Would it be more efficient/less costly for National Grid to manage all dispatching? Please indicate the likely scale of any efficiencies/reduction in costs

Our assessment of the various efficiency impacts of the adoption of central dispatch is given in an appendix to this document.

Overall, we have not yet identified any significant improvement in the physical operation of generation that would result from the adoption of central dispatch. In particular, the practical issues that are likely to require all central dispatch decisions to be determined and instructed at a time that is sufficiently in advance of actual delivery to suite all units would incur larger forecast errors and unavoidable divergences from such instructions due to plant breakdowns or other uncontrollable events than is the case with the more bespoke scheduling decisions under competitive pressures up to 1 hour before delivery under NETA/BETTA. There is also a risk that innovation to develop the flexibility of the generation fleet observed under NETA/BETTA would also be reduced.

One benefit of centralised dispatch arrangements could be the potential for better price and volume information to emerge across the market and inform demand and future investments. However, this benefit might also be achieved by encouraging greater voluntary participation in auctions (e.g. day ahead power exchange markets) without imposing the restrictive compulsion of central dispatch.

In terms of balancing, the adoption of central dispatch would require corresponding larger balancing actions in the period from day ahead to delivery. The need for larger balancing volumes, the risk of reduced innovation in dispatch and unit flexibility could outweigh any pricing benefits that might read across from more transparent day ahead bids (especially since such information will often not be directly applicable at shorter delivery timescales). As the system operator already has the freedom and discretion to procure balancing services in whatever manner and over whatever timescale is deemed most efficient, we do not expect the introduction of central dispatch to affect the efficiency of balancing activities.

Whereas, on the basis of the above factors, the re-implementation of central dispatch is considered unlikely to improve overall operating efficiency, this note has identified areas that could be explored further to assess the potential for improvements. These are:

- Encouraging use of power exchange auction platforms to improve the robustness of market index prices (a topic considered in Ofgem’s liquidity workstream).
- Permitting the notification of bilateral market trades to central settlement closer to or sometime after real-time delivery. This would allow wind generators greater opportunity to trade out short-term imbalance and provide the market with more opportunity to innovate and develop short-term flexibility. Such changes would need to consider the risk of market power being exercised very near real-time when few competitive alternatives may be available. It would also need to consider how the stability and accuracy of information to the system operator could also be maintained.

NG/LAD 4 November 2014

Appendix: Details of central dispatch vs current NETA/BETTA efficiency impacts assessment

Our efficiency assessment is based on a comparison of current NETA/BETTA arrangements with a central dispatch counterfactual in which:

1) The system operator performs a central unit commitment and dispatch service (providing instructions to start and stop all main[1] generating and pumped storage units, setting the initial load profile for them, and dispatching all other balancing actions as now). Such unit commitment decisions seek to satisfy a demand curve compiled by the system operator using price/volume demand information notified by suppliers and reflecting a central forecast of the contribution of wind generation to national supply.

2) Instructions to start and stop units are given with sufficient notice so that all relevant generation technologies are able to comply with a low risk of failure, imbalance or damage. To avoid potential bias between units that have different notice periods or flexibilities, all generators receive an initial schedule at the same time. For this note, it is assumed that this initial schedule is provided in the day before required delivery at a time which meets the longest required notice period and which is concurrent with similar day-ahead auctions in European neighbours (thereby facilitating implicit auctions for interconnector capacity).

3) Following notification of the day-ahead schedule, imbalances that arise from forecast errors and unit availability changes will be addressed by the system operator giving instructions to balancing service providers (of which centrally dispatched units would be a subset). Such instructions will be in accordance with dynamic parameters notified by service providers concerning maximum service availability, required notice periods, ramping restrictions, etc. Instructions will be issued in a manner which optimises costs given that, once called, some services may entail costs that cannot be later avoided by a reverse instruction.

4) To ensure sufficiency of service capabilities and facilitate economic purchase of the services, the system operator will tender for contracts to provide services ahead of need (as under NETA/BETTA).

5) In terms of incentives on parties to provide accurate information and operate in accordance with this central dispatch, we assume the following:

a) To encourage cost-reflective bidding, centrally dispatched units are paid for their instructed volumes at a marginal price for each half hour trading period in the subsequent day derived from the central dispatch optimisation. (In this assessment it is assumed that GB remains a single price area although it would be possible to derive locational marginal prices subject to a methodology for determining appropriate network capacity limits.) Suppliers pay for the computed demand curve volumes at the same marginal prices.

[1] Main generation is here taken to be units larger than 100MW and/or directly connected to the transmission system. Although this may include some larger wind farms, it is expected that their low marginal costs will mean they will always be continuously despatched with their actual output then dependent on the availability of wind.

b) Centrally dispatched units and other balancing service providers which depart from the instructed dispatch profile are subject to an imbalance cashout which charges for under provision and pays for over provision. The difference between supplier metered volumes and the notified demand curve derived volumes are similarly cashed out.

The detailed form of the day-ahead and imbalance prices that might be used in this counterfactual is beyond the scope of this paper but some high-level features can be identified:

- The activities in 3) and 4) above would be very similar to the balancing tasks under NETA/BETTA arrangements (despite a different contractual baseline). Thus, the imbalance charges to market parties which would signal the appropriate actions they should take to avoid costs that would otherwise be incurred by the system operator would need to consider largely the same issues that have been addressed in the Electricity Balancing Significant Code Review (EBSCR). However, as wind forecast error would be much larger at day ahead than 1 hour ahead, there would need to be consideration of the extent that certain parties should be exposed to factors they would not be able to control.

- For the centrally dispatched market, it would be necessary to decide how the day-ahead clearing prices should reflect startup costs, the linkages between time periods due to ramping constraints, the use of storage, and any reserve or capacity payments (or whether any such “missing money” issues should be addressed by an enduring capacity market).

Our suggested central dispatch counterfactual departs from the original England & Wales Pool arrangements by maintaining some features in the current NETA/BETTA arrangements (and observed in some other pool arrangements overseas), including:

- The participation of suppliers in creation of the market demand curve.
- Recognising that day ahead bids and dynamic parameters may not be the most appropriate for addressing emerging short-notice balancing tasks.
- Providing an incentive for accurate forecasting and instruction following based on the costs that the system operator would otherwise occur (i.e. making pool contracts firm).

For comparison, features relevant to our efficiency comparisons are therefore identified as follows:

Issue	**E&W Pool arrangements**	**NETA/BETTA**	**Suggested central dispatch counterfactual**
Demand representation in main generation scheduling decisions	SO day-ahead demand forecast with no explicit elasticity representation. (Suppliers engaged in pool price hedging through EFA forwards market but no resulting information used in pool dispatch)	Supplier willingness to contract in national bilateral markets (with such contracts refined up to 1hr ahead) informed by commercial factors including imbalance exposure	Suppliers provide demand curve information day ahead (eg. like NordPool) informed by commercial factors including imbalance exposure. Opportunity for SO demand volume

			adjustments (made transparent as an SO day ahead trade)
Renewable and small embedded generation representation in main generation scheduling decisions	SO forecasts small/renewable generator contributions (and deducts them from demand to be met by main generation)	Supplier willingness to contract national bilateral contracts reflects agreements with small local generators. Large scale renewables sold in national bilateral contracts (often as part of larger portfolios)	Supplier relationships with small generators reflected in day ahead demand curves. Large scale renewable contributions forecast by SO (the degree to which resulting wind contracts are subject to imbalance requires further consideration)
Main generation representation in scheduling decisions	Standardised day-ahead bids with startup costs and piecewise supply curve. Dynamic parameters describe available & usable capacity but generators not exposed to consequential costs arising in the short-term if they fail to meet them.	Owner manages generation (potentially on a unit bespoke basis) to deliver agreed national bilateral contracts or imbalance costs otherwise.	Day ahead standardised complex bids & dynamic parameters with imbalance exposure to under or over delivery.
Balancing timescale demand forecast	SO updates demand forecasts until real-time	SO updates demand forecasts until real-time with volume information from suppliers up to 1hr ahead	SO updates demand forecasts until real-time
Balancing timescale representation of main generation	Incremental or decremental adjustments chosen on basis of day ahead bid prices. Availability depends on day ahead schedule decisions and dynamic parameters.	Owner manages generation on a unit bespoke basis to offer and deliver Balancing Mechanism or other SO service contract obligations (in accordance with advised dynamic parameters and subject to competitive pressures as existing near real-time)	Like NETA/BETTA. Main generators compete with other service providers for balancing contracts.

To compare the efficiency of the current NETA/BETTA arrangements with the central dispatch counterfactual we categorise any differences into:

1) Differences between market contracts (prices and volumes) given the same underlying consumer demand and willingness to pay.
2) Differences in the accuracy of delivering such contracts by main generation and flexible demand (imbalance volumes).
3) Difference in the volume and price of balancing actions.

The error in the volume of market contracts in 1) plus the error in delivering such contracts 2) should equal the difference in balancing action volume in 3).

Comparing the NETA/BETTA system and the suggested counterfactual in these areas gives the following:

		NETA/BETTA	**Central dispatch counterfactual**	**Difference**
1)	Market contracts vs consumer need	A mix of contracts in various timescales refined up to 1hr before delivery.	Main generation contracts determined from central dispatch optimisation with day ahead generator and supplier information.	Day ahead CD contracts will have larger volume errors but potentially

		Suppliers typically contract long by ~700MW to manage asymmetric imbalance exposure risks.	Suppliers may determine demand requirements on commercial grounds including imbalance exposure. Effective contract prices may differ from pool prices due to hedge contracts struck in various timescales.	more competitive prices than NETA markets
2)	Day ahead schedule accuracy (volume)	Generation owner performs bespoke unit scheduling to deliver agreed contracts with opportunity to refine contracts and dispatch up to 1hr before delivery. Similar incentives on flexible demand.	Main generation owners follow day ahead central schedule in accordance with code duties and imbalance cashout incentives. Wind generators subject to wind availability unless breakdown or constrained.	Generators and suppliers will have larger unavoidable imbalances from day ahead CD contracts.
3)	Balancing	SO forecasts energy imbalance and other service requirements using, inter-alia, physical position notifications. Chosen contracts result from trade-offs between advantageous prices (earlier) and volume certainties (later). Predominance of pay as bid contracts with SO (especially for BM and other short-notice actions)	Similar to NETA/BETTA. The SO would additionally know the contract basis of unit physical positions but would still need to balance positions that actually emerge with a similar certainty/price trade off. The SO may be able to use observations of pay at margin day-ahead market bids to negotiate service prices but some updating by generation is justified and potentially valuable.	SO will need to procure more balancing services given CD contract errors & dispatch errors.

On the basis of this comparison we identify the following reasons why a central dispatch may be less ideal than NETA/BETTA self-dispatch in terms of contracted volumes:

- The need to conduct such scheduling further ahead of real-time than the current 1 hour gate in NETA/BETTA (to avoid market discrimination and facilitate harmonisation with adjacent markets) would introduce larger forecast errors and instruction following errors.
- Simplifications and inaccuracies in central representation of generation costs and capabilities compared to owner bespoke decision making under NETA/BETTA[2].
- The standardisation of generation representation in the scheduling process and the compulsory nature of the day ahead schedule would risk dampening innovation in plant management and contracting[3].

These dispatch issues would need to be addressed by the system operator contracting additional balancing services. With somewhat longer timescales, there may be opportunities to adjust the balancing service procurement arrangements.

The central dispatch would provide the system operator with direct information on unit contracted position at the day-ahead and this would be additional to the unit physical position notifications available under NETA/BETTA. However, as we are not aware of any

[2] Following the implementation of NETA, self-dispatching owners of marginal units were observed to have reduced the number of unit stop/starts from those that would have been scheduled by the Pool central dispatch algorithm. It was inferred that the owners preferred to incur the higher costs of minimum load running through the night in preference to the market risks of late synchronisations and start related breakdowns.

[3] We have seen significant innovation under NETA/BETTA for generator owners to create value from improving flexibility to address short-term market requirements. For example, some CCGT power stations have been upgraded by their owners to improve their flexibility.

deliberately misleading physical notifications and we doubt that any such misinformation would materially impact the chosen energy balancing actions, we doubt this property of central dispatch gives any meaningful efficiency benefit.

The centrally dispatched day ahead market would be larger and potentially more transparent (subject to suitable monitoring of the complex bids and dynamic parameters) than the voluntary power exchange markets used under NETA/BETTA. This may well provide more robust market index prices, which more accurately inform demand, encourage better hedging and ultimately give better investment decisions. It may also reveal more information on the nature of main unit costs relevant for short-term balancing although there may be various reasons which mean not all such costs could be accessed in practice at short-notice (for example, they would not be deliverable if a startup or necessary headroom had not been previously scheduled).

To illustrate the magnitude of the difference between day ahead forecasts and current NETA/BETTA within day forecasts, the following statistics may be of assistance:

	Within day	**Day ahead**
Mean absolute errors on demand forecast (last year + recent year range average)	379 MW 337 – 397 MW	444 MW 407 – 493 MW
Mean absolute error on wind forecasts (current wind capacity levels)	284 MW	329 MW
Estimated reserve requirements (covering plant breakdowns together with current wind and demand forecast errors)	As now	Circa +1000 MW

NB The day ahead values only approximately correspond to those that would be relevant to a central dispatch counterfactual as the exact timings of the necessary forecasts have not been determined in detail.

NG/LAD 04 November 2014.