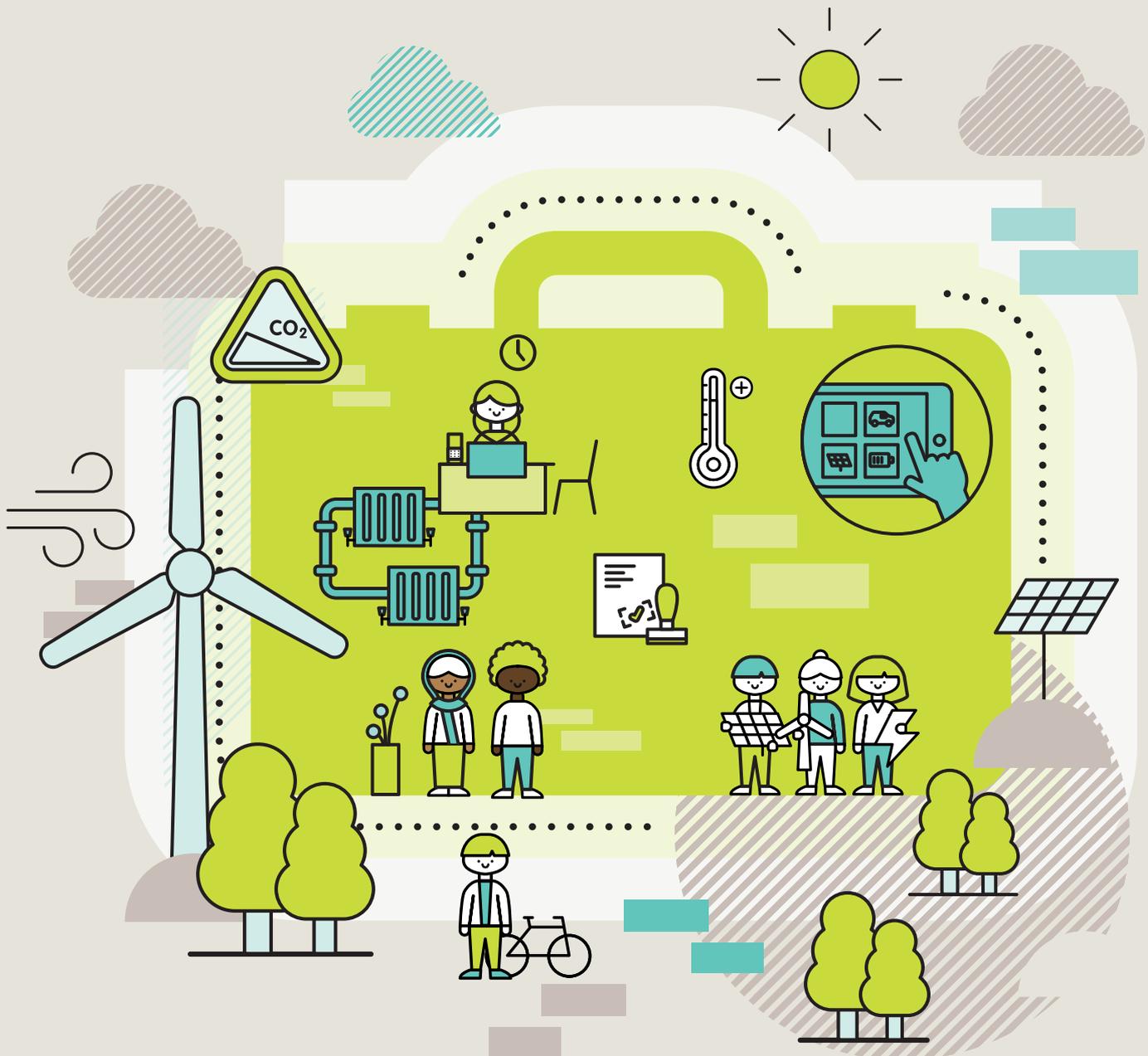


What does an Energy Management Solution look like for businesses?

Shenay Kinyok



What do businesses need from an energy management tool?

Introduction

The energy transition is upon us, with many governments now committed to achieving net zero carbon emissions by 2050. To reach these goals we need to be able to make the most out of renewable energy by balancing supply with demand. Smart technologies can automate this balancing by increasing demand when supplies are high or reducing it when supplies are low. This practice is called Demand Side Response (DSR).

Non-domestic consumers will need to play their role in helping cut their emissions. However, their number one priority is their core business. They may be interested in reducing energy and want to save carbon to do their bit, but this will only ever be a secondary priority.

UK & Canadian Governments have funded the Energy-IQ project to understand how to help businesses manage their energy and reduce their emissions together with DSR.

Energy Systems Catapult set out to understand what non-domestic consumers need to better manage their energy. To do this, we worked with Q Energy, a digital energy services company who have a platform that aims to deliver energy, cost and carbon savings.

We report our findings in three insight papers: the first paper identifies user needs; the second looks at what a solution requires to meet these needs; and the third paper focuses on DSR, highlighting some key barriers and how to overcome them.

The Energy – IQ project

We spoke to several organizations in the UK and Canada (Ontario and Alberta) to understand their energy management needs. We included large commercial property owners, municipalities (local councils) and Small or Medium-sized Enterprises (SMEs).

Within each organisation we spoke to people who were responsible for energy management. We found that engagement in energy management varied depending on the role and responsibilities of the participant.

Participants included:

- Customer Operations Managers, who work within large commercial properties to ensure their buildings' are operating efficiently for their customers.
- Energy Managers, who are solely dedicated to managing their buildings' energy and operations. They typically manage several buildings.
- Small Business owners (SMEs), who have no dedicated Energy Manager and so manage all their business needs themselves.

In this paper we refer to these participants collectively as Energy Managers (EMs).

We showed participants Q Energy's energy management tool to discover what worked well, what didn't work so well and what was missing from the tool. We combined this with our understanding of their user needs and jobs to be done to determine what EMs need from an energy management solution.

This paper focuses on what we found and makes suggestions on the requirements of an energy management solution to help EMs do their jobs better.

The fundamentals of energy management

There are two key components which are fundamental to energy management.

1. Measuring building performance: Benchmarks, Predictions and Targets

EMs need to know how well their buildings are performing against an expectation. This provides them with the necessary context of what a building should be using. Any deviations from this can be a sign that something isn't right. But, to trust this, EMs need to know how these are being calculated. Knowing if targets and predictions consider the building's historical usage, occupancy levels, and the weather is crucial as this lets them know to what extent their target is reliable.

Incorporating weather or external temperatures is a key requirement for understanding energy use, as weather has a direct effect on demand.

Recommendation: Incorporate weather as a factor when creating benchmarks, targets and predictions. Explain how these are calculated and where possible, work with the EM to set them. Within the tool show what the benchmark or target is so that they don't have to rely on memory. Include how far/close their usage is to the benchmark (e.g. 10% under) to help them make quick and easy comparisons and identify if they need to take further action.

2. Making comparisons

To understand a building's usage over time, EMs need make comparisons, particularly to the same period last year. Being able to compare energy use, costs and emissions helps them identify trends and detect if anything is unusual. It's useful to compare between years rather than months due to changes in weather conditions across months.

Making these comparisons also allows EMs to measure the impacts of any changes they have made and if they are achieving their goals. For example, if they have made changes to equipment, they will expect to see a difference in energy consumption from previous years.

Recommendation: Allow EMs to manipulate their energy data to make comparisons. When showing comparisons between years and months be clear on what the data is showing and include details such as dates and periods of time, so the user doesn't have to work it out.

Helping Energy Managers get their Jobs done

In a previous report we highlighted Energy Managers' needs and identified that there are four key jobs they want to achieve to help reduce emissions, energy usage or costs.

I want a simple way of tracking and monitoring my buildings' usage



I want to quickly detect any spikes and/or issues with my building's energy usage



I want a simple way of monitoring and understanding my buildings' costs/budget/overspend



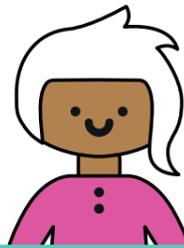
I want a simple way of sharing and reporting energy data



In the tables that follow we focus on the four jobs they want to get done and what a tool needs to show or do to help them achieve these.



I want a simple way of tracking and monitoring my buildings' usage



Feature	What it does	Why	Recommendation
Energy consumption Out of hours Vs Business hours "Is equipment on when it shouldn't be"	Highlights if a building is/is not functioning as expected.	<ul style="list-style-type: none"> Provides EMs with a simple way of knowing if a building is operating as expected. Highlights unusual usage in an easy and quick way, saving the EM the time of manually detecting where this is coming from. 	Show energy consumption during and outside of business hours and include the times and days that define them. This can help EMs who manage multiple buildings which may have different operational hours. To help EMs easily identify unusual usage, emphasise the times when the business is closed e.g. by using different colours.
Monitor Kilowatt demand and Kilowatt per hour (Relevant to Canada Only) 	Shows if there is a reduction in energy usage even if costs do not change.	<ul style="list-style-type: none"> In Canada, commercial electricity bills are made up of both kilowatt demand (kW) and energy consumption (kWh). EMs need to differentiate the two to understand their energy usage and costs. In Canada a large proportion of bills for commercial buildings comes from paying high rates for demand. 	Include both energy demand and energy usage in the same graph to allow EMs to easily monitor and distinguish between the two.
Peak demand	Shows when peak demand occurs so users can be proactive and look at ways to avoid or reduce this.	<ul style="list-style-type: none"> EMs are interested in seeing their business' peak demand. In Canada, larger businesses are charged a global adjustment charge if they contribute to the 5 main peaks in energy demand. This allows them to plan what can be done to avoid peaks and where applicable being charged high costs. This will also be relevant if businesses are on a time-of-use tariff (ToU) in the future. 	Within the tool show the times of peak demand so users know when it's going to occur. If businesses are on a ToU tariff the different prices of energy should be clearly reflected in a graph alongside the business's own usage and peak demand. This will allow them to focus on how to reduce their peak and make use of cheaper rates. For those not on ToU tariff, seeing this information can also be useful as they can see their potential savings.

I want to quickly detect any spikes and/or issues with my building's energy usage



Feature	What it does	Why	Recommendation
Real time usage display "I Want to see if AC and heating is operating at the same time as they shouldn't be."	Provides a quick and easy snapshot of how a building is operating at any moment.	<ul style="list-style-type: none"> Allows EMs to be reactive as they can see what's happening in their building at any moment. To detect issues before they cause large spikes in consumption, emissions or costs. To compare real time usage to what's been predicted to ensure this has been calculated correctly. 	Provide a way for energy managers to understand what is happening in their building at any moment, allowing them to be reactive. This could be a graph which shows real-time consumption alongside predicted usage. Many buildings have a building management system (BMS or BAS) which has valuable data on consumption: consider integrating this into a tool.
Anomaly Detection	Raises alarms for any issues, allowing quick detection of problems and reducing time of investigations.	<ul style="list-style-type: none"> Allows EMs to be reactive and implement changes quicker, therefore saving time and limiting any spikes in energy usage and costs. Response time can be paramount especially in critical environments. An alarm could include energy usage going above the set benchmark, spikes in costs or equipment not working as expected. 	Alarms should be relevant and reliable. EMs need to be able to set their own thresholds for alarms, particularly for spikes in demand. Include a hyperlink within the alarm that shows the detected problem within the tool. This will save the EM time and improve usability. There is a risk of having too many alarms. A daily/weekly report compiling the alarms could be a solution, but EMs must be able to prioritise those most important.
Device energy demand breakdown graph	Shows which devices contribute to energy usage and helps pinpoint the source of a spike or issue.	<ul style="list-style-type: none"> Seeing different devices within a building and the amount of energy they use helps EMs understand their usage. To identify the source of issues which is critical for deciding which changes to implement. 	Present a device energy demand breakdown graph. Where possible show demand through time (years/ months) so EMs can understand trends and what contributes most to their energy usage. Allow them to customise labels for different devices and add comments e.g. device location, maintenance information.

I want a simple way of monitoring and understanding my buildings' costs/budget/overspend



Feature	What it does	Why	Recommendation
Budget monitoring	Helps EMs stick to financial budgets and identify if there is room for improvement.	<ul style="list-style-type: none"> Showing yearly budgets allow EMs to see if they are within budget or expected to go over. EMs can use this information to make decisions on how they can improve to avoid overspend. Note that not all EMs have yearly energy budgets. Yet participants were able to see the value in tracking this. 	<p>Show budgets and targets within the tool so that Energy Managers know what they are working towards and how far/close they are from this. Present this in a clean and visual way.</p> <p>When showing or making comparisons to budgets and targets include the actual values as we can't expect the user to remember this.</p>
Bill breakdown	Enables EMs to understand where costs are coming from and identify where savings have been made.	<ul style="list-style-type: none"> Bills can be confusing as they are made up of numerous elements, such as distribution costs, estimations etc. It's hard to understand where costs are coming from and where savings have been made. It's important to have costs broken down to see how real usage impacts costs. 	<p>Include billing information within the tool and provide a breakdown of the different components to help EMs identify where costs are coming from.</p> <p>Allow EMs to compare bills between months and years so they can better understand costs and monitor the impacts of making changes such as replacing old equipment.</p>

Things to consider

EMs typically monitor other utilities such as water and gas. In Canada and the UK businesses can get their main heating from natural gas as well as electricity. It's Important for EMs to monitor both to ensure that in reducing one they are not increasing their usage of the other.

Think about Incorporating other utilities within an energy management tool. Having one tool to access all energy management is much more efficient, as many EMs reported they don't want to be logging into numerous tools.

I want a simple way of sharing and reporting energy data



Feature	What it does	Why	Recommendation
Measurement and reporting of Emissions, Energy use and Cost savings	Helps users understand and measure impacts of these on energy management.	<ul style="list-style-type: none"> EMs need to be able to measure and report on 3 key things: Cost, Emissions (particularly carbon) and Energy savings To help EMs understand if and how they are reaching their goals and targets. It's crucial EMs know where their savings are coming from. To understand the impacts of making changes e.g. equipment upgrades or implementing efficiency projects. Gives EMs confidence to continue making progress and share good news stories with others. Helps build a case to implement more energy efficiency projects in the future if they have proven to have a positive impact. 	<p>Present Energy, Carbon and Cost savings in a simple way.</p> <p>Make it easy to identify where savings have come from by including when and where there has been a reduction and by how much e.g. 6% reduction in energy use between April and May. This allows EMs to see the impact of changes they made as well as build a business case for future investments. They can then communicate this with others in their business.</p> <p>Be clear on how cost savings are calculated and how the business will receive them.</p> <p>Be aware that in Canada different provinces apply different emissions factors to calculate carbon emissions.</p>
Data extraction and graphs	Saves the time of manually doing analysis and creating reports for different stakeholders.	<ul style="list-style-type: none"> EMs discuss energy use with a variety of people, from members of their team to clients and customers. EMs need to be able to create custom reports/extract data depending on who they are engaging with to make it relevant to that person. Extracting data directly from the tool saves EMs time by allowing them to see all their data and extract the most relevant parts. 	<p>Present data visually using graphs and allow users to easily manipulate them. EMs will want to select specific parts of their energy data to look at and compare.</p> <p>Allow EMs to easily export different graphs and data from the tool so that they can customise their reports to better engage specific people.</p>

Having Insights and recommendations on energy management is extremely valuable to Energy Managers

When we presented recommendations in the tool, for example, insights identifying out of hours usage rising above a set benchmark, it was highly valued by the participants.

Out of hours energy use higher than usual

Yesterday your 'out of hours' energy use (between 19:00 and 07:00) was 6% higher than the average.

Many EMs said that they wanted these types of insights to make energy management easier and to use their time more effectively.

"that particular type of recommendation is exactly what I would want to have...if I could set a threshold for after hours energy use greater than the previous day, and then have it flagged for me, then that saves me a lot of time, from like, manually looking at these things".



We recommend incorporating insights and recommendations into a management solution. To be useful, they need to be specific to that business and provide enough information to allow EMs to understand the issue and investigate. Recommendations should have a clear process which allows users to easily action, track and monitor them. This is important as they will want to go back and see what's been done, understand any changes in usage or operations as a result of this, and to report this to others.



The right tool for the right Energy Manager

We identified the four key jobs EMs are trying to achieve, and how a tool could meet their needs. However, there are various types of 'Energy Manager', each with their own understanding of energy and engagement with energy management in their organisation. Therefore, there are going to be features of an energy tool that are more relevant to some than others.

It's important to consider the type of EM you are designing for, including their roles and responsibilities, and the goals they are working towards in their business. We recommend creating a tool that is customisable so that different EMs can build a dashboard that is relevant and bespoke to them.

It's also likely EMs will share this tool with others in their organisation, therefore you should allow them to customize a version of the dashboard to share with others. This will allow them to create a dashboard that is relevant to their clients, stakeholders or staff, whilst still having access to all the information they need.

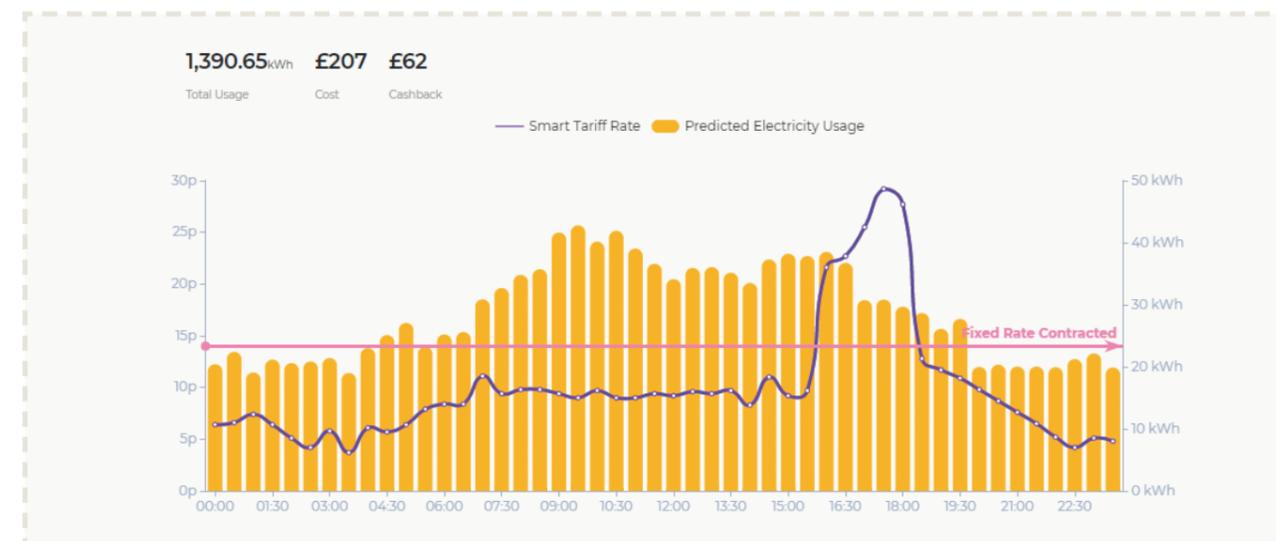
Integrating DSR into an energy management tool

Within the Q Energy tool, a time-of-use (ToU) tariff was used to introduce flexibility, alongside DSR recommendations.

The ToU tariff was called a 'smart tariff'. The graph below shows how the smart tariff reflects the different price of electricity throughout the day, to help participants understand how savings could be made.

Participants found the graph confusing and often misinterpreted the smart tariff as showing their buildings' real time usage.

Once the graph was explained, participants were able to understand that the tool could help them take advantage of cheaper energy throughout the day, but there were questions over how feasible this was and how it would work.



The recommendations for using DSR were referred to as 'ECO mode'. They focused on how they could achieve savings through flexibility and demand shifting.

Activate ECO Mode on your EV Charge Station to earn £250 a month

Q Energy could activate Eco Mode on your EV Charge Point. This will make use of cheap electricity, and avoid the most expensive times while ensuring your vehicle is fully charged when required.

For participants to consider engaging with flexibility they need to be assured that DSR will not negatively impact their business, including their staff and customers.

Any service looking to introduce flexibility solutions should consider an Energy Manager's understanding of energy, and not assume they will immediately understand how DSR works. You should ensure the benefits of DSR are well explained and be explicit about any disruptions it may cause to the business.

Want to know more?

To find out more about DSR read our third paper '**How to help businesses engage with DSR through Energy Management**', which looks at what Energy Managers need to know to engage with DSR, and what some of the key barriers are.

Read our first insight paper '**How to help businesses manage their energy**' to dive deeper into the four jobs to be done and user needs when it comes to energy management.

Energy-IQ project – who's involved:

bruntwood

CATAPULT
Energy Systems

 dunsky

 hildebrand

 **iconics**

 Manchester
Metropolitan
University


Penso Power 

q·Energy

CATAPULT
Energy Systems

Energy Systems Catapult supports innovators in unleashing opportunities from the transition to a clean, intelligent energy system.

7th Floor, Cannon House, The Priory Queensway,
Birmingham, B4 6BS

© 2021 Energy Systems Catapult

Published 2021