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Commercial consumer energy systems:

An analysis of market pricing and supply, and opportunities for increasing adoption

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Procurement and supply chain analysis

A record 1.1 trillion US dollars was invested in clean energy globally in 2022. According to Bloomberg NEF, this was the first time that investment in clean energy was equal to the global investment in fossil fuels. However, the International Energy Agency (IEA) says that the world needs to immediately triple this amount to get on track for net zero emissions in 2050 – not including further investment in the global power grid.

The urgency is clear, and there are ever increasing opportunities for consumers to leverage commercial consumer energy systems (CES) to reduce costs and increase energy security, whilst delivering against net zero.

CES – or more precisely, "site level, distributed integrated clean energy systems" – enable the local integration of clean energy generation, such as solar and wind, with energy storage through batteries and the powering and heating of buildings and charging of electric vehicles (EV). These systems can often be connected to the grid, which can generate modest additional revenue for consumers where feed-in-tariffs exist, as well as helping to balance the grid, potentially further reducing the wholesale costs of electricity[1].

With volatile and rising energy costs around the world – for businesses and households alike – CES are an increasingly compelling solution to manage cost pressures, with the added benefit of reducing emissions. Furthermore, where energy supply and resilience are key concerns – for example, in communities with poor or no grid supply – CES can provide more secure supply, keeping vital energy services going for productive use, thermal comfort, lighting, wi-fi, and other modern energy needs.

This research for Integrate to Zero explores the CES market to help organisations around the globe make decisions that best meet their energy needs in a cost-effective way. The sector is growing rapidly, propped up by increasing demand, a growing supplier base, and advances in technology.

Research Approach

We sought to understand current market prices and supply, the procurement and supply chain barriers to implementing CES, as well as the opportunities for driving faster adoption. We asked the following questions:

- What is the supply market for components, and are they becoming commoditised?
- What are current pricing trends for CES?
- Is the market capacity constrained and, if so, is it due to component supply and/or labour availability?
- Do CES offer procurement and/or energy efficiencies, compared to individual components?
- Do CES offer a commercially viable alternative to grid and/or other energy solutions?
- How could adoption be accelerated and facilitated?

[1] Carbon and cost reduction opportunities from integrated energy in GB, Cornwall Insight with Integrate to Zero

Insights

Procurement Context

CES viability and adoption will accelerate as both Commercial and Technology drivers improve.

Affordability

- Costs need to be commercially favourable with reference to grid pricing and/or other energy sources to support business cases when costs are constrained
- Funding approaches will have to change to support upfront capital expenditure, followed by lower operational cost

Reliability & Usability

- Components need to perform at the outputs and capacities stated – as well as have the longevity – to support business cases
- Purchase decisions need to be simple and transparent to promote early adoption

Awareness

- Consumers need to understand how clean energy systems work, and the benefits of using and investing in them
- Consumers need to understand how to build the business case for investment, and what financial support is available

Availability

- Businesses need to be able to secure components and labour to deliver systems
- They need to have the ability to effectively utilise and then maintain the equipment
- The market needs to scale in line with demand

Figure 1: Adoption increases as affordability and awareness improve (Commercial drivers), alongside Reliability and Availability (Technology drivers)

Summary Insights

We ran a commercial pricing exercise (further detailed in Appendix A) to better understand the costs associated with both CES components and system installation in the UK and South Africa. The findings are summarised in the two charts below: Figure 2 shows pricing for individual components, and Figure 3 summarises total price, including installation.

CES Component Pricing

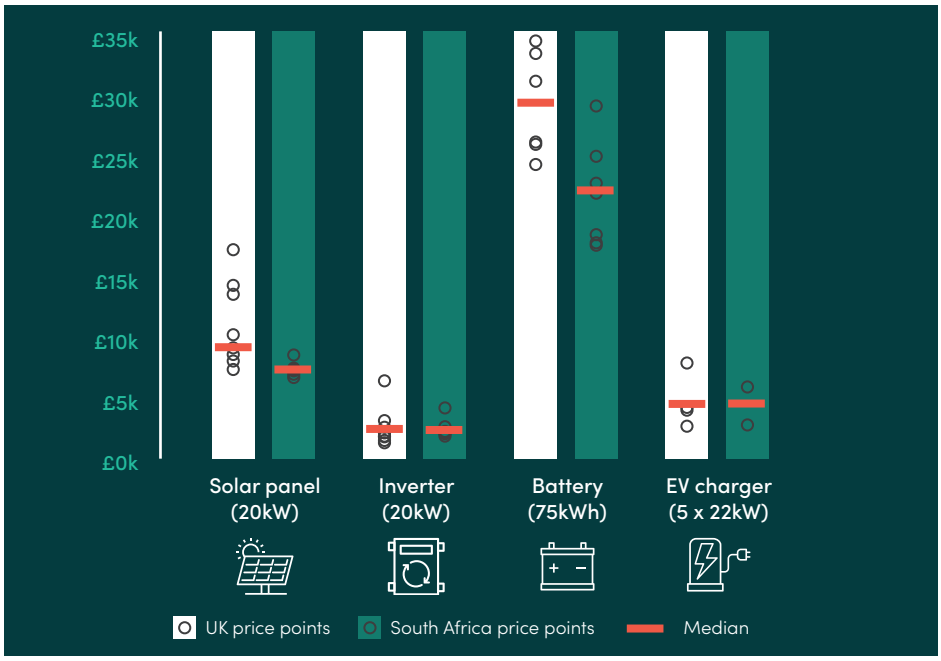


Figure 2: Component price analysis (based on UK and South Africa pricing from 10+ market sources in each country)

CES System Pricing

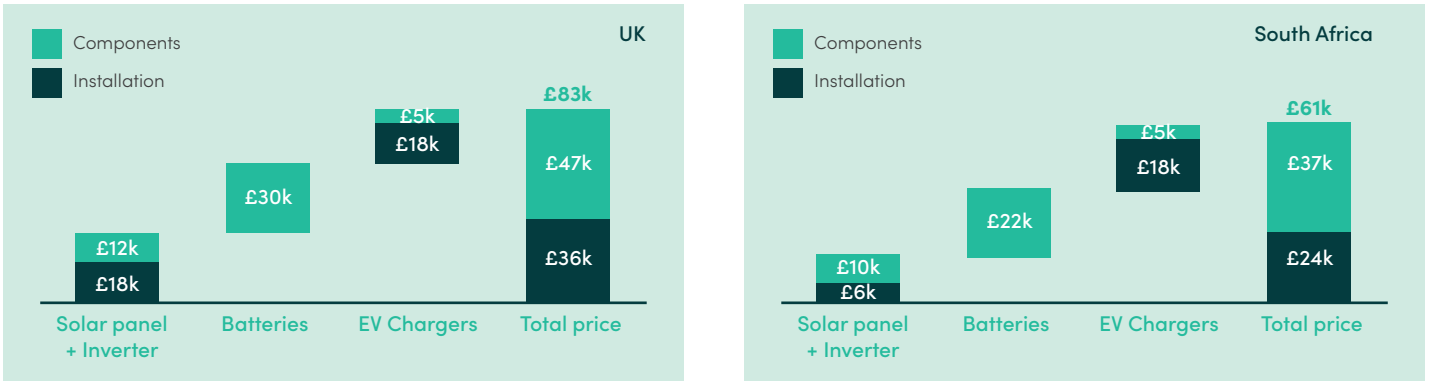


Figure 3: Commercial summary including installation

Note: *Installation cost of batteries is nominal when part of solar installation, so it has been absorbed into solar installation costs.*

Insight 1: Installation is a key cost driver

In the UK, technology costs for CES averaged 55% and installation costs averaged 45% (68% if the cost of batteries is excluded, because their technology cost is higher than installation cost compared to other components) of the total cost of an installed CES. Our research suggests that this is due to a shortage of skilled labour, which may be exacerbated by current labour market shortages in the UK more generally. South Africa shows a lower installation to component cost ratio, probably due to lower labour costs in South Africa. We note that installers emphasised that their work is in high demand and were therefore only able to offer limited time to provide pricing information.

Insight 2: Component pricing is readily available online for comparison

Pricing for components (and in cases, CES as a whole) is readily comparable and often available online in the UK and South Africa. South Africa's overall pricing for components is c.20% lower than the UK. In the UK, there is a larger variance in prices for solar panels due to more product selection, such as different-sized panels, multiple brands, high end products – for example, those with build-in optimisers or slimline design.

Insight 3: CES are commercially attractive

Solar, on its own, is relatively cost-effective, assuming most of the energy generated can be used without the need for storage. Over the expected 20+ year life of a solar panel, the returns are significant.[2] The time required for an investment to break even, compared to purchasing energy from the grid, is likely to further decrease with technology improvements, procurement leverage, and development of the labour market. (See report from Frontier Economics for more information.) Full CES are similarly attractive, and whilst the payback period may currently be longer than for solar alone, depending on the use case, they will often have wider benefits, see below.

Insight 4: Increasing affordability of batteries will accelerate CES

The cost of batteries has fallen 97% since 1991 to $132/kwh and whilst they rose by c.1% in 2022 to $134/kwh, driven by rising metal prices, BNEF predicts prices will fall again by 2024 to $100 per kw/h. Integrating batteries within a CES will prolong the payback period in most use cases; however, batteries can critically add to the resilience of the system, and efficiencies can be realised through smart integration such as purchasing and storing energy during off-peak rate hours.

Insight 5: Performance efficiencies from an integrated system

Components for CES can be selected and installed as desired; however, having an integrated system delivers efficiencies in performance that cannot be achieved with individual components alone, and thus may help justify the investment in a CES, depending on the use case.

- An integrated system with grid access can optimise the return on investment and reduce the carbon intensity and cost of the electricity used, such that consumption is always delivered in merit order, starting from the optimum lowest cost and lowest carbon source available to the site.
- Any surplus electricity generated from solar panels can be stored in batteries to compensate for periods when less electricity can be generated from the solar panels.
- With a time-of-use tariff, lower-priced electricity from the grid can be purchased and stored in batteries during the night for use during the day.
- As technology for electric vehicle (EV) chargers matures further, bidirectional EV chargers will become more prevalent in the market, whereby electricity can be taken from and provided to the grid, offering additional battery storage capacity. Energy from the vehicles can be extracted to support the site during peak times, and the vehicles can be charged when the rates are lower or when there is an abundance of solar generated electricity.

[2] Commercial consumer savings with distributed energy systems, Frontier Economics

Insight 6: Supply chain constraints are currently limiting CES growth

Growth in the number of new businesses supplying CES, combined with interviews with established players, suggests that the supply chain is expanding through start-ups, as well as larger engineering firms redeploying their capabilities – but it is still not expanding fast enough to meet demand.

Component market analysis

- In 2022, 75% of global production capacity for batteries and as much as 97% of global capacity for wafer manufacturing for PV cells were located in China[3].
- Rare earth metals required for the production of components are supply constrained and present their own environmental risks.
- The COVID-19 pandemic adversely impacted the supply chain for the components of CES, and created a worldwide supply shortage, resulting in many components being out of stock.
- The International Energy Association[4] (IEA) has encouraged governments to diversify their supply of solar panels and to move closer to markets where the products are demanded, but this requires a significant investment of capital and time.

Labour market analysis

- There is a significant lack of skilled and qualified labour. Employees within the energy sector need to increase from just over 65 million today to 90 million in 2030 to achieve a Net Zero scenario[3], according to a World Energy Outlook Report.
- The waiting time for many UK implementations could be more than one year due to increasing demand, in part triggered by the rapid rise in grid energy prices.
- The shortage of skilled labour results in high installation costs, which reflects additional costs, or a "Green Labour Premium". However, the costs should normalise as the labour force develops in line with other civil and electrical engineering roles and structural constraints on the labour market are eased.

Insight 7: Installing CES as an entire system is more cost effective than purchasing in stages

The total price of CES will typically reduce if an entire system is purchased rather than individual components that are separately installed, due to labour efficiencies and reduced costs of sales. We found an average of 10% pricing reductions for system procurement versus the procurement and installation of individual components. The market would benefit from reducing the burden of the upfront capital expenditure and should be supported by funding or financing options to make the investment more accessible.

[3] World Energy Outlook Report 2022, IEA
[4] Special Report on Solar PV Global Supply Chains, IEA

Accelerating CES through improving procurement and markets

Future procurement models

Consumers can improve procurement approaches, and the standardisation of CES can help accelerate adoption through enhanced and simplified business cases.

We make four recommendations for improving procurement and markets for CES:

Recommendation 1: Price transparency

- Increased price transparency will encourage competition and allow potential buyers to build an initial business case. Transparency should further be reflected in standardised product performance data, and suppliers should lead the way in this. A lack of price transparency is detrimental to consumer decision making and may be associated with market failure[5].

Recommendation 2: Toolkit

- Procurement processes take time and can be costly. Procurement could be streamlined through better use of supplier ratings, pro-forma pricing toolkits, and standardised best practice contracts. Furthermore, digital comparison tools save time and effort for buyers and are particularly helpful for complicated services[6].

Recommendation 3: Pipeline

- Supply chains perform more efficiently and scale better when they have a clear opportunity pipeline. Visibility over the pipeline helps suppliers reserve stock, secure funding for expansion, and invest in training and staff development. Facilitating discussions between key buyer and seller groups can help develop the market.

Recommendation 4: Aggregation

- There are efficiencies to be gained by sourcing across sites, through:
  - Labour and installation efficiency
  - Increased purchasing power/leverage
  - Reduction in administrative process
- Establishing local lots, consortia, or frameworks could cover multiple installations and encourage larger players into the market.

How governments can help

To further expand the CES market, opportunities for both consumers and suppliers need to be seized and explored and then cemented through clear policy setting.

Grow the labour pool: The skilled and available labour pool needs to increase, and the market would benefit from incentives for labour to become trained and qualified, or diverted from the fossil fuel industry to meet the increasing demand.

Diversify the supply chain: The component supply chain should be diversified and brought closer to the location of deployment, wherever feasible, to ensure steady and reliable supply. Suppliers need greater incentives and funding for more domestic development and production of components to grow capacity and stabilise supply chains. Signs are this is starting to happen with the Inflation Reduction Act (IRA) in the USA and a similar package from the EU.

Increase awareness: Awareness needs to be raised by promoting CES use cases, as well as procurement and funding approaches to develop the market. This could be accelerated by creating transparency through better product guidance and by

[5] Consumer Decision Making and European Consumer Law, Willem H van Boom, W.H. Price Intransparency, J Consum Policy 34, 359–376 (2011)
[6] Digital comparison tools market study, Competition & Markets Authority, 2017

developing independent and trusted performance and evaluation standards. Notably, any funding of financing options must be broadly communicated with a robust marketing programme to ensure good uptake.

What next for CES?

Our research suggests that the business case for CES is clear and that market trends are likely to reinforce this over time. The pace of change required, however, suggests that government intervention can support markets to facilitate faster, more cost-effective adoption.

Whilst CES are only one part of a cohesive energy strategy, for many user types – especially those facing volatile and high energy prices - they can be critical pillars for reducing costs, reducing emissions, and increasing energy security.

As systems become more integrated and smarter — for example, dynamic two-way interfaces with grid infrastructure – the amount of usable energy these systems can supply and the cost at which they can supply will improve. This all adds up. Wise energy consumers should carefully review the options and benefits of integrated and clean energy systems.

How we can help

If your business requires support in sustainable procurement and category management, from roadmap development, target setting, and putting in place actionable improvement plans, please visit our Sustainability Improvement service page or contact Edward.Cox@efficioconsulting.com

Appendix A

Use case: Implementing a CES for a commercial business, such as a small supermarket, based on pricing in the UK and South Africa

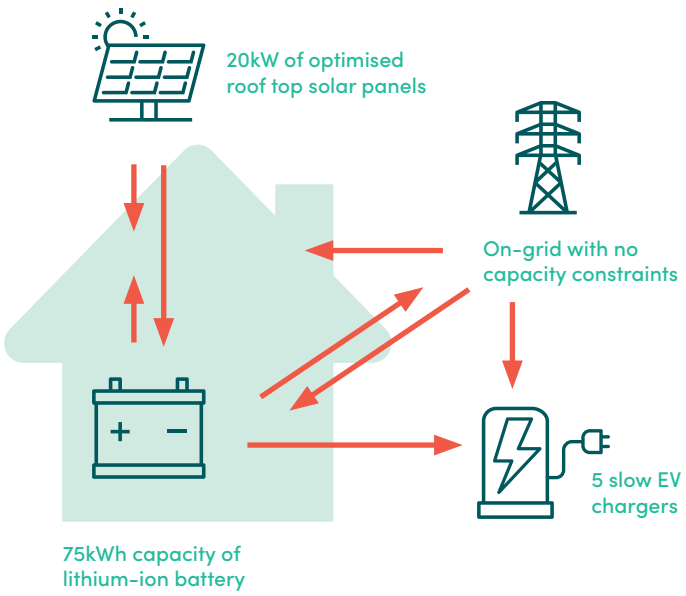
We defined a standardised use case for the market engagement exercise. We also wanted an example with global and scalable applicability.

The scenario was to implement a CES (see illustration) for a commercial location – for example, a small supermarket – with daily electricity consumption around 100kWh[7], which is typically about 100sqm of optimised solar panels. In this scenario, the system should generate about 40-50% of the annual electricity consumption for this site in the UK.

Further system components included battery storage of 75KWh (similar to those found in a large electric car) and EV charging. We sought to test this through a commercial pricing exercise supported by supplier interviews. We also conducted desk-based research into market awareness, offering different types and pricing. The pricing exercise and research focussed primarily on the UK and South Africa.

Assumptions and requirements

The defined use case is illustrated below.



Site specifications:

- Flat rooftop or south-facing sloping rooftop
- Freestanding building with single floor
- Floor size of approximately 250sqm in total
- Consumption profile of 80% during daytime and 20% during nighttime
- Electricity consumption of around 100kWh per day (excluding charging of EVs)
- A site able to source a "time-of-use" tariff to better optimise asset scheduling
- EV chargers used for overnight charging of delivery fleet

Figure 4: Site illustration

[7] Supermarket Energy Use in the UK, M. Kolokotroni, Energy Procedia, 161 (2019), pp. 325-332

Commercials

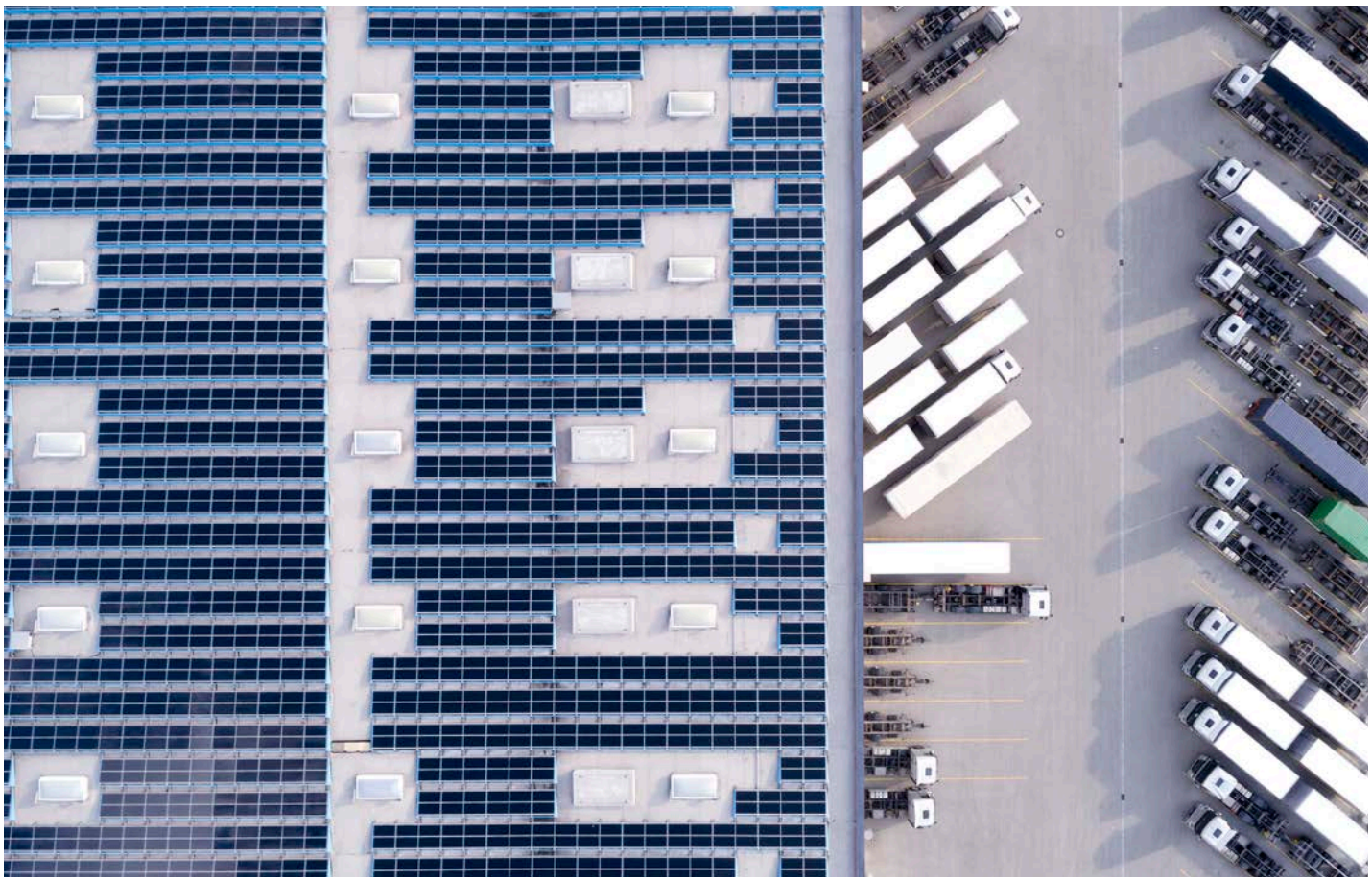
To meet the requirements for the scenario, the specification of components for which we obtained quotes are:

Figure 5: Component details

Component	Detail
Solar panel	Mono-crystalline panels are selected for their high efficiency. The power of each solar panel is around 400W peak, having 50 will have a total power of around 20kW peak output.
Inverter	Either a 20kW or 2x10kW inverter is selected depending on the supplier, such that it matches with the power of solar panels.
Batteries	Lithium-ion batteries are selected as they have high energy density and require low maintenance. The power of each battery cell varies between suppliers; however, as batteries are stackable, the total capacity of purchase is around 75kWh.
EV Charger	5 x 22kW EV chargers are selected.

Note: *accessories such as mounting structures and wires have been excluded for simplicity*

Please see Figures 2 and 3 for the pricing results.



About Efficio

Efficio has specialised in procurement and supply chain management for more than 20 years, supporting our clients across the globe to identify, deliver, and sustain improvement opportunities. This scale and singular focus set us apart. We help organisations reduce costs, improve internal processes, and upskill their procurement teams, enabling them to become high value-generating functions within their businesses. Our combination of expertise, data, technology, and human intelligence delivers value improvements at speed, allowing organisations to operate more efficiently and compete more effectively in an ever-changing landscape.

Efficio supports blue chip multinationals, private equity firms and their portfolio companies, and SME clients around the world to deliver increased value from procurement and supply chain management. For further information, please visit **www.efficioconsulting.com**.

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