Fixing the roof while the sun is shining

A briefing for the National Infrastructure Commission

on the home energy efficiency infrastructure opportunity

Introduction

The National Infrastructure Commission (NIC) has been asked by Government to investigate the UK's infrastructure needs and has issued a consultation on several Government priorities, including transport infrastructure requirements in London and the north of England and how best to balance electricity supply and demand.

These investigations are welcome, but there is a gaping hole at the heart of the National Infrastructure Plan that must be fixed. That most crucial element of infrastructure – the fabric of our existing housing stock – is missing from the Government's list of infrastructure priorities.

On 25th November 2015 the Government set out its plans in the Comprehensive Spending Review for investing £120 billion of public capital funds in infrastructure projects[1]. This included £10 billion of investment in new housing infrastructure and regeneration and £20 billion for building schools[2]. But no infrastructure funds were allocated for a retrofitting programme to make UK homes energy efficient.

Yet our existing UK housing infrastructure is in poor condition. As a result the UK has one of the highest rates of fuel poverty and Excess Winter Deaths in Western Europe[3]. Our homes are also responsible for over a quarter of the UK's carbon emissions and these emissions must be almost entirely eliminated in the first half of this century. These challenges simply cannot be addressed without making UK homes energy efficient. To achieve this means recognising home energy efficiency as an infrastructure opportunity.

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[1] Treasury, Spending Review Nov 2015
[2] Treasury, Spending Review Nov 2015
[3] ACE, Cold Man of Europe Update, Oct 15

This is entirely appropriate as domestic energy efficiency can be classified as infrastructure[4]. A public investment of approximately £49 billion is required to make the UK housing stock energy efficient, bringing 21 million homes up to at least Band C on an Energy Performance Certificate. The investment required is on average £2.5 billion / year if it was spread over the next 20 years.

Following the Spending Review the Government is committed to spending only £650 million each year on energy efficiency measures, raised from the Energy Company Obligation. This means an additional investment of £1.85 billion is needed each year. Given that over the next 5 years the Government plans to spend £24 billion every year on capital projects[5] this would represent only 6.6% of the capital infrastructure budget.

In this briefing we highlight evidence showing that such an investment is not only affordable, it is also an extremely good investment for UK plc.'

We call on the National Infrastructure Commission to launch a consultation on how best to make the existing housing infrastructure energy efficient and de-carbonise our heating infrastructure in the most cost effective way.

The poor condition of existing housing infrastructure

All UK homes need to be brought up to Band C or above on an Energy Performance Certificate in order to make them energy efficient and so minimise fuel poverty and meet our carbon budgets[6]. There are 26 million existing homes in the UK and **21 million UK homes have a poor standard of energy efficiency, rated below EPC Band C[7]. This means that approximately 80% of UK homes need their energy efficiency to be improved.**

The Association for the Conservation of Energy (ACE) analysed the latest official European Commission data to compare the state of the UK housing stock and fuel poverty levels with 15 other European countries. They found that:

- The UK has amongst the lowest energy prices, with the lowest gas price, but ranks 14th out of 16 on the affordability of space heating[8].
- The UK ranks 14th out of 16 for fuel poverty[9].
- The UK ranks 12th out of 16 for households reporting that their home is in a poor state of repair[10].
- In terms of energy efficiency, out of 11 countries for which data is available, the UK's walls are ranked 7th, roofs are ranked 8th, floors are ranked 10th and windows are ranked 11th[11].

[4] Frontier Economics, Energy Efficiency as Infrastructure, Sep 2015
[5] Treasury, Comprehensive Spending Review, Nov 2015
[6] Cambridge Econometrics and Verco, Building the Future, Oct 2014
[7] ACE, Cold Man of Europe Update, Oct 15
[8] ACE, Cold Man of Europe Update, Oct 15
[9] ACE, Cold Man of Europe Update, Oct 15
[10] ACE, Cold Man of Europe Update, Oct 15
[11] ACE, Cold Man of Europe Update, Oct 15

ACE concluded that no other country of the 16 comparable European countries assessed performed as poorly overall as the UK across the range of housing indicators[12].

Reducing Energy Demand – The first energy infrastructure priority

Reducing energy demand is the most cost effective way to free up additional energy capacity and this is why it has been described by the International Energy Agency as *'an invisible powerhouse'* and the *'world's first fuel'*[13].

The Climate Change Committee estimates that to comply with future carbon budgets under the Climate Change Act the power sector will need to largely decarbonise by 2030, to an average grid intensity of around 50-100 gCO2 /kWh[14]. This challenge is all the greater because the Committee on Climate Change projects that the significant electrification of the heat and transport systems will be required[15].

It is essential to be aware that much more energy is needed to provide space heating and hot water to our residential and commercial buildings than to provide power and other services. In residential buildings 83% of energy is used in this way and in commercial buildings it is 64%[16]. It is therefore essential to decide on the projected energy performance of the built infrastructure, in order to optimise the methods of heat generation and distribution as well as to understand the impact on future electricity needs.

Total current levels of heat consumption in the UK are approximately 750TWh pa. Approximately 20% of this is attributable to the industrial sector, but about 600TWh is needed to generate space heating and hot water in residential and commercial buildings[17].

Most energy system scenarios to meet the UK's carbon budgets assume that heat pumps will be the main replacement for gas[18]. **But even meeting 20% of demand for heat using heat pumps would almost double the peak electricity demand by 2030 unless overall demand can be reduced[19].**

That is why, under all major energy model decarbonisation scenarios analysed by UKERC, a reduction in heat consumption of buildings of 20-30% is required by 2030[20].

To reach this heat reduction target by 2030 requires a significant infrastructure investment programme in the energy efficiency of existing buildings. To achieve this, approximately 1 million properties per annum will need to be treated[21], roughly equivalent to the peak deployment levels under previous schemes, such as CERT, but with a wider and deeper range of measures in each property.

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12 ACE, Cold Man of Europe Update, Oct 15
13 International Energy Agency, Energy Efficiency Market Report 2014
14 Climate Change Committee, Power Sector Scenarios for the 5th carbon budget Oct 15
15 Climate Change Committee, Power Sector Scenarios for the 4th carbon budget 2014
16 DECC, Energy Consumption in the UK, 2014
17 DECC, Delivering UK Energy Investment, 2014
18 UKERC, Which Energy Scenario? Time to Decide, 2015
19 Sansom, The Impact of Future Heat Demand Pathways, 2012
20 UKERC, Which Energy Scenario? Time to Decide, 2015
21 UKERC, Which Energy Scenario? Time to Decide, 2015

At the moment the Government has a target of insulating 1 million homes in the next 5 years, or 200,000 homes per year. One energy efficiency measure per home has been delivered under ECO. If this rate is continued it would take 250 years to make all UK homes energy efficient[22].

The Energy Company Obligation programme is funded by a levy on energy bills. Although the Government has recently announced that some form of supplier obligation will continue up until 2022, the Government only plans to fund home energy efficiency via such an obligation, with no public funding support. This will be the first Parliamentary term in the last 30 years that there will have been no public funding in England for home energy efficiency.

Due to concern about the impact of levies on energy bills, the Government has cut the rate of this levy from £56 / consumer / year to £26 / consumer / year[23]. But this means there is not enough investment available in home energy efficiency to meet the 4th carbon budget or to meet the obligation in the UK's fuel poverty strategy to get all fuel poor homes up to EPC Band C by 2030.

A key part of the infrastructure programme to deliver a low carbon energy system, including balancing electricity supply and demand, therefore has to include making the UK building stock energy efficient, using public infrastructure capital to provide the long term revenue stream to help fund it.

The building blocks for an energy efficiency infrastructure programme

There are three key elements of an energy efficiency infrastructure programme:

A long term goal: Firstly, the Government needs to set a long term home energy efficiency goal, to give confidence to investors in the infrastructure pipeline and help facilitate a clear delivery plan. To meet carbon reduction targets and fuel poverty obligations, a commitment is required to make all UK homes energy efficient by 2035, within 20 years. A target to bring 1 million homes up to EPC Band C each year is needed.

A strategic infrastructure delivery programme: A devolved approach would work best, allowing local authorities to plan an area based scheme. Low income areas would be the primary focus for improvements, with support also provided to vulnerable households outside these areas. This is the basic approach undertaken in Scotland and is recommended by many leading businesses, fuel poverty groups such as ACE and NEA and the leading consumer group Citizens Advice, as the most effective[24].

Infrastructure investment: The Government has set a cap of £650 million / year to be raised from the Energy Company Obligation to support the delivery of energy efficiency measures[25]. For a programme to bring all UK homes up to EPC Band C within 20 years, a public investment of approximately £2.5 billion is required each year to cover both grants for low income households and subsidised loans for the able to pay[26].

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[22] Energy Bill Revolution: 2015
[23] Treasury, Comprehensive Spending Review, Nov 2015
[24] Citizens Advice, Closer to Homes, May 2015
[25] Treasury, Comprehensive Spending Review, Nov 2015
[26] Cambridge Econometrics, Building the Future, Oct 2014

That means that on the assumption a supplier obligation continues at the same level, the energy efficiency investment level in existing buildings needs to be raised by £1.85 billion per year on average if the investment was to be evenly spread over the next 20 years.

This means that the current level of investment in domestic energy efficiency set by the Government is only a quarter of the annual investment required and it has only been agreed to 2022. So the investment is neither large enough nor long enough. This is a direct consequence of the Government failing to adopt a long term infrastructure vision to make the entire UK housing stock energy efficient at the scale and speed required to meet carbon budgets.

The Economic Case for Energy Efficiency as Infrastructure

The home energy efficiency market can stimulate both construction and manufacturing industries. Over 135,000 people are currently employed in the energy efficiency industry[27]. By improving all the UK's existing homes, business opportunities would be spread across the country and the investment has the potential to boost local employment and regional economic growth[28]. Up to 108,000 extra jobs could be created across the economy[29].

A building programme to make homes energy efficient has the advantage that many projects are 'shovel ready' unlike many other infrastructure projects that have to go through major planning processes. There is already a pent up funnel of projects which could be aggregated and delivered quickly if the infrastructure funds were made available.

The energy efficiency sector has enormous potential to attract investment and provide a major source of additional income for central Government. For every €1 of public funds spent on the KfW Energy-efficient Construction and Refurbishment programme in Germany in 2010, over €15 were invested in construction and retrofit, and more than €4 went back to the public finances in taxes and reduced welfare spending[30].

Exports from the UK's energy efficiency sector were already worth over £1.8 billion in 2011-12[31]. Establishing a domestic energy efficiency market delivering at least 1 million deep retrofits a year would place UK industry in a prime position to further increase the export of knowledge, skills and products to other countries.

There are two major reports by two of the UK's leading economic consultancies which have examined the economic impact of making home energy efficiency an infrastructure priority. Both use different methodologies for estimating the net benefits but both conclude that those benefits are substantial.

a. Frontier Economics: Energy Efficiency as Infrastructure

Frontier Economics published a report in September 2015 examining the case for energy efficiency as infrastructure. They reached the following conclusions:

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[27] Department of Energy & Climate Change, Energy Efficiency Strategy: 2013 Update, Dec 13
[28] Department of Energy & Climate Change, Energy Efficiency Strategy: The Energy Efficiency Opportunity in the UK, Nov 12
[29] Cambridge Econometrics, Building the Future, Oct 2014
[30] KfW, Impact on public budgets of the KfW promotional programmes, 2011
[31] Department of Energy & Climate Change, Energy Efficiency Strategy: 2013 Update, Dec 12

- There is a strong case for Government to make home energy efficiency an infrastructure investment priority and to develop an infrastructure programme to deliver it[32].
- Examination of academic and official citations of infrastructure demonstrates that energy efficiency investment can be classified as infrastructure. Domestic energy efficiency investment can free up energy sector capacity just as effectively as delivering new generation plants, networks or storage[33].
- Energy efficiency investments provide public services, by reducing carbon emissions and improving health and wellbeing. They also provide option value in the fact of uncertainty over future energy sector conditions – eg uncertainty over future fuel prices.
- An energy efficiency programme would meet the criteria HM Treasury apply for determining their top 40 infrastructure requirements. It would also fit with the eight characteristics of infrastructure identified in HM Treasury's valuation guidance. In addition, classifying energy efficiency as infrastructure is consistent with the way energy efficiency is considered by a range of international organisations such as the European Investment Bank (EIB) and the International Energy Agency (IEA)[34].
- Energy efficiency investments provide value for money. Analysis of Government Impact Assessments shows that they have comparable benefits to other major infrastructure investments. In fact, a programme to make British buildings more energy efficient would generate £8.7 billion of net benefits[35]. This is comparable to benefits delivered by the first phase of HS2, Crossrail, smart meter roll out or investment in new roads. This finding holds, even without quantifying many of the key social benefits of energy efficiency measures, including health and wellbeing improvements[36].
- An infrastructure programme to deliver energy efficiency measures can overcome key barriers to delivery. The market failures around energy efficiency provide a strong case for Government intervention. As part of a broad energy efficiency programme there are benefits to delivering a coordinated area-based scheme under a directly funded approach. This could be used to target the consumers who would benefit the most[37].
- The incremental nature of energy efficiency investments means that strategies can be changed as new information comes to light. This flexibility is not possible with more lumpy capital investments such as nuclear power plants.

b. Cambridge Econometrics: Building the Future

This report, published in October 2014, undertook detailed modelling to assess the economic, fiscal, and environmental impacts of bringing all UK homes up to EPC Band C with grants for the fuel poor and low interest loans for able to pay households. It captured broader macro-economic benefits than the Frontier analysis which was focused on Government micro-economic modelling. It concluded the following:

[32] Frontier Economics, Energy Efficiency as Infrastructure, Sept 2016
[33] Frontier Economics, Energy Efficiency as Infrastructure, Sept 2016
[34] Frontier Economics, Energy Efficiency as Infrastructure, Sept 2016
[35] Frontier Economics, Energy Efficiency as Infrastructure, Sept 2016
[36] Frontier Economics, Energy Efficiency as Infrastructure, Sept 2016
[37] Frontier Economics, Energy Efficiency as Infrastructure, Sept 2016

- **The economic case for making the energy efficiency of the UK housing stock a national infrastructure priority is strong.**
- **£3.20 returned through increased GDP per £1 invested by government[38].**
- **0.6% relative GDP improvement** by 2030, increasing annual GDP in that year by £13.9bn[39].
- **£1.27 in tax revenues per £1 of government investment**, through increased economic activity, such that the scheme has paid for itself by 2024, and generates net revenue for government thereafter[40].
- **2.27 : 1 cost benefit ratio** (Value for Money), which would classify this as a "High" Value for Money infrastructure programme.
- **Increased employment by up to 108,000 net jobs per annum over the period 2020-2030**, mostly in the service and construction sectors. These jobs would be spread across every region and constituency of the UK[41].
- **£8.61 billion per annum in total energy bill savings** across housing stock, after comfort take (including energy price inflation)[42].
- **Net benefit of £4.95 billion per annum** from the total energy bill savings across the housing stock (after able-to-pay energy efficiency loans have been repaid)[43].
- **23.6MtCO_2 reductions per annum by 2030**, after accounting for direct, indirect, and economy-wide rebound effects. This is roughly equivalent to cutting the CO_2 emissions of the UK transport fleet by one third[44].
- **Improved health and reduced healthcare expenditure**, due to warmer and more comfortable homes, and improved air quality. For every £1 spent on reducing fuel poverty, a return of 42 pence is expected in National Health Service (NHS) savings[45].
- **A more resilient economy**, less at risk of shock changes in gas prices, as the economy becomes less reliant on fossil fuels**. Investment in energy efficiency in the domestic sector could result in a 26% reduction in imports of natural gas in 2030, worth £2.7bn in that year**[46].

Increase Energy Security

Energy efficiency can improve the UK's energy security and reduce our reliance on imported gas. Reducing domestic energy demand through energy efficiency is vital to ensure there is sufficient supply to meet the UK's energy needs. Demand reduction is critical to guaranteeing a secure energy supply and stable prices, and minimising the costs of new generating capacity and imported fossil fuels. Investing in energy efficiency is a more cost effective approach for meeting the UK's growing demand for energy than building additional energy generation infrastructure. Energy saving

[38] Cambridge Econometrics, Building the Future, Oct 2014
[39] Cambridge Econometrics, Building the Future, Oct 2014
[40] Cambridge Econometrics, Building the Future, Oct 2014
[41] Cambridge Econometrics, Building the Future, Oct 2014
[42] Cambridge Econometrics, Building the Future, Oct 2014
[43] Cambridge Econometrics, Building the Future, Oct 2014
[44] Cambridge Econometrics, Building the Future, Oct 2014
[45] Cambridge Econometrics, Building the Future, Oct 2014
[46] Cambridge Econometrics, Building the Future, Oct 2014

measures cost less on average per unit of power than large-scale power generation[47]. Through cost-effective investment in all forms of energy efficiency, the UK could be saving 196TWh in 2020, equivalent to 22 power stations[48].

Meeting energy needs through demand reduction will reduce our dependence on imported fossil fuels and increase national security. In 2004 the UK ceased to be self–sufficient in gas and in 2012 net imports of gas accounted for just over 40 per cent of gas use[49]. By 2020 the UK is expected to import more than half its oil and gas[50]. The UK could reduce its reliance on imported gas by 26 per cent in 2030 by making UK homes more energy efficient, saving £2.7 billion in gas imports per year[51].

Reduce Carbon Emissions

The Climate Change Act 2008 commits the UK to reduce carbon emissions by 80 per cent by 2050. Carbon budgets are set for each five year period up to 2050 in order to track progress towards this reduction target. Binding EU targets also require carbon reductions of 20 per cent by 2020 and 40 per cent by 2030. Achieving these significant levels of carbon reductions will require a complete transformation of the UK's existing homes to dramatically reduce domestic emissions. **The speed of the cuts needed is also likely to increase following the Paris Agreement that has set a goal of limiting the global temperature increase to 'well below 2C' and pursue efforts to limit warming to 1.5C.**

85 per cent of the UK's existing homes will still be standing and in use in 2050, presenting a significant low carbon refurbishment challenge[52]. To meet carbon reduction targets all UK homes will have to be made energy efficient within the next 20 years.

Reduce energy bills and fuel poverty

Domestic energy efficiency is the best way for households to gain control of their energy bills and insulate themselves against future price rises. By installing insulation measures households can reduce their heating use by up to 40%, saving £6 billion in heating costs nationally each year[53].

4.5 million households are classified as being in fuel poverty in the UK, based on the two different definitions used across the UK. In England there are 2.5 million households in fuel poverty[54]. The only permanent solution to fuel poverty is to retrofit the existing housing stock to a high level energy efficiency.

Improve Health and Well Being

Energy inefficient homes are not only expensive to heat but can also damage the health of their occupants. Cardiovascular and respiratory diseases are caused or worsened by living in cold

[47] Sustainable Energy Association, Clean energy measures in buildings are cheaper, Apr 14
[48] Department of Energy & Climate Change, Energy Efficiency Strategy: The Energy Efficiency Opportunity in the UK, Nov 12
[49] Energy Bill Revolution, Re-build Britain; June 14
[50] Department of Energy & Climate Change, The Carbon Plan, Delivering our low carbon future, Dec 11
[51] Cambridge Econometrics, Building the Future, Oct 2014
[52] Federation of Master Builders, Strategy for low carbon and building refurbishment market, May 13
[53] Energy Bill Revolution, Re-build Britain, Jun 14
[54] ACE, Cold Man of Europe Update, Oct 15

conditions. Children living in cold homes are significantly more likely to suffer from chest problems such as asthma and bronchitis[55]. Fuel poverty also adversely affects mental health. More than 1 in 4 adolescents living in cold homes are at risk of multiple mental health problems compared to 1 in 20 adolescents who have always lived in warm housing. Cold homes negatively affect children's educational attainment and emotional wellbeing[56].

An estimated 43,900 excess winter deaths occurred in England and Wales in 2014/2015[57] and around 30 per cent of these are likely to be due to cold homes[58]. The UK has one of the highest excess winter death levels in Europe despite our moderate climate, with deaths in the coldest quarter of housing almost three times higher than in the warmest quarter[59]. Many of these excess winter deaths could be prevented through warmer housing[60]. Investing in energy efficiency can help protect the health of residents and offset health spending on treating preventable illnesses.

NHS expenditure has been reported to rise by 2 per cent in the cold months[61]. Age UK has calculated that the annual cost to the NHS in England of cold homes is £1.36 billion[62], as well as the associated cost to social care services, which is likely to be substantial.

Conclusion

Fixing the UK's existing, leaky housing stock is a huge infrastructure opportunity. Not only does the government's own economic data show that it would deliver comparable economic returns to other major infrastructure projects, but it is an essential investment to strengthen energy security, end fuel poverty and meet our carbon budgets.

The Government has recognised in its infrastructure plan that new buildings must be included. But now is the time to include a retrofitting programme to eliminate energy waste in our homes. It is one of the most widely supported infrastructure solutions in the UK today, with over 200 major businesses, cities, unions and charities in support[63], including the CBI, Age-UK and Citizens Advice.

We call on the National Infrastructure Commission to launch a consultation on how to make our existing housing infrastructure energy efficient and de-carbonise our heating infrastructure in the most cost-effective way.

Now is the time to make our homes fit for the 21st century.

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55 Marmot Review, The Health Impacts of Cold Homes and Fuel Poverty, May 11
56 Marmot Review, The Health Impacts of Cold Homes and Fuel Poverty, May 11
57 ONS, Excess Winter Deaths, England and Wales, Nov 15
58 World Health Organisation, Environmental burden of disease associated with inadequate housing, 2011
59 Marmot Review, The Health Impacts of Cold Homes and Fuel Poverty, May 11
60 Public Health White Paper, 2010
61 Marmot Review, The Health Impacts of Cold Homes and Fuel Poverty, May 11
62 Age UK, Cost of the Cold, Nov 12
63 http://www.energybillrevolution.org/whos-behind-it/

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