To: **ESI Sector Executive Committee**

CC: **Science Engineering & Sustainability Advisory Committee**

5 November 2015
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Dear Colleague

Prospect's submission: Designed for a different past

Attached is the Prospect submission to the Energy and Climate Change committee inquiry into the UK's low carbon electricity network infrastructure. The submission may also be downloaded via https://library.prospect.org.uk//download/2015/01330

Highlighting member concerns raised at the 2015 sector Conference and using member expertise, the paper argues for a just transition to the low carbon economy with an emphasis on greater investment in people and assets.

The purpose of the Select Committee's inquiry is to investigate what changes are required from today's electricity infrastructure to build a low carbon, flexible and fair network.

Yours sincerely

Michael MacDonald & Beverley Hall

Negotiator & Research Officer

New Prospect House, 8 Leake Street, London SE1 7NN

T 020 7902 6600 **F** 020 7902 6667 **E** enquiries@prospect.org.uk **W** www.prospect.org.uk

Designed for a different past

Submission by Prospect (Union for Professionals) to the Energy and Climate Change committee inquiry into the UK's low carbon electricity network infrastructure

November 2015

www.prospect.org.uk

Latest revision of this document: https://library.prospect.org.uk/id/2015/01330
This revision: https://library.prospect.org.uk/id/2015/01330/2015-11-02

INTRODUCTION

1) Prospect is a democratic and politically neutral trade union, not affiliated to any political party, representing approximately 24,000 professionals in all areas of the electricity sector including staff in operational and engineering business; energy trading and supply; specialist corporate functions, sustainability and safety. We are the largest union in the UK representing professional engineers.

2) Whilst addressing climate change, environment impacts and ensuring energy security of supply - we recognise the UK electricity sector has experienced organisational upheaval since privatisation; changes of ownership; an aging workforce with a pressing need to replenish the workforce and retain key skills. At the same time, the UK has lost much of the intellectual property for infrastructure development with an increased dependency on foreign manufacturers as the higher value and higher skill work is performed overseas.

EXECUTIVE SUMMARY

3) The sector is in a period of substantial technological change moving from a traditional passive network to technically complex active smart-grids. Balancing change with increasing demand for electricity will affect how energy will be produced, transmitted, distributed and traded. Therefore we:

- support a balanced energy policy including nuclear new build and carbon capture and storage;
- call for a "just transition" plan to address the interlinked priorities of:
  - climate change adaptation with the move to a low carbon economy;
  - security and sovereignty of supply; and
  - strategic industrial policy linked to jobs and growth;
- support the need for a substantial programme of investment in transmission and distribution networks to maximise the potential of renewables;
- recognise that investment in all forms of energy generation is long-term in nature and requires a greater degree of financial certainty than given by current markets; and
- urge increased investment in people, skills development and knowledge transfer. The ability of the UK to meet the energy challenge rests on the skills and knowledge of our workforce.

4) Key concerns raised by Prospect members include:

- The intermittency of wind and PV generation in particular increases wear and tear on aging assets – resulting in safety and power quality issues, with increasing maintenance/repairs with risks of plant failure.
- The need to change network operations from passive to active with required investment and timescales to achieve this.
- The strain on resources resulting from the frenetic rush to connect as many projects as possible before the annual change in tariff levels deadline may have led to customers cutting corners.

LIMITATIONS OF TODAY'S ELECTRICITY INFRASTRUCTURE

Designed for a different past

5) The current transmission networks were constructed to process a continual flow of generated electricity, carrying large quantities of electricity across long distances through cables and overhead lines. The electricity transmission network carries high voltages of electricity at up to 400kV, which is more than 1,600 times the average domestic supply. By using extra-high voltages, the transmission system reduces losses.

The current structure is not designed for a modern smart network

6) Published in Prospect's energy sector journal, EnergyEye, we outlined the history of the UK's grid. "It is a network of wires that were designed in the late 1940's to early 1950's to connect large, centralised, mainly coal-fired, generation, near to water and easy links to coal pits and consumers in cities, towns and the country."

Intermittent generation of low carbon electricity

7) With the large-scale introduction of intermittent renewable generation, the current transmission and distribution structure is not well-equipped to provide a reliable and cost-effective system.

8) Prospect electricity Members are extremely concerned that the existing United Kingdom network infrastructure is unable to cope with the demands set by the Government's renewable energy strategy. The networks need improved technology and capacity to provide secure, safe and reliable electricity supplies. Regulation has focussed on cost rather than incentives for innovation and skills development to manage a modern smart network.

9) Government policy appears to lack a strategic response to the problems of connecting such a large number of embedded generators to an electricity network which was designed to connect a small number of large power stations. The increasing number of embedded generator connections (wind, solar and biomass) as a result of the various tariff incentives is causing concern for Prospect members working within electricity distribution and transmission. Intermittent generation presents issues of voltage control and the need to redesign maintenance cycles to reflect changed patterns of use. It is disappointing that the financial incentives for network operators to invest in training were removed at the most recent price review.

10) As the use of wind and solar increase from its current level of 8% to help meet renewable power targets set for 2012, we need a strategic overview of networks to determine what investment is required in equipment and skills. At the same time, we believe that additional infrastructure is needed to respond to the large fluctuations in output. We believe that the infrastructure required is a combination of additional skills, additional capacity and innovation designed to make most efficient use of existing equipment.

11) The German Fraunhofer Institute for solar energy systems 2012 research demonstrates the scale of the issue, "On a countrywide basis, the output varied over

more than two orders of magnitude from a minimum of 0.115 GW to a maximum of 24 GW."

Severe & extreme weather resilience

12) The Intergovernmental Panel on Climate Change Fifth Assessment Report, highlights the increasing challenges due to climate change, for energy production and transmission. A progressive temperature increase, along with an increasing number and severity of extreme weather events and changing precipitation patterns will affect energy production and delivery. In December 2013, the UK floods left some 50,000 homes across the country without electricity.

13) According to the World Energy Council in their "Road to resilience" report existing infrastructure must adapt and new energy infrastructures must be developed to withstand risks so that current and future energy supply is reliable and secure. Again we recommend that these issues are considered and solutions agreed to be delivered through the next regulatory review of prices.

Backdated maintenance and upgrade

Assets are being kept for longer and being worked harder.

14) Due to low investment from the mid-1990s, existing networks have little spare capacity to respond to changes in demand. At the same time, there is price competition for new networks. There needs to be clear technical guidelines for independent distribution network operators so networks under different ownership operate efficiently as a system.

HOW THESE LIMITATIONS CAN BE ADDRESSED

Investment

15) Our experience agrees with the Energy UK estimate of £30 billion needed to modernise the grid with the ultimate aim of a 'smart grid'. A true smart grid[i] will look at how all the different silo's – centralised generation, transmission, distribution, end-users cooperate more efficiently with each other to provide improved affordability, security and long term sustainability. It is envisaged that a smart grid would bring:

- More efficient transmission of electricity;
- Faster restoration of electricity after power disturbances;
- Reduction in peak demand; and
- Better integration of both small and large scale renewable energy generation.

16) The Energy Networks Association in their 2015 guide to energy networks, repeat the need for investment, "Over the coming years the UK energy networks require an unprecedented level of investment to maintain and replace ageing infrastructure, to meet the demands of a growing population and to connect new sources of low carbon energy to the grid. Investment priorities include:

Current policy conflict deters large scale investment

- flood mitigation;
- use of insulated overhead line conductors;
- rebuilding lines to a heavier construction specification;

- increasing lightning surge withstand capability; and
- automated switching to isolate faults and restore supplies.

17) It is clear that within the United Kingdom grid increased levels of transmission are also important with major upgrades and new lines planned, particularly from north to south to connect Scottish renewables with demand centres in the South East and reinforcements for the new, bigger nuclear plant.

18) An ETUI[ii] report, Europe's energy transformation in the austerity trap, states that developing smart grids is particularly important to facilitate the integration of renewable electricity supply and improve load balancing – and estimated EUR 140 billion is required for high voltage electricity transmission systems across the EU.

Clear, stable and cohesive policy framework

19) Since May 2015, the Government have reversed at least 10 green energy and energy efficiency policies, without any clear alternative strategic direction. For example:

- Changing and ending enabling policy and funding schemes such as Feed-in tariffs, onshore wind, climate change levy and replacing the Renewables Obligation with the Contract for Differences.
- Initiated to address discrepancies in the true net cost – the introduction in April 2015 of new RIIO price control framework across all 4 network sectors is as yet untested and unproven.
- Offshore Transmission Regime and The Integrated Transmission Planning and Regulation (ITPR) may well address future ambitions to reduce carbon emissions and replace existing infrastructure – they do however attract inbound investment but raises the question of sovereignty and ownership of the national asset

People & skills

20) DECC estimate that the development of smart grids will employ 9,000 people in highly skilled jobs over the coming decades with the potential to contribute £5 billion to the economy in exports as the UK takes a leading role in the smart grid field. However without prompt action to fund and encourage investment in skills, the UK will miss this business opportunity.

21) Whilst the current workforce levels are approximately 12,630 the National Skills Academy (Transmission & Distribution) 2015 report predict an increase of 62% on current levels is needed to ensure secure and sustainable energy supplies are maintained. The Energy Networks Association (ENA) however indicates a 74% increase. The ENA figures resonate with Prospect member experience of the overall challenges faced by the sector compounded by a chronic shortage of skills and an aging experienced workforce leaving the industry over the next decade. However Ofgem bases its price controls on a stable workforce: given that 97% of income is set by Ofgem this indicates that the UK runs a high risk of failing to get the skills and technology to meet domestic need let alone export potential.

22) In Prospect's 2013 submission to the Competition Commission Inquiry (Northern Ireland Electricity – Transmission and distribution price controls 2012-2017) we noted that 4 out of 5 employees in the sector is set to retire in the next

Prospect strongly supports further skills investment to meet the future energy challenge.

15 years. This position is compounded by difficulties in attracting and retaining graduate engineers amidst cross-sector competition for their skills.

Industrial policy linked to energy supply and solutions

23) As early as 1988[iii], Prospect (then the Institution of Professional Civil Servants – IPCS), has called for cohesion between industrial and energy policy and advocated for strategic, long term planning to ensure secure, competitively priced supply of energy from all sources. The impact of the 1972 OPEC oil embargo, the miners' strike and the government's state of emergency declaration, resulting in power cuts and electricity to industry being restricted to three days a week cannot be repeated.

24) A TUC report, Strategies for a low-carbon industrial future in Yorkshire and the Humber, shows that thousands of new jobs could be created through a new carbon capture and storage network, and 25,000 jobs in energy-intensive industries protected through new technology investment. This is a clear example of the benefits of co-ordinating industrial and energy policy.

25) At the heart of the region's low carbon future stands the White Rose Carbon Capture and Storage (CCS) project, planned for construction on land beside the existing Drax Power Station, Selby. The associated 200km carbon dioxide pipeline provides the potential to capture and store carbon emissions from the regions 26 power stations and heavy industry sites, such as steel and chemicals. The report adds that industrial clustering in this region lends itself to a shared infrastructure. This does however need integrated policy on energy and infrastructure.

Future Networks

26) In general, better interconnection within the GB grid and with other European grids is an important way of increasing the diversity of the whole system which, in turn, improves resilience. With more variable renewable generation on the system, there is the assumption that wider interconnection will smooth out some of the variations in supply but this should not be an excuse for under-investment in generation. The UK is already dependent upon electricity imports to meet normal demand.

Stakeholder involvement ~ the experience of successful partnership between unions and employers on health and safety shows the value of a partnership approach.

27) Given that networks are an inherent monopoly, then regulation is required to ensure that all parts of the country get fair access to distribution capacity that is vital to industrial investment. Given the impact on the local environment and local economy, we believe that Ofgem should improve its stakeholder and community engagement. This includes a return to the successful involvement of unions.

Incentives to improve technology

28) Ofgem's own electricity network innovation competition is indicative of the range and scale of innovation needed. In addition, other organisations support Prospect's call for more funding for innovation.

29) The Energy Technologies Institute state in their 2015 report, "There is no time to invent and deploy a set of novel breakthrough technologies and the cost of adaptation

will inevitably be higher than the cost of mitigation. The UK can allow itself a 35-year transition to low carbon, by developing, commercialising and integrating known but currently underdeveloped solutions. In the decade ahead the UK's low-carbon energy policy should focus on 'preparedness'. We have to develop options and explore trade-offs, while also testing our technical, operating, business and regulatory models at a sufficient scale to give stakeholders the confidence they need to commit to full-scale implementation."

30) The Royal Academy of Engineering report, A Critical time for UK energy policy – highlights the engineering reality of delivering the future energy networks: it recommends the retention of a centralised national transmission system but making the distribution system smarter.

31) Significant extra infrastructure is needed in order to smooth out this erratic output to meet long-standing demand profiles. Solar PV for example generates no power whatsoever for the majority of the time and delivers most of its energy in the few hours around noon. We believe that both technological and commercial change is required to provide incentives to fill the gaps in demand resulting from intermittent solar and wind.

Carbon capture and storage (CCS)

32) An ambitious roll-out of CCS technology would generate a large number of jobs, create a market worth £15-35bn by 2030, and reduce household electricity bills by £82 a year, according to a joint report published in 2014 by the TUC and the Carbon Capture and Storage Association (CCSA).

33) The report – The Economic Benefits of CCS in the UK – shows that a number of actions need to be taken by government in the immediate future to boost CCS and deliver significant benefits to the UK economy. Key findings from the report include:

- CCS plays a vital role in helping the UK meet its statutory target to reduce greenhouse gas emissions by 80 per cent by 2050. It has been estimated that without CCS, the cost of meeting this target will rise by £30-40bn per year.
- Inclusion of CCS in the mix of low-carbon technologies would result in a 15 per cent reduction in wholesale electricity prices – leading to an average cut in household bills of £82 a year.
- Each new-build CCS power plant would generate between 1,000 and 2,500 jobs in construction, with a further 200-300 jobs in operation, maintenance and the associated supply chain.
- CCS could help the UK to retain existing industries, such as coal and gas power generation, and support vital energy-intensive industries (such as chemicals, steel and cement manufacture) which employ 800,000 people directly and in supply chains.

The total economic benefits of CCS could reach £2-4bn per year by 2030

LESSONS FROM OTHER COUNTRIES

34) The UN 2015 Africa Progress report on Africa's energy revolution is not that dissimilar to the UK's experience including lack of investment, lack of maintenance to existing structures, skills shortages and policy deficits.

Vietnam:

35) The UN report cites Vietnam as a case study of high ambition and achievement in transforming their energy system. In 1990, only 14 per cent of the population had access to electricity – today nearly universal coverage. Electricity production rose by a factor of ten between 1990 and 2010. The factors behind Vietnam's success include the development of a central grid and a decentralized system, pragmatic market reform with strong regulation and financing provisions including community-level contributions and aid for financing energy structures for rural electrification.

36) The extension of the transmission and distribution grid played a critical role in facilitating Vietnam's transition to energy for all. Public investments in the 1990s created a network of high-voltage and medium voltage transmission lines, including a national North-South line, allowing power produced by major hydropower projects to be transmitted across the country.

Sub-Saharan Africa

37) Across Africa there has been a sharp increase in investment in electricity. Since 2010, the electricity sector has attracted around US$4 billion annually. Independent power providers (IPPs) have become an increasingly prominent feature of the energy landscape over the past 15 years. Few governments have embraced wholesale liberalisation or privatisation of their energy market.

38) What has emerged is a mix of state-owned utilities and regulatory system transformation to allow for growth and development. Emerging strategies include extending the existing grid and development of mini-grids comprising a single generator and low-voltage distribution network - designed to facilitate future connectivity.

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[i] Prospect's sector journal, EnergyEye (Issue 2, May 2014, page 7)

[ii] ETUI (European Trade Union Institute)

[iii] IPCS energy policy, report by the National Executive Committee, February 1988 (Chapter 2, Energy policy and the economy)