Options for access pricing methodology

Upstream market reform

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Foreword from Severn Trent Water

For upstream entry to occur, it is vital that Access Prices enable efficient entrants to compete on level terms. Water and sewerage networks are a natural monopoly, and it would not be efficient for an entrant to duplicate this network. But competitors could provide alternative resources—raw or treated—and should be able to use the incumbent's pipes to supply their customers. Although there are practical difficulties, these have been overcome in other sectors such as energy and telecoms. In principle, there is no reason why upstream competition should not be possible in water.

There are, however, critical differences in the engineering and economics of water compared to other utilities: the assets have much longer lives; there is not a national network - or even fully integrated networks within companies' area of supply; and water is heavy, making it expensive to move over long distances. Crucially, the difference between the cost of constructing new assets and companies' Regulatory Capital Values (the "RCV discount") is much larger than in telecoms or energy. This means that there is no direct read across from other industries and the approaches that have been adopted in those sectors will not necessarily work in water.

To date, access to networks has been based on the Costs Principle which underpins the Water Supply Licensing regime. When it was introduced, Ofwat had a specific interpretation of this principle, which companies have largely followed. The margin available for an entrant was based on a narrow view of costs avoided or reduced as a result of the alternative supply. This has not encouraged competition. For some time, Severn Trent has offered Access Prices based on a different interpretation that would allow for efficient entry. When the Costs Principle is withdrawn, its replacement needs to consider the costs and benefits in the widest sense:

- The environmental costs and benefits, as well as the pure economic case for entry.
- The impact on the resilience of water resources.
- The impact on customers in the short and long term.
- The effect on company financing, where a stable regulatory regime has enabled large scale investment in very long term assets.

As part of its Water 2020 project, Ofwat asked Severn Trent to look at the issue of Access Pricing and the future allocation of the Regulatory Capital Value as two separate exercises. While these two topics could be related under some approaches, the allocation of the RCV is not necessary to enable efficient upstream entry. We support this view.

Any form of bottom-up approach to access pricing will be difficult to implement, because new entrants need to be able to recover the cost of the assets they use. The RCV discount reflected within existing wholesale charges means that prices do not reflect the cost of constructing new assets. And the long-life of the existing assets means that, if any are displaced or "stranded", it will take many years for the costs to be removed from the system.

A modified costs principle could allow efficient entry to occur. To promote efficiency, it is important that access prices are defined at a local level. There are some water resource zones where incumbents may have a deficit, or new resources are expensive to develop, and this is where new entry should be

encouraged. But geographical averaging of prices for end-users must be maintained. The tension between these imperatives has been managed in other utilities; there is no reason why it should not be possible in the water sector.

The key is to ensure that Access Prices reflect the incremental cost faced by the entrant over an appropriate time horizon—one which allows the entrant to make a reasonable margin, but does not jeopardise future investment in the industry. Competition needs to operate in customers' interests; the scale of potential future benefits needs to be weighed against the cost that they may ultimately have to bear in order for a market to develop.

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The issue of potential competition in upstream activities in the water sector has been debated for some time now. With new provisions outlined in the Water Act 2014, the practicalities of designing a regulatory regime that makes such competition viable and delivers benefits to customers require careful thought.

As part of ongoing work by various stakeholders, including Ofwat and the industry, we understand that Severn Trent (SVT) is keen to contribute to the debate by providing practical options for change that are likely to deliver most value to the different parties concerned. In this context, SVT has asked Oxera to consider possible access pricing methodologies that might be suitable for different entry points upstream.

A key component of the Water Act 2014 are the reforms to the licensing regime, which will allow upstream-only entry (resources and potentially treatment) into the water value chain without the need to also hold a retail licence. However, an upstream entrant will need to be connected to its own or another licensee's retail entity. Further, a separate licence for some of the wastewater services will also be introduced. Finally, the Water Act also seeks to increase the scope for water trading between companies (bulk supplies).

Importantly, the Water Act implies that Ofwat will need to set charging rules for the different types of access in water and wastewater and for bulk supplies.

This report focuses mainly on assessing possible options for charging new entrants for access to the water distribution network (which represents the non-contestable, i.e. naturally monopolistic, element of the value chain) and potentially water treatment facilities (which may be contestable in some instances). We also discuss some of the possible options relating to entry in sewerage (mainly in regards to the possibility of new entrants providing sludge treatment and disposal). Finally, we also cover the issues around pricing of bulk supplies.

In assessing the relative merits of different access pricing methodologies, it is worth bearing in mind some of the unique features of the water sector.

- Assets involved in the provision of water and wastewater are characterised by very long economic lives which are not typically observed in other sectors. This means that if existing assets are displaced by entrants, it may take many years for the costs to disappear from the system. In other words, the costs of operating the existing assets cannot be reduced very quickly, leading to stranded asset costs.

- The cost structure of the water sector is unusual in that the transportation of water (which is a naturally monopolistic activity) comprises a much bigger proportion of total underlying economic costs than in other industries such as energy.

- Water networks are often relatively local in nature and do not easily lend themselves to the creation of an integrated national grid. In particular, water is relatively costly to pump over long distances, limiting the extent of net benefits from existing and future inter- and intra-connectivity.

- The Regulatory Capital Value (RCV), a key driver of customer bills, remains materially lower than the replacement cost of assets. The size of the RCV discount to replacement cost is uniquely large compared to other

infrastructure sectors. The RCV effectively puts an upper bound on aggregate customer prices, which may in turn limit the possibility for new entry.

What this suggests is that the sources of long-run net benefits of competition might be less obvious in the water sector relative to other sectors. In this context, it is also important to recognise another important objective on the government's and regulator's agenda—that is, addressing the challenges of population growth, climate change, and water scarcity in different regions. Upstream competition might certainly contribute to addressing these challenges, but it cannot be guaranteed to deliver these objectives.

Possible approaches to access pricing

In assessing the relative merits of different options, we have had specific regard to two important dimensions.

- Promoting efficient competition. We have assumed that Ofwat is likely to place more weight on longer-term efficiencies that the process of competition might deliver (i.e. the scope for widespread entry to reduce industry costs or improve sustainability, service levels and choice tomorrow) rather than on shorter-term efficiency considerations.

- Ensuring that customers experience benefits from introducing competition. While in the long-run competition may lead to lower costs (and subsequently lower prices), initially there may be some costs and potentially stranded assets associated with making entry happen. It is likely that Ofwat's position is that these costs should be borne primarily by the industry (i.e. investors) rather than customers.

In developing potential approaches to access pricing, a key question to consider is the choice of the cost standard. The possible options typically fall within two broad categories.

- **Economic Component Pricing Rule (ECPR)**, sometimes referred to as **retail-minus**. In the context of upstream entry in the water sector, it might be more appropriate to refer to it as **wholesale-minus.** Effectively, the access charge paid by the entrant is equal to the incumbent's wholesale price (which covers end-to-end cost of abstracting, treating and delivering water less retail costs) minus some measure of cost (typically costs that are avoided by the incumbent as a result of entry).

- **Cost-based approaches**. An alternative to determining access prices is to consider the actual cost of providing such access through the pipes and pumps used to transport water to customers.

Both ECPR and cost-plus are possible approaches for access pricing. The choice often comes down to the objectives of the regulator and industry structure. Ultimately, the practicality of each approach is vital to determining a reasonable access pricing methodology.

Assuming that Ofwat's overriding focus is longer-term efficiencies that the process of competition might deliver, an access pricing regime that makes entry more viable and allows some of these benefits to be realised is needed. In theory, this requires a regime that adequately provides for entrants to recover the forward-looking cost of contestable activities, taking into account variations in cost, relevant to the context of entry (e.g. regional).

Assuming further that Ofwat is also of the view that customers should experience the benefits of competition, this means that Ofwat will want to ensure that any costs arising from the introduction of competition are not fully borne by customers in such a way that they are 'worse off'.

These considerations suggest that any form of cost-plus approach to access pricing is unlikely to be feasible in the water sector, certainly in the short-term but potentially even in the medium- and longer-term. The key reason for this is the RCV used to underpin the existing wholesale charges. The RCV exhibits a very large capital value discount, which still to a large degree reflects the basis on which the companies were privatised in the 1990s. As a result, the aggregate RCV remains some way from being a helpful indicator of economic asset values. Moreover, the long-lived nature of these assets means that the problem will not go away, and, in the case of any displacement of existing assets, it may take many years for the costs to be removed from the system.

A modified ECPR, or wholesale-minus approach to access pricing, however, could be a reasonable approach to move forward, as long as there is greater clarity about the application of the approach in practice and the 'minus' component reflects a meaningful measure of avoided costs. An approach to assessing avoided cost that is based on long-run incremental cost (LRIC) is one that theoretically is most likely to ensure that efficient entry occurs in the long-run. It is also an approach that is likely to be compliant with competition law. The regime could be applied at the level of each water resource zone (WRZ) to ensure geographical differences in costs are reflected in the access charge but at the same time allowing to retain geographical averaging of prices for end-users.

However, the water sector is unique in several aspects, which may limit the applicability and desirability of a pure LRIC-based approach to assessing avoided upstream costs.

First, upstream entry may not lead to full displacement of an incumbent's existing assets, due to scale and modularity. Second, where assets are displaced (in part or in full), the costs of those assets may not be removed from the system for a very long time. In other words, the 'friction' costs of introducing competition in the water sector can potentially be material.

By subtracting LRIC from wholesale charges, the entry generated by this approach may mean that, due to the above factors, overall costs across the industry are not reduced over the medium-term, or even the longer-term. Using a pure LRIC approach, as part of a wholesale-minus methodology, may also generate problems for cost-recovery for the network business.

This suggests that a long-run avoided cost measure that lies somewhere below the true long-run LRIC but above long-run marginal cost (LRMC) could strike the right balance between the identified issues. This long-run avoided cost measure can largely be based on LRIC, but in defining an appropriate time horizon for the LRIC model, using a timescale of between 10 and 20 years (as used in other sectors), rather than the time horizon that would span the full life of the assets, might be appropriate. Alternatively, the LRAC could be based on some form of a net present value approach. For example, some form of an annualised equivalent of the expected present value of future avoided costs over the asset life may be in option. This would take into account the fact that avoided costs are likely to be small initially but over the longer-term would converge to the full LRIC over the asset life horizon.

1 Introduction

The issue of potential competition in upstream activities in the water sector has been debated for some time. With new provisions outlined in the Water Act 2014, the practicalities of designing a regulatory regime that makes such competition viable and delivers benefits to customers require careful thought.

As part of ongoing work by various stakeholders, including Ofwat and the industry, we understand that Severn Trent (SVT) is keen to contribute to the debate by providing practical options for change that are likely to deliver the most value to the different parties concerned.

In this context, SVT has asked Oxera to consider possible access pricing methodologies that might be suitable for different entry points upstream. This requires an understanding of the commercial models that might emerge, the incentives faced by different players in each model, and the economic properties of different access pricing options.

This section starts by providing some background to the issues. The rest of the report focuses on developing possible options, and is structured as follows:

- section 2 outlines some key features of the water sector and key factors that differentiate water from other infrastructure sectors;
- section 3 discusses the commercial models that might emerge;
- section 4 introduces the different access pricing regimes and provides a relative assessment on the basis of economic criteria;
- section 5 discusses the practicality of the different approaches in the water sector;
- section 6 provides a review of regulatory precedent.

1.1 Current regime

The current framework allows for competition through the Water Supply Licensing (WSL) regime introduced in 2005 under the following arrangements.

- Retail-only licence for entry into the non-household retail segment,[1] with all other services provided by the incumbent.
- Combined licence for entry into both the non-household retail segment and resources and treatment: the entrant supplies treated water to the network and deals with the customer, and the incumbent is responsible for distribution.

The prices for accessing the services of the incumbent under the WSL regime need to comply with the Costs Principle. Historically, the Costs Principle has been interpreted as setting access charges based on the difference between the incumbent's retail price and ARROW costs (costs that the incumbent avoids, reduces or recovers in other ways). It is a form of retail-minus access pricing. The Costs Principle has been criticised for not providing enough incentives for the incumbents to reduce costs, and for making entry difficult. In practice, the application of this principle has generally focused on subtracting short-run avoidable costs from the incumbent's retail price, leaving little margin to make entry viable.

[1] From 2017, all non-households in England will be eligible to switch supplier. In Wales, all non-households using more than 50Ml/year will be eligible to switch.

1.2 The Water Act 2014

The Water Act received Royal Assent on 14 May 2014. The key part of the Water Act is the retail market opening for all non-households in England and in Wales (subject to eligibility thresholds) from April 2017.

Another key component of the Act is enabling legislation for competition in the upstream markets. In particular, the Act reforms the licensing regime by unbundling the current combined-WSL licence into wholesale and retail.

The new wholesale authorisation licence will allow the introduction of water into the system at different points in the value chain (including reservoirs, treatment works and storage). However, a wholesale authorisation will need to be connected to its own or another licensee's retail authorisation—this suggests that some form of bilateral trading will need to emerge. Sewerage wholesale and disposal authorisations have also been introduced in the Act.

These licence changes will not come into force until 2020 at the earliest. Any upstream changes will also need to be considered jointly with abstraction trading reforms, and any changes will need to be implemented gradually.

Two areas that could develop faster (before 2020) are bulk water trading between existing water companies, and further innovation by incumbents in sludge treatment and disposal (in particular, anaerobic digestion). Ofwat has introduced new incentives to encourage the former (as discussed below). The latter will be encouraged by the open market for anaerobic digestion of agricultural, food and industrial organic waste, in which there has been substantial entry over recent years.

As recommended by the Cave Review, the Costs Principle has been replaced with a requirement for Ofwat to issue industry codes based on guidance from Defra and Welsh Ministers. This implies that Ofwat will need to develop a sound access pricing regime that could work in both theory and practice.

1.3 Implications of the Water Act and Ofwat's recent thinking

Effectively, the Water Act means that Ofwat must set charging rules and market codes for upstream access. It is not yet clear what this means, although, in the context of retail access pricing, Ofwat has signalled that, where information is better, it might be more appropriate to switch from a retail-minus to a cost-plus approach.[2] There might then be a knock-on effect for upstream access pricing:

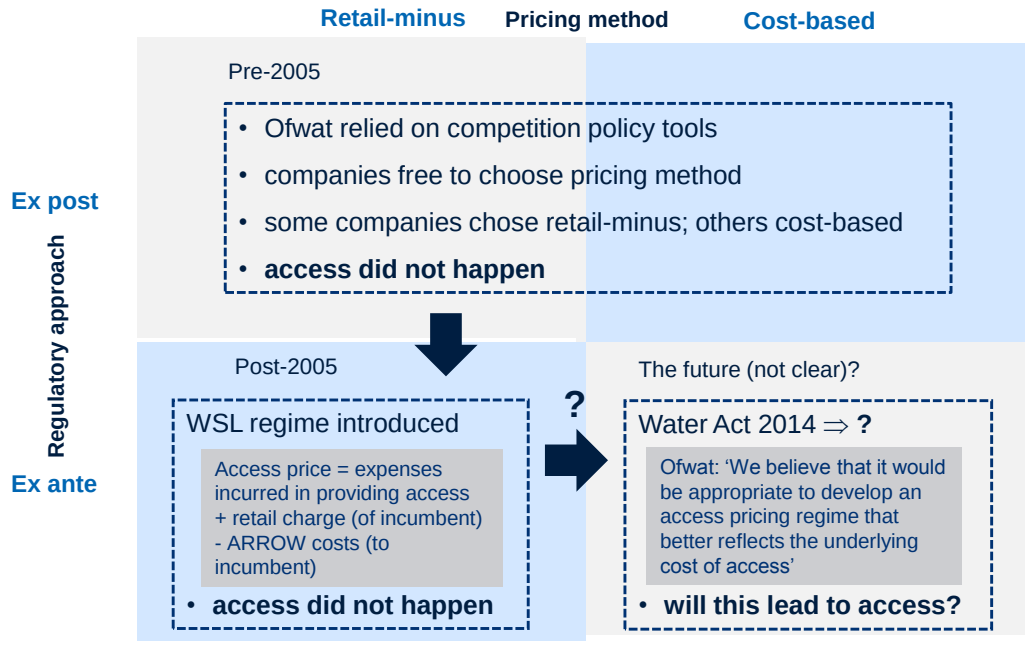
> In any determinations relating to non-household retail access to wholesale services … we intend … to set access prices in line with a bottom-up wholesale charging approach - as opposed to retail-minus. …
>
> This approach reflects the improved quantity and quality of information on retail access pricing that is now available to us through companies' default tariffs and the separate price caps under the current price control. Because such enhanced information is not available in relation to activities taking place under the current **supplementary** authorisation in the combined WSL licence, this approach is focused on the pricing of retail access to wholesale services only.
>
> We expect water companies to **consider** moving away from a retail-minus approach when approached by WSLs for bundled access prices.[3] [emphasis added]

[2] The differences between a retail-minus and a cost-plus approach are explained in detail in section 4.
[3] Ofwat (2014), 'The costs principle and access pricing – companies operating wholly or mainly in England', Letter to Regulatory Directors, 18 August.

However, the Water Act does not rule out an amended form of retail-minus access pricing upstream. Ofwat has likewise not ruled out an amended form of retail-minus access pricing for upstream activities.

The choice of approach is likely to depend on whether it can indeed stimulate efficient entry. Ultimately, it will be up to the companies to demonstrate that they comply with competition legislation and the charging guidance issued by Ofwat.

Figure 1.1 Overview of developments



Source: Oxera.

1.4 Bulk supply trading

Bulk supplies are effectively sales of water between neighbouring water companies. While bulk supplies do not necessarily involve other entrants, the appropriate methodology for pricing bulk supplies is likely to be closely linked to access pricing regimes for entrants upstream.

The majority of existing bulk supply arrangements between incumbents date back to the pre-privatisation period. A number of obstacles have been previously identified that discourage bulk supplies. For example:

- each company is responsible for security of supply only to its own customers;
- given the historical treatment of operating and capital expenditure, companies might have had a preference for capital solutions (from a financial and efficiency assessment perspective);
- risk-averse companies may prefer within-area capital solutions that deliver certainty in outcome as opposed to relying on neighbouring companies to honour contractual operating solutions.

In PR14, a number of amendments have been introduced to make bulk supplies more attractive. First, the bias towards capital solutions should now be mitigated by the move to a TOTEX regime for assessing expenditure. Second, Ofwat has introduced enhanced incentives for both importers and exporters. Water importers will be able to retain 5% of their costs from new qualifying imports

during 2015–20, as well as benefit from the TOTEX efficiency-sharing mechanism. Water exporters will be able to retain 50% of the lifetime economic profits (over and above the normal rate of return) on new qualifying exports that start in 2015–20. These incentives will apply to regulated water companies.

In addition to the regulatory changes, the Water Act seeks to increase the scope for bulk supplies. The Act gives Ofwat new powers (on receipt of an application) to order a bulk supply to be made by the supplier and taken by the recipient (provided that certain conditions are met). The Act also gives Ofwat powers to introduce codes and charging rules for bulk supplies, taking into account guidance from Ministers and in consultation with the Environment Agency.

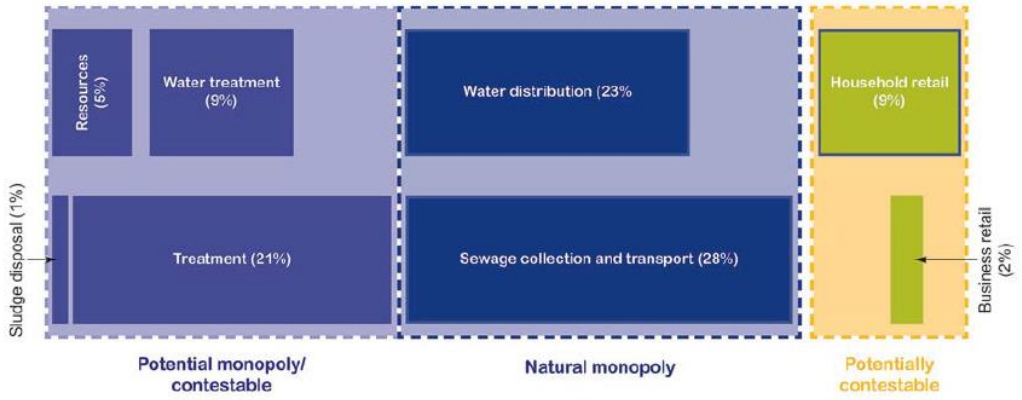
As the players involved in bulk supplies may equally represent entrants requiring access to the incumbent's network, it is likely that some consistency of the pricing methodology for upstream access and bulk supplies will be needed.

2 Unique characteristics of the water sector

In almost all infrastructure sectors, at least one segment of the value chain is considered to be a natural monopoly or an economic bottleneck. If there are other segments of the value chain where multiple operators can potentially compete, but in order for them to do so they require access to the segment of the value chain that is naturally monopolistic, this raises the question of what price the monopolist should charge other parties for using its network.

In the water and wastewater sector, the distribution and transport of water and sewage exhibit natural monopoly characteristics, but some other activities, such as retail, water extraction (resources), and (potentially) treatment of water and wastewater, could in principle be provided by a party other than the incumbent regional monopolist.

Figure 2.1 Which activities are naturally monopolistic?



Note: Percentages show the proportion of revenues attributed to each activity based on companies' accounting separation data for 2011–12.

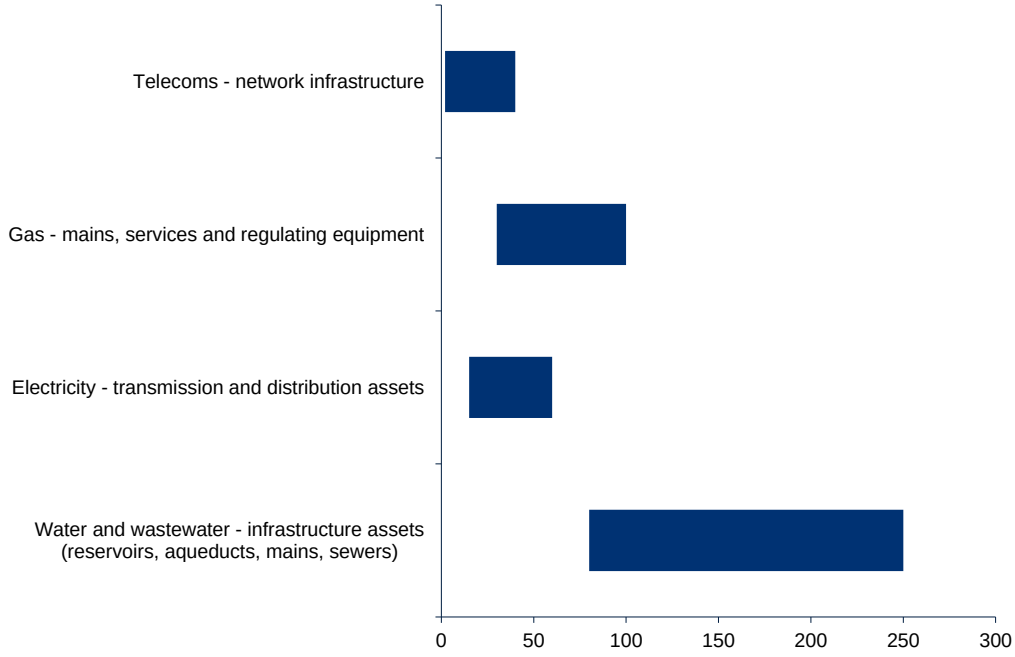
Source: Ofwat (2013), 'Observations on the regulation of the water sector', a lecture by Jonson Cox, March, p. 15.

Before discussing the commercial models of competition that might emerge, and assessing how the access charge to different parts of the value chain might be set, it is important to identify the unique features of the water industry. Some of these features may mean that models of competition employed in other sectors are of less relevance to the water sector and/or may not deliver the same types of benefits.

2.1 Long asset lives

Assets involved in the provision of water and wastewater are characterised by very long economic lives, something that is not observed in any other sector (Figure 2.2). For example, in statutory accounts water reservoirs and aqueducts are often assumed to have economic asset lives of 250 years.

Figure 2.2 Economic asset lives in different sectors (years)



Note: The asset lives shown correspond to the accounting treatment of the assets. The asset lives used in calculating regulatory depreciation do not necessarily correspond to the accounting asset lives in some sectors.

Source: 2014 annual accounts for BT, National Grid and Severn Trent.

In a regulatory context, the assumed asset lives in some other sectors are even shorter than those shown in Figure 2.2. For example, in energy, most assets are depreciated using asset lives of between 20 and 45 years. In water, until the most recent price control, some assets were not depreciated at all in the regulatory framework.[4]

This means that defining long-run costs in the sector is difficult, and that clarity around the remuneration of any new or existing investment, from both the incumbent and new entrant perspective, would be even more important than in other sectors.

In particular, if existing assets are displaced in the water sector, it will take years for the costs to disappear from the system. In other words, the costs of operating the existing assets cannot be reduced very quickly, leading to stranded asset costs. Balancing the trade-offs between these costs and the potential benefits of competition, even in the medium and long term, is likely to be more challenging in the water sector than in other sectors in which competition has been introduced.

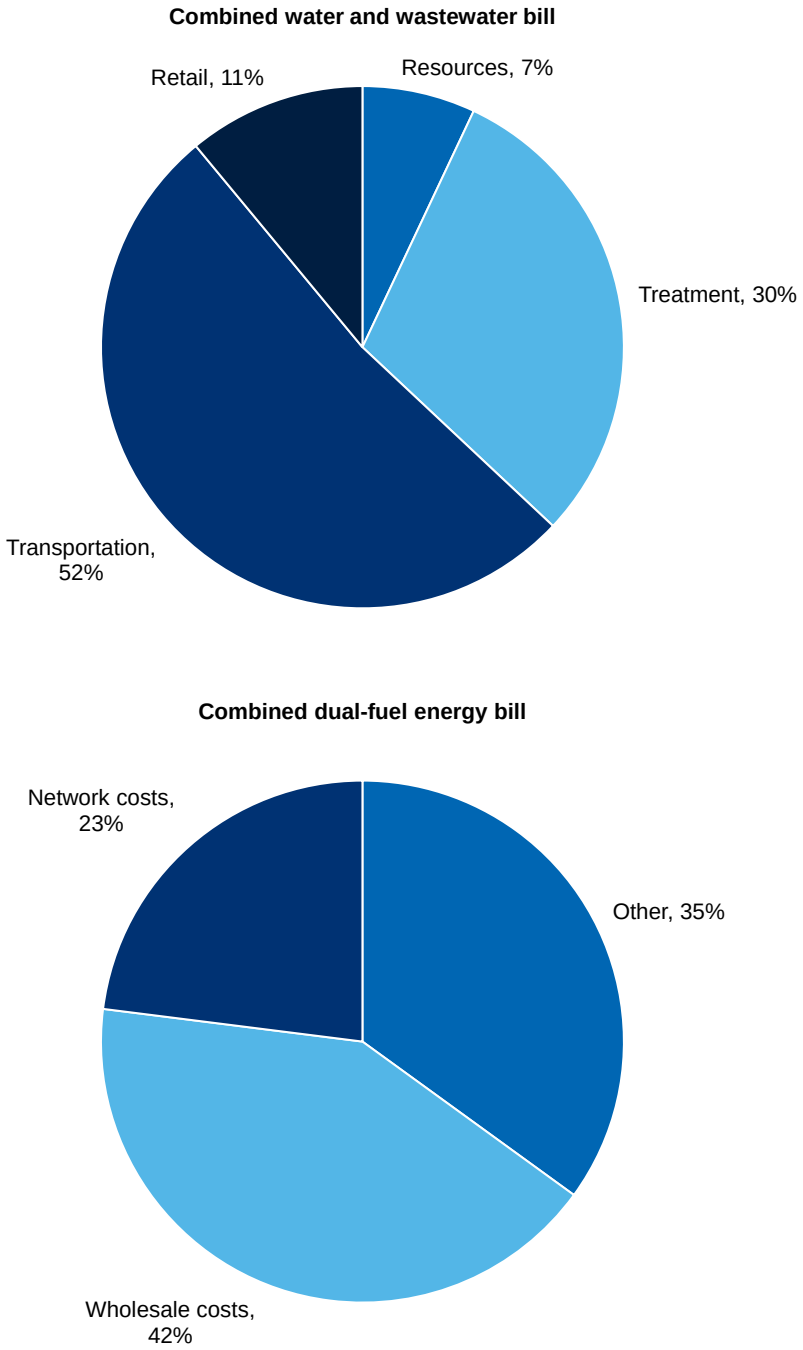
2.2 Differences in cost structure by value chain component

There are also notable differences in the cost structure of the water industry relative to other infrastructure sectors. In particular, the transportation of water (which is a naturally monopolistic activity) comprises a much larger proportion of the bill than in other industries such as energy (see Figure 2.3). In addition, the upstream costs of resources only, excluding treatment, are very small. In part, this is because these costs currently do not reflect the potential economic value

[4] A more detailed discussion of the historical and current approach to depreciation can be found in Oxera (2015), 'Options for future treatment of the RCV', June.

of water as a scarce resource. However, even if over time greater value is attributed to resources, the underlying differences in the cost structure might imply that there is less scope to reduce industry costs through competition.

Figure 2.3 Bill composition, water versus energy



Source: Data underpinning Figure 2.1; Ofgem.

2.3 Differences in costs by topography and geography

Water companies in England and Wales are based around regional river catchment areas, which are determined partly by topography. The multiple (and embedded) abstraction points are determined by the location of rivers and aquifers, as well as reservoirs. Many of these factors are fixed and cannot be changed over time.

Other factors also affect how costs differ within a company area, some of which are unique to the industry, as follows.

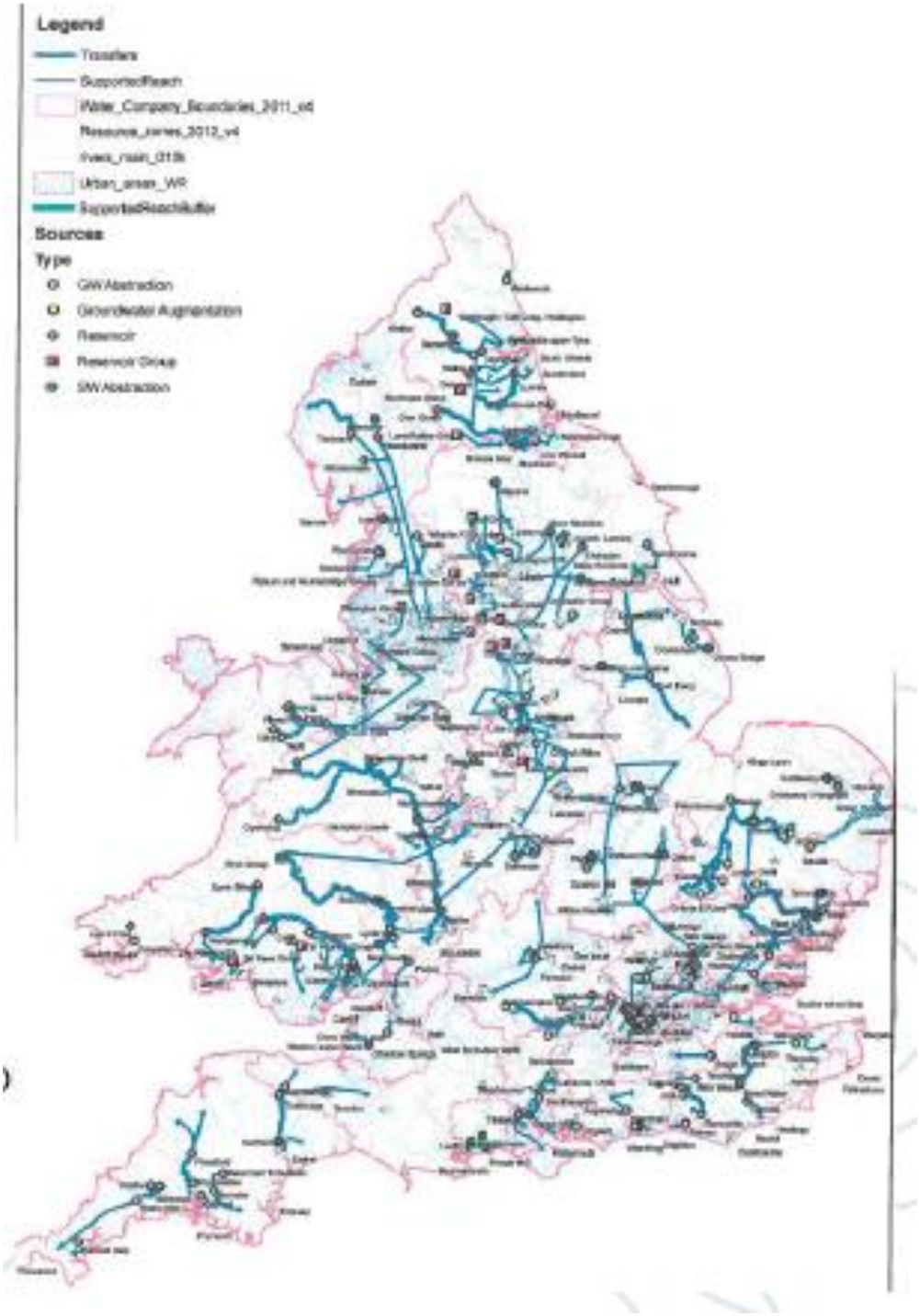
- **Sparsity of population**. This is because sparsely populated areas are likely to require a longer network of pipes per property, and may also have to supply customers from smaller treatment works.
- **Location**. The cost of supply depends on the distance between the source and the customer property—i.e. it is generally more expensive to supply customers whose property is located further from the water source.
- **Type of water resources**. For example, water from surface water sources (e.g. reservoirs) can be expensive to treat. This is because the raw water quality at surface water sources is generally poorer than the raw water quality at other types of water sources. However, surface water may be more readily transported in bulk than water from a 'spider's web' of local borehole sources.
- **Topography of the terrain**. For example, it may be more expensive to transport water around flat land, because the company has to rely on pumping rather than gravity.
- **Asset age and condition**. In general, unit costs increase with asset age, since unit maintenance costs are generally a function of the age and condition of the asset.
- **Non-contiguous or non-intra-connected areas**. Costs are likely to differ depending on how intra-connected the different resource zones are within a company's licensed area.

There is likely to be greater variation in costs within a company area for water than (for example) for energy. The differences will be driven by some of the factors above, which include both inherent and inherited factors (in particular, differences in asset sizes to serve populations), and by higher unit transportation costs (for a lower-value product) than for electricity or gas. For example, a cubic metre of water weighs about one tonne, whereas the weight of an equivalent volume of gas is negligible. This makes water relatively costly to pump over long distances, limiting the extent of existing and potential inter- and intra-connectivity.

2.4 Physical characteristics of the network

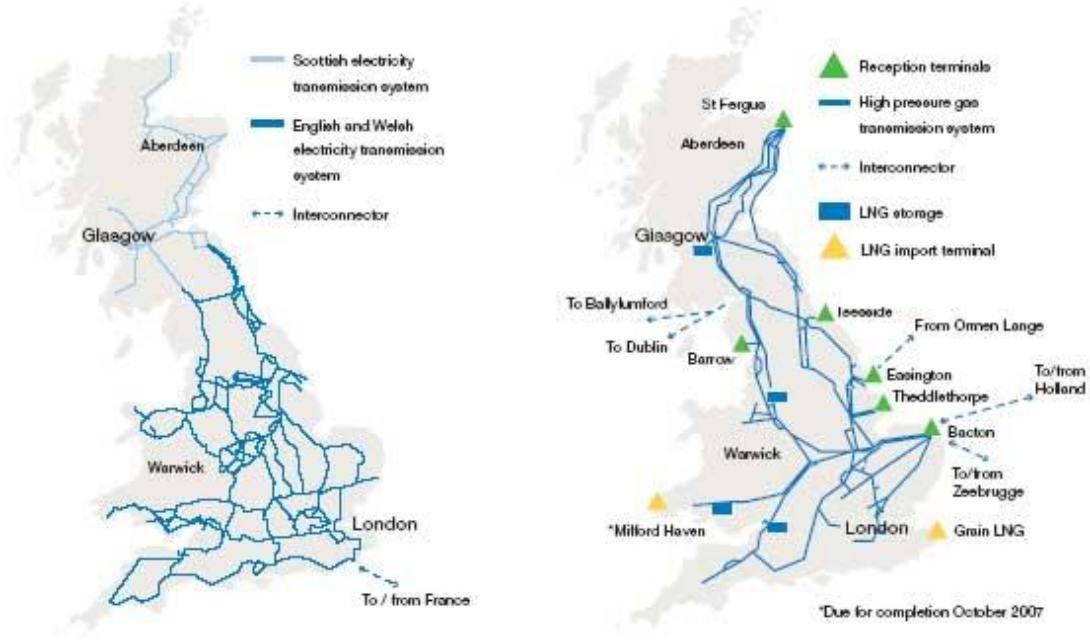
Given some of the characteristics described above, there is generally relatively limited intra- and inter-connectivity within and between company areas. Larger pipes tend to be present around major population centres (or, through the grid, between these centres), with smaller pipes in rural areas and towards the water company boundaries. These networks were generally not designed to be interconnected. This is contrast to electricity and gas transmission national grids (Figure 2.4 and Figure 2.5).

Figure 2.4 Water grid



Source: Beesley Lectures, Presentation by Tony Ballance, 'What are the prospects for a competitive water market?' October 2014.

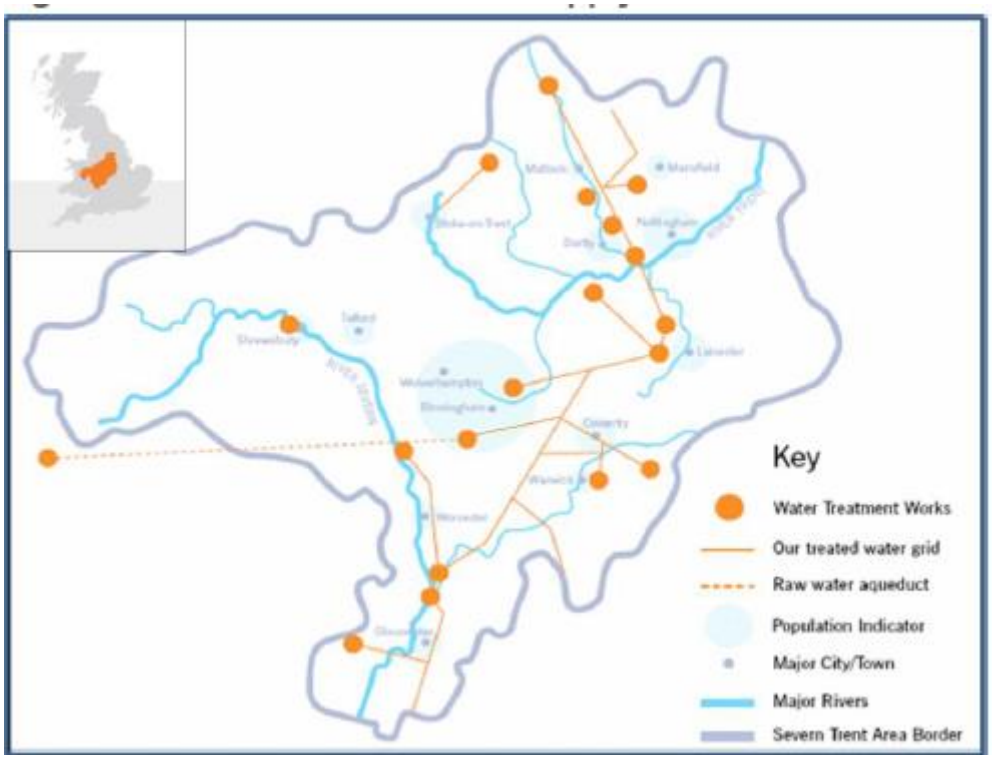
Figure 2.5 Electricity and gas transmission grids



Source: National Grid website.

The degree of intra-connectivity within company-licensed areas also varies (Figure 2.6).

Figure 2.6 Severn Trent Water's supply network



Source: Severn Trent Final Water Resources Management Plan 2014.

There are some interconnections between companies through transfer schemes and bulk supplies. Many of these arrangements have been inherited from pre-privatisation. Some work has been undertaken by companies on within-area

connectivity (e.g. ring mains in Severn Trent, United Utilities, Yorkshire; and other within-area changes in abstraction licences/transfers) since privatisation.

Ultimately, water networks are relatively local in nature and do not easily lend themselves to the creation of an integrated national grid.

2.5 Legacy issues

At the time of privatisation, the replacement cost (modern equivalent asset, MEA) valuation of the companies' assets was £224bn, while the proceeds from privatisation of the water and sewerage companies (WASCs) were £9bn.[5] In other words, the price paid by investors was only about 5% of the estimated MEAV. This price paid was used to set the initial regulatory capital value (RCV) for the sector.

The RCV acts primarily as a tool to ensure the recovery of the invested capital, including an appropriate rate of return, to investors over the life of the assets. It also acts as a commitment device to ensure that the necessary capital investment takes place and that investors have confidence in the regulatory framework.[6]

The size of the initial RCV discount to the MEAV is unique among infrastructure sectors.[7] To a large extent, the historical profile of water rates (which were mainly a function of government tax policy with no relationship to the underlying costs of providing the service) has had a material impact on the size of the gap between the initial RCVs and MEAVs.

The size of the discount today is still significant (the RCV is only 15% of the MEAV). In effect, the value of the RCV bears no relationship to the current replacement costs of assets in aggregate or for individual services (water and waste).

To ensure that appropriate price signals are created, there is a need for some measure of the current cost of the assets to be captured in any access pricing framework. However, these considerations need to be balanced against the price currently paid by customers, which does not reflect the significantly higher replacement cost of the assets.

2.6 Potential dynamic benefits of competition

Based on the discussion of the background (section 1), we assume that Ofwat's overriding objective is to promote efficient competition, which requires efficient entry. Efficiency, however, can be defined in many ways. The key question is whether the focus should be on short-term productive efficiency (e.g. does limited entry reduce costs in the industry today?), or the longer-term dynamic efficiencies that the process of competition might deliver (e.g. does widespread entry reduce costs in the industry tomorrow?).

We assume that Ofwat is likely to be more concerned with dynamic efficiency, although productive efficiency is also likely to be important. This is also consistent with views expressed elsewhere.

The Cave Review, for example, examined different forms of upstream competition that could be introduced, and assessed the productive efficiencies, dynamic efficiencies and resource optimisation benefits that might result (as

[5] Figures are quoted in 2010 prices, http://www.ofwat.gov.uk/publications/rdletters/ltr_rd0410rcv.
[6] More detail on the role and evolution of the RCV can be found in Oxera (2015), 'Options for future treatment of the RCV', June.
[7] Oxera (2015), 'Options for future treatment of the RCV', June.

compared to various potential costs). While the benefits of productive efficiencies were estimated to be higher than those of dynamic efficiencies, both were estimated over a long timescale (30 years), and thus are 'dynamic' benefits in the sense used in this report.[8]

In passing the Water Bill (which subsequently became the Water Act), the government noted:

> The upstream reforms set out in the Water Bill will [make] it easier for new players to enter the water sector who might offer new water sources, water efficiency goods and services or innovative ways for dealing with wastewater and sewage sludge. This will both increase the scope for innovation and entry into the sector and increase the incentives on incumbent water companies to identify the most environmentally and economically efficient options for meeting future resource requirements. These reforms will also make it easier for water companies to trade water with each other, increasing flexibility in the system, particularly during periods of drought ... These relatively modest changes to the existing system are designed to benefit both customers and the environment[9]

Again, this focuses on longer-term innovation over time, and hence dynamic benefits.

Relative to other sectors, customer benefits of upstream competition at the level of individual customers are somewhat less obvious. The customer experience and quality of service will be affected by the retailer (given the assumption of a common carriage model), but less so by the provider of the upstream resource. The main benefits of competition are likely to be at the system level.

- In the long term, competition might be expected to reduce industry costs overall, which should translate into lower customer bills (for the same level of service).
- Competition might also lead to more sustainable abstraction levels and better uses of available resources, increasing resilience and security of supply.

This suggests that the sources of dynamic benefits of competition might be less obvious in the water sector than in other sectors. In this context, it is also important to recognise another important objective on the regulator's agenda—that is, addressing the challenges of population growth, climate change, and water scarcity in different regions. This also reflects the government's objective to ensure that all costs (economic and environmental) are considered. Upstream competition may well contribute to addressing this challenge, but it might also impede the process, if competition discourages investment as a result of increased risk. Any choice regarding the access pricing framework needs to consider the relative importance of the different objectives faced by the regulator.

[8] See Cave, M. (2009), 'Independent Review of Competition and Innovation in Water Markets', Final report, April, Appendix A: Upstream cost-benefit analysis. Some aspects of upstream reforms recommended in the Cave Review were not included in the Water Act 2014 (e.g. an economic purchasing obligation, and a potential contracting entity model).
[9] Department for Environment, Food and Rural Affairs (2014), 'Water Bill: Upstream Competition and Abstraction Reform', March.

3 Defining possible commercial models

To understand the merits of different access pricing regimes, it is first important to establish viable commercial models that might emerge in the future (i.e. identify the services for which an access price is needed) on the basis of the current legislative framework and the future framework once the provisions of the Water Act 2014 are enacted.

Although it is likely that similar considerations will apply at different entry points throughout the value chain, it is still informative to consider the specific features of each potential type of trading arrangement.

3.1 Water value chain

On the water side, there are a number of potential entry points. The two most likely scenarios are:

- an upstream entrant wants to introduce treated water into the system—i.e. the entrant provides its own water resource and treatment, but needs access to distribution in order for that water to reach the final customer;
- an upstream entrant wants to introduce untreated water into the system—i.e. the entrant provides its own water resource, but needs access to treatment and distribution in order for that water to be usable and to reach the final customer.

The former case is already possible under the WSL regime, where the new entrant has a combined licence and provides both the upstream and retail services.

The latter case, where the entrant is involved only in the 'resource' activity, should become possible under the Water Act 2014.

Under the Water Act, a new entrant obtaining an upstream-only licence ('wholesale authorisation') would need to be connected to its own or another licensee's 'retail authorisation'. In other words, the new entrant would need to a have a retailer to whom to sell the water that it wants to introduce into the system.

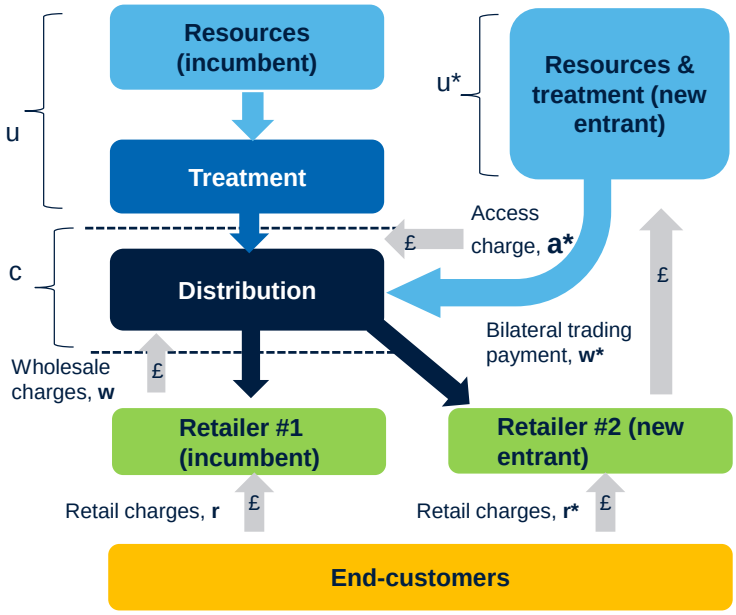
This implies that the most likely commercial model to emerge is a model of bilateral trading between upstream (resources) and downstream (retail) players, with the upstream player paying an access charge to the incumbent for use of the network, and the retailer interacting directly with the upstream entrant. A key driver for change may therefore be the development of a well-functioning retail market.

Sub-sections 3.1.1 and 3.1.2 examine these forms of entry and the associated issues in more detail. Sub-section 3.1.3 discusses bulk supplies.

3.1.1 Access to distribution only

These arrangements would be similar to the current WSL regime, with the exception that the new entrant and retailer #2 in Figure 3.1 do not have to be the same entity.

Figure 3.1 Possible model of competition: distribution



Source: Oxera.

In this framework, the end-customers interact with retailers only and pay a retail price (r or r*).[10] The retailers pay a wholesale charge (w or w*) either to the incumbent water company or to the new upstream entrant. The new entrant pays an access charge (a*) in exchange for using the treatment facilities and the distribution network of the incumbent, which allows the new entrant to deliver its water to the end-customer served by retailer #2.[11] Table 3.1 discusses the outcomes that would be desirable for each of the parties concerned.

Table 3.1 Access to distribution

Perspective of:	Outcome preferred
Retailer	Attractive to buy water from the new entrant rather than the incumbent if **w* ≤ w**
New entrant	Attractive to enter the market if **w* ≥ u* - a***, where u* is the cost of the new resource incurred by the entrant, inclusive of the required rate of return
Incumbent	Attractive to sell access if it is more profitable than choosing to supply retailer #2—i.e. if **a* ≥ w - u**
End-customer	New entry upstream is beneficial if it leads to either a lower retail price or a more optimal service/price combination (e.g. reduced risk of hosepipe bans)
Ofwat	Efficiency benefits of entry that are passed on to customers + improved resilience of the system

Source: Oxera.

In principle, the lower the access price, the more likely entry is to occur. However, an access price that is too low may encourage inefficient entry.

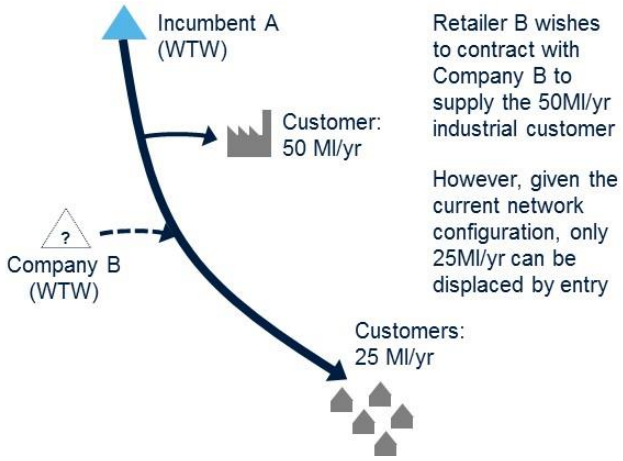
It should be noted that an incumbent could be a new entrant into another incumbent's area, and therefore the overall attractiveness of a particular access pricing regime, from the perspective of the incumbent, may depend on whether the incumbent is likely to be a net provider of access overall (i.e. a net receiver of access charges), or vice versa.

[10] All customers in this framework are non-households, as retail competition is currently possible only in this segment.
[11] The upstream new entrant and retailer #2 could also be the same entity.

To assess the relative attractiveness of different access pricing regimes, it is therefore critical to consider their impact on the incentives faced by different stakeholders.

The above model assumes that the current distribution network is configured in such a way that it is possible for the incumbent, with the entrant's treated water, to balance the system and convey water to the intended point of supply (e.g. a large user served by the entrant retailer). However, based on the existing network configurations of water companies, this may not always be physically possible. Discussions with SVT have indicated that many water companies are configured such that there is a one-way flow of treated water from the treated works to customers. This is illustrated in Figure 3.2.

Figure 3.2 One-way flows and entry possibilities



Note: WTW, water treatment works.

Source: Oxera.

In Figure 3.2, it is assumed that, within the water resource zone (WRZ) concerned, the incumbent (A) currently supplies water both to domestic customers (25 Ml/yr) and to an industrial user nearer to the water treatment works (WTW). Company B has identified a potential source and wishes to build a WTW at the point shown in the figure. Retailer B wishes to contract with Company B to supply 50Ml/yr to the industrial customer.

However, if the current network configuration does not support reverse flows, entry by Company B will, at most, only displace 25 Ml/yr from the incumbent while retaining the system in balance.

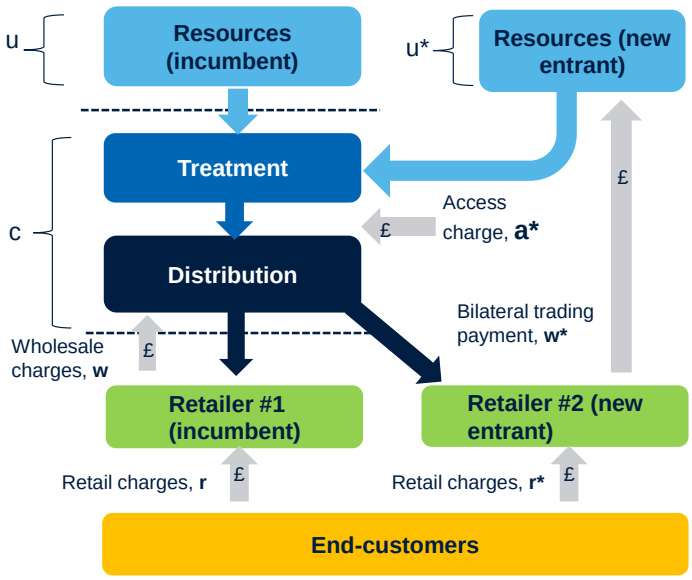
This will mean that either Retailer B can only commit to the sale of 25Ml/yr to the industrial user, or that funding for network reinforcement would need to be provided to facilitate reverse flows. Evidently, the issue is less pronounced for companies with integrated grids that can already accommodate reverse flows.

To supplement the current water resource management planning (WRMP) process, a system operator function is likely to be required to identify where such reinforcements should take place, in a non-discriminatory way, and at least cost. Some funding may be provided in price limits. However, alternative approaches to connection charging will also need to be considered in determining the structure of charges in the access pricing regime (see section 5).

3.1.2 Access to treatment and distribution

These arrangements are similar to the ones described above, with the exception that water is introduced earlier in the system—i.e. the entrant requires access to both treatment and distribution facilities.

Figure 3.3 Possible model of competition: distribution and treatment



Source: Oxera.

The considerations that apply in this example are very similar to the ones outlined in the previous sub-section, with the exception that u and u* have a slightly different definition in the diagram above.

Potential differences in the cost functions for treatment and distribution may lead to some differences in the most appropriate cost measure to be used to set the access price, but overall the incentives faced by the players remain broadly the same.

On a more practical note, such a model may potentially emerge as a more viable proposition compared to the previous model since there would be less issues around ensuring compliance with the quality of the water that is introduced in the system.

Since in this model raw water is introduced into the system at an incumbent's existing treatment works, it is less likely that the concerns discussed above, in relation to the input of treated water and one-way flows, are present.

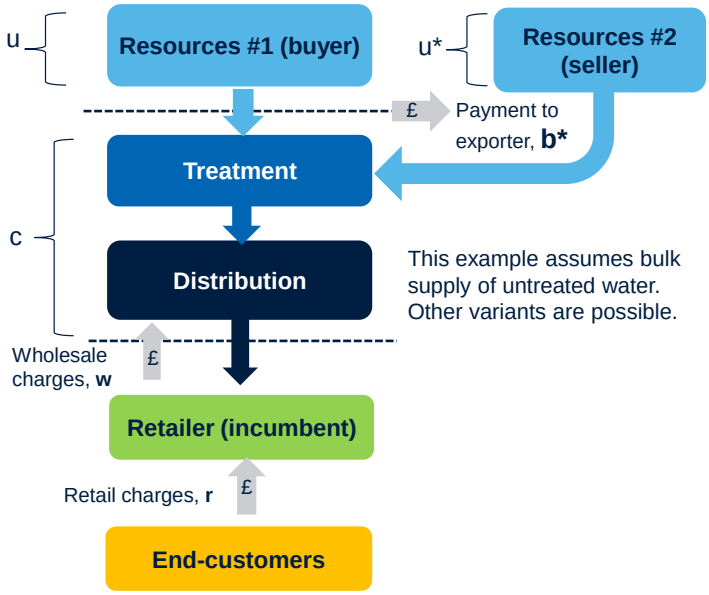
The implication for WRMP is that companies will need to consider a wider array of options than at present in appraising future ways of balancing supply and demand. As for treated water, a system operator may seek to plan and secure a network configuration that calls upon treated water optimally.

3.1.3 Bulk supply

Bulk supplies are effectively sales of water between neighbouring water companies. They do not involve other entrants but to the extent that another water company's water source is being used to supply customers of a different water company, there are some parallels to the models described above.

Figure 3.4 shows the commercial arrangements from the perspective of the importer (buyer) of water from the neighbouring water company.

Figure 3.4 Bulk supplies model



Source: Oxera.

Table 3.2 details the outcomes that would be desirable for each party.

Table 3.2 Bulk supplies

Perspective of	Outcome preferred
Retailer	Bulk supplies beneficial if they reduce the wholesale charge w and/or increase security of supply/resilience of the system.
Exporter	Attractive to sell water if the payment **b* ≥ u*** where u* is the cost of the resource (+any potential interconnection costs) and the regulatory framework allows to keep a sufficient share of the profit Non-financial incentives, such as confidence that exporting water does not jeopardise resilience/security of supply in own area (and does not increase risk of hosepipe bans), also important
Importer	Attractive to buy water if the payment **b*** (+any potential interconnection costs) **≤ u**, where u is the cost of resource on own territory for the importer the regulatory framework allows to keep a sufficient share of the saving to incentivise the trade Non-financial incentives, such as confidence that an import can provide the same security of supply as own resource, also important
End-customer	Bulk supplies beneficial if they reduce the overall cost of the system and/or increase security of supply/resilience of the system
Ofwat	Efficiency benefits of entry that are passed on to customers + improved resilience of the system

Source: Oxera.

The incentives faced by the importer and exporter are in principle similar to the incentives faced by the new entrant and the incumbent in previous examples. The key differences stem from the fact in that, in this example, the payment is made by the incumbent to another party (instead of the incumbent receiving payment in the form of an access charge).

One potential consideration is to what extent the exporter might have incentives to sell its excess water directly to a retailer downstream rather than to the incumbent (in effect, the exporter could become the new upstream entrant

shown in Figure 3.1 and Figure 3.3 above). This may place some constraints on the relationship between the access charge a* and the payment for bulk supplies b*.

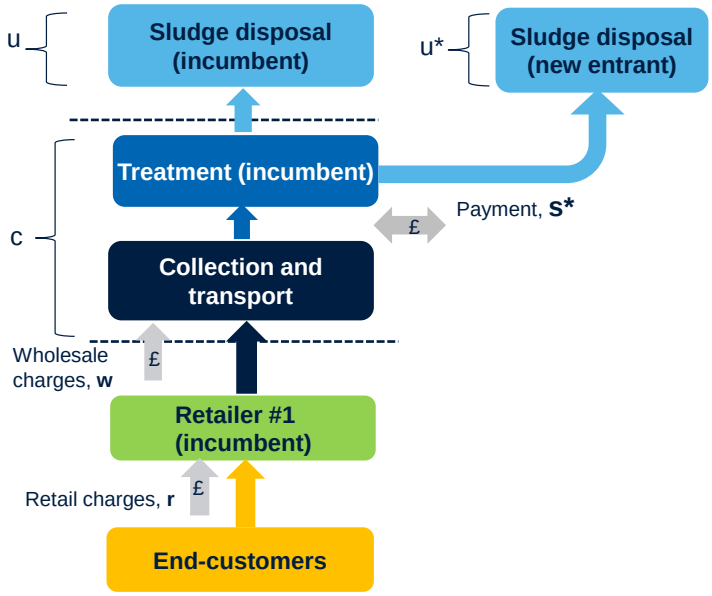
Assuming that a water company has some excess water, and the cost to extract it and deliver it to the neighbouring company's network is u*, then it becomes more attractive to try to sell this water to a retailer downstream rather than simply export it if (w*-a*-u*) ≥ (b*-u*). In other words, if the margin between the wholesale price that can be charged by the entrant and the access price paid is bigger than the bulk supply payment (i.e. if (w*- a*) ≥ b*).

Finally, another important consideration is the impact on reputational incentives. If trading water in any way puts security of supply within the company's border at risk, financial incentives on their own in practice could prove insufficient to ensure all economically viable trades take place.

3.2 Wastewater value chain

In the wastewater sector, there is potential for other players to treat and dispose of sludge and potentially to treat sewerage (the Water Act 2014 includes provisions for a sewerage licence).

Figure 3.5 Waste model



Note: in this example, treatment is not contestable, but in principle it can be.

Source: Oxera.

There is already a market for organic waste treatment; however, at the moment other players do not treat sludge, but other types of waste (agricultural, food, industrial).[12] However, the fact that there is a market with multiple players for other products that act as substitutes to sludge suggests that this in itself could potentially act as a sufficient constraint on pricing of any sludge 'purchased'/'sold' by/to the incumbent to other players.

The issues around potential entry into sewerage treatment would in principle be similar to the issues around entry into water treatment. If another party can

[12] Notwithstanding this, there are examples of entrants who offer design, build and operate services to the water industry for various sludge treatment and disposal activities. In these instances, the incumbent water company will outsource those activities that it sees fit (a form of competition for the market), but the licence (and the associated obligations and liabilities) remains with the water company.

provide these services cheaper than the incumbent, there should be a mechanism that enables that option to be chosen (at least for new assets/incremental capacity). In this case, it is not necessarily an issue of 'access' pricing but some form of bidding mechanism might be required (with clear guidance how bids would be assessed).

3.3 Summary

Although the specific arrangements in each of the models described above differ slightly, and in particular, whether the incumbent receives a payment for access to its network, or in fact pays another party to import water and/or to treat/dispose of waste, there is a set of common questions that needs to be considered in relation to the explicit or implicit charges for using the network.

- What is the effect of new entry on costs and future requirements of the incumbent network?
- How should costs be measured (e.g. average versus marginal costs; short-run versus long-run costs; treatment of common and joint costs)?

In all cases, the different cost standards reflecting these questions might either be applied directly to the access network itself, or might be applied to upstream activities, with the resulting access charge calculated as some form of 'residual'.

Before considering these issues further in section 4, it is also worth noting a number of dimensions that are relevant across all of the models discussed above and that are likely to influence the appropriateness of the different access pricing methodologies and the answers to the questions above.

- Ofwat's overriding objective is to promote *efficient* competition—this requires *efficient* entry. Efficiency, however, can be defined in many ways. In particular, the key question is whether the focus should be on short-term productive efficiency (e.g. does limited entry reduce costs in the industry today?), or the longer-term dynamic efficiencies that the process of competition might deliver (e.g. does widespread entry reduce costs or increase sustainability, improve service levels and choice in the industry in the future?). In this context, it is also worth noting that the government would like to ensure that all costs (economic and environment) are considered and that sufficient emphasis is given to increasing the resilience of the system.
- Ofwat's other main objective is likely to be ensuring that customers experience benefits from introducing competition. In particular, if the focus is on longer-term dynamic efficiencies from competition, while in the long run competition may lead to lower costs (and subsequently lower prices), initially there may be some costs and potentially stranded assets associated with making entry happen. It is likely that Ofwat's position is that these costs should be borne by the industry rather than customers.
- The attractiveness of different access pricing regimes for the incumbent will depend on a combination of several factors: (i) potential entry in their licenced area affecting the net receipts of access charges; (ii) potential for the incumbent to enter in other areas affecting the net payment of access charges; and (iii) whether in the long term the company is a net exporter or a net importer of bulk supplies. This might have some effect on the incentives faced by the individual water companies.

4 Possible approaches to pricing

In developing potential approaches to access pricing, a key question to consider is which cost standard to use. The possible cost standards typically fall within two broad categories.

- **Economic Component Pricing Rule (ECPR)**, sometimes referred to as **retail-minus**, whereby the access price is calculated as the cost of providing access plus the incumbent's lost profit in retail markets caused by providing access.[13] The Costs Principle that has been used in the water sector is a form of ECPR (Box 4.1). Note that in the context of upstream entry in the water sector, it might be more appropriate to refer to it as **wholesale-minus**.

- **Cost-based approaches**. An alternative to determining access prices is to consider the actual cost of providing such access for the use of the monopoly part of the network.

It should be noted that for both methods different cost concepts could be relevant: in the case of ECPR, a measure of cost is required to calculate the incumbent's avoided costs; whereas a cost-based approach, by definition, required some estimate of the relevant costs of the monopoly activity.

In this section, we provide some background on the existing access pricing regime in the water sector and consider how it could evolve either under an ECPR or a cost-based approach going forward, relying in the first instance on the theoretical underpinnings of each method. The practicality of each approach is then considered in more detail in section 5.

A number of cost concepts are relevant to this discussion. These essentially encompass various dimensions, as follows.

- **Variable versus fixed costs**—variable costs vary with output in the short run (e.g. certain categories of OPEX), whereas fixed costs do not (e.g. indirect OPEX, CAPEX).

- **Short run versus long run**—in the long run all inputs (including capital) are variable.

- **Marginal costs**—how total costs increase as output increases, by one unit, in the short run (i.e. the slope of the total cost function). Long-run marginal cost (LRMC) refers to how total costs increase as output increases by one unit when all inputs (including capital) may be varied.

- **Direct versus indirect costs**—direct costs can be directly attributed to (and are caused by) the production of specific goods or services; indirect costs span products/services, and cannot be directly attributed to a particular good or service. Indirect costs include joint and common costs.

- **Incremental costs**—costs that are directly attributable to, or are caused solely by, a specified product or service(s) increment, over and above the provision of existing products or services. Long-run incremental cost (LRIC) refers to the costs that in the long run (when capital is variable) can be directly attributed to a sustained product or service(s) increment.

[13] The ECPR sometimes is referred to as the 'margin rule' where the access charge is equal to the incumbent's retail price minus the incumbent's cost in the retail activity.

- **Fully-allocated costs (FAC)**—an accounting method for attributing all the costs of a company to its various products and services, typically following the principle of cost causality.
- **Stand-alone costs (SAC)**—the cost of meeting a defined service or product increment on its own.

4.1 The status quo: retail-minus pricing in water

Any change to the pricing methodology needs to consider the existing charging guidance in place and the access pricing regimes adopted by water companies currently. A review of Ofwat's existing guidance on access codes is provided in Box 4.1.[14]

Box 4.1 Existing retail-minus approach to access pricing

In its 2007/08 guidance, Ofwat's view was that water companies must set access prices in accordance with the 'Costs Principle', as set out in Sections 66D and 66E of the Water Industry Act 1991 (as amended under the Water Act 2003). Ofwat noted that, in providing access, the Costs Principle allows the incumbent water company to recover:

- any expenses reasonably incurred in allowing access; and
- the appropriate amount in respect of 'qualifying expenses' and a reasonable return on that amount

Deducted from this calculation would be:

- any financial benefits which the undertaker receives as a result of the supplier supplying water to the premises of relevant customers.

Ofwat's interpretation was that, for access under 66A (wholesale access) or 66B (common carriage), the Costs Principle was equivalent to a 'retail-minus' approach to setting access prices, as follows:

Access price = any expenses reasonably incurred + retail charge – ARROW costs.

Here:

- the starting point is the revenues the water undertaker would have 'reasonably expected to recover from the customer which is now to be supplied by the licensee'—the retail tariff
- deducted from retail charges are then ARROW costs, or 'costs that the water undertaker will no longer face because the licensee supplies water to the customer. These costs are expenses that can be **a**voided or **r**educed; or any amount that is **r**ecoverable in some **o**ther **w**ay (other than from other customers of the water undertaker)'
- if additional costs are incurred in providing access, these could then be added back in to the access price.

Crucially, Ofwat set out the customer dimension, time dimension and categories of cost that should be included in the ARROW—the 'minus'—part of the calculation:

Water undertakers should calculate annual ARROW costs by comparing the forecast expenditure arising from a water resource management plan when the licensee does **not have access**. The expenditure profile in the case where the licensee **has access** should include forecast savings in operating expenses (OPEX) and the value of any investment avoided, deferred or advanced, including allowances for changes in the level of depreciation.

Ofwat stated that water companies should publish **indicative** access prices, expressed as a discount (in £/m^3) to the retail price.

- For (wholesale and combined) indicative access prices, undertakers would need to calculate prices for each WRZ, based on two standard volumes associated with the licensees water (50Ml and 500Ml), for five years.
- For common carriage (i.e. combined) supply, surplus/deficit information for each WRZ would also need to be published, setting out the supply surplus *without* the licensee's water and (for 50Ml and 500Ml, respectively) and the supply surplus *with* the licensee's water and the water undertaker's revised investment plan.

[14] Ofwat (2011), 'Access codes guidance', September. Ofwat (2007), 'Access Codes, Guidance', July.

However, **case-specific** access prices[15] were particularly relevant to combined supply arrangements as:

[these] depend on the entry point(s) for the licensee's water, whether the licensee requires connection and whether this generates the need for network reinforcement. Water undertakers may also be able to change their investment plans when licensees make water available. They should identify changes in the scope and timing of projects needed to optimise their future costs of maintaining a supply-demand balance. Specifically, water undertakers may be able to defer or reduce the scale of individual projects.

In relation to case-specific combined supply access prices, Ofwat noted:

The water undertaker needs to calculate the ARROW costs for **obtaining and treating** water by comparing its forecast costs of maintaining the **supply-demand balance** with and without entry by the licensee. These common carriage ARROW costs are in addition to those used to calculate indicative wholesale prices. They should include a **rate of return**.

Ofwat made clear that such ARROW costs would include both OPEX and CAPEX elements:

- For a particular WRZ, if no supply/demand balance shortfall is expected, then ARROW costs would primarily be elements of wholesale-related costs and costs for obtaining, treating and pumping reduced volumes of water from existing sources.
- If, however, for a particular WRZ, a shortfall is expected—which would otherwise necessitate further leakage reduction, or investment in additional resources, by the incumbent—then the ARROW costs would include any deferment in leakage reduction, and any deferment of resources schemes.

Source: Oxera.

What the above meant in practice was that Ofwat's methodology for combined supplies (i.e. common carriage, including retail):

- was retail-minus, taking the prevailing retail price as given;
- allowed for transaction costs to be added to the access price;
- was applied on a WRZ-by-WRZ basis, allowing for geographical differences in access prices by region;
- considered a wide range of forward-looking costs in calculating ARROW costs (savings in OPEX and CAPEX) stemming from access;
- applied the concept of avoidability to the expenditure deferred in relation to the specific entrant being considered.

The last point is particularly relevant—the cost subtracted from the retail price assumes that a specific number of customers switch—it is the avoided cost associated with the specific entrant under consideration, projected forward. This will in general be lower than a broader consideration of LRIC or LRMC. In addition, these avoided costs exclude a contribution towards joint (operating and capital) costs.

Ofwat's revised guidance, as published in 2011,[16] was far less prescriptive in setting out the preferred approach to access pricing, other than stating that charges should be set in accordance with the Costs Principle, and that indicative access prices for combined supplies should clearly show the difference between retail charges and the combined supply access charge.

Different water companies have interpreted the guidance in different ways. Box 3.2 summarises the current approach adopted by SVT.[17]

[15] For case-specific access prices, companies would need to specify a fixed and variable wholesale discount to the retail charge, together with a common carriage discount. Companies would again need to express access prices as a discount to the retail charge.
[16] Ofwat (2011), 'Access codes guidance', September.
[17] Severn Trent (2014), 'Severn Trent Water Network Access Code', October. Severn Trent (2014), 'Indicative combined prices – Severn Trent Water'.

Box 4.2 Severn Trent's current approach to combined access

SVT's network access code (updated Oct 2014) states:

> In any situation where the input of water allows capital investment to be deferred or avoided, Severn Trent Water would apply for the input to be designated as strategic. If the source is designated as strategic, then capital investment costs could be considered as avoidable or reducible, affecting the access charge.

Wholesale (retail entry) access charges are now calculated on a cost-plus basis; whereas common carriage (upstream entry) charges *seem to be* levied using a retail-minus approach. No avoided investment costs are assumed in SVT's current common carriage access pricing:

> These are indicative access prices. We will provide case-specific prices to a licensee on application for access. This may require some adjustment to the assumptions underlying the indicative access prices, which may lead to differences between indicative and case-specific prices provided to a licensee…
>
> …The guidance specifies that indicative prices should be produced **for each water resource zone**, for access starting in each of the five years from 2014-15 to 2018-19 for the different sized customers. This assessment has been undertaken for each of these scenarios using the same methodology as used for the company's Water Resource Plan. The **indicative prices are different** for each of company's 15 water resource zones…
>
> …Modelled inputs of water do not lead to the avoidance or deferral of any capital schemes.
>
> The indicative prices provided… allow for avoidable costs for **reduced leakage** detection.

Source: Oxera.

Therefore, SVT's current approach to combined supplies uses a retail-minus approach, in which the minus element is composed of the long-run avoided costs associated with the volume no longer provided to the specific customer concerned (who has switched to an entrant). These avoided costs include savings in leakage detection, but no avoidance or deferral of any capital schemes. The avoided costs do not necessarily reflect LRMC or LRIC.

4.2 Alternative forms of ECPR

The basic intuition of ECPR relates to providing adequate incentives for the entrant's make-or-buy decision and achieving productive efficiencies. In principle, under this rule entry would occur only if the entrant is more (productive) efficient than the incumbent (i.e. if the entrant has a lower cost than the avoided cost of the incumbent, it is productively efficient for access to occur).

ECPR is typically applied in the context of a vertically integrated incumbent, potentially (although not necessarily) taking as a given the current cost structure of the industry. The application of ECPR in the water sector to date has been criticised for potentially leading to an anticompetitive margin squeeze. A margin squeeze usually occurs when a vertically integrated operator, which is dominant in the wholesale market and provides an essential input to entrants in the contestable downstream market, sets its access charges 'too high'—and/or its (downstream) retail charges 'too low'—so as to 'squeeze' the margin available to efficient entrants, excluding them from the downstream market.

This form of margin squeeze was discussed in the case of Albion Water, as summarised in Box 4.3 below.

Box 4.3 Albion Water case

The Albion Water/Welsh Water case is a seminal case in the water sector, which was reviewed by the Competition Appeal Tribunal (CAT) and Court of Appeal. In this case, under the inset appointment regime (a form of entry into the sector), Albion Water took over the retail supply to Shotton Paper Mill from Welsh Water, and subsequently sought to buy water upstream from United Utilities, while paying a 'common carriage' network access charge to Welsh Water.

The arrangement left Albion Water with no effective margin. In 2001, Albion Water complained to Ofwat that the access price was excessive and gave rise to margin squeeze. Ofwat disagreed, arguing that the Water Industry Act 1991 (Section 66E, as introduced under the Water Act 2003) mandated the use of the Costs Principle, which in turn required a retail-minus approach to access pricing—specifically, one in which access prices are calculated by taking the retail price of the network owner and subtracting any avoided costs to the network owner (Welsh Water) from providing access (the ARROW methodology). In the regulator's view, since there were no avoided retail costs in this case (Albion Water would simply replace Shotton Paper as the interface with Welsh Water), there was no margin squeeze.

The CAT, however, argued that Ofwat had not assessed the alleged margin squeeze correctly. It stated that the retail-minus approach to access pricing in this instance was unsound, and that Welsh Water's access price was excessive in relation to the value of the service provided. It argued that the retail-minus approach applied, which subtracted avoidable costs only, meant that an entrant would need to support the incumbent's overheads (and loss in revenues) as well as its own overheads. This needed a new entrant to be 'super-efficient', rather than just 'efficient'. Moreover, the CAT argued that the subtraction of 'short-term' avoided costs only (associated with one customer switching), as applied in Ofwat's Decision, was not sound, since this eliminated existing competition from Albion Water and prevented market entry. Indeed, as the CAT case progressed, Ofwat stated that in the medium to longer term all retail costs could become avoidable, although the CAT noted that there were difficulties in calculating those elements that are avoidable.

The CAT stated that there was a potential clash between the narrow short-run productive efficiency sought in theory through the ECPR (retail-minus approach), and the wider dynamic competition benefits and level playing field that the Chapter II prohibition is designed to safeguard.

The CAT similarly took the view that, in applying a test for margin squeeze, avoided costs (and, by extension, short-term avoidable costs) were not an appropriate benchmark. It argued that the 'avoided cost' approach was not a satisfactory basis for a margin squeeze test, since it took no account of the incumbent's fixed costs or the entrant's total costs, and required the entrant to be more efficient than the incumbent. In addition, the CAT noted that there were problems in determining 'avoided' costs. Rather, the relevant imputation tests, set out in established cases, were the 'as efficient competitor' test (based on the incumbent's own downstream costs, as per the Deutsche Telekom case), and the 'reasonably efficient competitor' test (based on an entrant's downstream costs). As regards the former, the CAT argued that Ofwat's 'failure' to consider the costs of a notional Welsh downstream business, which would have placed Welsh Water and Albion Water on an equal footing, was 'an error of analysis'. The CAT ruled that there had been a margin squeeze, a Decision upheld by the Court of Appeal.

Source: Oxera analysis of Competition Appeal Tribunal (2006a), *Albion Water Limited & Albion Water Group Limited v Water Services Regulation Authority (Dŵr Cymru/Shotton Paper)*, Judgment, Case Number 1046/2/4/04, 6 October; Competition Appeal Tribunal (2006b), *Albion Water Limited & Albion Water Group Limited v Water Services Regulation Authority (Dŵr Cymru/Shotton Paper)*, Judgment, Case Number 1046/2/4/04, 18 December; England and Wales Court of Appeal (2008), *Dŵr Cymru Cyfyngedig v Albion Water Limited*, [2008] EWCA Civ 536; European Commission (2003), *Deutsche Telekom AG*, Decision of 21 May 2003 relating to a proceeding under Article 82 of the EC Treaty, 2003/707/EC.

While the Albion case concerns entry at the retail level, in which the costs avoided are lower than would be the case under upstream entry, it does illustrate the practical issues of applying ECPR in sectors where competition is not already established. The concern in the context of upstream competition is whether the wholesale charges levied by an incumbent (as charged to retailers), less the access charges an upstream entrant would need to pay the incumbent, allow an efficient upstream entrant to earn a competitive margin.

The current approach to combined access is an application of ECPR that is customer-specific and assumes one switcher. Furthermore, no joint costs are deducted (in fact, qualifying expenses are added); only avoided costs are

deducted, and these correspond to the deferred supply–demand balance OPEX and CAPEX associated with the switcher.

Ofwat's future objective, in promoting competition, will arguably be to encourage entry that will lead to longer-term dynamic efficiencies—i.e. does widespread entry reduce costs in the industry in the future?

However, the current application of ECPR in the water sector leans heavily towards achieving short-term productive efficiency: in facilitating access, the only costs that are subtracted are the (albeit longer-term) avoidable costs associated with the specific entrant. In addition, reasonable expenses associated with providing access can be added to the access price. Taken together, only in situations where the one entrant reduces overall industry costs, including compensating the incumbent for reasonable expenses, would entry be feasible. In turn, this may mean that no entry actually occurs. It is also unlikely that a cost standard of this nature would pass a test for margin squeeze—as highlighted in the Albion case.

Therefore, a wholesale-minus approach, where the avoided costs are based on the following standards, may not be appropriate::

- short-run avoidable costs (short-run OPEX only);
- long-run avoidable costs associated with a marginal decrement (less transactions costs).

In taking forward wholesale-minus access pricing, taking dynamic efficiency considerations into account would involve considering what costs might become avoidable over the longer term were there to be more prevalent entry.

Furthermore, to be compliant with competition law principles, the margin between access charges and wholesale prices would need to be sufficient to ensure that an 'as-efficient' entrant would be able to earn a competitive return. This requires consideration of whether a share of joint costs should also be included in the cost standard (as alluded to in the Albion case).

These factors point to an array of cost concepts that might be subtracted from wholesale charges as part of a reformed ECPR regime (all of these concepts might be regarded as 'avoidable' costs). These include the following.

- **LRMC**—this would represent the additional cost (OPEX and CAPEX) of meeting additional water demand over the long term, when all costs are variable. The implementation of LRMC in water is demand-based, and is in essence the derivative of costs with respect to volumes over the longer term. However, the precise methodology used, and its implementation, varies considerably across the industry (and this concept is problematic to compute in areas not facing a supply–demand imbalance). LRMC may be regarded as a special case of LRIC where the 'service increment' is an additional amount of water.
- **LRIC**—costs that, in the long run, are directly attributable to, or are caused solely by, a sustained product or service(s) increment, over and above the provision of existing products or services.
- **LRIC+**— the LRIC for the product or service in question, plus a share of the costs that are common between different products or services.
- **Fully allocated cost (FAC)**—an accounting method for attributing all the costs of a company to its various products and services. At a total-service

level, the capital cost component of the FAC should represent the MEAV of all products and services.

- **Stand-alone costs (SAC)**—the cost of meeting a defined service or product increment on its own.

In general, SAC > FAC > LRIC+ > LRIC. The difference in magnitude between LRIC and LRIC+ will depend on the scale of joint costs.

4.2.1 Ex ante margin squeeze test

The appropriateness of a particular cost standard under ECPR pricing can be considered in the context of an ex ante margin squeeze test, which involves two steps.

- Is the spread between wholesale charges and upstream access charges positive?
- Is this sufficient for an as-efficient competitor to cover its costs?

To proxy the likely costs of an as-efficient competitor, incumbent's own costs are often used (equally efficient operator (EEO)), although entrant costs might be considered in more stringent forms of margin squeeze test (reasonably efficient operator (REO)). Various types of test and cost benchmarks are then illustrated below.

Table 4.1 The imputation test: alternative benchmarks and precedent

Test: no margin squeeze if wholesale charge - access price ≥ upstream contestable costs + a competitive return

	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7
Margin squeeze test	w-a ≥ AAC-transaction costs	w-a ≥ AAC	w-a ≥ LRMC	w-a ≥ LRIC	w-a ≥ FAC	w-a ≥ FAC of entrant	w-a ≥ FAC of entrant, product by product
Transaction costs netted off?	Yes	No	No	No	No	No	No
Short-/long-run costs	Short-run avoidable costs (AAC)	Short-run avoidable costs (AAC)	LRMC (demand-based)	LRIC (increment is entire service)	FAC or LRIC+ (some common costs)	FAC/LRIC+	FAC
Whose costs?	Incumbent (EEO)	Incumbent (EEO)	Incumbent (EEO)	Incumbent (EEO)	Incumbent (EEO)	Entrant (REO)	Entrant (REO)
Aggregation level	Aggregate products	Aggregate products	Aggregate products	Aggregate products	Aggregate products	Aggregate products	Product by product
Precedent and assessment approach				Deutsche Telekom, Albion Water? (ex post)	Telefónica (ex post)		Ofcom, Broadband

Less likely to comply with competition law | **Likely tests?** | **Too stringent?**

Source: Oxera.

EU precedent in margin squeeze tests leans towards using LRIC or LRIC+ as the relevant measure of avoided costs. In the Albion Water case, the use of short-run avoided costs was criticised, and it was noted that the entrant would need to cover other costs.

4.3 Alternative forms of cost-plus

A cost-plus methodology directly estimates the cost of providing a particular service. In principle, the same cost standards that were considered for the calculation of avoided cost under ECPR can be used to produce an estimate of the cost of providing the monopoly service.

Various forms of LRIC and FAC are usually the main cost standards used for access pricing in other sectors.[18] LRIC-based approaches have typically been of interest to regulators in cases where bypass of incumbent networks is a possibility; if access to the incumbent's network is priced above cost, an entrant may wish to build its own network even if using the existing network is more efficient (although the extent to which a LRIC+ approach would create efficient signals would depend on how significant the mark-up to be added to LRIC is). In the context of traditional infrastructure assets, such as energy and rail, FAC is usually used.

In the context of the water sector, the key question will be which asset values to use to calculate some form of LRIC or FAC for the network assets.

Given the large difference in the RCV and the MEAV of the industry,[19] which is unique in the water sector, using MEAVs for the monopoly assets would lead to access prices that would be too high for entry to occur. The upstream costs of the new entrant would have to be extremely low to enable them to compete downstream.

This suggests that, in principle, two approaches might be feasible, to ensure that customer bills do not increase overall.

- If access is to happen as a result of market forces—by providing appropriate commercial incentives for new entrants—the asset value of the network would need to be based on the residual RCV obtained after subtracting the MEAV of upstream assets from the total RCV ('focused approach'). However, as shown in more detail in the Oxera report on the future treatment of the RCV[20], such an approach would undermine the financial viability of the network business and in some cases could lead to negative access charges.

- Another approach would be to base the FAC (or LRIC) of the network on some arbitrary allocation of the RCV (e.g. proportionately to the MEAV, which is sometimes called the 'unfocused approach'[21]). In this case, neither the access charge for the network nor payments for resources would reflect true costs. Such an approach is unlikely to deliver the potential benefits of competition.

Neither of these options provides an immediately viable solution in the water sector, which is why, when discussing the practical implications of each approach in the next section, we focus more heavily on potential options for modifying the current ECPR approach.

4.4 Summary of the theoretical assessment

The above methodologies can be appraised against a selection of relevant criteria, as follows.

- **Productive efficiency**—to what extent does the approach lead to reduced costs in the short run?

- **Dynamic efficiency**—to what extent does the approach lead to reduced costs in the longer term?

[18] See section 6.
[19] Oxera (2015), 'Options for future treatment of the RCV', June.
[20] Oxera (2015), 'Options for future treatment of the RCV', June.
[21] Oxera (2015), 'Options for future treatment of the RCV', June.

- **Cost recovery**—does the approach enable the incumbent, in providing access, to recover its relevant costs (which will affect all customers)?
- **Cost reflectivity**—to what extent are charges reflective of the costs of supply (including at a geographical level)?
- **Social equity**—to what extent does the approach retain cross-subsidies (including at the geographical level)?
- **Compliance with competition law**—is the approach likely to pass a margin squeeze test?

In addition, the issue of allocative efficiency is explored (in terms of whether charges exclude monopoly profits).

A narrow interpretation of ECPR would involve subtracting short-run avoided costs, associated with a particular entrant, from wholesale charges. This secures cost recovery for the incumbent (including in relation to stranded costs or expenses), so long as wholesale charges recover all costs. By taking account of the opportunity cost of access and allowing entry *only* where this reduces total short-run industry costs, it also ensures short-run productive efficiency. Existing cross-subsidies in the value chain can be retained for end-users, for example in relation to geographic averaging, leading to social equity.

However, applying ECPR in this way does not guarantee allocative efficiency, in that it assumes that the wholesale charges exclude monopoly profits (or indeed productive inefficiencies)—although this is unlikely to be a major issue given the regulatory framework in place to set wholesale allowed revenues. Also, it may not lead to dynamic efficiency, in that short-run avoided costs do not reflect the longer-term dynamic benefits that competition might bring. Importantly, from a competition law perspective, ECPR applied in this way is likely to fail a test for margin squeeze.

Hence, in applying an ECPR approach, a longer-term assessment of avoided costs, taking account of more extensive entry and the consequent impact on industry costs, is likely to be required to secure dynamic efficiency and competition law compliance. Options include subtracting from wholesale charges LRMC, LRIC, LRIC+, and FAC. The trade-off here will be between cost recovery for the incumbent, on the one hand, and the likelihood of securing dynamic efficiencies (which are uncertain) and competition law compliance, on the other.

Applying ECPR assumes a vertically integrated sector upstream, in which there are benefits to this integration (e.g. economies of scope). A cost-plus approach assumes more separation between upstream activities (and hence assumes fewer vertical economies of scope).

Cost-plus approaches, applied to the network, include LRIC, LRIC+ and FAC. While FAC may lead to full cost recovery at the network level, LRIC or LRIC+ may fall short of full cost recovery. In addition, productive efficiency is not necessarily guaranteed if, in the vertically integrated case, there are significant vertical economies of scope between resources and treatment and distribution. Cost recovery is not guaranteed across the value chain if access to distribution leads to stranded resources and treatment assets. Balanced against this are the positive potential impacts of competition on allocative and dynamic efficiency.

A crucial issue concerns how the existing RCV is allocated between resources and treatment (the potentially contestable services) and distribution. Allocating the RCV using a focused approach may lead to entry and dynamic efficiencies,

but also to access prices that are too low (or even negative) and which do not allow the network business to recover its costs. Industry costs may also increase in the short term, meaning productive inefficiencies. On the other hand, allocating the RCV using an unfocused approach is likely to lead to access prices that are too high, meaning too little entry, and hence few dynamic efficiencies. Such access prices may generate a margin squeeze and fall foul of competition law.

Table 4.2 provides a high-level summary of the pros and cons of ECPR versus cost-plus based on key economic criteria.

Table 4.2 Relative assessment of ECPR versus cost-plus

Criterion	ECPR				Cost-plus	
	Wholesale minus LRMC	Wholesale minus LRIC	Wholesale minus LRIC+	Wholesale minus FAC	Focused	Unfocused
Productive efficiency	✓✓✓	✓✓	✓	×	×	✓✓✓
Dynamic efficiency	✓	✓✓	✓✓✓	✓✓✓	✓✓✓	×
Cost recovery	✓✓✓	✓✓	✓	×	×	✓✓✓
Cost reflectivity	✓	✓✓	✓✓	✓✓✓	✓✓✓	×
Social equity	✓✓✓	✓✓	✓✓	✓	×	✓✓✓
Compliance with competition law	?	✓✓	✓✓✓	✓✓✓	✓✓✓	×

Source: Oxera.

Overall, both ECPR and cost-plus are possible approaches for access pricing. The choice often comes down to the objectives of the regulator and industry structure (e.g. vertical integration versus disaggregated value chain). Ultimately, the practicality of each approach is vital to determine a reasonable path for any changes. This is what we turn to in the next section.

5 Practicality of the proposed approaches

In this section we provide a discussion of what might be required in practice in order to implement possible access pricing methodologies in different entry points in the value chain.

Both ECPR (wholesale-minus) and cost-based approaches are considered. The approaches might be implemented at the company level, or by WRZ. As a starting point, some relevant data is currently available at the WRZ and company level. However, further data would need to be compiled in order to implement the approaches.

In our discussion we take into account the implications for geographical de-averaging of prices. We also briefly discuss the considerations that would influence the appropriate charging structure.

5.1 Access to treated water distribution

As discussed in section 2, water distribution is likely to be naturally monopolistic, whereas water treatment may or may not be contestable. The discussion below assumes that an entrant undertakes both the resources and the treatment activities. Similar considerations would apply where access is required to treatment as well as to distribution.

5.1.1 ECPR-based access charges

In using ECPR, it is assumed that the industry remains vertically integrated upstream, and that there are benefits (in terms of economies of scope) to this integration. Entry is possible when this reduces overall industry costs.

Before considering how a ECPR-based access pricing methodology can be modified to deal with some of the issues identified with the current approach, it is useful to examine the assumptions behind the current approach using specific examples (in this case SVT's approach). Changing these assumptions will indicate the direction of travel for access prices.

Existing wholesale-minus approach

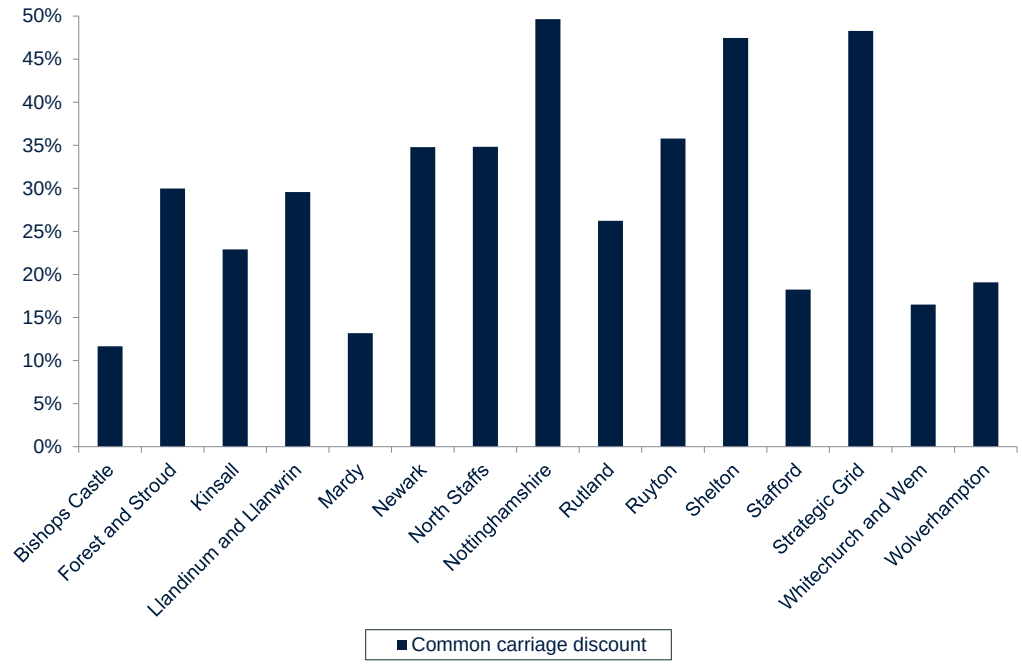
As discussed in section 4, in line with published guidance, SVT currently uses an ECPR-based approach to combined entry (retail plus common carriage) access pricing, with these prices calculated for each WRZ. Importantly, to derive common carriage network access charges, local WRZ avoided costs are subtracted from geographically averaged wholesale charges.

To implement the approach, avoided costs for each of the 15 WRZs are those associated with lower leakage detection activity (no resources capital schemes are deferred in the modelling), stemming from an entrant serving a customer consuming 5Ml, 25Ml, 50Ml and 500Ml/yr. The avoided costs are therefore associated with these specific decrements. From discussions with SVT, our understanding is that these avoided leakage costs, at the network level, are high compared with the avoided resources and treatment costs that might be attributed to these decrements. This is because the marginal cost of leakage detection is high. The methodology therefore goes beyond a pure ARROW approach in generating avoided costs.

The discounts to the wholesale charges that emerge are provided in Figure 5.1. This shows that the discounts offered for the largest users (500Ml) to wholesale

charges range from 12 to 50%, averaging 29% and 45% on an unweighted and weighted basis respectively.[22]

Figure 5.1 SVT's existing common carriage discounts



Note: Based on simple average of the discount offered for annual consumption of 500 Ml for payment in arrears and in advance.

Source: Oxera analysis of Severn Trent (2014), 'Indicative combined prices – Severn Trent Water', October.

The starting point for the above calculation—the wholesale charges—stems from the approach adopted by SVT to retail-only entry. Here, to derive wholesale charges, SVT Trent has switched from a retail-minus to a cost-plus based approach. In line with Ofwat's 2011 guidance, however, the calculation is still presented as a discount to the retail charge.

The retail charge does not vary by WRZ, and, likewise, avoided retail costs do not vary by WRZ, so the wholesale charges derived are the *same* for each WRZ. In Table 5.1, the avoided costs associated with common carriage, which do vary by WRZ, have then been deducted from these common (regionally averaged) wholesale charges.

It is also worth considering how avoided costs due to common carriage are calculated. SVT notes that, for each customer band and each WRZ, its avoided cost assessment has 'been undertaken for each of these scenarios using the same methodology as used for the company's Water Resource Plan'.[23] Figure 5.1 illustrates that the Nottinghamshire and Strategic Grid WRZs have particularly high avoided-cost figures, with discounts around 50%. Notably, these are the two largest WRZs.[24]

SVT's Water Resources Plan (2014) indeed distinguishes between the two main zones and other WRZs:

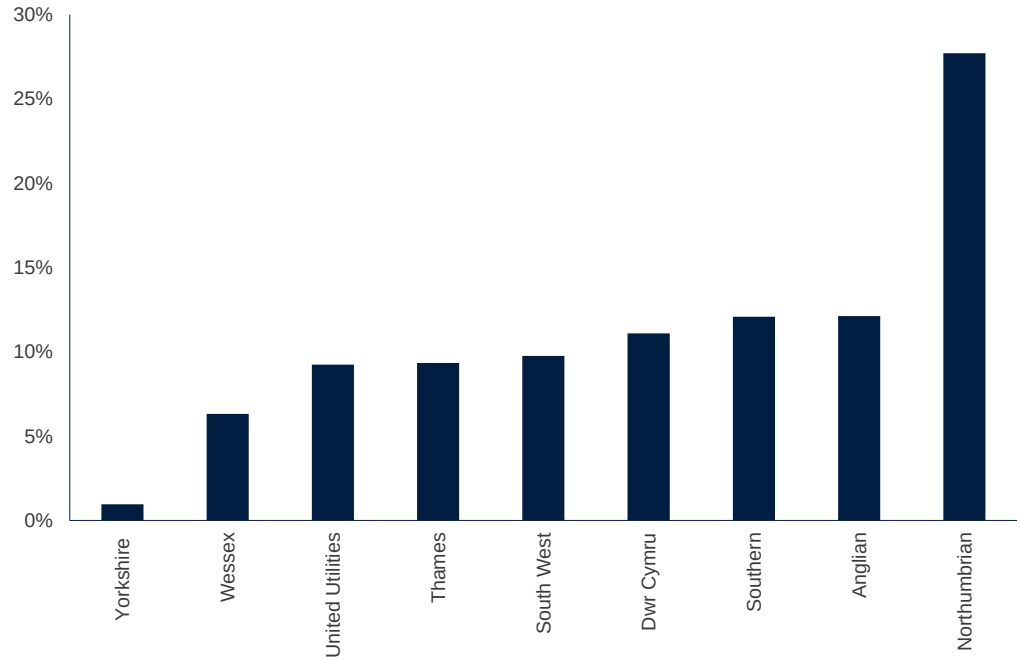
[22] Weighted using distribution input. Discounts for lower-usage bands (5Ml, 25Ml, 50Ml) are lower.
[23] The modelled inputs of water do not lead to the avoidance or deferral of any capital schemes, but allow for avoidable costs associated with reduced leakage detection.
[24] Severn Trent (2014), 'Final WRMP', Appendix A.

> Without new investment, our Strategic Grid and Nottinghamshire zones face some significant supply shortfalls in the long term as a result of the need to reduce abstraction from unsustainable sources and the potential impacts of climate change. These two zones will require new sources of water supply… Our other thirteen water resource zones are less impacted by the need to reduce unsustainable abstractions, and our modelling shows they are more resilient to the impacts of future climate change risks. As a result our long term plans in these zones are to optimise the operation of our existing sources, and to manage demand through water efficiency and leakage control measures.

This may explain why avoided costs are higher in the Strategic Grid and Nottinghamshire zones than in other WRZs.

SVT's avoided costs are also higher than those submitted by most companies, as illustrated in Figure 5.2.

Figure 5.2 Combined access discounts of other WASCs



Note: Based on simple average of the discount offered for annual consumption of 500 Ml across the different WRZs for each company. The discounts are combined access rather than common carriage. Common carriage discounts would be slightly smaller as they would exclude avoided retail costs.

Source: Oxera analysis of Severn Trent (2014), 'Indicative combined prices – Severn Trent Water', October.

It is also instructive to compare SVT's existing common carriage discounts to a bottom-up assessment of costs. Based on accounting data[25] for Severn Trent, OPEX plus capital maintenance charges for resources and treatment account for 44% of total water service costs (excluding retail). This indicates that avoidable costs, however calculated, could be material (although these would need to be calculated by WRZ).[26]

[25] Ofwat June Return 2011.
[26] These figures do not include a return on capital, or the fact that (prior to PR14) most of the network assets (except for pumps) did not incur current-cost depreciation (they were subject to an infrastructure renewal charge, or IRC). The simplified depreciation approach introduced by Ofwat in PR14 does not distinguish between above- and below-ground assets or base and enhancement expenditure. Hence the IRC approach for underground assets is no longer used.

Towards a new wholesale-minus approach

Moving forward there is then a question of how avoidable costs would be calculated in a revised wholesale-minus approach. For example, the Cave review recommended, as part of the upstream reforms (in relation to bilateral trading):[27]

> For supplies to retailers or large customers, replacing the costs principle with an ex ante access pricing framework based on long-run avoidable costs. Access prices would be determined by Ofwat at a water resource zone level on a common methodology, with reference to guidance from Defra and Welsh ministers.

The difference between long-run avoidable costs (LRAC) and those calculated for each WRZ under the current approach to access pricing is that, in the longer term, it may be assumed that there is a higher degree of entry, and a higher avoidance of costs (including capital costs avoided or deferred). While the avoided costs for the Strategic Grid and Nottinghamshire might remain broadly similar to those under the current approach, avoided costs could increase for the remaining WRZs.

As discussed in section 4, alternative approaches to calculating LRAC include (for each WRZ) LRMC, LRIC, LRIC+.

LRMC has been emphasised by Ofwat in the past (before the WSL regime was introduced) as a potentially relevant cost standard for retail-minus access pricing:[28]

> ECPR-based access prices are based on subtracting the avoidable costs associated with the competitor's provision of part of the value chain from the retail price. Where a competitor is providing bulk treated water for common carriage by the incumbent, the LRMC of resources and treatment could measure avoidable costs to the incumbent. Using this rule would mean that those companies with a high LRMC for the resources and treatment aspect should have a low charge for access to the distribution network (and vice versa).

However, as noted in section 4, calculating LRMC in practice can be difficult, and different companies across the water sector have adopted different approaches. Over recent years Ofwat has also placed less emphasis on the role of LRMC in tariff-setting more generally, and companies have not been required to submit updated estimates. Furthermore, competition law precedent for applying a margin squeeze test leans towards calculating LRIC or LRIC+ as the relevant cost standard, rather than LRMC.

This is not to say that LRMC should be ruled out altogether as a relevant cost standard. Indeed, Ofwat refers to LRMC, LRIC and LRIC+ in its 2013 access pricing paper.[29] At the very least, the assumptions behind, and calculations of, LRMC, LRIC and LRIC+, should be compared.

The water sector also differs in a number of important respects to other sectors, which may limit the applicability and desirability of a pure LRIC-based approach to assessing avoided upstream costs.

First, upstream entry may not lead to full displacement of an incumbent's existing assets, due to scale. An incumbent's reservoir is likely to keep operating following upstream entry, albeit at somewhat lower capacity. As noted in section

[27] Cave, M. (2009). 'Independent Review of Competition and Innovation in Water Markets', Final report, April.
[28] Ofwat (2001), 'Report A: The role of LRMC in the provision and regulation of water services'.
[29] Ofwat (2013), 'Future access pricing in the water sector: A discussion paper', November.

3, a system operator may be required to ensure resilience in the presence of upstream entry. Second, where assets are displaced (in part or in full), the costs of those assets may not be removed for some time, since the water sector is characterised by comparatively long-lived assets to other sectors (as discussed in section 2).

In selecting a cost standard, it is important to take account of regulatory objectives. As discussed in section 4, the idea behind ECPR is that entry should be feasible where this reduces overall industry costs—a concept that can be extended to the longer-term cost savings, and take account of dynamic efficiencies emerging from the competitive process. An issue with subtracting LRIC from wholesale charges is that the entry generated by this approach may mean that, due to the above factors, overall costs across the industry are not reduced over the medium term. Notwithstanding this, the issue of displacement and avoidance of costs was discussed in the Albion Water case. Here, the Court of Appeal ruled that the ex post test for a margin squeeze does not demand that an entrant displaces the incumbent provider, or that the incumbent avoids costs in the specific case considered.

Using a pure LRIC approach, as part of a wholesale-minus methodology, may also generate problems for cost-recovery for the network business—in a similar way to how using a pure focused approach to setting access charges might generate cost-recovery problems as part of a cost-based approach (as discussed in section 4.3). In the former case, LRIC for resources and treatment is subtracted from overall wholesale charges. In the latter case, MEAV for resources and treatment is subtracted from the overall RCV. In both cases, the resulting low access charges may not lead to cost recovery for the network.

There is therefore some uncertainty about what LRAC standard to use as part of a revised wholesale-minus approach. This is likely to lie somewhere between LRMC and LRIC.

Box 5.1 provides a discussion of the practical issues involved in calculating LRIC as an upper-bound measure of avoided cost (which could be calculated for each WRZ). Discussions with SVT have revealed that most WRZ costs are direct in nature, with few joint costs (overheads) across WRZs. Hence LRIC and LRIC+ for each WRZ would be expected to be similar.

Box 5.1 Calculating LRIC by WRZ

Incremental cost of a defined service is:

- the costs **directly caused by** (i.e. directly attributable to) the provision of that service (e.g. of B) in addition to the other services the firm already produces (e.g. A);
- the **difference** between total costs when the service is provided and the total costs when the service is not provided (e.g. A+B minus A).

LRIC is:

- a **long-run** concept, in which both operating and capital costs are variable, calculated over the lifetime of the assets;
- a **forward-looking** concept, based on current replacement costs and assumptions about future optimisation and efficiency.

Practical issues in estimating LRIC.

- How to define the relevant increment? (Assume number of customer switches per WRZ?)
- Incremental costs of introducing a new service? (one option)
- Avoided costs in ceasing an existing service? (another option)

By overall service level (e.g. water service), or by individual sub-services (e.g. by WRZ)?

Timescale: how long is ‘long run’? (particularly challenging in the water industry)

- When all costs are variable (planning horizon? asset lifespan?)

Higher-level information or detailed operational modelling?

- 'top-down' (using accounting information) or 'bottom-up' (using engineering information) computation of costs (do the former first).

How 'forward-looking' and 'optimal' is the approach? (scorched node)

- It can be based on 'scorched node' costs (taking the existing infrastructure as given), 'scorched earth' costs (which would consider a full re-optimisation of the existing infrastructure), or an intermediate 'modified scorched node' approach.

Which costs to include?

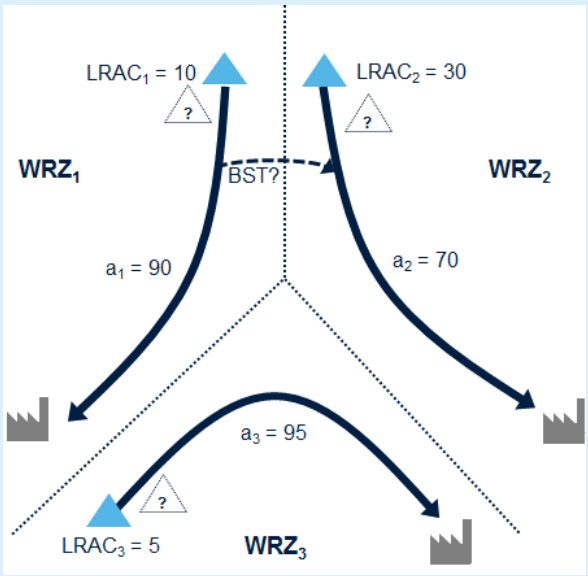
- Solely volume-driven direct incremental costs? (incremental quality also, service-related)
- Allocating joint common costs: LRIC versus LRIC+ (may not be much difference for each WRZ).

The LRIC figures derived should inform LRAC, but are likely to be an upper bound on LRAC. One option could be to base LRAC on LRIC, but with the LRIC component calculated over a period of 10 or 20 years (as observed in other sectors), rather than the time horizon that would span the full life of the assets. Alternatively, the LRAC could be based on some form of a net present value approach. For example, it could reflect the annualised equivalent of the expected present value of future cost reductions (based on LRIC) over the asset life.

Once LRACs have been calculated for each WRZ, it would be possible to calculate revised access prices. A potential approach is explained in Box 5.2. As per the current approach, it is assumed that both retail charges (to end-users) and wholesale charges (to retailers) are geographically averaged. Upstream access prices, also in line with the current approach, are then geographically *deaveraged* by WRZ. The aim is to encourage efficient long-term entry by WRZ, while retaining averaging in end-user charges across a company's WRZs.

Box 5.2 Applying ECPR ('wholesale minus LRAC') by WRZ

An illustration of a water company comprised of three WRZs is provided below. In each WRZ it is assumed that the water company supplies water from its resources and treatment works to industrial users at the end of the network.



Source: Oxera.

Assume that wholesale charges to retailers are cost-based and set at 100, and that the retail element of charges (also cost-based) is 10, meaning that end-users (here industrial customers) pay 110. Both wholesale charges (w) and the retail element of charges (r) are regionally averaged across WRZs. Wholesale charges are regulated, whereas retail charges are subject to default caps (and to competitive pressure at the retail level).

An entrant is considering whether to enter each of the WRZs with its own resources and treatment (R&T). Based on the incumbent's own assessment of costs, the LRAC for resources and treatment varies by WRZ, with a LRAC of 10 in WRZ_1, 30 in WRZ_2, and 5 in WRZ_3 (reflecting, for example, variations in topography and water availability).

Using the regional wholesale-minus rule, the network access price the entrant would then pay would be:

$a_1 = w - LRAC_1 = 90$

$a_2 = w - LRAC_2 = 70$

$a_3 = w - LRAC_3 = 95$

Entry is then feasible for an entrant if the total costs it faces (including its own R&T costs and network access charges) are 100 or less at the wholesale level (or 110 or less including retail).

Assuming that the entrant has R&T costs of 10, the wholesale costs that it would face in each WRZ (and its entry decision) would be:

WRZ_1: 10 + 90 = 100 ⇔ indifferent towards entry

WRZ_2: 10 + 70 = 80 ⇔ enter

WRZ_3: 10 + 95 = 105 ⇔ not enter

Put simply, the entrant has lower costs than the incumbent in serving WRZ_2; thus, the ECPR provides the entrant with a margin. In contrast, the entrant has higher costs than the incumbent in serving WRZ_3; as such, the ECPR does not provide a margin within the confines of the regionally averaged wholesale charge cap w of 100. Here, entry occurs where it reduces long-run industry costs.

Deaveraged access prices are used to encourage efficient entry while retaining averaging in wholesale and retail charges (and hence end-user charges).

As the model of upstream competition envisaged in the Water Act is bilateral trading, the financial flows present in the case of WRZ_2 would be as follows (see Figure 3.1). The upstream entrant pays as access charge of 70 to the incumbent, and the retailer pays an agreed amount for wholesale services to the upstream entrant (this will be negotiated, and will be more than 80 but less than 100). The retailer must cover its own retail costs (of 10). The total cost faced by the retailer is then more than 90 but less than 110.

If, however, network access prices are averaged across WRZs, a different picture emerges. For example, assume that avoided costs are averaged across WRZs—i.e. 45/3 = 15.

Access charges are then ($a_1 = a_2 = a_3$) = w – 15 = 85.

Assuming again that an entrant has R&T costs of 10, the wholesale costs that it would face in each WRZ (and its entry decision) would be:

WRZ_1: 10 + 85 = 95 ⇔ enter

WRZ_2: 10 + 85 = 95 ⇔ enter

WRZ_3: 10 + 85 = 95 ⇔ enter

Here, entry occurs in WRZ_3 even though this is inefficient (the entrant has higher costs than the incumbent).

If, on the other hand, an entrant has costs of 20, the wholesale costs that it would face in each WRZ (and its entry decision) would be:

WRZ_1: 20 + 85 = 105 ⇔ not enter

WRZ_2: 20 + 85 = 105 ⇔ not enter

WRZ_3: 20 + 85 = 105 ⇔ not enter

Here, entry fails to occur in WRZ_2 even though this would be efficient (the entrant has lower costs than the incumbent).

As noted in Box 5.2, using geographically deaveraged access prices by WRZ enables entry to occur where this is efficient, while still securing averaging of wholesale and (regulated) end-user charges. In contrast, geographically averaged access prices may impede efficient entry, or lead to inefficient entry.

The approach discussed in Box 5.2 may also be extended to bulk water trading, as explained in Box 5.3 below.

Box 5.3 Applying ECPR to bulk supplies by WRZ

Assume that WRZ_1 and WRZ_2 are owned by different incumbent water companies, and Company 1 is considering whether to build a bulk supply transfer pipeline to serve industrial customers in Company 2's area.

The access charge that would be payable to Company 2 would be priced at:

$a_2 = w - LRAC_2 = 70$

The costs incurred by Company 1 in providing R&T services would be:

$LRAC_1 = 10$

In addition, Company 1 would need to charge itself for the limited use of its own network (say, 10):

$a_1 = 10$

The total cost faced by Company 1 would then be:

$a_1 + a_2 + LRAC_1 = 90$.

Company 1 would then find this bulk supply transfer opportunity profitable if the cost of the transfer is below 10 (to remain within the wholesale cap of 100).

One final note is that LRAC by WRZ excludes a contribution towards overheads. SVT has noted that joint costs between its own WRZs are low. However, an entrant seeking to enter one WRZ would incur overheads without the benefit of being able to spread these over multiple WRZs. There is a question then as to whether an additional adjustment should be made to LRAC to take account of overheads (i.e. LRAC+).

5.1.2 Cost-based access charges

Cost-based approaches to access are typically used in industries that have undergone some form of vertical separation (e.g. accounting, functional, business or ownership separation). The price of access then reflects the costs allocated or attributed to the network business. A cost-based approach therefore implicitly assumes that there are benefits to upstream vertical separation that exceed the costs.

As discussed in section 4, in the water sector the key question will be which asset values to use in calculating some form of LRIC or FAC for access to the network. As discussed, in principle, two approaches might be feasible, to ensure that customer bills do not rise overall.

One approach would be to estimate the asset values of the network based on the residual RCV value obtained after subtracting the MEAV of resources and treatment assets from the total RCV (sometimes called the 'focused approach').

The methodology could potentially be undertaken by WRZ, with the MEAV of resources and treatment in each case subtracted from an (allocated) total RCV for each WRZ. Alternatively, the structure of access charging by WRZ could be determined at a later point.

As discussed in section 4, however, a number of problems with the focused approach limit its appeal in the water sector.

An additional concern relates to the use of a 'pure' LRIC for resources and treatment, as discussed in the context of wholesale-minus access pricing above. (Section 5.1.1 discussed the limitations of using the LRIC concept in the water sector as regards displacement of incumbents' assets and overall reductions in industry costs.)

Another approach would be to base the FAC of the network on some arbitrary allocation of the RCV (e.g. proportionately to the MEAV, which is sometimes

called the 'unfocused approach'[30]). In this case, neither the access charge for the network, nor payments for resources, would reflect true costs.

Both the focused and unfocused approaches to access pricing are therefore problematic in the water sector. A residual-focused approach may lead to problems of cost recovery for the network business, while an unfocused approach may limit efficient entry.

In effect, a compromise cost standard is required, which is more likely to be found in a wholesale-minus approach, as discussed in section 5.1.1, than in a cost-based approach to access. As discussed, the LRAC cost standard, to be subtracted from wholesale prices by WRZ, is likely to be between LRMC and LRIC.

5.2 Bulk supply pricing

The majority of bulk supply water trading arrangements in existence in the water sector date from pre-privatisation. Ofwat has sought to introduce regulatory measures to encourage companies to seek, and provide, bulk supplies. The Water Act 2014 also includes provisions for Ofwat to require, and issue pricing codes on, bulk supplies.

The new codes will affect existing agreements (when these expire and are renegotiated and renewed) and new agreements (including arrangements for new interconnection).

SVT has a number of special agreements in place for the import and export of water. Its current bulk supply export charges are based on a range of price points, including its standard, large user and intermediate user tariffs, and a reduced charge to reflect the cost of supply.[31]

In its Water Resources Management Plan (Appendix D), SVT identifies some new options for importing and exporting water, including raw and treated water transfers. Potential trades have been discussed with Thames Water, United Utilities, Yorkshire Water, Anglian Water, South Staffordshire Water, and Dŵr Cymru. None of the options to import or export water is likely to be required in AMP6 (2015+), but there are options that could be deployed within AMP7 (2020+) if needed.

The business case for these new transfers will rely, in part, on the codes issued by Ofwat in relation to bulk supplies (codes that will also need to be considered in the context of upstream access pricing discussed above).

To date, the majority of guidance issued by Ofwat in relation to bulk supplies concerns the provision of a bulk supply to a new appointee, rather than in relation to water trading between companies. However, the regulator has stated that the former has implications for the latter. Box 5.3 below summarises the current guidance.

[30] Oxera (2015), 'Options for future treatment of the RCV', June.
[31] Ofwat, '2014-15 Special Agreement Register: Severn Trent Water Ltd'.

Box 5.4 Ofwat current bulk supply pricing guidance

Ofwat has noted that there are two main types of bulk supply:

- bulk supplies between one existing appointed water company and another. These often involve the transfer of large volumes of water. For example, the providing company might expand one of its existing water resources to provide a large volume of water to supply the receiving company's customers;
- bulk supplies from an existing appointed company to a new appointee. The main difference here is that these usually involve the supply of fairly small volumes of water. For example, a new appointee might supply a new housing estate using a bulk supply from an existing water company.

Previously Ofwat stated: 'Generally, the Director will use the principle of long-run marginal cost (LRMC) when determining a price for a bulk supply.' However, in 2011, it issued guidance on the pricing principles it would adopt were it required to make a determination on bulk supply terms under Sections 40 and 40A of the Water Industry Act 1991. It emphasised that, in the first instance, bulk supplies are a matter of negotiation between parties. The guidance focused on bulk supplies provided to new appointees, as opposed to bulk transfers between incumbents, although Ofwat noted that the guidance had wider implications for bulk transfers.

Ofwat stated that, if called upon to do so, it would determine bulk supply prices so that those prices:

- reflect the costs reasonably associated with the provision of the relevant services;
- facilitate the efficient use of resources and effective competition within the water supply industry, where appropriate; and
- are consistent with the discharge of the relevant duties and obligations of the relevant supplier.

In relation to the first point Ofwat highlighted, for example, since bulk supply agreements do not involve the provision of retail services, 'retail costs are not relevant to the assessment of a reasonable reflection of costs'. It also noted that 'when considering already incurred or likely to be incurred costs, it will be necessary to consider the level of costs reasonably associated with the provision of the relevant services.' This included discussion of average versus customer-specific costs, and the treatment of joint and common costs.

More detail has subsequently been placed on Ofwat's website, in which the regulator has stated that: 'in many respects, a new appointee may often share the same cost characteristics as a large user from the relevant appointed water company's point of view, such as:

- the delivery of a large amount of water to a single point of supply
- one customer to manage
- no use of the local distribution network.'

For new appointees, therefore, Ofwat considered it sensible for parties to use the relevant large user tariff as a basis for negotiations where the new appointee's forecast demand qualifies, and that: 'any costs that the relevant appointed water company will incur or not incur as a result of the new appointee serving the site should be added or deducted, respectively from the bulk price.' Ofwat noted, however, that other approaches have been successfully used in previous negotiations, including bulk supplies based on the relevant full standard volumetric tariff; and a retail-minus approach to costs.

If large user tariffs are the relevant starting point, Ofwat has stated that discounts to large users 'can reflect the lower costs of providing services to large users, such as: delivering large quantities of water to a single point, which does not require all levels of the distribution system; supplying water to customers whose peak demands do not coincide with the system's; and delivering a lower level of service to customers on an optional basis'. It noted: 'we expect each company to justify its large user charges on a robust allocation of accounting costs across the groups of customers concerned.'

However, in August 2013, Ofwat stated that bulk supplies should be set 'on the basis of relevant average accounting costs…because average accounting cost has been, to date, the mode of cost assessment in the water sector'. It 'will only depart from this approach where [its] testing shows that this approach would cause material adverse effects'. Ofwat would consider whether the use of average accounting costs were appropriate given the geographic nature of supply, and whether it would give rise to competition concerns or efficiency concerns. It noted that the Water Act 2014 might mean that its price determinations are revisited in the future.

Source: Ofwat (2011), Bulk supply pricing–a statement of our policy principles', February.

Box 5.4 shows that guidance on bulk supplies has not been definitive to date. In so far as Ofwat has noted, however, that the large user tariff of the provider of

the bulk supply could be used as a starting point for negotiations, and that large user tariffs involve deductions of certain average accounting costs (e.g. avoided local distribution costs), this might be regarded as a form of retail-minus pricing. However, Ofwat has also stated that bulk supplies should be set 'on the basis of relevant average accounting costs', which could be interpreted as indicating a cost-plus approach.

For example, in the context of bulk supplies to a new appointee, Ofwat recently stated that:[32]

> ECPR may not be the most appropriate tool for determining prices. A strict interpretation of the ECPR requires the new entrant to pay the monopoly company for its lost revenues. In general regulators have moved away from 'retail minus' to 'cost plus' methodologies. Instead, competition authorities and regulators use the 'equally efficient operator' (EEO) test – which is the approach we are most likely to consider under our competition assessment.

Its view here arguably concerns bulk supplies to new appointees (small volumes), rather than bulk water trading between neighbouring water companies (larger volumes). Also, a less strict or narrow interpretation of ECPR is to consider long-run avoidable costs at a WRZ level, rather than short-run avoided costs associated with a specific customer at a specific site. Furthermore, the EEO test is not necessarily confined to cost-plus methodologies—merely, it would involve testing for a margin squeeze by subtracting a relevant cost standard from wholesale prices using cost and price data from the incumbent. These factors mean that wholesale-minus pricing for bulk supplies should not be ruled out.

Any future approach across the industry will need to be consistent with the criteria outlined in section 4, while being practical. It should not lead to over-recovery of costs, but it should provide efficient signals and entry. It would need to be consistent with a number of elements in the approach for access pricing, while recognising the differences.

The true value of water varies by location, and one of the current barriers to trading is that this is not reflected in bulk supply prices. As discussed in Box 5.3, Ofwat has noted that bulk supply pricing could take account of the geographic nature of supply. Without geographical pricing signals, it is not clear that a water trading market would develop. This does not mean that end-consumers would face geographical de-averaging under more bulk water trading between companies. Neighbouring companies would act as single buyers, and could absorb these variations.

SVT has sought to apply a methodology using a longer-term measure of avoidable costs in a model of water trading. This can be considered to be a form of a wholesale-minus methodology, in which the measure of avoidable cost is the LRMC (as avoided in the competitive area).[33]

As per the discussion of section 5.1, there is an issue about whether LRMC is the relevant LRAC standard, or whether this should be between LRMC and LRIC. There are also issues concerning the variation in methodologies used to calculate LRMC across companies.

[32] Ofwat (2014), 'Summary of comments received in response to 'IN 13/08: Ensuring consistency in our approach to resolving pricing disputes'.
[33] Severn Trent (2009), 'Competition and pricing for water', Annex B.

5.3 Wastewater

The Water Act 2014 introduces the prospect of entry into wastewater treatment (through a wholesale authorisation) and disposal (through a disposal authorisation). Some of the principles discussed above could apply, although the nature of wastewater is different to water.

In sewage treatment, bypass or self-treatment has always been possible for larger industrial users (or required where certain toxins are involved, prior to conveyance via sewer or discharge to a river). This has occurred in only a limited number of circumstances (very large users) due to the current low cost charged by incumbents (which is exploiting economies of scale and the RCV discount), the need for significant amounts of capital and long pay-back periods, and the planning and consenting difficulties faced by entrants.

For sludge treatment and disposal, incumbents have increasingly developed their anaerobic digestion capabilities, to produce electricity from domestic sludge and other organic waste (the latter transported to the works via road tanker). Independent entrants have also entered the market for stand-alone digestion of non-sludge organic waste (e.g. food, beer, agricultural, and industrial waste).

These developments have occurred outside of the WSL framework (or the Water Act 2014 framework), and the markets continue to develop. The feasibility of movement of organic waste by road in effect provides a means of network bypass for entrants—so access *per se* (and common carriage) is less of an issue.

The Water Act 2014 does, however, potentially pave the way for entry into sludge treatment and disposal, through the wholesale and disposal authorisations. However, current regulatory barriers to the co-digestion of sludge with other organic waste—a more efficient means of obtaining biogas—may impede this entry. In addition, the regulatory capital discount, and economies of scale, provide a competitive advantage to incumbents in treating sludge. It is these factors, rather than the absence of an access regime, which arguably are problematic.[34]

If an entrant wished to obtain sludge from a nearby sewage treatment works, transporting this by road to its own AD facility nearby, the incumbent might pay a charge to the entrant for receiving the waste. This charge would reflect the avoided treatment and disposal cost to the incumbent associated with the waste. However, the net avoided cost to the incumbent may actually be *negative* if the biogas capabilities of the waste—and the income generated from the sale of electricity and renewables credits—are taken into account. If this is the case, the entrant may actually need to pay for the sludge. The charge could reflect the incumbent's forgone income, net of sludge processing costs.

If the entrant then employs new advanced AD technologies, combined with the co-digestion of sludge and high-strength waste, even in the presence of this charge, it may be able to profitably process domestic sludge. Entry would be feasible only if this means that industry costs fall.

However, it is not clear that these charges should be regulated; rather, they would be subject to normal competition law. The wording of the Water Act 2014 also means that entry into sludge treatment and disposal would need to be

[34] Note that there are examples of entrants who offer design, build and operate services to the water industry for various sludge treatment and disposal activities. In these instances, the incumbent water company will outsource those activities that it sees fit (a form of competition for the market), but the licence (and the associated obligations and liabilities) remains with the water company.

accompanied by an agreement with a retailer. This may be the retail arm of the incumbent.

5.4 Charging structure

Once an appropriate cost standard is chosen, there is the question of charging structure. A range of concepts can be used to set charges (Table 5.1). The appropriate charging structure depends on whether costs are customer-related, fixed, driven by peak-system demand/maximum capacity required, or driven by volumes.

Table 5.1 Charging concepts

Concept	Simplified definition
Variable (unit) charges	Charges that vary with output (e.g. p/m^3, p/kWh, element-based charge)
Capacity (reservation) charges	Charges that vary with the maximum required output in a given time frame (e.g. pence per peak-day-therm per year)
Fixed (standing) charges	Charges that are fixed over a given time frame (e.g. in £/quarter)
Customer-related charges	Charges that are fixed over time but vary according to customer characteristics (e.g. meter size charges in £/mm per year)

Source: Oxera.

Thus far in the water sector, these considerations have been reflected in end-user charges for larger non-domestic customers. For example, SVT's current larger non-domestic end-user charges are structured as follows:

- intermediate user discount (with peak/off-peak volumetric rate);
- large user discount (with peak/off-peak volumetric rate);
- standby tariff for large users with own back-up supply and storage;
    - capacity charge (fixed, and by notified volume);
    - volume charge (by actual volume);
    - premium charge (penalty for going over reserved capacity).

Similar considerations could overlay onto access charges. The appropriateness of a particular charging structure is then related to which of these elements are tied to variations in resources, treatment or distribution costs.

Capacity charges are likely to be necessary for water access pricing, in that entrants will need to pre-book network capacity in order to provide water through common carriage. The maximum amount of water that an entrant would supply into the system would also affect the required network size.

In addition, some form of a usage-based or additional 'stand-by' charge is likely to be required. The exact split between the types of charges might be affected by whether the water is supplied continuously or not.

Ofwat has noted that these kinds of charges can also be reflected in bulk supply agreements.[35] In this regard, from discussions with SVT, our understanding is that, at present, traded water is mainly intended to meet peak demand.

A final, but important, issue is how access charges are split between use-of-system charges (the charges outlined above) and connection charges for the

[35] Ofwat (2012), 'Negotiating bulk supplies –a consultation on our guidance', December.

specific upstream entrant. This is relevant to either a wholesale-minus or cost-plus methodology.

While it is fairly uncontroversial that the entrant should pay for the direct costs at the point of connection to the network, a more controversial issue concerns who should pay for any necessary distribution network reinforcement required as a consequence of entry. For example, as explained in section 3.1, to facilitate entry it may be necessary to modify the core distribution network to accommodate two-way flows. More generally, capacity in certain parts of the network may need to be increased through re-sizing mains.

In terms of common carriage, SVT's current approach, as set out in its 2014 access code, is that:

> Activities associated with managing the connection of source infrastructure to the supply system will be design and location specific. Severn Trent Water will provide a quotation for all work to be carried out. Costs will be recovered on an **actual cost** basis. [36]

These case-specific costs would include 'but are not limited to connection and supply system extension/reinforcement'.

Going forward, the question occurs as to *who* should pay for the network reinforcement under a revised approach. The two central mechanisms for charging for connections to the network are 'deep' and 'shallow' connection charging.

The principle of deep-connection charging is that the charges levied on the entrant for network connection should include *all* costs to the network resulting from the connection—which might, for example, include network reinforcement due to additional capacity. This would appear to be the current approach in water access charging.

By contrast, shallow-connection pricing implies that entrants connecting to the network pay only for those assets in the immediate vicinity of their point of connection, which might simply involve the costs of assets required to make the physical connection to the network. All further network reinforcement charges that may result from the connection would, in this case, be charged through the use-of system charge and be levied on the generality of entrants seeking access and/or through wholesale charges levied on retailers.

In the water sector, options for upstream connection charging then include:

- the entrant pays for all reinforcement costs that are directly associated with its entry (deep connection);
- the entrant pays a portion of reinforcement costs directly associated with its entry, with the remaining costs recovered through use-of-system access charges (such as capacity charges) and/or from regulated wholesale charges levied on retailers; or
- the entrant pays only the direct costs of securing a physical connection to the network (shallow connection), with reinforcement paid for through use-of-system access charges (such as capacity charges) and/or regulated wholesale charges levied on retailers.

[36] Severn Trent (2014), 'Severn Trent Water Network Access Code', 15th October.

An advantage of deep connection is that it is likely to provide strong locational signals, in terms of the costs that may be involved with connecting at different points in the network. Up-front payments of deep-connection charges may also minimise the network owner's exposure to stranded assets on the network that may result from certain areas of the network being exposed to more usage than others in future, or if the incumbent invests in reinforcement and the entrant withdraws from the market at a later date. So there are both efficiency and cost recovery arguments for deep charging, as well as cost reflectivity (those imposing costs on the network pay for these costs).

However, deep connection charging has its drawbacks. It may serve as a barrier to new entry, in that an initial upstream entrant would need to pay for all reinforcement costs triggered by its entry. This acts as a first-mover disadvantage, potentially forestalling entry. It also means that the entrant is paying for the reconfiguration of a network that is not necessarily efficient. Subsequent entrants might also free-ride, facing a smaller connection fee while benefiting from the reinforced assets. In short, deep charging may generate dynamic inefficiencies, and potential competition rules issues.

There are parallels here with the debate concerning the use of ECPR, and whether a short-run or long-run view of avoided costs should be taken into account. Pure deep charging (like ECPR) may lead to productive efficiency, at the expense of the dynamic efficiencies that competition might bring.

In the GB electricity sector there has been a move towards shallower connection charges, for both end-users and upstream entrants (e.g. distributed generation). Hence charges include the costs of connection to the existing network, but not reinforcement of assets further away from the point of connection. Reflecting the cost of wider network reinforcement associated with a given connection in use-of-system charges has the effect of socialising that cost among a wider user group. This is, however, combined with zonal charging, in which use-of-system charges varying by connection zone, depending on the need for reinforcement of network capacity (see section 6).

The water sector is somewhat different to electricity, and at the network level it differs in terms of the existing level of connectivity and scope for reverse flows, as well as the physical cost of moving water relative to its value.

In the water sector, Ofwat's guidance on end-user connection charging is instructive, as this sets out what charges can be levied and what costs (including reinforcement costs) these might recover.

Box 5.5 Approach to end-user connection charging in water

In the England and Wales water sector, where a domestic customer requests a connection for the first time, the customer must pay an **infrastructure charge**. As standard charges, infrastructure charges do not relate directly to the actual costs of connection, but rather provide a source of funding for water companies to improve and develop their networks to meet general increases in demand, caused by new connections, over time.

These may also be other **contributions**. For example, the water company 'is entitled to recover the reasonable costs of making the connection, including the cost of laying a service pipe from the main to the boundary of the public highway'. For non-domestic new connections, the company may recover 'the reasonable costs of making the connection and a rate of return on any capital expenses it incurs'.

Furthermore, if it is necessary for the water company to invest in a new main or main extension to facilitate the connection, the customer (most likely a housing development company) must pay a **requisition charge**. While the water company is entitled to charge for providing the on-site main and any necessary off-site reinforcement, it must net off future income that it will receive from the newly connecting property or properties. Only the costs of those off-site works considered necessary to provide a service to the on-site main can be included in the calculation

of requisition charges. So, these costs must be directly attributable to the newly connected property (i.e. requisition charges must not be used to fund other works that are not directly attributable).

In contrast, infrastructure charges may be used to fund other network reinforcement works within the monopoly company's general area of appointment.

The Water Industry Act 1991 (WIA91) gives Ofwat a duty to make determinations on certain new connections disputes (including infrastructure charges, contributions, requisition payments, and asset payments to self-lay organisations[37]).

The guidance on requisitions is of particular interest, since this concerns who should fund reinforcements associated with a particular customer. In this regard, the WIA91 sets out what can be included as part of the 'costs reasonably incurred' in calculating the requisition charge:

- the costs should exclude those incurred in the provision of additional capacity beyond the requirement of the requisition
- the costs can include that of providing other infrastructure necessary as a consequence of the new main. For water mains this other infrastructure can include other water mains, tanks, service reservoirs and pumping stations
- the costs can include a proportion of the costs incurred in providing additional capacity in an earlier requisitioned main (up to 12 years preceding the new main/sewer), which falls to be used in consequence of the new main/sewer.

The requisition charges also allow for the income that would be generated from the new properties being connected to the water network, as a result of the new water mains, to be offset against the costs reasonably incurred in providing the infrastructure.

Where infrastructure is provided solely to meet the requisition, Ofwat does not foresee a need to split ('apportion') the costs of providing it for the purposes of calculating charges. However, where the infrastructure provided will also serve existing customers and/or potential future developments, Ofwat expects the reasonably incurred costs to be apportioned between these relevant customers, in most cases on the basis of the percentage of the total capacity provided that is to be used by the new customer.

In contrast, Ofwat has rejected a 'notional costs' approach, in which all costs would be borne by the new customer. This is because this approach would risk deterring development and distorting competition between new connections customers, as a new connections customer may be the sole party bearing the risk (and cost) of triggering a monopoly company's decision to provide network reinforcement works or additional capacity. The new customer would also face higher charges than other customers who would ultimately share (and benefit from) the same infrastructure.

Source: Ofwat website, http://www.ofwat.gov.uk/regulating/newconnections/charging

The discussion of Box 5.5 highlights that, in the water sector, immediate costs at the point of connection are, at present, recovered through paying contributions. Infrastructure charges, in contrast, may be used to fund general capacity reinforcement and expansion needs across the water company area.

Requisition charges are more case-specific, and involve deeper charging elements. In addition to providing the new main near the point of connection (on-site), any off-site network reinforcement that needs to be undertaken by the incumbent company, as a direct consequence of the new customer, can be charged to that customer. Offsetting this, the future income generated by the new customer, and any benefit that the network reinforcement generates for other customers, should be netted off the charge. This recognises the entry barrier and free-rider issues discussed above.

Therefore there is some precedence in water for incorporating into connection charges part of the cost of reinforcement. This is an option that could be applied to upstream entry, and would ensure that charges are cost reflective to some degree (those who impose costs on the system pay them), and that entry does

[37] The discussion abstracts from self-lay. In practice a developer can choose for on-site work to be undertaken by the incumbent water company (the on-site requisition option), or by an independent self-lay organisation. In the latter case the incumbent can levy a self-lay charge on the developer for any off-site works (including reinforcement) necessary.

not occur where this leads to significant increases in network costs (productive efficiency).

However, connection charging that is too deep risks not generating entry (implying potential dynamic inefficiencies, and competition issues). Ofwat has recognised this in its guidance on requisition charging. There is also the potential to annualise any reinforcement contributions, rather than to levy these as an upfront charge, or to offer refunds to first-mover entrants who have paid for network reinforcement as and when new entrants join the network.

Ultimately a policy and regulatory decision would need to be made as regards the extent to which upstream entrants in general and/or final customers should pay for reinforcement (shallow connection), as opposed to each individual upstream entrant (deep connection). Some of these issues could also be resolved through the terms and conditions of the contracts with new entrants.

There is also an important role for a system operator in determining the need for investment in network capacity and reinforcement, in a way that takes account of future upstream entry possibilities. At present, different companies have different capabilities in undertaking network management.[38]

5.5 Overall assessment

Assuming that Ofwat's overriding focus is longer-term efficiencies that the process of competition might deliver, an access pricing regime that makes entry more viable and allows some of these benefits to be realised is needed. In theory, this requires a regime that adequately provides for entrants to recover the forward-looking cost of contestable activities, taking into account variations in cost, relevant to the context of entry (e.g. regional). .

Assuming further that Ofwat is also of the view that customers should experience the benefits of competition, this means that it will want to ensure that any costs arising from the introduction of competition are not borne in full by customers in such a way that they are 'worse off'.

These considerations suggest that any form of cost-plus approach to access pricing is unlikely to be feasible in the water sector, certainly in the short term but potentially even in the medium and longer term. The key reason for this is the large capital value discount and the long-lived nature of these assets, which mean that, in the case of any displacement of existing assets, it would take many years for the costs to be removed from the system.

A modified wholesale-minus approach to access pricing, however, could be a reasonable approach to move forward, provided that there is greater clarity about the application of the approach in practice, and that the 'minus' component reflects a meaningful measure of avoided costs. A LRIC-based approach to assessing avoided cost is one that, in theory, is most likely to ensure efficient entry in the long run. It is also an approach that is likely to be most compliant with competition law.

However, the water sector is unique in several aspects, which may limit the applicability and desirability of a pure LRIC-based approach to assessing avoided upstream costs.

First, upstream entry may not lead to full displacement of an incumbent's existing assets, due to scale and modularity. Second, where assets are displaced (in part

[38] See Oxera (2012), 'Network optimisation: Options in setting future price limits in the England and Wales water industry. An independent report prepared for Ofwat by Oxera', 22nd August.

or in full), the costs of those assets may not be removed from the system for a very long time. In other words, the 'friction' costs of introducing competition in the water sector can potentially be material.

By subtracting LRIC from wholesale charges, the entry generated by this approach may mean that, due to the above factors, overall costs across the industry are not reduced over the medium term, or even the longer term.

Using a pure LRIC approach, as part of a wholesale-minus methodology, may also generate problems for cost-recovery for the network business—in a similar way to how using a pure focused approach to allocating the RCV in setting access charges might generate cost-recovery problems as part of a cost-based approach.

This suggests that a LRAC measure that lies somewhere between LRMC and LRIC could strike the right balance between the identified issues. This long-run avoided cost measure can largely be based on LRIC, but in defining an appropriate time horizon for the LRIC model, using a timescale of between 10 and 20 years (as used in other sectors), rather than the time horizon that would span the full life of the assets, might be appropriate. Alternatively, the LRAC could be based on some form of a net present value approach. For example, some form of an annualised equivalent of the expected present value of future avoided costs over the asset life may be in option. This would take into account the fact that avoided costs are likely to be small initially but over the longer-term would converge to the full LRIC over the asset life horizon.

6 Regulatory precedent

This section reviews the approach to access pricing adopted in other sectors in Great Britain. Table 6.1 provides a summary.

Table 6.1 Cost standards used in other sectors

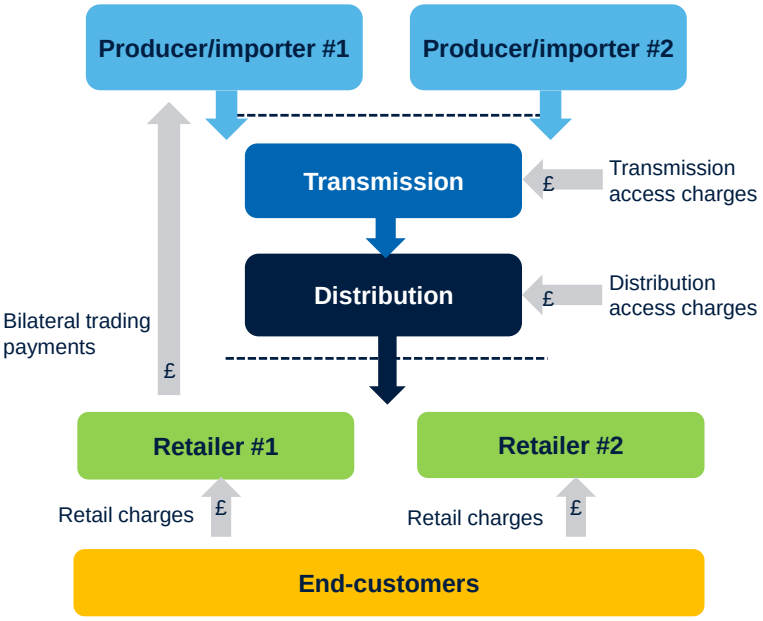
ECPR		Cost of providing the bottleneck service *'cost plus'*	
Retail charges minus upstream LRIC	**Retail charges minus upstream FAC**	**LRIC+/FAC of bottleneck network**	**FAC of bottleneck network**
Ex post margin squeeze test (future approach for Royal Mail?)	Ex post margin squeeze test used for Royal Mail	GB telecoms	GB gas GB electricity GB rail

Source: Oxera.

6.1 GB gas

The gas transport network is a natural monopoly. Unlike in water, however, the gas transport network is divided into two types of network: a high-pressure National Transmission System (NTS) owned by National Grid Gas (NGG) transports the gas from upstream suppliers to regional gas distribution networks (GDNs). Figure 6.1 illustrates the British gas supply chain. Retailers include gas shippers and suppliers. Suppliers supply domestic consumers and SMEs, while shippers arrange the delivery of gas via both the NTS and GDNs to industrial and commercial customers, as well as to suppliers. Gas shippers pay access charges to use the NTS and GDNs. Gas production, import, shipping and supply are competitive activities.

Figure 6.1 GB gas value chain



Source: Oxera based on Ofgem (2009), 'Regulating energy networks for the future: RPI-X@20 – history of energy network regulation – Supporting paper', 27 February.

Since 2002, separate price controls have been applied to the NTS and the GDNs. In addition, the NTS control is split between the transmission operator (TO) and the system operator (SO). Access charges cover the network and system operators' allowed revenues ('cost-plus' regulation), which are based on

FACs using the standard regulatory building blocks (the SO's allowed revenue is based on costs and incentive schemes).

Figure 6.2 outlines the structure of access prices. NTS charges are split between capacity charges (pence per peak-day kWh) and commodity charges (pence per kWh). TO entry and exit charges are specific to each entry and exit point.

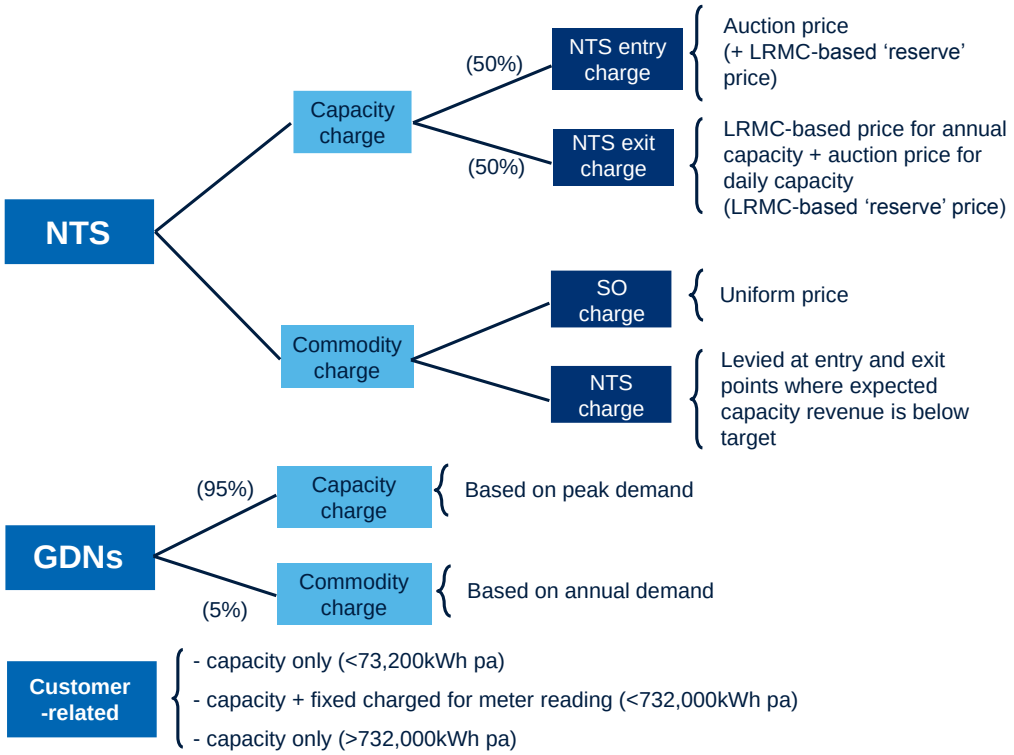
Entry charges are based on entry capacity auction prices, with a reserve price informed through a calculation of LRMC, using the NTS transportation model.

Discounts (up to 100%) to the reserve price of 'day ahead' and 'within day' auctions of the remaining capacity ensure efficient use of capacity. Once purchased from NTS, all entry capacity can be traded between shippers. NTS annual exit capacity is bought during application windows at a fixed price (based on LRMC using the same transportation model), while auctions allocate daily exit capacity—the auction reserve price is equal to the annual exit capacity price. Off-peak exit capacity is auctioned daily with a zero reserve price. The target revenue is split equally between entry and exit charges. In addition, a SO commodity charge is levied to cover the SO's allowed revenue.

A commodity charge is added at entry and exit points where National Grid forecasts under-recovery of the target revenue. In case of over-recovery of revenues, excess revenues are used to offset the costs of capacity buy-back by NGG via the capacity neutrality mechanism.[39] Shippers bear buy-back costs—and hence receive NGG's excess revenues—in proportion to their share of allocated capacity in the month. Excess revenues that are not redistributed in a given month are carried forward to the next month.

[39] The capacity neutrality mechanism compensates costs that NGG incurs to maximise available capacity, such as from buying back entry capacity it has sold in advance where it expects it will not be able to deliver it (because of temporary physical constraints, for example).

Figure 6.2 Structure of GB gas networks access prices



Source: Oxera based on Ofgem (2013), 'Gas transmission charging review – Call for evidence', 24 June. Ofgem (2009), 'Regulating energy networks for the future: RPI-X@20 – history of energy network regulation – Supporting paper', 27 February. Ofwat (2013), 'Future access pricing in the water sector: a discussion paper'.

GDN charges are independent of the customer's location on the network. They consist of a capacity charge (pence per peak-day kWh) and a commodity charge (pence per kWh). In December 2007, Ofgem approved a change in the charging methodology so that capacity charges cover 95% of use-of-system revenue and commodity charges 5%. Historically, the split was equal. In addition, GDNs levy customer-related charges (to cover service pipes, emergency work, opening meter reads, etc.). The nature of these charges depends on the size of the customer concerned, as shown in Figure 6.2.

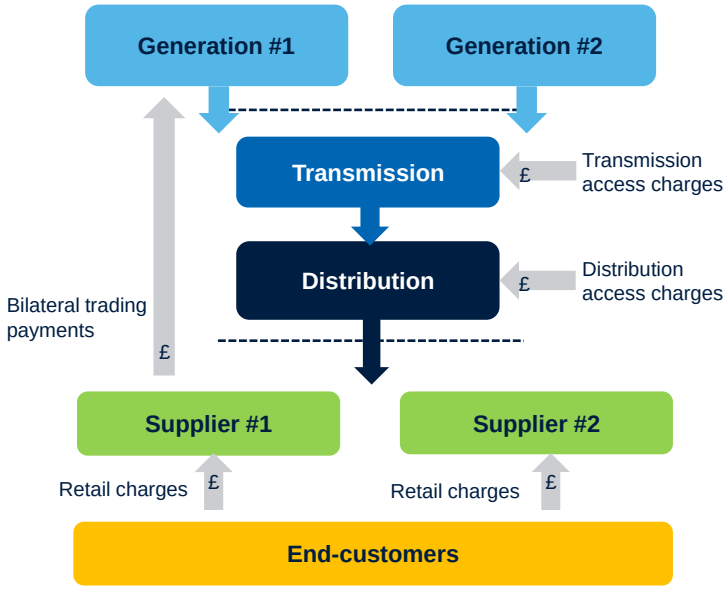
The regulator requires GDNs to ensure their charges are cost-reflective, facilitate competition, and reflect developments in gas distribution network businesses.[40] Unlike for transmission, efficiency is not one of the objectives.

6.2 GB electricity

The electricity supply chain, as displayed in Figure 6.3, is similar to that of gas. A high-voltage transmission network owned by National Grid Electricity Transmission (NGET) transports electricity from generation facilities (or from the borders in the case of imported electricity) to medium-voltage regional networks operated by distribution network operators (DNOs). Several electricity suppliers compete to sell electricity to end-consumers. Suppliers and electricity producers pay for access to the networks. As in gas, transmission and distribution are natural monopolies.

[40] Ofgem's website: https://www.ofgem.gov.uk/gas/distribution-networks/charging-arrangements.

Figure 6.3 GB electricity value chain



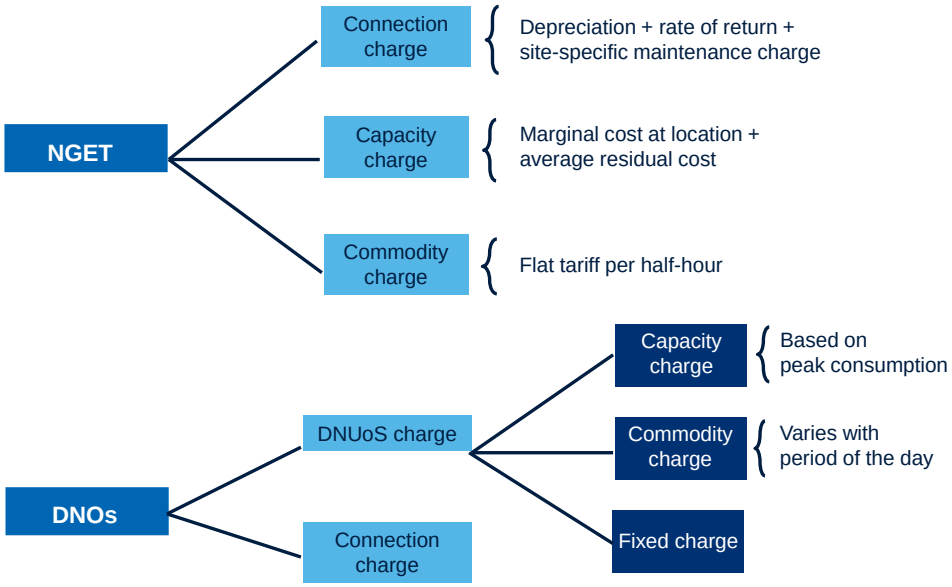
Source: Oxera based on Ofgem (2009), 'Regulating energy networks for the future: RPI-X@20 – history of energy network regulation – Supporting paper', 27 February.

Ofgem sets separate price controls for NGET and DNOs. Access charges cover the network operators' allowed revenues ('cost-plus' regulation), which are based on FACs using the standard regulatory building blocks.

The structure of access prices is shown in Figure 6.4. Transmission charges include a connection charge covering both capital and non-capital costs of connecting individual users to the network. Capacity charges (use-of-system or TNUoS charges) cover the cost of installing, operating and maintaining the transmission system. The revenue split is 27:73 between generators and consumers respectively. For half-hourly metered consumers, TNUoS charges are based on the average demand (kW) over the three identified half-hour periods of maximum demand in the winter ('triads'), while they are based on average annual consumption between 5pm and 7pm (kWh) for non-half-hourly metered consumers.[41] Charges for generation (per kW) are negative in zones where demand is highest.[42] A locationally varying element derived from a transport model reflects the marginal cost of investment in the system that would result from an increase in demand or generation at each connection point or node based on peak conditions. A location-independent element covers the residual revenue. TNUoS charges thus provide efficient signals for the use of and for investments in the system. Commodity (BSUoS) charges (per MWh) calculated every half hour and equal across generators and consumers cover the costs of operating the transmission system.

[41] Flexitricity (2010), 'Triad guidance notes', http://www.flexitricity.com/docLibrary/30041-02%20Triad%20guidance%20notes%202011%201.0.pdf.
[42] Oughton, S. (2013), 'Triads – TNUoS charges', *KRR ProStream*, 8 November, http://www.krrprostream.com/blog/triads-tnuos-charges/.

Figure 6.4 Structure of GB electricity networks access prices



Source: Oxera based on National Grid (2014), 'Connection and Use of System Code: section 14 – charging methodologies v1.9', 24 November. DCUSA Limited (2006), 'Distribution connection and use of system agreement', 5 October.

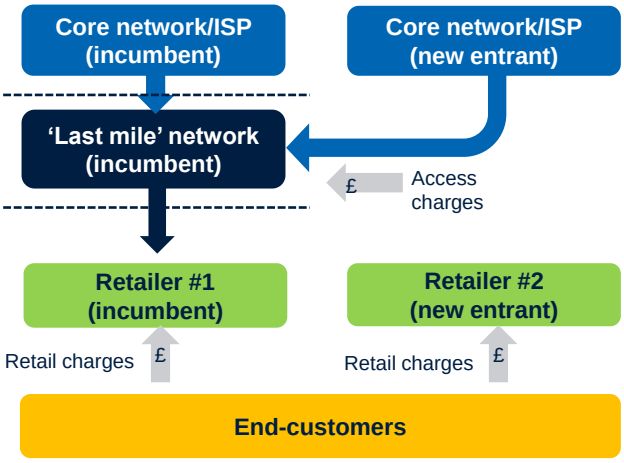
Each DNO has its own access pricing methodology approved by Ofgem, with the requirement to charge consumers in an 'appropriate way'.[43] DNOs' network-related costs are covered by use of system (DNUoS) charges, which are location-independent but vary with the type of consumer. DNUoS charges typically include a fixed charge (per connected customer), a commodity charge (per kWh)—which varies with the period of the day to account for peak hours—and a capacity charge (per kVA) based on a consumer's peak electricity consumption, which reflects the cost of the keeping this capacity available. DNOs also charge for connecting individuals to their network.

6.3 GB telecoms

Telecoms include voice, data and/or television services. While retail and the core network are competitive, 'last mile' connections to customers are natural monopolies. BT, the incumbent, must therefore provide access on an equivalent basis to other service providers (with 'local loop unbundling'). Figure 6.5 shows the telecoms value chain in Great Britain. For data and television services, the value chain includes a content provider at the top.

[43] Ofgem's website: https://www.ofgem.gov.uk/electricity/distribution-networks/charging-arrangements.

Figure 6.5 GB telecoms value chain



Source: Oxera.

Access charges to BT's assets are based on a combination of top-down FAC estimates on a current-cost accounting (CCA) basis and bottom-up engineering LRIC models. In some instances, access charges reflect CCA FAC, however, Ofcom notes that the results produced are similar to using LRIC+ (i.e. pure LRIC plus a mark-up for common costs).

LRICs are most appropriate in telecoms since short-run marginal costs can be very low, while fixed costs are material. Hence, prices based on marginal costs would understate the costs of the service.[44]

New entrants pay BT an annual charge for access to each line (or customer). Access charges vary with the type of access chosen (e.g. access only for Internet provision or for provision of all services). In some markets where BT is deemed to have significant market power, Ofcom also regulates BT's wholesale prices (as, for example, in wholesale broadband access).[45]

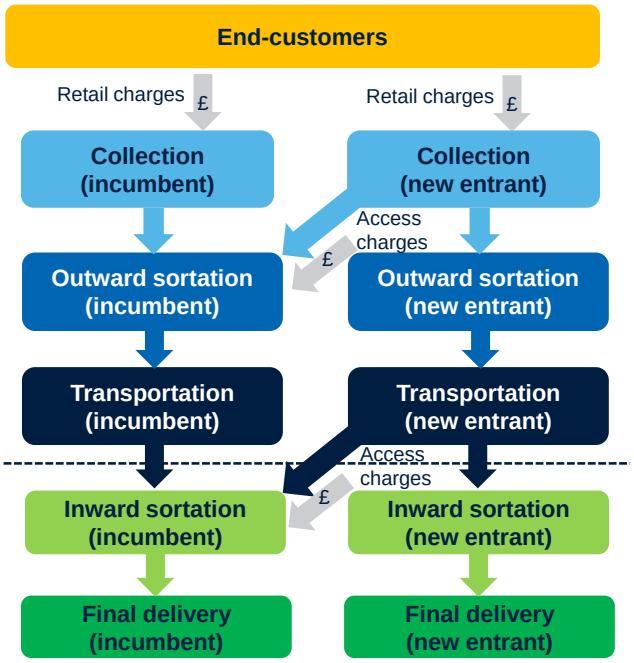
The access pricing methodology for the 'last mile' network aims to encourage entry through efficient price signals and to allow cost recovery without excessive revenues.

6.4 GB post

Royal Mail is a for-profit vertically integrated incumbent in the GB mail market. Since the full opening of the UK postal market to competition in 2006, large customers and private operators may insert mail at two points in Royal Mail's value chain: they can bypass Royal Mail's collection service (e.g. pillar boxes); or bypass both collection and the outward sortation function of Royal Mail's Mail Centres, by transporting mail directly to Mail Centres for inward sortation. Mail is subsequently sent to Royal Mail's Delivery Offices, where it is handed to postmen for delivery. Although mail delivery is a natural monopoly, in 2013 about 0.6% of total addressed mail was delivered by new entrants.[46]

[44] Ofcom (2013), 'Fixed access market reviews: approach to setting LLU and WLR charge controls', 20 August.
[45] Ofcom (2014), 'Review of the wholesale broadband access markets – Statement on market definition, market power determinations and remedies', 26 June.
[46] One approach to the identification of natural monopolies has been to test the presence of economies of scale. Overall, the literature suggests that there is likely to be a natural monopoly in delivery. Oxera (2010), 'Downstream access in the postal sector: is ex ante regulation needed?', prepared for La Poste, August. Ofcom (2014), 'Royal Mail access pricing review', 2 December.

Figure 6.6 GB post value chain



Source: Oxera.

Since 2006, access charges to Royal Mail's distribution were subject to a 'headroom' price control, which took the form of a minimum percentage between the price of specific retail products and the price of the corresponding wholesale product. The headroom was based on historical access prices negotiated between Royal Mail and access seekers. Ofcom loosened the access regime in 2012, as the 'headroom' approach had not achieved the regulatory objectives of increasing efficiency and preventing price increases for customers, nor had it proved financially sustainable for the universal service.[47]

The current price control requires Royal Mail to grant access at the Inward Mail Centre only for retail D+2 and later than D+2 letters and large letters.[48] The headroom control was replaced by a margin squeeze test—a retail-minus price control, where the test for the level of the access charge is based on retail price less the costs of the upstream service. Ofcom would have preferred to test for a margin squeeze using the LRIC of upstream services.[49] However, until a robust model to estimate LRICs is available, it estimates upstream FAC as the difference between the end-to-end FAC and the FAC of the downstream natural monopoly service (including wholesale costs).[50]

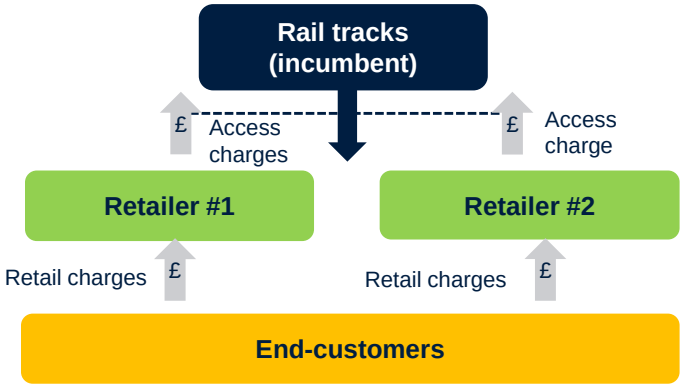
6.5 GB rail

Although there is little direct competition between train operators on the same track, competition in rail takes places 'for the market', with companies bidding for

[47] Ofcom (2014), 'Royal Mail access pricing review', 2 December.
[48] 'D+2' denotes mail that is delivered two working days after collection. In addition to access regulation, Royal Mail is subject to a price cap for some retail services. Ofcom (2014), 'Royal Mail access pricing review', 2 December.
[49] Retail minus in water.
[50] Ofcom (2013), 'Modification to the control preventing Royal mail margin squeeze: Statement', 26 February. Ofcom can also impose regulation on new entrants if they are shown to threaten the Universal Service provision. Royal Mail's website: http://www.royalmailgroup.com/regulation/regulatory-reform, accessed 5 May 2015.

concession or franchise agreements. The rail infrastructure is operated by Network Rail, to which train operators pay for access to rail tracks.

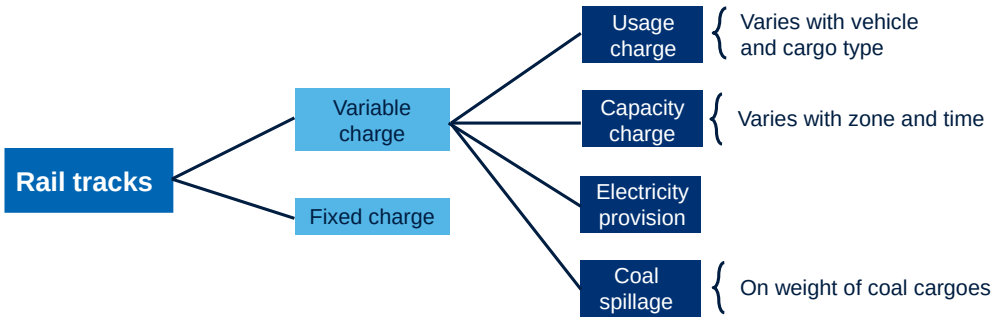
Figure 6.7 GB rail value chain



Source: Oxera.

Rail access charges are based on FACs ('cost plus', although a share of costs is covered by government grants). ORR determines Network Rail's allowed revenues, based on the standard regulatory building blocks, and approves its charges.[51] These are made up of a fixed and a variable component. Fixed access charges reflect fixed costs, while variable track access charges are based on a range of cost drivers and reflect short-run marginal costs (SMRC) of using the network. They include a usage charge (pounds per vehicle mile) to reflect the cost of damage to tracks; a capacity charge (pounds per train mile) to allow Network Rail compensation for reductions in revenues in case of delays beyond its control; [52] a charge for electricity provision for traction purposes (pounds per vehicle mile or per 1,000 gross tonne mile) on electric trains; and a coal spillage charge (pounds per 1,000 gross tonne mile) on coal shipments. The charging structure is illustrated in Figure 6.8.

Figure 6.8 Structure of GB rail access charges



Source: Oxera, based on Network Rail's website and on Ofwat (2013), 'Future access pricing in the water sector: a discussion paper'.

Rail is different from other networks in that only one company can use a given track at a given time of the day. Hence, fixed costs can be covered by the 'rent' paid by the company for the track, and variable costs can reflect marginal costs only. The usage charge is similar to a commodity charge.

[51] Ofwat (2013), 'Future access pricing in the water sector: a discussion paper'.
[52] The charge varies by geographical area and time to compensate Network Rail for increases in the likelihood of delays as volume increases.

The regulator's objective of cost reflectivity is achieved with variable and fixed charges based on a range of cost drivers. The charging structure also provides accurate price signals (the regulator's other objective) that incentivise operators to make efficient use of the network.

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