FACILITATING ENERGY EFFICIENCY IN THE ELECTRICITY SYSTEM

The Energy Institute (EI) welcomes the opportunity to submit the following response to the Department for Business, Energy & Industrial Strategy (BEIS)'s call for evidence for facilitating energy efficiency in the electricity system. This response has been created by collating the views of EI members on issues laid out in the call for evidence, which includes market barriers, creation of new markets, contributing to flexibility and the role of energy efficiency in the wider energy market.

About the Energy Institute

The EI is the chartered professional membership body bringing global energy expertise together.

We're a unique network with insight spanning the world of energy, from conventional oil and gas to the most innovative renewable and energy efficient technologies.

The global energy industry, the people working in it and wider society all benefit from the EI's work.

We gather and share essential knowledge about energy, provide the skills that are helping us all use it more wisely, and develop the good practice needed to keep it safe and secure.

We articulate the voice of energy experts, taking the know-how of around 20,000 members and 200 companies from 120 countries to the heart of the public debate.

And we're an independent, not-for-profit, safe space for evidence-based collaboration, an honest broker between industry, academia and policy makers.

Background

Amid increasingly ambitious climate change targets and challenging market conditions, energy efficiency has, for some time, been recognised as one of the most cost-effective ways of reducing global energy demand. Energy professionals see it not only as the most effective measure for meeting greenhouse gas emission reduction targets, but also as the best way to capitalise on the economic opportunities of the low carbon transition (Energy Barometer 2017[1]). As businesses and homeowners turn their attention in greater numbers to managing energy use, best practice and professionalism are needed to maximise benefits and capitalise on opportunities.

The EI supports businesses aiming to improve their energy performance by managing their energy use with greater efficiency. We provide training and guidance for professionals involved in energy management; either as independent consultants or as in-house experts responsible for managing energy within their organisation. Our resources range from introductory learning materials explaining the basics, to advanced qualifications and recognition for those who have achieved the highest level of competence as professional energy managers. Our Register of Professional Energy Consultants (RPEC) helps organisations in need of identifying specialists that can provide further advice and support. By collaborating with industry stakeholders, providing evidence for policymaking, and hosting industry-led conferences, we support good practice in energy management and efficiency to address the biggest challenges facing the current energy system.

[1] Visit energyinst.org/barometer to access the Energy Institute's Energy Barometer reports in full.

The EI places energy efficiency at the heart of the energy debate. Further to enabling continued progress in decarbonisation in a cost-effective way, energy efficiency also contributes to meeting other societal aims, primarily alleviation of fuel poverty. The EI's Energy Barometer revealed that energy efficiency is seen as key for a just low carbon transition across society. In the 2019 survey, some 40% of respondents believed the UK Government should focus on increasing funding for energy efficiency improvements benefitting low income households to best ensure the low carbon transition helps to alleviate fuel poverty. A further 12% thought there should be more stringent minimum efficiency standards.

Method

This response is based on views of EI members, collected via several member engagement activities about facilitating energy efficiency in the electricity system, including:

- A survey of qualified professional EI members on the specific consultation questions. A questionnaire was circulated to Chartered Energy Managers, members of the Register of Professional Energy Consultants and members of the EI Energy Management Panel, all of which represent the highest level of expertise in energy efficiency within EI's membership. Eleven respondents have completed the questionnaire in the three weeks leading up to 9 September 2019. The number of respondents for each question varied as questions were optional and respondents were recommended to provide evidence to questions that they found applicable to their expertise and interest. Their responses have been collated where possible or otherwise included as separate points and examples.
- The Energy Barometer, an annual survey of the EI College, a group of EI professional and pre-professional members.
- Ongoing consultation and engagement with industry specialists and subject matter experts.
- Other industry reports and analyses.

1. Executive summary of consultation responses

1.1. Market barriers to energy efficiency investment are predominantly covered by those described in the call for evidence. Within the market barriers described, measurement and verification, high implementation costs and behaviour change are particularly important. Additionally, inadequate skills and information pose a barrier to investment.

1.2. Communication, financial incentives and policy measures are the main mechanisms to overcome barriers to energy efficiency investment. Having a comprehensive national energy strategy which enhances collaboration between market participants and acknowledges energy efficiency as a fundamental component of the energy system is an overarching requirement for overcoming market barriers.

1.3. Making markets available to energy efficiency first and foremost requires valuing it correctly via better collection and utilisation of data. Nevertheless, trying to leverage current markets to facilitate energy efficiency may be counterproductive. A holistic approach that looks at where different solutions fit within the whole system would deliver greater benefits than many fragmented market mechanisms that are trying to address energy efficiency and flexibility separately.

1.4. New markets should encourage energy efficiency based on comparing actual usage against benchmarks, with users benefitting from the increased efficiency. There is significant value in learning from other sectors and focusing on the intersection of energy efficiency products and consumer behaviour when it comes to creating new markets for energy efficiency.

1.5. Decarbonisation is a global challenge and international collaboration is key; the UK has to learn from other countries in this process, even as it transfers its own experience and skills abroad. Germany is a good example where public awareness has successfully played its part in the high prominence of energy efficiency.

1.6. Looking at how energy efficiency measures can integrate with other solutions may be more cost-effective than focusing on how they can compete with other solutions as a potential alternative to network reinforcement. Integrating efficiency with other energy solutions can enable a project to deliver benefits greater than the sum of its parts.

1.7. There are benefits from combining energy efficiency and flexibility. In fact, with technological advances, many energy efficiency solutions are increasingly suited to also provide flexibility. Education of technology providers and in-house energy personnel is the first step towards maximising the benefits from combining energy efficiency and flexibility.

1.8. Aggregation of small energy efficiency projects into an investment portfolio can enable economies of scale to find greater value in the market. Setting industry standards for aggregation of energy efficiency and further development of intelligent systems and smart controls can attribute a greater role to aggregators for facilitating energy efficiency.

1.9. Existing policies have to be simple and coherent with each other. The whole policy package needs to ensure that the costs of complying with various schemes translates to results, and that the technical effort to maximise energy efficiency is not diluted by unnecessary administrative burdens.

1.10. Behaviour change should certainly be supported. It should be treated as an important means of delivering energy efficiency, alongside installation of measures and equipment, rather than as a tangential concept. Efforts should start from public awareness and engagement as well as accurate measurement and verification of behaviour change.

Responses to consultation questions

2. Do you agree with the market barriers to energy efficiency investment described? Do you think there are additional barriers?

2.1. Market barriers to energy efficiency investment are predominantly covered by those described. Within the market barriers described, measurement and verification, high implementation costs and behaviour change were repeatedly highlighted.

2.2. High implementation costs can lead to energy efficiency not finding its place as a primary action in business agendas. Although energy costs are high and rising, they are still relatively low for most UK businesses when compared with other business costs. Furthermore, energy efficiency typically competes with other business requirements for the same investment budget. Even when the argument for energy efficiency is clear, other investments are prioritised because they are seen as more urgent or can provide a better return on investment than energy efficiency.

2.3. Measurement and verification is the only way to accurately attribute financial savings to energy efficiency projects and therefore is the first step to calculate expected returns and justify investment. Overcoming barriers relating to measurement and verification comes down to having the necessary data systems in place, which has market barriers to investment of its own. These potential barriers relate to a lack of top-level commitment, the upfront resources required to design and deliver fully scoped data solutions as well as the level of ability and desire to capitalise on them.

2.4. Furthermore, measurement and verification of energy efficiency should encompass not only financial costs but also environmental impacts. This requires looking at the whole life cycle of an energy efficiency investment. For instance, switching to LED lights could decrease operational carbon emissions by reducing electricity consumption, but have higher embodied carbon than traditional incandescent bulbs. Carbon cost is an externality and therefore does not automatically factor into investment decisions.

2.5. Additionally, inadequate skills and information can undermine energy efficiency investment. Individuals managing energy efficiency programmes within businesses need to be equipped with the specific set of skills and knowledge required to lead on this work. Similarly, consultants need to be sufficiently experienced and/or professionally qualified to recommend appropriate solutions. Respondents suggested that this is not always the case and the resulting confusion creates a new barrier to investment.

3. What are the ways we can overcome the market barriers to energy efficiency investment?

3.1. Respondents suggested communication, financial incentives and policy measures as the main mechanisms to overcome barriers to investment. Overcoming many of the market barriers requires a comprehensive national energy strategy that acknowledges energy efficiency as a fundamental component of the energy system. Policies should encourage collaboration between

energy users, energy suppliers, meter operators and infrastructure providers. Some of these market participants currently experience a disconnect.

3.2. Raising the profile of energy efficiency among energy users, as well as establishing a better understanding of its benefits and the underlying technologies, could improve uptake in the most cost-effective manner. There is a need to demystify the techniques behind energy efficiency, given that final-decision makers are typically not from technical energy backgrounds. Examples given include awareness campaigns in the media, sharing evidence of success through energy data, and standardising energy billing in a way that separates fixed costs from controllable costs. In the business context, the financial benefits of energy efficiency should be communicated more effectively to key target audiences, particularly finance directors and senior management teams.

3.3. The financial argument for energy efficiency has to be robust and sufficient to reward all parties along the supply chain involved in delivering a project, including energy consultants, equipment suppliers and infrastructure providers, as well as the end user. Financial incentives suggested include:

3.3.1. Micro-credits for small energy efficiency projects.

3.3.2. More repayable funding made available by the Government, where the monthly repayments are covered by the savings achieved. This could remove many of the barriers reported by businesses relating to lack of funding/finance available.

3.3.3. Tax reliefs. These are commonly proposed as an appropriate financial incentive for energy efficiency.

3.3.4. Premiums for energy savings. A respondent offered an example programme from Luxembourg called Enoprimes [2]. This programme offers businesses financial aid for their energy efficiency projects linked to the volume of future energy savings, thus kickstarting the process while reducing upfront costs. Applying this programme would be more complex for specialised improvements that need individual validation than for simple measures (e.g. thermal insulation, replacement of windows). Nevertheless, it is important to keep the option open for specialised improvements as many industrial opportunities that do not fit the standard measures can be realised this way.

3.4. Respondents also suggested a range of policy and regulatory measures that could help overcome market barriers:

3.4.1. Improved standardisation of electrical appliances.

3.4.2. Combining energy and carbon reporting legislation with financial incentives for making step-changes in energy efficiency i.e. combining the 'carrot and stick'. This should help to make a stronger case of cost/benefit for energy efficiency, thus pushing investment in energy efficiency up the list of priorities in organisations at board level. ESOS and SECR are particularly important pieces of legislation that can encourage significant

[2] Please refer to enoprimes.lu/en/Professionals/enoprimes-programme/Premium-programme for further information.

investment in energy efficiency. Expanding these frameworks to all businesses and making it mandatory that the opportunities identified under ESOS are implemented are routes to explore.

4. How can we leverage current markets to facilitate energy efficiency? For example, markets flexibility technologies can access such as the Capacity Market, National Grid Energy System Operator's (ESO) balancing services markets or Distribution Network Operators (DNO) tenders for alternatives to network reinforcement.

4.1. We first and foremost need better collection and utilisation of data to value energy efficiency correctly. Any energy efficiency solution would have to prove itself via data beforehand. The additional cost of this data (via hardware such as metering) often makes any project difficult to justify, especially when it involves a number of smaller assets. If we start by installing data systems in place to prove energy efficiency at scale, we can unlock means of valuing energy efficiency comparably to other solutions and the markets should be available in due course.

4.2. Nevertheless, one should bear in mind that trying to leverage current markets to facilitate energy efficiency can actually make the process more complex. Organisations who can participate in flexibility provision are not necessarily energy companies and tend to have other business priorities that are more central to their primary revenue streams. All these different markets available for flexibility provision can already be challenging to explain to decision makers whose day job is not about energy, let alone helping to encourage action and investment into participating in these markets. Forcing energy efficiency to share the same fate as flexibility provision could prove counterproductive.

4.3. Energy efficiency measures are typically designed to make savings across a range of demand times over a day, which helps to reduce both peak and overall demand. This means that the complicated UK energy market structure is perhaps best dealt with outside the realm of pure 'energy efficiency' to enable a clear focus on using less at all times. A holistic approach that looks at where different solutions fit within the whole system would deliver greater benefits than many fragmented market mechanisms that are trying to address energy efficiency and flexibility separately.

5. How can we create new markets for energy efficiency? Please provide suggestions on how to design the different mechanisms.

5.1. There is significant value in learning from other sectors in order to avoid re-inventing the wheel.

5.2. Energy efficiency should be encouraged based on comparing actual usage against benchmarks, with users benefitting from the increased efficiency. However, overcoming low demand for energy efficiency action within organisations may require going beyond simply promoting savings inherent to energy efficiency improvements. One route to this could be mandating implementation of ESOS findings, and/or extending the scheme to all organisations regardless of size.

5.3. Creation of new markets for energy efficiency will require different thinking, particularly at the intersection of energy efficiency products and consumer behaviour. As technologies get smarter

and populations become more adept at using them, the challenge is to make these step-changes count in terms of energy efficiency. A large number of small gains from behavioural changes could rival the benefits from large-scale efficiency improvements carried out by a select few. Simple changes in behaviour can amount to substantial efficiency benefits at the system level, and will likely be replicated in all parts of consumer lifestyles and need harnessing in meaningful ways.

5.4. Respondents suggested several specific ideas for creating new markets for energy efficiency:

5.4.1. Support further development of small Energy Service Companies (ESCOs).

5.4.2. Establish a framework that assigns a price to the life cycle carbon footprint of energy products/equipment.

5.4.3. Establish a framework that incorporates energy efficiency within the rateable value of buildings. If increased energy performance was to reflect directly on the valuation, investment in many efficiency measures such as embedded CHP or battery storage systems could be more easily justified.

5.5. One respondent expressed concern about using auctions to create a market for energy efficiency. Although auctions are theoretically an efficient way of allocating capital, they are too uncertain in outcome, involve high transaction costs and can be too time-consuming for small efficiency projects. It can be simpler to administer a programme offering a fixed price per MWh saved (such as the Enoprimes programme described in 3.3.4.) rather than auctions.

6. What can we learn from other countries' electricity systems from an energy efficiency perspective?

6.1. The main lesson to be learned is that decarbonisation is a global challenge and international collaboration is key; the UK must learn from other countries in this process, even as it transfers experience and skills abroad. The perception that the UK is at the forefront of some technological and intellectual advances should not hinder learning opportunities. There is potential for adopting some ideas and technologies usually associated with countries with different climates, building stock, or other circumstances and adapting them to a UK context, especially as climate-related changes require different energy solutions.

6.2. Germany was cited by a respondent as an example country where public awareness has successfully played its part in the high prominence of energy efficiency. There is wide public support in Germany for a more efficient and greener energy supply which the respondent attributed to the place of energy issues in the national curriculum and the German media, as well as efforts to distribute accurate technical information on energy efficiency issues in a clear and simple language to non-specialist audiences e.g. in the form of brochures. A similar approach in the UK could help establish an energy culture where energy is not taken for granted, efficiency is valued for its benefits and the difference individual actions can make at the system level is well understood.

7. **How could networks ensure that energy efficiency can compete fairly with other solutions as a potential alternative to network reinforcement?**

7.1. A cost-effective focus for the Government could include examining how energy efficiency measures can integrate rather than compete with other solutions, thereby enabling an energy project to deliver benefits greater than the sum of its parts.

7.2. Some energy efficiency measures were highlighted as particularly worthy of investment to deliver potential alternatives to network reinforcement:

7.2.1. Combined heat and power (CHP) is an effective and quick way to improve energy efficiency. It can provide up to 40% reduction in grid electrical demand for each site if appropriately sized, designed and installed. Embedded CHP is a well-known and proven energy efficiency measure which is made more attractive by new thermal storage solutions.

7.2.2. Installation of measures to optimise existing systems, such as:

7.2.2.1. Switching to LED lighting

7.2.2.2. Improved motor management via application of variable-speed drives (VSDs) e.g. on old heat and ventilation equipment

7.2.2.3. Compressed air systems optimisation

7.2.2.4. Building Management Systems (BMS) optimisation.

8. Are there potential benefits from combining EE and flexibility? How can we maximise these benefits?

8.1. There are certainly benefits from combining energy efficiency and flexibility especially in light of the level and rate of decarbonisation required for meeting the UK's climate target of net-zero emissions by 2050. In fact, with technological advances, many energy efficiency solutions are increasingly suited to also provide flexibility. For instance, a new model of a dishwasher would likely be both more efficient than a previous model and also equipped with the ability to time its consumption according to grid signals so that it can be used when flexible tariffs become commonplace.

8.2. The benefits from combining energy efficiency and flexibility need to be harnessed at business case evaluation and delivery level. As such, education of technology providers and in-house energy personnel is the first step towards maximising these benefits. Technology providers need to be honest and transparent whilst connecting the dots between technology capability and markets. In-house personnel need increased levels of knowledge and skills to develop appropriate business cases that combine energy savings and market revenues where applicable.

8.3. Some further areas of focus are highlighted by respondents to maximise these benefits:

8.3.1. Facilitating the development of ultra-variable tariffs[3]

8.3.2. Enhancing deployment of a mix of energy storage solutions including pumped hydro, batteries and hydrogen

8.3.3. Integrating energy systems via smart controls

8.3.4. Electrification of heat for buildings via heat pumps

8.4. Even if energy efficiency and flexibility are to be delivered as solutions to separate problems, they can be financially synergistic. Flexibility will not necessarily save energy but can save money which the consumer can then re-invest in energy efficiency projects, driving down overall energy usage. Reinvestment of profits from flexibility provision into energy efficiency projects can be an important financing mechanism in general and the viability of making it mandatory under certain schemes should be explored.

8.5. Combining energy efficiency and flexibility is especially crucial in the context of decarbonising heat. Decarbonising heat will likely involve a significant deployment of heat pumps to replace natural gas boilers currently used in most UK homes. Even though heat pumps are generally very efficient, they – especially air-source heat pumps – have an inherent problem that their efficiency and capacity drop at very low temperatures. This problem is typically dealt with by installing electric resistance heaters for use when ambient temperatures are lowest, but this brings the risk of very large peak demands on the grid on certain cold days. To prevent this peak, policy and technical measures are needed to incentivise alternative methods of providing peak heating capacity. Two possible options, one of which involves flexibility, are:

8.5.1. Significant heat storage per building (ideally integrated with the operation of the heat pump, and flexible in when it 'charges');

8.5.2. Hybrid systems with fossil fuel or hydrogen back-up systems (ideally integrated with the heat pump so that the exhaust heat from combustion can be fully recovered);

8.6. Installation of either of these options requires extra capital and extra space. Because the economics of such measures will be poor for the individual building owner (but may be significantly attractive at system level), Government should consider measures to encourage installation including financial incentives as well as standardisation of building designs, training of supply chain actors and opportunities from economies of scale. It may be necessary to support further research and development to improve heat pumps for different usage regimes (space heating, hot water heating, higher temperatures for industrial purposes).

9. What is the role of aggregators?

9.1. Aggregators' role is to help bring the volume of demand side response (DSR) from smaller individual consumers to the market, to help balance the grid by introducing flexibility to offset the need for supplementary generation. Although the current focus for aggregators is energy flexibility

[3] In the Energy Barometer 2019, 62% of respondents thought tariffs that reward flexible demand will be among the new energy service offers most likely to be attractive to domestic customers in the UK electricity and gas retail markets by 2030. For the full report, visit energyinst.org/barometer/2019.

more than energy efficiency, there is potential for this business model to also apply to aggregation of small energy efficiency projects into an investment portfolio, by grouping buildings or eligible parts of broader refurbishment projects together. This can enable economies of scale to find greater value in the market. Aggregation of energy efficiency projects would also be preferable from the viewpoint of Distribution Network Operators as this could deliver a viable alternative to network reinforcement at sufficient scale.

9.2. The Association for Decentralised Energy (ADE), in collaboration with demand side response (DSR) aggregators, has published a voluntary Code of Conduct, called Flex Assure[4], setting common standards for DSR aggregators. A potential next step would be to apply a similar governance framework to aggregation of energy efficiency.

9.3. Connecting more devices and appliances to intelligent systems and smart controls can give a greater role to aggregators, as they are able to access a larger base of electric loads to provide demand response services. Smart Impulse[5] is an example that identifies a building's consumption by end-use (lighting, IT, heating, etc.), significantly facilitating targeted energy efficiency decisions. Rolling out such solutions at scale can help monitor energy consumption and identify energy savings across a network of buildings.

9.4. Market participants are not only influenced by aggregators regarding efforts to facilitate energy efficiency in the electricity system. Third Party Intermediaries (including switching websites, energy brokers and energy efficiency advice providers) interact with consumers as part of their day jobs and certainly have influence over consumer choices. It is important that they use their intermediary position to enhance knowledge and understanding among market participants about energy markets, flexibility, efficiency and how these elements may tie into a broader energy strategy. Respondents suggest that there are still cases of Third Party Intermediaries disseminating information in an over-simplified and/or non-transparent way which can significantly jeopardise consumer trust in legitimate solutions.

10. How should we best align with existing policies, particularly those referenced in section 2.4?

10.1. Respondents call for simplicity and coherence between existing policies. The whole policy package needs to ensure that the costs of complying with various schemes translates to results, and that the technical effort to maximise energy efficiency is not diluted by unnecessary administrative burdens. The focus should be on outcomes rather than paperwork.

10.2. Currently, the UK energy policy landscape is complicated and fast-changing. For instance, one 12-month period has seen the end of CRC Energy Efficiency Scheme, introduction of SECR, increase of the Climate Change Levy and the ESOS Phase 2 compliance period. This suite of policies should be consistent with each other so compliance can be maintained across a number of mandatory schemes without increasing the resource required for participating organisations.

10.3. Respondents had a range of specific suggestions for existing policies:

[4] Visit theade.co.uk/resources/guidance/demand-side-response-code-of-conduct for more information.
[5] Visit smart-impulse.com/en/ for more information.

10.3.1. **Energy Savings Opportunity Scheme (ESOS)**:

10.3.1.1. The scope should be extended to cover Small to Medium Enterprises (SMEs).

10.3.1.2. Implementation of the identified opportunities should be made mandatory. This can be supported via the interest-free loans available through Salix Finance Ltd. This would mean that these energy efficiency measures would not have to compete for finance with other business projects.

10.3.2. **Building regulations** should be aligned more closely with energy efficiency objectives. It is far cheaper to install efficiency measures at initial construction than to retrofit, so building standards need to be rapidly raised to a level that is compatible with meeting the UK's climate ambitions of net-zero emissions by 2050. Compliance with and enforcement of energy saving construction measures is widely viewed as inadequate. Some of this may be due to limited knowledge in both the installation industry and building control departments, and some enforcement gaps may be due to not inspecting at the right time, resulting in measures no longer being visible (e.g. cold bridges in insulation). Support for training for specifiers and installers together with adequate resourcing and training of building control departments is key.

10.3.3. **Streamlined Energy and Carbon Reporting (SECR)** should go beyond energy efficiency and include wider energy themes such as renewables, demand side response and data mapping. This would enable a more comprehensive energy strategy that capitalises on interactions between different themes.

10.3.4. **Climate Change Agreements (CCAs)** can become more effective if access is simplified and widened to more sectors, or preferably opened to all sectors if a framework compliant with state aid rules can be identified. The long-term future of CCAs also needs to be clearly signalled. CCAs are already an important mechanism for supporting efficiency as they lead to a leverage effect by allowing organisations to save money on the entire energy bill if a certain % of energy is saved (assuming the buy-out price is not too low). A manageable portfolio of efficiency projects can then have a reasonable IRR.

10.3.5. **Advertising and Trading Standards** should introduce a more stringent and technically competent policing operation to help ensure that the information circulated about marketed products is accurate and clear. There are currently many false and misleading product claims in the UK market, aimed at both the wider public and at industrial and commercial users. These lead to misinformation and disillusionment which undermines legitimate products. Trade show organisers and energy industry magazines also need to be selective about the information and companies they welcome on their platforms.

10.4. Innovation in energy should always be supported. Heat pumps are a crucial area of focus with the expected growth in heat electrification. High temperature heat pumps have potential, but commercially-ready options are few with a limited track record, so companies are reluctant to risk investing.

10.5. One respondent offered detailed suggestions on existing policies of further scope:

10.5.1. **Wiring Regulations** may have some opportunities for improvement. For example, cable sizes are chosen to meet safety and functional requirements, but there are significant losses in distribution. For example, a 4% voltage drop represents roughly 4% loss of energy – specifying a thicker cable requires more investment but would reduce losses. This is most important for equipment which is in operation for a large proportion of the day – which would include most industrial equipment, and some building services equipment (heat pumps, chillers, ventilation).

10.5.2. **Statutory Voltage Limits:** The DNOs can deliver within a wide tolerance range. At the lower end of this range there is an apparent demand reduction effect. However, as the lower voltage results in a smaller output (heat, motor power, light) per amp, and in most cases lower efficiency, it is likely that the long term effect is to increase demand (longer running duration for heaters and motors, more lights switched on, higher current leading to higher cable losses). Similarly, higher voltages result in lower efficiency and higher demand, as well as a shorter lifetime for electrical insulation. While there is an operational need for some flexibility, the DNOs could be incentivised to maintain voltages within a tighter tolerance about the nominal 400V/230V for Low Voltage customers.

11. Should we support behaviour change? If so, should it be supported in the same way as energy efficiency, which requires installation of measures?

11.1. Behaviour change should certainly be supported. It should be treated as an important means of delivering energy efficiency, alongside installation of measures and equipment, rather than as a tangential concept. In fact, behaviour change can be the cheapest way to achieve energy efficiency and thus it would be to the disadvantage of an organisation to ignore this solution in favour of installation of measures and equipment. Installation of measures and equipment in isolation will still equate to some volume of energy consumption, which could potentially be avoided entirely if implemented in conjunction with behaviour change.

11.2. Public awareness and engagement should be the first step towards supporting behaviour change. It is vital to establish behaviour change at all levels of the society from school children to senior management of large corporations. Television and social media can be exploited as channels to promote understanding of energy efficient practices and encourage behaviour change. The Blue Planet[6] documentary by Sir David Attenborough has contributed to increasing public awareness of plastic pollution which may have helped recent initiatives against single-use plastics. Similar productions can benefit the promotion of behaviour change.

11.3. Measurement and verification of behaviour change is also crucial. If there has to be a choice between supporting behaviour change or installing energy efficiency equipment e.g. due to budgetary limitations, it can be much more difficult to quantify and therefore justify the value from behaviour change. Behaviour change programmes often fail as they are poorly researched and planned in relation to the individual needs of an organisation. A behaviour change programme

[6] Please refer to bbc.co.uk/programmes/p04tjbtx for further details.

therefore should invest most efforts into planning which should first and foremost assess the need correctly. It should also anticipate a certain level of resistance from the workforce and have a plan in place to gain acceptance of the proposed measures. Using insights from behavioural or social psychology could contribute to the efficacy of behaviour change programmes.

11.4. There is not a straightforward answer to who should be funding behaviour change initiatives. Respondents named different alternatives from government funding of behaviour change projects to laying the responsibility on energy users, issuing financial rewards or penalties that correspond to the level of best practice they can demonstrate.

11.5. Results of the Energy Barometer 2016[7] provided useful insights into the role of behaviour change for enhancing energy efficiency. In the survey, for both transport and industry, behaviour change was seen to have potential for achieving short term gains (i.e. over the next three years), whereas technological or infrastructure upgrades would have longer lead times (by 2030). For each of these sectors, respondents who felt behaviour change had the most scope to increase efficiency were asked to identify specific, highly-impactful behaviour changes. Within the transport sector, the behaviour changes most frequently identified included reduced road vehicle use, through increased use of public transport and modal shift in transport types. For industrial processes, improving knowledge and attitudes and integrating energy into business activity were identified as the main behavioural opportunities to impact energy efficiency.

[7] Visit energyinst.org/barometer to access the 2016 Energy Barometer report.