Operating expenditure efficiency targets

PAPER FOR NORTHERN IRELAND WATER

The Utility Regulator has published its draft determination for the water and sewerage service for 2013 to 2015. The draft determination includes catch-up operating efficiency targets of 6% per year. Northern Ireland Water has asked Frontier to assess whether the available evidence supports the scale of the catch-up efficiency target.

Introduction

The Utility Regulator (UR) has published its draft determination for the water and sewerage service for 2013 to 2015. In setting the allowance for operating expenditure for the period UR has estimated the relative efficiency of Northern Ireland Water (NIW). It has also assessed the scope for NIW to close the gap to the most efficient comparators (the efficiency frontier). UR has included, in the draft determination, catch-up operating efficiency targets of 6% per year.

NIW has asked Frontier to assess whether the available evidence supports this scale of catch-up efficiency target. In addressing this issue, we have considered the following elements:

- the assessment of NIW's operating efficiency relative to comparators and the robustness and reliability of the modelling;
- UR's assumption on the rate at which any inefficiency can be closed and whether this is consistent with regulatory precedent; and
- evidence on the actual rate of operating efficiency improvement that GB comparators have achieved since privatisation / regulation.

This note summarises our assessment of the evidence on these elements. The assessment concludes that, based on these factors, the catch-up target of 6% per year is too high and is not supported by the evidence or regulatory precedent.

Specific findings in support of this conclusion include the following.

- There are concerns around the robustness of the efficiency modelling and therefore the degree of certainty of the estimation of NIW's efficiency. This uncertainty does not support UR's catch-up assumption of 72.5% over five years that is greater than the assumption of 60% over five years that has been applied by UR at the previous price control (PC10) and by Ofwat at previous price control reviews in England and Wales.

- The evidence on actual out-turns does not support the catch-up figure and the data shows that England & Wales companies have not generally exceeded the 60% catch-up figure that Ofwat has applied.

- The 6% efficiency target that is implied by the catch-up factor sits at the top of the range experienced by GB utilities since privatisation. It is higher than the rates achieved by water and sewerage companies in England and Wales. It is also higher than the average improvement witnessed in Scotland since 2002/03.

The note considers the elements of the evidence base in turn.

Robustness of the efficiency modelling and precision in assessing relative efficiency

Summary of UR's approach

UR's approach to the assessing the relative operating efficiency of NIW can be summarised briefly as follows:

- UR use econometric (and unit cost) models to compare NIW's actual and predicted expenditure for different categories of opex, based on 2010/11 data;

- the models are based on those that have been developed by Ofwat over successive price control periods and includes data on England and Wales companies;

- the modelled expenditure is adjusted to include PPP concessionaire payments as a proxy for the costs of operating PPP assets;

- the models are also used to predict the level of expenditure of the most efficient or 'frontier' company, again using the methodology developed by Ofwat;

- adjustments are made, off-model, to atypical costs and legitimate cost drivers that are not captured in the models (special factors); and

- UR assumes that NIW can close 72.5% of the gap to the efficiency frontier over a five year period, this compares to the assumption of 60% catch-up applied by NIAUR in PC10 and by Ofwat in previous price controls.

This section considers a number of factors that indicate that the assessment of NIW's relative efficiency is less robust and precise when compared to the assessment's made of England and Wales (E&W) companies. This would

suggest, by itself, that UR is not justified in applying the higher catch-up factor of 72.5%.

The factors that are considered in this section are that:

- first, NIW faces greater scale of special factors and uncertainty over special factors compared to a typical E&W company;
- second, Ofwat no longer supports the benchmarking models and therefore they are increasingly out of date; and
- third, UR has excluded the business activities models from the assessment of efficiency and has also included PPP concessionaire costs within modelled opex.

Scale and uncertainty over special factors

The first factor is that NIW faces a greater scale of special factor adjustment and also uncertainty over the special factors compared to a typical E&W company. This generates uncertainty over the assessment of relative efficiency.

The inclusion of special factor adjustments is a valid element of the efficiency modelling that has been developed by Ofwat. Each of the separate efficiency models (e.g. water distribution or business activities) is based on a small number of explanatory factors (typically one or two). As a result, there is a real prospect that legitimate cost drivers will not be captured in the modelling. If adjustments were not made for these factors then the modelling would include the impact of these in the calculation of the efficiency gap and potentially penalise the company with an unrealistic efficiency target.

Adjustments for cost drivers that are not reflected (or not fully reflected) in the models are referred to as special factors. For the E&W companies Ofwat has considered the case of including special factors for most of the companies. Over successive price controls a set of special factors have been developed and estimated. The special factors range of items that only affect one or two companies (for example, a requirement to soften water) to items that affect many companies (for example, differences in regional wages).

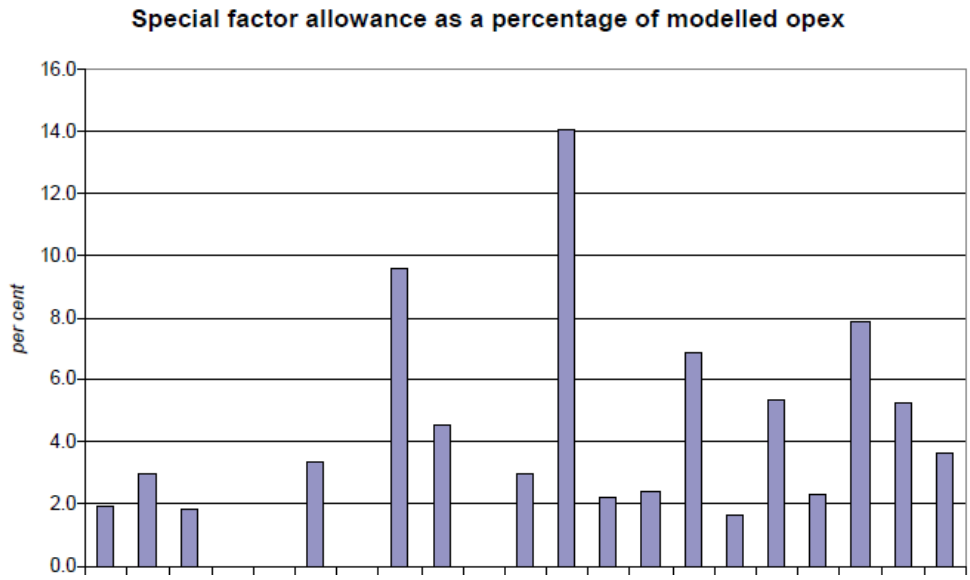
Figure 1 below shows the scale of special factors allowed by Ofwat for E&W companies at the 2009 price control. This figure was produced by the Competition Commission for the determination of charges for Bristol Water in 2010[1].

The figure shows that special factor adjustments are applied to the majority of companies in E&W.

---

1 Competition Commission, *Bristol Water plc*, Appendix K, August 2010.

Figure 1. Special factors in England and Wales PR09



Source: Competition Commission, Bristol Water, 2010

When it comes to applying Ofwat's efficiency modelling approach to NIW, there are issues around special factors that increase the uncertainty around the assessment of efficiency.

The scale of total special factors for NIW is large compared to E&W average. For NIW, the scale of total special factors expressed as a percentage of total modelled opex is around 9%. Only two of the E&W companies have a total special factor contribution that exceeds this (see Figure above). These are smaller water only companies that face specific operating environments.

The extent of the special factors applied to NIW indicates that the efficiency models are less suited to NIW than to E&W. At one level this is not surprising given that the models were developed by Ofwat to be applied to E&W companies. It does though suggest that more caution should be applied in assessing the catch-up factor for NIW based on the modelling results.

Process of identifying and estimating NIW special factors is ongoing. In addition, the special factor estimates in E&W have been developed and refined over a number of price controls. This has not been the case in Northern Ireland, which is at a much earlier point in the development of economic regulation. There appears to be agreement on the side of both the regulator and the company that further work is needed on NIW's special factors.

Specifically, there is ongoing uncertainty over the estimation of the water distribution special factor. This is the largest single special factor for NIW, UR allowed a factor of £9.5m out of a total special factor adjustment of £13.1m.

There is agreement that a special factor adjustment for water distribution is required but different approaches to modelling and estimating the special factor give different results. The analysis submitted by NIW indicated a special factor of £15.7m, while UR's modelling approach gave an estimate of £9.5m. For the purpose of this analysis we are not considering the merits of the different models. Nevertheless, it is clear that there is not (yet) a clear definitive appraoch to estimating the special factor and UR agree that further investigation is required in advance of the next price control in 2015:

> *"there is recognition that a new specification must be sought in order to better predict distribution opex and efficiency at PC15."*[2]

Therefore, there remains a range of uncertainty over the true value of this special factor. This uncertainty is greater than that over the estimation of special factors in E&W, which have been researched and reviewed over many years.

Furthermore, UR acknowledges (in Annex A) that there may be other special factors which have yet to be determined.

> *"There may be other special factors which have yet to be determined. The scope of this two year price control is somewhat limited. Consequently, neither the company nor the Utility Regulator has pursued new special factors."*[3]

NIW considers that there could be a case for a significant special factor in relation to sewerage opex, and that this should be properly explored. The fact that the efficiency modelling indicates that NIW is much further from the benchmark on sewerage than water opex, provides some preliminary support for this view.[4]

UR assumes for PC13 that additional special factors would be offsetting and therefore have an expected value of zero. Even if this were the case it still implies that there is greater uncertainty and variation around the true value of the special factor than would be the case in England and Wales.

In summary, the extent of the special factors for NIW and the uncertainty over the estimation of the water distribution factor and the identification of further factors **would justify adopting a more cautious approach with respect to**

---

2 Utility Regulator, *Water and Sewerage Service Price Control 2013-2015*, Draft Determination, Annex A, page 7.

3 Utility Regulator, *Water and Sewerage Service Price Control 2013-2015*, Draft Determination, Annex A, page 27]

4 Note that the observation that the modelling puts NIW closer to the efficiency frontier on water compared to sewerage is apparent when the special factors are properly allocated. In UR's calculation (Annex B) this is not obvious because the special factors are allocated pro rata across water and sewerage. This is not justified as the clear majority of special factors relate to water expenditure. UR's approach makes only a minor difference to the calculation of the efficiency target but it does materially affect the calculation of water efficiency versus sewerage efficiency.

catch-up factors. It is not consistent with applying a more aggressive assumption that used by Ofwat. It is also at odds with the more cautious approach adopted by the Water Industry Commission for Scotland in its 2002 determination (see below).

As a way of illustrating the significance of this uncertainty, **Table 1** shows the implied catch-up factor if NIW's estimate of the water distribution special factor was correct. The Table holds all other elements of UR's proposals the same, including the 6% efficiency target. It indicates that in this scenario the 6% target would imply a catch-up rate of 80% over five years, rather than 72.5%.

Table 1. Uncertainty over special factor estimation

	UR proposals	Revised to allow for £15.7m distribution factor
Allowed special factors	£11.9m	£18.6m
Cost savings over 5 years	27.62%	27.62%
Efficiency gap to frontier	38.12%	34.65%
Implied catch-up rate	72.5%	79.7%

Source: Frontier Economics calculations

Modelling process is less robust

The second area where the efficiency modelling is generating uncertainty is that the efficiency modelling is becoming less robust over time. The modelling structure was developed by Ofwat, but it has not updated the models since 2008/09.

This introduces the risk therefore that the models will become increasingly out-of-date and less robust. UR has re-estimated the models using 2010/11 data available from the E&W companies. However, UR does not have access to the steps and resources that Ofwat did in developing the models.

When Ofwat was making use of this type of econometric framework, the core model would be reviewed at each price control in a thorough way. The process that Ofwat followed is summarised in Annex 1. One of the important set of tasks in this process is the validation and refinement of data. This area, in particular, is one where UR is not able to undertake the same thorough process as Ofwat. Specifically, UR cannot benefit from the feedback from E&W

companies on atypical cost items and the interpretation of data. This could be particularly important when there are issues around the data in the June Return submissions

Similarly, when it comes to the development, review and refinement of the econometric models, UR is unlikely to have the same level of resources as Ofwat and also will not receive feedback from the E&W companies on the model specifications.

The model co-efficients that UR has estimated using the 2010/11 data are different to those used by Ofwat. In some cases the changes in the model specification are material. The sample size for the water models has also reduced from 22 to 21 companies. Details of the models where the co-efficients have changed materially are shown in Annex 2. For example:

- In the water distribution model, there is a significant change in the co-efficient on mains length per property from -0.713 in the Ofwat 2007/08 model to -0.376 in the UR updated model.

- In the resource and treatment model, the co-efficient on number of sources per distribution input has changed from 25.136 in the Ofwat 2007/08 model to 14.989 in the UR updated model.

- In the sewerage network model, the co-efficient on holiday population over resident population has changed from 1.253 in the Ofwat 2007/08 model to 2.150 in the UR updated model.

The changing specification of the models and the smaller sample size raises concern that the models are becoming less robust over time. This, combined with the lack of resources available to UR (including the feedback from E&W companies), it would be appropriate to apply a greater degree of caution in applying the efficiency models.

Regulatory precedent for applying less stringent efficiency targets

There is regulatory precedent for applying a less stringent approach to catch-up and efficiency targets in the face of less robust modelling evidence. For example:

- Ofwat and UR have applied larger residual adjustments to sewerage models (20%) compared to water models (10%) to reflect the smaller sample size and less precise results from the sewerage models.

- When Ofwat used econometric models for capital maintenance efficiency (for example, at the 1999 and 2004 price controls) they applied a lower catch-up factor of 40% to the efficiency frontier. This lower catch-up factor (i.e. compared to the 60% for operating costs) reflected the fact that the capital maintenance models were less robust.

Furthermore, in the 2010 determination of charges for Bristol Water the Competition Commission considered the robustness and suitability of Ofwat's modelling approach. The CC's conclusions drew a clear link between the scale of the catch-up factor and the degree of confidence in the modelling results.

> *"We also emphasize that the main justification for having the 60 per cent catch-up rate over a five-year period is that there is noise in Ofwat's efficiency estimates. If it were not for this noise, a 100 per cent catch-up over a five-year period would not be an unreasonable target, especially for opex expenditure."*

This supports the view that an increase in the uncertainty associated with the modelling results, i.e. an increase in 'noise' should be reflected in a lower catch-up target.

Treatment of business activities modelling and PPI costs

There are two final areas where UR's treatment is likely to increase uncertainty over the efficiency assessment.

First, an area of uncertainty arises from UR's treatment of the business activity modelling. UR has based its efficiency targets on modelling results that exclude the results of the business activity models. It should be noted that NIW's actual expenditure on both water and sewerage business activities is below the predicted expenditure by the model (i.e. it appears to be relatively efficient).

UR has a legitimate concern about the validity of the business activity modelling results for NIW. The reason for this is that the E&W companies undertake activities in terms of billing for household customers that are not undertaken by NIW (where household customers are not billed for water and sewerage services).

Nevertheless, there are aspects of UR's approach that raise concerns.

- First, although there is clearly a weakness with the business activities results for NIW, there is a risk in excluding it entirely from the analysis. Essentially UR is excluding a model where there is a factor that operates in NIW's favour. The risk is that there may be factors in the other models that act in the other direction, and therefore that UR's approach is one-sided.

- Second, a more direct concern is that the UR has estimated the efficiency target based on the models excluding business activities but has then applied the targets to operating expenditure including business activities. UR is implicitly assuming that NIW's underlying efficiency in business activities is the same as its measured efficiency in the other models. This is a strong assumption that does not appear to be supported by any evidence. Given the results of the modelling it seems difficult for UR to rule out that NIW's efficiency in business activities is superior to its measured efficiency in the other models.

Operating expenditure efficiency targets

UR's treatment of business activities raises additional uncertainty about its finding that NIW has an efficiency gap of 38% from the frontier.

Second, UR includes PPP concessionaire payments as part of the modelled opex. It is important to note that concessionaire payments are not an operating cost incurred by NIW. These payments are a 'third party' cost which UR uses as a proxy for cost of operating PPP assets. We understand that these costs are based solely on valuations provided by the external PPP contractors and that NIW does not subject these valuations to the normal cost verification process. This also increases the uncertainty in the assessment of NIW's efficiency.

Regulatory precedent on the catch-up factor

This section considers the evidence on the catch-up factor that has been applied in other sectors. The evidence we consider does not support UR imposing a higher catch-up factor than the 60% that has been applied by Ofwat.

This is based on evidence from decisions made by other regulators and we have also considered evidence on the actual catch-up that has been achieved by E&W water and sewerage companies. We consider this evidence first.

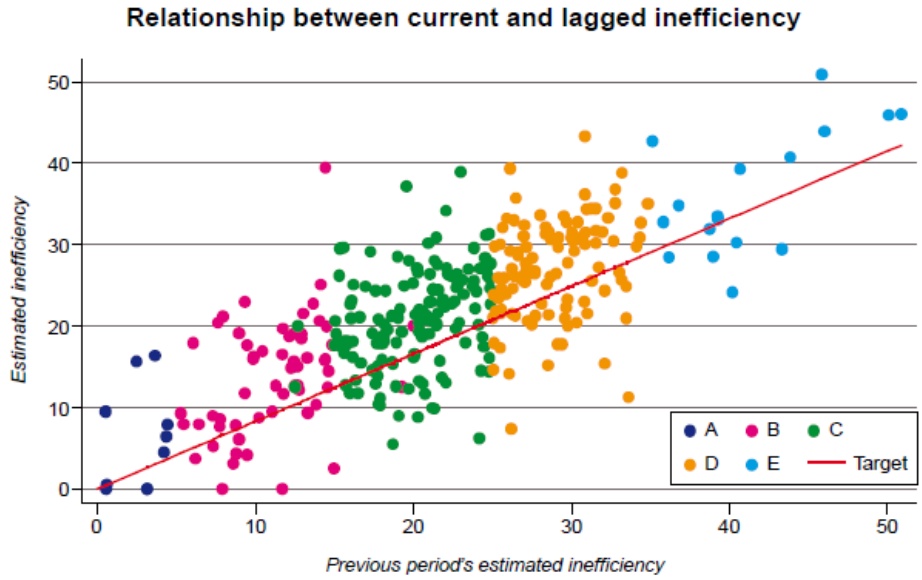
E&W companies have not systematically exceeded the 60% figure

There have been two studies that have considered whether E&W companies have managed to achieve the 60% catch-up assumption that Ofwat has applied at successive price controls.

The Competition Commission considered this issue in the 2010 Bristol Water determination. The CC's analysis is summarised in **Figure 2** which is taken from its final report.

In this figure the CC plotted the estimated inefficiency against the previous period's assessment. The line represents the target set by Ofwat based on 60% catch-up.

Figure 2. E&W performance against target



Source: CC Bristol Water 2010

If a company exceeds Ofwat's target then it would fall below the line on the figure, if it failed to meet the target then it would lie above the line. The CC's analysis revealed the following:

- In the majority of cases (two-thirds) the company did not achieve the target based on 60% catch-up.
- This result did not vary depending on the starting point. In other words, companies with a high degree of assessed inefficiency were just as likely to fail to achieve the target.

The CC concluded that:

> *"Fewer than one-third of observations lie on or below this line, suggesting that the majority of companies do not meet the catch-up efficiency targets."* [5]

Reckon time-series approach

The previous analysis on this issue was undertaken by Reckon in 2008. They undertook a study on Ofwat's econometric models for UKWIR. Reckon developed a time series model based on 9 years of historical data for E&W companies.

---

5 Competition Commission, *Bristol Water plc*, Appendix K, August 2010.

The Reckon study adopted the following approach:

- It measured unobserved cost differences, these being cost differences between companies that are not accounted for by explanatory variables or special factors in the model.
- It could be assumed that these unobserved cost differences in the model were inefficiencies.
- Efficiency catch-up was measured as these unobserved cost differences reducing over time.
- Reckon estimated that 65% catch-up over 5 years was implied using this measure.

However, as Reckon acknowledge the weakness with this interpretation of the results lies in the assumption that all unobserved cost differences were inefficiencies. We can decompose unobserved cost differences into:

  - Inefficiencies - unobserved cost differences that can be caught-up over time; and
  - Systematic cost differences - unobserved cost differences that will never reduce over time. These costs should not be subject to the same efficiency catch-up modelling because they are not inefficiencies.

The Reckon model assumes that all unobserved cost differences can be caught-up. This is inaccurate because not all systematic cost differences have been accounted for. As stated in the report, the 65% catch-up estimate is an upper bound of the true scope for efficiency catch-up.

Other regulatory decisions on catch-up factors

We have also considered catch-up decisions by WICS for Scottish Water and ORR for Network Rail.

Scottish Water

WICS have determined the appropriate catch-up factors to apply to Scottish Water in three price determinations: 2002, 2006 and 2010.

2002 determination

In 2002 WICS imposed a catch-up factor of 80% applied over 4 years. WICS's methodology involved a benchmarking exercise that identified that water companies costs would need to fall by 44% to reach the frontier. WICS assumed that 80% of this gap would be closed over a five year period from 2001/02 to 2005/06 (i.e. including the last year of the current period). The 80% catch-up was profiled as set out in Table 2 below:

Table 2. Profile of WICS catch-up target of 80%

	2001/02 (pre review period)	2002/03	2003/04	2004/05	2005/06
Profile of WICS catch-up target	10%	30%	20%	10%	10%
Annual opex real reduction targets*	4%	13%	10%	5.5%	5.5%

*Source: Table 18.1 Strategic Review 02-06, Section 4

Therefore the catch-up was focused in the first two years of the new price control period. There are three important considerations relating to this catch-up assumption:

- First, the efficiency frontier was set on a different basis to Ofwat's methodology;
- Second, the extent of the catch-up was dependent on the merger of the three water authorities that went to form Scottish Water; and
- Third, the opex allowance for Scottish Water included significant funding for measures to improve efficiency.

The frontier was calculated by WICS based a group of comparable companies from the E&W industry. It did not reflect the more efficient company that Ofwat used as the frontier benchmark in its analysis. WICS identified three companies (Northumbrian, South West and Yorkshire) who most closely resembled the three Scottish authorities[6]. The rankings and banding of these companies in 1999-2000 is summarised below in Table 3.

WICS assessment of the efficiency gap was based on the ranking of the lower of the comparator companies, thus reducing the size of the efficiency gap further compared to the Ofwat methodology.

There were a number of other differences in approach to assessing efficiency:

- WICs carried out an alternative assessment of the efficiency gap to validate the efficiency modelling results.

6 WICS, SR02 FD Section 2 Chapter 7 P76

- WICS made a number of adjustments to Ofwat models to better reflect local issues. For example they amended explanatory factors in the water resource and treatment model (WICS included different source types) and in the small wastewater treatment works model (WICS extended banding to include many small WWTW in Scotland and gave these works a higher unit cost).

- Benchmarking included the full costs incurred by the companies for leakage targets, domestic metering and other imposed costs not faced in Scotland.

Table 3. WICS comparators in 2002

	Water band	Water rank	Sewerage band	Sewerage rank
Northumbrian	A	2nd	C	9th
South West	C	9th	C	8th
Yorkshire	B	8th	B	3rd

*Source: WICS Strategic Review 02-06

Second, the extent of the catch-up was dependent on the merger of the three water authorities that went to form Scottish Water.

In addition WICS also identified that the scale of catch-up would be lower if the merger of the Scottish water authorities did not proceed. They concluded that the catch-up would be 50% by 2005/06 rather than 80%.

The third factor is that the opex allowance determined by WICS included £200m of Spend to Save funding. These allowances were profiled to match the profile of efficiency savings.

These factors are important in understanding the context of the 80% catch-up target imposed by WICS in 2002. It is therefore not directly comparable to the approach adopted by UR in the draft determination.

2006 determination

In the 2006 determination WICS imposed a 50% catch-up over 4 years. This is broadly equivalent to Ofwat's 60% over 5 years. The assessment of efficiency was based on evidence from a number of modelling formulations including the Ofwat models, the Ofwat models extended to include Scottish Water data, and an alternative model. WICS placed greater weight on the model results that implied a lower efficiency gap.

The catch-up target should also be seen in the context of an overall increase in the opex allowance, partly reflecting additional opex relating to enhancements.

WICS allowed new operating expenditure to deliver general improvements in the 2006-10 regulatory period. **Table 1** shows the profile of allowed total operating expenditure over the period.

Table 4. Summary of allowed total operating costs for 2006-10 (real terms)

	2006/07	2007/08	2008/09	2009/10
Total allowed opex	£400.1m	£408.4m	£429.4m	£448.7m

Source: WICS, The Strategic Review of Charges 2006-10: The final determination

WICS allowed Scottish Water's operating costs to be 8.4% higher by the end of the regulatory period.

2010 determination

In the 2010 determination WICS applied a 100% catch-up to the upper quartile performance rather than the frontier.

> *"Scottish Water's recent improvements in performance mean that the Commission can now set a new challenge on behalf of customers. It expects Scottish Water to match upper quartile performance for the United Kingdom on both levels of service and operating costs. Scottish Water should do this by 2013-14 at the latest. Upper quartile performance is defined as the average of the second and third placed water and sewerage companies that was achieved in 2007-08. As this paper goes on to show, this will require considerable, but achievable further improvement by Scottish Water."*[7]

This approach was accepted by Scottish Water:

> *"We accept 100% catch-up of the efficiency gap to the third ranked leading company by the end of the regulatory control period and welcome the inclusion of a glide path in Staff Paper 6 when calculating the total operating cost allowance, prior to deriving the average annual operating cost allowance."*[8] *SW response*

This approach to setting the efficiency target is different in a number of respects to the Ofwat approach.

- The frontier approach used by Ofwat involves choosing an appropriate company as a benchmark from which the efficient frontier is constructed and companies' efficiency gaps are calculated (in Ofwat's case using 60% catch-up).

7 WICS, SR 10, Staff Paper 6

8 Scottish Water, Response to draft determination

- Upper quartile performance is defined as the average efficiency score between the second and third companies (out of the ten E&W water and sewerage companies) based on companies' rankings. In this case WICS applied a 100% to this level.

- The percentage catch-up based on the two different approaches cannot be directly compared. This is because they are measuring catch-up relative to a different benchmark. The WICS 2006 approach would imply a higher overall efficiency target than the Ofwat approach for a company that was significantly inefficient, but a lower target for a company that was relatively close to the upper quartile.

Overall, in the 2010 determination Scottish Water was set efficiency targets that were relatively modest. In particular, controllable opex was expected to fall from £296m to £278m by 2015 (in real terms). This represents only a 6% fall over the 5 year period.

ORR – catch-up for Network Rail

In the 2008 price control for Network Rail, ORR applied a 66% catch-up factor over a five year period. This was based on catch-up to the upper quartile performance.

> *"[W]e decided to profile further significant efficiency improvement (to catch-up the efficiency gap) over ten years (in both CP4 and CP5). We recognised that many of the further cost savings that the company needs to make may be difficult to achieve and significant implementation of new technologies and working methods. Given the challenges Network Rail faces in CP4 we decided that it is right to give the company sufficient time to do this and not to expect that the efficiency gap can be closed completely in CP4.*
>
> *We judged that ten years is an appropriate time period for Network Rail to close the gap to its peers. This necessarily required a large degree of judgement but we have examined the rate of change that other regulated industries have achieved and we have considered some of the specific changes Network Rail may make to reduce its costs (and the speed at which these could be made). We took account of Network Rail's own aspirations to achieve 'world class' status, although the company has not set out a date for when it hopes to achieve this. We considered that a balance of making two-thirds of the improvement in CP4 and one-third in CP5 is appropriate."*[9]

The relevant features of this approach are as follows.

- As with the WICS approach in 2010, the efficiency target was set as a catch-up towards the upper quartile performance as opposed to the frontier

9 ORR, Periodic review 2008, page 162.

performance. As a result a 66% catch-up to the upper quartile would result in lower efficiency targets than 66% catch-up to the frontier performance.

- ORR identified the relevant efficiency benchmarks based on an extensive analysis considering a variety of sources of evidence. This included top-down and bottom-up assessments of efficiency, separate studies for different components of operating and maintenance expenditure. This focus on multiple sources of evidence would help to improve the reliability of the efficiency assessment.

The efficiency target imposed by ORR on Network Rail was 4.9% per year, compared to NIW's draft determination target of 6% per year. The assessed efficiency gap of 35% was broadly similar to UR's assessed gap for NIW of 38%.

Conclusions on regulatory precedent

Overall, the following conclusions can be drawn from the regulatory precedent on setting efficiency targets.

- The regulatory precedent does not support a catch-up target of more than 60% catch-up to an efficiency frontier.

- The examples where higher catch-ups than 60% have been implied involve specific characteristics that distinguish them from the NIW determination. The specific characteristics include a situation where the savings are based on merger savings (WICS 2002) or are applied as catch-up to upper quartile performance rather than frontier performance (WICS 2010 or ORR 2008).

- The analysis undertaken by the CC in the Bristol Water determination illustrated that the E&W companies have typically not exceeded Ofwat's 60% catch-up assumption.

Evidence on cost savings actually by utilities after privatisation or regulatory reform

This section considers the actual efficiency performance achieved by utilities following privatisation or a move to a new regulatory model. It considers whether a 6% is justified given this experience.

Data from previous Frontier analysis

Previous analysis by Frontier for NIW (2010) showed that 6% cost savings per year represented a challenging target that only a few utilities have been able to achieve since privatisation. This considered evidence from a number of sources:

- Analysis by Transco suggested that the compound annual reduction in real unit operating expenses (RUOE) for a number of regulated UK sectors since privatisation has been 4.8% on average.

- Similar analysis by the CAA that adjusted for changes in volume suggests a slightly lower average reduction in RUOE of 3.4%[10].

- The England and Wales water and sewerage companies had, since 1993, achieved a much smaller reduction in RUOE of 2.9%[11].

- Data presented by WICS[12] on efficiencies achieved by England and Wales water companies over five year periods in the late 1990s suggested that the achieved opex savings have been higher. Utilising this data it could be suggested that the achieved reductions in base service operating expenditure range from 4.1% per year for the companies deemed to be most efficient and 6.6% per year on average for those companies deemed to be less efficient[13].

This data is shown in Figure 3 below. WICS calculated the operating cost reduction that had been achieved over a five year period – choosing the best period for each company. Only two companies have achieved savings of over 30% over a five year period. For comparison, UR is assuming a 28% reduction in opex over five years.

10 LECG, (2008), *Top down analysis of efficiency assumptions in the UK regulator sector,* 22 January 2008

11 LECG, (2008), *Top down analysis of efficiency assumptions in the UK regulator sector,* 22 January 2008

12 WICS, SR026 Section 4.

13 Based on companies 1992 Ofwat efficiency banding. For companies for deemed less efficient the average reduction is presented.

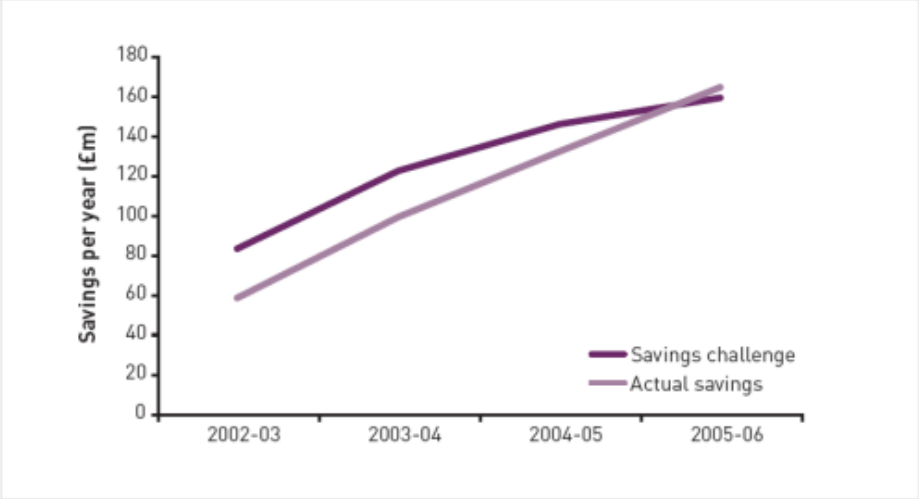
Figure 3. Opex reductions by E&W companies over 5 years

Five year real % reductions in base service operating expenditure[5]			
	From	To	% reduction
Anglian	1994	1999	27
Dŵr Cymru	1996	2001	26
North West	1996	2001	19
Northumbrian	1994	1999	34
Severn Trent	1994	1999	21
South West	1995	2000	29
Southern	1996	2001	39
Thames	1995	2000	18
Wessex	1993	1998	27
Yorkshire	1994	1999	22

Source: WICS

In Scotland, Scottish Water did manage to achieve the efficiency savings set out by WICS in the 2002 price review. While, Scottish Water achieved these savings at a fairly even pace, it is significant to note that it did not meet the challenging targets set by WICS in the early years of the period.

Figure 4. Scottish Water opex savings



Source: WICS

It should be noted that savings shown above include merger savings. WICs estimated that potential for merger savings ranged from a minimum of £36

million to £52 million. Therefore, it would be reasonable to assume that upto one third of total savings delivered in this period could be attributed directly to the merger of the three authorities.

Recent analysis by CEPA for ORR

ORR, as part of the preparation for the next price control for Network Rail, has also commissioned CEPA to estimate efficiency performance based on changes in RUOE. The study considered the efficiency savings for a number of utility sectors in the period since privatisation / regulation. The study covered the efficiency savings for the water and sewerage sectors in England & Wales and Scotland.

The main results of this study are summarised in **Table 4** below. The key findings are:

- The efficiency savings in E&W companies range from 1.1% in water to 0.2% in sewerage. This includes frontier shift efficiency and average catch-up efficiency across all the companies.

- The efficiency savings for Scottish Water have been 2.1% for water and 5.3% for sewerage, in the period 2002/03 to 2009/10.

Table 5. Reductions in real unit operating costs

Sector	Time period	Reduction in RUOE per year
E&W water opex (operations)	1992/93 to 2009/10	0.1%
E&W water opex (general & support)	1992/93 to 2009/10	2.2%
E&W water opex (total opex)	1992/93 to 2009/10	1.1%
E&W sewerage opex (operations)	1992/93 to 2009/10	-0.3%
E&W sewerage opex (general & support)	1992/93 to 2009/10	1.0%
E&W sewerage opex (total opex)	1992/93 to 2009/10	0.2%
Scottish Water (water opex)	2002/03 to 2009/10	2.1%
Scottish Water (sewerage opex)	2002/03 to 2009/10	5.3%

Source: CEPA

The experience of Scottish Water is the most relevant in the context of NIW, for two reasons. First, it relates to a single company that started from a position of significant inefficiency. Second, it covers a relatively short time period (seven years) over which much of the inefficiency was addressed. Therefore, this evidence would support a range for efficiency targets of 2% - 5% per year.

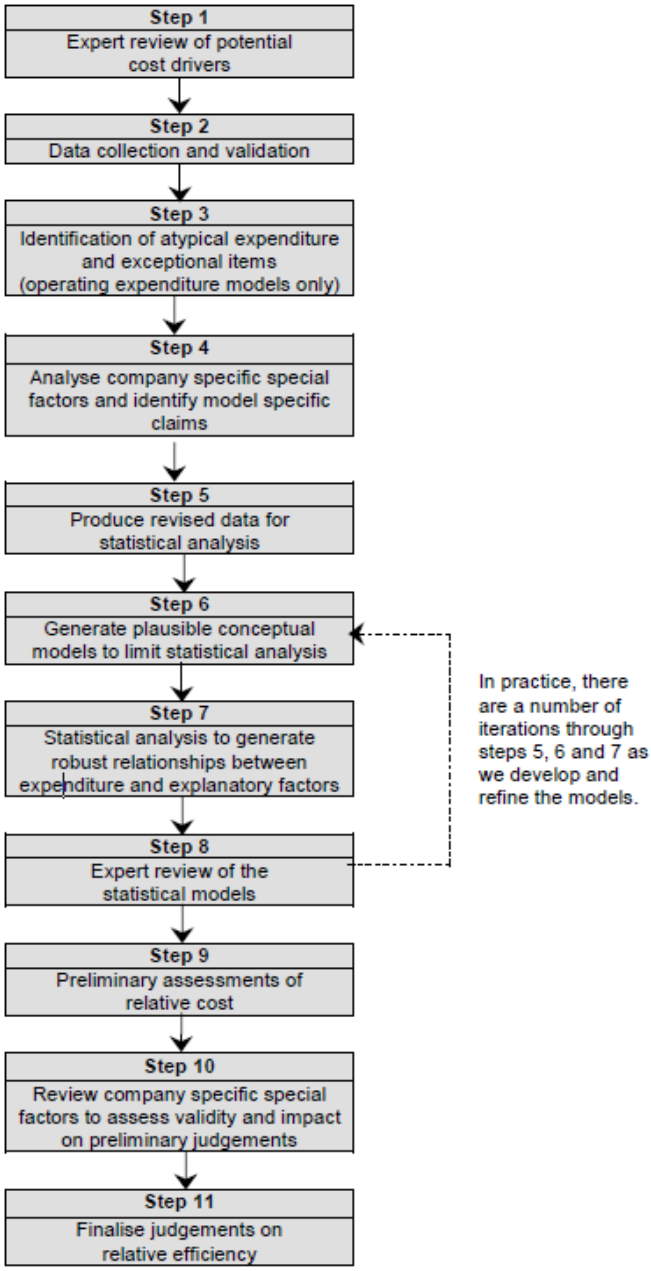
Annex 1: Ofwat modelling approach

Figure 5 below summarises the Ofwat's approach to estimating efficiency models. The figure is taken from Ofwat's published methodology for the 2004 price control review.

The eleven steps in the process can be combined into some core groups of tasks.

- review of cost drivers (step 1);
- data collection, checking and validation (steps 2 – 5);
- estimation of models, expert review and refinement of models (steps 6-8); and
- incorporation of special factors and estimation of relative efficiency factors (steps 9-11).

Figure 5. Step-by-step approach used to derive the statistical models



Source: http://www.ofwat.gov.uk/regulating/reporting/rpt_unc_2004-05_appendix1.pdf

Annex 1: Ofwat modelling approach

Annex 2: Model specification changes

This annex summarises the model specifications for the different water and sewerage models, from Ofwat in 2007/08 and UR in 2010/11.

Water distribution

Figure 6 below shows the co-efficients and statistical results for the water distribution models.

Figure 6. Water distribution model

Table 2.3 - Ofwat 2007-08 water distribution model

Water Service:	Water Distribution Expenditure	
Data:	June Returns	
Modelled cost:	ln (distributional functional expenditure less power costs [£m], divided by number of properties connected at year end [000's])	
Explanatory Variables:	Coefficient	Standard Error
Constant	-2.066	0.711
Ln (length of main [km], divided by number of connected properties [000's])	-0.713	0.267
Form of Model:	ln modelled cost = -2.066 - 0.713 * ln (length of main/connected properties)	
Statistical Indicators:	Number of observations = 22	R^2 = 0.263
	Model standard error = 0.268	F test = 0.015

Table 1.3 – Water distribution model 2010-11

Water Service:	Water Distribution Expenditure	
Data:	June Returns	
Modelled cost:	ln (distributional functional expenditure less power costs [£m], divided by number of properties connected at year end [000's])	
Explanatory Variables:	Coefficient	Standard Error
Constant	-2.926	0.841
Ln (length of main [km], divided by number of connected properties [000's])	-0.376	0.318
Form of Model:	ln (modelled cost) = -2.926 – 0.376 * ln (length of main / connected properties)	
Statistical Indicators:	Number of observations = 21	R^2 = 0.069
	Model standard error = 0.317	F test = 0.252

Source: Ofwat, UR

Water resource and treatment

Figure 7 below shows the co-efficients and statistical results for the water resource and treatment models.

Figure 7. Water resource and treatment

Table 2.4 - Ofwat 2007-08 water resource and treatment model

Water Service:	Water Resource and Treatment	
Data:	June Returns	
Modelled cost:	Functional expenditure less power costs [£m], divided by resident winter population [millions]	
Explanatory Variables:	Coefficient	Standard Error
Constant	6.098	1.003
Number of sources divided by distribution input [Ml/day]	25.136	8.115
Proportion of supplies from boreholes	-7.165	2.569
Form of Model:	Modelled cost = 6.098 + 25.136 * (number of sources/DI) – 7.165 * (proportion of supplies from boreholes)	
Statistical Indicators:	Number of observations = 22	R^2 = 0.341
	Model standard error = 2.438	F test = 0.019

Table 1.4 - Water resource and treatment model 2010-11

Water Service:	Water Resource and Treatment	
Data:	June Returns	
Modelled cost:	Functional expenditure less power costs [£m], divided by resident winter population [millions]	
Explanatory Variables:	Coefficient	Standard Error
Constant	8.339	0.737
Number of sources divided by distribution input [Ml/day]	14.989	4.558
Proportion of supplies from boreholes	-7.155	1.810
Form of Model:	Modelled cost = 8.339 + 14.989 * (number of sources/DI) – 7.155 * (proportion of supplies from boreholes)	
Statistical Indicators:	Number of observations = 21	R^2 = 0.470
	Model standard error = 1.926	F test = 0.003

Source: Ofwat, UR

Sewerage network model

Figure 8 shows the co-efficients and statistical results for the sewerage network models.

Annex 2: Model specification changes

Figure 8. Sewerage network models

Table 2.7 - Ofwat 2007-08 sewerage network model

Sewage Service:	Sewerage Network	
Data:	June Returns	
Modelled cost:	ln (network functional expenditure [£m] plus terminal pumping station costs [£m], less service charges [£m], per km of sewer)	
Explanatory Variables:	Coefficient	Standard Error
Constant	-5.146	0.380
ln (area of sewer district per km of sewer)	0.199	0.033
ln (resident population [000's] per km of sewer)	0.961	0.195
Holiday population divided by resident population [000's]	1.253	1.092
Form of Model:	Modelled cost = -5.146 + 0.199 * ln { area of sewer district per km of sewer } + 0.961 * ln {resident population [000's] per km of sewer} + 1.253 * {holiday population / resident population}	
Statistical Indicators:	Number of observations = 63	R^2 = 0.469
	Model standard error = 0.260	F test = 0.000

Table 1.7 - Sewerage network model 2010-11

Sewage Service:	Sewerage Network	
Data:	June Returns	
Modelled cost:	ln (network functional expenditure [£m] plus terminal pumping station costs [£m], less service charges [£m], per km of sewer)	
Explanatory Variables:	Coefficient	Standard Error
Constant	-5.177	0.469
ln (area of sewer district per km of sewer)	0.184	0.042
ln (resident population [000's] per km of sewer)	0.935	0.242
Holiday population divided by resident population [000's]	2.150	1.446
Form of Model:	Modelled cost = -5.177 + 0.184 * ln { area of sewer district per km of sewer } + 0.935 * ln {resident population [000's] per km of sewer} + 2.150 * {holiday population / resident population}	
Statistical Indicators:	Number of observations = 61	R^2 = 0.371
	Model standard error = 0.318	F test = 0.000

Source: Ofwat, UR

Large sewage treatment works model

Figure 9 shows the co-efficients and statistical results for the large sewage treatment works models.

Annex 2: Model specification changes

Figure 9. Large sewage treatment works models

Table 2.8 - Ofwat 2007-08 large sewage treatment works model

Sewage Service:	Large Sewage Treatment Works	
Data:	June Returns	
Modelled cost:	ln (sewage treatment functional expenditure [£000's], less service charges [£000's], less terminal pumping costs [£000's])	
Explanatory Variables:	Coefficient	Standard Error
Constant	-1.165	0.245
ln (total load [kg COD/day])	0.766	0.027
Activated sludge	0.326	0.052
Tight effluent consent	0.110	0.046
Form of Model:	Modelled cost = -1.165 + 0.766 * ln (total load) + 0.326 * (activated sludge) + 0.110 * (tight effluent consent)	
Statistical Indicators:	Number of observations = 382	R^2 = 0.725
	Model standard error = 0.450	F test = 0.000

Table 1.8 - Large sewage treatment works model 2010-11

Sewage Service:	Large Sewage Treatment Works	
Data:	June Returns	
Modelled cost:	ln (sewage treatment functional expenditure [£000's], less service charges [£000's], less terminal pumping costs [£000's])	
Explanatory Variables:	Coefficient	Standard Error
Constant	-0.728	0.244
ln (total load [kg COD/day])	0.733	0.027
Activated sludge	0.248	0.053
Tight effluent consent	0.114	0.046
Form of Model:	Modelled cost = - 0.728 + 0.733 * ln (total load) + 0.248 * (activated sludge) + 0.114 * (tight effluent consent)	
Statistical Indicators:	No. of observations = 387	R^2 = 0.700
	Model standard error = 0.455	F test = 0.000

Source: Ofwat, UR

Annex 2: Model specification changes