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Boosting the sustainability of manufacturing processes

Simon Copley, 42 Technology outlines a robust process to investigate your manufacturing process and unlock sustainability improvements



Manufacturing processes rely on consumption of natural resources. Image credit: Shutterstock/DedMityay

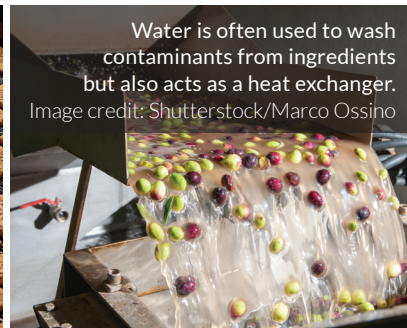
Consider the sustainability of any product, anything from electronic gadgets to food and drink, and you might think about its constituent materials, packaging, and how easy both are to recycle.

But a key impact on a product's sustainability is hidden from the end-user, occurring long before it hits the shelves: the natural resources such as energy or water consumed during manufacture.

Many manufacturing processes rely on a significant consumption of natural resources such as electricity, gas, and water. Not as ingredients or materials that end up as part of the final product, but resources used during manufacture. Think of a biscuit factory, and the hidden resource is gas burned during cooking; or in



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Water is often used to wash contaminants from ingredients but also acts as a heat exchanger. Image credit: Shutterstock/Marco Ossino

semiconductor manufacture where water usage is surprisingly high.

This natural resource use is necessary, but carries twin disadvantages:

- 1) Environmental impact, either from carbon emissions or by-products such as wastewater, and where manufacturers need to play their part in drastically reducing emissions and consumption of natural resources.
- 2) Increased operating costs.

Many manufacturers have set themselves tough challenges to reduce natural resource consumption, driven by one of the two factors above.

How can resource savings be unlocked?

As manufacturing consultants, we are often asked by FMCG brand owners to highlight where reductions can be made because for mature technologies merely tweaking process parameters will only yield small savings.

Unlocking significant savings requires a different mindset and more thorough analysis. In other words, taking a more structured approach to help uncover more opportunities for savings, and to predict where investment could best reduce resource consumption.

Understanding the current process

It's not unusual for manufacturers to have preconceptions about their processes: how resources are used and what parts of the process can and can't be changed. But make sure you're approaching the task with an open mind, otherwise you might overlook some great solutions.

First you need to define exactly where and how resources are used. Why 'how'? Because it's often overlooked that natural resources perform several functions at once.

The next step is to work your way through the process from start to end, noting where and crucially how resources are used. For example:

- Electricity is commonly used for heating and cooling, general machinery operation, and for motion or transport.

- Gas is used for inexpensive, high-power heating, but also increases local absolute humidity when burnt.
- Water can be used for adding, removing, or transferring heat, washing ingredients or equipment, diluting chemicals, and for transporting solids in pipes.
- Air, which can be considered as a natural resource, because in some cases expense is incurred to control air temperature/humidity.

Some optimisations may already be obvious but don't stop at 'local' solutions when 'system-level thinking' could be more fruitful. One example we have seen was a food industry process, where the product was cooled, then much later heated. The best option was at the system level: a heat exchanger linking both steps.

To avoid missing these system-level gains, especially for areas such as heating and cooling, construct a flow diagram of the entire process to show the resource flows at each process step. For resources like water or controlled air, this diagram is a great way to spot solutions like rerouting flows of waste heat/water to other process steps with looser requirements.

Understanding how resources are used

It may appear obvious how a resource is used, but don't overlook important secondary functions. Two examples of 'dual purpose' resources we have experienced are:

- Gas being used for direct heating within an enclosed setting also added water vapour to the surrounding air. Where gas is replaced with electric heating, the missing moisture can cause problems, especially when baking food.
- Water was used to wash contaminants from ingredients. But simultaneously it acted as a heat exchanger and cooled the ingredients ready for the next step. Each function required a certain amount of water, and understanding which was limiting was crucial to optimising the process.

Generating ideas

Once you understand the resource use throughout your process, you can build up a menu of ideas with a range of potential savings. This is easier said than done; assembling the right team and involving a fresh pair of eyes is crucial.

Your list is likely to range from cheap, simple optimisations (such as adding insulation) to more complex equipment redesigns, or complete system changes (such as linking separate process steps to reuse waste heat or water).

Selecting the best ideas for genuine savings

The next step is to make it actually happen. This means securing budget or buy-in from budget

It's important to understand how much of each natural resource you're using and why.
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holders. A sensible development plan is crucial to getting this buy-in, focusing on an estimation of the technical risk of the leading ideas, and how they will benefit your business's sustainability objectives.

Selecting the best ideas for further development doesn't necessarily mean selecting the ideas with the highest potential resource savings; these might be risky with obstacles obvious to the team. Instead, less risky 'lower hanging fruit' ideas might be the best way to go. It all depends on the specific circumstances.

Top tips for making genuine savings:

- 1) Understand how much of each natural resource you're using at every step of the process, and crucially what functions they each perform.
- 2) Generate a menu of possible improvements, and calculate the potential for each.
- 3) Select which improvements to develop, based on their potential and your attitude to technical risk.

Although the steps outlined above won't take you all the way to meet your sustainability goals, following a systematic process from the start will put you in the best place to make changes. And to start unlocking genuine sustainability improvements. **F2U**

About the author

Simon Copley is a senior manufacturing consultant at 42 Technology. He has extensive experience in improving the sustainability of a range of manufacturing processes, with a primary focus on the food and beverage sector.

About 42 Technology

42 Technology (42T) is a product design and innovation consultancy, based near Cambridge (UK), that helps to create innovative new products and manufacturing processes for some of the world's best-known brands, as well as start-ups and SMEs. It works across three key sectors: industrial including transport and energy, consumer, and healthcare and life sciences.

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