PRODUCTION

What levers can be used to make production processes more sustainable?

The design and optimization of production processes for sustainability is nothing new; it takes place all the time, through the optimization of material consumption, the better utilization of machines and the reduction of waste. However, these selective measures are not enough in themselves to achieve the required sustainability goals. Rather, what is needed is a greater intensity and focus on tackling the biggest contributors to emissions, as well as a willingness to devote time and resources to developing and procuring more effective solutions, even if they prove more costly.

The focus here is primarily on reducing CO2 emissions from the production processes themselves (Scope 1) and the energy required for them (e.g. for operating machinery) which is defined as Scope 2. In order to influence these in an effective manner, structural adjustments to existing production processes are usually required. Examples could include the switching of energy supplies to electricity generated by renewable sources, or the introduction of new, CO2-neutral or CO2-reduced production processes (e.g. in the steel industry).

For those with responsibility for production, this gives rise to three main challenges; they must create the necessary transparency around the main emission drivers, find effective levers to combat them, and, finally, reconcile them with existing measures both inside and outside production. How successful they are in doing so also depends to an extent on whether companies can afford the associated investments, not easy, given the current economic situation.

What does transparency mean when it comes to sustainable production?

The pre-occupation with increasing Industrial Sustainability reinforces the need for better transparency with regards to energy sources, resources, and waste that is sourced and disposed of by the factory. On the one hand, it's needed to meet sustainability reporting requirements for disclosure of Scope 1 and 2 emissions. On the other hand, it forms the basis for identifying relevant emitters and waste drivers in the production process.

Companies are therefore faced with a dual challenge. On the one hand, they have to create end-to-end transparency about sustainability-relevant energy and resource flows, all the way from the corporate to the machine level. On the other hand, they must also find ways to control the time and cost involved in transparency reporting.

The digital twin has a key role to play here. It enables the simulation of consumption or entire production plants on the basis of existing sensor technology, so reducing the cost and effort required to create transparency. But its simulation and forecasting capabilities also make it possible to leverage efficiency potential. A prime example is in the operation of complex production plants, where it can help to resolve potential objective conflicts by improving the basis for decision-making. This can range from providing a decision-making basis for employees, in the context of shopfloor management, to self-optimized machine control.

How can today‘s production be aligned with tomorrow‘s sustainability goals?

One of the particular challenges of Industrial Sustainability is the knowledge that, thanks to the long service life of machinery and equipment, investments made in production infrastructure today will affect the achievement of mid-century sustainability goals many years down the line.

This shifts the planning horizon for investment decisions massively backwards and poses some complex weighting decisions for production managers. For instance, is it worth investing in new, more energy-efficient plant or manufacturing technology today if you already know your product portfolio is likely to change in the coming years, because of sustainability considerations? Is the efficiency level of the planned production plant sufficient to meet future sustainability requirements? Which framework conditions (e.g. with regard to the type of energy supply), will determine the use of machinery and equipment in the future?

Answering these questions requires a more forward-looking view of the production system than needed before. In some cases, new instruments and methods, such as scenario planning, will have to be deployed, in order to identify dependencies, and take into account the effects of different developments in framework conditions (e.g. gas price changes) on the decision-making process.

Is the 'Zero Carbon' Factory accessible?

The ultimate aim of a Zero Carbon Factory is to completely eliminate production-related Scope 1 and Scope 2 emissions. In principle, three complementary approaches are available for reducing production-related emissions.

The first involves the avoidance of emissions, for example through more efficient processes, the use of emission-free production methods, or the switching of energy supplies. The second involves the recycling of CO2 and other greenhouse gases back into the production process, or their capture and storage. And the third is offsetting emissions through compensation measures.

In the case of products where, in addition to the energy used, the manufacturing process itself releases greenhouse gases - as in cement production, for example – the Zero Carbon vision can only be achieved via a combination of these different approaches.

Creating a zero-emission factory is therefore not just down to optimizing production: it also requires interaction with other areas of the company. In addition to reducing the emission drivers which can be directly influenced, the role of those responsible for production is, above all, to create the necessary transparency that's needed as the foundation for such a combined approach.

What is the end goal of sustainable production?

A narrow focus on CO2 emissions, as the primary optimization variable for Industrial Sustainability, ignores other significant factors which influence the ecological and social footprint of manufacturing companies. In the production environment, in particular, there are two key influencing variables that must be taken into account, as part of comprehensive energy and resource optimization.

The first entails ensuring the sustainable use of one of the most critical resources: water. This involves both reducing water consumption within the production processes, and avoiding contamination and other environmental pollution when extracting and recycling process water. The second involves avoiding, properly disposing of, and recycling or recirculating waste and residual materials in the production process.

Both aspects have potential impacts on people, as well as the environments inside and outside the factory. That makes them a crucial consideration in any holistic ESG approach, alongside other important issues such as occupational safety and fair pay.

In order to properly understand their impact in the overall production process, it's necessary to dig deeper when it comes to transparency, in order to gain better insights into the associated environmental and social footprints. Unsurprisingly, such efforts will invariably go well beyond merely considering straightforward CO2-related emissions.