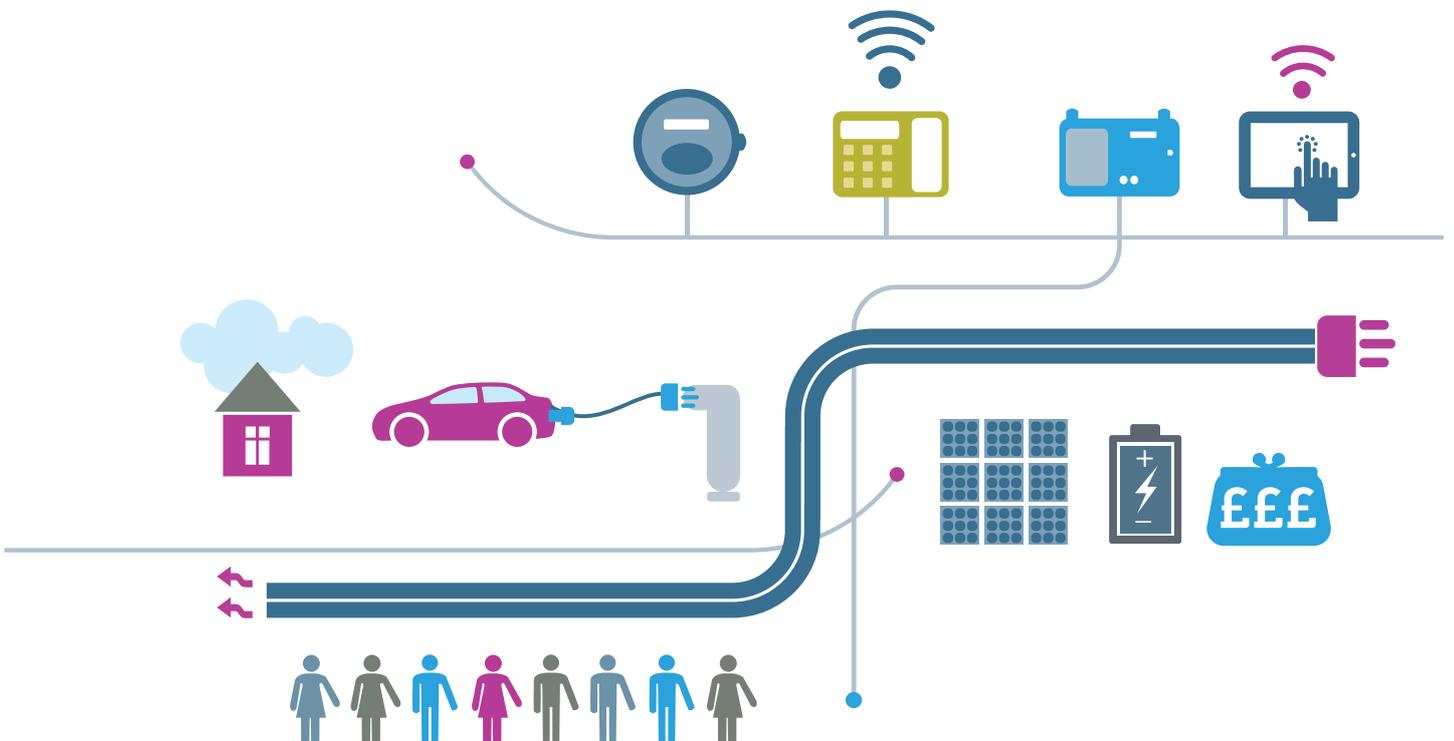


SMART HOMES BY DESIGN

MARKET IMPERATIVES FOR THE INTERNET OF THINGS



April 2018

INTRODUCTION

In December 2017 BEAMA published a report, *Electrification by Design*¹, exploring simple policy and market mechanisms to promote deployment of low-carbon electric systems. In it we identify critical enablers of a flexible and efficient low-carbon energy system. Among other things, these include consumer engagement with energy use, targeted automation of energy management in buildings, and demand-side energy management.

In the report we identified some of the challenges facing the market for smart products (for the purposes of this document, a product may be a device or a service, or a combination of both marketed together). We also made some recommendations for how Government, Industry, consumers and other stakeholders can work together to enable and maintain this market and maximise benefits to the consumer and to the network. This short paper provides some more detail of BEAMA's view of the market for smart home products, what the benefits could be and how to realise them.

Challenges



Smart metering as a key enabler for the smart home

The Government's smart metering policy requires energy suppliers to offer all domestic and small business customers smart electricity and gas meters and an in-home display to allow access to the energy data the meters measure. This is an "all reasonable steps" obligation, and as certain technical and non-technical issues have caused delays it is becoming clear that completing the rollout before 2021 will be a considerable challenge. Nevertheless, most people receiving smart meters would recommend them to others and most consumers are seeing energy and cost savings as a result of behavioural change since receiving their smart meter². The benefits of smart metering are not limited to those outlined in the Government's cost-benefit analysis and business case, but also include the exciting variety of new products (devices or services) that are emerging to utilise the energy use data that smart metering provides.

Smart electricity meters continuously measure the energy used and can provide consumption updates at intervals as frequently as every ten seconds, but the finest granularity of data currently available to their energy supplier is only in half-hourly blocks. Even then the consumer would need to agree to share this half-hourly data under controlled conditions; without that permission, the energy supplier gets only a daily reading. The more detailed data (readings every ten seconds constitute 'near real time data') will be available to the consumer via either a logical Consumer Access Device (CAD) application on a phone, tablet or computer or an in-home display (IHD).³ Consumers can choose to share this near real time data with a third party or a service provider in order to take advantage of additional services. Most products (whether devices or services) developed for the management of energy in smart homes will rely on data derived from the mandated smart metering system. As such, the successful rollout of smart metering equipment through Great Britain is imperative for the availability of data that will be needed to support dynamic time of use (ToU) tariffs and related price signals for demand-side network management.

¹ The report can be found here: <http://www.beama.org.uk/resourceLibrary/electrification-by-design-pdf.html>

² *Smart energy outlook* Smart Energy GB March 2018

³ For a technical discussion of the role of CADs, see BEAMA & University of Salford (2018) *How do we get consumers connected to their data?*

THE INTERNET OF THINGS (IoT)

As energy data becomes more detailed and easier to access and analyse, disruptive technologies and services are emerging that will improve the energy efficiency of buildings and energy networks, while assisted living, health and social care applications are improving people's quality of life. Some of these improvements come from new consumer behaviours, but the availability of data is driving innovation in smart appliances and devices as well. Many of these improvements are enabled by intelligent automation. These constantly learning and increasingly responsive management functions can improve safety, performance and productivity by enabling each smart element to be managed as a system of web-based interconnections between appliances and devices (the Internet of Things).

The IoT is accelerating significant technological transformations, including the mobility, interoperability, value, analytics and security of devices and data. All present both opportunities and challenges.

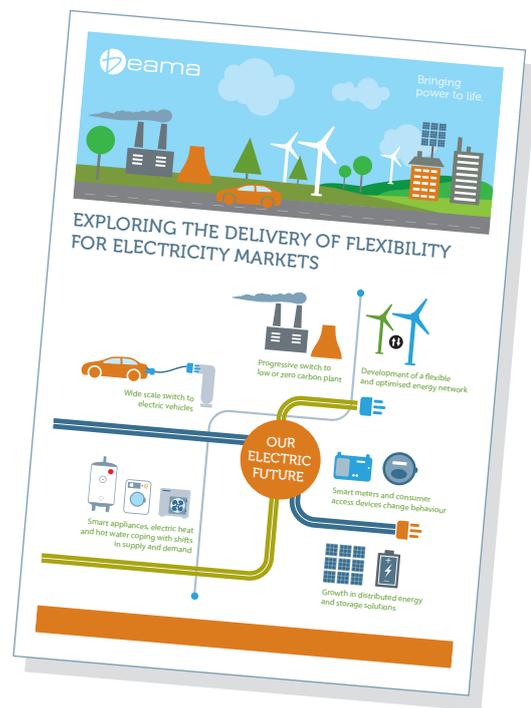
Challenges and Recommendations

Not all smart home products have the same optimal route to market. For the purposes of this paper we make a distinction, discussed in more detail below, between smart lifestyle products (intelligent assistants, smart security or entertainment systems and the like) and smart home energy management systems. There will be a large overlap of products and services doing both, and one of the benefits of the rise of domestic IoT is that it allows responsible energy management practices to be incorporated seamlessly into consumers' daily lives.

Finance

Energy management products that do not provide 'soft' lifestyle benefits and only justify themselves with energy bill savings will struggle in the emerging markets for smart products. One reason for this is that energy is a small proportion of most households' costs and thus the potential savings are either marginal or low compared to the upfront capital cost of installing smart products. Another is that most people do not think much about their energy use, and changes (especially expensive ones) are more likely to be made to access new lifestyle services than to marginally improve home energy efficiency. Therefore, if the value of the market for domestic IoT products is to achieve its potential then new and innovative **finance packages** must emerge that facilitate routes to market for products that pay for themselves over a long period (solar panels and heat pumps also fall into this category).

That said, improvements in the market to enable demand side management should ensure that more value can be passed to the customer through the energy savings that smart devices can enable. BEAMA acknowledges that the value proposition of energy-saving smart technologies needs to improve and consumer understanding of it needs to grow, and we will shortly be publishing a further paper exploring the delivery of flexibility for electricity markets. This will include consideration of how the operational needs of the networks can be translated into demand response in the home and how the network value of this can be passed to customers.



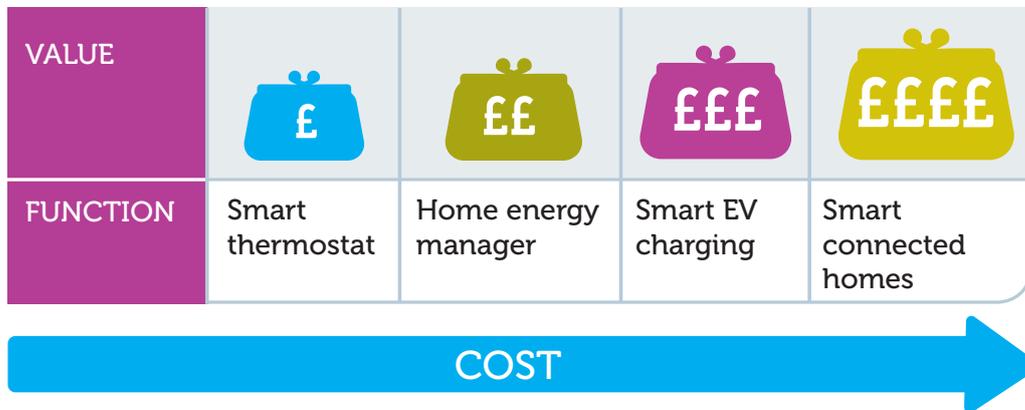
Supply chain capacity

There is also the challenge of **supply chain capacity**. This must be sufficient to support rapid growth, but the current economic climate, particularly with uncertainty over the UK's participation in European markets and the prospects for exports, suggests the need for caution. A more deep-seated uncertainty has been bred by a perceived lack of political leadership in setting a consistent energy strategy that would in turn foster confident investment and capacity building to meet anticipated demand. Notwithstanding the political and economic uncertainties, the manufacturing community has to wrestle with understanding its role in a changing market. This is no time for marketing myopia. We are experiencing a period of convergence in the telecommunication, data and energy sectors which in itself is resulting in a divergence of technology propositions as manufacturers expand their consumer offering to embrace traditional products linked to enabling IoT equipment. How long before we have the 'Brand X Home Package', with a single entity undertaking to provide every desired service under a single generic brand? Will this approach push manufacturers towards white-label box shifting for re-badging by other suppliers or service providers, or will it bring about more complex offers built around technology supply, data management, maintenance and servicing contracts? There are many questions, even without addressing the need to develop the skills of designers and installers of traditional and new service equipment. This role is often played by manufacturers but, again, how will their changing role facilitate this? There is no more interesting time to be a product or channel manager working for a manufacturing business, let alone having the responsibility for overall strategic direction.

Consumer confidence

As in any market, **consumer confidence** is key. Some of these challenges may have solely market solutions; others may need regulatory and policy changes, and others may also rely on the development of new standards or codes of practice. In this latter category are the two primary concerns

for new or potential entrants into the smart homes market: interoperability and compatibility between products; and cybersecurity to improve system resilience, consumer protection and data privacy.



Interoperability

Interoperability between devices and services should also encourage greater competition and benefit both the consumer and for the industry. A competitive energy market relies on easy and transparent mechanisms for consumers to switch energy providers. As the market changes and the relationships between energy providers and consumers become more complex, it is essential that IoT products are not a barrier to switching. Devices that work only with a specific service provider or energy supplier, and that must be replaced

when a customer ends that contract, work against this principle. As an example, a router or a set top box usually comes 'free' with a contract for internet and telecommunications services, and is either returned or discarded at the end of the contract because it is incompatible with any other service provider's systems. That is not a sustainable or responsible business model for more expensive or complex IoT devices.

Agreed standards and an industry-wide approach that facilitates the interoperability of smart devices in the home will have three particular benefits for the consumer journey.

1 Consumer confidence to start small

2 A gradual consumer journey amortizing costs

3 Manageable risk of 'false starts' or obsolescence

The Internet of Things will enrich the user experience and facilitate remote access and control; Cloud-based data storage will also enable the aggregation and sharing of data, but consumers need confidence in interoperability so they do not become locked in to specific brands or protocols. Many people will want confidence that their 'consumer journey' will be flexible, with the ability to start small, perhaps purchasing or renting only one or two devices, in the knowledge that their system can grow gradually to reflect their individual and changing needs. This gradual consumer journey spreads the upfront costs (especially of installation) over time and can significantly change the way consumers will approach the

financing of IoT. They can then add or augment new bespoke services to their smart system without false starts or obsolescence due to the incompatibility of devices or protocols. In a world where consumers are already making choices about purchasing smart devices, for example the market for 'smart controls' for central heating systems, it could be argued that consumers are already exposed to the 'interoperability cliff edge', as many of these products use proprietary methods to exchange information and will only work with products from the same provider or within a specific ecosystem, potentially limiting their ability to add further value in the future.

Security

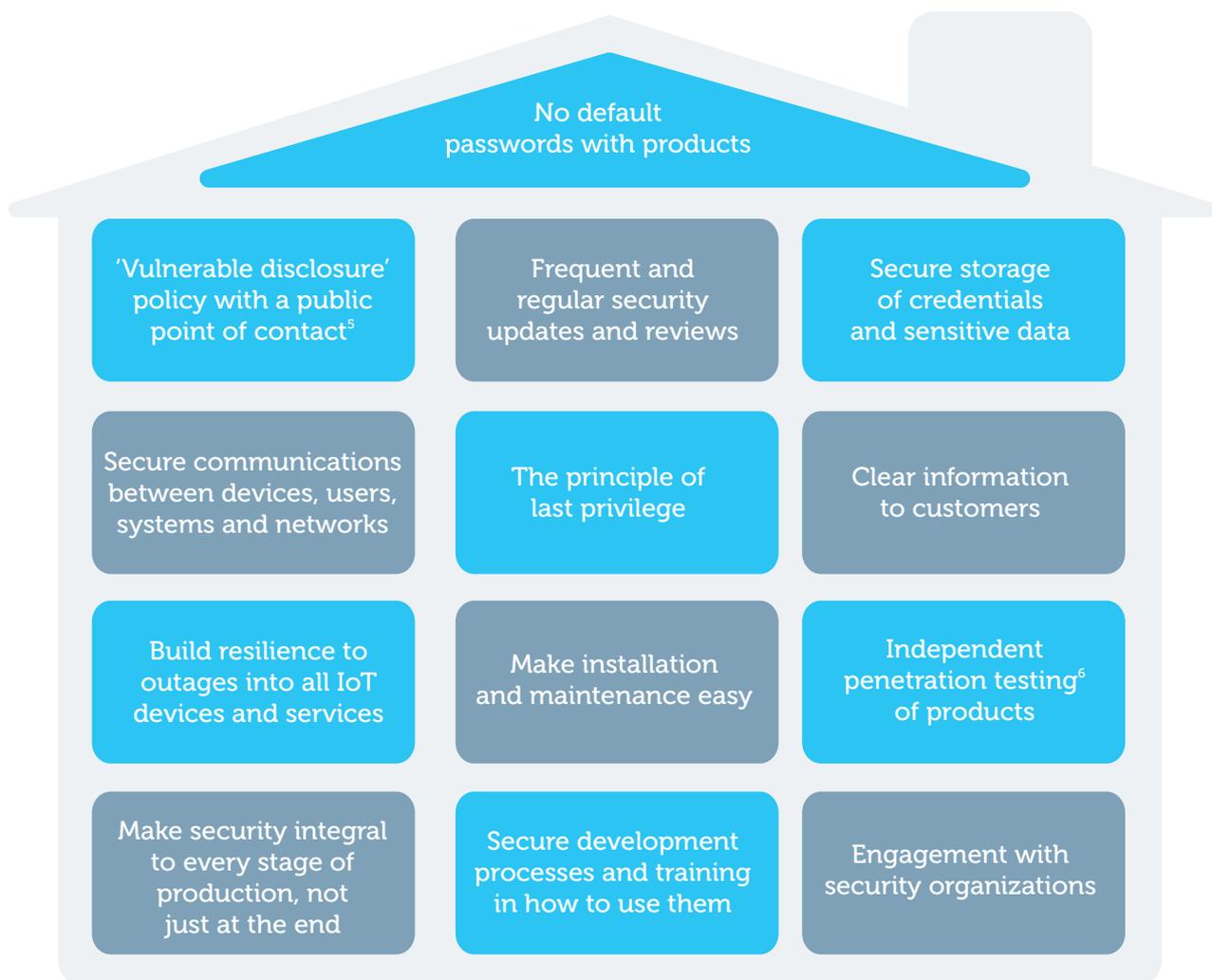
Security of smart home products, delivered by Codes of Practice and industry standards, will also be crucial to providing consumer confidence in the security of their smart devices and the systems they inhabit. BEAMA's position is that promoting the cybersecurity of smart systems and devices should be at the heart of the Government's industrial strategy for the smart and flexible energy system.

But if the IoT is to achieve its potential then Government, industry and consumers will need to incorporate these transformations into the standards and norms governing building construction and maintenance.

New standard open IP-based industrial network connectivity and protocols will bring challenges and opportunities to

protect consumers and ensure the cybersecurity of devices and systems. It is particularly important that cybersecurity of the IoT is not addressed in isolation but is made a key element of the Government's industrial strategy, to ensure that advances and innovations in smart communication and management remain at the centre of the Government's plans for the transition to a low-carbon economy.

Device manufacturers and service providers should build cybersecurity into every stage of the development and delivery of their products, not just the beginning or end of the process. The IoT Security Foundation has published its own best practice guidelines.⁴ BEAMA supports the IoT Security Foundation's approach, and recommends that manufacturers and service providers take the following precautions at a minimum:



⁴ <https://www.iotsecurityfoundation.org/best-practice-guidelines/>

⁵ Guidance on vulnerable disclosure can be obtained from the IoT Security Foundation: <https://www.iotsecurityfoundation.org/best-practice-guidelines/#VulnerabilityDisclosure>

⁶ Penetration testing is the systematic probing for vulnerabilities in applications and networks. It is essentially a controlled form of hacking (see <https://www.itgovernance.co.uk/blog/five-reasons-you-need-a-pen-test/>).

Value for money

Value for money is also critical. Smart home devices will deliver a huge and growing variety of services to consumers and provide benefits that people will want to buy for their own sake: intelligent personal assistants will answer questions, manage entertainment systems and the like; smart controls will enable consumers to get more personalized, targeted benefits from their systems. But if this market is to flourish, it is important that smart devices also provide a pathway for consumers to save money on their energy bills.

However, the potential for savings driven by a more efficient home and therefore a reduction in energy used is quite small, and may be only marginal. The real value of this market needs to be that it provides a way for consumers to shift their patterns of use, allowing the network to be managed more efficiently and smoothing out peaks and troughs of both energy demand and power supply. So we need to see new and innovative market and business models that return some of the value of that flexibility to the ones who provide it – namely, consumers.

SMART HOMES DEVICES WILL NEED TO PROVIDE CONSUMERS CONTEXTUAL AND HISTORICAL DATA AS WELL AS NEAR REAL TIME DATA

Many current schemes to increase energy efficiency and reduce waste are delivered by energy utilities in ways that create perverse incentives. For example, both the GB Smart Metering Implementation Programme and the Energy Company Obligation effectively place the responsibility on energy utilities to take steps that are intended to reduce the market for the utilities' products, thus reducing sales and potentially impacting profits. But what if energy could be sold as a service, with market and business models emerging that allow a utility to agree a set price for delivering an agreed level of heat, warmth, comfort, convenience and other services? Then the complexity could be owned by the utility and would not concern consumers, and the incentive would be on the utility to deliver that service as efficiently as possible – that is, to provide the same level of benefit and service but using less energy, and ultimately producing less carbon pollution. It will be up to the Regulator (Ofgem) to support new, integrated and innovative market and business models that move away from premium pricing and support value price signaling in ways that consumers can respond to. We expect to see the market share of the larger energy utilities fall as an increasing number of smaller providers enter the market, some of them with challenging and agile propositions. It is for this reason that BEAMA is pushing for an ambitious market design package in the EU and leading the way in demonstrating how new market models can work in the UK and internationally.

The value for money of smart products will also depend on the interoperability of devices, systems and services, as mentioned above, and on the ability of the consumer to leverage investment via participation in other value-adding services such as demand management. Consumers will need to see smart technology driving genuine changes and benefits to their lifestyle and energy bills; for the market to succeed and deliver, IoT will need to become part of the fabric of ordinary people's lives (as mobile phones have done) and not just expensive toys. The industry needs to take the lead in demonstrating to consumers that the services and benefits of smart technologies are worth the capital cost and any potential trade-off of consumer privacy.

Currently, most consumers interested in acquiring smart technology have three separate considerations. They buy their services (energy, security, health, entertainment and so on) from one or more providers. They might then buy a smart device, or a few together, from a variety of vendors. They would then approach a third party to install and manage the system into which those devices are placed. But the future may be much simpler for the consumer, with the complexity taken on by a single entity that sells or leases the devices, manages the system and supplies the ancillary and related services all as part of a bundled package. In this model, as far as the consumer is concerned, the distinction between 'product', 'system' and 'service' disappears.



Targeted services

Smart homes devices will need to provide consumers **contextual and historical data** as well as near real time data. This will empower consumers to get value from the data and share it with trusted third parties or service providers with confidence. Once they have controlled access to this data, service providers will be able to identify new customers and tailor their packages more sensitively to existing ones. It is no secret that energy utilities have lagged far behind other large technology and data companies in this respect, with a dozen or fewer identified customer types compared to the bigger technology companies with a segmentation of thousands. Better data will also give service providers a more nuanced historical profile on which to base a proposition, thus making it easier to manage risk when offering services.

Better data (and data management) will enable the development of new and innovative market and business models centred around new ways of buying and selling energy, especially peer-to-peer energy trading and the supply of **energy as a service**. BEAMA will use its response to the Government's current consultation on Proposals regarding smart appliances⁷ to discuss ways to increase the market deployment and penetration of smart appliances, including consideration of a Smart Readiness Indicator for buildings.

⁷ <https://www.gov.uk/government/consultations/proposals-regarding-setting-standards-for-smart-appliances>

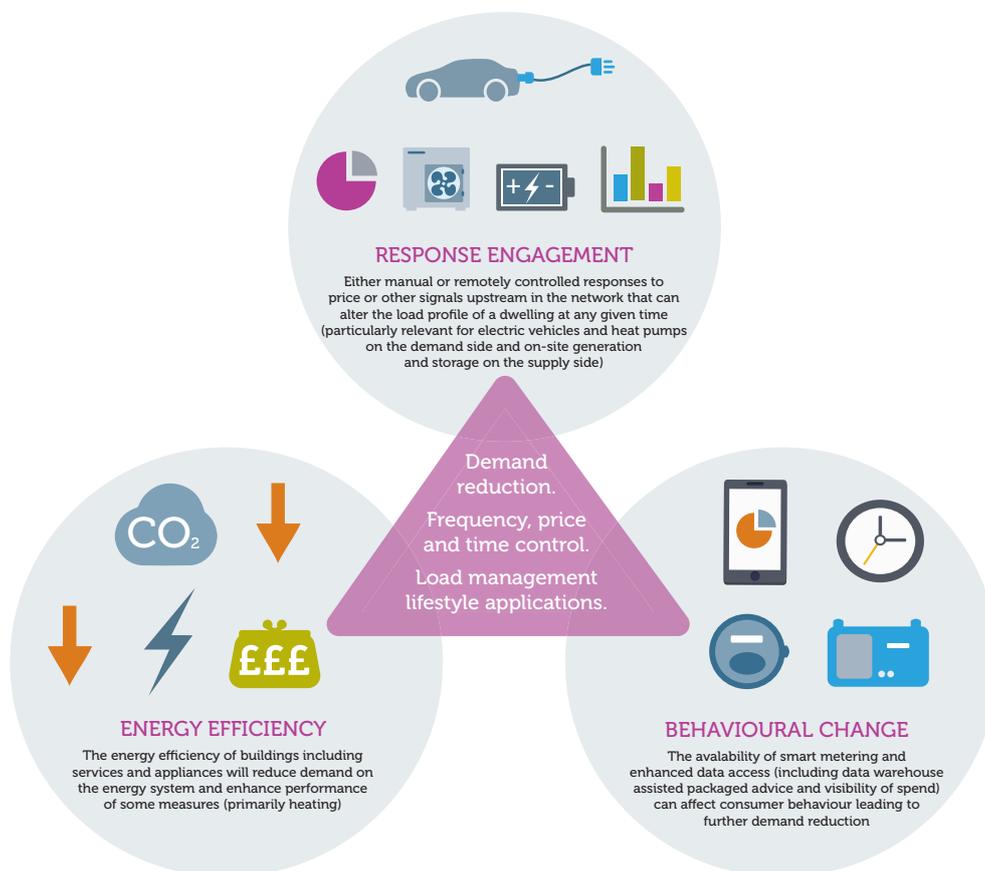
THE BUILDING-BASED FLEXIBLE ENERGY SYSTEM MIX

Smart home products relating to energy management will also further drive the efficiency of buildings and networks.

Behaviour change to reduce energy use is important, but the real value is to be found in making the grid more efficient. More detailed and more targeted data makes for better network design and a more efficient system, so we need to reward consumers not just for using less energy (as important as that is) but for using smart and automated systems to provide flexibility to the grid. Price signals can encourage and reward using less, generating more or releasing stored energy back into the grid when energy is scarce and shifting energy use to times when it is plentiful. But even with a highly intelligent automated home system it may make for a lot of

complexity for the consumer for relatively small financial savings.

In this scenario, the consumer is a participant in the flexible energy system but does not have to be fully and actively involved in the research and decision-making process for technology investment or tariff engagement. In addition, the consumer does not need to make complex behavioural changes; these can be coordinated remotely by a service provider based on agreed permissions or service packages. The business-to-business leadership and collaboration model defines the pre-packaged offer, and the service provider delivers it.



In a full mix scenario the consumer:

- Installs cost effective energy efficiency measures in the building fabric to manage peak heat demand
- Adopts the most efficient appliances to further reduce energy demand
- Adopts electric appliances or systems in favour of carbon-intensive building services technology
- Generates electricity to export, store or use on-site
- Engages with response offers such as static or dynamic time of use (ToU) tariffs
- Adjusts energy use behaviour to adapt to generation, storage and optimum use profiles (which are usually dynamic).

Routes to market

As the market expands, the cost of smart home products will fall and interactive services and demand-side price signals will bring new value to consumers. It is essential that consumers retain confidence in the value for money of smart sensors and controls, and that the upstream beneficiaries of smart data management pass on savings in an equitable and transparent fashion. This will naturally lead to new and more complex ways of buying or leasing devices and energy services, and the increasing complexity of the market will have far-reaching consequences for how we think about competition and consumer protection.

Contextualizing historical data with sensor data in near real time will enable even more advanced analytics. How these analyses are translated into new systems and services and, ultimately, new consumer behaviours, will be critical.

As the market develops, an increasingly disaggregated supply chain will have to navigate a path of financing the design, development, manufacture and distribution of its devices and services while also engaging consumers in a market that is becoming increasingly fractured and complex. One way of thinking about this that may be useful is to differentiate between smart products that are primarily tariff-related, designed within a service environment to shift and smooth peak loads by responding to price signals, and other products that are primarily lifestyle related, related to home security, entertainment, or health and social care benefits. Of course many products will fall into both categories, such as an intelligent personal assistant that also uses intelligent automation and machine learning to manage the home's energy profile and anticipate or respond to commands or changes in human behaviour.

Energy services products

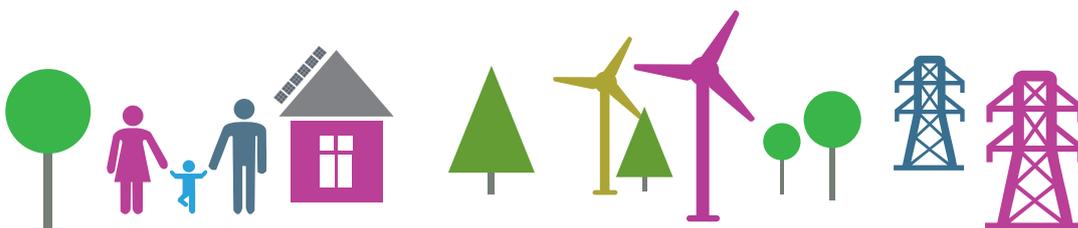
Finance

As the distinction between devices, systems and services becomes less clear to the consumer and these 'products' are bundled together into market relationships, there will be increasing pressure on energy service providers to collaborate with the supply chain to deliver products that reduce demand for energy and allow it to be used more flexibly. We are already seeing consumers having a different relationship with the larger, more expensive products in the smart home, as ownership declines and new lend/lease arrangements become more popular. The best example of this in recent years is the electric vehicle, a product that is very suited to this approach as its running costs are so much less than the petrol or diesel alternative, but some consumers are put off by its high upfront capital cost.

There is not one correct answer to these uncertainties, or to the challenge of supporting and financing a supply chain that will provide customer choice in a market of increasing complexity. As discussed above, business models involving white label box shifting for re-badging by other suppliers may coexist alongside much more complex offers built around technology supply, data management, maintenance and servicing contracts.

Consumer engagement

The key will be flexibility tariffs. Static time of use (ToU) tariffs have been commonplace in the market for decades, but do not under all circumstances deliver value. This is partly because some demand a level of engagement on the part of the consumer that is not always realistic. But smart home energy management systems that empower even passive consumers to engage in the flexibility market would address that challenge. Very recently we have seen a small number of dynamic ToU tariffs emerging, even some headline-grabbing announcements of a short-lived negative energy price, with a few hours in the middle of the night when an energy company will pay its customers to use energy. But without a widespread rollout of home energy management systems to provide the automation that can take full advantage, this is of only limited value to either the consumer or the network operator.



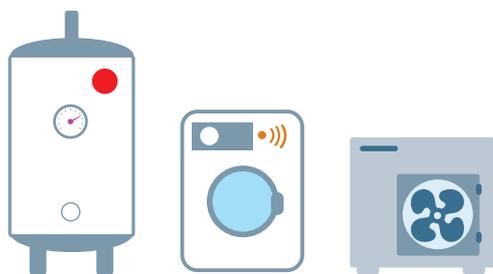
Lifestyle-related IoT products

Finance

The financing of lifestyle-related smart products is already well advanced, and routes to market for smart appliances are already mature in many cases. We see two imperatives for this market: one is for regulators, legislators and consumers to understand the implications of data sharing, and the other is for a more 'democratic' approach, making smart technology of benefit to everyone and not just a luxury consumer item.

To take the first point: the supply chain and service providers need to be able to market and sell products at an acceptable cost and profitability without factoring in an excessive valuation of the personal data they collect by doing so. This means the product (service, device or both) needs to be attractive and value for money on its own terms. It is a cliché that data is the new 'oil' because its value underpins the growth of its own and other related industries. But there is another analogous link, in that oil – like personal data – is a concealed natural resource that is increasingly mined by private entities for private profit, without adequate discussion of the social consequences or management of the impacts. It may not be overstating the case to suggest that the business models of some 'technology giants' relies on finding and monetizing ever more innovative ways of undermining privacy. This is unlikely to be sustainable in the long term, and Industry should take the lead on developing standards and regulations that support a productive, useful and profitable market while protecting consumers. The answer may lie less in limiting the data that can be harvested – as this will be very difficult to define, let alone enforce – but to limit the ways in which the data can be shared. The development of anti-trust laws may be a useful way to go about this.

On the issue of access to smart technology, we expect to see a gradual but accelerating shift towards better affordability of smart devices. Currently the chip in a household appliance that makes it 'smart' is a tiny fraction of the cost of the product; yet smart appliances sell for much higher prices than their average non-smart equivalents. As smart systems become more and more ubiquitous, we expect to see such smart chips being rolled out into middle-end and low-end appliances, not just the most expensive, top-of-the-range models.



Consumer engagement

We expect new business and market models to emerge that will make it easier for energy suppliers and network operators to pass on these savings to their customers while shielding consumers from most of the added complexity. This approach acknowledges that, with few exceptions, consumers don't want to think about their energy bill more than they have to.

Smart Energy GB has recently published research⁸ showing that many people (and a clear majority of young people) would prefer to buy their energy bundled in with other home services. This is likely to lead to consumers no longer paying for kWh (whether on a fixed or dynamic tariff) but instead buying energy as a service, or buying 'outcomes' such as warmth, comfort, an available electric vehicle. They may still be specific outcomes, perhaps an agreed rate to maintain the building at a certain temperature; under this scenario, there is incentive for the energy supplier to increase the efficiency of the building and decrease the amount of energy needed to maintain comfort. This solves the problem created by tasking energy suppliers to drive efficiency, which is effectively requiring them to invest in measures that mean they sell less of their product.

The Smart Energy GB research found that consumers are likely to welcome the increasing digitalization of the energy sector, including the smart metering rollout, that will enable diverse service providers and retailers such as supermarkets, online retailers and broadband or entertainment providers to provide energy as part of a wider package of lifestyle services. Such an approach may build its own momentum, as it was more popular with people who had a smart meter than with those who had not, and most popular with younger demographics.

If we accept the statement above, that most people don't want to think about their energy bill more often than they have to, and also that for most people not on low incomes their energy bills are a relatively small proportion of total household outgoings, then the path to consumer engagement in energy-saving smart home products may be in bundling those devices and services in with other, more lifestyle-oriented products, that are more obviously attractive to consumers.

⁸ <https://www.smartenergygb.org/en/resources/press-centre/press-releases-folder/liscos-research?tab=1&docspage=1>

THE INTERNATIONAL POLICY CONTEXT

A number of current fundamental policy agendas at European level will have a significant impact on facilitating a route to market for domestic IoT products and supporting the transition to electrification and the automated intelligence of UK homes.

Market design:

The EU Clean Energy Package has the potential to reshape the demand side market across the EU by creating more dynamic pricing regimes and facilitating flexibility markets.

Smart appliances:

BEAMA has been supporting work to provide a voluntary 'Energy Smart' label to support the rollout of smart appliances (Eco Design, Lot 33). Regulation will need to be inclusive of all viable technologies that provide demand side management, and the associated standards will need the support of industry.

A Smart Readiness Indicator for Buildings:

The recast of the Energy Performance in Buildings Directive (EPBD) contains a voluntary requirement for member states to adopt an SRI under national building regulations, potentially forming part of the existing Building Energy Performance Certificates. This has huge potential provided it is developed to simply identify buildings that are 'ready', focusing on enabling features (such as access to data) and on the outputs that a building can deliver for demand side services. BEAMA supports a simple framework that can be applied to the building regulations, driven by service operators, to assess a building's capacity for different market services.

Cybersecurity:

With the new General Data Protection Regulation (GDPR), along with other cybersecurity and e-privacy legislation, we anticipate cybersecurity requirements to become increasingly stringent. This is likely to be in the form of certification and industry led schemes.

BEAMA's activity

BEAMA is engaging with these agendas through our EU trade bodies and directly with UK Government departments. We are increasing our input into the EU standardisation work that will be fundamental in ensuring a market-led approach to any labelling scheme and to the development of standards for interoperability.

Policy intentions

BEAMA supports a buildings-based approach to demand side management products backed by a voluntary market led 'Energy Smart' label inclusive of any appliance offering flexibility for demand side services. This should be EU wide, and any separate UK initiative should be directly aligned. On all the policy areas mentioned we are protecting the future capabilities of IoT systems. Over-regulating at a product level will jeopardise the potential for integrated systems and automated domestic services that IoT facilitates: it will be a delicate balance between mandatory regulations, market-led standards development, and voluntary schemes.

BEAMA IS ENGAGING WITH THESE AGENDAS THROUGH OUR EU TRADE BODIES AND DIRECTLY WITH UK GOVERNMENT DEPARTMENTS

CONCLUSION

This paper has explored some of the challenges and opportunities for the market for smart home devices and services. The success of this market will require targeted regulation to promote and direct innovation towards achieving real benefits for consumers, networks and industry.

This innovation will deliver a smart, flexible energy system, but it must not end there: firstly, the benefits must be realisable as tangible value offerings for the consumers and other end users providing the flexibility; and secondly, the solutions must engage consumers for more than just the value of the energy efficiency or network flexibility gains. They must actually provide consumers with attractive and appropriate ways to use their real-time energy data, but the incentive for consumers to do so will not generally be in the form of lower energy bills. Instead it will be more convenience, a better service, or even a simpler and easier life. Developments in the smart home market will unlock real-time data to inform the big decisions that consumers make about energy efficiency, such as building design, microgeneration and electrification of

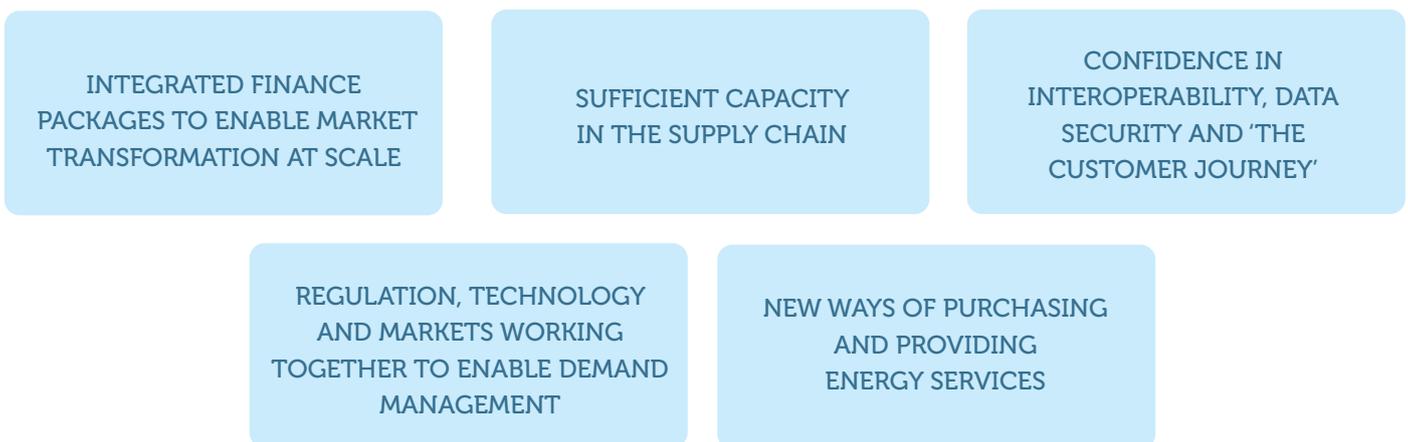
heat and transport, as well as small, everyday behavioural decisions that reduce energy waste, while also providing consumers with desirable and attractive services that improve the quality of people's lives.

BEAMA is working towards making smart systems standard in new homes by promoting national and international approaches to standards and specifications. We envision a market that will provide consumers with interoperable devices, systems and services that are easy to access and participate in, and that engage consumers to manage energy more effectively. In this market, consumers would not become locked in to a particular brand, communication protocol or system approach, but would be free to build a diverse and bespoke system of devices and services that suits their individual needs. We trust that this paper has been a useful addition to the debate of how best to engage the Regulator, Government, service providers, the supply chain and consumers themselves to realise the vast and still largely untapped potential of smart homes by design.

RECOMMENDATIONS

The market for domestic IoT products, whether they are lifestyle products or linked to energy management services or both, is growing quickly and will continue to grow. But for the market to deliver the energy savings,

network flexibility and consumer satisfaction and benefits needed to support the transition to a low-carbon economy, certain things are essential.



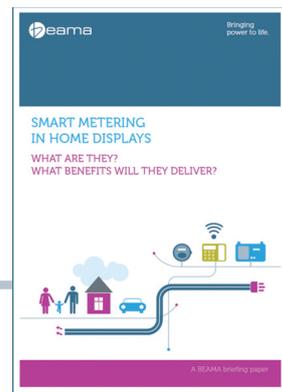
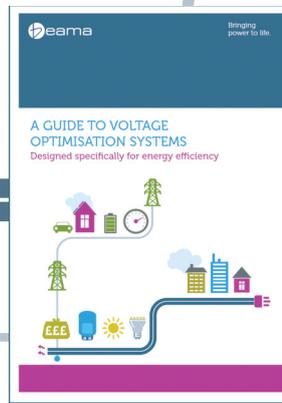
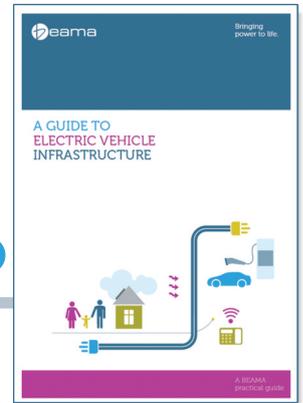
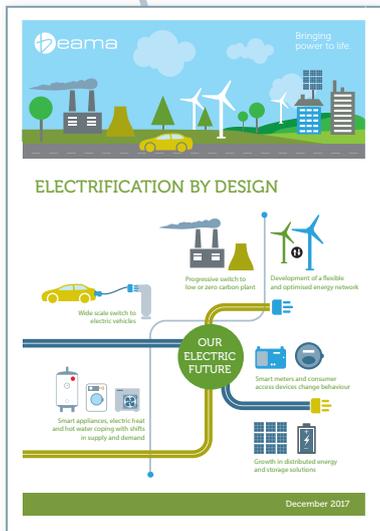
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