Consultation on DEMAND SIDE VISION FOR 2020

SEM/10/052

ESB Networks Response

Status: **Final**

Date: **21/10/2010**

ESB Networks Ltd.

Contents

1 SUMMARY COMMENTS

1. For Demand Side Management (DSM) to be successful in Ireland, clearly it has to be economically feasible. This in turn depends on the quantity of suitable load available and the cost of implementing DSM.

2. The cost of DSM controllers such as a Home Area Network (HAN) are low, and with a significant proportion of Irish customers already having broadband access, this could be used for HAN communications. The role of the SmartMeter would be to provide data to the DSM HAN, with the DSM HAN process open to the market. In the US there is a trend for Burglar Alarm systems to come with DSM HAN as a 'free' extra.

3. A major challenge to the implementation of DSM will be the cost of installing remote control switches on items such as Immersion Heaters and Night Storage Heaters, as such controls are not simple 'plug ins' and likely to require installation by an electrician. One way of stimulating the market for DSM would be by incorporating additional energy efficiency requirements into the Building Regulations - currently under review – e.g. to require the installation of such switches in new homes, where the extra cost of the switch would be less than a certain threshold e.g. €20.

4. The substitution of inefficient fossil fuel heating systems with electrical equipment such as Heat Pumps or Night Storage Heating should be encouraged and thus assist in meeting national emission targets for CO_2. Currently the Building Regulations do not fully encourage this substitution because the figures used for energy efficiency and CO_2 emission factors are based on historical levels and thus are not reflective of future 2020 levels where 40% wind is in use.

5. Furthermore there needs to be consistency in the treatment of the environmental impact of heat pumps in relation to building regulations and their use in meeting EU targets (i.e. all the heat from the air or ground is regarded as renewable with only the electricity kWh being taken as non-renewable).

6. The potential to use loads such as Immersion Heating and Night Storage Heating to absorb surplus wind at night should be examined.

2 DETAILED RESPONSE

CONSULTATION RESPONSE TEMPLATE	
NAME OF RESPONDENT	ESB Networks (Contact Person: Anthony Walsh)
CONTACT DETAILS	+353-1-7027942
TYPE OF COMPANY	Distribution Network Operator and Distribution/Transmission Asset Owner
INTEREST IN DSM	Relationship to Smart Meters and Network operations

SECTION 2

QUESTION 1: Do you agree with our characterisation of the four types of benefits that demand side management can provide?

ANSWER:

Yes, although strictly speaking three of the four items listed (overall demand reduction , static peak reduction and flexible measures) are not actually benefits per se but features which lead to benefits.

The benefits are actually what may be driven from these features, namely:

(a) Less capital investment in Generation and Transmission Network Infrastructure in meeting the peak

(b) Greater generation efficiency due to the avoidance of marginal plant resulting in lower costs and less emissions

(c) Reduced dependence on fuel imports

QUESTION 2: Are there other cost savings which you believe demand side management can deliver?

ANSWER:

It may also be possible to use DSM to switch on loads so as to absorb excess wind, thus facilitating greater utilization of wind resources e.g. at night when wind generation may be in excess of normal demand.

QUESTION 3: Are there additional studies and reports (to those listed in Error! Reference source not found.**) which you are aware of and believe we should review?**

ANSWER:

SMART A :Detailed analysis of all Domestic loads for DSM:
http://www.smart-a.org/WP2_D_2_3_Synergy_Potential_of_Smart_Appliances.pdf
Their other reports can be found on www.samrt-a.org

Residential Monitoring to Decrease Energy Use and Carbon Emissions in Europe
http://www.isr.uc.pt/~remodece/

Internet Control of Loads: EU Address FP7 Project
http://www.addressfp7.org/

Detailed breakdown of Water Heating methods in EU Countries incl. Ireland:
http://www.ecohotwater.org/

QUESTION 4: What other insights do you have from your experience of demand side management adopted internationally?

ANSWER:

Many cities in Australia, such as Brisbane, have a significant proportion of water heating load controlled remotely via 'ripple' control. This is an old fashioned but effective system whereby a high frequency signal is placed on the MV system and used to control the times at which water heating is operated. In effect it is like a flexible Timeswitch. This system is also used in New Zealand to control a significant proportion of load. as outlined in Transpower's report already cited in the study.

The key feature whish has made these schemes successful is that the wiring of the customers water heating loads incorporated the Ripple receiver from the construction stage, so that implementation costs were low.

Using modern DSM via the internet would be a cheaper and more effective system than ripple

control, but the key requirement is that homes are fitted with Remote Control switches on significant loads at the construction stage.
On the industrial side, commercial demand aggregators such as Enernoc operate successfully in the US, Gas de Suez in the UK and Energy Response in Australia. Obviously success depends on having load available which is suitable for switching as well as the correct market structure and incentives. For industrial/commercial loads one constraint is that deferred production needs to be made up at a later time, which assumes excess capacity available in the process.
Finally, on a point covered in the EU Address project, some consideration need to be paid to the situation where DSM is very extensive and where DSM switching could destabilize the operation of the Grid. In the ADDRESS project this was covered by the suggestion that the TSO/DSO would have some way of validating control signals sent to switch loads. In particular this could be important where DSM is operated by a number of third parties where hackers/terrorists could take over the DSM controls in order to destabilize the Grid. This is an issue that has already raised itself in the US as one of future significance.

QUESTION 5: Are you aware of other quantitative findings from international experience which you believe are important for us to capture and consider?
ANSWER:
Yes –
(a) the impact of DSM via remote control thermostats with Con Edison and other utilities in the US. Whilst air conditioners are becoming more frequent in larger Irish buildings, it can be expected that Heat pumps will become common domestically. These will typically be of significant size (About 3-5kW) and operate best through relatively continuous use during the day, so that they can be expected to increase network and system peaks. They have little facility for control unless it has some associated thermal storage such as a large hot water tank.
In the US the remote thermostat is used to control the cooling coil, with the fan still allowed to operate.
(b) Little experience of DSM of electric cars abroad, but it could be an issue for the future and needs consideration.
(c) The reduction in demand due to the replacement of incandescent bulbs with CFL's/LEDs – this reduces scope for savings due to Conservation Voltage Reduction (CVR). In general the improvement in energy efficiency in the household through the use of more energy efficient appliances reduces demand but also reduces the scope for active demand management, and this factor needs to be taken into account in predicting the effectiveness of DSM programs.

QUESTION 6: Do you agree with our identified drivers of future value for demand side response/management? Are there any additional drivers we should consider?
ANSWER:
Not entirely – the positive drivers for DSM are fine, but there are also potentially drivers which will reduce the value of active DSM, specifically the tendency toward more energy efficient appliances which have less scope for control by active DSM, as their demands are already low. However this effect could be counterbalanced if there was a trend to replace fossil fueled heating systems with electric e.g. Night Storage Heating, as this would provide extra load with thermal inertia suitable for active DSM.

SECTION 3

QUESTION 7: Are there any other aspects of current demand side activity in Ireland which should be captured?

ANSWER:

No

QUESTION 8: Do you agree with our high level assessment of the potential for demand side management in Ireland by 2020?

ANSWER:

Yes – although it is not clear how the Industrial /Commercial figures were derived.

In relation to the suggestion that Heat pumps and Electric Vehicles should receive less priority for DSM than Existing Space Heating and Water Heating, it could be argued that as these are new loads it would be very simple and inexpensive to install controls at installation stage to facilitate DSM e.g a timeswitch at simplest.

SECTION 4

QUESTION 9: Do you agree with our definition of each individual demand side measure?
ANSWER:
Yes

QUESTION 10: Is our description of the current policy baseline for each demand side measure accurate and complete. If there are omissions please point them out.
ANSWER:
Yes, but for clarity it would be better to refer to a 'smart meter system', as the smart meter itself will be a facilitator of DSM but unlikely to be the device which actually carries it out, which would be the Home Area Network (HAN) system – essentially a consumer product installed by the customer and which receives consumption data from the SmartMeter in real time. If DSM is to develop commercially the device which implements it must change with the technology and also bundle other desired features e.g. in the US, DSM devices are actually embedded in Home Security Systems as a byproduct, as the Home Security system provides greater value to the customer, yet the DSM device which provides Home Automation as well as DSM is then virtually free e.g. Control4, GE etc.

QUESTION 11: Do you agree with our categorisation of different types of "market issue" and typical remedies for each?
ANSWER:
Yes

QUESTION 12: Do you agree with our identified barriers and enablers for each of the specific demand side measures we have identified?
ANSWER:
Yes with the ones identified, but one barrier/enabler that has not been identified is whether there is sufficient load present at peak which is capable of being switched to provide DSM benefits. In the US air conditioning is a load which is on at peak and which can be switched, but in temperate climates such as Ireland this is not usually available. The Water and Space Heating loads are generally used at night rather than during the day and could be useful in absorbing extra wind generation which might otherwise be spilled, but this will not affect system peak. There is relatively little data available on the usage patterns for Domestic loads, what loads are on at peak and what is the cost benefit of switching these loads.
Similarly on the Industrial/Commercial side the presence/absence of suitable loads is either a barrier or an enabler, but less of an issue as the cost of DSM control equipment will only be incurred if there is worthwhile load to switch, and the cost of the DSM controls is low in relation to the loads involved.
The specific recommendations in relation to Smart Meter features required should be addressed through the existing CER SmartMeter process.
In relation to Electric Vehicles there may be future potential for Vehicle to Grid use for Spinning Reserve, and any solutions proposed should not exclude this possibility.

QUESTION 13: Do you agree with our identified market issues for each specific demand side measure and our proposed remedies to address these?
ANSWER:
For each issue:
4.2.2.3 Recommendation 1 – Agree
4.2.3.3 Recommendation 1 – Agree, but in addition it will be necessary to also educate customer about SmartMeters so as to avoid any unfounded anxieties.

QUESTION 14: What are your views on the likelihood and effectiveness of the identified policy options addressing the specified market issue and delivering the desired change?
ANSWER:
In relation to Market issues no comments are offered as these are outside the scope of ESB Networks.
Policy options which have not been mentioned and which would be likely to have a significant effect on the success of DSM would include the following:

(a) Encouragement of the electrification of Residential heating

Currently the DEAP software used in calculating CO_2 and Energy Efficiency standards in the Building Regulations uses grid carbon intensities which reflect past grid CO_2 intensities, yet for heating installations in new houses it is ***future*** CO_2 and energy efficiency figures which should be used. These will reflect the Govt. target of 40% wind and be substantially lower than the figures currently used. Current figures encourage the the use of fossil fuels such as gas, rather than electricity.
In addition, as electrical CO_2 emissions are included under the Emissions Trading Scheme, the inclusion of CO_2 emissions from electricity should be eliminated, as any saving on CO_2 simply allows a similar increase in other countries.
The increase in electrical heating load from the above changes would not alone help meet Govt. targets but would also provide significant load with thermal inertia which could be used for DSM, particularly in relation to Wind, as excess wind is often present at night.

(b) Requirement in the Building Regulations for Wireless Switches on large domestic electrical loads

In New Zealand and Australia large domestic loads such as water-heating are equipped with remote control switches which can receive control signals from outside. If the Building Regulations required that all new houses were provided with (say) Zigbee controlled switches on Water Heating and other electrical Heating loads then this would provide a significant Demand Aggregation market which could be entered at low cost. It would also facilitate the use of a more sophisticated Building Energy Management System by the Householder.
The marginal cost of the wireless controlled switches would be low as similar switches without wireless need to be installed anyway. The cost of providing external control is low as such controllers typically plug into existing internet routers. If no internet is present home automation could be provided from the customers PC.
At (say) 30,000 houses per annum and a minimum of 3kW immersion heating per home, the potential gross load available for switching would be 90MW per annum which is quite substantial.

(c) Correct treatment of Heat Pumps:

Currently the DEAP assessment of Heat Pumps which is used in the Building regulations discourages the use of Heat Pumps and is not in line with the way such calculations are done in other European countries. Accordingly the renewable treatment of heat pumps should be the same as how they are treated in EU targets so that incentives to meet local regulations line up with Ireland's requirement to meet EU targets (i.e. all the heat from the air or ground is regarded as renewable with only the electricity kWh being taken as non-renewable).

(d) Facilitation of Renewables

Electrical loads could be controlled so that they preferentially used surplus wind electricity, thus displacing any electricity from fossil fuel generation. This could be considered as a means by which the customers could meet the 4kWh per m2 renewable targets (10kWh/m2 Thermal).

The above proposals would address the two most significant issues in DSM in Ireland:

(a) the lack of significant controllable domestic electrical loads

(b) the introduction of low cost automation to provide DSM.

QUESTION 15: Are there any unintended undesirable consequences that any of the options might create elsewhere?

ANSWER:

As Market issues are outside the scope of ESB Networks there are no comments on the related policy options mentioned. In relation to 4.2.7.3 Recommendation 4 'Overly restrictive regulation' which covers network design standards and costs, these are already reviewed by the regulator, customers and ESB Networks on an ongoing basis.

In relation to 4.2.9.3 Recommendation 2 'Split incentive' which calls for the impact of DSM on distribution networks of DSM there may be a confusion between Distribution and Transmission networks, as the paper cited 'Deferral of network investments by DSM – New Zealand experience' Transpower, March 2008 refers to the Transmission Network.

By it's nature the cumulative effect of DSM appears most significantly on the Transmission network which covers all the DSM in a large geographic area and where isolated pockets of DSM add cumulatively to have an overall impact. In contrast Distribution Networks cover significantly smaller areas where DSM is unlikely to be sufficiently concentrated to make a difference, and where the items of plant involved have much smaller capacities, so that normal load growth or a new load would require upating anyway, regardless of DSM.

In relation to the impact of Electric Vehicles on the network ESB Networks and EPRI (The Electric Power Research Institute) have formed an alliance focused on R&D and demonstration of a number of the key innovations in the Smart Grid strategy. One of the four elements of the project focuses on electric vehicles with a brief to assess the network impact of electric vehicles, with an emphasis on field trials, customer participation, and charging strategies.

In relation to 4.2.9.3 Recommendation 3 the proposal to engage with EV manufacturers may not be feasible on a per-jurisdiction basis. A more fruitful approach would be to consider interaction between the smart meter ***system*** and smart EV charger hardware, which will most likely be intermediated through smart-meter/HAN and EV (e.g CAN bus communications).

SECTION 5

QUESTION 16: Do you agree with our identified specific demand side measures and our assessment of the different types of benefits each demand side measure provides?

ANSWER:

'Yes' to some, 'No' to others!

(a) Smart Metering – this is already being considered by a CER/Industry workgroup which is examining issues such as customer communication methods such as in-home displays.

(b) Home and Office Automation – Frequency Response

- possibly such frequency response could be provided through Internet communications and cover all controllable loads, not just refrigerators. Building frequency response controls into loads such as fridges which have low loads (40W) and where the impact is not seen until there is a significant penetration of new fridges may not be optimal. Furthermore the inability to change the frequency setting would be a disadvantage, and some customers may disagree with their control over when they use their appliance being ceded to others without any acceptable level of compensation being agreed.

(c) Industrial /Commercial DSR interruption Contracts

Good idea!

(d) Industrial/Commercial DSR

Good idea especially where customer already has a Building Energy Management System that can implement the controls. In UK aggregators find that the main difficulty in these areas is the costs of setup with the customer, as the customer wants the aggregator to deal with the customers BEMS people, who are normally external to the customers business. This means that the cost of such meetings falls on the aggregator, making the business less attractive.

On commercial side, electricity is about 2% of costs so not a priority for the owner and meetings can be difficult to arrange.

Yet these are energy intensive businesses and it would be worthwhile to find a way of making an entry, as once made the business would tend to continue indefinitely. Possibly some tax relief/incentive scheme could be worthwhile in these areas to overcome this barrier.

(e) Heat Pumps with storage:

This is a good idea as Heat Pumps are a new load and will require to be installed on a separate circuit via a registered Contractor. Introducing a 'Zigbee' type control on the Heat Pump at installation would be inexpensive and insignificant in the overall costs. However because it's a new load it would be possible to have 100% penetration of such installations, many of which will be in existing houses.

(f) Electric Vehicles - Night Charge

If electric vehicles charge at night then there is minimal impact on either the Transmission grid or the Distribution system. However it is not necessarily the case that EV's will charge at night rather than say during the day. If customers are not on a day/night tariff then unless they have a specific Night Storage meter (which has an additional installation cost) they may not have any tariff incentive to charge at night.

Similarly, if a customer feels that the cost of charging is so low that the difference in price between charging during the day and at night is insignificant, then the customer may not charge at night.

Whilst night charging of EV's can be expected to have relatively little impact on networks, charging at peak in the evening could have significant effects if penetration levels are high. Different policy options could be considered:

(a) Encouraging houses with EV's to change to a Day and Night tariff to encourage night

use of electricity

(b) Time of Day DUOS tariffs which penalized use at peak

(c) DSM control of EV's

(g) Electric Vehicles – hybrid vehicles:
Similar issues to above although the lesser capacity of Hybrids would mean greater diversity and less coincidence at peak.
(h) Electric Vehicles – Price Responsive Charging
Good in principle but if the cost of fully charging an EV during the day is circa €5 and less than €3 at night, will the customer change their behavior for an incentive of less than €2?
(i), (j) Microgeneration and Aggregation of DG:
Again good in principle but depends on the penetration levels of DG and what it is driven by. If DG is from wind then it's availability is driven by the wind. If from gas then it is heat led and requiring it to run when heat not also required could be sub-optimal.
(k) Storage
Assuming this is Battery storage, agreed.
In contrast, thermal storage through Night Storage Heaters or Water Tanks associated with Heat Pumps could provide significant scope for DSM.

QUESTION 17: Are there any additional demand side measures that we should individually identify and assess? If so, what type of benefit(s) is it felt they provide?
ANSWER:
Thermal storage via Night Storage Heaters and Hot Water storage associated with Heat Pumps. Also some current studies in Austria to (a) use refrigeration loads in Supermarkets for DSM by pre-cooling the units before DSM is applied, so that the refrigeration units act a giant 'battery' (b) combine large BEMS equipped buildings into a DSM load with a suitable load shape and control this in a similar way to disaggregated generation.

QUESTION 18: Have we identified all of the relevant criteria for assessing the individual and comparative merits of the demand side measures?
ANSWER:
Yes – but in relation to CO_2 savings these only arise where the DSM facilitates the replacement of fossil fuelled systems with electrical ones. Reductions in CO_2 from less electricity use does not reduce overall CO_2 emission, as these are set by the Emissions Trading System, whereby any reduction in Ireland simply allows an increase in other EU countries.

QUESTION 19: What are your views about our approach to high level assessment of different demand side options?
ANSWER:

(a) Smart Meter issues – these proposals should be considered by the CER/NIAUR/Industry Smart Meter workgroup. The use of the term 'Smartmeter' may be confusing as it indicates that the full solution proposed is incorporated in one single unit – the SmartMeter. A better description would be Smart meter system, as this allows the possibility of having more market and technical flexibility through the use of a Home Area Networks operating in conjunction with a SmartMeter.

(b) Home and Office Automation – Price responsive

Subsidies for adoption of Smart Devices proposed should be confined to early adopters, but are a good idea to 'seed' the market.

(c) Home and Office Automation – frequency response

This is worth investigating, as one frequency meter which could send a signal to large groups of loads within the time dictated by internet messaging could be worthwhile, and would have low marginal costs.

(d) Heat Pumps with Storage

This is worth exploring at an early stage as air-Air Heat Pumps tend to run more or less continuously during the day and have loads of up to 5KW – much greater than the load presented by an Electric Vehicle. Furthermore, at about €6-€8,000, they are about 20% of the cost of an EV so that their penetration levels could be significantly greater. The controllability of these loads for DSM is greatly facilitated if they have associated thermal storage.

QUESTION 20: Do you agree with our assessment of each demand side measure against each of the identified factors?
ANSWER: See above answer to Question 19

QUESTION 21: Do you agree with our overall assessment of the relative merits of the different demand side options?
ANSWER: See above answer to Question 19

QUESTION 22: Do you have any comments on our high level assessment of the benefits of different demand side measures?
ANSWER:
The possibility of altering the Building Regulations so as to facilitate the electrification of heat and the creation of greater scope for DSM is an option which should be included.

SECTION 6

QUESTION 23: Do you agree with our assessment of the relative priorities of different demand side options in developing a 2020 Demand Side Vision?
ANSWER:
No .

1. The CO_2 impact may be overstated due to the impact of the ETS.

2. Changes to the specification of SmartMeters themselves would probably involve high costs unless these were generic features already available on all Smartmeters, and which had already been tested in the field. In contrast, achievement of similar goals through the use of ancillary equipment would likely have low costs and low risk, as the implementation would only be where customers found it justified. This would also allow a more gradual installation as benefits were available and facilitate 'learning' so that no major mistakes occurred.

3. For Electric Vehicles the Overall Ranking depends on the cost/benefit of the control level proposed. Simple control measures – such as the incorporation of a pre-set timeswitch /Zigbee switch – on the control circuit at installation would cost little but have a significant effect, in which case they would rank highly. In contrast if very complicated schemes are proposed then they will only deserve a low ranking. Accordingly it would be more appropriate to adopt a simpler control scheme and increase the ranking for EV control.

4. Home Office Automation with Frequency Control should have a high ranking and low cost if it is assumed that a DSM facility is available, and that instantaneous control is not required, In this case one frequency relay broadcasting via internet can provide the necessary signals.

QUESTION 24: What alternative views do you have on relative (merits and) priorities?
ANSWER: See above answer to Question 23

QUESTION 25: Do you agree with our proposed high level 2020 Demand Side Vision as described above?
ANSWER: Yes, but with the caveats expressed earlier in the document.

QUESTION 26: What alternative vision would you put forward?
ANSWER:
Concentration on the Domestic Sector through electrification of heat and the equipping of such loads with controls which are accessible via DSM.
Changing the Building Regulations to support electrification of heat and the installation of such controls in new houses as a means of meeting the renewable energy requirement.
Focus on large industry/commercial premises for DSM savings, as the DSM controls are similar to those required in small premises yet the loads are significantly greater, and once coupled to any BEMS systems installed will continue indefinitely.

QUESTION 27: Do you agree with our proposed policy pathways for implementation of the identified different policy options for realising our proposed 2020 Demand Side Vision?

ANSWER:

Broadly Yes.

QUESTION 28: What alternative policy pathways would you propose based on your previous comments and responses?

ANSWER:

Broadening the scope of the SmartMeter through the use of the customers Home Area Network and Broadband to facilitate more sophisticated value added services, including DSM but also other features which customers would find attractive and which could motivate the adoption of the appropriate technology. In the US a number of leading companies are promoting Burglar Alarm systems on which the DSM sits as an added feature. This approach could allow significant flexibility in how DSM is implemented as the HAN and associated software are decoupled from the SmartMeter and can be provided by the market.

For larger Industrial/Commercial customers tariff changes could perhaps provide savings that would be sufficient to change behavior, particularly if such behavioral change were institutionalize by an automatic system.

For Domestic customers the savings from behavioral change may not be sufficient to cause a change. If this is the case then other methods should be found – e.g. the DSM might be introduced as a feature of a home automation system which facilitates the customers lifestyle through the elimination of timeswitches and which provides statistics etc on energy usage. The device itself might be provided free to the customer by the Supplier as a marketing exercise with the Supplier then having the right to switch loads which do not inconvenience the customer, and with the customer having the right to override such signals via an internet message etc.

SECTION 7

QUESTION 29: Do you have any additional view or comments you feel are important/useful for us in (a) establishing a Demand Side Vision for 2020; (b) identifying associated policy development and (c) determining policy pathways?
ANSWER: See Above answer to Question 28

QUESTION 30: Are there any final comments industry stakeholders wish to make about this consultation and the proposed next steps in the consultation process?
ANSWER:
Any changes proposed should be subject to a detailed cost/benefit analysis and investment appraisal.