2021/22, power cost accounts for 11% of base costs on average across the industry, while it accounts for almost 15% of base costs at SES Water. This provides an illustrative example of the materiality of our claim.

41. In order to match the claim with Ofwat’s requirement, we split our claim into two separate power cost claims, one for water resources, and one for network plus. We then calculate the materiality as the percentage of the claim amount in the totex of the corresponding price control. For water resources, the claim amount accounts for 51% of AMP8 totex, while for network plus, it is 9%. Therefore, the claim amounts of both price controls are material.

3. Cost efficiency

In this section we set out in further detail the basis on which we have calculated our proposed APH cost adjustment claim and why we consider the claim to be consistent with our efficient costs. We have developed an approach that utilises econometric modelling to estimate the impact of our additional pumping requirements on our required base cost allowances.

We have also accommodated within our claim, real price increases in power costs that are not captured in Ofwat's base cost modelling as a result of moving to a real 2022/23 price base. We have linked this real price adjustment to an external benchmark index published by DESNZ.[9]

A. Calculation and supporting evidence

43. The additional expenditure we include in this cost claim comprises higher power costs, maintenance (labour and materials) and investment costs (i.e. capital replacement). Additional power costs form the majority of our cost claim, as shown in Table 9.

44. As described in Section 2, we have used econometric analysis to estimate our cost exposure and to forecast our cost claim over the period 2025/26 to 2029/30.

45. Although we have provided a point estimate, the exact size of our cost claim will ultimately be dependent on the final base cost models that are chosen by Ofwat. Specifically, the size of our claim will be dependent on the extent to which APH (both for TWD and for WRP) is captured directly as an explanatory variable within the models. Our point estimate below is based on the base cost models in Ofwat's April consultation, assuming an equal weighting of each of the top-down and bottom-up models consistent with Ofwat's guidance for preparing CACs.

Our gross claim

Estimated impact of APH on power costs

46. To estimate our claim, we have modelled the gross impact of APH on power costs outside of the base cost modelling suite, using five different models. We specifically use power costs (or power costs normalised by distribution input (DI)) as our dependent variables rather than total costs, as we would expect APH to affect power costs directly. As the results of the model show, APH is a significant variable when used to estimate power costs specifically. We have also used multiple models to test the robustness of our findings across a range of model specifications. Our justification for each model is provided in the table below, with the detailed results included in Annex A.

9 A published index that is outside SES Water's control and captures general price increases (over and above CPIH inflation) in energy costs for non-domestic entities in the economy.

Table 9. Selected models for power cost adjustment claim

Model	Dependent variable	Explanatory variable	Justification
1	Power WRP/DI	Properties, WRP APH/DI	The value chain matches those Ofwat models that do not have a power cost driver. The unit cost and cost drivers provide strong evidence of APH's impact in driving power cost when normalised by DI.
2	Power WRP/DI	Properties, WRP APH	Same as above, but with total APH for the value chain used instead as a robustness check.
3	Power WR/DI	Properties, WR APH	The value chain that matches the price control, but not modelled by Ofwat. The impact of APH on cost is most significant for SES in this price control. Strong empirical evidence.
4	Power WRP	Properties, WRP APH	The value chain matches those Ofwat models that do not have power cost driver. Use total APH for this part of the value chain for robustness check.
5	Power WW/DI	Properties, WW APH/DI	The value chain matches Ofwat's models. Use APH/DI following strong evidence that APH impact is properly assessed when normalised by DI.

Source: SES Water Analysis
Note: For the dependent variables, we have deflated power costs to 2017/18 prices using the DESNZ electricity price index (Non-Domestic Energy Prices, Table 3.3.2) to better account for real price inflation of power costs.

47. To calculate the gross claim for each price control, we have taken the following steps.

- Step 1: Run the five econometric models that we use as the basis of our claim to obtain the model coefficients.
- Step 2: Multiply the coefficients with the corresponding forecast of the explanatory variables, reversing the logarithm transformation, to obtain the model predicted cost.

  Where appropriate, we multiply the cost allowance per Ml of distribution input by distribution input to obtain the total claim.
- Step 3: For those models that do not match the price control, we apportion the claim based on historical proportions of expenditure.
- Step 4: Where there are multiple models for a single price control, we average the claim amounts to form a single claim weighting each model equally.

48. The table below provides a summary of the implied claims under each model, including when the model is apportioned to a specific price control. These claims are in 2017/18 prices and exclude the effect of real electricity price increases.

Table 10. Summary results of econometric analysis (£m, 2017-18 prices)

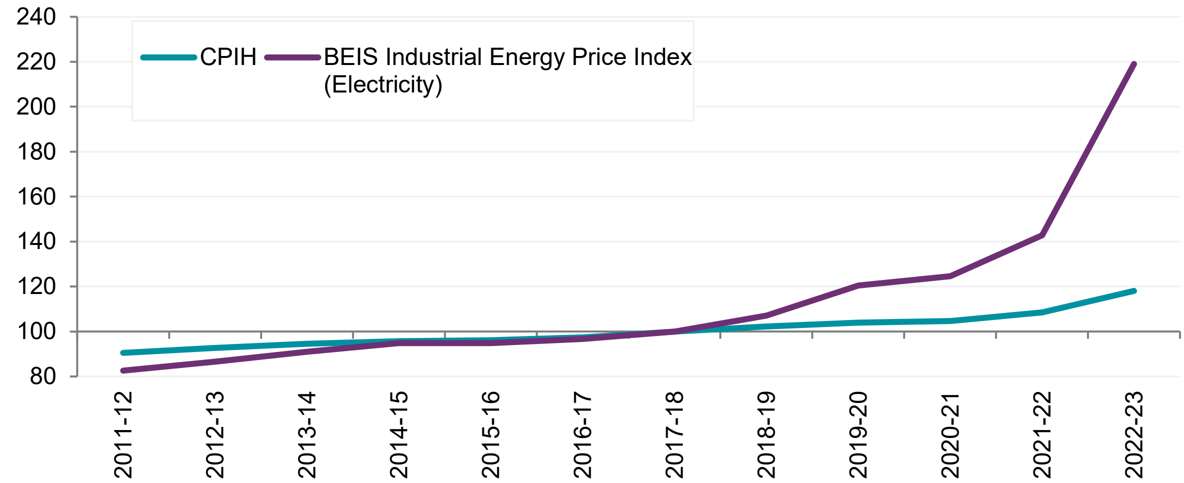
Model	Dependent variable	Dependent variable price control	Raw claim	Apportioned price control	Apportioned claim
1	Power WRP/DI	Water resources plus	11.52	Water resources plus	
2	Power WRP/DI	Water resources plus	11.49	Water resources plus	
3	Power WR/DI	Water resources	3.79	Water resources plus	11.47
4	Power WRP	Water resources plus	11.52	Water resources plus	
5	Power WW/DI	Wholesale water	23.37	Water resources plus	
5	Power WW/DI	Wholesale water	23.37	Treated water distribution	9.18

Source: SES Water Analysis

Adjustment to account for real price increases in electricity costs

49. As can be seen from the figure below showing data on electricity prices from DESNZ,[10] industrial electricity prices have increased by 76% between 2020-21 and 2022-23 in nominal terms (56% in real terms). In real terms, between 2017-18 (the price level base we assume is implicitly reflected in Ofwat's models) and 2022-23, electricity prices have increased by 86%. This real price increase is not captured in Ofwat's models.

Figure 5. Industrial electricity prices and CPIH, 2017-18 = 100



Source: SES Water analysis of DESNZ data

10 DESNZ (2023) Gas and electricity prices in the non-domestic sector. Available at: https://www.gov.uk/government/statistical-data-sets/gas-and-electricity-prices-in-the-non-domestic-sector

50. Understanding how much of the recent increase in electricity prices is captured in Ofwat's models is not a straightforward exercise. While the data is presented in a real 2017-18 price base, it is possible that some of the recent increase in energy costs is implicitly captured in some of the model coefficients.

51. As a rough estimate of how much of the recent increase in energy costs may be captured in the models already, we look at the average electricity price index in real terms over the modelled period (i.e. 2011-12 to 2021-22) and compare that against the index for 2017-18. We see that the average price over the modelled period was approximately 4% higher than it was in 2017-18. As such we assumed 4% of the 86% real price increase observed between 2017-18 and 2022-23 has been captured in the models and assume the residual 78% is yet to be captured.

52. We have included this in our cost claim due to the specific impact energy RPEs have on our power costs associated with pumping.

Estimated impact of APH on investment and maintenance costs

53. To estimate the impact of APH on investment and maintenance costs, we assume an 80:20 ratio between power costs and other costs associated with pumping. Our rationale for including such an adjustment is on the basis that more pumping, and more intensive pumping, requires greater maintenance of pumps.

54. The estimate of the relationship between power and maintenance costs is an internal engineering-based judgment of the ratio. We apply this ratio to our power cost estimate before the real price effect adjustment, to avoid distortions from recent real price increases.

55. There are a number of considerations to the expected impact of APH on maintenance costs, including pump configuration - being a combination of capacity of the pump in terms of flowrate and its NPSH/APH - and aspects of maintenance being a fixed cost.

Further management mitigations

56. A number of our existing mitigations are included within our base cost submission. To ensure we continue to challenge ourselves to mitigate the impact of our network topography on our power costs, we are assuming a 1% ongoing efficiency challenge to our costs. As we have been requested to provide a claim excluding ongoing efficiency, this is not reflected in our claim estimate.

Implicit allowance for APH within Ofwat base cost models

57. We have calculated the implicit cost allowances for each of Ofwat's top-down and bottom-up base cost models by taking the difference of the calculated total allowance under two runs:

(a) We first calculate the total allowance using SES Water-specific forecasts of each of the explanatory variables.

(b) We then calculate the total allowance using industry average estimates of the two pumping related explanatory variables – booster pumping stations per length and APH for treated water distribution.

58. The implicit allowance varies significantly by model: in models that incorporate APH it is relatively high but for the models that use booster pumping stations as an explanatory variable, we estimate the implicit allowance to be negative. As discussed previously, the inclusion of this variable creates a larger gap between the modelled costs and our actual

cost exposure from an engineering fundamentals perspective. In the table below, we summarise our estimate of the implicit allowance by model over the AMP8 period.

Table 11: Calculation of implicit allowance over AMP8

Model	Allowance using SES variables	Allowance using industry average variables	Implicit allowance	Implicit allowance excluding negative
WRP1	68.9	68.9	-	-
WRP2	65.2	65.2	-	-
WRP3	72.5	72.5	-	-
WRP4	68.7	68.7	-	-
WRP5	75.0	75.0	-	-
WRP6	70.9	70.9	-	-
TWD1	82.2	101.8	-19.6	-
TWD2	79.1	96.7	-17.6	-
TWD3	80.4	100.9	-20.5	-
TWD4	102.1	99.3	2.7	2.7
TWD5	100.0	96.9	3.1	3.1
TWD6	104.0	101.3	2.8	2.8
WW1	147.4	182.3	-34.9	-
WW2	145.2	178.4	-33.2	-
WW3	143.9	182.2	-38.3	-
WW4	142.2	178.2	-36.0	-
WW5	157.0	187.1	-30.1	-
WW6	154.0	181.3	-27.3	-
WW7	181.1	176.5	4.7	4.7
WW8	177.3	172.8	4.4	4.4
WW9	185.2	180.3	5.0	5.0
WW10	181.7	177.0	4.8	4.8
WW11	190.9	186.9	4.0	4.0
WW12	185.3	181.7	3.7	3.7
Average			**-11.3**	**1.8**
Average incl. catch-up efficiency challenge			**-11.8**	**1.9**

Source: SES Water

59. When aggregating these implicit allowances to provide a point-estimate, we conservatively assume that there are no negative implicit allowances. Therefore, we have only captured instances where the implicit allowance is zero or positive.

60. An implication of our approach is that for the WRP model, we assume there is no implicit allowance within Ofwat's base cost models currently.[11] We consider this appropriate in the context of half the top-down models including booster pumping stations as an explanatory variable, which is negatively correlated with our power consumption, as shown in Table 13 in Annex A.[12]

61. As a result, our current assumption is that any implicit allowance is being allocated according to scale across the industry. This would imply that SES is indeed getting a negligible allowance in some of the base cost models.

Symmetrical cost adjustment

62. We consider our claim for costs associated with pumping to be a symmetric one. Most costs associated with pumping are likely to be reflected in power costs, which Ofwat has aimed to account for through its inclusion of the booster pumping stations and treatment complexity variables within its base cost models. While we consider that the exclusion of APH from a subset of the base cost models reduces our estimates of efficient costs, those missing costs are likely to be included in the allowances of other water companies.

63. We do not think the entirety of our claim is symmetrical. The adjustment we make to account for real energy price increases up to 2022/23 are designed to account for costs that are not in the base cost models. As such, we calculate our symmetrical adjustment excluding this adjustment.

64. In Annex B, we set out how we have estimated symmetrical adjustments for other water companies.

B. Undertaking a top-down sense check of our claim

65. As shown in Table 7, our total claim is £42.0m over AMP8, or £8.4m per annum in 2022/23 prices. We have undertaken a series of top-down cross-checks to assure ourselves of the appropriateness of the size of our claim.

66. Ofwat's own analysis of base costs in its recent consultation offers an initial insight into the potential size of our claim. A subset of its models include APH for Treated Water Distribution (TWD), while other models either exclude variables linked to network topography entirely or include an alternative variable (the number of booster pumping stations). We have reviewed the model results including and excluding APH for TWD.[13]

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11 We considered an approach – consistent with Ofwat guidance - to calculate the implicit allowance where the WRP models were run with and without APH included as an explanatory variable directly in the model. However, since the variable is insignificant in Ofwat's testing, while our disaggregated regressions clearly demonstrate that APH is a statistically significant driver of power related costs, we concluded this was not a viable approach.

12 We also note that for the bottom-up models, there is little to no correlation between the explanatory variables in the models and APH.

13 For Wholesale Water (WW) and Treated Water Distribution (TWD), this exercise is straightforward. For Water Resources Plus (WRP), since there are no models that include APH, we have had to make some assumptions. At one end of the range, we assume that including APH in WRP models would have a similar percentage impact on our efficiency score as in the WW and TWD models. At the other end of the range, we assume that including APH in WRP models would result in a similar overall efficiency score as in the TWD models including APH; this efficiency score is also comparable with our overall efficiency score in the PR19 Final Determination (including successful cost adjustment claims).

(a) Using the bottom-up models and the most recent five years' worth of outturn data, we would expect the 'gross' value of our claim to be £83m and the net value of our claim to be £68m (in 2022/23 prices), before accounting for real energy price trends.

(b) Using the top-down models, we would expect the 'gross' value of our claim to be £45m and the net value to be £23m. The size of our actual claim is comfortably within this £23m to £68m range, even before we account for real energy price trends.

(c) This range sits above our recent aggregate power expenditure, which indicates that there are potentially significant non-power related costs associated with APH that are not accounted for in Ofwat's base cost modelling. It also indicates that the models that exclude APH in fact provide us with a negative implicit allowance for our network topography.

67. We have reviewed the APH claim submitted by Anglian Water, which estimates the size of SES' symmetric adjustment as £40m in 2022/23 prices. This is before accounting for real energy price increases to 2022/23. The Anglian Water claim only considers pumping costs related to TWD and excludes WRP. As such, we consider our claim to be relatively conservative.

4. Customer protection

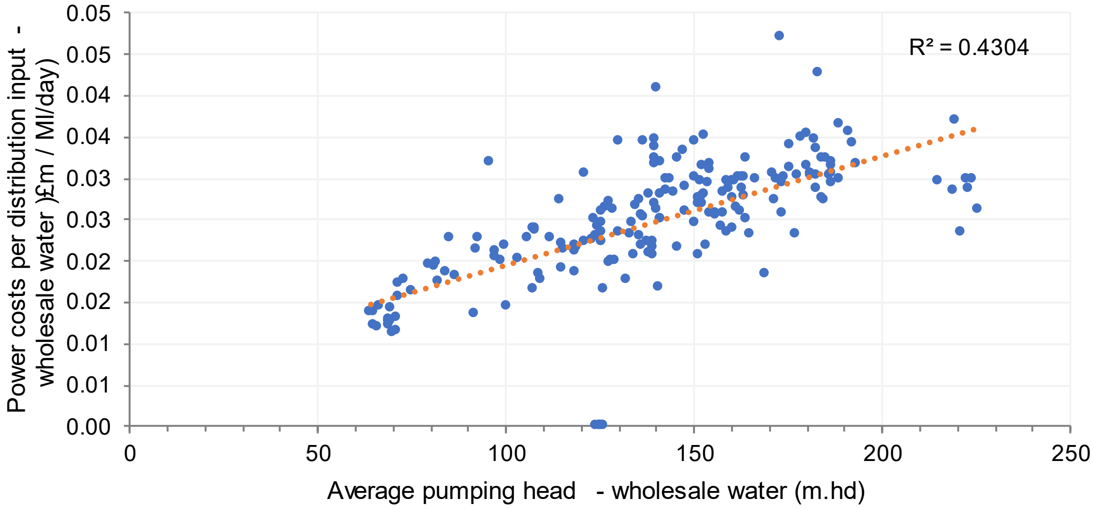
The consumption of electricity in general is integral to our service delivery. And the pumping requirements we refer to in this submission are at the core of our delivery of water to our customers.

69. Customer protection is achieved through the fact that if the expenditure this claim seeks to secure is cancelled, delayed or reduced in scope, then we would not be able to deliver on a range of our performance commitments that will be set out as part of our PR24 Business Plan, including:
    - (a) Reducing supply interruptions
    - (b) Reducing the risk of unplanned outages at treatment works
    - (c) Via the Retail Cost control, delivering a positive C-MeX score
    - (d) Delivering a positive BR-MeX score
    - (e) Delivering a positive D-MeX score
    - (f) Limiting the occurrence of customer concerns about their water
    - (g) Maintaining industry-leading levels of water quality compliance
70. We consider there to be material reputational damage at stake if these performance commitments are not met, along with significant additional costs to the business. As such, we believe that customers are adequately protected from any risk of the expenditure within the cost adjustment claim not being progressed.

Annex A: Further evidence

A. Supporting evidence of claims made in this submission.

Figure 6: Correlation between average pumping head and normalised power costs



Source: SES Water analysis

Table 12. Average correlation of dependent variables in WRP models

	aph_wr	aph_wrp	prop	prop_km	prop_km_s	wac	pctwatertre	wad_msoa	wad_msoa	lad_msoa
aph_wr	1.0000	0.6103								
prop	- 0.5361	- 0.3644	1.0000							
prop_km	- 0.3577	- 0.3104	0.3513	1.0000						
prop_km_squared	- 0.3876	- 0.3403	0.3764	0.9864	1.0000					
wac	- 0.1420	0.2069	0.2818	0.0894	0.1088	1.0000				
pctwatertreated36	- 0.0900	0.2980	0.2210	- 0.0614	- 0.0696	0.8906	1.0000			
wad_msoa	- 0.4822	- 0.4066	0.4684	0.9202	0.9576	0.1697	- 0.0320	1.0000		
wad_msoa_squared	- 0.4411	- 0.3515	0.4822	0.8248	0.8998	0.2138	- 0.0046	0.9619	1.0000	
lad_msoa	- 0.4481	- 0.3865	0.4450	0.9309	0.9705	0.1766	- 0.0120	0.9791	0.9514	1.0000
lad_msoa_squared	- 0.4049	- 0.3349	0.4734	0.7920	0.8770	0.2203	0.0047	0.9272	0.9902	0.9402

Source: SES Water analysis

Table 13. Correlation between booster/km and real power cost in WR, WRP, TWD, WW, or normalised by DI or MWh

	boosterperle	realpowerwr	realpowertwd	realpowerww	realpowerv	realpowerv	realpowerv	realpowerw
boosterperlength	1							
realpowerwr	-0.352758	1						
realpowertwd	-0.312602	0.80279063	1					
realpowerww	-0.3019	0.89451541	0.88370695	1				
realpowerwrp	-0.229903	0.79522034	0.59447394	0.90169918	1			
realpowerwrp di	0.2369758	-0.0571032	-0.3559083	-0.0781894	0.194446	1		
realpowerww di	0.2778217	-0.0322637	-0.0154603	-0.0833041	-0.12884	0.509174	1	
realpowerww mwh	0.0277686	0.20795255	0.20353025	0.18203934	0.124736	0.116154	0.278377	1
realpowerwr di	-0.174801	0.09103957	-0.1266628	-0.2091249	-0.24228	0.251681	0.470431	0.1400748

Source: SES Water analysis

Table 14. Regression result of selected models for cost claim

	WRP/DI	WRP/DI	WR	WRP	WW
lnprop	0.661***	0.144**	1.115***	1.155***	0.644***
	{0.000}	{0.030}	{0.000}	{0.000}	{0.000}
lnaph_wrp_di	0.511***				
	{0.000}				
lnaph_wrp		0.517***		0.498***	
		{0.000}		{0.000}	
lnaph_wr			0.207**		
			{0.049}		
lnaph_ww_di					0.611***
					{0.000}
_cons	-12.260***	-8.371***	-15.141***	-15.949***	-11.729***
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}
depvar	lnrealpowerwrp_di	lnrealpowerwrp_di	lnrealpowerwr	lnrealpowerwrp	lnrealpowerww_di
Est. method	RE	RE	RE	RE	RE
N	187	187	187	187	187
vce	cluster	cluster	cluster	cluster	cluster
R_squared	0.303	0.31	0.694	0.884	0.572

Source: SES Water analysis

B. Forecast of cost drivers

71. To calculate our claim, we make the following assumptions around how each of the cost drivers are expected to grow:

- **Connected properties:** We extrapolate based on the compound annual growth rate (CAGR) between 2011-12 and 2022-23, at 0.67% growth per annum.
- **SES' APH:** We assume APH for each of the price controls will be the same as in 2022-23 for the whole forecast period.
- **Distribution input:** We extrapolate based on the compound annual growth rate (CAGR) between 2011-12 and 2022-23, at 0.40% growth per annum.
- **Length of mains:** We extrapolate based on the compound annual growth rate (CAGR) between 2011-12 and 2022-23, at 0.22% growth per annum.

- **Industry average APH:** We assume APH for each of the price controls will be the same as in 2021-22 for the whole forecast period.
- **Industry average booster pumping stations per length of mains:** We assume the number of booster pumping stations per length of mains, when averaged across the indutsry, remains constant at the 2021-22 value.

Annex B: Symmetric adjustment

72. In this annex, we set out how we have estimated the symmetrical adjustments for other water companies.

73. We argue in our claim that wholesale water APH per distribution input is the most appropriate explanatory variable for costs associated with pumping. As a result, we estimate our symmetric adjustment on the basis that our claim is implicitly included in the allowance of other water companies, inversely proportional to this explanatory variable. In other words, we use the inverse of wastewater APH per Ml of distribution input as our scale variable.

74. We do not think the entirety of our claim is symmetrical. The adjustment we make to account for real energy price increases up to 2022/23 are designed to account for costs that are not in the base cost models. As such, we calculate our symmetrical adjustment excluding this adjustment.

- Our net claim in 2022/23 prices over AMP8 is £42.0 million
- Of this, £18.9 million relates to our adjustment for real energy price increases to 2022/23.
- As such, the net claim excl. the RPE adjustment is £23.1 million, which is the basis of our symmetrical adjustment calculation.

75. The result of this symmetrical adjustment calculation is as follows:

Table 15: Symmetrical adjustment

Company	WW APH/DI	Inverse of WW APH/DI	Allocation of symmetrical adjustment	Symmetrical adjustment
AFW	0.14	7.17	5.9%	-1.36
ANH	0.14	6.97	5.7%	-1.32
BRL	0.68	1.47	1.2%	-0.28
HDD	2.40	0.42	0.3%	-0.08
NES	0.09	10.89	8.9%	-2.06
NWT	0.04	22.74	18.6%	-4.31
PRT	0.39	2.56	2.1%	-0.48
SES	1.15	0.87	0.7%	-0.16
SEW	0.29	3.46	2.8%	-0.66
SRN	0.30	3.35	2.7%	-0.63
SSC	0.47	2.13	1.7%	-0.40
SVE	0.09	11.51	9.4%	-2.18
SWB	0.23	4.39	3.6%	-0.83
TMS	0.04	25.61	21.0%	-4.85
WSH	0.17	5.83	4.8%	-1.10

Company	WW APH/DI	Inverse of WW APH/DI	Allocation of symmetrical adjustment	Symmetrical adjustment
WSX	0.41	2.42	2.0%	-0.46
YKY	0.10	10.35	8.5%	-1.96
Total	**7.14**	**122.13**	**100%**	**-23.12**

Source: SES Water