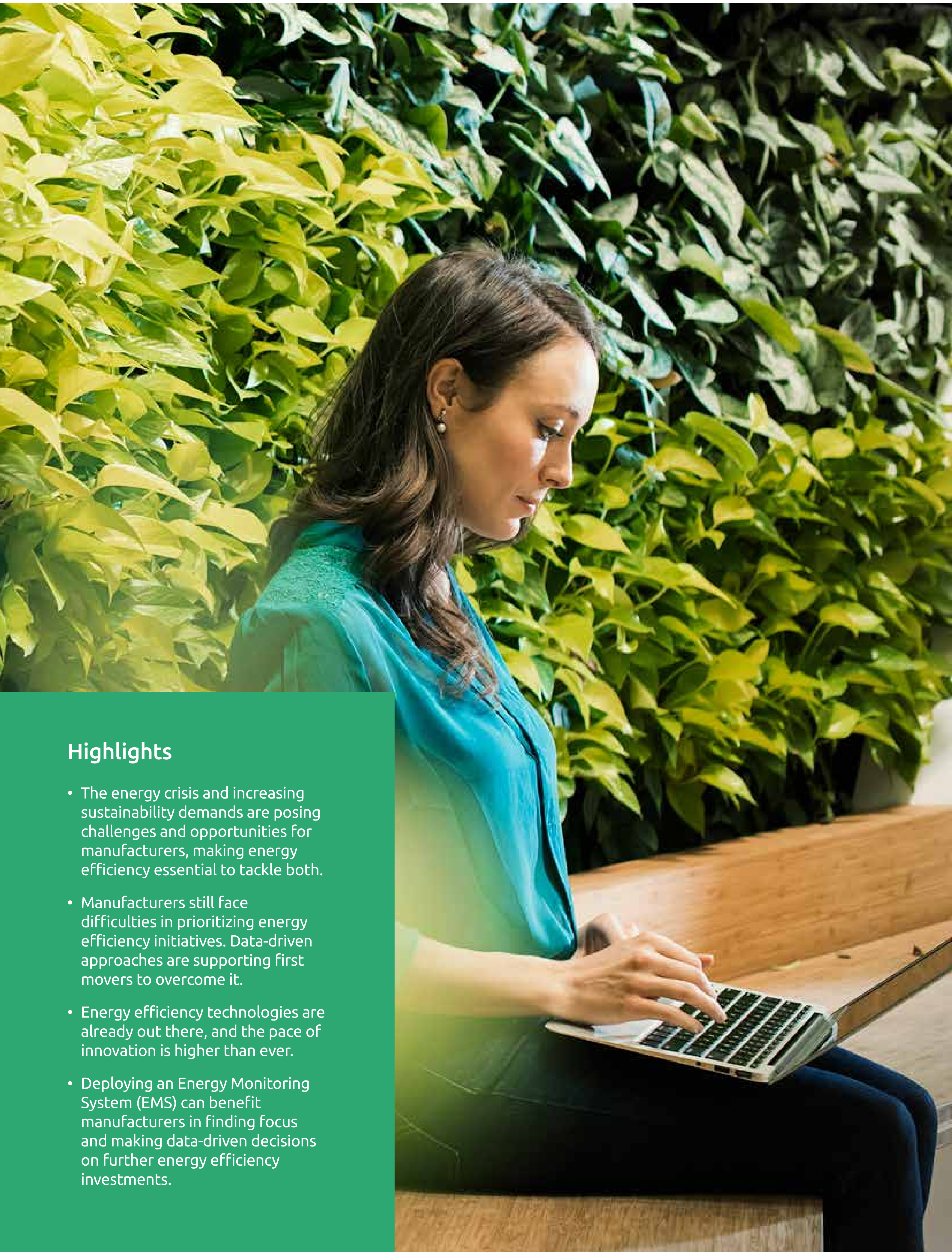
ENERGY EFFICIENCY AND SUSTAINABILITY

The New License to Operate for Manufacturers



Highlights

- The energy crisis and increasing sustainability demands are posing challenges and opportunities for manufacturers, making energy efficiency essential to tackle both.
- Manufacturers still face difficulties in prioritizing energy efficiency initiatives. Data-driven approaches are supporting first movers to overcome it.
- Energy efficiency technologies are already out there, and the pace of innovation is higher than ever.
- Deploying an Energy Monitoring System (EMS) can benefit manufacturers in finding focus and making data-driven decisions on further energy efficiency investments.

INTRODUCTION

The European industry sector is being challenged to rethink how it contracts and consumes energy at production facilities. The sector is facing an unprecedented scenario with two major forces demanding immediate action: the rise in energy costs and the increasing sustainability demands. The first puts loads of pressure on their cost base of production. The second poses different challenges such as compliance with emerging regulations such as CSRD and the Energy Saving Obligation in the Netherlands), as well as pursuing emission reduction targets.

The IEA Analysis 2022 highlights that countries are increasingly prioritizing energy efficiency in response to the energy crisis, due to its unique capacity to simultaneously address affordability, supply security, and climate objectives. Despite this global recognition, manufacturers continue facing barriers to the practical implementation of energy efficiency on the production floor due to limited tech awareness and competing priorities among their investment agendas.

Data and technology are becoming crucial for manufacturers to overcome these barriers. By harnessing the power of Data Analytics, Cloud and AI, manufacturers are overcoming the initial hurdles of energy efficiency, enabling cost-effective initiatives and data-driven decision-making on future capital-intensive investments. Data-driven insights also facilitate the integration of sustainability practices with conventional manufacturing concerns such as maintaining product quality, operational efficiency, and production throughput.

This article aims to analyze this scenario and provide actionable insights for manufacturers to enable data-driven energy efficiency in operations. Beyond mere cost reduction and emissions mitigation initiatives, Data-Driven Energy Efficiency is already equipping manufacturers to secure their new license to operate, sustain their competitive advantages, and meet the evolving demands of sustainability-conscious markets.

THE CHALLENGE: HOW TO PRIORITIZE ENERGY EFFICIENCY?

Some manufacturers are still facing the challenge of prioritizing energy efficiency amidst traditional manufacturing imperatives such as maintaining quality and sustaining production levels. One significant hurdle is related to technology awareness and technology choice. Integrating energy-efficient technologies and systems into existing IT and OT infrastructure of brownfield production plants might not always be a straightforward process, creating a cost and complexity perception that might deter manufacturers from prioritizing energy efficiency. Additionally, there is a prevailing perception that technology aimed at improving energy efficiency is expensive and may not yield immediate returns, making it a tougher sell compared to more immediate production-related initiatives. Balancing these priorities is a formidable challenge, but as the benefits of energy efficiency become clearer in terms of cost savings and sustainability, manufacturers are increasingly recognizing the importance of finding a strategic equilibrium.

In the previous years, we have seen a major shift in the industry sector, with several players adopting data-driven transformations and including energy efficiency initiatives. By harnessing data-driven insights, they can identify energy-saving opportunities that align with production goals and quality standards, ultimately reaping both cost savings and sustainability benefits. In addition, these insights provide manufacturers with the necessary insights to make informed decisions about more capital-intensive investments in energy efficiency and decarbonization of energy sources.

Think about the positive effects of reducing overall energy consumption on a production plant before installing solar panels and re-negotiating green energy supply contracts. As these data-driven strategies continue to evolve, manufacturers are realizing that technology investments can indeed enhance their competitiveness on multiple fronts simultaneously.

THE GOOD NEWS: CLIMATE TECH IS ON HYPE AND ENERGY EFFICIENCY TECHNOLOGIES ARE OUT THERE!

The pace of innovation and development in energy efficiency has never been so high. Existing energy efficiency measures are already contributing significantly to offsetting some of the growing energy demand in the industrial sector. IEA claims that in 2022, their impact helped IEA member countries lower energy bills by $680 billion worldwide. In addition, on the 16th of March 2023, the European Commission proposed the Net-Zero Industry Act to scale up manufacturing of clean technologies in the European Union (EU) and make sure the Union is well-equipped for the clean-energy transition. The Act aims to strengthen the resilience and competitiveness of the EU industry and will accelerate progress towards the EU's 2030 climate and energy targets[1].

Cloud computing, the Internet of Things (IoT), and Artificial Intelligence (AI) are sparking a new era of energy efficiency adoption in the manufacturing sector. IoT, comprised of interconnected sensors and devices, plays a pivotal role in capturing real-time data on equipment performance, energy usage, and environmental conditions. This data, which can also be seamlessly integrated with legacy systems such as Manufacturing Execution Systems (MES) and Supervisory Control and Data Acquisition (SCADA), enables manufacturers to monitor and control machinery, optimize production processes, and schedule maintenance with precision. AI algorithms, deployed in the cloud, analyse this data to identify patterns, anomalies, and optimization opportunities. By supporting legacy systems with IoT and AI, manufacturers can not only reduce energy waste and costs but also improve the longevity of equipment through predictive maintenance. This harmonious integration empowers the manufacturing sector to embrace energy efficiency while maximizing the utility of their existing technology infrastructure, ultimately contributing to sustainable and environmentally responsible production practices.

HOW TO START? DEPLOY AN ENERGY MONITORING SYSTEM (EMS)

Peter Drucker's famous quote "you can't manage what you can't measure" is highly welcome in this topic. This dictum emphasizes the crucial role of precise measurements to start energy efficiency, especially with the assistance of Energy Monitoring Systems (EMS). These systems play a pivotal role in gathering relevant data on energy consumption and performance metrics. EMS not only enables pinpointing areas for improvement but also ensures that investments are strategically allocated, maximizing environmental and economic benefits while aligning with quality and production goals.

In practical terms, we suggest the following steps to start the deployment of an EMS in a manufacturing environment:

- Map the current situation of sensors and tacit knowledge across a production site. Shop floor stakeholders (Operators and Technologists for example) have lots of valuable experience that can support the initial focus of measurement.
- Structure the data ingestion across the production site in a way that is comparable on-site and enterprise level. Make sure 80% of the energy bill is measured at the consuming assets, focusing most on the high-energy consumers.
- Build a bridge between energy production and energy consumption to fully analyze the energy flow in the factory. Also, close the loop by measuring the energy regain systems, such as heat recovery.

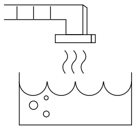
This data combined forms the basis of an energy monitoring system and will allow an analyst to build the business case for broader energy efficiency initiatives and

USE DATA-DRIVEN INSIGHTS TO EVALUATE FURTHER ENERGY EFFICIENCY LEVERS

The picture below highlights some examples of energy efficiency levers per type of assets, utilities, and equipment. However, more important than the levers and initiatives themselves is the question: why is this lever relevant, and are we already using our assets in the most efficient way? Insights from an Energy Monitoring system (explained in the previous section) can significantly answer these questions. Our advice is to use the data-driven insights from EMS to evaluate hypothesis and technical feasibility and choose the best fit-for-purpose energy efficiency lever across a production site.

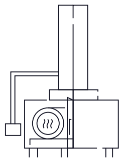
[1] https://ec.europa.eu/commission/presscorner/detail/en/IP_23_1665

ENERGY EFFICIENCY ACTIONS EXAMPLES PER EQUIPMENT TYPE



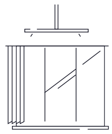
Hot water & Steam

- **Size:** Size appropriately the system according to the needs (hot water vs steam, instantaneous, by accumulation, …)
- **Control:** Control limestone, reduce flow, Maintain the temperature of the tarp (if existent) to naturally deoxygenate water and limit purges
- **Optimize:** Find ways to pre-heat water (subcooling of steam condensates, heat recovery…), Optimize heat distribution, improve the water treatment to reduce the residues
- **Decarbonate:** Use renewable heat source



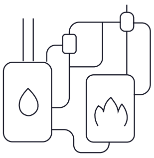
Ovens

- **Size:** Appropriately size the system size and temperature
- **Control:** Reduce the size and duration of opening doors and exits, control temperature
- **Optimize:** Check the composition of the fumes and their temperature, install a heat recovery system, put a high emissivity ceramic coating on the oven's interior walls, adjust the amount of excess air depending on the gas composition of the fumes and the fuel used
- **Decarbonate:** Introduce green fuels



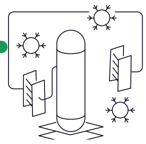
Lightning

- **Size:** Give priority to local/ supplementary lightning rather than general/overall lightning
- **Control:** Use motion captors to automatically switch off lights, maintain and clean lights
- **Optimize:** Appropriately use natural lighting (windows, skylights) or at least leds,



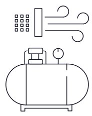
HVAC & Heating system

- **Size:** Size appropriately the collection device according to the needs, adapt and size the heating system (convection, radiation, …) to the rooms configuration and the activity
- **Control:** Maintain the system to avoid accumulation of dust and dirt and replace if necessary, adjust parameters (hours of use; flow rate, speed), monitor consumptions thanks to automatic control system, regulate heating upon the needs and adjust the setpoint temperature
- **Optimize:** Reuse heat from extracted air, Recycle air after purification, optimize distribution, reduce primary heat T° level, replace heat production system
- **Decarbonate:** Use recovery or renewable heat source



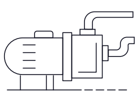
Cold production

- **Size:** Use the appropriate cold production system according to the needs (direct, indirect, free-chilling)
- **Control:** Monitor the energy efficiency ratio (EER) and the load rate, use precise temperature and pressure delta set up between the condenser and the evaporator, use automatic control system (sensors)
- **Optimize:** Optimize cold distribution systems, maintain or replace necessary components
- **Decarbonate:** Use renewable cold source



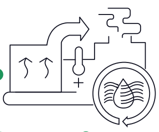
Compressed Air

- **Size:** Adapt the system sizing versus the needs, eliminate the non-mandatory elements of the system (i.e dryers)
- **Control:** Select the most appropriate regulation system, control the distribution network quality



Motors & Pumps

- **Control:** Monitor and regulate the flow (valves, bypass circuit, reduce speed of the motor) according to the needs



Dryers & separation processes

- **Control:** Set up a control system, improve the frequency of degreasing and inspect the insulation's integrity and the drying chambers' sealing on a regular basis
- **Optimize:** Optimize the dryer's use to reduce the frequency of the starting and stopping phases, use a mechanical drying process upstream of the thermal dryer, recover the hot air coming out of the dryer to be recycled, use thermal drying by radiation or superheated steam, check the drying specifications and make them as light as possible, a complementary system of mechanical vapor compression can be set up , If the drying process uses compressed air: isolate the drying station from the rest of the compressed air network
- **Decarbonate:** Use solar energy either directly through natural drying or through solar thermal panels producing hot air

Capgemini has an extensive range of capabilities and experience in both Energy Efficiency and Sustainable Operations. In addition, we have the ambition to help our clients in reducing 10 MtonCO2eq by 2030. Would you like to discuss your energy efficiency challenges with us? Please reach out to:

About the authors

Patrick Melman

Patrick is a business analyst with experience in the industrial market and deploying Energy Monitoring Systems. His expertise is in implementing dashboard systems and improving industrial processes. Within his projects, Patrick has experience in connecting OT/IT and business. Patrick has a passion for improving processes and driving sustainability using a data driven approach. He has a background in industrial engineering and logistics and is adept at the LEAN way of thinking.

Wilson Camargo Junior

Wilson Camargo Junior bridges the domains of sustainability and intelligent industry, helping clients select the right technology landscape to achieve business and sustainability goals. He sees the realization of a sustainable future for our world and our society as his personal mission. Wilson is an electrical engineer, MBA and aspiring solution architect with background in FMCG, IoT, e-mobility, construction and automotive industries.

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