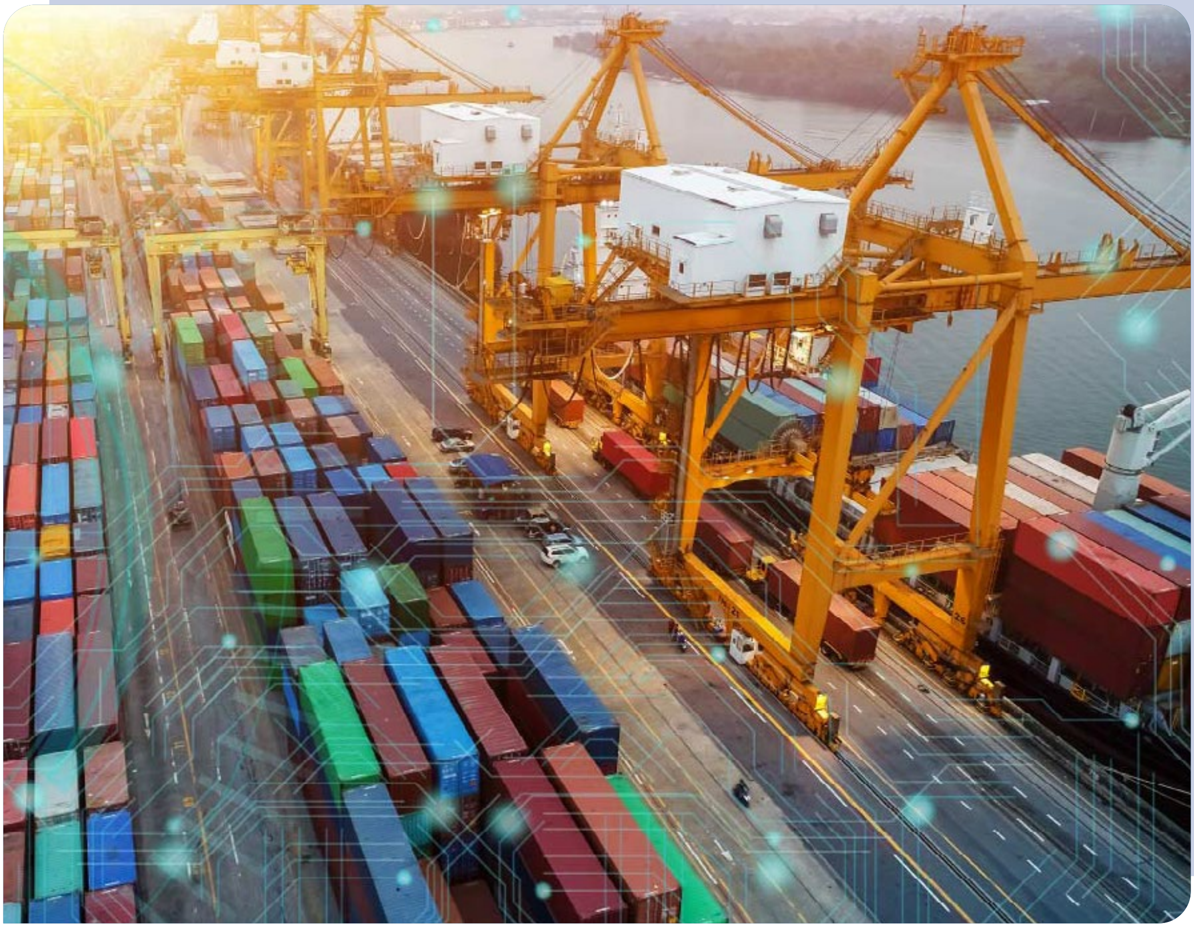
COMPACER'S DIGITAL TWIN HELPS PORTS SAVE ENERGY

Data hub **edbic** ensures smart energy distribution and resource efficient port operations



www.compacer.com

compacer's Digital Twin helps ports save energy

Data hub **edbic** ensures smart energy distribution and resource efficient port operations

The topic of energy efficiency is at the very top of the agenda in the business world. Like many other industries, logistics companies and ports are also searching for ways to make their processes more energy efficient. In ports, particularly in the complex loading and unloading operations of cargo and container ships, numerous approaches are emerging to become not only more digital but, above all, carbon neutral. The development of digital twins plays a special role in this process. And this is just the beginning.

Success factors for ports and terminals include the safe, intelligent maximization of capacity and throughput. Logistics and digital hubs along important transport routes, as well as seamless transitions between ships, roads, and railways, should have minimal environmental impact. To compete internationally, innovative technologies and sustainable solutions must be put in place. Sustainability projects are now commonplace, but establishing a Digital Twin for energy optimization is a masterclass. This is the case for a port in northern Germany, where two container cranes whose capacities were insufficient for use in this port were dismantled and shipped across the Baltic Sea to Estonia. The commissioning on-site was then used to create a Digital Twin of the energy management of these container cranes and to make their operation more energy-efficient in the future.

FROM OLD TO NEW

Looking back: The two container cranes were successfully used for loading and unloading container ships in the original port for about 15 years. They could unload freighters with up to 14,000 containers, as the unloading of a ship is called in technical jargon. However, since large freighters with up to 23,000 containers are now at home in the world's major ports, the use of these bridges in their old homeland was no longer very lucrative. Not only was the width insufficient, but the crane arms were also too short to unload large container ships.

Space had to be made for new container terminals with a higher processing volume. Since the bridges were far from ready for the scrap yard and an Estonian partner port is smaller, a potential benefit was seen here. That's why they decided to ship the 1,400-ton bridges. A logistically challenging undertaking since, among other things, the tides in the tidal calendar had to be observed, but a masterful achievement with enormous sustainability.

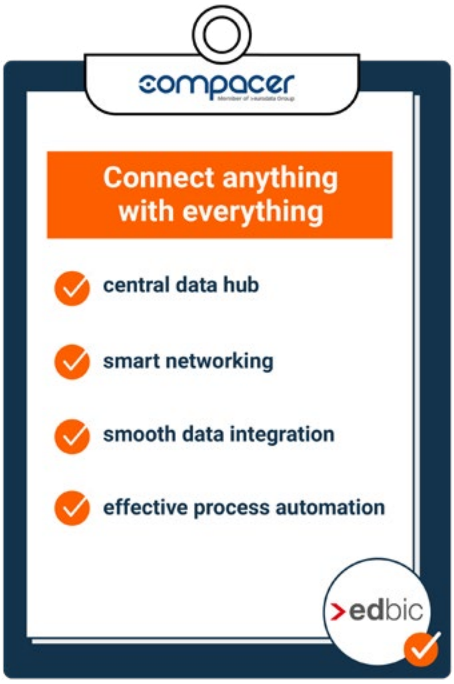
From the idea of subjecting the container cranes to further use, further projects developed to optimize processes, costs, and energy consumption. It is clear that the digitization and automation of the various hardware and software components required to operate a bridge play a central role. A large number of manufacturers install an even larger number of individual parts, components, and systems in such a container crane. Since the bridges mentioned have already been in use for over one and a half decades - their construction time is about 20 years ago - it is understandable that the degree of digitization of these complex crane structures was not up to date. It was all the more important to not only build the bridges back up after their transfer but also to find a way to equip the hardware components with modern sensor technology so that the port operator can carry out reliable and future-oriented control. It was essential not to ignore the different IT levels of digitization, automation, and integration and to use an open and flexible architecture that can be adapted to future requirements at any time.

MORE TRANSPARENCY – YOU CAN ONLY CONTROL WHAT YOU KNOW

It was clear that this form of retrofitting could not be implemented immediately for all areas of the bridge. Since environmental protection was an important requirement for the port operator, it was decided to start with the digitization of energy management. Background: During loading and unloading, energy is consumed but also released. For example, a lot of energy is required to lift a container, but the energy consumption is lower during horizontal movement from ship to land, and energy is even generated during unloading. They wanted to find a way to better integrate the demand for electricity and the generation of electricity into port operations. One idea was to use the energy generated during the loading process to supply the electric-powered driverless transport vehicles, which are usually used for land transport. The advantage of this type of use is that the operational load management of these vehicles already corresponds to a high degree of digitization, so it is easy to understand where electricity is needed.

The biggest problem: The visibility of the data. Therefore, additional electricity measuring sensors, so-called power meters, were attached to the bridges that were put back into operation in Estonia in order to obtain data on electricity demand and energy production in this way. To evaluate and use the data generated in this way in a targeted manner, they wanted to use the technical possibilities of digital twin technology. But what exactly is a digital twin? There are certainly different opinions and ideas about this. According to Wikipedia, it is “the digital representation of a material or immaterial object from the real world in the digital world.” Digital twins are known in the production environment mainly from the automotive industry. There they are used to develop new products, improve manufacturing processes or simulate certain situations. The digital twin is therefore mainly used in the test environment. The tasks and application area of the digital twin in the mentioned port project are different. There, the digital image of the sensor data is referred to as the digital twin.

DIGITAL TWIN



But how is it possible to collect and visualize the sensor data? Can it be structured and evaluated? Is it possible to integrate the digital twin data into port management and connect it to other partner systems, e.g. SAP or the Terminal Operating Systems (TOS) mostly used in ports? Can the Port Community System (PCS) and other order management systems be included? These and other questions were asked before the search began for a digital data hub that should not only take care of data exchange but also provide a solution for condition monitoring with the help of the data. This was hoped to not only generate a digital twin but also offer a wide range of evaluation and connection options.

And it works. With the modern Business Integration Cluster **edbic** from **compacer**, which functions as a data hub, not only are the previously hidden data made available and visible, but also the data from the new energy sensors are mapped. It collects all data, consolidates it, and provides it in a uniform structure, the so-called metaformat, which can easily be integrated into the existing software landscape. The result: The collection of “old data” and the new energy sensors provides a concrete image of the energy demand and the energy generated by the two container cranes. The data is very detailed and meaningful, so that the port operator is able to operate efficient energy management.

In the past, the energy generated during unloading was carelessly released as heat into the air. Today, there is the possibility of storing this energy and using it for other purposes. Software supported by methods of artificial intelligence provides a prediction of future consumption. In combination with data from other industries, applications, and cloud services, this forecasting software is currently able to predict the electricity flow one week in advance with an accuracy of between 96 and 98 percent. In the long term, the aim is to establish an optimally designed energy cycle that recognizes the current demand for electricity in advance and reuses the energy produced in a continuous process with software support.

COPY & PASTE: HOW SUCCESSFUL CONCEPTS CAN BE MULTIPLIED

But that’s not all. Other European ports belonging to the port group want to scale and use this approach for themselves. With the learnings from Estonia, the aim in the next step is to improve energy management in other container terminals in the port and save CO2. In addition, there are considerations to expand the principle of the digital twin to other areas - for example, to rope length monitoring. This would be an entry into predictive maintenance activities, because by monitoring the rope lengths and thus the rope quality, downtime and failures of container cranes could be detected and avoided in advance in the long term.

The fact is - on the way to an energy-saving and resource-conserving port management, the connection of horizontal and vertical processes is the key to success. Only if it succeeds in extracting a maximum of data from the port components in operation and making them visible so that they can be further processed, modern ports can work in an energy-saving manner and become “greener”.

[1] Wikipedia

KNOWLEDGE-FACTS ON THE DIGITAL TWIN

In principle, a digital twin can be defined as a virtual representation of a real object and thus consist of many data, algorithms, and sensors. Data is compared in real time with the real world. To create a virtual representation, three elements are needed: An object to be imaged, a digital twin in virtual space, and sensors that form the connection between the real object and the digital twin. A digital twin is therefore:

- A virtual image
- The networking of various sources of information
- The expansion to an IoT system

The most important thing in creating a digital twin is the motivation or rather the “why?”. If this has been clarified in advance, it forms the basis on which the twin is aligned. From a technical point of view, the following points should be considered:

1. HIGH AVAILABILITY:

whether on-premises or in the cloud

2. OPEN STANDARDS:

lead to more flexibility and avoid dependence

3. CONSISTENT CONNECTIVITY:

only a uniform network ensures flawless agreements

4. INDIVIDUAL INTEGRATION:

gives the freedom to decide which information should be included and can be added successively

The compacer digital twin provides an efficient solution for ports to monitor and optimize energy consumption in their daily operations. By creating a virtual replica of a port’s physical systems and assets, this technology enables port operators to simulate different scenarios and identify areas where energy savings can be made. With the increasing importance of environmental protection and sustainability, this solution not only contributes to cost reduction but also to the greening of ports. The compacer digital twin can be customized to the specific needs of each port and is a powerful tool for ports looking to become more sustainable.

The data hub edbic is a central platform for the collection, processing, and distribution of energy data in ports. It enables the smart and efficient distribution of energy, ensuring optimal energy utilization and reducing costs. By providing real-time data on energy consumption and production, edbic helps port operators to optimize their energy use and reduce their environmental impact. The platform also enables the integration of renewable energy sources, supporting the transition to a more sustainable and environmentally friendly port operation. With its powerful data analytics capabilities, edbic provides valuable insights into energy usage patterns and helps port operators identify opportunities for energy savings and efficiency improvements. Overall, edbic is a key tool for ports seeking to become more sustainable and efficient in their energy use.