From: <email address redacted>
Sent: 15 November 2015 22:19
To: EnergyEvidence Infrastructure-Commission
Subject: National Infrastructure Commission call for evidence - Energy - Submision by <name redacted>

Dear Lord Adonis and Committee

I spent many years in Electricity operation including a long period with
Operational Modelling.
In the current situation GB needs a co-ordinated approach to developing the Electricity, Heat and Gas mechanisms.

Since I retired I have been trying to get common sense into the areas of Renewables and Distributed Energy Management Integration.
My take on a practical approach to the Electricity, Gas and Heat strategy is below my signature. It refers to the initiative for Low Carbon Gas which also maintains Fuel diversity. Then getting the 'meaning of time and participation' into the Supplier to Retail customer area to encourage more and larger CCHP in large premises.

We have the trilemma of Cost, Emissions and Sustainability to deal with, including the issues of Fuel security and diversity as well as Generation capacity, basic fuel supply and Electricity system stability and security (fault resilience).
An odd note is that non-synchronous Wind penetration in any AC system is limited by the need to maintain adequate Synchronous plant for Intertial stability. Ireland has the largest proportion of wind in any AC system and has been stuck with a maximum instantaneous limit on non-synchronous infeed
(Wind, Sun, Import) of 50% for some time. Thus, even with flexing of the
large (to them) GB Interconnectors there is a limit on how much energy that can accept from renewables.
My ideas also attempt to address this issue.

I was interested to see the three strategies from the Infrastructure Transition Research Consortium, especially the approach to decentralised Energy.
I will be interested to see how they handle time series modelling of Electricity; a crucial factor in any evaluation and my specialist area over many years.

One point I would note, having dug into Electricity history and the mess GB got into by the early 1920's (and how we got out of it) is that managing lots of distributed (large premises) CCHP (use the Gas better) as I propose would be the biggest change to Electricity operational logistics since 1933!! However, we do have the communications and management technology; just need to put it together carefully to get the best result.

My webspace is at www.eleceffic.com on which you can find my 22 Articles on Future Power Systems - Basics (some not always well understood) through to Brave New World.
Each Electricity system is in fact a large machine, with the elements coupled together by Electromagnetics which are somewhat tetchy. Ours gets up to 60 million BHP at the Peak.

Best Regards

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Sorry about the length of this but it is an engineering problem we have, now spanning Electricty, Gas, Heat and possibly Transport!!!.

Since retiring (for the first time!) from System Ops in 2003 I have been trying to get common sense into the integration of Renewables and Distributed Generation - the 'Big+Little' picture.
For 10 years I have been trying to push time band retail tariffs for half hour metered premises ('Simple Smart'), as the first stage in developing customer participation and to encourage more and larger CCHP. At two DG conferences a few years ago (parties at daggers drawn) I said the DNOs needed to get Smart (Grid) and the DG developers needed to understand Participation. And that is happening.....

With our Coal plant shutting down (LCPD and IED) we need to use gas better but also maintain diversity of primary fuel input while trying to reduce emissions.

As John Loughhead said at a recent ETI event, Gas is highly versatile which makes it a difficult fuel to replace..... In fact the Power ramping capability of the Gas mechanism is awesome!!

Tony Day and Chris Hodrien (ex Brit Gas research) are promoting Low Carbon Gas by resurrecting the BG-Lurghi+HiCom Slagging Gasifier-methanator mechanism. "Eats" Coal, Biomass and Trash and produces Methane and CO2 at high pressure. Thus it is CCS ready - or perhaps we would combine with H2 (electrolysis from excess Wind) for more methane??.... Also gives us some diversity of primary fuel input to the gas system. A production scale BGL-HiCom system was in operation as Westfield up to 1992 when the Government cancelled the project, not appreciating of course that the CCGTs then coming in would increase Gas burn by 50% and advance the run down of UKCS (one reason for the Gasifier-methanator being developed in the first place).

The way I work on from that is to use the Gas better.... Large building plant room Engine based CCHP in cities with heat/cool connections to the immediately adjacent neighbours (inc flats etc). Internal Combustion Engine CHP + Absorption Chillers as at Leicester and the Nat Hist Museum; the latter also supplies heat and cool to the V&A and used to connect to the Science Museum and Imperial College.

Such large premises already have HHR electricity meters; @120000 retail connections with max demand > 100kW and the next tranche of non-domestic premises are being converted to HH metering. In total these premises consume @half the GB Electricity demand.

Predeclared Time period retail tariffs can be applied (Peak/Plateau/Trough Weekdays/Sats/Suns Summer/Winter) and Heat stores installed to get the Engines to run at the best times.... This also encourages larger installations as, with flat rate Import tariff and Export PPA, the present CCHP units are only sized for minimum Electrical and Heat demands .... The Nat Hist Mus Generator is 1.9MWe where their max demand is @4MW. I believe the Shard may have @1.9MWe of CHP but it's max demand is @12MW...

Then Community District schemes in Urban areas where the roads aren't as busy, again Energy Centre CCHPs which will be Half Hour metered.
Each site or area needs to be assessed on its individual merits; one size wont fit all...

As we get larger penetrations of variable renewables on the system we need to move on with the larger premises to more interactive communication - Tariff and bartering mechanisms. Need to make the smart interface flexible as regards Data Content (my FPS 21).

The existing Gas Distribution is in place to support more CCHP but the

Electricity Distribution is straining in Cities.
Thus CCGT/Wind+Heat Pumps/AirCon would need a large Electricity
infrastructure reinforcement alone (serious digging up of roads).....
Also, as I'm trying to research, Internal Combustion Engine CCHP with large flywheels for Inertia and declutchable Prime mover should help with stability and voltage control
(MVAr Export/Import) when the Engine is shut down. Inertia is of course an
overall system requirement and MVAr absorption/production is especially
important in cabled City networks. In fact Ireland, with the highest
penetration of renewables (mainly Wind) in any AC system is 'stuck' with a Power limit; instantaneous Wind + Import Power cannot exceed 50% of total
Generation Power (Demand + Exports). Hence we are helping them out by
letting them export over the Interconnectors (rather large in proportion to their system) overnight....

Now, as regards buffering large Wind variability, perhaps if we also produce
H2 from Electricity when the wind is blowing hard and combine it with CO2 from the Gasifier to produce Methane, that also leaves Electrical demand for the CCHPs to meet.

We also need larger CCHP to support the Peak capacity requirement and, as they run harder at the Peaks with time based tariff/PPA, that also relieves some Distribution loading. Mind you, as I said at the DG conferences a few years ago, the DNO systems need to get 'Smarter' (Smart Grid) and the DG developers need to understand Participation... which I see is happening.
The bigger CCHP systems would need larger Thermal storage to make the whole 'joined up' Low Carbon Gas + Time band tariffs + bigger CCHP' initiative work.
It was an integral part of my project proposal which would assess each Premises and Larger system (Microgrid up to community) on its merits.
Analysis, proposed facilities (Technology and Supplier/Distributor
interface) then installation if cost effective.
Horses for Courses, each premises and community system assessed on its merits and the various options; one size definitely dont fit all.

All in all we need a communication hierachy with Aggregation up and Dissemination down Premises - Microgrid - Grid Supply Point - DNO - TSO with cross links to the Suppliers.
We need standards for communication protocols but flexible data content as we learn what data needs to flow each way.

If we do end up with the Retail side buffering wind generation then the current industry methods of top down demand forecasting are rendered useless (FPS 20) We have to move towards bottom up 'bartering'....

If we can demonstrate that this strategy works then the IP sales potential is enormous... China is already trying to 'sort out' the impact of its massive 4bntpa coal burn (ours is @52mtpa) with over 900GW of Coal fired generation. It looks like they realise that Pithead (North & West China) Gasification and long Gas pipes would allow cleaner generation. The patents for the HiCom methanator are held by Johnson Matthey Davey and the BGL Gasifier is under a Chinese company.

On my webspace at www.eleceffic.com are the 22 articles on Future Power Systems - Basics (inc synchronous lock with the 'Biggest machines in the
World' comment) through to Brave New World.
FPS 21 looks at the Smart Customer, FPS 20 at the overall smart system and impact of Customer interaction and FPS 22 carries the requirements to evaluate the strategies to find the best one.
In FPS 1 I have a graph of Gas Power Generation and Demand which shows the effect of the massive internal storage (linepack).

On a more serious note there are fatal flaws in the modelling studies (my specialist area with CEGB/NG), run for the CCC by Poyry in 2010 for the
2030/2050 strategy (Big Nuc Big Wind, Big Heat from Electricity) flexibility analysis.

Hope that all makes sense... Brave New World, Here we come,