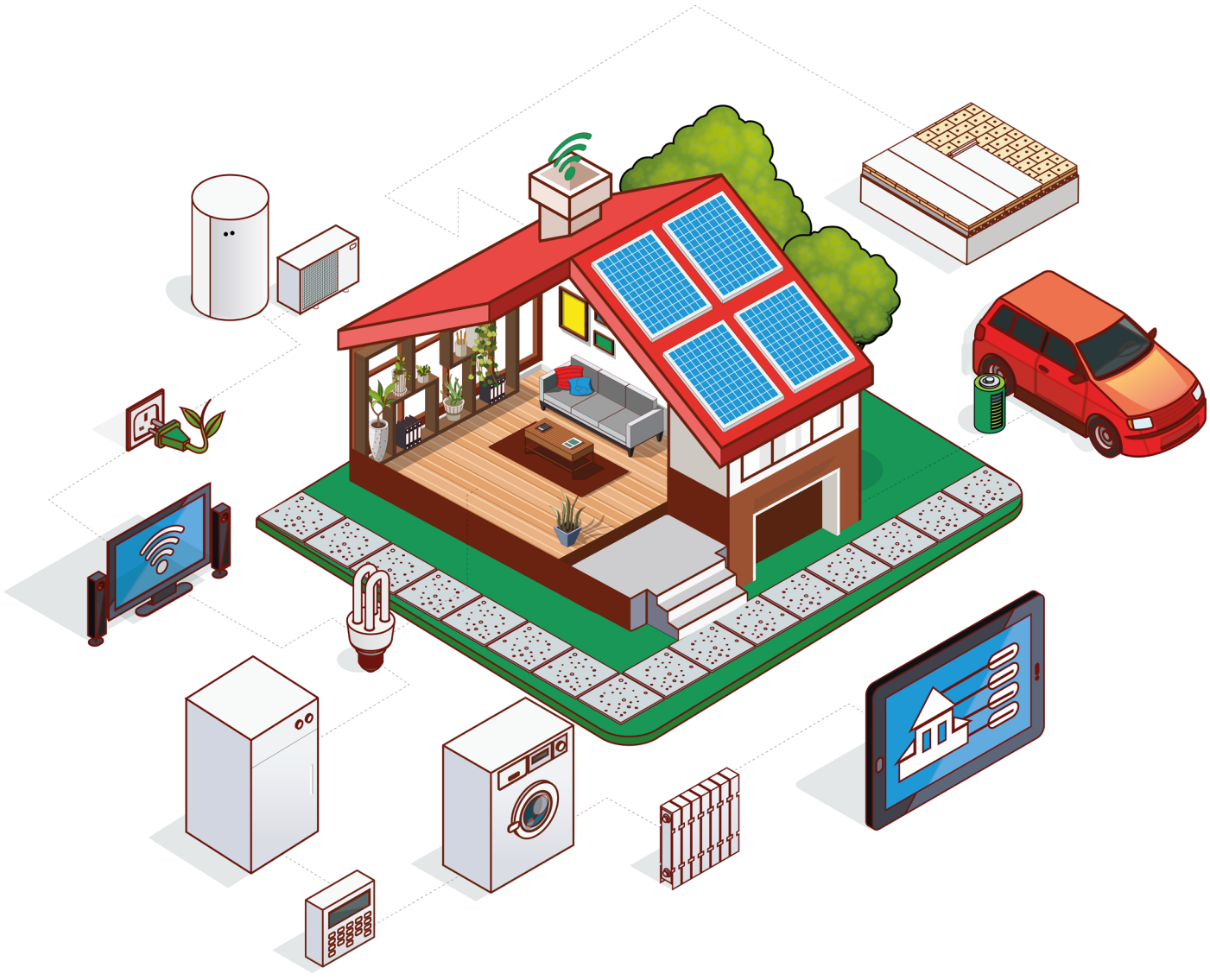
Electrical Safety First

The UK's electrical safety experts

Future Homes

Electrical Safety in the Net Zero Home



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About Electrical Safety First

Electrical Safety First is the UK charity dedicated to reducing deaths and injuries caused by electrical accidents. Our aim is to ensure everyone in the UK can use electricity safely. We campaign on behalf of consumers to improve electrical safety regulation and make sure that safety messages are appropriate, up-to-date and well communicated.

Executive Summary

The Race To Net Zero

The Race To Net Zero

The UK has set ambitious climate change targets which will mean an inevitable change to our housing stock and the way we use energy. We know that our homes need to minimise energy demand and carbon emissions, and that this needs to happen quickly if we are to mitigate the risks of climate change. However, we must ensure that this does not come at the expense of consumer safety.

Policy makers and industry are not giving electrical safety the attention it requires, particularly given the pace of change needed to meet climate change targets. There is a risk that in a rush to retrofit our existing homes for net zero and meet targets to build hundreds of thousands more each year, the crucial issue of safety will be neglected. A range of individual technologies will be important in the transition to a low carbon future, but with this variety of solutions comes a complex web of interconnected challenges and risks. This report looks at some of the technologies that may be present within the home of the future and some of the risks that may be associated with the transition, before proposing recommendations to mitigate them.

The Future Home

A net zero ready or future-proofed home is likely to consist of a highly insulated building fabric and many technologies and solutions that are not commonplace within the UK today. Features may include a source of low carbon heat, on-site renewable electricity generation, smart technologies and high efficiency ventilation and lighting. It is also increasingly likely that many homes will have an electric vehicle and associated on-site charging. However, with existing homes likely to represent the majority of homes in 2050, these technologies will be deployed in the UK's ageing housing stock, which introduces inherent safety risks.

The integration of technologies in the home will be key to achieving net zero and it is likely that these solutions will communicate and work together to minimise emissions and costs for consumers. There are clear benefits that could be realised through the enabling of smart technology, for example, but there are potential risks associated with the use of appliances at off-peak times or when the home is unoccupied which need to be mitigated. The deployment of emerging technologies must be closely monitored to fully understand potential electrical safety risks associated with the transition to a future home. Effective collaboration and co-ordination is critical to ensuring that all key actors work to mitigate these risks.

Addressing the Safety Risks

Whilst products which meet UK safety standards are largely safe, there are many factors beyond the product itself that can influence consumer safety and it is therefore essential that this is not overlooked in the race to net zero. Consumer misunderstanding and misuse is a common cause of many electrical safety accidents. How consumers use electrical products, where they purchase them from and who they use to install a product are critical decisions that have a significant influence on electrical safety, making consumer education fundamental on this journey.

Our research suggests that there are several hurdles to overcome to ensure that the future home is not only low carbon and smart, but also safe. These include:

- A lack of specialised and certified installers and registered electricians in the low carbon space to be able to deliver net zero.
- An inconsistent approach to installation quality standards and reporting requirements across the sector.
- The risk of installations and repairs being undertaken by consumers themselves if specialised and certified installers and registered electricians are not available.
- A lack of financial support to enable retrofits to be carried out safely.
- Low consumer awareness of the safety risks and ongoing maintenance requirements of low carbon solutions.

We know that the safety risks associated with individual products are significantly minimised with careful installation by a competent tradesperson and when users can operate and maintain them effectively. We therefore believe that the UK cannot safely move forward towards net zero without growing the base of registered electricians, and other specialised and certified installers, with the skills and competencies required to install and maintain new low carbon and smart technologies. As we rush to retrofit our homes, there is a risk that corners will be cut in delivery, which could pose risks. Growing the base of registered electricians and specialised and certified installers now will be critical if we are to scale up delivery in the next decade, whilst protecting safety.

According to the Construction Leadership Council, approximately 500,000 new professionals and trades required for retrofit packages are needed to bring homes up to a minimum EPC C target by 2030 [1].

However, simply growing the number of installers and electricians alone is not enough. It is paramount that the tradespeople supporting the net zero transition are upskilled to a high standard to ensure they are competent and possess the skills required to install measures whilst minimising any risk of unintended consequences. It is also important that tradespeople are cross skilled and possess an understanding of how solutions work together. With an ever changing and evolving market, there is also a need for ongoing assessments of competence and continuing professional development to ensure a skilled and competent workforce.

It is also essential that all tradespeople are held to consistently high standards and that there are not discrepancies in the level of service provided to customers depending on the solution installed or source of funding. A patchwork of standards currently presents a disparity across the sector which could put consumers at risk. This is particularly the case where measures are not installed via government funded schemes. All households deserve to live in safe accommodation. However, the current inconsistent approaches across regulatory and policy frameworks mean that this is not a reality today. There is a need for consistent minimum standards, enhanced safety checks and reporting across all tenures, and financial support available to enable holistic high-quality retrofit and remedial works to be undertaken. Without this, we are concerned that some may be exposed to electrical safety and health risks.

There are different approaches to electrical safety and decarbonisation across the UK nations and policies are often inconsistently implemented which leads to confusion and variable messaging. The lack of clarity around ownership of safety issues among government departments also risks things falling through the gaps which could put consumers at risk.

Next Steps

A range of key actors have a role to play in ensuring that the electrical safety of consumers is upheld in the transition to net zero and crucially, everyone must learn to adapt. Some of the key actors include:

- Local and National Government, who have a responsibility to ensure that relevant standards and regulations are put in place to protect consumers, particularly those who are most vulnerable.
- Manufacturers, who have a responsibility to ensure that new appliances produced are of high quality and continue to meet or exceed relevant standards.
- Specialised and certified installers, who have a responsibility to ensure that high quality installations are delivered, that regular checks and maintenance are encouraged, and that consumers are educated about how to operate and maintain their systems.
- Charities and other organisations, who have a role to play in ensuring that consumers can access advice and support to enable them to adapt to the transition.

We hope that this report helps to bring to light some of the challenges and opportunities that the transition to net zero brings. Our recommendations are summarised on the next page.

It is clear that we must work together to ensure that consumers understand the risks and make informed decisions. As such, consumer engagement is a golden thread throughout the report and an area in which we believe Electrical Safety First has a key role to play.

It is also vital that we grow and upskill our specialised and certified installer base to holistically retrofit properties. This is a challenge that has been highlighted by the supply chain and by government. However, this is not simply about switching from fossil fuels to low carbon. Installers need to assess and minimise safety risks, advise consumers on operation and maintenance and understand how technologies interact, as well as ensure that systems are installed to a high standard.

Safety must be part of upskilling discussions and collaboration will be key to ensure that there are enough specialised and certified installers to meet increasing demand.

Meeting net zero will require investment in innovation and research which must extend to reducing safety risks and unlocking the benefits of low carbon solutions. Finally, policy and minimum standards need to be implemented consistently and government schemes should incorporate funding to facilitate safety improvements to ensure that consumer safety is not endangered.

Summary of Recommendations

Housing Infrastructure
Government housing departments should ensure that housing standard reporting contains references to the state of electrical wiring and seek to understand capacity constraints. This would enhance their understanding of the suitability of building stock for the future and identify where improvements are needed.
Government should introduce a common, cross-tenure housing standard for electrical safety which includes mandatory five-yearly electrical safety checks for all homes in all parts of the UK.
UK Government and Energy suppliers should launch free services including electrical checks to support the electrical safety of vulnerable consumers as we transition away from gas.
Government should ensure that any funding made available for low carbon technologies has a portion reserved for associated remedial and/or ancillary works such as rewiring or the installation of a new fusebox.
The Home Office, the Scottish Fire and Rescue Service and devolved governments should ensure that information relating to property age, tenure and EICR status following an electrical fire is recorded in a consistent and comparable way to enable better tailoring of guidance and policy to reduce future risks.
Smart Home Technologies
The Office for Product Safety and Standards should monitor the number of incidents related to the running of appliances when the home is unoccupied or households are asleep and improve safety standards for smart technologies to minimise risk.
Manufacturers must ensure that products are as safe as practicable and innovate to ensure that any additional foreseen risks associated with running appliances overnight or when the home is unattended are minimised.
Consumer awareness campaigns that look at how to mitigate the risk of fires caused by appliances in the home should be run by Government, Fire and Rescue Services and consumer protection organisations.
Electric Vehicles (EVs)
Further consumer education is needed around the risks of using a standard 13A plug and socket to charge an EV. Consumer organisations, Industry and Government should collaborate to ensure that consumers have appropriate information when they switch to EVs from standard diesel and petrol cars.
The Department for Transport and devolved governments must ensure that there is adequate financial support for households to install charging infrastructure at home using an Office for Zero Emission Vehicles authorised installer.
The Department for Transport, the Office for Zero Emission Vehicles, Local Authorities and Industry must ensure that there is adequate EV charging infrastructure across the UK to reduce the risk associated with dangerous charging practices. Support should be focused on areas where existing charge point deployment is particularly low. Consideration should be given to undertaking a mapping exercise to ensure that the deployment of future projects is co-ordinated, and that a further disparity by geography is not created.

Growing the Installer Base
Government should introduce a clear and consistent policy framework to provide industry with long-term certainty of demand and encourage investment in upskilling.
Government should introduce grants and/or tax incentives to encourage individuals/enterprises to upskill and enter the low carbon market.
Education authorities and training providers should continue to develop high quality training courses and regulated qualifications to support the upskilling of professionals. New and existing apprenticeship standards should also incorporate energy efficiency/low carbon content. This could be supported via a combination of current and additional government funding.
As the market grows, National Government(s), and specifically Energy and Housing Teams, should introduce minimum installation quality standards across the whole industry.
Online Marketplaces
The Office for Product Safety and Standards/the Department for Business, Energy and Industrial Strategy should put in place appropriate regulations for online marketplaces so that consumers buying electrical products online have the same protections as they have in a high street shop.
Replacing and Repairing Products
The Department for Environment, Food and Rural Affairs and the Office for Product Safety and Standards should develop a network of qualified and competent repairers via collaboration between low carbon, energy efficient and smart solution product sellers.
Electrical Safety First should facilitate collaboration between manufacturers, retailers and consumer awareness groups, and launch an awareness raising campaign through media and digital channels.
Consumer Education
Energy advice organisations should ensure that information campaigns regarding net zero home technologies include links and guidance on electrical safety and provide recommendations on how consumers can find a specialised and certified installer in their region.
Governments in all nations should increase the promotion of using competent tradespeople and raise awareness of authorised installer registration platforms.
The Department for Levelling Up, Housing and Communities and devolved Governments should consider whether competent person schemes could become a mandatory requirement for installations.

Definitions

Term	Definition
Building Services	Appliances installed to make homes comfortable and functional, such as ventilation and lighting.
Carbon Budget	An amount of carbon dioxide that a country, company or organisation has agreed is the largest it will produce in a particular period of time.
Citizens' Assembly	A group of citizens of a country who are invited to discuss an issue of national importance and make recommendations about policy.
Demand Side Response (DSR)	DSR is where energy users alter their consumption patterns in response to a signal or incentive from the network operator.
Electric Vehicle (EV)	An electric vehicle is a vehicle that is driven by an electric motor which draws its current either from storage batteries or from overhead cables.
Electrical Installation Condition Report (EICR)	An electrical installation condition report (EICR) identifies any damage, deterioration, defects and/or conditions which may give rise to danger along with observations for which improvement is recommended.
Fuel Poverty	Governments across the UK have varying definitions of fuel poverty. There are three important elements that may be used in determining whether a household is fuel poor; household income, household energy requirements and fuel prices.
Greenhouse Gas (GHG) Emissions	The emission into the earth's atmosphere of any of various gases, especially carbon dioxide, that contribute to the greenhouse effect.
Heat Pump	A device, as used in a refrigerator, for extracting heat from a source and delivering it elsewhere at a much higher temperature.
Intermittency of Electricity Generation	The unpredictable variation in output from sources of electricity such as wind and solar due to unpredictable weather events such as cloud formation.
Internet of Things (IoT)	A network of objects that are fitted with microchips and connected to the internet, enabling them to interact with each other and to be controlled remotely.
Microgeneration Certification Sceheme (MCS)	MCS was developed to safeguard high quality within the industry. Crucially, in order to demonstrate the competence of its employees, installation companies are required to either provide evidence of the valid qualifications held and/or short courses attended or demonstrate experience to an MCS Certification Body.
Measures	Products installed in a property to improve thermal performance, reduce energy bills, provide low carbon heat.
Net Zero	Net zero refers to achieving an overall balance between emissions produced and emissions taken out of the atmosphere.
PAS Framework	PAS 2030:2019 covers the installation, commissioning and handover of retrofit projects and PAS 2035 is an overarching framework which embraces a whole house approach to retrofit and requires the use of a retrofit co-ordinator, amongst other roles. Under PAS 2035, projects must be overseen and logged into the TrustMark Data Warehouse by a qualified and TrustMark registered Retrofit Coordinator.

Term	Definition
Registered Electrician	A firm or individual, who is registered with a government authorized competent person scheme operator, deemed competent to install electrical equipment and wiring within a domestic or similar premises.
Retrofit Co-ordinator	Responsible for overseeing PAS 2035 compliant domestic retrofit projects from inception to completion, responsible for liaising with building owners and other retrofit project stakeholders in order to ensure effective project management.
Smart Home	A home where tasks that a homeowner would usually carry out manually are taken care of automatically through the intelligent use of technology. Key elements are an internal network, a gateway to manage systems and devices which link to services and systems outside the home.
Specialised and certified installer	Firm or individual having the recognized skills and competences required to install and maintain low carbon and smart technologies.
TrustMark	TrustMark registration is the Government Endorsed Quality Scheme that covers work a consumer chooses to have carried out in or around their home, including low carbon and energy efficiency installations. It is required for many government retrofit schemes (although sub-contractors are not required to register).
TrustMark Data Warehouse	A repository to hold information about work undertaken in a property under TrustMark to ultimately enable consumers to access more accurate data and information about their homes.
Variability of Electricity Generation	The predictable variation in output from sources of electricity such as wind and solar on a temporal basis (e.g. over day or night and with changing seasons).

Sources

Collins Dictionary; CIBSE; Cambridge Dictionary; The Grantham Institute; ADE; NICEIC; UK Government; CEsIfo Working Paper 7442; TrustMark; Elmhurst Energy

01

Our Homes Must Change If We Are To Meet Net Zero

Ensuring that existing homes, as well as those constructed in the future, are low carbon, resilient and fit for a changing climate is fundamental. However, it is important that upgrades to homes do not create unintended risks for consumer safety and that the future home has safety at its centre. Failure to do so would be both dangerous and regressive.

In 2019, Parliament passed legislation requiring the UK Government to reduce greenhouse gas (GHG) emissions to net zero by 2050, relative to 1990 levels[2]. Separate targets exist across the devolved administrations (DAs); the Welsh Government recently committed to a 2050 net zero target[3] and the Scottish Government has a more ambitious target to achieve net zero by 2045[4]. Northern Ireland remains the only part of the UK with no legally binding emission reduction targets[5].

Our homes and vehicles are responsible for a large proportion of the UK's emissions. The residential sector was responsible for approximately 15% of UK GHG emissions in 2018, whilst transport was responsible for over a quarter of emissions, of which road transport was the largest source of emissions, largely due to the impact of passenger cars[6].

As a result, the decarbonisation of domestic building stock and personal transport will be critical to meeting our climate change targets. The challenge is significant; the UK needs to retrofit approximately 26 million homes[7] and over 38 million cars in the UK will have to be replaced by Ultra Low Emission Vehicles (ULEVs) [8] [9] [10].

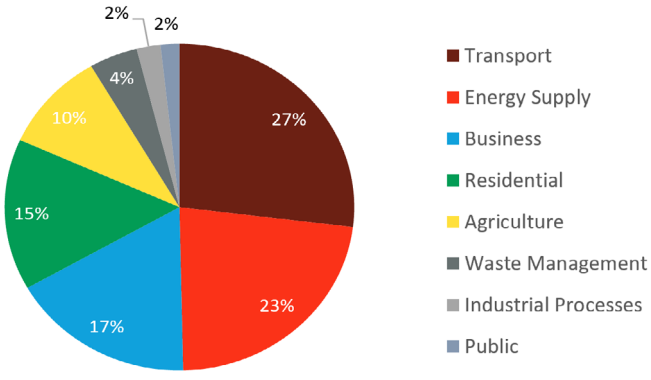


Figure 1 - UK Greenhouse Gas Emissions by Sector in 2018.
Data From: BEIS and ONS

Achieving the UK's net zero target will rely, in part, on consumers making changes to their homes and the way that they use energy. Under the Climate Change Committee's (CCC's) Net Zero Balanced Pathway, more than half the emissions saving needed will come from people and businesses adopting low carbon solutions, as high-carbon options are phased out[11]. This will be supported by policy and regulatory changes over the coming years. The Construction Leadership Council (CLC) envisages four phases to delivering retrofit over the programme period 2021 – 2040 (see Box below).

The Construction Leadership Council's National Retrofit Strategy

The CLC envisages four phases to deliver the ambitious retrofit programme required.

- **Phase 1** - Government endorsement of the strategy, amongst other policy activities, to underpin capability.
- **Phase 2** – Efforts focused towards the education of key stakeholders including consumers and wider industry via a communications campaign, alongside a rigorous training programme for new entrants to the industry. The CLC sees this as a slower start with piloting and field trials taking place.
- **Phase 3** – A more rapid middle period of deployment once supply chains have matured and strong consumer protection is in place.
- **Phase 4** – A ramp down of pace towards 2040, with a focus on hard-to-treat properties. A phased redeployment of resources would be required to alternative sectors once the retrofit

Source

Construction Leadership Council. (2021). Greening Our Existing Homes.

However, decarbonisation alone is not enough. According to the CCC, "efforts to adapt the housing stock for higher temperatures, flooding and water scarcity are falling far behind the increase in risk from the changing climate"[12]. Failing to prepare our housing stock for a changing climate could have electrical safety implications.

For example, failure to prepare our houses for flooding events may lead to greater incidences of water ingress into electrical systems. The CCC has called for improvements to existing homes and more stringent standards for new build homes to ensure they are prepared for climate change. They note the importance of external shading and passive and active cooling measures to mitigate against overheating and the relocation of appliances and/or raised electricals to improve flood resilience[13].

There is a risk that in the rush to meet the targets and ensure homes are zero carbon, the crucial issue of safety will be neglected. In fact, only 3% of the 108 Climate Assembly members who were brought together from all walks of life to discuss the UK's route to net zero chose "need to consider health and safety of interventions to ensure no negative effects on health e.g. from insulation or technologies" as a priority[14]. Yet it is imperative that safety runs throughout the strategy.

With targets to build hundreds of thousands of new homes each year, it is essential that these homes are built to high efficiency standards, incorporate smart technologies, low carbon heat and vehicle charging infrastructure and consider how electrical safety can be protected in a changing climate. Whilst the risk of electrical fires and hazards is higher in the existing building stock, efforts must be made to minimise risk in new builds. A strategy which fails to do this would present a significant concern.

It is clear that the retrofitting of our existing building stock is a bigger challenge and one which needs to be addressed holistically, with safety at its core. However, consideration must also be given to the changing way consumers will use energy. The prevalence of smart home technologies is increasing at a rapid scale[15]. These technologies have a range of benefits. In particular, better data capture and Internet of Things (IoT) enabled controls will help to empower consumers to manage energy use more efficiently at the device level. They may allow for more intelligent and safer use of energy (for example through allowing heating appliances to be switched off based on occupancy or allowing downstairs sockets to be switched off when they are not required)[16].

However, new electrical safety risks may emerge from the increasing ability of homeowners to remotely control and programme their electrical appliances to operate when they are asleep or away from the property. There are also potential cyber security risks associated with this transition, such as appliances being hacked if insufficient security provision is put in place[17].

We believe that policy makers and industry are not giving electrical safety the attention it requires. Electricity is a major cause of death and injury across the UK every year. In 2019 alone, there were tens of thousands of accidental electrical dwelling fires and hundreds of fatalities and injuries. We believe that these figures could rise if adequate attention is not paid to electrical safety as we move to retrofitting our existing housing stock to achieve net zero.

To drive positive change, key stakeholders require access to a strong evidence base to help guide policy decisions.

Electrical Safety First is committed to reducing the number of deaths and injuries caused by electricity in UK homes. This paper has been developed to evidence the need for electrical safety to be a fundamental consideration in the transition to net zero and to urge policy makers and industry to give it greater attention.

02

What Will The Future Home Look Like and How Can We Keep It Safe?

A net zero ready or future-proofed home is likely to consist of a highly insulated building fabric and include many technologies and solutions that are not commonplace within the UK today. Features may include a source of low carbon heat, on-site renewable electricity generation and highly efficient building services installed to make homes comfortable and functional, such as improved ventilation and lighting[18]. It is also increasingly likely that many homes will have an electric vehicle and associated on-site charging. These technologies are likely to be IoT enabled and connected via smart control systems, which have the potential to transform the way home systems operate, with technology increasingly able to make decisions and take actions independently of the home occupier. These systems will utilise sensors in the home which will also create a host of solutions and challenges for the safe design and management of home systems.

Further research is required to better understand the potential risks associated with the transition to the future home and effective policy and engagement is needed to ensure that all key stakeholders are prepared for the transition.

A range of individual technologies will be important in the transition to a low carbon future. The CCC's Net Zero Balanced Pathway within the Sixth Carbon Budget includes a relatively balanced mix of contributions to carbon emissions reduction, from demand-side action (reducing and shifting energy demand), electrification and hydrogen[19]. Below we explore some of the solutions that are likely to be prevalent in homes as we transition to net zero.

Whilst there are challenges that apply across the market, those posed by low carbon technologies are discrete. These solutions also have individual installation and maintenance requirements that must be carefully considered. The following sections take a more focused look at some of the key strategic technologies that are likely to play an important role within homes of the future.

2.1 Heat Pumps

The Government has ambitious targets to deploy heat pumps across the UK housing stock. However, at present, more stringent requirements for safety checks are placed on the gas sector than on the electricity sector, even though electricity is responsible for a greater proportion of house fires. Greater parity in checks is required to ensure electrical safety is protected in the transition to low carbon heat.

Under the CCC's Net Zero Balanced Pathway, low carbon heat installations in homes represent up to 80% of sales by 2030, of which 75% are heat pumps[20]. Further to this, the Prime Minister's Ten Point Plan set out an ambitious target to install 600,000 heat pumps every year by 2028[21]. Meeting this objective will require significant growth across low carbon heat supply chains. Ensuring that there are sufficient numbers of certified heating engineers and registered electricians to support this growth is essential.

More than 95% of heat pumps sold in the UK use electricity as the main energy source, indicating the importance of electrical safety in the operation and maintenance of these technologies. According to Microgeneration Certification Scheme (MCS), the "installation, operation and maintenance of heat pump systems do not normally present excessive health and safety requirements and should normally have low/medium risk." However, notice should be given to a range of hazards including electrical supplies, and MCS states the below with regard to heat pump installation[22].

Information from MCS Regarding Electrical Safety and Heat Pump Installation

"Electrical supplies - care should be taken with any appliance that utilises electricity in any way and should only be installed and serviced by a competent electrician."

"...installers should also be familiar with all relevant health and safety legal requirements and information...[on topics including] general electrical safety."

Source

MCS. (2020). Domestic Heat Pumps: A Best Practice Guide.

In the same way that traditional gas boilers require regular servicing, it is important that heat pumps are regularly serviced by a specialised and certified installer or heating engineer[23]. There are a range of mechanisms currently in place to prevent faults with fossil fuel heating systems and protect consumers including that:

- Boiler repairs must be done by a Gas Safe Engineer, and it is illegal for someone who is not adequately trained to attempt to repair or replace a boiler themselves[24].
- Under the Gas Safety (Installation and Use) Regulations 1998, landlords have a duty to arrange for a Gas Safe registered engineer to conduct checks and undertake maintenance of all pipework, appliances and flues. Landlords are also required to arrange for an annual gas safety check every 12 months[25].

Gas and Electrical Fires in the UK

Electricity is responsible for approximately half of the domestic fires that occur in the UK, which is a significantly higher proportion than those caused by gas. In fact, in 2019/20, electricity was responsible for six times more fires than gas. Despite this, at present, more stringent requirements on safety checks are placed on the gas sector than on the electricity sector. Parity between the safety check requirements for gas and electricity is required.

Source

HQN. (2021). Opinion: Why More Emphasis and Regulation Needs to be Placed on Electrical Safety.

With the shift to electrified heating, it is fundamental that stringent standards and processes are applied to low carbon heat installations. Given that all electrical installations deteriorate with age, it is important that they are periodically inspected and tested to confirm whether they are in a satisfactory condition and operating correctly. More stringent requirements on mandatory safety checks are placed on the gas sector than the electricity sector. This lack of parity is an issue which must be addressed.

2.2 Solar PV

Whilst the incidence of fires involving solar PV systems is low[26], small issues such as an electrical fault can turn into significant hazards if left unidentified or untreated. This indicates the importance of ensuring high quality installations and conducting regular checks and maintenance, particularly given that the financial case for Solar PV is likely to grow over the next five years.

Photovoltaic panels, also referred to as solar PV, provide on-site low carbon electricity generation which can be used by the household or exported to the grid. Equipping homes with solar PV, battery storage and smart controls will be valuable in offsetting the additional electricity demand that will arise from increasing electrification and will be an important part of the route towards net zero[27].

In 2019, there were an estimated 1.1 million dwellings with PV panels in England[28]. The future of Solar PV deployment in the UK is somewhat uncertain. The replacement of the Government's Feed in Tariff (FiT) scheme with the Smart Export Guarantee (SEG) may lead to a fall in installation rates to around 3,000 per annum[29]. However, the cost of solar PV globally has fallen as deployment has increased. The International Energy Agency (IEA) projects that growth in EVs and heat pumps will further build the financial case for Solar PV, and predicts that solar power costs will reduce by 15% to 35% between 2020 and 2024[30], suggesting that the market may not need government support in the long-term.

The rapid deployment of solar PV over the last decade has inevitably led to an increased prevalence of media reports linking PV installations with fires. A study conducted by the Building Research Establishment Ltd. (BRE), National Solar Centre (NSC) and BRE Global Fire Safety Group investigated 80 potential PV fire related incidents. The study looked at installations on domestic and non-domestic buildings, as well as solar farms. The study found that of the incidents investigated, approximately 58 were believed to have been caused by PV, of which 22 were deemed to be 'serious fires'[31].

Poor installation practices were found to be one of the key causes of fire within the study, indicating the importance of installer competence and ensuring installers are regularly assessed, undertake continued professional development activities and are regularly required to upskill in light of new research as well as innovations within the market[32].

Whilst the incidence of fires involving solar PV systems is low[33], solar panel systems cannot be switched off easily, and as such small issues such as an electrical fault can turn into significant hazards if left unidentified or untreated. Further to this, most solar panels do not have an automatic fire detection system, so a fire can take hold quickly and spread before it is discovered. This may be exacerbated by the fact that the design of some solar panel systems can also make it more difficult to reach a fire with water[34].

Whilst mitigating the risk of electrical fires through quality installation and regular inspection and testing is critical, it is also important to ensure key stakeholders are prepared in the event that a fire does arise. Effective guidance and education can help to ensure fire services are prepared in the event that a fire does occur and that they are not exposed to additional risks, in particular electrical safety risks, when trying to control the spread of a fire.

2.3 Battery Storage

With an increasing penetration of renewable sources of electricity, such as wind and solar, energy generation is likely to become more variable and intermittent than today. Battery storage will play a critical role in storing surplus generation when it is not required, and releasing it when generation is insufficient to match demand. However, safety must be maintained with increasing deployment of battery storage, as batteries can cause fire risks.

Increasing demand for electricity, alongside increasing reliance upon variable and intermittent sources of renewable generation, means that balancing services and system flexibility will become increasingly important to the National Grid[35]. Technologies including battery storage can help make domestic energy demand more flexible and ensure that electricity generated at times where demand is low can be stored for future use[36].

For example, battery storage may be coupled with Solar PV to enable electricity generated during the day, when solar irradiance is high but demand is low, to be stored until the evening when domestic demand is typically higher. However, due consideration must be given to the electrical safety implications associated with deployment of domestic battery storage.

A study on the safety risks associated with domestic battery storage systems found that fires or explosions can be caused by electrical misuse as well as poor installation, manufacture or design[37]. In addition, there may be other electrical hazards (e.g. electrical shock) associated with routine maintenance if the system is at hazardous voltage or energy levels. Root causes of electrical hazards include environmental conditions, such as moisture, which can lead to corrosion and short circuits within the system. There is therefore a need to ensure that installers and households understand these risks and the need to undertake regular inspections of the system to maintain optimal conditions for operation. According to research conducted by BEIS and the Office for Product Safety and Standards (OPSS), if manufacturers and installers follow industry best practices and standards, they can significantly mitigate risks in the residential applications[38].

Electrical Safety First recommends that any electrical installation work is undertaken by a registered electrician. The Institution of Engineering and Technology (IET) has also produced a Code of Practice for Electrical Energy Storage Systems which provides information to enable practitioners to safely and effectively specify, design, install, and commission systems. It also provides information on the operation and maintenance of such systems[39].

2.4 Smart Home Technologies

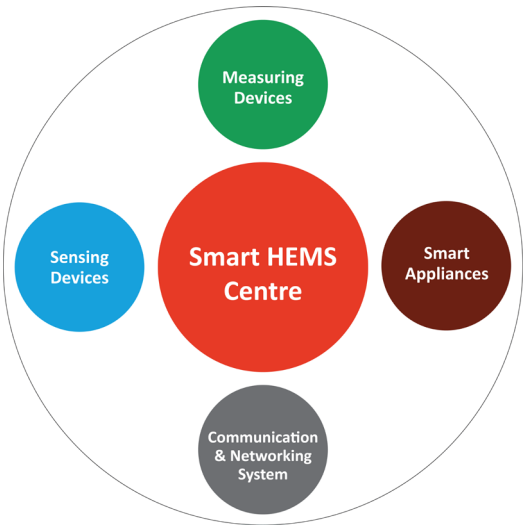
The prevalence of smart home technologies is increasing at a rapid scale. Smart home systems offer significant potential for flexible energy consumption, control of electrical systems and appliances within the home, and increased safety. Whilst the benefits of smart homes are plentiful, there are also potential electrical safety risks. For example, risks could be posed if appliances decide or are instructed to run when occupants are asleep or not at home, unless industry and standards evolve and innovate to mitigate these risks. There is also a need to better understand the potential security risks associated with the wide-scale deployment of smart home technologies.

2.4.1 The Capabilities of Smart Home Technologies

The capabilities of Smart Home Energy Management Systems (HEMS) extend beyond devices such as smart meters and thermostats by monitoring the internal and external environment of the home and occupant activities. Measuring devices such as smart meters allow for real time monitoring of energy consumption, whilst sensing devices can detect key parameters such as temperature, light, and motion. There is also greater interest in Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) which enable the consumer to better control and understand their property. Smart Home Energy Management Systems have five component groups and multiple functionalities (see Figure 2). The interaction of these components unlocks the following benefits for consumers:

- Systems can effectively manage the production, storage and consumption of energy.
- Appliances respond to price signals through demand response.
- Systems can allow for the remote control of household appliances (e.g. if anomalies are detected).
- Systems can monitor the conditions of electrical devices[40].
- Systems can be used to control access to the property such as for emergency response or by maintenance technicians.

Smart HEMS Components



Smart HEMS Functionalities

1. Monitoring
2. Logging
3. Control
4. Alarm
5. Management

Figure 2 - Smart Home Energy Management System Components and Functionalities.
Adapted From: Nacer, Marhic and Delahoche[41]

There will be increased need for smart and adaptable technology that can deliver services such as Demand Side Response (DSR). DSR is where energy users alter their consumption patterns in response to a signal or incentive from the network operator[42]. DSR can be used to move loads to when there is an excess of supply and help to reduce demand during peak periods. For example, electric vehicles can not only draw energy from the grid but also supply energy when demand is high, allowing the householder to be paid for exporting the energy[43]. There are also other technologies that can make use of DSR such as heat pumps and hot water storage; when equipped with smart devices, these appliances can be turned on or off or up and down depending on demand and supply of energy[44].

A recent study found that when using a simple time-based penalty signal, the average peak-hour energy consumption in the home was reduced by 85% with little impact on overall energy consumption and indoor temperature[45]. The ability to shift demand without requiring significant behaviour change or consumer interaction provides a significant opportunity for energy bill and carbon savings as well as improved comfort. This transformation will require increased availability of time of use tariffs and deployment of smart appliances.

2.4.2 Protecting Safety in the Shift to Smart Homes

Whilst the benefits of smart homes are abundant, there are concerns that Demand Side Response (DSR) could present safety risks if appliances decide or are instructed to run when occupants are asleep or not at home[46]. According to statistics published by the Home Office, there are generally fewer fires between midnight and 11am, but the number of fire-related fatalities is high during this time period[47].

Electrical Safety First, alongside other organisations such as the London Fire Brigade, has for many years advised that appliances such as washing machines, tumble dryers and dishwashers should not be left running overnight or unattended because if a fire breaks out overnight, the risk to life is greater[48]. The increasing use of appliances at night, which may result from an increasing prevalence of solutions which enable DSR, could therefore create an inherent risk to safety if not appropriately considered.

These potential risks need to be better understood. For example, it is unclear to what extent consumers will be driven by price signals and to what extent smart technology will be self-enabled or influence consumers to use their appliances at night. Whilst research has indicated that variable pricing can encourage users to shift EV charging, to what extent UK consumers will be able and willing to shift heat demand or appliance use, for example, is uncertain[49]. Crucially, safety must be considered as part of consumer research into DSR going forward.

Recommendation

OPSS should monitor the number of incidents related to the running of appliances when the home is unoccupied or households are asleep and improve safety standards for smart technologies to minimise risk.

Manufacturers must ensure that products are as safe as practicable and innovate to ensure that any additional foreseen risks associated with running appliances overnight or when the home is unattended are minimised.

Developing products or solutions which overcome some of the risks associated with smart technologies will be key to their successful and safe roll out. For example, when a smart appliance fails or there are fluctuations in mains voltage, appliances should default into a safe state[50]. Electrical safety risks can be minimised by ensuring that products are developed so that risks are balanced with risk mitigation. Appliances should ideally have the capability to alert consumers if safety features are triggered.

Whilst the electrical safety risks associated with the transition to smart homes must be monitored and mitigated, it is important to recognise that smart home devices have a range of benefits. They can enable energy to be used more efficiently and safely by introducing zoning (e.g.allowing ground floor appliances and sockets to be switched off at night, where appropriate).

Furthermore, smart home devices can monitor behaviours so that unsafe activities can be identified early. Assistive technology can also be used to prevent incidents as they can be used to reduce electrical hazards. Products can self-monitor and alert, adjust or isolate to help prevent electrical shocks and fires. This can be particularly valuable for consumers experiencing memory problems associated with conditions like dementia, which can lead to electrical appliances being left unattended or on for a dangerous length of time. This can be exacerbated by potential difficulties in retaining advice on electrical safety[51].

These systems can help identify risks and accidents such as falls, inactivity, fire, floods or gas leaks[52] and allow alerts to be sent to family or carers in case of an emergency[53]. The most advanced telecare systems will be able to automatically record everyday data such as opening and closing doors and analyse the data to monitor wellbeing and assess the need for help and support[54]. Smart technology may therefore allow people to continue to live independently and safely until later in life[55].

Ensuring that consumers operate and maintain appliances correctly is crucial and the importance of this only increases as time of use is shifted. Inappropriate use of technology or poor maintenance can significantly heighten the risk of electrical fires. There is therefore a need to increase awareness of maintenance procedures such as cleaning filters, especially if appliances are used at off-peak times.

Recommendation

Consumer awareness campaigns that look at how to mitigate the risk of fires caused by appliances in the home should be run by Government, Fire Services and consumer protection organisations.

2.4.3 Regulating the Market

There is less regulation, monitoring and compliance of smart devices compared to other more established systems. Therefore, work is needed to ensure a joined up and consistent approach to minimise safety and security risks, for example, the minimal coordination of training standards for the safe installation, set-up and ongoing maintenance of smart home systems. With increased demand for smart home systems, it is important that similar procedures that are currently in place for smart meters are developed and applied to the installation of smart HEMS. Government investigation into consumer safety and security for smart appliances is ongoing to ensure that households are protected wherever possible from core product safety risks, as well as protected against the threat of cyber hacks.

In the past, there have been instances where devices on the market were found to lack basic security measures[56]. However, guidance and legislative measures have now been introduced to protect security. For example, last year, the Government introduced a new law to ensure that all consumer IoT enabled smart devices sold in the UK adhere to specific security requirements[57]. There is a need to monitor compliance against these security requirements and also analyse the prevalence and cause of electrical safety fires to assess whether additional safety standards are needed in relation to smart technologies.

Further interventions are likely to be required as the market continues to grow and develop and responsibility is currently split between several departments. There is a risk that important issues will fall between multiple government departments. As shown in the graphic to the right, activities have been undertaken across various stakeholder groups.

Figure 3 – The Various Government Departments and Stakeholders Involved in Regulating and Monitoring the Smart Device Market

2.5 Building Fabric Efficiency Measures

Improving the fabric efficiency of buildings across the UK is an important step in the route towards net zero. However, applying insulation can present an electrical safety risk. It is important that installations are undertaken by specialised and certified installers and that trades work together to ensure homes can be retrofitted safely.

The Clean Growth Strategy sets out the Government's ambition for as many homes as possible to be EPC Band C by 2035 where practical, cost effective and affordable[58]. However over 60% of homes do not meet this standard and as such, a significant retrofit programme is needed to address our leaky building stock. Changes to the building fabric may not initially present direct implications for electrical safety. However, there is potential for fabric efficiency measures to interact with electrical appliances and wiring, leading to unintended consequences. Efforts should be made to improve the fabric efficiency of homes in such a way that does not compromise electrical safety.

When insulation measures are applied in areas where electrical cables are present, measures should be installed in a way that minimises contact between the electrical wiring and thermal insulation measure[59]. Insulating materials typically have a low thermal conductivity to limit the passage of heat; this can lead to the overheating of wires and cables. Further to this, certain insulating materials can cause the plasticiser contained within PVC cables to migrate, which can cause premature cable degradation and in a worst-case scenario, fire[60].

However, for fabric components such as walls and ceilings, contact between the fabric efficiency measure and electrical cables can be unavoidable. Regulations have been developed to account for the impact of fabric efficiency measures on overheating risk. These rules have been developed to help limit any overheating such that it is not sufficient to damage or degrade the cable insulation or connected accessories[61] [62]. Caution is needed when cables are surrounded by thermal insulation, or cables are routed in a thermally insulating wall or above a thermally insulated building.

The application of insulation over light fittings can also lead to a risk of overheating and fire. Poorly installed downlighters are a cause of fires in homes. Downlighters are not designed to be covered by thermal insulation in the absence of sufficient ventilation to permit the safe dissipation of heat. As a result, downlighters and any associated transformers must not be covered by thermal insulation and should be protected against potential future covering (e.g. loose-filled insulation can be moved easily by draughts and may come into contact with the downlighter if it is fitted in close proximity)[63].

Educating fabric efficiency installers on the electrical safety implications associated with measures such as loft and wall insulation is essential. City and Guilds Level 2 Qualifications in 'Insulation and Building Treatments', includes some level of provision to educate installers about the electrical safety risks associated with the application of fabric efficiency measures[64] but there is more that could be done on a broader scale.

Additionally, for measures such as loft insulation, which is sold at DIY merchants, there is a risk that consumers will seek to install energy efficiency improvements themselves, without due consideration for the electrical safety implications and other unintended consequences that this could have. There is therefore a need to increase awareness of the risks and provide clear guidance for consumers installing these systems themselves.

2.6 Electric Vehicles

As Electric vehicles become more popular there will be increased demand for chargers at home and in public places. If an EV is not charged in a safe way, there can be electrical safety risks for the user.

The UK Government has set out targets for vehicle transition. The Prime Minister's 10 Point Plan confirmed that the UK would end the sale of new petrol and diesel cars and vans by 2030, with the sale of certain hybrid vehicles permitted until 2035[65]. The Scottish government has committed to phase out the sale of new petrol and diesel cars and vans by 2032[66]. Whilst 86% of Climate Assembly members were in favour of quickly stopping the sale of the most polluting vehicles, members highlighted that emphasis should be placed on the shift to EVs and improvements to public transport links, as opposed to driving large scale reductions in car use[67]. According to the International Energy Agency (IEA), over 40% of global passenger vehicle sales by 2030 will likely have to be EVs under Paris aligned pathways[68].

The Net Zero Public Dialogue report raised concerns regarding the lack of available charging infrastructure[69]. According to data from ZapMap, there has been an estimated 220% growth in the number of publicly accessible chargers compared to 2016 levels[70]. However, there is a need for further expansion; a survey of 2,000 people found that 76% of UK drivers were concerned about the need for more EV infrastructure[71]. In addition, the CCC stresses that the number of charging points will need to increase in line with the rising number of EVs on roads in the UK[72].

Battery Electric Vehicles (BEVs) (pure battery only EVs) now account for over 7% of all new car registrations, up from 0.4% in 2016 and 2020 saw the biggest ever increase in new BEVs. As of 2nd June 2021, there were 15,384 publicly accessible charging locations, with 24,104 individual charging devices, and an estimated 246,701 BEV (pure battery only EVs)[73].

The Government's Electric Vehicle Homecharge Scheme (EVHS) provides grant funding of up to 75% towards the cost of installing EV charge points at domestic properties in the UK[74]. The Government is proposing to also alter building regulations for new homes to include a requirement for EV charge points to be installed[75]. This suggests a substantial increase in the prevalence of charging infrastructure over the coming decades.

Anyone can apply to their local council to request the installation of a charging point on their street, and local authorities can apply for grant funding via the Government's on Street Residential Chargepoint Scheme. For those living in flats, access to charging can be particularly challenging and access to public charging points appears to be a postcode lottery, with the number of public charging devices per 100,000 of population varying across the UK (see Figure 3).

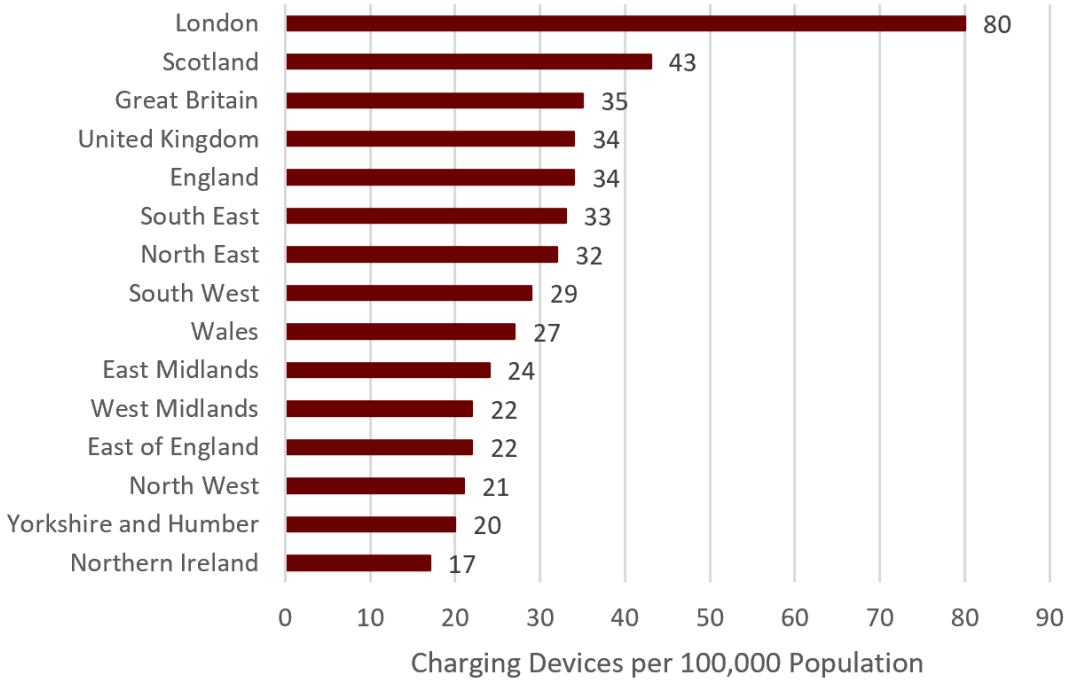


Figure 4 – Public Charging Devices per 100,000 of Population by UK Country and Region. Adapted From: Department for Transport (April 2021)

There is evidence that inadequate public charging infrastructure for EVs in the UK is forcing drivers to take risks by opting for highly dangerous alternatives at home. Some of the dangerous charging practices that consumers may adopt if they cannot locate a professionally installed public or private charging point are outlined on the subsequent page[76].

Examples of Dangerous EV Charging Practices

Using standard domestic extension leads to charge vehicles outside

Wet conditions and contact with the ground mean that the risk of injury or death from electric shock is much greater outside, compared to using electrical equipment indoors.

Daisy-chaining extension leads together

This dramatically increases the risks of socket overload and electric shock and can also place excessive physical strain upon both socket and extension lead. This practice also leads to extension leads, intended for temporary supply of power, rapidly becoming permanent.

Allowing extension leads to cross pavements

In urban areas, the sight of charging cables crossing pavements has become common, despite this practice being against the law and creating an additional hazard for pedestrians. Any accidental force on these leads could result in damage to the cable, plug and socket, again increasing the risk of electric shock and fire resulting from the use of damaged equipment.

Source

Electrical Safety First. (2019). Driven to Danger: Electric Vehicle Drivers Charging Dangerously Due to Lack of Public Infrastructure.

In 2019, Electrical Safety First investigated the charging habits of 1,500 EV drivers[77] and some of the key findings were:

74% Believed that a lack of public charging points near their home had led them to use domestic multi-socket extension leads, not suitable for outdoor use, to charge from the mains in their home.

90% Who charged from home due to a lack of public charging points admitted to using domestic multi-socket extension leads, despite knowing that these should not be used outside.

35.5% Of EV owners said that, in their opinion, the accessibility of charging points within their area at the time was 'not adequate at all.'

75% Of those who indicated that they charged using a domestic extension lead admitted to 'daisy-chaining' extension leads to reach their vehicle. This is highly dangerous as it can lead to overheating and an increased risk of electric shock.

Recommendation

Further consumer education is needed around the risks of using a standard 13A plug and socket to charge an EV. Consumer organisations, Industry and Government should collaborate to ensure that consumers have appropriate information when they switch to EVs from standard diesel and petrol cars.

Dedicated home charging points have built-in safety features and most home chargers, which are rated at 3 kW or 7 kW, are wired directly to the fixed electrical installation on its own circuit for safety and to enable monitoring separate from other electrical loads[78]. The Government's Office for Zero Emission Vehicles (OZEV) provides a list of authorised installers[79] and as of May 2021, there were 4,482 home charge installers in the UK[80].

However, installers are only required to be registered to deliver installations when Government Grants are provided, meaning that installers of EV charge points do not necessarily have to be OZEV registered. If a charge point is not installed by a specialised and certified installer, such as a registered electrician, then there can be safety risks to the consumer, particularly due to the devices being high powered and often located outside where they will get wet. While the financial incentive is in place to use an OZEV registered installer, it is likely that market forces will encourage consumers to use them. It is important that the OZEV grant scheme is extended so that consumers can easily access a specialised and certified installer, such as a registered electrician.

Having charge points installed can also be challenging for people in the Private Rented Sector as they are entirely reliant on their landlord providing permission for the installation of a charging point. This can lead to delays to the installation or prevent tenants from accessing home charge points.

In some housing types, such as flats or properties with on street parking, or where the streets are too narrow to allow on-street charging, other measures will need to be provided, such as 'Charging Hubs' which would allow consumers to access chargers as well as other amenities.

Recommendation

The Department for Transport and devolved governments must ensure that there is a dequate financial support for households to install charging infrastructure at home using an OZEV authorised installer.

Building regulations should also include the need for new properties to include EV charging. The UK Government ran a consultation for EV charging in both residential and non-residential buildings in 2019[81]. Some local councils require the inclusion of charge points when granting planning permission but there is no legislation around this currently.

Recommendation

The Department for Transport, the Office for Zero Emission Vehicles, Local Authorities and Industry must ensure that there is adequate EV charging infrastructure across the UK to reduce the risk associated with dangerous charging practices. Support should be focused on areas where existing charge point deployment is particularly low. Consideration should be given to undertaking a mapping exercise to ensure that the deployment of future projects is co-ordinated, and that a further disparity by geography is not created.

03 Housing Infrastructure

The UK's ageing housing stock introduces inherent safety risks and presents a challenge along the route to decarbonising our homes. Older properties are more likely to suffer from poor electrical wiring which could cause significant safety risks if not considered as part of the transformation.

Currently, the UK has the oldest housing stock in Europe, and most likely the world[82]. However, the state of these homes differs between nations within the UK and between tenures as shown below. In particular, the age of dwellings varies; Wales has the oldest housing stock in the UK, whilst Northern Ireland has the most modern housing stock[83] and across the UK, the private rented sector has the highest proportion of homes built pre-1919 with the owner-occupied sector following close behind. Homes built pre-1919 have the highest prevalence of electrical problems[84].

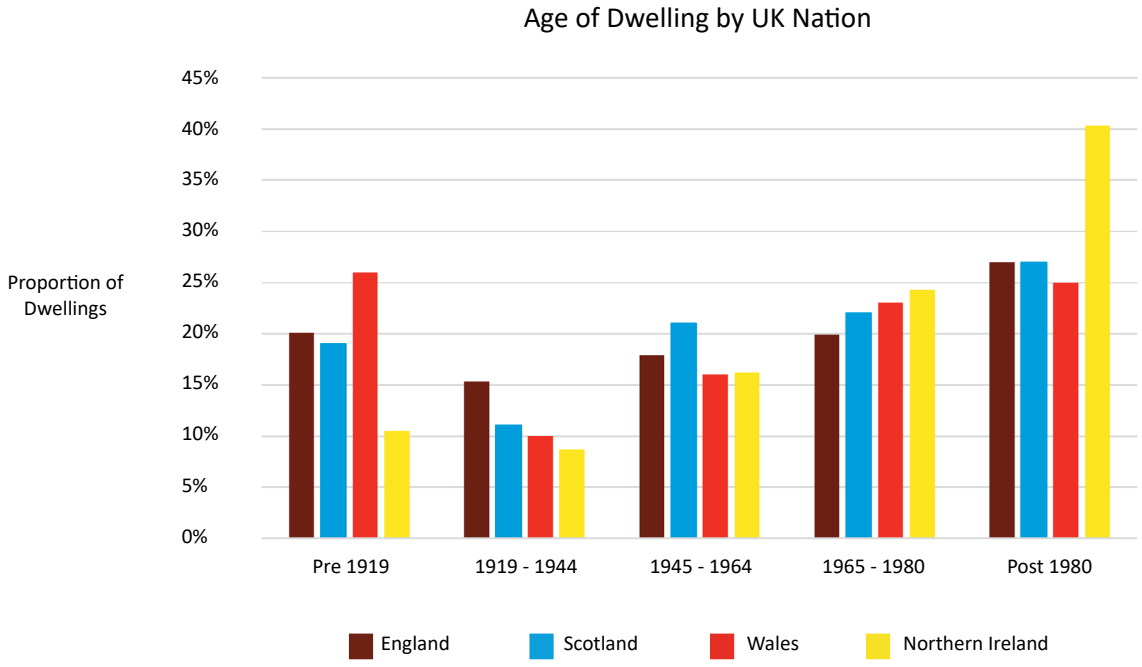


Figure 6 – Age of Dwelling by UK Nation. (a) Scotland figures relate to 1965-1982 and 1982 Onward. Sources: English Housing Survey 2019/20, Scottish House Condition Survey 2019, Welsh Housing Survey 2017/18, Northern Ireland House Condition Survey 2016

The age and state of the housing stock has been identified by installers as barriers to low carbon heat deployment. Those working on older properties cited a lack of insulation as a limiting factor in a heat pump's suitability for these houses[85]. There is a risk that old wiring throughout the ageing stock may not be able to cope with the increased electricity demand that will arise from activities such as charging electric vehicles. This could lead to major events such as electrical fires or outages, if not adequately considered and managed.

Despite the importance of ensuring that electrical wiring is safe and capable of embracing low carbon solutions, the state of an electrical circuit in a home is not captured by housing condition reporting (e.g. English Housing Survey or Decent Homes Standard reporting). As such, it is unclear what proportion of homes fail to meet the minimum standards due to the electrical wiring[86] or whether homes can safely adopt low carbon technologies due to capacity constraints. Any retrofitting for low carbon solutions needs to be done safely with a registered electrician or specialised and certified installer who is qualified for the job that they are carrying out, and able to identify electrical wiring that is not up to minimum standards. The inclusion of specific questions on the condition of electrical wiring and capacity as part of national housing surveys would enable better targeting of resources and enhance the Government's understanding of the suitability of the housing stock for the future. It would also support efforts to raise awareness of the need to improve wiring in conjunction with wider renovation works.

Recommendation

Government housing departments in all nations should ensure that housing standard reporting contains references to the state of electrical wiring and seek to understand capacity constraints. This would enhance their understanding of the suitability of building stock for the future and identify where improvements are needed.

It is important to note that whilst the national housing surveys undertaken across the UK provide the government with a useful overview, they only provide a snapshot of the whole building stock and do not prevent occupants from being exposed to significant risks or ensure that homes are fit for the future.

The need for an updated assessment is more important than before, as the condition and age of wiring needs to be understood if net zero ambitions are to be realised.

Regular five-yearly checks of electrical wiring across all tenures would support the decarbonisation of the building stock and help ensure that homes are safe. These should be undertaken by a qualified and competent person such as a registered electrician and result in the development of a report which outlines if any remedial action is needed to enable property owners to identify risks within individual properties before they cause harm. These checks could be funded through government or other stakeholders for low-income households, and be mandatory on the sale of a property in the same way that Energy Performance Certificates (EPC) are.

The report should be provided to the occupier and local authority where appropriate. In the case of the Private Rented Sector, if there are Class 1 or 2 hazards identified, these must be reported to the local authority. The same should apply to other tenures. The reports can also be used to improve the Government's understanding of electrical safety risks and the prevalence of unsafe practices. Anonymised results from the safety checks should then be published so that progress across the country can be tracked.

Approaches to inspections vary across the devolved administrations and tenures at present, which can cause confusion. In particular, owner-occupiers are not required to have regular checks of the electrical wiring which may put them at risk if issues are not identified. In Northern Ireland, there is no requirement for regular electrical safety checks across any tenure. Despite the fact that electricity causes more fires than gas each year, in Northern Ireland, landlords are required to have the boiler and gas appliances inspected every year by a Gas Safe registered engineer. A consistent approach across all tenures and geographical regions would be more equitable, enable better decarbonisation planning and reduce risks for all households.

Recommendation

Government housing departments in all nations should introduce a common, cross-tenure, housing standard for electrical safety which includes mandatory, five-yearly electrical safety checks for all homes in all parts of the UK. These checks could become mandatory on the sale of the property in the same way that Energy Performance Certificates (EPC) are.

Energy suppliers currently provide a range of free services to vulnerable customers as part of their Priority Services Register Obligations, including free annual gas checks. However nothing is provided to assess electrical risks. There is a need for parity across electricity and gas in terms of the support available.

Recommendation

UK Government and energy suppliers should launch free services including electrical checks to support the electrical safety of vulnerable consumers as we transition away from gas.

The Scottish Government has recently consulted on its Heat in Buildings Strategy[87] which includes consideration of how further financial support may be offered to households to enable them to complete the retrofitting work required, and there are already financial support schemes for retrofit in place across the UK.

However, it is essential that this support also enables safety improvements to be made alongside any remedial works needed to facilitate the adoption of low carbon solutions (e.g. new wiring or fuseboxes). Without such provisions, households could be put at risk as property owners seek to minimise the cost of compliance.

Recommendation

Government should ensure that any funding made available for low carbon technologies has a portion reserved for associated remedial and/or ancillary works such as rewiring or the installation of a new fuse box.

The prevention of fire should be a priority. However, if an electrical fire does occur, it is essential that as much evidence as possible is gathered to enable remedial action and reduce the risk of future incidents. Despite aging infrastructure being a key factor, the Fire and Rescue Services' Incident Reporting System does not record the age of the property affected or if the most recent Electrical Installation Condition Report (EICR) was passed or failed. It is important to note that the approach to reporting varies across the devolved administrations. However, the need to enhance our understanding of the cause of fires is essential and property age and tenure should be considered key factors. This will help key actors to better understand the correlation between the age of the housing stock and electrical fire risk[88] and also monitor the impact of the mandatory EICRs.

Recommendation

The Home Office, the Scottish Fire and Rescue Service and and devolved governments should ensure that information relating to property age, tenure and EICR status following an electrical fire is recorded in a consistent and comparable way to enable better tailoring of guidance and policy to reduce future risks.

04 Policy and Standards

There are different approaches to electrical safety and decarbonisation across the UK nations and policies are often short-term and inconsistently implemented, which leads to disparities across the UK. The lack of clarity around ownership of safety issues across government departments also risks things falling through the gaps which could put consumers at risk.

The tables on the following pages display the extent to which responsibility for a range of key issues is distributed. Whilst this is not an exhaustive list of all policies in place across different sectors, it provides an indication of the number of different actors present within the decarbonisation and electrical safety space.

In addition to the variation in approaches, the policy landscape is not always conducive to investment and market growth. To meet net zero, stable, long-term policy is needed to enable businesses to expand and upskill the workforce. Moreover, consumers need clear messaging and encouragement to upgrade their homes. However, there are many historical and recent examples of support schemes for low carbon heating and energy efficiency measures being closed ahead of schedule or cancelled before they have been introduced. These changes cause confusion for key stakeholders in the transition to net zero and reduce certainty needed for investment, which presents challenges for upskilling and product development.

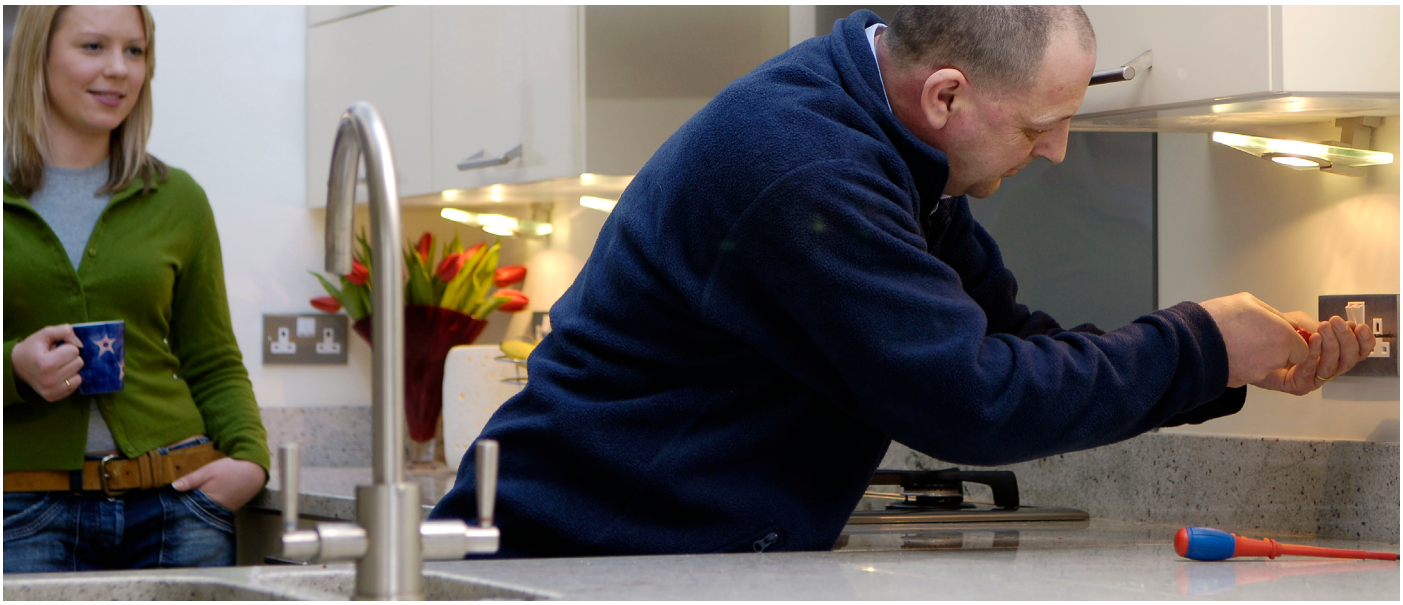
Technology Deployment	England	Wales	Scotland	Northern Ireland
Heat Pump Deployment	Department for Business, Energy and Industrial Strategy via Renewable Heat Incentive and Clean Heat Grant (Effective from March 2022)			—
	Department for Business, Energy and Industrial Strategy and Ofgem via Energy Company Obligation			Energy Saving Trust via Northern Ireland Sustainable Energy Programme
	Department for Levelling Up, Housing and Communities via Building Regulations	Welsh Government via Building Regulations	Scottish Government via Building Regulations	Northern Ireland Department of Finance
	Department for Levelling Up, Housing and Communities via Energy Performance Certificates		Scottish Government via Energy Performance Certificates	Northern Ireland Department of Finance and Personnel via Energy Performance Certificates
	Local Authorities (with support from the Department for Business, Energy and Industrial Strategy via Green Homes Grant Local Authority Delivery Scheme		Scottish Government via Home Energy Scotland loan scheme	Northern Ireland Department for the Economy due to publish final Energy Strategy later in 2021
	Home Upgrade Grant (commencing delivery in early 2022)	Welsh Government via Nest (part of the Warm Homes Programme)	Scottish Government via Warmer Homes Scotland scheme	As Above
	Local Authorities (with support from the Department for Business, Energy and Industrial Strategy) via Social Housing Decarbonisation Fund Demonstrator			As Above
Solar PV Deployment	Department for Business, Energy and Industrial Strategy and Ofgem via the Smart Export Guarantee			Power NI via Export Tariff for electricity exported to the grid
	Department for Levelling Up, Housing and Communities via Building Regulations	Welsh Government via Building Regulations	Scottish Government via Building Regulations	Northern Ireland Department of Finance via Building Regulations
	Department for Levelling Up, Housing and Communities via Energy Performance Certificates		Scottish Government via Energy Performance Certificates	Northern Ireland Department of Finance via Energy Performance Certificates
	Local Authorities (with support from the Department for Business, Energy and Industrial Strategy) via Green Homes Grant Local Authority Delivery Scheme		Scottish Government via Home Energy Scotland loan scheme	Northern Ireland Department for the Economy
Smart Meters	Department for Business, Energy and Industrial Strategy and Ofgem via Smart Metering			Northern Ireland Electricity Networks Meter Replacement Programme
Fabric Efficiency Deployment	Department for Business, Energy and Industrial Strategy and Ofgem via Energy Company Obligation (N.B In Scotland, this funding is blended with Home Energy Efficiency Programmes for Scotland (HEEPS) funding via Local Authorities)			Northern Ireland Housing Executive via Affordable Warmth Scheme
	Department for Levelling Up, Housing and Communities via Building Regulations	Welsh Government via Building Regulations	Scottish Government via Building Regulations	Northern Ireland Department of Finance via Building Regulations
	Department for Levelling Up, Housing and Communities via Energy Performance Certificates		Scottish Government via Energy Performance Certificates	—
	Local Authorities (with support from the Department for Business, Energy and Industrial Strategy) via Green Homes Grant Local Authority Delivery Scheme		Scottish Government via Home Energy Scotland loan scheme	Northern Ireland Utility Regulator via the Northern Ireland Sustainable Energy Programme
	Home Upgrade Grant (Commencing Delivery in Early 2022)	Welsh Government via the Warm Homes Programme	Scottish Government via Warmer Homes Scotland scheme	—
	Local Authorities (with support from the Department for Business, Energy and Industrial Strategy) via Social Housing Decarbonisation Fund Demonstrator			Northern Ireland Housing Executive via Affordable Warmth Scheme
Electric Vehicle Deployment	Plug-in Car, Van and Truck Grant via the Department for Transport and Office for Zero Emission Vehicles			
	—	—	EV Loan via Transport Scotland	—
Electric Vehicle Charge Point Deployment	Office for Low Emission Vehicles/Office for Zero Emission Vehicles via EV Homecharge Scheme		Office for Low Emission Vehicles/ Office for Zero Emission Vehicles via EV Homecharge Scheme with top-up Funding from Energy Saving Trust	Office for Low Emission Vehicles/ Office for Zero Emission Vehicles and the Department for Infrastructure
	Local Authorities (with support from the Office for Low Emission Vehicles/Office for Zero Emission Vehicles) via On Street Residential Chargepoint Scheme			

Housing Infrastructure	England	Wales	Scotland	Northern Ireland
Assessment of the State of the Stock	Department for Levelling Up, Housing and Communities via English Housing Survey	Welsh Government via Welsh Housing Conditions Survey	Scottish Government via Scottish House Condition Survey	Northern Ireland Housing Executive via House Condition Survey
Assessment and Recording of Dwelling Fires	Home Office	Welsh Government	Scottish Fire and Rescue Service	Northern Ireland Fire and Rescue Service

Product Safety and Standards	England	Wales	Scotland	Northern Ireland
Product Recall	Department for Business Energy and Industrial Strategy and specifically the Office for Product Safety and Standards (product regulator for the UK)			
	Citizens Advice		Consumer Scotland	The Consumer Council

Consumer Education	England	Wales	Scotland	Northern Ireland
Energy Efficiency and Renewable Energy	Simple Energy Advice		Home Energy Scotland	NI Energy Advice
Electrical Safety	Home Office – Fire Kills Campaign (in association with Electrical Safety First)	3 x Fire and Rescue Services in Wales	No Government appointed body, however, Scottish Fire and Rescue Service leads on national electrical safety messaging	No Government appointed body, Northern Ireland Fire and Rescue Service would lead on electrical safety messaging

Installer Training and Standards	England	Wales	Scotland	Northern Ireland
Energy Efficiency	Department for Business Energy and Industrial Strategy via TrustMark and PAS2035/PAS 2030:2019		Scottish Government considering PAS and TrustMark	Northern Ireland considering enhancing quality assurance and standards as well as using an accreditation body to provide guarantees
	Department for Education	Welsh Government	Scottish Government	Department for the Economy (Northern Ireland)
Renewable Heat and Energy	Department for Business Energy and Industrial Strategy via MCS		Scottish Government considering MCS	Northern Ireland considering enhancing quality assurance and standards as well as using an accreditation body to provide guarantees
	Department for Education	Welsh Government (Education and Public Services Group/ Economy, Skills and Natural Resources Group)	Scottish Government, Fair Work, Employability and Skills Directorate	Department for the Economy (Northern Ireland)
Electrical Installations	Department for Levelling Up, Housing and Communities via Part P of Building Regulations Department for Education, Institute for Apprenticeships and Technical Education	Welsh Government via Part P of Building Regulations	Scottish Government via Building Regulations	There are currently no statutory requirements for domestic electrical installation work in Northern Ireland. However, there are certification organisations that register and assess electrical contractors



05 A Growing and Changing Market

5.1 The Existing Installer Skill Base is Insufficient

5.1.1 Growing the Installer Base

We are likely to become increasingly reliant on electricity on the route towards net zero, yet there are already reports of a lack of registered electricians. Electrical Safety First believes that we cannot safely achieve net zero without growing the base of registered electricians, and other specialised and certified installers, with the skills and competencies required to install and maintain new low carbon and IoT enabled (smart) technologies. As we rush to retrofit our homes, there is a risk that corners will be cut during installation, which could pose risks. Growing the base of highly trained, specialised and certified installers now will be critical if we are to scale up delivery in the next decade, whilst protecting safety.

A labour market report by the Electro-technical Skills Partnership (TESP) looking specifically at the electrotechnical industry estimated that an additional 12,500 - 15,000 additional skilled electricians will be required over the five years from 2019 - 2024 to meet the anticipated growth in demand. The electrification of heat and transport combined with the evolution of smart technology means that this could be seen as a conservative estimate. Research suggests that even if an additional 5,000 new apprentices qualify by 2023 (which would represent a 33% increase from today), there will be a significant shortfall in registered electricians[89].

Given the projected shortfall in electricians, it is key that new and potential entrants are engaged in the sector. As we transition to the future home, electricians are likely to be required to support the installation of innovative low carbon technologies and will need a wide skill set to enable them to work with new technologies emerging across the UK market. There is potential to engage young people and encourage them to consider a career in the electrotechnical sector by promoting the benefits and opportunities and also removing the barriers to entry. They may also be encouraged by being part of a sustainable industry which can support the achievement of net zero. Research shows that 78% of UK adults want to play a part a part in reaching the UK's net zero goal and 57% want to work for an organisation that helps us get there[90]. Learnings may be drawn from Science, Technology, Engineering and Mathematics (STEM) Learning, regarding how to attract various actors to drive transformative change.

Good Practice Example

STEM Learning works with key stakeholders including education providers, community groups and employers to deliver world leading STEM education to young people across the UK and ultimately encourage them to engage in careers within the sector. STEM Learning has six key principles:

- Help young people to understand the importance of STEM.
- Challenge the perception that "STEM isn't for me".
- Help young people to see the value and transferability of STEM skills.
- Develop the employability skills amongst young people required to be successful in STEM.
- Ensure young people are aware of the wide range of roles available within STEM industries.
- Increase awareness of study routes and labour market information.

Source

STEM Learning. STEM Careers Inspiration and Support.

Whilst a growth in registered electricians will be key, specialised and certified installers will also be required to support the transition to the future home. The shortage of suitably qualified and competent heat pump engineers, for example, presents a significant challenge. Whilst there are over 100,000 installers trained on the Gas Safe Register to install gas boilers and conduct checks and maintenance, there are less than a thousand trained heat pump engineers[91]. According to the Heat Pump Association (HPA), a rapid growth in the heat pump engineer base is required, and by 2035 up to 69,500 heat pump engineers could be required[92]. Encouraging installers to specialise, and upskill and retrain in low carbon technologies is essential.

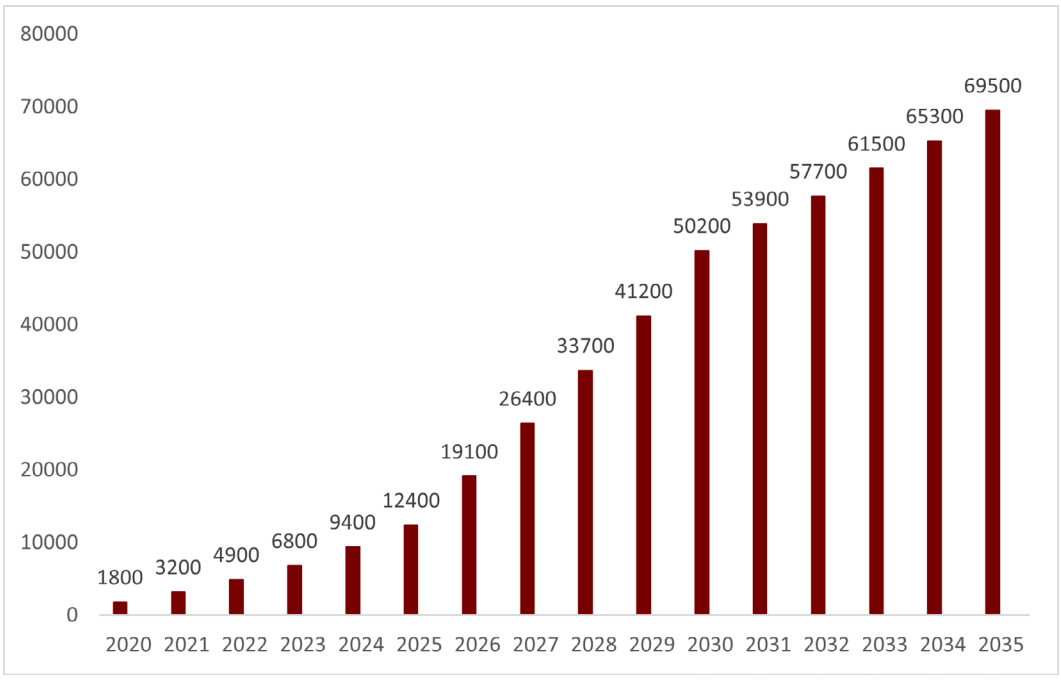


Figure 6 - Potential Total Number of Installers Needed. Adapted From: HPA

The shortfall in required heat pump engineer numbers, combined with a need to upskill the current workforce to be competent to install low carbon solutions, could result in households using unregulated, incompetent or unqualified installers to undertake works. Furthermore, if consumers are unable to locate a specialised and certified installer, there is a risk that they will attempt to install systems themselves. Installers are a key source of information for consumers and self-installation could result in incorrect use or set-up as tailored advice is not given. This is not only unsafe but could mean that homeowners are not protected if the installation does not meet best practice guidelines. This is a significant concern which must be addressed as we embark on the transition to net zero.

Many of the technologies discussed throughout this report are emerging and, as such, there is less market regulation and fewer mechanisms to undertake monitoring and compliance of installations, compared to other more established technologies. The CCC has noted that "the chopping and changing of Government policy has inhibited skills development in critical areas." A clear and consistent policy framework will provide the workforce with the confidence to upskill and invest, in order to deliver high quality installations of low carbon and energy efficiency measures and support the retrofit of the UK's building stock to achieve net zero. Without certainty and in the absence of regulation, monitoring and enforcement, essential investment will not be made and inexperienced, unqualified individuals could present significant risks to safety if allowed to operate in the industry to meet increasing demand.

Recommendation

Government should introduce a clear and consistent policy framework to provide industry with long-term certainty of demand and encourage investment in upskilling.

Recommendation

Government should introduce grants and/or tax incentives to encourage individuals to upskill and enter the low carbon market.

5.1.2 Developing a Skilled and Competent Workforce

Simply growing the number of installers and electricians alone is not enough. It is paramount that the tradespeople supporting the net zero transition are upskilled to a high standard to ensure they are competent and possess the skills required to install measures to a high standard whilst minimising any risk of unintended consequences. It is also important that tradespeople are cross-skilled and possess an understanding of how solutions work together. With an ever changing and evolving market, there is also a need for ongoing assessments of competence and continuing professional development to ensure a skilled and competent workforce.

Whilst there are specific training courses developed to upskill installers in different measure types, there remain concerns regarding competency. There is generally a lack of awareness of these courses, and adoption is low. This is evidenced by multiple studies. For example, almost 70% of electricians consulted in a recent survey indicated that they did not feel they have the necessary skills and knowledge to install EV equipment confidently. However, electricians face barriers to upskilling in EV technology, with key barriers to training including insufficient time (76%) and the high associated cost (46%)[93]. Similarly, a BEIS study found 29% of heat engineers, who had installed a heat pump in the past 12 months, had not received dedicated heat pump training.

The top three barriers for heating engineers upskilling included proximity to retirement (35%), lack of consumer demand (25%), and lack of time (15%)[94]. This is concerning given the anticipated increase in EV charging points and heat pumps needed. Dedicated training opportunities have been found to improve the reported levels of confidence in installing low technologies. It is important that barriers faced by electricians and heating engineers are addressed to ensure high quality installations and prevent a situation whereby homeowners are exposed to unnecessary risk due to poor installation practices or unavailability of specialised and certified installers.

Potential Initiatives to Increase the Uptake of Heat Pump Training and Upskilling Activities.

Installer research indicates that a range of initiatives to increase upskilling are popular.

• 88% of surveyed installers support the idea of extending the law so that a register applies to all heating system installers and installations, not just gas.

• 86% of surveyed installers support the idea of 'low carbon training schemes which are only accredited if they are delivered to an agreed standard'.

• 83% of installers support the idea of 'subsidised costs for low carbon training /voucher schemes to retrain'.

Other popular measures included mandatory low carbon modules in all heating/plumbing qualifications and a requirement upon installers to complete training in low carbon heating to register with key trade organisations within the sector.

Source

BEIS (2021) Heating Systems in off Gas Grid Areas: Installers' Experiences and Attitudes Towards Low Carbon Heating

Whilst the number and competency of electricians is important, the other trades working alongside electricians and within the home retrofit space also need to be aware of the electrical safety risks that could be associated with poor quality installations. In addition to having the technology-specific skills and competencies, specialised and certified installers play an important role in futureproofing homes and minimising potential risks. For example, if energy efficiency installers do not adequately consider electrical safety or consult a registered electrician during the installation process, there is a risk that remedial work may be needed. This could mean that walls which have been insulated and plastered may need to be dismantled in the future to replace cables. A lack of awareness of the risks or care in relation to electrical safety could endanger consumers and lead to remedial work being required at a later date, increasing the cost of the transition to net zero. Ensuring effective co-ordination and collaboration between all sectors will help to minimise risk.

There is therefore a need to ensure that energy efficiency and low carbon courses adequately address electrical safety, highlighting the issues which should be considered during the installation of

different products. We believe that specialised and certified installers should be able to identify and prevent unsafe practices to deliver holistic services to consumers. A recent BEIS study found that no heating engineers routinely recommended upgrades to insulation to enable heat pumps to operate at their most effective level; instead, they indicated that they would recommend an alternative heat source that complemented the existing property infrastructure[95]. This suggests that many heating engineers do not consider renovations holistically, indicating an area for improvement.

As highlighted in the good practice example below, some specialised installers do provide a more comprehensive service to clients, identifying safety risks and proposing remedial actions. However, this is only possible through the availability of suitable training and guidance.

Smart Meter installations can have positive implications for electrical safety as engineers can provide a free check of electricity supplies within the home; in 2017 alone, over 270,000 pre-existing safety issues such as dangerous wiring and fuseboxes were identified by smart meter installers. In addition, smart meters can send information about the meter's status which may be used to diagnose meter faults, security risks and energy theft. These alerts are monitored by suppliers and distributors, allowing them to take action where appropriate.

Source

Smart Meters. (2021). Technical Information.

The installer is often seen as the most important source of advice and guidance for consumers with 79% of individuals changing their heating system indicated that their heating engineer was a helpful source of advice[96]. It is therefore essential that installers are highly skilled in the solution being installed and also able to offer reliable and useful advice to help customers make informed decisions about the most appropriate solutions for their home. The role of the installer also extends to providing guidance on how to operate any system efficiently to deliver optimal results and minimise safety risks.

Advice and Guidance

The installer must be able to minimise operational electrical safety risks that may be posed by consumers failing to operate their system correctly by providing reliable advice on the suitability of the solution, controls, maintenance and interoperability.

Interpersonal communication

It is essential that installers have the interpersonal skills to be able to clearly communicate electrical safety risks as well as concisely sharing relevant product and operational information to consumers. Guidance from a trusted installer is important in raising consumer awareness of electrical safety risks and it should be provided in a clear and concise way (i.e. jargon free).

With an ever changing and evolving market, there is also a need for ongoing assessments of competence and continuing professional development to ensure a skilled and competent workforce.

Recommendation

Education authorities and training providers should continue to develop high quality training courses and regulated qualifications to support the upskilling of professionals. New and existing apprenticeship standards should also incorporate energy efficiency/ low carbon content. This could be supported via a combination of current and additional government funding.

5.2 Ensuring Consistency Across the Market

There is a risk that market growth without adequate standards or enforcement in place could compromise the quality of installations and subsequently, electrical safety.

To meet net zero, it is clear that the base of specialised and certified installers and registered electricians must increase. However, it is important that installation quality is not adversely impacted by labour market growth and that high standards of education, training and assessment are maintained. There is a risk that a rapid growth in demand may lead to an influx of rogue traders or installers without the skills and training required to deliver high quality installations which might put the safety of customers at risk[97] [98]. In fact, training and accreditation and the presence of a Compliance and Quality regime are seen as two of the critical elements required for the delivery of the Construction Leadership Council's (CLC's) National Retrofit Strategy.

Each Home Counts and Hackitt Review

The Each Home Counts Review was an independent review of consumer advice, protection, standards and enforcement of energy efficiency and renewable energy installations within homes.

The review found cases of poorly targeted interventions, poor practice and sub-standard work. Ofgem's Technical Monitoring Report investigated 6.9% of 1.5 million measures installed under ECO between January 2013 and March 2015 and found that almost 10% did not meet installation standards in the first instance and additional work was subsequently required.

The majority of failures are not believed to be due to intentional poor performance but a lack of training or gaps in standards. However, the findings of this review indicate the importance of standards and training in maintaining high quality installations, even when a rapid growth in demand is observed.

These findings were also highlighted within the Hackitt Review which identified a range of issues with existing building practices and building regulations. Key issues identified included ignorance, indifference, an absence of clarity on roles and responsibilities and inadequate regulatory oversight and enforcement within the building industry.

Installers and delivery partners partaking in all Government schemes are required to meet certain minimum standards and register with certification schemes including but not limited to those outlined in Figure 8 on the following page.

TrustMark

Trustmark registration is the Government Endorsed Quality Scheme that covers work a consumer chooses to have carried out in or around their home, including low carbon and energy efficiency installations.

It is required for many government retrofit schemes (although sub-contractors are not required to register).

The PAS Framework

PAS 2030 covers the installation, commissioning and handover of retrofit projects and PAS 2035 is an overarching framework that embraces a whole house approach to retrofit and requires the use of a retrofit co-ordinator, amongst other roles.

Under PAS 2035, projects must be overseen and logged into the TrustMark Data Warehouse by a qualified and TrustMark registered Retrofit Coordinator.

Microgeneration Certification Scheme (MCS)

The Microgeneration Certification Scheme (MCS) was developed to safeguard high quality within the industry. Compliance to MCS or an equivalent scheme is required when installing appropriate measures under government schemes.

Crucially, in order to demonstrate the competence of its employees, installation companies are required to either provide evidence of the valid qualification held and/or short courses attended or demonstrate experience to an MCS Certification Body.

Figure 8 – Government Endorsed Quality Assurance and Certification Schemes for Retrofit.
Sources: TrustMark, MCS and TrustMark PAS 2035 Information Page.

However, there is significantly less in place in terms of certifications and standards for measures not installed under Government schemes or for products that fall outside of MCS. Although anyone can use a TrustMark/MCS installer, not all installers are TrustMark and/or MCS certified and not all adhere to PAS 2035. This creates a disparity across the sector and could put consumers who self-fund measures at risk if they do not use competent tradespeople. It is essential that all work is carried out to a safe standard and therefore consumers need to be encouraged to use individuals or enterprises belonging to the appropriate quality mark scheme or registration body, regardless of how it is funded.

Building a critical mass of specialised and certified installers and registered electricians will help to increase the salience of these quality marks and also reduce the risk of consumers using unqualified tradespeople. We therefore support this phased approach but stress the urgent need to expand the coverage of such schemes.

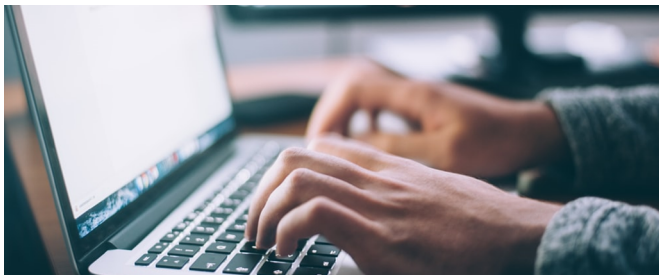
It is also important that consumers can access redress if work undertaken does not meet a sufficient standard. Enforcement is needed to ensure that work is undertaken by a qualified person who is competent in the work being carried out, such as a registered electrician. Registered electricians are

insured so consumers will get additional protections if something goes wrong[99].

Recommendation

As the market grows, National Government(s), and specifically Energy and Housing Teams, should introduce minimum installation quality standards across the whole industry.

5.3 Online Marketplaces



Consumers assume online marketplaces are responsible for ensuring that products sold on their platforms are safe, but this is not the case. Online marketplaces do not have the same consumer protections as high street retailers and can expose consumers to unsafe goods. We believe that without Government intervention, the problem will worsen.

93% of consumers expect e-commerce sites to protect them against counterfeit goods[100]. However, online marketplaces are not bound by the same laws as traditional retailers. This means that unsafe goods can be bought online[101], and consumers do not have the same legal protections as they would when buying from a high street retailer. With the growth in online shopping accelerated by the Coronavirus pandemic, better protection for online shoppers is vital.

Recommendation

The Office for Product Safety and Standards/ the Department for Business, Energy and Industrial Strategy should put in place appropriate regulations for online marketplaces so that consumers buying electrical products online have the same protections as they have in a high street shop.

Whilst primary legislation is an important first step in the route towards making online marketplaces safer, enforcement will be critical to ensure that those failing to comply with regulations are penalised. Action is therefore required to both tighten regulations and ensure such regulations can be enforced in practice. It is also important to highlight that regulating online marketplaces will not cover private sales from person to person. To this end, consumer education regarding electrical safety is critical, as discussed in the following section.

5.4 Replacing, Repairing and Recalling Products

Consumers are wanting to replace and repair their products to make them last longer instead of being thrown away. Items need to be repaired to a high standard to ensure that they remain safe. There also needs to be an improved recall system, so that consumers know when their products have been recalled and understand the need to act on the safety advice given.

5.4.1 Replacing and Repairing Products

As we see the prevalence of low carbon, energy efficient and smart technologies increase over the next decade, the market for replacement products is also set to grow. To reduce environmental impact, Climate Assembly members supported the idea of individuals repairing and sharing more to reduce the number of new products purchased. Consumer surveys suggest that consumers are already repairing rather than replacing items (72%) and borrowing or buying second-hand rather than buying new products (52%)[102]. Whilst it is widely agreed that repairs should be favoured over buying new, where practical and economical to extend the life of a product, there is a risk that consumers will opt for low cost and often sub-standard, second-hand or counterfeit products to replace faulty or broken equipment. This is a significant concern as counterfeit technologies can cause serious electrical safety issues. Counterfeit electrical goods almost always contain sub-standard or faulty parts that can overheat or break just days after purchase, increasing the risk of fire or electric shock[103].

EU right to repair legislation took effect on 1st March 2021. This legislation requires manufacturers of electrical goods to effectively make their products "repairable" for a minimum of 7-10 years after first coming onto the market, with certain parts only made available to professional repairers (e.g. motors and pumps) and others made available for end users (e.g. hinges and seals)[104]. The UK Government has committed to mirroring this legislation[105] following the exit of the UK from the Single Market which took place on 31st December 2020[106]. This legislation will need to be appropriately enforced to ensure products that are non-compliant are identified and removed from marketplaces. Products impacted will include washing machines, fridges and a range of other household electrical appliances[107]. It will aim to address environmental concerns and e-waste and make it easier for consumers to have products repaired. A recent report by the Green Alliance found that prioritising the repair and reuse of manufactured goods could create over 450,000 jobs in the circular economy over the next 15 years, with roles including repairers of machinery and electronics. However, if a product is to be repaired, it is important that the electrical safety implications of this are considered, and that consumers use reputable and competent tradespeople to repair equipment. We are calling for manufacturers to establish and support a network of authorised repairers to ensure that consumers are able to access high quality workmanship when it makes environmental and economic sense, minimising the risk to life from hazardous repairs.

5.4.2 Developing a Skilled and Competent Workforce

The UK's complex and self-regulated product recall system has left many unsafe products in people's homes. However, smart technology in a future home could allow for more effective recalls by alerting consumers or even enabling the remote switching off of recalled appliances. Social media and digital technology can also be used to improve product registration and recall response rates. Electrical products could have data feedback to the manufaccturer, helping them to identify possible defective products and enabling them to recall these products more easily. Electrical Safety First has developed a Voice Skills app, available on Alexa and Google Nest. Users are able to ask whether products in their homes have been recalled, along with other features[108]. Consumers agree that social media and digital technology can improve product safety, traceability and recalls; however, there are also concerns around data security[109]. An Improving Product Registration and Recall (IPRR) Group has been set up by the Charity to work with stakeholders to consider how to improve both product registration and recall response rates.

Recommendation

DEFRA and OPSS should develop a network of qualified and competent repairers via collaboration between low carbon, energy efficient and smart solution product sellers.

Recommendation

Electrical Safety First should facilitate collaboration between manufacturers, retailers and consumer awareness groups, and launch an awareness raising campaign through media and digital channels.

06 Consumer Education

Consumers need to be at the heart of the transition to net zero and the Government must not underestimate the challenge that this brings. Consumer misunderstanding and misuse is a common thread to many electrical safety risks. How consumers use electrical products, where they purchase them and who they use to install them are critical decisions that have a significant influence on electrical safety and as such, consumer education is fundamental.

6.1 Low Carbon Technologies and Electrical Safety

Consumer awareness surrounding the Government's strategic technologies for the future home is highly variable. Consumer research indicates that there are very low levels of awareness of certain technologies, such as heat pumps (see Figure 9). Consumers do not know enough about the benefits of low carbon technologies; for example, 21% of heating engineers surveyed saw the lack of awareness, knowledge and understanding among consumers as a barrier to heat pump deployment[110].

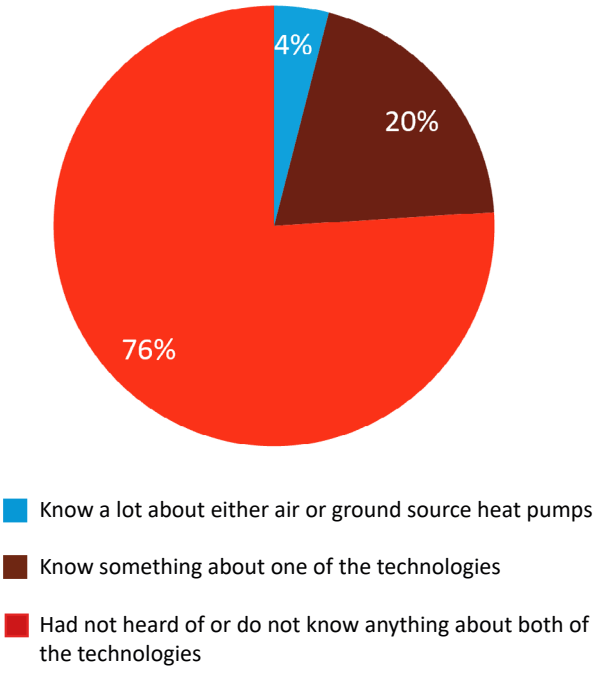


Figure 9 – Consumer Awareness of Heat Pumps. Data From: BEIS

Research shows that new technologies may suffer from low take-up rates if consumers lack experience and understanding of the technology and its benefits[111]. This demonstrates the importance of engagement and information campaigns in building consumer awareness of the key technologies likely to be present within the home of the future. Increased awareness should, in theory, lead to greater uptake and acceptance. In fact, members of the Climate Assembly thought that 'informing and educating everyone' (including the public) should be top of the priority list in terms of principles that should underpin the UK's path to net zero[112].

However, crucially, a lack of technology familiarity could lead to safety risks if consumers are not aware of the most appropriate technologies for their home and how to use and maintain them. Consumer misuse is one of the main causes of electrical fires in UK homes[113]. Clear and consistent messaging is needed on the importance of electrical safety in campaigns developed to promote new net zero technologies. Technologies relied upon on a daily basis such as heating systems and cars are likely to be replaced by new technologies which will have different maintenance and usage requirements, and it is critical that consumers are educated about these.

Recommendation

Energy advice organisations should ensure that information campaigns regarding net zero home technologies include links and guidance on electrical safety and provide recommendations on how consumers can find a specialised and certified installer in their region.

6.2 Using a Registered Electrician or Specialised and Certified Installer

Ensuring that systems are correctly specified and installed, as well as regularly inspected and maintained, is an important step in protecting the electrical safety of consumers. Electrical Safety First advises that all homeowners should use a registered electrician or specialised and certified installer who is assessed and able to demonstrate competency in the particular technology being installed. It is also recommended that consumers arrange regular inspections and testing by a registered electrician, to help identify any faults.

Following the Each Home Counts Review which looked at consumer protection and advice surrounding the installation of energy efficiency measures and renewable energy in homes, there has been an increasing focus on quality assurance and consumer protection under Government funded schemes. When installing energy efficiency and low carbon heat in England and Wales, installers are typically required to be TrustMark Registered and, in the case of low carbon heat engineers, MCS Certified.

However, as highlighted in Table 1, there is a significant degree of variation in standards across the UK, including standards surrounding installer competency, which can make it difficult for consumers to locate specialised and certified installers. Some specific proposals to expand standards in order to improve consistency have been outlined below:

- Certification should be introduced for Installers of Smart Home Energy Management.
- TrustMark, MCS and PAS 2035 and PAS 2030:2019 or similar schemes should be introduced in Scotland and Northern Ireland.
- Statutory requirements for domestic electrical installation work should be introduced in Northern Ireland.

Outside of Government schemes, there is little provision to mandate whether a homeowner uses a TrustMark and/or MCS Certified installer, for example. Whilst it may be recommended that consumers use specialised and certified installers,

they will not necessarily select an installer who is fully competent to undertake the work required, potentially placing themselves at additional risk of electrical safety hazards.

There is also a risk that if a consumer cannot locate an installer, or installation costs are considered high, they may resort to undertaking electrical work themselves. This is a particular risk for certain measures such as the installation of certain types of fabric efficiency, which can in fact pose an electrical safety risk. Measures such as loft insulation are easily available to purchase at trade and building supply stores and as such there are limited barriers to discourage consumers from undertaking work themselves.

Every year in the UK, several people die and many more are seriously injured by electrical accidents in the home. In a survey of registered electricians, a third had seen electric shocks caused by botched DIY, with 15% reporting that it had caused an electrical fire[114]. It is critical that consumers are educated about the dangers of undertaking work themselves.

Recommendation

Governments in all nations should increase the promotion of using competent tradespeople and raise awareness of authorised installer registration platforms. Prior to this, greater consistency is required in terms of standards surrounding installer competency. Some specific proposals have been outlined below:

- Certification could be introduced for Installers of SHEMs.
- TrustMark, MCS and PAS 2035 and PAS 2030:2019 or similar schemes could be introduced in Scotland and Northern Ireland.
- Statutory requirements for domestic electrical installation work should be introduced in Northern Ireland.

Consumer awareness is essential to minimise this risk. Electrical Safety First has continuously campaigned for better consumer education and raised awareness of the need to appoint specialised and certified installers, such as registered electricians, regardless of the electrical works being undertaken. The policy interventions proposed in this section of the report may be valuable in driving the use of specialised and certified installersat least to some extent. However, there is a need to ultimately introduce a mandatory requirement on skills for certain activities, with enforcement where installers are found to be operating without the core competencies required. There is also a need for consumer redress if products are mis-sold or work undertaken is not of a sufficient standard. Whilst this may not be feasible in all cases at the present time, Government should work with industry to understand whether this is possible in future with the appropriate support.

Recommendation

The Department for Levelling Up, Housing and Communities, and devolved governments, should consider whether competent person schemes could become a mandatory requirement for installations.

07 Recommendations

Housing Infrastructure
Government housing departments in all nations should ensure that housing standard reporting contains references to the state of electrical wiring and seek to understand capacity constraints. This would enhance their understanding of the suitability of building stock for the future and identify where improvements are needed.
Government housing departments in all nations should introduce a common, cross-tenure housing standard for electrical safety which includes mandatory five-yearly electrical safety checks for all homes in all parts of the UK. These checks could become mandatory on the sale of the property in the same way that Energy Performance Certificates (EPC) are.
UK Government and Energy suppliers should launch free services including electrical checks to support the electrical safety of vulnerable consumers as we transition away from gas.
Government should ensure that any funding made available for low carbon technologies has a portion reserved for associated remedial and/or ancillary works such as rewiring or the installation of a new fusebox.
The Home Office, the Scottish Fire and Rescue Service and devolved governments should ensure that information relating to property age, tenure and EICR status following an electrical fire is recorded in a consistent and comparable way to enable better tailoring of guidance and policy to reduce future risks.
Smart Home Technologies
The Office for Product Safety and Standards should monitor the number of incidents related to the running of appliances when the home is unoccupied or households are asleep and improve safety standards for smart technologies to minimise risk.

Manufacturers must ensure that products are as safe as practicable and innovate to ensure that any additional foreseen risks associated with running appliances overnight or when the home is unattended are minimised.
Consumer awareness campaigns that look at how to mitigate the risk of fires caused by appliances in the home should be run by Government, Fire and Rescue Services and consumer protection organisations.
Electric Vehicles (EVs)
Further consumer education is needed around the risks of using a standard 13A plug and socket to charge an EV. Consumer organisations, Industry and Government should collaborate to ensure that consumers have appropriate information when they switch to EVs from standard diesel and petrol cars.
The Department for Transport and devolved governments must ensure that there is adequate financial support for households to install charging infrastructure at home using an Office for Zero Emission Vehicles authorised installer.
The Department for Transport, the Office for Zero Emission Vehicles, Local Authorities and Industry must ensure that there is adequate EV charging infrastructure across the UK to reduce the risk associated with dangerous charging practices. Support should be focused on areas where existing charge point deployment is particularly low. Consideration should be given to undertaking a mapping exercise to ensure that the deployment of future projects is co-ordinated, and that a further disparity by geography is not created.
Growing the Installer Base
Government should introduce a clear and consistent policy framework to provide industry with long-term certainty of demand and encourage investment in upskilling.
Government should introduce grants and/or tax incentives to encourage individuals/enterprises to upskill and enter the low carbon market.
Education authorities and training providers should continue to develop high quality training courses and regulated qualifications to support the upskilling of professionals. New and existing apprenticeship standards should also incorporate energy efficiency/low carbon content. This could be supported via a combination of current and additional government funding.
As the market grows, National Government(s), and specifically Energy and Housing Teams, should introduce minimum installation quality standards across the whole industry.
Online Marketplaces
The Office for Product Safety and Standards/the Department for Business, Energy and Industrial Strategy should put in place appropriate regulations for online marketplaces so that consumers buying electrical products online have the same protections as they have in a high street shop.
Replacing and Repairing Products
The Department for Environment, Food and Rural Affairs and the Office for Product Safety and Standards should develop a network of qualified and competent repairers via collaboration between low carbon, energy efficient and smart solution product sellers.

Electrical Safety First should facilitate collaboration between manufacturers, retailers and consumer awareness groups, and launch an awareness raising campaign through media and digital channels.
Consumer Education
Energy advice organisations should ensure that information campaigns regarding net zero home technologies include links and guidance on electrical safety and provide recommendations on how consumers can find a specialised and certified installer in their region.
Governments in all nations should increase the promotion of using competent tradespeople and raise awareness of authorised installer registration platforms. Prior to this, greater consistency is required in terms of standards surrounding installer competency. Some specific proposals have been outlined below: - Certification could be introduced for Installers of SHEMs. - TrustMark, MCS and PAS 2035 and PAS 2030:2019 or similar schemes could beintroduced in Scotland and Northern Ireland. - Statutory requirements for domestic electrical installation work should be introduced in Northern Ireland.
The Department for Levelling Up, Housing and Communities and devolved Governments should consider whether competent person schemes could become a mandatory requirement for installations.

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