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Think of energy as a service

By James Brittain, director of the Discovery Mill and freelance energy consultant

Back in the late 1980s Amory Lovins of the Rocky Mountain Institute in the US first used the term 'negawatt'. The story goes that he spotted a misprint in a utilities report and coined the term to describe the unit of power saved through energy conservation and energy efficiency activities (saved MWs). His premise was that this one concept could drive the change required to reduce our dependence on consuming excessive amounts of energy within our society.[1]

There is still so much opportunity to reduce energy consumption today. The UK's Clean Growth Strategy (2017) is targeting at least a 20 per cent improvement in energy efficiency within the business and industrial sector by 2030. Many energy systems are left 'on' most of the time to maximise service availability or for perceived better reliability. Engineers designing energy systems naturally err on the side of caution in their assumptions about operations, perceptions and behaviours which means they often over provide. For example, it has been found that UK buildings consume two or three times more energy than their equivalents in Melbourne, Australia, where the best buildings are using five or six times less energy than the UK average.[2]

This inevitably means there is often significant avoidable energy waste across our facilities and operations. This is much more widespread than most people think. Whether this situation stems from our energy supply models, design approaches, low energy prices or other barriers, our progress to be more efficient has been hindered. Somewhere along the line, energy and service have become disconnected.

Amory Lovins argues that customers want energy services such as lighting, heating, hot water, cooling, entertainment, etc, rather than buying kWhs of energy. By concentrating on the overall service, the focus for energy then is shifted to delivering better overall value for the customer rather than just managing energy supply and consumption in isolation by itself.

Focusing on continually better energy service productivity is what generates the negawatts that Amory Lovins visualised. If we get this right, this can bring about large social, economic and environmental benefits. For the last 35 years, Amory Lovins has been dreaming of a negawatt revolution worth gigabucks.

Delivering best value

In its simplest form, energy as a service (EaaS) is a philosophy that re-orientates an approach to energy management to focus on service and delivering best value. Partnering up with specialist energy service partners can help organisations enhance their energy management strategies, target the avoidable energy waste, upgrade energy service assets, accelerate energy efficiency programmes and deliver large energy savings at scale.

At its most extreme, EaaS can mean an energy services company (ESCO) is providing specialist energy services, without the consumer needing to own the service systems or pay for the direct operational costs of those services, including energy.

To understand the concept of energy as a service a change in mindset is required. It doesn't have to be complicated. This CPD article aims to explain the concept as well as giving an overview of how approaches are applied in practice. Learning objectives include the following:
- understand the drivers for energy as a service;
- explain total service life cost and value;
- identify ways to partner with specialist service providers; and
- review key aspects to consider when setting up an energy services contract.

The time for the negawatt revolution is now. Pressures to reduce consumption have never been so strong including:
- we have increasing urgency to deliver our climate change goals (UN 2019 report);
- the UK has recently declared a 'climate emergency' (May 2019);
- the Climate Change Committee has set out the case for a net-zero carbon target by 2050;
- there's an ever increasing threat of rising wholesale energy prices; and
- increasing pressure on our infrastructure from electrification of heating, transport, etc, is also likely to lead to higher energy prices in the long-run unless we significantly reduce our existing consumption.

Many in the industry, such as Amory Lovins, have been arguing for years that we already have the technology and approaches to deliver huge savings across our economy. Many organisations have demonstrated savings in the range of 10 to over 30 per cent by exploiting efficiency measures such as lighting, behaviour change, building systems control and optimisation, and upgrades in motors and drives, etc. Most programmes payback, on average, in approximately four years[3] but many can pay back in significantly less. The industry continues to find more opportunities,

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as technologies and approaches develop and improve, and as we better understand how energy performance can be optimised for better service.

More end-users, in recent years, have been looking towards energy service models to help fast-track energy efficiency projects, clear maintenance backlogs, replace old assets and/or to install embedded energy supply infrastructure. Good practice is to target energy conservation and efficiency measures first in line with the energy hierarchy. This change in approach has been led by the public sector, but more private sector companies are beginning to follow suit.

The opportunity for energy service models is to help optimise energy performance for a wide range of different types of organisations. If they get this right, these strategies can help drive value beyond just energy through, for example, delivering better customer service, better security of supply, better system resilience, reducing overall service costs, improved environmental impact and better organisational reputations.

Back in the 1880s, when pioneers likes Thomas Edison marketed new electric products, the propositions were about supplying a service.

When procuring a new service, to make the best value decision, a consumer needs to optimise across all their objectives, including across both the capital cost of equipment and operational costs. This is the value of energy as a service and it is this approach that incentivises reducing energy consumption.

As a simple illustration, Table 1 shows example costs for a range of different fridge freezer models, all rated at the same service level, considering capital and running cost and combining them in equal terms in the form of a total service life cost (ignoring discount rates/inflation).

In simple terms, there are two approaches to procurement:
• buy the product: energy use is usually invisible at time of purchase so our decision is based on capital cost alone – we tend to buy the cheapest, the A model.
• buy the service: if total service cost (say over 10 years) was packaged up in one sum – we are more likely to buy the most economic option, the

Fridge freezer model	Capital cost	kWh per year	Running cost per year	Total cost over 10 years	Monthly cost over 10 years	Savings impact (compared to model A)
A	£350	408	£66	£1,010	£8.42	-
A+	£400	270	£44	£840	£7.00	17% total cost 34% energy kWh
A++	£500	206	£33	£830	£6.92	18% total cost 50% energy kWh
A+++	£600	157	£25	£850	£7.08	16% total cost 62% energy kWh

Table 1: illustrative costs and energy savings for a range of fridge freezer options

A++ model; this costs 18 per cent less in total cost and 50 per cent less in energy consumption.

Unfortunately, most of us still generally procure using Approach 1: the desire of both developers and construction clients, for example, to keep product project costs down generally overrules. Many projects still don't forecast operational energy use and cost. Consequently, there's a general lack of awareness of the benefits of more efficient options. Enhanced energy efficiency measures are seen as discretionary and so they can be engineered out as service value isn't properly understood. These awareness barriers mean that customers end up paying the cost of inefficiency over the service life.

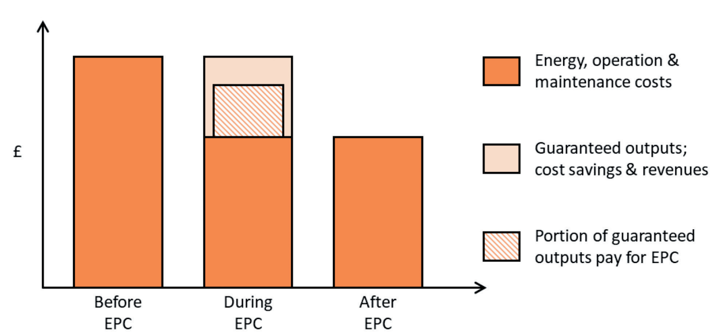
Energy service pricing models are based on selling the customer an end service for a periodic fee, e.g. based on a monthly cost. These can take into account other monetary equivalent value such as reduced maintenance costs or improved service levels. For many energy services, energy consumption tends to account for a large proportion of total cost so this model opens up the opportunity to reduce energy service cost (and so increase the value of the service) by targeting avoidable waste and enhancing energy service productivity.

When considering energy as a service, a consumer would naturally switch to another energy service option if it would deliver better service at reduced cost (the Win Win).

According to ESTA's Energy Services Contracting Group, an ESCO is an Energy Services Company that offers a turnkey service to the client to identify, implement, operate and maintain energy cost saving or revenue generation measures in the form of an energy performance contract (EPC) or energy supply contract (ESC) depending on the scope of services[4].

This may be for a whole building/facility or for a proportion of the energy services. ESCOs typically operate on an agnostic technology or solution basis, bringing together specialist sub-contractors depending on the specific project requirements; they are often offered by existing facilities management, engineering

Figures 1: typical financial model for EPC4



or energy management specialists.

As such, energy expertise requirements, life cycle cost analysis and technical, performance and/or financial risk exposure can be transferred by the client to an ESCO so the approach has the potential to overcome the awareness and risk barriers associated with traditional approaches to procurement.

ESCO provision through EPCs in the UK is currently valued at approximately €100m a year[5].

There are two common EPC models in the UK that can either be used separately or in combination:
• guaranteed performance model – typically based on an upfront capital payment and/or a regular service fee in return for implementation of new assets and/or energy-saving measures, with a guaranteed minimum level of energy cost savings and revenues. This is the main approach used in the UK; it's the basis for programmes such as Refit, the Scottish non-domestic energy efficiency framework, etc. Financed projects allow clients to avoid up-front capital cost, in preference for a monthly positive cash flow. The guarantee means the provider covers any short fall below the guaranteed level such that the project's financial performance is always maintained;
• shared savings model – the provider is paid based on a percentage share of delivered cost savings and/or revenues. Even though more popular in Europe, in the UK this is generally used in combination with a guaranteed performance model with shared savings providing a bonus level for any over performance, such as for the Carbon and Energy Fund framework for the NHS/public sector.

Figure 1 shows a typical finance model for an EPC illustrating how guaranteed cost savings and revenue pay for the cost of the service. In most cases, the contract term is set to exceed the payback period of the investment.

On average, typical UK EPC projects have a capital outlay of €1-5m and a contract length of 5-10 years (20 per cent of EPCs are for less than five years). Also, they use a guaranteed savings model and are paid for using the client's internal funds or debt arrangements[5].

An energy supply contract (ESC) could be considered to be a subset of

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an EPC and usually takes the form of a long-term contract to supply useful energy to a site in the form of steam, hot water, coolant or electricity. Depending on the nature of energy supplies, this may be referred to as heat supply, energy services or a power purchase agreement. A rate is agreed that provides savings to the client in return for commitment to a minimum level of consumption, while the provider guarantees minimum energy supply service levels and availability.

Figure 2 illustrates how an EPC may typically be implemented in five common steps. Approaches used will depend on the scope and programme chosen.

The QualitEE project is focused on quality assurance for energy efficiency services across Europe. Their research has identified key elements for quality in EPC projects. Top-rated UK aspects include: a robust preliminary technical-economic analysis and energy audit, good communication between provider and client, measurement & verification (M&V), transparency and completeness of contracts, implementation of technical measures, and achieving expected savings levels[5]. This research is being used to set new guidelines for quality evaluation of EPCs[6].

It is important that there is a clear understanding of the brief and roles and responsibilities at the start. Top management needs to be on board by setting out key requirements, appointing an internal project manager and ensuring appropriate targets are stipulated. Different people are likely to be involved in the process; for example financial managers (interested in cost) and property managers interested in technical specifications and service levels. Clients need to have the procurement (and contract management) capabilities to ensure appropriate risks are truly transferred to the provider.

Commonly, the provider takes on project, technical and performance outcome risks. Some risks will need to be shared or taken on by the client. These may include energy unit price changes, weather impacts or impact of major changes in customer building/process use (both the latter can be accounted for in the M&V process). Upfront assumptions need to be transparent and clearly documented.

An investment grade audit, used to identify and set specifications for energy conservation measures, can be quite involved (and expensive) especially where assumptions need to be made up front for a long-term commitment.

Defined and measured

Service level requirements need to be defined and measured, depending on the services in scope. For example, building user comfort requirements may be specified using objective measures (temperature, air quality, lighting levels, etc.), supported and evidenced by collective user customer feedback.

Energy consumption should be understood in terms of its driving factors. For instance, units produced is often important in manufacturing sites, covers in restaurants, and external temperature for supermarkets with high refrigeration load. This can help understanding of energy service productivity, drive continual improvement and form the basis for M&V.

For better insight into effective energy savings measures, it is important to involve local maintenance and operations teams who are closest to and so best understand the (changing) needs of their customers. Beware, without a collaborative ethos, an EPC model can cause conflict with incumbent service providers. The secret is often to blend the technical and people-based approaches, with good energy management ISO 50001 system controls alongside.

The M&V plan to verify energy savings delivered needs to be developed early so sufficient baseline information can be collected. A gap analysis identifies existing metering and where upgrade provisions are necessary. The International Performance Measurement and Verification Protocol (IPMVP)[7] defines good practice in M&V.

Raising finance can be seen as a barrier for UK projects[5], even though there is a wide range of finance options available. Debt finance is often used, for example from Salix Finance for public sector projects.

Where necessary, clients use independent EPC facilitators for project development, provider selection, M&V, behaviour change or other ways to add value.

The energy as a service approach has the potential to offer significant benefits for end user organisations for a wide range of applications.

Recognising energy as a service means that energy use can be viewed holistically, with the end point of the value chain being the end service rather than the energy meter. This means avoidable energy can more easily be targeted, generating the negawatts that Amory Lovins believes are one of the biggest opportunities in our economy today.

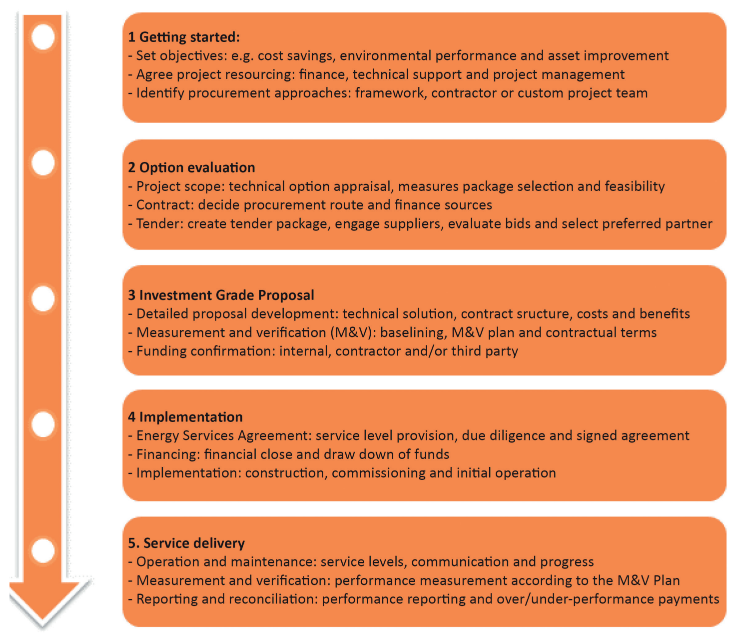
At its best, optimum energy service productivity can be considered to be the point that the organisation is confident its systems and practices are using only what they need.

You will know what works best for your organisation, whether it's contracting services out or working with specialists on particular areas and engaging, empowering and incentivising the teams involved. This can be structured under the wider remit of an EPC[8] or set up through in-house initiatives such as energy crediting (bottom-up tracking of savings linked to people and teams).

The overall package needs to be right so it that delivers enhanced value for the customer, reduced energy consumption and cost and benefits for the parties and people involved (the 'Win Win Win'). If service pricing is competitive, more organisations will get buy-in. A culture of continuous learning, creativity, innovation and leadership is what typically drives enhanced levels of quality and service for customers and colleagues.

To succeed the approach needs to be desirable, focused, (relatively) easy and continual, but most importantly it needs to be owned by the people involved.

Figure 2 Energy performance contracting in 5 steps



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8) *European Code of Conduct for EPC, www.theema.org.uk*

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ENTRY FORM

ENERGY AS A SERVICE

Please mark your answers on the sheet below by placing a cross in the box next to the correct answer. Only mark one box for each question. You may find it helpful to mark the answers in pencil first before filling in the final answers in ink. Once you have completed the answer sheet in ink, return it to the address below. Photocopies are acceptable.

QUESTIONS

1. According to Amory Lovins, what is the definition of a Negawatt?

- ☐ Saved MWh
- ☐ Saved MW
- ☐ Negative MW
- ☐ Neutral MWh

2. What is the UK's Clean Growth Strategy target for improvements in energy efficiency (within the business / industrial sector) by 2030?

- ☐ 5 per cent
- ☐ 10 per cent
- ☐ 20 per cent
- ☐ 30 per cent

3. What does ESCO stand for?

- ☐ Energy supply company
- ☐ Energy services company
- ☐ Energy scalable committee
- ☐ Energy sources committee

4. According to Energy Efficiency Trends market research [3], what is the approximate average payback of energy efficiency programmes in the UK?

- ☐ 1 year
- ☐ 2 years
- ☐ 4 years
- ☐ 5 years

5. What of these drivers is the key objective for a total life service cost assessment?

- ☐ Increasing urgency to deliver our climate goals
- ☐ Reducing risks associated with rising energy prices
- ☐ Reducing overall service cost
- ☐ For better energy system resilience

6. According to the Energy Hierarchy, which energy performance improvement measures would normally be targeted first?

- ☐ Embedded new energy supply infrastructure
- ☐ Carbon offsetting
- ☐ Energy conservation and energy efficiency
- ☐ Procuring green tariff electricity

7. Which challenge can limit the energy performance of a product only approach to procurement?

- ☐ Lack of awareness (of benefits) of more efficient options
- ☐ Beliefs that investments in energy efficiency are not justified
- ☐ Lack of awareness of what other organisations are doing
- ☐ Conflict with previous efforts and investments

8. In context of energy services models, what is an EPC?

- ☐ Energy performance certificate
- ☐ Energy performance contract
- ☐ Energy product code
- ☐ Energy process control

9. Which of the following is not an EPC partnership model?

- ☐ Energy supply contract
- ☐ Portfolio purchasing
- ☐ Guaranteed performance model
- ☐ Shared savings model

10. According to ESTA's Energy Services Contracting Group, what are the five common steps of an EPC?

- ☐ Partner - Energy review - Energy audit - Investment approvals - Energy management
- ☐ Getting started - Option evaluation - Investment grade proposal - Implementation - Service delivery
- ☐ Brief - Identify - Implement - Operate - Maintain
- ☐ Plan - Do - Check - Act - Continual improvement

Please complete your details below in block capitals

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