DIGITALIZATION FOR ENERGY EFFICIENCY AND GHG EMISSIONS REDUCTION

Reference

Based on Annex proposal:
Digitalization for Energy Efficiency and GHG Emissions Reduction
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Introduction

Digitalization, artificial intelligence and related technologies (designed as digitalization hereinafter) represent disruptive technologies that could have an important ability to render industrial processes to be much more productive in the future – and with this, result in significant reductions in GHG emissions. This considered such a fundamental change that the term fourth industrial revolution has been widely adopted.

In the manufacturing industry most of the data collected today are not used, and the data that are used, not fully exploited. This is due to barriers like Big Data accessibility, integrity and ownership, financial constraints, lack of business cases, and a talent gap. Although large manufacturers have been using statistical process control and statistical data analysis to optimize process operations over the last years, harnessing and analyzing the wide variety of data that exists in different sources will allow them to improve quality, increase

manufacturing throughput, increase insight into the root causes of manufacturing issues, and reduce machine failure and downtime. With these new business values and technology capabilities, manufacturers will be able to change business model designs for greater adaptability and manufacturability – thereby improving supply chain management, process performance, and energy management – and ultimately, use the insights of analytics at all stages of the whole industry value chain.

Energy-intensive processes today can incorporate sophisticated data management systems, which capture process data across the supply chain for business decisions, as well as at the process level for quality, control and automation purposes. This dataset is possibly the foundation of an opportunity to identify new strategies for achieving radical GHG mitigation as global warming increasingly takes hold – related to increased efficiency and improved competitiveness. This application of Big Data and Digitization to achieve GHG emissions reduction will be further driven by new policy instruments and carbon pricing, new types of primary energy, managing energy cost volatility, etc.

Big Data: The Base for Digitalization

Big Data is about "lots of data", but far beyond this - including different kinds of data to make better decisions. In applications of Big Data and Digitalization the breadth of data types and Big Data techniques could create disruptive

competitive advantage and at the same time result in radical GHG emissions reduction.

Digitalization has been identified as having the potential to change the ways industry do business, direct applications in energy-intensive industries. There is a significant opportunity for developing Big Data applications for energy use reduction and sustainability purposes. Novel approaches for exploiting the pre-existing amounts of existing structured and unstructured data, and development of new methods and tools considering energy and sustainability are therefore important areas as well as data security and safety. Another aspect to consider is the distribution of roles between industry, technology providers and academia in this development.

Technological infrastructure and enablers

For the digital transformation of industry, the following technological infrastructure and enablers are often emphasized:

SIMULATION AND MODELLING The capability to model and simulate new product and processes in a virtual environment becomes increasingly important. Benefits of simulation and modelling are many, such as shorter development times. Steady state approaches are useful for example in optimization of production planning, while dynamic approaches are closely related to process control and automation.

SYSTEMS OF SYSTEMS The ability to integrate systems that have independent lifecycles, manufacturers and owners becomes more important. Integration of systems, within companies as well as with external parties, is a precondition for many of the long term visions of a digitalized industry.

BIG DATA ANALYTICS The massive data streams that are created through the increased number of sensors and connected devices require new analytical methods. Through big-data analysis knowledge is created enabling development of new services, improved products and process efficiencies.

WIRELESS COMMUNICATION Connection of equipment and products is increasing significantly. Many new applications require significantly increased reliability, increased transmission capacity, reduced latency and more efficient energy usage. In general, sensors and other technologies for obtaining and communicating measurements is of high importance regardless if part of a wireless system or not.

CYBER SECURITY Digitalization drives security solutions that go beyond traditional IT security because products and production processes are also requiring protection.

HUMAN FACTORS Digitalization renders new opportunities for designing equipment, devices and processes that fit the human body and its cognitive abilities. This can be utilized when striving for high productivity promoted by engagement and wellbeing of employees. Gamification can be one tool in this area.

Besides relating to digitalization, a main part of the above mentioned factors has long been related to process control and automation in a traditional sense. Consequently, the new digital technologies give opportunities for upgrading and improving current control and automation strategies.

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About IETS

The IEA TCP on Industrial Energy-Related Technologies and Systems (IETS), founded in 2005, is dealing with new industrial energy technologies and systems.

The mission of IETS is to foster international cooperation among OECD and non-OECD countries for accelerated research and technology development of industrial energy-related technologies and systems. In doing so, IETS seeks to enhance knowledge and facilitate deployment of cost-effective new industrial technologies and system layouts that enable increased productivity and better product quality while improving energy efficiency and sustainability.

Through its activities, IETS will increase awareness of technology and energy efficiency opportunities in industry, contribute to synergy between different systems and technologies, and enhance international cooperation related to sustainable development.

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