Dear Claire,

Please find some comments on Wind Generation - System Security Issues as outlined on the CER website.

The document named

Wind generation - System Security Issues - Demand side management.doc

is my private submission to the CER, while the paper titled

The case for Electricity demand side management in Ireland v5.doc

Is a reproduction of the article I wrote for the Engineers Journal, subsequently published in June of this year, and serves as background information.

I would be obliged if you could review these documents and I am available for consultations/clarifications etc. as required.

Regards

Fergus

Wind generation - System Security Issues - Demand side management.doc

Wind Generation – System Security Issues

About the Author

Fergus Wheatley currently works in the power generation industry and has in addition, extensive experience designing SCADA systems within power distribution networks throughout the world.

It is the intention of the author to deliver this paper early in the new year. Relevant parties will be informed in due course. This paper is an adaptation of an article originally published by the author in The Engineers Journal.

Introduction.

This paper introduces domestic demand side management as a valid methodology to increasing Grid stability and matching variable renewable energy production by switching domestic and industrial load.

The installation of new metering technology and switched plug top controllers will allow the National Grid to communicate with a large number of different types of loads within defined (addressable) geographical areas. Effectively the National Grid could remotely control domestic and industrial loads that contain some degree of inherent energy storage. (e.g. storage heating, immersion heaters, fridges & freezers, and tumble dryers).

This remote control can be used to provide low impact load shedding in the event of system disturbances and provide a load sink in periods of excess energy production. A significant advantage of this would be the reduction in the costs of maintaining spinning reserve.

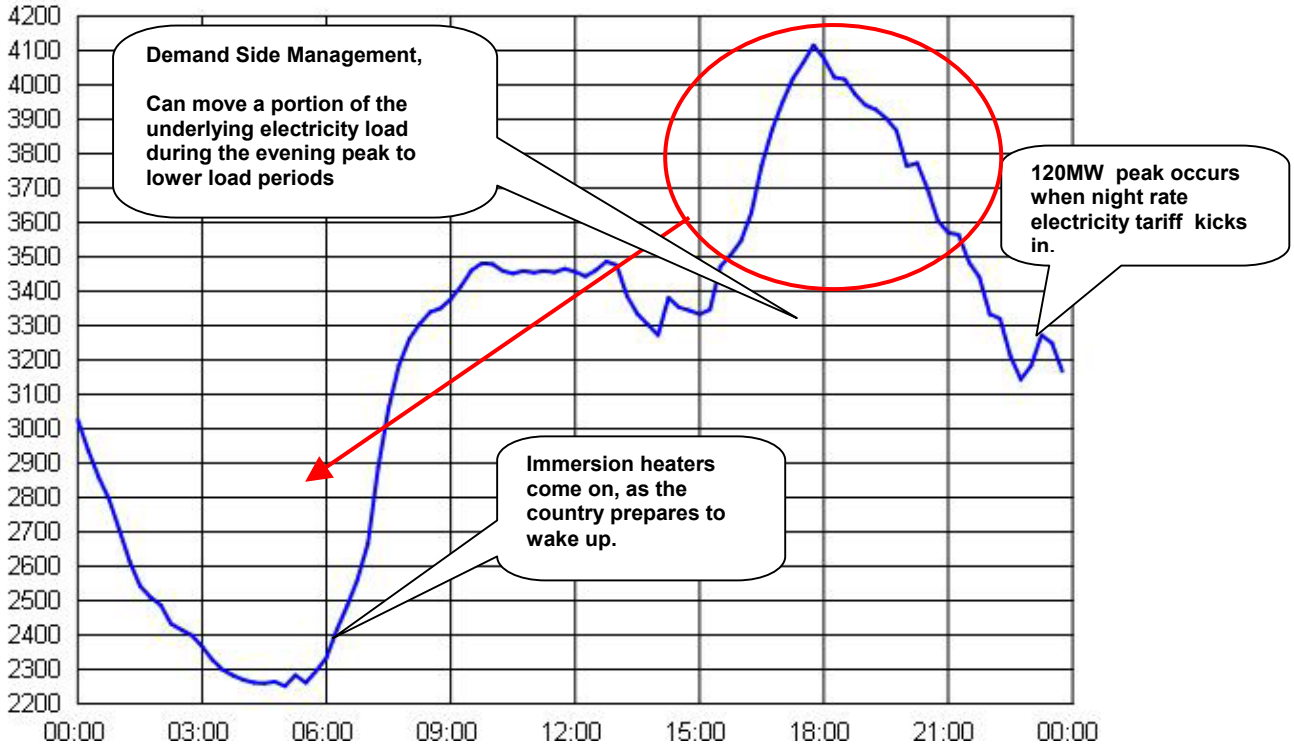
An additional cost saving to the Metering Authority would be the ability to read meters remotely (via a telephone link), offering a significant saving on meter reading costs.

Example

The graph below shows the electricity usage for the 28/11/02, what is immediately apparent is the large demand between about 4 O'clock in the afternoon and 8 O'clock at night, culminating with a peak of 4116 MWatts at ten to six in the evening.

Electricity usage on Thursday 28/11/02

Source: **www.eirgrid.com**



AVG 3201 MWatts MAX 4116 MWatts MIN 2252 MWatts

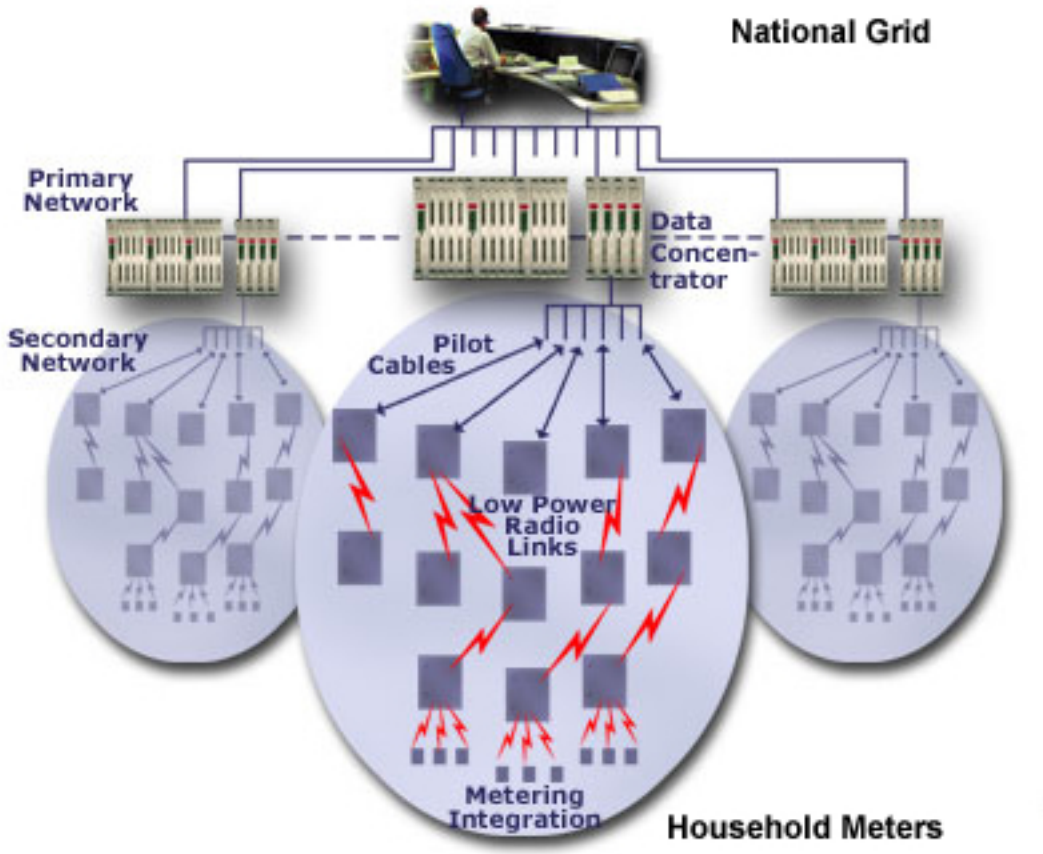
As can be seen from the graphic above, there is almost 1000 MWatts difference between the peak and average load.

This 1000 MWatts is a very attractive target for Demand Side Management. Even succeeding in moving only one third will expand the system capacity by the equivalent of one modern generation set.

Metering Technology

The technology exists at the moment to help control consumer demand with floating tariffs and remote control. Tariffs/ commands can be broadcast via low power radio, land line telephone or the mobile phone network to house meters via addressable communication protocols (ModBus, IEC870-5-101 etc.). These meters in turn would broadcast on-off signals to plug top controllers, which would switch electrical appliances on and off as required.

The metering technology is an adaptation of widely available off-the–shelf technologies.



Picture courtesy of Microsol Ltd.

Household Meters and Socket Controllers

The household meter can be about the same size as the meters currently installed in houses, but will also contain a modem, which would receive tariff information and grid commands and in turn transmit timed electricity usage to the electricity billing authority.

The socket controllers can be designed to look physically very like current household 13A sockets, (or indeed be designed like a plug adapter to plug into an existing socket). One version might consist of a selection switch to allow the consumer to select between 5 priced options for each (named) appliance.

1. Renewable Energy only.
2. Cheapest tariff. (3am to 6 am or during periods of high renewable energy production)
3. Max peak off. (Power down during evening peak 5pm to 7pm).
4. Non critical load (non vital appliance to be switched off in the event of load shed).
5. Critical load (to remain available at all time).

Costs of technology

Based on current similar industrial applications currently installed in substations, the author estimates that the average Irish house can be fitted out with new metering and appliance controllers for about 250 Euro.

References

www.esb.ie
www.eirgrid.com
www.microsol.ie
www.huntstownpower.com

Disclaimer

The views within this paper are the authors own views and do not represent policy or views held by his employers.

The case for Electricity demand side management in Ireland v5.doc

The case for Electricity Demand Side Management

Introduction.

Because electricity cannot be economically stored in large quantities, electricity generation and consumption need to be matched at all times. Generating and transmission networks have therefore been built to deal with the maximum peak load rather than the average load. In Ireland the difference between average and peak load is currently about 1000MW. This is the equivalent output of three large generators.

Managing, moving and balancing electricity demand from high load to low load times would provide a number of advantages both for the economy and the environment in terms of CO2 / NOX emissions reduction. This is known as Demand Side Management and can be achieved with new metering technology.

Advantages to Demand Side Management.

1. Better usage of existing generating and distribution infrastructure.
2. Less efficient/ environmentally unfriendly generating capacity can be de-commissioned.
3. Load can be matched to variable renewable energy availability.
4. Lower generating and transmission costs.
5. Lower transmission and distribution losses.
6. Reduction in "spinning reserve" costs.
7. Less intrusive load shedding.
8. More consumer growth capacity.
9. Better maintenance opportunities.
10. More availability (less black-outs).

Maintenance Issues

During the last number of years Irish electricity demand has grown so fast that during peak periods generation and distribution networks are stretched to the limits, with little reserve capability available to cope with unplanned power stations trips or transmission line breakages.

This extra demand has forced power stations into production during maintenance periods, a risky situation particularly in the high load winter period (demand peaks in mid January). Less maintenance will invariably lead to unexpected breakdowns.

Renewable Energy

The major renewable energy source available in Ireland is wind power. Major offshore developments are being planned for the Arklow and Kish banks. However wind power is not constant, and availability is more difficult to predict. This is not a problem while wind remains a small percentage of the overall generation profile, but as it becomes more important, it is vital to introduce technology that will match load to available power.

Spinning Reserve

The National Grid keeps a number of power stations on reduced load ready to go to full load in case another power station trips. Currently the National Grid with Northern Ireland Electricity tries to keep 80% of the capacity of the largest operating generator in standby. This has a typical value of about 300 MW. This is known as "spinning reserve" and can be expensive.

Heating Losses

Power is lost during transmission through heating losses. Unfortunately due to the way electricity works, doubling power transmitted quadruples the power losses. Thus limiting power peaks helps the transmission efficiency.

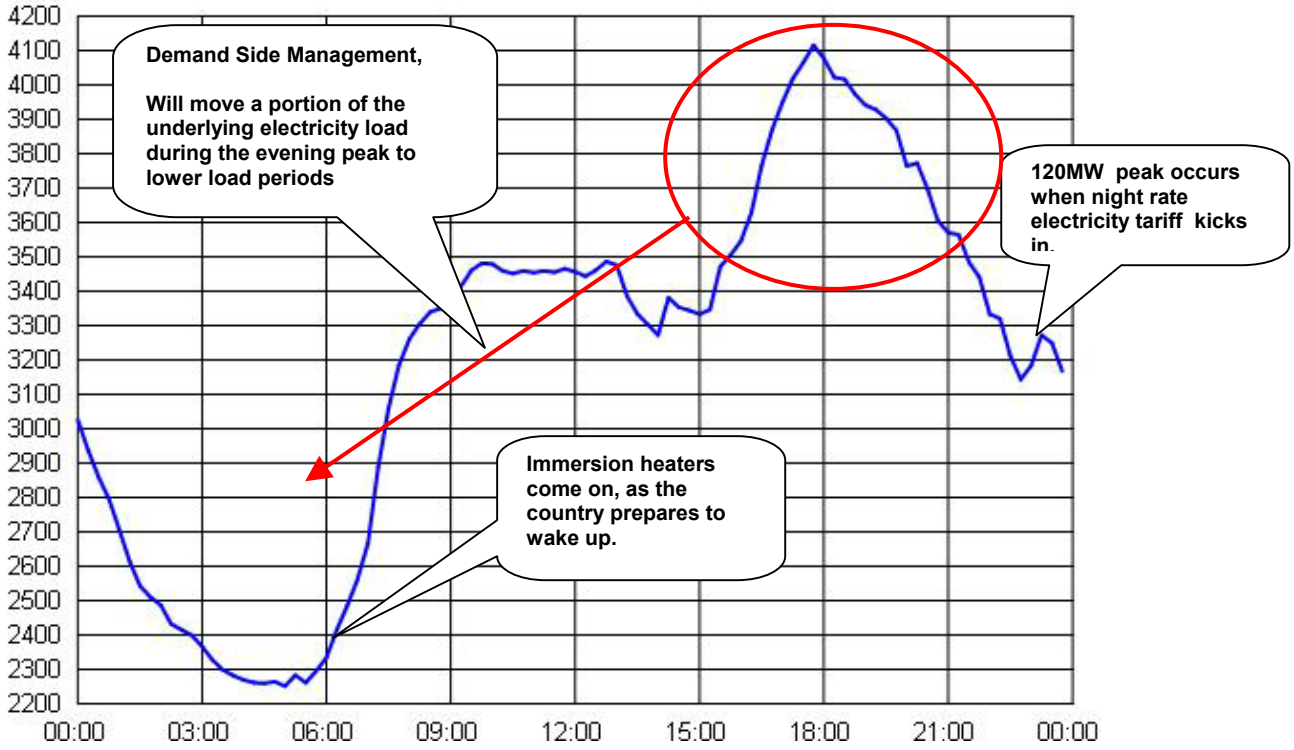
Historic Electricity Demand in Ireland

The demand for electricity in Ireland has continued to grow strongly at a rate of up to 6% annually. Peak demand first exceeded 2000MW in 1983, 3000MW in 1995, 4000MW in 2001, 4300MW in 2003. Despite Irelands signing of the Kyoto protocol this increase is continuing unabated.

The graph below shows the electricity usage for the 28/11/02 (the previous day to writing the first draft of this paper), what is immediately apparent is the large demand between about 4 O'clock in the afternoon and 8 O'clock at night, culminating with a peak of 4116 MWatts at ten to six in the evening.

Electricity usage on Thursday 28/11/02

Source: **www.eirgrid.com**



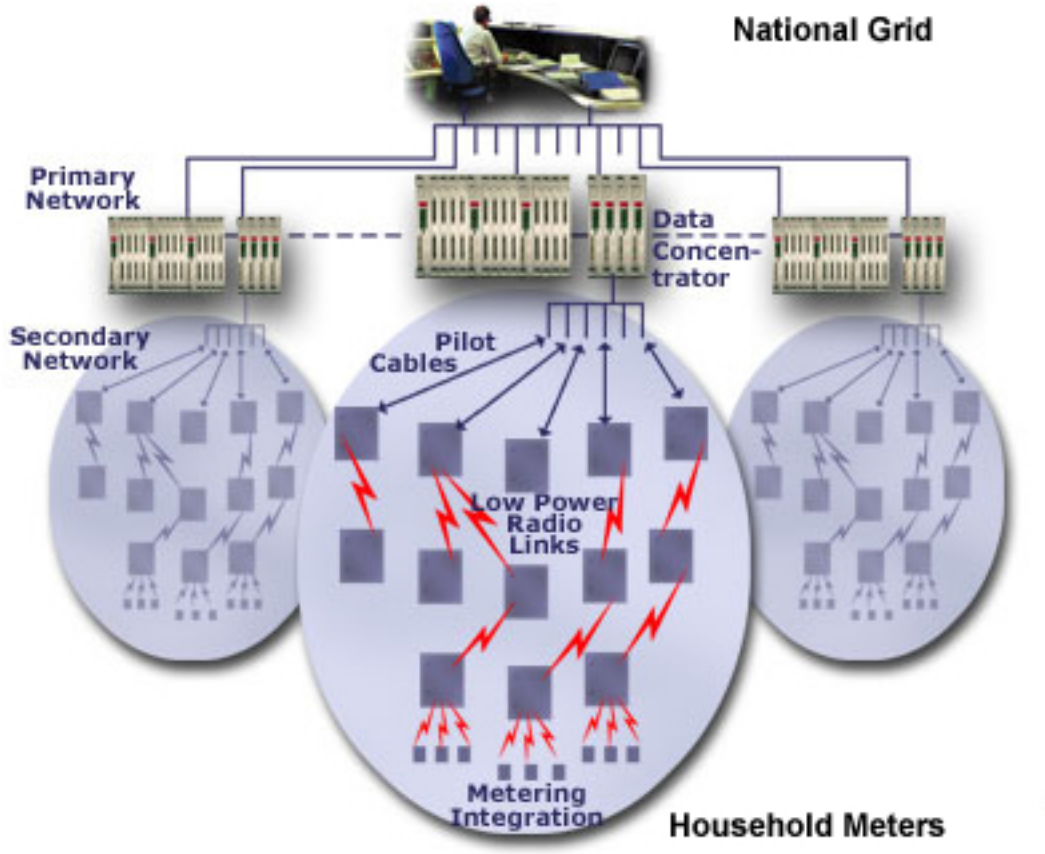
AVG 3201 MWatts MAX 4116 MWatts MIN 2252 MWatts

As can be seen from the graphic above, there is almost 1000 MWatts difference between the peak and average load.

This 1000 MWatts is a very attractive target for Demand Side Management. Even succeeding in moving only one third of this load will save the building of a new power station. Currently a modern 350 MWatt gas power station costs about 200 Million Euro and has a build time of about 2 years.

Metering Technology

The technology exists at the moment to help control consumer demand with floating tariffs. Tariffs can be broadcast via low power radio links or the mobile phone network to house meters and these meters in turn would broadcast on-off signals to plug top controllers, which would control electrical appliances. Naturally a majority of houses and businesses nationwide would require new electricity metering and socket controllers.



Picture courtesy of Microsol Ltd.

Household Meters and Socket Controllers

The household meter will be about the same size as the meters currently installed in houses, but will contain a modem working over the mobile phone network, which would receive tariff information and transmit electricity usage to the electricity billing authority.

Socket controllers can be designed to look physically very like current household 13A sockets. They would be simple to install, designed to replace existing sockets. A selection switch allows the consumer to select between 5 priced options for each appliance.

6. Renewable Energy only.
7. Cheapest tariff. (3am to 6 am or during periods of high renewable energy production)
8. Max peak off. (Power down during evening peak 5pm to 7pm).
9. Non critical load (non vital appliance to be switched off in the event of load shed).
10. Critical load (to remain available at all time).

Costs of technology

Based on current similar industrial applications, the author estimates that the average Irish house can be fitted out with new metering and appliance controllers for about 250 Euro.

For the same cost of a new 350MW power station, 800,000 houses can be converted to the new metering technology. Introducing the technology to the National Grid Control Centre (NCC) would be very cost effective as this technology is available "off-the-shelf". An important cost saving to the National Grid would be the ability to read household meters remotely (via a telephone link), offering a significant saving on meter reading costs.

Fire Safety

Electrical appliances have a fire starting potential, and are a source of additional personal risk if they are being run while people are sleeping. To counter this risk it would be essential that any installation of new metering technology would also include mains powered (battery free) smoke alarms.

Interim Measures

Adopting the following interim measures will have benefits for both the electricity network and the environment and should be encouraged.

- Energy efficient bulbs and light coloured lampshades should be encouraged. 20% of electricity usage comes from lighting requirements. Most of this could be saved with energy efficient bulbs.
- Timers can be used to time electricity loads, such as washing machines, to come on at minimum loads times (4 am). (After installing smoke alarms).
- In addition timers can be used to stop thermostatically controlled loads from occurring during peak periods (between 5pm and 7 pm). (Freezers and fridges will keep quite cool enough for several hours).
- Immersion heaters can be timed to come on and turn off earlier in the morning and later in the evening. With adequate tank insulation there is minimum consumer intrusion.
- Electric cookers and kettles have the highest load of all household electrical appliances, using these items sparingly during peak periods will help reduce peak load considerably. (e.g. encourage boiling of only enough water for specific requirements, smaller kettles, and the use of the microwave oven as an alternative to the conventional electric oven).
- Converting to gas for cooking and heating. (Most Power stations in Ireland are only about 30% thermally efficient, so using electricity for heating is effectively using over three times more power).
- Supporting modern gas turbine technology to replace peat and coal burning power stations. The efficiency of modern gas turbine technology is over 50%, compared to efficiencies in the order of 30% for peat or coal stations. In addition there are far less emissions and no ash waste.
- Offer incentives/penalties to industry to turn off power hungry non-mission critical equipment while it is not being used.

Summary
Adapting our electricity usage to follow a "flatter" profile throughout the day will have significant environmental and economical advantages. Generating and transmission networks have to cope with the maximum peak load rather than the average load, because less efficient power stations have to be used during these periods, this peak load is both more expensive and environmental damaging.

References
www.esb.ie
www.eirgrid.com
www.microsol.ie
www.huntstownpower.com

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