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ELECTRIFICATION



State of the Nation: Driving UK Energy Smart Appliance Manufacturing for Clean Power



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Executive Summary

This report provides a snapshot of how ready UK manufacturers of energy smart appliances are to deliver the products and systems needed for *Clean Power 2030* and the UK's wider Electrification ambitions.

Effective development of the ESA market is vital for ensuring consumers benefit from CP2030 and a fully clean power system. The Clean Flexibility Roadmap, developed with government, NESO, and Ofgem, sets a vision for a smart, flexible electricity system placing consumers at the heart of flexibility and committing to action that maximises bill savings through demand-side solutions. Organisations like Energy UK have underlined that only widespread adoption of flexibility enabling consumers to shift and reduce their energy use will reliably deliver on the promise of lower bills, and without urgent delivery of roadmap measures, most consumer benefits may be more than a decade away. Achieving this requires coordinated reforms, open energy markets for flexibility service providers, and rapid ESA market growth to drive commercial investment and widespread adoption.

Recent changes to the Boiler Upgrade Scheme and the new consultation on heat alternatives signal continued government engagement, but neither provides the regulatory certainty industry needs. The sector remains unclear about the future direction of the heat market, and many now look to the forthcoming Warm Homes Plan to finally set a clear trajectory for heat decarbonisation.

Manufacturers sit at the frontline of the energy transition. Their technologies from clean heat systems and hot water solutions to batteries, EV charging, and smart home controls will determine how consumers interact with energy, how flexible our electricity system becomes, and how fast we can decarbonise.

The evidence gathered through BEAMA's engagement with industry and government shows good momentum, but also a fragmented policy and regulatory landscape that limits confidence and investment.

While some technologies, such as heat pumps, benefit from clearer policy pathways, others, particularly heat batteries, electric hot water, and demand-side flexibility products remain constrained by inconsistent signals, limited fiscal support, and uncertain market design.

Electricity pricing also remains a structural barrier to electrification. The current electricity-gas price gap continues to limit consumer demand for heat pumps and other electric heating technologies, weakening the commercial case for smart, flexible products. Without clearer progress on electricity-market reform, manufacturers face an uphill task in scaling the very technologies needed to deliver a flexible, low-carbon power system.

To deliver a smart, flexible energy system that underpins clean power by 2030, government and industry must align across four core levers of market attractiveness:

Regulation

A clear, consistent "right to trade" for compliant, interoperable products.

Recognition

Product standards that emphasise simplicity, alongside data models that reward efficiency and connectivity.

Fiscal measures

Stable, visible incentives for consumers and investors.

Market environment

Pricing, flexibility rules, and financing that value smart behaviour.





Purpose of this Report

This “State of the Nation” exercise builds an honest, evidence-based picture of how ready UK manufacturers of energy smart appliances (ESAs) are to meet the ambitions of *Clean Power 2030* and the *Smart Secure Electricity Systems (SSES)* Programme.

It provides:

- A snapshot of where the industry stands today
- Insight into what’s holding progress back
- A view on what’s needed to unlock confident investment and scale manufacturing for smart, connected energy products

Introduction

The UK’s *Clean Power 2030* vision sets a bold direction: a decarbonised electricity system powered by renewables, underpinned by flexibility, and enabled by smarter use of energy in our homes and businesses.

Manufacturers of energy smart appliances are central to achieving this ambition. From connected heat pumps and EV chargers to intelligent home energy systems, these products define how people engage with energy when they use it, how much they use, and how easily they can respond to price or carbon signals.

In many ways, the success of the clean power transition will hinge on how quickly and confidently manufacturers can bring interoperable, ‘smart energy-ready’ electrification products such as advanced smart heat pumps and connected heat batteries to market. Some are already well advanced; others need clearer signals and support to invest in new designs, standards, and digital capabilities.

This paper draws on conversations with manufacturers across the ESA sector to assess readiness - technically, commercially, and organisationally for the next 5 years. It highlights areas of progress, identifies where clarity and coordination are needed, and sets out the conditions for a thriving UK manufacturing base supporting a smart, flexible energy system.



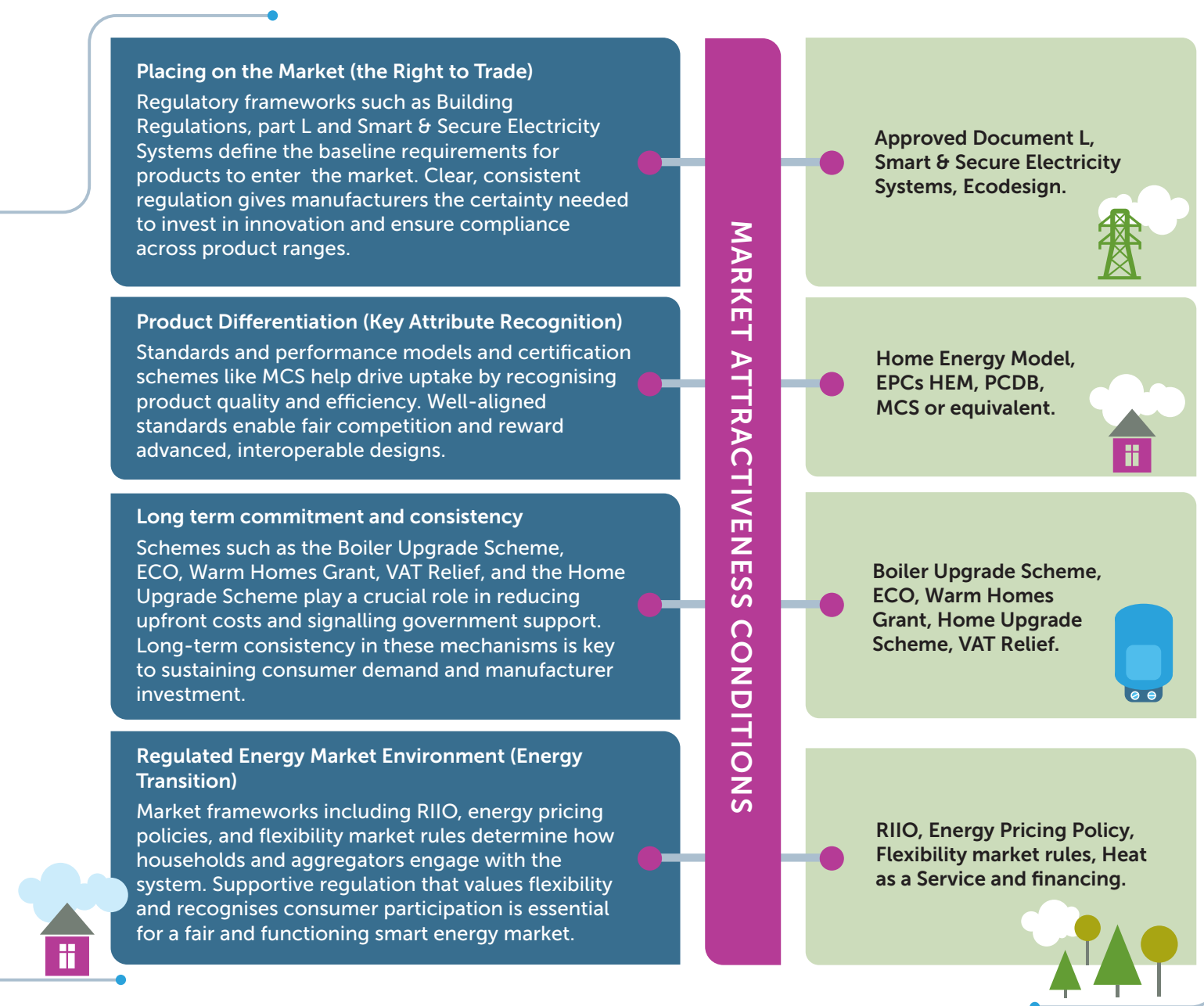


Market Drivers and Conditions

The transition to electrification and flexibility is being shaped by multiple, overlapping policies and regulatory initiatives. Yet the current approach remains fragmented. Differences in how technologies are treated under various schemes create uncertainty, making it difficult for manufacturers to plan and invest at scale.

The figure below (adapted from BEAMA's Market Attractiveness Framework) outlines the key levers that influence investment, innovation, and consumer adoption of smart, clean technologies.

STRUCTURED INNOVATION AND PRODUCT DEVELOPMENT DRIVERS



Together, these levers define how attractive the UK is as a place to invest in clean, smart energy manufacturing. When aligned, they build confidence, stimulate competition, and accelerate adoption; when fragmented, they stall progress.

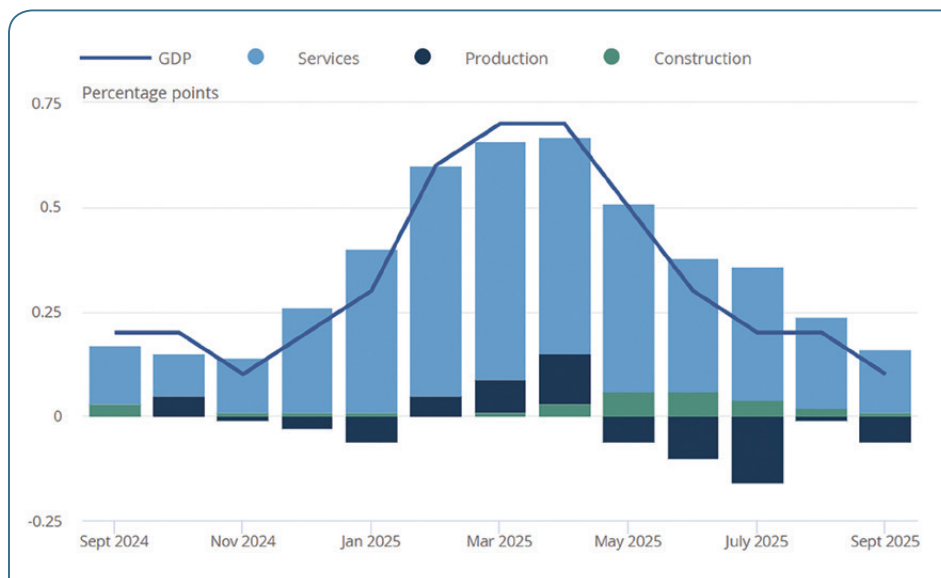


Economic Insights Driving the Manufacturing Environment

These figures highlight the backdrop manufacturers are working in. Economic growth has been very modest as GDP rose only 0.1% in the three months to September 2025 and many businesses are feeling the strain.

A growing share of innovative and high-growth firms say regulation is a challenge, and in February 2025 almost a third of businesses reported economic uncertainty affecting their turnover. This combination of slow growth, regulatory pressure and uncertainty helps explain why manufacturers are cautious about committing to long development cycles for smart products.

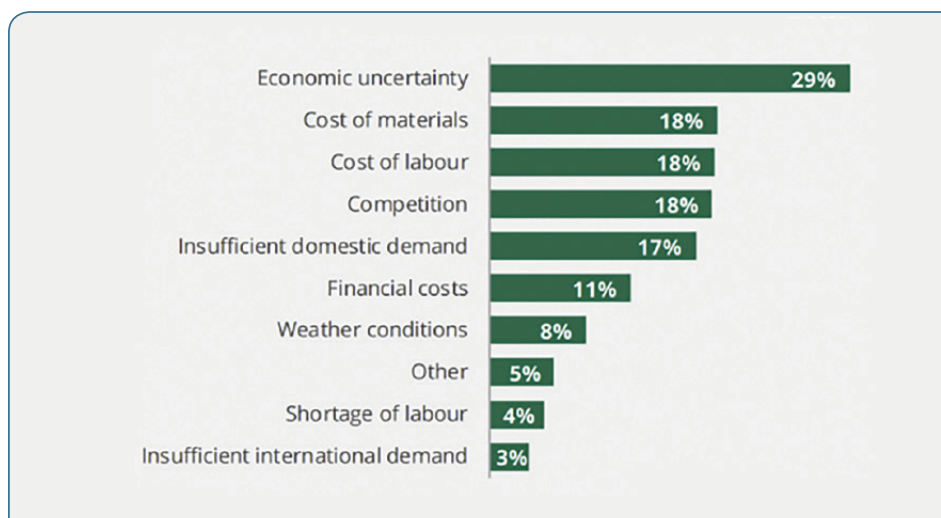
Figure 1: Real GDP grew by 0.1% in the three months to September 2025, following three-month on three-month growths of 0.2% in August 2025 and 0.2% in July 2025



A greater proportion of innovative and high-growth businesses report that complying with regulation presents a challenge to their business¹.

Business sentiment in the UK remains subdued – in February 2025 29% of businesses reported economic uncertainty as a turnover challenge. This broader context of uncertainty amplifies the effect of unclear policy signals on smart-appliance investment².

Figure 2: Challenges reported by businesses in February 2025



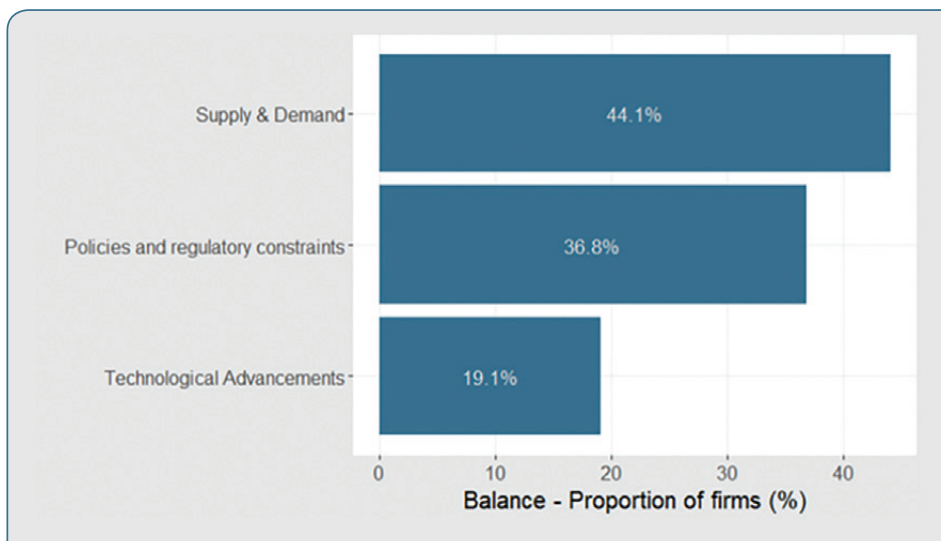
Source: <https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/gdpmonthlyestimateuk/september2025>

¹ HM Treasury Policy paper Regulation Action Plan – Progress Update and Next Steps

² Office for National Statistics, Business insights and impact on the UK economy dataset for wave 126, 20 February 2025, table 'Turnover Challenges TS (WTD)'



Figure 3: External factors that could influence investment decisions³



BEAMA's latest trends survey also shows that demand remains one of the biggest factors affecting output across the sector. Manufacturers are increasingly cautious about committing to new product lines or expanding production when demand signals are weak or unpredictable, which adds another layer of pressure alongside the wider economic and policy uncertainty.



³ BEAMA Trends Survey Q3 2025.



Why consumer-led flexibility shapes the market for manufacturers

Consumer-led flexibility is not just a system benefit - it is a key market driver that shapes the commercial landscape manufacturers operate in.

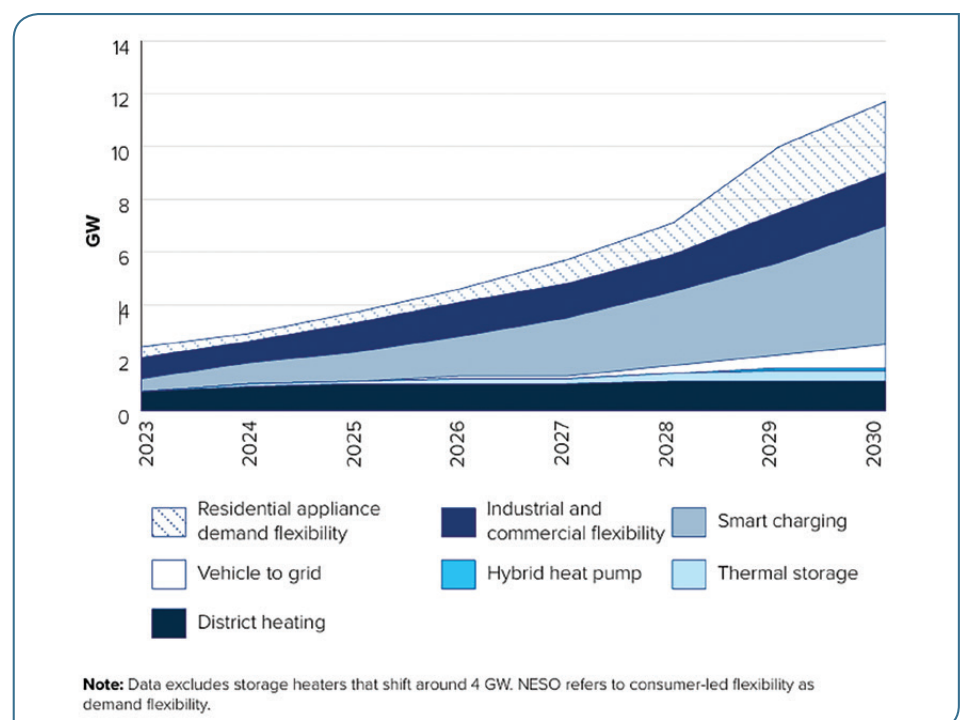
As flexibility becomes central to how the electricity system is balanced, the value of appliances increasingly depends on their ability to respond to price signals, shift demand and integrate with energy-service platforms. That means the products manufacturers bring to market over the next few years must be capable of supporting these new services.

For consumers, the shift is just as important. Flexible appliances give households more control over their energy use and create opportunities to save money without changing their routines. By allowing a heat pump, EV charger or appliance to run at times when electricity is cheaper or the system is under less strain, consumers can reduce bills while still getting the comfort, hot water or charged vehicle they expect. As tariffs and services become more sophisticated, flexibility will open the door to clearer rewards, simpler automation and a smoother experience overall making it easier for households to take part without having to think about it.

The scale of this shift is significant. Great Britain already delivered around 2.5 GW of consumer-led flexibility in 2023, and NESO/DESNZ expect 10–12 GW by 2030, largely coming from EV smart charging and smart heating. For manufacturers, this growth signals a clear direction of travel: the system is moving towards a world where connected, flexible appliances are no longer optional add-ons but core features that enable consumers to benefit from cheaper energy and help cut system costs.

For the manufacturing sector, this creates both opportunity and pressure. Products that can support flexibility; heat pumps, hot-water systems, smart white goods, EV chargers will increasingly align with consumer incentives, government programmes and future market design. Those that can't may become less competitive or require retrofitting. In short, flexibility is becoming a fundamental part of product value, and manufacturers need stable policy and clear standards now to design products that make sense in the energy system of the 2030s.

Figure 4: Consumer-led flexibility at peak (GW), 2023–2030⁴



⁴ NESO (2024), 'Clean Power 2030'.



Market Context and Current Challenges

While policy ambition is strong, delivery on the ground remains inconsistent. Manufacturers often face a patchwork of requirements, incentives, and standards, creating uncertainty about how and where to focus investment.

Uncertainty around forthcoming product standards, particularly under Ecodesign, continues to affect investment decisions. With key requirements still not finalised, manufacturers face difficulty committing to R&D and product development cycles that require long-term clarity.

Alignment with European standards remains a significant factor for many manufacturers, particularly those supplying UK, Ireland, and EU markets from shared production facilities. Divergence between UK and EU Ecodesign outcomes risks added complexity, cost, and product fragmentation. Industry continues to await clarity on future alignment.

For example, high heat retention storage heaters (HHRSH) are recognised under SSES but receive little targeted support beyond the *Energy Company Obligation (ECO)*. Hot water systems, despite being vital to flexibility and decarbonisation, are even less visible within current schemes.

This selective treatment risks market distortion and undermines investor confidence. When energy pricing, fiscal incentives, or financing schemes favour specific technologies, others are left struggling to compete even when they offer equivalent or greater system value.

The result is an uneven investment landscape. Heat pumps benefit from clearer policy attention, while heat batteries, EV integration, and smart control technologies are making progress toward inclusion but are not yet fully supported. The long-term success of the UK's clean power strategy will depend on creating a coherent, investable environment where manufacturers can innovate and compete fairly.





Manufacturing Lifecycle Process

Developing and bringing a new energy product to market is a long, complex process that requires significant lead time, even before a business case is written or funding is secured. From early concept and research through to design, testing, production, and optimisation, each stage can take years to complete. Manufacturers must plan for compliance, secure supply chains, and align designs with evolving standards and policy frameworks.

Once a product reaches market, additional time is needed for scaling, installer training, and consumer engagement. This means that any delay or uncertainty in policy, regulation, or market signals can ripple through the entire product development process, slowing progress and increasing costs. Clear, consistent direction from government and early visibility of requirements are therefore essential if manufacturers are to plan investment effectively and bring smart, low-carbon technologies to market at the pace Net Zero demands.

The journey from concept to commercial success in smart energy manufacturing follows a well-established lifecycle, each stage building on the last to ensure safety, quality, and long-term market value.

Delays and inconsistencies in policy development also carry a real risk for product deployment. If clarity comes too late, manufacturers may simply not have the time they need to design, develop and bring compliant products to market. This creates a genuine risk of missing the technologies required to achieve the 2030 targets.

The Department for Business and Trade's 2024 Business Perceptions Survey reveals that almost half of businesses (47%) reporting in 2024 find that regulation is an obstacle to their success, up from 45% in 2022⁵.

Manufacturers are investing in a slow-growing economy, which compounds risk. In the three months to September 2025 UK GDP grew by only 0.1%. Against a backdrop of very modest economic growth, manufacturers face heightened risk for long-term investment in smart-appliance programmes, which require 4-6 years to deliver. see statistic in the email body.

⁵ DBT (2025), Business Perceptions Survey





Industrial Strategy, Clean Energy Jobs Plan and the Opportunity for UK Manufacturing

Government's work on smart, flexible energy sits firmly within the ambitions of the Industrial Strategy and the Clean Energy Jobs Plan. The move towards UK-specific regulations and specifications means domestic manufacturers are closer to the policy environment and therefore better placed to respond. This creates a potential first-mover advantage for UK-based design and manufacturing teams.

There is a clear opportunity to grow UK capability in Energy Smart Appliances from product development and testing through to manufacturing and to anchor more of the value chain domestically. These technologies align directly with the aims of Clean Power 2030 and the wider industrial-growth agenda.

But this opportunity depends on Government giving manufacturers the clarity and time needed within the product-development cycle. If decisions come too late, the UK risks losing the advantage to overseas production. Timely, stable policy will allow businesses to invest with confidence and support the jobs and economic value that the Clean Energy Jobs Plan seeks to deliver.

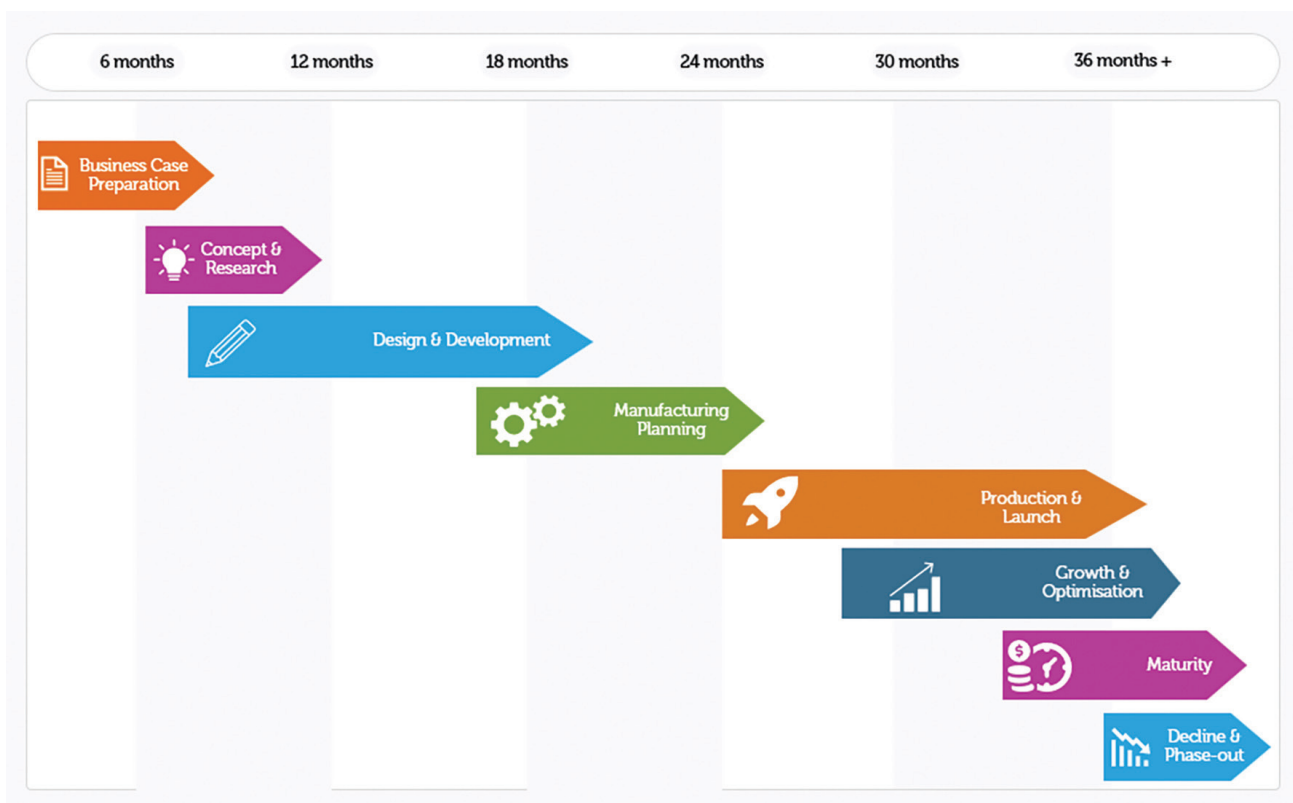




From Concept to Market: Understanding Manufacturer Lead Times

Manufacturers require a substantial lead time to design, test, and bring new electrification products to market, a process that varies widely among businesses depending on size, complexity, and innovation cycles.

While each manufacturer's approach differs, in general, successful product development follows a series of stages, from initial concept and research through design, compliance testing, and manufacturing planning to final production and market launch. Securing clear, timely regulatory signals and standards early in this cycle is critical to enable confident investment and avoid delays that could jeopardise meeting 2030 decarbonisation goals. Below shows a typical manufacturing process timeline.



Business case (6–12 months)

Shaping the idea, securing internal resource and funding.

Concept and research (3–18 months)

Developing concepts, testing user experience, refining the portfolio.

Design and development (9–30 months)

Moving from early concepts through iterative testing to final product design.

Manufacturing planning (18–36 months)

Production design, sourcing equipment, tooling, and preparing early production samples.

Production and launch (from 30 months onwards)

Finalising manufacturing processes, approving products for sale and building stock for launch.

Growth & Optimisation

Continuous improvement based on performance data, user feedback, and evolving standards, driving cost reduction and efficiency gains.

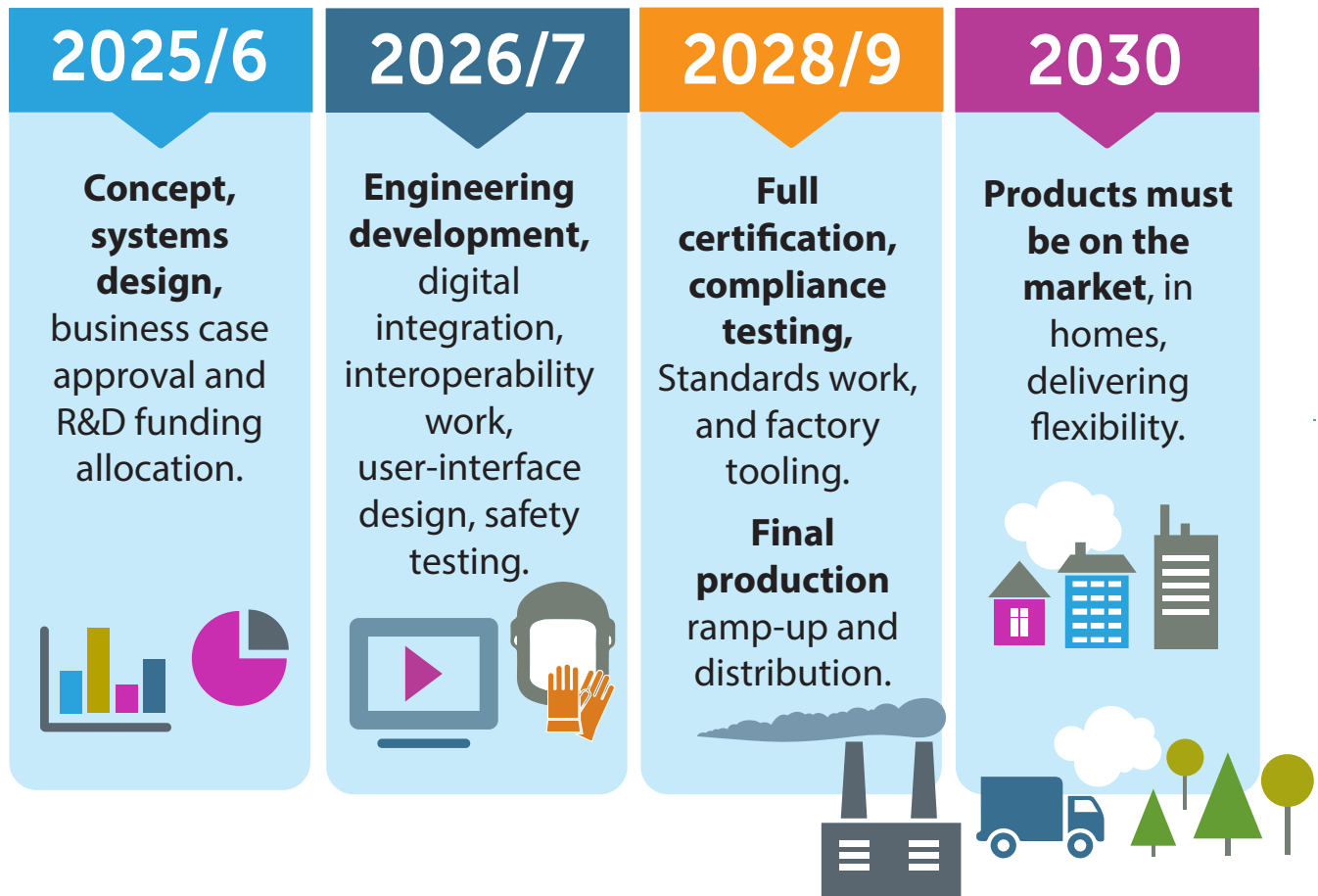
Maturity, Decline & Phase-out

As technologies evolve, mature products are gradually replaced or redesigned, with lessons from one lifecycle feeding into the next generation of innovation.



A typical large-appliance development cycle

A typical large-appliance development cycle takes 3 to 5 years from concept to market launch.
Working on a five-year cycle:



If policy decisions and technical standards are not settled by 2025–26, manufacturers risk running out of time to deliver compliant, flexible products at scale before 2030.



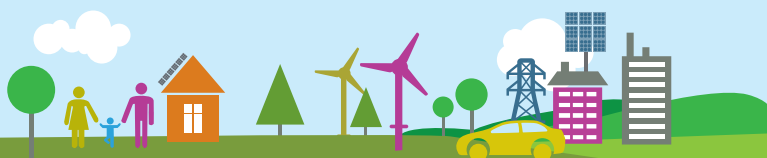


Summary of Key Barriers and Opportunities

The table below summarises the key challenges manufacturers face across clean heat, flexibility, and smart systems along with the implications and actions needed to strengthen confidence and accelerate delivery.

Next Steps and BEAMA's Position

Problems	Consequences & Challenges	What's Needed to Build Commercial Confidence
Policy decisions on ESAs, Ecodesign and related smart-energy requirements remain unclear, unfinished or shifting, compressing the product-development window.	Manufacturers can't commit to R&D or investment. • Product cycles risk missing the 2030 window. • Risk of non-compliant or withdrawn products. • UK loses first-mover advantage and investment moves elsewhere.	Stable, finalised policy decisions by 2025–26. • Clear specifications and test methods. • Realistic regulatory lead times. • Aligned timelines across DESNZ, Ofgem, NESO and BSI.
Possible divergence between UK and EU requirements creates uncertainty for multi-market manufacturers and affects the UK's ability to attract investment.	Duplicated design, testing and certification. • Higher product costs and slower UK deployment. • High Risk of the UK becoming a "special case" market. • Lost opportunity to build domestic ESA supply chains and clean-energy jobs.	Clarity on future UK–EU alignment. • Early communication on UK-specific differences. • Policy sequencing that supports UK R&D and manufacturing investment. • Alignment between ESA policy and wider industrial-strategy aims.
Electricity remains significantly more expensive than gas, reducing consumer appetite for electrified smart products.	Slower uptake of heat pumps and electric heating. • Weaker value case for smart functionality and flexibility services. • Manufacturers struggle to justify smart-product investment.	Clear direction on electricity-market reform. • Signals showing how flexibility will support affordability. • Joined-up approach between pricing policy and ESA requirements.
Flexibility is still viewed as a compliance requirement rather than a commercial opportunity.	Limited incentive to innovate beyond minimum standards. • Risk mandated features don't reflect consumer value. • Challenges for certain products (e.g. direct cylinders) if requirements are applied too early.	Proportionate, product-specific expectations. • Support for voluntary pathways where appropriate. • A roadmap linking technical capability to consumer demand and system value.
SSES ESA, Boiler Standards & Efficiency reform including MEPS for heat-pumps, F-Gas revision, PFAS review.	UK teams compete for limited global R&D resource. • Fragmented timelines make long-term planning difficult. • Progress on next-generation products stalls without coherence.	A holistic, cross-Government approach across DESNZ, DEFRA, HSE and standards bodies. • Aligned requirements and timelines. • Clear visibility of what future HVAC products must deliver and when. • Clarity for phasing out gas boilers and definitive decisions on hydrogen's role.





Delivering a smart, decarbonised energy system will require stronger coordination between government, industry, and standards bodies. BEAMA and its members stand ready to work across departments and programmes to help design and deliver a coherent policy and market framework.

Key priorities include:

- **Clarity and alignment** between regulatory frameworks, product standards, and fiscal incentives.
- **Stable, long-term policy signals** to give manufacturers and investors confidence to scale production and innovation.
- **Interoperability and open protocols** as the foundation for a flexible, connected energy system.
- **Skills and training support** to ensure installers can deliver high-quality, consumer-friendly smart energy systems.
- **Transparent consumer engagement** through clear price signals, simple propositions, and visible benefits.

By aligning regulation, standards, incentives, and market design, the UK can create the right conditions for confident investment, skilled employment, and global leadership in smart, flexible energy technologies.



BEAMA and its members remain committed to working in partnership with government and other stakeholders to deliver that vision, ensuring the UK's clean power and Net Zero ambitions are matched by a thriving, competitive, and future-ready manufacturing base.



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