

8<sup>th</sup> January 2016

## **National Infrastructure Commission call for Evidence**

**Submission from Catherine Mitchell, Professor of Energy Policy, University of Exeter, Energy Policy Group**

### **Questions asked by the National Infrastructure Commission (NIC)**

#### **Electricity interconnection and storage**

1. What changes may need to be made to the electricity market to ensure that supply and demand are balanced, whilst minimising cost to consumers over the long-term?
2. What are the barriers to the deployment of energy storage capacity?
3. What level of electricity interconnection is likely to be in the best interests of consumers?
4. What can the UK learn from international best practice in terms of dealing with changes in energy technology when planning to balance supply and demand?

### **Summary**

We, the Energy Policy Group of the University of Exeter, welcome the NIC's investigation. We argue that the fundamental problem for GB energy infrastructure and the balancing of supply and demand within markets is that the current GB governance system is not fit for purpose. IGov, a project within the EPG, has put forward an alternative governance framework (as shown in Figure 1, 2 and 3). We believe if this governance framework were put in place, competition between the various energy resources – whether they be demand side or system capabilities, such as interconnection or storage – would be improved, as would operation, security and environmental outcomes. We would also see this as the long term cost minimisation strategy to meet the GB carbon commitments. The transformation to an energy system capable of meeting the environmental, security and social goals – and the infrastructure and market needs of that – should be overseen by an Independent and Integrated System Operator (an IISO), as the technical executor of Government policy. It should be a state owned not for profit IISO created from the SO functions of National Grid. This alters the balance of power between institutions in the GB energy system. We do not believe that Ofgem

should continue with multiple competing Duties. It should revert to being an economic regulator. These two institutions should be on the same level of institutional hierarchy. The IISO should implement the required energy system transformation from the CCC recommendations, and the economic regulator should regulate it. Both of them would be working to a Strategy and Policy Statement (SPS) from an Energy Policy Committee (the executor of, and advisor to, the Secretary of State) and DECC. We think this will go a long way to help overcome the barriers of storage, but at the moment a central barrier to a 'smarter' energy system are data flows. Until there is a fundamental re-structuring of those flows and who 'owns' that data, it is difficult for storage (and many other capabilities) to capture its value to the energy system. Also, there is no right answer to the amount of interconnection there should be. This is something the IISO will re-assess at regular intervals as the energy system develops. Finally, there is a great deal of international best practice the GB should learn from. IGov's work falls squarely in the area of the NIC exploration. IGov itself has been investigating international best practice in this area (Denmark, Germany and the US) and would welcome more detailed discussions of the issues.

## **Introduction**

I am currently a Professor of Energy Policy at the University of Exeter and an 'Established Career Fellow' with an EPSRC project on Innovation and Governance for a Sustainable Economy [www.exeter.ac.uk/igov](http://www.exeter.ac.uk/igov) (IGov), which funds a small team and lasts from 2012-2016. With respect to the four questions above, our IGov work falls squarely with Q1 and Q4, although of course, Q2 and Q3 are part of that. Because of this, we welcome your investigation and consider our work extremely relevant to it.

IGov considers governance both as the 'rules of the game' (ie policies, institutions, rules and incentives), and the politics and decision-making processes of how those rules are implemented. It is a comparative study of GB with Denmark, Germany and three US States in particular: California, Texas and NY.

At root, we argue that GB energy governance (including of interconnection and storage) is not fit for purpose. We are slowly developing an energy governance framework which we consider would meet the regulatory and infrastructural challenges of energy.

This submission is laid out in the following way: the next section sets out our arguments for GB governance change. The following sections then answer your 4 questions above.

## **GB Energy Governance for a Whole System**

Energy is a whole system and needs a governance system which reflects that. If something is done to it in one place, there will be an impact in another. It is therefore insufficient to think narrowly about what changes need to be made to the electricity market to ensure that supply and demand are balanced, whilst minimising cost to consumers over the longer-term. The governance framework has to be set up to do this - and this would include markets, networks, the system operator, distribution service providers, Codes, Data bodies, market monitoring and so on.

IGov wrote a couple of introductory papers to explain GB's governance problems, and then what needs to be done in order for them to be overcome. Although they are now a year old, they are both

useful for explaining the issues in full. The first paper set out what we see as key issues for [governance in GB](#). The second paper is a high level explanation to what we called [Public Value Energy Governance](#) [now changed to Output Based Regulation] which was a straw- proposal for necessary governance change in GB.

In this latter paper, we argued that there are three fundamental issues of our current regulatory process which needs to be dealt with:

- the lack of legitimacy within our energy policy process, which has developed because of the changing nature of the challenges that the energy system faces
- the lack of nimbleness in its decision-making, which means that there is a gap between the removal of regulatory barriers and technology take-up, so that practice change is slow; and
- the way that its rules and incentives suits the characteristics of fossil technologies and their related business practices, thereby undermining new business models and competition and perpetuating the current system and current ways of thinking

We have now developed an [overall governance](#) framework as shown in Figure 1 below. We argue that the roles and relationships between the GB energy institutions need to change to:

- an energy policy committee (EPC), which both advises the Secretary of State but also executes the Secretary of States decisions, thereby bringing in more [legitimacy](#) to decision-making;
- an integrated and independent system operator (IISO) which is the body tasked with energy system transformation (ie to ensure system capability of meeting the carbon reduction targets for 2030, 2040 and 2050 as set out by the Committee of Climate Change); ensuring security; and combining complementary market and network functions;
- that Ofgem be restructured so that it becomes an economic regulator

We think the IISO and the Economic Regulator should be overseen by the EPC and that they are both on the same level of hierarchy.

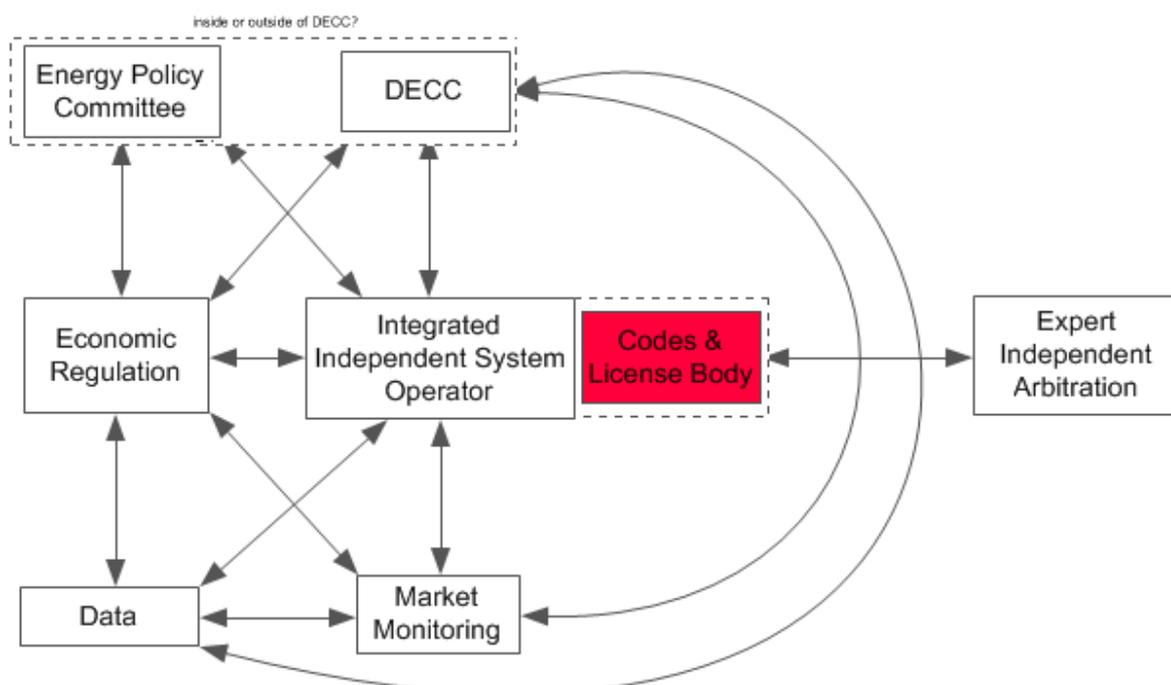


Figure 1

In the same way that we think the transmission system operator role needs to be transformed, we think distribution network operators (DNO) should also alter their role. We think that this is best done by means of new regulation which alters the incentives received by the DNO. Transforming DNOs into market facilitators has been discussed as far back as the Embedded Generation Working Group in [January 2001](#). Currently, there is a spectrum of possible roles that the DNOs can transform into – and these options need to be discussed fully.

At one end, the minimal change is that DNOs are regulated in a different way from currently. At the other end, DNOs are transformed into [Distribution Service Providers](#), as envisaged in the New York Reforming the Energy Vision regulatory transformation ([NY REV](#)), which facilitate fully formed local markets for energy. Somewhere in the middle, are DNOs transformed into distribution service providers / market facilitators but where local markets, if they exist, are ad hoc arrangements which buy and sell into a national market. It seems to us that DNOs need to transform. We also like the idea of local markets because of the arguments put forward by the [NY REV](#) and because of the (already) increasing interest from places of different sizes in GB to develop local markets (eg [Bristol](#) and [Wadebridge](#)).

Figure 2 below sets out how we see the transformed distribution service provider interacting with other energy institutions such as the IISO, markets, customers, data and so on. Please also see Figure 1 for how this fits into the IGov governance framework which has been developed so far.

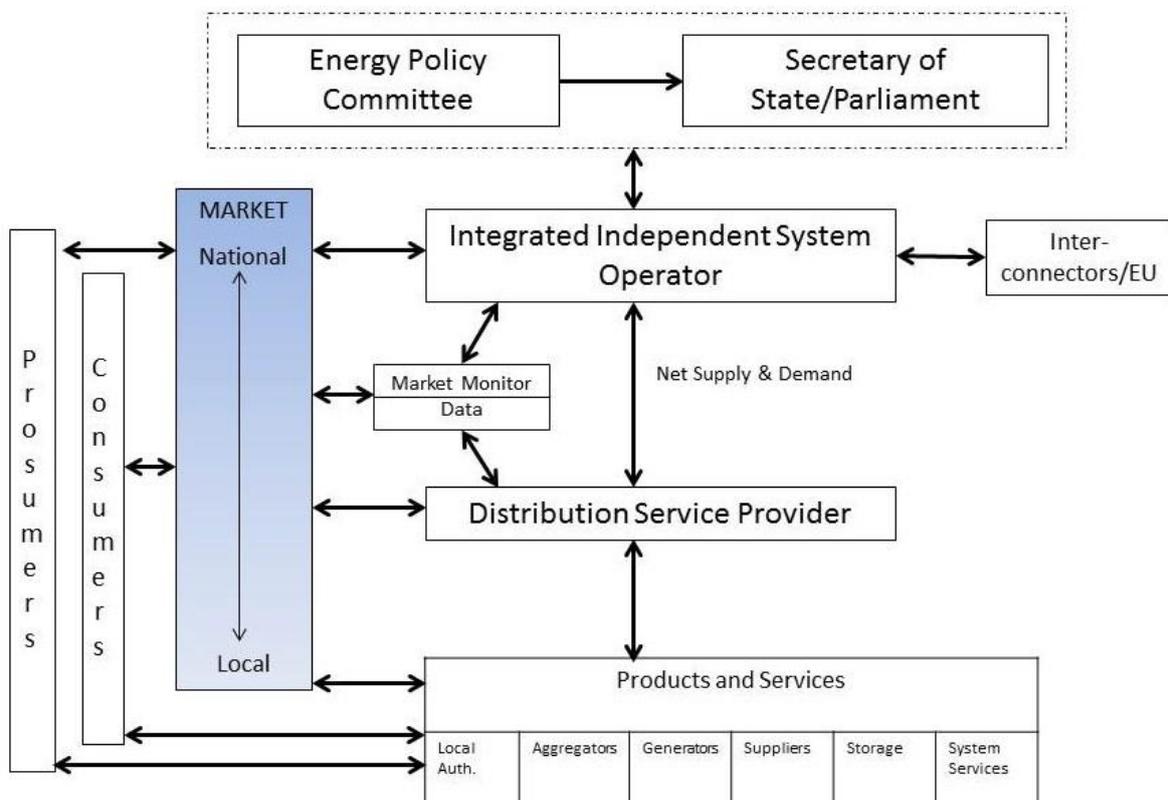


Figure 2

## Codes

Codes and Licenses are the legal basis of energy system operation. The current governance of Codes and Licenses needs root and branch restructuring – both with respect to text, process and institutions. Codes (and data flows, discussed below) are actually central blockers to a new energy system. Policy and regulation can change, but before they are implemented the relevant Codes have to be altered. The process for Code change is entirely unfit for purpose, and this is something which has been taken up by the Competition and Mergers Authority (CMA). IGov has set out its governance framework for Codes within a [Working Paper](#) and [here](#), and show in Figure 3 below.

IGov has participated very actively within the CMA investigation in [general](#) – including arguing that the CMA investigation should increase its theories of harm from four to five to include the governance framework as a potential of harm – which they accepted. Our specific recommendations for Code Governance change to the CMA can be found [here](#).

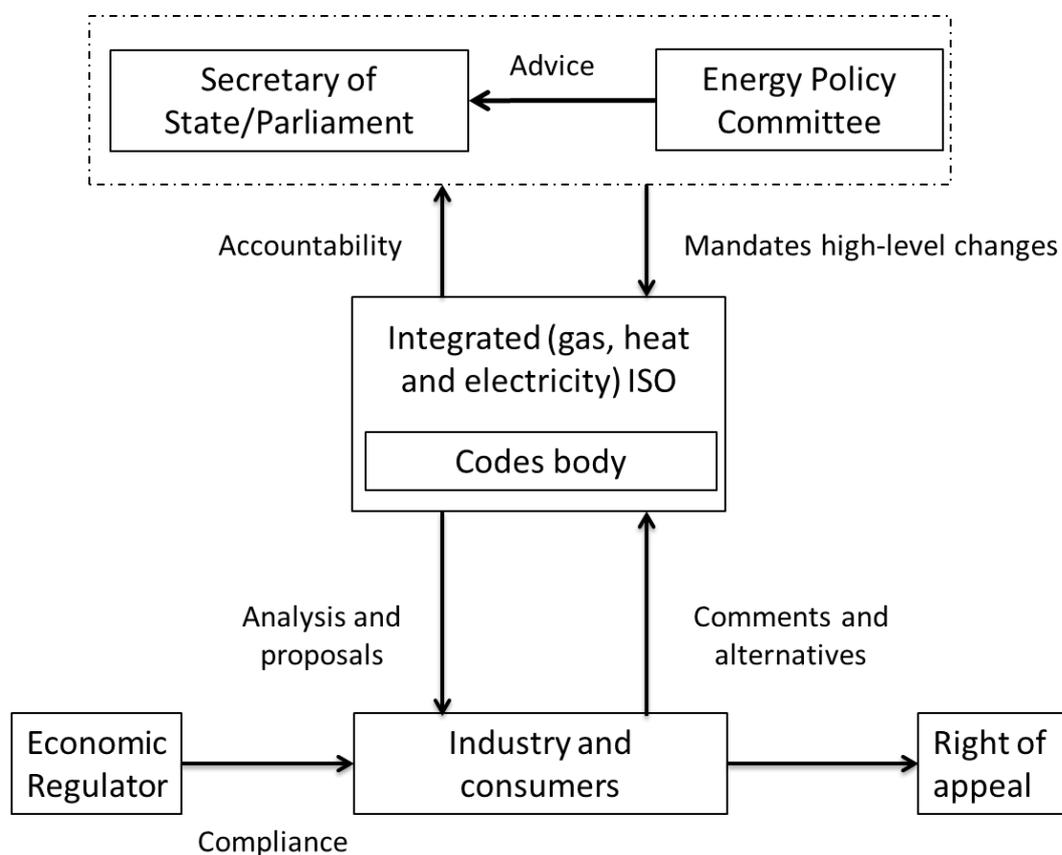


Figure 3

## Data

Data is another underpinning requirement for appropriate competition, market and network interactions, and GB's process for data flows are also not fit for purpose. As with Codes, which requires getting rid of the basic principle of self-regulation, so data flows has to move beyond suppliers as the institution with customer to a central data body, as [DataHub](#) in Denmark.

## Strategy and Policy Statements

We argue that the governance framework should have [Strategy and Policy Statements](#) (SPSs) between the institutions so that while their individual roles may differ, they all have the same goals. Ultimately, we argue, that the Minister gives authority to the EPC to execute energy policy. There should be SPSs between DECC, the EPC and all the institutions – the economic regulator, the IISO, the Data Cody, the market monitor, the Code Body and so on. The current model of SPS leaves Ofgem to handle the trade-offs, which leaves too much of the political aspects of energy [in their hands](#). The EPC would be handling the political aspects of policy decisions, including trade-offs, which would be the basis of advice to the Minister. While our model still has [concerns](#), we argue it is more legitimate than the current model.

## Denmark as a useful example

Our GB governance framework has drawn on governance examples from elsewhere, in particular Denmark but also various States in the US. Please see a recent [Working Paper](#) on Danish energy governance, and the NY REV update link for distribution governance above.

## Answering the Questions

1. What changes may need to be made to the electricity market to ensure that supply and demand are balanced, whilst minimising cost to consumers over the long-term?
2. What are the barriers to the deployment of energy storage capacity?
3. What level of electricity interconnection is likely to be in the best interests of consumers?
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### ***What changes may need to be made to the electricity market to ensure that supply and demand are balanced, whilst minimising cost to consumers over the long-term?***

As I am sure you know, the EU currently has a consultation on [electricity market design](#), and individual Member States are working out their preferences for how their own markets are designed, including how they interconnect with other countries (eg [Germany](#)) and how they establish the value of a [multitude of capabilities](#) within the market which is needed to keep an energy system running securely.

We argue that there are a few central issues for this.

Firstly, that market reforms are part of a wider restructuring of the governance framework set out above. Secondly, that it is recognised that markets and networks are inextricably linked, which is why the IISO should be responsible for both system and market operation, and why distribution service providers enable greater involvement of local supply and demand. And thirdly, markets need to be set up to suit the characteristics of variable power, and their system needs. IGov produced a blog series called [No resource is 100% reliable](#) which endeavoured to explain that while different technologies and fuels have different characteristics, they are all in their different ways unreliable. The important point is that markets should be designed to maximise their flexibility, which includes a capability market as opposed to a capacity market. One argument is that markets have to value energy and capacity. We would argue that capacity is only one capability which needs to be valued. All the different capabilities of system operation – such as rapid ramping etc – need to be able to be

valued within a newly designed [market](#) for a no-regret energy policy so that it can '[reduce, flatten and flex](#)'.

***What can the UK learn from international best practice in terms of dealing with changes in energy technology when planning to balance supply and demand?***

GB can learn a lot from international best practice – as set out in the various links above. Denmark as a country, whilst small, has created a [very interconnected](#) energy system – this is not just from Denmark to other countries, but also within Denmark between resources (such as heat and electricity) and between local and national markets. Other countries, in particular many [US States](#), have been very successful in developing capacity markets which include the demand side. As explained more fully in the link, The Federal Energy Regulating Commission ([FERC](#)) publishes an annual Staff Report which sets out what US State or market has done in the last year to their CMs, and why. [Over 10%](#) of peak capacity is provided by DSR in PJM, while DSR averages 6% of peak across the US. This translates to between [5-8% reduction in wholesale prices](#) averaged across the year, although this is a whopping 90% cut for the [peak time price](#). As set out above, the NY REV is endeavoring to establish an energy system governance process which will enable a more efficient energy system operation, at lower cost to customers.

The intention of IGov is to bring this best practice to GB, and we would welcome discussions about this.

***What are the barriers to the deployment of energy storage capacity?***

At the moment, storage is not cheap enough to be incorporated into the energy system without any changes to its governance. Moreover, the energy system market as set up and discussed above, does not value capabilities such as flexibility - which storage provides. The [current capacity market](#) is far too narrow in what it provides value to, and needs to be rethought so that flexibility (and its different capabilities) can be included. The US markets are the best examples currently of that (see links in section above), although Germany is moving towards that now.

Thus, for the appropriate amount of storage to come forward, the GB governance system has to alter. At the moment, it is a system based on competition but set up to suit the characteristics of fossil fuels. It needs to alter so that it enables 'better' competition by getting rid of the de facto pursuit of fossil fuels but also to enable better direction to meet carbon reduction targets cost effectively. We believe that the IGov framework will enable an appropriate process for doing this – and within that the barriers for storage would be removed, and the appropriate amount of storage would come forward.

***What level of electricity interconnection is likely to be in the best interests of consumers?***

There is no 'right' answer to this. We have an energy system at the moment. We would hope, with appropriate governance change, as set out above, that the energy system transforms into one capable of meeting our environmental, security and social goals.

Because the energy system is a whole system, it is never possible to say that X amount of interconnection is correct. Interconnection is a very important function of a secure and [flexible](#) energy system, as shown by the [Agora](#) study of Denmark. The EU makes a recommendation for

about 15% of supply to be available from interconnection – some countries have well above that, and GB is still well below that.

We argue that the IISO is the body which is responsible for energy system transformation. So, for example, if we need X million electric vehicle chargers by 2040 to ensure Y carbon reduction, then the IISO would make that recommendation, ensure that the market rules were in place, and the economic regulator would regulate for that. As the GB system develops, it will have a certain amount of flexibility – which will differ depending on its development. The IISO may take the view that we need more interconnection. They should then be able to tender for that through a targeted strategic capacity mechanism – a mechanism with different properties from that in place at the moment.

We therefore do not think the NIC should worry about the ‘right’ amount of capacity or storage. More, the NIC should recommend a governance system which enables better system wide decision-making, as we recommend.

## **Conclusion**

We, the Energy Policy Group of the University of Exeter, welcome the NIC’s investigation. We argue that the fundamental problem for GB energy infrastructure and the balancing of supply and demand within markets is that the current GB governance system is not fit for purpose. IGov, a project within the EPG, has put forward an alternative governance framework (as shown in Figure 1, 2 and 3). We believe if this governance framework were put in place, competition between the various energy resources – whether they be demand side or system capabilities, such as interconnection or storage – would be improved, as would operation, security and environmental outcomes. We would also see this as the long term cost minimisation strategy to meet the GB carbon commitments. The transformation to an energy system capable of meeting the environmental, security and social goals – and the infrastructure and market needs of that – should be overseen by an Independent and Integrated System Operator (an IISO), as the technical executor of Government policy. It should be a state owned not for profit IISO created from the SO functions of National Grid. This alters the balance of power between institutions in the GB energy system. We do not believe that Ofgem should continue with multiple competing Duties. It should revert to being an economic regulator. These two institutions should be on the same level of institutional hierarchy. The IISO should implement the required energy system transformation from the CCC recommendations, and the economic regulator should regulate it. Both of them would be working to a Strategy and Policy Statement (SPS) from an Energy Policy Committee (the executor of, and advisor to, the Secretary of State) and DECC. We think this will go a long way to help overcome the barriers of storage, but at the moment a central barrier to a ‘smarter’ energy system are data flows. Until there is a fundamental re-structuring of those flows and who ‘owns’ that data, it is difficult for storage (and many other capabilities) to capture its value to the energy system. Also, there is no right answer to the amount of interconnection there should be. This is something the IISO will re-assess at regular intervals as the energy system develops. Finally, there is a great deal of international best practice the GB should learn from. IGov’s work falls squarely in the area of the NIC exploration. IGov itself has been investigating international best practice in this area (Denmark, Germany and the US) and would welcome more detailed discussions of the issues.