Gas Smart Meters for GB Homes : New Smart Tariffs and Smart Pre-Payment

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OUTLINE

This article for Respond 2010 considers the back-drop to the proposed roll-out of household gas smart meters in Great Britain. It draws on two newly-completed multi-sponsor studies by the authors – covering both gas and electricity household smart meters in Great Britain – as well as on earlier published research[1]. In particular, it sets the forthcoming GB gas smart meter roll-out within the context of the dominant role played by gas in GB homes, considers the kinds of tariffs which might develop with gas smart meters and the scope for new developments in GB for smart gas pre-payment.

GB GAS SMART METER ROLL-OUT

The UK Government has decided that all homes should have electricity and gas smart meters by 2020 – ~ 26 million electricity meters and ~22 million gas meters in GB. Responsibility for the roll-out and the key relationship with the customer will remain with the energy supplier (retailer). As now, GB retail tariffs will continue to be offered to customers on a non-regulated and competitive basis. As now, customers will be able to

opt for a choice of tariff and their chosen means of payment from any licensed retailer – eg single fuel, dual-fuel, standard-credit, monthly direct-debit, internet, pre-pay – and will continue to be able to switch supplier in search of better retail offers. Hence a very active GB debate currently about assuring inter-operability, to avert stranded smart-meter assets.

The mandate for the £8 billion GB roll-out of both gas and electricity household meters was decided after lengthy consideration of the costs and benefits[2]. Notably, a higher proportion of the estimated total benefit of a GB household smart meter roll-out is attributed to expected energy savings from better feedback and carbon reduction (~50 %) than to total estimated savings to suppliers as a result of reduced cost-to-serve (~40 %) (ie avoided meter reads, improved debt handling, reduced theft).

Delivery of these anticipated energy savings must therefore be a central plank of the GB smart meter roll-out. Otherwise, there is a risk that customers will ultimately pay for smart meter investment, helping to reduce costs for retailers (the benefit of which, in a competitive retail market, suppliers can be expected to share with their customers) - but without customers necessarily obtaining the additional and greater estimated cash benefit to them of reducing their energy demand.

To this end, the government has also introduced a requirement for a visual display with every smart meter so that, largely through improved feedback, customers will be encouraged to save energy. For gas, the estimated saving in the impact assessment is 2 % pa (0.5 % for gas pre-pay customers, judged to have less scope to reduce their gas-use). The annual 2 % estimated saving is also expected to save some 'additional' carbon under the UK carbon accounting arrangements (6% of the total smart meter benefit)[3]. The estimated gas savings in the impact assessment are assumed to be from better feedback rather than explicitly via the introduction of new price-incentives to reduce gas use[4].

GB HOUSEHOLD GAS-USE

The requirement to install gas smart meters in GB homes needs to be understood in the wider context of GB household gas-use.

Gas dominates household space and water heating in GB – around 80% for each. Around 20 million homes have gas-fired heating systems (~85 % of domestic central heating systems in England – less in Scotland). 363 TWh of gas was consumed by GB households in 2008, equating to emissions of around 67 MtCO2 [5]. An estimated 2 % annual energy saving by 2020 from better feedback from smart meters (including, say, the effect of demand-reduction incentives in new gas tariffs) could, in very approximate terms, be expected to deliver a 1.3 MtCO2 pa saving.

Gas-demand from households is now judged to be largely saturated, possibly starting to decline. Largely, this is due to more efficient boilers, better controls and to continuing improvements in thermal insulation. Average household gas use (on an equivalent kWh basis) is around five-times greater than electricity[6]. On average, gas is the largest household fuel-bill by around one-third despite being the lower-cost fuel. Domestic gas-use is highly correlated to external temperature, and with around five or six-times more gas being used in winter than in summer (with some regional variation). For the foreseeable future, reducing household gas consumption is likely to be the single most effective available measure to reduce GB household energy use and also to reduce household carbon emissions. In practice, prospective gas and carbon savings from boiler-related measures (upgrading with new efficient models, installing user-friendly controls, thermostat turn-down and improved thermal insulation) will dwarf potential savings which smart-meters may indirectly encourage. Nonetheless, feedback, price incentives and tariffs from smart meters will have a role in support of these other direct physical energy-saving measures. By offering householders better feedback about their gas-use, including more information on their spend and potentially coupled with stronger price signals or incentives, consumers could become more open to making gas-savings via these other measures.

GAS SMART TARIFFS FOR GB

Household Gas Tariffs in GB Today

Today in GB, for most standard household gas tariffs, costs are averaged across a customer group and charged at a flat unit-rate regardless of time-of-day, day-of-the week or time-of-year. There are currently two main types of standard household gas tariff in GB :

- Standing-charge tariffs - a daily charge (to recover fixed costs) and a uniform price per unit of gas consumed. For households with average consumption, the average standing charge accounts for eight percent (£60.41) of the annual gas bill[7].

- Two-tier tariffs – which do not have fixed standing charges. Instead they include a higher unit price on the first tier or block of consumption of electricity or gas (to recover fixed costs). Consumption above the level of the first consumption block is charged at a *lower* per unit rate. For households with average consumption, the first threshold accounts for 3048 kWh for gas[8].

These two-tier tariffs (effectively *inclining* block) have become more prevalent than standing charge tariffs – currently about two-thirds of tariffs on offer are two-tier[9] [10]. In GB, there is a long and successful history of basic off-peak time-of-use tariffs for

electricity, but not for gas[11]. Moreover, there is no history in GB of seasonal household gas tariffs.

New Smart Approaches to GB Gas Tariffs?

With universal gas smart meters there could be new developments in household GB gas tariffs – very broadly speaking, tariffs or incentives designed to reduce household gas demand overall – and / or tariffs designed to reduce winter peak or seasonal shoulder use – in effect static time-of-use tariffs. While both these approaches to gas tariffs are feasible without a smart meter, their development is more likely with smart meters, given a new capability for accurate measurement by time and volume, and with two-way communication, allowing remote tariff adjustment.

Until detailed findings from the GB energy demand reduction trials become available (expected 2010-11), there is relatively little empirical GB evidence on gas price-response. However, indications in the past five years are that :

- Household gas customers responded to higher real gas prices (or anticipation of higher prices) by reducing their consumption – ie there appears to be some available price-response for household gas.
- Household gas price-response plateau'd in response to exceptional cold periods in winter 08/09 and 09/10 – ie people chose to heat their homes rather than save gas.

The Ireland gas smart meter trial (2010), is understood to be trialling a gas demand-reduction incentive.

Overall Demand Reduction Tariffs for Gas

Presently, most household gas in GB is purchased by retailers from shippers on long-term forward contract. Tariffs that incentivised reductions in overall household gas-use could therefore in principle reduce costs related to gas purchase, storage or balancing. Network cost savings are unlikely (see peak demand tariffs below).

Suppliers could see cost reductions that they could pass through to customers. Customers who respond to incentives to reduce gas-use (e.g. through behavioural change, such as turning down thermostats, or having their heating on for shorter periods; through measures such as better controls, a new boiler, better insulation etc) should therefore see lower bills. However, over time, a rising-block gas-tariff could perhaps serve to increase the 'peakiness' of household gas-use (and associated costs) as measures to reduce unnecessary boiler-use (eg better adjusted boiler clocks, thermostats, insulation) begin to take effect. [12]

Peak-Demand Reduction Tariffs for Gas

Tariffs that incentivised reductions in peak-demand for gas could in theory reduce costs for gas purchase, short-term storage and system-balancing. 'Within-day' time-varying tariffs (eg peak and off-peak tariffs within the same day) would not however reflect current commercial arrangements in the GB gas market for a daily balance[13]. There are very limited cost-savings available to the gas transmission and distribution networks from peak-demand reduction – gas networks are already sized to meet peaks – and, as noted, household gas demand is not expected to grow significantly (and indeed may decline).

Suppliers could potentially see some limited cost-reductions that they could pass through to customers in peak-shifting gas tariffs. Within-day household peak-pricing seems unlikely for the foreseeable future but off-peak rates for weekends or middle-of-the-day or, possibly more likely, seasonal variations might have some commercial logic. This could reduce bills for some customers – but households with inflexible or large peak-time gas-use could suffer and/or the tariffs could trigger switching to electric heaters / water heating. In practice, peak gas-tariffs may have the effect of reducing customer gas-demand overall, because some gas used for heating may not shift to another time of day – so customers could see bill savings from this effect.

Conclusion on Economic Incentives in GB Market for New Approaches to Household Gas Tariffs

There are many detailed issues of principle and practicality to consider, but the Chart below illustrates how integrated players (gas shippers, energy retailers) may in the end be best placed to capture the benefits of both demand- and peak reduction via a 'least-cost' approach through :

- Improved contract match – gas procurement, imbalance
- Avoided supply-side capital expenditure – gas storage
- Reduced overall costs to suppliers of meeting environmental Obligations (eg new Renewable Heat Incentive).

Stand-alone players could possibly benefit from more efficient management of winter- or seasonal demand for gas – but will perhaps find little economic benefit in overall reduction in gas demand. Significant network savings are unlikely to be available to the GB gas networks, because both transmission and distribution are already sized to peak (household gas-use declining). Some balancing-related cost reductions may be available to the gas system operator.

Economic Incentives for Household Demand Response in the GB Gas Supply Chain

GAS – Illustration of economic potential for market actors and consumers from gas household demand reduction or peak / load tariffs pre- and post- 2020.

	Demand Reduction		Peak Avoidance	
	2010	**2020's**	**2010**	**2020's**
Gas Suppliers - integrated	**√√√**	**√√√**	**√**	**√√**
Gas Suppliers – non-integrated	**√?**	**√**	**x**	**√**
Shippers - Integrated	**√√**	**√√√**	**X**	**√√?**
Shippers – Non-Integrated	**x**	**x**	**x**	**√√ ?**
Gas Networks	**x**	**x**	**x**	**x**
System operator	**√**	**√√**	**√√**	**√√√**
Environmental costs Gas - ie avoided costs of Obligations (RHI ?)	**√**	**√√** Reduced RHI costs ?	**x**	**√ ?**
Customers - Gas	**√√**	**√√√**	**√**	**√√√**

*Notes - Central estimates for central comms case - DECC GB Meter Impact Assessment. December 2009.
Smart Meter Gas Demand Reduction - est. 2 % – ie say 7.2 TWh – (total household gas demand in 2008 – 360 TWh). Valued – £1.9 bn pv. Assume £14 saving per customer pa per fuel from improved feedback from smart meters - **but does not necessarily incorporate additional demand-reduction potential from new incentives or tariffs**.
Global CO2 reductions - £896m pv. Non-traded sector carbon savings over 20 years – 24 MtCO2

Gas - some potential GB household smart tariff-types – reflecting commercial interests of market actors

Gas Demand Reduction

Rising Block
Overall Load Reduction Incentives
Boiler Related – Improved Efficiency / Better Control – thermostat / boiler clock

Gas Peak

Peak – Less likely under present commercial arrangements - but could consider ToU – eg morning, evening & weekend rates. CPP, CPP with automation also feasible.

Seasonal – could take gas pricing higher in winter & spring & autumn – but what to do in summer ?

Smart Tariff Design for Great Britain - Principles

Where retail energy markets remain price-regulated, one start-point for development of time-varying tariffs or rising-block tariffs has been a goal of revenue-neutrality. In a fully non-price regulated retail market like GB however, cost-neutrality is not likely to be an explicit goal in devising new tariffs but, instead, price-competition may be expected to act as a downward overall pressure on price.

In considering the impact of possible new retail tariffs prompted by the roll-out of GB gas smart meters, there are some important issues of principle for suppliers, the regulator, government and the consumer bodies to consider in respect of tariff design.

- **Price Elasticity** – i.e. how much response to price signals is likely from GB household gas-customers ? As noted, there is relatively little GB empirical evidence on household gas price-response to inform tariff design, although the current GB trials may offer some insight.
- **Cost reflectivity** - i.e. how far will tariffs designed to reduce overall gas demand or suppress peaks, reflect under-lying costs (fixed and variable) in the gas supply chains (ie reflect the actual costs of production and shipping, storage, system operation, transmission, distribution, retail). How far will gas tariffs which are more cost-reflective serve either to deter or to attract or retain certain customer groups ?
- **Fairness** - winners / losers and the proportion of customers who will achieve savings on their energy bills. Individual household gas consumption – together with the flexibility / inflexibility of that consumption - are the key factors which will determine who will gain and who will lose in moving away from average-cost / flat tariffs. The basis by which the size and steps of any increments for rising-block tariffs are determined – or the differentials by which peak and off-peak charges are shaped – are key considerations. This will partly be driven by likely elasticity – and also by the consumption profile of the existing customer-base and current cross-subsidies among customers.
- **Distributional** – impacts of different forms of tariff on low income and fuel-poor customers. This is a major issue.
- **Unintended outcomes** - eg certain tariffs may prompt substitution or fuel-switching (eg from gas to electricity). Such outcomes may be economically sub-optimal – unless all other tariffs are broadly cost-reflective.
- **Consumer understanding / acceptance –** avoiding the potential for higher-bills, confusion and possible negative impact on competition if consumers find new tariffs too complex.

Consumers and New Smart Tariffs for Gas

The chart below illustrates how different forms of gas-tariff could affect consumers with different consumption patterns – i.e. those with flexible and inflexible usage and those who use most gas at on-peak or at off-peak times. The impacts on low and high users are also considered in the charts.

Potential impact of smart household gas tariffs on different types of consumer			
	Gas Peak	**Improved Control**	**Gas Demand Reduction**
High Gas Users			
Inflexible	**X**	**?**	**X X**
Flexible	**√**	**√√**	**√?**
On-Peak	**X**	**√**	**?**
Off-Peak	**√√**	**√√**	**X**
Low Gas Users			
Inflexible	**X**	**X?**	**X X**
Flexible	**√**	**√**	**X?**
On-Peak	**X**	**X?**	**X?**
Off-Peak	**√**	**?**	**√?**

The chart suggests which customers might gain or lose according to their gas-consumption patterns and to the tariff types. However, because GB retail gas prices are unregulated, in practice the impacts of new tariffs will vary according to how competitive the retail market is for different customer groups. Energy suppliers are likely to make attractive offers to customers they are keen to retain or attract – for example dual-fuel customers, and perhaps make less attractive offers to less commercially attractive customer groups.

Given that GB tariffs will be voluntary (opt-in) or offered only to certain customers (targeted), it is important to note that customers may face impacts whether or not they are on the new tariffs.

- Voluntary 'opt-in' tariffs will encourage sign-up by participants who do not change their behaviour but who benefit because their pattern of gas-use is best suited to the tariff type. Whilst this can be viewed as positive for those customers because they receive a 'reward' - for example, a weekend off-peak gas-tariff, this may do little or nothing to help reduce peak demand. (In economic parlance they would be described as 'free riders'). If the rewards (e.g lower unit rates) exceed system

benefits, other customers with high on-peak use may have to pay higher gas prices to pay for the bill savings enjoyed by the participants.

- Targeted tariffs may also result in non-participant customers paying more if the rewards to the participants exceed system benefits.

Overall Demand Reduction Tariffs (including rising block tariffs)

Overall demand reduction tariffs for gas would benefit those households who are either low-users, or, who can reduce their demand. For example, such tariffs might incentivise households to fit physical measures to reduce their gas-use (thermal insulation, replace inefficient boilers, improved thermostats and boiler controls). Consumers who cannot or do not respond in these ways could however, could end up paying more. Some key implications of demand-reduction tariffs for customers are :

- Increments and shapes of blocks - for example, how much gas is delivered at a relatively low price ; determining when customers move from one block to the next – e. g. daily, weekly, monthly etc.
- Demand reduction tariffs could in time be unsustainable for suppliers who would need to recover fixed costs over fewer energy units. This may mean they need to increase the prices of the first blocks or apply a standing charge. Similarly cash rewards for consumers who reduce their consumption may be unsustainable if large numbers of consumers signed up to such pricing plans (and suppliers may therefore prefer to offer non-cash reward.

In Great Britain, rising block tariffs would almost certainly have to be introduced on a mandatory universal basis. Otherwise, only those customers likely to save money would opt for them. Large users would almost certainly switch retailer, which would mean that rising block tariffs would quickly become uneconomic for suppliers. In practice, rising block tariffs would only be effective with some form of retail price regulation. For GB, the benefits that might accrue from rising block tariffs would probably be insufficient on their own to justify such re-regulation of household retail prices[14]. However, development of voluntary monthly Pricing Plans (as for mobile phones) may effectively share some features of a rising block tariff to incentivise energy demand reduction (see next section below).

What might Great Britain smart retail tariffs look like? Lifestyle Tariffs, Pricing Plans and other potential new offers.

The actual range of tariffs offered by retailers to customers could in practice be very wide. Actual tariff-offers may be single- or dual-fuel and/or combine elements of overall demand reduction charging and / or time-of-use. Whilst there are important

differences in the markets, it is possible that some of the sorts of offers seen in the telecommunications sector could spread to energy. These might include:

- **Lifestyle tariffs** – e.g. types of time-of-use tariff designed to suit those who are at home all day; or out for most of the day; offering lower prices at evenings and weekends ; or for low-usage.

- **Pricing plans** – e.g. the bundled minutes and texts commonly offered in mobile phone contracts. Energy pricing plans could offer a fixed price for consumption up to xx therms / kWh per month (which might mean a relatively low unit charge), but a relatively high unit charge for consumption above that limit. These plans could be sold alongside energy saving measures to help customers keep their consumption within the bundled amount. Such plans could be available in different forms for different types of customer (including for prepayment customers). In effect these could be a form of voluntary rising block tariff that could be compatible with the GB competitive market.

- **Energy or carbon saving tariffs**. Packages could include energy saving measures and financial or other incentives for reduced consumption. S&SE's non-smart Better Plan is an example. Those who reduce their energy use by 10% in one year earn a £15 credit on their bills; those who reduce by 20% earn £25. There are further bill credits (£20) for customers who take up energy saving measures and customers who sign up get a free home energy display. The attraction for customers is the *total* saving – plus the 'reward'. These tariffs might develop in particular if new forms of supplier energy saving obligations seek to encourage demand reduction or carbon saving. However, if suppliers were using such mechanisms to deliver an obligation they would need to be certain they could secure the demand reduction and also that customer interest would be sustained – this might require some automation, or contractual obligation or very strong price incentive to deter high usage.

It is harder to envisage some approaches to household gas-tariffs which may be likely for household electricity – for example, remote load-control / load-management, critical peak-pricing, and real-time pricing. Similarly interruptible tariffs, familiar in the I&C gas market in GB, seem unlikely for household gas (albeit gas smart meters with a safety-valve would in practice permit remote-switching).

Further Consumer Issues for Consideration

Other important considerations from a consumer perspective are :

- Payment methods may dull the impact of smart-tariff price signals. For example, households who pay by direct bankers order (c. 50% of GB households) have less awareness of their energy spend compared to those who use pre-pay.

- The messages to customers from their energy billing, chosen payment methods, in-home display and any new tariffs linked to a smart meter need to be consistent and well-coordinated to enable consumers to respond in ways that will help them to reduce their bills and help deliver the public policy goals.
- How information on tariffs and other price signal is communicated to consumers will thus also be important. Displays and information on bills will be relevant here to ensure consumers know the prices at different times of day or when they are moving from low priced to higher priced units.
- Low income and vulnerable households will face many of the same impacts as other households from the introduction of smart tariffs. However there are also some more specific issues to consider. Some vulnerable households will find it difficult to respond to tariff signals by improving energy efficiency, due to lack of resources. Those in expensive to treat properties (eg solid wall construction) could have particular problems. Some vulnerable households may cut back on heating in response to greater price signals – this may apply particularly to elderly people who already tend to underheat their homes.

Conclusions on New Smart Gas Tariffs for GB Households

To conclude, in developing new smart-meter facilitated tariffs for gas for GB households, the following considerations will therefore be important:

- The regulator, government and consumer organisations need to continue to develop their understanding about potential winners and losers and the fairness and distributional issues arising from new tariffs and pricing plans for GB. Particular attention needs to be given to tariffs offered to low income and vulnerable households. In particular, there is a need for better data on heating amongst low income households (now and in the future).

- Savings on energy bills will drive customer interest in new tariffs. In the current GB market, smart tariffs will be (and should be) optional for consumers. Consumers should not be locked into inappropriate tariffs that may be a bad deal for them. Consumers will need to be fully aware of the potential implications of any new tariff structure on their bills, in the event of a change of personal circumstance. The regulator and suppliers need to explore terms and potentially punitive arrangements which lock customers into unsuitable tariffs and ensure that consumers have enough information to make appropriate choices.

- Although increased choice will be valuable, too much choice may actually be unhelpful. Ease of comparison will be key, so, suppliers need to think carefully about the range of tariffs they offer to avoid complexity and confusion. Lessons should be learnt from other countries and other markets. Suppliers will need to work closely with consumer groups and the regulator to ensure clear, fair and transparent packages are on offer.

SMART GAS PRE-PAYMENT - FUTURE DEVELOPMENTS IN GB

There are around 50 countries with some use of prepayment meters, including some small island states. Widespread pre-payment is found in a relatively small number of countries outside Great Britain – e.g. Northern Ireland, Tasmania, South Africa. Moreover, outside Great Britain, most prepayment meters are for electricity rather than gas (Turkey being one exception). In a number of countries there is opposition to the use of prepayment from consumer organisations and parliamentarians.

In Great Britain, prepayment meters for gas (and electricity) have a long history dating back to coin-in-the-slot meters, used until the 1980s, when they began to be replaced by meters using tokens, keys or cards.

There are currently 2.3 million gas pre-pay meters (~11 % of GB gas customers) and 3.6 million electricity pre-pay (~13% of GB electricity customers). Pre-payment is not used exclusively by low income households but low income households – notably lone-parent families - are the main users.

While prepayment meters have both advantages and disadvantages, they are generally popular with those who use them - largely because of the budgeting control which such meters give them**.** In a large-scale survey[15] of prepayment meter users, 85% preferred this method of payment, even though most realized that it was more expensive than alternatives. Even when pressed, half of prepayment meter users could cite no disadvantages. For those who could find disadvantages, the possibility of self disconnection was the predominant drawback cited[16].

To date, three key factors have limited the attractiveness of prepayment as a payment method from a GB customer point of view. These are : the higher prices paid by GB pre-payment meter users; inconvenience; the risk of self disconnection either due to lack of money or difficulties adding credit. These factors have led to gas and electricity prepayment being perceived in GB as a payment method of last resort for people who have got into debt or have difficulties in budgeting. However, the GB smart-meter rollout is widely seen as an opportunity to provide major improvements in pre-payment – greater convenience, flexibility, new services and lower prices.

The proposed smart meter specification developed on behalf of GB energy suppliers by the Energy Retail Association (ERA) includes every gas and electricity meter being able to operate in both pre-pay and credit mode and to be remotely switched between the two modes. The specification also includes the following functionalities relevant to prepayment.[17] :

- manual credit updates (i.e. to enable the customer to key details into the meter);
- remote credit updates - to support a range of electronic payment options and infrastructures;
- to display to the customer ongoing values for credit available;
- an emergency credit facility that can set remotely – to enable suppliers to offer different periods;
- remotely configurable non-disable (disconnection) periods, where energy is supplied regardless of credit balances. Non-disable periods will be time bound, with a start and finish time and may also be configured to cover a specific date or day of the week;
- The fuel debt recovery rate will be capable of remote configuration to allow customers and suppliers to make individual arrangements for the amount and nature of the recovery of fuel debt;
- The metering system will be capable of configuration to display a “Low Credit” warning message to the customer which could also be replicated on any separate display used by the customer.

- Load limiting – electricity only (maximum load control);

Work is still being done by the ERA on the ability of suppliers to remotely configure the recovery rate by the meter for energy that has been consumed in a non-disable period where there was no remaining credit balance. In 2010 the ERA will continue their work on functionality in conjunction with the work being done by the government and the regulator.

However, although the ERA specification does provide for all meters to be credit and prepay, the Government is only so far committed to including pre-pay functionality for all electricity meters, and has commissioned further work on gas pre-pay functionality. The Government has taken this position as responses were divided on whether a valve should be included in all gas meters to enable remote switch between credit and prepayment. Some argue that this approach would lead to higher costs because meters with valves cost more (estimated in the impact assessment as ~£13 per gas smart meter) and that the higher cost could not be warranted, given that a large proportion of customers would never use the functionality.

Others argue that a pre-pay requirement for all 22 million household gas smart meters will in the long-run be the more cost-effective because even though the initial costs may be higher, the extra long-term benefits will outweigh the extra costs. Other arguments put forward against including a gas valve on every meter were : about the safety of the remote operation of the valve (especially after a long period of dormancy in homes that had not used the meter in prepayment mode for many years); that it would maximise the stranding of legacy gas meters (because it would effectively rule out the option to retrofit the existing gas-meter with a data-logger or similar device, hubbed via the electricity meter or other smart-box in the home) and thereby increase the overall costs of the GB smart meter roll out[18].

Meter manufacturers do not anticipate new or additional safety issues from inclusion of a gas-pre-pay capability. On the costs side, the overall benefits of including prepayment functionality in all gas meters may in the end outweigh the overall costs. However, the cost implications will differ between market actors and therefore the commercial, regulatory and operational issues need to be fully considered.

If a gas valve is not included in every GB household meter this would significantly limit the scope to deliver many of the benefits that smarter pre-pay could in time deliver. Common functionality in all meters could help to simplify (and reduce the costs of) the processes for procuring, installing and managing meters. A gas valve in every gas smart-meter could provide the opportunity to equalise costs and service between credit and pre-payment for both fuels, reducing costs of administration and costs associated with debt and credit risk management, and facilitating a more active market for dual-fuel pre-pay offers. It would also avoid the additional asset and installation costs for changing meters when a customer moves from credit to pre-payment. Take-up rates for

smart pay-as-you-go (which is likely to become attractive to more customers) will be assisted if customers can switch without changing their meter but could be hindered if meters have to be changed.

Smart energy pre-pay may rapidly prove itself attractive to new customer segments, including young or mobile customers in private rented accommodation, and perhaps some older customers too (nearly 90% of over-65's with a mobile phone use pre-pay).

Pre-Pay and Customer Protection

As now, a number of particular customer protection issues arise with pre-pay meters, and these will remain with smart pre-pay – for example, the extra costs of pre-pay, treatment of debt, approaches to emergency credit and 'self-disconnection'. These will continue to be areas where the regulator, suppliers and consumer bodies will wish to ensure suitable safeguards and protection.

The one new area requiring new considerations for customer protection in moving to smart pre-pay (both gas and electricity) will be safeguards in remote-switching from credit to prepay

Smart meters will be able to be switched from credit to prepay mode remotely by suppliers. This will deliver cost savings to suppliers which should help to reduce prices for prepay customers. Another very important benefit to customers is that it should effectively end statutory disconnection for debt because suppliers would have the ability in every case to switch a property to prepayment. However, there are some concerns about how the current customer protection mechanisms will work when remote switching becomes possible.

At present, energy suppliers tend to offer a non-smart prepayment meter to customers who have debt and have not been able to agree or maintain another payment arrangement. The energy supplier has to gain access to customers' homes to install a prepayment meter or disconnect supply. If the customer refuses access or never answers when the supplier calls, the energy supplier must obtain a warrant from a magistrates court to enter and either to fit a prepayment meter or to disconnect supply.

Clearly, access will not be an issue with smart meters – this will avoid the costs associated with obtaining entry warrants. However, the concern that arises is whether remote switching capability could lead to customers in debt, or with poor payment histories, being switched from credit to prepay, without the current judicial safeguards and processes. Energy suppliers will still need to follow existing procedures for debt recovery and disconnection, irrespective of smart meters. The supply licence conditions governing debt recovery and disconnection, as well as the Energy Retail Association's protocol, are also designed to minimise disconnections or prevent them altogether in

the case of vulnerable households. Nevertheless, licence conditions may need to be changed at least at the final stages of debt recovery/ disconnection in respect of smart meters, to take account of their capability for remote switching between credit and pre-pay.

Smart Gas Pre-Pay – Conclusion

To conclude, the GB roll-out of smart meters will provide the opportunity to improve existing payment systems, reduce costs for suppliers and therefore prices for customers. New gas smart pre-pay will enable suppliers to develop a range of new services for customers including new payment means and facilities, information to the user for better management of payments, better awarness of energy usage. A wider range of more customer friendly credit could provide new solutions to risk of self-disconnection. At the same time, new pre-pay technology will bring some new consumer protection issues to address.

OVERALL CONCLUSIONS ON GAS SMART METERS FOR GB.

GB has the highest household gas consumption overall and the highest number of household gas customers in Europe. In the coming decade, smart gas meters are to be rolled out to around 22 million GB homes. This article has shown that the main anticipated benefits from household gas smart meters for GB revolve around :

- Reduced cost-of-service : especially ending pedestrian meter reads, (albeit safety checks still likely) and development of lower-cost smart pre-pay.
- Customer benefits : improved billing accuracy (estimated bills the most common customer complaint) ; reduced costs through improved competition for household gas customers – including through new offers for dual-fuel, pre-pay ; lower bills through improved awareness of gas-consumption.
- Environmental – in support of other boiler-related and insulation measures targeted at reducing household gas consumption and therefore reducing household carbon emissions; offering a capability to ‘measure’ energy savings and carbon reduction emissions, to enable a tie-in to potential future developments on energy saving obligations for energy retailers or others.

Smart tariffs could form one part of a wide range of measures which will impact on GB household energy use. In the period to 2020 in GB, there will be substantial new demand-side investment - on insulation, renewable heat, micro-generation, smart meters and smarter networks. These separate policy streams need to be integrated at a householder level through good programme coordination by UK government and the regulator, together with energy suppliers, consumer organisations and third parties. Incentive schemes and the GB smart meter programme need to be brought together at

a householder level in such a way that the ‘whole’ in the end adds up to be more than the sum of its parts.

End Notes and References

[1] **Smart Tariffs and Household Demand Response for Great Britain**.
Gill Owen and Judith Ward for Sustainability First. March 2010

Smart Pre-Payment in Great Britain.
Gill Owen and Judith Ward for Sustainability First. March 2010.

Further reports for Sustainability First by Gill Owen and Judith Ward – available at www.sustainabilityfirst.org.uk – including :

- The Consumer Implications of Smart Meters. A report for the National Consumer Council. July 2008.
- Smart Meters in Great Britain; the next steps ? July 2007.
- Working Paper 1 : Gas meter market, regulation and technology. July 2007.
- Smart Meters : Commercial, Policy and Regulatory Drivers. March 2006.

[2] Impact Assessment of a GB-wide Smart Meter Roll-out for the Domestic Sector. Department for Energy and Climate Change. December 2009. p.44 – Option 2 – Mandated roll-out of smart meters under the centralized communications model by the end of 2020. Total estimated costs £8.6 bn pv ; total estimated benefits £14.6 bn pv.

[3] 2.8% pa estimated electricity saving in GB impact assessment. No 'additional' carbon saving attributed to electricity savings - under the UK carbon accounting arrangements, carbon from end-use electricity is treated as already capped upstream under the EU Emissions Trading Scheme. However, the estimated 2.8% electricity saving is estimated to lead to a reduced cost of EU ETS Allowance purchasing (£460 m) – treated in the impact assessment as 3% of the total estimated smart meter benefit – ie half the value of the estimated carbon-saving from gas smart meters.

[4] For electricity, the impact assessment makes a modest assumption about savings from peak-shifting induced by time of use tariffs.

[5] Compared with 118 TWh (2008) of end-use household electricity consumption.

[6] Average GB household gas consumption ~19,500 kWh ; average GB household electricity consumption - ~4,300 kWh

[7] Ofgem, 2008. Energy Supply Probe – Initial Findings Report.

[8] Ibid.

[9] Ukpower.co.uk. November 2009

[10] There are many approaches to fixed and variable cost-recovery in household energy tariffs in other countries. In some places, network charges are separately identified**.** There are also some examples of rising ('inclining') and reducing ('declining') block / stepped tariffs, in countries and

states that have regulated household retail tariffs – including some examples which combine inclining block tariffs in summer and declining block in winter.

[11] Economy 7 and Economy 10 are mainly used by people with electric storage heating as high off-peak use is needed to benefit (the unit rate at other times is higher than on other tariffs). The tariff passes some of the benefit of lower over-night electricity system costs to the customer. Economy 7 and Economy 10 have been available in GB for very many years without smart meters, albeit many of the meters (not all) have a remote tele-switch capability. 31% of electricity consumed in 2008 in the household sector was reported as being purchased under some form of off-peak pricing structure.

[12] DECC Smart Meter Impact Assessment – assumes 2% gas saving from improved feedback (0.5% from gas pre-pay).

[13] Electricity has a half-hourly pricing structure which can to some extent reflect the underlying costs of electricity system balancing. Hence, electricity prices which change throughout a day could, to some degree, reflect underlying costs. Although GB household gas end-use has strong peak-related characteristics, (and therefore peak-related costs) these are not presently fully reflected in the GB commercial gas market arrangements, which provide for a single daily balancing price, because short-term gas storage is available within-day (line-pack, safety monitors). Should GB gas market commercial arrangements change at some future point (eg say from daily to four-hourly resolution), then, unlike today, there could be a commercial incentive to develop *within-day* gas load-shifting for non-I&C customers could develop. Settlement arrangements would also need addressing for suppliers to capture the benefit.

[14] One option for serious consideration in the GB competitive market might be to apply a rising block principle just to the environmental costs within the gas bill (eg the future Renewable Heat Incentive). For more detailed discussion, see Smart Tariffs and Household Demand Response for Great Britain. Gill Owen and Judith Ward. March 2010. p.27

[15]Affording Gas and Electricity: Self Disconnection and Rationing by Prepayment and Low Income Credit Consumers and Company Attitudes to Social Action Centre for Management under Regulation, University of Warwick Centre for Competition and Regulation, University of East Anglia, 2001.

[16] In Northern Ireland, the number of electricity pre-pay customers (using 'semi-smart' key-pad meters) has grown steadily over the past decade and now stands at around 30 % of all homes, including some better-off households. This is not directly comparable to GB, because electricity retail tariffs in Northern Ireland remain regulated, and pre-pay tariffs are lower than standard credit tariffs.

[17] For the full details of functionality see : (http://www.energy-retail.org.uk/documents/SRSMMeteringSystemRequirementsv2.pdf)

[18] For a more detailed discussion of gas meter retrofit options in GB, see Gill Owen and Judith Ward . Sustainability First. Working Paper 1 : Gas meter market, regulation and technology. July 2007. pp 17-20.