



Options for Assessing Northern Ireland Water's Capital Efficiency

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Northern Ireland Authority for Utility Regulation

Report

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I. INTRODUCTION

This note presents different approaches that have been implemented by regulators to benchmark capital efficiency. It is part of a call off arrangement designed to give the Northern Ireland Authority for Utility Regulation (the UR) technical econometric support as it develops its approach to PC21.

When evaluating capex efficiency, a regulator needs to consider three main components:

- What is the level of capex the company could be expected to incur to deliver its outputs?
- Is that expenditure efficient when compared with other companies? (catch-up efficiency)
- How would the cost of an efficient company evolve over time? (ongoing efficiency)

This note focuses on the first two questions. The third question is normally considered separately and, as a result, it should be the focus of a different analysis.

It is worth noticing at the outset that the application of the methodologies discussed below in Northern Ireland will be limited by the possibility of obtaining comparable information in other jurisdictions (e.g. England and Wales). Hence, the absence of robust and comparable data may restrict the number of options available to assess capex efficiency.

When considering these two questions, one needs to consider the main characteristics of the capex expenditure. More concretely, it will be important to consider that in the water sector, it is common to split capex into maintenance and enhancement. Maintenance capex involves the upkeep of existing assets, it is an ongoing expenditure and is, therefore, fairly consistent over time and relatively predictable. Enhancement capex involves the construction of new physical assets or the upgrade of existing ones. These works are much more one-off and bespoke in nature. Therefore, the level of expenditure they require over a control period is lumpy and much less predictable.

As a result, different approaches have been applied to assess maintenance and enhancement capex efficiencies. This note presents the potential answer to the two questions above.

2. MAINTENANCE COSTS

Ofwat defines maintenance costs as capital expenditure on infrastructure and non-infrastructure assets to maintain the long term capability of those assets and deliver the base levels of service. Therefore, it is an ongoing expenditure that is fairly consistent over time and relatively predictable.

The sections below discuss how to assess the level of maintenance costs the company might be expected to incur to deliver its outputs, and whether that level of maintenance expenditure is efficient relative to other companies (catch-up efficiency).

2.1. WHAT LEVEL OF MAINTENANCE COSTS MIGHT A COMPANY BE EXPECTED TO INCUR?

To estimate maintenance costs we have identified four main approaches:

Table 2.1: Methodologies to estimate maintenance costs

Title	Description
Base year	<ul style="list-style-type: none"> ○ The regulator takes the maintenance costs incurred in one year (e.g. year 3 in a 5 years price control) and considers these costs as the base expenditure the company will be spending each year going forward. ○ Adjustments could be introduced to account for the new assets coming online during the regulatory period.
Procedural approach (e.g. Ofwat PR09)	<ul style="list-style-type: none"> ○ The regulator evaluates whether the companies have followed a robust process when putting together its maintenance plan. ○ If the process is considered to be robust, the regulator will accept the costs put forward by the company as the base for its assessment.
Unit cost benchmarking	<ul style="list-style-type: none"> ○ Maintenance expenditure could also be calculated as a function of the assets owned by the company. ○ This approach could use different degrees of complexity. For example, the regulator could use a very detailed analysis where there are asset specific unit costs. However, it could also use a very high level methodology with one single unit cost for all kinds of assets (e.g. based on MEAV).
Econometric models (e.g. Ofwat PR14 and Ofgem RIIO-ED1)	<ul style="list-style-type: none"> ○ Maintenance costs (alone or in combination with opex and/or enhancements) could be estimated using econometric models. ○ These models would consider the relationship between these costs and the relevant cost drivers. ○ By using a benchmarking methodology, this approach would also allow answering the second question (catch-up efficiency) in one single step.

Source: CEPA

When considering these methodologies, UR would also need to consider whether to use the same approach for the maintenance of all assets of the company. For example, Ofwat used to separate analysis of maintenance costs of infrastructure (underground) and non-infrastructure (above ground) assets. However, since PR14, Ofwat has significantly reduced the use of this approach to mitigate issues related to the allocation of costs between different categories.

Once the base expenditure is set, the regulator may need to consider special cost factors. In presenting these factors, companies aim to justify modifications to the base estimate for reasons that are outside of the company's control and/or represent expenditure that is not relevant for other companies and, as a result, will not be included in the historic data used in the calculations.

2.2. IS THAT EXPENDITURE EFFICIENT WHEN COMPARED WITH OTHER COMPANIES?

When developing a catch-up efficiency challenge for maintenance costs, regulators have tended to use approaches that are similar to those applied to opex. These would include:

- **Comparative efficiency approach:** The regulator could use a number of (simple) econometric models to benchmark the efficiency of the company against similar companies. The results of that analysis will be used to group companies into efficiency levels. Each one of these levels would face a different ongoing challenge that would be applied to its estimated costs.
- **Alternative estimation methodologies:** The regulator could use a number of models to estimate the "efficient" level of maintenance costs. These efficient costs could be used to set the actual allowance and/or to estimate an efficiency challenge. This efficiency challenge could be calculated by



comparing the estimated costs with those put forward by the company and develop a ranking. Examples of cases where this approach has been used are:

- **Capital maintenance models:** At PR04, Ofwat developed a series of simple capital maintenance expenditure econometric models to assess efficiency. These models attempted to identify a relationship between capital maintenance and a set of exogenous cost drivers, with the overall aim of determining an efficient level of capital maintenance expenditure given a certain set of characteristics. Ofwat placed a 50 percent weight on their econometric models when assessing capital maintenance efficiency and based the remaining 50 percent weight on unit cost / cost base analysis, which we discuss below.
- **Base expenditure models:** Ofwat and Ofgem used econometric models that included opex and maintenance in their most recent price controls (and they appear inclined to keep using them going forward). The models use a number of cost drivers to estimate the forecast costs of the company going forward. As indicated above, this approach combined the answer to both questions being considered in this note.

3. ENHANCEMENT COSTS

Enhancement costs are defined as the investment undertaken to increase the level of service and/or to improve the quality of service provided. These costs may be related to the construction of new physical assets, the upgrade of existing assets, or the improvement in quality standards. For PR19, Ofwat has asked companies to provide a breakdown of enhancement costs by purpose, which includes, but is not limited to:

- **Making ecological improvements at abstraction sites:** expenditure to deliver projects required to deal with the environmental impact of water abstraction during the reporting year.
- **Enhancements to the supply / demand balance:** expenditure associated with schemes to deliver enhancements to supply/ demand capacity in a dry year, peak and annual average conditions.
- **New developments:** expenditure associated with the provision of local distribution infrastructure and non-infrastructure assets for water and wastewater services for new customers with no net deterioration of existing levels of service.
- **First time sewerage:** expenditure for new and additional sewage treatment and sewerage assets for first time sewerage schemes.
- **Sludge enhancement (quality):** expenditure on sludge treatment and disposal assets and associated biogas treatment for meeting new environmental obligations listed in the National Environment Programme (NEP).

The level of enhancement expenditure companies require over a control period is lumpy. In addition, enhancement requirements tend to change over time, which means that historic data is unlikely to (fully) reflect future expenditure. The combination of these factors means that enhancement costs are significantly less predictable, which limits the techniques we can use to assess efficiency.

The sections below discuss how to assess the level of enhancement costs a company might be expected to incur over a regulatory period, and whether that level of enhancement expenditure is efficient relative to other companies (catch-up efficiency).



3.1. WHAT IS THE LEVEL OF ENHANCEMENT COSTS THE COMPANY COULD BE EXPECTED TO INCUR?

To estimate enhancement cost we have identified three main approaches:

Table 3.1: Methodologies to estimate enhancement costs

Title	Description
Econometric models (e.g. Ofwat PR14 and Ofgem RII0-EDI)	<ul style="list-style-type: none"> Enhancement costs (alone or in combination with opex and maintenance) could be estimated using econometric models. However, the volatility of this expenditure and the change in cost drivers over time has made this approach infeasible when enhancement costs are considered in isolation. Models that include enhancement costs were heavily criticised by the CMA in PR14 and they are unlikely to feature in Ofwat's PR19 approach.
Unit costs models (e.g. Ofwat PR14 and Ofgem RII0-EDI)	<ul style="list-style-type: none"> Enhancement costs can normally be divided into specific areas of investment (e.g. new connections or reduction in a pollutant). Therefore, it is possible to develop unit costs for each one of these components. There are different approaches to calculating these unit costs models. In addition to the traditional unit costs (total costs / by cost drivers), Ofwat also used unit costs with a fixed component (total costs = constant + variable component). This approach faces the challenge that not all components of an enhancement costs were necessarily included in previous price controls. As a result, there are areas of expenditure that will need to be modelled separately.
Bottom-up review of the business plans (e.g. Ofwat PR09)	<ul style="list-style-type: none"> The regulator requests companies to provide a full list of the projects they aim to deliver as part of their enhancement costs. For each project, the company is required to provide a business case. The regulator will then review each one of these business cases and decided which should be allowed/rejected based a number of criteria (e.g. is the need justified? Is the cost efficient? Is there a positive CBA, Is the analysis robust)? In some cases, the regulator could decide to apply a different degree of scrutiny to the projects depending on their value/criticality.

Source: CEPA

3.2. IS THAT EXPENDITURE EFFICIENT WHEN COMPARED WITH OTHER COMPANIES?

The methodologies that have been discussed above for maintenance have also been used for enhancement at some point in time. However, they have all been shown to be unstable and / or difficult to implement. As a result, Ofwat applied tailored solutions for these costs in both PR09 and, we expect it will do so again for PR19. In PR09, Ofwat used an approach that was specific to enhancement costs: the cost base from which they derived a catch-up target was developed by comparing company estimates of capital works costs for a range of uniform capital projects with a chosen benchmark. This approach is discussed in more detailed in the following section.

For PR19, it appears that Ofwat is considering the option of developing a bottom-up approach for totex efficiency. This approach would combine the assessment of the frontier shift (question 3 above) with an assessment of efficiency in the delivery of specific projects. However, Ofwat has not yet published its methodology.



3.2.1. Cost base approach

The cost base approach uses a database of 'standard costs' for a wide range of uniform projects or units of work, based on cost data submitted by companies and independent sources. These standardised costs are typical for investment in water and sewerage services and could include both capex maintenance and enhancement capex. From this database, a benchmark is created, and each company's standard costs are compared to obtain a catch-up efficiency target.

At PR04 and PR09, Ofwat used the cost base approach to assess the relative efficiency of water companies in procuring and implementing capital projects. In turn, it was used to inform its assessment of relative efficiency for both capital maintenance and enhancement capex.

The cost base approach was implemented by Ofwat in four stages, as summarised below:

Figure 3.1: Ofwat application of the cost base approach

Review company standard cost submissions

- Ensure that company submitted standard costs comply with specifications and guidance, and are comparable across companies.
- Ensure engineering judgement grades have been applied correctly.
- Confirm companies have derived standard cost estimates independently.

Assess company-specific factors

- Assess company arguments for why their cost base is higher than average. For example, regional variation in input costs such as labour.
- At PR04, regional price factors were applied to the typical civil construction and plant installation elements of each submitted standard cost.

Choose benchmark

- A benchmark is chosen out of the standard cost estimates provided by the companies.
- This is usually the lowest reported cost for each standard project providing certain criteria are met (e.g. engineering grade of B3 or better).
- The chosen benchmark tested for appropriateness against an independent cost estimate procured by Ofwat.

Determine catch-up efficiency targets

- The relative efficiency of each company is estimated by comparing each company's standard cost with the benchmark, and then weighting the result according to capital investment in the review period.
- The latter ensures that standard costs for projects that represent a large proportion of the capex programme have greater weight in the overall efficiency assessment.

Source: CEPA

It is worth noting that Ofwat has not collected this data since PR09 making a repetition of this exercise in PR19 infeasible.

4. EMERGING THINKING FOR DISCUSSION

The different characteristics in the predictability of capex costs suggest that different approaches should be considered for maintenance and enhancements costs.

As maintenance costs tend to be more consistent in magnitude and content over time and will arguably be driven by factors that also drive opex (e.g. size of the company, density, age of the network, etc.), the UR could consider developing botex models. This would bring the UR in line with Ofwat which would facilitate the data required for the analysis being available. Furthermore, it would allow UR to mitigate the issues related to the potential differences in cost allocation between opex and maintenance expenditure.

If choosing this approach, the UR would need to decide whether it aims to use the result of these models to forecast expenditure and / or set an efficiency challenge. If the models are used only to estimate an efficiency challenge, the UR will need to identify a methodology to estimate the expected maintenance expenditure. As indicated above, there are different approaches the regulator could use. All these approaches would have advantages and disadvantages that would need to be considered as part of a broader discussion about the strategy to be followed in the price control.

For enhancement costs, econometric models have shown to perform relatively poorly. Therefore, it would appear more appropriate for the UR to consider a bottom-up approach to the evaluation of this expenditure. This could be done by either undertaken a detailed review of the projects put forward by the company and / or developing unit cost models based on similar activities in other jurisdictions. To set an efficiency challenge, the options appear to be more limited. One option that might be considered is for the UR to consider developing unit costs for enhancements that have been repeated between price controls. These models could be used to calculate an efficiency challenge that might then be extrapolated to all enhancement costs.



APPENDIX A OFWAT'S APPROACH TO CAPEX EFFICIENCY OVER TIME

For each price control up to, but not including, PR14, opex and capex were assessed separately during the price review. However, PR14 saw the introduction of a totex-based approach. A similar approach will remain for the upcoming PR19 price review, which runs from 2020 to 2025.

A.1. PR04 (2005-10)

In PR04, Ofwat assessed the relative efficiency of each companies operating, capital maintenance and capital enhancement expenditure, each area being assessed separately.

Statistical models using econometrics were used to assess the relative efficiency of the companies for operating and capital maintenance expenditure. There were some parts of expenditure where Ofwat was not able to develop econometric models so, the assessment was based on unit costs. Three adjustments were then applied to the companies' combined actual expenditure post modelling for: leakage expenditure allocation (water only); special factors and future expenditure.

Capital enhancement relative efficiency was calculated using a cost base assessment. Company specific catch-up elements of enhancement project were based on a comparative assessment of the cost base submission only. The cost base includes examples of standard enhancement programmes, using a representative sample of the company's investment programmes for the period 2005 to 2010 to compute catch-up factors. Then, for some types of enhancement works, Ofwat compared unit capital and operating costs between companies and applied a challenge based on comparisons between companies.

A.2. PR09 (2010-15)

During PR09 expenditure was split into three categories: opex, maintenance capex and enhancement capex, from which price limits were set. Baseline estimates of total capex were set for each company, and each companies service (water and/or wastewater), through separately developed forecasts of maintenance and enhancement expenditure. For the final determinations, the cost baseline was used as the primary determinant of capital maintenance and enhancement efficiency.

The benchmarking approach had two stages. The first, was for Ofwat to estimate the costs of each company. Ofwat then applied an efficiency challenge to these costs for each company, For maintenance capex, this involved a review of the process undertaken by each company to calculate their cost forecasts.

Enhancement capex involved an assessment of the relative efficiency of capital projects, with regards to procurement and delivery. This was achieved by benchmarking the companies estimates of capital works unit costs for a range of uniform capital projects, which best reflect the company's standard capital costs (cost base methodology). Each company provided both draft and final audited estimates for these standard costs based on, where possible, their own current and previous capital work programmes. These estimates were subject to focused independent audit / review by Ofwat's reporters.

A.3. PR14 (2015-20)

For PR14, the current price control, a totex-based approach was introduced to assess efficient expenditure and set the price limit. Ofwat introduced the totex approach to mitigate a potential bias towards capex investment as a result of the difference in regulatory treatment.



The cost assessment approach in PRI4 focused on top-down benchmarking of totex through the use of regression models and unit cost models. These estimates were then adjusted to account for company specific characteristics. This approach does not analyse the individual elements of each company's services but, it allows for special characteristics of the companies to be accounted for.

Ofwat's PRI4 cost assessment used a two-stage approach:

- **Modelling:** Efficiency modelling for both water and wastewater, which used a combination of (a) totex modelling; (b) botex modelling; (c) enhancement unit cost modelling; and (c) simple modelling estimates to account for other 'unmodelled' enhancement costs. This modelling was used to develop 'initial cost thresholds'.
- **Special cost factor adjustments:** Companies were able to propose – and attempt to justify – any areas where their costs would be higher than those indicated by the modelling across all companies. This could be opex factors (e.g. regional wage variations) or capex factors (e.g. a large one-off enhancement project). The criteria used by Ofwat illustrates that 'efficiency' takes into account not only cost but also quality, as well as whether such quality is cost-beneficial.

Note that Ofwat's approach relies on having a number of companies, with data collected in the same format, i.e. using consistent enhancement categories. A key issue when benchmarking NI Water against water and wastewater companies in E&W, or more widely against European or international counterparts, is ensuring robust and comparable data.

A.4. PRI9 (2020-25)

For PRI9 Ofwat is aiming to use econometric models to evaluate costs across companies. These econometric models are expected to cover base costs (opex and maintenance capex) and, where appropriate, elements of enhancement capex.

As well as benchmarking between companies in the water and wastewater sectors, cost performance and efficiencies in other sectors, particularly those that have adopted a totex approach, will also be used as a comparison where possible.

The rationale for including costs from other sectors is to ensure the 'efficient' cost baselines do not prolong any inefficiencies within the water and wastewater sectors.





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