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Smart meters in Great Britain : the next steps ?

Social and prepayment meter issues

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Social issues

Smart meters will facilitate a broader range of tariffs - time-of-use, block, seasonal, for example – that could provide new services of value to consumers. However, there is evidence from work by Chris Wilson and Catherine Waddams[1], that between one fifth and one third of consumers actually lose money by switching supplier (although they may derive other benefits such as new services). Clearly if low income households took up tariffs that ended up costing them more money, this could be a cause for concern. It would therefore be important that such tariffs are marketed sensitively and accompanied by clear information to enable consumers to make informed choices.

There are two other potential social impacts of smart meters and time-of-use tariffs that need to be considered :

- Whether low income/vulnerable households can benefit from new tariff options
- Whether, as a result of greater information, low income/vulnerable households cut back on essential use in general and at high price periods in particular

Both could be more important for gas than electricity given its use for heating.

Effects of time-of-use tariffs

In assessing the impacts of time of day and time of use tariffs on low income and fuel poor households it is necessary first of all to understand a bit about their energy use. The following are some basic facts and figures.

- There were 22 million households in England in 2004 of which 19 million had central heating and 1.6 million had storage heaters. About 400,000 relied on electric on-peak heating (older forms of CH and individual heaters).
- 40% of fuel poor households in England do not have a boiler and so will mainly be using electric heating (EHCS 2003)

[1] Do Consumers Switch to the Best Supplier ? By Chris M. Wilson Department of Economics, University of Oxford & Catherine Waddams Price. ESRC Centre for Competition Policy and Norwich Business School, University of East Anglia CCP Working Paper 07-6

Table : Main heating fuel[2]

Fuel poor	**average**
16% electricity	10.5% electricity
60% gas	83.5% gas
20% other	6% other

Due to the impact of the Warm Front programme some of the above figures will now be out of date. However, what they are still likely to show is that whilst most low income households (like other households) have gas central heating, more of those on low incomes use electric heating. Since it is in electricity that time of day or time of use tariffs are most likely to be introduced (as this report suggests elsewhere there is little value in such tariffs in gas), then it would appear that low income households are more likely than better off ones to be impacted by these tariffs in terms of essential use that may be difficult to time-shift. Clearly the actual impacts would depend upon the structure of the tariffs in terms of peak and off-peak periods.

An example of the issues this could raise comes from Ontario, where the Ontario Social Housing Services Corporation[3] has examined the effect of the use of smart meters and time of use tariffs on low income tenants of social housing. Statistics Canada data gathered by LIEN (Low income energy network) shows that the poorest income quintile are almost twice as likely as the provincial average to have electric heat.[4] Households using electricity for heating will be less able to shift demand than those with more discretionary uses (e.g. dishwasher, washing machine). The current time-of-use pricing plan sets electricity prices in the winter between 5 p.m. and 8 p.m. (a peak heating use time) at 10.5 cents/kWh, with mid range prices at 7.5/kWh and off-peak rates of 3.5 cents/kWh. This compares to 5.8 cents/kWh for the first 1000 kWh/month and 6.7 cents/kWh for the rest in non smart-metered homes. High peak prices in the summer would affect mainly the better-off as poorer households don't have air conditioning.

In Northern Ireland, trials of a time of day tariff for prepayment meter customers suggested that such customers actually had usage patterns which meant they would benefit from the time day tariffs introduced there (see Paper 6 for details). It is clear therefore that time of day tariffs can be constructed in ways that either benefit or disadvantage certain types of households.

[2] English House Conditions Survey 2001

[3] Smart meters and social housing : energy conservation and energy poverty issues. Ontario Social Housing Services Corporation, August 2006.

[4] TEA web site www.torontoenvironment.org

Effects of more information

In the absence of evidence on the impacts of information from smart meters on low income/vulnerable households (no studies on smart meters to date seem to have looked at this) the nearest proxy is to look at the impact of energy advice in its various forms (via leaflets, one-to-one advice by phone or face-to-face etc). Two studies that shed some light on this are outlined below. Another possible proxy is evidence on self disconnection and rationing by prepayment meter users and this is dealt with in the next section.

Energy advice studies

A study undertaken by BRECSU (The Building Research Institute Energy Conservation Unit), in 1998[5] aimed to determine the costs and benefits of providing energy advice to social housing tenants. The research surveyed 100 households, before and after energy advice was delivered, and found that the provision of energy advice did not lead directly to savings for the majority of tenants in the group studied. Most were already using their heating systems correctly and, due to financial constraints, used energy very efficiently. In contrast a control group (who had previously received energy efficiency improvements to their housing) were using 20 per cent less energy on average despite achieving 2°C higher internal temperatures. However, despite knowing how to operate their heating systems they were not motivated to make further energy savings through modifying their behaviour and average temperatures were higher than recommended. The researchers concluded that for low-income households in inefficient homes, energy advice aimed at changing behaviour is no substitute for improvements to the building fabric, for example, cavity wall insulation.

Research for the EST to evaluate differences in the effects of advice delivered in various ways[6] aimed to determine what actions result from advice and identify the benefits of following that advice. The study (based on 1,900 interviews with people who had received energy advice 9-15 months earlier) found that 70% of those advised to install some measures do so, and 75% of those advised about energy saving behaviour follow some of that advice.

Estimates of the energy savings likely to arise from each change in behaviour were based on the latest research and published findings from earlier studies. The estimated savings for each action (£, kWh and CO_2 emissions) were then applied to the households making each change in behaviour to estimate the average savings achieved by each household receiving and following each type of behavioural advice:

[5] Energy advice to tenants: Does it work? by John Walker and Nigel Oseland, published by the Chartered Institute of Housing in association with the Joseph Rowntree Foundation

[6] New Perspectives/Energy Inform (2004) Savings from behavioural changes following energy advice: report on a survey. New Perspectives, Ipswich

- Advice on cooking, use of cold appliances (e.g. refrigerators), laundry appliances, and not leaving appliances on stand-by.
- Advice on the control and use of heating and hot water (HW) systems.
- Advice on the control of lighting and the use of low energy bulbs.
- Other tips on the use of blinds and curtains, internal doors, sealing gaps in floorboards and blocking unused chimneys.

55% of those who recalled receiving advice on use of heating and hot water followed some of this advice, on average adopting 4 to 5 changes in behaviour each – e.g. adjusting thermostats and timers to suit living patterns, taking more showers, using less hot water for baths or laundry, and fixing dripping hot taps. Those who adopted more energy conscious actions and seemed likely to save more were private tenants, quite low income households (£5,001 to £10,000 a year), C2/DE social grades and people aged 16 to 34 – savings for these groups were estimated at between £45-57 per year. AB social grades and those on the lowest incomes changed their behaviour less after advice (savings of £35-37 per year)– ABs probably because they can afford not to, and low income households because some may already do much to save energy and others may have no central heating to adjust.

41% of those who recalled receiving advice on use of cooking and appliances said they had adopted around 4 or 5 measures such as only putting as much water in the kettles as they needed, putting lids on saucepans, adjusting their fridge, washing clothes at lower temperatures, using the clothes line not the tumble drier and not leaving appliances on standby. The demographic groups which seemed likely to save more were council tenants (savings of £10.87 a year), DE social grades (£10.33), low income households (£9.93) and households where English is not their first language (£9.35). High income (£5.12) and professional (AB) households (£3.64) seem likely to save less as they follow fewer tips. Savings from changes in use of lighting were estimated as similar between demographic groups (£11-13 per year) although slightly higher amongst those on the lowest incomes.

85% of those who recalled advice on other energy saving tips (such as closing curtains or blinds at dusk and opening them at daylight, fitting heavier curtains, and blocking up unused chimneys and gaps in floorboards) followed some of this advice (each doing three or four things). Estimated savings were £15-17 for those on modest incomes, those whose first language is not English, C2/DE social grades, and 16-34 year olds, compared to £10-11 for the AB social grades and those on the highest incomes.

Self disconnection and rationing amongst prepayment meter users

Other relevant information is the evidence on the extent to which existing prepayment meters users self disconnect or ration their use. PPM users are generally much more aware of how much they are spending on energy than those who pay by other means, because they often know how much credit they need to put onto the meter each week. Thus PPM users can already be seen to have some of the information that more consumers would get with a smart meter (albeit that the smart meter would provide more sophisticated information on hourly and daily costs).

A 2001 survey aimed to establish how prevalent were self disconnection and self rationing amongst low income energy consumers.[7] Self disconnection from fuel for prepayment meter users is defined as interruption to supply because the card has not been charged and inserted into the meter. Self rationing is a less well defined concept, and one object of the research was to gain a better understanding of the nature of rationing of fuel. The definition used most frequently is that the respondent reports not being able to afford sufficient fuel to heat the home. The research included 3417 households, of which 941 had prepayment meters for both fuels; 1150 had an electricity prepayment meter only; 41 had a gas prepayment meter only; 1285 households had no prepayment meter.

The survey found that only about a quarter of prepayment consumers had self disconnected in the previous year, and most of these had done so only for periods of less than seven hours. Pensioners did so less than average. However most of those who had self disconnected had done so more than once in the previous twelve months, and some had done so more than twenty times. Self-disconnection from gas is more common than from electricity, but this seems to be because gas pre-payers have lower average income than electricity pre-payers. Most of those who had self disconnected attributed this to having forgotten to recharge the card, rather than to shortage of money. However self disconnection for money reasons clearly is a significant problem for a minority of prepayment users. Most households surveyed tried to economise on their use of fuel; only 27% of consumers reported that they neither self disconnected nor self rationed. Pensioners were least likely to self disconnect, and most likely to be in a group reporting neither self disconnection nor self rationing. Households with both gas and electricity prepayment meters were most likely to both
self disconnect and self ration.

Conclusion on social issues

As the above information shows, smart meters may raise a number of social issues, depending upon how they are deployed. Key factors will be the use of time of use or time of day tariffs and the extent to which smart meters form part of a broader strategy to improve energy efficiency for low income households. This is not meant to be an argument against smart meters but these factors do need to be borne in mind in their deployment. The trials over the next 2 years will clearly be very helpful in shedding light on how different demographic groups respond to the information provided by smart meters and the different tariffs that they facilitate.

[7] 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

Prepayment meter issues

Prepayment meter use in Great Britain

Prepayment meter usage has been growing in Great Britain since the early 1990s. Although electricity PPM use has fallen slightly from its peak in 2001, gas prepayment meter usage has continued to grow. There are currently around 5.9 million pre-payment meters in use in Great Britain representing around 13% of domestic meters. There are 2.3 million gas PPMs – 12% of domestic gas customers. Almost all gas pre-payment meters are Quantum meters, which use smart-card technology[8]. There are 3.6 million electricity PPMs – 14% of domestic electricity customers, of which: 1.3 million are token meters; 1.5 million are key meters; 0.8 million are smart card meters.

PPM penetration differs across demographic groups as the figures below show, with low income households much more likely to have a PPM than households in general. PPM use is greatest amongst single parent households, the unemployed and those with long term illness or disability. PPM use is relatively low amongst elderly households, although higher amongst pensioners dependent upon state benefits than those with occupational pensions.

Table : Percentages of different household types using prepayment meters[9]

	Gas	**Electricity**
All GB consumers	12%	14%
Households with income of less than £10,000 a year	21%	23%
Single parents with dependent children	33%	35%
Unemployed receiving benefits	36%	36%
Long-term illness or disability	29%	32%
Retired - state pension only	6%	7%
Retired - occupational pension	3%	4%

[8] Under their meter price control, National Grid Gas charges Suppliers £29.73 pa for a PPM, of which £7.86 pa is for meter provision. Gas pre-payment meter costs are currently quite substantially cross subsidised by charges made for domestic gas credit meters.

[9] Ofgem. March 2005 Accent Survey. Ofgem are currently (mid-2007) updating this information.

Prepayment meter price differentials compared to direct debit

Prepayment meter users tend to pay more for gas and electricity than do those who pay by different methods. The following are two recent assessments :

- Although most suppliers have equalised their prepayment and standard credit tariffs within their incumbent areas, outside those areas their prepayment tariffs are 1-7% higher. The difference between prepayment and direct debit is more substantial - prepayment tariffs are 2-17% higher in incumbent areas and 7-10% outside those areas.[10]
- The average gas prepayment bill is £615 per annum (20,500 kwh consumption) compared to £546 for the average direct debit customer (a difference of £69 or 12.6%). The average electricity prepayment bill is £385 compared to £349 for the average direct debit customer (a difference of £36 or 10.2%)[11]

The differential appears to be increasing – in 2000 it was £47 for gas and £29 for electricity.[12]

It is generally accepted that prepayment meters are a higher cost payment method than direct debit. This is due both to higher costs of the meters themselves and higher servicing costs, although these costs are offset to some extent by the cash flow advantages to suppliers of cash in advance of energy use and the elimination of debt. However, whether differentials on the current scale are fully cost reflective is a matter of some debate. The Fuel Poverty Advisory Group (FPAG) is concerned that differentials on this scale may reflect the lower propensity of prepayment meter customers to switch supplier, which enables suppliers to keep prices higher without risking customer losses. Conversely, direct debit customers are more likely to switch and hence suppliers have to offer them lower prices in order to retain them. None of the suppliers pays switching sites such as Uswitch for prepayment switchers, whereas they do pay for direct debit customers.

If there is less active competition for prepayment meter customers, this is likely to be due to three main reasons. Firstly, suppliers are less keen to recruit PPM customers due to the higher costs of serving them. Secondly, PPM customers tend to be on lower incomes than direct debit customers and hence are less good propositions for selling other services. Thirdly, customers with debts over £100 can be prevented from switching. Although only around 15% of gas PPM customers are in debt at any one time (and only 5% have more than £100 of debt) , two-thirds initially have a PPM fitted because they are in debt.[13] Thus there is a strong perception (even if the reality is somewhat different) that PPM customers are likely to be paying off debt. For every PPM customer that wishes to

[10] As at 13 March 2007 – Ofgem
[11] As at 26 April 2007 – Energywatch
[12] DTI - FPAG paper, May 2007 meeting
[13] http://www.ofgem.gov.uk/Sustainability/SocAction/Monitoring/COPMonitor/Documents1/18330_ExternalReport61206.pdf

switch, suppliers will therefore want to check whether they have a debt before the customer can switch which represents another cost.

By way of comparison , it is worth noting that prepay mobile phones have higher per call charges than those where customers sign up to contracts. Prepay customers also pay more for the phones than contract customers. This is primarily because prepaid customers are generally less valuable to mobile phone companies. They spend less than those on pay monthly contracts, with an average monthly spend of £24.27, compared to the £44.18 bill paid by contract customers[14] Although more than 50% of mobile phone users worldwide use prepaid, they are responsible for only 25% of mobile phone company revenues.[15] Mobile phone companies also often have very little data on prepay customers compared to contract customers and so cannot so easily segment the market and cross-sell to them.[16]

Not all of the factors that make prepay mobile phone customers less attractive than contract customers apply to gas and electricity PPM customers. The average spend of gas and electricity prepayment customers is only slightly lower than that for direct debit customers. Suppliers will have as much data on PPM as other customers, but it is probably true that they are less valuable for cross selling. It is thus important to note that, whilst improvements in technology may tackle some of the causes of higher charges for prepayment meter customers, there are also other factors causing the differentials between prepayment and direct debit.

Prepayment meter technology

Token meters have a number of shortcomings, including greater susceptibility to fraud and mis-directed payments and high maintenance costs due to the need for site-visits to set tariffs and obtain meter readings. A problem for households with token meters is that they can accumulate debt when meters are not recalibrated as soon as tariffs change - some suppliers (EDF, SSE and British Gas) only apply changed tariffs from the date on which the meter is recalibrated but others backdate it. Suppliers often have difficulty gaining access to recalibrate token meters – many report that they gain access on average to 6 customers out of every 10 visits, but this can decline to 3 in 10 in some areas. Offers to write off debts and not backdate recalibration are sometimes used as incentives to gain access. Suppliers are in the process of removing token meters – switching customers either to key meters or onto another payment method such as direct debit. Numbers fell from 1.5 million in early 2006 to 1.3 million by the end of 2006. Powergen and British Gas expect to have removed all or most of theirs by the end of 2007. Ofgem estimates that by the end of 2009 all token meters will have been removed.

[14] J D Power Associates. Monthly spend on mobile rises, 2004
[15] Innovative strategies to gain access to end-user information and use it to improve CRM. Presentation to 10th Annual Prepaid mobile 2006. Bruce Swain & Geoff Hardy – 21 March 2006)
[16] Ibid.

In Northern Ireland 175,000 keypad electricity prepayment meters have been installed, initially replacing token meters, but now covering c.25 % of residential customers, these have led to costs savings and lower prices for prepayment customers. (Northern Ireland is dealt with separately in more detail in Paper 6) However, the scope for similar savings and benefits in Great Britain is lower because most of the prepayment meter stock is key or smart card. 'Key' meters and smart card meters allow transfer of information such as tariff-changes and meter reading data to and from the key or card at the payment service-point. In this sense, key and smart card meters are 'semi-smart'[17].

How new PPM technology could reduce PPM costs

Whilst recognising that it is not just the technology that causes suppliers to charge prepayment meter customers more than those who pay by direct debit, nevertheless, newer technology could offer the potential to reduce the costs of prepayment. The main potential would seem to lie in the following areas.

- Eliminating the need to insert a card or key into the meter. Breakages and loss of cards or keys lead to costs of replacement, risks of fraudulent use and in some cases may necessitate a visit (e.g. to repair a meter/remove a stuck card or key). (Transco undertake 1 million visits a year due to problems at a cost of £50 a visit - 50 million)

- Eliminating misdirected payments. Another problem with cards and power-keys is that some customers continue to use the old suppliers' key or card when they switch supplier leading to misdirected payments. This means that a supplier can receive payment for energy it has not actually delivered. Although there is an agreed industry process for power-key users, which ensures misdirected payments are correctly re-allocated, this still causes costs for suppliers. These misdirected payments cause costs within the energy companies, which have to employ staff to reconcile the payments to the correct supplier or customer account. Estimates put the value of payments sent to the wrong supplier at £150 million a year, raising the cost of managing prepay even further.[18]

- Eliminating the need to visit the property to change the meter from prepayment to credit and vice versa. Having a single meter that can operate in credit or prepay mode could eliminate the need for substantial numbers of visits each year to change meters (about 10% (600,000) of the prepayment meter population changes each year, so at £50 per visit - £30 million) An electricity smart meter that can be remotely switched between credit and prepay costs little more than a credit smart

[17] Ofgem. Pre-payment Meters. Consultation on New Powers under the Energy Act 2004 and Update on Recent Developments. February 2005. 32/05.

[18] Logica CMG newsletter, Vision Online, Issue 6, 2005

meter, so it would probably make sense for all electricity smart meters to be capable of being switched between credit and prepayment. In gas the differential is greater, so the costs and benefits of fitting remotely switchable gas smart meters in all properties needs to be considered more carefully. It may be most cost effective to fit combined gas credit/prepay meters, on a widespread rather than selective basis, in areas where there is high prepayment use (for example on some social housing estates and in multiple occupation dwellings).

- Having a greater range of options for customers to top up credit. This partly links to getting rid of having to insert a card or key into the meter. The potential is to make credit top up as flexible and simple as for prepay mobile phones, where customers can top up credit at a Paypoint (or similar outlet) using cash (and a special swipe card) or debit/credit cards; over the phone or internet using a debit or credit card; at supermarket checkouts using cash (and a special swipe card) or credit/debit cards; at a cash point machine using their cash machine card. Credit would be sent automatically (via GSM/GPRS either directly to the meter, or to a data concentrator and onward to the meter, in the case of Radio or PLC communications) to the smart meter with no need for the customer to enter a number. A key pad would probably be provided for back up and if credit had actually run out on a gas meter, then the customer would probably have to press a button to re-open the safety cut-off valve . All the components of technology required to facilitate this broader range of credit top-up facilities are available. As yet no such meters have been produced but, if the demand was there, they could be. This greater range of payment options would not necessarily reduce costs of itself but offers the potential to make prepayment a more attractive payment method (more like "pay as you go" mobile phones) and thus the potential for more customers who have payment problems (and thus cause costs) to move onto it.

Logica CMG estimate suppliers could save up to 30% of the cost of managing prepayment through smart technology.[19] However, some questions remain about how far costs can reduce.

- If prepayment meter customers still buy credit frequently (thus causing the supplier to incur transaction charges for top-up via Paypoint etc) costs might not fall as much as expected.
- There is also the question of whether payment infrastructure expansion (e.g. to include top-up by phone, internet, cash machines, supermarket check outs) would reduce or increase costs ? As suppliers would have to pay to use these different payment infrastructures (presumably on a per transaction basis), this would depend upon the relative costs of new methods compared to existing ones.

[19] Logica CMG op cit

Prepayment customers will not necessarily see savings, even if new smart prepayment meters reduce suppliers' costs. Many suppliers have already equalised their PPM tariffs with credit meter tariffs, so these PPM customers are being cross subsidised. In these cases, suppliers will be more likely to keep the benefit of the reduction in costs or use it to reduce prices to other customers if they need to do so to remain competitive. As noted above, there are also other reasons why PPM customers are less attractive to suppliers, which are not technology related. The impact on PPM customers of reduced costs through smarter forms of PPM is therefore also likely to be affected by the value of PPM customers to suppliers as compared to customers using other payment methods (notably direct debit).

A number of suppliers envisage that the numbers of customers using prepayment meters will increase with the introduction of smarter forms of prepayment and pay as you go meters. There may therefore be some concerns amongst consumer groups that remote switching capability could lead to customers being switched from credit to prepay without the safeguards and processes that currently apply. At present, suppliers offer a prepayment meter to customers who have debt problems and have not been able to agree another suitable payment arrangement (or where a payment agreement has broken down). The supplier has to gain access to customers' homes to install a prepayment meter – this means either that the customer has to consent or the supplier has to obtain a rights of entry warrant from a magistrates court. Entry warrants are only granted provided magistrates are satisfied that the supplier has gone through the appropriate processes.

Remote switching capability will clearly save the costs of suppliers having to get into properties to change the meter and will mean that debts can be recouped sooner and that debt build up can be lessened. However, remote switching capability could enable the current processes to be by-passed, so some consideration will need to be given as to whether the current protections and systems are adequate and appropriate. This may mean some review of supply licence obligations is required.

Conclusions on prepayment meters

Smarter prepayment meters offer the potential to reduce some of the suppliers' costs associated with PPMs, which could benefit PPM customers (many of whom are on low incomes) if cost savings are passed on. The main scope for cost reductions could come from remote switching between credit and prepayment (avoiding the need to visit the property) and eliminating cards and keys and their associated problems of misdirected payments, card and key replacement costs etc. If prepayment can be made more attractive through smarter meters and a wider prepayment infrastructure (using cash machines, internet, phone etc) then it might also attract more customers who currently have debt problems, thus producing further savings in supplier costs. However, if prepayment

customers still top up their credit as frequently as at present then costs might not fall so much and a wider payment infrastructure might push up costs. There are also other reasons why PPM customers are less attractive to suppliers and hence why they pay higher charges than customers on direct debit. PPM customers tend to be on low incomes and hence are not such good propositions for selling other services. Many PPM customers have debt and can be prevented from switching - suppliers will have to check this before the customer can switch which represents another cost. Therefore, whilst improvements in technology may tackle some of the causes of higher charges for prepayment meter customers, there are also other factors causing the differentials between prepayment and direct debit.