Hirst Solutions Limited

Innovation Technology Sustainability

Smart Metering Implementation Programme

HSL Technical Consultation Response

Abstract

DECC have published various documents concerning the "Smart Meter" Implementation Programme, including a Consultation on draft licence conditions and technical specifications for the rollout. This document is offered in response to this consultation, and provides responses to a selection of the questions asked.

To put the responses in context, there is a short description of what HSL believes an intelligent metering system should offer, and an appropriate approach to rollout. This would be significantly cheaper and more useful than the proposed programme, facilitating the integration of variable renewables, and does not need the expensive, risky and wasteful infrastructure that is currently planned.

The key weakness of the current approach is the failure to use the intelligence available in the meter to perform billing calculations. If this were to be done, the vast and complex data communications and data processing infrastructure can be radically simplified, without loss of value to consumers. The current approach to billing prevents reward for the flexible and responsive demand behaviour future electricity systems will need.

Date: 13 October 2011

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1 Introduction

This is a response to the DECC Smart Meter Implementation Programme call for evidence: a consultation on draft licence conditions and technical specifications for the roll-out of gas and electricity smart metering equipment. It is submitted by Hirst Solutions Limited (HSL), a company providing consultancy in support of sustainable electricity and pursuing intellectual property in the field. It has been prepared by David Hirst, who invented the technologies being commercialised by RLtec (although there is no relationship between RLtec and HSL.)

The basis of the submission is that the DECC Smart Meter programme, as currently envisaged, is inappropriate. It fails to offer benefit to consumers; gives unnecessary capability for commercial enterprises to exercise arbitrary and risky controls in people's homes over consumption; fails to provide for desirable tariff structures to facilitate efficient integration of variable renewables; and gives even greater opportunity for suppliers to bamboozle their customers with needlessly complex and incomprehensible and confusing pricing plans.

The key weaknesses of the programme are:

- **Separation of consumption measurement from pricing and billing calculations**. This means that very large scale, potentially fine grained, consumption information has to be transmitted (via complex communications and switching infrastructures), back to complex, large scale calculation engines. It also means that the meter does not know, and so cannot display to consumers, what the actual price is. If what the meter holds is not used for billing, it can diverge from the actual price. In vegetable markets for potatoes, this would be against weights and measures legislation.
- **Lock in to the "half hour" accounting and settlement structure**. In a system as dynamic and changeable as our electricity system, the "market value" of electricity can change rapidly and unpredictably. With today's system, value changes most dramatically when a nuclear power plant has an unplanned shutdown. The immediate loss is covered (at significant cost) by various forms of frequency reserve, but there is then a big gap in the forward schedules, as it will take at least a few days for the nuclear plant to come back on stream. Plant capable of filling the gap can command high prices. With future systems, the scheduling problem is enhanced by the variability of wind, which, broadly, can be estimated for about a day ahead. Within that, however, weather fronts can cause steep ramps in wind generation, and the timing of these is hard to predict with precision. Half hour pricing structures are inadequate, even today, and have involved construction of baroque, complex, and unfair adjustments such as the "balancing mechanism". The benefits of an electricity market reform programme are already significantly constrained because trading is administered in half hour blocks[1].
- **Universality of rollout**. Only a relatively small (but hopefully growing) segment of consumers (and their devices) are able to benefit from the smartness of the meters. Most of any benefits of demand response will come from this minority of consumers (or rather their devices). Yet the rollout is to all, even the majority of consumers (who have to paid for it, however indirectly) will get no benefit. It would be better, and more acceptable, if any meter change can coincide with new appliances (such as electric cars) that are equipped to modify their behaviour, as so reduce their owner's electricity bills. Lessons learned from early adopters can then be incorporated into later product offerings.
- **Loss of consumer autonomy and freedoms**. The meters give suppliers (and others) capability to control significant parts of a home. Yet they cannot be aware of the impacts this control may have on residents and consumers. Consumers face additional risks from unattended restoration of supply.
- **Other weaknesses**. Including: the bureaucracy surrounding the standardisation of meter features; the monolithic and so inflexible nature of the DCC; the universality of the communications networks, rather than the capacity to evolve and grow as needs and benefits grow; the domination of suppliers (corporate) needs above those of consumers without reciprocal accountability – a relationship that is

[1] It is worth noting that, within UCTE, the European electricity system, most disturbances occur close to the hourly boundaries dictated by trading mechanisms. The really big UCTE disturbance and blackout in n2006 was just past the hourly tariff boundary.

already unbalanced; the failure to include calculation of parameters that would be useful in allocating network costs. Without this, and its transparency, network cost allocations will remain opaque, and probably regressive.

All this makes the programme vastly more expensive, risky and unaccountable than is necessary.

The need for change

There is undoubtedly a need for metering that is more intelligent than that invented over a century ago, and now no longer fit for purpose.

The approach advocated is for a "flowcost" meter, in which it is the intelligent meter that performs the billing calculations, based on prices that are previously broadcast, and that can continuously change. The prior broadcasting allows consuming devices to plan their consumption to minimise their costs, as well as giving the meter the information to perform the billing calculation (consumption times cost) at short intervals (such as a few seconds). The continuous change avoids the risk of large numbers of automated devices synchronising their behaviour – a possibility that risks large scale blackouts triggered at any significant tariff boundary – particularly the times when the system conditions are changing most quickly, and the system is most difficult to keep stable.

The meter would maintain a single register accumulating of the cost of consumption. There is no need for a host of registers accumulating consumption in a complex and opaque way. Such registers may be included as an audit aid, and perhaps to reveal to consumers their consumption patterns, but become redundant.

There is no risk of sudden large changes of load from the precision synchronisation of many devices recognising a tariff change. The natural diversity of consumer utility assessments can be used, along with small changes in prices, to ensure gradual changes in load. There is no need for any centralised control of load, but rather a more subtle influencing of load by price.

The same price curve can be used to reward local generation (duly adjusted for any buy: sell margin), and so allows flexible local generation to plan for the times when its output is most valuable. This may make it appropriate to hold an export register, as well.

Since it is the meter that performs the consumption (or generation) times cost calculation, there is no need to transmit the consumption data back to a central system. Current processes for data collection remain valid and useful, and can be enhanced as the value of them increases, or the availability, convenience, capability and infrastructure lowers costs.

Export metering can be embedded within the accumulation of costs (as negative cost), or maintained as a separate total.

Each supplier would broadcast their own cost curves, so their tariffs would be visible and transparent. It is, at least in principle, possible for consumers to see multiple cost curves, and so choose the one that best suits them. This would, however, need a more sophisticated meter, which suppliers are unlikely to offer.

Devices (such as battery cars) that can see and make use of the price curve can display the cost consequences to consumers at the time they connect them or initiate a demand for service. The devices can also display options, so consumers can make trade-offs between their need or urgency, and the resulting cost. At its simplest, it can be an urgent or cheap choice. More sophisticated choices and policies in the light of changed prices are also possible. Any consumer decisions can thus be made at the time when the consumer is entering into the consuming "transaction", and not at the times imposed by the needs of the system.

The specification and approach so far does not enable flowcost concepts. These (or something else like it) are vital to sensible participation by consumers in their electricity transactions, and so sensible integration of variable renewables into the system.

The most urgent implementation step is to review the flowcost concepts, and its implications, and, in the light of this, review all aspects of the technical specification and roll-out plans. This is a significant piece of work, but the comments here are intended to indicate where significant changes are needed, and how the overall programme can be much simplified.

Responses to Specific Questions

2.3 Licence Conditions

4. Do you agree that Smart Metering Equipment should be compliant with the SMETS extant at the time of installation and that it should continue to be compliant with that version of the SMETS through the operational life of the equipment? Please explain your reasoning.

No, or only of the SMETS specification is radically simplified and reduced. To require compliance with future SMETS implied a lock in, and huge barriers to any change to it. This is inappropriate.

2.5 Interoperability obligations

One supposed benefit of competition is to enable innovation and "getting ahead" of rivals without unnecessary constraint or early revelation. The conditions negate that.

15. *What do you think the implications would be of extending the new and replacement obligations to the licences of other relevant parties in relation to installing Smart Metering Equipment in new developments without the involvement of a supplier? Do you think mechanisms other than licence conditions should be considered to achieve the policy objective? Please explain your reasoning.*

Since you ask, I think retail competition in electricity is wasteful and harmful to the well-being of consumers, and the efficiency of the system. It is impossible to measure wholesale deliveries without unverifiable assumptions about the behaviours of their consumers.

A more appropriate model would be competitive franchising within areas that correspond to wholesale metering points.

2.8 Consequential changes to legislation, licence conditions and industry codes

22. *Do you think there are any consequential changes to existing legislation needed in order to make the proposed roll-out obligations work correctly? Please explain your reasoning.*

Yes. The meter rollout should coincide with the capability and individual purchase of devices that can benefit from it. This may require legislative, licence and code changes concerning the settlement processes.

3.2 Developing the Technical Specifications

24. Do you think that there are other requirements that the Government should adopt in the SMETS? Please explain your reasoning.

Yes. Two are critical.

First that the concepts of flowcost metering are incorporated, or at least enabled, within the specification. They have been explained above.

Second is that the meter should include a unique IPv6 address, and incorporate concepts of the "Internet of Things".

Both are non trivial, and will need further work.

27. Do you agree that the process outlined above is a suitable way forward to develop the SMETS? Please explain your reasoning.

No. It will serve to inhibit, slow down, or prevent any significant progress that is not to the advantage of incumbent suppliers.

28. Do you think that the SMETS should ultimately be governed as part of the Smart Energy Code? What alternative arrangements could be adopted for the ongoing governance of the SMETS? Please explain your reasoning.

No. It is too much to the benefit of incumbent suppliers, and does not have sufficient intelligent "public interest" involvement.

3.3 Outstanding Technical Issues

30. Do you agree that the Government should include a requirement for a Communications Hub in the SMETS? Please explain your reasoning.

Two way WAN communications are not necessary to deliver smart meter benefits to consumers. So the communications capability is an optional extra and should not be within SMETS.

It would be reasonable for SMETS to include a requirement to measure loss of power events and their duyration, and for this to be used within billing.

32. Do you agree that the DCC Communication Service Providers should specify the requirements for outage detection as part of their general role in specifying the WAN technology? Please explain your reasoning

The DCC is redundant, so it should have no role.

The outage reporting is of greatest value to Network Operators. So they should do the specification.

33. Do you think that the Communications Hub should also have the functionality to send a communication to the DCC when power is restored? Please explain your reasoning.

If there is a communications hub with WAN capability, then it is reasonable for that to attempt to report loss of power. This does not need meter functionality.

34. Do you agree with the Government's proposal that fully integrated electricity meters and Communications Hubs will not comply with the SMETS? Please explain your reasoning.

No and yes. It is quite rational to install intelligent meters without having two way communications. The only essential communication is for broadcasting the price curve. The broadcast standards and reception technology standards will need to be common across suppliers, and so should be incorporated within the standard meter. Other, two way communications are optional, and so can vary, and so need not be part of the core specification.

If a supplier needs to have reliable two way communications with a meter to support its billing functions, it is not reasonable for a meter supplier to depend upon communications services provided to the home for other purposes, such as internet access. Similarly, for a flowcost meter, the broadcast channel to the home has to be independent of other domestic communications services, or it may be prevented from fulfilling its core function.

However, if there are additional benefits or savings to a consumer that arise from the meter sharing a communications channel, then there is an incentive to keep the communications channel available, and it would be reasonable to depend upon a customer supplied (and funded) communications service. In such circumstances, the communications hub appropriate to the customer's choice of communications service is appropriate. So yes, integrated communications would not comply with SMETS. The meter communications will need to be protected from cyber tampering, so need to be encrypted appropriately.

36. Do you agree there should be no restrictions on the HAN standards adopted by suppliers, provided they are available as a European (CEN, CENELEC or ETSI) or International (IEC or ISO) standard? Please provide evidence to support your position.

Yes. There should be minimum constraint on the HAN choice.

42. Is the provision of a single network-layer address for each Communications Hub a reasonable and sufficient functional requirement for the Smart Meter WAN? Will this requirement limit potential future capability or present challenges, for example, in multi-occupancy buildings?

No. Given the capacity of 128 bit addressing, and concepts of the Internet of Things, it would be sensible to ensure all meters and communications hubs have their own addresses.

44. Do you think that network registers should be included in the SMETS? Please provide supporting evidence for your response (including the cost implications for Smart Metering Equipment, and any alternative approaches that would provide this functionality).

Broadly, yes, the meter can reasonably collect parameters that participate in network services billing outcomes. The key issue is one of fair allocation of the largely fixed network costs. The parameters and their outcomes should be visible via the meter. They can be collected as part of routine meter reading, so do not need new communications, although this would be helpful.

The parameters have strong political implications, and will need public debate. They should have progressive impacts on consumer costs.

The costs will arise from the collection and processing of the data. They will be significant, but should fall to the Network Operators, who should, in turn, have a billing relationship with the customers they serve.

46. Do you agree with the proposed approach for consumers to access data and transfer it from the HAN via a separate "bridging" device? Please explain your reasoning.

Yes, but there should be an obligation on the meter supplier to offer the bridging devices for their meters to popular HANs at a "reasonable" cost. Perhaps as seller of last resort.

48. *Do you agree with industry's proposals for an overall architecture of an application layer standard with translation through a Communications Hub to a HAN? Do you believe there are any consumer, economic or technical issues?*

Not yet. The applications layer needs to be more precisely defined before standardisation is attempted. Any communications hub should be optional. It should not be a requirement of smart meters. The concept of government involvement in a competitive market is somehow contradictory. There is no need for a decision now.

49. *Where do you believe that translation is best managed:*
a) At the Communications Hub; Or
b) At the DCC?
Do you have any economic, technical or consumer evidence to assist Government in evaluating the options?

There is no value in a DCC. If billing calculation is done in the meter (as they should be), the communications should be direct with the relevant supplier(s).

50. *Do you agree that the IHD should only be required to display ambient feedback based on energy usage? Please explain your answer.*

No. Absolutely not. Any consumer decision to switch something depends on their circumstances and the cost. It also needs to be displayed at the device that would be switched on or off, NOT at the meter. How can the meter possibly make a decision without awareness of the consequences of service to consumers? That is arrogance.

With flowcost metered intelligent devices, consumer decisions can be based on the displayed cost of the service (say charging the battery), and their own view of the urgency of their need and the cost.

51. *Do you agree that Smart Metering Equipment should be designed to support the calculation and/or display of account balances as described above, even though suppliers may not initially be mandated to invoke such functionality for credit customers?*

I do indeed agree that the meter should maintain the cost accumulation, and do so for all consumers not just credit customers. I do not think it essential for the balance to be adjusted in the light of external financial transactions. Certainly, such a function does not justify the costs of the communications infrastructure, which would otherwise be unnecessary.

Prepayment meters and "credit" customers may justify an enhanced communications capability for those users. However, this does not justify the rollout of new meters and communications to all consumers.

If there is the capability for remote disconnection, any meter related device that might decide to disconnect supply for commercial reasons should have an absolute obligation to display how imminent this disconnection will be.

3.4 Assurance and interoperability

54. *Do you think that an assurance framework, underpinned by regulatory obligations, is needed to support the delivery of the required functionality, interconnectivity, interoperability, and security of Smart Metering Equipment? Please explain your reasoning.*

Yes, very much so. The suppliers have shown themselves willing to actively confuse and even bamboozle their customers, and the "smart meter" significantly amplifies the opportunities they have to do this. There need to be very strong assurances that this will not happen.

I do not believe this to be feasible within a competitive retail environment. It will often not be clear at what point bamboozlement occurs, and sales oriented trading corporations like suppliers will not be good judges of any boundary.

A geographical franchise model, with a monopoly supplier across a geographical area within which the overall (wholesale) consumption can be reliably measured – ideally by flowcost type techniques – will allow the franchised supplier to set and vary tariffs so they can play an active role in the wholesale market. They would have the ability to influence consuming devices within their franchise, and so would not be at the mercy of generator set prices.

Part of the franchise conditionality could be active participation by stakeholders other than investors in the business strategies. This will likely involve responsibility by local political leaders and parties, as well as special interest groups representing, for example, vulnerable groups, the environment, and, of course, consumers.

It is really only this sort of broadly based, locally focused publicly disclosed setting of tariffs, that trust in the utilities can be restored.

There would be major cost benefits in the current context in not needing a DCC, but also a huge simplification of the whole settlement process, removing the opaqueness and possible corruption of the "deemed" consumption by suppliers.

3.5 Security Trust Model

59. Do you agree that cryptographic/ key management is necessary to secure the End-to-end Smart Metering System? Please explain your reasoning

Yes. The huge money flows associated with energy make corruption of the measurement system an attractive target for criminal cyber-attack, possibly on a substantial scale. There is also scope for subversion of the control capabilities to be used to create shocks that could blackout the system, potentially repeatedly. So effective and multi-layer defence tools need to be embedded from the beginning, and this cannot be done without powerful key management capabilities.

This suggests a hybrid cryptographic solution.