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Review of Bulk Supply Contracts and Pricing in the English & Welsh Water Sector

Prepared for RAPID

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Contents

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Executive Summary

NERA Economic Consulting has been commissioned by the Regulators' Alliance for Progressing Infrastructure Development (RAPID) to conduct a study into the role of contract design in promoting the efficient bulk trading of water in England and Wales.[1] Our study focuses on the trading of bulk supplies between incumbent water utilities.

RAPID has asked that we evaluate the potential role for standardisation of contracts to support efficient bulk transfers. RAPID has also asked that we identify recommendations in relation to two important aspects of contract design in this study:

- The ***pricing of water transfers*** to promote efficient trade and infrastructure development, as parties will only trade when exchanges take place at a price above the supplier's costs of fulfilling the trade, and below the buyer's costs to obtain water from an alternative source; and
- The ***mitigation and allocation of risks in the contract*** such as the uncertain ability of the seller to deliver water as agreed in the contract, variation in water quality, or environmental risks associated with the transfer.

In order to develop our recommendations to improve contracts to trade bulk water in England and Wales, we considered the economic theory regarding the role contract design and pricing in supporting efficient trade. We also relied on two main sources of further evidence:

- Our analysis of ***current contracts to trade bulk water in England and Wales*** which were submitted by water companies to RAPID. We identify potential shortcomings in contracting structure and opportunities to improve Ofwat's current regulation of water trading.
- A review of ***bulk trading in six other jurisdictions*** including water trading in Australia, Nebraska, and California; and trading of electricity in Great Britain, upstream gas in Europe, and contracts for electricity interconnector capacity across the EU. We use our evidence of trading in other jurisdictions to understand good contracting practice and to draw lessons to improve contracting in bulk water trading in England and Wales.

We summarise our recommendations in the table below. We outline our recommendations in full in Section 7 of this report.

Summary of Our Recommendations to Improve Contracts to Trade Bulk Water	
Our Recommendations to Reduce the Transaction Costs of Trading	
Developing a Standardised Form of Bulk Water Contracts	▪ **We recommend that RAPID encourages the industry (e.g. via Water UK) to develop published, standardised contract forms to encourage trade and reduce the transaction costs of organising new water trades. The industry could develop such standardised contract terms within a remit defined by RAPID, accounting for the**

[1] We define efficiency as when firms produce at as lowest cost possible, and they produce as much output as possible up to the point where consumers value an additional unit of output at a price that is equal to the marginal cost of production. We apply the concept of economic efficiency on a dynamic basis such that future consumers are not harmed by or do not harm current consumers. In economics, our definition of efficiency is termed dynamic allocative efficiency.

Summary of Our Recommendations to Improve Contracts to Trade Bulk Water	
	other recommendations of this report and other ongoing work by the industry regulators. ▪ Standardised contracts should be explicit about their "firmness" and the circumstances under which the seller is entitled not to provide the contracted supply volume.[2] ▪ The use of this standardised contract need not be mandatory, and existing contracts need not necessarily change following development of a standardised contract form.
Standardisation of Water Quality Management Protocols	▪ **Trades for potable water should include references to the Drinking Water Inspectorate's (DWI's) water quality standards and protocols.** ▪ The standardised contracts developed by the industry should include clear obligations in standardised protocols that ensure regulatory-approved good practice on water quality and wholesomeness can be incorporated into contracts for potable water at low transaction costs. ▪ DWI guidance on details of water quality standards and wholesomeness states that formal transfer agreements should meet the requirements in the Regulations, clearly define responsibilities for conducting risk assessments on new sources; stipulate water quality and sustainability monitoring arrangements, and enable both parties to make necessary contingency arrangements to meet their licence obligations. ▪ Standardised contracting terms for raw water quality should be flexible enough to account for differences in water sources.
Our Recommendations for Ofwat to Improve Guidance to Water Companies	
Enhancing Guidance on Contract Pricing	▪ **In order to give companies clear and strong incentives to trade – and thus minimise long-term costs across the industry for customers – we recommend that Ofwat issues guidance on the pricing of bulk supply contracts for water.** ▪ We recommend that the pricing of bulk transfers should reflect the expected long-run average incremental cost of supplying the contracted volumes, plus a mark-up. The mark-up should reflect a proportion of the economic rent associated with the trade, defined by the difference between the costs incurred by the seller to supply the contracted volumes of water, and the costs avoided by the buyer from not having to develop a more expensive resource. ▪ This new guidance would allow a more consistent interpretation of Ofwat's existing requirement for "cost-based" pricing of transfers.
Dividing the Gains from Trade	▪ **While Ofwat has put in place a water trading incentive for PR19, going forward we recommend that Ofwat should provide incentives to trade by allowing a mark-up on the pricing of bulk supply contracts above the cost of supply, rather than through a separate water trading incentive.** ▪ As we note above, we recommend that the pricing of bulk transfers should reflect the expected long-run average incremental cost, plus a mark-up to reflect a proportion of the economic rent associated with the trade. The costs of the transfer, plus the additional incentive to

[2] The firmness of a contract refers to the extent to which the supplier commits to supply the water under the contract, and the circumstances and extent to which it is able to reduce the volume of water supplied under the contract.

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Summary of Our Recommendations to Improve Contracts to Trade Bulk Water	
	encourage the seller to agree the transfer, should be paid by the customers of the buyer, which benefit through avoiding the costs of a more expensive water resource scheme. A sharing factor could be used to divide these savings between the buying company and its customers, to incentivise cost minimisation. ▪ **In the meantime, we recommend that Ofwat clarifies how its existing water trading incentive is intended to operate.** ▪ To our knowledge, Ofwat does not specify in public documentation the precise definition of "economic profit" in its current trading incentive, how the present value of economic profit is calculated, and how the early termination of contracts would be managed after the incentive has already been paid. ▪ In order to further promote regional planning, Ofwat should also clarify the rights of the "transfer party" to economic profit from regional trades of bulk supplies.
Advertising Trading Opportunities	▪ **We recommend that Ofwat enhances current obligations on companies to advertise spare water resources as part of the water resource management plans, which may increase the potential to exploit, and lower the transaction costs of, trading opportunities.** ▪ Specifically, we recommend that enhanced obligations to advertise trading opportunities should not just focus on highlighting spare resources but identifying the new resources that could be developed to provide additional capacity, and the likely costs incurred to do so. ▪ New guidance could also require companies to identify potential opportunities for wider regional trade, not just trading with neighbouring companies.
Clarifying Companies' Obligations in Drought Conditions	▪ **We recommend that Ofwat clarifies companies' obligations in drought conditions.** ▪ Ofwat's current guidance does not clearly set out its view as to whether a supplier must prioritise its own customers in times of scarcity (under its supply obligations under the Water Industry Act 1991) or may instead continue to supply volumes in contracts to trade bulk water.
Our Recommendations to Improve Contract Design	
Penalty Clauses (Liquidated Damages) in Contracts	▪ **Standardised contracts should include a provision for penalties[3] in cases where the seller fails to deliver contracted volumes of water.** ▪ Including penalties for non-delivery in contracts ensures that buying companies have assurances that the selling company will have strong incentives to supply the contracted volumes, and are in this sense "firm" contracts. Penalties could be set to reflect the buyer's costs of acquiring water from alternative sources at short notice.

3 Throughout this report, we use penalty clauses to refer to what lawyers may term liquidated damages: "A fixed or determined sum agreed by the parties to a contract to be payable on breach by one of the parties". We understand that under English Law, if liquidated damages are excessive and cannot be justified, they are deemed to be "penalties" which are unenforceable under English Law. Our use of the term "penalty clauses" does not refer to the latter.

Source: Thomson Reuters Practical Law, "Liquidated damages", Last accessed 9 July 2020, Link: https://uk.practicallaw.thomsonreuters.com/7-107-6769?transitionType=Default&contextData=(sc.Default)&firstPage=true&bhcp=1.

Summary of Our Recommendations to Improve Contracts to Trade Bulk Water	
	▪ **We also recommend that Ofwat provides guidance stipulating how the costs of bespoke infrastructure should be shared between suppliers' and purchasers' customers in the case of early termination of contracts.**
Impact of Uncertainty over Abstraction Licences	▪ Arrangements for issuing abstraction licences are beyond the scope of this study. However, we identify that the lack of availability of abstraction licences over the tenor of contracts could potentially act as a deterrent for trading firm contracts and may distort the incentives to trade. ▪ The Environment Agency (EA) in England and Natural Resources Wales in Wales do not award perpetual abstraction rights to water utilities. Perpetual rights would give water suppliers confidence to supply water under firmer contractual arrangements, such that – should abstraction rights be removed – water companies would be able to recover the additional costs they would incur through the next regulatory price control review. ▪ **We therefore recommend that the EA considers if its current abstraction licensing scheme is appropriate, in light of RAPID's desire to promote trade and strategic schemes.** ▪ In addition, it is unclear whether, under Ofwat's current pricing rules, water companies who wish to trade water in contracts with tenors beyond the length of issuance of abstraction licences can price the contract to reflect the risk they take on the availability of water. ▪ **In order to allow companies to effectively price their risks, we recommend that, when clarifying the definition of cost-based pricing as we recommend above, Ofwat also considers approaches for pricing the risks related to revocation of abstraction licences.**
Third Party Access to Infrastructure	▪ In other jurisdictions we review in this report, contracts supporting significant investment in infrastructure are subject to regulation prescribing that infrastructure should be made accessible to third parties on non-discriminatory terms. ▪ **To promote regional trade, we recommend that Ofwat consider developing rules that mandate that water companies make spare capacity available at incremental cost and non-discriminatory terms to facilitate such transfers.** ▪ In conjunction any approach should consider guidance on common carriage issued by the Drinking Water Inspectorate.
Destination Clauses	▪ Some current contracts stipulate that the buyer can only use the contracted water supply to fulfil its statutory requirements to serve the buyer's customers. ▪ **We recommend that Ofwat advises water companies to avoid such destination clauses in future bulk water sale agreements to promote regional efficient trade.** ▪ We note that the EA has concerns with the environmental risks of raw water transfers, noting that it can be environmentally damaging to discharge water of the incorrect quality and type into certain water bodies. However, rather than managing this risk through destination clauses in contracts, it would be more appropriate to manage such risks through the use of discharge permits.

1. Introduction

1.1. Our Assignment

NERA Economic Consulting has been commissioned by Regulators' Alliance for Progressing Infrastructure Development (RAPID) to conduct a study of the role of contract design in promoting the efficient bulk trading of water in England and Wales.[4]

Climate change and increased drought risk create new challenges for the water industry. Following the report by the National Infrastructure Commission (NIC) on "preparing for a drier future" in April 2018 and the Environment Agency (EA) "National Framework for water resources planning", RAPID has been created to improve water resilience and promote investment in new infrastructure for efficient water transfers. It aims to provide a "seamless regulatory interface, working with the industry to promote the development of national water resources infrastructure that is in the best interests of water users and the environment".[5]

Developing regulatory mechanisms for realising the gains from trade in bulk water, including contracts to develop joint infrastructure, is necessary to enable water utilities to follow a regional approach to water resource planning rather than a more costly localised approach.

Achieving efficient bulk trading of water requires regulatory and commercial mechanisms that give the parties developing joint infrastructure a reasonable prospect of cost recovery, and assurance they will continue to have access rights. While a variety of regulatory interventions may be needed to support efficient trade in bulk water, this study addresses a particular regulatory challenge that RAPID faces: the design of contracts to promote efficient trade.

NERA has been appointed to review the contracts currently in use to support bulk water trading in order to identify areas for improvement, and to assess the potential role for standardised contract design in reducing the transaction costs of trading. We have also been asked to consider the roles contracts play in supporting efficient trading in other sectors.

RAPID has identified two important aspects of contract design that we address in this study:

- The ***pricing of water transfers*** to promote efficient trade and infrastructure development, as parties will only trade when the price at which exchanges take place is at a price below/above the opportunity cost of the buyer/seller; and
- The ***mitigation and allocation of risks in the contract***, such as credit risk, the uncertain ability of the seller to deliver water as agreed in the contract, variation in water quality, or environmental risks associated with the transfer. Poorly designed contracts may also create incentives for "hold-up" if one party makes a relationship-specific investment without sufficient commitments from the other party to pay for the share of the project from which it benefits. Contracts which fail to envisage future developments or value

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4 We define economic efficiency as when firms produce as much output as possible, at as lowest cost as possible, and if consumers value that output at a price that is equal or higher than the marginal cost of production. We apply the concept of economic efficiency on a dynamic basis such that future consumers are not harmed by or do not harm current consumers. In economics, our definition of efficiency is termed dynamic allocative efficiency.

5 Ofwat, RAPID, Last accessed: 22 May 2020, Link: https://www.ofwat.gov.uk/regulated-companies/rapid/

drivers such as quality-level, price, quantity, or time of delivery may also create inefficiency and deter trade.

1.2. Our Approach

We adopt the following approach to develop our recommendations to improve contracts for bulk trading of water between water companies in England and Wales.

In Section 2 we establish the regulatory background and context of the water industry in England and Wales. We provide a brief summary of the structure of the water industry, the current regulation with respect to the award and trading of abstraction rights, the water resource management planning process, and we clarify the types of water trading that we address in this study.

In Section 3 we summarise the current regulation of water trading in England and Wales. We summarise Ofwat's involvement in the contracting process, and how the costs of trades interact with the regulation of companies. We also detail the water trading incentive that companies face through their price control process. Finally, we detail Ofwat's approach to water trading at PR19 including its determination regarding the Havant Thicket reservoir.

We establish the economic theory of water trading in Section 4. We focus on the economic theory of pricing of water trades, as well as the role of contracts in water trading. We also present a discussion of the risks that contracts should address explicitly.

Having established the background, theory and facts about water trading, we turn to compiling evidence of contracts for bulk trading. The challenge of efficient contract design has been considered in both the water and other infrastructure industries. Hence, this study requires a review of current contracting practices for bulk transfers in the English and Welsh water industry, including for recent infrastructure projects (e.g. Havant Thicket), and a review of practices in other sectors.

We draw on an analysis of ***current contracts to trade bulk water in England and Wales*** which were submitted by water companies to RAPID (see Section 5).

We also conduct a review of ***bulk trading in six other jurisdictions*** (see Section 6). Long-term contracts for the trading of energy products, including those which require investment in new infrastructure, are commonplace. For instance, long-term contracts are widely used to support investments in infrastructure such as new power stations, interconnectors, and upstream gas/oil production facilities. Standardised forms of contract have also been used as a way of promoting liquid trade in competitive wholesale gas and electricity markets.

Jurisdictions where water trading is more commonplace than in the UK may also provide lessons for efficient contract design in the UK, especially in countries with relatively limited water resources. For instance, trading of abstraction rights takes place in parts of Australia and some US states (e.g. California, Nebraska).

Therefore, we examine trading and the role of contracts in the following six case studies:

- Trading of electricity in Great Britain;
- Electricity interconnectors in Great Britain;
- Upstream gas contracts in Europe;

- Trading of water in Australia, in the Murray Darling Basin;
- Trading of water in Nebraska, in the Central Platte River; and
- Trading of water in California.

We refer to both evidence from current contracts to trade water in the UK and the role of contracts in the case study jurisdictions when drawing out recommendations to improve current contracts to trade bulk water in Section 7.

2. Regulation of Water Resources in England and Wales

2.1. Structure and Regulation of the Water Industry

The Water Act 1973 established 10 publicly owned, Regional Water Authorities to manage water resources and to supply water and sewerage services to customers in their areas of appointment. Those 10 Regional Water Authorities were privatised in 1989 and became limited companies, now known as the Water and Sewerage Companies (WaSCs). Prior to 1989, there also were 20 private Statutory Water companies who provided water services only within areas of appointment carved out from the Regional Water Authorities' supply areas.[6] After the privatisation of the WaSCs, the Statutory Water companies maintained their responsibilities as Water Only Companies (WoCs). After a series of mergers and acquisitions, there are now 11 WaSCs and 6 WoCs each with a regional monopoly on supply of water or sewerage services in their respective areas of appointment.

These regional monopolists are regulated by three independent bodies:

- The National Rivers Authority, now the Environment Agency (EA) in England and Natural Resources Wales (NRW) in Wales, acts as the environmental regulator of the water industry to promote sustainable benefit, reduce flood risks, and secure environmental benefits;
- The Drinking Water Inspectorate (DWI) sets regulatory standards for drinking water supplied by water companies and implements regulation to ensure companies take appropriate actions to maintain wholesome water supplies; and
- The Director General of Water Services, now the Water Services Regulation Authority (Ofwat), acts as the economic regulator of the water industry, promoting economic efficiency, resilience, protecting consumer interests and contributing to the achievement of sustainable development.

The regulators work within the overall water and sewerage policy framework and enforce minimum standards set by the Department for Environment, Food and Rural Affairs (Defra), the Welsh Government, and the European Union.

2.1.1. Water companies may choose to trade water when fulfilling their statutory responsibilities

WoCs and WaSCs are regional monopolists within their areas of appointment, with a statutory responsibility:[7]

> "to develop and maintain an efficient and economical system of water supply within its area and to ensure that all such arrangements have been made—
>
> (a) for providing supplies of water to premises in that area and for making such supplies available to persons who demand them; and

[6] María Molinos-Senante, Simon Porcher, Alexandros Maziotis (June 2017), Impact of regulation on English and Welsh water-only companies: an input-distance function approach, p. 5.

[7] Water Industry Act 1991, Part III, Chapter I, Section 37.

(b) for maintaining, improving and extending the water undertaker's water mains and other pipes"

In fulfilling these, and other duties, they may choose to trade raw or treated water with other WoCs or WaSCs, or with third parties. Ofwat states that most water trades that are currently enacted between water companies were signed before privatisation, and that around 4 to 5 per cent of water into supply results from water trading arrangements.[8] The majority of the water traded is raw water, although potable water may also be traded. Ofwat identifies that trading of water can benefit:[9]

- "customers, as it can improve resilience of supply and allow more expensive investment in developing new resources within a water company's area to be deferred, reducing future upward pressure on bills;
- the environment, by ensuring water is supplied to where it is scarce and there are existing environmental pressures, instead of developing new resources or using unsustainable abstractions; and
- the water sector, by enabling water companies to share in cost savings from trading instead of investing, and providing opportunities for companies to profit and innovate from trades."

Both the NIC's report on preparing to increase drought resilience and Ofwat have identified scope for further benefits to be realised from increased trading of water between water companies.[10]

2.2. Award and Trading of Abstraction Licences

In England, water companies apply for abstraction licences from the EA. The EA issues abstraction licences based on its assessment of the water balance in the catchment area and other environmental and ecological factors.[11]

The Water Resources Act 1963 introduced the system of abstraction licensing and specified that abstraction of water from a source, under most circumstances, would require a water abstraction licence.[12] We understand from RAPID's legal advisors that abstraction licences granted under the act were granted in perpetuity with an entitlement to compensation if revoked. However, we understand that the Water Act 2014 removed compensation rights for companies on the basis that it was more appropriate for them to seek funding necessary to replace any water lost through licence variation through their price control.

The EA now grants licences for abstraction under the Water Resources Act 1991 up to a time limit which is common within each catchment area. Consequently, when the EA grants a

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8 Ofwat, Water Trading, Last accessed 22 May 2020, Link: https://www.ofwat.gov.uk/regulated-companies/markets/water-bidding-market/water-trading/

9 Ofwat, Water Trading, Last accessed 22 May 2020, Link: https://www.ofwat.gov.uk/regulated-companies/markets/water-bidding-market/water-trading/

10 National Infrastructure Commission (April 2018), Preparing for a drier future, p. 11.

11 Environmental Agency (8 January 2020), Water management: abstract or impound water, Link: https://www.gov.uk/guidance/water-management-abstract-or-impound-water#water-abstraction

12 B. Evans and P. Howsam (2005), A critical analysis of the riparian rights of water abstractors within England and Wales, Journal of Water Law, p. 2.

licence, the tenor of the licence is typically between 6 and 18 years. When the EA renews the licence it is normally extended for an additional 12 years. Therefore, water companies have abstraction licences with a mix of tenors.

In certain circumstances, the EA grants long duration abstraction licences for periods up to 24 years. To apply for a long duration abstraction licence, a water company must demonstrate that:

- the lifetime of its infrastructure will extend over the desired duration of the licence;
- the service that the infrastructure supplies will be continuously required throughout the duration of the licence;
- the company has assessed environmental and economic changes that may affect abstraction over the duration of the licence and no significant concerns have been raised; and
- the infrastructure contributes to sustainable development.

Water companies may trade abstraction licences through bilateral negotiation subject to approval by the EA through the granting of new or varied abstraction licences. Should parties agree to trade their licensed abstraction rights, they will need to apply to the EA for a new licence and to cancel any existing licence, unless the trade is temporary, in which case the donor company's licence will be reduced for the period of the trade. Whilst the EA does not aid in the negotiation of trading of such licences, it may advise before an application whether the proposed trade is likely to be licensed. Trades for abstraction licences may be for the whole of the abstraction licence or just a part, and may be made on a permanent or temporary basis.

In preparing their water resources management plans (WRMPs), as we discuss below, we understand that water companies treat EA abstraction licences as if they were issued in perpetuity i.e. with the assumption that they will renew. Ofwat states that "the expectation is that at the time of reform abstraction licences will be sustainable, or a plan will be in place to make them sustainable".[13] In practice however, the EA may need to recover water for the environment or restrict the volumes of water that can be traded to meet environmental obligations.

2.3. Water Resource Management Planning

Water companies' trades for both raw and treated water form part of their WRMPs. WRMPs are mandated plans that companies must prepare every five years.[14] Companies must demonstrate in their WRMPs that they are meeting government objectives by "deliver[ing] secure, reliable, sustainable and affordable supplies of water, valu[ing] nature in decision-making and connect[ing] people with the environment".[15] We understand that the Welsh government publish its own guiding principles that stipulate WRMPs "should contain cost

13 Natural Resources Wales (May 2016), Final Water Resources Planning Guideline, p. 17.

14 Unless a material change in circumstances occurs in which case companies may need to draw up and consult on a new plan.

15 Defra (May 2016), Guiding Principles for Water Resources Planning, p.1.

effective solutions" that are "supported by evidence on why the options selected are the best value for customers and the natural environment".[16]

In the development of the WRMP, companies aim to find the optimal combination of solutions to bridge a forecast dry-year supply-demand deficit over a minimum planning horizon of 25 years.[17] This deficit profile will depend on forecast demand (e.g. based on population and economic growth), as well as on forecast supply, both of which are subject to a range of uncertainty.

Companies are required to develop their WRMPs at the Water Resource Zone (WRZ) level. A WRZ describes "an area within which the abstraction and distribution of supply to meet demand is largely self-contained (with the exception of agreed bulk transfers)".[18] The guidance adds that "significant numbers of customers should not experience different risks of supply failure within a single WRZ".[19]

Unlike previous WRMPs which were tested against the worst historic drought on record, companies prepared their WRMP 2019 against more "severe" drought scenarios. This is in line with Defra's 2016 Guiding Principles, which encourage companies to test the vulnerability of their systems not solely to historic events, but also to "future events that could reasonably be foreseen".[20]

Therefore, planning for resilience to drought through the development of WRMPs will determine how much water companies expect they are able to supply, or need to source by trading or developing new sources. However, companies' determination of their forecast surplus or deficit of water are complex and depend on:

- The resilience level that the company chooses to plan in accordance with;
- The resilience of each water source in the company's area of appointment; and
- The impact of drought across multiple water sources, and the extent of substitutability of those water sources in periods of drought.

To some extent, companies may organise transfers between sources in their own area of appointment to improve resilience and supply their customers in periods of drought. Similarly, companies can look to neighbouring or regional companies to source or supply additional water. The potential for trade with a company is determined by neighbouring or regional companies' own forecasts of surplus or deficits, and their forecast position relative to the company in question.

WRMP guidelines for England encourage companies to engage with other water companies to provide water "at a lower cost than [their] own solutions".[21] WRMP guidelines stipulate

16 Welsh Government (April 2016), The Welsh Government Guiding Principles for Developing Water Resource Management Plans (WRMP's) for 2020, p. 1.

17 While companies are encouraged to plan for a longer time horizon if they consider it appropriate, 25 years is the statutory minimum set out by Defra and the Environment Agency.

18 EA and NRW (April 2017), Water Resources Planning Guideline: Interim Update, p. 11.

19 EA and NRW (April 2017), Water Resources Planning Guideline: Interim Update, p. 11.

20 Defra (May 2016), Guiding principles for water resources planning, p.2.

21 Natural Resources Wakes (May 2016), Final Water Resources Planning Guideline, p. 28.

that "any solution being delivered by a third party will be subject the same rules and legislation" as the water company purchasing the water.[22] However, the responsibility for meeting such regulations lies with the purchaser under the WRMP.[23] The selling water company would need to demonstrate that it meets the resilience targets of its own WRMP accounting for its obligations under the bulk supply contract.

Water companies in England and Wales that forecast surplus water relative to their requirements under the WRMP, must provide evidence that they have contacted other water companies to make that forecast surplus water available for trading. Companies that forecast that they may be short of water must demonstrate that they have approached parties who could provide alternatives to their proposed solutions to meet their resilience targets in their WRMPs. Companies must provide details that justify their choice to source water within their own area of appointment and/or source data from third parties to demonstrate their WRMP is delivered at best value to its customers.

2.4. Types of Water Trading Covered in this Study

A trade for a bulk supply of water is an agreement by a supplier to provide a large quantity of water to a buyer in return for financial compensation. There are two main types of trade for the bulk supply of water:

- **Trades for the bulk supply of raw water:** Trades for the bulk supply of raw water may be made between water utilities, or between a water utility and "owners" of raw water, for instance the Canal & River Trust (CRT), large power stations and other industrial or agricultural water users with rights to abstract raw water from a given source over a specific period of time. Such trades for the bulk supply of raw water may be accompanied with the development of infrastructure to abstract the raw water from a specific source, and/or may specify as part of the contract that the raw water originates in a specific source. Given that large investment in infrastructure is required to develop sources for these trades, the quantities of water traded may need to be larger to justify the investment in infrastructure.
- **Trades for the bulk supply of potable water:** Trades of the bulk supply of potable water may be agreed between water companies, between water companies and New Appointments and Variations (NAVs).

In addition to trades for bulk supplies of water, some entities enter into contracts for the *option* to supply or purchase bulk supplies of raw or potable water. Two forms of option contracts may exist:

- **Option to purchase water:** In such a contract, the buyer is presented the option to buy raw or potable water at pre-agreed terms and prices from the seller. The buyer can elect not to purchase such water after entering into the contract. Contracts that present the option to purchase water may or may not stipulate the conditions under which the buyer may exercise the option. A contract for the option to purchase water may be useful in time of emergency for the buyer, such as when the buyer's own water resources are temporarily unavailable due to emergency.

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22 Natural Resources Wakes (May 2016), Final Water Resources Planning Guideline, p. 28.

23 Natural Resources Wakes (May 2016), Final Water Resources Planning Guideline, p. 28.

- **Option to sell water:** In such a contract, the seller is presented with the option to sell raw or potable water to the buyer at pre-agreed terms and prices. The seller can elect not to sell such water after having agreed the terms of the contract. Contracts that present the option to sell water to the supplier may or may not stipulate the conditions under which the seller may exercise the option. A contract for the option to sell water may be useful for suppliers wishing to protect their own customers in periods of water scarcity but would otherwise wish to trade with other entities.

Our study focuses on the trading of bulk supplies between incumbent water utilities. We do not consider trades where NAVs purchase water from water utilities. However, it is possible that some of our recommendations may be directly extended to trades between water utilities and other entities.

However, we do consider trades for both potable and raw water between water companies, and where water companies purchase water from parties such as the CRT or major water users holding abstraction licences. We also consider both contracts for the trading of specific volumes of water, and contracts for the option to buy or sell volumes of water.

3. Current Regulation of Water Trading in E&W

3.1. Defra's Guidance on Contract Pricing

Defra identifies that "transfers of water between companies and regions may offer the best value option to address the potential gap between the supply and demand of water resources".[24] Defra published guidance for Ofwat prescribing how Ofwat may set its Charging Rules for bulk supply trades in England. We understand that Defra's guidance was largely developed in the context of trades with NAVs but Defra states that the guidance "covers agreements for the supply of bulk water between incumbent water companies".[25]

Defra sets guidance under five principles:

- **Environmental protection and enhancement:** Defra states that Ofwat should take into account the government's plan for resilience and sustainability when setting charging rules. It states that Ofwat "should ensure that companies have the right incentives to consider and take into account the environmental costs".[26] It also states that "Ofwat should set charging rules that allow for relevant costs to be adequately reflected" in bulk charges.

- **Resilience to extreme events including drought:** Defra states that Ofwat should aim to set charging rules that:[27]

  - "provide incentives for efficient resource use to encourage collaboration between neighbouring companies";
  - "incentivise the water industry to develop a resilience standard to underpin guarantees of reliability in drought and extreme weather events of bulk water transfers between incumbents"; and
  - "are consistent with aims to encourage incumbents to undertake appropriate, timely and no regret investment decisions ahead of future need".

- **Drinking water quality:** Defra states that the DWI and Water Supply (Water Quality) Regulations 2016 are clear and that incumbents are legally responsible for the quality of their water supply to customers. Defra states that because of this legal responsibility, Ofwat should not force incumbents to take supply from another party. Defra also states "it is important that companies' costs related to meeting water quality standards are accounted for in the principles companies follow in their charging structure".[28]

- **Consumer protection:** Defra identifies that "Charging has an important role to play in incentivizing and securing [efficient use of resources] through encouraging innovation and reflecting the true cost of water".[29] Defra states "It will therefore be beneficial to use price signals to reveal the value of water and improve recognition of environmental

[24] Defra (April 2018), Water Industry: Guidance to Ofwat for water bulk supply and discharge charges, p. 2.

[25] Defra (April 2018), Water Industry: Guidance to Ofwat for water bulk supply and discharge charges, p. 2.

[26] Defra (April 2018), Water Industry: Guidance to Ofwat for water bulk supply and discharge charges, p. 4.

[27] Defra (April 2018), Water Industry: Guidance to Ofwat for water bulk supply and discharge charges, p. 5.

[28] Defra (April 2018), Water Industry: Guidance to Ofwat for water bulk supply and discharge charges, p. 6.

[29] Defra (April 2018), Water Industry: Guidance to Ofwat for water bulk supply and discharge charges, p. 7.

costs".[30] Defra also argues that price signals "should occur without any de-averaging of network costs".[31]

- **Level playing field:** Defra states that "Ofwat should consider the correct balance of incentives to ensure that the cost of bulk supplies reflects the environmental, drinking water quality and the economic costs of the trade".[32] It also states that "Ofwat should ensure that rules allow appropriate margins that ensure that there is a level playing field between incumbent water companies and the NAVs".[33]

We are unable to determine how Ofwat incorporated Defra's guidance into its bulk supply policy principles.

3.2. Ofwat's Role in Determining Bulk Contract Prices

Ofwat does not limit the prices agreed in commercial arrangements between companies, but it expects the prices "to be consistent with [its] bulk supply pricing policy principles" and may be asked to make a determination of the price in a bulk supply contract.[34] Ofwat's bulk supply pricing policy principles are intended to provide it with a clear basis to make decisions on individual contracts. They are:[35]

- Bulk supply prices should reflect the costs reasonably associated with the provision of the relevant services.
  - Ofwat states that reasonably incurred costs should include both past and future incurred costs, and costs associated with termination of the contract.
  - Ofwat states that the costs reasonably incurred may be determined using an average costing basis or specific customer cost basis depending on the contract in question.
  - Ofwat allocates joint costs using principles of "practicability and proportionality" and will attempt to reflect the costs of serving customer requirements.[36]
- Bulk supply prices should facilitate the efficient use of resources and effective competition within the water supply industry. Where appropriate:
  - Ofwat will guard against the use of bulk supply to "prevent, restrict or distort" competition.
  - Ofwat states that "to do this, it is important that bulk supply prices reflect costs. Cost reflectivity is central to the provision of efficient economic signals – which feed into the assessments of potential competitors – and, more generally, for efficient resource use".[37]

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30 Defra (April 2018), Water Industry: Guidance to Ofwat for water bulk supply and discharge charges, p. 7.

31 Defra (April 2018), Water Industry: Guidance to Ofwat for water bulk supply and discharge charges, p. 7.

32 Defra (April 2018), Water Industry: Guidance to Ofwat for water bulk supply and discharge charges, p. 7.

33 Defra (April 2018), Water Industry: Guidance to Ofwat for water bulk supply and discharge charges, p. 7.

34 Ofwat (2015), Bulk Supply Pricing – A Statement of Policy Principles, p. 5.

35 Ofwat (2015), Bulk Supply Pricing – A Statement of Policy Principles, p. 7.

36 Ofwat (2015), Bulk Supply Pricing – A Statement of Policy Principles, p. 8.

37 Ofwat (2015), Bulk Supply Pricing – A Statement of Policy Principles, p. 9.

- Bulk supply prices should be consistent with the discharge of the relevant duties and obligations of the relevant supplier
  - The onus is on the supplier to alert Ofwat about inconsistencies between its bulk supply agreement and discharge of its duties and obligations under the Water Industry Act.

Companies may, in some circumstances, ask Ofwat to determine prices and conditions of arrangements. In particular, Ofwat has powers (under sections 40 and 40A of the Water Industry Act) to make determinations on contracts between:[38]

- "an existing appointed company providing a bulk supply to a new appointee that, in turn, serves a customer who uses more than a given amount of water (a 'large user');
- an existing appointed company providing bulk supply to a new appointee that, in turn, serves a new development, such as a new housing estate; and
- a bulk supply between existing appointed companies."

Ofwat will follow its bulk supply pricing policy principles when making a determination. It will only make a determination when referred by either party in the arrangement and when the agreement "will secure the efficient use of water resources or the efficient supply of water".[39]

3.3. Funding the Costs of Water Trading

3.3.1. Regulatory allowances to cover the costs of buying and selling water

Ofwat sets allowances to cover the costs water companies incur to purchase or supply water from/to other companies as part of the total expenditure (totex) allowances determined at its quinquennial price review process. These allowances include any costs associated with the infrastructure developed to support trade and any other operational costs to facilitate trading. For large infrastructure projects, for example the Havant Thicket reservoir, Ofwat may make a separate determination on the totex allowances pertaining to the project.

Under Ofwat's methodology in the PR19 final determinations, the costs of providing bulk supplies to another water utility fall under the wholesale price controls. Therefore, investment in infrastructure and other operational costs to facilitate bulk trading are funded through companies' totex allowances, which Ofwat sets using its benchmarking models and other aspects of its cost assessment.[40]

The revenues and prices agreed in bulk supply agreements between companies are not set as part of the price review process. In order to control for the revenues of bulk supply arrangements in the price control, Ofwat nets the expected revenues from bulk supply trades from the costs of the regulated business in the water network price control.[41] The remaining costs are then recovered from other customers within the company's area of appointment.

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38 Ofwat (2015), Bulk Supply Pricing – A Statement of Policy Principles, p. 5.

39 Ofwat (2015), Bulk Supply Pricing – A Statement of Policy Principles, p. 5.

40 Ofwat (December 2019), PR19 Final Determinations -Havant Thicket Appendix, p. 4.

41 Ofwat (December 2019), PR19 Final Determinations -Havant Thicket Appendix, p. 4.

Ofwat argues that, by netting off revenues from bulk trading, customers benefit because "economic profits are passed to them through lower bills".[42]

3.3.2. Ofwat's additional incentive scheme to encourage water trading

While Ofwat provides allowances through the price review process that it intends to cover the costs of water trading, the incentive for companies to trade may be limited, except to the extent Ofwat gives companies an incentive to reduce their long-term costs and scrutinises their WRMP decisions.

To address this, Ofwat introduced a water trading incentive at PR14, which it has maintained in its PR19 determination. Ofwat's water trading incentive allows companies to share a proportion of "economic profits" from new bulk supply arrangements. if:

- the company has an Ofwat approved water trading and procurement code (which we discuss in Section 3.3.4); and
- the bulk supply terms of the trade meet the requirements for a qualifying trade. In particular, for a trade to qualify for an incentive payment at PR19:[43]
  - The trades must be agreed after July 2013;
  - The trade must be or must have been operating between April 2015 (the start of AMP6) and March 2025 (the end of AMP7); and
  - The trade must be between unrelated parties i.e. not the same group of companies.

Under the incentive, the shareholders of companies selling water (exporting) are allowed to retain 50 per cent of lifetime "economic profits" of all new qualifying trades in the regulatory period. Ofwat defines economic profits as profits over and above the normal return on undepreciated capital invested. The shareholders of companies purchasing water (importing) receive an import incentive of 5 per cent of the costs of water imported under new agreements during the regulatory period. Ofwat caps both incentives "to protect customers":[44]

- The export incentive is capped at 100 per cent of the economic profit for the years that the export operates in the regulatory period
- The import incentive is capped at 0.1 per cent of the importer's wholesale water revenue in each year of the control period

The export incentive is paid to companies at the end of the first qualifying regulatory period based on the outturn economic profit during the regulatory period, and the forecast present value of the remainder of the economic profit over the tenor of the contract. The incentive payment is added into companies' allowed revenues in the next regulatory period. Thereafter, shareholders of the supplying company assume all risk that the profits are not as great as forecast, and assume all upside that profits are greater than forecast.

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[42] Ofwat (December 2019), PR19 Final Determinations -Havant Thicket Appendix, p. 4.

[43] Ofwat (December 2019), PR19 Final Determinations -Havant Thicket Appendix, p. 4.

[44] Ofwat (December 2017), Delivering Water 2020: Our final methodology for the 2019 price review, p. 101.

The box below summarises a worked example, provided to us by Ofwat, demonstrating the intended functioning of the PR19 water trading incentive.

Box 1: Ofwat Worked Example Illustrating Our Understanding of the Mechanics of Ofwat's Incentive Scheme to Encourage Water Trading

Consider a water company ("the supplier") with a revenue requirement of £100m p.a. It signs a bulk supply agreement to supply water to a neighbouring water company at the start of a regulatory period in 2020 which lasts until 2040. Suppose there is no capital expenditure required to facilitate the trade. Instead, it will cost the supplier £1m p.a. to fulfil the trade, and its expected revenue is also £1m p.a.

Ofwat deducts the expected revenue from the trade from the revenue requirement of the supplier each year from 2020. Therefore, the supplier's revenue requirement is £100m p.a. *minus* £1m p.a, or £99m p.a. The supplier finances the cost of the trade through the revenue of the trade.

Units: £m p.a.	Trade Revenue	Trade Cost	Revenue Req.	Shareholder Profit	Customer Profit
2020-24	1	1	99	0	0
2025-29	1	1	99	0	0
2030-34	1	1	99	0	0
2035-40	1	1	99	0	0

Now assume the outturn revenues to the supplier were £1.3m p.a. in 2020 through 2024 but outturn costs were unchanged. In 2020 through 2024, economic profit of the trade (£0.3m p.a.) was retained by the suppliers' shareholders.

Units: £m p.a.	Trade Revenue	Trade Cost	Revenue Req.	Shareholder Profit	Customer Profit
2020-24	1.3	1	99	0.3	0
2025-29	1	1	99	0	0
2030-34	1	1	99	0	0
2035-40	1	1	99	0	0

In 2024, Ofwat evaluates the outturn economic profit over the first regulatory period of the trade. It uses its evaluation to forecast future expected profit from the trade. We assume Ofwat expects revenue to be maintained at £1.3m p.a.

Ofwat passes 50 per cent of the PV of its forecasted economic profit over the lifetime of the trade[45] (£0.15m p.a.) to the shareholders of the supplier in the next regulatory period, 2025-2029.[46] Ofwat adjusts its payment to reflect the profits already realised by shareholders in 2020-2024 (£0.3m p.a.).

After paying shareholders the incentive, Ofwat adjusts the revenue requirement to reflect its updated expected revenue of the trade. After 2029, the revenue requirement is set at £100m p.a. *minus* the expected revenue £1.3m p.a, or £98.7m. In 2025-2029, Ofwat adds the incentive payment to the suppliers' shareholders, reflecting 50 per cent of the future

45 Which we assume does not exceed Ofwat's cap in the trading incentive.

46 For simplicity, we assume no discounting factor.

forecasted profit, back into the revenue requirement to result in a revenue requirement of £99m p.a.

Units: £m p.a.	Trade Revenue	Trade Cost	Revenue Req.	Shareholder Profit	Customer Profit
2020-24	1.3	1	99.0	0.3	0
2025-29	1.3	1	99.0	0.3	0
2030-34	1.3	1	98.7	0	0.3
2035-40	1.3	1	98.7	0	0.3

After Ofwat's assessment, any changes in the future outturn economic profit of the change are fully borne by the shareholders of the supplier. For instance, if revenue falls to £1.2m in the final period, the shareholder profit would become negative in the 2035-40 period.

Units: £m p.a.	Trade Revenue	Trade Cost	Revenue Req.	Shareholder Profit	Customer Profit
2020-24	1.3	1	99.0	0.3	0
2025-29	1.3	1	99.0	0.3	0
2030-34	1.4	1	98.7	0.1	0.3
2035-40	1.2	1	98.7	-0.1	0.3

3.3.3. Potential to improve on Ofwat's existing trading incentives

While Ofwat has set out some aspects of how the trading incentive will operate, there remain some aspects of it which are not precisely defined. Such ambiguities may reduce the incentive companies have to pursue efficient trading opportunities.

First, Ofwat defines economic profit as "profits over and above the normal return on capital invested".[47] However, Ofwat does not explain how it determines "the normal return on capital invested". We understand Ofwat's definition to mean the difference between the revenue under the contract and the costs to fulfil the contract, where the costs include a return on capital left undepreciated in the supplying companies' Regulated Asset Value (RAV).

It is not clear from public documentation how Ofwat would manage the early termination of a contract after the incentive for the contract had been paid. It is also unclear how Ofwat would determine the costs of infrastructure attributable to a trade, when the infrastructure provides a benefit to both parties.

Moreover, Ofwat's definition of economic profit seems at odds with its pricing policy principles which state that Ofwat, should it be asked to determine the price between two parties, would choose a price that reflected cost and would imply economic profit would be zero. If economic profit was zero, there would be no incentive for parties to trade instead of developing their own water resources, other than any statutory obligations to provide water to customers at best value.

We understand that Ofwat introduced the incentives for importers, in part, to correct what it considered to be "capex bias" encouraging companies to use investment-based solutions rather than trading to secure supplies to meet resilience targets.[48] Indeed, in a report prepared

47 Ofwat (December 2017), Delivering Water 2020: Our final methodology for the 2019 price review, p. 101.

48 Ofwat (July 2015), Reflections on the price review – learning from PR14, p. 31.

for South East Water, Frontier Economics argued that even the new incentive for importers may not be large enough to overcome capex biased solutions.[49]

3.3.4. Ofwat's approved trading and procurement codes

In order to be eligible for the water trading incentive, Ofwat also requires that companies develop their own trading and procurement code and submit it to Ofwat for approval.[50] Trades must comply with the company's Ofwat-approved trading and procurement code to qualify for an incentive. The companies' codes are published on Ofwat's website.[51]

For Ofwat to approve trading and procurement codes, it tests that they meet 12 principles:

- Principle 1: Non-discriminatory procurement by importers
- Principle 2: Economic purchasing by importers
  - The importer must purchase from the most economical source available and consider the quality and quantity available for purchase
- Principle 3: Use of competitive processes by importers
- Principle 4: Contract lengths
  - The party must provide reassurance that fixed contract durations will be reasonable
- Principle 5: Transparency
  - Parties must provide information to demonstrate compliance with its code and make available appropriate information to market participants and other parties (without compromising the commercial position of any contracting party)
- Principle 6: Link to water resources management plans (importers and exporters)
  - Parties should explain differences between the company's approach to trading and its process for selecting options under the WRMP
- Principle 7: Rational economic and environmental flows (importers and exporters)
  - Parties should explain how the company will ensure protection of environmentally sensitive abstraction sites and ensure that the trades involve "economically and environmentally rational flows"
- Principle 8: No artificial ending and restarting of trades (importers and exporters) to take advantage of incentive arrangements
- Principle 9: Correct assessment of costs (exporters)
- Principle 10: Appropriate allocation of incentives between relevant controls
- Principle 11: Consistency with the company's bid assessment framework
- Principle 12: Evidence of assurance processes

49 Frontier and South East Water (July 2015), Water 2020 – water resource planning and third party options, p. 36.

50 Ofwat (May 2018), Trading and procurement codes – guidance on requirements and principles.

51 Ofwat, Trading Procurement Codes, Last accessed 22 May 2020, Link: https://www.ofwat.gov.uk/regulated-companies/company-obligations/trading-procurement-codes/.

- Parties should explain how the company decides on trades and how it accounts for long-term demand-supply balances

3.3.5. Ofwat's treatment of the Havant Thicket reservoir

The Havant Thicket (HT) reservoir is being built by Portsmouth Water (PRT) to facilitate the trade of water with Southern Water (SRN) to meet the water resilience needs of its customers.

At PR19, Ofwat set a separate 10-year price control for the HT reservoir that uses the same principles as for the other price controls it applies to the wholesale businesses of water companies. Ofwat sets a cost allowance of £123.6 million for HT and applies an efficiency challenge of £10.1 million following feedback from SRN and PRT. In other words, it grants PRT's shareholders an allowance of £123.6 million to build HT, and the shareholders face risk of cost-overspend beyond the target.

Ofwat calculates the allowance by assessing the costs submitted by both PRT and SRN in their PR19 business plans, and applies an "efficiency challenge" to PRT to spend less than its submitted costs. The costs of HT form a regulatory capital value on which PRT will earn depreciation and return in control periods.

Ofwat sets a limit on what PRT can charge its customers for the costs associated with the HT reservoir, but not a limit on what PRT can charge SRN under bulk supply arrangements. It sets a limit on the revenues that PRT can recover from its customers for HT based on a determination of the economic costs of developing HT net of the revenues that PRT expects to recover from bulk trading the water. Ofwat argues that the bulk supply charges paid by SRN should be sufficient to fund the economic cost of developing the reservoir, and therefore the price limit on PRT's customers should be zero or negative in the case of economic profit. Therefore, Ofwat places the risk that bulk supply revenues are not sufficient to cover the costs of the reservoir on PRT's shareholders.

Ofwat states that, should the HT bulk supply trade qualify for its water trading incentive, that PRT shareholders can claim 50 per cent of the economic profits on an NPV neutral basis over the operational life of the reservoir through its water trading incentive. However, it does not allow profits to be earned during the construction of the reservoir. It states that at PR29, Ofwat will calculate economic profits as outturn revenues earned relative to the efficient costs of construction, to insulate PRT's customers from cost under or out-performance. Ofwat will return any economic profit earned by PRT from SRN during the building of HT to SRN's customers at PR29.

Ofwat proposes to profile the water trading incentives over the lifetime of the agreement (80 years) rather than allowing companies to recover their share of the expected profits up front which constitutes an intergenerational transfer.[52]

Consequently, Ofwat deviated from its own water trading incentive in its determination of allowed costs and incentives for HT. We understand Ofwat's deviation from the water trading incentive at HT, in part, reflects a recognition that aspects of the water trading incentive are unsuitable for large strategic resource options with investment in infrastructure.

52 Ofwat argues that the existing trading incentives allow companies to recover their share of expected profits up front, providing greater certainty to investors and strengthening incentives to trade.

4. The Economics of Water Trading

As explained in Section 1, RAPID has asked us to consider two key aspects of contracting for water resources in England and Wales: the pricing of bulk transfers and the allocation of risks in the contract between trading parties. As explained in Section 2, our review focuses on trades of treated or raw water between incumbent regulated water utilities.

To provide a framework for our review of existing contracts and trading practices in other sectors, this Section provides a discussion of some economic principles relevant to our review. Specifically, in Section 4.1 we discuss the role contracts play in supporting efficient trades between buyers and sellers of water. In Section 4.2 we discuss the economic theory of how we would expect prices for water trades to be determined and how this price formation depends on market structure. In particular, we consider what pricing rules are likely to incentivise buyers and sellers of water to trade "efficiently".

In Section 4.3 we discuss the risks buyers and sellers of water face when they trade, how the existence of these risks affects incentives for efficient trading, and the role contracts can play in managing these risks effectively to promote efficient trade.

4.1. The Role of Contracts in Water Trading

Contracts impose legally binding commitments between a buyer and the seller to honour the agreed terms of trade. Contracts support efficient trade by precisely defining the product traded between parties, and the obligations of the contracting parties in the trade.

The economics literature defines the concept of "complete" contracts.[53] A contract that is complete specifies the obligations on the contracting parties and how the terms of trade vary across all different states of the world. In other words, complete contracts describe how the trading agreement changes with uncertain future developments (e.g. drought, changing costs), the circumstances in which contract parties do not have to meet their obligations, and any penalties incurred for failing to meet obligations.

Complete contracts can therefore support efficient trade, allocating risks to buyers and sellers transparently and predictably. The aim of the design of contracts to trade water (or other commodities), is that the contract is complete, and contains mechanisms to allocate risks between buyers and sellers, and contains terms to account for foreseeable changes in conditions over time (e.g. drought risk).

However, while complete contracts can support efficient trade, real contracts are unlikely to meet the theoretical ideal of "completeness". A truly complete contract is often prohibitively expensive to write, and may in any event be infeasible because the identification of risks is uncertain at the time of signing. Indeed, real contracts recognise this expectation of incompleteness, defining provisions for dispute resolution (e.g. recourse to courts or arbitrators). A substantial body of economic literature also considers the consequences of contracts that are incomplete.

[53] See for example: David Martimort (2008), Contract Theory. In: Palgrave Macmillan (eds) The New Palgrave Dictionary of Economics. Palgrave Macmillan, London.

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When evaluating contracts for water trade, we therefore consider the consequences of contracts being "incomplete" and ways of mitigating them, drawing on experience from infrastructure industries and economic theory.

For instance, a well-known risk faced by investors in infrastructure industries is the risk of "hold-up". Suppose a seller offers to provide water to a buyer at an agreed price, and sinks capital into a relationship-specific investment to enable the particular trade. Without a complete and legally enforceable contract, the buyer has an incentive to renegotiate the price once the infrastructure is provided, to a level below the full operating and capital costs of serving the contract, but above the costs that the seller would avoid if it chose not to supply the water. While this risk would deter the seller from making an investment in the first place, contracts that strive to be "complete" can assure buyers and sellers regarding the terms of trade, and allow them to be reasonably sure of their ability to fund long-lived infrastructure.

Reasonably complete contracts can also mitigate other risks, such as the risk that the seller may not have an incentive to serve the contract in conditions where costs are unexpectedly high or the availability of water resources is low, such as in drought conditions.

However, in practice complete contracts can be expensive to write and monitor. Such "transactions costs", combined with the consequences of incomplete contracts where contracts are not adequately complete, may deter trade from taking place.

One solution is to standardise terms across multiple contracts. Standardising terms across contracts reduces the costs of managing contracts and minimises transaction costs, in cases where a number of different transactions have similar commercial and legal terms. Standardisation may therefore have a role to play in promoting trades that would not be efficient without standardised contracts in place.

4.2. Economic Theory on the Pricing of Water Trades

The method to agree prices in a contract is important to promote efficient trade and needs to give both buyer and seller economic incentives to exchange water when it is economically efficient to do so.

4.2.1. The objective for prices: enhancing economic efficiency

In the context of regulated utilities, a company is often described as "efficient" if it is delivering its required services at the lowest cost that it can reasonably achieve. In the case of water, for instance, Ofwat assesses companies' relative efficiency through a process of benchmarking to estimate companies' "efficient costs". However, this definition of efficiency, which Economists would generally describe as "productive efficiency",[54] where a firm uses the cheapest mix of inputs in order to produce a given amount of output, is just one aspect of what Economists term "economic efficiency".

Economic efficiency also encompasses the concept of "Pareto efficiency", sometimes referred to as "allocative efficiency",[55] which means that one could not reallocate resources to make one party better off without making another party worse off. In essence, Pareto efficiency

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54 Harold Fried et al (1993), The Measurement of Productive Efficiency, p. 10.

55 David Kreps (1990), A Course in Microeconomic Theory, p. 153.

requires producers to increase their output up to the point where the cost to consumers of producing more output becomes larger than consumers' willingness to pay for it. That is, firms operating in a market should produce as much output as possible, as long as consumers value that output at a price that is equal or higher than the marginal cost of production.

Finally, there is a time component to efficiency. In practice, ensuring economic efficiency requires consideration of "dynamic efficiency", such that present consumers should not be made better off by harming future consumers, and vice versa.[56] In essence, this requires application of the concept of economic efficiency on a forward-looking basis.

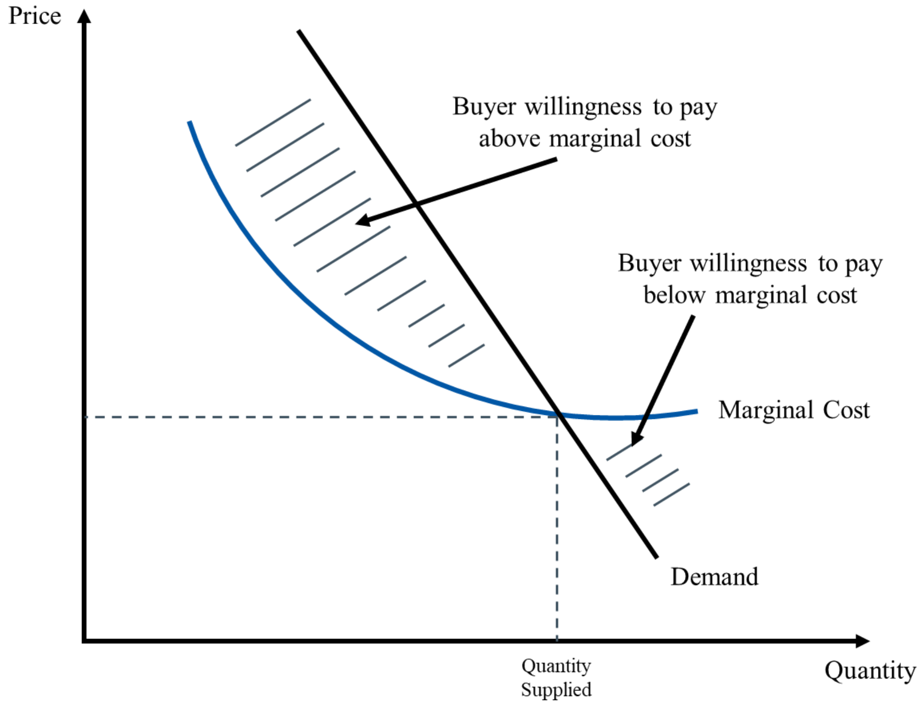
4.2.2. In theory, setting price equal to marginal cost would promote efficient trading of water

In a theoretical competitive market, trade of a product between a buyer and supplier occurs when the buyer's willingness to pay for the product exceeds the seller's marginal cost of supplying the product. Such trades maximise allocative efficiency, as described above.

The supplier's marginal cost is determined by the costs it bears from producing the additional unit to trade to the buyer. For example, the marginal cost for the supply of an additional litre of potable water may include the cost of abstracting that additional unit of water and the costs of treating an additional unit of water. Meanwhile the willingness to pay for an additional litre of potable water is determined by the opportunity cost of the buyer, in other words, the costs that the buyer would otherwise face to source the unit of potable water from the next cheapest source, see Figure 4.1.

[56] Daron Acemoglu (2009), Introduction to Modern Economic Growth, p. 338.

Figure 4.1: Trade at Marginal Cost Maximises Pareto Efficiency



Source: NERA Analysis

In theory, if there were many buyers and sellers of single litres of potable water without transaction or transportation costs, the price of water would reflect the marginal cost of producing an additional unit of potable water across the industry. Suppliers who could produce a unit of water for less than the price of water would sell their water to any buyer with a willingness to pay higher than the market price.[57]

Box 2: Worked Example Illustrating the Efficiency from Pricing at Marginal Cost

Consider a theoretical example where Company A forecasts it has surplus water to sell and can produce each unit of surplus water at £5. Therefore, Company A has a marginal cost of £5. Assume that there are many possible buyers of the water, and many other sellers.

Company A would be willing to sell the unit of water at a price greater than or equal to £5. For prices below £5, it would not be profitable for Company A to sell the water because it would cost Company A £5 to produce the unit of water.

Company B can produce a unit of potable water itself for £6, so its marginal cost is £6. Its willingness to pay for a unit of potable water is therefore £6 because for prices above £6 it would be cheaper for Company B to produce water itself. For prices below or equal to £6 Company B would save money by purchasing the water elsewhere rather than producing it itself.

[57] Because all buyers with a willingness to pay above the marginal cost of production would be able to purchase water, this theoretical model achieves "allocative efficiency".

Company B can efficiently trade with Company A for water because Company B's willingness to pay for water (£6) exceeds Company A's marginal cost of producing water (£5).

In fact, Company A would be willing to trade with any company at prices that were greater than or equal to its marginal cost of £5. Efficient trade or allocative efficiency is achieved when the price in the market reflects Company A's marginal cost of £5. In this market, all buyers with a willingness to pay greater than or equal to £5 purchase water from Company A. All companies who can produce their own water at marginal costs that are less than £5, produce their own water.

However, a number of factors mean that the bulk trading of water in practice does not reflect the theoretical trade of water in a competitive market as described above.

4.2.3. The water market differs from a notionally competitive market because of transport costs and quality differences

In reality, transportation costs may limit the ability of companies to trade. Whilst water companies already own networks which they use to transport water, in order to transport raw water from where it is abstracted to new customers or neighbouring utilities, investment in significant infrastructure such as pipelines and pumping stations may be required. Differences in water quality across regions may also increase treatment costs:

- Variations in the quality of raw water are often uncontrollable due to environmental factors, and can affect the cost that the company bears to treat water before supplying it to customers.
- Whilst the DWI imposes minimum standards on water companies for the quality of treated water that they can supply to customers, variations in quality and differences in water quality across regions may affect treatment costs, and mixing water types can impact on the aesthetic qualities of water (e.g. occasional discolouration) even if all sources are compliant with DWI standards.

Consequently, while the benefits of trade may be considerable, there are also transactions costs that may, efficiently, prevent the price of water from converging across the country.

Box 3: Worked Example Illustrating the Limitations Created by Transportation Costs

Consider the same theoretical case where Company A can produce water at a marginal cost of £5 and Company B's willingness to pay for water is set by its own marginal cost of £6. As before, trade can efficiently occur because Company B's willingness to pay for water exceeds Company A's marginal cost of producing water.

However, now assume it costs £2 to transport the water from Company A to Company B. Now, no trade can efficiently occur. Company A would need to receive a price of £5 to cover its marginal cost of producing the water. However, Company B would need to pay both £5 for the water and £2 to transport the water. Its total cost of purchasing a unit of water is therefore £7 which exceeds its willingness to pay (£6).

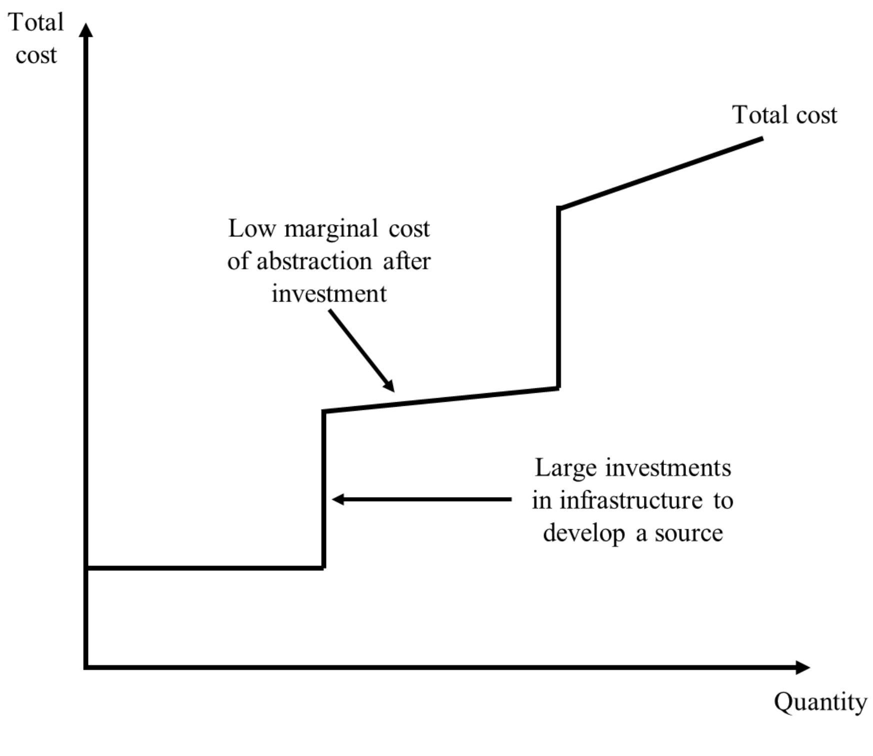
4.2.4. Bulk water trading sometimes requires investments in infrastructure, preventing pricing at marginal cost

In a theoretically competitive market with many sellers, the supply curve is the same as the marginal cost curve and describes a supplier's willingness to supply water at each price level. The supplier would be willing to sell an additional unit of water so long as the price of that unit is at least as great as the marginal cost that the supplier bears from producing that unit.

However, the trade of bulk supplies often requires significant investments in order to transport, treat, or develop infrastructure to support the abstraction of water for trade. Large one-off investments to develop infrastructure mean that the supplier will incur substantial fixed costs, so that it will not necessarily recover its costs should the price of water be set at the marginal cost of selling water.

In fact, the total cost curve for the supplier may look as it does in Figure 4.2 below.

Figure 4.2: Supplier Total Cost Curve



Source: NERA Analysis

As shown above, having invested in infrastructure, the marginal cost at which the supplier would be willing to sell an additional unit of water to the purchaser will likely be relatively low. However, should selling an additional unit of water require new infrastructure, the marginal cost will be higher, reflecting the investment required to build such infrastructure. Therefore, in industries with significant investment in infrastructure, pricing at marginal cost (which in a theoretical competitive market achieves efficiency), may not recover fixed costs of the investment.

Box 4: Worked Example Illustrating Why Pricing at Marginal Cost May Not Ensure Cost Recovery with Fixed Costs

Consider the same theoretical case where Company B's willingness to pay for water is set by its own marginal cost of £6 but assume there are no transaction costs. In addition, assume that Company A must invest in £100 in order to develop a source to facilitate the trading of water. Having developed the source, Company can then produce water at the same marginal cost of £5.

Hence, if Company A charged Company B for water at marginal cost, it would cover its costs of producing water but would not recover the £100 investment to develop the source.

In order to ensure cost recovery, Company A would need to charge more than its marginal cost in order to recover its fixed costs of investment. The fraction Company A would need to charge above marginal cost would depend on the volume bought by Company B in the trade.

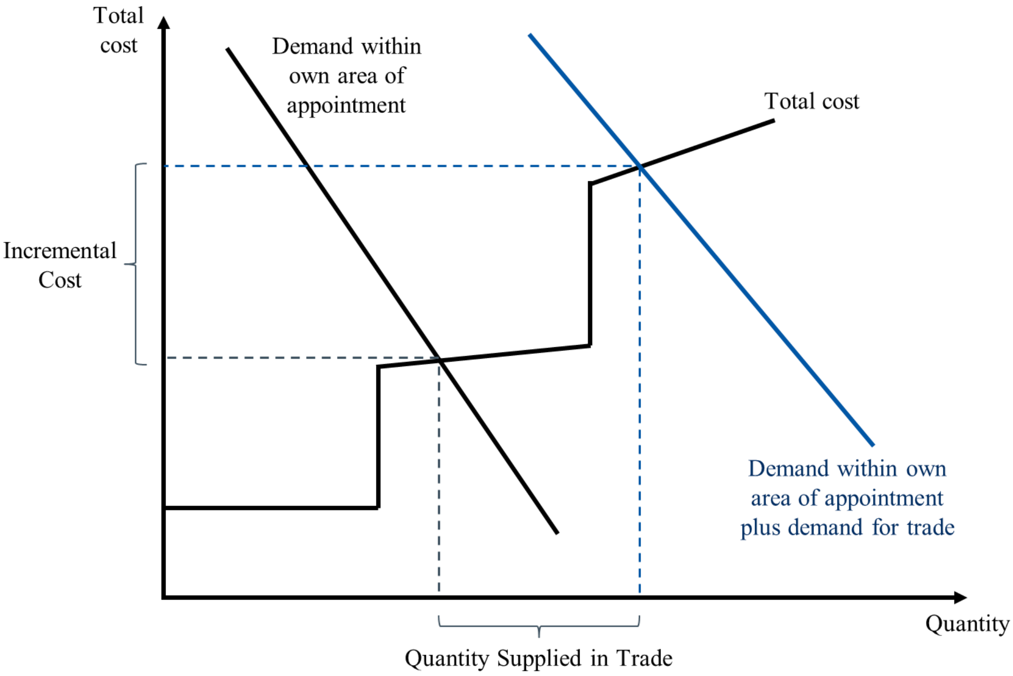
4.2.5. Pricing at average incremental cost would promote efficient trade

Given the need to set a price above marginal cost to recover infrastructure costs, companies could choose to price all water trades based on their average cost. Average cost pricing would overcome the cost-recovery problem of marginal cost pricing. However, there are two problems associated with average cost pricing:

1. **Average cost pricing is inefficient:** Pricing at average costs means that some buyers with higher willingness to pay than marginal cost but lower willingness to pay than average costs do not trade with suppliers which are constrained to sell at average cost. The lack of trade between these buyers and suppliers results in higher overall average costs across the industry and a loss of Pareto efficiency, i.e. a "deadweight loss". Sellers may also sell more water than is economically efficient, if the marginal cost of selling some units of water exceeds average cost, which would also reduce efficiency.
2. **Average cost pricing may result in a cross-subsidy between customers of the trading companies (as may marginal cost pricing):** For example, suppose the costs of infrastructure required to serve a contract, when spread over the life of the trade, exceed the average cost of the selling company. In this case, pricing the trade at the average cost of the seller would cause a cross-subsidy from the supplier's customers to the buyer's customers.

Given these problems with average cost pricing, and the need to price above marginal cost to recover fixed costs, an alternative approach would be to price at *incremental cost*. Incremental cost examines the change in the seller's total costs caused by supplying the total quantity agreed with the buyer in the trade. Should the trade require the supplier to invest in infrastructure to facilitate the trade, the fixed costs of the investment would be captured within the incremental cost of the trade. For example, in Figure 4.3 we illustrate the incremental cost of a trade.

Figure 4.3: The Incremental Cost of a Trade



Source: NERA Analysis

The incremental cost of a trade may be largely comprised of the fixed costs of the investment in the infrastructure to facilitate the trade. These fixed costs would be included in incremental cost as a mark-up above marginal cost over the tenor of the contract.

Indeed, in a competitive market exhibiting fixed investment costs, we would expect the efficient price to reflect the *average incremental cost* of facilitating the trade. The average incremental cost would equal the incremental cost of the trade divided by the quantity supplied in the trade. In the context of bulk water trading, a supplier would be willing to supply water if its average incremental costs of facilitating the supply over the lifetime of the agreement are less than price agreed in the contract. Buyers would be willing to trade if the price agreed in the contract was less than their opportunity cost of sourcing the water from the next cheapest alternative.

Box 5: Worked Example Illustrating Why Pricing at Average Incremental Cost May Be Efficient

Consider the same theoretical case where Company B's willingness to pay for water is set by its own marginal cost of £6. Company A must invest in £100 in order to develop a source to facilitate the trading of water. Having developed the source, Company can then produce water at the same marginal cost of £5.

The average incremental cost of the trade is determined by:

- Company A's costs of producing the traded volume; and
- the volume purchased by Company B under the trade.

If Company B wishes to purchase 20 units of water under the trade, then Company A's cost of fulfilling the trade is found:

Company A's Cost = Fixed Cost (£100) + (Quantity Traded (20) x Marginal Cost (£5))

Company A's Cost = £200

Therefore, the average incremental cost of fulfilling the trade is found:

Average Incremental Cost = Company A's Total Cost (£200) / Quantity Traded (£20)

Average Incremental Cost = £10

In this case, the trade would not be efficient despite Company A having a lower marginal cost. Company A can produce the traded volume at £10 per unit, but Company B can produce the traded volume at its own marginal cost of £6 per unit. Therefore, Company B's willingness to pay does not exceed the average incremental cost of the trade.

However, if Company B wishes to purchase 100 units of water, then the average incremental cost of the trade would be £6. In this case, trade would be efficient, because the willingness to pay of Company B is at least as great as the average incremental cost of fulfilling the trade by Company A.

However, Company A would not face a strong incentive to trade, because it would not expect to earn a margin on the trade.

4.2.6. The price for bulk water transfers depends on bilateral negotiation

The market structure of the English and Welsh water industry, that of water companies with regional monopolies, means that the theoretical competitive market with many suppliers and buyers competing to trade water does not exist in practice. Instead, buyers and sellers who are often monopolists determine the price of water in contracts through the process of bilateral negotiation, rather than through the process of competition.[58] Moreover, competition and trading between regional water companies may be limited because of high transportation costs of water, local scarcity of water, and variations in water quality imposing environmental and water treatment costs from trading.

In the bilateral negotiation, sellers seek to price water up to the buyer's opportunity cost of sourcing water of the buyer, because without competition the seller does not face the risk of being undercut by a competitor. Meanwhile, the buyer would want to price the trade at the average incremental cost of the supplier. Therefore, the price of water agreed in the contract would, in theory, be set at least above the average incremental cost of facilitating the trade by the supplier and no greater than opportunity cost of sourcing the water of the buyer.

In such a trade, the seller would earn economic profit equal to the difference in the revenue from the trade less the incremental cost of fulfilling the trade. This economic profit provides an incentive for the seller to trade. Therefore, in principle, a water trade between two water companies may benefit both customers and the owners of the trading companies.

58 In economics, a monopolist buyer may be termed a monopsonist.

Box 6: Worked Example Illustrating Why Incentivising Trade Through A Margin Can Make Both the Buyer and Seller of Water Better Off

Consider the same theoretical case where Company B's willingness to pay for water is set by its own marginal cost of £6. Company A must invest in £100 in order to develop a source to facilitate the trading of water. Having developed the source, Company can then produce water at the same marginal cost of £5.

We found, in Box 5, that trade would be economically efficient at average incremental cost if Company B wished to purchase at least 100 units of water from the source developed by Company A. However, Company A would not be incentivised to trade for 100 units because it would not earn a margin on the trade and would therefore be indifferent between trading and not trading.

Suppose instead that Company B wished to purchase 200 units of water from Company A as part of the trade. Company A's average incremental cost of fulfilling the trade is £5.50.

Company A can bilaterally negotiate with Company B and set a price between Company A's average incremental cost of fulfilling a trade (£5.50) and Company B's willingness to pay (£6). Suppose that through this negotiation, the Companies decide to price the trade at £5.75.

Company A earns a margin on the trade of £50. Company A's customers would benefit if some of the profits of the sale are passed through to them. Company A's shareholders would also benefit if they were allowed to retain some of the remaining profit. The retention of profit by the shareholders of Company A represents the allowed margin of the trade, and provides incentives for Company A to trade.

Meanwhile, both customers and shareholders of Company B may also benefit. Company B saves £50 by purchasing water at lower cost (£5.75) than if Company B produced that water at marginal cost (£6). Customers of Company B would be better off if some of the cost savings were passed through to them in the form of lower bills. Meanwhile shareholders of Company B would also be better off if they could retain some of the cost savings of the trade, instead of passing the savings through to customers.

If Company A was not allowed to earn a margin, then it would not face an incentive to trade (as it would have to charge its average incremental cost of £5.50). Meanwhile, if Company B's shareholders were not allowed to retain some of the cost savings, then they would be indifferent between trading and producing their own water at higher cost. In both of these cases, the lack of trade is inefficient and does not allow the consumers (and shareholders of Companies A and B) to benefit from trade.

In fact, so long as regional water companies have an incentive to maximise profits from trade, i.e. some of the profits from trade are retained by the owners of each trading company, then theory suggests the pattern of trade would be efficient such that trade is mutually beneficial to both parties at a price that leaves both parties better off.

However, companies may not achieve efficient trade if regulation, to mitigate the market power of natural monopolists, forces prices to differ significantly from average incremental cost and a margin or if regulation prevents companies' from retaining profit or cost reductions from trading.

4.3. Ensuring Complete Contracts by Addressing Risk Factors

As well as defining the price that promotes efficient trade, contracts also need to ensure they preserve each party's incentive to adhere to the contract terms in light of the key risks that companies might face in relation to the value of the traded water to the buyer, the seller's ability to supply the water, or the costs it faces to do so.

As noted above, a "complete" contract would contain provisions that define how contract terms should adjust in all states of the world, but in practice complete contracts are infeasible. Hence, good practice in contract design should consider how the terms of the contract would change depending on the key risk factors facing the trading companies.

4.3.1. Some changes in circumstances can be managed through defined mechanisms

Some changes in circumstances are predictable, and thus can easily be accounted for mechanistically within a contract. One type of predictable change in circumstances are changes in costs over time due to the effects of inflation. Hence, across many industries, indexation of prices to inflation indices is commonplace. Some contracts, especially those involving infrastructure development, also index prices to changes in debt cost indices. Contracts can, depending on the context, also include mechanistic adjustment provisions for a range of other external factors as we discuss further in Section 6 of this report.

4.3.2. Companies could price-in the risks associated with drought risk

The seller's availability of water and/or the costs it faces to fulfill the contract depend on the scarcity of water. In drought conditions the seller may need to ration water or undertake relatively expensive measures to meet demand (including contracted demand). This risk could be dealt with in a number of different ways, depending on the nature of agreement reached between the parties.

First, cost or resource availability risk should affect the pricing of the contract. Uncertainty over the volume of resource available does not necessarily affect the theory set out above, which suggests efficient trade results from pricing at average incremental cost. However, in conditions of uncertainty we would expect suppliers and buyers to negotiate on the basis of *expected* average incremental costs over the tenor of the contract or *expected long-run average incremental costs*. Companies' expectation of long run average incremental cost could be based on a probabilistic model whereby incremental costs of providing the water are weighted by the probability of periods of drought, in which water is scarce and incremental costs are higher, and the probability of periods of surplus, where water is abundant and the incremental costs of fulfilling the agreement are lower.

Equally, buyers seeking to minimise their water resource costs would enter into trades based on their expected opportunity cost of sourcing water from the next cheapest source. The opportunity cost of sourcing water will be greater in periods of water scarcity and lower in periods of water surplus, and the buyer would balance these values by the probability of periods of scarcity or surplus respectively.

Therefore, suppliers would be willing to supply water in a bulk contract if its expected long run average incremental costs of facilitating the supply over the lifetime of the agreement are less than price agreed in the contract. Buyers would be willing to trade if the price agreed in the contract was less than their expected opportunity cost of sourcing the water from the next cheapest alternative over the tenor of the contract. Should an efficient trade occur, the price agreed would reflect the buyer's expected opportunity cost of sourcing the water from an alternative source over the lifetime of the agreement.

4.3.3. Contracts can address drought risk by defining the conditions in which the seller can curtail supply

As noted above, one way to address drought risk in contract design is for the seller to price-in the costs it faces to supply the contracted volumes in drought conditions, weighted by the probability of this occurring. However, another approach is to define the conditions in which the seller is not obliged to supply water to the buyer.

The specification of who bears volume risk under the contract is sometimes described as defining the "firmness" of the supplier's obligation to supply the specified volume to the purchaser under the contract. The firmness of a contract refers to the degree to which the supplier commits to supply the water under the contract. A firm contract would stipulate high penalties for non-delivery of water by the supplier. A non-firm contract would give the supplier an option to supply water under the contract and would not penalise the supplier for not delivering water. Firmness of volumes of water may differ within the same contract.

In a firmer contract, the price paid by the buyer for the water will be higher to reflect the volume risk that the seller undertakes. In a less-firm contract, or an option to sell, the price paid by the buyer for water will be lower to reflect the volume risk that the buyer undertakes.

In other words, when pricing a non-firm contract, a seller's expected incremental cost need not consider periods of high-water scarcity because in those periods the seller would contractually renege on its agreement to supply the buyer. In a more firm contract, the seller's expected incremental cost may be higher to reflect its obligation to supply the buyer even in periods of drought. Equally, the opportunity cost of sourcing the water elsewhere for the buyer would be higher in periods of drought. Therefore, the value of a firm contract that delivers water in periods of scarcity will be greater to the buyer.

Hence, there is a relationship between the penalties for non-compliance, the firmness of the contract, and the price of the water in the contract. The higher the penalties for non-compliance, the firmer the contract, and the higher the price that the purchaser pays for water.

A firmer contract will also be more effective as a water resource planning option to the purchaser. In order for a trade to effectively form part of a buyers plan to have sufficient water available for its customers during drought, a buyer needs to be sure that the seller will supply the volumes specified under the contract.

4.3.4. Trading parties also face the risk of regulatory change

Similar to the risks regarding the seller's ability to supply water due to drought, the EA's decisions to revoke abstraction licences can also restrict the volume of water the seller has available to sell. Other regulatory decisions, such as changes in drinking water quality standards, may also affect the costs faced by the seller to meet its obligations under a contract.

Defra states that "Incumbent water companies have statutory environmental duties to prevent them from entering into water bulk supply and discharge agreements that would damage the environment".[59] The act of trading may increase environmental risks, or the costs of complying with environmental requirements and regulations in order to manage higher environmental risks. The costs of compliance, and the pricing of environmental risk, could be priced in the contract through adjustments to the expected long run average incremental cost.

However, pricing regulatory or environmental risk could be challenging, as the nature and effect of future changes in regulation cannot be known when a contract is first signed. Hence, an alternative approach could be for the contract to include provisions which allow for adjustment of the contract provisions due to changes in regulation. For example, it is very common for contracts to include "change in law" provisions.

59 Defra (April 2018), Water Industry: Guidance to Ofwat for water bulk supply and discharge charges, p. 5.

5. Overview of Existing Contracts to Trade Water

In this section, we provide a summary and our key findings from our review of current contracts. We provide an overview of the number and type of contracts that we examine in Section 5.1, and then present our key findings in Section 5.2. We present full findings from our review of current contracts in Appendix A.

5.1. Overview of the Contracts Examined

We reviewed 21 contracts for bulk water trades in England and Wales that were submitted by water companies in response to a request from RAPID. Most contracts submitted were for trades between incumbent water companies, however, 2 contracts were NAV supply contracts and therefore fell outside the scope of this study. We list the contracts that we received in Table 5.1 below.

We reviewed 7 contracts pertaining to the bulk supply of raw water, and 12 contracts pertaining to the bulk supply of potable water. Of those potable water contracts, the majority were for the continuous bulk supply of potable water, with only 3 contracts written explicitly for the emergency supply of potable water under conditions of drought or water shortage caused by maintenance. Most raw water contracts pertained to the supply of raw water from a specified source, along with the construction of infrastructure to facilitate the bulk supply from that source. One raw water contract was an option bought by a water company for the right to reduce the abstraction by an industrial customer. One contract was for the emergency supply of raw water.

The vast majority of contracts for bulk supply of potable water were written since 2015 (9 out of the 12 potable water contracts). However, the majority of raw water contracts that we reviewed were older agreements, often commencing prior to 2000 (4 out of the 7 raw water contracts).

Many of the contracts that we reviewed referred to an associated water quality protocol or operational agreement, however few contracts that we reviewed had the agreements attached. Water quality protocols provide more detailed agreements governing the water quality of the supply, and may be used to place obligations on the supplier to meet water quality standards that are different from the DWI’s minimum standards. Operational agreements provide more explicit contractual agreements governing the operation of assets built to support the contracted trade.

While the contract pricing terms are stated in contracts, only in a very small number of cases were we able to determine the approach taken to decide upon the price agreed in the contracts. We engaged with some stakeholders to further understand the context between the contracts that we reviewed, and to understand their approach to agreeing the terms in the contract.

Table 5.1: List of Bulk Water Supply Contracts that We Received

[✂]

5.2. Key Findings from Our Overview of Existing Contracts

The table below provides a summary of the contracts we have reviewed.

	Key Lessons from Current Contracts
Contract Description	
Contract Standardisation	▪ We found, despite no industry standardised contract, that contracts between water companies for potable water followed some similar structures and contained similar elements. ▪ We understand that some companies have made a deliberate and focused effort to standardise terms across all their contracts, including updating legacy contracts in order to reduce the costs of managing contracts. These companies use their standardised contracts to both procure and supply water. ▪ However, some terms were not standardised across the contracts we examined, in particular the mechanism by which prices update over the tenor of the contract. The obligations placed on the supplier to fulfil the trade when water is scarce in its own area of appointment differed across contracts we examined. ▪ The contracts for raw water vary significantly. The lack of standardisation of raw water contracts relative to potable water contracts may be because raw water contracts are often associated with the development of bespoke infrastructure.
Quality Provisions	▪ Most of the contracts we examined used a relatively standardised form to set out the water quality standards that the seller was obliged to meet. ▪ Most of the contracts we examine refer to an associated Protocol governing agreements between the parties on water quality. However, many of the Protocols were not provided to us alongside the contracts and we were unable to review details pertaining to water quality outside of the main clause in the contracts. ▪ The DWI carried out a review of water quality provisions in contracts in 2014 (using a different sample of contracts from those we examine). It found that most companies had adopted standardised terms governing water quality following the "Water Quality Protocol for Bulk Supply Arrangements" but the DWI identified a number of issues with the use of the Protocol. It found companies had not agreed schedules of reporting water quality, did not mention a Drinking Water Safety Plan, or did not indicate how to periodically update the Protocol.
The Role of Industry Codes	▪ The contracts we examined commonly refer to industry standards set by regulators in acts of parliament or legislation. For instance, clauses for water quality commonly state that suppliers must ensure that the water meets standards specified in the Water Industry Act, the Water Supply (Water Quality) Regulations 2000 or an authorised departure from such standards. ▪ In contracts for the emergency supply of water, regulatory approved standards are commonly used to define an emergency under which the purchaser may access the supply e.g. issuance of drought permits or order. ▪ The application of a drought permit or order is often used to alleviate the supplier's obligation to supply water under a continuous supply contract.

	Key Lessons from Current Contracts
	▪ On the one hand, referring to industry codes and regulatory definitions may save significant transaction costs in the trading of bulk water. ▪ Referring to industry codes also provides trading parties a degree of protection from unforeseen circumstances. For instance, tying definitions of water scarcity and quality to industry codes ensures that parties do not need to define such standards to be robust to all future events at the commencement of the contract. ▪ The management of regulatory risk varies across the contracts we examine. In some cases, contracts include terms whereby the contract could be renegotiated following significant regulatory change.
Nature of Contractual Commitment	▪ Most raw and potable contracts involve a firm commitment to supply or purchase a minimum volume of water, and a call-option for the purchaser to buy additional volume up to a maximum flow rate. ▪ The purchaser of water in the contract often faces volume risk in the event that the supplier faces water scarcity in its own region. Clauses that allow the supplier to renege on its obligation to supply water to the purchaser without penalty in order to prioritise its own customers under the contract in times of water scarcity are common in the contracts we reviewed. ▪ However, the definition of water scarcity that triggers such adjustments in the supplier's obligations is not standardised. ▪ Clauses that allow suppliers to prioritise their own customers in times of water scarcity, by allowing the supplier to default on its obligation supply to the purchaser without penalty, reduce the firmness of the contract.
Typical Tenor of Contracts	▪ Contracts for raw water tend to have longer tenors than contracts for potable water. The longest tenor of a contract for potable water that we reviewed was 25 years, whereas the shortest tenor of a contract for raw water was 25 years.
Secondary Trading	▪ Water companies may not trade the bilaterally negotiated contracts they hold with other companies, as it seems from our review that the contracts cannot be transferred between parties. ▪ Each water company is a regional monopolist and is therefore the only counter-party that may hold a contract to supply or purchase water with its neighbour. ▪ However, in some cases, water companies may be able to trade the water that they purchase through trades thereby engaging in secondary trading. ▪ Some contracts that we reviewed include destination clauses stating that the purchaser could only use the water to fulfil its statutory requirements to serve its customers. Some contracts also explicitly stated that the purchaser could not use the water supplied to sign additional bulk supply contracts.
Pricing and Cost Allocation	
Approach to Determine Pricing	▪ The approach to determine the level of pricing in the contracts we examined is not explained in the contracts themselves. Therefore, we do not know how the charges were calculated and the costs they reflect, except when contracts refer to published wholesale charges.

	Key Lessons from Current Contracts
	▪ When companies use their published wholesale charges to underpin bulk supplies, they are pricing on the same basis offered to their own customers within their main networks. We understand that water companies publish wholesale charges that follow Ofwat's wholesale charging rules. ▪ The published wholesale charges therefore provide a baseline from which the supplier can price the trade. Should the purchaser request terms different to those received by other customers in the supplier's network, the supplier would adjust the prices from the baseline to reflect the costs of offering those terms. ▪ Our review therefore suggests that suppliers are adopting a mix of average cost and marginal cost pricing approaches.
Link to Costs	▪ We are unable to determine from the contracts how the prices were determined in the contract and how the prices link to the costs of facilitating the bulk trade.
Typical Structure of Pricing	▪ The majority of contracts for the bulk supply of potable water follow a two-part charging structure with a fixed standing charge paid irrespective of the flow demanded and a volumetric charge paid on the basis of actual metered demand. ▪ Other contracts for potable water followed a tiered volumetric pricing structure whereby the volumetric charge that applies to the first X litres of water is lower than the volumetric charge that applies to the subsequent Y litres of water demanded by the purchaser. The tiered volumetric pricing structure may allow charges to better reflect the cost structure of supplying the contracted volumes. ▪ Very few of the pricing structures that we examine had provisions for the charge paid by the purchaser to change across the year. ▪ In the contracts we examined, the pricing structure in contracts for raw water were more diverse than for potable water.
Adjustments to Price for Changing Costs	▪ In most contracts, adjustments to prices are not explicitly linked to changing costs of operation. Consequently, prices may not recover changing costs if the mechanism used to update prices does not capture the change in costs incurred. ▪ Whilst most contracts that we review update charges over time, there was not a standardised approach to updating prices. Approaches included updating prices with inflation indices (RPI, CPI or CPI-X), updates to published wholesale charges, or updates that reflect average annual changes in consumer bills.
Infrastructure and Investment	
Links to Infrastructure	▪ Water requires infrastructure to facilitate its transportation, abstraction, and treatment. Even the simplest trading agreement to facilitate a supply of water to a neighbouring network requires both a meter, to measure flow and ascertain the charging basis, and a connection with the source network. ▪ In our sample, contracts for raw water seemed in general to be linked to larger investments in infrastructure than contracts for potable water.

	Key Lessons from Current Contracts
The Role of Contracts to Support Infrastructure	▪ In most contracts for potable water, some infrastructure is required to support the trade e.g. meters and connections. In these cases, the contract explicitly allocates the liability for the costs of the infrastructure between parties. ▪ In raw water contracts, contracts often relate to the joint development or use of a water source. In these cases, contracts for raw water not only define cost sharing between parties, but also commit parties to purchase water from the source after its development in order to finance the investment in the infrastructure. ▪ Agreements for raw water typically include a schedule of payments in the event of early termination in order to protect the party which bears most costs from the risk of stranded assets. However, the form of the schedule of payments was not standardised across contracts.
Cost Sharing	▪ The costs of assets or works borne by each party are normally explicitly defined in the contract along with the ownership of the asset. ▪ Generally, cost sharing in the contracts that we examined follows a beneficiary pays principle. In contracts where infrastructure is developed to facilitate the trade of water to the purchaser, the costs of that infrastructure are normally borne by the purchaser. ▪ A common asset installed as part of a bulk supply contract for potable water is a meter to monitor the flow demanded by the purchaser of the water. In most contracts that we examined, the meter is installed and operated by the supplier. ▪ In raw water contracts to develop joint works or sources, the costs of infrastructure or operating costs are generally borne by parties in proportion to the benefit they receive from the asset. ▪ However, the party that bears the cost of constructing the asset is not necessarily the party which manages the construction of the asset or the eventual operation of the asset. Normally, contracts provide clear instructions to share details of the tender for construction and cost overruns with the purchaser, which may bear some or all of the construction costs. We understand that most contracts are also supported by an operational agreement of the asset agreed by both parties to set out operational terms of the infrastructure upon commissioning. ▪ In at least one contract we examined, the operational limitations of the infrastructure did not align with the financial flexibility offered by the contract. ▪ Potable water contracts place an obligation to treat the water on the supplier, and define the supplier's obligations to supply potable water to the standards set out in the Water Supply (Water Quality) Regulations 2000. ▪ Should the purchaser require additional treatment of the water beyond the regulated standard, it faces the costs of that additional treatment.
Role of Industry Codes	▪ Industry codes are not used explicitly in contracts to share costs or determine the assets appropriate to support the bulk trading of water. ▪ However, investment in infrastructure and other operational costs to facilitate bulk trading are funded through companies' total expenditure

	Key Lessons from Current Contracts
	allowances, which Ofwat sets using its benchmarking models and its cost assessment.
Allocation of Risks	
Allocation of Risks	▪ **Risk around the availability of water:** In most contracts, the purchaser faces volume risk over the availability of water. Most contracts that we reviewed include clauses that absolve the supplier of its obligation to provide the supply when water is scarce in its own supply area. Moreover, few contracts that we review include penalties for non-compliance such that the purchaser is remunerated for the supplier failing to deliver the volume demanded. ▪ **Risk of cost changes:** The allocation of price risk, or more specifically the risk that costs change at a rate different to the price in the contract, depends on the pricing structure in the contract. When price is linked to the published wholesale charges of the supplier, the purchaser faces the risk that prices in future years are significantly different when the supplier updates its charges. In contracts which require the development of infrastructure, the risk of cost overruns is borne by the parties responsible for developing the infrastructure. ▪ **Risk of asset stranding:** The parties who invest in assets to support the trade also face the risk that the trade is subject to early termination and that they therefore lose their investment in those assets. Contracts that involve significant investment in infrastructure often include provisions by which the costs of investment are remunerated in the event of early termination of the contract. The mechanism by which investment costs are remunerated is not standardised. However, in other contracts, the recovery of investment in infrastructure in the case of early termination is not specified, and therefore parties would have to reach agreement through specified dispute resolution processes should the need arise. ▪ **Risk of asset failure:** The risk that the asset fails, and therefore that the flow is interrupted is borne by all parties who are supplied water from the resource. ▪ **Risk of regulatory changes:** Both parties face the risk of regulatory change, depending on the change in question and the resulting impact on the contractual obligations of the party. Many contracts we examine included provisions for the parties to renegotiate the contracts following change in regulatory determinations, and typically aligned such options to renegotiate with the regulatory periods that Ofwat adopts in its price control methodology. However, in cases of renegotiation, amendments must be mutually agreed between parties. ▪ **Risk of water quality:** Typically, the supplier faces the risk over raw water quality in a contract for the bulk supply of potable water because it is contractually obliged to treat and deliver water to the purchaser at the standard set out by the Water Supply Regulations 2000. However, the supplier often does not face penalties for non-compliance with quality standards. In addition, the purchaser also faces risks over water quality, and in particular around variations in water quality and content above the regulatory standards met by the supplier. ▪ **Risk of creditworthiness of the counterparty:** The counter-party risk in most contracts is borne by the customers of the water company, to the extent that the costs of fulfilling the trading arrangement are included in the company's totex allowances. In some contracts we examine, a

	Key Lessons from Current Contracts
	clause is included to allow the supplier to demand the purchaser obtains a parent company guarantee or alternative form of finance e.g. letter of credit, should the credit worthiness of the buyer fall below a given standard.
Dispute Resolution	
Dispute Resolution	▪ The vast majority of the contracts that we examined do not include penalties for supplier non-compliance beyond formal dispute resolution channels. ▪ In the cases where the supplier may break the terms of the contract, the purchaser is often entitled to terminate the contract with less notice than it otherwise would be obligated to give but does not receive compensation for the supplier's failure to honor the agreement beyond refunds of existing payments for volume. ▪ Instead, most contracts rely on dispute resolution processes to settle non-compliance. In the case of dispute, and if negotiated settlement cannot be reached, disputes are referred to an arbiter defined in the contract – typically the Centre for Effective Dispute Resolution (CEDR). ▪ Most contracts include penalties for non-compliance by buyers including interest on late payments, particularly under contracts for potable water.

6. Key Lessons from Case Study Research

In this section, we draw key lessons from our review of trading in other jurisdictions. We examine trading in the following jurisdictions:

- Trading of electricity in Great Britain;
- Electricity interconnectors in Great Britain;
- Upstream gas contracts in Europe;
- Trading of water in Australia, in the Murray Darling Basin;
- Trading of water in Nebraska, in the Central Platte River; and
- Trading of water in California.

In this section, we summarise our findings from examining each of the above case studies. We present a brief introduction to the background of each case study and the need to trade as well as a summary of our key findings in each subsequent sub-section. We then summarise our findings across case studies in Section 6.7. We present our detailed review of all case studies in the appendices to this report.

6.1. Trading of Electricity Great Britain

Producers of electricity in power stations (or importers from neighbouring markets) produce electricity from other forms of energy (fossil fuels, renewable energy, etc.). They export this electricity onto transmission and distribution systems, which convey electricity to end customers.

The design of the electricity market places obligations on retailers to ensure they have procured sufficient electricity (measured in kilowatt-hours) to meet the needs of their customers within each 30-minute trading interval. Retailers meet this obligation by entering into contracts in the wholesale market to purchase electricity from generators. If they do not purchase sufficient electricity to meet the needs of their customers, they are required under the market rules to purchase electricity in the “balancing market”, organised by the Electricity System Operator (ESO).

Generators which agree to sell electricity to a retailer take on an obligation to supply the contracted volume of electricity in the trading periods covered by the contract. If they fail to do so, the retailer is not affected, but the generator is obliged to purchase any shortfall compared to the contracted volumes from the balancing market.

Hence, retailers and generators typically trade through forward contracts, and do not buy or sell their product in real-time. Instead, parties trade forward, striking contracts to buy or sell a particular volume of electricity for particular trading periods in the future, at a particular price, as described further below. Standardised forward contracts for electricity in Great Britain are traded on over-the-counter (OTC) markets, or through power exchanges. Contracts may also be privately negotiated between parties.

Forward trading for electricity has some similarities to the trading of water between regional utilities, i.e. securing bulk supplies to meet anticipated demand in the future. Long-term Power Purchase Agreements (PPAs) can also be used to trade electricity in conditions where new investment in physical infrastructure is required to supply the contracted volume.

However, unlike water, the value of electricity is determined in a competitive market with many buyers and sellers located throughout the country, which is possible because there is a national transmission system. There is also no variation in quality, as electricity is (at the point of use) a homogenous product. Because the electricity wholesale market is reasonably liquid and competitive, the price is not directly subjected to regulation.

We draw the following key lessons from the case study:

- The contracts to trade electricity in Great Britain are highly standardised. The process of standardisation was led by market participants who have developed trading agreements within the regulatory rules, British Electricity Trading and Transmission Arrangements (BETTA) and the Balancing and Settlement Code (BSC) which dictate how the contractual positions for power relates to the physical delivery of power. Standardisation of electricity products is made easier because electricity has no quality differentiation and the market rules allow electricity generated in any location to be treated as substitutable when contracted for in forward markets.
- Contract standardisation means that the most important information to parties is the price that other market participants are willing to buy or sell the contract at. The value of transparency in pricing leads to concentrating liquidity on a specific platform. For example, contracting for electricity forward products has concentrated on the OTC market in Great Britain.
- Industry codes support trading by specifying penalties for non-compliance and thereby incentivise efficient forward trade. The BSC stipulates the penalties for parties whose physical position does not comply with their contractual position for power. If a party over-consumes or under-produces relative to its contractual position, it must purchase the additional volume of energy at the real time balancing price. Likewise, if a customer over-supplies electricity relative to its contractual position or under-consumes, it will sell that extra energy at the balancing price. The balancing price is derived from the weighted average prices of offers and bids accepted by the SO in the balancing market.
- Suppliers may pass risks and costs to customers through higher prices. However, given competition in supply, customers are able to switch between suppliers to avoid higher pricing. Customers bear the transaction costs associated with switching, but can limit their exposure to a supplier with higher costs by switching. Ofgem protects customers through its supplier licensing rules. More specifically, if customers are in credit with their supplier and their supplier declares insolvency, the credit balance is protected and funded by mutualising the costs across the industry, i.e. the costs are borne by all customers in the market through Balancing Use of System (BSUoS) charges. Whilst that still means customers in aggregate bear the costs of the supplier's failure, the costs are shared across the wider industry.

6.2. Electricity Interconnectors in Great Britain

Electricity interconnectors are the transmission cables that allow the trade of electricity from one country to another. Electricity interconnection allows the purchase of electricity in Great Britain and its sale in an "interconnected" market, or vice versa. And because half-hourly electricity prices are volatile, the direction of trade can change from hour-to-hour.

The use of interconnectors is governed by contractual rights. The party holding the right to use capacity on an interconnector has the option to "nominate" power flows in one or either direction across the interconnection line. These power flows, which involve a volume of energy trade defined in megawatt-hours, have a value to the capacity holder equal to the difference in wholesale electricity prices at either end of the interconnector. The value of interconnection capacity rights therefore is determined in the wholesale electricity market, through the process of electricity trading on either side of the interconnector.

There are two types of investment in interconnectors:

- *Regulated investments developed by regional Transmission System Operators (TSOs):* As TSOs are natural monopolies, they tend to be subject to economic regulation allowing investors a reasonable opportunity to recover their costs through similar types of regulatory procedures as apply at Ofwat's price reviews. When the regulator approves a new investment, the costs of the investment will be included in the Regulated Asset Base (RAB) of the company via regulated tariffs passed through to consumers.[60] In this model, investors' revenue depends only the regulatory determination of allowed costs, rather than on congestion rent based on the sale of capacity contracts that allows the holder to arbitrage wholesale prices at either end of the interconnector.

- *Merchant investments:* Some new interconnectors have been developed as "merchant" projects, which means that unlike the regulated model, the investor obtains a derogation from obligations to offer regulated third-party access. Such derogations require approval from national and European regulatory agencies, and require that the new interconnection owner meets a number of tests, including that the project would not be viable without the derogation, that it improves competition, etc. In such cases, the investor may be allowed to earn a return higher than a regulated rate of return.

Whilst contracts between parties may be signed throughout the investment and construction of the interconnectors, the contracts to support the investment in the infrastructure are contracts signed between the owner of the interconnector and users of the interconnector before its construction. These are the contracts that we focus on in this case study.

Contracts to use the interconnector can have various tenors, and can be traded on secondary markets. In principle, they can be as short as a single 30-minute trading interval or span multiple years. Indeed, because interconnectors are significant capital investments, capacity is sometimes sold to market participants through long-term contracts that support the development of new "merchant" projects (described further below). However, interconnectors can also be developed and funded through more traditional regulatory models, with the capital costs added to the RAB of the regulated transmission company in one/both of the interconnected markets.

There are a number of similarities between the case of electricity interconnectors and the bulk trading of water. Like water trading between areas, trading of electricity over interconnectors involves the development of (or use of existing) long-lived infrastructure to support the exchange of a commodity. The infrastructure is also often developed by regulated natural monopoly companies, so this case study may bring lessons with respect to the design of contracts and regulation to encourage and remunerate development of infrastructure by regulated companies.

60 A RAB is equivalent to the Regulated Capital Value (RCV) of a water company.

Like water trading, electricity trading between jurisdictions has the potential to increase costs for customers in the exporting country and reduce costs for the importing country. Hence, the methods used to allocate costs need to ensure an equitable distribution of the gains from trade, to ensure customer protection and political acceptance of trade in each jurisdiction.

We draw the following key lessons from the case study:

- The costs of new interconnection investments can be allocated across trading parties based on a mutually agreed split. However, in the event of disagreement of how to split the costs of a project, the parties may appeal to the European Agency for Cooperation Energy Regulators (ACER), which uses "beneficiary pays" rules to determine the cost allocation of projects. The set of rules may promote efficient investment in infrastructure by ensuring that the parties who benefit from the infrastructure pay for that infrastructure whereas the parties who may be potentially harmed may be compensated.
- However, following significant investment in infrastructure, the European Commission imposes third party access rules to ensure that access to that infrastructure is provided on competitive, incremental cost terms. Therefore, owners of infrastructure financed through bespoke contractual arrangements, either as merchant investors or TSOs financed by customers, cannot earn rent from infrastructure above the rate of return allowed by the regulator.
- Instances of merchant investments in interconnectors highlights the importance of providing economic incentives to trade. Under a regulated approach to interconnector investment, TSOs do not greatly benefit from investment because the costs of investment enter into their RAB to be recovered from customers. Therefore, TSOs do not face an opportunity to recover economic profits on their investment. However, derogations to EU rules, dictating how investors in interconnectors can use the revenue from congestion and what access they must give to third parties, allow some merchant investors to identify new opportunities to build interconnectors and allow them to earn higher returns reflecting the higher exposure they face to the market value of their asset.
- In Great Britain, Ofgem's "cap and floor" regulatory mechanism allows for a range of regulated returns to interconnection developers, allowing those developers a guaranteed floor on returns, with some exposure to the market value of the asset up to a cap. This gives investors some incentive to promote efficient projects, above the regulated rate of return on transmission and distribution network investments within Great Britain.

6.3. Upstream Gas Contracts in Europe

The upstream market for gas is where buyers, such as gas retailers and utilities, traders and large industrial users, sign contracts to purchase gas from large producers of gas. Like electricity, most European gas customers draw gas from a national transmission system of pipes for gas which is operated by a Transmission System Operator (TSO). Large producers extract the gas from its source, either underground or under the sea bed, and transport ("ship") the gas to entry points to the national transmission system.

Unlike electricity, the locations where gas is produced, or extracted, are not determinable by market participants and therefore the gas must be shipped to where it is consumed. In other words, one may locate an electricity generator to produce electricity near to where electricity is going to be consumed, and near to existing transmission infrastructure to transport the electricity to customers. A gas producer cannot change where natural gas has formed and must therefore construct the infrastructure to move the gas to where it is to be consumed.

The location-specificity of gas production means contracts to source gas are associated with large infrastructure investments to ship the gas to market. Moreover, because infrastructure investments are bespoke and represent a commitment to ship gas to a single market, the risks associated with recovering the investments are tied to the volume demanded and price of gas in the market.

Like gas, water is expensive to transport, and requires infrastructure to facilitate bulk trading arrangements. To this extent, water is also location-specific and long-term contracts to abstract and transport water along bespoke infrastructure are subject to volume and price risks at both the source and delivery point. In addition, gas varies in quality, for example through calorific value and biproducts.

However, whilst initially long-term contracting for gas occurred across jurisdictional borders, and often between monopolists (regulated or owned by the state), the value for gas is largely determined by market forces. Where a market for gas had not developed, participants instead gauged the market value for gas based on the market value of oil-based products or coal as a substitute to gas. On the other hand, water is often priced on a cost basis rather than a market basis.

Therefore, the risks facing buyers and sellers in the water industry have some similarities with those facing buyers and upstream producers in gas. In particular, suppliers face volume risks when they invest in infrastructure to ship the gas to market. Buyers may be willing to sign long-term contracts for water to ensure resilience, in other words to ensure security in supply. Both parties may require long-term contracts to achieve price certainty, hedge market risks and secure long-term commitments to fund infrastructure investments.

We draw the following key lessons from the case study:

- Upstream contracts for gas frequently require investment in significant infrastructure to ship the gas to market. The risk facing the supplier is that demand in the market where the pipeline ends, or from the purchaser, is not high enough to recover the costs of investment. The supplier manages this volume risk through take or pay commitments in the contract: a minimum commitment from the purchaser to buy gas from the supplier.
- Third party access rules aim to reallocate spare capacity on pipelines financed by bespoke long-term contracts with take or pay clauses, so that it may be used by other parties. Ensuring third party access at fair terms to existing infrastructure can support the development of new, smaller fields, which are not large enough to support investment in new infrastructure to bring the gas onshore. EU regulators have also perceived that such processes prevent potential anti-competitive behavior by owners of key pipelines financed under bespoke long-term contracts, who could otherwise extract profits through charging parties for access to their infrastructure. In the UK the Oil and Gas Authority (OGA) enforces similar access terms for British pipelines in the North Sea.
- Legacy contracts included destination clauses which prevented or limited the buyer from reselling the gas in other markets. The European Commission has moved against destination clauses deeming them uncompetitive, and has negotiated the deletion of such clauses from legacy contracts.

- Standardisation of terms, led by market participants, of LNG contracts and terms governing shipping, insurance and taxes has lowered the transaction costs of trading and provided clearly defined transfer of property rights of gas between the supplier and the buyer.
- Upstream contracts for gas often reflected the asset life of, or financial terms of investment in, the associated infrastructure. Initial contracts underpinning large pipeline investments were signed on long tenors of 25 years. On the other hand, contracts for gas to support financing in CCGTs were signed over shorter durations e.g. 10 years, reflecting the financial terms of investment in the infrastructure.

6.4. Bulk Trading of Water in Australia

We focus on water trading in the Murray-Darling Basin (MDB) which accounts for the majority of water trading in Australia.[61] The MDB spans five states/territories: Queensland, New South Wales, Victoria, South Australia and Australian Capital Territory. The MDB is classified into different water systems:

- Regulated surface water systems: these are parts of the MDB where river flows are regulated (i.e. controlled) by dams and weirs;
- Unregulated surface water systems: where there are no controls or structures that can alter in-stream flow; rather it is dictated by natural events; and
- Groundwater systems: water beneath the land surface in aquifers.

The majority of systems in the MDB are regulated systems.[62] Systems are defined for broad geographical areas within the MDB. Much of the MDB is hydrologically linked, such that water can move through the MDB from one point to another. Where different systems (regulated and/or unregulated) are hydrologically linked, trade can occur between the two systems.

The market for water rights in the MDB is considered to be one of the more sophisticated and well-developed water markets in the world. There is a relatively large volume of trading, and trade has been increasing in recent years. Trades in the MDB relate to different types of water rights. The main types of water rights are:[63]

- **Water access rights:** these are rights to take and/or use water. The main types of rights are “entitlements” or “allocations”. An entitlement is an ongoing right allowing the holder to take from the MDB a share of available water over the life of the entitlement. An allocation provides the holder with a right to a specific volume of water in a given year – it depends on how much water is available in the water resource in the relevant year;
- **Water delivery rights:** these are rights to have water delivered by an irrigation infrastructure operator (IIO). They are typically specific to having water delivered

[61] Goesch, Tim, Manannan Donoghoe & Neal Hughes (2019), Snapshot of Australian Water Markets, Department of Agriculture and Water Resources, p. 2.

[62] Australian Bureau of Meteorology (2019), Australian Water Markets Report 2017-18, Southern Murray-Darling Basin Section, p. 6.

[63] Australian Competition and Consumer Commission (17 October 2019), “ACCC inquiry into water markets in the Murray-Darling Basin”, Issues paper, p. 3.

through irrigation infrastructure owned by a given IIO (delivery rights are not required for an individual irrigator that uses its own irrigation infrastructure); and

- **Irrigation rights:** these are also rights within an IIO's network. They are essentially a specific contractual arrangement, separate to the water entitlement/allocation, which entitle the holder to receive water from the IIO. An IIO will hold the water entitlement on behalf of its irrigator members, and allocate irrigation rights to those members for a share of that entitlement.

Irrigators are the main participants in water markets.[64] However, other groups also trade (often becoming significant traders at different times[65]), including urban water companies, environmental water rights holders, indigenous users and communities, water brokers and exchanges, and investors.

While the MDB is probably the most well-developed water trading market in the world, there are some key differences between trading in the MDB and trading for bulk supplies in the water industry in England and Wales. In MDB, most trading occurs in a single catchment, but one that covers a very wide geographical area. Because of hydrological interconnectivity of the catchment, there is not a separate requirement for infrastructure to facilitate the physical delivery of traded water entitlements/allocations. However, we understand that individual market participants invest in infrastructure to support use of the rights they have purchased on the platform.

On the other hand, most water trading in England and Wales occurs across multiple catchment areas and requires bespoke infrastructure to allow for delivery of the water. In addition, trade over multiple catchment areas may increase the environmental risks and water quality variation relative to trade within the same catchment area or source.

In addition, water trading in the MDB is between private companies with firm rights over abstraction. Those private holders trade their rights on a temporary or permanent basis, often through a centralised platform for trade or facilitated by brokers. On the other hand, water trading in England and Wales occurs through private bilateral negotiation between regional monopolies with non-firm abstraction rights issued by the EA. Water companies can only trade those abstraction rights with approval from the EA.

We draw the following key lessons from the case study:

- Water markets in the MDB are considered to be relatively sophisticated, with a high volume of trading, strong institutions and regulatory arrangements, and innovative products. The increase of trading volumes throughout the development of trading arrangements has been slow, which may suggest that markets need time to mature.
- Water rights are unbundled, with separate rights for water take/use and water delivery, and no requirement for rights to be tied to land. The former allows trading of part of a water take right, while still retaining a water delivery right. The latter allows participation by others such as environmental users, which can enhance market liquidity.

64 Goesch, Tim, Manannan Donoghoe & Neal Hughes (2019), Snapshot of Australian Water Markets, Department of Agriculture and Water Resources, p..4.

65 Australian Competition and Consumer Commission (17 October 2019), "ACCC inquiry into water markets in the Murray-Darling Basin", Issues paper, p. 7.

- Water rights are relatively homogeneous and standardised. While some differences between rights do occur in terms of priority, and differences across states and regulated/unregulated systems, industry codes have been developed to allow trading across states and systems. The rules create a standardised product that makes it easier to trade within the MDB.
- Consequently, transaction costs are considered to be relatively low,[66] which has facilitated trading.

6.5. Bulk Trading of Water in Nebraska

Most water in Nebraska is sourced from groundwater. Nebraska lies above the Ogallala Aquifer, one of the largest underground water resources in the world, spanning eight US states.[67] This and other groundwater resources are the source of 80 per cent of the total volume abstracted in Nebraska each year.[68]

Water resources in Nebraska are managed at the local level by 23 Natural Resource Districts (NRDs). NRDs are local government entities responsible for natural resource management, including water resources, within a defined region. Our focus in this case study is on groundwater trading within the Central Platte NRD (CPNRD). The land area of the CPNRD is approximately 2.1 million acres, of which approximately 1 million acres is irrigated farm land (with 937,000 acres irrigated by groundwater abstractions).[69] As a result, a key use of water in the District is irrigation, which is mostly used to grow corn and soybeans.[70] Other water users include municipal water users and commercial/industrial users not on the municipal supply.

Water rights being traded in the CPNRD are referred to as “certified acres” (or “certified irrigated acres”). These are rights to extract groundwater and irrigate a certain acreage of land area. Trade of certified acres can be either permanent or temporary. Until recently, only permanent trades of certified acres were allowed. Permanent trades are made by buyer and seller through bilateral negotiation, and require approval from the CPNRD for the trade to be effective.

In 2016 a Groundwater Exchange Program (GEP) was established to allow for short-term leases of certified acres. This allowed for certified acres to be traded on a temporary basis for the forthcoming growing season and was designed to lower transaction costs of trading. Trades only applied for the upcoming growing season, and certified acres reverted back to their original owner at the end of the season.

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66 See, e.g., Sarah Ann Wheeler and Dustin E. Garrick (2020), “A tale of two water markets in Australia: lessons from understanding participation in formal water markets”, *Oxford Review of Economic Policy*, 36(1), 132-153.

67 Elan Ebeling, Zach Kearl, Emma Weaver, and Noah Wentzel (June 2019), “Water Banking and Water Marketing in Select Western States: Case Study Review: Colorado, Idaho, and Nebraska”, Washington State Department of Ecology, p. 62.

68 Elan Ebeling, Zach Kearl, Emma Weaver, and Noah Wentzel (June 2019), “Water Banking and Water Marketing in Select Western States: Case Study Review: Colorado, Idaho, and Nebraska”, Washington State Department of Ecology, p. 63.

69 CPNRD, Mission Statement, Last accessed 7 April 2020, Link: http://cpnrd.org/about/.

70 Elan Ebeling, Zach Kearl, Emma Weaver, and Noah Wentzel (June 2019), “Water Banking and Water Marketing in Select Western States: Case Study Review: Colorado, Idaho, and Nebraska”, Washington State Department of Ecology, p. 72.

Trading occurred via an online platform. This operated in two distinct 10-day “windows” per year, where bids to buy/sell certified acres were submitted on the online platform. Prior to trading, potential participants registered through a pre-approval process, which required verification that the certified acres were held and agreement to the rules of the platform.

“Streamflow buyers” were allowed to participate on the platform and allowed certified acres to be purchased for uses other than irrigation. The idea was to allow flows to increase in the Platte River to enhance wildlife habitats, although this would only be on a temporary basis.

The GEP was discontinued after 2018. The lack of improvement in environmental outcomes (combined with lower participation rates than the CPNRD anticipated and high costs of running the program[71]) led to it being discontinued.

The use of a centralised platform for trading in the CPNRD differs from most cases of water trading where trading occurs by bilateral negotiation between buyer and seller. The platform explicitly sought to lower transaction costs (e.g. making pre-trade approval easy, simple to submit bids, etc.).

A key difference relative to water trading in England and Wales is that the main water use in Nebraska is irrigation, and the main trades that occur are between irrigators, or between irrigators and environmental water users. There is also relatively little link with infrastructure or water delivery. Most water rights relate to a groundwater resource, which can be tapped at different points in the District through the installation of the water user’s own well.

Similar to Australia, trading of water rights in Nebraska are between private entities with firm, often perpetual rights, drawing water from a single source. In England and Wales, water trading occurs between water companies who are regional monopolists across multiple sources, with abstraction right trading conditional on EA approval.

We draw the following key lessons from the case study:

- The use of a centralised auction platform in Nebraska may have lowered transaction costs and facilitated trade. However, the platform was discontinued after 3 years. The platform only allowed temporary trades, whereas permanent trades were made through bilateral negotiation.
- The platform did not achieve its environmental purpose to enhance in-stream flows through its promotion of temporary trading. It may be that promoting permanent trades is more important to reach such an environmental objective. It will be important to ensure that any trading regime is “fit for purpose” i.e. that the trading regime used is the most appropriate to meet the underlying objective.
- Whilst there were few trades on the platform, trading regimes can take some time to reach maturity (as the Australian experience indicates).
- The CPNRD set common rules over water scarcity that dictated the firmness of water rights in times of relative scarcity. Common rules on the firmness of water rights may

[71] Elan Ebeling, Zach Kearl, Emma Weaver, and Noah Wentzel (June 2019), “Water Banking and Water Marketing in Select Western States: Case Study Review: Colorado, Idaho, and Nebraska”, Washington State Department of Ecology, p. 75.

have significantly reduced transaction costs and facilitated trade by platform rather than bilateral negotiation.

6.6. Bulk Trading of Water in California

The California water market is characterised by a locational mismatch between water demand and water supply due to differing climate and geography.[72] This leads to a need for large amounts of water to be transported long distances from the north of the state to meet demand from agriculture and large urban areas in central and southern parts. Approximately 50 per cent of water use in California is for environmental uses, 40 per cent is for agriculture and the remaining 10 per cent is urban uses.[73] Environmental water use includes water that is protected for a number of environmental reasons, including “wild and scenic” protected rivers, water required to maintain habitats and wetlands, and water needed to maintain water quality for agricultural and urban uses.[74]

California has an extensive network of infrastructure, including canals, aqueducts, dams and rivers to move water around the state, generate power, and for flood protection.[75] Water is predominately allocated from managed infrastructure systems (or projects) in California, managed by state or federal agencies. The largest water project in California is the State Water Project (SWP), which transports water from rivers in Northern California to urban and industrial users in Southern California.[76] In addition, the Central Valley Project (CVP), covers two watersheds, associated with the Sacramento and San Joaquin Rivers. Initially built to regulate water shortages and floods, the project now also supplies municipal water and generates power.[77]

Water is allocated from these projects to water users, some of which are irrigation districts (which in turn allocate water to individual irrigators), while others are individual irrigators, municipal or urban water users.

Water users in California hold water rights. Within water projects, rights are generally held by government agencies or state water contractors who then supply water to different municipal, industrial and agricultural users. Individual municipal, industrial and agricultural users also hold water rights.

72 Schwabe, Kurt, Mehdi Nemati, Clay Landry, and Grant Zimmerman (2020). "Water Markets in the Western United States: Trends and Opportunities." Water 12, no. 1, 233, pg.5

73 Public Policy Institute of California (May 2019), Just the Facts – Water Use in California. From: https://www.ppic.org/publication/water-use-in-california/

74 Public Policy Institute of California (May 2019), Just the Facts – Water Use in California. From: https://www.ppic.org/publication/water-use-in-california/

75 Public Policy Institute of California (September 2019), Just the Facts – California’s Water Grid, From: https://www.ppic.org/publication/californias-water-grid/ accessed 09/04/20

76 California Department of Water Resources, State Water Project, Last accessed 16 April 2020, Link: https://water.ca.gov/Programs/State-Water-Project

77 Bureau of Reclamation, California-Great Basin, About the Central Valley Project, Last accessed 16 April 2020, Link: https://www.usbr.gov/mp/cvp/about-cvp.html

There are a variety of different types of water rights in California. Some are firm rights, where others are adjusted depending on precipitation.[78] The two main types of surface water rights in California are riparian and appropriative rights:

- **Riparian rights** come from owning land adjacent to a water body and gives rights to use a share of the water flowing past a property. Riparian rights do not require a specific permit, but also do not entitle the owner to store water for the dry season or use on land outside the watershed.[79]
- **Appropriative rights** are essentially a "first come first served" right which must be applied for from the State Water Board.[80]

In California, water rights can be sold or leased over the short or long-term. From 2009-2018, a large majority of the water right transfers in California were leases rather than permanent sales.[81] Trades are usually made between water users within water projects, or are purchased by government entities.

The water rights system in California is highly heterogeneous: there are different types of rights (e.g., riparian, appropriative), some of which do not require an associated permit. Similarly, the specification of the rights can be quite variable, as can pricing for water use.

Trading of rights is relatively complex, requiring regulatory approval but also the approval of third parties to ensure that trades do not impose adverse effects on those parties. The process has different rules for different agencies and different types of water rights, so it is often fragmented and inconsistent.[82] This has resulted in relatively high transaction costs, and limited trading.

Again, trading in California, like Nebraska and Australia, relies on the distribution of firm abstraction rights across private entities, and a subsequent system of rules to allow trade between private agents. Like England and Wales, water trading in California occurs across multiple water sources, and with a system of rules to prevent third party or environmental damage.

We draw the following key lessons from the case study:

- The water rights system in California is highly heterogeneous: there are different types of rights (e.g., riparian, appropriative), some of which do not require an associated permit, and different priorities. Similarly, the specification of the rights can be quite variable, as can pricing for water use.
- Trading of rights is relatively complex, requiring regulatory approval but also the approval of third parties to ensure that trades do not impose adverse effects on those parties. The process also has different rules for different agencies and different types of

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78 Hagerty, Nick (2018), "Liquid constrained in California: Estimating the potential gains from water markets." Department of Agricultural and Resource Economics, UC Berkeley: Berkeley, CA, USA.

79 California Water Boards, The Water Rights Process, Last accessed 8 April 2020, Link: https://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.html

80 California Water Boards, The Water Rights Process, Last accessed 8 April 2020, Link: https://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.html

81 Schwabe, Kurt, Mehdi Nemati, Clay Landry, and Grant Zimmerman (2020). "Water Markets in the Western United States: Trends and Opportunities." Water 12, no. 1, 233, p. 6-7.

82 Public Policy Institute of California (May 2019), Just the Facts – California's Water Market.

water rights, so it is often fragmented and inconsistent.[83] This, combined with a lack of contract standardisation, has resulted in relatively high transaction costs, and limited trading.

- Litigation and disputes are also relatively common, and challenges to trades (e.g. by third parties) can be time consuming and expensive.[84]

6.7. Summary of Key Lessons from Our Case Studies

The table below provides a summary of the lessons drawn from our case studies.

Table 6.1: Summary of Case Study Research

	Key Lessons from Case Studies
Contract Description	
Contract Standardisation	▪ Contracts conformed to some degree of standardisation in most of the industries that we examined. ▪ Contract standardisation, whilst often supported by industry codes, is often market-led and organic with the development of the market. In electricity and downstream gas markets, contract standardisation and large numbers of market participants led to the pooling of trades at centralised hubs which further reduces transaction costs and promotes transparent pricing. ▪ Contract standardisation is less apparent in markets with fewer trading participants and when the contract is more bespoke, such as those underpinning investments in infrastructure. Contracts to develop interconnectors are a particular example of this.
Quality Provisions	▪ Few of the case studies we examine have the same degree of differences in product quality as the water industry in England and Wales. ▪ Two of the water trading case studies we examine, Nebraska and Australia, draw water from a common (or at least hydrologically linked) source, reducing the risks of variations in water quality. ▪ To the extent that variations in quality of product are possible e.g. the voltage of electricity, trading arrangements refer to industry codes for standardised definitions of quality to be used in contracts.
The Role of Industry Codes	▪ Industry codes played important roles in all the case studies we examine. ▪ In some markets, industry codes facilitated the development of contracts by defining common rules to coordinate trade. For example, in the British electricity market, the BSC provides a common set of rules defining how contractual power links to the physical delivery of power. ▪ In other markets, industry codes define minimum standards referred to in the contracts thereby reducing transaction costs. For example, in trading

[83] Public Policy Institute of California (May 2019), Just the Facts – California's Water Market.

[84] Haneman, Michael and Michael Young (2020), "Water rights reform and water marketing: Australia vs the US West", Oxford Review of Economic Policy, 36(1), 108-131.

	Key Lessons from Case Studies
	for water in Nebraska, certified acres are supported and defined in a set of rules and regulations developed by CPNRD. ▪ Industry codes are also important in defining clear property rights to facilitate efficient, competitive trade. In the trading of rights for water in the MDB, the government sets common rules of trade to facilitate efficient and competitive trade by removing restrictions on the use of water under the right. The European Commission intervened in upstream gas contracts to prevent destination clauses in order to promote efficient competitive trade. ▪ In addition, the government sets rules minimising externalities, for example environmental externalities, from trades thereby facilitating efficient trade.
Nature of Contractual Commitment	▪ The nature of the contractual commitment varied across the case studies that we examined. Contracts with less firm commitments to deliver the product can place higher volume risks on the buyer. However, they can also increase the price risk faced by the seller. Equally, contracts that allow the buyer an option to purchase the product place higher volume risks on the seller. The price of the product reflects the corresponding risks borne by the parties in the contract. ▪ Some of the products we examine defined the availability of the product for trade with reference to a regulatory decision. For example, in the trading of water rights in Nebraska, the CPNRD could reduce the amount of water abstracted using the right by defining the "acceptable decline" based on the level of water table.
Typical Tenor of Contracts	▪ The tenor of contracts we examine varied across the case studies. In all the water trading schemes we examine, rights were issued in perpetuity. However, those rights could be traded, permanently or temporarily in the market. In cases where government agencies determined that water abstraction should be reduced, the agencies would need to buy back the rights previously allocated. ▪ When contracts related to infrastructure, the tenor of contracts often reflected the asset life of, or financial terms of investment in, the infrastructure. For example, in upstream gas, initial contracts underpinning large pipeline investments were signed on long tenors of 25 years. On the other hand, contracts for gas to support financing in CCGTs were signed over shorter durations e.g. 10 years, reflecting the financial terms of investment in the infrastructure.
Secondary Trading	▪ In many cases we examine, a party enters into a contract with a specific counter-party and therefore is unable to engage in secondary trade. However, to the extent that the contract is standardised, the party could enter into a new trade to augment its original contracting position. ▪ In markets involving centralised "hubs" with standardised contracts, e.g. trades at MDB, the water rights do not stipulate an explicit counter-party and therefore secondary trading may be engaged. ▪ In upstream gas, destination clauses in legacy contracts place restrictions on the purchaser to sell the gas bought in long-term contracts to other

	Key Lessons from Case Studies
	markets or participants. The European Commission deems destination clauses uncompetitive except in rare circumstances e.g. restrictions on flaring.
Pricing and Cost Allocation	
Approach to Determine Pricing	▪ In all but one of the case studies we examine, the price of the contract is determined by market forces. Market forces determine prices that reflect the opportunity cost of purchasing the product, in other words, the cost that the buyer would otherwise need to pay in order to access the product. In a competitive market the opportunity cost of purchasing the product reflects the marginal cost of the product. ▪ The one exception in the case studies we examine is the market for interconnectors. In this market, two pricing approaches have developed. The regulated model is a cost-based model of pricing investment whereby the costs of investment enter into the RAB of the TSO. In this sense, the "price of the contract", in other words the price borne by the customers of the TSO, reflects the costs of the investment. However, cost based pricing provides little incentive for the TSOs to identify opportunities to build interconnectors. Some projects have been developed under a merchant model of pricing whereby the investor is subject to some uncertainty over the return from building the interconnector. The return is determined by market forces i.e. purchasing of standardised products to use the interconnector. ▪ Ofgem's "cap and floor" approach represents a compromise between these two models, in which the regulated rate of return is defined, but with exposure to the market value of the interconnection capacity relative to the project costs between a floor and a cap.
Link to Costs	▪ In all but one of the case studies we examine, the price of the contract is determined by market forces rather than by costs. Therefore, whilst the price reflects costs implicitly, it is not directly linked to costs. ▪ The regulated model of investment in interconnectors does directly reflect costs, and those costs are passed into the RAB of the TSO.
Typical Structure of Pricing	▪ The structure of pricing varied across industries and contracts. However, in most cases the structure of pricing was organically developed by market participants through trading and bilateral negotiation.
Adjustments to Price for Changing Costs	▪ There was not a common approach to adjusting pricing for changing costs. In most cases, contracts are standardised and continually traded in a market with transparent prices. Consequently, the market value of a contract is known, and parties may trade other standardised contracts to implicitly adjust the price agreed in the original product. For example, in downstream electricity, a retailer or generator may agree further trades in the market at different prices to adjust their position in terms of volume, but also the price paid for that volume. ▪ In other cases, e.g. the trading of water rights in Nebraska and Australia, the ability of market participants to trade rights on a permanent or

	Key Lessons from Case Studies
	temporary basis in the secondary market allows them to adjust the price received or paid for the water right. ▪ In upstream gas contracts, prices in historical contracts were linked, in the absence of the market value for gas, to the prices of substitute fuels e.g. oil-based products. As the market for gas developed, and hub-to-hub trading increased, contracts began to index to hub prices to update the price of gas in line with market prices. Legacy contracts were often renegotiated to re-index to gas hub prices instead of oil-based products.
Infrastructure and Investment	
Links to Infrastructure	▪ In two of the case studies that we examine, upstream contracts in gas and investment in interconnectors, one of the main purposes of the contract is to finance significant investment in underlying infrastructure.
The Role of Contracts to Support Infrastructure	▪ Contracts are often used to manage the volume risks, and risk of stranded assets, associated with large infrastructure investment. For example, upstream gas contracts require large investment in pipelines to ship the gas from where it is produced to the purchaser. The risk facing the supplier is that demand in the market where the pipeline ends, or from the purchaser, is not high enough to recover the costs of investment. The supplier manages this volume risk through take or pay commitments in the contract: A minimum commitment from the purchaser to buy gas from the supplier. ▪ Similarly, merchant contracts for interconnectors allow the investors to sign long-term contracts for capacity to the interconnector which provides a guaranteed amount of congestion revenue, and helps mitigate the risk that actual congestion revenue is insufficient to recoup the costs of investment. In regulated contracts for interconnectors, the risk of stranded assets is borne by customers of the TSO, from whom the TSO recovers its RAB.
Cost Sharing	▪ Contracts may also explicitly specify the sharing of costs of joint investment in infrastructure. In the case studies we examine, such splitting of costs is often backed by industry codes. ▪ The costs of new interconnection investments can be allocated across trading parties based on a mutually agreed split. However, in the event of disagreement of how to split the costs of a project, the parties may appeal to the European Regulatory Body, ACER, who uses a set of rules to determine the cost allocation of projects. This framework for allocating costs applies particularly to Projects of Common Interest (PCIs), projects identified by the European Commission as meeting certain criteria, such as having a significant impact on the energy markets of at least two EU Member States, contributing to the integration of their networks, and increasing competition in energy markets. ACER sets out a framework for determining Cross-Border Cost Allocation (CBCA), with the general principle that costs of cross-border transmission (i.e. interconnection) projects should be recovered from those Member States of the European Union that substantially benefit from those investments.

	Key Lessons from Case Studies
	▪ Contracts for gas, particularly LNG shipments, have standardised terms developed by industry that specify the sharing of costs of shipping, insurance, and taxes between purchaser and supplier.
Role of Industry Codes	▪ Industry codes are used to define common rules on cost sharing, for example ACER's rules for cost sharing of the investment in interconnectors and the shipping INCOTERMS described above. ▪ Industry codes are also used to ensure competitive use of the infrastructure once built: – In upstream gas contracts, large long-distance pipeline investments are financed by long-term take or pay contracts. Such contracts require a sufficiently large consumer market to warrant investment. However, such contracts may not utilise the full capacity of the pipeline built. Other gas fields may not contain enough gas to profitably finance the construction of a separate long-distance pipeline. Moreover, it is efficient for existing infrastructure to be fully utilised. Therefore, industry codes mandate that spare capacity on existing infrastructure is rented to third parties on reasonable, competitive terms. The Oil and Gas Authority mandates this for pipelines in the North Sea. Without such industry codes, owners of pipelines financed through long-term take or pay contracts may exercise market power when renting out capacity, because smaller producers are unable to finance their own infrastructure. – In interconnectors, EU directives mandate that owners of interconnectors rent out capacity on non-discriminatory terms to third parties. Moreover, EU directives stipulate the products and means by which capacity is rented out to ensure a competitive price for the capacity is achieved by market forces. ▪ Industry codes, for example through INCOTERMS, are used as standardised terms of defining, in detail, the transfer of property rights from the supplier to purchaser in the contract. The clear point of transfer of property rights from supplier to purchaser defines the responsibility for infrastructure of each party, who must invest in the necessary infrastructure up to the point of transfer. Standardised, and commonly understood, terms of property rights lower the transaction costs of trade.
Allocation of Risks	
Allocation of Risks	▪ Contracts are inherently designed to allocate the risks of a transaction to each party in the contract willing to bear those risks. Historical long-term contracts for upstream gas allocated volume risks from the supplier to the buyer through take or pay commitments and price risks from the buyer to the seller through indexed pricing. ▪ When the value of a standardised contract, which represents a standardised allocation of risks, is determined in a market, the parties most willing to bear the risks of transaction are those which offer the best prices for the contract. If one believes that those most willing to bear risks are also those who can best efficiently manage that risk, then market outcomes will allocate risks efficiently. Consequently, the determination

	Key Lessons from Case Studies
	of a market price ensures that those best placed to manage risks inherent in the contract end up bearing those risks. ▪ Regulation may be required to protect third parties who face the risks that the parties directly involved in the transaction can pass-through, and therefore are not priced into their decision to engage in a contract. For example, in downstream electricity, suppliers can pass risks onto their customers. However, Ofgem protects customers from excess risk accumulated by their supplier by guaranteeing customers' credit balances with the supplier in the case when the supplier declares bankruptcy. Regulators of TSO may apply efficiency challenges to investment in interconnectors by those TSOs, and limit the pass-through of costs to the RAB of the TSO in order to protect customers from cost over runs.
Dispute Resolution	
Dispute Resolution	▪ There is not a common dispute resolution process in the markets we examine. However, in most cases a dispute resolution process is often included in the contract alongside penalties for non-compliance with the contract. ▪ In some cases, penalties for non-compliance with the contract are backed by industry codes such as the BSC in downstream electricity trading in GB. ▪ Costly dispute processes, e.g. international arbitration in upstream gas, are viable in the case of high-value contracts underpinning significant infrastructure. ▪ However, in cases where the dispute process is costly, the justifications for dispute broad, and the contract is of relatively low-value e.g. the trading of water rights in California, costly dispute processes can increase the transaction costs of trade and limit the amount of trading that occurs in the market.

7. Our Recommendations to Improve Contracts to Trade Bulk Water in England and Wales

In this Section we set our recommendations to improve contracts to trade bulk water in England and Wales based on our review of current contracts to trade water, our review of Ofwat's current regulatory approach to water trading, and our analysis of bulk trading in other jurisdictions. We develop ten recommendations on the following themes:

- Developing a Standardised Form of Bulk Water Contracts;
- Standardisation of Water Quality Management Protocols;
- Enhancing Guidance on Contract Pricing;
- Dividing the Gains from Trade;
- Advertising Trading Opportunities;
- Clarifying Companies' Obligations in Drought Conditions;
- Penalty Clauses in Contracts;
- Impact of Uncertainty over Abstraction Licences;
- Third Party Access to Infrastructure; and
- Destination Clauses.

We outline each of our recommendations in more detail below.

7.1. Developing a Standardised Form of Bulk Water Contracts

7.1.1. Contract standardisation can reduce the transactions cost of trade, and has developed organically in other sectors

Contract standardisation, as we explain in Section 4.1, can reduce the transaction costs from trading in addition to the costs of managing agreed contracts. Reducing the transaction costs from trade may in turn increase efficient trade between water companies by making the act of trading cheaper for both contracting parties.

In the existing contracts that we examine, we found that some contract terms were already standardised across the industry. For instance, terms on disputes, and ownership and operation of relatively simple assets such as meters were relatively standardised across the contracts we examined. We understand that some companies have made a deliberate and focused effort to standardise terms across all their contracts, and in some cases have worked to update legacy contracts to the standardised terms. We understand that the CRT uses a standardised contract to trade with water companies.

However, to our understanding, beyond standardised water quality protocols produced by Water UK, there has not been a coordinated effort to standardise terms for new water trading agreements between water companies.

In the energy industry, and across the case study jurisdictions that we examine, standardisation has come about organically as a way of reducing transaction costs, enabling market participants to trade more efficiently. BP has developed standardised terms for LNG contracts in gas.

Market-led standardisation of contracts in downstream electricity trading is also prevalent. Organic standardisation has occurred through the collaboration of power exchanges and industry associations, and may have been necessary to:

- Manage risk positions resulting from the bilateral trade of large volumes; and
- Facilitate the secondary trading of contracts and management of open market positions.

Contract standardisation and volumes of trade support one another. A higher degree of contract standardisation supports higher volumes of trade. Higher volumes of trade result in higher incentives to standardise contracts to manage risks and reduce transactions costs.

Standardisation of contracts in energy did not come about through regulatory intervention, but was led by trading parties in the competitive segments of the market, sometimes in response to regulatory interventions. Contract standardisation was generally developed through two routes:

- The development of standardised terms of trading on centralised trading platforms to facilitate the primary and secondary trading of contracts. Exchange platforms may standardise rules of trade, for example collateral arrangements, to reduce transaction costs of trading on the platform.
- Market-led standardisation of contract terms through industry associations. For instance, the GTMA was developed by the Futures and Options Association in response to the New Electricity Trading Arrangements (NETA) reform in Great Britain. More recently, standardised contracts were developed by the Energy Networks Association for the procurement of new flexibility services.

7.1.2. While less important in water than energy, developing a standardised contract form could reduce transaction costs and promote trade

Given the significantly larger scope for competition and higher trading volumes in energy, the impetus for standardisation is likely to have been much greater than it currently is in the water industry. Due to the location-specificity of issues surrounding water trading, and the market structure of the industry, centralised trading platforms do not exist.

Therefore, we recommend that RAPID asks the industry (e.g. via Water UK) to develop published, standardised contract forms to encourage trade and reduce the transaction costs of organising new water trades. The industry could develop such standardised contract terms within a remit defined by RAPID, accounting for the other recommendations of this report and other ongoing work by the industry regulators. We understand that Water UK recently led an industry group to develop standardised contracting terms for supplies of water from incumbents to NAVs.

We recognise that water trades are necessarily more bespoke than downstream electricity contracts. Unlike electricity, water quality varies across locations, and specific technical treatment of water may be required depending on the source and the buyer’s network. Moreover, bespoke infrastructure to transport or develop a source in a raw water trade would need bespoke contract terms to govern the development, funding, and wind-down of such infrastructure.

Therefore, contracts are likely to be less standardised in water than in energy markets. Moreover, any standardised agreement should be flexible enough for it to be tailored to location or context specific aspects of each water trade. We expect that such standardisation should be easier for bulk trades of potable water, which are less frequently linked to large investments in bespoke infrastructure.

However, there are a number of aspects of a contract to trade both raw and potable water that could be standardised. For instance, standardising the following aspects of contract design may all reduce transaction costs of trade:

- Reporting requirements on water quality (see Section 7.2);
- Operation agreements on metering;
- Force majeure;
- Notice periods;
- Use of supply;
- Responsibility of controlling flow supply;
- Provisions for maintenance and repair;
- Liability;
- Consequences of termination;
- Payment terms including invoicing and receipt arrangements;
- Responsibility for maintenance of assets;
- Dispute resolution; and
- Confidentiality.

Standardised contracts should be explicit about their "firmness" and the circumstances under which the seller is entitled not to provide the contracted supply volume.

The use of this standardised contract need not be mandatory, and existing contracts need not necessarily change following development of a standardised contract form. Instead, a standardised template should only aim to set a framework with guidance as a means of minimising transaction costs for new trades, and thereby encouraging trade to take place. It would not prescribe terms that must be used for each trade.

7.2. Standardisation of Water Quality Management Protocols

7.2.1. Trades for potable water should include references to DWI's water quality standards and protocols

The majority of the existing contracts we have reviewed involving trade in potable water have specified water quality standards consistent with the DWI's minimum requirements. Most of the contracts that we reviewed specifically referenced the Water Supply (Water Quality) Regulations 2000 (as amended).

However, we note the DWI has conducted a separate review of water quality testing and reporting provisions in bulk contracts. In its review of existing contracts, which were different to the contracts we reviewed, the DWI reported a number of shortcomings to contractual arrangements pertaining to:

- The lack of fixed schedules stipulating when sampling results from the bulk supply source would be made available to the purchaser;
- The lack of reference to the Drinking Water Safety Plan (DWSP) which assesses the risk for drinking water quality in the supply chain in question, nor how often the plan would be shared between companies;
- The lack of agreed timeframe for the review of the Protocol nor the update of DWSPs; and
- The lack of details on water quality arrangements relevant to the specific bulk supply arrangement.

Following its investigation, the DWI set out minimum standards that companies should incorporate into existing bulk supply agreements in addition to any new water trades:

- Companies are required to update protocols to include a section on the minimum sampling data to be communicated between them;
- Companies are required to update protocols to include a minimum frequency of meetings between providing and recipient companies to update, discuss and review the protocol;
- Companies are required to ensure that the protocols are signed and dated. The signature and dates should be updated each time the protocol is reviewed together by both companies; and
- Companies are required to ensure protocols are reviewed in unison by both companies on an annual basis and include updated information on the DWSP and Risk Assessments where relevant.

While very few of the contracts we have reviewed seem to exhibit the problems the DWI identified, any new standardised contract could encapsulate the DWI’s recommended quality standards for potable water trades, and protocols for water quality monitoring and reporting.

For example, the existing practice of drafting water quality clauses to reference DWI’s published standards, such as in the Water Supply (Water Quality) Regulations 2000/2016/2018, saves the transaction costs in the trading of bulk water associated with drafting bespoke quality protocols and standards into individual contracts.

The standardised contracts developed by the industry should include clear obligations in standardised protocols that ensure regulatory-approved good practice on water quality and wholesomeness can be incorporated into contracts for potable water at low transaction costs.

DWI guidance on details of water quality standards and wholesomeness states that formal transfer agreements should meet the requirements in the Regulations, clearly define responsibilities for conducting risk assessments on new sources; stipulate water quality and sustainability monitoring arrangements, and enable both parties to make necessary contingency arrangements to meet their licence obligations.

Similar to other forms of standardised contract terms that we discuss above, there may be value in RAPID asking the industry (e.g. via Water UK) to develop published, standardised contract forms and obligations on best practice to maintain water quality and wholesomeness to encourage trade and reduce the transaction costs of organising new water trades. Such standardised terms could improve upon the existing water quality management protocol by incorporating the DWI's guidance following its investigation.

There may also be scope for the DWI to issue further guidance on what details of water quality standards should be included in all contracts of potable water, to the extent that they are not captured in the Water Supply (Water Quality) Regulations 2000/2016/2018. However, guidance should be flexible enough to ensure trades of potable water which require bespoke treatment due to location-specific circumstances may still occur at low transaction costs.

7.2.2. Quality standards for raw water trades may need to be more flexible

Some of the recommendations in Section 7.2.1, such as regarding the monitoring of raw water quality, may apply equally to treated and raw water trades.

However, standardised water quality standards in bulk contracts for the trade of raw water may be less appropriate for raw water, given the more bespoke and source-specific nature of agreements. Nevertheless, transfers of raw water may result in significant environmental risks, and changes in discharge can have significant effects on local water systems.

Therefore, clear obligations and protocols to maintain environmental standards in raw water transfers should be stipulated in contracts to ensure they are as complete as possible, because water quality and environmental risks may change significantly over the tenor of the contract. Raw water contracts tend to have longer tenors than contracts for the potable trade of water.

To the extent that trades in raw water require different protocols to manage the environmental risks of water transfers compared to potable water trades, there may be scope for the EA to issue further guidance on water quality standards that should be included in all contracts for trade of raw water. Again, guidance should be flexible enough to accommodate trades of raw water which require bespoke treatment due to location-specific circumstances.

7.3. Enhancing Guidance on Contract Pricing

7.3.1. We have seen a wide range of different pricing rules in our review of existing contracts

The price at which companies trade is pivotal to ensuring that companies have incentives to trade when it is economically efficient for them to do so. Creating incentives for economically efficient trade will be pivotal to encouraging trade that minimises long-term water resource and treatment costs across the whole of England and Wales, thereby protecting the interests of customers.

While Ofwat requires contract pricing to be "cost-based", this terminology is not explicitly defined, and so there is scope to interpret this requirement differently. Indeed, we have seen examples of companies pricing based on the average incremental cost of trades, and others pricing based on their published schedule of wholesale charges. Pricing based on wholesale charges, because these charges apply to all wholesale sales, is equivalent to pricing based on average production costs. We have also seen a wide range of different methods used in existing contracts to update prices over time, e.g. updating in line with published wholesale charges, in line with average tariffs for consumers, or indexation by CPI or RPI.

7.3.2. Theory suggests a pricing rule based on incremental cost (plus a margin) would encourage efficient trade

Economic and accounting literature, as well as regulatory and competition law precedents, define "costs" in a number of different ways. In competitive markets, which exhibit efficient trading patterns, economic theory suggests prices will tend to reflect the marginal cost of production as we explain in Section 4.2.2. However, for markets with substantial fixed costs and uncertainty over future costs, efficient trade can result from prices set equal to expected long-run average incremental cost (see Section 4.2.5). For instance, this could be computed in practice using a water resources planning tool to:

- Estimate the probability weighted cost (e.g. accounting for uncertainties such as weather patterns and future demand growth) of serving the selling company's demand over the planning horizon, including both operational and capital costs, and accounting for supply-side and demand-side measures;
- Re-estimate the probability weighted cost of serving the selling company's demand, but with higher demand to include the demand of the trade in question; and
- Compute the price based on the Net Present Value difference in cost between the probability weighted cost of serving demand with and without the demand from the trade, levelised over the contracted volumes.

This pricing rule, if implemented in water, would promote efficient trade, and achieve a price similar to that we would expect to emerge in equilibrium in a competitive market.[85] In a competitive market, this would also be equivalent to charging average cost. However, two particular challenges in water are as follows:

- Pricing bulk trades based on expected long-run average incremental cost could price water sold through bulk contracts at a price above or below the price at which water is sold to other customers, which reflects average cost recovered through companies' wholesale charging schedules. Because water has elements of natural monopoly, the expected long-run average incremental cost associated with a particular trade may tend to be below average costs of the company across its entire business, in which case prices charged to the generality of customers could be higher than the prices charged for bulk trades. This difference may raise concerns about equity; and
- A requirement to price based on cost, and the role Ofwat's price reviews play in limiting companies' returns, may limit companies' incentive to sell water because they can only ever recover the costs of supply. In competitive markets, prices higher than cost provide signals that can attract investment into the market, which ultimately delivers new capacity to compete away economic rents and drive down prices for customers.

Therefore, there are strong arguments grounded in both efficiency and equity for allowing water companies to sell water through bulk exchanges at a price reflecting the expected long-run average incremental cost of the trade, plus a margin to provide them with an incentive to

[85] This is, of course a simplification. Even in competitive markets, prices can be higher or lower than this in certain circumstances. Prices above expected long-run marginal cost may occur because of temporary scarcity or because of market power. Prices above expected long-run marginal cost provide a useful signal/incentive to suppliers to enter the market and/or for existing suppliers to produce additional output. Prices below expected long-run marginal cost can arise, amongst other reasons, in situations where there is excess capacity relative to the prevailing level of demand. They can provide signals that some producers should exit (or should not enter) the market.

do so. This approach would be consistent with the approach that we understand, anecdotally, is taken by other entities (e.g. the CRT) when selling based on its "market value". We discuss further the division of the value associated with trading and the need for a margin to provide an incentive to trade in Section 7.4.2.

7.3.3. We recommend that Ofwat issues guidance on the pricing of bulk supply contracts for water

In order to give companies clear and strong incentives to trade – and thus minimise long-term costs across the industry for customers – we recommend that Ofwat issues guidance on the pricing of bulk supply contracts for water.

We recommend that the pricing of bulk transfers should reflect the expected long-run average incremental cost of supplying the contracted volumes, plus a mark-up. The mark-up should reflect a proportion of the economic rent associated with the trade, defined by the difference between the costs incurred by the seller to supply the contracted volumes of water, and the costs avoided by the buyer from not having to develop a more expensive resource.

Recognising that estimating long-run average incremental costs and accounting for future uncertainties entails some complexity, some guidance may be needed on how companies should approach this. This guidance could build on the guidance already issued to companies regarding the preparation of their WRMPs and the practices they should follow to identify efficient water resources investments and estimate their costs.

Similar guidance has been published in other industries. For instance, from our study of the gas industry, we understand that the OGA's guidance on pipeline access terms requires pricing on the basis of incremental cost. This requirement, which would apply in cases where the OGA is called upon to make a determination on access prices, provides an example of regulatory guidance on pricing to third parties.

7.4. Dividing the Gains from Trade

7.4.1. Ofwat has put in place incentives for companies to trade but they lack transparency and impose costs on selling companies' customers

Related to the guidance on how companies should determine contract prices, as we set out above, companies should be able to retain some portion of the gains from trade, so that they have an incentive to trade when it is economically efficient for them to do so. Allowing suppliers to earn a price that reflects the incremental costs associated with the trade does not provide them with an incentive to trade. Indeed, the need to provide an incentive to trade bulk water, through a margin, distinguishes bulk trading of water from other trade, for instance providing third party access to existing infrastructure.

As we explain in Section 7.3, an incentive to trade could be achieved through setting a price between the incremental costs incurred by the seller, and the incremental cost of the alternative (more expensive) resource that could have been developed by the buyer instead of making the trade. However, if pricing is cost based and reflects the incremental costs of the trade, the seller will not earn a margin to provide an incentive for it to sell. And if both parties have their allowed revenues determined by Ofwat through the price review process in a way linked to their cost, the gains from trade will not be retained by the company at all.

To address these problems, Ofwat has provided companies with an incentive to trade through mechanisms put in place at PR14 and PR19, allowing companies to retain a portion of the economic rent from new bulk sales agreed during the relevant Asset Management Period, subject to some eligibility criteria set out by Ofwat.

These incentives allow the seller to retain 50 per cent of the present value of economic rent associated with the sale over the life of the contract, while the buyer can earn an incentive equal to 5 per cent of the purchase price. Both incentives are capped as we discuss in Section 3.3.2.

From our discussions with Ofwat, we understand that this economic rent would be calculated in Net Present Value terms over the life of the contract. It would be calculated at the end of the first AMP in which the contract is agreed based on a forecast of the economic rent over the life of the contract, and remunerated as an uplift on companies' allowed revenue during the subsequent AMP.

However, as far as we can tell, the "economic rent" from trading is not well-defined in public documentation. It would therefore improve incentives for companies to trade if the rules through which they can profit from doing so were more transparently defined.

Possibly reflecting this problem, as well as the long lead time between signing the contract and the commissioning of the new scheme, Ofwat's recent decision on the Havant Thicket reservoir represents a case-specific determination of how the gains from trade should be shared. Ofwat's trading incentive could not be easily applied to Havant Thicket because:

- The tenor of the contract was relatively long, and therefore forecasting economic profit over the life of the contract was difficult;
- The first 10 years of the agreement resulted in no sale of water to Southern, and yet under the trading incentive, Portsmouth would receive its export incentive after the five-year regulatory agreement; and
- Under the trading incentive, Portsmouth would receive all of the forecast economic profit over the eighty years of the contract up-front at the end of the first regulatory period.

7.4.2. We recommend that economic incentives to trade should be created through the pricing of water transfers rather than through a separate water trading incentive

While Ofwat has put in place a water trading incentive for PR19, going forward we recommend that Ofwat should provide incentives to trade by allowing a mark-up on the pricing of bulk supply contracts above the cost of supply, rather than through a separate water trading incentive.

To achieve a more equitable distribution of the gains from trade between customers of the buyer and seller, while also providing an incentive to the seller to trade, we therefore recommend that the pricing of bulk transfers should reflect the long-run average incremental cost (see Section 7.3), plus a mark-up to reflect a proportion of the economic rent associated with the trade. This mark-up would be earned as an additional revenue by the selling company from the bulk sale throughout the life of the agreement. It could also be shared between the selling company's shareholders and its customers, e.g. by using some of the revenue earned from applying this mark-up to offset the company's revenue requirement.

The costs of the transfer, plus the additional incentive to encourage the seller to agree to the transfer, would be paid by the customers of the buyer, which benefit through avoiding the costs of a more expensive water resource scheme. A sharing factor could be used to divide these savings between the owner and customers of the buying company, to ensure it has an incentive to minimise costs. In order to further promote regional planning, Ofwat should also clarify the rights of the "transfer party" to economic profit from regional trades of bulk supplies.

This approach of sharing the costs of the trade in proportion to the benefits it creates has precedent in the EU-level regulation of interconnection to support trades in gas and electricity between countries. As explained above, ACER's beneficiary-pays policy shares the gains from trade for "projects of common interest" between EU Member States in proportion to the benefits they derive from it. Ofgem's cap and floor regime for interconnectors provides another example of how economic rent can be defined and shared

The calculation of economic rent is more challenging in the water sector than in energy, as the value of an interconnection project can be measured based on the costs of the project observed on the accounts of the project development company, less revenue earned from the sale of capacity rights.

However, it could be achieved by estimating long-run expected incremental cost of serving the additional demand for the transfer by the seller. Then, subtracting the long-run expected cost avoided by the buyer as a result of the transfer, gives an estimate of the economic rent. This could be converted into a percentage mark-up on the long-run expected incremental cost of the seller to provide an incentive to sell, and divide the economic rent created by the sale between the seller, buyer and their customers.

In order to further develop such regional planning, Ofwat would need to clarify the rights of the "transfer party" to incentives accruing from such trade. For instance, in the example above, Company B can, under current trading rules, receive an incentive for buying water from Company A, and also an incentive for selling water to Company C. In this case, if Company B is simply displacing water across its network, it is not clear the economic value that it is providing other than through its *de facto* location as a regional monopolist, and therefore what incentives it should be allowed to receive.

In the meantime, we recommend that Ofwat clarifies how its existing water trading incentive is intended to operate.

7.5. Advertising Trading Opportunities

We recommend that Ofwat enhances current obligations on companies to advertise spare water resources as part of the water resource management plans, which may increase the potential to exploit, and lower the transaction costs of, trading opportunities. Specifically, we recommend that enhanced obligations to advertise trading opportunities should not just focus on highlighting spare resources but identifying the new resources that could be developed to provide additional capacity, and the likely costs incurred to do so.

Enhancing obligations on companies to advertise spare water resources, which are already in place as part of the WRMP guidance, may increase the potential to exploit trading opportunities and lower the transaction costs of identifying such opportunities. Third parties could choose to follow similar approaches and to advertise forecast surplus water in order to encourage trade. For instance, we understand that water companies encourage third parties to trade with them through the development of bid assessment frameworks, which they may apply in development of their WRMPs.

The monopoly ownership of access to and licence to abstract from water sources may justify regulatory obligations for owners to advertise trading opportunities to ensure transparency, and may substantially reduce the transaction costs created by differences in information across market participants. As we note above, water companies already face obligations to advertise opportunities through the WRMP processes.

Similar standards to publish past executed trades and capacity availability exist for electricity and gas interconnectors across the EU. The European Commission sets minimum standards on the publishing of information by interconnector operators. Such information includes the amount of capacity made available, the products made available, and the indicative prices paid for capacity as soon as possible after each capacity auction.

It is possible that existing obligations to advertise trading opportunities in the water industry through WRMP guidance could be extended to advertise, not just spare resources, but the costs of developing new resources. Publishing cost information may allow more transparent identification of trading opportunities with neighbouring companies.

Publishing cost information may also form a basis for transparent pricing in eventual contracts to develop such resources. Both the willingness to pay for the buyer and the incremental cost of the supplier could be identified through such information. In particular, companies could not only understand the incremental cost of developing an additional resource to facilitate a trading agreement, but also the incremental cost of the next resource available to support resilience, having committed to developing the first resource to facilitate the agreement.

We understand that water companies already communicate regularly amongst themselves and their neighbours throughout the water resource planning process. We understand that some regional planning already occurs through water resource regional planning groups, and that the regional plans will be of pivotal importance in the development of the next round of WRMPs. Future obligations to advertise trading opportunities should continue to focus on promoting trade on a regional planning basis because efficient trading opportunities may exist between regional companies who are not neighbours. These more complex trades may require higher transparency of opportunities that companies can explore as part of their resource plans. Similarly, more complex trades may not be discovered through bilateral discussions between water companies.

The consequence of increased transparency may be that it improves the ability of suppliers to price up to buyers’ opportunity costs of sourcing water supply. We understand third parties may be able to, and do, price up to buyer’s opportunity costs through cost information included in WRMPs.

Transparency over the costs of developing the supply stack for both parties may allow third party suppliers to set the price of the contract fractionally below the buyer’s long run average incremental cost of developing its own resource or purchasing water from another supplier, whichever is lower. In doing so, the supplier captures the majority of the economic profit of the trade.[86]

However, if the transparency created by advertising the costs of developing the supply stack increased trading, it could still benefit customers. For instance, the counterfactual in which cost information is less transparent may result in the third-party offering prices above the buyer's opportunity cost in an attempt to maximise the value of its water resources.

The supplier would also need to offer a water supply that is at least as firm as the buyer's alternative options to the transfer, and price the transfer fractionally below the cost of the next-cheapest scheme to be attractive. If the buyer faces risk through the contract that it would not face if it owned the resource itself, it would need to be compensated for this risk through a lower contract price. Therefore, the supplier would be unable to price up to the buyer's opportunity cost which it observes through the obligation to publish costs.

In other words, such pricing by the seller as a result of the publication of the costs of the supply stack would only be possible if the contract was complete and the buyer faced the same risks that it would face pursuing its alternative options. Otherwise the price of the contract would need to reflect the difference in risks facing the buyer as a consequence of the trade.

7.6. We recommend that Ofwat clarifies companies' obligations in drought conditions in relation to bulk transfer customers

Ofwat's current guidance does not clearly explain its view as to whether a supplier must prioritise its own customers in times of scarcity in order to satisfy its supply obligations under the Water Industry Act 1991, or may instead choose to provide a firm commitment to the buyer to continue to supply. The lack of a common approach to specifying the degree to which a company's own customers should be prioritised over those customers of the trading counter-party is a problem that Ofwat also noted in its final determinations over Havant Thicket. Ofwat states:

> "We recognise that greater clarity around the interaction between water undertakers' obligations to supply their own customers and their obligations to provide bulk supplies of water to other water undertakers under bulk supply agreements may be beneficial. This is an area that has been raised in relation to potential strategic transfers and we recognise that the sector considers it to be an important issue. We will consider this issue further in 2020 and engage and consult with stakeholders across the industry"

Most bulk sales contracts we reviewed do not have penalties for non-delivery (beyond the option to cancel the agreement or pursue dispute resolution channels). The firmness of a contract relates to the trade-off that the supplier faces to renege on the contract and incur penalties for non-delivery and the penalties that the supplier might incur for continuing to supply the contract, if as a consequence it breaches its statutory obligations in its own supply area.

To our knowledge, Ofwat's current guidance does not clearly set out its view as to whether a supplier must prioritise its own customers in times of scarcity (under its supply obligations

[86] This would not be a problem in relation to trades between incumbent WoCs and WaSCs, as they are subject to pricing rules that limit their ability to price in excess of cost, as discussed above.

under the Water Industry Act 1991) or may instead continue to supply volumes in contracts to trade bulk water. Hence, to the extent that contracts allow suppliers to renege on their agreement to supply without penalty, such contracts are in effect interruptible. In one contract in our review there was an explicit clause that required the supplier to provide symmetric treatment of both the buyer and its own customers in the event of drought.

Water companies have obligations under the Water Act 1991 to secure supplies for the benefit of their own customers including in the event of drought. However, to the extent that times of scarcity correlate between the source of the supplier and the destination of the buyer, water trades may be less useful for water resource planning if suppliers renege on their delivery of water to the buyer in times of scarcity.

It would be beneficial for any standardised contracts to be explicit about their firmness and the circumstances under which the seller is entitled not to provide the contracted supply volume. For instance, the use of interruptible capacity rights in EU gas network pricing provides an example of users accessing the natural monopoly infrastructure on a non-firm basis and paying a lower fee.

7.7. Penalty Clauses (Liquidated Damages) in Contracts

7.7.1. Penalty clauses are necessary to ensure contracts are "firm"

A key feature of the existing contracts we examined is the lack of automatic penalties for non-compliance with the contract.[87] In particular, suppliers do not face automatic penalties on volumes that they do not deliver under the contract. The only means by which the purchaser can receive compensation for non-compliance is through early termination and mutual settlement or a costly dispute process. In the meantime, current contracts to trade both raw and potable water remain incomplete, and consequently represent non-firm agreements whereby the supplier is often able to renege on its commitment to supply water without specified penalty. This incompleteness undermines companies' use of contracts in water resource planning and therefore incentives to trade.

Standardised contracts should include a provision for penalties in cases where the seller fails to deliver contracted volumes of water. Penalties are necessary to ensure the "firmness" of the contract without the need to pursue formal dispute resolution channels. Penalty clauses may in turn increase the value of transfer contracts to buyers in their water resource planning.

The firmness of a contract is largely determined by the penalties that the supplier faces for not delivering the specified volumes to the buyer. If the supplier does not face a penalty, then the contract is non-firm or interruptible. On the other hand, if the supplier faces a penalty that is high enough such that it is better off supplying the water in times of scarcity, then the contract is firm. The willingness to pay for a firm contract will be higher than for an interruptible contract.

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[87] Throughout this report, we use penalty clauses to refer to what lawyers may term liquidated damages: "A fixed or determined sum agreed by the parties to a contract to be payable on breach by one of the parties". We understand that under English Law, if liquidated damages are excessive and cannot be justified, they are deemed to be "penalties" which are unenforceable. Our use of the term "penalty clauses" does not refer to the latter. Source: Thomson Reuters Practical Law, "Liquidated damages", Last accessed 9 July 2020, Link: https://uk.practicallaw.thomsonreuters.com/7-107-6769?transitionType=Default&contextData=(sc.Default)&firstPage=true&bhcp=1.

The lack of penalties for non-compliance reduces the firmness of contracts to purchasers, which may consequently impact the ability of purchaser to rely on bulk supplies in their water resource plans. It is unclear whether lack of stipulated penalties in the contracts we examine is because of companies' interpretation of their obligations to their customers in their supply area relative to bulk transfer customers in drought conditions, which means that suppliers may be unwilling to sign firm agreements. The introduction of penalties for non-compliance may improve the willingness and commitment of suppliers to meet contractual terms.

7.7.2. Penalties could be set to reflect the costs of acquiring water from alternative sources at short notice

Regarding the level of the penalty, ideally a firm contract would require the buyer to be compensated by the seller for non-delivery at a rate reflecting the costs, including the transactions costs, that the buyer would face to source the water from elsewhere. For instance, electricity contracts are structured so that if the seller fails to deliver, the buyer is held whole through an obligation on the buyer to procure an equivalent amount of energy from the balancing market.

This approach is not possible for water as there is no balancing market, but an equivalent approach would involve setting penalties for non-delivery equal to the expected average incremental cost the buyer would face to source water from an alternative resource at short notice when water resources are scarce (i.e. in drought conditions) in the local area, or compensating customers for curtailing their water usage.

The penalty could also be made conditional on the amount of notice provided by the seller that it would not be able to supply the contracted volumes. This would also allow the seller to make an economic trade-off between the decision to supply the contracted volumes or not in conditions when water resources are scarce.

7.7.3. Complete contracts should specify the consequences of early termination

We recommend that Ofwat provides guidance stipulating how the costs of bespoke infrastructure should be shared between suppliers' and purchasers' customers in the case of early termination of contracts. Depending on which party funded the costs of such infrastructure, that funding party is subject to the risk that its counter-party terminates the contract prematurely, in which case it may not have recovered its costs of investment. Across the raw water contracts that we examined, most contained means of recovering historically incurred capital costs in the case of early termination. However, the approach used by parties was not standardised across agreements, resulting in various risk and cost recovery patterns by shareholders and consumers.

Similar to its guidance on appropriate mechanisms for cost recovery and pricing (see Section 7.4), Ofwat may need to provide guidance that stipulates how the costs of bespoke infrastructure should be shared between suppliers and purchasers' customers in the case of early termination.

Any guidance on cost recovery of assets in the case of early termination will need to stipulate who refunds those costs in the case of termination. In some cases, termination may be economically efficient for the terminating party, and as such it may be appropriate to share the costs owed to the counter-party for stranded assets between shareholders and customers. In other cases, it may be more appropriate to protect customers from the costs incurred due to early termination.

The decision on whether the costs of early termination be recovered from customers and from which customers may also need to depend on whether the infrastructure can be used by either party after the contract is terminated.

7.8. Impact of Uncertainty about Abstraction Licences

Arrangements for issuing abstraction licences are beyond the scope of this study. However, we identified that a crucial risk inherent in current potable and raw water contracts is the availability of abstraction licences over the tenor of the contract. Water availability is dictated by both the incidence of drought and by the certainty that the supplier has the right to abstract water from the source over the tenor of the contract.

All of the case studies of water trading that we reviewed in other jurisdictions (i.e. Nebraska, Australia, California) allow the ownership and trading of perpetual rights. Perpetual rights give the holder the right to abstract water from the source in perpetuity. In cases where perpetual rights need to be revoked, for reasons such as environmental protection, holders are financially compensated for the loss of the right.

Perpetual rights give water suppliers confidence to supply water under firmer contractual arrangements because, should their rights be removed, they will be financially compensated for the costs they incur as a result. In England and Wales, by contrast, the EA or Natural Resources Wales can revoke or reduce the amount of water abstracted through licences at any time and, in the case of water companies, without the payment of compensation. This possibility undermines incentives for suppliers to sell water because they face risk over the availability of water resources. In the case study jurisdictions that we reviewed, alternative products for water that were not backed by the seller's ownership of perpetual licences or rights to abstract were sold at lower prices as interruptible, or non-firm water contracts.

Moreover, the EA limits the issuance of licences to durations which are less than the tenors agreed in water trading agreements. In order to effectively use trades for raw water for water resource planning, which requires companies to plan for a minimum of 25 years, such contracts should involve firm commitments to supply over relatively long tenors. The risk of losing abstraction licences within the tenor undermines the use of such contracts for planning purposes.

We therefore recommend that the EA considers if its current abstraction licencing scheme is appropriate, in light of RAPID's desire to promote trade and strategic schemes.

In addition, it is unclear whether, under Ofwat's current pricing rules, water companies who wish to trade water in contracts with tenors beyond the length of issuance of abstraction licences by the EA can price the contract to reflect the risk they take on the availability of water.

In order to allow companies to effectively price their risks, we recommend that, when clarifying the definition of cost-based pricing as we recommend above, Ofwat also considers approaches for pricing the risks related to revocation of abstraction licences.

7.9. Third-party Access to Infrastructure

In our review of case studies from other sectors/jurisdictions, when contracts supported significant investment in infrastructure, such infrastructure was subject to regulation prescribing that it was made accessible to third parties on non-discriminatory terms.

For instance, in upstream gas contracts, third party access rules aim to allow spare capacity on pipelines, financed by bespoke long-term contracts with take or pay clauses, to be used by other parties. Ensuring third party access at fair terms to existing infrastructure is important for the development of new, smaller fields, for example in the North Sea, which are not large enough to support investment in new infrastructure to bring the gas onshore.[88] EU regulators have also perceived that such processes prevent potential anti-competitive behavior by owners of key pipelines financed under bespoke long-term contracts, who could otherwise extract profits through charging parties for access to their infrastructure. Similar directives on third party access applies to interconnector capacity funded by merchant investors (who may seek derogations from such rules) and regulated transmission service operators in the EU.

In the North Sea, The Oil and Gas Authority (OGA) enforces similar access terms for British pipelines. Parties in the North Sea sign up to the voluntary, industry-led, “Code of Practice on Access to Upstream Oil and Gas Infrastructure on the UK Continental Shelf” which sets out the principles of third party access to existing infrastructure.[89] If parties are unable to agree on terms of access to a pipeline under the agreement, they may appeal to the OGA that makes an assessment on the basis that spare capacity is made available to third parties at incremental cost to the capacity owner.

Mandating that spare capacity of infrastructure financed under long-term contracts is made available to third parties may significantly reduce the transaction costs in water trading. In particular, mandating that spare capacity be made available on non-discriminatory and incremental cost terms to third parties may reduce the transaction costs of trading across multiple water companies. Obligations on third-party access terms may stretch to third parties of water owners, such as the CRT, in order to better facilitate trade.

For instance, suppose Company A wishes to provide a bulk supply to Company C but they do not share a border in their areas of appointment because Company B lies between the two. Third party access would mandate that Company B provide capacity at incremental cost to ship water from Company A to Company C so long as the water was correctly treated to be carried in Company B’s network.

Such third-party access terms would facilitate regional planning between water companies through trading of water resources. Water companies need not merely trade with their neighbors, but with other companies further afield, and access spare capacity to facilitate the transfer. Existing proposals, such as the Severn Thames Transfer demonstrate that such regional coordination may require Ofwat to develop rules mandating that water companies

88 Oil and Gas Authority (May 2019), Guidance on Disputes over Third Party Access to Upstream Oil and Gas Infrastructure, p. 13.

89 Oil and Gas Authority (May 2019), Guidance on Disputes over Third Party Access to Upstream Oil and Gas Infrastructure, p. 5.

make spare capacity available at incremental cost and non-discriminatory terms to facilitate such transfers.

To promote regional trade, we recommend that Ofwat consider developing rules that mandate that water companies make spare capacity available at incremental cost and non-discriminatory terms to facilitate such transfers.

We understand that in cases where companies utilise the spare capacity of other utilities or third parties, that those companies would need to ensure such use and transfer was environmentally safe. The contract for use of such spare capacity would need to stipulate the distribution of risk between parties and the obligation to treat raw or potable water in order to safely use such capacity. The environmental standards to be maintained on such a transfer can be dealt with through discharge permitting and water quality standards alongside industry protocols, as we discuss in Section 7.2.

7.10. Destination Clauses

Some of the current contracts that we reviewed included destination clauses stating that the buyer could only use the water to fulfil its statutory requirements to serve its customers. Some contracts also explicitly stated that the purchaser could not use the water supplied to sign additional bulk supply contracts.

Similar destination clauses are prevalent in long-term upstream gas contracts in Europe which prevent buyers from selling the gas on to other markets. Historically, long-term contracts often prevented the buyer from trading with other national monopolists thereby allowing the large producers of gas to maintain price differentials, and price discriminate, across European markets. Other contracts include profit sharing clauses that would allow the supplier to benefit should the buyer resell gas on in different markets. Profit sharing clauses may achieve the same result as destination clauses by limiting the buyers' incentives to resell gas.

The European Commission has moved against destination clauses deeming them uncompetitive, and has negotiated the deletion of such clauses from legacy contracts. Most notably, the Commission negotiated the exclusion of clauses in contracts between Gazprom and EU trading partners e.g. ENI, OMV, E.ON and Ruhrgas. The Commission has applied similar rulings to LNG supply contracts.[90]

Ensuring that water contracts do not include destination clauses may also ensure efficient trade. Some of the bulk supply contracts we examined specified that the purchaser could only use the water to fulfil its statutory requirements to serve customers under the Water Industry Act 1991. It is unclear whether this specifically relates to customers within the purchaser's area of appointment. It may be inefficient if these clauses prevent the purchasers from selling water onto another water company. Using the above example, it may be efficient, if Company C is particularly water scarce for Company B to supply it with water, and Company B may be able to source that water through bulk supply arrangements with Company A.

Similar to the case of third-party access, any onward trade of water, or displacement of water across a company's network should still meet environmental or water quality standards. Such

[90] European Commission (21 June 2018), Antitrust: Commission opens investigation into restrictions to the free flow of gas sold by Qatar Petroleum in Europe.

standards may prevent the onward selling of the same unit of water without further treatment. However, such issues may be dealt with through industry standards and regulation, as we discuss in Section 7.2.

However, some instances may justify destination clauses in contracts. For instance, implementing destination clauses may be appropriate when the onward use of the water damages the reputation of the original supplier. For instance, one restriction on use that may be upheld by competition law in upstream gas is restrictions on the flaring of gas by the buyer after purchasing. One may argue that flaring gas, given the environmental impact, negatively impacts the reputation of the supplier of that gas who may therefore be justified in restricting the use of gas for flaring in the contract.

In cases where destination clauses may be efficient, then the burden to prove that clauses are efficient should be placed on the supplier in the contract.

We recommend that Ofwat advises water companies to avoid such destination clauses in future bulk water sale agreements to promote regional efficient trade. Removing destination clauses, like ensuring third party access to infrastructure, may be useful steps in promoting efficient trade on a regional planning basis, rather than simply efficient trade between bilateral parties.

We note that the EA has concerns with the environmental risks of raw water transfers, noting that it can be environmentally damaging to discharge water of the incorrect quality and type into certain water bodies. However, rather than managing this risk through destination clauses in contracts, it would be more appropriate to manage such risks through the use of environmental permits.

Appendix A. Overview of Current Contracts to Trade Water

A.1. Contract Description

A.1.1. The standardisation of contracts

Ofwat does not govern the commercial agreements reached by water companies with one another to trade water. Moreover, to our knowledge, the industry has not developed a standardised contract for the bulk trading of water. One explanation for this is that achieving contract standardisation in the water industry may be difficult because of:

- The relatively few contracting parties, and the fact that those few parties may only trade with their neighbours;
- The terms on which companies trade vary in a number of dimensions, including the “firmness” of the agreement to trade, pricing structures, water quality, whether the agreement is linked to infrastructure development, the tenor of trades, etc.; and
- The terms of trades already agreed between parties are not published or viewable on a platform for trade but held in confidential contracts.

However, through our review of current contracts, we found that contracts between water companies for potable water were similar in many respects in relation to their allocation of risks, pricing structure, and general terms of trade. In particular:

- Whilst we were unable to determine the approach used to set contract prices, most parties use a two-part charge as part of the bulk trading arrangement with a standing fixed charge and a volumetric charge;
- Most contracts stipulate both minimum and maximum flow rates (or maximum volumes in the year) and provide the purchaser with the option, with varying periods of notice, to offtake different volumes between the minimum and maximum flow rates;
- Most contracts allowed the supplier to terminate or reduce the supply in the case of drought or in the case of an emergency beyond the control of the supplier;
- In most contracts for potable water, the supplier is responsible for the costs of installing and operating the meter to measure the flow demanded by the purchaser; and
- Most contracts did not have penalties for non-compliance other than any compensation that results from formal dispute through the agreed channel, most commonly the Center for Effective Dispute Resolution (CEDR).

We understand that some companies have made a deliberate and focused effort to standardise terms across all their contracts, including updating legacy contracts to the standardised terms. By standardising terms, they argue that contract management becomes much easier and the transaction costs of signing new agreements is reduced.

These companies developed their own standardised contracts which they applied to multiple water trades with only minor adjustments. These companies also used their standardised contracts to both procure and supply water, suggesting they deem the terms of trade in those contracts to provide a fair allocation of risks.

Besides water quality, discussed in Section A.1.2, other aspects of contracts to trade potable water were not standardised. In particular, the obligations placed on the supplier when water is scarce in its own area of appointment differed across contracts we examine. We discuss this further in Section A.1.3.

We were also unable to determine how prices were set in many of the contracts we examined, and are therefore unable to ascertain whether the approach to set prices was standardised across contracts.

The method by which prices update across the tenor of the contract was not standardised in the contracts we examined. Different contracts use different inflation indices and some index prices to end-use customer tariffs or the annual updating of standardised wholesale customer charges.

Moreover, the tenor of supply contracts and the terms under which those contracts could be renegotiated in light of changes to regulation is not standardised across the contracts we examined.

The contracts for raw water vary significantly. The lack of standardisation of raw water contracts relative to potable water contracts may be because:

- Raw water contracts are more likely to be associated with the development of significant infrastructure and therefore require bespoke terms and agreement over the sharing of costs, often with a longer tenor of the contract; and/or
- We understand raw water contracts associated with new infrastructure are rarer than contracts for treated water, but cover larger volumes of water.

Consequently, the raw water contracts we examined typically have longer contract tenors and were in some cases signed pre-privatisation, whereas the potable water contracts we examine were signed more recently.

A.1.2. Water quality provisions

Most of the contracts we examined used a relatively standardised form to set out the water quality standards that the seller was obliged to meet. The contracts also contain similar clauses to explain obligations in respect of water quality testing and reporting on the results.

The DWI carried out a separate review of water quality provisions in bulk supply contracts in 2014 (using a different sample of bulk supply agreements from those we examine). It found that most companies had adopted standardised terms governing water quality following the "Water Quality Protocol for Bulk Supply Arrangements". The Protocol is a standardised document published by Water UK's Task and Finish Group in 2012. The Protocol sets out a number of standards that contracts should meet with regards to water quality including:

- minimum information that the supplier should present the purchaser with respect to the quality of the water in the supply and any authorised departure from the regulations;
- minimum information and notice of any changes to the water quality supplied such as the potential impact of planned works, significant aesthetic issues with the supply, or significant changes in the number of water quality customer contacts that may impact the supply; and

- minimum standards for the communication of such information, i.e. by telephone made available 24 hours per day.

However, in its audit, the DWI identified a number of issues with the utilisation of the Protocol in the bulk contracts it reviewed:

- whilst companies had incorporated the Protocol into their bulk supply agreements, the companies had not set fixed schedules of when sampling results from the bulk supply source would be made available to the purchaser;
- most agreements did not mention the Drinking Water Safety Plan (DWSP) which assesses the risk for drinking water quality in the supply chain in question, nor how often the plan would be shared between companies;
- most agreements did not agree a timeframe for the review of the Protocol nor the update of DWSPs; and
- some protocols were not signed, and most did not include details specific to a bulk supply arrangement.

Following its investigation, the DWI set out minimum standards that companies should incorporate into existing bulk supply agreements in addition to any new water trades:

- Companies are required to update protocols to include a section on the minimum sampling data to be communicated between them;
- Companies are required to update protocols to include a minimum frequency of meetings between providing and recipient companies to update, discuss and review the protocol;
- Companies are required to ensure that the protocols are signed and dated. The signature and dates should be updated each time the protocol is reviewed together by both companies; and
- Companies are required to ensure protocols are reviewed in unison by both companies on an annual basis and include updated information on the DWSP and Risk Assessments where relevant.

Most of the contracts we examine refer to an associated Protocol governing agreements between the parties on water quality. However, often the Protocols were not provided to us alongside the contracts and therefore we were unable to review details pertaining to water quality outside of the main clause in the contracts. The contracts we examine place the responsibility on the supplier of the water to ensure that it met standards set by the DWI and to regularly report the quality of water to the purchaser through an agreed channel.

A.1.3. The role of industry codes

The contracts we examine commonly refer to industry standards set by regulators in acts of parliament or legislation. These standards are used to support contracts between parties, and ensure that the concepts and terms of trade within the contract are explicitly defined and understood by both parties. If parties were unable to rely on such definitions or codes they would need to decide and define the relevant terms through bilateral negotiation in every contract, which may result in significantly higher transaction costs.

In the contracts we examined, the most common reference to industry codes is when defining minimum water quality standards under a bulk supply arrangement for potable water. In such a contract, the responsibility that the water meets the water quality standards sits with the supplier of the water. In contracts, clauses for water quality commonly specifies that the supplier must ensure that the water meets the quality as specified in the Water Industry Act, the Water Supply Regulations 2000/2016 or an authorised departure from such regulations as agreed between the supplier and Defra or the DWI. Beyond fulfilling such standards, the supplier may vary the quality of water, for example through the addition of orthophosphate or fluoride, above those standards.[91]

In contracts for the emergency supply of water, regulatory approved standards are commonly used to define an emergency under which the purchaser may access the emergency supply. For example, the application of a drought permit or order is sometimes used in a contract to alleviate the obligation for the supplier to supply water under the arrangement.

On the one hand, referring to industry codes and regulatory definitions may save significant transaction costs in the trading of bulk water. Parties do not have to define such concepts at the point of striking the contract but may merely refer to industry codes.

Referring to industry codes also provides trading parties a degree of protection from unforeseen circumstances. For instance, tying concepts of water scarcity and water quality to defined industry codes ensures that parties do not need to define such standards at the commencement of the contract and ensure that their definition captures all possible potential changes in those standards over the tenor of the contract. For example, by defining water scarcity in relation to the award of a drought permit, contract parties allow the regulator to determine whether water is sufficiently scarce to trigger certain contractual provisions. Similarly, by setting water quality requirements based industry standards, the contract adjusts for changes in DWI's standards without the need to change the contract itself.

On the other hand, whilst tying concepts to dynamically changing regulatory and industry avoids the need for continuous contract renegotiations when regulations change , it does expose the contacting parties to regulatory risk. Regulatory risk in this context means that parties' obligations under the contract may be affected by changes in regulation, which may impose additional costs on the buyer or seller. For example, should the DWI enforce stricter water quality standards, the supplier would face the cost of treating water to such standards and may not be able to reflect such costs in the price charged to the purchaser.

The management of regulatory risk varies across the contracts we examine. In some cases, contracts include terms whereby the contract could be renegotiated following significant regulatory change, although parties must mutually agree for such decisions to translate into changes in the contract. In some cases, definitions of key concepts were not tied to dynamic concepts but referred to specific iterations of the Water Industry Act 1991. In other contracts, it was unclear as to how the obligations of the supplier or purchaser under the contract would change following changes in the industry codes referred to in the contract.

A.1.4. The nature of contractual commitment

In both raw and potable contracts, most contracts we examine involve a firm commitment to supply or purchase a minimum volume of water, commonly referred to as a "sweetening flow", and a call-option for the purchaser to buy additional volume up to a maximum flow

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rate. The option to buy additional water provides security of supply to the purchaser, which is entitled to demand the additional water up to the maximum flow rate, but creates volume risk for the seller, which cannot know in advance what volume the buyer will require.

The purchaser of water in the contract often faces volume risk should the supplier face water scarcity in its own region. Clauses that allow the supplier to reduce its obligation to supply water to the purchaser under the contract in times of water scarcity are common in the contracts we reviewed. However, the definition of water scarcity that triggers such adjustments in the supplier's obligations were not standardised. We saw the following approaches in the contracts we reviewed:

- The supplier is able to limit the supply due to limitations in its own system, but those limitations are not defined;[92]
- The supplier's obligations adjust if it is unable to fulfil its statutory duties under the Water Industry Act 1991 to its own customers;[93]
- The supplier must only deliver the contracted supply when it has surplus water at the time requested, though the definition of surplus water was not defined;[94]
- The supplier is allowed to suspend supply when the supplier seeks a drought permit or order, or imposes a temporary use ban;[95] or
- One contract specifically stated that under conditions of water scarcity the supplier would be required to treat its own customers consistently with the customers of the purchaser.[96] It was not defined how consistent treatment would be ensured in practice.

The lack of a common approach to specifying the degree to which a company's own customers should be prioritised over those customers of the trading counter-party is a problem that Ofwat also noted in its final determinations over HT. Ofwat states at FD:

> "We recognise that greater clarity around the interaction between water undertakers' obligations to supply their own customers and their obligations to provide bulk supplies of water to other water undertakers under bulk supply agreements may be beneficial. This is an area that has been raised in relation to potential strategic transfers and we recognise that the sector considers it to be an important issue. We will consider this issue further in 2020 and engage and consult with stakeholders across the industry"

Clauses that allow suppliers to prioritise their own customers in times of water scarcity, by allowing the supplier to default on its obligation to provide the volume of water to the purchaser without penalty, reduce the firmness of water secured in the bulk trade.

Hence, when planning their water resource portfolio to ensure resilience to drought, purchasing parties' ability to rely on water purchase agreements is limited. In essence, the supply secured through bulk trades is "interruptible" in times of water scarcity. This is

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particularly true when bulk supply agreements involve relatively local trades, where drought is more likely to concurrently affect the purchaser and supplier.

A.1.5. Typical tenor of contracts

The contracts we examine commonly have tenors of 10, 15, 20, and 25 years. Some are perpetual.

Contracts for raw water tended to have longer tenors than contracts for potable water. The longest tenor of a contract for potable water was 25 years, whereas the shortest tenor of a contract for raw water was 25 years. We assume that raw water contracts tend to have longer tenors because they are more commonly linked to the development of a source and significant infrastructure to support the trade.

The terms by which the contract could be extended beyond the initial tenor varied across the contracts we examined. Often, contracts included terms allowing the contract to be extended by mutual agreement.

A.1.6. Secondary trading

Water companies may not trade the bilaterally negotiated contracts they hold with other companies pertaining to the bulk supplies of water, because it seems from our contract review that the contract cannot be transferred between parties. Indeed, each water company is a regional monopolist and is therefore the only counter-party that may hold a contract to supply or purchase water with its neighbor. Consequently, even if water companies could trade their contracts in a secondary market, there would be no companies who could take on the liabilities of the contract.

However, in some cases, water companies may be able to trade the water that they purchase through bulk supply trades thereby engaging in secondary trading of the commodity. In these cases, the exact unit of water purchased may not be the one that is subsequently traded in the secondary market. For example, to the extent that a water company could substitute units of water across its network, it could purchase water through a bulk supply trade thereby “freeing” an additional unit in its network for sale with other water companies.

However, some contracts that we reviewed include destination clauses stating that the purchaser could only use the water to fulfil its statutory requirements to serve its customers. Some contracts also explicitly stated that the purchaser could not use the water supplied to sign additional bulk supply contracts. Destination clauses prevent the resale of water through “secondary markets”.

A.2. Pricing and Cost Allocation

A.2.1. Approach to determining the level of pricing

The approach to determining the level of pricing in the contracts we examined is not explained. Therefore, whilst we know the structure of pricing used in the contract, we do not know how the charges were calculated and what costs they reflect.

Some of the contracts for the bulk trade of potable water use the suppliers' published wholesale charges. We understand that water companies publish wholesale charges that follow Ofwat's wholesale charging rules, which follow a cost-based pricing principle.[97]

In its wholesale charging rules, Ofwat specifies that "Charging structures must reflect the long-run costs associated with providing the relevant service". Ofwat also specifies that differences between the charges applied to larger or smaller customers must only be based on "cost differences associated with differential use of network assets, differential peaking characteristics, different service levels and/or different service measurement accuracy". Ofwat specifies that, should differences in costs from serving large or small customers arise because of different peaking characteristics, the charges must be structured on an appropriate peak demand basis. It sets minimum timeframes for the publication of such charges and rules setting out the terms by which companies may update the charges.

We understand that some companies use their published wholesale charges to underpin bulk supplies on the same terms offered to their own customers within their main networks. The use of published wholesale charges ensures that trading customers pay the same average cost as other customers within their area of appointment.

The published wholesale charges therefore provide a baseline from which the supplier can price the trade. Should the purchaser request terms different to those received by other customers in the supplier's network, the supplier would adjust the prices from the baseline to reflect the costs of offering those terms. For instance, should the purchaser wish to be supplied water only if surplus water was available, then the price it would pay could potentially be set at a price below the published wholesale charges to reflect the less firm contractual commitment to supply relative to other customers in the supplier's network. In addition, the costs of infrastructure required to support a bespoke trading agreement could be reflected in the price of water in the contract.

Our review therefore suggests that suppliers are adopting a mix of average cost and marginal cost pricing approaches. Whilst the published wholesale charges reflect the average cost of the provision of water, incremental changes to those terms offered to reflect different options in the contract or additional infrastructure are priced on an incremental or marginal cost basis.

A.2.2. Link between prices and cost

We are unable to determine from the contracts how the prices were determined in the contract and therefore how the prices link to the costs of facilitating the bulk trade.

A.2.3. Typical structure of pricing

The majority of contracts for the bulk supply of potable water follow a two-part charging structure with a fixed standing charge paid irrespective of the flow demanded by the purchaser and a volumetric charge paid on the basis of actual metered demand. Some of the contracts use the most appropriate wholesale supply charges as published by the supplier.

Other contracts for potable water followed a tiered volumetric pricing structure whereby the volumetric charge that applies to the first X litres of water is lower than the volumetric charge

[97] Ofwat (20 December 2018), Wholesale Charging Rules issued by the Water Services Regulation Authority under sections 66E and 117I of the Water Industry Act 1991.

that applies to the subsequent Y litres of water demanded by the purchaser. The tiered volumetric pricing structure may allow charges to better reflect the cost structure of supplying the contracted volumes. For instance, if the fixed costs of the transfer are recovered through the charges associated with the minimum contracted volume under the contract, the charge that applied between the minimum and maximum volumes can reflect the marginal cost of supply to allow the purchaser to make more efficient decisions on when to use the contracted resource.

Very few of the pricing structures that we examine had provisions for the charge paid by the purchaser to change across the year. In other words, most charges reflected a volumetric rate which was unchanged across the year. However, some of the contracts we examine included a schedule of volumetric payments that varied by month within the year, with higher charges in the summer relative to the winter.[98] Higher charges in the summer in these contracts may reflect both the higher marginal cost of abstracting water which may be more scarce in the summer or also the market value of water being higher in the summer.

In some cases, tiered volumetric payments with an annual minimum quantity of water that the purchaser must demand under the contract are used to reflect a two-part charging structure. The annual minimum volume multiplied by the corresponding volumetric represents the annual payment that the purchaser commits to make from the supplier, and in some contracts is paid upfront for the year reflecting a fixed payment or standing charge. Volumes beyond the minimum volume are charged at a volumetric rate that may differ from the rate applied to the minimum volume.

In the contracts we examined, the pricing structure in contracts for raw water were more diverse than the contracts for potable water, reflecting the purpose of the contract. Some contracts for the continuous or emergency supply of raw water adopted similar pricing structures to the majority of potable water contracts, with an annual standing charge and a volumetric payment for additional water taken.

Some contracts, where the supplier is temporarily selling or transferring the right to abstract water from a given source in its area of appointment to another party outside its area of appointment, charge a fixed cost per year for the abstraction right. Other contracts where the right is being transferred adopt a one-off, fixed payment structure.

A.2.4. Adjustments to prices over time for changing costs

In most contracts, adjustments to prices are not made explicitly in light of changing costs of operation. Consequently, either party may face risk of changing costs to the extent that the mechanism used to update prices does not capture the change in costs incurred.

Whilst most contracts that we review update charges over time, there is not a standardised approach to updating prices:

- Often, contracts for treated water are linked to the supplier's published wholesale water bulk supply charges. In these cases, contract prices are linked to costs because the published charges must reflect long run costs, and are updated annually.

98 [✂]

- In most contracts which are not linked to published wholesale charges, prices in the contract update with inflation over time. However, contracts with similar commencement dates adopt different inflation measures to update pricing, for example CPI, CPIH and RPI.
- In some contracts, the volumetric charge is linked to inflation whilst the standing charge updates with the published wholesale charges of the supplier.[99]
- In one contract for raw water that we reviewed, the fixed annual charge updates with the average annual change in average consumer bill across both parties in the contract.[100]

A.3. Infrastructure and Investment

A.3.1. Links to infrastructure and investment

Water requires infrastructure to facilitate its transportation, abstraction, and treatment. Even the simplest trading agreement to facilitate a supply of water to a neighbouring network requires both a meter, to measure flow and ascertain the charging basis, and a connection with the source network.

In our sample of contracts, there were fewer contracts pertaining to raw water. However, contracts for raw water seemed in general to be linked to larger investments in infrastructure than contracts for potable water.

A.3.2. The role of contracts to support infrastructure

In most treated contracts, infrastructure is required to support the trade. In these cases, the contract defines which party is liable for the costs of building the infrastructure so as to facilitate the trade in question. Examples of this infrastructure include connections and meters.

In other raw water contracts, the contract relates to the joint development and use of a water source. In these cases, contracts for raw water not only define cost sharing between parties, but also commit parties to purchase water from the source after its development in order to finance the investment in the infrastructure. Through the contractual commitment, volume risk for the investing company is reduced.

Agreements for raw water typically include a schedule of payments in the event of early termination in order to protect the party which bears most costs from the risk of stranded assets.

A.3.3. Cost sharing in contracts

The costs of assets or works borne by each party are normally explicitly defined in the contract along with the ownership of the asset. Typically, the sharing of costs in the contracts that we examine follows a beneficiary pays principle. In contracts where the infrastructure is developed to facilitate the trade of water to the purchaser, the costs of that infrastructure are

99 [✂]

100 [✂]

normally borne by the purchaser. The typical exception to this rule is the installation of a meter, the costs of which are normally borne by the supplier.

In raw water contracts to develop joint works or sources, the costs of infrastructure or operating costs are generally borne by parties in proportion to the benefit they receive from the asset. For example, in one contract we examine, the purchaser receives the right to abstract a given percentage of the annual licensed abstraction from a source. The purchaser also bears an equal percentage of all operating costs related to abstraction from the source.

However, the party that bears the cost of constructing the asset is not necessarily the party which manages the construction of the asset or the eventual operation of the asset. The construction and operation of assets is normally managed by the company whose area of appointment covers the location of the asset. Normally, contracts provide clear instructions to share details of the tender for construction and cost overruns with the purchaser, which may bear some or all of the construction costs. Therefore, whilst the purchaser is kept informed of the costs of construction, it still faces the risk of cost over-runs. Some contracts had stop-go points built in whereby the purchaser would be able to halt construction, in part to protect the purchaser against significant cost overruns or unforeseen circumstances.

The party responsible for the operation of the assets is also explicitly stated in the contracts we examined. We understand that most contracts are also supported by an operational agreement of the asset agreed by both parties. The contracts often stipulate that the operator of the asset should operate the asset within the terms set out by that operational agreement. The operational agreements underpinning the contracts we examined were not available for us to evaluate in our review.

In at least one contract we examine, the technical operational limitations of the infrastructure did not appear to align with the financial flexibility offered by the contract.[101] In one particular case, a treatment plant owned by both contracting parties was built to treat water from a single source so that it could be transported in the network of both contracting parties. Crucially, each network required different treatment processes, and therefore the treatment works was built with the technical ability to switch from treating water suitable for one network to treating water suitable for the other. The financial contract allowed either party to call upon the works to produce potable water for it to consume. However, the flexibility afforded by the financial contract exceeded the technical ability of the plant to switch from treating water suitable for one network to treating water suitable for the other.

A significant component of the costs of providing a bulk supply of potable water is the costs of treating raw water. Most contracts place the obligation to treat the water solely on the supplier, and define the supplier's obligations to supply potable water to the standards set out in the Water Supply Regulations 2000/2016. The designation of the explicit responsibility for a party in the contract to guarantee a level of water quality implicitly shares the costs of treating water to that specified standard. Furthermore, should the purchaser require additional treatment of the water beyond the regulated standard in order to supply the water through its network, it faces the costs of that additional treatment. In some contracts, the

101 [✂]

purchaser may request that the supplier treats the water to a standard to allow it to be transported through its own network at the purchasers cost.[102]

The most common asset installed as part of a bulk supply contract for potable water is a meter to monitor the flow demanded by the purchaser of the water. Across almost all the contracts we examined, the meter is installed and operated by the supplier. The supplier must take meter readings at regular, defined intervals and inform the purchaser of the readings. However, the buyer may request, and bear the costs of, testing of the meter for its accuracy. There is no penalty borne by the supplier for a faulty meter reading.

A.3.4. The role of industry codes

Industry codes are not used explicitly in contracts to share costs or determine the assets appropriate to support the bulk trading of water. However, investment in infrastructure and other operational costs to facilitate bulk trading are funded through companies' total expenditure (totex) allowances, which Ofwat sets using its benchmarking models and other aspects of its cost assessment. Consequently, Ofwat's regulatory model in part determines the risk ultimately borne by the consumers of the water company, as we discuss in Section A.4.

A.4. Allocation of Risks

A.4.1. Risk around the availability of water

In most contracts, the purchaser faces the volume risk over the availability of water. Most contracts that we reviewed include clauses that absolve the supplier of its obligation to provide volume greater than the minimum guaranteed volume or sweetening flow when water is scarce in their own jurisdiction. Moreover, few contracts that we review include penalties for non-compliance such that the purchaser is remunerated for the supplier failing to deliver the volume demanded.

A.4.2. Risks of cost changes

The allocation of price risk, or more specifically the risk that costs change at a rate different to costs, depends on the pricing structure agreed in the contract. In the case where price is linked to the published wholesale charges of the supplier, the purchaser faces the risk that prices in future years are significantly different when the supplier updates it charges. The supplier is protected from trends in the costs of fulfilling the trade through its ability to update is wholesale charges on an annual basis. However, the supplier still faces price risk within-year whereas the purchaser is absolved of price risk within the year.

In contracts which require the development of infrastructure, the risk of cost overruns is borne by the parties responsible for developing the infrastructure as designated in the contract. Often, whilst the purchaser may finance the costs of constructing infrastructure to support the trade, the supplier contracts for and manages the construction of the infrastructure. Contracts often require the purchaser to approve the choice of contractors made by the supplier, and also stipulate intermediate stop points throughout construction which may help manage the risk of cost overruns.

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102 [✂]

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A.4.3. Risk of asset stranding due to early termination

The parties who invest in assets to support the trade also face the risk that the trade is subject to early termination and that they therefore lose their investment in those assets. Contracts that involve significant investment in infrastructure often include provisions by which the costs of investment are remunerated in the event of early termination of the contract. The mechanism by which investment costs are remunerated is not standardised, and varies across the contracts that we examine:

- One contract specified a series of exit payments relating to the costs of investment in infrastructure to develop a raw water source. Another stipulated refund payments to the investor in the infrastructure on a straight-line basis for the remaining asset life after the date of early termination;[103] and
- One contract for an abstraction right specifies that the seller of the right must refund the payment for the right on a pro rata basis across the remainder of the contract

However, in other contracts, the recovery of investment into infrastructure in the case of early termination is not specified, and therefore parties would have to reach agreement through specified processes of dispute should the need arise. We understand, in cases when the assets could otherwise be used by the party in their own network, that the party faces lower stranding risk and may not need provisions in the contract specifying how the initial investment in those assets should be recovered in the case of early termination.

A.4.4. Risk of asset failure

The risk that the asset fails, and therefore that the flow is interrupted is borne by all parties who are supplied water from the resource. Typically, the purchaser is thought to bear more of this risk, as the supplier is not obligated to provide the volume of water to the purchaser in cases where emergency repairs or asset failure means that the water is not available for supply.

A.4.5. Risk of regulatory change

Both parties face the risk of regulatory change, depending on the change in question and the resulting impact on the contractual obligations of the party. For example, purchasers who face prices determined by published wholesale charges face the regulatory risk that Ofwat alters its wholesale charging rules governing how those charges are set and updated. On the other hand, the supplier may face the risk that the DWI changes its standards and treating water becomes more costly. Many contracts we examine included provisions for the parties to renegotiate the contracts following change in regulatory determinations, and typically aligned such options to renegotiate with the regulatory periods that Ofwat adopts in its price control methodology. However, in cases of renegotiation, amendments must be mutually agreed between parties.

A.4.6. Risk of water quality variation

Typically, the supplier faces the risk over raw water quality in a contract for the bulk supply of potable water because it is contractually obliged to treat and deliver water to the purchaser at the standard set out by the Water Supply Regulations 2000/2016. However, the purchaser

103 [✂]

also faces risks over water quality, and in particular around variations in water quality and content above the regulatory standards met by the supplier. For example, the purchaser faces the risk of impurities in the water that do not affect the quality of water in relation to the regulatory standard, but compromise its ability to be transported in the purchaser's water network.

A.4.7. Risk of creditworthiness of the counterparty

The counter-party risk in most contracts is borne by the customers of the water company, to the extent that the costs of fulfilling the trading arrangement are included in the company's totex allowances. In some contracts we examine, a clause is included to allow the supplier to demand the purchaser obtains a parent company guarantee or alternative form of finance e.g. letter of credit, should the credit worthiness of the buyer fall below a given standard. Typically, a credit worthiness standard set on the corporate debt credit rating of the company was used. In the long run of all water trading, the customer bears the costs of counter-party failing.

A.5. Dispute Resolution

The vast majority of the contracts that we examined do not include penalties for supplier non-compliance beyond formal dispute of the contract. In the cases where the supplier may break the terms of the contract, the purchaser is often entitled to terminate the contract with less notice than it otherwise would be obligated to give but does not receive compensation for the supplier's failure to honor the agreement beyond refunds of existing payments for volume. The lack of penalties for non-compliance in the contracts we examined, suggest that the majority of contracts rely heavily on trust between contracting parties.

However, some contracts included terms by which the supplier faced a penalty in the event of non-compliance:

- One contract that we examined stipulates that, in the event that the supplier terminates the agreement early, that the supplier would meet reasonable costs for the purchaser to source alternative potable water for its customers from another source.[104]
- One contract penalises the supplier when the guaranteed supply is not been made available at double the pro rata rate that the purchaser pays for the guaranteed supply.[105]

Instead, most contracts rely on dispute resolution processes to settle non-compliance. In the case of dispute, and if negotiated settlement cannot be reached, disputes are referred to an arbiter defined in the contract – typically the Centre for Effective Dispute Resolution (CEDR). In cases where parties dispute investment in infrastructure to support the trading arrangement, some contracts specified that the dispute be resolved through appointment of an expert engineer who makes a determination on the infrastructure required.

On the other hand, most contracts include penalties for non-compliance by buyers including interest on late payments, particularly under contracts for potable water.

104 [✂]

105 [✂]

Appendix B. Trading of Electricity in Great Britain

B.1. Background and the Need to Trade

B.1.1. Organisation of the industry

Producers of electricity in power stations (or importers from neighboring markets) produce electricity from other forms of energy (fossil fuels, renewable energy, etc.). They export this electricity onto transmission and distribution systems, which convey electricity to end customers. In this respect, electricity is similar to gas and water, but electricity has the unique characteristic that the system has to be balanced in real time (i.e. second-to-second) to ensure supply equates to demand at all times.

The design of the electricity market places obligations on retailers to ensure they have procured sufficient electricity (measured in kilowatt-hours) to meet the needs of their customers within each 30-minute trading interval. Retailers meet this obligation by entering into contracts in the wholesale market to purchase electricity from generators. If they do not purchase sufficient electricity to meet the needs of their customers, they are required under the market rules to purchase electricity in the "balancing market", organised by the Electricity System Operator (ESO).

Generators which agree to sell electricity to a retailer take on an obligation to supply the contracted volume of electricity in the trading periods covered by the contract. If they fail to do so, the retailer is not affected, but the generator is obliged to purchase any shortfall compared to the contracted volumes from the balancing market.

Hence, retailers and generators typically trade through forward contracts, and do not buy or sell their product in real-time. Instead, parties trade forward, striking contracts to buy or sell a particular volume of electricity for particular trading periods in the future, at a particular price, as described further below. If retailers and generators are not balanced, they buy/sell in the balancing market. The process of ensuring retailers and generators buy/sell the right volumes of electricity takes place after the trading interval has finished through a process known as "settlement".

In addition to ensuring all generators and retailers buy/sell the right volumes of electricity, the ESO is also responsible for managing the supply-demand balancing in real time (i.e. within a 30-minute trading interval on a second-to-second basis). It does this using "ancillary services", which involves paying generators or consumers to adjust their supply/demand in real time to ensure the system operates stably.

The electricity market in Great Britain comprises a mix of vertically-integrated players that owned both generation and retail businesses, as well as independent generators and independent suppliers. The vertically integrated players do not need to strike contracts to aggregate the positions of their generation and retail activities as these are netted off during the settlement process.

B.1.2. Organisation of trading and the role of contracts

When electricity generators and retailers enter forward contracts for the sale or purchase of electricity, they are making a firm commitment to offtake from the grid (buy) or supply to the grid (sell) electricity of a particular volume, for particular trading periods in the future, at an agreed price.

Different forward contracts have different tenors, and are agreed at different lengths of time ahead of delivery. For instance, some contracts may be annual, and so cover all the trading periods in a particular calendar year, while others may have a shorter or longer tenor, covering fewer or more trading periods. The price is defined in terms of pounds per megawatt-hour of electricity traded. Standardised forward contracts for electricity in Great Britain are traded on over-the-counter (OTC) markets, or through power exchanges. Products may also be privately negotiated between parties.

As explained above, parties trade for power bilaterally and inform the ESO of their contractual positions. Therefore, by trading forward, parties are not making a commitment to produce or consume electricity. Rather, generators selling electricity forward contracts make a firm commitment to the system operator that they will supply a defined volume of electricity on behalf of the seller, or else take responsibility for buying it in the balancing market. Conversely, retailers buying electricity forward contracts make a firm commitment to the system operator that their customers will use a defined volume of electricity, and if they do not (or their customers use more than the contracted volume) the surplus or shortage is disposed of or acquired in the balancing market.

Contracting parties can trade multiple times to adjust their net position. Therefore, parties can trade in the market without ever committing to a physical supply of or demand for power, by ensuring their net demand is zero at the point of delivery. Indeed, this allows trading businesses which are neither retailers supplying customers nor generators to participate in the wholesale electricity market (e.g. banks).

Forward trading of electricity contracts can take place months or years before the trading interval in which the electricity is bought/sold. When the time of delivery arises, the SO halts trading, a point known as "gate closure". At this stage, all parties' contractual positions are netted off, with surpluses disposed of into (shortages purchased from) the balancing market.

Within the British electricity market, there are many reasons why parties may wish to trade power in the forward market (i.e. ahead of delivery), rather than rely solely on the balancing market:

- To support the development of major the infrastructure required to produce electricity in power stations, their investors may require long-term contracts to ensure they have reasonable certainty on their ability to recover their investment costs. Hence, they may enter long-term "Power Purchase Agreements" (PPAs).
- Electricity prices, even more so than for other commodities, are volatile. Hence, retailers and generators can hedge their exposure to these risks by trading power forward, and lower their working capital requirements. For example, customers of suppliers are often unwilling to accept a volatile monthly bill that would result from facing the real-time price for electricity. Consequently, suppliers often offer customers fixed tariffs, or tariffs which do not reflect the real-time price of electricity, for a fixed period of time into the future. As such, suppliers are willing to trade forward to lock in their margins for those contracts.

- To efficiently balance the market in real-time, contracts to generate power may need to be struck ahead of delivery. For example, some plant may have longer start-up times but may produce power more cheaply if they can be scheduled to produce electricity with several hours' notice before gate closure.

With the exception of PPA contracts, which may be linked to investment, forward contracts for electricity tend not to be linked to any investment in infrastructure.

B.1.3. Possible lessons for bulk water trading

Forward trading for electricity has some similarities to the trading of water between regional utilities, i.e. securing bulk supplies to meet anticipated demand in the future. Long-term PPAs can also be used to trade electricity in conditions where new investment in physical infrastructure is required to supply the contracted volume.

However, unlike water, the value of electricity is determined in a competitive market with many buyers and sellers located throughout the country, which is possible because there is a national transmission system. There is also no variation in quality, as electricity is (at the point of use) an homogenous product. Because the market is reasonably liquid and competitive, the price is not directly subjected to regulation.

B.2. Contract Description

B.2.1. The standardisation of contracts

Contract standardisation, and the regulatory rules governing contracts, have evolved in Great Britain's electricity markets alongside the introduction of competition. The introduction of industry codes to establish balancing markets provided the incentives to trade forward for power in the wholesale market. Meanwhile, the introduction of competition into the wholesale market led to an increase in the number of parties contracting forward. With more parties trading, the industry led standardisation of contract terms in order to reduce transactions costs in the competitive market.

Key features of electricity allow for forward contracts to be standardised to a large degree, allowing market participants to more easily value the traded product:

First, electricity is largely of common quality[106] which means, unlike water, it is easily defined in contracts and varies simply depending on the time of delivery.

Also, the wholesale market is designed so that market participants do not need to contract for the actual 'unit' of electricity generated or demanded. Contracting for electricity is separated from the transmission of the product. That is, at the point of gate closure, the settlement system treats all contracted sales and purchases of electricity as perfectly substitutable, wherever the contracting customer and generator are located. A generator in the north of Scotland can sell to a retailer with customers in Cornwall.

While the generator and the customer both pay for the use of the transmission system, these payments do not depend on who they choose to trade with. Indeed, payment of these Transmission Network Use of System (TNUoS) charges are made in return for access to the

[106] Whilst variation in voltage may occur, minimum standards are set by the Grid Code. See for example National Grid (21 March 2017), The Grid Code, Issue 5 Revision 21, CC.6.1.4.

grid, allowing network users to inject power to or withdraw power from the grid irrespective of where that power is used or generated. For this reason, this approach to transmission access and charging is sometimes referred to as an entry-exit model.

Of course, ignoring limitations on transmission capacity across the country is an approximation. In reality, increasing generation in Scotland to serve increased demand in Cornwall may impose costs on the ESO through the balancing market. Other electricity market designs used in other parts of the world define different wholesale market "zones" so that transmission constraints show up as differences between prices in different parts of the country.

However, the British market, like many others in Europe, is designed with a single national price. The alleged advantage of this approach is that it promotes liquidity in the wholesale market, and locational signals can be sent to customers and generators through locational variation in transmission access charges.

We discuss the how these standardised contracts have evolved over time in more detail below.

B.2.2. The role of industry codes

The wholesale market arrangements in Great Britain are known as the British Electricity Trading and Transmission Arrangements (BETTA).[107] Under BETTA, the market rules do not stipulate how power should be traded (e.g. OTC, by exchange or by other means) or specific terms of the contract. Rather, they specify common rules in the Balancing and Settlement Code (BSC) that determine how trades in the forward market relate to the physical delivery of power.[108] The BSC defines processes for market participants to nominate their forward contract positions to the ESO, and defines how prices are set in the real-time balancing market for market participants with unbalanced forward contract positions.

With the introduction of BETTA (and the New Electricity Trading Arrangements – NETA – than preceded it) market participants began to standardise contractual forms. The role of contract standardisation in a market is to reduce transaction costs and improve risk management. Instead of reviewing the terms for each contract, parties trading standardised contracts can simply trade on the price of the contract with an acceptance and understanding of the remaining standardised terms of that contract.

The most common contractual agreement used by market participants is the Grid Trade Master Agreement (GTMA),[109] which has been refined alongside the development of the market and is the basis for most OTC trades around Great Britain, including those between the ESO and market participants.[110] Alternatively, exchanges such as the Intercontinental

[107] ELEXON, History of the BSC, Last accessed: 22 May 2020, Link: https://www.elexon.co.uk/knowledgebase/bsc-history/

[108] Ofgem (February 2005), BETTA User Guide.

[109] Ofgem (February 2005), BETTA User Guide, p. 30.

[110] National Grid ESO, Trading, Last accessed: 22 May 2020, Link: https://www.nationalgrideso.com/industry-information/balancing-services/trading

Exchange (ICE) have their own standardised terms of trade which parties must agree to before trading their products.[111]

Whilst the GTMA and exchange agreements set general standardised terms of trade, including terms of credit cover, and conditions for force majeure and dispute resolution, parties enter into these standardised contract forms the settlement periods they cover, the volume of electricity traded, and contracted price of the trade.[112] However, the scope for customisation of these standardised contract forms to specify quantities, prices and settlement periods is limited by the rules of the power exchanges and the GTMA.

The standardised forward contracts developed by the industry has also been used by the regulator (Ofgem). For example, Ofgem mandated incumbents to make certain forward products available in the market for new suppliers to purchase in the Secure and Promote Market Making Obligation.[113] In addition, Ofgem's determination of the default tariff cap for electricity is based on the average price of specified standardised forward contracts.

As new products for electricity have been demanded, the market has led the development of standardised contracts to facilitate trading in that new product. For example, the Energy Networks Association (ENA), with input from all of Great Britain's Distribution Network Operators has recently developed a standardised contract to procure flexibility providers. The ENA hired international lawyers to draft the legal text in the contract. It aims to use the standardised contract to "boost market confidence and participation in local markets for flexibility by building a level playing field, with liabilities and indemnities capped at contract value".[114]

B.2.3. The nature of contractual commitment

By trading a single forward contract, parties make a firm commitment to supply or offtake a particular volume of electricity from the market during a particular period of time. However, because parties may strike trades using multiple forward contracts, parties may trade out of their firm commitment to supply or offtake power, by ensuring their net commitment to offtake or supply at the time of delivery is zero. Consequently, non-physical participants (e.g. energy traders or banks) may strike forward contracts so long as they balance their net position before the time of delivery, or alternatively face the prices in the balancing market, specified by the BSC, to balance their position.

B.2.4. Typical tenor of contracts

Forward contracts of different tenors have been developed by market participants to enable them to balance their supply with demand positions, in accordance with the requirements set out in the BSC.

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[111] ICE, ICE OTC Participation Agreement, Last accessed: 22 May 2020, Link: https://www.theice.com/publicdocs/ICE_OTC_PARTICIPANT_AGREEMENT.pdf

[112] Thomson Reuters, Glossary, Grid Trade Master Agreement (GTMA).

[113] The MMO was suspended in November 2019. Ofgem (14 November 2019), Decision to suspend the Secure and Promote Market Making Obligation with effect on 18 November 2019.

[114] Energy Networks Association (6 April 2020), Market changing standard contract for flexibility delivered, Link: https://news.energynetworks.org/news/market-changing-standard-contract-for-flexibility-delivered

With the exception of PPAs, the longest contract tenor for commonly traded physical electricity contracts is a baseload seasonal product, which is a commitment to supply or offtake a volume of electricity for six months. Quarterly, monthly, and weekly/week-end products are also common. Parties may use different products to determine how many hours within the delivery period they commit to supply or offtake power. For example, a seasonal peakload contract is a contract with a tenor of six months, but only requires a commitment to supply or offtake power between 7am and 7pm on working days.

In addition, parties agree different forward contracts at different times ahead of delivery. Trades further from the time of delivery tended to occur in products with longer delivery periods e.g. quarters or seasons. There is little trading of within-day contracts until close to gate closure for the trading period in question. These more granular products are more frequently traded on the prompt end of the forward curve to meet the expected demand shape which is forecast more accurately closer to delivery (given volume risk on the number of customers each supplier must serve and other factors e.g. the weather). For example, contracts such four-hour Electricity Forward Agreement (EFA) block contracts are used closer to refine contracted volumes to anticipated demand.

Not only are the tenors of contracts standardised, but also the time periods to which they relate. For example, monthly and seasonal products are standardised contracts with tenors of one months and six months respectively, but standardised products are not available for every possible monthly or six-monthly period. Instead, monthly contracts exist for standardised time periods (e.g. January, February), whereas seasonal contracts are defined over blocks of six months corresponding to winter and summer. This standardisation allows parties to more easily adjust their positions in the market, using prices in the market which continually value the contract they hold.

B.2.5. Secondary trading

There is not an explicit secondary market for the same contract. However, parties can agree to trade another standardised contract in the market for the same delivery period and contract terms, but with a different counter-party and at a different price to adjust their net position. Hence, every megawatt-hour of electricity used could have been traded multiple times in the forward market. There are two features of the contract that allow this:

- the contract delivery period is standardised;
- and the counter-party to the contract is not related to the physical delivery of power, in other words the contract simply requires each party to notify the SO of its commitment to supply or offtake power during a particular time (i.e. a trading interval).

Parties are still liable for posting collateral and margin call payments under its existing contracts.

B.3. Pricing and Cost Allocation

B.3.1. Approach to determining the level of pricing

Prices for electricity forward contracts are determined by the process of competition in the wholesale market. For standardised products, prices of forward products are publicly available depending on the trading platform. If traded through an exchange e.g. ICE, the exchange displays prices for each product at which participants may buy or sell. However, most electricity forward products in Great Britain are traded on the OTC market through a platform, TradePort, which displays live bids and offers by all market participants willing to trade for each product. Given contract standardisation, market participants can track the price, as determined by the market, of the same forward product over time until delivery.

Contract standardisation means that the most important information to parties is the price that other market participants are willing to buy or sell the contract at. The value of transparency in pricing leads to concentrating liquidity on a specific platform. For example, contracting for electricity forward products has concentrated on the OTC market in Great Britain. In Germany, on the other hand, most electricity contracts are traded on an exchange rather than the OTC market. As a new party wishing to trade, there is an advantage to continue to trade where most other parties are trading in order to obtain the most information about the market value of each contract. The concentration of market liquidity in the OTC market for electricity forward contracts in Great Britain is not well understood and may be due to historical, structural reasons in the development of the market.

In addition to forward contracts, the ESO also defines standardised contracts to provide balancing services in the balancing market. The price of balancing services contracts with the ESO is also determined by the market. However, given the ESO is a monopsony (a single buyer), it typically uses auctions to determine the market value of those balancing services. The services are well defined in a publicly available contract shared across participants to ensure that they understand, and may price correctly, the product in auction.[115]

For example, one balancing service contracted by the ESO is the Short-Term Operating Reserve (STOR) which provides power to the grid when demand is greater than anticipated.[116] The contract specifies minimum technical requirements for STOR providers including minimum volumes of reserve to be provided, maximum response times, and a minimum time that the supplier may be required to sustain the generation of power. In order to bid to be a STOR provider, one must accept standard contract terms to enter into the STOR framework agreement. Then, the ESO runs a competitive tender process three times a year to select STOR providers.

In the tender process, the ESO selects providers based on the ability of the provider to fulfil the minimum criteria set out above and the bid of the provider. The ESO uses a three-tier pricing structure to remunerate STOR providers. In the tender, each bidder provides a bid for each component of payment in the tender:

- An availability fee: the provider is paid for the number of hours in which it makes the service available in a month (in £/MWh);
- A utilisation fee: the provider is paid for the energy that the provider delivers under the service (in £/MWh); and
- An optional fee: when the provider is utilised outside of the contracted windows of availability in the contract (in £/MWh).

The ESO has a statutory requirement to provide balancing services at least cost to customers.

[115] National Grid ESO (7 May 2020), ESO Balancing Services: A guide to contracting, tendering and providing response and reserve services.

[116] National Grid (January 2018), Short Term Operating Reserve (STOR).

B.3.2. Link between prices and costs

There are no explicit links to the cost of producing or supplying power to the market in standardised contracts. However, the process of competition means that typically the price of electricity will short-run marginal production costs of the most expensive generator required to serve demand, or the price at which customers would be willing to reduce demand rather than consume electricity.

B.3.3. Typical structure of pricing

As explained above, forward contracts for electricity are agreements to supply or purchase a fixed volume delivered over a period of time for a fixed price. Therefore, the pricing structure is volumetric.

B.3.4. Adjustments to prices over time for changing conditions

The products are standardised and are continuously traded in a competitive market with transparent prices. Therefore, the market adjusts pricing over time to reflect changing conditions. The prices agreed in standardised contracts do not adjust formulaically as part of the contract. However, market participants can adjust their contract position by agreeing new contracts to manage their supply/demand position as conditions in the market change.

B.4. Allocation of Risks

There are two main risks that parties face when trading forward contracts for electricity.

The first is that the counterparty to a contract wishes to supply or demand a different volume of electricity from its contracted volume at the time of delivery:

- In order to trade power, market participants must agree to the BSC which defines common rules around the balancing of physical positions against contractual positions in the market.[117]

- The BSC stipulates the penalties for parties whose physical position does not comply with their contractual position for power. If a party over-consumes or under-produces relative to its contractual position, it must purchase the additional volume of energy at the System Buy Price (SBP). Likewise, if a customer over-supplies electricity relative to its contractual position or under-consumes, it will sell that extra energy at the System Sell Price (SSP). These cash-prices are derived from the weighted average prices of offers and bids accepted by the SO in the balancing market.[118] The prices reflect the costs of balancing the market and, because the cost of balancing is relatively costly and volatile, provide an incentive to participants to contract for power ahead of gate closure.

[117] National Grid ESO, Balancing Settlement Code (BSC), Last accessed: 22 May 2020, Link: https://www.nationalgrideso.com/industry-information/codes/balancing-framework-and-balancing-and-settlement-code-bsc

[118] Appendix 5.1 Wholesale electricity market rules, p. A5.1-13, 1-14, Link: https://assets.publishing.service.gov.uk/media/559fb56940f0b61567000041/Appendix_5.1_Wholesale_electricity_market_rules.pdf

- Hence, the buyer of power is not exposed to any risk that the seller with which it has contracted produces more or less power than expected. Market participants are solely responsible for their own physical positions relative to their contracted position.

The second risk is that a counter-party is unable to settle the contract financially at the point of delivery. This counter-party risk is managed through a common set of rules agreed through the contract, and depends on the where the contract is traded:

- If the contract is traded on an exchange, each party does not face risk with the "counter-party" but instead enters into the contract with the exchange. A contract with an exchange-trading platform includes a standardised requirement to post collateral with the exchange which, in effect, manages counter-party risk across all participants. Parties post collateral based on the marking-to-market i.e. to cover the difference between the strike price agreed in the forward contract, and the prevailing market strike price of the same forward contract (which represents the market's expectations over the actual price of the electricity come delivery). The collateral is used as payment in the event that a party is unable to pay out at the time of delivery.
- If the contract is traded OTC, each party accepts counter-party risk with the other party directly. Normally, contracts include provisions for margin call whereby parties can request collateral or a letter of credit in cases where the strike price agreed significantly deviates from the market price of the contract. The terms of posting collateral may also be standardised within the contract.

In both cases, the risk of the contract is ultimately borne by the customers of the supplier, or the shareholders of the generator. In the case of suppliers, customer's exposure to the risk is limited in two main ways:

- Suppliers may pass risks and costs to customers through higher prices. However, given competition in supply, customers are able to switch between suppliers to avoid higher pricing. Customers bear the transaction costs associated with switching, but can limit their exposure to a supplier with higher costs by switching.
- Ofgem protects customers through its supplier licensing rules. More specifically, if customers are in credit with their supplier and their supplier declares insolvency, the credit balance is protected and funded by mutualising the costs across the industry, i.e. the costs are borne by all customers in the market through Balancing Use of System (BSUoS) charges. Whilst that still means customers in aggregate bear the costs of the supplier's failure, the costs are shared across the wider industry.[119]

For balancing services, the risks that a provider of services may fail to provide the services are shared between the provider and customers. In the event of failure, the ESO may need to procure additional balancing services at potentially greater cost and passes those costs to customers through BSUoS charges. However, penalties are also applied to the provider of balancing services. For example, a STOR provider who defaults on its obligation to provide

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119 Ofgem is currently reviewing its supplier licensing rules in light of the perverse incentives that may face suppliers and customers due to mutualisation. In other words, customers may switch to suppliers offering low prices through risky business models, which may result in a large amount of costs being mutualised and borne by all customers across the industry.

the service to the agreed standard of the contract faces a penalty of up to 30 per cent of the monthly availability payment.[120]

B.5. PPAs and Contracts to Support Investment

While standardised contracts are commonly used to organise relatively short-term trade in electricity between generators and retailers and for hedging, these contracts are not used directly to remunerate investment in infrastructure. Market participants may rely on their ability to sell power into the wholesale market when making investments on a “merchant” basis. However, standardised electricity contracts themselves provide no direct link to the remuneration of generation investments, and electricity transmission and distribution costs are recovered through regulated network access charges.

However, in some cases retailers agree long-term contracts with generators known as Power Purchase Agreements (PPAs), and these contracts may be used to underpin investment in generation capacity. PPAs relating to investments at particular plants are typically negotiated on a bespoke basis, but PPAs have converged to some extent in their design. The approach to pricing can differ across PPAs, but they are often designed to guarantee a level of financial return to the generator. This can be achieved in a number of ways:

- Some PPAs stipulate defined prices for defined volumes power, similar to the standardised contracts described above. Pricing terms may be fixed, include variable pricing between upper and lower limits, or prices linked to indices.[121]
- Some include a fixed availability payment from the retailer to the generator that gives the retailer the option to use the contracted power station and gives the generator some assurance on the level of payments it will receive. The retailer would then pay a variable price per megawatt-hour for each unit it asks that power station to produce to cover variable operating costs such as fuel and emissions permits; or
- A Contract for Difference (CfD) that guarantees the generator a fixed price for the output. It achieves this by requiring the buyer to make a payment to the generator equal to the difference between the underlying market price of power and a fixed contracted price. Therefore, by selling power at the wholesale price, the generator receives total remuneration equal to the contract price for the power it sells.

PPA parties accept counter-party risk which may require posting of collateral or letters of credit.

PPAs are increasingly used to fund corporate renewable projects worldwide. PPAs are useful for renewables which produce at zero marginal cost after commissioning and have variable, volatile output resulting in volatile revenue streams.

Through their increased use, corporate PPAs have used increasingly standardised terms. For example, the European Federation of Energy Traders (EFET) publishes a standard Corporate

[120] National Grid (January 2018), Short Term Operating Reserve (STOR), p. 18.

[121] EEX (August 2018), Power purchase agreements.

PPA to set a cross-country standard across Europe for PPAs and to reduce the transaction costs associating with negotiating agreements.[122]

Standardised PPAs using CfDs are the main mechanism by which the government in Great Britain is supported investment in renewable generation.[123] CfDs provide investors a guaranteed price for the power that their generation produces for 15 years after commissioning. CfDs also provide customers with a guaranteed price of power and may protect customers from paying increased costs when prices are higher than anticipated.

The government sets out minimum eligibility requirements for renewable generators to qualify to receive a CfD for their power. Those generators that meet the minimum requirements may submit sealed bids for the CfD in a tender allocation process. The successful companies enter into the CfD with the Low Carbon Contracts Company (LCCC) which is a private company owned by BEIS. The government is the only counter-party which can credibly offset the risk of changes to government policy on decarbonisation, and therefore signing such CfDs can ensure that the risk of changes in government policy are insured for the investor.

122 EFET (19 June 2019), EFET Standard CPPA officially launched – press release.

123 Department for Business, Energy and Industrial Strategy (2 March 2020), Contracts for Difference, Link: https://www.gov.uk/government/publications/contracts-for-difference/contract-for-difference

Appendix C. Electricity Interconnectors in Great Britain and the EU

C.1. Background and the Need to Trade

C.1.1. Background on interconnectors

Electricity interconnectors are the transmission cables that allow the trade of electricity from one country to another. Great Britain currently has interconnectors with Northern Ireland, Ireland, Belgium, France and the Netherlands. These interconnectors provide total capacity of around 4 gigawatts (GW), which is approximately 5 percent of total capacity in GB.[124] However, a number of new projects are in the development pipeline.[125]

Building on the case study research on the electricity market in Great Britain in 0, electricity interconnection allows the purchase of electricity in Great Britain and its sale in an "interconnected" market, or vice versa. And because half-hourly electricity prices are volatile, the direction of trade can change from hour-to-hour.

Significant investment in new interconnection capacity is taking place throughout Europe, which is in part driven by investment in renewable power generation. Interconnection capacity is helpful to the power system as more "intermittent" generation technologies like solar and wind are added to the system, because they provide the flexibility for electricity to be moved from areas of surplus (e.g. areas with a lot of wind farms on windy days) to demand centres.

As discussed further below, the use of long-term contracts to support investment in interconnectors, the processes for allocating interconnection once interconnectors have been developed, and the allocation of interconnection costs between EU Member States is heavily influenced by both national and EU-level regulation of the electricity industry.

C.1.2. Organisation of the industry and the role of contracts

The use of interconnectors is governed by contractual rights. The party holding the right to use capacity on an interconnector has the option to "nominate" power flows in one or either direction across the interconnection line. These power flows, which involve a volume of energy trade defined in megawatt-hours, have a value to the capacity holder equal to the difference in wholesale electricity prices at either end of the interconnector. The value of interconnection capacity rights therefore is determined in the wholesale electricity market, through the process of electricity trading on either side of the interconnector.

Contracts to use the interconnector can have various tenors, and can be traded on secondary markets. In principle, they can be as short as a single 30-minute trading interval or span multiple years. Indeed, because interconnectors are significant capital investments, capacity is sometimes sold to market participants through long-term contracts that support the development of new "merchant" projects (described further below). However, interconnectors can also be developed and funded through more traditional regulatory

[124] Ofgem (May 2014), Electricity Interconnectors factsheet, p. 1.

[125] The Crown Estate (3 July 2018), Electricity interconnectors.

models, with the capital costs added to the Regulatory Asset Base of the regulated transmission company in one/both of the interconnected markets.

The prices of interconnection capacity are typically determined through auction mechanisms. Longer-term capacity rights for “merchant” projects can be allocated through competitive “open season” processes, while EU regulatory mechanisms require that other projects subject to regulated Third Party Access (TPA) requirements have their capacity allocated through more regular auctions for contractual capacity rights with shorter tenors.

In all these types of auctions, the price of interconnection capacity rights is driven by electricity traders’ expectations about price differentials between the two markets over the tenor of the contract for interconnection capacity rights. Hence, depending on supply-demand conditions in the electricity market, the revenue realised from the sale of interconnection capacity may be higher or lower than the costs of the interconnection link (including a return on capital, etc). Depending on the regulatory treatment of a particular link, and in particular whether it is a merchant project or covered by regulated TPA requirements, profits/losses by the infrastructure owners may be passed onto/recovered from customers on one or both ends of the line through the allowed revenues of the regulated, natural monopoly transmission companies.

C.1.3. Possible lessons for bulk water trading

There are a number of similarities between the case of electricity interconnectors and the bulk trading of water. Like water trading between areas, trading of electricity over interconnectors involves the development of (or use of existing) long-lived infrastructure to support the exchange of a commodity. The infrastructure is also often developed by regulated natural monopoly companies, so this case study may bring lessons in respect of the design of contracts and regulation to encourage and remunerate development of infrastructure by regulated companies.

Like water trading, electricity trading between jurisdictions has the potential to increase costs for customers in the exporting country and reduce costs for the importing country. Hence, the methods used to allocate costs need to ensure an equitable distribution of the gains from trade, to ensure customer protection and political acceptance of trade in each jurisdiction.

C.2. Contract Description

C.2.1. Contracts for interconnector capacity

The European Commission issues a set of regulations which operators of interconnectors, or nominated electricity market operators (NEMOs), must follow when determining and auctioning capacity for interconnectors once they have been built. The regulations ensure standardised products for interconnector capacity, and minimum standard processes, are used throughout Europe with an objective of:[126]

> “(a) promoting effective competition in the generation, trading and supply of electricity;
>
> (b) ensuring optimal use of the transmission infrastructure;
>
> (c) ensuring operational security;

126 COMMISSION REGULATION (EU) 2015/1222 Article 3.

(d) optimising the calculation and allocation of cross-zonal capacity;

(e) ensuring fair and non-discriminatory treatment of TSOs, NEMOs, the Agency, regulatory authorities and market participants;

(f) ensuring and enhancing the transparency and reliability of information;

(g) contributing to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union;

(h) respecting the need for a fair and orderly market and fair and orderly price formation;

(i) creating a level playing field for NEMOs;

(j) providing non-discriminatory access to cross-zonal capacity."

In particular the EC Directives provide:[127]

- Regulations determining how NEMOs should calculate available capacity on a day-ahead and intraday basis. Such available capacity should include the available capacity as determined by the approved methodology and any capacity released from existing holders.
- Definitions of firmness of allocated day-ahead capacity, including details for firmness in the case of force majeure or emergency situations;[128]
- Fines for non-compliance with EU directives of up to 1 per cent of total turnover.[129]
- Regulations to ensure coordination in capacity allocation across integrated markets and TSOs.
- Regulations on the congestion management products made available at interconnectors, including provisions:
  - That the congestion management methods be market based and therefore capacity should be allocated only by the means of explicit (capacity only) or implicit (capacity and energy) auctions;
  - That the congestion management mechanisms may need to allow for both long and short-term capacity allocation;
  - That long- and medium-term firm transmission capacity rights be allocated on a use-it-or-lose-it (UIOLI) or use-it-or-sell-it (UIOSI). UIOLI terms are introduced to prevent the hoarding of capacity from market participants;
  - That the highest bid be successful in auction and the capacity should not discriminate between "market participants that wish to use their rights to make use of bilateral supply contracts or to bid into power exchanges"; and
  - That unless derogations allow, reserve prices for capacity cannot be set.

[127] European Union (13 July 2009), Directive 2009/714/EC of the European Parliament and of the Council, Annex I Section 2.

[128] European Union (24 July 2015), Directive 2015/1222/EC of the European Parliament and of the Council, Article 72.

[129] European Union (13 July 2009), Directive 2009/714/EC of the European Parliament and of the Council, Article 22.

Moreover, EC Directives stipulate that secondary trading of capacity rights must be made available:[130]

> "Capacity shall be freely tradable on a secondary basis, provided that the TSO is informed sufficiently in advance. Where a TSO refuses any secondary trade (transaction), this must be clearly and transparently communicated and explained to all the market participants by that TSO and notified to the regulatory authority"

Lastly, the EC sets minimum standards on the publishing of transparent information pertaining to the amount of capacity made available, the products made available, and the indicative prices paid for capacity as soon as possible after each capacity auction. Such information should:[131]

> "be made freely available in an easily accessible form. All data shall also be accessible through adequate and standardised means of information exchange, to be defined in close cooperation with market participants. The data shall include information on past time periods with a minimum of two years, so that new market entrants may also have access to such data."

As a consequence of such industry regulations on the market for interconnector capacity, and with the exception of some long-term sales of capacity granted to merchant investors in interconnectors under derogations from EC Directives, the contracting market for interconnector capacity is relatively standardised across the EU. Actions and methodologies by NEMOs are subject to both national and trans-national regulation.

Without such regulations on third party access to infrastructure, and methodologies of setting prices for products, owners of interconnectors could abstract economic rents from customers across the wider European market because of their monopoly ownership on investments. Even a TSO with a regulated rate of return could abstract rent from sales to customers outside of its operating area in order to reduce costs to its own customers.

C.2.2. Contracts for investment in interconnectors

Contracts relating to investment in interconnection capacity are not standardised due to the relatively small number of projects, differences between project characteristics, different locations and technologies (subsea cables, underground cables, overhead lines, etc.) and parties. However, as we discuss further below, contracts are subject to common rules (e.g. Third Energy Package and oversight by the Agency for Cooperation of Energy Regulators – ACER), which results in a degree of standardisation. As noted above, there are two types of investments:[132]

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130 European Union (13 July 2009), Directive 2009/714/EC of the European Parliament and of the Council, Annex I Section 2.

131 European Union (13 July 2009), Directive 2009/714/EC of the European Parliament and of the Council, Annex I, Section 5.

132 Oxford institute for Energy studies (June 2016), Business model for cross-border interconnections in the Mediterranean basin, p. 11-12.

C.2.2.1. Regulated investments developed by regional Transmission System Operators (TSOs)

As TSOs are natural monopolies, they tend to be subject to economic regulation allowing investors a reasonable opportunity to recover their costs through similar types of regulatory procedures as apply at Ofwat's price reviews. When the regulator approves a new investment, the costs of the investment will be included in RAB of the company via regulated tariffs passed through to consumers.

In this model, investors' revenue depends only the regulatory determination of allowed costs, rather than on congestion rent based on the sale of capacity contracts that allows the holder to arbitrage wholesale prices at either end of the interconnector. If revenues earned from the sale of capacity rights are higher than allowed costs, EU rules require that the surplus revenue obtained must be used for maintaining the current network, carrying out new investments in interconnectors or passed through to consumers via reduced regulated tariffs. If revenues are lower than allowed costs, there are usually arrangements in place to recover costs as a mark-up on the charges levied for use of the onshore transmission system. While this model provides strong protections on interconnection developers' ability to recover their costs, these cost recovery arrangements provide little incentive to carry out new investments.

C.2.2.2. Merchant investment

Some new interconnectors have been developed as "merchant" projects, which means that unlike the regulated model, the investor obtains a derogation from obligations to offer regulated third-party access. Such derogations require approval from national and European regulatory agencies, and require that the new interconnection owner meets a number of tests, including that the project would not be viable without the derogation, that it improves competition, etc. In such cases, the investor may be allowed to earn a return higher than a regulated rate of return.

Theoretically the merchant model incentivises efficient investments, as the merchant investor faces risk on the upside and downside return of the investment, and an efficient investment is profitable and an inefficient investment is not. However, as a condition of awarding derogations, we have seen instances of the derogation decision imposing an upper limit on profit from the merchant project.

The business model for merchant interconnectors can sometimes be challenging for investors without some kind of state or regulatory support, and as such very few merchant projects have been developed in practice. In particular, there is significant uncertainty in long-term electricity market conditions at present due to uncertainty over future government policy in relation to the generation mix caused by rapidly changing climate policy. Also, the risk of regulated interconnection projects being developed to compete with merchant projects can undermine their business case.

C.2.2.3. Ofgem's cap and floor mechanism

As noted above, the fully regulated model provides weak incentives to develop new projects, and the merchant model is challenging in practice because of the significant risks faced by investors. Recognising these limitations, in Great Britain Ofgem has developed a regulated system that places some market risk exposure on the developer of the interconnector, known as a "cap and floor" approach. Under this approach the interconnector developer bears some

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risk on the revenue recovered from the sale of capacity, but has protection because its allowed rate of return is collared to be between a cap and a floor.

C.2.2.4. Summary

EU regulation favours the regulated model as opposed to the merchant model. Directive 2009/72/EC states that the regulated TSO is responsible for investing in infrastructure, including interconnectors to ensure reliability.[133] Under EU regulation, the merchant model is considered as an exception, which is allowed when the project would only take place if this exception is granted.

The table below summarises the key features of the regulated and merchant approaches.

Table C.1: Key Characteristics under Regulated versus Merchant Interconnector

	Regulated model	**Merchant model**
Investor	Often TSOs or regulated utilities	Private investor
Main objective	Improving reliability	Making profit
Payer	Captive consumers of utility company	Market players who buy transmission rights
Business model	Return on regulatory asset base under incentive regulation	Value of congestion rents and other potential revenues
Tariff setting	Regulated tariff approved by authority	Exempted from regulated tariff setting
Risk	Risks are mainly borne by rate payers	Risks are mainly transferred to investors
Regulator's main concern	Lack of incentive for investment	Allocative inefficiency

Source: Oxford institute for Energy studies. [134]

C.2.3. The role of EU-level regulation of interconnectors

As explained above, interconnectors in the regulated models are subject to EU regulation. Under EU regulation, contracts are supported by the following key industry codes:

- Directive 2009/72/EC article 9: on vertical integration, states "each undertaking which owns a transmission system acts as a transmission system operator".[135] This prevents vertical integration, meaning the same person(s) are not intitled to directly or indirectly exercise control over any functions of generation or supply to customers.

- Directive 2009/72/EC article 32: on third party access, states that all third parties are entitled to access the transmission and distribution systems based on published tariffs

[133] European Union (13 July 2009), Directive 2009/72/EC of the European Parliament and of the Council, Article 9, p. L211/68.

[134] Oxford institute for Energy studies (June 2016), Business model for cross-border interconnections in the Mediterranean basin, p.13.

[135] European Union (13 July 2009), Directive 2009/72/EC of the European Parliament and of the Council, Article 9(1)(a), p. L211/68.

applicable to all customers, without discrimination between system users.[136] Non-discriminatory third-party access is necessary for an efficient and competitive wholesale and retail electricity market.[137]

- Directive 2009/714/EC: on general principles of congestion management states that any revenues from interconnectors shall be used for guaranteeing the actual availability of the allocated capacity and (or) maintaining or increasing interconnection capacities through network investments.[138] The TSO is responsible for investing in infrastructure, including interconnectors to ensure reliability. If revenues cannot efficiently be used for these purposes, it may be used as income, subject to approval of the regulator, which is taken into account when tariffs are determined.

As explained in Section C.2.1, investors can seek exemption for a merchant investment. Article 17 EU 714/2009, on new interconnectors, explicitly recognises the conditions for exemption, which may be used when regulatory rules prevent efficient and beneficial infrastructure from being build. The interconnector must meet all six requirements.[139] These requirements include the following six conditions for an exception to be granted:

1. Investment must enhance competition in electricity supply;
2. Risk of project is so high that investment would not take place without exemption being granted;
3. Interconnector must be owned by a natural or legal entity and is legally separate from the system operator of the region;
4. Charged are levied on the users of interconnector;
5. No parts of capital or operational expenditures have been claimed from any components of charges for transmission or distribution network to which interconnection is connected; and
6. Exemption must not come at the cost of ineffective operation of internal electricity market or inefficient functioning of regulated system governing interconnector.

[136] European Union (13 July 2009), Directive 2009/72/EC of the European Parliament and of the Council, Article 32, p. L211/80.

[137] For instance, as transmission operators are natural monopolies, it can use its market power anticompetitively. For instance, by denying access to certain generators, discriminate in granting access (i.e. horizontal foreclosure), or use vertical market power to electricity consumers (i.e. downstream exploitation). To mitigate these risks, energy regulators ensure open access to all transmission networks through non-discriminatory open access tariffs.

[138] European Union (13 July 2009), Directive 2009/714/EC of the European Parliament and of the Council, Article 16(6), p. L211/24.

[139] European Union (13 July 2009), Directive 2009/714/EC of the European Parliament and of the Council, Article 17, p. L211/24.

Box 7.1: Example Exemption Sought by AQUIND

AQUIND, a privately-owned developer of high voltage electricity interconnector between France and Great Britain, sought exemptions for a merchant investment.

Unlike regulated interconnectors, the rate of return is not determined by the regulator. Instead, AQUIND's revenue will be determined by investors who earn revenue by selling capacity rights, providing transmission capacity between France and Great Britain. Merchant investors have stronger incentives to minimise costs and improve efficiency.

On 19 June 2018 ACER rejected AQUIND's request for exemption for building a merchant interconnector, based on Article 17(1)(b), of Regulation 714/2009, requiring that "the level of risk attached to the [merchant] investment is such that the investment would not take place unless an exemption is granted".[140] However, ACER's conclusion that there are feasible alternative regulated options appeared not to be true. Therefore, as there was no proposed regulated alternative, ACER concluded that this was evidence of that a feasible alternative option would not exist. As such, AQUIND applied for the following exemptions from EU regulations: [141]

- Use of revenue: AQUIND sought exemption for the use of revenue according to EU regulation, which states that any revenues resulting from interconnectors shall be used for guaranteeing the actual availability of the allocated capacity and (or) maintaining or increasing interconnection capacities through network investments.[142] In order to make an adequate return and recover investment costs, AQUIND's has offered a profit-sharing mechanism, where above a determined rate of return threshold profits will be shared with consumers in France and Great Britain.
- Unbundling: EU regulation forbids transmission operators to be vertically integrated and exercise control over any functions of generation or supply to customers.[143] AQUIND sought exemption, for a limited period of time, which would enable to be partly financed by investors who may hold a share in generation or supply activities, which would otherwise be prohibited.
- Third Party Access: an exemption from EU regulation on third-party access, which states that all third parties are entitled to access the transmission and distribution systems based on published tariffs applicable to all customers, without discrimination between system users.[144] Exemption from this law would enable AQUIND to allocate a certain share of

[140] European Union (13 July 2009), Directive 2009/714/EC of the European Parliament and of the Council, Article 17(1)(b), p. L211/24.

[141] Article 17(1) states that "[n]ew direct current interconnectors may, upon request, be exempted, for a limited period of time, from the provisions of Article 16(6) of this Regulation and Articles 9, 32 and Article 37(6) and (10) of Directive 2009/72/EC".

[142] European Union (13 July 2009), Directive 2009/714/EC of the European Parliament and of the Council, Article 16(6), p. L211/24.

[143] European Union (13 July 2009), Directive 2009/72/EC of the European Parliament and of the Council, Article 9(1)(a), p. L211/68.

[144] European Union (13 July 2009), Directive 2009/72/EC of the European Parliament and of the Council, Article 32, p. L211/80.

annual capacity through multi-year contracts, which enables AQUIND to develop a secure and stable revenue stream to make investments more attractive to debt providers.

- Access rules and approval of tariffs: an exemption from EU regulation on responsibilities of regulatory authorities, which enables AQUIND, for a limited period of time, to determine the length, profile, size and timing of multi-year contracts within the share of capacity included in the Third-Party Access exemption (see point immediately above).[145]

C.3. Infrastructure and Investment

C.3.1. Use of contracts to recover infrastructure costs

As noted above, for merchant contracts covered by derogations from EU TPA requirements, long-term contracts, typically allocated competitively through open seasons processes with a tenor sufficient to recover upfront investment costs, have been used to support the recovery of project costs. However, these contracts are highly project-specific. In some cases, while the merchant nature of the investment means the company has the opportunity to earn higher rates of return than for regulated assets, the conditions of the derogation may impose upper bounds on its rate of return (i.e. as a cap on the project's Internal Rate of Return – IRR).

However, for regulated projects, while contracts are sold to allocate interconnection capacity on relatively short-term basis (i.e. up to a small number of years ahead), the recovery of infrastructure costs is assured through allowing a regulated rate of return. In the case of Ofgem's model, which differs from those in use elsewhere in Europe, this rate of return is collared between a cap and a floor.

C.3.2. Sharing of costs between trading parties

An important consideration of regulated interconnection projects developed jointly by neighbouring TSOs is how to allocate costs between parties. The costs of new interconnection investments can be allocated across trading parties based on a mutually agreed split. However, in the event of disagreement of how to split the costs of a project, the parties may appeal to ACER who uses a set of rules to determine the cost allocation of projects.

This framework for allocating costs applies particularly to Projects of Common Interest (PCIs), projects identified by the European Commission as meeting certain criteria, such as having a significant impact on the energy markets of at least two EU Member States, contributing to the integration of their networks, and increasing competition in energy markets.

The European regulatory body ACER sets out a framework for determining Cross-Border Cost Allocation (CBCA), with the general principle that costs of cross-border transmission (i.e. interconnection) projects should be recovered from those Member States of the European Union that substantially benefit from those investments.

The CBCA process begins with the submission of a CBCA request to ACER in relation to a PCI. Following this, the National Regulatory Authorities (NRAs – Ofgem in Great Britain,

145 European Union (13 July 2009), Directive 2009/72/EC of the European Parliament and of the Council, Article 37(6) and 37(10), p. L211/84.

for example) of the affected EU Member States have six months to reach an agreement on the allocation of costs under the request. If the NRAs are unable to reach an agreement within six months, then ACER is required to make a decision on how investment costs should be allocated between Member States under the CBCA framework.

At the heart of it, the CBCA methodology is based on a project-specific and per country disaggregated cost benefit analysis (CBA)[146] that weighs the cost of each project against the benefits of usage accrued to that particular transmission project. In relation to costs, ACER requires that the following items be taken into consideration:[147]

- Development costs (studies, rights of way, environmental planning) and project management cost;
- Expected costs for materials and assembly;
- Expected costs for temporary solutions which are necessary to realise a project;
- Expected environmental and consenting costs;
- Maintenance and replacement costs during the asset's life cycle; and
- Decommissioning costs.[148]

ACER requires that (at least) the following benefits should be estimated and monetised for the purposes of allocating costs:

- The *"Socio-economic welfare* [SEW] *(calculated by a European market study)"*, which could include the benefits from the increased potential to trade energy, share reserves and reduce the need for installed generation capacity in each affected EU Member State*;*
- *"Variation in losses (calculated by network studies)"*;
- *"Security of supply (load) (calculated by network studies)"* which represents factors such as the reduced incidence of load shedding;
- *"Relieving national constraints"*, i.e. within national transmission systems; and
- *"Variation in generation curtailments"*, i.e. the costs of resolving transmission constraint costs.[149]

Following the CBA, the ACER methodology then defines "beneficiaries" to be those Member States that exhibit a "significant" positive net benefit, in which the positive net

146 ACER. (18 December 2015). *Recommendation No 5/2015 of the Agency for the Cooperation of Energy Regulators,* Annex I.1 & I.2.

147 On the face of it, this definition appears narrow and may be read as excluding the ongoing financing costs associated with any upfront investments. However, we understand that this mechanism works by allocating capital expenditures amongst EU Member States in proportion to benefits, leaving each Member State to recover their allocation of capital expenditure over time in whatever manner their national institutional/regulatory framework allows.

148 ACER. (18 December 2015). *Recommendation No 5/2015 of the Agency for the Cooperation of Energy Regulators,* page 22.

149 ACER. (18 December 2015). *Recommendation No 5/2015 of the Agency for the Cooperation of Energy Regulators,* page 22.

benefit they receive exceed *"a significance threshold equal to 10% of the sum of positive net benefits accruing to all net benefitting countries"*.[150,151]

ACER then determines the compensation that the Member States identified as beneficiaries (after applying the aforementioned 10% significance threshold) have to pay to those Member States whose project costs exceed their share of benefits. This obligation to pay compensation is allocated among beneficiaries in proportion to their shares of total net benefits (above the significance threshold), using the following Contribution Indicator (CI):

$$CI = \frac{\text{Positive net benefit of the country exceeding the significance threshold}}{\sum \text{(net benefits exceeding the significance threshold of all countries exhibiting significant positive net benefits)}}$$

Whilst the CI determined the proportion of costs allocated to each beneficiary country, it is applied to the absolute value corresponding to the positive net benefits exceeding the significance threshold.[152] This ensures that, whilst beneficiary countries do compensate those countries incurring higher costs than benefits, they are not required to pay compensation that exceeds their own realised net benefits.

C.3.3. Illustration of cost allocation using ACER's CBCA procedure

Following ACER's CBCA framework described above, consider a hypothetical scenario where an investment project with a cost of $100 million affects six Member States: A, B, C, D, E and F.[153] Suppose that a CBA estimates that the project delivers the costs and benefits set out in Table C.2 to the six Member States:

1. Overall, the benefits of the project (totalling $166.6 million) exceed the costs, so it is economically efficient for the six Member States to develop the project;
2. Member States A and F "host" the project and incur the capital costs of developing it (assumed to be $50 million each);
3. The main beneficiaries are Member States A and B, which realise relatively large benefits of $100 million and $33.3 million respectively, with Member States C, D, E and F all realising relatively small benefits;
4. Member States A, B, C, D and E realise positive *net* benefits totalling $100 million; and
5. Member State F realises negative net benefits of $33.3 million, as its share of capital costs exceeds the benefits it earns, so without compensation would have no incentive to pursue the investment.

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150 ACER. (18 December 2015). *Recommendation No 5/2015 of the Agency for the Cooperation of Energy Regulators,* page 12.

151 However, ACER notes that a lower significance threshold may be applied in certain cases, such as when the net benefits in excess of the threshold of the contributing counties are insufficient to meet the required level of compensation, or when the compensating imposes an unreasonable burden to a contributing country.

152 ACER. (18 December 2015). *Recommendation No 5/2015 of the Agency for the Cooperation of Energy Regulators,* page 12.

153 Our illustration draws from the example found in: Nitsov, B. (2015). *Cross-border cost allocation: EU perspective. A Viewpoint from ACER*, slides 16-17.

Table C.2: Net Benefits Accruing to Each Member State

	Country A	Country B	Country C	Country D	Country E	Country F	Total
Cost	50	0	0	0	0	50	100
Benefit	100	33.3	8.3	5	3.3	16.7	166.6
Net benefit	**50**	**33.3**	**8.3**	**5**	**3.3**	**-33.3**	**66.6**

Table C.3: Application of ACER's Beneficiary-Pays Methodology

	Country A	Country B	Country C	Country D	Country E	Country F	Total
Cost	50	0	0	0	0	50	100
Benefit	100	33.3	8.3	5	3.3	16.7	166.6
Net benefit	50	33.3	8.3	5	3.3	-33.3	66.6
Net benefits above significance threshold	40	23.3	0	0	0	0	63.6
Share of Total	63.2%	36.8%	0%	0%	0%	0%	100%
Compensation paid to Country F	21	12.3	0	0	0	-33.3	0
Total costs, including compensation	71	12.3	0	0	0.	16.7	100
Overall net benefits	**29**	**21**	**8.3**	**5**	**3.3**	**0**	**66.6**

ACER's beneficiary-pays methodology allocates investment costs in a way that ensures the countries that benefit from the investment (countries A, B, C, D and E) compensate any countries that lose out (Country F), as illustrated Table C.3:

- The first step is to apply the 10 per cent significance threshold, which ACER uses to identify the beneficiaries of the project. In this case, *"10% of the sum of positive net benefits accruing to all net benefitting countries"* is $10 million.[154] In this way, only countries A and B are defined to be the "beneficiaries", as their positive net benefits individually exceed the 10 per cent threshold.
- Estimated net benefits above this significance threshold define the two beneficiaries' share of the compensation costs to be paid to Country F: $40 million (63.2 per cent) for Country A and $23.3 million (36.8 per cent) for Country B.
- Country F requires compensation of $33.3 million in total, so Country A pays $21 million and Country B pays $12.3 million;
- As a result, the overall costs of the investment are spread amongst countries A, B and F, and no country has a <u>negative</u> net benefit from the investment.

154 This is equivalent to 10% of 100.

C.3.4. ACER's guidance influences bilaterally negotiated arrangements

Given either party can default to ACER rules by declining a bilaterally negotiated settlement, the on "beneficiary pays" cost allocation rules implicitly govern cost allocation in projects when no appeal to ACER is made and costs are allocated based on a bilateral negotiation. For instance, in relation to a new "East-West" interconnection between Great Britain and the Republic of Ireland, the whole costs of this link are funded through the RAB of the Irish TSO. This approach recognises that the benefits of this project were intended primarily to accrue to Irish customers.

C.3.5. Examples of ACER applying the beneficiary pays principle

ACER has not been called upon to make a large number of determinations under the CBCA framework, but did recently make one regarding cost allocation between EU Member States for the Lithuania part of the Lithuania-Poland Interconnector (LitPol Link), when the NRAs of the affected Member States were unable to reach an agreement. ACER decided that, despite several Member States benefitting from the interconnection, Lithuania would not be remunerated for the investment from other Member States under the CBCA framework, and that all investment costs should be borne by Litgrid AB, the Lithuanian Transmission System Operator (TSO).

Following review of costs, benefits and other economic effects using new parameters, values and information, ACER concluded there to be no "*negative net benefit in Lithuania from LitPol Link*", hence no need for Lithuania to be compensated by other Member States. ACER reached these conclusions following its review of the CBA provided by Litgrid AB and information from affected NRAs.

In Litgrid AB's CBA, the estimated costs included the Net Present Value (NPV) of capital and operational expenditure of the new interconnection. The benefits included the following:

- Improvements in security of supply, calculated using the Loss of Load Probability (LOLP) and the Expected Unserved Energy (EUE) indicators;
- Changes in social and economic welfare, composed of consumer surplus, producer surplus and congestion rents and calculated by the BID/BID3 market model. In essence, this estimates the gains to each Member State from the increased potential to trade energy across the new interconnection; and
- Changes in transmission losses, estimated using a load flow model.

C.3.6. Summary and implications

In summary, the EU CBCA methodology is underpinned by the principle that countries that achieve a large positive net benefit from the development of an interconnector must use some of this benefit to contribute to the cost of the project incurred by other countries. This has the implication that for projects with an overall positive net benefit, it would be possible *"to provide compensation to eliminate the country-specific negative net benefit so as to facilitate* [the agreement of] *the investment".*[155]

[155] ACER. (18 December 2015). *Recommendation No 5/2015 of the Agency for the Cooperation of Energy Regulators,* page 1.

Thus, not only is ACER's approach to CBCA a "fair" system of cost recovery in that it allocates costs to the party which benefits from the trade, it also "greases the wheels" of developing new interconnection projects that are potentially economically efficient in a competitive market environment, but could be blocked because one affected party loses (even if the benefits to others more than offset this loss).

C.4. Pricing and Cost Allocation

C.4.1. Determining the level of pricing

As mentioned above, interconnectors derive their revenues from congestion revenues, defined by the price difference between the two markets at both ends of the interconnector. In Britain, Ofgem adopts two pricing models that govern the portion of these gains from trade that the interconnector investors are allowed to retain:[156]

A regulated route under the 'cap and floor' regime. The cap and floor model is an attempt by Ofgem to bridge regulated models used elsewhere in Europe where investment incentives are weak, and merchant models. Developers earn a return from auction revenues that is between the cap and a floor. The regime sets a maximum (cap) and minimum (floor) level of revenue developers are allowed to earn. Under this regime, investors can earn profit (up to the cap) on building the interconnector, so it incentivises project developers to maximise their profit.

Similar as the merchant model, the investor faces upside and downside risk. However, the cap ensures that investments are compliant with EU requirements for use of revenues, making sure investors are not earning an excessive return and providing a floor ensures that more interconnector capacity will be built, decreasing the downside risk for investors. Developers comply with all other aspects of EU regulation including use of revenues.

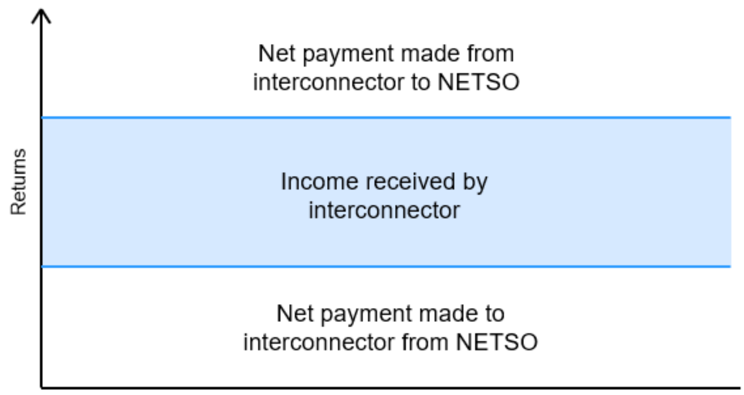
Under the cap and floor regime, the bounds on allowed returns apply for 25 years into the project's life.[157] The cap and floor are set by cost of debt and cost of equity benchmarks respectively.

In the UK, if revenue is below the floor, interconnector developers are paid by the National Electricity Transmission System Operator (NETSO), which recovers these costs by increasing tariffs charged to customers for use of the onshore transmission network. Similarly, if revenue is above the cap, the additional revenue will be paid back to NETSO, which in turn reduces the charges for transmission users. Therefore, investors pass through returns above the cap to customers (see Figure 7.1).

[156] Ofgem, Electricity Interconnectors, Last accessed 9 April 2020, Link: https://www.ofgem.gov.uk/electricity/transmission-networks/electricity-interconnectors?page=7#block-views-publications-and-updates-block

[157] Ofgem (23 May 2014), The regulation of future electricity interconnection: proposal to roll out a cap and a floor regime to near-term projects, p.18

Figure 7.1: Cap and Floor Regime Payments between NETSO and Interconnector



Source: NERA analysis.

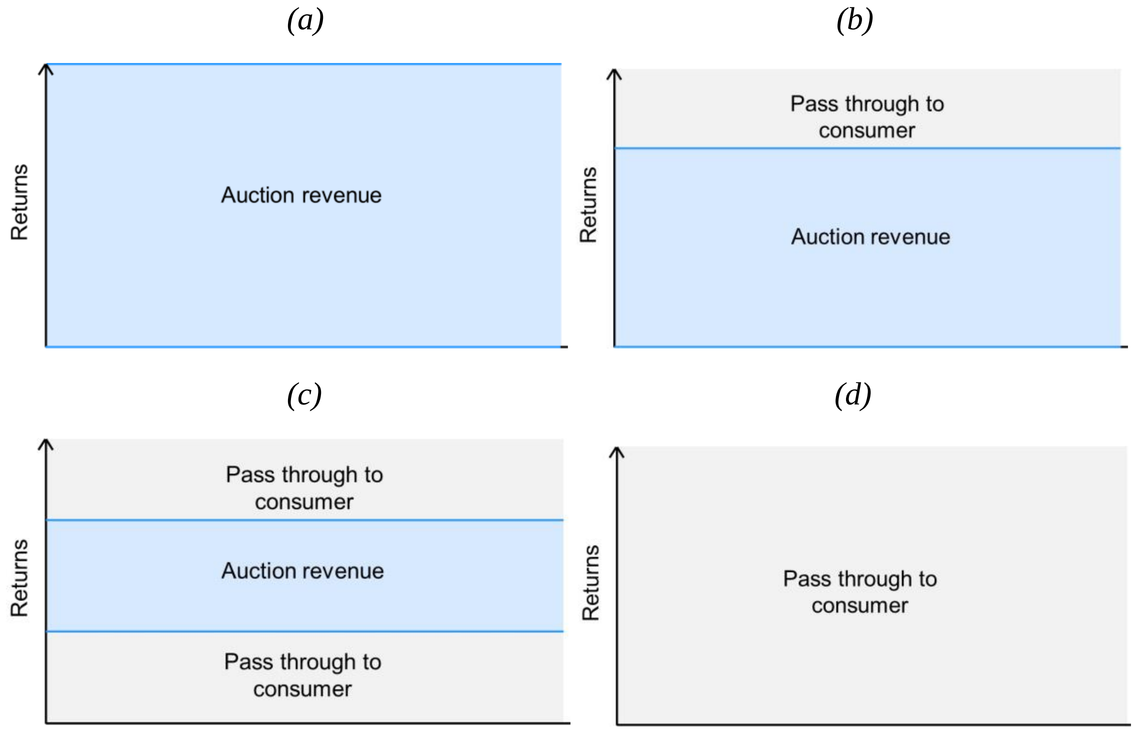
As an alternative to the cap and floor model, developers can still seek exemptions from regulatory requirements. Under this “merchant” route developers would face the full upside and downside of the investment and would usually apply for an exemption from certain aspects of European legislation (e.g. TPA waivers to allow the interconnector owner to sign long term capacity contracts instead of auctioning capacity in order to ensure profitability of investment).

For instance, BritNed, a cable between the Netherlands and Britain, receives market return up to a cap. It has a 25-year exemption from regulated access charges and the use of congestion revenue. The costs are recovered through the sale of short-term capacity contracts in auctions, but with a cap above which excess returns must be invested in additional capacity or passed through to consumers. Another interconnection project, Eleclink between Britain and France, also has a derogation from regulated TPA requirements, and has consent to auction a portion of its capacity on a long-term basis, subject to certain restrictions, and has accepted an overall cap on its level of revenues earned over the life of the project.

The figure below shows a range of other pricing models that have governed past investment:

- Uncapped *(a)*: returns depend entirely on auction revenues. Under this route developers would face the full upside and downside of the investment.
- Regulated cap *(b)* (BritNed): returns depend on auction revenues, but with a cap. Excess returns will be passed through to customers or must be invested in additional capacity.
- Cap and floor regime *(c)*: returns within the range depend on auction revenues. Above or below the range will be passed through to consumers via transmission tariffs.
- Regulated revenues *(d)*: this is the normal EU transmission tariff mechanism, where there is no upside or downside risk as all revenues above or below the estimated required revenue will be passed through to consumers.

Figure 7.2: Pricing Models



Source: NERA analysis.

C.4.2. Adjusting prices over time for changing conditions

As explained above, Great Britain has two types of regulatory models for interconnection: the regulated cap and floor model (the default option) and the merchant model. The price at which capacity is sold to market participants via regular auctions updates over time under both models depending on market supply-demand conditions. However, in the regulated cap and floor model there tends to be a greater degree of sharing of costs and market value risk with the wider customer base.

In the cap and floor model, the regulatory parameters are set for 25 years to provide a long-term framework for the investment and revenue will be assessed every 5 years.[158] In addition, to ensure viability, a within period annual adjustment is possible when this is necessary and justified.

C.5. Allocation of Risks

The default EU model, which follows a regulated approach, places risk regarding the value and costs of the investment on customers. However, allocation of risks depends on the regulatory model:

- In a regulated value model, customers face both downside and upside risk on return. As explained in Section C.2.1, all costs will be passed through to consumers.

[158] Ofgem (23 May 2014), The regulation of future electricity interconnection: Proposal to roll out a cap and floor regime to near-term projects, p. 18.

- In a merchant (uncapped) model, interconnector owners face risk on return. It faces upside risk and downside risk. This can disadvantage consumers as excess return to owners represents forgone potential price reductions for customers. However, this can also benefit consumers, as they are shielded from downside risks.
- A cap and floor approach shares risks between both parties. Customers face downside risk if the return falls below the floor. NETSO recovers these costs by increasing tariffs charged to customers. Similarly, customers face upside risk should the return be greater than the cap. The interconnector owners face upside and downside risk if returns are in the allowed band.

Appendix D. Upstream Gas Contracts in Europe

D.1. Background and the Need to Trade

D.1.1. Organisation of the industry

The upstream market for gas is where buyers sign contracts to purchase gas from large producers of gas. Buyers may be large end-use customers of gas, for example a gas-fired power generator or large industrial customer, or distribution and retail utilities which serve smaller customers as suppliers. Like electricity, most gas customers may utilise a national transmission system of pipes for gas which is operated by a Transmission System Operator (TSO). Large producers extract the gas from its source, either underground or under the sea bed, and transport (“ship”) the gas to entry points to the national transmission system.

Unlike electricity, the locations where gas is produced, or extracted, are not determinable by market participants and therefore the gas must be shipped to where it is consumed. In other words, one may locate an electricity generator to produce electricity near to where electricity is going to be consumed, and near to existing transmission infrastructure to transport the electricity to customers. A gas producer cannot change where natural gas has formed and must therefore construct the infrastructure to move the gas to where it is to be consumed.

The location-specificity of gas production means contracts to source gas are associated with large infrastructure investments to ship the gas to market. Moreover, because infrastructure investments are bespoke and represent a commitment to ship gas to a single market, the risks associated with recovering the investments are tied to the volume demanded and price of gas in the market.

The evolution of upstream contracts for gas has largely been driven by the evolution of the market for gas and the changes in both the number and types of buyers for gas in the market, and the location of gas production and technology used to transport it to market. Consequently, upstream contracts for gas in the United States follow different structures to those in Europe largely because of the differences in institutional arrangements that have evolved in both markets. In this case study, we focus on upstream long-term contracts for gas in Europe.

Prior to 1990 and the utilisation of gas to generate electricity, the markets for gas in Europe were highly concentrated with vertically-integrated monopolists, often state-owned, who both supplied the gas to end users and owned the networks through which it was transported in each country. The national monopolists bought gas upstream, striking long-term contracts with large producers of gas, who extracted and shipped the gas from fields to the networks onshore.

The lack of trading between national monopolists meant that there was no defined market value for gas. Instead, the prices agreed in long-term contracts for gas often reflected the price of alternative, substitutable fuels, most notably oil-based products. At the time, the risk facing large producers of gas was volume risk, in other words, the risk that having committed to a large upfront investment in infrastructure, that the downstream demand would not grow sufficiently strongly to recoup that investment. A large determinant of that demand was the price of substitutable fuels.

Over time, national regulators introduced network codes to support privatisation and the introduction of competition into the gas market, leading to an increase in the number of market participants and the development of gas trading hubs, beginning with the National Balancing Point (NBP) in Great Britain. Similar to electricity, trading hubs were required to balance the demand and supply for gas in the national network, because the introduction of competition increased the numbers of buyers and sellers wishing to ship gas around the network. The development of trading hubs and investment in interconnectors, supported by unifying regulation on cross border trade in the EU, began to establish market prices for gas that reflected demand and supply conditions across the wider European market.

Gas use and consumption increased, as gas became the primary fuel source for a number of European countries. With rising demand driven by demand for gas as a means of producing electricity, and lower reserves in the North Sea, Europe turned to signing contracts for pipeline imports from outside of Europe. The contracts struck with large producers in fields outside of Europe followed the same contracting structure as the long-term legacy contracts signed with producers in the North Sea. However, despite technological improvements and privatisation downstream, the market remained relatively concentrated, especially given the relative few large producers of gas upstream.

More recently, the development of technology has significantly reduced the costs of the Liquified Natural Gas (LNG) supply chain which in turn has radically begun to change the markets for gas. Rather than investment in production being reliant on a single geographic area of consumption linked by pipeline, LNG tankers can more flexibly respond to arbitrage opportunities across hub prices worldwide. LNG exports from Qatar, Yemen, Russia, Peru and Indonesia now ship to establish trading hubs where buyers can purchase gas and use the system of national networks and interconnectors to ship their gas to end-user customers in European markets.[159]

D.1.2. Organisation of trading and the role of contracts

Historically, the European gas market has been dominated by a high concentration of large buyers and producers of gas. Consequently, bespoke long-term gas contracts were formed through bilateral negotiation between market participants rather than trade on a formalised platform or market. Contracts converged in design due to the alignment of risks and needs across parties in different gas markets and due to the commonality of upstream large producers who would sell to multiple downstream buyers.

Gas is relatively expensive to transport and store relative to the equivalent energy that could be sourced from oil products and coal.[160] In addition, the supply chain is relatively complex, requiring significant investment and infrastructure to facilitate trade between producers, shippers, and consumers.[161]

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[159] Jonathan Stern and Howard Rogers (December 2014), The Dynamics of a Liberalised European Gas Market: Key determinants of hub prices, and roles and risks of major players, p. 12.

[160] Jonathan Stern and Howard Rogers (December 2014), The Dynamics of a Liberalised European Gas Market: Key determinants of hub prices, and roles and risks of major players, p. 2.

[161] Energy Sector Management Assistance Programme – World Bank (January 1993), Long-term gas contracts – Principles and applications, p. 9.

Consequently, the primary role of upstream long-term contracts between producers and buyers are to finance the investment in infrastructure that the producer, and shippers, require to extract and ship gas to market. In making large infrastructure investments, large producers face volume risk that demand at the point of delivery is insufficient for them to recover their investment in infrastructure.

Long-term contracts provide producers with a minimum volume commitment to purchase gas over the tenor of the contract. This reduces the volume risk for the investor by guaranteeing a minimum demand for gas at the point of delivery for a relatively long period of time.

Buyers may also benefit from long-term contracts which provide them with a security of supply of gas. Whilst a minimum volume commitment to purchase gas over the tenor of a contract is a liability for the buyer, it also gives the buyer firm access to the minimum volume of gas over the lifetime of the contract. The firm access is particularly important for gas generators who need to secure volume to generate for power.

Buyers and sellers may also hedge price risk by entering into contracts for gas. A price agreed in a long-term contract, along with any volume commitments, may provide both parties with more certainty over their future revenue and cost streams. By linking contracts to the price of substitutable products, buyers were also able to hedge their commitment to invest in gas a fuel technology.

Whilst the development of European gas markets and trading hubs have increased the numbers of small buyers for gas downstream, the industry is still dominated by a small number of large producers of gas. Consequently, long-term contracts are still negotiated bilaterally with upstream producers. In some cases, upstream consortiums of producers may require negotiated bilateral agreements in place from multiple buyers in order to commit to the infrastructure investment to serve any of them e.g. the consortium of producers in the Shah Deniz II field in Azerbaijan signed multiple sales agreements with European utilities before committing to the investment required.[162]

However, with the development of liquid markets for gas at trading hubs and LNG technology to flexibly ship gas to markets where it is most demanded, standardised forward contracts for gas over shorter tenors have developed to facilitate the balancing of gas networks. These standardised forward contracts are similar to those traded in electricity as we describe in Appendix A, and are often traded on formalised OTC markets or exchanges. However, in part because gas storage is cheaper than electricity storage,[163] gas markets are balanced on broader time periods than electricity markets, and therefore require fewer standardised products to support second to second balancing in electricity. Trading hubs and forward markets also present an opportunity for larger producers to sell additional volumes of gas beyond those committed in long-term contracts with buyers.

162 Gas Tech Insists (4 October 2013), European utilities buy 10 Bcm/year of Caspian gas, Link: https://gastechinsights.com/node/1006https://gastechinsights.com/node/1006

163 Indeed, to some extent, it is available freely through variation of pressure within gas pipelines. This form of gas storage flexibility is commonly referred to as “line pack”.

For the majority of this case study, we focus on the long-term upstream contracts negotiated bilaterally between large producers and buyers rather than the standardised forward contracts traded on formal OTC and exchange-based markets.

D.1.3. Possible lessons for bulk water trading

Like gas, water is expensive to transport, and requires infrastructure to facilitate bulk trading arrangements. To this extent, water is also location-specific and long-term contracts to abstract and ship water along bespoke infrastructure are subject to volume and price risks at both the source and delivery point. In addition, gas varies in quality, for example through calorific value and bi-products, however the degrees of variation are probably less than that in water.

Therefore, the risks facing buyers and sellers in the water industry are similar to those facing buyers and upstream producers in gas. In particular, suppliers face volume risk over demand particularly when they invest significantly in infrastructure to ship the gas to market. Buyers are willing to sign long-term contracts for water to ensure resilience, in other words to ensure security in supply. Both parties may hedge price risk with long-term water contracts.

However, whilst initially long-term contracting for gas occurred across jurisdictional borders, and often between monopolists (regulated or owned by the state), the value for gas is largely determined by market forces. Where a market for gas had not developed, participants instead gauged the market value for gas based on the market value of oil-based products or coal as a substitute to gas. On the other hand, water is often priced on a cost basis rather than a market basis.

D.2. Contract Description

D.2.1. The standardisation of contracts

Upstream contracts are not standardised by regulation, nor are long-term upstream contracts traded on a formalised market such as an exchange with transparent pricing. Instead, contract forms reflect the risks facing parties and the supply-demand balance of the wider gas market over time.

Whist some differences between historical contracts did occur, reflecting different approaches to pricing and market structure, contracts were relatively similar because of the similarity of risks facing buyers and sellers. In particular, legacy long-term contracts were primarily signed to underpin investment in infrastructure in greenfield sites to bring gas to market. As such, and with gas competing with other fuel sources in those markets such as coal and oil, the primary risk facing sellers of gas was volume: that consumption would not grow, or grow sufficiently quickly, to result in profitable investment in the supply chain. Given the costs and difficulty in transporting gas, suppliers are particularly reliant on demand at the location where the buyer receives gas to support the investment in assets to ship the gas to that location.

In initial contracts in Great Britain and Continental Europe, parties developed take or pay terms to manage the volume risk facing suppliers, and to aid the terms of finance in infrastructure. In Great Britain, pre-1990 contracts were standardised, signed with British Gas Corporation (BGC), and had high take or pay percentages of around 85 per cent of the volume. Take or pay contracts meant BGC was obliged to purchase 85 per cent of the volume made available from the supplier, and faced an option on purchase volume above the take or pay minimum. Take or pay terms remain in contracts to this day, particularly those where significant investment in infrastructure is required, in order to manage volume risk of suppliers.

However, with the development of trading hubs for gas and the flexibility provided by interconnection and more importantly LNG, the pricing and rules across modern markets have homogenised. The development of a global market for gas has allowed more standardisation in contracting which has been led by market participants within a set of industry codes and regulation defining clear property rights and anti-competitive behavior.

For example, BP has led the development of a standardised LNG master sales and purchase agreement providing a standard contract to trade LNG.[164] Standardised agreements allow traders to refer to such terms and conditions, reducing transaction costs and allowing them to respond more quickly to spot market signals for LNG. These arrangements are similar to those in downstream electricity where standardised agreements such as the GTMA provide general terms and conditions for traders to refer to.

D.2.2. The nature of contractual commitment

The nature of the commitment to purchase gas depends on the contract agreed. Typically, total gas imports to a market involve three main tranches of gas: firm, inflexible tranches of imports, and interruptible, flexible tranches of imports, and options to purchase:[165]

- **Firm, inflexible tranches:** Take or pay commitments in long-term legacy contracts constitute firm commitments to purchase minimum volumes. These contracts include imports from Russia, Algeria, legacy Norwegian and British contracts, and Azerbaijan. Whilst long-term take or pay contracts normally involve a minimum commitment to take financial volumes, they may allow for flexibility on physical volumes.
- **Interruptible supplies:** A significant feature of modern trade in LNG is destination flexibility for the supplier. Qatar incorporates put-option clauses into its LNG contracts allowing it to arbitrage across European and Asian markets. Some contracts for LNG shipments allow the cargo to be redirected with mutual agreement of buyer and supplier to alternative markets or hubs. Interruptible supplies may also be arranged through contracts for gas imports across interconnectors where the capacity is booked as interruptible.
- **Options to purchase:** Above minimum take or pay volumes, most long-term take or pay contracts have options to purchase additional swing gas. Some long-term take or pay contracts may have the ability for the buyer to bank gas across contract years.[166] Buyers may also purchase uncontracted LNG at spot prices at hubs.

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164 BP, LNG master sales and purchase agreement, Last accessed: 22 May 20202, Link: https://www.bp.com/en/global/bp-global-energy-trading/features-and-updates/technical-downloads/lng-master-sales-and-purchase-agreement.html

165 Jonathan Stern and Howard Rogers (December 2014), The Dynamics of a Liberalised European Gas Market: Key determinants of hub prices, and roles and risks of major players, p. 25.

166 Jonathan Stern and Howard Rogers (December 2014), The Dynamics of a Liberalised European Gas Market: Key determinants of hub prices, and roles and risks of major players, p. 25.

Typically, contracts that support investment will require the buyer to commit to purchase a minimum volume under take or pay conditions. This firm commitment to purchase represents the transfer of (some) volume risk from the investor to the buyer.

D.2.3. The role of industry codes

The role of industry codes in upstream gas is not to prescribe a contracting structure for market participants to use, but to instead define clear property rights and codes on anti-competitive behavior to allow the market to standardised contracts within an institutional framework. Key to the contract for upstream gas is the definition of where the gas becomes the property of the buyer, and to what extent the supplier may limit the actions of the buyer through its contract thereafter.

In particular, legacy long-term contracts often stipulated destination clauses and territorial sales restrictions. Historically, large producers of gas sold gas to buyers, national monopolists, who then sold on to end-users. Destination clauses prevented the buyer from trading with other national monopolists and allowed the large producers of gas to maintain price differentials, and price discriminate, across European markets. Other contracts include profit sharing clauses that would allow the supplier to benefit should the buyer resell gas on in different markets. Profit sharing clauses may achieve the same result as destination clauses by limiting the buyers' incentives to resell gas.

The European Commission has moved against destination clauses deeming them uncompetitive, and has negotiated the deletion of such clauses from legacy contracts. Most notably, the Commission negotiated the exclusion of clauses in contracts between Gazprom and EU trading partners e.g. ENI, OMV, E.ON and Ruhrgas. The Commission has applied similar rulings to LNG supply contracts.[167]

One restriction on use that may be upheld by competition law is restrictions on the flaring of gas by the buyer after purchasing. One may argue that flaring gas, given the environmental impact, negatively impacts the reputation of the supplier of that gas who may therefore be justified in restriction use of gas for flaring in the contract. Very few gas contracts include such limitations, but some prohibit flaring explicitly unless in the case of emergency or safety reasons.[168]

Industry codes have a much more active role in developing downstream gas markets and the standardisation of contracts at trading hubs, similar to the role of the BSC in downstream electricity markets.

For example, in Great Britain, the 1995 Gas Act and 1996 Network Code altered contract structure in the downstream gas market entirely. The set of rules governing third party access to the pipeline grid required day-ahead balancing at National Balancing Point (NBP). Market participants developed new, shorter term, standardised contracts to secure gas and the prices of these contracts were linked to the price at the NBP.

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[167] European Commission (21 June 2018), Antitrust: Commission opens investigation into restrictions to the free flow of gas sold by Qatar Petroleum in Europe.

[168] International Institute for Sustainable Development (7 October 2011), Foreign investment contracts in the oil & gas sector: A survey of environmentally relevant clauses.

The most-used standardised contract was the NBP'97, or the "Short Term Flat NBP Trading Terms and Conditions". It is a standardised contract which only leaves traders to define the period of delivery, the quantity and the price. In particular, it had three components which led to its simplicity, clarity and firmness and encouraged its use in trading:[169]

1. Volume traded was guaranteed on the NBP (rather than pro-rated depending on physical flows like on other European Hubs) therefore volumes delivered equals volumes traded.
2. Quantities traded are delivered at constant flow throughout the period meaning there was no interruption or volume variation allowed (often subject to take or pay clauses).
3. There was limited force majeure (even the shutdown of an upstream field or exit point did not constitute force majeure).

The collapse of Enron and TXU Europe in the early 2000s led to further standardisation as risk managers attempted to avoid counterparty risk in negotiated contracts.[170] As markets became more connected and contracts more standardised, gas-to-gas competition and hub trading developed.

D.2.4. Typical tenor of contracts

Pre-1990, long-term take or pay contracts were signed with upstream suppliers for contact tenors of 25 years or more, reflecting the large investment in greenfield gas fields and transportation infrastructure required to bring the gas to market.

After 1990, contracts between electricity generators in Great Britain and upstream producers were signed to support the financing of Combined Cycle Gas Turbine (CCGT) plant. At the time, pipeline infrastructure to bring gas from the North Sea to the national network had largely been developed under long-term take or pay contracts with BGC. Consequently, contracts to supply generators required relatively less additional infrastructure to connect those generators to the existing network and connect brownfield sites to the major pipelines bringing has onshore. As such, contracts with generators also involved take or pay commitments over a shorter contract tenor of typically around 15 years and were often signed out of security of supply concerns to support financial agreements with banks to invest in such generators, rather than support infrastructure to bring gas to the generators.

More recently, security of supply contracts are signed in the competitive market for shorter durations of around 8-10 years. LNG contracts have also been signed under shorter-term contracts of 10-15 years.[171]

However, long-term take or pay contracts may still be signed in the market, in particular for greenfield investment: For example, European buyers and Azerbaijan signed a long-term contract of 25 years to support the financing of USD 25 billion of upstream investment and pipelines of USD 20 billion to facilitate supply.[172] Moreover, many contracts to support

[169] Patrick Heather (August 2010), The Evolution and Functioning of the Traded Gas Market in Britain, p. 11-12.

[170] Jonathan Stern (1997), The British Gas market 10 years after privatisation: a model or a warning for the rest of Europe?, Energy Policy, Vol. 25 No. 4, p. 387.

[171] Luic Franza (2014), Long-term gas import contracts in Europe, The evolution in pricing mechanisms, p. 19.

[172] Jonathan Stern and Howard Rogers (December 2014), The Dynamics of a Liberalised European Gas Market: Key determinants of hub prices, and roles and risks of major players, p. 64.

finance for LNG infrastructure still rely on long-term contracts. For example, over 80 per cent of Qatar's LNG supply is sold under long-term contracts.[173]

D.2.5. Secondary trading

Upstream contracts are bilaterally negotiated between counter-parties and cannot be resold in a secondary market. However, gas purchased through long-term take or pay contracts may be resold by the buyer at trading hubs using short term standardised products, subject to destination clauses in the upstream contracts (as we discuss in Section D.2.3).

D.3. Infrastructure and Investment

A key feature of long-term upstream contracts for gas is their use to support finance in the extensive infrastructure and investment often required to ship gas from where it is produced to national transmission networks. The infrastructure and supply chain for gas has altered over time with technology. Whilst historically, contracts supported primarily pipeline investment to bring gas from the North Sea, Groningen fields, Algeria, and Russia to European markets, they now also support investment in terminals and liquidation facilities required to ship LNG from markets further afield e.g. Qatar.

D.3.1. Links to infrastructure and investment

Whilst long-term contracts are used to finance investment, and hedge against volume risk, we understand that the costs and details of the infrastructure required are normally determined outside of the contract terms, as we discuss further below.

D.3.2. The role of contracts to support infrastructure

Long-term contracts are used to finance investment in infrastructure such as production facilities, terminals, liquefaction plants, pipelines etc. The contract supports the investment by guaranteeing a purchase of a specified volume of gas for a specified period of time and therefore hedges the investor against the volume risk that they would otherwise face on recovering their investment.

D.3.3. Cost sharing in contracts

We understand that the costs required to ship gas are determined outside of the long-term contract for gas. Instead, the contract will specify a delivery point which defines the transfer of property rights of the gas from the seller to the buyer. Each party implicitly bears costs associated with the delivery point. Suppliers bear the costs to ship the gas from the field upstream to the delivery point, and buyers bear the costs of receiving and subsequently shipping or storing the gas from the delivery point to where it is ultimately consumed. The contract between parties only reflects the sharing of infrastructure costs through minimum volume commitments, contract tenor, and agreed pricing between parties.

However, with the development of LNG markets, a significant cost component is the transport of the LNG. The costs and risks of shipping LNG are normally determined in the contract through internationally recognised, and standardised, commercial terms

173 Luic Franza (2014), Long-term gas import contracts in Europe, The evolution in pricing mechanisms, p. 19.

(INCOTERMS) governing the shipment of goods, underpinned and updated annually by the International Chamber of Commerce.[174] The three most common INCOTERMS are:[175]

- "FOB (Free on Board) means that the seller delivers when the goods pass the ship's rail at the named port of shipment. This means that the buyer has to bear all costs and risks of loss of or damage to the goods from that point.
- DES (Delivered Ex Ship) means that the seller delivers the contract goods when those goods are placed at the disposal of the buyer on board of the ship at the named port of destination. The seller has to bear all costs and risks involved in bringing the goods to the named port of destination before discharging.
- CIF (Cost, Insurance and Freight) means that the seller delivers the contract goods when those goods pass the ship's rail in the port of shipment. The seller must pay the costs and freight necessary to bring the goods to the named port of destination and procure marine insurance against the buyer's risk of loss of or damage to the goods during the carriage. However, the risk of loss of or damage to the goods, as well as any additional costs due to events occurring after the time of delivery, are transferred from the seller to the buyer in the loading port"

The choice of INCOTERMS in the contract for LNG both determines the sharing of shipping costs and insurance between parties and the transfer of property rights of the gas from the supplier to the buyer. With FOB, the buyer is transferred property rights of the cargo at the port of shipment, and may subsequently divert the cargo to a different terminal under an agreement with the shipper but independent of its arrangement with the seller. However, under CIF, both the seller and buyer would need to approve such a diversion, because the seller would be liable for the goods until their destination.

D.3.4. The role for industry codes

Industry codes are used to support efficient investment across pipelines underpinned by multiple contracts. In particular, third party access rules aim to reallocate spare capacity on pipelines financed by bespoke long-term contracts with take or pay clauses, so that it may be used by other parties. Ensuring third party access at fair terms to existing infrastructure is important for the development of new, smaller fields, for example in the North Sea, which are not large enough to support investment in new infrastructure to bring the gas onshore.[176] EU regulators have also perceived that such processes prevent potential anti-competitive behavior by owners of key pipelines financed under bespoke long-term contracts, who could otherwise extract profits through charging parties for access to their infrastructure.

The Oil and Gas Authority (OGA) enforces similar access terms for British pipelines in the North Sea. Parties in the North Sea sign up to the voluntary, industry-led, "Code of Practice on Access to Upstream Oil and Gas Infrastructure on the UK Continental Shelf" which sets

174 International Chamber of Commerce, INCOTERMS, Last accessed: 22 May 2020, Link: https://iccwbo.org/resources-for-business/incoterms-rules/incoterms-2020/

175 Harold Nyssens and Iain Osborne, Profit splitting mechanisms in a liberalised gas market: the devil lies in the detail, p. 27.

176 Oil and Gas Authority (May 2019), Guidance on Disputes over Third Party Access to Upstream Oil and Gas Infrastructure, p. 13.

out the principles of third party access to existing infrastructure.[177] If parties are unable to agree on terms of access to a pipeline under the agreement, they may appeal to the OGA that makes an assessment in line with its own published guidance. The OGA assesses the costs and risks of access on a case by case basis to determine whether one party is withholding access to the other and the fair terms to make that access available. The OGA states that the terms determined by it would:[178]

> "likely to be in line with those that would be offered by infrastructure owners were they to face effective competition from other infrastructure owners who also have sufficient spare capacity to accommodate the hydrocarbons in question"

The terms under effective competition, and therefore the OGA's assessment, would represent the market value of the capacity owned by the party. This approach to regulating access pricing is similar to the approach taken by ACER in determining cost allocations between EU Member States for interconnection projects (see Appendix C.3.4). By setting out the principles it would apply in making access pricing determination, market participants can negotiate bilaterally, knowing the principles the regulator would apply to dispute resolution if they cannot agree terms.

The European Commission has developed third party access rules in an attempt to reduce anti-competitive behavior arising due to the ownership of infrastructure financed under long-term contracts. However, the Commission ensures derogations to third party access requirements are made to facilitate take or pay arrangements in legacy contracts in the case where those suppliers would otherwise be unable to secure capacity without facing financial difficulty.

The EU's Third Energy Package also stipulates common rules governing cross border trade of gas, similar to those rules governing cross border trade in power using interconnectors. These rules help facilitate the development of liquid trading hubs, for example the TTF hub as the most liquid hub for gas in continental Europe, by allowing participants to access to ship gas across borders. Increasing the number of trading participants at these hubs reduce transactions costs, and provides both reference prices for long-term bespoke contracts as well as incentives for market participants to standardise contracting further.

D.4. Pricing and Cost Allocation

D.4.1. Approach to determine the level of pricing

There are four broad pricing approaches used in upstream, long-term gas contracts:[179]

- **Oil Price Escalation (OPE):** Prices in the contract are linked to a basket of competing fuels, normally oil-based products but also coal. Normally, a fixed, base price is updated through an escalation clause. Reopeners in the contract allow parties, normally every

[177] Oil and Gas Authority (May 2019), Guidance on Disputes over Third Party Access to Upstream Oil and Gas Infrastructure, p. 5.

[178] Oil and Gas Authority (May 2019), Guidance on Disputes over Third Party Access to Upstream Oil and Gas Infrastructure, p. 14.

[179] Jonathan Stern (2012), The Pricing of Internationally Traded Gas, p. 7.

three years, to update the base price for changed economic circumstances beyond their control.[180]

- **Gas-On-Gas Competition (GOG):** Prices in the contract are linked to gas price indices, hub spot prices and spot LNG prices and therefore capture the market value of gas.
- **Regulated Price (RP):** Prices are determined or approved by a regulatory authority to cover the cost of service including a reasonable rate of return. In some cases, prices are determined below the cost of service to represent a state subsidy to the entity.
- **Netback from Final Product (NET):** The price received by the supplier is set in relation to the final product of the buyer. NET contracts apply when gas is used as an input to a chemical plant where the gas is a major variable cost in the production of the output e.g. ammonia or methanol.

The common choice of approach to pricing in long-term upstream contracts has evolved over time along with the development of the gas industry.

Throughout the early development of the gas industry in Great Britain, the state monopoly, BGC, signed long-term contracts with producers situated offshore in the North Sea. The cost base for these producers was relatively high due to the infrastructure required to bring the gas onshore. Moreover, key to BGC's concerns was the relative affordability of gas as heating to end consumers relative to existing fuel sources of heat, town gas and coal.[181]

Consequently, BGC entered into negotiations with producers using a cost-plus approach to both allow producers to capture a reasonable return but also to ensure that natural gas retained its competitiveness relative to oil based products.[182] The prices in the contracts were fixed, with no reopeners, but were indexed to a basket of heavy fuel or gas oil to ensure relative competitiveness to alternative fuel sources.[183] The contracts represented a combination of OPE approaches and RP approaches, in light of national fuel policy.

On the other hand, long-term contracts for gas from the Groningen field in the Netherlands adopted a market-value approach to price the gas. The adoption of a market value rather than cost-based approach was because the costs of production at Groningen were relatively low, principally because the gas was already onshore. The market value approach allowed Shell, Exxon and the Dutch government to obtain much higher revenues whilst allowing for gas to gradually displace oil products in consumer markets.[184]

However, at the time, there was not a competitive, liquid gas market with a price reflecting the market-value of gas. In the absence of a market value for gas, contract prices at Groningen were linked to a weighted average of the value of gas in competition with other fuels, mainly oil-products. The market value of gas was therefore set by the opportunity cost

[180] Jonathan Stern (2012), The Pricing of Internationally Traded Gas, p. 56.

[181] Jonathan Stern and Howard Rogers (December 2014), The Dynamics of a Liberalised European Gas Market: Key determinants of hub prices, and roles and risks of major players, p. 3.

[182] Jonathan Stern and Howard Rogers (December 2014), The Dynamics of a Liberalised European Gas Market: Key determinants of hub prices, and roles and risks of major players, p. 3.

[183] Patrick Heather (August 2010), The Evolution and Functioning of the Traded Gas Market in Britain, p. 30.

[184] Jonathan Stern and Howard Rogers (December 2014), The Dynamics of a Liberalised European Gas Market: Key determinants of hub prices, and roles and risks of major players, p. 3.

of using gas i.e. the oil products, whose market value was determined in a competitive, liquid market.

With the introduction of competition, the establishment of hub trading, and the growing role of LNG, the market value of gas is now well defined in a competitive market. Moreover, oil-based products are no longer direct substitutes for gas use, due to developments in technology for gas plant and national fuel policy. As such, the market value of gas has decoupled from the market value of oil-based products.

Consequently, modern long-term contracts are more likely to follow a GOG approach to index pricing rather than an OPE approach. For example, the Shah Deniz-2 contract with Azerbaijan is priced on the basis of GOG indexing.[185]

Moreover, legacy contracts with price reopeners have re-indexed away from OPE to GOG pricing to better reflect the market value for gas.[186] In cases where mutual agreement under price reopeners of legacy contracts has not allowed those contracts to be re-indexed to GOG indexing, arbitrators have often recognised buyer's claims for re-indexation save for contracts in markets without integrated hubs.

D.4.2. Link between price and costs

Whilst minimum take or pay clauses alongside the price agreed in long term contracts relate indirectly to the infrastructure required to supply gas, to our understanding, most long-term agreements do not explicitly link to the costs of investment. Inherent in long-term contracts, is an obligation for the seller to ship gas to the buyer at a defined location. How the seller transports gas to that location may require it to invest in new infrastructure or utilise existing infrastructure so long as it meets its firm commitment. However, the costs of shipping (and insuring) LNG are explicitly defined in the contract using INCOTERMS as we describe in Section D.3.3.

D.4.3. Typical structure of pricing

We understand that pricing in most long-term upstream gas contracts is on a volumetric basis up to the minimum quantity of take or pay. Beyond that minimum quantity, pricing remains volumetric but may be at a different rate giving rise to a tiered pricing structure. For example, Russian contracts to Europe include take or pay volumes, beyond which Russia sells swing gas based on contract and hub price relationships.[187]

D.4.4. Adjustment in prices for changing costs

Under GOG or OPE contracts, prices in long-term contracts are updated in line with a defined index or market price as specified in the contract. In NET contracts, prices update with the final produced product of the buyer. In other regulated contracts, pricing may be updated alongside the price controls or updates to regulation of the parties involved.

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[185] Luic Franza (2014), Long-term gas import contracts in Europe, The evolution in pricing mechanisms, p. 19.

[186] Luic Franza (2014), Long-term gas import contracts in Europe, The evolution in pricing mechanisms, p. 14.

[187] Jonathan Stern and Howard Rogers (December 2014), The Dynamics of a Liberalised European Gas Market: Key determinants of hub prices, and roles and risks of major players, p. 26.

Legacy long-term contracts tended to adopt an OPE approach to pricing, with prices linked to oil-based products in order to capture the degree of substitutability between the products as fuel sources. Moreover, the absence of a liquid gas market historically meant that contracting parties determined the market value of gas using the opportunity cost, or the value of the nearest alternative as a fuel source.

Whilst long-term OPE contracts in continental Europe had price reopeners, long-term contracts signed by BGC did not and set a fixed price linked to a basket of oil-based product prices.[188] Reopeners, typically every three years, allow parties to update the base price agreed in the contract due to changed economic circumstances beyond the control of either party.[189] The use of reopeners manages the potential volatility in pricing whilst ensuring the price updates alongside the index, chosen to reflect market conditions or changing costs.

The degree of substitutability between oil-based products and gas as a fuel source is no longer feasible in practice given national fuel policy choices, and the technological improvement to gas power production. Accordingly, holders of legacy contracts have recently entered into negotiations with their counter-parties to re-link their contracts to market-based prices for gas, adopting instead the GOG pricing approach including full indexation of contract prices to hub prices.[190]

D.5. Allocation of Risks

A primary determinant of the contracting structure for upstream gas is the distribution of risks across parties. Consequently, a large driver of the change in contracting structure has been changes in the risks, or magnitude of risks, faced by market participants due to the changes in the market for gas.

Pre-1990, the primary risk facing producers was volume risk: that demand for gas would not grow sufficiently quickly, if at all, to recompensate them for their investment in the greenfield infrastructure used to bring that gas to market. A key determinant of volume risk was that either alternative fuel sources were relatively cheaper compared to gas. On the other hand, the buyer historically faced the price risk on the contract: that other fuel sources were relatively cheaper to gas and that they were committed into a contract to offtake gas at a specified price.

Consequently, long-term legacy contracts ensured that parties hedged each other’s risks. Buyers adopted volume risk by committing to minimum take or pay volumes that would guarantee sellers with the volume certainty that they required to develop infrastructure to support the trade.

Meanwhile, sellers adopted the price risk, by accepting base prices indexed to the prices of substitute products. Therefore, should the price of competitive fuels fall, the buyers would be committed to purchasing gas but at similarly lower prices. Sellers exposure to price risk was limited by price reopeners whereby the base price in the contract would be reset to reflect underlying changes in economic conditions beyond either parties’ control. Reopeners did not

188 Patrick Heather (August 2010), The Evolution and Functioning of the Traded Gas Market in Britain, p. 30.

189 Jonathan Stern (2012), The Pricing of Internationally Traded Gas, p. 56.

190 K. Talus, Natural Gas Contracts and Antitrust Law in the EU and the USA, p. 286.

feature prevalently in British contracts but did in Continental Europe, and commonly presented the opportunity to reset base prices every three years.[191]

In more recent contracts, buyers may hedge security of supply risks through signing long-term contracts whereas sellers continue to hedge volume risk against their investment in infrastructure. The risks of shipping freight are divided between parties depending on the terms of the contract, see our discussion of INCOTERMS in Section D.3.3.

LNG contracts with optionality clauses for sellers, for example put-option clauses in long-term contracts with Qatar, illustrate the changing allocation of risks in upstream contracts. With a liquid global market for gas, and the flexibility to respond to price signals through LNG shipments, suppliers are less reliant on demand in a single location to recover their costs of investment in infrastructure. Consequently, the volume risk in contracts with put options is now borne by the buyer who faces the risk that the supplier will exercise the option in order to sell in a more profitable market elsewhere. Meanwhile, suppliers are adopting more price risk in the contracts, as buyers' willingness to pay for gas with a put-option for the seller will likely be less than the buyer's willingness to pay for a firm volume of gas.

D.6. Dispute Resolution

International arbitration underpins many long-term contracts in upstream gas reflecting that most upstream contracts in gas are cross-border obligations. International arbitration provides a route by which either parties may challenge clauses in contracts as a result of developments in the market e.g. legacy destination clauses. International arbitration is also important in upstream gas because one side of the contract may frequently be held by government, or a government owned entity, and may therefore not be enforceable under local law.

[191] Jonathan Stern and Howard Rogers (December 2014), The Dynamics of a Liberalised European Gas Market: Key determinants of hub prices, and roles and risks of major players, p. 2.

Appendix E. Bulk Trading of Water in Australia

E.1. Background and the Need to Trade

E.1.1. Organisation of the industry

The focus of this case study is water trading in the Murray-Darling Basin (MDB) which accounts for the majority of water trading in Australia.[192] The MDB spans five states/territories: Queensland, New South Wales, Victoria, South Australia and Australian Capital Territory.

The main use of water in Australia (and from the MDB) is irrigated agriculture, which accounted for 72 per cent of consumptive water use in 2017-18, urban use which accounted for 19 per cent, and industry use which accounted for 9 per cent.[193] The key irrigated crops in the MDB are rice and cotton, dairy farming, and horticulture.[194]

Consequently, irrigators are the main participants in water markets.[195] However, other groups also trade (often becoming significant traders at different times[196]), including urban water companies, environmental water rights holders, indigenous users and communities, water brokers and exchanges, and investors.

The main reasons trade occurs are:

- Farmers expanding production, finishing a crop or selling excess water allocation in the short-term;[197]
- Farmers changing production or crop types, or managing water availability risks in the longer term;[198]
- Water being purchased for environmental reasons, typically by State or the Commonwealth government;[199] and
- Water being purchased by urban water corporations, to supplement their bulk supplies.[200]

The MDB is classified into different water systems:

[192] Goesch, Tim, Manannan Donoghoe & Neal Hughes, *Snapshot of Australian Water Markets*, Department of Agriculture and Water Resources, 2019, pg.2.

[193] Australian Bureau of Meteorology, *Water in Australia 2017-18*, May, p.71.

[194] Australian Bureau of Meteorology (2019), *Australian Water Markets Report 2017-18*, Southern Murray-Darling Basin Section, p.7.

[195] Goesch, Tim, Manannan Donoghoe & Neal Hughes, *Snapshot of Australian Water Markets*, Department of Agriculture and Water Resources, 2019, pg.4.

[196] Australian Competition and Consumer Commission (2019), “ACCC inquiry into water markets in the Murray-Darling Basin”, Issues paper, 17 October, p.7.

[197] Australian Competition and Consumer Commission (2019), “ACCC inquiry into water markets in the Murray-Darling Basin”, Issues paper, 17 October, p.7.

[198] Australian Competition and Consumer Commission (2019), “ACCC inquiry into water markets in the Murray-Darling Basin”, Issues paper, 17 October, p.7.

[199] Tim Cummins & Associates (2015), “Water Market Trends: Trends in Northern Victorian Water Trade 2001-2015”, 24 February, at p.5.

[200] Tim Cummins & Associates (2015), “Water Market Trends: Trends in Northern Victorian Water Trade 2001-2015”, 24 February, at p.5.

- Regulated surface water systems: these are parts of the MDB where river flows are "controlled" (i.e., regulated) by dams and weirs;
- Unregulated surface water systems: where there are no controls or structures that can alter in-stream flow; rather it is dictated by natural events; and
- Groundwater systems: water beneath the land surface in aquifers.

The majority of systems in the MDB are regulated systems.[201] Systems are defined for broad geographical areas within the MDB. Trade can occur within and between regulated systems, within and between unregulated systems, and between regulated and unregulated systems. In some cases, trade between systems cross state boundaries, which is referred to as interstate trade.

E.1.2. Organisation of trading and the role of contracts

Trades in the MDB relate to different types of water rights. The main types of water rights are:[202]

- **Water access rights:** these are rights to take and/or use water. The main types of rights are "entitlements" or "allocations". An entitlement is an ongoing right allowing the holder to take from the MDB a share of available water over the life of the entitlement. An allocation provides the holder with a right to a specific volume of water in a given year – it depends on how much water is available in the water resource in the relevant year;
- **Water delivery rights:** these are rights to have water delivered by an irrigation infrastructure operator (IIO). They are typically specific to having water delivered through irrigation infrastructure owned by a given IIO (delivery rights are not required for an individual irrigator that uses its own irrigation infrastructure); and
- **Irrigation rights:** these are also rights within an IIO's network. They are essentially a specific contractual arrangement, separate to the water entitlement/allocation, which entitle the holder to receive water from the IIO. An IIO's will hold the water entitlement on behalf of its irrigator members, and allocate irrigation rights to those members for a share of that entitlement.

Water trading at the MDB accounted for 97 per cent of all allocation trade and 77 per cent of entitlement trade in Australia in 2016-17.[203] In 2018-19 (year to 30 June 2019), approximately 95,000 entitlements to water (discussed below) were issued to water users in the MDB, amounting to nearly 20,000 GL of surface and groundwater.[204] Of this,

[201] Australian Bureau of Meteorology (2019), *Australian Water Markets Report 2017-18,* Southern Murray-Darling Basin Section, p.6.

[202] Australian Competition and Consumer Commission (2019), "ACCC inquiry into water markets in the Murray-Darling Basin", Issues paper, 17 October, p.3.

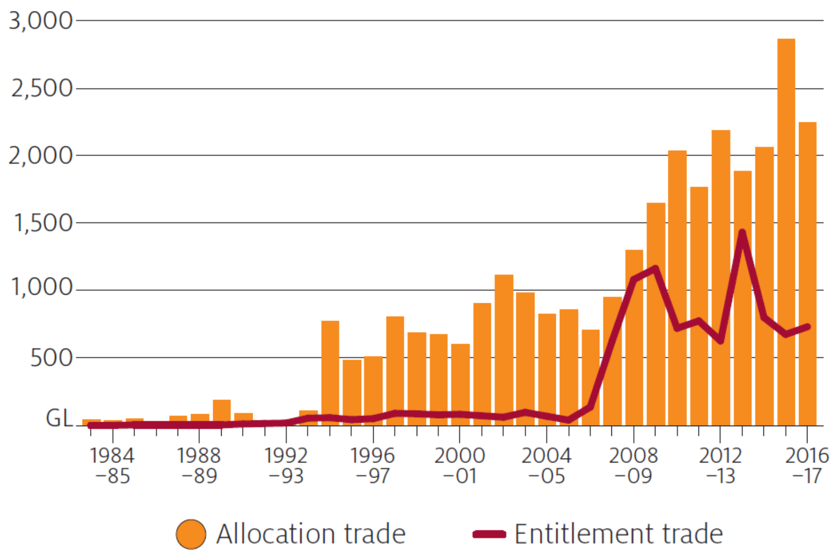
[203] Goesch, Tim, Manannan Donoghoe & Neal Hughes, *Snapshot of Australian Water Markets,* Department of Agriculture and Water Resources, 2019, pg.2.

[204] Based on data available at Bureau of Meteorology, Water Markets Dashboard: http://www.bom.gov.au/water/dashboards/#/water-markets/mdb/eoi, accessed 25 March 2020.

approximately 6,700GL (or 33 per cent) was traded in 2018-19, made up of both permanent trades of entitlements or temporary trades of annual allocations.[205]

The level of trade in the southern MDB has steadily increased in the last 10 years.

Figure E.3: Allocation and Entitlement Trade in the Southern MDB 1984 - 2018



Source: Goesch, Tim, Manannan Donoghoe & Neal Hughes, Snapshot of Australian Water Markets, Department of Agriculture and Water Resources, 2019, p.2.

Most trades in the MDB are for water entitlements and water allocations. Trade in a water entitlement is a permanent trade, while trading an allocation is considered only a temporary trade as it relates only to the water available in a given year. The 6,700GL traded in 2018-19 reported above relates only to trading of water entitlements and allocations. Of this volume, approximately 5,500GL was trading in allocations (82 per cent), with the remainder trading in entitlements.

Trades in water delivery rights are low relative to the volume of rights held – in 2017-18 it was estimated that only 1 per cent of water delivery rights held were traded.[206] Whilst water entitlement rights and delivery rights are often separate from one another, but water users may hold multiple rights e.g., a water entitlement providing the right to use water, and a water delivery right to have it delivered by an IIO.

Much of the MDB is hydrologically linked, such that water can move through the MDB from one point to another. Where different systems (regulated and/or unregulated) are hydrologically linked, trade in entitlements/allocations can occur between the two systems. This might also result in trades occurring across state boundaries. In the southern part of the MDB, where most trade occurs, only 16 per cent of trades in 2017-18 were interstate trades.[207]

[205] Based on data available at Bureau of Meteorology, Water Markets Dashboard: http://www.bom.gov.au/water/dashboards/#/water-markets/mdb/eoi, accessed 25 March 2020.

[206] Australian Competition and Consumer Commission (2019), *Water Monitoring Report*, May, p.48.

[207] Australian Bureau of Meteorology, *Water in Australia 2017-18*, May, p.64.

Because of this hydrological interconnectivity, trade in entitlements/allocations does not necessarily need to be associated with physical infrastructure to deliver the water from the seller to the buyer. Essentially, the MDB itself provides the physical infrastructure e.g., a surface water trade from an upstream user to a downstream user involves the upstream user no longer extracting the water, so that it remains instream to flow to the downstream user to extract.

There can, however, be trading restrictions imposed across regions, due to physical or hydrological limitations within the river system. One example is the Barmah Choke, which is a narrow section of the Murray River near Echuca in Victoria. The flow of the river is relatively restricted through the Choke, which makes it difficult to provide sufficient water to downstream water users. Because of this trade restrictions are imposed from upstream of the Choke to downstream of the Choke – in particular upstream users can only sell water to downstream users if there is the same or greater volume of water transferred from downstream to upstream users first. This restriction is intended to ensure sufficient water is available to existing downstream users.[208]

E.1.3. Possible lessons for bulk water trading

Australia is considered to be one of the more sophisticated and well-developed water markets in the world. There is a relatively large volume of trading, and trade has been increasing in recent years. It also has strong institutional arrangements and regulatory oversight.

There are some key differences between trading in the MDB and trading for bulk supplies in the water industry in England and Wales:

- Most trading occurs in a single catchment, but one that is covers a very wide geographical area.
- Main water use is agriculture.
- Because of hydrological interconnectivity of the catchment, there is not a separate requirement for infrastructure to facilitate the physical delivery of traded water entitlements/allocations.
- However, there are also separate water delivery rights within irrigation schemes which do relate to physical water delivery.

E.2. Contract Description

E.2.1. The standardisation of contracts

The different states (NSW, Queensland, South Australian and Victoria) each issue different types of water entitlements, which often depend on the particular regional system to which they apply:[209]

- NSW: High Security; General Security; and Supplementary Water.
- Queensland: High Priority; and Medium Priority.

[208] See https://www.mdba.gov.au/managing-water/water-markets-trade/barmah-choke, accessed 26 March 2020.

[209] Information on the different products available is available at: https://www.mdba.gov.au/managing-water/water-markets-trade/water-markets-product-information

- South Australia: different classes of entitlement based on use, covering stock use; urban water use; irrigation, recreation and environment; industrial; and wetlands. The stock use, urban water use and industrial classes are deemed critical to human needs, so are higher priority than the remaining classes (which all have the same priority).
- Victoria: High Reliability; and Low Reliability.

A key difference between some of these products is their priority (also referred to as security or reliability). Higher priority rights are more likely to receive their full allocation in a year, while those that are lower priority will be the first to experience reductions in water allocations in periods of low flows.

Most water entitlements are "unbundled" in the sense that they are not specifically tied to any particular land for their use.[210] While water entitlements (and the resulting annual water allocations that they provide) are specific to each state and each regional (regulated/unregulated) system, they can nonetheless still be traded across states and systems. This depends on specific trading rules which have been established, which specify (among other things) the regions between which trades are allowed to occur.[211]

Trades generally occur from an upstream source to a downstream source, as this is the direction of water flow. However, trade can occur from downstream to upstream if there is a corresponding trade occurring in the other direction. This is known as "back trade".

Trading of water entitlements/allocations across different states is managed by a process known as "tagging". If a water entitlement issued in one state is traded to a different state, then it is "tagged" on a public water register as allowing water to be taken in the different state.

Water delivery rights are specific to a particular irrigation scheme. They are typically specified in terms of a share of capacity within the irrigation scheme's infrastructure, as a particular volume of water that can be delivered in a given time period.[212]

E.2.2. The nature of contractual commitment

While no water entitlement is firm, in the sense of guaranteed delivery, there are some that are higher priority than others. Generally high priority entitlements receive close to their full allocation, while lower priority entitlements can receive materially less. This depends on factors such as climate, inflows, storage, etc., as to water availability.

It has been noted that there does not appear to be any option contracts operating in the MDB, although these and other derivative products have been mooted for development.[213]

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[210] The ACCC noted in 2010 that most regulated systems in the MDB have water entitlements that are unbundled from land (ACCC, *Water trading rules: Final advice*, March, p44). There may, however, be some bundled rights existing under legacy systems, as noted for example for South Australia at https://www.environment.sa.gov.au/topics/water/water-licences-and-permits/unbundling-water-rights

[211] Further detail on the trading rules is available at: https://www.mdba.gov.au/managing-water/water-markets-trade/basin-plan-water-trading-rules

[212] Australian Competition and Consumer Commission (2019), *Water Monitoring Report*, May, p.29.

[213] Australian Bureau of Meteorology (2019), *Australian Water Markets Report 2017-18*, Southern Murray-Darling Basin Section, pp.24.

E.2.3. The role for industry codes

Water entitlements/allocations, and rules for trading, are supported by relevant federal government legislation, the Water Act 2007 and water trading rules developed by the MDB Authority. The trading rules address three aspects of market operation:[214]

1. reducing restrictions on trade;
2. improving transparency and access to information; and
3. maintaining market integrity and confidence.

The MDB water trading rules contribute to achieving the Basin water market and trading objectives detailed in Schedule 3 of the Water Act 2007. These objectives are to:[215]

- "facilitate the operation of efficient water markets and the opportunities for trading, within and between Basin States, where water resources are physically shared or hydrologic connections and water supply considerations will permit water trading
- minimise transaction cost on water trades, including through good information flows in the market and compatible entitlement, registry, regulatory and other arrangements across jurisdictions
- enable the appropriate mix of water products to develop based on water access entitlements which can be traded either in whole or in part, and either temporarily or permanently, or through lease arrangements or other trading options that may evolve over time
- recognise and protect the needs of the environment
- provide appropriate protection of third-party interests."

The trading rules include provisions such as:

- Water access rights can be traded free of any conditions requiring the holding of a separate water delivery right.
- Water access rights can be traded free of any restrictions on trading to a particular water use, on the use of water after it has been traded, on whether or not the resource is overallocated (i.e., they can still be traded even if there is an overallocation), and a few other aspects.
- Rules allowing recovery of loss or damage (through private court action) arising from non-compliance of the rules by others.
- Rules around restrictions on trade for breaches of state water management law.

Water delivery rights and irrigation rights are non-statutory rights, so are not supported by any legislation. IIO's do establish their own set of rules around trading, but these do not appear to be supported by any specific industry codes.

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214 Australian Government, Guidelines for Water Trading Rules, Link: https://www.mdba.gov.au/sites/default/files/pubs/01_WTG-REFERENCE_final.pdf

215 Australian Government, Guidelines for Water Trading Rules, p. 1. Link: https://www.mdba.gov.au/sites/default/files/pubs/01_WTG-REFERENCE_final.pdf

E.2.4. The typical tenor of contracts

Water entitlements provide perpetual access to a share of the water resource. Water allocations provide only specific volumes of water in a given year.

E.2.5. Secondary trading

Trade occurs in each of water entitlements, water allocations, water delivery rights and irrigation rights, but there are no secondary markets for these trades.

E.3. Allocation of Risks

A key risk is volume risk e.g., that the volume of water associated with a water entitlement ultimately differs from what the buyer/seller anticipated at the time of the trade.

Volume risk in the MDB is managed as follows:

- A water entitlement specifies the share of the "consumptive pool" of water that is available. There is no risk in respect of changes in the percentage share itself (it is specified on the entitlement).
- A water allocation is the volume of water that the user can take in a given year, based on determining the total available water and applying the percentage share. If the total available water changes, then the total volume of water that the user can take changes accordingly. This total available water is set for a given year, but can also change within the year due to climatic conditions over the year.
- Reductions in water availability due to natural events such as climate change or drought are borne by water users;
- Reductions in water availability due to improvements in scientific knowledge about sustainable extraction levels are borne by:
  - Water users for the first 3 per cent reduction in water allocation;
  - a one-third/two-third split between the state and federal government for reductions between 3 per cent and 6 per cent;
  - an equal split between the state and federal government for reductions greater than 6 per cent (with water users receiving compensation in the latter two cases).

Meanwhile, reductions in water availability due to changes in government policy will be borne by the relevant government (with water users receiving compensation). The most relevant example is when the 2012 Murray-Darling Basin Plan was released. Under this Plan there were new "sustainable diversion limits" introduced (new caps on the volume of water that can be taken for consumptive use), which in many cases resulted in reductions in allocations available to water entitlement holders. The government accepted full risk of any reductions based on it being a "change in government policy". The compensation was initially implemented by government "buybacks" of water rights on a voluntary basis from willing sellers. The government has since moved more to implementing infrastructure investments to improve efficiency, in exchange for a proportion of the water "saved" in the form of water rights.[216]

[216] Murray-Darling Basin Royal Commission Report, 29 January 2019, p.556.

Counterparty risk is likely to be relatively immaterial for water entitlements or water allocations. There is no real risk around non-delivery of water from a seller to a buyer, because there is no need to physically extract water and deliver to the buyer. Rather, water will just remain instream to flow to the buyer's point of extraction.

Water quality risks are borne by all users and all relate to the quality of water at the MDB

E.4. Pricing and Cost Allocation

E.4.1. Approach to determine the level of pricing

Pricing for trades of a water right itself are determined based on negotiation between buyer and seller.

However, there are also prices that relate to holding the water right (rather than trading it).[217] Prices relate to the infrastructure, and this depends on whether it is operated "on-river" (e.g., dams, reservoirs, etc. operated on natural watercourses) or "off-river" (network of channels and pipes, off the river, usually operated by an IIO). Holders of water entitlements and allocations pay on-river infrastructure charges, while holders of water delivery rights and irrigation rights pay off-river infrastructure charges. In the latter case the IIO may also pass through the on-river infrastructure charges.

Charges for some on-river infrastructure operators are regulated. In the MDB, the largest operators are Goulburn-Murray Water, Lower Murray Water (both regulated by the Victorian Essential Services Commission), and WaterNSW (regulated by the Independent Pricing and Regulatory Tribunal of NSW).[218] Regulated prices are generally determined by a regulated revenue cap approach.[219]

E.4.2. Link between price and costs

While infrastructure operators use pricing to recover their costs (e.g., of water harvesting, storage, and delivery), there is no explicit link in the prices set to costs. The exception is the regulated on-river infrastructure operators, where regulated prices are set in a way to ensure sufficient revenue to cover efficient costs.

E.4.3. Typical structure of pricing

For on-river infrastructure operators, pricing structure can be a combination of:

- A fixed volumetric charge based on the volume of water held in water entitlements; and
- A variable volumetric charge based on the volume of water actually delivered to customer's point of water extraction.

However, in practice most of these operators predominately just use a fixed volumetric charging structure.

For off-river infrastructure operators, pricing structure is a combination of:

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217 Information in this section is set out in Australian Competition and Consumer Commission (2019), *Water Monitoring Report: Supplementary Information*, May.

218 Australian Competition and Consumer Commission (2019), *Water Monitoring Report 2017-18*, May, p.67.

219 See, for example, IPART's decision on regulated prices for WaterNSW, available at: https://www.ipart.nsw.gov.au/Home/Industries/Water/Public-water-utilities-we-regulate/WaterNSW

- A fixed volumetric charge based on the volume of water held in delivery rights; and
- A variable volumetric charge based on the volume of water actually delivered to the irrigator.

E.4.4. Adjustment in prices for charging costs

There does not appear to be an explicit mechanism in which infrastructure operators adjust their prices due to changes in costs. However, for the regulated infrastructure operators, regulatory prices are determined for specific regulatory periods. For example, for WaterNSW prices are currently set for a 4-year regulatory period (2017 to 2021), which are based on forecasts cost over the regulatory period.

E.5. Infrastructure and investment

E.5.1. Links to infrastructure and investment

Water entitlements and allocations may provide for water take on use on a regulated river where infrastructure is present, but there does not appear to be a specific link to infrastructure within these rights, aside from prices for water entitlements seeking to incorporate infrastructure costs. Heaney et al (2005) note that water entitlements in the MDB provide "implicit rights" which include "access to a location-specific pool of resources, storage facilities and delivery channels".[220]

Water delivery rights are implicitly linked to infrastructure, in that they provide for the delivery of water over the IIO's infrastructure. However, we have not been able to uncover any specific details around the ways in which these rights are explicitly linked to the IIOs infrastructure.

E.5.2. The role of contracts to support infrastructure

In terms of ongoing infrastructure investment, costs of infrastructure investment are captured in the prices charged by on-river and off-river infrastructure operators. As noted, these prices are not related to trade *per se*. However, Heaney et al (2005) note some potential effects of trading on infrastructure:[221]

- By changing the location in the River from which water is taken, trading may result in either an increase or decrease in capacity constraints e.g., if water is traded from one area where there are no capacity constraints, to another where there are (or vice versa).
- Trading may increase or decrease the number of entitlement holders from which infrastructure costs in a given area are apportioned. This could result in either higher or lower charges to the remaining entitlement holders, as the fixed infrastructure costs are spread over a smaller or larger customer base.

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220 Anna Heaney, Gavan Dwyer, Stephen Beare, Deborah Peterson, and Lili Pechey (2005), "Third-party effects of water trading and potential policy responses", paper presented at the American Agricultural Economics Association, Providence, Rhode Island, 25-27 July.

221 Anna Heaney, Gavan Dwyer, Stephen Beare, Deborah Peterson, and Lili Pechey (2005), "Third-party effects of water trading and potential policy responses", paper presented at the American Agricultural Economics Association, Providence, Rhode Island, 25-27 July.

E.5.3. Cost sharing in contracts

As discussed above, infrastructure operators seek to recover costs for infrastructure through charges for water entitlements and/or water delivery rights.

E.5.4. The role for industry codes

There do not appear to be any specific industry codes. As noted above, the water rights system is supported by relevant federal government legislation, the Water Act 2007 and water trading rules developed by the Murray-Darling Basin Authority.

E.6. Compliance and Dispute Resolution Terms

It is unclear if there are any formal mechanisms in place to allow for dispute resolution. The Murray-Darling *Basin Plan 2012* has no reference to any specific mechanism. There have been reports that there is limited ability for irrigators to resolve disputes with an IIO. The Australian Institute notes that there is no external or regulatory authority with jurisdiction to resolve disputes between irrigators and an IIO, and reports receiving many anecdotal reports of such disputes.[222]

[222] The Australian Institute (2019), "Submission to the ACCC inquiry into water markets in the Murray-Darling Basin", November.

Appendix F. Bulk Trading of Water in Nebraska

F.1. Background

F.1.1. Organisation of the industry

Most water in Nebraska is sourced from groundwater. Nebraska lies above the Ogallala Aquifer, one of the largest underground water resources in the world, spanning eight US stages.[223] This and some other groundwater resources are the source of 80 per cent of the total volume abstracted in Nebraska each year.[224] However, surface water is also important in Nebraska, because of the hydrological link between surface water resources and groundwater resources i.e., increased groundwater abstractions can ultimately impact streamflows.

Water resources in Nebraska are managed at the local level by 23 Natural Resource Districts (NRDs). NRDs are local government entities responsible for natural resource management, including water resources, within a defined region.

Our focus in this case study is on groundwater trading within the Central Platte NRD (CPNRD). The CPNRD is a central area in Nebraska, with a population of 138,000.[225] The land area of the CPNRD is approximately 2.1 million acres, of which approximately 1 million acres is irrigated farm land (with 937,000 acres irrigated by groundwater abstractions).[226] There are approximately 18,000 registered irrigation wells in the District.[227] As a result, a key use of water in the District is irrigation, which is mostly used to grow corn and soybeans.[228] Other water users include municipal water users and commercial/industrial users not on the municipal supply. The focus in this case study is on irrigation – they (along with environmental users) are the main water users who trade.

The Platte River is a 500km braided river of which about 300km lies in the Central Platte. About 14,000 acres are irrigated from water abstractions from the Platte River. The River is a particularly important fish and wildlife habitat. The portion of the River that runs through the District is considered to be the most critical area of the River for endangered species.[229] Environmental water users are also involved in water markets.

Much of the District is considered to be fully or over appropriated in terms of water allocations.[230] This has resulted in a declining groundwater table, and resulting reduced surface water flows and threats to endangered species habitats.[231] As a result, there has been a strong focus on utilising water markets (and other tools) to help enhance in-stream flows for

223 Elan Ebeling, Zach Kearl, Emma Weaver, and Noah Wentzel (2019), "Water Banking and Water Marketing in Select Western States: Case Study Review: Colorado, Idaho, and Nebraska", Washington State Department of Ecology, June, at p.62.

224 Ebeling et al (2019), p.63.

225 Source: http://cpnrd.org/about/, accessed 7 April 2020.

226 Source: http://cpnrd.org/about/, accessed 7 April 2020.

227 CPNRD (2019), *Integrated Management Plan*, 11 September, p.2.

228 Ebeling et al (2019), p.72.

229 Ebeling et al (2019), p.73.

230 Ebeling et al (2019), p.67.

231 See, e.g., the discussion at http://cpnrd.org/groundwater-quantity/, accessed 8 April 2020.

environmental purposes e.g., by purchasing water rights and allowing the water to remain in-stream to augment existing flows.[232]

F.1.2. Organisation of trading and the role of contracts

Water rights being traded in the CPNRD are referred to as "certified acres" (or "certified irrigated acres"). These are rights to extract groundwater and irrigate a certain land acreage of land area.

Trade of certified acres can be either permanent or temporary. Until recently, only permanent trades of certified acres were allowed. Permanent trades are made by buyer and seller bilateral negotiation, and require approval from the CPNRD for the trade to be effective. The CPNRD may deny trades because:[233]

- The landowner request would result in re-locating certified irrigated acres from one river basin to another river basin.
- The landowner fails to report changes in land use on all tracts that are involved in re-location of irrigated acres.
- A citizen or NRD staff provides information to the NRD Board of Directors indicating that adding irrigated acres in a particular area would likely be harmful to the area or is otherwise contrary to NRD rules or state or federal laws.

For the 2018 calendar year, CPNRD allowed 129 permanent transfers of certified acres, covering 1,067 acres.[234] In general there are around 200 permanent groundwater transfers per year. This is considered to be one of the highest levels of transfer activity in the different NRD's in Nebraska.[235] However, we understand that the transaction costs of trading – finding someone to trade with, negotiating a price, going through the approval process – were high.

In 2016 a Groundwater Exchange Program (GEP) was established to allow for short-term leases of certified acres. This allowed for certified acres to be traded on a temporary basis for the forthcoming growing season, and was designed to lower transaction costs of trading. Trades only applied for the upcoming growing season, and certified acres reverted back to their original owner at the end of the season.

Trading occurred via an online platform. This operated in two distinct 10-day "windows" per year, where bids to buy/sell certified acres were submitted on the online platform. Prior to trading, there would be a pre-approval process, which required verification that the certified acres were held and potential buyers/sellers agreed to the rules of the platform.

"Streamflow buyers" were allowed to participate – to allowed certified acres to be purchased but not used for irrigation. The idea was to allow flows to increase in the Platte River to as to enhance wildlife habitats, although this would only be on a temporary basis.

The participation rates in the GEP were:

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232 Ebeling et al (2019), p.73.

233 CPNRD Rules and Regs Clause 6.5.2.

234 CPNRD (2019), *Integrated Management Plan*, 11 September, p.27.

235 Ebeling et al (2019), p.74.

- In 2016 (first year of operation), there were 30 sellers and 6 buyers.[236]
- In 2017, there were 25 sellers and 5 buyers.[237]

The GEP was discontinued after 2018. Because the GEP only allowed temporary trades, prices were quite different from permanent trades e.g., in the range of US$8-$US121 per acre for temporary trades, compared to $2,000-$3,500 per acre for permanent trades.[238] This meant that water to be purchased for environmental uses, for which a permanent trade was preferable, was considerably more expensive than water purchased for irrigation. This also resulted in an overall increase in irrigated acres in the District. It appears that the lack of improvement in environmental outcomes (combined with lower participation rates than the CPNRD anticipated and high costs of running the program[239]) led to it being discontinued after 3 years.

F.1.3. Possible lessons for the bulk trading of water

The CPNRD example is interesting because of the innovative use of a centralised platform for trading. This differs from most cases where trading occurs by bilateral negotiation between buyer and seller. The platform essentially provides a way of getting buyers and sellers together to implement trades, and explicitly sought to do so in a way that lowered transaction costs (e.g., making pre-trade approval easy, simple to submit bids, etc.). While the platform was discontinued after 3 years, this still provides some lessons for trading.

A key difference to bulk trading in England and Wales is that the main water use in Nebraska is irrigation, and the main trades that occur are between irrigators, or between irrigators and environmental water users.

There is also relatively little link with infrastructure or water delivery. Most water rights relate to a groundwater resource, which can be tapped at different points in the District through the installation of the water user’s own well.

F.2. Contract Description

F.2.1. The standardisation of contracts

Irrigators in the CPNRD wanting to irrigate their crops require: (1) a well permit, which is a permit allowing the irrigator to install a well to tap the groundwater resource and (2) a certification document which specifies the location of the irrigation, the number of acres of land being irrigated, and the crop being irrigated. To our understanding, the certification document does not specify the volume of water that can be taken. That is, an irrigator can take any volume of water, so long as it is applied to, at most, the irrigated acres specified in the certification document.

Irrigators must also ensure that the water they use is being put to beneficial use. In practice this involves a requirement to irrigate the land at least 2 years in every 10-year period starting

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[236] CNPRD (2019), *Long Range Implementation Plan for fiscal years 2019-2024*, November, p.30.

[237] CNPRD (2019), *Long Range Implementation Plan for fiscal years 2019-2024*, November, p.30.

[238] Ebeling et al (2019), p.74.

[239] Ebeling et al (2019), p.75.

from 2010.[240] Certified acres can be transferred to another location and/or another crop use, provided they do not cause an increase in depletions to the river.

F.2.2. The nature of contractual commitment

The land area (acreage) that can be irrigated can be reduced if the groundwater table falls below certain maximum acceptable declines.

The maximum acceptable decline varies in different parts of the District. There are different phases of reduction, depending on whether the water table falls to 50 per cent, 70 per cent, 90 per cent or 100 per cent of the maximum acceptable decline.[241] At each phase there is a specific percentage reduction in irrigated acres that is applied to all certified irrigated acres. The exact percentage reduction depends on: the area within the District and the associated maximum acceptable decline and the crop that is being irrigated.[242]

Ebeling et al (2019) state that the acceptable decline thresholds have never been reached, so these restrictions have not had to be imposed.[243]

F.2.3. The role of industry codes

Certified acres are supported by a set of rules and regulations developed by CPNRD.[244]

F.2.4. Typical tenor of contracts

Certified acres are perpetual rights, subject to the beneficial use provision noted above that land must be irrigated for at least 2 years out of every 10-year period.

F.2.5. Secondary trading

We understand that rights may be traded outside of the trading platform through bilateral negotiation.

F.3. Allocation of Risks

As noted above, there is some risk around reductions in land acreage e.g., the land area to be irrigated differs from what the buyer/seller anticipated at the time of the trade because of water restrictions being imposed.

There is also some risk around a reduction in irrigated acres as a result of a transfer due to the application of “stream depletion factors”. The CPNRD has developed a hydrological model which determines the level of depletion of the surface water in different zones within the District. If certified acres are being transferred from an area of low depletion to an area of high depletion area, then the number of irrigated acres transferred is reduced accordingly by a

240 CPNRD (2014), *Rules and Regulations For Groundwater Use in Fully and Over Appropriated Areas*, as amended 24 April 2014.

241 See https://cpnrd.org/conjunctive-management/, accessed 8 April 2020.

242 See CPNRD (2014), *Rules and Regulations for the Enforcement of the Nebraska Groundwater Management and Protection Act*, as amended 18 December 2014.

243 Ebeling et al (2019), p.73.

244 CPNRD (2014), *Rules and Regulations For Groundwater Use in Fully and Over Appropriated Areas*, as amended 24 April 2014.

"stream depletion factor". The approach is intended to ensure that the transfer does not adversely impact streamflow.

However, the risk is symmetrical. Irrigated acres can increase from a transfer, because the approach also works in the opposite direction i.e., when from a high to low depletion area, the number of irrigated acres transferred can be increased. This can result in the total irrigated acres in the District increase (which is what occurred from trading under the GEP).

F.4. Pricing and Cost Allocation

F.4.1. Approach to determine the level of pricing

Pricing for permanent trades of certified acres are determined based on negotiation between buyer and seller.

For temporary trades, buyers and sellers submitted bids to the centralised trading platform in terms of price per acre that a buyer was prepared to buy at, or seller prepared to sell at. The price was then converted to a price per acre-feet of water based on the acreage of land and a "streamflow unit" based on the hydrological model discussed earlier. This is how the streamflow depletion factors discussed earlier are incorporated in the pricing.

Once all bids to buy and sell are submitted, the trading platform uses an algorithm to match buyers to sellers and determine the optimal (market-clearing) price.

The optimal price also takes into account any restrictions on trade. In some cases, there were restrictions on trading between certain zones in the District e.g., where streamflow depletion is so great that no additional water could be taken in these zones.

F.4.2. Link between prices and costs

As noted above, prices relate specifically to trades and are determined by market forces, rather than costs. Irrigators are required to pay a small, one-off, fee for registering a well,[245] but there is no ongoing fee or fee associated with certified acres.

F.4.3. Typical structure of pricing

Buyers will pay a fixed amount for a given certified acreage.

F.5. Infrastructure and Investment

F.5.1. Links to infrastructure and investment

Irrigators in the District require a well permit to be able to build a well, from which to take groundwater for irrigation. Irrigators will also invest in their own on-farm irrigation infrastructure (irrigation canals, pipelines, pivot irrigators, etc).

F.5.2. The role of contracts to support infrastructure

While a transfer of certified acres does not necessarily need to be associated with a well permit (e.g., certified acres can be transferred to environmental users, who do not extract the water but leave it in-stream), if certified acres are being transferred from one irrigator to another at a different location, then a new well (and other irrigation infrastructure) will be needed at the new location.

[245] See: https://cpnrd.org/well-regulations/, accessed 8 April 2020.

Nonetheless, to our knowledge the certified acreage itself does not have any mechanisms to support the development of infrastructure. The onus is on the irrigator purchasing the certified acres to ensure that the well and other infrastructure is put in place.

F.5.3. Cost sharing in contracts

Infrastructure costs are incurred by the owner of the well permit/certified acreage.

F.5.4. The role for industry codes

We are not aware of any industry codes relating to infrastructure and investment.

F.6. Compliance and dispute resolution terms

Disputes are managed via a process set out in the Basin-Wide Plan, a plan providing for joint water management of the Platte River.[246] The Basin-Wide Plan provides for disputes to be put to CPNRD (and potentially also the Nebraska Department of Natural Resources). The relevant entities will then work with the affected parties to resolve the issue. It is unclear what further dispute resolution process is in place if it cannot be resolved by CPNRD and/or the Nebraska Department of Natural Resources.

[246] CPNRD et al (2019), *Basin-Wide Plan for Joint Integrated Water Resources Management of Overappropriated Portions of the Platte River Basin, Nebraska*, 17 September.

Appendix G. Bulk Trading of Water in California

G.1. Background

G.1.1. Organisation of the industry

The California water market is characterised by a locational mismatch between water demand and water supply due to differing climate and geography.[247] This leads to a need for large amounts of water to be transported long distances from the north of the state to meet demand from agriculture and large urban areas in central and southern parts.

Approximately 50 per cent of water use in California is for environmental uses, 40 per cent is for agriculture and the remaining 10 per cent is urban uses.[248] Environmental water use includes water that is protected for a number of environmental reasons, including “wild and scenic” protected rivers, water required to maintain habitats and wetlands, and water needed to maintain water quality for agricultural and urban uses.[249] Despite population growth and increases in the economic value of agricultural activities, both agricultural and urban water use has been declining over recent years.[250] Environmental water use is allocated by various federal and state laws, and regulations.[251]

Within agriculture, the largest water use comes from “orchards and vines” accounting for 34 per cent of water use, followed by “alfalfa” at 18 per cent, “other field crops” at 14 per cent and “irrigated pasture” at 11 per cent.[252]

California has an extensive network of infrastructure, including canals, aqueducts, dams and rivers to move water around the state, generate power, and for flood protection.[253] Water is predominately allocated from managed infrastructure systems (or projects) in California, managed by state or federal agencies. The largest water project in California is the State Water Project (SWP), which transports water from rivers in Northern California to urban and industrial users in Southern California.[254] In addition, the Central Valley Project (CVP), covers two watersheds, for the Sacramento river and the San Joaquin. Initially built to regulate water shortages and floods, the project now also supplies municipal water and generates power.[255] There are also a number of water projects related to the Lower Colorado river.

247 Schwabe, Kurt, Mehdi Nemati, Clay Landry, and Grant Zimmerman (2020). "Water Markets in the Western United States: Trends and Opportunities." Water 12, no. 1 (2020): 233, pg.5

248 Public Policy Institute of California (2019), *Just the Facts – Water Use in California*, May 2019. From: https://www.ppic.org/publication/water-use-in-california/ accessed 07/04/20

249 Public Policy Institute of California (2019), *Just the Facts – Water Use in California*, May 2019. From: https://www.ppic.org/publication/water-use-in-california/ accessed 07/04/20

250 Public Policy Institute of California (2019), *Just the Facts – Water Use in California*, May 2019. From: https://www.ppic.org/publication/water-use-in-california/ accessed 07/04/20

251 See: https://www.scpr.org/news/2015/04/15/50941/10-things-to-know-about-california-water-use/ accessed 16/04/20

252 Public Policy Institute of California (2019), *Water for Farms*, November 2018

253 Public Policy Institute of California, *Just the Facts – California’s Water Grid*, September 2019. From: https://www.ppic.org/publication/californias-water-grid/ accessed 09/04/20

254 See: https://water.ca.gov/Programs/State-Water-Project accessed 16/04/20

255 See: https://www.usbr.gov/mp/cvp/about-cvp.html accessed 16/04/20

Water is allocated from these projects to water users, some of which are irrigation districts (which in turn allocate water to individual irrigators), while others are individual irrigators, municipal or urban water users.

Water users in California hold water rights. Within water projects, rights are generally held by government agencies or state water contractors who then supply water to different municipal, industrial and agricultural users. Individual municipal, industrial and agricultural users also hold water rights.

There are a variety of different types of water rights in California. Some are firm rights, where others are adjusted depending on precipitation.[256] Two main types of surface water rights exist in California, riparian and appropriative rights. Riparian rights generally come from owning land adjacent to a water body and gives rights to use a share of the water flowing past a property. Riparian rights do not require a specific permit, but also do not entitle the owner to store water for the dry season or use on land outside the watershed.[257] Appropriative rights are essentially a “first come first in” right which must be applied for with the State Water Board. They originated in the gold rush for diverting water away from the original system.[258] There are also other less common water rights that exist in California including reserved rights and pueblo rights.

For groundwater, in many areas California does not have a permit process for groundwater rights, but landowners may extract groundwater for “beneficial use” without approval. However, there are certain areas in California where groundwater is regulated and have pumping restrictions or fees.[259]

G.1.2. Organisation of trading and the role of contracts

In California, water rights can be sold or leased over the short or long-term. From 2009-2018, a large majority of the water right transfers in California were leases rather than permanent sales, and water transfers represented about 2 per cent of all water allocation.[260]

The largest sellers/leasers of water by far has been the agricultural sector at around 76 per cent over 2009-2018, and the largest buyers have been the municipal followed by the agricultural and environmental sectors, at around 55 per cent, 25 per cent and 18 per cent respectively.[261]

Trades are usually made between water users within water projects or are purchases by government entities. As of 2012, the majority of water trades were within projects, among agencies that have rights to use water within the projects. As Figure G.4 shows, only 16 per

[256] Hagerty, Nick (2018), "Liquid constrained in California: Estimating the potential gains from water markets." Department of Agricultural and Resource Economics, UC Berkeley: Berkeley, CA, USA (2018).

[257] See: https://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.html accessed 08/04/20

[258] See: https://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.html accessed 08/04/20

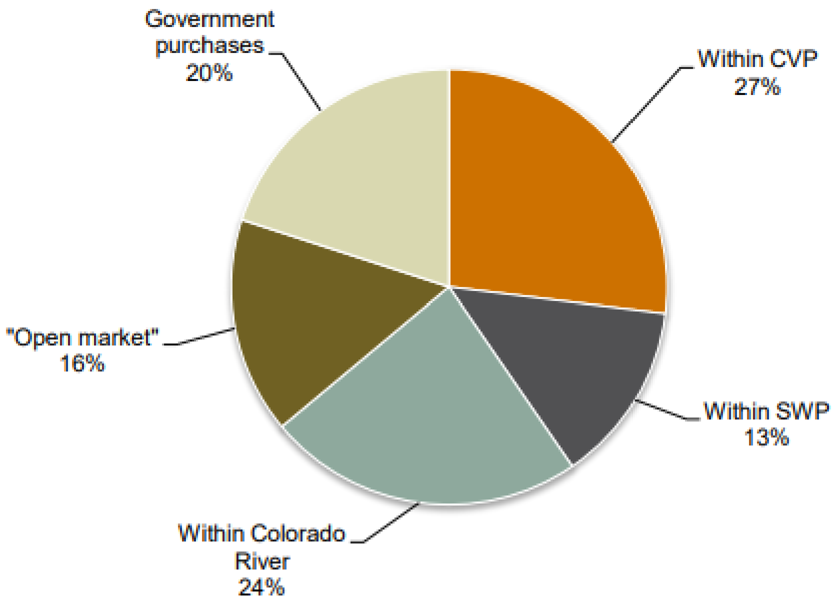
[259] See: https://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.html accessed 08/04/20

[260] Schwabe, Kurt, Mehdi Nemati, Clay Landry, and Grant Zimmerman (2020). "Water Markets in the Western United States: Trends and Opportunities." Water 12, no. 1 (2020): 233, pg.6-7

[261] Schwabe, Kurt, Mehdi Nemati, Clay Landry, and Grant Zimmerman (2020). "Water Markets in the Western United States: Trends and Opportunities." Water 12, no. 1 (2020): 233, pg.11

cent were open market trades (i.e. trades between projects or not related to a project). As of 2019, 77 per cent of trades occurred within the same county or region.[262]

Figure G.4: Water right and contract trades by type - 2012



Source: Public Policy Institute of California (2012), California's Water Market, By the Numbers: Update 2012, November 2012, p.27.

Water transfers are facilitated by bilateral negotiation, but also must be approved by the State Water Board or other relevant regulator. Any third party can challenge the transfer on a number of grounds, including if the water transfer causes third-party injury.[263]

G.2. Contract Description

G.2.1. The standardisation of contracts

Anyone that takes water from a surface water or groundwater resource in California requires a water right. There are a range of different types of rights, some of which are explicitly defined "permits", while others result from simply taking water and applying it to beneficial use. These rights include:

- Groundwater rights: which arise when water is extracted and put to beneficial use and does not require a specific permit. These may be either overlying groundwater rights (used on the land over the groundwater basin) or appropriative groundwater rights (used somewhere else). The former is higher priority over the latter;
- Riparian water rights: rights to use surface water on land that touches the surface water resource, which does not require a permit;

[262] Public Policy Institute of California (2019), *Just the Facts – California's Water Market*, May 2019

[263] Michael Hanemann, Michael Young, (2020), "Water rights reform and water marketing: Australia vs the US West, Oxford Review of Economic Policy", Volume 36, Issue 1, Spring 2020, Pages 108–131, pg.113

- Appropriative water rights, which is a right to use water on non-riparian land, which requires a permit, unless it was acquired prior to 1914 and the amount of water used has not increased since then (in which case no permit is required).

Water rights specify a variety of aspects, including: location; amount of water that can be taken; the water use; and the time period in which the water can be take (e.g., some authorise water takes for only certain times of the year, such as the winter month). The exact specification can vary across the different water projects.

In California, trading is regulated to minimise the environmental impact of moving water one place to another. The regulation is complicated and inconsistent, with different regulations for different types of water rights and agencies.[264] Irrigation districts can restrict trading of surface water with users outside the district and counties can do the same for groundwater.[265]

Groundwater markets are being established in certain areas in California. For example, the Fox Canyon Groundwater Management Agency gives each farm a specific water allocation and allows farms to fallow their land to sell their groundwater rights to other farms. [266]

Riparian rights have higher priority over appropriative rights, and riparian rights generally have equal priority as each other. Appropriative rights have a hierarchy of priorities based on when the application was filed with the state board. In times of shortage, the newest rights must discontinue use first.[267] Riparian rights are tied to the land so are not transferrable unless the land is sold. On the other hand, appropriative rights are transferrable.[268]

Within water projects, rights are generally held by government agencies or "state water contractors" who then supply water to different municipal, industrial and agricultural users. In the SWP, 29 different water agencies ("state water contractors") hold the rights to the water in the project.[269] Similarly, in the CVP, around 250 contractors have long-term agreements for water supply with the project.[270]

G.2.2. The nature of contractual commitment

The water right will specify what volume of water the right holder is entitled to use, and this is the same each year unless another factor overrides the right.

However, this may be different within water projects. In the SWP, water rights are given to government agencies through long-term contracts which set a maximum volume an agency may request annually, and which changes each year depending on conditions.[271]

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[264] Public Policy Institute of California (2019), *Just the Facts – California's Water Market*, May 2019. From: https://www.ppic.org/publication/californias-water-market/ accessed 07/04/20

[265] Public Policy Institute of California (2019), *Just the Facts – California's Water Market*, May 2019. From: https://www.ppic.org/publication/californias-water-market/ accessed 07/04/20

[266] See: https://www.newsdeeply.com/water/articles/2018/06/22/a-new-groundwater-market-emerges-in-california-are-more-on-the-way accessed 09/04/20

[267] See: https://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.html accessed 08/04/20

[268] Public Policy Institute of California (2012), California's Water Market, By the Numbers: Update 2012, *November 2012*

[269] See: http://www.mojavewater.org/state-water-project.html accessed 16/04/20

[270] See: https://www.usbr.gov/mp/cvp/ accessed 16/04/20

[271] See: https://water.ca.gov/Programs/State-Water-Project/Management accessed 16/04/20

G.2.3. The role of industry codes

To trade water, the water must be "wet", i.e. it must be physical water available, not just rights on paper, and there must be a way to get the water from the seller to the buyer (i.e. infrastructure).[272] There is four potential sources of "wet" water to trade:[273]

- excess water stored in surface reservoirs to which the seller has rights;
- other excess amounts of surface water that the seller has the right to use, but does not need and cannot store;
- "conserved" surface water that the seller saves by reducing his or her own use; and
- groundwater.

There is an approval process for water transfers which depends on the type of water right and the source of the water.[274] Buyers and sellers generally must get permission from the State Water Resources Control Board or the relevant project to trade.[275] This process has different rules for different agencies and different types of water rights, so it is often fragmented and inconsistent.[276] For groundwater, often parties must demonstrate that the transfer will not cause injury to other groundwater-users.[277]

G.2.4. Typical tenor of contracts

Water rights are generally perpetual. However, most appropriative water rights lapse if no water is used for five consecutive years to prevent hoarding and speculation.[278]

G.3. Allocation of Risks

The largest risk in California is probably volume risk. Depending on the type of right, lower priority rights may lose some or all of their allocation in years with lower rainfall, or if a dormant riparian right holder starts to use their right again. When there are water shortages, riparian rights holders share the shortage equally.[279] Additionally, the State of California can cut back water diversions to avoid environmental harm, which could affect water rights.[280]

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272 Public Policy Institute of California (2012), California's Water Market, By the Numbers: Update 2012, *November 2012,* pg.9

273 Public Policy Institute of California (2012), California's Water Market, By the Numbers: Update 2012, *November 2012,* pg.10

274 Public Policy Institute of California (2012), California's Water Market, By the Numbers: Update 2012, *November 2012,* pg.14

275 Public Policy Institute of California (2012), *California's Water Market, By the Numbers: Update 2012*, November 2012, pg.14

276 Public Policy Institute of California (2019), *Just the Facts – California's Water Market*, May 2019

277 Public Policy Institute of California (2012), *California's Water Market, By the Numbers: Update 2012*, November 2012, pg.14

278 Public Policy Institute of California (2012), *California's Water Market, By the Numbers: Update 2012,* November 2012, pg.10

279 See: https://www.kcet.org/redefine/whose-water-is-it-anyway-california-water-rights-explained accessed 16/04/20

280 Public Policy Institute of California (2012), California's Water Market, By the Numbers: Update 2012, *November 2012,* pg.35

For some water rights such as those in the SWP and CVP, there could also be volume risk because water volumes are adjusted yearly, and volumes are determined by a number of factors.[281,282] Both the SWP and CVP allocations have been significantly lower than the maximum contract allocations over recent years due to drought.[283]

G.4. Pricing and Cost Allocation

G.4.1. Approach to determine the level of pricing

The level of pricing for trades is generally negotiated between the parties.

Prices are also charged for the use of water itself, although the pricing approach is quite varied across the different water agencies,[284] in terms of rate structure, level of rates, and cost recovery (see answers below).

G.4.2. Link between price and costs

Water users in the CVP originally paid a fixed charge for water which did not increase with changes in operating and maintenance costs over time. However, in 1982 new legislation was passed requiring the price of water to fully cover capital, operation and maintenance costs.[285] Similarly in SWP prices are set so as to recover the capital, operation and maintenance costs of the infrastructure.[286]

G.4.3. Typical structure of pricing

As noted above, the rate structure can be quite variable among different water agencies and in different irrigation districts. In the latter, it appears that volumetric pricing is the typical approach, with a law from 2009 requiring volumetric water pricing to be implemented for all large irrigation districts.[287] The structure of volumetric charges can vary, including uniform rates, increasing or decreasing block rate structures, or seasonal rates with charges varying from season to season.

281 See: https://water.ca.gov/Programs/State-Water-Project/Management accessed 16/04/20

282 Congressional Research Service (2020), *Central Valley Project: Issues and Legislation,* April 2020 https://fas.org/sgp/crs/misc/R45342.pdf

283 Congressional Research Service (2020), *Central Valley Project: Issues and Legislation,* April 2020, pg.9-11 https://fas.org/sgp/crs/misc/R45342.pdf

284 See: https://waterfm.com/pricing-californias-water-drought/ accessed 16/04/20

285 Dennis Wichelns (2010), “Agricultural Water Pricing: United States”, OECD.

286 See: http://www.mojavewater.org/state-water-project.html accessed 16/04/20

287 Juliet Christian-Smith and Chris Kaphiem (x), “Volumetric Water Pricing and Conjunctive Use: Alta Irrigation District”, Pacific Institute.

G.5. Infrastructure and investment

G.5.1. Links to infrastructure and investment

Groundwater banking is commonly used by groundwater managers in regulated groundwater districts, to store surface water in aquifers during wet years to save for dry years, essentially transferring water rights between wet and dry years.[288]

There are infrastructure projects all around California which means that there is essentially a state-wide market for water (not taking into account regulatory limitations of trade).[289] Projects like the CWP and the SWP have created hydraulic connections among population and farming centres. These can make transfers between parties indirect, through exchanges, an intermediary can take water from a seller at one point in the project and give it to the buyer elsewhere in the project.[290]

G.5.2. The role of contracts to support infrastructure

Trading itself does not appear to support infrastructure development. Rather, it is the water use itself that ensures infrastructure costs are recovered via water pricing.

G.5.3. Cost sharing in contracts

As noted above, in the SWP and CVP, the state water contractors who hold the water rights within the project pay the capital, operation and maintenance costs.[291]

G.5.4. The role of industry codes

We have not determined if there are any industry codes.

G.6. Compliance and dispute resolution terms

California law states that individuals cannot own water, water belongs to 'the people of California', but individuals can own the right to use water.[292] Most water related dispute resolutions are made by the courts or through legislation.

Water rights have been in conflict with each other since the introduction of riparian and appropriative water rights in the 1800s, and cases relating to these conflicts have been heard as far up as the Supreme Court since then, leaving a large amount of case law regarding water rights.[293] Legislation requires that water use be 'beneficial' and 'reasonable' which has also

288 Public Policy Institute of California (2012), California's Water Market, By the Numbers: Update 2012, *November 2012,* pg.13

289 Public Policy Institute of California (2012), California's Water Market, By the Numbers: Update 2012, *November 2012,* pg.10

290 Public Policy Institute of California (2012), California's Water Market, By the Numbers: Update 2012, *November 2012,* pg.12

291 See: http://www.mojavewater.org/state-water-project.html Last accessed 16/04/20

292 See: https://www.kcet.org/redefine/whose-water-is-it-anyway-california-water-rights-explained Last accessed 16/04/20

293 See: https://www.kcet.org/redefine/whose-water-is-it-anyway-california-water-rights-explained Last accessed 16/04/20

been the source of conflicts and legal cases. Even confirming that one has a water right must be decided by the courts.[294]

If someone is found diverting water without a right, they can be fined up to $500 per day.[295]

294 See: https://www.waterboards.ca.gov/waterrights/board_info/faqs.html Last accessed 16/04/20

295 See: https://www.waterboards.ca.gov/waterrights/board_info/faqs.html Last accessed 16/04/20

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