

Annex B: Literature review of efficiency measures implemented internationally and across other sectors

To help us identify potential options to increase water efficiency (WE) in the non-household (NHH) water retail market, we have undertaken a detailed review of both: (i) WE measures that have been implemented internationally; and (ii) efficiency measures across other sectors (such as energy) that have been implemented in the UK and abroad. We have found that (i) most countries employ a variety of price and non-price measures to improve WE; (ii) the mix of policy and regulatory measures used reflects that there are multiple and interdependent barriers to WE; and (iii) most of the measures used internationally are directed at the consumer level (as opposed to e.g. water companies).

1.1 Overview of key findings from our review

This section of our report provides an overview of the key findings from our review of the academic and grey literature.

1.1.1 Internationally, a mix of price and non-price measures have been used to increase WE

A wide mix of policy and regulatory interventions have been used to increase WE internationally. Within individual countries, both price and non-price measures have been used to target improved WE.

Price measures include options which increase the price of water such as:

- a. Tariff design adjustments e.g. introducing volumetric tariffs or inclusion of water conservation taxes
- b. Indirect consumption taxes e.g. water conservation / resource taxes paid on the volume of water consumed.

Non-price measures generally include regulatory options which either mandate the implementation of measures which either directly increase WE or do so indirectly through information provision. For example:

- a. Water restrictions e.g. controls on water abstraction or consumption via 'cap and trade' systems
- b. Mandatory installation of water efficient technologies e.g. smart meters
- c. Information / awareness campaigns
- d. Water labelling e.g. WE certificates
- e. Reputational incentives e.g. benchmarking / peer comparison on water usage
- f. Funding provided via grant / loan schemes

1.1.2 The variety of measures used reflects the multiple barriers to WE

As the barriers to WE are multi-faceted, the measures to address them also require varying approaches. Individual measures will be designed to overcome specific kinds of barriers to WE.

For example, price measures may be designed to reduce demand by increasing the cost of consumption. On the other hand, non-price measures, could reduce water consumption directly via regulation which requires the use of water efficient technologies, or indirectly through the provision of information on how behavioural changes can reduce water consumption.

It is important to note that the prevalence and interdependence of barriers to WE will depend on individual sectors / countries. Therefore, any water demand management strategy must account for local circumstances.

1.1.3 The quantitative evidence on the evaluation of individual WE measures is limited

There is limited quantitative evidence on the success of individual WE measures. This is because, generally, multiple measures are introduced over time – making the evaluation of individual measures difficult, in terms of e.g. amount of water saved or cost-effectiveness due to attribution problems.

It is also important to note that the WE measures implemented internationally are typically in countries with a history of acute water scarcity. WE measures may be more effective in countries where there is greater public awareness of water scarcity.

1.1.4 Efficiency measures from other sectors can provide lessons for improving WE

There have been numerous policy and regulatory interventions to increase efficiency in other sectors such as energy. Since the agreement of internationally binding climate change targets over two decades ago, a wide range of price and non-price measures have been implemented to target household (HH) and NHH energy efficiency. The design of measures used in the energy sector can provide useful insights when considering options to improve WE in the NHH market.

1.1.5 WE measures are primarily focussed on reducing customer demand for water

The WE measures that have been implemented internationally, as well as the measures used in other sectors, generally focus on achieving efficiency by directly focussing on reducing customer demand. Both the price and non-price intervention are targeted at individuals and businesses to reduce (water) consumption, rather than their suppliers (e.g. water companies).

Furthermore, interventions to reduce customer demand are typically implemented alongside strong signals from central government that WE is a policy priority.

1.2 WE measures implemented elsewhere

As part of our research to identify options to increase the WE savings in the UK NHH water retail market, we have undertaken a detailed review of measures that have been implemented internationally. The following tables provide an overview of the price and non-price WE measures that we have examined.

In the following subsections, we briefly expand on each, setting out what each measure entails, why it has been implemented, along with any indications of its success.

Table 1: Summary of WE measures used internationally (1)

Type of measure	WE measures	Purpose	Example(s)
Price	Tariff adjustments e.g. volumetric tariffs	Increase financial incentives to reduce water consumption	Multiple EU countries, Singapore
Price	Indirect tax measures for e.g. water conservation, wastewater, and / or leakage	Increase financial incentives to reduce water consumption	Denmark, Netherlands, Singapore, Germany, Hungary and Portugal
Non-price	Water restrictions / licensing	Set restrictions / caps on total water consumption	France, Spain, United States
Non-price	Water trading / 'cap and trade' system	Create a market price for water that reflects scarcity	Australia, Chile, China, Mexico, South Africa and the United States
Non-price	Mandatory meter installation	Reduce informational barriers on water consumption / efficiency	Singapore

Source: Economic Insight analysis

Table 2: Summary of WE measures used internationally (2)

Type of measure	WE measures	Purpose	Example(s)
Non-price	Water labelling / WE certificates	Increase awareness of WE	Australia, Canada, EU, New Zealand, Singapore and the United States
Non-price	Mandatory WE standards for e.g. equipment	Mandate use of more water efficient technologies	Singapore
Non-price	WE grant / loan mechanism	Reduce the cost of investing in WE	Singapore
Non-price	Information / awareness campaigns	Improve information available on WE	Cyprus, Denmark, France, Italy, Spain
Non-price	Benchmarking / peer comparison	Benchmarking for reputational incentives	Denmark, Singapore

Source: Economic Insight analysis

1.2.1 Price measure: tariff adjustments

What is the measure?

Tariffs set out the pricing framework that governs the price paid for given volumes of water consumption, wastewater, or sewage collection.¹ Adjusting the tariff structures can change the incentives customers face when deciding how much water to consume.

For example, a tariff could be structured to be:

- (i) **Fixed tariff**, where the price is unrelated to the volume of water consumed.
- (ii) **Uniform volumetric tariff**, where a fixed amount is paid for each unit of water consumed.
- (iii) **Combination of fixed and volumetric tariffs**, where the price paid is unrelated to the volume of water consumed up to a certain level after which a fixed amount is paid for each additional unit.
- (iv) **Rising or falling block tariff**, where the volumetric rate increases or decrease with the volume of water consumed.

Countries that have historically had abundant supplies of water often tend to have fixed tariffs which provide no incentives to use water efficiently. Typically, this is due

¹ *'Pricing and non-pricing measures for managing water demand in Europe.'* European Environment Agency (2017).

to the low administrative burden as fixed charges do not require any monitoring of actual levels of water consumption.

Why is this measure used?

Adjusting tariffs to be based on the volume of water consumed incentivises more efficient use of water. For example, a uniform volumetric tariff incentivises lower water usage as customers’ bills will be determined by the amount of water used. A rising block tariff goes further and increases the unit cost of water paid as the volume of water increases. This has been introduced in countries such as Spain, Cyprus, Italy, and France to promote water conservation.

The following tables outline the pricing structure of selected European countries. All of these countries use a volumetric component to charge household customers for their water demand.

Table 3: Domestic water tariff structures across selected EU countries (1)

Country	Tariff structure / mechanism	Effectiveness
Cyprus	Mixed: fixed and volumetric	Academic literature has so far noted that the water pricing reforms from 2014 has been an ineffective policy instrument. However, it is too early to understand whether they have been effective.
Denmark	Rising block tariff All households are metered	Water demand has decrease substantially over the last 25 years but attributed to the combined effect of mandatory metering, tax reform and information campaigns.
France	Mixed: fixed and volumetric component	Whilst domestic consumption has fallen by around 15% since the 1990’s there is no clear evidence this is directly caused by price increases.
Germany	Mixed: fixed and volumetric component	Falling water consumption in Eastern Germany has been attributed to several factors including water efficient technologies, increased environmental awareness as well as increased prices.

Source: Adapted from European Environment Agency (2017).

Table 4: Domestic water tariff structures across selected EU countries (2)

Country	Tariff structure / mechanism	Effectiveness
Italy	Mixed: fixed and rising block tariff (and price increases)	Water consumption has decreased by almost 18% prior to 2017, however, there is no evidence this is due to increased prices. Reduced consumption could also be attributed to more water efficient technologies and public awareness of the economic value of water.
Romania	Volumetric pricing	Lack of data means it is not possible to assess the impact of water pricing structures.
Spain	Progressive tariffs (and price increases)	Spanish Association of Water Supply and sanitation attributes the constant reduction in water consumption to a mix of measures in addition to pricing structures. This includes more water efficient technologies and increased public awareness.
Sweden	Metering and volumetric pricing	Swedish water pricing is not used for water demand management but as cost recovery instrument – pricing is designed to reflect cost of providing the service.

Source: Adapted from European Environment Agency (2017).

How effective is this measure?

Table 3 and 4 outline the effectiveness of tariff mechanisms used across selected EU countries to incentivise efficient water usage. In most countries, there is little evidence available to estimate the direct effect that these tariffs have on water use. The relation between the between pricing mechanisms and the effect on water demand is often unclear. Attributing any changes in water consumption to pricing is difficult as countries often use a combination of measures like mandatory metering and information campaigns.

A report by the European Environment Agency found that farmers in many EU states paying a fixed tariff consumed, on average, 10-20% more water than those on a volumetric tariff.² However, the effectiveness of water tariff structures will depend on:

- **Proportion of fixed versus volumetric charges.** WE incentives are stronger the higher the proportion of volumetric charges relative to the total water bill.

² *'Assessment of cost recovery through water pricing.'* European Environment Agency (2013).

- **Price elasticity of demand.** Consumers that are not price sensitive to water are less influenced by price mechanisms to incentivise WE. In this case, other non-price mechanisms might work better to improve WE.
- **Effective / smart metering.** Without accurate and timely data on water consumption, more complex water pricing mechanisms which are determined by e.g. peak and off-peak consumption cannot be implemented. This is discussed further in 1.2.5.

1.2.2 Price measure: indirect taxes

What is the measure?

An indirect tax (or levy) on water is charge paid on the consumption (or supply) of water. Water taxes can be used to supplement the water pricing (tariff structures) to increase the price of consuming or producing water.

Why is this measure used?

Water supply or consumption taxes can be introduced to incentivise the efficient use of water.

In Denmark, a **water supply tax** has been used to provide incentives for water companies to control leakage by making them liable to pay tax if their metered water supply is less than 90% of abstracted water in any given year.³ In other words, companies must pay a penalty tax if their rate of leakage for the water abstracted is greater than 10%.

A **water consumption tax**, on the other hand, increases the incentive to reduce water consumption as it increases the price per unit of water consumed. In 1993, Denmark introduced a tax on each cubic metre of tap water (€ 0.67/m³). Since 2011, an additional tax has been introduced at the same rate for drinking water. Similarly, the Netherlands also have a tax on tap water that is levied only on the first 300m³ each year per connection.⁴

Water taxes can also be used to complement existing water tariff structures. For example, Singapore's water conservation tax introduced in 1991 designed to reduce water consumption and reflect the scarcity value of water. It was implemented as a percentage of the existing water tariff e.g. for 'potable' water the tax is set at 50% of the tariff and for recycled water it is 10%. This is designed to reduce the cost of consuming recycled water and therefore encourages water conservation. Several EU countries such as Germany, Hungary and Portugal also apply a water resource taxes based on the volume of water consumed.⁵

How effective is this measure?

The effectiveness of water taxation in increasing WE will depend on the following factors:

³ *'Water in figures 2020.'* Danish Water and Wastewater Association (2020).

⁴ *'Water tax.'* Government of the Netherlands, accessed on 11th March 2022. Available here: <https://www.government.nl/topics/environmental-taxes/water-tax>

⁵ *'Sustainable water use in agriculture.'* European Court of Auditors (2021); p.23.

- The tax rate on water volumes. Both the rate and how it is structured e.g. flat vs. marginal tax rates.
- The price elasticity of demand for water. How responsive customers are to changes in the price of water.
- Whether tax revenues are hypothecated. Revenues could be directed to fund WE activities in the form of grants / loans.

Case study: business water tariffs in Singapore⁶

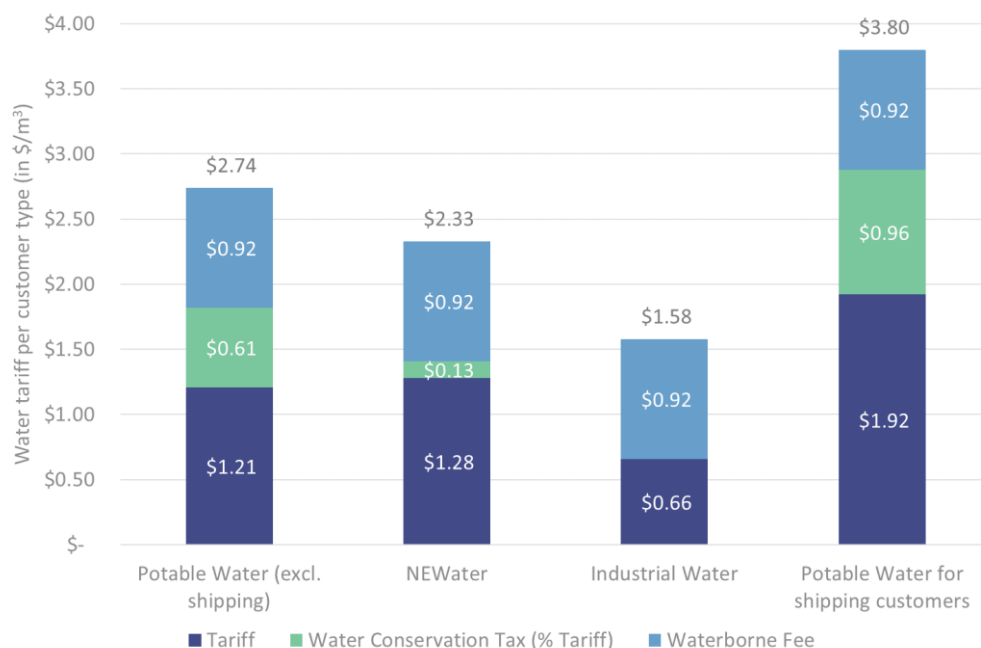
The current water tariff for businesses has been in place since July 2018. There are three parts to the water tariff which are the following:

- **Tariff.** The water tariff covers the costs incurred of the water production process from collection of rainwater to the distribution of treated potable water to customers. It is a volumetric charge based on \$/m³.
- **Water Conservation Tax.** This tax was introduced in 1991 to encourage water conservation and reflect the scarcity value of water. It is imposed as a percentage of the water tariff. For potable water, the tariff is 50%, and for recycled water it is 10%.
- **Waterborne Fee.** This fee covers the cost of recycling used water and maintaining the used water network. It is a volumetric charge based on \$/m³. Currently, the charge is \$0.92 per m³ consumed for business customers.

There are a further four different water tariffs for business customers, as follows: (i) a potable water tariff; (ii) a NEWater tariff for the use of recycled water; (iii) an industrial water tariff; and (iv) a potable water tariff for shipping customers only. Figure 1 overleaf shows that shipping customers face the highest charges due to an increased cost of water supply compared to the supply of non-shipping customers. This tariff is designed to incentivise the use of recycled water (NEWater) – which is cheaper – over potable water through the differential water conservation tax rates.

⁶ *'Water Price.'* PUB Singapore's National Water Agency, accessed on 28th January 2022. Available here: <https://www.pub.gov.sg/watersupply/waterprice>

Figure 1. Current water tariff for business customers in Singapore



Source: *'Water Price.'* PUB Singapore's National Water Agency, accessed on 28th January 2022. Available here: <https://www.pub.gov.sg/watersupply/waterprice>

1.2.3 Non-price measure: water licensing / restrictions

What are the measures?

Water licensing involves controlling water resource by granting access to e.g. water abstraction. This allows for protecting of water resources and to ensure abstractions do not damage the environment.

Water restrictions. Control on abstraction and / or consumption applied in periods of acute water shortage. This could involve:

- (i) Limiting certain types of water use e.g. lawn irrigation, car washing or filling of swimming pools.
- (ii) Establishing a 'water hierarchy' that prioritises between water uses. For example, in France priority is given to health, hygiene, and national security, whilst Spain prioritises between urban supply, irrigation, industrial use, and agriculture.^{7,8}

Why are these measures used?

Water licensing is used as a mechanism for water demand management by directly controlling the amount of water resources that can be accessed. This directly determines the amount of water that can be supplied to consumers. Furthermore, licensing can be combined with wider policy objectives. For example, in Germany an abstraction license can generally only be granted if there is no impairment to the

⁷ *'Water Resources Allocation: France.'* OECD. Accessed on 11th March 2022. Available here: <https://www.oecd.org/france/Water-Resources-Allocation-France.pdf>

⁸ *'Water Resources Allocation: Spain.'* OECD. Accessed on 11th March 2022. Available here: <https://www.oecd.org/spain/Water-Resources-Allocation-Spain.pdf>

ecological status of the water body (as required by the EU Water Framework Directive).

Water restrictions are typically used as to ensure sufficient water resources are available for priority uses. These are typically deployed in periods of drought caused by lack of rainfall or high temperatures. Drought conditions in California, for example, have resulted in ban wasteful water practices such as using potable water for washing pavements and driveways.⁹

How effective are these measures?

The effectiveness of water licensing depends on how it is implemented. If there is an over-allocation of water abstraction, licensing will not lead to more efficient water use. For licensing to be effective, the licensed volume of water should be set to incentivise making efficient use of the water available.

Water restrictions can be very effective in the short-term, however, such measures are unlikely to have any effect on demand for water, unless they are combined with additional WE measures. It is also important to note that water restrictions are also likely to affect water companies' metered revenue.

1.2.4 Non-price measure: water markets / trading

What are the efficiency measures?

Water trading involves the voluntary buying and selling of water – in terms of existing supplies of future supplies of water.¹⁰ Trade of water 'property rights' can include:

- (i) Short-term / temporary transfers of existing water allocations that is available for immediate use
- (ii) Medium-term leasing of water allocations
- (iii) Permanent transfers of water entitlements i.e. on-going property rights to a proportion (or fixed quantity) of available water.

There are multiple water trading and market arrangements across the world including Chile, China, Mexico, South Africa and the United States but the Murray-Darling Basin in Southern Australia is one of the most developed in the world.¹¹

The water market consists of a 'cap and trade' system, where the total amount of water available for consumption is capped and the water can only move between market participants (farmers) through trading water rights.

Why is this measure used?

⁹ *'Governor Newsom Expands Drought Emergency Statewide, Urges Californians to Redouble Water Conservation Efforts.'* Office of Governor. Accessed on 11th March 2022. Available here: <https://www.gov.ca.gov/2021/10/19/governor-newsom-expands-drought-emergency-statewide-urges-californians-to-redouble-water-conservation-efforts/>

¹⁰ *'Developing a water market readiness assessment framework.'* Wheeler, S; Loch, A; Crase, L; Young, M; Edward Elgar Publishing (2021).

¹¹ *'Water Markets and Trade.'* Government of South Australia. Accessed on 11th March 2022. Available here: <https://www.environment.sa.gov.au/topics/water/water-markets-and-trade>

Water markets – and cap and trade systems more generally – provide a market-based solution to manage the production or consumption of a commodity by setting a ‘cap’ on the amount of e.g. water that can be consumed.

For example, in the Murray- Darling Basin, once water entitlements have been set, farmers are able to buy or sell their allowances to each other on a secondary market. The supply of water available and the demand (influenced by e.g. rainfall) determines the market price which subsequently promote more efficient uses of water as farmers with excess water can sell their allocations to those with water shortages.

Cap and trade systems are used because they both (i) limit the total amount of water consumed but (ii) create financial incentives for longer term WE as excess supplies of water can be sold on secondary markets. This is discussed in further detail in 1.3.4.

How effective is this measure?

The water markets in Australia are generally considered a success in encouraging the best use of scarce water resources. These markets have been developed over the last 30 years in response to water resource pressures because of droughts and population growth. Nationally, the annual turnover was worth \$6 billion in 2020-21.¹²

The effectiveness depends on setting appropriate caps and allowing for trading without any market frictions. In the initial phases of the EU’s carbon trading system, an over-allocation of allowances (i.e. not a low enough cap) reduced the impact on carbon abatement.¹³

1.2.5 Non-price measure: mandatory meter installation

What is the measure?

Water metering is the measurement of water consumption (e.g. in m³) in residential and commercial buildings. Mandatory meter installation programmes involve widespread installing of metering devices in residential and / or commercial buildings.

Why is this measure used?

There are multiple reasons for mandating meter installations including:

- (i) Improving customer awareness of water consumption habits which may lead to behavioural changes to reduce their water use
- (ii) To improve accurate and timely data to enable detection of leakages
- (iii) To enable regulators to understand how specific areas or industries use water so more targeted conservation measures can be developed

Since 2015, Singapore has required large water users (those consuming 60,000 m³ or more a year) to install private meters and submit an annual Water Efficiency Management Plan (WEMP) to the regulator.¹⁴ Large users will have to appoint a

¹² *'The Australian Water Markets Report 2020-21.'* Australian Government, Bureau of Meteorology. Accessed on 11th March 2022. Available here:

http://www.bom.gov.au/water/market/documents/The_Australian_Water_Markets_Report_2020-21.pdf

¹³ *'Assessing the effectiveness of the EU Emissions Trading System.'* Laing, T; Sato, M ; Grubb, M.; Claudia, C; Centre for Climate Change Economics and Policy Work Paper No. 126 (2013)

¹⁴ *'Our Water, Our Future.'* PUB Singapore's National Water Agency (2018); p.44.

WEMP representative attend a three-day WE manager course from 2019 onwards. In combination, these requirements enable businesses to identify and consider WE improvements. As part of Singapore's Smart Water Meter Programme, the National Water Agency plans to install 300,000 smart meters in residential and commercial buildings, free of charge by 2023.¹⁵

How effective is this measure?

We are not aware of any evaluation of Singapore's Smart Water Meter Programme. However, studies have shown that water metering in households can result in a 10-20% reduction compared to non-metered households.¹⁶ Ornaghi and Tonin (2019) find that households in the Universal Metering Programme in the South-East England decreased their consumption by 22%.¹⁷ This is predominantly attributed to the 'price effect' of consumers switching to metered tariffs where they pay for each unit of water consumed.

More generally, the wide-spread use of (smart) meters is a necessary requirement for the implementation of many price and non-price measures discussed in this literature review. For example, introducing more complex pricing frameworks such as tariffs with a volumetric component requires accurate and timely data on customers' water consumption. Similarly, knowledge of water consumption enables more effective monitoring of water use and could therefore promote the development and diffusion of water efficient technologies.

Selective metering may be a more cost-effective solution compared to universal metering programmes. For example, the potential water savings are likely to be greatest when specifically targeting:

- Intensive water users i.e. where the most water can be saved
- Price-sensitive customers i.e. those who are most likely to cut water use

However, it is also important to note that selective metering may be subject to greater administrative cost and be unable to unlock the potential economies of scale achieved by a universal metering programme.

1.2.6 Non-price measure: WE labelling / certificates

What is the measure?

WE labelling /certification involves assessing products or businesses, and buildings with a certification rating their WE standards. Labelling and certification could be comparative (based on a sliding scale of efficiency) or an endorsement (to confirm a minimum standard is met).

Why is the measure used?

WE labelling / certification are frequently implemented due to the following benefits¹⁸:

¹⁵ 'Smart Water Meter.' PUB Singapore's National Water Agency. Accessed on 11th March 2022. Available here: <https://www.pub.gov.sg/smartwatermeter/>

¹⁶ 'The full costs & benefits of moving to full water metering.' Environment Agency (2018); p.5.

¹⁷ 'The effects of universal metering on water consumption, welfare and equity.' Ornaghi, C; Tonin, M. (2019)

¹⁸ 'Review of international water efficiency product labelling.' International Water Association (2019)

- Labels / certificates to help individuals and businesses understand the WE performance of products (or their producers).
- Drive technological development of water efficient products / processes.
- Enable businesses to communicate their commitment to corporate social responsibility.
- Raise awareness of WE more generally

Internationally, there are numerous WE labelling schemes, with mandatory schemes in countries such as Australia, New Zealand and Singapore and voluntary schemes in Canada, the EU and the United States. As part of Singapore's Water Efficiency Labelling Scheme, eligible products (such as taps, urinals and washing machines) must publicly display their WE label enabling customers to make informed choices. For example, Australia's Water Efficiency Labelling and Standards scheme requires products such as toilets, urinals, taps, showers, dishwashers and washing machines to be labelled. This includes a 6-star rating system following testing by a laboratory accredited testing authority.¹⁸

In 2004, Singapore's regulator introduced the Water Efficient Buildings programme as a certification programme to encourage companies to reduce water consumption.¹⁹ To attain the certification, a company must meet certain standards such as adopting recommended water efficient technologies.²⁰ This certificate aims to provide reputational incentive for businesses, industries, schools and buildings.

How effective is this measure?

The effectiveness of WE labelling depends on the how they are designed.¹⁸ Typically, mandatory schemes are more successful. The design of any labels or certificates also needs to be carefully considered to reflect the national context including extent of water scarcity.

Australia's Water Efficiency Labelling and Standards scheme has been found to be highly effective and research suggests 87% of consumers recognise the labelling. It is estimated that the scheme will have permanently reduced domestic water consumption by c.8%.²¹

1.2.7 Non-price measure: minimum WE standards

What is the measure?

Minimum WE standards can be implemented to promote or mandate the use of water efficient technologies. For example, new builds may be required to incorporate technical elements such as water saving taps or dual flush toilets.

Why is this measure used?

The use of minimum WE standards can promote reductions in water demand. For example, since January 2022, Singapore's minimum commercial equipment standards requires that commercial water equipment sold must meet certain WE

¹⁹ *'Water efficient building design book.'* PUB Singapore's National Water Agency (2008).

²⁰ *'Water efficient building (basic) certification.'* PUB Singapore's National Water Agency. Accessed on 11th March 2022. Available here: <https://www.pub.gov.sg/savewater/atwork/certificationprogramme>

²¹ *'Water use efficiency for resilient economies and societies roadmap.'* United Nations Sustainable Development (2016)

requirements.²² This aims to drive greater WE in Singapore's non-domestic sector, which accounts for more than half of its water demand.

How effective is this measure?

The effectiveness of minimum WE standards is determined by:

- The level of WE standard required
- The scope of standards e.g. for building standards, does it include only new builds or all buildings

1.2.8 Non-price measure: WE grant / loan scheme

What is the measure?

Grant and / or loan schemes can provide individuals or businesses with external finance to improve WE by providing e.g. upfront capital funding, part or full-funding of projects.

Why is this measure used?

Funding measures addresses the potential financial barriers to implementing WE technologies. To overcome the

Grants and loans provided by central government reduces the financial cost of individuals or businesses implementing WE. Grants, for example, may enable businesses to approve projects which previously did not meet the required 'payback' periods or internal hurdle rates for investments. Low-interest loans provided by the government may also enable those with liquidity constraints to finance WE investments.

Since 2007, the Singaporean water regulator has provided a fund to help implement projects to improve WE.²³ Funding is available for all stages from exploratory to actual implementation and co-funding projects. Within this fund, there are 5 categories for which funding is made available: WE assessment, pilot study, recycling / use of alternate sources of water, adoption of water efficient equipment, and industrial water solutions demonstration fund.

For most of the funding categories, the business case must show the percentage amount of water savings achievable. The eligibility criteria for the fund for each category are outlined in Table 5.

²² *'New efficiency standards to drive water conservation in non-domestic sector.'* Construction Plus Asia (2021), accessed 25 January 2022. Available here: <https://www.constructionplusasia.com/sg/%E2%80%8B%E2%80%8B%E2%80%8B%E2%80%8Bnew-efficiency-standards-to-drive-water-conservation-in-non-domestic-sector/>

²³ *'Efficiency measures.'* PUB Singapore's National Water Agency, accessed on 25th January 2022. Available here: <https://www.pub.gov.sg/savewater/atwork/efficiencymeasures>

Table 5: Eligibility criteria for businesses to apply for WE funds

Name of fund	Description of funding program	Eligibility criteria
WE assessment	Water audit carried out for the premises to monitor and identify opportunities for improvement in WE.	- Premises with monthly water consumption of at least 1,000 m ³
Pilot study	Implementation of small-scale pilot recycling plant to determine the feasibility of implementing the project / technology on full-scale basis.	- Premises with monthly water consumption of at least 1,000 m ³ - At least 10% water savings OR annual water savings of at least 6,000 m ³
Recycling / use of alternate sources of water	Implementation of full-scale recycling plant for realisation of water savings.	
Adoption of water efficient equipment	Realisation of water savings with the use of water efficient equipment.	- Premises with monthly water consumption of at least 1,000 m ³ - Annual water savings of at least 1,200 m ³
Industrial Water Solutions Demonstration Fund (IWSDF)	Implementation of full-scale recycling plant for realisation of water savings. IWSDF aims to support early adopters of innovative solutions or emerging / recently developed technologies.	- Premises with monthly water consumption of at least 1,000 m ³ - At least 5% water reduction within premises - The project should utilize an emerging / recently developed technology or an innovative application of existing technologies which has not been implemented in the industry, that is approved by PUB.

Source: '[Application form for water efficiency fund \(WEF\)](#).' PUB Singapore's National Water Agency (2020), page 2.

How effective is this measure?

As of October 2020, Singapore's Water Efficiency Fund has provided over \$24 million in funding and facilitated the co-funding of more than 350 projects. All approved projects must yield at least a 10% reduction in water consumption or annual water savings of at least 6,000m³.

1.2.9 Non-price measure: information / awareness campaigns

What is the efficiency measure?

Information or consumer awareness campaigns are designed to change the behaviour of individuals, households, and businesses. These campaigns aim to provide information about:

- The wider societal costs of excess water consumption i.e. long-term resource scarcity
- Behavioural changes that can enable WE
- The benefits of WE saving technologies

Why is this measure used?

Information campaigns targeted at households have been used in Cyprus, Denmark, France, Italy, Spain. These campaigns generally reach a large population and disseminate information based on a range of mediums such as:

- Websites
- Organised events
- Educational activities for children
- Radio, newspapers and TV
- Social media

How effective is this measure?

It is generally difficult to monitor the effectiveness of information campaigns because they are designed to change behaviours. However, some studies have found previous awareness-raising campaigns in Zaragoza, Spain saved an equivalent of c.6% of the city's annual water consumption during 1997 to 1998 alone.¹ In general, information campaigns are likely to be more effective when combined with additional price and non-price measures that promote WE.

1.2.10 Non-price measure: benchmarking / peer comparison

What is the measure?

Benchmarking and peer comparison is an approach used to compare the performance and practices of individuals and businesses. In the context of WE, this could be comparisons of water companies in terms of their customer's WE.

A benchmarking 'network' can then also provide its members with insights on relative performance and efficiency opportunities

Why is this measure used?

In the water sector, benchmarking and peer comparison can result in reduced operating costs, greater WE and improved service quality.

In countries such as Denmark, there is a voluntary benchmarking programme set up by the Danish Water and Wastewater Association.²⁴ Benchmarking will aim to:

- **Create of reputational incentives.** Comparison of participants against each other could incentivise participants to improve their performance.

²⁴ 'Water in Figures 2019.' DANVA Statistics & Benchmarking; DANVA (2019)

- **Enable sharing of best practice.** Benchmarking participants can learn from each other through networks that centrally gather information on efficiency improvements.

Reputational incentives and peer comparison can also exist in the form of awards. For example, Singapore has a biennial Water Efficiency Awards (WEA) to recognise the top WE performers in their respective industries.

How effective is this measure?

The effectiveness of benchmarking and peer comparison ultimately depends on how it is designed. If performance is only assessed in relative terms between utilities, there is little incentive to go beyond the performance of the majority.

In general, benchmarking and peer comparison will be more effective if relative rankings are published and can be easily understood by the wider public – if consumers care about the relative performance within benchmarking, water companies may face greater incentives to improve their performance.

1.3 Efficiency measures implemented across other sectors

We have also reviewed efficiency measures that have been implemented in the UK and abroad across other relevant sectors (such as energy), which may also provide helpful insight into the possible options for incentivising greater WE in the NHH market. The following tables provide an overview of the measures that we have examined. In the following subsections, we briefly expand on each, setting out what each measure entails; why it has been implemented; along with any indications of its effectiveness.

Table 6: Overview of efficiency measure implemented elsewhere (1)

Country	Sector	Efficiency measure	Purpose	Effectiveness of measure
UK	Energy	Consumption tax (Climate Change Levy)	Increase the cost of energy consumption strengthening financial incentives.	Successful in focussing attention on energy efficiency.
UK	Energy	Tax relief (capital allowances)	Reduce the cost of investing in efficiency savings opportunities.	Considered by stakeholders to influence decision-making.
UK	Energy	Compliance measures	Improve information on energy use or efficiency opportunities.	Some measures effective in raising awareness but obligations could be strengthened.
UK	Energy	Cap and trade scheme	Create a market price for carbon (energy) reduction.	Considered effective in delivering significant carbon savings.
UK	Energy	Financial incentive schemes	Provide financial rewards for using less carbon intensive energy.	Encouraged adoption and growth of the renewable energy market.
UK	Energy	Financial support schemes	Provide financial support in the form of grants / loans.	Financial support schemes have funded hundreds of projects and attracted billions in private capital.

Source: Economic Insight

Table 7: Overview of efficiency measure implemented elsewhere (1)

Country	Sector	Efficiency measure	Purpose	Effectiveness of measure
France	Energy	Feebates	Financial reward and penalty system based on energy consumption / standards.	France's scheme is considered an example of best practice in feebate scheme design.
USA	Energy	Revenue decoupling	Remove the disincentive by utility providers to support customers' demand reduction.	Empirical evidence suggests decoupling associated with demand reduction.
UK	Energy	Supply-side improvement	Policies to foster development of the market for energy efficiency.	N/A
UK (East Sussex)	Multiple (namely energy, water and waste)	ES betre rural waste minimisation club	Provided information and funding to reduce informational/awareness and financial barriers to waste management and resource efficiency.	Achieved total savings (of resources and avoided fines) of £271,572, at a project cost of £100,512.
UK	Plastics	Plastic bag charge	Provided a statutory incentive for retailers to reduce their customers' plastic bag consumption, and a financial disincentive on the use of plastic bags for consumers.	95% reduction of plastic bag use since the legislation was enacted in 2015, and £178m of proceeds donated to good causes.

Source: Economic Insight

1.3.1 UK energy taxation (Climate Change Levy)

What is the efficiency measure?

Since the Government's review of the business energy efficiency tax landscape, the UK has moved to a single business energy tax – the Climate Change Levy (CCL) which has been in place since April 2001.

The CCL is a direct consumption tax paid by businesses on their electricity, gas or solid fuel consumption per kilowatt hour of usage.²⁵ The main levy rates are currently 0.775p/kWh for electricity and 0.465p/kWh for gas.

Business energy suppliers are responsible for charging the CCL to their customers. However, there are discounts and exemptions available for:

- (i) businesses who enter into a voluntary 'Climate Change Agreement' to reduce energy use and carbon emissions based on agreed targets;²⁶
- (ii) businesses who use small amounts of energy; and
- (iii) charities involved in non-commercial activities.

Prior to 2018-19 the Carbon Reduction Commitment Energy Efficiency Scheme was also in place, for which eligible organisations had to report their carbon emissions and purchase allowances to cover these emissions. The Government ended the scheme to simplify the business energy tax landscape by replacing it with an increase in the CCL rates.

Why was this measure used?

The CCL creates financial incentives for business energy users to decrease their energy consumption by increasing the price paid for each unit of energy.

How effective is this measure?

The National Audit Office considers the CCL to have contributed to businesses focussing attention on energy use since its introduction.²⁷ Evaluating the effectiveness of the CCL, however, is difficult given it was introduced at a similar time as other measures – in addition to further measures that have been introduced since.

1.3.2 Energy tax relief (enhanced capital allowance)

What is the efficiency measure?

Businesses were able to receive a tax relief by claiming an 'enhanced capital allowance' for eligible energy efficient, or low or zero-carbon technology they purchase.²⁸ For example, firms could claim for:

- Eligible energy saving equipment e.g. particular types of motors
- Eligible water saving equipment e.g. smart meters and efficient toilets
- Zero-emission goods vehicles

As part of the enhanced capital allowance scheme, the Government published an approved list of energy-efficient products – the Energy Technology List (ETL) – which included 56 technologies.

²⁵ 'Climate Change Levy.' UK Government. Accessed on 11th March 2022. Available here: <https://www.gov.uk/green-taxes-and-reliefs/climate-change-levy>

²⁶ 'Climate Change Agreements.' UK Government. Accessed on 11th March 2022. Available here: <https://www.gov.uk/guidance/climate-change-agreements--2>

²⁷ UK Government. Accessed on 11th March 2022. Available here : 'The Climate Change Levy and Climate Change Agreements.' National Audit Office (2007); p.4.

²⁸ 'Capital allowances on energy-efficient items.' UK Government. Accessed on 11th March 2022. Available here: <https://www.gov.uk/green-taxes-and-reliefs/capital-allowances-on-energyefficient-items>

From April 2020 the first-year allowance and tax credits for products on the ETL has been removed and the revenue will be used to fund the Industrial Energy Transformation Fund (see 1.3.6a below).

Why was this measure used?

The Government used tax relief measures for energy efficient technologies to reduce the investment costs faced by businesses. A reduction in the costs of investment may reduce the 'payback' period of a project which can enable companies to invest.

How effective is this measure?

Whilst there is no quantitative evaluation of the tax relief on energy efficiency technologies, a stakeholder workshop has suggested the key successes have been to: (i) increase demand for energy efficient technologies; (ii) raise awareness of environmental conservation; and (iii) establish an independent source of energy efficient technologies.²⁹

1.3.3 UK energy compliance measures

What is the efficiency measure?

Businesses in the UK are subject to multiple energy and carbon compliance measures. These measures seek to either: (i) improve the information available on energy use and potential saving opportunities; and / or (ii) increase the adoption of energy efficient technologies. Five examples are described in more detail below.

g. Energy Savings Opportunity Scheme (ESOS) is a mandatory energy assessment scheme introduced in 2014 for organisations that meet certain criteria.³⁰ This involves conducting audits of energy used in organisation's buildings, industrial processes, and transport to help identify potential energy savings available. The Environment Agency administers the scheme and qualifying organisations must carry out ESOS assessments every 4 years. These assessments involve the following steps:

- (i) Calculate total energy consumption by assets held or activities carried out by the organisation.
- (ii) Identify the organisation's areas of significant energy consumption and check whether any sources fall under regulations such as requirement to:
 - Undertake a (Green Deal Assessment)
 - Display a certificate in public buildings to inform visitors about the energy use of a building (Display Energy Certificates).
 - Follow a framework to improve energy efficiency (ISO 50001).
- (iii) Appoint a lead assessor to carry out and oversee the energy audit and overall ESOS assessment – these can be external contractors or employees provided they are members of an approved professional body register.

²⁹ *'The Energy Technology List: beyond the Enhanced Capital Allowance scheme.'* Engagement report from 2019 workshops; Department for Business, Energy and Industrial Strategy (2019)

³⁰ *'Energy Savings Opportunity Scheme (ESOS).'* UK Government. Accessed on 11th March 2022. Available here: <https://www.gov.uk/guidance/energy-savings-opportunity-scheme-esos>

- (iv) Notify the Environment Agency of the completed assessment and compliance with relevant obligations.

Although ESOS audits create an administrative burden on businesses, they enable organisations to identify potential energy savings opportunities and therefore reduce any potential information failure. However, there is no obligation for organisations to implement the savings opportunities identified.

- h. **Streamlined Energy and Carbon Reporting (SECR)** was introduced in April 2019 and requires large UK companies to report their energy use and carbon emissions within their Directors' Report.³¹ The introduction of SECR is designed to increase awareness and visibility of energy use and costs to key decision makers.

The administrative burden of SECR is considered to be low because the information is already collected and reported by businesses through existing schemes such as the ESOS.

- i. **Energy Company Obligation (ECO)** is a scheme launched in April 2013 and was designed to reduce carbon emissions and tackle fuel poverty. This involves legal obligations on larger energy suppliers to deliver energy efficiency to homes in Great Britain, supported by around £640m of annual funding for a 5-year period.³² The funding is used to install energy efficiency solutions such as insulation and heating measures in residential homes.
- j. **Display Energy Certificates (DECs)** were introduced in October 2008 and show the energy performance of public buildings based on actual energy consumption in the last 12 months. This involves a rating from best to worst on a scale from A to G. Since July 2015 any large building (over 250m²) occupied by a public authority and frequently visited by the public must prominently display their DEC.

A DEC is accompanied by an advisory report that contains recommendations for improving the energy efficiency and performance of the building with options including details on cost-effectiveness e.g. payback periods. The advisory report enables the occupier to identify potential improvements.

- k. **Energy Performance Certificates (EPCs)** were introduced in August 2007 provide an energy efficiency rating from best to worst on a scale from A to G and indicates how costly it may be for an occupier to heat or light. All private buildings must have an EPC when they are built, sold or let.

Energy intensive industries, the power generation sector and aviation must also comply with the UK Emissions Trading Scheme – this is detailed in the following subsection.

Why are these measure used?

Compliance measures ensure that businesses must either collect information on existing energy use and potential efficiency savings and / or comply with standards on energy efficient technologies. This reduces the informational barriers to identifying

³¹ 'Environmental Reporting Guidelines: Including streamlined energy and carbon reporting guidance.' UK Government (2019). Accessed on 11th March 2022. Available here: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850130/Env-reporting-guidance_inc_SECR_31March.pdf

³² 'Energy Company Obligation (ECO).' Ofgem. Accessed on 11th March 2022. Available here: <https://www.ofgem.gov.uk/environmental-and-social-schemes/energy-company-obligation-eco>

energy efficiency opportunities. Compliance measures such as DECs create additional reputational incentives which incentivise companies to improve their energy efficiency.

How effective are these measures?

Whilst quantitative evaluation of energy efficiency compliance measures has been limited, some qualitative information has been gathered from stakeholder engagement exercises. In particular:

- ESOS has been cited as an influence by over 30% by complier organisations in making energy-related improvements.³³ However, previous responses by stakeholders to Government consultations suggest that ESOS could be strengthened by mandating investment to unlock the savings identified.
- DECs have increased public and private sector organisations' engagement with energy management.³⁴ Although most participants noted the larger cost savings where due to schemes such as the CRC energy efficiency scheme.

1.3.4 UK Emissions Trading Scheme (ETS)

What is the efficiency measure?

A cap-and-trade scheme effectively creates a market for carbon (and energy) reduction. The UK ETS was introduced in January 2021 replacing the UK's membership to the EU ETS, which began in 2005 as the world's first international cap and trade scheme. This works as follows:

- (i) A cap is set on the total number of carbon emissions by sectors within the scheme.
- (ii) Participants receive free allowances and/or buy emissions allowances at auction or on the secondary market which are traded with other participants as required.
- (iii) The cap can then be decreased over time so that total carbon emissions fall and therefore incentivises investing in energy efficiency.

Why was this measure used?

An ETS introduces a market price for carbon emissions. Participants are incentivised to undertake cost-effective investments to reduce their energy-use and carbon emissions, instead of having to purchase additional carbon allowances.

The advantage of an ETS is that for the desired level of carbon emissions reduction, the price for carbon is decided by the market. Whereas the alternative, a carbon price set externally by central government (effectively a tax), is less linked to a desired level of carbon emissions reduction.

³³*Evaluation of the Energy Savings Opportunity Scheme: Interim process and early impact evaluation report.* Department for Business, Energy and Industrial Strategy (2017)

³⁴*Exploring the use of Display Energy Certificates.* Department for Energy and Climate Change (2013)

There are numerous other carbon cap-and-trade systems around the world at both the national and sub-national level. This includes schemes in Canada, China, Japan, New Zealand, South Korea, Switzerland and the United States.³⁵

How effective is this measure?

Whilst there are not yet any evaluations of the recently formed UK ETS, the EU ETS which preceded it is widely considered to have been successful in reducing carbon emissions. A report by the Grantham Institute reports that the EU ETS has led to an estimated 100-200 million tonne reduction in CO₂ across all participating sectors and countries in its first two years.³⁶

1.3.5 UK energy financial incentive schemes

What is the efficiency measure?

There have been a wide variety of financial incentive schemes in the UK designed to encourage the take-up of energy efficient technologies by compensating businesses based on factors such as the amount of renewable energy. These incentive schemes include:

- a. **Non-domestic Renewable Heat Incentive (RHI)** was a scheme providing financial incentives to businesses, public sector, and non-profit organisations to increase uptake of renewable heat. Eligible parties receive payments to meet the cost of installing renewable heat technologies over a 20-year period based on the heat output of their system.³⁷

The RHI is set to be replaced by the Clean Heat Grant from 2022, which will provide upfront capital funding for households and businesses integrating green heating technologies e.g. heat pumps.³⁸

- b. **Feed-in Tariff (FIT)** payments provided financial incentives for individuals or businesses who generate their own electricity. The scheme opened in 2010 but closed to new applications in 2019.³⁹

FIT payments are designed to encourage the take-up and investment into renewable and low-carbon generation technologies (e.g. solar panels or wind turbines). This in turn reduces the demand for electricity from energy suppliers.

Payments are made on the basis of a £/kWh rate and are based on the meter readings submitted to energy suppliers. Any surplus energy generated by a business can also be sold back to their electricity supplier with additional compensation based on the 'export tariff'.

³⁵ *'International carbon market.'* European Commission. Accessed on 11th March 2022. Available here: https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/international-carbon-market_en

³⁶ *'Evaluating the EU Emissions Trading System: Take it or leave it? An assessment of the data after ten years.'* Grantham Institute Briefing Paper No 21 (2016)

³⁷ *'Non-Domestic Renewable Heat Incentive (RHI).'* Ofgem. Accessed on 11th March 2022. Available here: <https://www.ofgem.gov.uk/environmental-and-social-schemes/non-domestic-renewable-heat-incentive-rhi>

³⁸ *'Find business energy efficiency grants and schemes.'* Ofgem. Accessed on 11th March 2022. Available here: <https://www.ofgem.gov.uk/information-consumers/energy-advice-businesses/find-business-energy-efficiency-grants-and-schemes>

³⁹ *'Feed-in Tariffs (FIT).'* Ofgem. Accessed on 11th March 2022. Available here: <https://www.ofgem.gov.uk/environmental-and-social-schemes/feed-tariffs-fit>

Why are these measures used?

Financial incentive schemes are designed to provide monetary reward for adopting energy efficient technologies, and in some cases, reduce the upfront capital costs. This addresses not just the financial barriers but also the perceived uncertainty and risk that firms associate with energy efficiency investments.

How effective is this measure?

A qualitative survey of non-domestic RHI applicants suggests that participants consider:⁴⁰

- The significant growth in the biomass market (a renewable energy market) has been partly attributed to the RHI.
- The impact of the RHI on the energy sector to have been positive.

An evaluation of the FIT scheme finds that there have been over 650,000 installations in the first 5 years.⁴¹ This is equivalent to 13.5% of total installed renewable capacity in the UK and suggests successful diffusion of (small-scale) renewable energy technologies.

1.3.6 UK energy financial support schemes

There are large number of Government schemes which can provide (or have provided) businesses with financial support for energy efficiency investments, through providing grants or loans. Grants and loans overcome slightly different financing barriers:

- Grants enable businesses to reduce the costs of investments which may allow them to satisfy internal capital financing rules, for instance those based on the length of payback periods.
- Government loans may provide a cheaper source of external finance – private providers may charge higher interest rates due to the risk and uncertainty associated with energy efficiency investments. Cheaper loans may result in energy efficiency investments becoming cost-effective.

A non-exhaustive list of some examples of the financial support schemes and institutions for energy efficiency is given below.

- a. **Industrial Energy Transformation Fund (IETF)** supports businesses to develop and deploy technologies to reduce energy use and / or carbon emissions.⁴² The Government has made a £315m biddable pot available from 2018 to 2025.

The Government has not undertaken an evaluation of the scheme which is still live.

- b. **Energy Innovation Programme (EIP)** was a government scheme that aimed to accelerate the commercialisation of innovative clean energy technologies.⁴³ EIP

⁴⁰ 'Survey of Non-Domestic RHI Applicants (Wave 2),' Department for Energy and Climate Change (2016)

⁴¹ 'Performance and Impact of the Feed-in Tariff Scheme: Review of Evidence,' Department for Energy and Climate Change (2015)

⁴² 'Industrial Energy Transformation Fund,' UK Government. Accessed on 11th March 2022. Available here: <https://www.gov.uk/government/collections/industrial-energy-transformation-fund>

⁴³ 'BEIS Energy Innovation Programme (funding closed)' UK Government. Accessed on 11th March 2022. Available here: <https://www.gov.uk/guidance/energy-innovation#beis-energy-innovation-programme-funding-closed>

had a budget of £505m for the period 2015 to 2021 and provided individual funding pots for themes including the following:

- Smart systems
 - Energy efficiency and heating
 - Industrial decarbonisation inc. carbon capture, use and storage
 - Renewables innovation
 - Green financing
- c. **Salix Finance Ltd** is a non-departmental public body set up to provide government funding to the public sector to improve energy efficiency.⁴⁴
- d. **Green Investment Group** is a specialist in green financing.⁴⁵ It was originally set up by the UK Government (in the form of the Green Investment Bank) but has since been acquired by Macquarie Group and is independent of the UK Government. The bank was set up to support public and private investment in energy efficiency.

The initiative has also involved specialist financial instruments based on energy efficiency projects e.g. Green Loans which are designed around the savings made on energy efficiency projects.

Why are these measures used?

Providing funding for unknown and uncertain technologies will enable businesses and individuals to reduce their risk and exposure when the potential benefits of investing is unknown. This process supports faster development of effective energy efficient technologies.

Financial support mechanisms which directly provide grant funding also help reduce the payback period on projects. Despite being cost-effective, energy efficiency projects may need to meet internal investment rules relating to the desired length of the payback period.

How effective are these measures?

- To date, Salix Finance Ltd. has provided over £1bn of funding to 19,700 projects via loans to date and is estimated to have unlocked over £200m of *annual* financial savings.
- The National Audit Office reported that the Green Investment Bank had funded 100 projects by March 2017 – providing over £3.4bn of capital – and had been effective in helping the Government achieve its commitments on climate change.⁴⁶
- The Green Investment Group reports its projects to have avoided 222 MtCO₂e of greenhouse gas emissions – equivalent to removing nearly 3 million cars from the road.

1.3.7 Vehicle efficiency feebates (France)

⁴⁴ *'Salix Finance Ltd.'* Accessed on 11th March 2022. Available here: <https://www.salixfinance.co.uk/>

⁴⁵ *'Green Investment Group.'* Accessed on 11th March 2022. Available here: <https://www.greeninvestmentgroup.com/en.html>

⁴⁶ *'The Green Investment Bank.'* National Audit Office (2017)

What is the efficiency measure?

A fee and rebate or 'feebate' system was implemented in France in 2008 to encourage the energy (fuel) efficiency of vehicles.⁴⁷ A feebate works on the basis of:

- A fee levied on vehicles below a desired level of vehicle efficiency, in terms of emissions standards such as CO₂ (g/km); and
- A rebate (payment) given to vehicles which are above the set standard.

Why is the efficiency measure used?

This incentivises the manufacturers of vehicles to improve the energy efficiency of their automobiles.

The vehicle feebate scheme in France is adjusted annually to: (i) ensure a balance between the fees collected and rebates paid; and (ii) strengthen the incentives to improve vehicle efficiency standards.

There are various considerations in designing a feebate system such as the thresholds set and how the rebate and fee amounts are calculated. On the latter, the policy can be revenue neutral (excluding any administrative costs) if total rebates are set to the fees charged.

How effective is this measure?

Feebates in general are regarded as effective policy tools – particularly in promoting the adoption of low emissions technology in France.⁴⁷ In the case of France, there has been a process of learning over the last decade to adjust and refine the policy design to (i) limit any incentives for gaming and (ii) to ensure the scheme remained revenue neutral – a balance struck between rebates and fees.

1.3.8 Utility revenue decoupling (United States)

What is the efficiency measure?

Revenue decoupling is a regulatory mechanism to “decouple” utility companies' revenues from the volume sold to consumers. That is, the volume of a utility sold and consumed no longer has any bearing on the utility providers' revenues.⁴⁸

Why is the efficiency measure used?

By decoupling, energy suppliers do not face a disincentive to encourage the customers to engage in demand reduction - as it does not impact on their profitability if the volume of energy consumed is not linked to their revenue.

Decoupling of rates paid for electricity and gas has been implemented across some US States such as California, Massachusetts and Connecticut. Decoupling by itself does not promote energy efficiency but does remove one of the barriers, and therefore it is important to combine this measure with regulatory options to actively incentivise energy efficiency.

⁴⁷ 'Practical lessons in vehicle efficiency policy: The 10-year evolution of France's CO₂-based bonus-malus (feebate) system.' Yang, Z; International Council on Clean Transportation (2018)

⁴⁸ 'Decoupling policies.' Centre for Climate and Energy Solutions. Accessed on 11th March 2022. Available here: <https://www.c2es.org/document/decoupling-policies/>

How effective is this measure?

Empirical evidence from the US electricity sector suggests that there is a significant negative relationship between the decoupling of electricity revenue and consumption.⁴⁹ That is, revenue decoupling is correlated with demand reduction, and it has been shown to be an effective way of removing the disincentive utility providers face to promote energy efficiency.

1.3.9 Improving supply-side of energy efficiency market

The 'market for energy efficiency services' is made up of providers (Energy Service Companies) who support organisations to identify, install and manage energy efficiency measures. This business model exists because for many organisations it is simply not cost-effective to have in-house energy efficiency specialists e.g. as energy makes up a small proportion of costs.

Many Energy Service Companies (ESCOs) operate using an energy performance contract (EPC), where ESCOs implement energy efficiency projects and receive compensation based on actual energy savings delivered. These EPCs are therefore often based on a performance guarantee, with risk borne by the ESCOs. Alternative arrangements also exist where ESCOs implement an energy efficiency project on a fee basis.

What is the efficiency measure?

The 'efficiency measure' in this case is to support the development of the market for efficiency. This included a set of potential options such as:

- Standardising EPCs, methods and guidance
- Wider adoption of EPC in the energy services market to incentivise organisations to become more energy efficient
- National registry for energy service companies to improve confidence and assurance on quality of providers to customers
- Creation of an 'energy efficiency' network which links organisations who can share knowledge and best practice

Why is the efficiency measure suggested?

One of the barriers previously cited is the fact that the UK energy efficiency market is under-developed. This results in limited knowledge and skills on both the demand and supply-side of the energy efficiency market. BEIS (2018) identifies a list of potential policy interventions to improve the UK market for energy efficiency services.⁵⁰

1.3.10 UK (East Sussex): ES betre rural waste minimisation club

⁴⁹ *'Revenue decoupling and energy consumption: Empirical evidence from the U.S. electric utilities sector.'* Von Loessl, V; Wetzel, H; MAGKS Joint Discussion Paper Series in Economics, No. 18-2019 (2019)

⁵⁰ *'The Non-Domestic Energy Efficiency Services Market.'* Department for Business, Energy and Industrial Strategy (2018)

What is the efficiency measure?

East Sussex's business excellence through resource efficiency scheme, known as ES *betre rural*, was a waste minimisation club (WMC) tailored to the needs of rural businesses. The scheme ran from June 2005 to December 2006, and was developed in partnership between East Sussex County Council; South East England Development Agency (SEEDA); the Environment Agency (EA); Government Office South East (GOSE); Sussex Enterprise; and all East Sussex Local Authorities. The scheme cost a total of £100,512.⁵¹

The development of the scheme was prompted by Defra's steer to stimulate GDP growth of the region through using strategies such as sustainable consumption and production, which would help: (i) reduce the operational costs of businesses in the area and safeguard jobs; as well as (ii) improve resource efficiency and generate environmental benefits.

Specifically, the scheme involved providing:

- **Technical advice** and support on resource efficiency issues via a helpline;
- Detailed **site audits** covering compliance and all aspects of waste minimisation and resource efficiency (including utility bill analysis);
- **Training events** (on topics such as farm waste minimisation, hospitality sector waste minimisation, and simple utility management);
- Detailed **follow-up support** for businesses that attended training or received site audits;
- **Newsletters** that give advice on ways to minimise waste and increase water and energy efficiency services;
- **Grants** of 50% (up to the value of £500) were available to businesses to enable the implementation of environmental improvements.

Why was this measure used?

This scheme provided information and tailored advice, as well as funding to overcome informational and financial barriers to resource efficiency and waste management.

The design of the scheme and resultant focus on information provision, was informed by a federation of small businesses survey, which showed that evidence around the cost savings available as well as clear information provision were most likely to result in small businesses improving their environmental performance.⁵²

How effective is this measure?

Total savings of £271,572 were achieved as a result of the scheme, owing to a combination of: (i) £145,572 of resource savings (including 17,567m³ of water p.a.

⁵¹ *'A critical appraisal of the UK's largest rural waste minimisation project: Business excellence through resource efficiency (betre) rural in East Sussex, England.'* Ackroyd, J; Jespersen, S; Doyle, A; and Phillips, P. *S. Resources, Conversation and Recycling, Volume 52, Issue 6, April 2008, Page 898.*

⁵² *'A critical appraisal of the UK's largest rural waste minimisation project: Business excellence through resource efficiency (betre) rural in East Sussex, England.'* Ackroyd, J; Jespersen, S; Doyle, A; and Phillips, P. *S. Resources, Conversation and Recycling, Volume 52, Issue 6, April 2008, Pages 897-898.*

and 487 tonnes of CO₂ per annum); plus (ii) £126,000 savings from avoided fines for non-compliance with environmental legislation.⁵³

1.3.11 UK: Plastic bag charge

What is the efficiency measure?

To reduce consumption of single-use plastic, the UK government introduced a new legislation in: (i) England requiring large retailers (with 250 or more employees) to charge 5p for all single-use plastic carrier bags from October 2015;⁵⁴ (ii) Scotland requiring large retailers to charge 5p for all single-use carrier bags (including non-plastic carrier bags) from October 2014;⁵⁵ and (iii) Wales requiring large retailers to charge 5p for all single-use carrier bags from October 2011.⁵⁶

In 2021, the charge was increased to 10p, and extended from large to all retailers in Scotland and England.^{57,58}

Large retailers are required to report data to their local authority on: (i) the number of bags supplied; (ii) the money raised via the charge; and (iii) where this money has gone. The charge is not a tax, and therefore the money raised via the charge does not go to the government. Retailers are expected to donate the money raised to good causes (especially environmental causes), however this is not mandated. Retailers are permitted to deduct a portion of the proceeds to account for any reasonable costs (incurred by following the law on charging).⁵⁹

Fines apply if retailers fail to: (i) charge for bags appropriately; (ii) keep records of the number of bags sold; (iii) supply records of the number of bags sold to government.⁶⁰ The fines payable vary from £100 to £20,000.

Defra have also produced free artwork for retailers to display in their stores.

Why was this measure used?

Prior to the mandatory charge on plastic bags, Defra, the British Retail Consortium and seven major supermarkets (Asda, Co-op, Marks & Spencer, Sainsbury's, Somerfield, Waitrose and Tesco) took part in a voluntary agreement between 2008 and 2009 to reduce single-use bags by 50% on the levels seen in 2006.^{61,62} The

⁵³ *'A critical appraisal of the UK's largest rural waste minimisation project: Business excellence through resource efficiency (betre) rural in East Sussex, England.'* Ackroyd, J; Jespersen, S; Doyle, A; and Phillips, P. *S. Resources, Conversation and Recycling, Volume 52, Issue 6, April 2008, Pages 903-904.*

⁵⁴ Available here: '<https://www.gov.uk/government/publications/single-use-plastic-carrier-bags-why-were-introducing-the-charge/carrier-bags-why-theres-a-5p-charge#:~:text=The%20scheme%20aims%20to%20reduce,supermarkets%20in%20England%20during%202014>'

⁵⁵ Available here: '<https://www.zerowastescotland.org.uk/litter-flytipping/carrier-bag-charge>'

⁵⁶ Available here: '<https://gov.wales/single-use-carrier-bags-charge-wales-amendment-regulations-2020>'

⁵⁷ Available here: '<https://www.gov.uk/government/publications/single-use-plastic-carrier-bags-why-were-introducing-the-charge/carrier-bags-why-theres-a-5p-charge#:~:text=The%20scheme%20aims%20to%20reduce,supermarkets%20in%20England%20during%202014>'

⁵⁸ Available here: '<https://www.mygov.scot/carrier-bag-charge#:~:text=By%20law%2C%20all%20retailers%20in,paper>'

⁵⁹ Available here: '<https://www.gov.uk/guidance/carrier-bag-charges-retailers-responsibilities>'

⁶⁰ Available here: '<https://www.gov.uk/guidance/carrier-bag-charges-retailers-responsibilities#how-much-you-can-be-fined>'

⁶¹ Available here: '<https://www.theguardian.com/environment/2010/aug/25/plastic-bag-use-plummets-supermarkets>'

⁶² Available here: '<https://www.theguardian.com/environment/2008/dec/18/plasticbags-waste>'

retailers implemented a number of measures to get their customers to reduce plastic bag consumption, including more clearly marketing Bags for Life, hiding bags at checkout, and setting their own reusable bag charges.⁶³

While this voluntary agreement did lead to a reduction in plastic bag consumption, the target of 50% was missed (reaching 37% below 2006 levels in 2009, and 43% in 2010).⁶⁴ Once the voluntary agreement ended data suggested that consumption of single-use bags began increased by 18% between 2009 and 2013.⁶⁵

As a result of this voluntary agreement failing to meet the target intended, the government set about mandating the use of single-use carrier bag charges as a financial disincentive to consumption.

The mechanism by which a bag charge alters consumer behaviour is not entirely clear across the literature – with some studies concluding that increasing the cost of a plastic bag changes consumers’ cost-benefit calculation; while others suggest it is a way of disrupting habit, and preventing automatic use of plastic-bags.⁶⁶

We consider that this measure creates the following incentives.

- First, and most obviously, for consumers, the bag charge creates a financial disincentive to consume plastic bags.
- Second, for retailers, the design of the measure creates incentives to ensure their customers reduce consumption of plastic bags. Specifically, there is a statutory incentive, in the form of the legislation requiring they charge for bag use. In addition, there are financial incentives to comply with this legislation in the form of fines payable for non-compliance, and the charge itself effectively funds the retailer to implement these changes (as they can recoup ‘reasonable costs’). Finally, there is also a reputational incentive to use the proceeds as intended – and donate this money to good causes. This reputational incentive results from retailers having to annually report their use of the money, with certain details being published online.

How effective is this measure?

The number of single use plastic bags sold has reduced from 2.21 billion in 2016-2017, to 488 million in 2020-21. Overall, the number of bags sold has dropped by more than 95% since the charge was introduced in 2015. The number of single use plastic bags sold by all reporting retailers, per person of the population has reduced from 38 in 2016-17 to 9 in 2020-21. Further, the total amount donated to good causes as a result of the charge has totalled £178 million since the charge was introduced.^{67,68}

⁶³ Available here: '<https://www.bbc.co.uk/news/uk-11084876>'

⁶⁴ Available here: '<https://www.bbc.co.uk/news/uk-11084876>'

⁶⁵ Available here: 'https://www.legislation.gov.uk/uksi/2015/776/pdfs/uksiem_20150776_en.pdf'

⁶⁶ Available here: '<https://www.frontiersin.org/articles/10.3389/fpsyg.2019.00266/full>'

⁶⁷ Available here: '<https://www.gov.uk/government/news/plastic-carrier-bag-sales-slashed-by-more-than-95-since-5p-charge-introduced>'

⁶⁸ Available here: '<https://www.gov.uk/government/publications/carrier-bag-charge-summary-of-data-in-england/single-use-plastic-carrier-bags-charge-data-for-england-2020-to-2021>'

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