National Audit Office

Report
by the Comptroller
and Auditor General

Department for Business, Energy & Industrial Strategy

Rolling out smart meters

HC 1680 SESSION 2017–2019 23 NOVEMBER 2018

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Department for Business, Energy & Industrial Strategy

Rolling out smart meters

Report by the Comptroller and Auditor General

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Sir Amyas Morse KCB
Comptroller and Auditor General
National Audit Office

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This report examines the Department for Business, Energy & Industrial Strategy's progress in rolling out smart meters

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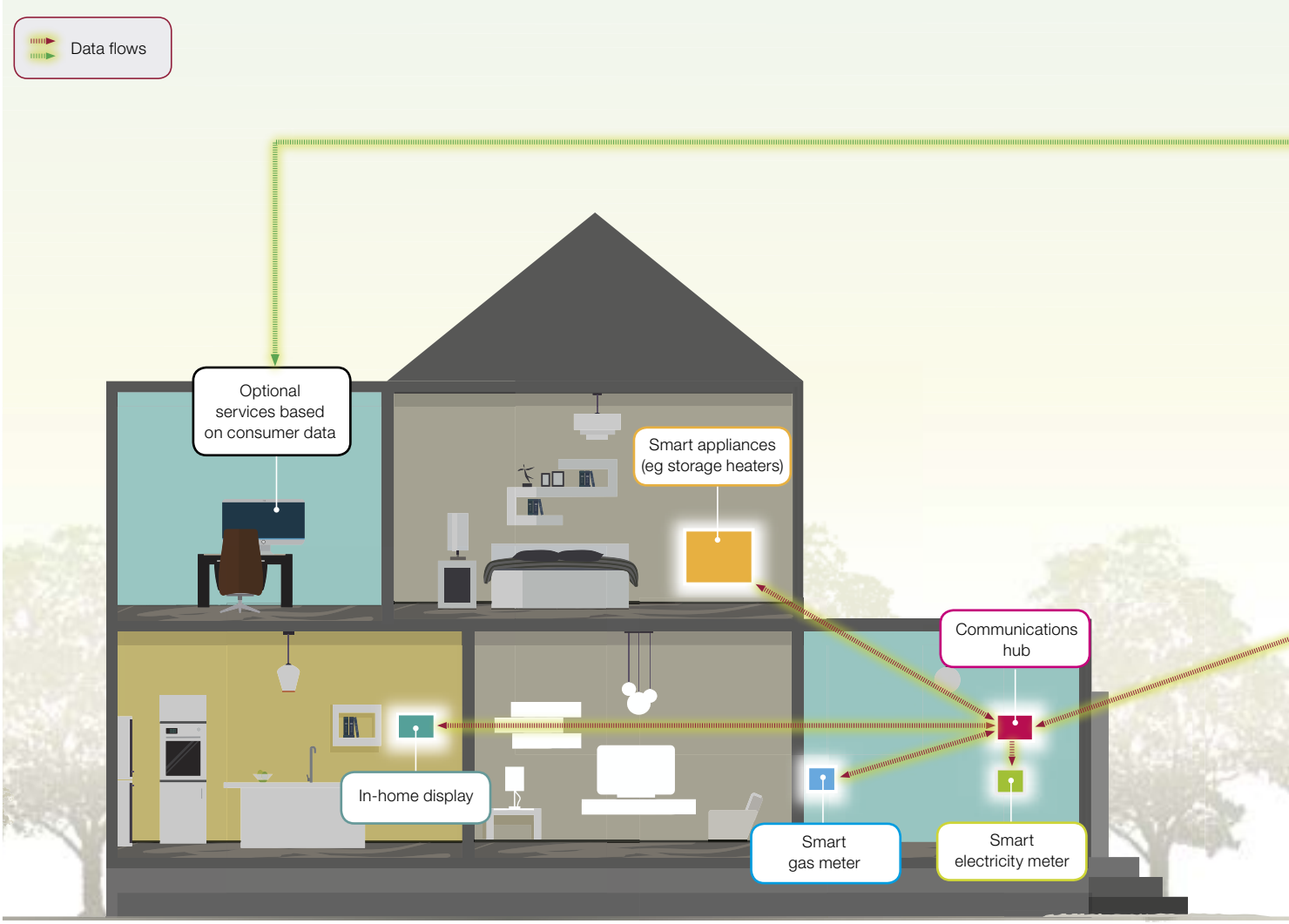
The smart metering system the Department intends to create

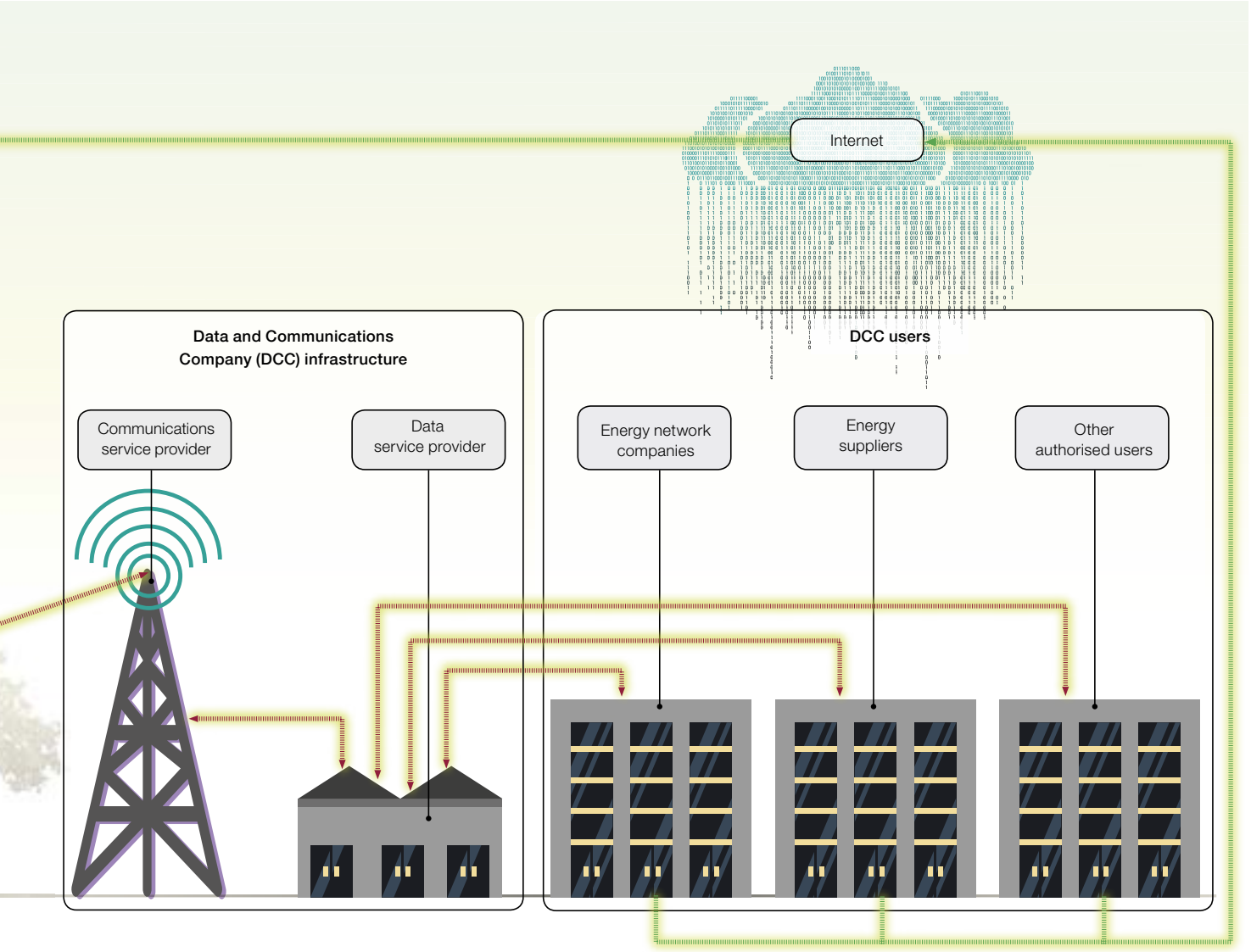
The system will link smart devices in consumers' homes to energy suppliers and other organisations, via a central data and communications infrastructure



Note

1 In the Department's intended system, smart appliances will connect to the in-home smart metering set-up via a Consumer Access Device (CAD). These appliances can then be switched on and off automatically to take advantage of times when electricity is available at a discount.

Source: National Audit Office analysis


Internet
Data and Communications Company (DCC) infrastructure
DCC users
Communications service provider
Data service provider
Energy network companies
Energy suppliers
Other authorised users

Key facts

End of 2020

date by which energy suppliers must have taken all reasonable steps to install smart meters in all homes and small businesses

70%–75%

proportion of meters energy suppliers say they expect to replace with smart meters by the end of 2020

39 million

number of meters that have not yet been replaced with smart meters as of June 2018

12.5 million number of 'SMETS1' meters installed. The Department for Business, Energy & Industrial Strategy's (the Department's) original expectation was that these would be limited to 5.4 million ('SMETS' stands for Smart Metering Equipment Technical Specifications).

Around 70% proportion of SMETS1 meters that currently lose smart functionality when consumers switch supplier. The Department intends to resolve this issue.

£11.0 billion expected cost of the programme according to the Department's 2016 analysis.

£16.7 billion expected benefits from the programme according to the Department's 2016 analysis, implying net benefits of £5.7 billion.

£18 per year amount the Department expects dual fuel households will save on average because of smart meters. This is the combined result of smart meters adding £31 of cost but also creating £49 of cost savings.

2.1 million estimated number of households that do not recall being offered advice on how to save energy when their smart meter was installed.

Summary

1 Smart meters can record energy consumption in each half-hour period and communicate with energy suppliers and network companies. Because traditional meters are incapable of doing this, replacing traditional meters with smart meters is a necessary step towards enabling a future 'smart energy system': a system that uses information and communications technology to control electricity generation and use in near real-time to provide a more reliable and cost-effective electricity system. The government expects this to have significant economic benefits in the long term as renewable energy and electric vehicles become more widespread. In addition to enabling a smart energy system, the government sees smart meters as a way of reducing energy suppliers' costs and encouraging consumers to pay more attention to the energy they use, reduce energy consumption and increase competition in the market. (**Figure 1** overleaf).

2 In 2008, the Labour government announced its intention to mandate energy suppliers to install smart meters for their customers. Subsequent Coalition and Conservative governments have affirmed their commitment to the Smart Metering Implementation Programme. Although energy suppliers British Gas, First Utility and Utilita began installing smarter type meters on a voluntary basis in 2008–2009, these meters had varying functionality and data communications standards. The government decided that it was necessary to intervene, to set minimum standards for functionality and ensure that smart meters would support a future smart energy system. In addition, it wanted to ensure that energy suppliers would be able to operate meters installed by their competitors, rather than have to replace them when customers switched supplier.

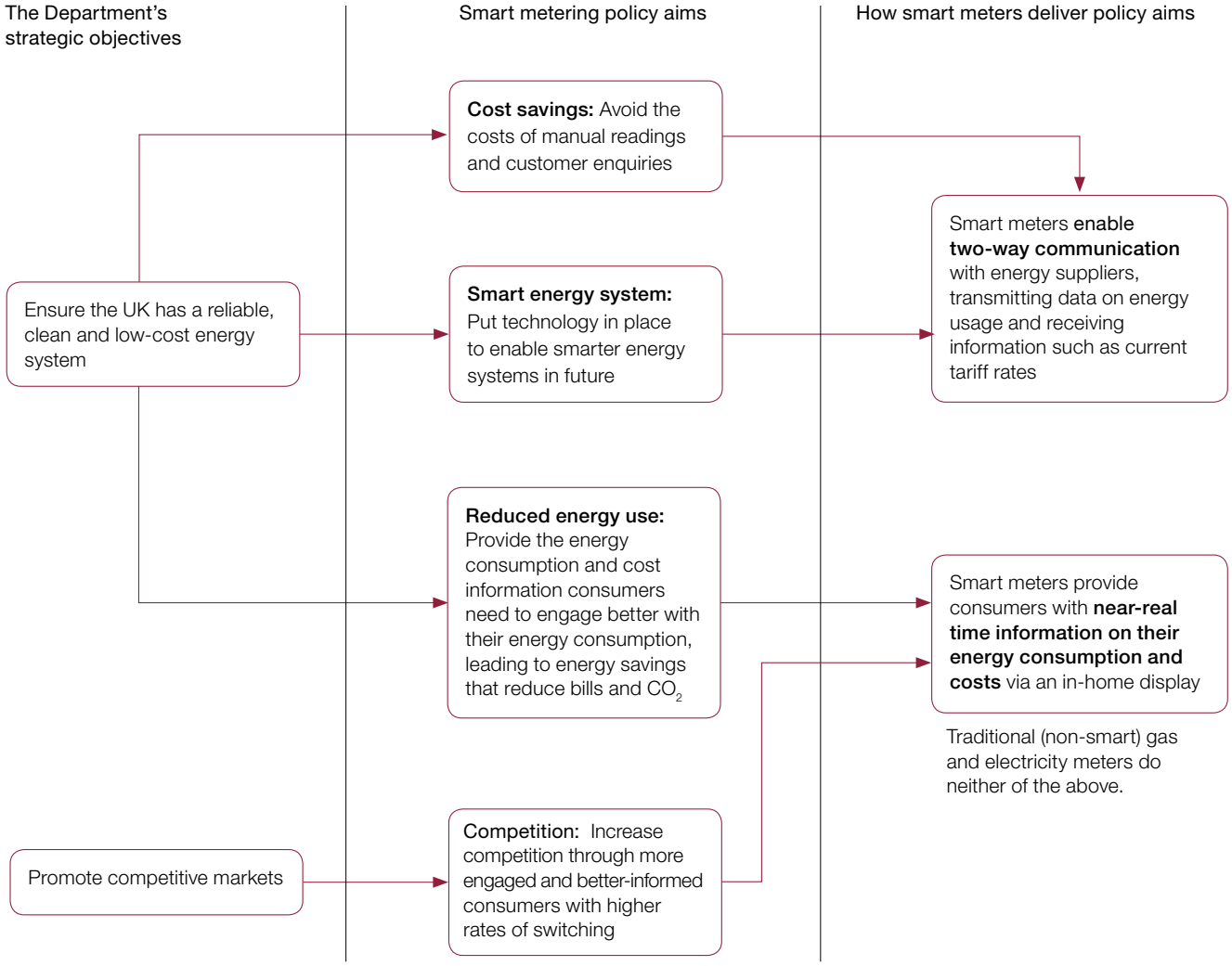
3 To make smart meters interoperable between energy suppliers, the government proposed to set new minimum standards for how they should work, and to connect them to a central data and communications infrastructure (the Data and Communications Company, or DCC). However, to accelerate the rollout, in 2012 it encouraged suppliers to start or continue installing smart meters before the central infrastructure was built. It did this so that consumers could benefit sooner from accurate billing and greater visibility of their energy use, and energy suppliers could prepare their business systems for mass rollout of smart meters.

4 In November 2012, the Department of Energy & Climate Change (the Department)[1] imposed a legal obligation on energy suppliers to take all reasonable steps to install smart meters in all homes and small businesses in Great Britain by 2019. In 2013, this deadline was pushed back to 2020. Ofgem will determine whether suppliers have met the obligation after 2020.

1 Throughout this report, we use "the Department" to refer to both the former Department of Energy & Climate Change, and its successor, the Department for Business, Energy & Industrial Strategy, which was formed in 2016.

Figure 1
The programme's policy aims

Smart meters are meant to help the Department for Business, Energy & Industrial Strategy (the Department) achieve two of its strategic objectives



Source: National Audit Office analysis of Department for Business, Energy & Industrial Strategy impact assessments

5 Some energy suppliers started installing smart meters in significant numbers in late 2012. These meters comply with the first version of the government-defined smart metering standards (the Smart Metering Equipment Technical Specifications version 1, or SMETS1). Energy suppliers were responsible for commissioning their own separate communications infrastructures for SMETS1 meters, prior to them being enrolled into the central communications infrastructure. The government's intention was that SMETS1 meters should only be installed until SMETS2 meters, which are designed to be interoperable from the point of installation, are ready to be deployed.

6 Although SMETS1 and SMETS2 meters appear similar to consumers, they differ in several respects. Currently, SMETS1 meters often lose smart functionality when consumers switch supplier because the new supplier is often unable to communicate with the meter. The Department stated in 2012 that SMETS1 meters would eventually be connected ('enrolled and adopted') into the DCC infrastructure to overcome this issue, and a solution for the first of three sets of SMETS1 meters is currently being tested. By contrast, SMETS2 meters are designed to be interoperable between energy suppliers from the point of installation. The Department also incorporated some additional functionality into the SMETS2 meter specification compared with SMETS1 to provide network operators with more information for managing the network, and give energy suppliers and consumers additional options for switching devices on and off to save money.

7 The Department has overall responsibility for the programme. It has taken, and continues to take, decisions that determine the high-level design of the smart metering system and the way smart meters are rolled out (**Figure 2** overleaf). Numerous private companies are responsible for implementing and operating parts of this system. The Department has to coordinate these organisations. They are incentivised through a regulatory framework that includes licences, codes and economic regulation of the monopoly company in charge of the DCC infrastructure (Smart DCC). This regulatory framework is enforced by the energy market regulator, Ofgem.

8 The Department forecast in 2013 and 2016 that the programme would require £11 billion of investment in installations, equipment and systems.[2] These costs will be met by energy companies rather than the government, then recovered from consumers through higher energy prices. The costs are equivalent to £374 per dual fuel household,[3] but these costs are expected to be more than offset by reduced energy consumption and operational cost savings for the industry. The Department assumes the latter will be passed on to consumers, although it has no way of assuring that this happens. The combination of industry cost savings and energy savings for consumers are expected to result in lower energy bills overall: according to the Department's 2016 modelling, households will save £18 a year on average between 2013 and 2030. Energy savings will also create environmental benefits for society. In 2013, the Department forecast that the total benefits of the programme would be £17.7 billion, creating net benefits of £6.7 billion. In 2016, it updated its analysis and forecast net benefits of £5.7 billion. The costs of the programme will mainly be incurred during the rollout phase, whereas most of the benefits will be spread over subsequent years (**Figure 3** on page 11). The benefits of the programme are therefore more uncertain than its costs. There is already some evidence that costs were underestimated in the 2016 analysis.

2 Unless otherwise stated, we use 2011 prices throughout this report because that is the price base the Department uses in most of its published analysis of the programme.
3 A dual fuel household has one gas and one electricity meter.

Figure 2

Key smart metering decisions taken by government

Date	Decision
Oct 2008	The government announces its intention to mandate the rollout of gas and electricity smart meters to all households in Great Britain as part of the passage of the 2008 Energy Bill.
Dec 2009	The Department for Business, Energy & Industrial Strategy (the Department) decides on a smart metering delivery model whereby energy suppliers (rather than network operators) will be responsible for procuring, installing and operating smart meters; and data and communications services will be provided by a central Data and Communications Company (DCC).
Jul 2010	Ofgem and the Department set out a high-level plan for the smart metering programme for consultation in a draft Prospectus.
Mar 2011	Ofgem and the Department publish their response to the Prospectus consultation. This set out a staged approach to rollout, which included an initial phase where first generation (SMETS1) meters, that met minimum standards and functionality, would be rolled out ahead of the main rollout phase involving second generation (SMETS2) meters.
Apr 2011	The Department starts the first stage of smart metering.
Apr 2012	The Department designates the first version of the Smart Metering Technical Specifications.
Nov 2012	The Department modifies energy suppliers' licences to impose an obligation on them to take all reasonable steps to install smart gas and electricity meters in all homes and small businesses in Great Britain by 2019.
Jan 2013	The Department publishes the draft second version of the Smart Metering Equipment Technical Specifications (SMETS).
Apr 2013	Ofgem designates the Smart Metering Installation Code of Practice (SMICoP). The Code regulates the process that energy suppliers must follow when installing meters in consumers' homes.
Jun 2013	The Department required energy suppliers to create a central delivery body to raise public awareness of smart meters (Smart Energy GB). This was set up in June 2013.
Sep 2013	Following a competitive tendering process, the Department appoints the DCC and its data and communications service providers.
Sep 2013	The Department designates the first version of the Smart Energy Code (SEC) – an agreement that defines the rights and obligations of industry parties involved in smart metering.
Mar 2015	The Department directs the DCC to assess the feasibility of options for enrolling SMETS1 meters into its system.
Jul 2015	The Department proposes an end date of August 2017 after which the installation of SMETS1 meters would no longer count towards suppliers' rollout obligations. The Department subsequently extends this end date four times: to October 2017 in December 2015; to July 2018 in August 2017; to October 2018 in January 2018; and to December 2018 in July 2018.
Apr 2018	The Department consults on options to enrol and adopt some SMETS1 meters into the DCC. It published its response to the consultation in October 2018.

Note

1 SMETS stands for Smart Metering Equipment Technical Specifications.

Source: National Audit Office analysis

Figure 3

Timing of the expected costs and benefits of the programme, as estimated by the Department for Business, Energy & Industrial Strategy (the Department) in 2016

The costs of the programme become certain before its benefits

	Costs	Benefits
Short term (2012–2020)	**Meters, other equipment, and installations** £6.5 billion (of which only £2.1 billion will be paid for by energy suppliers before 2021)[1]	**Energy savings** £1.5 billion **Industry cost savings** £2.2 billion
	Data and Communications Company (DCC) costs £1.0 billion	**Increased competition between suppliers** Unquantified
	Energy supplier IT costs £0.5 billion	
	Other costs £0.8 billion	
	Total costs that become certain in the short term £8.8 billion (of which only £4.3 billion will be paid for by energy suppliers before 2021)[1]	**Total benefits that become certain in the short term** £3.7 billion
Medium term (2021–2030)	**DCC costs** £1.0 billion	**Energy savings** £5.2 billion
	Energy supplier IT costs £0.5 billion	**Industry cost savings** £7.8 billion
	Other costs £0.7 billion	**Increased competition between suppliers** Unquantified
	Total costs that become certain in the medium term £2.2 billion	**Total benefits that become certain in the medium term** £13.0 billion
Long term (2021–2050)	**Smart energy system** The potential benefits of a smart energy system were not included in the programme's value-for-money case. These are estimated at up to £38 billion by 2050, but require further investments (beyond smart meters) of up to £18 billion.	

Notes

1 Energy suppliers are using finance to spread the costs of meters, other equipment and installations across the lifetime of the equipment. In this table, we show these costs become certain before 2021 because that is when the meters will be purchased and installed. However, due to energy suppliers' financing arrangements, consumers will not have to pay for all of these costs before 2021.

2 The figures in this table are based on the Department's latest (2016) estimates. Actual costs and benefits are likely to differ from these benefits (as discussed in Part Two). All values are in 2011 prices and discounted to a base year of 2016. Due to rounding, not all totals sum.

Source: National Audit Office analysis of the Department's 2016 cost-benefit analysis for the programme

9 We previously reported on the Smart Metering Implementation Programme in 2011 and 2014.[4] This report examines:

- progress with rolling out smart meters (Part One);
- the programme's value-for-money case (Part Two); and
- the government's approach to monitoring, reporting, assurance and risk management for the programme (Part Three).

Our audit approach is set out in Appendix One and our methods are set out in Appendix Two.

Key findings

Progress with rolling out smart meters

10 The rollout of SMETS2 meters started later and more slowly than the Department expected. In March 2011, the Department decided it would take a staged approach to rolling out smart meters. In the first stage, it encouraged energy suppliers to install SMETS1 meters. At that time, it expected that suppliers would be able to move onto the second stage, installing SMETS2 meters, by June 2014. In practice, the first SMETS2 meter was installed in July 2017. It took another 10 months for the first 10,000 SMETS2 meters to be installed. The delays are partly attributable to the requirements and technical specifications for the DCC and SMETS2 becoming more complex than the Department or Smart DCC anticipated. Another significant cause of delay is that Smart DCC took longer than planned to resolve the defects in its system to the satisfaction of the Department and energy suppliers. As of the beginning of November, 109,000 SMETS2 meters had been installed (paragraphs 1.7, 1.8, 1.14 to 1.18, and Figure 8).

4 Comptroller and Auditor General, Department of Energy & Climate Change, *Preparations for the roll-out of smart meters*, Session 2010-11, HC 1091, National Audit Office, June 2011; Comptroller and Auditor General, Department of Energy & Climate Change, *Update on preparations for Smart Metering*, Session 2014-15, HC 167, National Audit Office, June 2014.

11 Energy suppliers have installed over 7 million more SMETS1 meters than the Department planned, presenting risks and challenges for the programme. The unintended consequence of the Department's staged rollout strategy, combined with delays implementing SMETS2 and the DCC, was that 12.5 million SMETS1 meters were installed while SMETS2 was being developed, compared with the 5.4 million expected in the 2013 business case. The mass rollout of SMETS1 meters has enabled consumers to experience some of the benefits of smart meters earlier than they otherwise would have. However:

- Currently, around 70% of SMETS1 meters 'go dumb' when consumers switch supplier because the new supplier is unable to communicate with the meter. As of the end of June 2018, around 943,000 smart meters were operating in dumb mode. This means that many consumers will face a choice between remaining with a more expensive tariff or losing the benefits of their smart meter. This risks undermining the government's aim of increasing the number of consumers switching energy supplier to ensure that consumers get value for money.
- SMETS2 meters have some additional functions that SMETS1 meters lack. The Department says that SMETS1 meters can be used to achieve the same benefits as SMETS2 meters but:
    - network companies have said it is uncertain whether SMETS1 meters can provide the full network benefits provided by SMETS2 meters; and
    - the additional options provided by SMETS2 meters for switching devices on and off may become important to consumers in future, because they may help consumers with heat pumps and electric vehicles to save money.

(Paragraphs 1.25 to 1.29, 1.32, 2.21, and Figure 11).

12 The Department has not yet attempted to enrol SMETS1 meters within the DCC infrastructure. The target dates for this have been pushed back, and it is not certain that it will work as intended. The Department has always planned on enrolling SMETS1 meters to make them fully interoperable. But this is technically challenging and the solutions are still being tested or in development. The target start date for enrolment has been pushed back from November 2018 to May 2019 and there is a risk of further delay. The Department's assumption for the purposes of cost–benefit modelling is that 2% of the first two thirds of SMETS1 meters will not be successfully enrolled but some stakeholders told us that significantly more could fail. Furthermore, the Department has not yet decided if it will attempt to enrol all makes of SMETS1 meter. Therefore, the Department should be cautious about suggesting that the successful enrolment and adoption of all SMETS1 meters is inevitable (paragraphs 1.10, 1.30 and 1.31, and 2.37 to 2.39).

13 It may take years before we know if the SMETS2 system works in its entirety. While the core communications infrastructure has been implemented and shown to work with a range of meters, it may take years before we know if the SMETS2 and DCC system works in its entirety. The system consists of many interacting components, several of which are still being tested or have not yet been deployed or developed.

- As yet, no suppliers are offering prepayment functionality to those customers who have had SMETS2 meters installed. One in six customers prepay for their electricity. Until March 2019, energy suppliers can offer these customers SMETS1 meters instead, which have working prepayment functionality.
- The devices suppliers are currently deploying can only connect smart meters to in-home displays in up to 70% of premises. In spring 2019, the Department expects the industry to begin rolling out new technology that is intended to increase this to between 95% and 96.5% of premises. The technology that will be required for the final 3.5% to 5% of premises is still being developed.
- Only 3,000 of the 109,000 SMETS2 meters deployed so far have been installed in the North of England and Scotland because of problems integrating smart meters with the DCC infrastructure in those regions.

(Paragraphs 1.18, 1.22 to 1.24, and Figures 9 and 10).

14 The number of smart meters installed by 2020 will fall materially short of the Department's original ambitions. The Department originally aimed for all consumers to have a smart meter by 2020. Suppliers' licences require them to submit ambitious rollout plans to Ofgem annually, which must either aim for 100% rollout by 2020 or explain why this cannot reasonably be achieved. In the most recent set of plans accepted by Ofgem, energy suppliers have said they will only be able to install smart meters in around 70% to 75% of homes and small businesses by 2020. Suppliers attribute this to limited consumer interest and delays to SMETS2. Actual rollout by 2020 may fall short even of these estimates if the DCC infrastructure encounters further problems or if suppliers encounter further difficulty persuading consumers to accept installations. The Department's calculations suggest that each year of delay in completing the rollout reduces net benefits by around £150 million. This is because a slower rollout results in both costs and benefits being deferred (paragraphs 1.6, 1.36 and 1.37; and Figure 12).

15 The Department decided it would accelerate the rollout without making an economic assessment of the implications of this strategy. The Department told us its strategy of accelerating the rollout, by encouraging suppliers to install SMETS1 meters, allowed consumers and industry to experience some of the benefits of smart meters early. But the most significant benefits enabled by smart meters are expected to be achieved in the long term and therefore did not require an urgent rollout. These 'smart energy system' benefits will be realised between 2020 and 2050, subject to significant additional investments being made in smart power technology (paragraph 1.33 and Figure 2).

16 The 2020 target increases risk to the value for money of the programme. Because the start of the SMETS2 rollout was significantly delayed, the Department's sticking to its target of ensuring that all homes are offered a smart meter by 2020 puts significant timetable pressure on the programme. This increases the risk of cost escalation and/or technology being rolled out before defects have been addressed, both of which would undermine the value for money of the programme for consumers. The Department's view is that without maintaining its clear commitment to the 2020 end date, energy suppliers would have continued to underinvest in the rollout while repeatedly arguing for more time (paragraph 1.35).

The programme's value-for-money case

17 The costs of the programme have increased by at least £0.5 billion since the Department's last forecast and could increase further. The Department's 2016 cost–benefit analysis did not include the costs of the technical solutions for providing smart meters to the final 3.5% to 5% of properties because of lack of available information. The latest information suggests that this will add at least £0.2 billion to programme costs. Smart DCC is currently forecasting that its costs to 2025 will be £0.3 billion higher than the Department expected. The £0.5 billion increase in costs is equivalent to £17 per dual fuel household (in total, rather than annually) on top of the £374 per dual fuel household implied by the Department's 2016 cost–benefit analysis. This is a conservative estimate. It does not include the direct marketing and consumer engagement costs energy suppliers are incurring to persuade consumers to accept smart meter installations, which for some suppliers are significant. Costs will increase further if SMETS1 meters require replacement, or if the cost of installing smart meters, which in 2017 was 50% higher than the Department forecast, does not come down (paragraphs 2.23 to 2.39; and Figures 16, 17 and 18).

18 On the benefits side, it is currently uncertain whether the industry cost savings forecast by the Department will materialise. The Department expects the industry to save money from smart meters and pass these savings on to consumers, offsetting around two-thirds of the estimated £11 billion cost of the rollout. The cost savings are expected to come from various changes including energy suppliers being able to reduce the size of the call centres they need to help customers (£1.2 billion of savings), and network companies being able to use data from smart meters to manage their operation of the network more efficiently (£0.9 billion of savings). However, some of these prospective savings may yet fail to materialise. Energy suppliers and network companies will need to achieve savings within a mixed SMETS1 and SMETS2 system, which will be more difficult than achieving those savings in a system that is almost entirely SMETS2-based (with only 5.4 million SMETS1 meters), as the Department originally envisaged (paragraphs 2.14 to 2.21, and Figure 18).

19 Even if energy suppliers do reduce their costs, the Department has no way of proving that cost reductions are passed on to consumers. The Competition and Markets Authority (CMA) has investigated competition in the energy market and told us that, although suppliers charge higher prices than they would in a perfectly competitive market, it is reasonable to believe that energy suppliers will pass on cost savings from smart meters to consumers. However, the Department has no way of assuring consumers that this is happening in practice (paragraph 2.17).

20 Most consumers who have smart meters are satisfied with them, but most suppliers have found it harder and more expensive than expected to arrange installations with consumers. According to a Departmental survey, 74% of consumers who have received smart meters are satisfied with them and, according to Smart Energy GB, 48% of consumers say they would like to get them in the next six months. However, in practice, most energy suppliers have found it difficult to arrange installations with consumers because even customers who say they want a smart meter may treat it as a relatively low priority. The Department says it is facilitating the sharing of best practice between energy suppliers to help them secure installations. Some suppliers told us they are having to spend significant amounts on consumer engagement and direct marketing activity. If this expenditure were to be replicated across the energy market, we estimate that suppliers could spend around £200 million to increase consumer demand for installations. The Department did not include these costs in its business case (paragraphs 1.19, 1.20, 2.8, 2.33 and 2.34).

21 An estimated 2.1 million of the households that have been provided with a smart meter do not recall being offered advice on saving energy. Evidence from trials of smart meters showed that giving consumers advice on how to save energy can boost the savings they achieve when using smart meters by up to two thirds. Although energy suppliers have an obligation to offer this advice at the point of installation, it is frequently not offered. The Department has undertaken work to enable the sharing of good practice in this area, and since the beginning of 2018 performance has been improving, particularly among the worst-performing suppliers. Although this is a positive step, improvements will need to go much further if the Department is going to maximise energy savings: according to the most recent data, large energy suppliers are still failing to provide advice to some 27% of consumers (paragraph 2.7 and Figure 15).

22 The Department has tried to 'future proof' the smart metering system for the next 15 years, but it is difficult to predict what will happen over that period. The Department assumes that smart meters will not be replaced for at least 15 years. It recognises that, over that period, there is likely to be innovation in the range of smart household devices on offer to consumers. The Department has therefore taken steps to future-proof the smart metering system, for example by ensuring that smart meters will be able to send their data to other (newly invented) devices via a consumer access device.[5] However, it is difficult to predict what innovation will happen over the next 15 years, and there is inevitably a residual risk that the Department's smart metering system could be a factor that limits the range of 'smart home' benefits consumers can enjoy in future (paragraphs 3.15 and 3.16).

5 A consumer access device takes real time energy and pricing data from smart meters and uses it to help control devices in the home (for example, running appliances when electricity is cheap).

The government's management of the programme

23 The Department's monitoring of the programme is extensive, although we have identified some important gaps in its monitoring information. The programme is funded with consumers' money rather than from government spending, and this makes it even more important for the Department to adopt high standards of cost monitoring. The Department regularly collects information on costs, consumer experience and rollout progress, and it has comprehensively assessed the costs of the programme several times. However, the last such assessment was in 2016, and so the total costs of the programme are currently unclear. In addition, it is not collecting data on energy suppliers' costs of marketing smart meters, and it is not systematically monitoring energy savings. The Department says it is planning on performing a new cost–benefit analysis in 2019 and analysing more information on energy savings (paragraphs 3.3 to 3.7).

24 The Department has taken an optimistic view of the risks and challenges presented by SMETS1 meters. Submissions from programme officials to the Department's board and ministers have consistently stated that SMETS1 meters will be enrolled onto the DCC in 2018 to solve interoperability problems. In the written submissions, we did not find any evidence of the Department acknowledging the difficulties of enrolment and adoption until March 2018, when it was described as "technically and commercially complex". In its external communications, the Department has stated that all smart meters will retain smart functionality when they are enrolled, and that this upgrade will begin by the end of 2018. In practice, the start of enrolment is expected to be delayed until May 2019 and for some smart meters it may not be successful (paragraphs 1.10, 3.8 to 3.10).

25 Compared with other consumer-funded energy schemes, HM Treasury has less oversight of the smart metering programme. HM Treasury approved the full business case in 2013. Since then, it has received updates on the programme from the Department and receives assurance reviews from the Infrastructure and Projects Authority. However, the Major Projects Review Group, a joint HM Treasury and Infrastructure and Projects Authority body, has not reviewed the programme since 2012. Furthermore, the Committee of Public Accounts recommended that all consumer-funded energy schemes should have an HM Treasury representative on the main responsible board. While the Department and HM Treasury have implemented this recommendation for other schemes, they have not done so for smart meters. This is because the Department considers the smart metering programme to be an industry change programme, not a consumer-funded energy scheme. Although the programme is being delivered by the industry, it has been designed and driven by the Department, and the Department's decisions affect consumer costs. Therefore, we do not consider there to be a compelling reason for HM Treasury to have less oversight of smart meters than of other consumer-funded energy schemes (paragraphs 3.11 to 3.14).

Conclusion on value for money

26 The Department acknowledges that, notwithstanding the industry and other bodies involved, it is responsible for the overall success of Smart Meters. While recognising the team's achievements so far, we urge them to make sure the team culture does not become defensive, and resistant to inconvenient truths.

27 The facts are that the programme is late, the costs are escalating, and in 2017 the cost of installing smart meters was 50% higher than the Department assumed. 7.1 million extra SMETS1 meters have been rolled out because the Department wanted to speed up the programme. The Department knows that a large proportion of SMETS1 meters currently lose smart functionality after a switch in electricity supplier and there is real doubt about whether SMETS1 will ever provide the same functionality as SMETS2. The full functionality of the system is also dependent on the development of technology that is not yet developed.

28 The facts summarised above, and many more, are not fatal to the viability and value for money of the programme. However, there are serious issues that need to be addressed if Smart Meters is to progress successfully and deliver value for money.

Recommendations

29 The Department should:

a as part of its upcoming work to update its cost–benefit analysis, assess the value for money of leaving the 2020 deadline in place compared with adopting a new deadline;

b over the course of 2019, clarify for the industry what the smart metering policy landscape will look like beyond 2020;

c draw up contingency plans for maximising value for money in scenarios where the DCC and SMETS2 system encounters further delays or cost increases and SMETS1 meters are unable to enrol within the DCC;

d commission an expert independent review of testing, focused on determining whether energy suppliers are testing a sufficient cross-section of smart metering set-ups and scenarios (including change of energy supplier and swapping smart metering equipment) to provide reasonable assurance that the SMETS2 system will work as intended for all consumers;

e by early 2019, launch research to assess the potential impact of additional forms of energy efficiency advice and feedback to consumers, and consider whether new requirements should be introduced to support benefits realisation; and

f systematically monitor the actual energy savings that smart meters achieve and continue to assess the delivery of key consumer engagement activities, intervening if necessary.

30 Ofgem should:

a work with the CMA as part of its review of the prepayment price cap to understand the impact of SMETS1 meters on competition, and set out how issues will be addressed;

b work with the Department to improve the transparency of DCC costs, both for price control and for public and parliamentary scrutiny; and

c ensure, by March 2019, that no energy suppliers are falling materially short of their obligation to provide advice on energy efficiency.

Part One

Progress with rolling out smart meters

1.1 This part of the report sets out:

- the aims of the Smart Metering Implementation Programme;
- the government's strategy for rolling out smart meters;
- the roles and responsibilities of the main participants; and
- progress with the rollout of smart meters so far.

Aims of the programme

1.2 The strategic objectives of the Department for Business, Energy & Industrial Strategy (the Department) include ensuring that the UK has a reliable, clean and low-cost energy system, and promoting competitive markets. The Department aims to use the smart metering programme to:

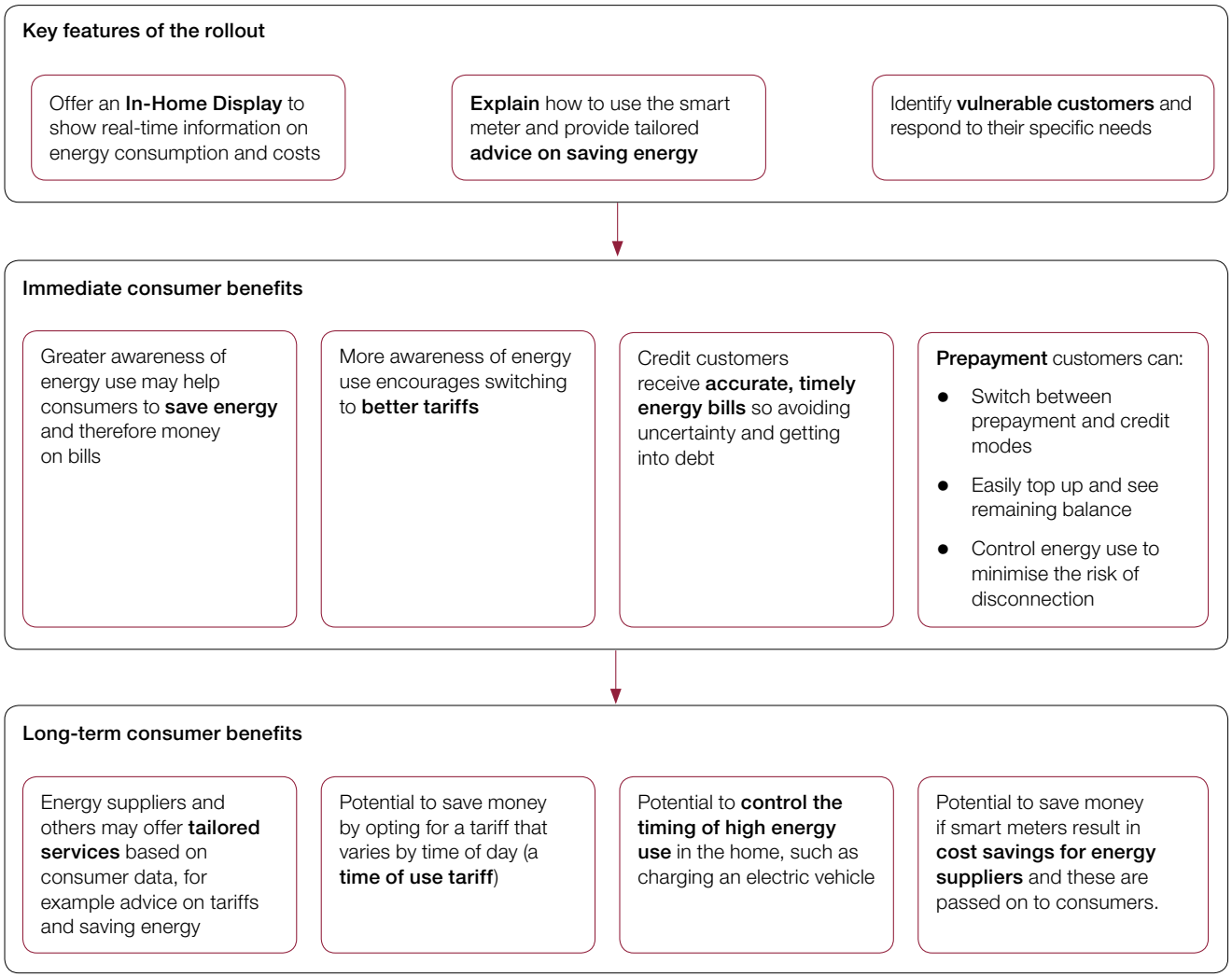
- put in place the technology needed within the home to enable smarter energy systems;
- provide the information on consumption and cost that consumers need to engage better with their energy use, so that they can reduce consumption, bills and carbon emissions;
- avoid the costs of manual meter reading and complaints about billing, and improve customer service by energy suppliers; and
- increase competition between energy suppliers by helping consumers to become better informed and engaged.

1.3 The Department expects consumers to benefit from smart meters in several ways (**Figure 4**).

Figure 4

Key features and benefits of the rollout for consumers

Smart meters are expected to provide consumers with several different benefits



Source: National Audit Office analysis

Government mandate and 2020 target

1.4 In 2008, the Labour government announced its intention to mandate energy suppliers to install smart meters across Great Britain.[6] Sweden had already started rolling out smart electricity meters in 2003 and, from 2006, the European Union (EU) used legislation to encourage all EU countries to do the same.[7]

1.5 The 2010 Coalition Agreement included a commitment to roll out smart meters and, in 2012, the Department modified energy suppliers' licences to impose an obligation on them to take 'all reasonable steps' to install smart meters in all homes and small businesses by the end of 2019. In 2013, the Department amended this obligation to move the deadline to 2020 (**Figure 5**). Although the government expects smart meters to bring significant benefits to consumers and the energy system, consumers can decide not to have them installed.

1.6 Neither Ofgem nor the Department has provided a fixed definition of what constitutes 'all reasonable steps'. Ofgem says the meaning of the obligation is 'dynamic'. That is, suppliers need to continually monitor and adapt their rollout plans in the light of experience and wider developments. Ofgem will only decide whether suppliers have met the obligation when considering compliance after the 2020 deadline has passed. To monitor whether suppliers are on track to take all reasonable steps, Ofgem requires energy suppliers to submit rollout plans annually, which must either aim for 100% rollout by 2020 or explain why 100% cannot reasonably be achieved. Larger suppliers agree binding annual rollout targets. Ofgem provides feedback on their plans, challenges their data and in some cases asks for resubmissions. In cases where Ofgem has concerns, it will discuss these with suppliers on a more frequent basis.

6 Northern Ireland is not covered by the Department's smart metering programme. Energy metering is a devolved matter for the Northern Ireland Executive.

7 Directive 2006/32/EC instructed EU countries to implement smart metering "so far as it is technically possible, financially reasonable and proportionate". Directives 2009/72/EC and 2009/73/EC instructed EU countries to roll out smart meters unless a cost–benefit analysis showed that there was not a positive economic case for them. The legislation called for rollout of smart electricity meters to 80% of consumers by 2020, but no deadline was set for smart gas meters. Some EU countries found that the economic case for smart metering was not positive and have chosen not to implement them, while others (such as Germany) have opted to roll out smart meters only to a subset of consumers who are more likely to benefit financially. A comparison of smart metering in Great Britain with other countries is set out in Appendix Three.

Figure 5
Commitments to smart metering

The government has made several commitments to roll out smart meters and imposed an obligation on energy suppliers to install them

2008	The government announced its intention to mandate electricity and gas smart meters for all households. No deadline is set.
2010	The Coalition Agreement states "We will establish a smart grid and roll out smart meters." No deadline is set.
2012	The Department for Business, Energy & Industrial Strategy (the Department) modifies energy suppliers' licences to impose an obligation on them to take all reasonable steps to install smart gas and electricity meters in all homes and small businesses by the end of 2019.
2013	The Department finalises its business case and revises its timescales for the programme. It modifies suppliers' licence obligations to move the deadline from the end of 2019 to the end of 2020.
2013	The Department finalises its business case for the programme. This sets out the government's aim that all homes and small businesses should have a smart meter by the end of 2020.
2015	The 2015 Conservative Party manifesto states "We will ensure that every home and business in the country has a smart meter by 2020, delivered as cost-effectively as possible, so consumers have instant, accurate bills and can switch to an alternative provider within one day."
2017	The 2017 Conservative Party manifesto states "We will ensure that smart meters will be offered to every household and business by the end of 2020, giving people control over their energy bills that they have not had before."
2017	The Department's Single Departmental Plan states "We will ensure that every household and small business in the country has been offered smart meters by the end of 2020."

Source: National Audit Office analysis

The Department's rollout strategy

1.7 Although energy suppliers British Gas, First Utility and Utilita began installing smarter type meters on a voluntary basis in 2008–09, these meters had varying functionality and data communications standards. The government decided that it was necessary to intervene to set minimum standards for functionality and ensure that smart meters would support a future smart energy system. In addition, it wanted to ensure that energy suppliers would be able to operate meters installed by their competitors, rather than having to replace them when customers switched supplier. The Coalition government set out its high-level proposals for a smart metering programme in July 2010. To make smart meters interoperable between energy suppliers, the government proposed to set minimum standards for how they should work and connect them to a central data and communications infrastructure. However, to accelerate the rollout, the government decided it would allow suppliers to start installing smart meters before the central infrastructure was built. It wanted the rollout to be accelerated so that the benefits of smart meters could be realised as soon as possible, and so energy suppliers could learn from their early experiences.

1.8 In December 2012, the Department finalised the first version of its meter standards (the Smart Metering Equipment Technical Specifications version 1, or SMETS1). At the same time, it acknowledged that it would need to develop a second version of the standards, SMETS2, to ensure that meters were interoperable from the point of installation and could perform some additional functions. At around this time, some of the large suppliers began installing SMETS1 meters in significant numbers. The government encouraged energy suppliers to do this and allowed them to count SMETS1 meters towards their rollout obligations.

1.9 In 2013, following a competitive tendering process, the government awarded a licence to build and operate the Data and Communications Company (DCC) infrastructure to Smart DCC Limited, a legal entity wholly owned by Capita plc. The SMETS2 and DCC infrastructure are interdependent and developing them has required the government to coordinate energy suppliers, meter manufacturers, Smart DCC and others. While the DCC infrastructure has been in development, energy suppliers have commissioned their own separate communications infrastructures for SMETS1 meters.

1.10 The SMETS1 and SMETS2 systems differ significantly. As well as having separate infrastructures, they have been delivered through different commercial and regulatory models (**Figure 6** overleaf). Compared with SMETS1, the SMETS2 standard is designed to provide network operators with more information for managing the network, and to give energy suppliers and consumers additional options for switching devices on and off to save money. SMETS2 meters have also been designed with cryptographic capabilities intended to ensure that, although they are part of a highly centralised system, they can withstand cyber attacks. Since the beginning of the SMETS1 rollout, the Department has said that SMETS1 meters will eventually be "enrolled and adopted" onto the DCC infrastructure, resolving their interoperability problems. The technical solution for enrolling and adopting a first set of SMETS1 meters is currently being tested and the necessary system upgrades to support enrolment are expected to start this year. In October 2018, Smart DCC's expected date for enrolment to begin was pushed back from November 2018 to May 2019.

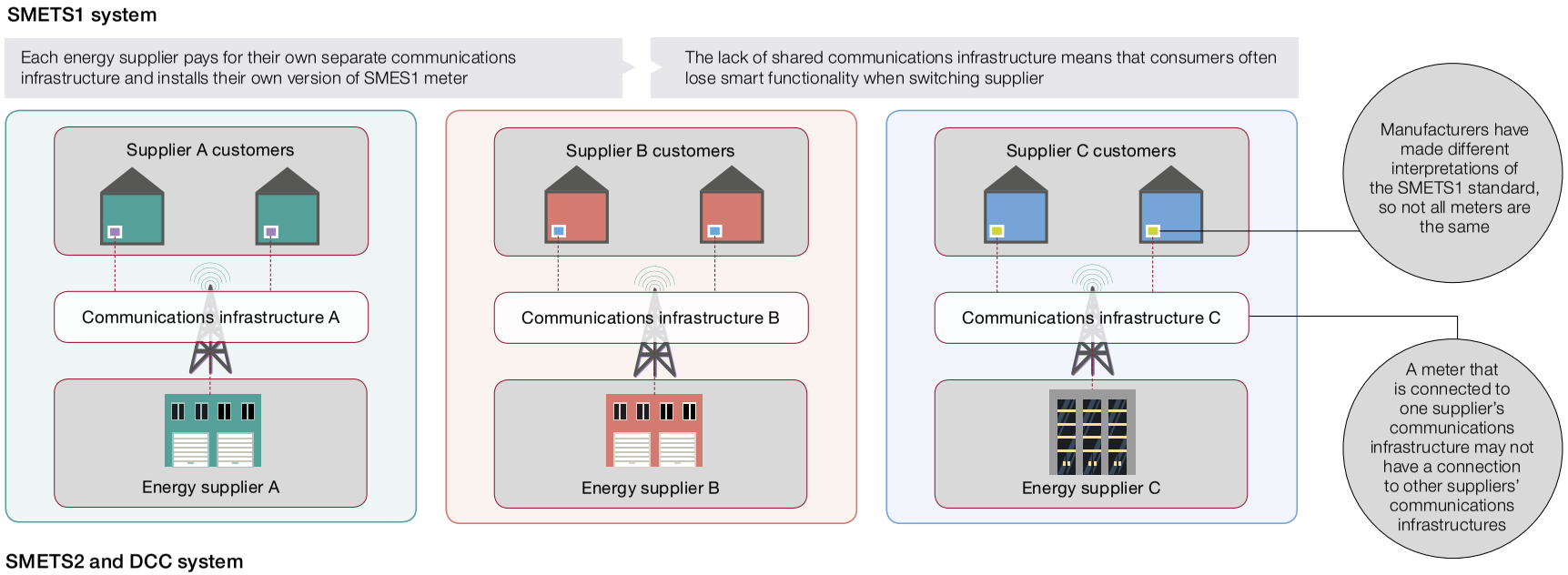
Delivery model

1.11 Following a consultation in 2009, the Department decided that energy suppliers should be responsible for procuring, installing and operating smart meters. Suppliers already had these responsibilities for traditional meters and the Department believed that a supplier-led approach to smart metering would be better for consumers because of the incentive for suppliers to provide a positive customer service. However, the supplier-led rollout model is complex to execute: there are now some 72 energy suppliers (there were 16 in 2012), with different business models and smart meter strategies. Competition law places limits around their ability to coordinate their rollouts. All energy suppliers are entitled to participate in the programme's governance and to contribute to the design of the smart metering system.

1.12 The Department decided to allow meter manufacturers to develop competing meter designs, as long as they met minimum standards. It may have been easier to achieve technical interoperability if the Department had instead mandated a single meter design.[8] The Department decided against this because it believed that a single meter design risked creating a single point of failure and stifling innovation in this area. It also believed that competition in meter designs would drive down costs.

8 Technical interoperability is one aspect of interoperability; others are commercial interoperability and data interoperability. A single meter design would not, on its own, ensure either commercial or data interoperability.

Figure 6
Comparison of SMETS1 and SMETS2 systems



Source: National Audit Office

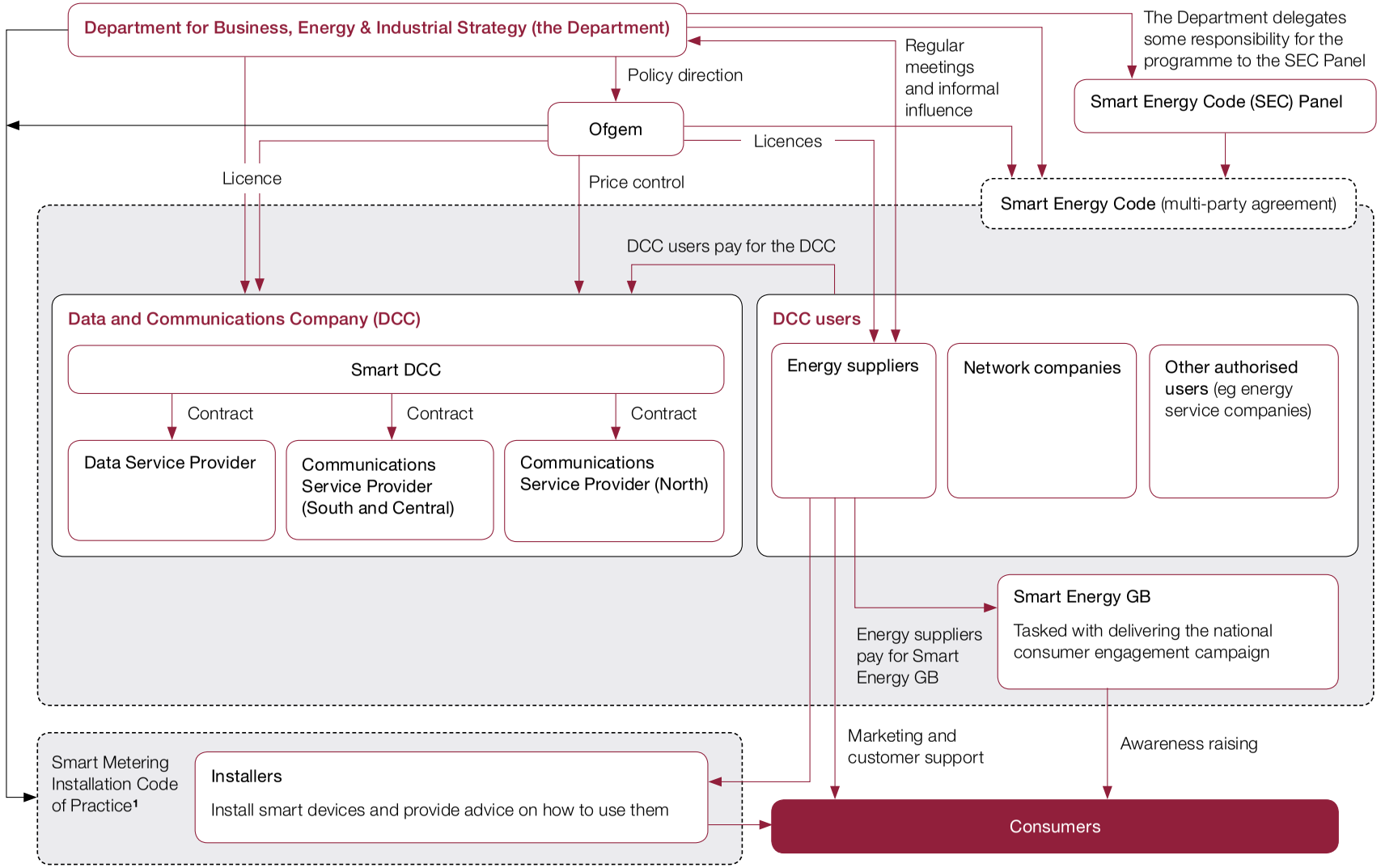
Roles and responsibilities

1.13 Numerous organisations are involved in the programme (**Figure 7** overleaf).

- **The Department** has overall responsibility for the programme, owns the policy and regulatory framework, and coordinates the various organisations involved. It has taken, and continues to take, decisions that determine the design of the smart metering system and the way smart meters are rolled out.
- **Smart DCC** is a wholly owned subsidiary of Capita plc, and is licensed and economically regulated by Ofgem. It is responsible for building and operating the DCC infrastructure, and for its interoperability between energy suppliers.
- Three main **service providers** are contracted with Smart DCC to provide the DCC's infrastructure (one to provide the central data infrastructure, and two others to provide communications infrastructures that connect to consumers' premises).
- Energy suppliers purchase meters from **meter manufacturers**.
- **Energy suppliers** can subcontract **installers** to install smart meters in customers' homes and give consumers advice on how to save energy.
- **Ofgem**, the energy market regulator, is responsible for holding suppliers to their rollout obligation and the economic regulation of the DCC. More generally, it is responsible for promoting competition and protecting consumers.
- **Smart Energy GB** is responsible for raising awareness of smart meters and building consumer confidence in them, as well as assisting vulnerable consumers.
- The **Smart Energy Code Panel** is a panel of representatives from various parts of the industry. It is responsible for administering the Smart Energy Code, an agreement relating to smart metering that the DCC, energy suppliers and other companies must be party to in order to operate in the energy industry. The Department uses the Code to orchestrate the rollout, and intends to eventually hand over operational responsibility for smart metering to the Panel.
- **HM Treasury** approved the Department's outline business case and full business case for the programme. It is responsible for controlling Departments' spending, including on consumer-funded schemes.
- The **Infrastructure and Projects Authority** (IPA) supports government departments in delivering their major projects, including helping to build capability, and in providing independent assurance of progress during the project delivery lifecycle.

Figure 7
Roles and responsibilities

Numerous organisations are involved in the programme



Note

1 The Smart Metering Installation Code of Practice (SMICoP) is an obligation on suppliers that specifies the minimum standards that must be followed when smart metering equipment is being installed.

Source: National Audit Office analysis

Progress with the rollout

1.14 In March 2011, the Department set out a high-level implementation plan for the programme (**Figure 8** overleaf). This strategy set out a staged approach to the rollout: in the first stage, energy suppliers would install SMETS1 meters. It aimed for energy suppliers to move on to the second stage, installing SMETS2 meters, once the DCC went live in June 2014. It aimed for the rollout to be complete by the end of 2019. In 2013, the Department finalised its business case and key milestones for the programme, and moved the rollout deadline to the end of 2020.

1.15 The DCC became operationally live in November 2016, two and a half years later than the Department expected when it formulated its 2011 plan, and 13 months later than it assumed in the 2013 full business case.[9] The main reasons for this were as follows:

- The initial procurement plan for the DCC proved over-ambitious and so the DCC licence was awarded later than originally expected.
- After the licence was awarded to Smart DCC in 2013, the requirements and technical specifications for the DCC infrastructure and SMETS2 meters became more complex. The Department therefore allowed the DCC to move implementation milestones back.
- During testing, it took Smart DCC longer than planned to resolve defects in the DCC infrastructure to the satisfaction of the Department and energy suppliers.

1.16 Smart DCC, its service providers and Ofgem all told us that neither the government nor bidders for the DCC licence anticipated how complex SMETS2 and the data and communications infrastructure would be. Smart DCC was not expecting to have to carry out so much work to integrate the components of the DCC or to integrate the DCC with energy suppliers' equipment and systems.

1.17 The expectation in the 2013 business case was that the transition to SMETS2 would happen following the DCC becoming operationally live in September 2015. In practice, the first live SMETS2 meter installation took place in July 2017 and the rate of installations was initially very low. By June 2018, the first 10,000 SMETS2 meters had been installed. The rate of installation of SMETS2 meters has continued to increase, with 109,000 SMETS2 meters operating as of the beginning of November 2018.

9 Although the DCC went live in November 2016, prepayment functionality was not supported until July 2017.

Figure 8
Progress against key milestones

The schedules for the programme set in 2011 and 2014 have proven over-optimistic

Milestone	Provisional target date[1]	Outturn/planned date at the time of National Audit Office's 2014 update report	Outturn/planned date as of November 2018
SMETS1 rollout commences	–	Apr 2011	
Establishing Smart Energy GB	Jan–Mar 2013	Jun 2013	
Appointing the Data and Communications Company (DCC) licensee	Oct–Dec 2012	Sep 2013	
Appointing the DCC's service providers	Jan–Mar 2013	Sep 2013	
Finalising of specifications for communications between SMETS2 meters and the DCC	Sep–Dec 2013	Jul 2014 (planned)	Sep 2017[2]
DCC operationally live	Apr–Jun 2014	Sep 2015 (planned)	Mostly achieved Nov 2016[3]
Mass rollout of SMETS2 meters starts[4]	Apr–Jun 2014	Sep–Dec 2015 (planned)	First meter installed in Jul 2017; 109,000 meters installed as of 7 Nov 2018
Transition to industry-led governance	–	Late 2015 (planned)	Underway, currently no end date for transition[5]
Mandated completion of rollout	End of 2019	End of 2020 (underway)	End of 2020 (underway)

Notes

1 Provisional target dates were set in March 2011 with the publication of the Department for Business, Energy & Industrial Strategy (the Department's) response to its programme prospectus consultation.

2 This is the date version 1 of the GB Companion Specification (GBCS) was finalised. The GBCS was required to enable mass rollout of SMETS2 meters. The GBCS had been baselined in late 2015 ahead of finalisation. This baselining, which was subject to change control, allowed the industry and smart metering stakeholders to start development of systems and devices before the DCC 'go live' date and formal finalisation in 2017.

3 The DCC met the definition of the 'go live' milestone set for it by the Department in November 2016, but support for prepayment meters was not delivered until July 2017.

4 The Department has never given a definition of 'mass rollout' in terms of a specific number of installations. The rate of installations has been gradually increasing since the first meter was installed in July 2017 and continues to increase.

5 Governance has been partially handed over to industry already. There is currently no threshold for the full handover of responsibilities. The Department intends to hand over governance in 2019 or 2020, but the Smart Meters Act 2018 extended the Department's powers to intervene in the programme as far as 2023.

6 SMETS1 stands for Smart Metering Equipment Technical Specifications version 1.

Source: National Audit Office analysis

1.18 Energy suppliers are currently testing their own systems and smart meters against the DCC, while they roll out SMETS2 meters. During this testing, defects with the DCC infrastructure are emerging and being resolved. As of September 2018, the DCC infrastructure had 131 open defects, none of which were critical.[10] Energy suppliers have also had to address issues with their own devices and systems. Current issues for Smart DCC and energy suppliers include the following:

- There have been problems integrating smart meters with the DCC infrastructure in the North of England and Scotland, although the network is now fully operational throughout the country. As of the beginning of November, 3,000 SMETS2 meters had been installed in the North region, compared with 106,000 in the rest of Great Britain.
- Suppliers are not yet operating SMETS2 meters in prepayment mode because they are still performing the testing required to confirm that customers with SMETS2 prepayment meters will receive a good service.
- Most SMETS2 consumers have been able to change energy supplier seamlessly. However, a small number have temporarily lost smart functionality when changing supplier – for example, when switching to a supplier whose systems are not yet integrated with the DCC network. The Department and the DCC are working to find solutions for the issues identified.

Consumer behaviour

1.19 Consumer behaviour has proven to be more of a barrier to mass uptake of smart meters than the Department anticipated. In its 2014 impact assessment, the Department included an initial estimate of £87 million for the potential costs of a national awareness-raising campaign for smart meters. This campaign would be carried out by a central delivery body (now known as Smart Energy GB). This estimate was subsequently increased to £192 million in the 2016 cost–benefit analysis. The Department made no provision in its estimates for the costs that energy suppliers might incur on marketing and consumer engagement.

1.20 In practice, energy suppliers have found it difficult to arrange installations with consumers. Although 48% of consumers say they want to get a smart meter in the next six months,[11] in practice, consumers who say they want a smart meter may still treat it as a relatively low priority. Energy suppliers cite consumer behaviour as one of the biggest challenges they face, and some suppliers told us they are spending significant amounts on getting their customers to accept smart meter installations. The Department says it is facilitating the sharing of best practice between energy suppliers to help them secure installations. Securing consumer uptake may become more challenging over time because it is likely that the consumers who have already accepted installations were among the easiest to persuade. We discuss this further in Part Two.

10 'Critical' defects are defects that block suppliers from using the DCC, or defects that could cause significant disruption or financial losses if left unresolved.

11 According to a survey conducted on behalf of Smart Energy GB.

Further technical developments required

1.21 The smart metering system requires further development before it can be offered to all the premises covered by the rollout obligation. The devices suppliers are currently deploying can only connect smart meters to in-home displays in up to 70% of premises. For the remaining 30%, enhanced technology is needed to ensure that smart meters and in-home devices can successfully communicate with each other over longer distances and through thick walls. Two sets of technology will need to be developed and deployed: dual band communication hubs (the prospective solution for an estimated 25% to 26.5% of properties) and alternative home area network (Alt HAN) technologies (the prospective solution for an estimated 3.5% to 5% – up to 1.5 million – of properties such as high-rise flats) (**Figure 9**).

- Smart DCC is responsible for procuring dual band communication hubs and upgrading the DCC infrastructure with a new software release to support the hubs. The Department expects energy suppliers to begin rolling out this equipment in spring 2019.
- The Alt HAN Company Ltd, which is jointly owned by energy suppliers, will deliver Alt HAN solutions. The Alt HAN Company is contracting with vendors groups to develop technology but has not yet chosen its preferred solutions. The timing, performance and cost of Alt HAN solutions are therefore uncertain at this point.

Assurance that the SMETS2 system will work

1.22 The SMETS2 system will consist of many components, operated by some 72 energy suppliers. Some of these, such as smart meters and in-home displays, are made by several different manufacturers (**Figure 10** on page 34). To ensure that all current and future components work together seamlessly, the Department has imposed technical standards across the system and mandated Smart DCC and energy suppliers to test parts of it.

1.23 According to the Department, the system is currently performing well. However, over time, as more energy suppliers roll out SMETS2 meters and customers with SMETS2 meters change energy supplier, new combinations of equipment will be made and energy suppliers will increasingly operate equipment installed by their competitors. Therefore, the Department's statement that the system is currently performing well does not necessarily provide us with assurance that it will continue to work well in future. It may be several years before we can be confident that the system works in its entirety.

1.24 The Department believes that energy suppliers are incentivised to ensure that the smart metering system works for their customers. We agree that energy suppliers have an incentive to ensure that the system works well for their *current* customers but it is less clear that there are incentives for suppliers to ensure that their equipment will continue to work well when their customers change supplier.

Figure 9

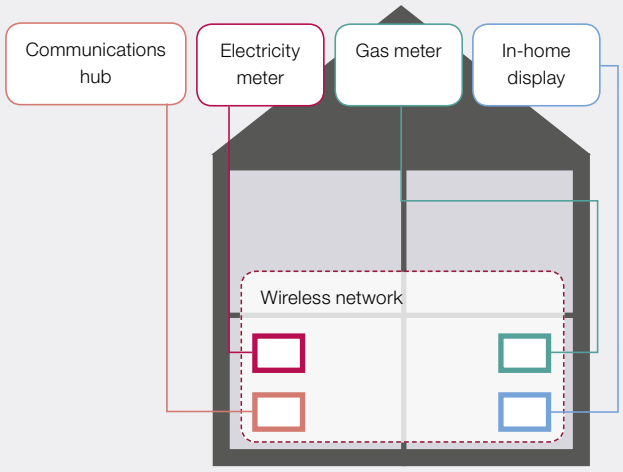
Dual band communication hubs and Alternative Home Area Networks

To fully benefit from smart metering, some 30% of homes will need to be provided with one of these technologies

a The Home Area Network

In the SMETS2 system, each home has a wireless home area network for connecting smart devices (meters, the in-home display, etc).

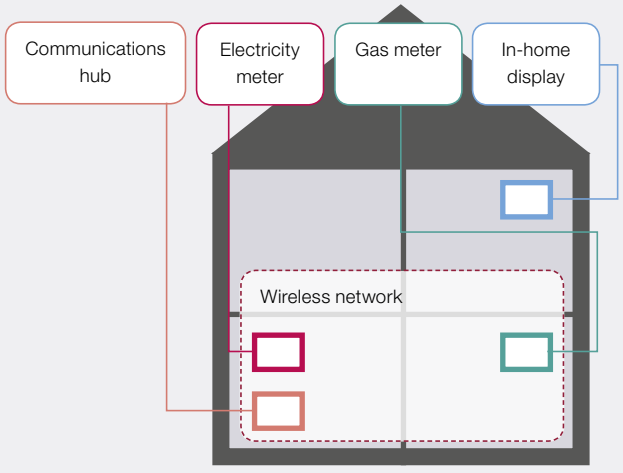
A communications hub creates the network and connects to the DCC infrastructure.



b Problems with the Home Area Network

In up to 70% of homes and small business premises, a normal communications hub and home area network is expected to be sufficient.

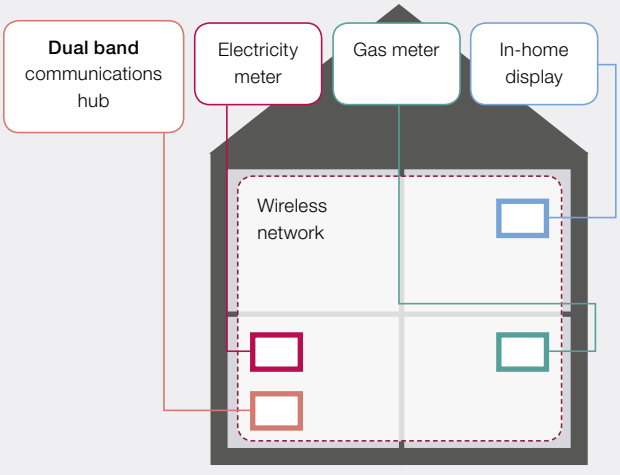
But in the remainder of premises, devices may not be able to connect because of distances or obstacles between smart devices.



c Solution 1: Dual Band Communications Hubs

The Department for Business, Energy & Industrial Strategy's solution for most of the remaining premises is to provide them with a communications hub that has a greater range – a dual band communications hub.

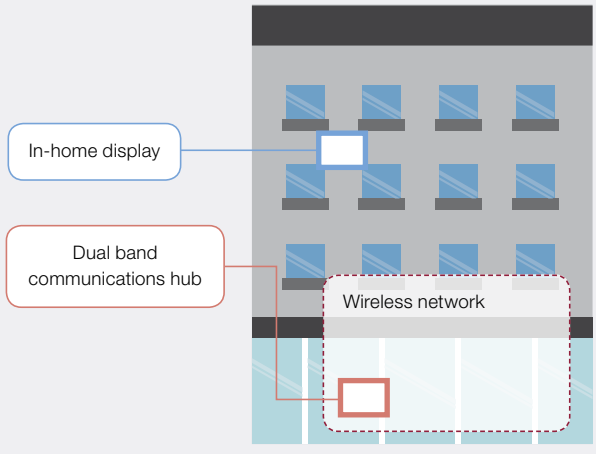
This will be required for 25%–26.5% of premises.



d Solution 2: Alternative Home Area Network

For the remaining 3.5%–5% of premises, dual band communications hubs will not be enough to overcome distances or obstacles between smart devices. This may be the case in high-rise flats, for example.

The set of technologies that will be used to overcome this have not been selected yet. They are referred to as the Alternative Home Area Network (Alt HAN).



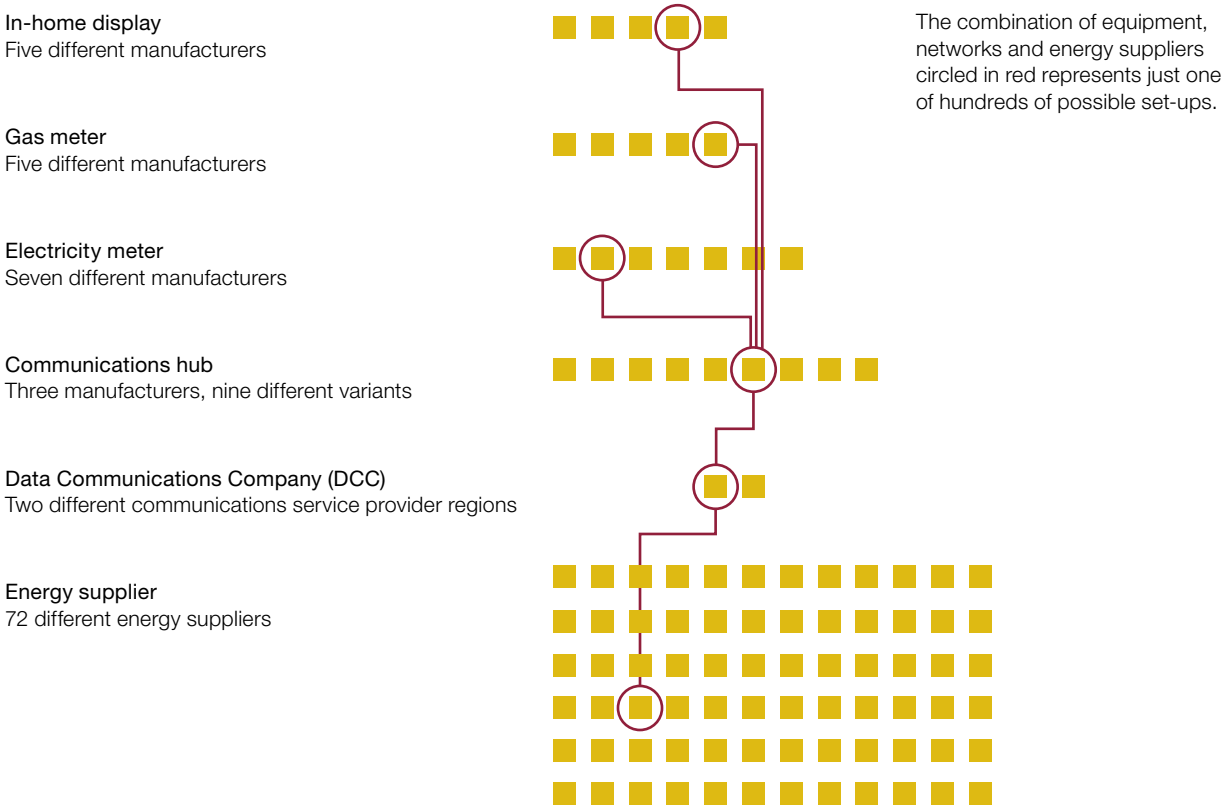
Note

1 SMETS2 stands for Smart Metering Equipment Technical Specifications version 2.

Source: National Audit Office

Figure 10
Technical integration complexity of SMETS2 equipment

The DCC and SMETS2 system consists of many components, and there are several versions of many of the components



Notes

1 A consumer may opt for gas and electricity to be provided by different suppliers. This means that the devices provided by the different suppliers must be compatible.

2 A device may need to be 'swapped out' during its lifetime for one manufactured by a different company. These also need to be compatible.

3 A consumer may change supplier. The new supplier's systems need to be compatible with the devices inherited, even if they are made by a different manufacturer from those used by the new supplier for its own installations.

4 SMETS2 stands for Smart Metering Equipment Technical Specifications version 2.

Source: National Audit Office analysis

Continued rollout of SMETS1 meters

1.25 While the DCC infrastructure and SMETS2 meters were being developed, the Department encouraged energy suppliers to continue installing SMETS1 meters, and permitted them to count these towards their rollout obligations. Because it has taken longer than expected to implement the DCC and SMETS2, the number of SMETS1 meters that have been rolled out significantly exceeds original expectations. As of June 2018, there were 12.5 million SMETS1 meters installed. This is over 20% of all currently operating meters and 7.1 million more than the number projected in the Department's 2013 business case (**Figure 11**).

Figure 11
SMETS1 meters installed versus expectations

The Department for Business, Energy & Industrial Strategy (the Department) has repeatedly revised its expectations for numbers of SMETS1 meters upwards, and seen those expectations exceeded each time

Date	SMETS1 meters already installed (million)	The Department's projection of final number of SMETS1 meters (million)
July 2013	0.4	5.4
November 2016	5.3	8.0
June 2018	12.5	14.2[2]

Notes

1 SMETS1 stands for Smart Metering Equipment Technical Specifications version 1.

2 For June 2018, the projection shown is the number of SMETS1 meters forecast by energy suppliers according to the Department's monitoring data.

Source: National Audit Office analysis

1.26 Mass rollout of SMETS1 has enabled consumers to experience some of the benefits of smart meters earlier than they otherwise would have, but it also presents a number of risks and challenges for the programme.

Loss of smart functionality

1.27 Currently, around 70% of SMETS1 meters lose smart functionality ('go dumb') when consumers switch supplier. As of the end of June 2018, 943,000 smart meters were reported as operating in dumb mode. In these situations, energy suppliers can treat the meter as if it were a traditional meter.

1.28 Consumers whose smart meters are at risk of going dumb on change of supplier could be less likely to switch supplier because it would mean losing the benefits of their smart meter. Encouraging more consumers to switch was seen by the Competition and Markets Authority (CMA) as an important benefit of the smart metering programme. The CMA told us that meters going dumb was likely to dissuade some customers from switching energy supplier.

1.29 The Department has cast doubt on the idea that SMETS1 meters are dissuading consumers from switching. A survey undertaken on behalf of Ofgem showed that 22% of households with a SMETS1 meter changed supplier in the past 12 months, whereas only 17% of households with a traditional meter changed supplier. However, this is not conclusive evidence that SMETS1 meters are not deterring consumers from switching[12] and, in any case, around 70% of the consumers who decide to switch will experience a loss of smart functionality.

12 Some energy consumers are more engaged with their energy use and have a much greater tendency to switch supplier than other consumers. If SMETS1 meters have mainly been taken up by these more-engaged consumers, it could be the case that the meters have reduced this group's tendency to switch, and yet they remain more likely to switch than consumers with traditional meters.

1.30 The Department plans to resolve the limited interoperability of SMETS1 meters by connecting them to the DCC ('enrolment and adoption'). If SMETS1 meters can be successfully enrolled and adopted, none should lose smart functionality when consumers change supplier and meters that have gone dumb should have their smart functionality restored. This has been the Department's intention since the beginning of the SMETS1 rollout, although the prospective scale of the project has grown with the continued rollout of SMETS1 meters. If it becomes possible to enrol and adopt some or all SMETS1 meters onto the DCC, energy suppliers will be obliged to do so for these meters within 12 months of Smart DCC offering an enrolment service. Otherwise, energy suppliers are permitted to leave SMETS1 meters operating in dumb mode until the end of 2020, at which point suppliers will be obliged to replace them with SMETS2 meters.

1.31 The DCC published plans to enrol SMETS1 meters in October 2017. It has divided SMETS1 meters into three sets, to be enrolled at different times.[13] Enrolment and adoption is complex because it requires Smart DCC to find a way of translating SMETS2 messages and processes into SMETS1 messages and processes. Integrating SMETS1 meters with the DCC also requires additional specific security requirements to be implemented in the DCC's security model. The solution for enrolling the first of the three sets of SMETS1 meters is currently being tested. The solutions for the other two sets are still being developed. The Department says it has high confidence in the delivery of the project. But, given the complexities involved and the fact that migrating SMETS1 meters into the DCC is novel, it is not certain that the process will work as intended for all SMETS1 meters.

- The target start date for enrolment of the first set of meters is expected to be pushed back from November 2018 to May 2019 and there is a risk of further delay.
- The Department's assumption for the purposes of cost–benefit modelling is that 2% of the first two thirds of SMETS1 meters will not be successfully enrolled, and some stakeholders have told us that they regard this as an optimistic assumption.
- The Department has not yet decided if SMETS1 meters manufactured by Secure and EDMI (around one third of SMETS1 meters) will be enrolled. It is awaiting cost and feasibility information from the DCC.

Therefore, we consider that the Department should be careful not to suggest that successful enrolment and adoption of all SMETS1 meters is inevitable.

13 The first set consists of meters manufactured by Aclara and Itron, and some Elster meters. The second set consists of Landis and Gyr meters and the remaining Elster meters. This leaves meters manufactured by EDMI and Secure, each of which may or may not be included in a third set.

Additional issues with SMETS1 meters

1.32 The widespread rollout of SMETS1 meters creates additional risks and challenges.

- Both SMETS1 and SMETS2 meters can be used to switch devices on and off automatically ('load control') to take advantage of tariffs that vary by time of day. However, SMETS2 meters provide support for more sophisticated load control set-ups in the home. The Department considers this difference to be marginal. However, the additional options for load control may help consumers save money in future with the uptake of electric vehicles and heat pumps.[14] If this happens, some consumers may ask for their SMETS1 meter to be replaced with a SMETS2 meter that can provide the additional functionality. There was no provision for this in the Department's 2016 cost–benefit analysis.
- For energy suppliers, maintaining a mixture of different models of SMETS1 and SMETS2 meters is likely to add to capital and operational costs.

We discuss these issues further in Part Two.

Rationale for accelerated rollout

1.33 The Department adopted its staged SMETS1/SMETS2 strategy so that it could roll out smart meters faster. It did not make an economic assessment of the advantages and disadvantages of aiming for a faster rollout. It told us that a period of rolling out SMETS1 meters enabled benefits to be realised much earlier than a SMETS2 only strategy. However, the most significant benefits enabled by smart meters are expected to be achieved in the long term, and therefore did not require an urgent rollout. These 'smart energy system' benefits will be realised between 2020 and 2050.

1.34 Once rollout of SMETS1 meters started, the Department could not bring installations to a halt to wait for a working SMETS2 solution without causing disruption to the supply chain. This left the Department exposed to the risk that delays to the DCC infrastructure would result in millions more SMETS1 meters being rolled out than the Department intended.

14 All SMETS2 meters support separate load control for up to five devices as standard whereas this is not the case with SMETS1 meters. Separate load control for devices may be important in future if energy suppliers choose to offer consumers a specific tariff for their electric vehicle in exchange for the consumer allowing the energy supplier to switch the vehicle charger on and off, for example.

1.35 Because the start of the SMETS2 rollout was significantly delayed, the Department's sticking to its target of ensuring all homes are offered a smart meter by 2020 puts significant timetable pressure on the programme. As we have previously stated,[15] we do not expect departments to avoid setting ambitious timescales, but decisions on timetables need to be based on an assessment of the trade-offs involved. The risks of timetable pressure in this case include the following:

- If technology is rolled out before sufficient time has been spent testing it, defects are more likely, which could be disruptive for consumers.
- Both meter costs and installation costs are likely to increase if energy suppliers attempt to install too many meters per month. The Department's 2016 cost–benefit analysis included a cost contingency for this eventuality but, since this analysis was performed, the rate of installation required to meet the 2020 target has increased.

The Department's view is that without maintaining its clear commitment to the 2020 end date, energy suppliers will continue to underinvest in the rollout, while repeatedly arguing for more time. It says its monitoring allows it to see if risks are materialising and it will act if necessary.

Prospects for hitting 2020 target

1.36 There is no realistic prospect of installing smart meters in all eligible premises covered by the rollout obligation by 2020. The business case envisaged that mass rollout of SMETS2 meters would start in 2015 and close to 100% of homes would have a smart meter by 2020. In practice, as of November 2018, energy suppliers are still in the process of transitioning into mass rollout of SMETS2 meters. As of June 2018, there were 39 million remaining traditional meters (**Figure 12**). There are several significant challenges involved in replacing these meters by 2020, including implementing dual band communication hubs and Alt-HAN, and suppliers scaling up their installation operations. Most of the rollout plans submitted by suppliers to Ofgem in early 2018 indicated that they are currently aiming to install smart meters in approximately 70% to 75% of customers' homes and premises by 2020. Suppliers attribute this to limited consumer interest and delays to SMETS2. Actual rollout by 2020 may fall short even of these estimates if the DCC infrastructure encounters further problems or if suppliers encounter further difficulty persuading consumers to accept installations.

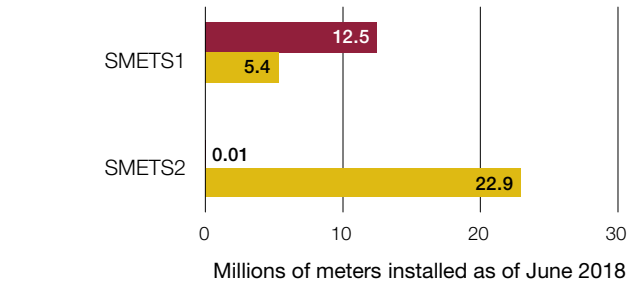
1.37 The Department told us that delays to completing the rollout would have a negative but relatively small impact on value for money. According to the Department's analysis, prolonging the rollout by one year would reduce net benefits by around £150 million. Although some benefits would be realised later, so would some costs. This estimate does not include the potential positive impacts of taking timetable pressure off the supply chain.

15 Comptroller and Auditor General, *Welfare Reform – Lessons Learned*, Session 2015-16, HC 77, National Audit Office, May 2015.

Figure 12

Comparison of actual rollout with business case: numbers of SMETS1 and SMETS2 meters

The Department for Business, Energy & Industrial Strategy's (the Department's) business case projected that there would be around 23 million SMETS2 meters installed by June 2018. The actual number installed was 10,000

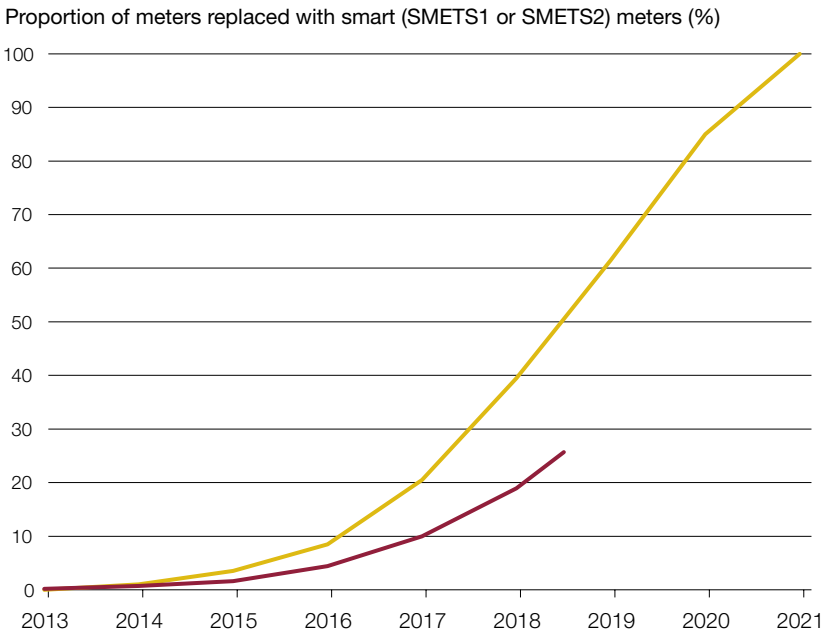


Actual rollout

2013 business case projection

Comparison of actual rollout with business case: total number of meters

Delays to implementing SMETS2 mean that progress towards replacing all legacy meters by 2020 is lagging significantly behind the Department's business case projection



	2013	2014	2015	2016	2017	2018	2019	2020	2021
Actual rollout as of June 2018	1	2	4	10	19	26			
2013 business case projection	1	4	9	21	40	51	62	85	100

Source: National Audit Office analysis of Department for Business, Energy & Industrial Strategy smart metering statistics and 2013 full business case

Part Two

The programme's value-for-money case

2.1 This part of the report considers:

- the risks of costs increasing or benefits in the programme's value-for-money case not being achieved; and
- whether the programme's business case was robust.

Overview of the government's value-for-money assessment

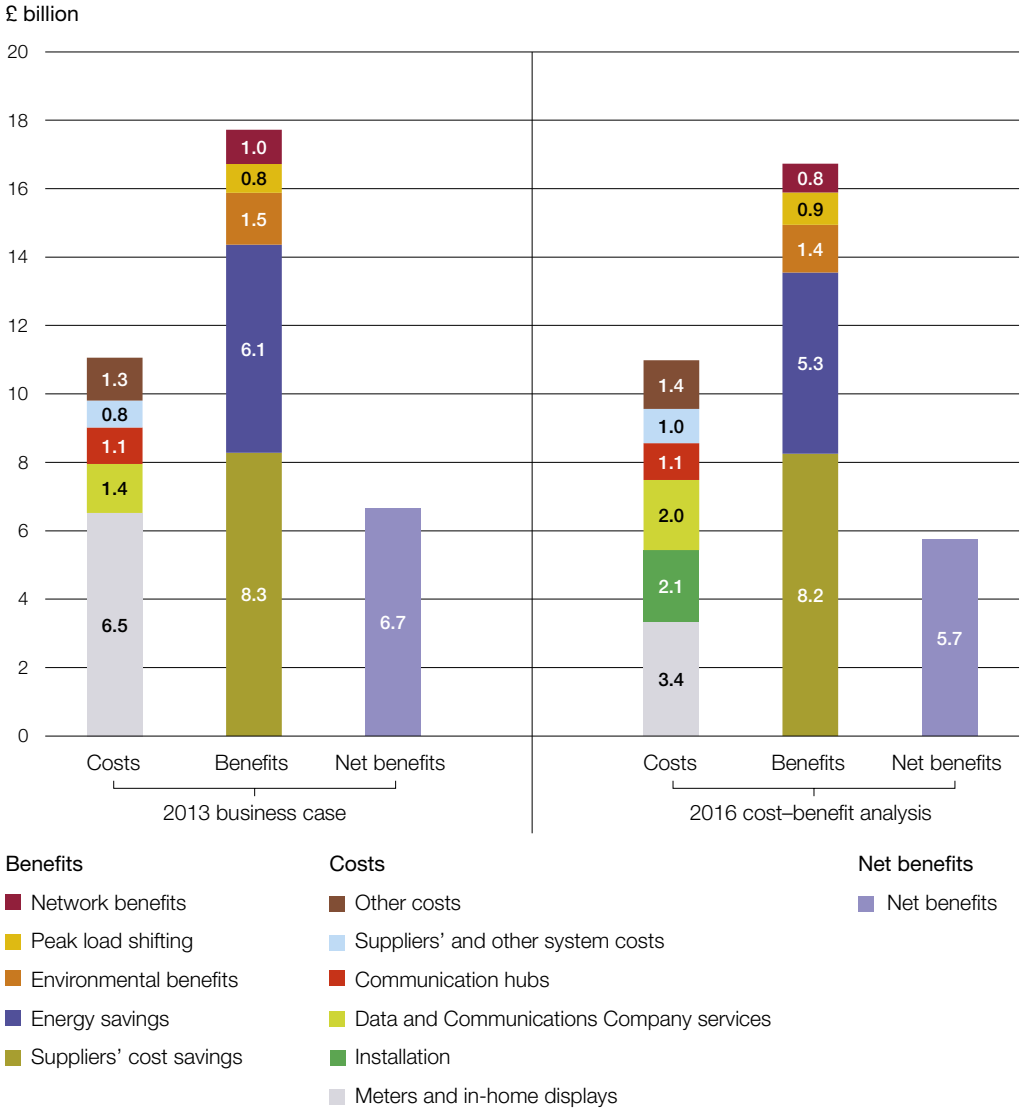
2.2 In its business case for the programme in 2013, the Department for Business, Energy & Industrial Strategy (the Department) forecast that it would cost £11.0 billion and provide benefits of £17.7 billion over the period 2013 to 2030. The Department produced an updated cost–benefit analysis in 2016. This also forecast costs of £11.0 billion, although the make-up of this total changed: some cost estimates had increased but, because the Department had gathered more accurate and detailed information of the cost of the programme, it offset these increases by using up some of the provisions for optimism bias that it had included in the 2013 business case. The 2016 analysis reduced the estimated benefits of the programme to £16.7 billion, giving a net economic benefit of £5.7 billion (**Figure 13**).

2.3 The Department estimated that rolling out smart meters would result in short-term increases in energy bills while the industry invested in equipment, installations and changes to business systems. According to the Department's 2016 modelling, the net bill increase peaked in 2016 at an average of around £13 a year for a dual fuel household. Between 2013 and 2030, the Department expected smart meters to add £31 to the typical annual dual fuel bill but also to remove £49, yielding a net saving of £18 a year. The net saving rises from £11 a year in 2020 to £46 a year in 2030 (**Figure 14** on page 42).

Figure 13

Costs and benefits of the programme estimated in the Department's 2013 business case and 2016 cost–benefit analysis

The 2016 cost-benefit analysis indicated that net benefits had reduced relative to the 2013 business case



Notes

1 The Department's 2013 estimate was discounted to a base year of 2013 whereas the 2016 estimate was discounted to a base year of 2016, in line with HM Treasury guidance on economic appraisal. If the estimates were both discounted to a base year of 2013, the reduction in net benefits from 2013 to 2016 would be larger than the reduction shown here (£1.5 billion instead of £1.0 billion).

2 Changes in estimated benefits are partly due to revisions to energy demand and price forecasts, and rollout profiles; and changes in estimated costs are partly due to the incorporation of new evidence into the estimates and revisions to assumptions about optimism bias.

3 The 2013 estimates for meters and in-home display costs include installation costs.

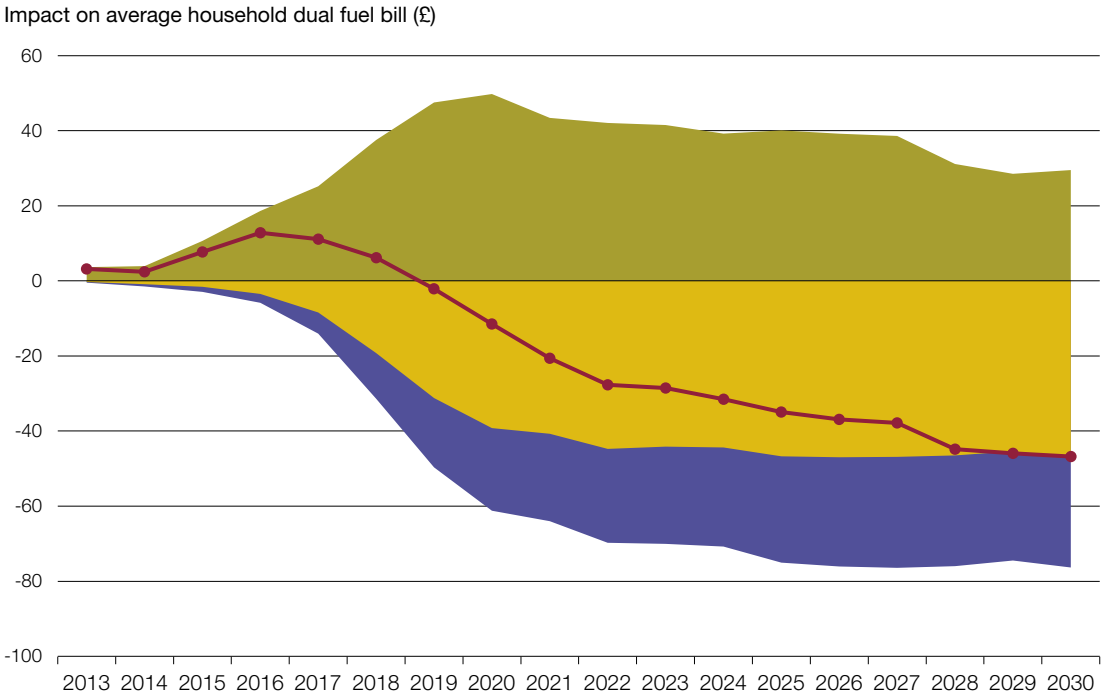
4 All costs and benefits are in 2011 prices.

Source: National Audit Office analysis of Department Energy & Climate Change and Department for Business, Energy & Industrial Strategy estimates

Figure 14

Impact of smart metering on average dual fuel domestic energy bills

The Department for Business, Energy & Industrial Strategy (the Department) expects that smart meters will lower domestic bills over the business case period out to 2030



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Net impact on household bill (£)	3	2	8	13	11	6	-2	-11	-20	-27	-28	-31	-34	-36	-37	-44	-45	-46
Costs to industry	4	4	10	18	25	37	47	49	43	41	41	39	39	39	38	31	28	29
Industry cost savings	0	-1	-2	-3	-8	-19	-31	-39	-40	-44	-43	-44	-46	-46	-46	-46	-45	-46
Energy savings	0	-1	-1	-2	-6	-12	-18	-22	-23	-25	-26	-26	-28	-29	-29	-29	-29	-29

Notes

1 The red line on this chart shows the expected net effect of smart meters on the average dual fuel domestic energy bill. The Department assumes that the industry will pass on to consumers both the costs of implementing smart meters and any cost savings it realises as a result of them. Over time, the Department expects industry cost savings and consumer energy savings to more than offset implementation costs. Therefore, the red line moves below zero after some of the initial investments in equipment, installation and changes to business systems have been made.

2 2011 prices, undiscounted.

3 Due to rounding, not all totals sum

4 The Department estimated these impacts using its Prices and Bills model. The Prices and Bills model assumes that policy costs are spread evenly across energy sales.

Source: Department for Business, Energy & Industrial Strategy estimates

2.4 The Department's cost–benefit analysis has been updated on several occasions throughout the life of the programme, but the last update took place two years ago. We have examined some of the main assumptions in the Department's 2016 analysis and considered, in light of available evidence, whether there is a risk that these assumptions will prove over-optimistic. In Appendix Four, we show the impact on net benefits of varying some of the assumptions in the Department's analysis. We have not comprehensively assessed all the programme's costs and potential benefits, and therefore we have not quantified the likely net benefits of the programme overall. The Department has told Parliament that it will provide an updated cost–benefit analysis in 2019.

Benefits

Energy savings

2.5 The Department's value-for-money case for the programme depends on energy savings being maintained for many years. The 2016 cost–benefit analysis assumes that smart meters, working alongside an in-home display that shows current energy consumption, will cause consumers to reduce their electricity consumption by 2.8% and their gas consumption by 2%. Appendix Four shows that small changes in these assumptions would have a large effect on the benefits of the programme. Significantly, the Department assumes that these energy savings will continue throughout the period covered by the appraisal (that is, up to 2030). If the effects do not persist, the value-for-money case will become marginal or negative.

2.6 The actual energy savings that smart meters will achieve remain uncertain. The Department believes that its assumptions on energy savings are prudent. Trials carried out before the rollout showed that, in the short term, consumers were able to reduce their energy use by amounts consistent with the assumptions in the business case. During the rollout, British Gas estimated that its own smart meter customers had reduced their electricity use by 4.1% and their gas by 2.5% over the first two years. However:

- there has been limited research into the extent to which energy savings from smart meters are likely to be sustained in the long term and the available evidence is inconclusive;[16] and
- the Department has previously overestimated the impact on energy use of other energy efficiency schemes; in 2015, three years after two national schemes for improving the energy efficiency of homes had come to an end, the Department adjusted its estimate of the amount of CO_2 they would save downwards by 50%.[17]

16 There has been very little research into whether the energy savings from real-time feedback are likely to be maintained. A systematic review of programmes for shifting residential electricity use out of peak periods concluded that research findings were complex, with many inconsistencies. Some trials and programmes showed energy savings persisted or increased over time, while others showed diminishing savings (B Parrish, R Gross and P Heptonstall, 'On demand: Can demand response live up to expectations in managing electricity systems?', Energy Research & Social Science, forthcoming, 2019).

17 Comptroller and Auditor General, *Green Deal and Energy Company Obligation,* Session 2015-16, HC 607, National Audit Office, April 2016. The energy efficiency schemes referred to here are CERT and CESP.

2.7 Trials of smart metering have shown that consumer engagement has a significant impact on the level of energy savings consumers achieve. Ofgem's 2007–10 Energy Demand Research Project found that advising consumers on how to save energy while giving them a smart meter increased their energy savings by up to two thirds. In light of these findings, the Department requires energy suppliers to advise customers on energy efficiency when they install smart meters, and it has developed guidelines on how to provide effective advice. However:

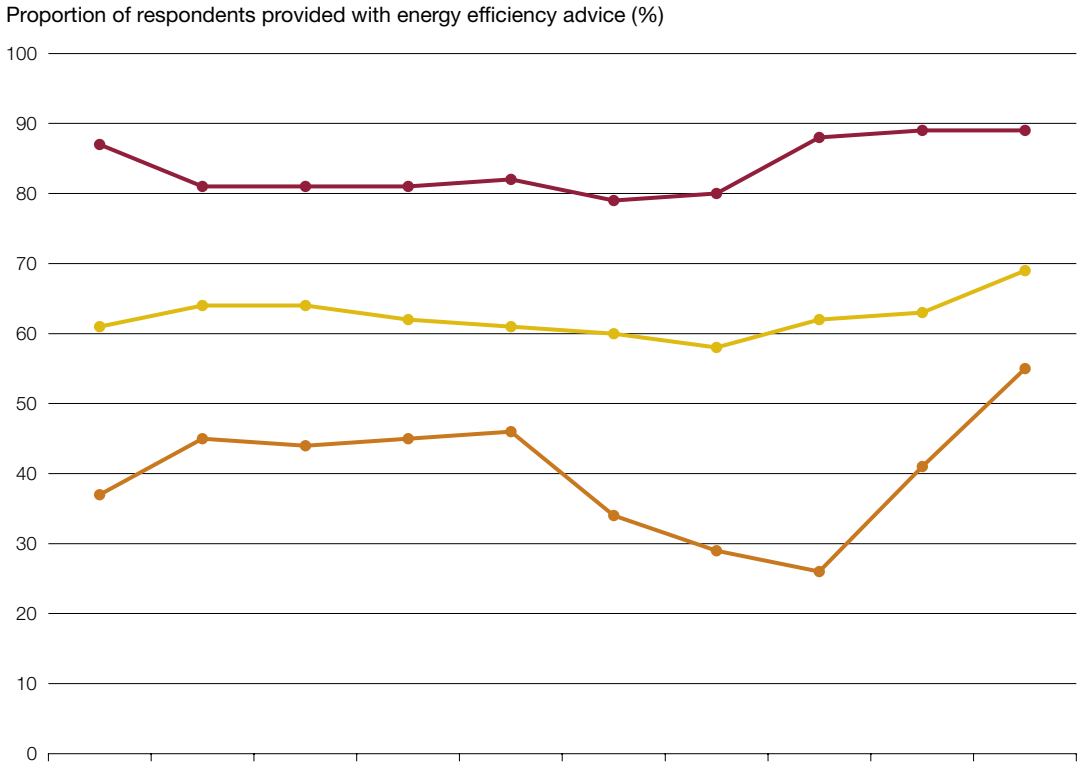
- Based on compliance survey evidence, the Department estimates that, so far, around 2.1 million households out of the 6.8 million with smart meters do not recall being offered advice on energy efficiency at the point of installation. Ofgem is engaging with suppliers about their failure to offer energy efficiency advice but has not opened any enforcement cases. The Department has undertaken work to enable the sharing of good practice in this area and, since the beginning of 2018, there has been an improvement in performance, particularly among the worst-performing suppliers (**Figure 15**). However, further improvements are required: according to the most recent data, large energy suppliers are still failing to offer advice to some 27% of consumers.

- The Department currently has no plans to continue engagement with consumers once the rollout is complete, although as part of its Clean Growth Strategy it has committed to 'explore' how smart metering data could be used to support personalised recommendations for saving energy. Providing advice after installation could help to mitigate the risk that energy savings are not maintained. The Department's 2017 customer experience study showed that around one third of customers with a smart meter said they wanted energy saving advice a year after installation.

Figure 15

Proportion of households being offered advice on energy efficiency during a smart meter installation visit

Over the past two years around 31% of households have not received energy efficiency advice



	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018
Best supplier in quarter (%)	87	81	81	81	82	79	80	88	89	89
All suppliers (simple average) (%)	61	64	64	62	61	60	58	62	63	69
Worst supplier in quarter (%)	37	45	44	45	46	34	29	26	41	55

Notes

1 The latest compliance survey, quarter 2 of 2018, collated the responses of over 8,000 customers. The results are compiled by SMICoP Ltd to provide an overall picture.

2 The yellow line in this figure shows the simple average across energy suppliers; ie it gives equal weight to suppliers regardless of the number of customers they have. When weighted by number of customers, suppliers' average performance is slightly better than shown on this chart: over the past two years, the number of customers who do not recall receiving energy efficiency advice was around 31%, and in the second quarter of 2018 it was 27%.

Source: Department for Business, Energy and Industrial Strategy analysis of the Smart Meter Installation Code of Practice (SMICoP) compliance survey

Who will benefit from smart meters?

2.8 A survey conducted on behalf of the Department in 2018 showed that 74% of consumers who received SMETS1 meters in 2017 were satisfied with them. Although the Department expects consumers on average to benefit financially from the programme, its impacts will vary from household to household, because not all households will save the same amount of energy. Saving energy depends on consumers' ability to make changes to behaviour, their home and/or their appliances. For example, consumers in rented accommodation may find it difficult to make changes to their homes and low-income consumers may not be able to afford to buy more energy-efficient appliances.

2.9 Differences in consumers' willingness to save energy and their level of engagement with their smart meter are also likely to result in differences in energy savings. A survey conducted on behalf of the Department in 2017 showed that 82% of consumers with an in-home display had used it to look at how much energy they were using or their credit balance, 67% looked at it at least once a week and 27% used it to set a baseline or budget for their energy use.

2.10 The Department has acknowledged that smart meters will have different impacts on different groups but it has not quantified those differences. It told us that there are significant challenges that prevent it from measuring the level of energy savings for specific groups of consumers, although it can and does measure indicators of energy-saving behaviour such as interaction with in-home displays. We consider that the Department should model the impact of smart meters on households with differing propensities to save energy.

Customers using prepayment meters

2.11 One group the Department believes are less likely to benefit financially from smart meters are consumers with prepayment meters. Some 4.5 million households (one in six) prepay for their electricity and 3.5 million (one in eight) prepay for gas. According to the Department's latest estimates, consumers who prepay for their energy will, on average, make annual energy savings of 2.8% for electricity (the same as consumers on credit meters) but only 0.5% for gas (compared with 2% for consumers on credit meters). This is because some consumers with gas prepayment meters already tightly control their energy use and therefore their opportunities to save more energy are limited.

2.12 Consumers who prepay may nonetheless benefit from the additional convenience of smart prepayment meters. These meters offer alternative top-up methods, such as topping up using a smartphone, and the in-home display makes remaining credit more visible than it is with a traditional meter. For these reasons, the proportion of prepayment customers who say they are satisfied with their smart meter is 80%, compared with an average across prepayment and credit meters of 74%.

Vulnerable consumers and consumers with disabilities

2.13 Vulnerable consumers and consumers with disabilities may require additional help to benefit from smart meters. The Department set itself an objective to "ensure that vulnerable, low income and pre-payment consumers can benefit from the rollout". The Department has established a good practice guide for supporting vulnerable consumers, and there are obligations under the Smart Metering Installation Code of Practice for energy suppliers to identify and meet the needs of vulnerable consumers, together with requirements for in-home displays to meet accessibility specifications. However, the results of a survey of energy suppliers published by Citizens Advice in 2017 found that, in practice, there was variable support for vulnerable consumers. Some energy suppliers were not providing vulnerable consumers with clear information about their consumer rights, offering support if a smart meter installation led to an appliance being condemned or making follow-up contact after an installation.

Operational cost savings for suppliers

2.14 According to the Department's 2016 cost–benefit analysis, the reduction in suppliers' operating costs will comprise almost half (£8.2 billion, 49%) of the quantified benefits of smart meters. The shift from legacy to smart meters is meant to reduce suppliers' ongoing costs – for example, by reducing the workload of call centres (an estimated £1.2 billion of cost savings), reducing the costs of serving prepayment customers (£1.1 billion) and reducing the number of manual meter readings required (£3 billion cost savings).

2.15 Energy suppliers told us that rollout of SMETS1 meters has already helped them reduce the number of manual meter readings and the Department's monitoring data show that inbound contacts to call centres have been lower (compared with a 2012 baseline) during the rollout of SMETS1 meters.

2.16 However, it is not certain that, once SMETS2 meters are rolled out at scale, suppliers will be able to reduce the cost of customer support to the extent set out in the 2016 cost–benefit analysis:

- The SMETS2 and DCC system consists of many interacting components. As discussed in Part One, some of these are still being tested as they are rolled out, and others have yet to be deployed or developed. This means there is a risk that defects will be found in the system in future, which suppliers will need to fix. This could result in increased contact between suppliers and customers, and/or early replacement of equipment.
- The industry will need to support a mixture of SMETS1, SMETS2 and legacy meters, potentially until the end of the 2020s, rather than a system in which almost all smart meters are SMETS2 (with only 5.4 million being SMETS1), as the Department assumed in its business case. This is likely to add to capital and operational costs.

2.17 The government assumes any operational cost savings realised by suppliers will also be passed on to consumers because suppliers compete on price. The Competition and Markets Authority (CMA) investigated the energy market between 2014 and 2016.[18] It found that energy suppliers charge higher prices than they would in a perfectly competitive market, mainly because of the "weak response" of disengaged energy consumers. Although it believes that this weak response gives energy suppliers a degree of market power, the CMA told us that there is no reason to believe that the introduction of smart meters would increase this market power. Therefore, there is no reason to believe that it would lead to a widening of the existing gap between energy suppliers' costs and the prices they charge consumers. The CMA is therefore supportive of the Department's assumption that energy suppliers will pass on any cost savings from smart meters. However, the Department has no mechanism for assuring consumers that this will in fact happen.

Peak load shifting

2.18 Smart meters enable the deployment of tariffs that vary by time of day (time of use tariffs). These are expected to save money by reducing the need for extra generating capacity, especially if in future the power system increasingly relies on intermittent sources like wind. Peak load shifting accounts for around £0.9 billion (5%) of expected programme benefits, based on an assumption that time of use tariffs would be in common use by 2018. However, time of use tariffs are unlikely to be widely available on the market until Ofgem introduces reforms ensuring that energy suppliers will have financial incentives to shift demand, known as 'market-wide half-hourly settlement'.[19] The move to market-wide half hourly settlement is unlikely to happen before 2022 at the earliest. Some £0.2 billion of the £0.9 billion in expected benefits from peak load shifting were forecast to occur before 2022, with the remainder coming after. It is now clear that the benefits forecast before 2022 are unlikely to be realised.

2.19 The Department told us that the potential benefits of peak load shifting in the 2020s may have increased since it performed the 2016 cost–benefit analysis, because the number of electric vehicles expected to be in use has increased significantly since then. Electric vehicles would create considerable additional 'flexible load' (i.e. demand for electricity that can be shifted outside the peak).

18 Competition and Markets Authority, *Energy market investigation: final report*, June 2016.

19 Market-wide half-hourly settlement will require energy suppliers to balance the electricity they buy from the wholesale market with the electricity their customers use in each half-hour period otherwise they will face additional charges. As a first step to market-wide half-hourly settlement, Ofgem has introduced new rules allowing suppliers to opt in to half-hourly settlement. This has led to two small suppliers launching smart time of use tariffs so far.

Network-related benefits

2.20 Around £0.8 billion (5%) of expected benefits in the 2016 cost–benefit analysis are associated with electricity network companies making use of smart metering data to operate more efficiently. For example, detailed power flow and voltage information from smart meters could be used to make better decisions about where to reinforce the network. The Department assumed this would be achieved through widespread (60% or greater) rollout of SMETS2 meters, which have additional network-related functionality compared with SMETS1 meters. But because of continued rollout of SMETS1 meters and difficulties in persuading some consumers to accept a smart meter installation, it is doubtful that SMETS2 deployment will reach 60% by 2020.

2.21 The Department told us it now believes that it might be possible to use SMETS1 meters instead of SMETS2 meters to achieve most of the network benefits in its 2016 cost–benefit analysis. But network companies said it is uncertain whether the full range of network benefits can be provided with SMETS1 meters because of differences in the way they have been designed. Network companies are commissioning an expert review of the potential for realising benefits from smart meters. The extent to which the £0.8 billion of potential network benefits are foregone will depend on the number and functionality of SMETS1 meters that have been installed.

Smart electricity system benefits

2.22 The Department's strategic case for smart meters relies in part on the view that they will facilitate a future smart electricity system. Smart electricity systems use information and communications technology to monitor and actively control generation and demand in near real-time. The potential benefits come from avoided investment in infrastructure and better operation of the system. A study by the Carbon Trust and Imperial College London estimated that the UK could realise net savings of between £16 billion and £38 billion out to 2050 from a smarter, more flexible electricity system. The study estimated that these potential benefits would require additional investment of £5 billion to £18 billion in electricity storage and demand-side response technologies (including some costs associated with smart metering infrastructure).[20] The Department chose not to quantify smart electricity system benefits in its cost–benefit analysis because the investment in smart meters alone would not be enough to realise these.

20 Carbon Trust and Imperial College London, *An analysis of electricity system flexibility for GB*, November 2016. We have converted the figures into 2011 prices.

Costs

2.23 The costs of the programme will be passed on to energy consumers. On the basis of the assumptions in the Department's 2016 cost-benefit analysis, we estimate that over the period to 2030, the costs of the programme are equivalent to £374 per dual fuel household.[21] The Department expects these costs to be more than offset by reduced energy consumption and operational cost savings for the industry.

2.24 We have identified several areas in which the Department's cost–benefit analysis is likely to understate the true costs of the smart meter rollout. We estimate that costs have increased by at least £0.5 billion since the Department last forecast them in 2016. Of the £0.5 billion, £0.3 billion relates to the increasing costs of the DCC and £0.2 billion relates to the cost of the technical solutions required to enable the full functionality of the system in the final 3.5% to 5% of properties.

2.25 The £0.5 billion increase is equivalent to a cost of £17 per dual fuel household (in total, rather than annually) on top of the £374 implied by the Department's 2016 analysis. This is a conservative estimate because it does not include energy suppliers' direct marketing and consumer engagement costs, the potential cost of replacing SMETS1 meters, or the costs that will be incurred if energy suppliers do not bring installation costs down from 2017 levels. Each of these cost increases and potential cost increases is described below.

DCC cost increases

2.26 The costs the DCC forecasts it will incur over its initial licence period (that is, 2013 to 2025) have increased by £0.9 billion (51%) since its licence was awarded in September 2013 (**Figure 16**).[22] The cost increases stem principally from the SMETS2 standard and DCC infrastructure becoming more complex than bidders or the Department anticipated, and the DCC needing to invest additional time and resources in testing to resolve defects to the satisfaction of its users. Another factor has been additional scope, which was known about at the time of the licence award, but not costed at that point. Expected costs have risen each year since the DCC was awarded its licence and there is a risk of further cost increases as major projects, such as the enrolment and adoption of SMETS1 meters, are carried out.

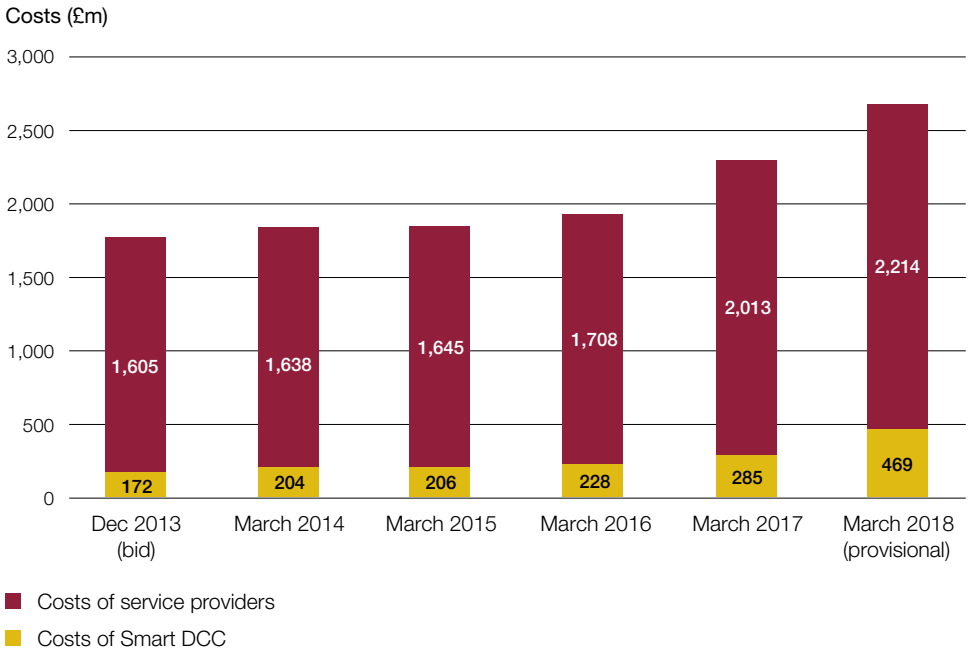
21 2011 prices, discounted. Without discounting, the figure is £465. The Department assumes that the costs will be recovered equally from consumers, regardless of how much energy they use.

22 2011 prices, undiscounted.

Figure 16

Forecast costs of Smart DCC and its service providers, September 2013 to September 2025

Forecast costs of the DCC have increased by £0.9 billion



Notes

1 2011 prices, undiscounted.

2 The DCC collects charges for other organisations involved in smart metering, such as the Smart Energy Code Panel. These costs are not included here, as they are not costs the DCC controls.

3 Ofgem is currently consulting on whether any of the £3,264 million forecast by the DCC in March 2018 (2018 prices) is not economic and efficient. Any costs which are not economic and efficient can be disallowed by Ofgem. Ofgem is proposing a disallowance of £137 million.

4 DCC stands for Data and Communications Company.

Source: National Audit Office analysis of Ofgem price controls

2.27 Responsibility for managing the DCC and controlling its costs is split across the Department, Ofgem and industry. The Department and industry are responsible for directing changes to DCC infrastructure and are informed by cost projections provided by the DCC. Ofgem is responsible for ensuring that the actual costs incurred by the DCC reflect economic and efficient implementation of changes. We consider that this split of responsibilities makes it more difficult to develop the DCC cost-effectively than if there were a single organisation negotiating with the DCC licensee on both requirements and costs.

2.28 Smart DCC is subject to economic regulation by Ofgem in the form of a price control, whose purpose is to ensure that costs are managed in an efficient and economic manner. So far, Smart DCC and its service providers have incurred costs of £329 million, compared with £195 million in Smart DCC's licence application (a 69% increase). Ofgem has used the price control to disallow £1.9 million of these cost increases (0.6%) on the grounds that they were not economic and efficient. This means that the DCC will not be able to recover these costs from energy suppliers.

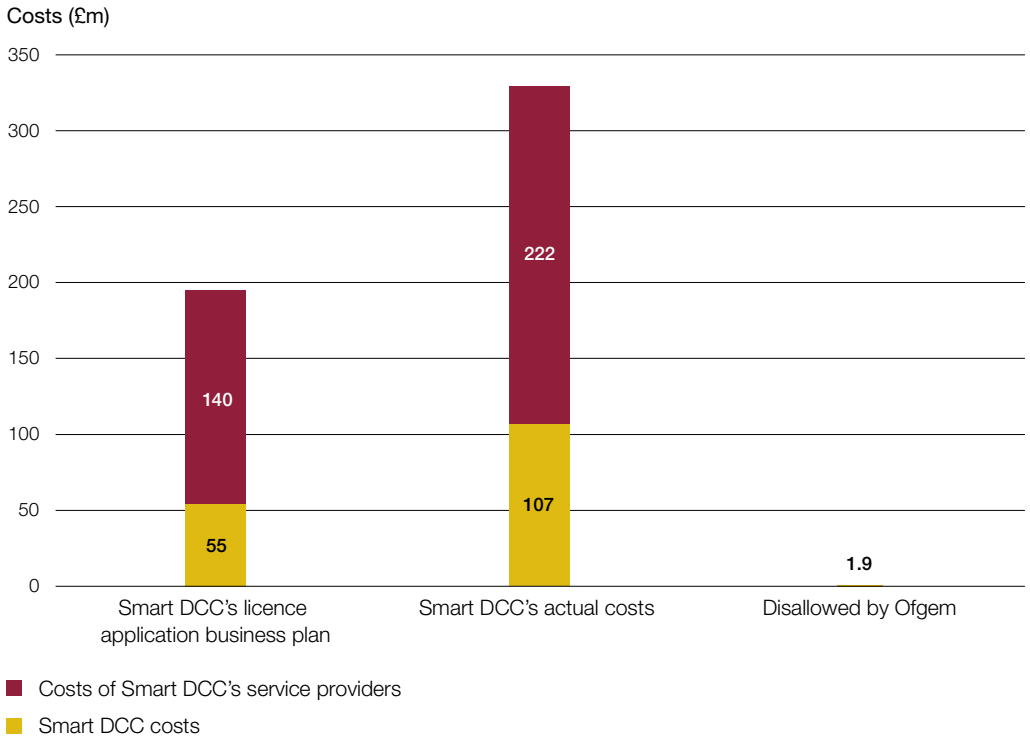
2.29 Energy suppliers are the DCC's customers and so are well placed to scrutinise the costs and benefits of the DCC's services, particularly where changes are being considered. However, energy suppliers said that they are prevented from scrutinising the DCC's costs because details are withheld on grounds of commercial confidentiality, especially when costs relate to the DCC's service providers, which make up around 70% of the DCC's costs. To date, Ofgem has assessed the DCC's service provider costs as economic and efficient "within the context of the evolving scope of the DCC's role", and none of the costs have been disallowed (**Figure 17**).

2.30 When we consider the change in expected DCC costs since the Department's 2016 cost–benefit analysis, Smart DCC's latest forecasts indicate that the costs of the DCC infrastructure up until September 2025 will be £0.3 billion higher (15%) than the Department assumed in its 2016 cost–benefit analysis. If the gap between Smart DCC's costs and the Department's original forecast does not close after September 2025, this would add further cost on top of the £0.3 billion.

Figure 17

Costs incurred by Smart DCC and its service providers, September 2013 to March 2017

Smart DCC has incurred more cost than forecast in its licence application. Ofgem has disallowed £1.9 million of these additional costs



Note

1 2011 prices, undiscounted.

Source: National Audit Office analysis of Ofgem price controls

2.31 One of the factors behind the understatement of DCC costs in the Department's 2016 cost–benefit analyses is that it removed provision for optimism bias in its estimate of DCC costs for its 2013 business case. It set its expectations of DCC costs at the level that Smart DCC and its service providers had set out in their bids for the DCC and service provider licences. The Department should instead have retained a generous provision for optimism bias in these estimates to reflect that the full requirements and technical specifications of the DCC were unknown at that point, and that major IT projects are prone to rising costs.

Alternative Home Area Network

2.32 Following a public consultation in 2015-16, the Department put a regulatory framework in place that obligated energy suppliers to work together to procure and deliver Alternative Home Area Network (Alt HAN) solutions through the Alt HAN Company Ltd, which is jointly owned by energy suppliers. These solutions will extend home area network coverage to premises and meters that are remotely located and beyond the coverage of dual band communication hub solutions, such as high-rise flats (see paragraph 1.20). The Alt HAN Company estimates that the total cost of providing Alt HAN technology solutions is around £0.3 billion in cash terms.[23] This estimate is based on an assumption that between 3.5% and 5% of properties will require Alt HAN equipment. If that proportion should rise, expected total costs will also increase. There was no provision for the costs of Alt HAN technologies in the Department's 2016 cost–benefit analysis because the Department was unable to quantify the costs.

Marketing and consumer engagement

2.33 The Department's 2016 cost–benefit analysis underestimated the costs of marketing smart meters to consumers. The only provision for this in the analysis was an assumption that Smart Energy GB, the organisation tasked with a national awareness-raising campaign, would be funded with £192 million between 2013 and 2021. However, Smart Energy GB will likely need additional funding to take it beyond 2021, because rollout may not be complete by then.

2.34 In addition, some energy suppliers told us they are having to spend significantly more than expected on direct marketing and consumer engagement to persuade consumers to accept smart meter installations. Some energy suppliers' smart meter marketing costs are similar to the amount they contribute to Smart Energy GB. If this were to be replicated across the energy supply market, the total cost of energy suppliers' marketing could be around £200 million. The Department did not include any of these costs in its 2016 cost–benefit analysis because it assumed that energy suppliers would repurpose part of their large marketing budgets for attracting and retaining customers. But the Department cannot evidence this assumption because it does not collect information on suppliers' marketing costs (Part Three).

23 This is equivalent to around £0.23 billion when converted to 2011 prices and discounted, using the government discount rate, to a base year of 2016.

Future potential cost increases

Installation costs

2.35 Information provided to the Department by energy suppliers shows that, during 2017, the average cost of installing smart meters was around 50% higher than the average installation costs the Department assumed in its 2016 cost–benefit analysis. The Department told us that one of the reasons installer productivity is currently low is that suppliers are training new installers and once the workforce becomes trained productivity will improve, bringing down the cost of installations. Installation costs account for 20% of the total programme costs. Therefore, if improvements in productivity are not as extensive or as fast as the Department hopes, the impact on the value for money of the programme will be significant. To illustrate this, we estimated that, if the cost of installing smart meters does not come down from 2017 levels, this would add £1.8 billion to programme costs relative to the 2016 cost–benefit analysis.

2.36 The Department has no mechanism for ensuring that energy suppliers minimise installation costs. It assumes that competition between suppliers will encourage less efficient suppliers to improve. But the CMA found that, although the energy market is competitive, large suppliers incur higher costs than they would in a perfectly competitive market.[24] Furthermore, even if some energy suppliers eventually lose market share as a result of failing to keep their costs competitive, market share is typically lost over a period of several years and therefore suppliers could continue to operate inefficiently until the end of the rollout.

Replacing SMETS1 meters with SMETS2 meters

2.37 We explained in Part One that because SMETS1 meters do not have the full functionality and interoperability of SMETS2 meters, there is a risk energy suppliers will have to replace some SMETS1 meters with SMETS2 meters.

2.38 The best possible scenario is that all SMETS1 meters are successfully enrolled and adopted, consumers remain content with the functionality these meters provide, and therefore none have to be replaced with SMETS2 meters. However, the Department's assumption for the purposes of cost–benefit modelling is that 2% of the first two thirds of SMETS1 meters will not be successfully enrolled and adopted, and some stakeholders told us the failure rate could be higher than this. Moreover, the Department has not yet decided if the final third of SMETS1 meters, manufactured by EDMI and Secure, will actually be enrolled. If 10% of the 12.5 million SMETS1 meters currently installed were replaced with SMETS2 meters, this would add around £140 million to programme costs.[25] This could happen as a result of enrolment and adoption failing for certain meters, the third set of meters not being enrolled, and/or consumers asking for their SMETS1 meter to be replaced with a SMETS2 meter so they have more options for switching devices on and off to save money.

24 Competition and Markets Authority, *Energy market investigation: final report*, June 2016.
25 This estimate is based on the expected costs of SMETS2 equipment and installations according to the Department's 2016 cost benefit analysis.

2.39 Regardless of how many SMETS1 meters need replacing, the Department believes that the uncertainty currently surrounding their replacement is pushing up the prices some energy suppliers currently pay to rent SMETS1 meters. These costs are passed on to consumers. The Department says it is gathering evidence on the extent of this issue.

Our assessment of the value-for-money case

2.40 Current evidence suggests that the Department's latest (2016) cost estimate for the programme was over-optimistic. We have previously reported on over-optimism in several of the Department's other energy schemes.[26] It is too early to say if the Department's estimate of benefits is inaccurate because most benefits are uncertain at this point. Whether the programme achieves a net economic benefit depends on the extent of operational cost savings and energy savings, but we will not know for several years if these have been achieved (**Figure 18** overleaf). The Department has told Parliament that it will provide a comprehensive update on costs and benefits in 2019. It is important that this updated analysis includes an assessment of the uncertainty ranges around the central estimates of costs and benefits, and modelling of the impact of smart meters on households with different levels of success in saving energy.

2.41 The Department could have taken a simpler, lower-cost approach to rolling out smart meters that focused only on the benefit of enabling half-hourly metering of electricity. Under such an approach, smart meters would still have enabled future smart energy system benefits worth up to £38 billion, although they would not have had the same potential for reducing energy suppliers' costs, saving energy and enhancing competition. The Department's decision to pursue those additional benefits led to the development of a technologically complex smart metering system with higher costs, higher potential benefits and more implementation risk. The Department and Ofgem have other policy measures (aside from smart meters) that they could have used to improve competition and reduce energy use without implementing a complex smart metering system.[27]

26 Comptroller and Auditor General, Department for Business, Energy & Industrial Strategy, *Low-carbon heating of homes and businesses and the Renewable Heat Incentive*, Session 2017-19, HC 779, National Audit Office, February 2018; Comptroller and Auditor General, Department for Business, Energy & Industrial Strategy, *Controlling the consumer funded costs of energy policies: the Levy Control Framework*, Session 2016-17, HC 725, National Audit Office, October 2016; Comptroller and Auditor General, Department of Energy & Climate Change, *Green Deal and Energy Company Obligation*, Session 2015-16, HC 607, National Audit Office, April 2016.

27 For example, the Department's Energy Company Obligation scheme is used to help consumers save energy by installing insulation in homes, and Ofgem is using various measures to encourage more consumers to switch supplier in order to improve competition.

Figure 18

Summary of cost increases, potential cost increases and risks to expected benefits

Cost increases	Effect on costs and benefits relative to the 2016 CBA
Data and Communications Company (DCC) costs	The latest available information suggests costs of the DCC will be £0.3 billion higher
Alternative Home Area Network (Alt HAN)	According to the Alt HAN company, the cost of Alt HAN technology will add at least £0.2 billion to the cost of the programme.
Marketing by energy suppliers	Available information suggests that energy suppliers' direct marketing and consumer engagement activities to drive uptake of smart meters could add £0.2 billion to the cost of the programme.
Potential cost increases	
Potential replacement of SMETS1 meters	If no SMETS1 meters require replacement, there will be no effect on programme costs. Replacement of 10% of the SMETS1 meters installed to date would add £0.1 billion to programme costs.
Potential additional installation costs	If installer productivity does not improve compared with 2017 levels, this would add £1.8 billion to the costs of the programme.
Risks to expected benefits	
Peak load shifting	It is unlikely that time of use tariffs will be widely available before 2022 at the earliest, which could reduce benefits by up to £0.2bn. Wider use of time of use tariffs in the 2020s could potentially offset this.
Network benefits	Network benefits make up £0.9 billion of programme benefits. It is uncertain how much of this can be achieved now that 12.5 million SMETS1 meters have been rolled out.
Energy savings	If energy savings are not persistent, the value for money of the programme could become marginal or negative.

Notes

1 2011 prices and 2016 base year.

2 SMETS1 stands for Smart Metering Equipment Technical Specifications version 1.

Source: National Audit Office analysis

Part Three

Monitoring, reporting, assurance and risk management

3.1 This part of the report examines the Department for Business, Energy & Industrial Strategy's (the Department's) handling of the Smart Metering Implementation Programme (the programme) in terms of monitoring, reporting, assurance and risk management. It also considers oversight of the programme by the centre of government.

3.2 The Department bears ultimate responsibility for the outcomes of the smart metering programme. It told us that smart metering is unlike most other government programmes because it must drive progress through energy suppliers. However, the government has various levers to accomplish this, from the Department's informal influence to Ofgem's ability to revoke suppliers' licences. Moreover, it was the government's decision to deliver the programme through energy suppliers. Therefore, if the programme fails to deliver its policy aims, this will ultimately be the Department's responsibility. Accepting this responsibility is an important step towards learning lessons from the programme.

Monitoring, benefits realisation and cost control

3.3 Monitoring costs and benefits is essential for ensuring that the programme achieves value for money. Without adequate monitoring, the Department will not know whether and in what ways the programme is off-track and needs to be adjusted. Furthermore, if data on the actual costs and benefits of the programme are never collected, taxpayers and Parliament may never know if the Department achieved its policy aims.

3.4 The Department collects key information relating to costs, consumer experience and rollout progress from energy suppliers and wider industry, and incorporates this into quarterly monitoring reports. It has also undertaken comprehensive assessments of the programme's costs annually from 2011 to 2014, and again in 2016. However, we found that there are important gaps in the Department's monitoring of both costs and benefits.

Benefits

3.5 The Department is not systematically monitoring the energy savings consumers achieve with smart meters. It measured the energy savings consumers achieved in large-scale trials conducted in 2011, but it has not carried out its own research on energy savings since then. Although British Gas has estimated its own customers' energy savings, the Department currently has not quality-assured data on the savings achieved by customers of other energy suppliers. Robust monitoring and evaluation of energy savings and industry cost savings are needed to ensure that the Department is held accountable for the outcomes of the programme. Without this monitoring, we may never know if smart meters really achieve the potential benefits that were used to justify investing consumers' money.

Costs

3.6 The programme is being funded with consumers' money rather than the Department's, which means it is not subject to the usual government spending controls. This makes it even more important for the Department to adopt high standards of cost control, monitoring and reporting. Although the Department collects a large amount of cost data from energy suppliers, there are some gaps in this information. The Department does not track suppliers' spending on marketing costs or upgrading IT systems for smart meters, which could be in the hundreds of millions of pounds.

3.7 The overall cost picture of the programme is currently unclear, because the Department has not updated its assessment of overall programme costs since 2016, although it has committed to do so in 2019. Prior to this, it produced cost–benefit analyses annually from 2011 to 2014. It is important for the Department to keep the overall cost picture up to date so that it can be used to inform management decisions.

Oversight and assurance

The Department's assessment of programme challenges

3.8 Reporting on the programme, both to senior figures at the Department and to the centre of government, has outlined the rollout's progress, together with challenges for delivery and progress towards addressing these. Reports to the Department's executive committee have consistently given the programme an amber or amber-green risk rating (**Figure 19**).

Figure 19

History of programme approvals, internal reporting and assurance

The Department and the Infrastructure and Projects Authority have consistently given the programme an amber delivery confidence rating

Notes

1 Where there was more than one review in a six-month period, and these reviews provided different delivery confidence ratings, we include all of the different ratings in that period.

2 Blank cells indicate that no review occurred in that half-year period.

Source: National Audit Office analysis

3.9 The Department has taken an optimistic view of the risks and challenges presented by SMETS1 meters. Submissions from programme officials to the Department's board and ministers have consistently stated that SMETS1 meters will be enrolled onto the DCC in 2018 to solve interoperability problems. In the written submissions, we have not seen any evidence of the Department acknowledging the difficulty of enrolment and adoption until March 2018, when it was described as "technically and commercially complex". In its external communications, the Department has stated that all smart meters will retain smart functionality when they are enrolled, and that this upgrade will begin by the end of 2018.[28] In practice, enrolment will not begin in 2018 and for some smart meters it may not be successful (as discussed in Part One).

3.10 In its external reporting, the Department is acting as an advocate for smart metering to drive consumer uptake of smart meters and ensure that energy suppliers meet their obligations. But in seeking to promote the programme, the Department risks focusing on making the case for potential positive outcomes at the expense of reporting objectively on progress, both externally and internally.

Central government oversight and assurance

3.11 HM Treasury approved the full business case for the programme in 2013 and was involved in the early stages of the programme, including the tendering process to appoint Smart DCC. As the programme has moved into operational delivery, HM Treasury has maintained strategic-level oversight through regular engagement with the programme's Senior Responsible Owner, updates on progress provided via the Major Infrastructure Tracker submitted by the Department, and regular engagement with energy suppliers.

3.12 However, compared with other consumer-funded energy schemes, HM Treasury has less oversight of the smart metering programme. There is no HM Treasury representative on the Smart Metering Steering Group or the Smart Metering Delivery Group, the main programme governance boards. The Committee of Public Accounts has previously recommended that boards responsible for consumer-funded energy schemes should include a sufficiently senior representative from HM Treasury,[29] and the Department has implemented this recommendation for other consumer-funded energy schemes. The Department and HM Treasury told us that HM Treasury's oversight of smart metering is consistent with the fact that the business case has been approved and the programme is now in its operational phase, and, moreover, the Department considers smart metering to be an 'industry change programme', not a consumer-funded energy scheme. We do not consider these to be compelling reasons for HM Treasury to have less oversight of smart meters than other consumer-funded energy schemes. Although the programme is being delivered by the industry, it has been designed and driven by the Department and the Department's decisions continue to affect consumer costs.

28 Department for Business, Energy & Industrial Strategy, *Smart meters – the smart choice*, August 2018, available at: www.gov.uk/government/news/smart-meters-the-smart-choice

29 HC Committee of Public Accounts, *Consumer-funded energy policies*, Thirty-ninth Report of Session 2016-17, HC 773, February 2017.

3.13 HM Treasury is relying in part on the Infrastructure and Projects Authority (IPA) to provide assurance over smart meters, as is the case with other major programmes. The IPA has consistently given the smart metering programme Amber ratings for delivery confidence (Figure 19). Amber indicates that a programme is deliverable if issues are addressed. Amber-Red indicates that delivery is in doubt with major risks or issues apparent in a number of key areas, and Red indicates that a programme is not deliverable and needs to be re-set.

3.14 In November 2016, the Department's own forecasts indicated that it would not meet the original aim in the 2013 business case of rolling out smart meters to all homes and small businesses by 2020. The Department told the IPA that the value-for-money case for the programme did not rest on achieving the 2020 target, and the IPA therefore decided that delivery of the programme was not in doubt. If it had assessed the programme as being 'in doubt' or in need of a re-set, this would have triggered additional scrutiny and a requirement for remedial action but that assessment was never made. The smart metering programme has not been subject to a Major Projects Review Group review, a joint HM Treasury and Cabinet Office review used for government's largest projects, since 2012.

Risk management

Obsolescence

3.15 A common risk in technology programmes is that the chosen technology becomes obsolete – that is, it is overtaken by new developments. The Department assumes that smart metering equipment such as meters and communication hubs will last for 15 years, because it is simple equipment that already does everything it needs to do. However, it also recognises that over this period there is likely to be innovation in the range of smart household devices on offer to consumers. The Department has therefore taken steps to future-proof the smart metering system, for example by ensuring that smart meters will be able to send their data to other (newly invented) devices via a consumer access device. It is difficult to predict what innovation will happen over the next 15 years, and therefore there is inevitably a residual risk that the Department's smart metering system could be a factor that limits the range of 'smart home' benefits consumers can enjoy in future.

3.16 Parts of the DCC infrastructure operate on the 2G network, which could be switched off before 2030. The DCC has contracted a provider to give network coverage until 2028 with an option to extend to 2033. The Department considers that this ensures sufficient network coverage in the event of the 2G network being switched off. But there is a risk that the current terms of the contract would not endure in this situation.

Contingency planning

3.17 We have previously recommended that departments should think through contingency arrangements rather than assume that risks can be mitigated or dealt with after the fact.[30] The Department did not fully consider what would happen if development of the DCC and SMETS2 encountered serious setbacks. It told us that its contingency plan in this scenario was to carry on rolling out SMETS1 meters. However, it did not fully appraise what this would mean for the programme's value-for-money case or the achievement of the core policy aim of providing an interoperable system. Such an appraisal might have led the Department to decide that there was too much risk in encouraging energy suppliers to start rolling out SMETS1 meters before the DCC and SMETS2 system had been proven.

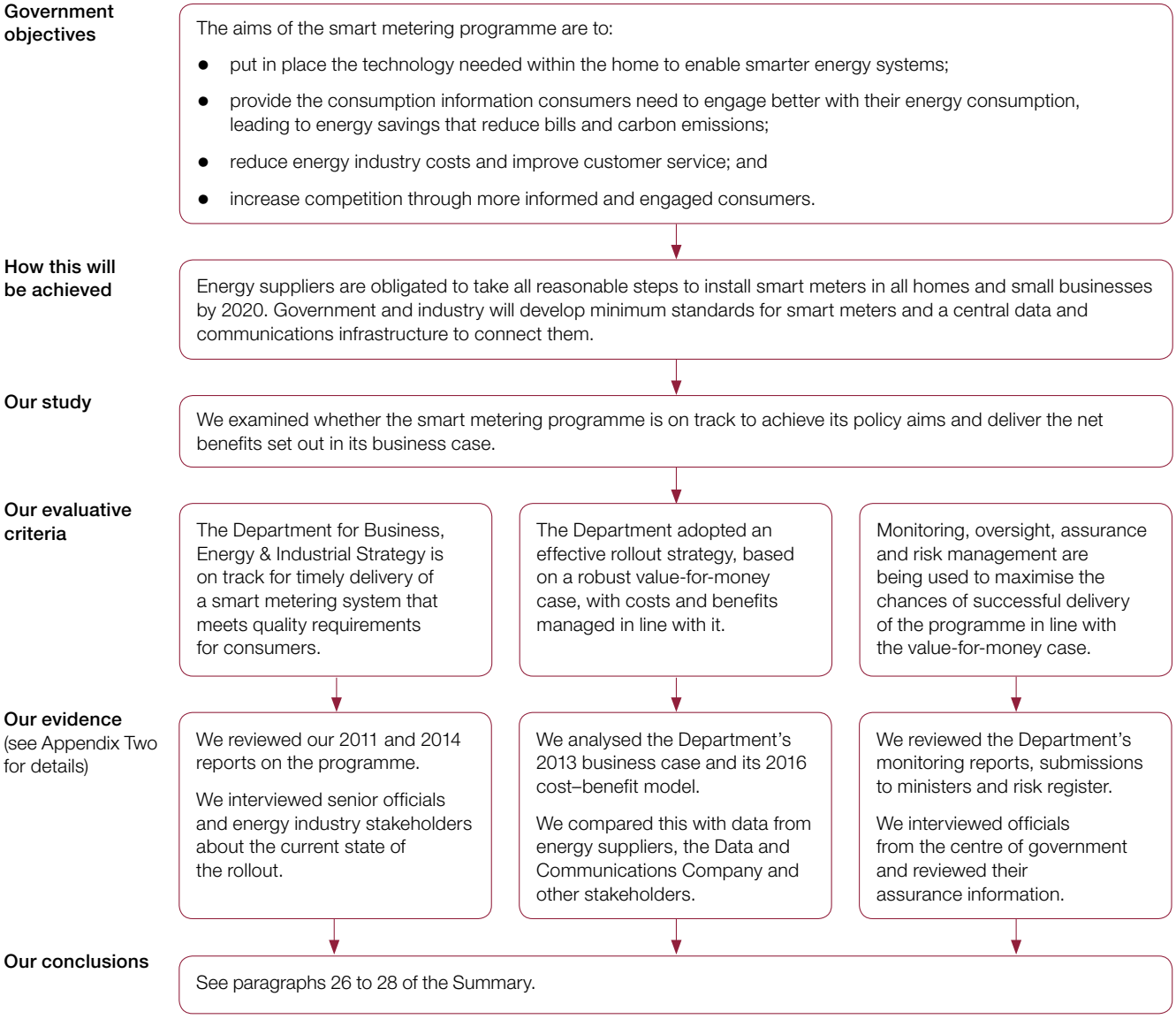
30 Comptroller and Auditor General, *Welfare reform – lessons learned*, Session 2015-16, HC 77, National Audit Office, May 2015.

Appendix One

Our audit approach

1 See **Figure 20** overleaf.

Figure 20
Our audit approach



Appendix Two

Our evidence base

1 We reached our independent conclusions on the value for money of the smart metering implementation programme by analysing evidence collected between January 2018 and November 2018.

2 Our evaluative criteria were informed by insights and analytical frameworks we have previously developed in programme and project management, cost–benefit analysis, digital projects, regulation, and commercial and contract management.

3 We considered relevant findings from our previous reports on government projects and programmes, including:

- our previous reports on smart meters;[31]
- our reports on transformational technology programmes that have encountered difficulty, including the Emergency Services Network, and the Ministry of Justice's Electronic Monitoring Programme; and[32]
- our reports on other government policies delivered through the energy industry, including the Levy Control Framework, and the Green Deal and Energy Company Obligation.[33]

31 Comptroller and Auditor General, Department of Energy & Climate Change, *Preparations for the roll-out of smart meters*, Session 2010-11, HC 1091, National Audit Office, June 2011; Comptroller and Auditor General, Department of Energy & Climate Change, *Update on preparations for Smart Metering*, Session 2014-15, HC 167, National Audit Office, June 2014.

32 The main National Audit Office reports we considered were: Comptroller and Auditor General, Ministry of Justice, *The new generation electronic monitoring programme*, Session 2017-19, HC 242, National Audit Office, July 2017; Comptroller and Auditor General, Home Office, *Upgrading emergency service communications: the Emergency Services Network*, Session 2016-17, HC 627, National Audit Office, September 2016; and Comptroller and Auditor General, *Department for Work & Pensions, Rolling out Universal Credit*, Session 2017-19, HC 1123, National Audit Office, June 2018. We also considered: HC Committee of Public Accounts, *The dismantled National Programme for IT in the NHS*, Nineteenth Report of Session 2013–14, HC 294, September 2013.

33 Comptroller and Auditor General, Department for Business, Energy & Industrial Strategy, *Low-carbon heating of homes and businesses and the Renewable Heat Incentive*, Session 2017-19, HC 779, National Audit Office, February 2018; Comptroller and Auditor General, Department for Business, Energy & Industrial Strategy, *Controlling the consumer funded costs of energy policies: the Levy Control Framework*, Session 2016-17, HC 725, National Audit Office, October 2016; Comptroller and Auditor General, Department of Energy & Climate Change, *Green Deal and Energy Company Obligation*, Session 2015-16, HC 607, National Audit Office, April 2016.

4 In Part One, we examined progress with the rollout of smart meters to date:

- We interviewed senior officials from the Department for Business, Energy & Industrial Strategy (the Department) and Ofgem.
- We interviewed stakeholders in the smart metering implementation programme including: ten energy suppliers; Energy UK; the Energy Networks Association; The National Skills Academy for Power; the Association of Meter Operators; Smart DCC and its communications service providers; the Alt HAN company; staff on the Smart Energy Code panel and its security sub-committee; Smart Energy GB; the Energy Savings Trust; Citizens Advice; Which?; Age UK; academic researchers; consultants in the energy industry; and several government organisations including the National Cyber Security Centre and the Competition and Markets Authority.
- We reviewed unpublished papers from the governance committees the Department uses to discuss the programme with the industry and drive progress with the rollout.
- We compared actual progress with the rollout with the Department's historical plans, including those set out in early consultation documents and its unpublished 2013 business case.
- We made visits to consumers' homes to see SMETS2 meters being installed.

5 In Part Two, we examined the Programme's value-for-money case:

- We assessed the likelihood that the programme's costs and benefits would be in line with the expectations set out in the Department's 2013 business case and 2016 cost–benefit analysis.
    - We analysed cost data from the Department's management information, annual reports energy suppliers are required to provide to the Department, and cost data Smart DCC is required to provide to Ofgem.
    - We analysed information on the likely benefits of the programme we collected from published reports on early trials of smart metering; interviews with energy industry participants; reports by consumer groups such as Citizens Advice; and unpublished research by British Gas on the outcomes of the rollout so far.
- We assessed whether the value-for-money case for the programme was robust.
    - We assessed the Department's strategy for rolling out smart meters, as set out in early consultation documents and the 2013 business case.
    - We reviewed the key assumptions in the Department's 2013 business case and 2016 cost benefit analysis, and performed sensitivity analysis around the key assumptions using the Department's cost–benefit model.

6 In Part Three, we examined the Department's management of the programme:

- We reviewed the Department's unpublished internal reporting on the programme, including the updates the programme team had provided to the Department's performance and risk committee, and submissions to the Department's board and ministers.
- We analysed the Department's risk register.
- We reviewed unpublished Infrastructure and Projects Authority (IPA) assurance reviews of the programme, and interviewed IPA and HM Treasury about their oversight of the programme.

7 In Appendix Three, we compared the rollout of smart meters in Great Britain with rollouts in other European Union countries.

- We reviewed published reports on smart metering in other countries authored by the European Commission and academic researchers.
- We interviewed participants in the rollout in Great Britain who also have knowledge of smart metering programmes in other countries.

Appendix Three

International comparisons

1 This appendix compares Great Britain's smart metering programme with equivalent programmes in other European Union (EU) countries. One of the drivers of smart metering in the EU was a set of directives that required EU countries to consider conducting a cost–benefit assessment of smart metering, then proceed with rollout if the value-for-money case were positive.[34]

Design choices

2 Compared to other countries, the design of the programme in Great Britain has several uncommon features:

- The rollout of smart meters is the responsibility of energy suppliers, not network companies.
- Consumers can choose to decline a smart meter installation.
- In-home displays have to be offered.
- Gas meters are being rolled out in addition to electricity meters.

The decisions to mandate smart gas meters and in-home displays reflect the government's focus on using smart meters to achieve consumer energy savings.

34 Directive 2006/32/EC instructed EU countries to implement smart metering "so far as it is technically possible, financially reasonable and proportionate". Directives 2009/72/EC and 2009/73/EC instructed EU countries to roll out smart meters unless a cost–benefit analysis showed that there was not a positive economic case for them. The legislation called for rollout of smart electricity meters to 80% of consumers by 2020, but no deadline was set for smart gas meters.

Delivery model and opt out

3 Great Britain has obligated retail energy suppliers to roll out smart meters. In all other EU countries that have decided to roll out smart meters, distribution network owners or operators are responsible for doing this (**Figure 21**). This is primarily because, in most countries, meters are owned by the network operator. Great Britain is unusual in having given energy suppliers responsibility for meters in 2003-04. In 2009, the Department considered adopting a network-led delivery model for smart meters but decided against this on the grounds that it would take additional time to re-regulate the meter market. The Department also believed that energy suppliers had a closer relationship with customers than energy networks, and that this relationship would be important for maximising the consumer benefits of the programme (as discussed in Part One).

Figure 21
International comparison of delivery models

Countries where energy suppliers are responsible for rollout	Countries where network companies are responsible for rollout
Great Britain	Austria
	Denmark
	Estonia
	Finland
	France
	Germany[1]
	Greece
	Ireland
	Luxembourg
	Italy
	Malta
	The Netherlands
	Poland
	Romania
	Spain
	Sweden

Note

1 In Germany both distribution network operators and meter operators will be responsible for rollout.

Source: National Audit Office analysis of European Commission, *Benchmarking smart metering deployment in the EU-27 with a focus on electricity*, June 2014

4 Great Britain is also unusual in allowing consumers to opt-out of smart metering. The Netherlands is the only other country to currently have a voluntary smart meter rollout. In Italy, smart meters were voluntary at the beginning of rollout but were later made mandatory.

Gas meters and in-home displays

5 The government decided to implement smart gas meters and in-home displays mainly in order to maximise the potential energy-saving benefits of smart metering. Only a minority of countries have chosen to roll out smart meters for gas. With the exception of Ireland, the countries implementing smart gas meters are ones that make greater use of gas for domestic heating than the countries that are implementing smart electricity meters only (**Figure 22**). Great Britain is almost unique in mandating an in-home display. The only other EU country to have done so is Ireland.

6 Because in-home displays and gas meters are typically located at a distance from electricity meters, the decision to include them in the design of the smart metering system in Great Britain has added to its overall complexity. Devices need a wireless network to connect to each other and, because gas meters do not have their own power supply, smart gas meters require battery packs. Batteries are non-replaceable and must therefore last for the lifetime of the meter. This means that, to save power, gas meters only 'wake up' to send and receive information once every 30 minutes. At other times, messages must be queued and this has contributed to technical complexity.

Figure 22
International comparison of decisions to enable smart gas metering

Numbers in brackets show the proportion of space heating provided by gas

Countries opting for smart gas metering	Countries not opting for smart gas metering
The Netherlands (87%)	Germany (46%)
Great Britain (76%)[1]	Romania (28%)
Italy (61%)	Czech Republic (27%)
Luxembourg (50%)	Spain (24%)
France (39%)	Denmark (16%)
Ireland (25%)	Poland (14%)
Austria (23%)	Bulgaria (4%)
	Portugal (1%)

Note

1 For Great Britain, the figure shown is the UK average.

Source: National Audit Office analysis of: European Commission, *Benchmarking smart metering deployment in the EU-27 with a focus on electricity*, June 2014; Eurostat 2016

Timescales for rollout

7 In a small number of EU countries, smart meter rollouts have already reached 95% or more of homes. In each case, this has taken at least five years:

- Finland: five years;
- Sweden: seven years; and
- Italy: a number of different rollouts for different network operators, which each took around five years.

In Great Britain, the government's original plan was for the SMETS2 rollout to take place over five years (2014–19). The deadline was subsequently pushed back to 2020 but because of delays to the DCC infrastructure and SMETS2 standard, rollout of SMETS2 meters only began in significant numbers in mid-2018, leaving around two and a half years for the SMETS2 installation phase.

Costs and benefits of smart metering

8 Some EU countries found that the economic case for smart metering was not positive, and therefore decided not to proceed, or postponed making a decision. In Germany, the government concluded that there was only a positive economic case for rolling out smart electricity meters to homes that consumed at least 6,000 kwh of electricity a year. Therefore, Germany opted to mandate rollout only to those homes (**Figure 23** overleaf).

9 There have been attempts to compare the costs and benefits of smart electricity metering reported by different EU countries. Like-for-like comparisons are difficult to make because different countries account for costs and benefits differently – for example, they use different discount rates and different cut-off dates beyond which costs and benefits are not counted. Furthermore, the costs of smart gas and electricity metering in Great Britain are hard to disentangle, making it difficult to compare with countries that are only implementing smart metering for electricity. According to the European Commission, among the countries that decided there was a positive economic case for smart meters, the range of estimated costs was between £72 and £329 for a smart electricity meter and between £131 and £230 for a smart gas meter.[35] By comparison, in Great Britain the estimated cost per smart meter (on average, across gas and electricity) is £187, according to the Department's 2016 cost–benefit analysis[36]

35 According to the European Commission, some 80% of countries who concluded that there was a positive case for smart electricity meters provided cost estimates of between €80 and €366 per meter. Of the countries that concluded there was a positive case for smart gas meters, 65% of countries estimated that the costs would be between €145 and €255 per meter. These costs are discounted, using different discount rates in each country. The Great Britain estimate of £187 per meter is also based on the discounted costs of the programme.

36 This implies that for a household with one gas and one electricity meter the total cost is £374.

Figure 23

Decisions to implement smart meters in European Union countries as of 2014

Country	Electricity meters – Decision to proceed	Gas meters – Decision to proceed
Austria	Yes	Decision pending
Belgium	No	No
Bulgaria	No decision yet	No decision yet
Cyprus[1]	No decision yet	N/A
Czech Republic	No	No
Denmark	Yes	No decision yet
Estonia	Yes	No decision yet
Finland	Yes	No decision yet
France	Yes	Decision pending
Germany	Selective	Selective
Great Britain	**Yes**	**Yes**
Greece	Yes	No decision yet
Hungary	No decision yet	No decision yet
Ireland	Yes	Yes
Italy	Yes	Yes
Latvia	Selective	No
Lithuania	No	No decision yet
Luxembourg	Yes	Yes
Malta[1]	Yes	N/A
Netherlands	Yes	Yes
Poland	Yes – decision pending	No decision yet
Portugal	No	No
Romania	Yes – decision pending	No
Slovakia	Selective	No
Slovenia	No decision yet	No decision yet
Spain	Yes	No
Sweden	Yes	No decision yet

Note

1 Not applicable because there is no natural gas network in Cyprus or Malta.

Source: European Commission, *Benchmarking smart metering deployment in the EU-27 with a focus on electricity*, June 2014

Appendix Four

Sensitivity analysis of benefits and costs

1 The Department for Business, Energy & Industrial Strategy (the Department) uses an Excel model to forecast the expected benefits and costs of the Smart Meters Implementation Programme. This model forecasts these economic impacts out to 2030 in 2011 prices.[37]

2 The Department's published impact assessments and cost–benefit analysis updates present estimates for the various benefits and costs. To understand the uncertainty around the central case estimate, we used sensitivity analysis to identify those assumptions that have the greatest impact on the estimated present value of benefits net of costs (the net present value).

3 Our first test varied each of the model's underpinning base case assumptions by a consistent +/-10%. We recorded the impact of this change and compared it with the baseline position. In this scenario, we found the Department's estimate of net present value is most sensitive to expectations about the amount of energy that consumers save following the installation of a smart meter. Other assumptions that were also important included the expected avoided costs of site visits following the installation of a smart meter, the costs of installing smart meters in consumers' homes and premises, and the capital costs of smart meters (see **Figure 24** on pages 74 and 75).

4 Our second test varied four assumptions by a high/low range as defined by the Department in its 2016 cost–benefit analysis.[38] Again, we recorded the impact of each change and compared it with the baseline position. This analysis provides further evidence that the Department's net present value estimate is most sensitive to its assumption on the amount of energy customers are likely to save because of their smart meters (see **Figure 25** on page 76).

37 Costs and benefits are discounted using the government discount rate (3.5% per annum). The base year for this discounting is 2016.

38 Department for Business, Energy & Industrial Strategy, *Smart meter roll-out cost–benefit analysis, Part II – Technical Annex*, August 2016.

Figure 24

Sensitivity analysis of the Smart Meters Implementation Programme net present value estimate (£m), varying a selection of its underpinning modelling assumptions by +/-10%

The net present value (£m) of the Smart Meters Implementation Programme is particularly sensitive to changes in assumptions on energy savings, site visit costs, installation and capital costs

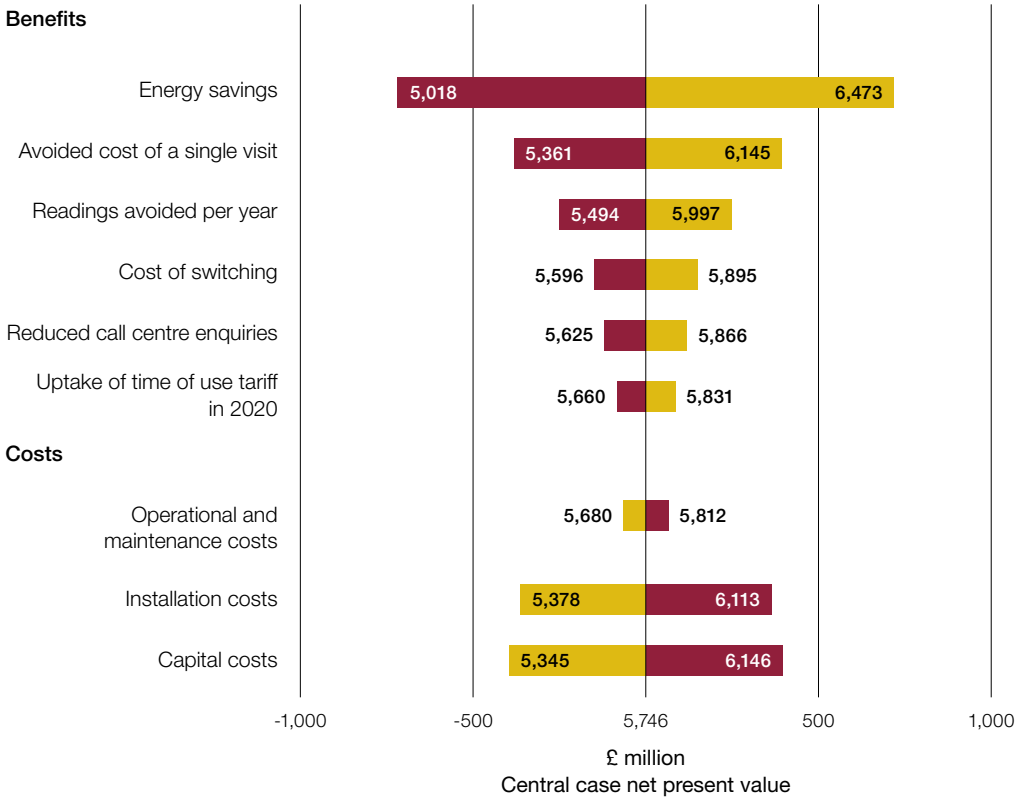


Figure 24 *continued*

Sensitivity analysis of the Smart Meters Implementation Programme net present value estimate (£m), varying a selection of its underpinning modelling assumptions by +/-10%

Notes

1 Net present value base year is 2016 and all estimates are in 2011 prices.

2 All assumptions are varied by +/-10%. For example, an assumption with a base case of 3% would be adjusted to 3.3% in the +10% case and 2.7% in the -10% case.

3 Sensitivity analysis on energy savings covers five distinct assumptions. For domestic and non-domestic electricity meters, the base case assumes an energy saving of 2.8%. For domestic credit and prepayment gas meters, the base case assumes energy savings of 2% and 0.5% respectively. For non-domestic gas meters, the base case assumes an energy saving of 4.5%.

4 Sensitivity analysis on the avoided cost of a single visit covers three distinct assumptions. In the base case, the avoided cost of a standard visit is £3, the avoided cost of a special read visit is £10 and the avoided cost of a special safety inspection visit is £17.50.

5 In the base case, the model assumes that two readings are avoided per year per customer after they have installed a smart meter.

6 Sensitivity analysis on the cost of switching covers four distinct assumptions that are consistently applied for both the domestic and non-domestic sectors. In the base case, the pre-DCC customer switching benefits are £0.75 per customer, post-DCC customer switching benefits are £1.58 per customer, switching benefits after centralisation of registration are £2.22 per customer and switching benefits after data aggregation are £3.12 per customer.

7 Sensitivity analysis on reduced call centre enquiries covers two distinct assumptions. In the base case, inbound call enquiries cost savings are £1.88 per customer and customer service overheads cost savings are £0.33 per customer.

8 In the base case, the model assumes that 20% of customers with a smart meter will adopt time of use tariffs.

9 Sensitivity analysis on installation costs covers different metering equipment assumptions that are consistently applied for both the domestic and non-domestic sectors. For example, in the base case, installation costs for gas and electric smart meters are £67; and a dual fuel efficiency discount of £27 is applied where gas and electric smart meters are installed at the same time, giving a total dual fuel installation cost of £107.

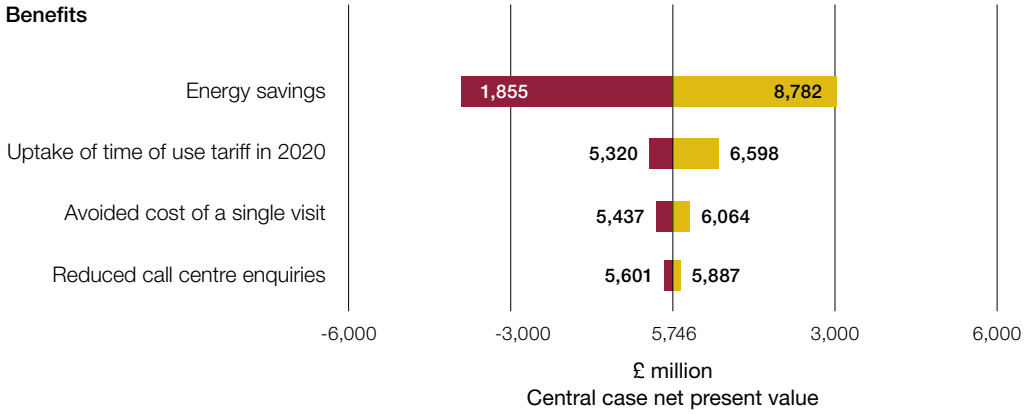
10 Sensitivity analysis on capital costs covers different assumptions that are consistently applied for both the domestic and non-domestic sectors. In the base case, for example, capital costs for in-house display devices are £15; electric smart meters, £44; and gas smart meters, £57.

Source: National Audit Office analysis of the Department for Business, Energy & Industrial Strategy business case model

Figure 25

Sensitivity analysis of the Smart Meters Implementation Programme net present value estimate (£m), varying four of its underpinning modelling assumptions within a high low range

The net present value (£m) of the Smart Meters Implementation Programme is particularly sensitive to changes in assumptions on energy savings



Notes

1 Net present value base year is 2016 and all estimates are in 2011 prices.

2 Sensitivity analysis on energy savings covers five distinct assumptions. For domestic and non-domestic electricity smart meters, assumptions were varied from 1% to 4%. For domestic credit and pre-payment gas meters, assumptions were varied from 1% to 3% and 0.3% to 1% respectively. For non-domestic gas meters, assumptions were varied from 3.5% to 5.5%.

3 For the uptake of time of use tariffs, assumptions were varied from 10% to 40%.

4 Sensitivity analysis on the avoided cost of a single visit covers three distinct assumptions. The avoided cost of a standard visit, the avoided cost of a special read visit and the avoided cost of a special safety inspection visit is varied by -8% and +8%.

5 Sensitivity analysis on reduced call centre enquiries covers two distinct assumptions. Inbound call enquiries cost savings were varied from £1.65 to £2.10 per customer and customer service overheads cost savings were varied from £0.29 to £0.36 per customer.

Source: National Audit Office analysis of the Department for Business, Energy & Industrial Strategy business case model and smart meter rollout cost–benefit analysis, Part II – Technical Annex, August 2016

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