Submission to the National Infrastructure Commission

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Introduction

The UK energy system is complex. To maintain a balanced, value for money perspective when considering interconnection and storage, as well as future generation projects, a whole system view should be taken.

On the supply and distribution side the need for robust gas and electricity supplies in industry has defined both the scope, and the reliability, of our national and local networks and generation infrastructure. On the demand side, the move away from coal towards gas in the 1980s has created one of the most integrated domestic gas networks in the world linking our homes directly to our gas requirements as a nation.

The move towards importing gas in 2004 has created pressures on the gas grid with new sources of LNG changing the flows within the system. For electricity, growth of consumer electronics in the home, particularly over the last ten years, has increased the amount of electricity we need. Renewable generation technologies – including an increase in 'embedded' generation, which is off the main electricity grid – add further system pressures and uncertainties.

The most significant energy use for individual households remains the amount of gas and electricity to heat their homes. This has stayed the same throughout.

On aggregate, in-home energy use makes up a very significant proportion of our national energy usage, more so when businesses are included. All avenues should be considered to maintain secure and affordable energy supplies, but silo based thinking must be avoided.

This paper sets out:

1. The clear definition of energy efficiency as infrastructure

2. Benefits for the UK, and for homeowners from improving this kind of infrastructure

3. A brief comparison of policy and market hurdles for energy efficiency:
   3.1. The lifespan of demand side and supply side assets
   3.2. Overview of supply side market interventions

The current asymmetry between supply side and upstream investment and demand side improvements, including our building stock, needs to be closely examined as part of future infrastructure investments. We are calling for a substantial consideration of demand side technologies as a UK infrastructure strategy is developed.

1. UK buildings: our most important infrastructure

The energy needed to heat our built environment is not fixed; it is wrong to see this as set in stone. Upgrading the infrastructure that we live and work within – namely the UK building stock – is an essential part of building a modern, workable, energy system.

In a recent paper, Frontier Economics, a consultancy, shows that energy efficiency fits clearly within each of HM Treasury's eight characteristics as defined by their valuation guidance[1].

Moreover, the research by Frontier emphasises that:

> *Domestic energy efficiency investments can free up energy sector capacity just as effectively as delivering new generation plant, networks or storage would. Energy efficiency investments provide public services, by reducing carbon emissions and improving health and wellbeing. They also provide option value in the face of uncertainty over future energy sector conditions (e.g. uncertainty over future fuel prices).*
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> Energy Efficiency, an Infrastructure Priority – Frontier Economics, October 2015

When balanced against wider infrastructure investment, the Energy Savings Trust notes that a rollout of energy efficiency provides a comparable economic return to HS2[2]. This statement is drawn from work completed in 2014 by Cambridge Econometrics who looked at the rate of return for Government for every £1 spent on investing in a large scale energy efficiency rollout[3]. They concluded that such a programme would have a rate of return of 2.27 : 1 under standard benefit cost ratio (BCR) calculations. BCR calculations by the Department for Transport in making the case for HS2 begin at between 1.4 : 1 and 1.6 :1 and rise to 2.5 : 1 if wider benefits and later stages of the programme are included.[4]

2. Benefits for the UK energy system, and for homeowners

The economic underpinning for improved energy efficiency is solid, and some of the programmes used to improve building fabric have been successful. Government energy efficiency schemes have been shown to have an impact on UK gas usage between 2005 – 2013 where the UK managed to reduce domestic median gas usage by 30%[5]. This trend began before the global recession of 2008, making significant improvements to building fabric during this period a clear factor. In today's prices, that 30% represents at least £5 billion pounds in annual household bill savings. This is money that UK consumers are saving on energy bills which can be spent in the wider economy. Such a scheme would also create over 100,000 jobs.

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[1] Supplementary Guidance to the Green Book – HM Treasury, March 2015

[2] http://www.energysavingtrust.org.uk/blog/2015/09/are-we-failing-understand-wider-benefits-energy-efficiency

[3] Building the future – Cambridge Econometrics, November 2014: http://www.energybillrevolution.org/wp-content/uploads/2014/10/Building-the-Future-The-Economic-and-Fiscal-impacts-of-making-homes-energy-efficient.pdf

[4] The Economic Case for HS2: Value for Money – Department for Transport, January 2012

[5] National Energy Efficiency Database, Analysis report 2015 – Department for Energy and Climate Change

Previous schemes, including those referenced above, have often attempted to treat a social problem – that of fuel poverty and high energy bills – rather than working to upgrade building infrastructure. This means that money spent has been targeted, quite rightly, at people in need. But additional money to future proof buildings and bring the whole of our built environment 'up to par' has not been so widespread or successful.

It is of course essential for Government to work to help homeowners, without breaching the imperative that Homeowners have to manage their own properties as they see fit, and as suits their own lifestyles and needs. However, Government also has a duty to help ensure that people have access to new technology that can benefit them and save them money, without exposing them to unnecessary costs. Especially if these are avoidable costs from rising or unstable energy prices, or from economically sub-optimal Government programmes that restrict available options.

Change in the home is already happening

Smart meters are a new tool representing a significant infrastructure upgrade to every home. They will help to monitor, and ultimately manage, shifting pressures upon UK energy system requirements centrally and with an in home display, or connected computer, can help individuals understand how they spend their money. Smart meters are rightly one of the UK's infrastructure priorities, but in order to fundamentally master the energy that we use as a country, we need to help people to improve the fabric of the buildings that they live and work within. If smart meters are seen as a stand-alone solution with homes remaining under insulated, costs to bill payers will be higher than they need to be even if they switch supplier.

The continuous development of technology and the 'Internet of Things' has already led to in-home environmental management systems entering the market. Npower have partnered with Google to provide the Nest learning thermostat, British Gas have rolled out remote controlled heating systems through their Hive thermostat and app pairing. This kind of development will only increase, and it is essential for the UK infrastructure strategy to recognise the interconnection between these developments, and allow for these kinds of innovations to work with wider fabric improvements and policy incentives that help to reduce the heating requirements that homes have currently.

3. Policy and market hurdles for energy efficiency

3.1. Asymmetry of supply side and demand side assets

3.1.1. Supply side – Gas

Much of the heat we generate in the UK is fuelled by Gas. In 2004 the UK became a net gas importer. In recent years a number of tight supply margins have caused National Grid to issue warnings to the market as part of normal operating procedure, and prices have spiked to ensure that demand has been met in a timely fashion. Whilst there is no reason to assume that UK gas needs will not be met in the short or medium term, large manufacturers have expressed concerns about the degree of uncertainty that they face in

these situations. They have also noted a number of price concerns over longer periods of time. In this context, recent investment to handle gas demand has been met by short, medium and long term investments in:

- LNG import facilities, such as the Isle of Grain which opened in 2005 and expanded in 2008 and 2010 to help meet growing UK gas demand;
- Fast cycle gas storage, such as Aldbrough in Yorkshire opened in 2011 and owned by SSE;
- Pipeline upgrades as stipulated by National Grid in their recent evidence for the RIIO-GD1 price control agreement;
- Commercial investments by National Grid in ventures such as BritNed, which opened in 2011 and connects with the Netherlands.

These are largely recent investments to handle growing demand and dwindling supply from the North Sea. It is important to ensure a secure and robust flow of gas, but it is equally right to balance these investments against what we can to do moderate our use as a country. Especially if it is more cost effective.

3.1.2. Supply side - Electricity

Infrastructure used to generate electricity lasts a long time. Recent changes to the UK electricity market have helped to overcome the 'missing money problem' which has held back some investment here. However, some of the main sources of electricity generation currently in use have an asset lifespan of fifty years or more. For example:

- Drax Power Station began 'commercial' generation in 1975, though it was generating from 1974. It is physically able to run much longer than the Government announced closure of unabated coal power in 2024, by which time it will have been running for 50 years.
- Hinckley point A began generation in 1965 and was decommissioned in the year 2000 after generating for 35 years.
- Hinckley point B began supplying electricity to the national grid in 1967 and is expected to run until 2023, a total of 56 years.

As noted above, part of our increased reliance on electricity is from growth in consumer electronics and the expected growth in electric cars. This paper does not look at these more predictable electricity loads. However, wider – reasonable – pushes to increase the use of electricity in heating homes to help to balance growth of intermittent renewables and to help to decarbonise heat need to be looked at in relation to building fabric. For example, we do not know how much 'top up' electric heating is used to account for poor insulation. The current policy environment reflects the fact that we are in an investment cycle for medium and long term assets such as the above. It is right for a long term plan to consider investment here against wider investments that could be made in demand side solutions.

3.1.3. Demand side – the UK building stock

The majority of the UK building stock has lasted for significantly longer periods of time than all generation and gas supply assets. As a country that commendably seeks to preserve our national heritage, this is very likely to continue.

- More than 55% of all UK homes were built before 1964[6]. The first significant thermal building regulations were brought in to effect in 1965[7] when the 'u-value'[8] was set at 1.7[9].
- 22% of UK homes were built before 1919[10]. Even though recent reports suggest these homes have continued to gain the most value due to build size, location and quality, these properties are often the hardest to insulate up to modern standards, requiring specialist investment.

New generation is being developed and it is right to modernise the way that electricity is generated so that we make best use of resources and maintain our global ability to compete. However, as you can see from the above, significantly more than half of the domestic demand side – particularly for heat – is already past the 50 year life span expected of generation assets. Moreover, the aesthetically desirable, and often most costly properties, are at least a century old, if not substantially older.

In an economic environment where cost effectiveness needs to be well considered, it is essential to make the opportunity to improve homes available to homeowners. Long term planning from a central body such as the NIC would also help to ensure that when investments by individuals or corporate bodies are made to improve buildings, thereby helping the UK as a whole, policy acts to make these improvements as economically efficient as possible.

In a recent speech[11], Amber Rudd noted that the new framework for funding could not see subsidy as part of a business model. She is entirely right. However, as acknowledged in the same speech, the constraints that are faced in the current investment cycle show that all technologies providing generation currently require some incentive to help manage the risks seen by investment committees.

The capacity market helps to ensure traditional gas generation is available for peak loads, contracts for difference create a clear incentive for renewable generation. Each of these address the 'missing money problem' that many see as hampering new investment. Upstream, tax incentives are being used to maximise exploitation of remaining North Sea oil and gas reserves alongside new incentives to boost UK domestic shale production.

It is right that all avenues be explored to maintain UK energy security. To do it cost effectively, a clear understanding of how demand is constituted and can be shifted also

[6] English Housing Survey 2010 – Department of Communities and Local Government
[7] UK Building Regulations 1965, Statutory Instrument 1965 No. 1373.
[8] U-values measure the effectiveness of a material as an insulator in buildings.
[9] The U-value was improved to 1 in 1975 to help conserve energy in new build homes following the oil crisis of that year.
[10] English Housing Survey 2010 – Department of Communities and Local Government
[11] https://www.gov.uk/government/speeches/amber-rudds-speech-on-a-new-direction-for-uk-energy-policy

needs to be undertaken. This means a clear assessment of the UK building stock. At present, incentives are not well aligned to address this half of the energy system. A balanced infrastructure approach would help to resolve this.

3.2. Regulatory drivers for supply

The economic underpining for the UK energy system is formed from interlocking market arrangements. These were most recently tweaked by the electricity market reform package in the Energy Bill 2014.

In simple terms the electricity market, as currently constructed, seeks to match demand and supply levelling punitive costs upon market players that incorrectly predict the supply that is required – purchasing too little or too much and therefore being 'out of balance'. The costs extracted from those who are out of balance are used by National Grid to make real time adjustments to the system, maintaining system frequency and keeping the lights on throughout the day, night, month and year. A similar process takes place for gas.

Managing supply and demand in this short term manner way works well on a daily basis, but it does little to consider the long term health of the system. Moreover, these arrangements do not allow for wider benefits to the system to be recognised at all – particularly for electricity – if they can not be priced within the minute by minute, second by second, market framework that has been constructed.

In pursuit of clear and commendable national benefits – particularly energy security – the Government has recognised that long term pushes are needed that are external to the current market framework.

- The introduction of Contracts for Difference (CfDs) as part of a reform of the electricity market in the Energy Act 2014 has created a system of contracting that sets the price of electricity provided by low carbon generators. This creates clear, long term certainty for the delivery of large projects.
- The capacity market is an additional boost to supply, working outside of the current electricity contracting system, which allows providers to bid in to be available to provide capacity at set times of noted system stress. This is intended to provide money to ensure that ensures generation capacity is available – no matter if it is used – at times when the UK electricity system is under stress. Some demand side measures are being trialled under this system, but only as a reactive measure, not as a long term reduction.

Each of these mechanisms is designed to overcome the 'missing money problem' which has caused a lack of significant investment in energy generation due to insufficient market incentives and provide long term stability for investors.

Although able to provide additional security, there has been a noted absence of long term certainty over the same period for demand side investment. Following the Autumn Statement 2015, the Chancellor is to be commended for ensuring that the next iteration of the energy company obligation – which will focus specifically upon the fuel poor – will last for five years.

For the majority of UK homes, however, and especially those built before 1919, incentives to date have been constructed in such a way that the financial impetus to improve a property – although present – is too complex to pursue, or the payback is too long to be seen as a reasonable investment if not linked to a mortgage. Scrapping the Zero Carbon Homes policy – which had been in development for nearly ten years – has also not helped investor confidence.

Conclusion

If a cost effective route to a modern energy system is to be achieved, we need a more comprehensive approach to our national built environment is needed. We suggest that the national infrastructure strategy considers this in detail on an equal footing to supply side energy concerns in a near term dedicated investigation.

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