

# Operating the Electricity Transmission Networks in 2020 Initial Consultation

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## Consultation Response

VERDANARCH



This response has been summarised to the related bullet point questions in: Operating the Electricity Networks in 2020, June 2009 consultation document for ease of access.

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**Question 9. Are there other developments which will change the way that electricity will be consumed in 2020 that we should consider?**

The considered flattening effect of micro island export generation may not be consistent, as electric vehicle recharging may be an omni-present effect, where the National Grid perceived majority of micro generation is likely to be from domestic Photo-Voltaics (PV) with present housing stock orientation. Such a latency in a flattening effect scenario, until possible 'Solar Extensions' are built to compliment current non-oriented stock and future stock replaces old, becomes significant to statistically and trend guided questioning in further rounds of consultation.

However, when likely commercially diversified embedded island generators are added, the effect of transport fleets (LA's, NHS, Asda) and in industrial PV-compressed air storage, use and surplus's may also drive a reduction in perceived grid-wide demand.

Additional delineating questioning may bring to light the chronology of 'tasks at hand' (Proven Generation and Storage Resource Mapped Investment Strategies). Operators may wish to fulfil these 'tasks' to build network 'pictures' of combined energy bridging portfolios and consumption patterns that they perceive themselves for 2020 and beyond, in connection to the National Grid direct commissioning remit.

**Question 11. Are our assumptions around the number of electric vehicles in 2020 reasonable?**

Consideration, mitigation and shifting time-lines of 'trade hardship' conditions\* and the Rare Earth Element (REE) production peak <sup>(1)</sup> have not been included. i.e. sporadic world resource and economic disruption due to global warming related and other events.

The former evidence lacking is ubiquitous to most government and industrial visioning. With the initial jump start to EV investment, this points to a wider future spread of technological development types for transport related energy storage, and a higher per commuter unit use of closer to eternal energy systems (compressed air, electric rail), which are technologically 'more simple' to replicate and maintain than current EV battery power alone. The minimum usability of current EV battery technologies for ± reserve would be reduced over time due to the cost of 1/1 recycling, not including the former evidence lacking. (technological entropy :intersect: sustainable element)

\*Missing from:

Manufacturing: New Challenges, New Opportunities September 2008

[http://www.dius.gov.uk/reports\\_and\\_publications/~media/publications/B/BERR\\_ManuStrat\\_Summary](http://www.dius.gov.uk/reports_and_publications/~media/publications/B/BERR_ManuStrat_Summary)  
BERR ECONOMICS PAPER NO. 2

Five Dynamics of Change in Global Manufacturing Supporting Analysis for 'Manufacturing Strategy: New Challenges, New Opportunities' 2008

[http://www.dius.gov.uk/reports\\_and\\_publications/~media/publications/B/BERR\\_Economics\\_Paper](http://www.dius.gov.uk/reports_and_publications/~media/publications/B/BERR_Economics_Paper)

Department for Business Enterprise and Regulatory Reform: CENEX ARUP

Department for Transport: Investigation into the Scope for the Transport Sector to Switch to Electric Vehicles and Plug-in Hybrid Vehicles 2008

<http://www.berr.gov.uk/files/file48653.pdf>

1. JackLifton@aol.com Resource Investor Published 19/04/09 <http://www.resourceinvestor.com/News/2009/4/Pages/Commentary---Nothing-but-sophistry-and-illusion-.aspx>

**Question 16. Do you have any views on our projected volumes, prices and costs for STORR under 'Gone Green'?**

Balancing Service STORR volumes and prices have been assumed by NG OETN2020 on use of current technologies and will be significantly affected by new storage projection. Inclusion of more widely used Advanced Adiabatic Geological Compressed Air Energy Storage with Thermal Exchange and Storage (AA (G) CAES/TES) air engine-electric and Underground Pumped Hydro (UPH)-electric providers, as fast STORR, will move associated costs toward model terms of reciprocity/efficiency £ – reciprocity/efficiency and achieve ±£ Base Load – reciprocity/efficiency, compared to ‘spinning’ response ±£ – ±£ fuel/efficiency. This is due to the ability to forecast fast storage ±reserve capacity (e.g. maintenance, pre-purchased reserve) over an extended time scale (compared to ‘spinning’ contingency) and its reliance on the same energising service as end users. This will create price parities, synergies and truer comparability of renewable revenue appraisals and effect increase in renewable energy island generator autonomy.

**Question 21. Are there further technical solutions for maintaining operating margins which we have not mentioned here?**

The first is a financial solution. Industrial diversification investment models for medium scale (0.5Mw – 50Mw) distributed and embedded renewable generation should be sought to create an expanded and diversified industrial field of knowledge, with major stakeholder partnering as a capital investment enabler (ROK contracts). These generators would provide a swift increment of decentralised energy capture capable of gaining utility levels of stability before UK 2020 / 2050 targets.

**Compressed air / Hydro electric storage and Island Network Exports**

It should be noted that AA (G) CAES/TES-electric <sup>(1)</sup> and UPH-electric are the only technologies that have a high enough technological maintenance and re-institution capability to remain reliable as mass direct energy exchange forms through by-decadal trade hardship. These technologies, whether underground or site specific, are also the only medium-technologies capable of supplying renewable generation energy storage and peak generation, with great enough efficiency, quantity and quality to reciprocate renewable industry ‘payback’ ratios above and beyond renewable generation technology repetition and servicing, with enough surplus to supply one planet life style populace demand quantities in the UK <sup>(2)</sup> in perpetuity.

Transmission Grid Commissioning Agreements have a need to include Low-Medium Voltage and Medium Voltage reverse transfer extensibility specifications.

National Grid should provide an industry assessment of *Electric Industry Energy Storage Base Load ramp-synchrony demands* during ‘whole field peak generation and capture’ scenarios for AA (G) CAES/TES air engine-electric and combined CAES CCGT-electric and UPH-electric, at 10%, 30%, 80%, 100% non-wind scenario STORR mixes and Base Load mix capable of providing Majority Smart Grid *Peak* ‘Whole Field Elasticity’.

1. HydroDynamics Group report on Norton Limestone mine compressed air energy storage (CAES) work load integrity for use with gas turbine electric generation. 08/08/2009

**Of note:** No forecast leakage, and 4% pore absorption of initial storage volume over 10 years at working pressures. <http://hydrodynamics-group.com/mbo/content/view/16/40/>

2. **EUSUSTEL WP3 Report [Storage] 1.3.1 Present Pumped Hydro Market** Published >2006 Björn Bolund, Urban Lundin and Mats Leijon, Department of Engineering, Uppsala University, Sweden [http://www.eusustel.be/public/documents\\_public/WP/WP3/EUSUSTEL%20WP3%20Storage.pdf](http://www.eusustel.be/public/documents_public/WP/WP3/EUSUSTEL%20WP3%20Storage.pdf)

**Missing specification for ‘Smart Grid’ phase synchrony codes and interoperable recognition of phase synchrony codes <sup>(5)(6)(7)</sup>.**

In order to reduce industrially diversified, embedded and domestic generation power factor losses at Smart Grid supply points, Smart Primary relays and more particularly Low-Medium Voltage Smart ‘urban sub-station’ Distribution Transformers, these will need to receive coherent electrical phase generation, at power, ‘By-Laterally’.  
i.e. To enable domestic peak generation power sharing across a district and/or Grid wide, the connection between households and Low-Medium Voltage urban sub-stations need as near perfect as possible a domestic AC phase output synchrony, per phase, for all 3 L-M Voltage domestic supply phases.

The code will enable coherent and simple domestic Smart Inverter output synchrony and avoid sinusoidal peak chase and harmonic-multiplier power-factor losses.

Further:- The embedding of a metronomic code as part of the Smart Communication specification is a resource that could significantly increase L-M Voltage power factor efficiency by way of asynchronous harmonics reduction from connected ‘high-spec’ Smart Devices and Appliances and assist reactive power-factor balancing activity.

- 5. not included: ERA SRSM Project: Electricity Smart Meter Functional Specification: 19th January 2007: Simon Harrison & Jason Brogden: <http://www.energy-retail.org.uk/pdfs/SRSM%20Electricity%20Smart%20Meter%20Functional%20Specification%20v2%20final.pdf>
- 6. not included: ERA SRSM Project Paper: Definition of Market Models: Version 1: Date: 12.08.08 <http://www.energy-retail.org.uk/documents/MarketModelDefinitionPaperv1.pdf>
- 7. not included: ERA SRSM and Beyond Local Communications Development: Version 1: Date: 09/12/08 [http://www.energy-retail.org.uk/documents/SRSM\\_Local\\_Communications\\_Development\\_v1.pdf](http://www.energy-retail.org.uk/documents/SRSM_Local_Communications_Development_v1.pdf)

**Question 26. Is it reasonable to assume that minimum demand periods will be managed using Interconnectors and Wind Generation in preference to the curtailment of Nuclear Generation?** inc. 6.82 6.83 6.84

Negative and Positive STORR response requirements may increase dramatically as embedded and distributed domestic and industrially diversified generation reaches and surpasses local islanded network saturation points. Such a scenario would need to be managed on a minute to minute basis. The primary fast Black Start technology capable of this is Underground Pumped Hydro (UPH), with <1 minute ramp times.

A second technology, that appears to promise fast Black Start generation, is CAES/TES. As air, engine and compressor conditioning requirements for this technology have greatly reduced start up thermal conditioning inputs, compared to high thermal primary drive units of mega steam generating fleet, CAES/TES may have a distinct advantage in ramp efficiency. Although technology development is on going, the near contiguous STORR and minimum demand Base Load generation should provide enabling coefficients.

**Question 27. Do you agree with National Grid's view of increased balancing activity in the future due to variation in market length?**

No. The scenario is based on current steam fleet ramp time and ‘spinning’ reserve costs. The analysis has displaced scenario reporting of more prevalent emerging technology case settings. (see previous)

**Question 29. Do you believe that a new approach is required in the development of System Operator to generation or demand control point interfaces for 2020?**

Based on peak control ‘traffic’ envisioned for 2020, contracted automatic ‘ramp to gate-connect’ control over large storage generators and large industrially diversified generation will become more prevalent. Network operator dynamic demand, frequency response and balancing reserve services, will also increasingly double as a distributed/domestic generation export agent through metering arrangements. Therefore, offer prices to aggregating agents, for balancing and export to storage services, will be informed by a central over-sight and communications operator (where network operators and agents wish to exchange beyond an ‘all-in-one-bag’ portfolio). Because such a system has National importance, for social and systems integrity, the national electric transmission system must remain nationally singular and monopolous; and therefore be retained by majority UK Treasury ownership on permanent contract.

**Question 30. Are there any specific factors which suggest that adequate flexibility will not be available to National Grid for use in operating the networks in 2020?**

Consideration, mitigation and shifting time-lines of ‘trade hardship’ conditions.  
i.e. sporadic world resource and economic disruption... (see response to Question 11)

Further:

The ‘all-in-one-bag’ scenario (above) also constitutes a ‘cease’ synchrony specification and governing provenance issue; where embedded, distributed and grid connected fast  $\pm$ reserve ‘whole field’ storage capability is insufficient. (including insufficient earthing capability and ‘over-shot’ negative reserve due to under forecast island network export and over peak network island transfer-gate trapping). This may be more apparent during Summer time peak generation non-wind events post peak shaving of renewables. One solution is an above ‘whole field’ peak surplus ‘at volume’ negative reserve and storage capability, calculated for over peak generation switching, in special investment strategy.

By-Lateral renewably derived storage  
grid connected renewables -  $E^{\Delta(1)}$  - island network export  
By-Lateral interconnector

Such strategy and services should be drafted as and engineered to national standards with perpetual or ‘eternal energy exchange systems’ embedded as elemental to the power 1. (.EEEs,  ${}_3E^3$ ,  $E^\infty$ ,  $E^{\Delta}$ , Renewable -  ${}_R E^{3s}$ )

The only system available for commensurate commercial roll-out at present, to negate embedded islanded network saturation point tripping, is the Smart Meter export cease mechanism. Although commercially available, this is not included within UK Electrical Retail Association Smart Meter specifications <sup>(2)(3)(4)</sup> and is vital to lines work safety.

2. Missing from: ERA SRSM Project: Electricity Smart Meter Functional Specification: 19th January 2007: Simon Harrison & Jason Brogden: <http://www.energy-retail.org.uk/pdfs/SRSM%20Electricity%20Smart%20Meter%20Functional%20Specification%20v2%20final.pdf>

3. Missing from: ERA SRSM Project Paper: Definition of Market Models: Version 1: Date: 12.08.08 <http://www.energy-retail.org.uk/documents/MarketModelDefinitionPaperv1.pdf>

4. Missing from: ERA SRSM and Beyond Local Communications Development: Version 1: Date: 9 December 2008: [http://www.energy-retail.org.uk/documents/SRSM\\_Local\\_Communications\\_Development\\_v1.pdf](http://www.energy-retail.org.uk/documents/SRSM_Local_Communications_Development_v1.pdf)

**Question 32. What criteria should National Grid use in developing any requirements for information regarding embedded generators? Are there other ways of obtaining this information?**

Field Elasticity can be determined on different operator levels, coordinated by a Central Communications system (suggested in the Smart Meter Roll-Out Program). Using on-spot operability modelling of automated embedded (e.g. urban, rural and district medium-large Methane CHP), embedded island (domestic/distributed Low Voltage network export, medium scale local renewable rural PH and UPH cooperative clusters) can provide scenario reporting for computerised load coordination (\*and metronomic phase synchrony) between:

Micro:\*Low Voltage distribution network connected exporting island generation to Low Voltage Ring-Main transformer sub-station  
(This is the area of greatest difficulty in ‘governing provenance’, but by extension is eased with the introduction of above saturation grid connected ‘fast’ storage.

Macro: Low-Medium Voltage Ring-Main transformer exports to sibling bridged imports and Medium Voltage primaries

Low-Medium Voltage industrially diversified exporting island generation to Medium-High Voltage Grid Supply points

Local-Inter-Regional:

Macro level compensated steady state nodal Base Load demand and export to Fast – Model response (<1 – <5 minute) Black Start and ± reserve  
(CAES/TES (unproven), UPH, PH)

Embedded urban and rural Methane plant are also likely to supply increasing seasonally affected volume exports. As introduction becomes commonplace, optimisation processes will require bio-gas storage, H<sub>2</sub> extraction and possible co-generation of electric. For network embedded and distributed rural feed stock plant, although dependant on the immediacy of electrical product utilisation, could resolve spot-opportunities with nodal and individual pole mounted Smart-gate to storage control systems.

**Question 35. What is your view on the potential of electric vehicles to provide balancing and other energy services?**

**Question 36. How much of the electricity demand in Great Britain do you think could be regarded as discretionary or deferrable and hence available for use as a Balancing Service or other energy service?**

**Question 37. What specific actions should National Grid take to facilitate Balancing Services from demand-side providers while maintaining the required quality and volume of service?**

Due to the complexity of electric vehicle (EV) and domestic/distributed frequency response, demand and load management;

Low Voltage network island aggregator services would appear better suited to Grid dynamic demand management only in periods of peak demand when Grid side balancing systems have un-forecast short-fall in supply i.e. sustained non-wind events.

The main use for Smart domestic dynamic demand balancing may become a more prevalent load shifting service as a direct command operation in relation to generation short-fall as a 'CO<sub>2</sub>' balancing requirement in a pre and post 2020 renewables provision short-fall scenario. Such events will be exacerbated by heavy EV recharge demands.

Renewably energized Balancing Services are projected beyond 2020 to provide further energy backup than current and perceived purely electric demand services, as augmentation of other energy demands will require renewably derived energy (H<sub>2</sub>, etc) storage and distribution. In terms of Electricity Transmission Grid connection, large storage Balancing Services from renewably derived energy are un-paralleled in their cost effectiveness to replace environmentally unaffordable provision and unclear toxin costs.

An investigative report into the Kilometer<sup>3</sup> or Nm<sup>3</sup> requirements for Compressed Air, Gas and Water energy storage technologies to cover 10%, 30%, 50%, 80% and 100% non-wind eventualities, with the foreseen generation percentages, will excite further independent financial inspection above a call for balancing services. This would further extrapolate storage resources, scales and mapping to assist special investment strategies. e.g. rural network Smart switching gear for medium scale UPH exporting island cooperatives and/or Low-Medium Voltage township island network Smart switching gear for embedded AA (G) CAES/TES with Methane augmentation.

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