CATAPULT
Energy Systems

MADE SMARTER INNOVATION

SMART MANUFACTURING DATA HUB

UNLOCKING THE VALUE OF SHARED DATA IN MANUFACTURING

AN INTRODUCTORY GUIDE TO COLLECTING AND UNDERSTANDING ENERGY DATA

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This handbook was written by the Data Scientists at Energy Systems Catapult (ESC) for the manufacturing companies interested in progressing their digital infrastructure through the Smart Manufacturing Data Hub (SMDH). The Data Scientists have the expertise to help you, as a manufacturing SME, gain new insights from your energy data so you can be better equipped to deal with the rising energy costs. This handbook is a guide on how to collect, understand, and extract useful insights from energy data.

CONTACT US

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1. GETTING STARTED WITH ENERGY MANAGEMENT

Our aim is to provide you with useful insights from your energy data that allow you to make more informed business decisions.

To get your first insights into your energy usage with the Smart Manufacturing Data Hub (SMDH) please follow the steps outlined below.

Contact us to arrange sharing of your energy data: if you have any energy data stored, whether that is in the form of your monthly bills, quarterly meter readings, smart meter, or submeter data, we can provide you with a data sharing agreement so that we can arrange for your data to be sent directly to us in a secure manner. Contact us by sending an email to smartmanufacturing@es.catapult.org.uk.

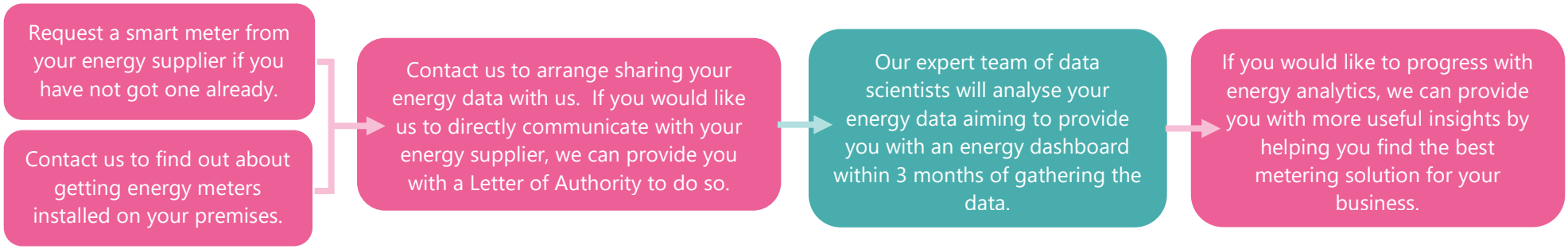
If you do not have a smart meter, follow the instructions outlined here (https://www.smartenergygb.org/about-smart-meters/get-a-smart-meter) to request a free smart meter for your business, and to find detailed information about smart meters. You can also contact your energy supplier directly to request a smart meter. There are plans to roll out smart meters to all customers (domestic and industry) in Northern Ireland by the end of 2024. Currently some suppliers, such as power ni, are rolling out smart- and half-hourly meters to SMEs. We advise contacting your supplier to see if they can install a metering device in your business. If your landlord pays the energy bills, they will have to request the smart meter installation themselves.

If you do not currently have access to your historic energy data, your energy supplier should provide you with access to the data they have collected but you may have to request it. When requesting energy data from your supplier, ask for all historic energy data to be transferred to you in CSV format, if possible. We can provide you with a Letter of Authority* which you can send to your energy supplier. This will allow our expert data scientist team at ESC to correspond directly with your energy supplier to access your energy data safely and securely.

**Your letter of authority must be signed by the business owner, a company director, or a specifically designated and authorised signatory from your organisation and is sent to your energy supplier.*

If you would like some advice on metering or want help with getting energy meters installed, get in contact with us and we can help you find metering solutions that best suit your needs. As part of the SMDH project, we are working together with the Institute for Manufacturing at the University of Cambridge to develop sensing solutions to monitor the energy usage at your manufacturing plant.

If you are unsure who supplies the energy for your business, or want further information on business energy, see https://www.ofgem.gov.uk/information-consumers/energy-advice-businesses.



2. HOW CAN ENERGY DATA IMPROVE MY BUSINESS?

With the cost of energy rising to unprecedented levels, you are probably finding that energy costs are eating into your profit margins, and potentially threatening your business.

Energy data can enable you to cut your energy costs by allowing you to understand exactly how, when, and why you use energy. This will reveal ways you can use less energy, whilst keeping your productivity high.

As a manufacturing SME, you are probably aware that energy bills are making up a significant proportion of your overall operating costs (where this proportion is often 10%+ for many manufacturers). Saving energy could therefore lead to yearly savings of hundreds to thousands of pounds.

It is likely that you will find a significant chunk of your energy bill can be cut using simple measures such as ensuring lighting, heating, and air conditioning is turned off when it is not needed (e.g., when there is a lot of natural light and during non-working hours), and checking the thermostat is set to a suitable temperature.

As an example, a medium sized car servicing and retailing company showed, by monitoring their energy usage, that they could potentially save around 40% of electricity through low-capital measures such as shutting down electrical equipment when it was not needed (e.g., overnight and at weekends), switching to LED lighting, and optimising their inefficient devices (such as those for air ventilation and their 30-year-old compressor).

This information was taken from a study by Marcel Richet in the Journal or Cleaner Production (vol. 164, page 221)

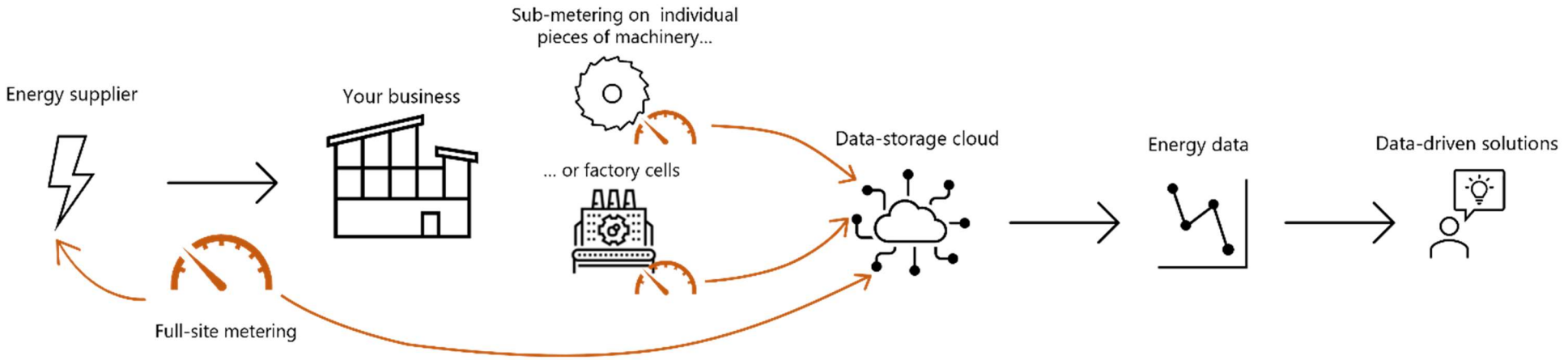
Having a good understanding of the energy consumption of your manufacturing equipment can massively help you reduce your energy costs. Through energy monitoring, you can identify sources of Vampire Power (equipment that uses power even when it is shut off) and further optimise the use of energy intensive machinery, such air compressors, or motors.

As well as helping you reduce your energy bills, monitoring your energy usage could have other key advantages which could benefit your business:

- **Costing:** the energy costs for specific client projects can be measured.
- **Carbon reporting:** the carbon footprint of your work can be estimated.
- **Budgeting:** future energy bills can be estimated based on your past energy data.
- **Measuring impact:** by collecting data you can see the real impact of any energy saving measures put into practice.
- **Fault identification:** if a machine is using more energy compared to an expected baseline value, then this may be indicative of a fault.
- **Benchmarking:** compare energy/carbon consumption against your past usage or rank it among other similar manufacturing businesses.

3. DATA COLLECTION

Having data collected automatically is essential to get accurate measurements of your energy usage. This diagram summarises the potential for energy data collection in your businesses. Ideally, full site-metering is done using a smart meter, and sub-meters are installed to monitor specific subsets of your factory. These subsets could be factory cells or individual pieces of machinery. The type of metering solutions you need depends on your energy goals (this is addressed Section 4 of this booklet). In this section we provide you with an introduction to the types of metering that are available to you.



3.1. FULL-SITE DATA

Every site will have meters measuring the total building energy consumption which may be read manually or automatically if an AMR (Automatic Meter Reading) or Smart Meter is installed on the premises. The resulting data is sent back to the energy supplier.

From January 2022 all gas and electricity suppliers will have binding annual installation targets to roll out smart and advanced meters to their remaining non-smart customers by the end of 2025, and smart meters will be provided at no up-front cost to yourself. We highly recommend you ask your energy supplier to install a smart meter on your premises (at no cost to you) which collects gas and electricity consumption readings **at least** every half an hour where possible.

The more frequently your energy readings are taken, the better you can understand when you are using most of your energy and identify the cost impact of certain energy-intensive activities.

When given permission from your business, data experts, like us working on the Smart Manufacturing Data Hub, can perform analysis on your energy data to provide you with useful energy insights tailored to your business.

3.2. SUB-METERING

Sub-metering installations allow you to see a breakdown of the total energy consumption of your site.

AREA-SPECIFIC METERING

Sub-meters can be installed to measure the energy usage of each individual floor or cell of your factory, or can measure the energy usage of individual assets, such as heating, cooling, lighting. This type of metering would be beneficial for businesses that want to know the energy costs arising from different areas of their site. Not only may this help with providing a breakdown of energy costs and carbon usage for specific projects, but it can also help us identify more accurately specific areas where your energy usage is more than it needs to be.

MACHINE-LEVEL DATA

Real-time energy monitoring at a machine level is useful to understand the energy costs associated with different machines and the efficiency of machine operation at any moment in time. You may not want to monitor every machine as this could become expensive, but you may find that insight into a few of your more energy-intensive machines may be useful. There are both non-invasive and invasive installation options to measure the energy usage of a particular machine:

- Non-invasive: clip-on energy monitors can be installed around the live wire feeding power to your machine. These monitors can provide decent measurements for electricity usage, but gas measurements tend to have large associated errors.
- Invasive: tends to give more accurate measurements but requires expert installation (usually by an electrician or engineer). The machine needs to be turned off during installation.

3.3. GETTING HOLD OF THE DATA

Metering is useless if you are not looking at the results. In the case of full-site meters, readings are first fed back to your energy supplier and are then shared with your business in the form of monthly bills. If there is a smart metering solution installed, energy suppliers might feed a breakdown of your energy usage over time via an app, for example.

Sub-meters may store the data they collect on a memory card which can be physically extracted for you to then visualise the data. Smart connections such as a hub which connects to a cloud-based platform will allow for real-time data to be visualised without any physical transfer of data.

The most intuitive way to read key insights from the energy data would be through a dashboard. Our specialist analytics team can work with you to develop and maintain a dashboard displaying recent and historic energy usage of your business.

3.4. IF SUBMETERING – WHAT SHOULD I METER?

Some machinery uses significantly more energy than others. The pie chart on the next page gives a general idea of the energy-breakdown in a manufacturing company, although the exact proportions will vary depending on your manufacturing sector.

As an example, compressed air units are expected to be major energy consumers on your shop floor. By installing a submeter on your air compressor, you can identify if the air compressor is using more energy

than an expected baseline value. If this is the case it may indicate that the machine is not running as efficiently as it could – either because the machine isn't being switched off when not in use, or this could indicate an issue with the system e.g., a leak. Either switching off the machine when it is not in use, or replacing the machine for a newer, more efficient model may be the take-away action to save on your energy bills going forward.

If starting out with submetering, consider which assets in your business are likely to be the most energy intensive and start by installing submeters to measure their energy usage. See the following flow chart for guidance.

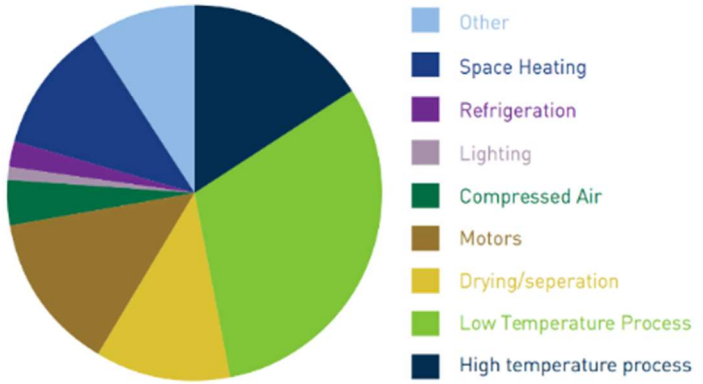
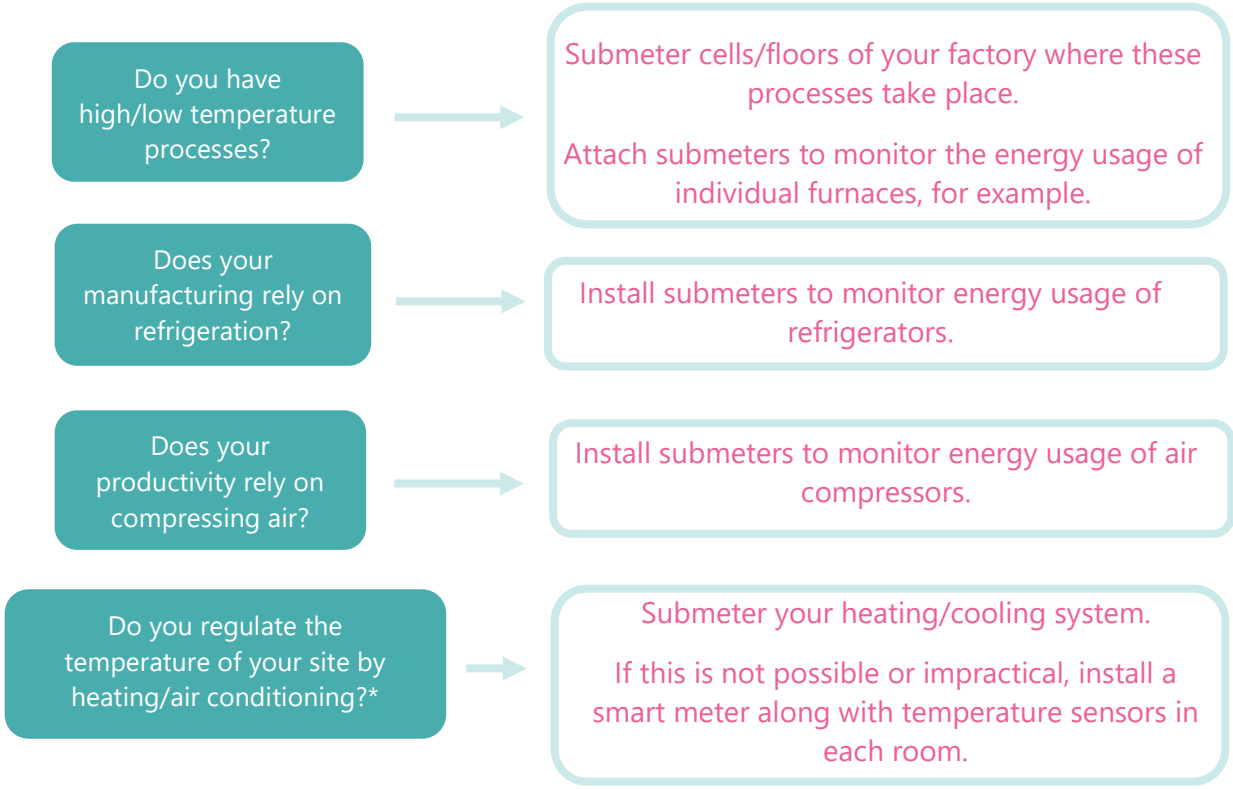


Figure: Industrial energy usage, 2016. Credit: Carbon Trust



Remember, please do not hesitate to contact smartmanufacturing@es.catapult.org.uk to find out if we can work with our partners to install energy sensors in your business.

**Note that space heating is expected to use a lot of energy and simple no-cost strategies can be used to reduce the related energy usage.*

4. ACHIEVING YOUR ENERGY GOALS

Before creating an action plan to install energy-monitoring sensors, it is important to ask yourself what you want to achieve from the data collection. This will determine the amount and type of energy sensors you need install.

Here are different examples of what you, as a manufacturing SME, may want to achieve from your energy data, and how you would take action to get an accurate answer:

I want to see the total amount of energy my business is using each day, and what the associated cost is.

- Ask your energy supplier to install a smart meter.
- Ask you energy supplier if they can offer you a consumer access display; this is a device that will allow you to see your daily energy usage and potentially other data depending on the product capabilities.
- Work with our Data Team. You will need to give us permission to access your smart meter and energy tariff data. We can then create an easy to use, flexible way of reading historic data via a dashboard app, for example.

I would like to provide clients with a report on our estimated energy and carbon usage during a project.

- Monitor the energy usage of the subset of equipment used for the client project, over the duration of the project. Submeters will need to be installed to monitor the energy usage of a cell (if that whole cell is dedicated to the project), or individual machinery relevant to the project.
- Our data analytics team can then use the data to estimate your carbon usage through your gas and electricity usage and make this visible to you on a dashboard, for example.

I want to minimise my business' energy bills.

- Ask your energy supplier to install a smart meter. This will allow you to identify if you are using energy at times when no useful output is being produced (e.g., in non-working hours).
- Install submeters which measure the energy usage of energy consuming assets (e.g., heating, lighting, energy-intensive cells/ machinery). This will allow identification of practices which lead to inefficient energy usage and of actions to reduce energy waste.

I want to use data to help me make long-term energy decisions.

Long-term energy decisions may involve, for example, investing in an energy management system for your business, investing in more efficient machinery, initiating new energy efficient practices, or switching your energy tariff.

- Work with our data analytics team. We can help you identify, using smart meter and submeter data, where you are currently using more energy than required so you can make informed decisions about where investment would be the most impactful. Data can also be used to estimate expected energy savings, and associated cost, if you were to invest in a specific energy saving asset.

I would like to compare my business' energy usage to the industry standard.

- Collect data on your current energy usage and provide us with secure access to it. Throughout the SMDH project, we aim to collect data from hundreds of manufacturing SMEs. If given permission, we would like to anonymise this data and create an industry standard benchmark to which you can compare.

Overall, there is a large variety of business questions you can ask that require energy data. Thinking about what you want to know will allow you make sensible metering decisions leading to the most useful insights to help you to make business decisions going forward. Remember to ask what you have available already – it might be that this data is already being gathered.

5. THE PROCESS OF ENERGY SAVING

Decide what benefits you want to get out of energy data	Understanding what you want to get from your energy data is important so you can install an appropriate level of monitoring. Examples of goal setting are given in Section 4.
Find out what energy monitoring is already in place	You might already have a way of monitoring your energy usage but may not be using it. If you can identify what meters are already in place, you just need a way of visualising the results of the data.
Install additional meters, if required	Different metering types are explained in Section 3. Reach out to our team for more information.
Look at insights from the data	Our expert data science team can provide you with insights into your energy data that will enable you to make informed decision.
Take action & review progress over the next few months	Once you act on the insights from your data you can start to reap the benefits – and see the impact of your actions over time.