IoD *Inspiring* business

Not too clever: will Smart Meters be the next Government IT disaster?

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IoD Policy Report

About the authors

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Summary

- Smart meters are the largest UK Government-run IT project in history, and the most expensive and complex smart meter programme in the world.
- The risks of such a huge programme with so much complexity are staggering.
- The pace of technological innovation may well leave the current generation of meters behind and leave consumers in a cycle of installation, de-installation and re-installation.
- Three assessments of the programme by the Major Projects Authority have not been published. This is unacceptable.
- It is imperative to move towards a cost-effective smart meter rollout by embracing one or all of the following cost-saving and simplifying measures:

  i) Halting the smart gas meter deployment;

  ii) Removing the requirement for an in home display;

  iii) Reduce rollout to only those homes that have a high energy usage;

  iv) Abandon attempts to stretch the rollout to flats and tower blocks;

  v) Make the programme genuinely voluntary;

  vi) Abandon the programme altogether and develop a smartphone app that allows customers to take their own readings.
- Over the years, the ambition and scale of Government IT projects has not been matched by appropriate management and planning.
- 80 per cent of surveyed IoD members believe Government's ability to deliver successful IT projects is poor.

"The IoD believes that British businesses should expect the government to set a gold standard for sound planning, management and oversight of major IT projects."

Introduction

Over the past decade and a half, successive governments have recognised the need for the UK to build a modern and efficient digital infrastructure. They have embarked on a number of ambitious programmes aimed at achieving just that. However, there are many who argue that while politicians and civil servants have been clear about the scale and need for these reforms, their management of some of these projects has been decidedly opaque.

Extended projects, such as the NHS National Programme for IT and the BBC Digital Media Initiative, have become notable and public examples of undertakings that, although well-intentioned, were plagued by management and planning issues. In addition to these, a recent spate of concerns surrounding high-profile IT projects has brought these issues further into the public eye. After all, when Government appears to be wasting significant funds on public projects at a time of widely publicised national belt tightening, it is unsurprising that people sit up and pay attention.

This is by no means a new discussion. Notably, however, it has taken a period of forced austerity to spur calls for improved efficiency, less complexity, and greater accountability. The scale and speed at which departments were called on to make cuts coincided closely with the recognition of significant waste and poor communication across Whitehall. Given the announcements made by the two major parties of the need to find still greater efficiencies, we can expect the imperative of better project management to remain high on the agenda for the duration of the next parliament.

The IoD believes that British businesses should expect the government to set a gold standard for sound planning, management and oversight of major IT projects. By all accounts, the private sector would benefit significantly from Government providing such a standard. Tellingly, a large, cross-industry report in 2012 revealed that companies with 'large IT projects run 45 percent over budget and 7 percent over time, while delivering 56 percent less value than predicted'. Furthermore, it suggested that '17 percent of IT projects go so bad that they can threaten the very existence of the company.'[1] Government simply cannot afford to match these figures in the management of major public projects.

British business leaders appear to be broadly negative about Government's ability to deliver successful IT projects. A recent survey of IoD membership revealed 80 per cent of members perceive it to be either 'poor' or 'very poor'.

With this in mind, and in view of the further cuts that are likely to face departments over the course of the next parliament, they simply cannot afford to be anything other than ruthlessly specific about ownership, targets, and costs before embarking on any large projects.

Next year, the largest government-run IT project in history, already much delayed and scheduled to cost £11 billion, will be unleashed across the country. By far the most complex and one of the most costly in the world, the Smart Meter Programme's goal is to remove over 53 million electro-mechanical gas and electricity monitors from every home and small business between now and 2020 and replace them with over 104 million pieces of new kit including a new communications network and real-time display monitors. Advocates - somewhat breathlessly - believe they will unleash a transformation in accurate billing, reduced domestic energy consumption plus enhanced competition and choice with 24-hour switching. Critics, many of whom are within the energy industry and prefer to remain anonymous, contend that the benefits will be at best marginal, the technology will soon be out of date and need replacing and, last but not least, there is absolutely no consumer demand for their money to be spent on them.

Doubtless, no area of energy policy is ever quite black and white. There is a genuine and valuable need for accurate energy consumption data. It is surprising, however, how little public attention and scrutiny have been given to such a huge project. But with a real cost of living crisis for many Britons, it's always right to ask what the cost is of doing nothing because the capital costs will come out of their disposable income. This paper will look at where the smart meter programme came from, and ask whether the benefits stack up against cheaper alternatives?

[1] Block, M.,Blumberg, S., & Laartz, J. (2013). Delivering large-scale IT projects on time, on budget, and on value, McKinsey & Company.

> **"failure to maintain pace with technological improvement is a real danger"**

A decade of lessons

At the outset, it is important to set the smart meter programme against the backdrop of a decade of large Government IT projects and the lessons that have been drawn from them.

The eBorders Programme (2007 – 2013):
Introduced by the Labour Government of 2007, the eBorders programme was intended as a means of storing data on all passengers and crew entering the UK and checking them against criminal and terrorist databases. The task of delivering the programme was originally handed to the US Defence Contractor, Raytheon. However, citing concerns over delays and targets not being met, the Government terminated the contract and responsibility for delivery was handed to IBM.

Raytheon, meanwhile, felt that it had been treated unfairly and went on to claim that no benchmarks for performance had been set by the UK Borders Agency. They claimed, therefore, that their contract had been wrongly terminated. This claim led to a tribunal ruling in 2014 that saw them awarded compensation of around £224 million. Although the Home Office has since successfully appealed against this decision, it has been reported that their legal costs associated with the case have so far been in the region of £35 million.

The eBorders issue appears to be an example of confused delivery, insofar as the contractor (the Government) and the contract holder appeared to be thinking at cross-purposes. In the same way, the failure was the product of bad stakeholder engagement. Importantly also, the Chair of the Home Affairs Select Committee declared at the time that the UK Borders Agency 'didn't know what they wanted from the eBorders programme'.[2]

NHS National Programme for IT (NPfIT): 2002- 2011
This programme was intended to bring about a single, centrally controlled care record of patients that could be accessed by 30,000 GPs and 300 hospitals. It was also intended to bring about computerised referral and prescription services and create a better system for online booking of appointments. It was hoped that it would make the Health Service more efficient and cohesive, bringing it forward into the era of big data and ubiquitous internet engagement. Contracts for firms to implement the programme were handed out on a regional basis.

Some of the major problems that confronted the programme were:

- that it was failing to engage clinicians effectively;
- that there were doubts over the security of the data that was being used;[3]
- that contract providers were repeatedly being replaced or downsizing their roles.

The NPfIT was eventually abandoned, having cost around £10 billion, on the grounds that top down decision-making was not appropriate for the NHS and the health service ought to be driven locally by patients and clinicians. Furthermore, the Public Accounts Committee noted that 'the Department's statement on the benefits expected from the National Programme showed that most of the benefits are yet to be delivered. There is a risk that some of these benefits may never materialise.'[4]

In addition to the costs that have already been incurred by the NPFIT, there have also been reports recently that Fujitsu is looking to sue the Department of Health over loss of their contract. The costs of this could run to £700 million.

2008 – 2013: BBC Digital Media Initiative
Intended to revolutionise the way that staff at the BBC shared audio and video material, this initiative was billed as an important part of the BBC's move to Salford. Siemens was originally hired to develop the project (with Deloitte consulting) before responsibility was handed to an internal BBC team. The programme was supposed to have been developed within a year but dragged on until 2013, when it was scrapped. The cost of the project was nearly £100 million between 2010 and 2012 alone.

A number of issues were flagged up during the fallout. A BBC Director, Eric Huggers, noted that the relationship between Siemens and the BBC was too distant as Siemens had taken on the risk associated with the programme.[5] Furthermore, once responsibility for delivery had been brought back into the BBC, issues of accountability arose. Margaret Hodge, Chair of the Public Accounts Committee, commented that when the BBC took it on 'no single individual had overall responsibility or accountability for delivering the DMI and achieving the benefits, or took ownership of problems when they arose'.[6]

Director General of the BBC, Lord Hall, commented also that the implementation of the DMI 'struggled to keep pace with new developments' both at the BBC and within the wider broadcasting industry. In particular, this failure to maintain

[2] Keith Vaz (2014) Available at: http://www.defensenews.com/article/20140818/DEFREG01/308180016/UK-Required-Pay-Raytheon-Over-Border-Security-Program-Termination.

[3] Available at: http://www.theguardian.com/business/2008/may/29/nhs.

[4] House of Commons Committee of Public Accounts (2013) '*The dismantled National Programme for IT in the NHS. Nineteenth Report of Session 2013-14*'. HC 294 House of Commons, London: The Stationery Office Limited.

[5] Oral evidence taken before the Public Accounts Committee. The BBC's management of its Digital Media initiative. House of Commons Committee of Public Accounts, 15 February 2011, p.20.

[6] Available at: http://www.bbc.co.uk/news/entertainment-arts-26963723.

> **"Many of the issues that have been faced by these projects are not necessarily restricted to IT projects"**

pace with technological improvement is a real danger associated with the drawn out implementation of IT projects. The risk of not keeping pace with technology underpins the need for firm deadlines.

2014: Ministry of Justice Back Office functions

In June 2014, the Ministry of Justice cancelled a contract for a project to improve back office functions (that would affect up to 90,000 individuals) like procurement, payrolling, and staffing. The contract was cancelled after they found that the Cabinet Office had been planning to implement a similar scheme since 2012. In addition to the issue of duplication, the project was also seen to be late and over budget. £56 million had to be written off. [7]

There are a great many lessons to be learned from these projects, not least that the process of creating a large piece of digital infrastructure is hugely complex and fraught with the potential for error. Large ICT projects over the last 10 years have been characterised, not just by poor implementation, but also by inadequate anticipation of likely issues, as well as failure to engage all stakeholders in gearing them towards the best interests of the public.

Many of the issues that have been faced by these projects are not necessarily restricted to IT projects, however. Issues concerning mismanaged contracting, poor engagement across departments and competences, and ineffective oversight are also faced by many major projects. Equally, it is the case with these projects, as with IT, that still greater efficiencies will need to be found.

[7] Available at: http://www.theguardian.com/politics/2014/jun/29/ministry-justice-56m-writeoff-it-project.

> “very few people are clear about what the programme actually entails – the installation of at least 100 million new pieces of electronic kit”

Smart Meters

The origin and chronology of the Smart Meter Programme

The legislative drive came originally from Europe, the Energy Act and the Coalition agreement. Directive 2006/32/EC on Energy End-use Efficiency and Energy Services laid the groundwork by saying, “Member States must ensure that end-users are provided with competitively priced individual metering and informative billing that shows their actual energy consumption,” and, “individual meters must be installed at a competitive price wherever economically and technically feasible”.[9]

The 2008 Energy Act gave the Secretary of State (SoS) powers to initiate the rollout of smart meters which the then SoS, Ed Milliband, duly did. Three years later, Directive 2009/72/EC, mandated the rollout of smart meters across the EU, with a vital caveat, saying;

“Where roll-out of smart meters is assessed positively, at least 80% of consumers shall be equipped with intelligent metering”.[10] The final push came from the 2010 Coalition agreement which underlined,“we will establish a smart grid and roll out smart meters”.[11]

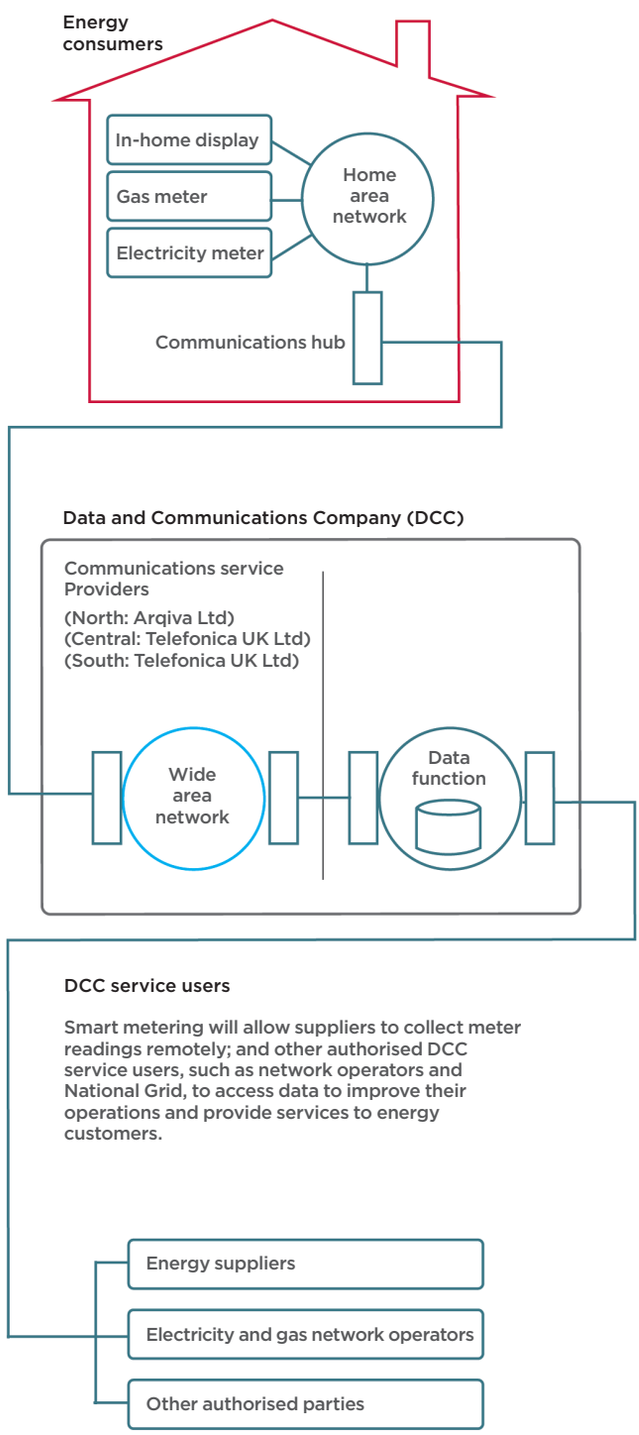
For all that, very few people are clear about what the programme actually entails – the installation of at least 100 million new pieces of electronic kit, namely:

27 million smart electricity meters;
23 million smart gas meters;
27 million in home displays (IHDs); and
27 million communications hubs (HAN or Home Area Networks and WAN or Wide Area Networks).

Add to this the creation of a Data Communications Company, responsible for linking the smart meters to the systems of the utility suppliers, energy service companies and distribution network operators. The contract for this new company was awarded to Capita plc who set up a company called Smart DCC Ltd, which has subsequently signed on large contracts downstream with different communications suppliers in different regions to carry the data. The largest so far is with Telefonica UK for £1.5 billion over 15 years to cover the South and the Midlands.

Figure 1

The main components of the smart metering programme[8]



[8] See National Audit Office report – Update for preparations for smart metering http://www.nao.org.uk/wp-content/uploads/2014/06/Update-on-preparations-for-smart-metering.pdf

[9] See http://europa.eu/legislation_summaries/energy/energy_efficiency/l27057_en.htm.

[10] See http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0055:0093:EN:PDF.

[11] See https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/78977/coalition_programme_for_government.pdf.

"Why would an energy supplier want to sell you equipment whose principal aim is to reduce your energy consumption?"

Finally, a new system of Smart Energy Codes has to be developed and maintained to enable switching and consumer protection. Gemserv was awarded the contract for this and the code is now contained in a 922 page document and growing.

Clearly, this is an immensely complex programme. But what has been the foreign experience of smart meters and what can we learn from it?

The first adopters of smart meters internationally, invariably are nations that do not have liberalised and unbundled energy markets like the UK and have been brought in by government mandate rather than consumer-led demand. That is no accident because according to CapGemini's head of energy, Colette Lewiner, "...it is difficult to find a good economic case for smart metering right now. The returns are scattered around the value chain: peak-shaving in summer or winter; better grid management; enhanced consumer relationships".[12]

In a liberalised market, what you may want, or not want, with a smart meter pulls you in three different directions if you are a consumer, a supplier or a distribution network operator. Why would a consumer volunteer to buy £250 of smart metering kit?

Why would an energy supplier want to sell you equipment whose principal aim is to reduce your energy consumption?

So the first nations to adopt smart meters have been correspondingly unliberalised Italy and Spain, and the paternalistic state of Sweden. The other benefit to these countries was that in Italy smart meters would play an important role in reducing electricity theft, and for Sweden, the advantage was that a large country with a small population would not require much more expensive meter reading. Two issues that Britain's urban density and relative honesty do not need to solve.

According to Alex Henney, long-time sceptic of smart meters and author of *"The British Electric Industry 1990-2010: The Rise and Demise of Competition"*, in a submission to the Energy and Climate Change Committee, Britain's smart meter programme stands out for being the most complex and costly in the world.

Further studies Henney has undertaken appear to show some correlation between positive benefits outweighing the costs when matched with high energy consumption, with the exception of Norway.

Table 1

Britain leads the world? Comparative costs of Electric Smart Meter Programme (2009 prices)

	Britain	ENEL (Italy)	ACEA (Italy)	Iberdrola (Spain)
All in cost per meter (GBP)	135	65	75	70
Programme cost for 30 million electric meters (£bn)	4.05	1.95	2.25	2.1

[12] See http://www.utilityweek.co.uk/news/Rocky-rollout-for-smart-meters/784742#.VNyFaNKsX0c

> **"only 5 of the 27 nations are pushing ahead with them for 2020"**

Table 2

Experiences around the world

Country	Annual electricity consumption residential customer in kwh	Result
Victoria (Australia)	5,700	A January 2014 Deloitte study showed a negative Cost Benefit Analysis (CBA) between 2008-2028 of AUD $ 319 million compared to a 2010 pre-deployment study that put the benefits at AUD $ 774 million[13]
Spain	3,200	Net disbenefit according to unofficial study by regulator's office
Sweden	8,000	Only justified for dwellings receiving more than 8,000 kwh p.a.
Norway	16,000	No benefit without including "uncertainties"
Denmark	3,800	Some benefit if customers reduce consumption
France	4,570	Benefits just cover costs from the perspective of the Distribution Network Operator (DNO)
Netherlands	3,350	Positive net benefit, but only if 20 per cent of consumers opt for the "switch-off"
New Zealand	7,400	Benefits likely to exceed costs for the majority of residential customers
Britain(£bn)	4,192	To be determined

A June 2014 European Commission report, *"Benchmarking smart metering deployment in the EU-27"*[14], showed that only 16 nations within the EU block were planning to roll out electricity smart meters by 2020, the rest having not conclusively proven that they were worth it. Meanwhile for gas, 12 nations concluded that these smart meters could not be justified and only 5 of the 27 nations (Ireland, Italy, Luxemburg, the Netherlands and the UK) are pushing ahead with them for 2020. Both electricity and gas meters have key parameters for measuring success and the EC study revealed a wide range of values amongst member states.

[13] See http://www.smartmeters.vic.gov.au/about-smart-meters/reports-and-consultations/advanced-meteringinfrastructure-cost-benefit-analysis/4.-analysis-of-costs-and-benefits-2008-2028.

[14] See http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=COM:2014:356:FIN&from=EN.

> "Germany's Economy Ministry commissioned EY to conduct a cost-benefit study and it concluded that smart meters for Germany were not worth it for consumers"

Table 3

Range of key smart electricity meter rollout parameters of EU states based on long-term economic assessments

	Range of values
Discount rates	3.1 to 10%
Lifetime	8 to 20 years
Energy saving	0 to 5%
Peak loading shifting	0.8 to 9.9%
Cost per metering point	€77 to €766
Benefit per metering point	€18 to €654
Consumer benefits (as % of total benefits)	0.6% to 81%

Table 4

Range of key smart gas meter rollout parameters of EU states based on long-term economic assessments

	Range of values
Discount rates	3.1 to 10%
Lifetime	10 to 20 years
Energy saving	0 to 7%
Cost per metering point	€100 to €268
Benefit per metering point	€140 to €1000

The stand-out example though, since this study is Germany. Germany's Economy Ministry commissioned EY to conduct a cost-benefit study and it concluded that smart meters for Germany were not worth it for consumers.[15] This is all the more surprising coming from a country that has the most expensive clean energy programme in the world, at very questionable cost, spending €16 billion on renewable subsidies in 2013 alone.[16] Compared to this, the price of 50 million smart gas and electricity meters spread over a decade or more, starts to look relatively small. And yet they still couldn't make the numbers add up, particularly for lower energy users.

[15] See http://www.smartmeters.vic.gov.au/about-smart-meters/reports-and-consultations/advanced-metering-infrastructure-cost-benefit-analysis/4.-analysis-of-costs-and-benefits-2008-2028.

[16] See http://www.economist.com/news/europe/21594336-germanys-new-super-minister-energy-and-economy-has-his-work-cut-out-sunny-windy-costly.

Table 5

Status of gas smart-metering rollout in EU (July 2013) [17]

Range of values	Range of values	Range of values	Range of values
Austria	Yes - official decision pending	Yes	Positive
Belgium	No	Yes	Negative
Bulgaria	No decision yet	No decision yet	Not available
Cyprus	Not applicable	Not applicable	Not applicable
Czech Republic	No	Yes	Negative
Denmark	No decision yet	Yes	Negative
Estonia	No decision yet	No	Not available
Finland	No decision yet	Yes	Negative
France	Yes - official decision pending	Yes	Positive
Germany	Selective	Yes	Negative
Greece	No decision yet	Yes	Negative
Hungary	No decision yet	In progress	Not available
Ireland	Yes	Yes	Positive
Italy	Yes	Yes	Positive
Latvia	No	Yes	Negative
Lithuania	No decision yet	Not available	Not available
Luxembourg	Yes	Yes	Positive
Malta	Not applicable	Not applicable	Not applicable
Netherlands	Yes	Yes	Positive
Poland	No decision yet	Not available	Not available
Portugal	No	Yes	Negative
Romania	No	Yes	Negative
Slovak Republic	No	Yes	Negative
Slovenia	No decision yet	Not available	Not available
Spain	No	Yes	Negative
Sweden	No decision yet	Yes	Negative
United Kingdom GB	Yes	Yes	Positive

What this shows then is that were Britain (Northern Ireland is not included in the Smart Meter Programme) to change its mind, it would definitely not be alone in Europe.

So just what are the intended benefits of smart meters and do they really stack up? It is a very live question and two English-speaking government auditors are far from won over.

[17] See http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=COM:2014:356:FIN&from=EN.

> **"Ontario's example is worrying because this is a smart meter programme run by an energy Ministry, just like in Great Britain, where it is being overseen by DECC"**

The UK's National Audit Office[18] claims that the programme remains positive with economic benefits of £17.1 billion and costs £10.9 billion. However, the NAO cautions that whilst these are low probability risks, were they to materialise, their impact would be very high, including potential resistance to smart meters, outstanding technical issues, the state of readiness of suppliers, network operators and the supply chain and the robustness of the data security.

More pertinently, across the Atlantic in the province of Ontario in Canada, where the smart meter programme is several years further down the line with 4.8 million meters already installed, the Office of the Auditor General issued a very damning report in December 2014.[19] It found that aggressive targets and tight timelines without sufficient planning and monitoring by Ontario's Ministry of Energy had been combined with a flawed cost benefit analysis where the net benefits of CAD $600 million over 15 years were overstated by CAD $512 million. This overestimation of the benefits stemmed from not including the projected annual net increase in the operating costs of distribution companies. Worse, the cost of the programme came in at a much higher price – CAD $900 million more than the projected CAD $1 billion. Ontario's example is worrying because this is a smart meter programme run by an energy Ministry, just like in Great Britain, where it is being overseen by DECC. As it is still early days for Britain's much more complex programme, the capacity for much to go wrong is very real.

In a recent report, *Smart meters: progress or delay?,* the Energy and Climate Change Committee of the House of Commons appears to have picked up on this. The report concluded that *"...without significant and immediate change to the present policy, the programme runs the risk of falling far short of expectations. At worst it could prove to be a costly failure"*.

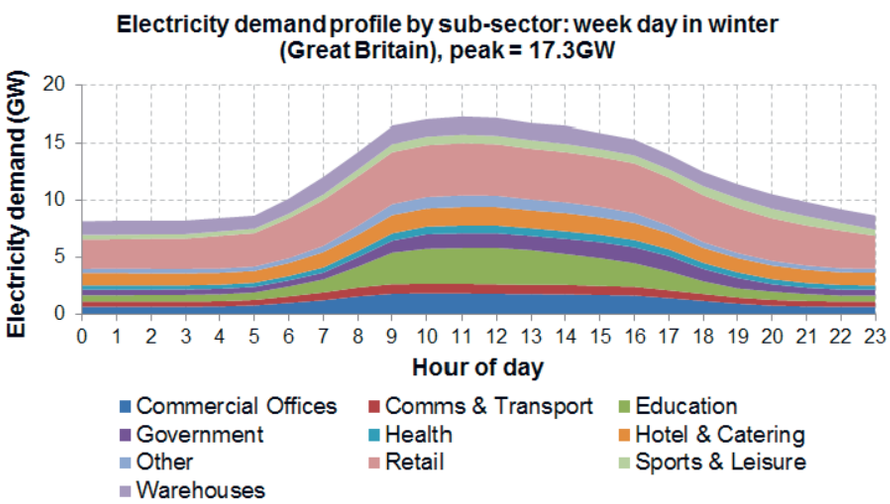
Box 1

Smart Meters' Bigger and Better Brother – Demand-Side-Response

Smart meters attract a lot of attention, but the energy savings are paltry – perhaps a few hundred megawatts in a best case scenario out of a peak demand of 59,000. Simply put, retail customers don't use and can't change that much. However, the same is not true for Demand-Side-Response (DSR) – a range of measures for non-residential buildings to save energy. It's called DSR as it represents a break from the traditional top-down supply management of energy.

Figure 2[20]

Electricity demand profile by sub-sector: week day in winter (Great Britain), peak = 17.3GW



The aim is to re-distribute end-users' demand with a combination of increased flexibility to reduce, delay and even generate power back to the grid in response to price signals and shortages. Unlike smart meters, the prize is a big one – between 0.6 and 4.4 GW according to a study by elementenergy for Ofgem. And in financial terms, npower in a recently published report, "The 20% imperative", estimated that if the UK's larger businesses could collectively reduce energy consumption by 20 per cent, the saving would be £4 billion per annum - £3 billion in reduced electricity costs and £1 billion in lower gas bills. When you break down where the energy consumption could be cut, there are seven sub-sectors; catering, computing, air conditioning & ventilation, heating, hot water, lighting and other areas like refrigeration.

[18] See "Update on preparations for Smart Metering".

[19] See Annual Report – Office of the Auditor General of Ontario.

[20] Elementenergy – Demand side response in the non-domestic sector – a report commissioned by Ofgem, July 2012.

“government is prescribing rules for technology that run a high risk of rapid technological obsolescence”

For all that, the most obvious and ostensibly non-disputable gain from smart meters is accurate bills and no more manual meter reading. Billing complaints are the bugbear of today’s energy utilities. But under the current setup, it’s impossible to have truly accurate billing when retail meters are inspected every 6-12 months, whereas consumption in electricity is parcelled out in 30 minute segments at the wholesale market level. While for the wholesale gas market, settlement comes with an estimate of Annual Quantity to which complex algorithms for weather, and so on are applied on a daily basis. Clearly there is a big accuracy gap between the wholesale market and the retail market. The only accurate figure for consumption is held across the region by the Distribution Network Operator – companies like Seeboard Power Networks or Eastern Electricity.

The estimate is arrived at by “profiling” – an algorithm that estimates for all electricity retail consumers, spread out over the quarterly period as a fraction of the DNO’s total measured energy distribution. Today there are eight deemed profiles for 25 million electricity households. Smart meters would create pinpoint accurate billing – i.e. 25 million profiles – because they would connect energy suppliers direct and transmit data from customers to suppliers, much more frequently, probably once a day and theoretically up to every 30 minutes, rather than a manual meter reading every 6 months.

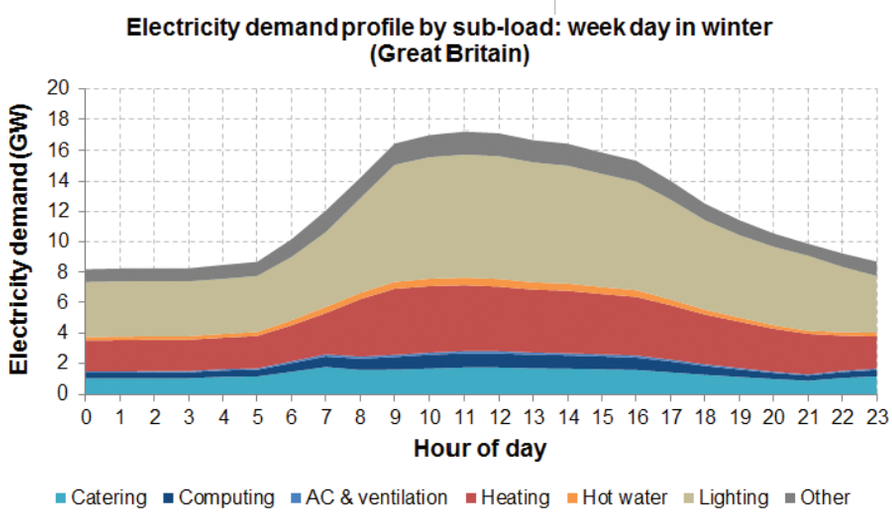
On the other hand, you have to wonder whether it would not be possible, as Adam Afriyie MP has argued, to fix a small camera or reading device onto the existing meter to regularly record and transcribe the meter readings perhaps combined with a smartphone app?[21]

Clearly that would obviate the need for manual meter readings and could generate a more precise and timely

Box 1 (continued)

Figure 3

Electricity demand profile by sub-load: week day in winter (Great Britain)



idea of energy consumption. The risk, as Afriyie argues, is that government is prescribing rules for technology that run a high risk of rapid technological obsolescence, calling smart meters “...a rigid and expensive solution dreamt up by bureaucrats in a former era”. A 2007 study commissioned by the Department for Business, Enterprise and Regulatory Reform by Mott McDonald, *“Appraisal of Costs & Benefits of Smart Meter Roll Out Options”*, would seem to agree with Afriyie’s low-cost, adaptive approach. It showed that simple clip-on customer display units or electricity display devices which received data from a clip-on current transformer attached externally to the meter had easily the highest benefit cost ratio compared to a range of other smartish metering systems.

And that inaccurate profiling will be ended is at least debatable. Smart meters can store and return actual load profiles, but Elexon – the clearing house of the electricity market, matching wholesale generators and suppliers – doesn’t have the systems in place to handle 25 million load profiles every day, broken down into half-hourly segments (HH). It currently only manages 1.25 million meter readings on a daily basis. It’s a concern that Elexon does not appear to be a key player in the smart meter rollout. And it is far from clear that the utilities will have the scaleable IT infrastructure in place and in time to cope with this new flood of data. That would suggest they may choose only to collect enough data for automated meter reading (AMR), rather than delve into consumption analytics.

Equally, Gemserv, the wholesale gas settlement house equivalent to Elexon, are not yet capable of handling daily meter reads from 25 million domestic customers. Current wholesale settlement practices, although far more accurate than the retail market, do mean that suppliers do not buy the exact volume of electricity and gas that they sell downstream to retail consumers. Smart meters will not change this.

[21] http://www.theregister.co.uk/2014/07/29/are_smart_meters_really_that_smart_adam_afriyie_mp/.

“Not many people are going to get up in the middle of the night to switch on the lights, make dinner and watch TV to save perhaps 30p”

The next perceived benefit is the fixed installation as standard of an in-home energy display (IHD) to discourage energy consumption. This will show your live energy consumption and bring up information on how much you have used in a previous week or month. Not everyone agrees though, and in particular Professor of Energy Policy at the University of Greenwich, Steve Thomas, argued in a paper for *Energy & Environment*, “Not too smart an innovation: Britain’s plans to switch consumers to small electricity and gas meters”. You can already buy devices that do this for you off the shelf, like an Owl display costing just £30. Moreover, he says, installing technology to display gas consumption which is dominated by non-flexible space and water heating, usually by a single boiler, with the odd bit of cooking, is even less likely to deliver the return of lower gas consumption. And in this day of portable tablets, smartphones and remote logins via a browser, who wants to read a fixed display stuck to the wall only in one place?

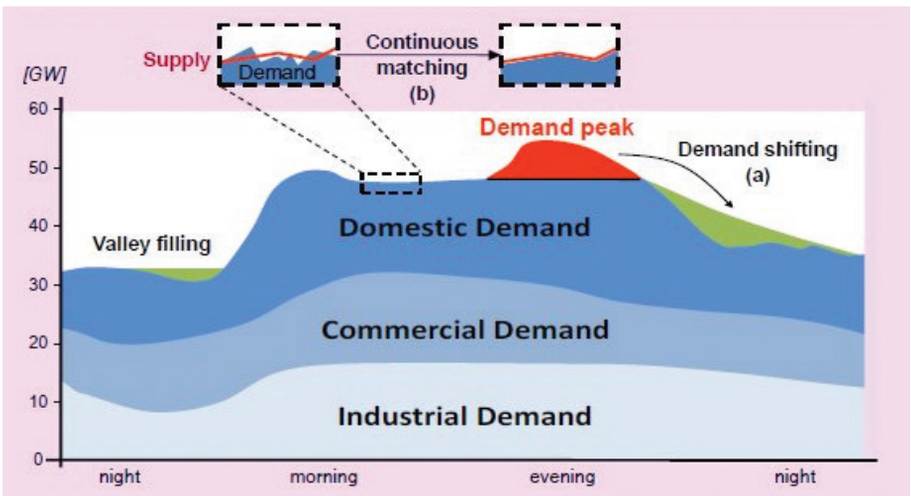
Currently, time-of-day pricing in half-hourly slots only exists on the wholesale market. Prices vary hugely for those large energy producers and consumers who trade in megawatt hours – perhaps as low as £30 per megawatt hour at night and £100 during the day and occasionally hundreds of pounds more. Recently though, most of the time, partly due to the declining share of nuclear power, peak/off-peak spreads are reaching historic lows of around £10.

Demand is very time-sensitive and this much affects the price. One of the stated aims of smart meters is to introduce half-hourly Time of Day Pricing to the retail consumer.

The objective of time-of-day pricing is to use the same kind of half-hourly pricing to change consumer behaviour, reduce demand and shift more of it to lower-priced periods at off-peak times.

Figure 4

Idealised outcome of Smart Meter-led redistribution of electricity demand



Conceivably, this could certainly lower consumer bills. A more careful analysis though suggests that the only real items that can be moved – and not without inconvenience – are washing machines and dishwashers. Not many people are going to get up in the middle of the night to switch on the lights, make dinner and watch TV to save perhaps 30p.

And one cannot overlook that retail energy consumers have had crude time of day pricing for electricity since the 1980s with not much real impact. Economy 7 was launched in the 1980s with the onset of storage space heaters. For people who used electricity for heating because they did not have access to the gas network, these storage heaters would store cheap overnight baseload electricity and return it as heat during the day. Secondary to space heating, was putting dishwashers, washing machines and tumble dryers on night timers. Economy 7 was a tariff which created the price differential of cheaper electricity between midnight and 7am. They peaked in popularity during the 80s and today there are still 5 million Economy 7 meters in service. However it is estimated that a large number of Economy 7 users, as many as 40 per cent today, end up spending more money with Economy 7 because they cannot cut down enough on their peak day time consumption or shift enough of their demand to night time or simply are just not that interested in tracking their energy usage. So if peak/off-peak spreads continue to stay at historic lows and even narrow further, the case for Economy 7 and, by extension, smart meters, becomes weaker still.

So how will it be possible to achieve a hoped-for 2 gigawatt saving from smart meters?

Clearly, what will have to happen is demand destruction and on a very large scale. But again, is this possible?

It will require much higher prices than are currently being set or that Ofgem will allow, and a much higher degree of trust between consumers and their electricity suppliers than currently exists.

> **"setting time of day prices to achieve demand shift, lower energy consumption, maintain utility profits and benefit the consumer is just possibly an intractable problem"**

The truth is that setting time of day prices to achieve demand shift, lower energy consumption, maintain utility profits and benefit the consumer is just possibly an intractable problem.

The price signal has to be just right, not to turn a peak into a trough or indeed, to create a peak further out. And consumers will have to have faith that higher prices reflect true market circumstances rather than the utilities trying to make up for lost energy consumption. It may also undermine the case for switching suppliers – a few big unpredictable jumps in prices may undermine the rationale for the original switch.

The demand destruction will also require a large number of connecting devices that can lower or switch off their energy requirements. According to *Which?*, UK households spend around £3.4 billion worth of electricity every year just on washing and drying clothing, cleaning the dishes and cooling and freezing food.[22] British Gas, the only supplier to have started at scale, who have rolled out over 1 million smart meters already in the UK, puts the annual savings on bills at around 2 per cent so far from smart meters. There is no evidence anywhere in the world yet, of what the long-term savings could be, 10 or 15 years later. Yet even with future remote appliance control of smart fridges and other gadgets, it's hard to see smart meters driving down consumption that much. Instead, what the UK has seen is falling primary and domestic energy consumption since 2005, especially when you take into account population growth from 60.2 million in 2005 to 64 million today.

This trend is being reinforced by onerous energy efficiency standards from the EU that dictate for example that any appliance on standby may not consume more than 1 watt. These regulations are certainly not all good however. Much damage has been done to Dyson's vacuum cleaner company which at a stroke had made illegal for sale its most powerful vacuum cleaners as no household appliance was allowed to have motors of over 1600 watts which ruled out their powerful 2000 watt plus models. In fact, James Dyson, a previously fervent supporter of Britain joining the single European currency, is so incensed by the regulation, that he now advocates leaving the EU.

Table 6

Falling UK Energy Consumption in million tonnes of oil equivalent – total and domestic[23]

Year	Total Primary Energy Consumption	Domestic Gas Consumption	Domestic Electricity Consumption
2005	203.2	47.5	7.1
2006	236.0	45.4	6.7
2007	233.4	45.3	5.5
2008	226.0	45.7	4.9
2009	212.4	44.6	6.2
2010	212.7	49.1	5.5
2011	208.5	37.7	6.3
2012	207.2	39.3	6.7
2013	203.2	38.8	7.0

The point here though is that it will be very difficult to disaggregate generally falling energy consumption, not least influenced by falling incomes over the last few years, from smart meter induced behavioural change.

The cost-benefit analysis studies that have been done, which were initially negative and then increasingly positive, are all undermined by the fact that DECC will only release a heavily redacted report – 13 out of 20 pages – which, if free to view, would reveal the underlying assumptions as to how they arrived at their positive cost-benefit analysis. This is currently the foundation of a dispute at a Freedom of Information tribunal between DECC and the Information Commissioner, due to report its findings in mid-December 2014, but running late.

[22] See http://www.britishgas.co.uk/products-and-services/gas-and-electricity/tips-and-advice/appliance-energy-costs.html.

[23] See https://www.gov.uk/government/statistics/energy-consumption-in-the-uk.

"A hacked smart meter would not just reveal when a homeowner was in or out, or enable a tech-savvy consumer to falsify readings, it would ultimately be able to control the off-switch."

The headline figure from the National Audit Office remains at costs of £10.9 billion and benefits of £17.1 billion. At the household level, the kit costs £215 and the savings over 15 years – assuming it lasts that long – would be about £23. Even if it proved to be correct, within that averaged figure though would be low-income, single, perhaps elderly- person households – maybe living in a studio flat where the benefits would almost certainly be negative to that consumer.

It is also of deep concern and does little to inspire confidence, as the Energy and Climate Change Committee of the House of Commons notes,[24] that not one of the three assessments conducted by the Major Projects Authority of the Smart Meter Programme has been published, citing commercial sensitivity reasons.

Other research, principally by Nick Hunn, author of *"The Essentials of Short-Range Wireless"*, points to the substantial risks of developing, testing and adopting a new wireless standard – ZigBee. Compared to WiFi or Bluetooth, ZigBee has a tiny market share because its mesh networking feature is complex and expensive. It has been preferred though for smart meters because of the theory that its mesh technology lets it work over long distances and thick walls that often exist between people's meters, the communications hub and the In Home Display at 2.4 GHz is the same frequency as WiFi and Bluetooth. However, in the GB deployment, the ZigBee mesh isn't used, as utilities fear that consumers might turn off or unplug some of the multiple mesh devices, which would stop data being sent back to them.

To try and recover the range, DECC and the smart meter manufacturers are developing a new ZigBee standard which operates at the lower frequency of 868 MHz. This will have longer range and bring within reach, most but not all, the meters of 7 million homes that are more remotely sited externally or in a basement. ZigBee will be used to transmit data from the smart meters to the IHD and to the Communications Hub. According to Hunn, the most underestimated risks for ZigBee are:

i) ZigBee chips product lifetimes are unlikely to exceed four years. This is much shorter than the duration of the installation stage of the smart meter rollout of 2015-2020. It is considerably shorter than the 12-15 year lifespan of a smart meter and considerably less than the 40 year lifetime of an analogue meter. Thus, new smart meter re-installations may be required only a few years into the programme right across the country.

ii) ZigBee is not a mature technology, the GB-only specification has been rushed and poorly tested and years could be required for debugging which will have to happen after the deployment.

Meanwhile others, including GCHQ, have expressed major concern over cybersecurity. Many argue that the security dimension was mistakenly not designed in at the beginning but bolted on at a later date. A hacked smart meter would not just reveal when a homeowner was in or out, or enable a tech-savvy consumer to falsify readings, it would ultimately be able to control the off-switch. One million meters suddenly switching off power either because of dormant Trojan horse code installed by a disgruntled OEM employee or due to an attack on a utility, would do huge damage to the national grid.

Box 2

The Non-Interoperability of Smart Meters and the threat to competition

Great Britain is just completing the foundation phase running from 2013-2015 of the Smart Meter Programme to be followed by the mass rollout phase to 2020. As at the end of September 2014, according to evidence given to the Energy and Climate Change Committee, 543,900 have been installed of which 328,800 were electricity and 215,100 were gas. However it has emerged that an undisclosed number of the first generation of smart meters known as SMETS 1 (Smart Metering Equipment Technical Specifications) will not be interoperable with Smart Meter infrastructure to be built by 2020, meaning a large number of them will have to be replaced, due to obsolescence after just a few years of service with SMETS 2 compliant meters. Meanwhile, SMETS 2 meters are behind in an agreed specification, meaning that suppliers will have to keep installing SMETS 1 meters just to meet the 2020 deadline.

Even more worrying from a competition point of view, switching could become more difficult because should a consumer choose to change supplier, they may well have to have a new smart meter installed and the old one removed. That is because there is no firm and agreed provision in the specification – guaranteeing interoperability – for the new supplier to be able to read the SMETS 2 meter of the previous supplier whereas with SMETS 1 it will not be possible at all.

This is exactly the sort of issue that would not have arisen if the Smart Meters were designed and installed by the Distribution Network Operators instead of the suppliers.

Instead Britain is potentially setting itself up for a neverending cycle of installation, de-installation and re-installation of smart meters, long before they reach their stated end of service dates at great advantage to the meter manufacturers and to the detriment of the consumer's pocket.

[24] See "Smart meters: progress or delay?" – published 7th March 2015.

"Britain's smart meter programme clearly fits the mould of the Megaproject: over budget, over deadline, over and over again."

The more you look at it, the more the risks of such a huge programme with so much complexity, managed by one of the smaller departments of state, with so much still on paper, are staggering. Great Britain's smart meter programme clearly fits the mould of what Professor Bent Flyvbjerg of Oxford Saïd Business School calls the Megaproject. Typically over budget, over deadline, over and over again, Flyvbjerg argues that all megaprojects are driven by the four sublimes none of which contain consumer demand;[25]

1. Technological – the engineering and technological excitement of tallest, fastest, longest;

2. Political – the rapture politicians receive from building and basking in monuments to themselves;

3. Economic – the delight businesses, blue chip contractors, trade unions and lawyers get from making money from megaprojects;

4. Aesthetic – the pleasure designers and architects get from building something large, complex and beautiful.

Surely it would be prudent to cut back or eliminate entirely the rollout and embrace what Sir Peter Hall, Britain's most famous planner and author of Great Planning Disasters, called "guided incrementalism". Guided incrementalism essentially advocates a risk avoiding strategy, adapting to what is in place, making minimal commitments at each stage of a project where a decision is necessary.

Towards a cost-effective smart meter programme – recommendations

There are a great many steps one could take to reduce the cost and complexity of the programme and avert disaster and the massive opportunity cost of £12 billion of consumers resources. Here are some suggestions:

1. Stop smart gas meter deployment – Great Britain is one of a handful of countries looking to deploy smart gas meters by 2020. Only 5 of the EU's 27 nations including Great Britain, were able to make a positive cost-benefit for them. For natural gas, times are changing though much faster than DECC has bargained for. With Britain's gas consumption falling and a glut of natural gas coming with shale and LNG and very little potential for consumers to change when they heat their homes, cook and have hot showers, this is one saving that could save a few billion pounds.

2. Remove the requirement for an in home display (IHD) – the IHD is slated to cost just under £800 million. It will soon be out of date and need replacing within a few years at most. Far better to connect smart meters to consumers phones, tablets and PCs at no additional hardware cost. What evidence exists shows that consumers lose interest quickly after the first month when faced with an IHD. British Gas has reported that after one year, only 60 per cent still look at their displays once a month. Ovo Energy have found that after 1 year, they are only still in touch with 60 per cent of their IHDs.

3. Reduce rollout to those homes that have higher energy use – the highest energy users with the least idea about it and willing to change are those who are the most likely to see net positive benefits from smart meters. The same is not true for low-income, single- person households running one or two electricity devices and some heating, in a small space, very parsimoniously. These are households that consume more than 5,100 kWh of electricity per year (versus national average of 3,300 and consume more gas than 23,000 kWh (versus national average of 16,500 kWh).[26] This would probably reduce the rollout requirement by about 80 per cent.

4. Abandon attempts to stretch rollout to flats and tower blocks – this is the most demanding technical aspect of the rollout by developing the ZigBee standard and will likely deliver the lowest returns. This would remove 7 million homes from the programme.

5. Make the programme genuinely voluntary – customers to be offered the system, but only at their own cost, rather than free for all and subsidised by everyone.

6. Abandon the £12 billion programme and develop a smartphone app – this app would work by allowing users to take a photo of their current mechanical readers which then convert the image into meaningful numbers which are matched to the suppliers' servers who match it with precise bill readings which are then fed back to the phone/tablet/cloud/PC. To incentivise users to do this, they should be offered a small financial incentive by the suppliers for each reading they make. Britain's electro-mechanical readers have served it well – many are still working from the 1930s. It is quite possible that moving to smart meters would mean a rolling four to five year replacement cycle by the meter companies, meaning that the cost of the programme is vastly underestimated. The cost of such an app for both android and iphones/ipad would probably be in the region of tens of thousands

[25] See "What You Should Know About Megaprojects and Why" as published in the Project Management Journal, April 2014.

[26] Defined as typical high consumption values by OFGEM – see https://www.ofgem.gov.uk/ofgempublications/64026/domestic-energy-consump-fig-fs.pdf.

of pounds and could be ready in nine months. Object Character Recognition software is off the shelf and already working for many other apps like the business card scanner app, CamCard. It would bypass the DNOs and connect customers straight to suppliers. Updates could be downloaded on a regular basis, switching would become easier too. Far more powerfully, DECC could get a far better idea of how many people are interested in engaging with their energy usage and build a two-way conversation with consumers as stakeholders in the programme.

The word “smart” has lent too much credibility to a programme that is anything but. The Pantheon of government IT projects that have haemorrhaged billions of taxpayers’ money to no discernible effect is already full and in need of no further additions. The UK is living beyond its means. Consumers will never forgive the already unpopular energy companies for a costly programme that fails to deliver and ends up making them poorer. As the rollout will start happening on their watch from April 2016, the next government would be well advised to consider a fresh start.

> **"Without the final authority to demand full data, there will always be room for omission."**

Major IT Projects: The Road Ahead

Oversight?

The Major Projects Authority (MPA) was established in 2011 to specifically tackle problems of ineffective oversight. It was created as a partnership between HM Treasury and the Cabinet Office and is part of the Cabinet Office's Efficiency and Reform Group. The group's aims are to drive reform of Government services in order to create greater efficiency and help to foster growth. It is also seen as a vehicle for cutting through the political short-termism that often plagues the oversight of major projects. As the 'projects' wing of the group, the MPA oversees the Government Major Projects Portfolio, covering about 200 projects 'whose lifetime costs stretch to over £400bn.[27]

The Authority sets out a Delivery Confidence Assessment (DCA) for each major project based upon a simple 'traffic light' (Green/Amber/Red) system. Green represents confidence in the delivery of the project while red, unsurprisingly, indicates a lack of confidence.

ICT projects are currently the second largest project type within the Government's Major Projects Portfolio and the Annual Report 2013-14 highlights that IT projects can be among the most complex, 'in the context of health, for example, developing new IT programmes requires hundreds of semi-independent organisations and trusts across public health and social care to work together to share information'.[28] Importantly therefore, in recognition of the need for a specific focus on improving IT project delivery, the recently founded Major Projects Leadership Academy 'will also develop specific training around particular challenges such as IT'.[29]

Despite such positive moves on the part of the MPA towards improving the handling of major projects, shortcomings persist. While the MPA provides greater levels oversight and awareness, absolute transparency and the question of whether it really has genuine 'clout', remain an issue. The National Audit Office noted alongside the MPA 2012-13 report that departments were withholding data from the authority and that final decisions over provision of full data (in line with Government transparency policy) rested with departments. Importantly '11 out of 19 departments did not provide at least one piece of data on one or more projects'.[30] A year later, this figure is down but omission of data continues to be an issue. In addition to not being able to effectively demand access to full data, the MPA also struggles to compel Government departments to be open about their reviews into ongoing projects. The Smart Meter Programme has certainly flagged this up.

Beyond these issues, it also appears that departments may simply be able to augment the basic criteria that the MPA uses, as a way of maintaining struggling projects. The vast IT undertaking that is Universal Credit, for instance, was assigned a confidence assessment of 'reset' in 2013. This assessment term appears to have been devised specifically for the purpose of the Universal Credit programme and was sanctioned by ministers.[31] Surely ministerial actions of this sort would undermine the effective oversight function of the MPA.

Part of the problem, it can be assumed, lies in the Authority's lack of 'teeth'. Without the final authority to demand full data, there will always be room for omission. In addition, the Treasury 'is under no obligation to follow'[32] recommendations that the MPA makes. Without being able to take on greater powers of enforcement, it is tough then to imagine a scenario in which the Authority can drive efficiency to the maximum. In the case of IT projects and especially the Smart Meter programme, speed and efficiency are vital, not least because delays can often lead to projects simply losing pace with technological improvements and user need. Issues surrounding the implementation of the BBC Digital Media Initiative also reflect this.

Is 'smaller and faster' the new 'bigger and better'?

Within the context of large Government IT projects, the Government Digital Service (GDS) has been a publicised and notable success. Also established within the Efficiency and Reform Agenda, the GDS aims to reduce the amount that the government wastes on IT projects, as well as provide an open digital service that is geared towards the users (the public). The GDS handling of the gov.uk website is seen as a flagship success for the service. Gov.uk draws together the online profiles of 24 ministerial departments and a further 331 other agencies and public bodies under one banner and one format. It is intended to make public services much more accessible to users.

Much of the GDS's success has been ascribed to its applying the Silicon Valley principles of 'building lightweight

[27] Francis Maude MP (2014) 'Major Projects Authority Annual Report 2013-2014', Cabinet Office.

[28] MPA (2014) 'Major Projects Authority Annual Report 2013-2014', Cabinet Office. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/388467/MPA_Annual_Report_UPDATE_Dec_12__1_.pdf.

[29] ibid.

[30] Comptroller and Auditor General (2014) 'Major Projects Authority Annual Report 2012-13 and government project assurance' HC 1047 SESSION 2013-14. National Audit Office Pg. 25.

[31] Available at: http://www.theguardian.com/politics/2014/aug/19/universal-credit-failings-pac-accuses-dwp.

[32] House of Commons Committee of Public Accounts (2014)' Major Projects Authority' Tenth Report of Session 2014–15. HC 147 House of Commons, London: The Stationery Office Limited.

"there may now be some hope for improvement"

applications so that if people don't like them or use them, they fail'.[33] The Government seem to have been willing to take these principles on. In a recent speech, Francis Maude, Minister for the Cabinet Office noted that "'move fast and break things' and 'fail fast' have long been the mantra of places like Silicon Valley and Israel. Governments and the public sector could learn a lot from this start-up culture'"[34]

The speed at which the GDS moves efficiently through discovery, alpha, and beta phases of product testing, does reflect this willingness and gives them the breathing space to re-think products if necessary.

The GDS, therefore, has certainly won its share of plaudits within the digital community. However, it remains the case that fully translating this process onto the still somewhat siloed and complex face of Government projects is a long way off. There has also been a degree of backlash to the notion that the size of government IT contracts should be capped (with an upper limit of £100 million), in order to break the hold of large IT companies within the public sector procurement bubble.

Although the 'smaller and faster' approach can certainly open up competition for contracts, as well as lead to more user-geared models, the case has been made that some large government services simply cannot rely on the 'fail fast' techniques. HMRC's Aspire Contract, for instance, holding the tax records of some 50 million Britons and worth around £10bn, has been highlighted as an example of this. Quoted in *The Times* in August, Richard Bacon MP, Member of the Public Accounts Committee, commented that 'there is nothing more critical than getting tax in and you can't start relying on hundreds of experimental start-ups taking this over. The potential for another disaster is huge.'[35]

This raises a more fundamental question of whether the Government's new digital model can be easily extended to new government projects, particularly those that require new or augmented IT systems. The GDS has been in the fortunate position of having the hardware (as well as the software foundations) already in place. In this sense, it has been able to apply itself swiftly to reforming the way the Government operates digitally. However, projects that require new hardware, as well as a need to educate people in how to engage with it, pose significantly greater problems. The Smart Meter Implementation Programme is one such project. The SMIP requires the installation of hardware across all businesses and homes in the UK, and by 2020 no less.

Although the history of IT project management has been plagued by controversy over the past decade, there may now be some hope for improvement. It could not come too quickly. Bad communication, siloed responsibility, lax deadlines, and ineffective oversight have all hampered the sound handling of many such projects up to this point. Given the scale of the challenge for the UK to become a global hub for the digital economy, as well as to drive urgent efficiencies in the use of public funds, lessons should continue to be learned.

Some considerations that should be taken into account:

- **Stakeholders on both the delivery, as well as the user, sides of projects should be thoroughly and regularly engaged in order to keep major undertakings in line with appropriate goals.**
- **These goals should also be constantly assessed within the context of how users will benefit from major IT projects.**
- **There is also a need for Government departments to recognise where they have 'done it right'. Where examples of best practice can be applied, they should be.**
- **It is also clear that while increased oversight (via the MPA) is undoubtedly a step in the right direction, it cannot be entirely effective without being handed the tools to enforce recommendations and demand full information.**

[33] Tim O'Reilly (2012) Quoted in the Wall Street Journal 'U.K. Digital Strategy Receives Praise' Available at: http://blogs.wsj.com/tech-europe/2012/11/12/u-k-digital-strategy-receives-praise.

[34] Francis Maude (2014). Opening speech at the inaugural D5 summit hosted by the UK, D5 is a new global network for leading digital governments, available at: https://www.gov.uk/government/speeches/opening-speech-for-d5-byfrancis-maude-minister-for-the-cabinet-office.

[35] Richard Bacon (2014) Quoted in The Times, 'IT 'disaster' could cost taxpayer billions', available at: http://www.thetimes.co.uk/tto/news/politics/article4187851.ece?shareToken=e415094ed801e86013d91d140ca7554f.