

Experiments and actions on the pilot projects 2 until 31.12.2023

1. Energy Consumption and Production Data

The purpose of this phase was to define the energy consumption and production data required for the digital twin. The main objective was to determine the available data and the methods for automatic data gathering via web services. A detailed walkthrough of ISKRA's ERP system was conducted, identifying key datasets for energy consumption and production.

For the IK20/25 production line, energy consumption data is available, but the exact data structure and collection frequency will need further analysis. The energy consumption of external users is monitored through an energy distribution metering system. There is also data available for electric vehicles (cars, scooters, forklifts) in separate systems. A decision was made to define the role of this data within the digital twin during the testing phase.

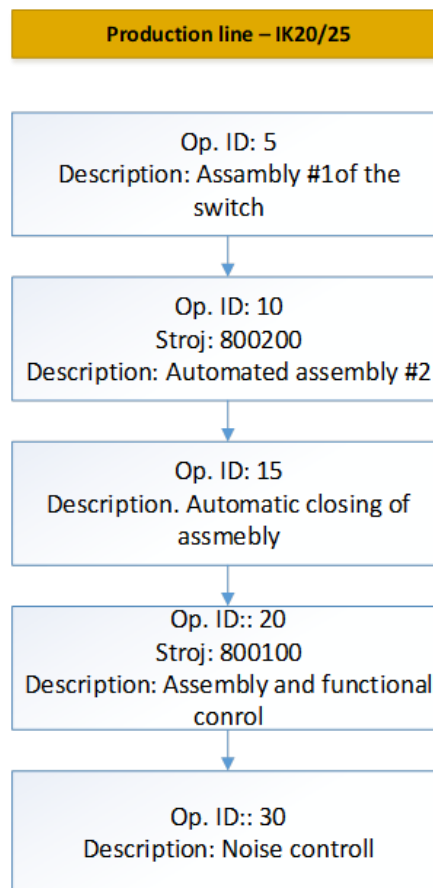


Figure 1: Operations order iin one production line.

Regarding energy generation, data for transformers, photovoltaics, cogeneration, and other sources are available in ISKRA's systems. This data will be made available in tabular form, initially covering a month's worth of data, with 15-minute intervals for the measurements.

2. Production Line and Energy Consumers

A major part of the project involves defining which production lines will be part of the digital twin. It was agreed that production lines will be treated as “black boxes,” meaning that data will be gathered on the energy consumption of entire lines, rather than tracking individual machine components. The focus will be on how much energy is used during production and standby times. Additionally, a decision was made to include energy consumption data for workplace lighting and smart tablets used by workers for traceability.

A key part of the analysis involved discussing how to gather real-time data on energy consumption for both production lines and individual machines. Several options for data collection were discussed, including the possibility of hosting a server inside ISKRA d.o.o. to improve data security and access.

3. Data Security and Confidentiality

During the discussions, data security and confidentiality were key concerns. It was agreed that the digital twin would not include sensitive data, such as details about faulty parts in production lines. Instead, each production line will act as a “black box,” with data regarding the number of orders and energy consumption being the main focus. To ensure secure data handling, DIGITEH agreed to limit data access to production orders and production line IDs, with a secure VPN connection for data transfer.

4. Development of Digital Twin model

The development of the digital twin began with the creation of the simulation model based on real-world data provided by ISKRA d.o.o. The data was gathered from ISKRA’s production in Kranj, and algorithms for self-building the digital model were developed. The digital model was connected to ISKRA’s database via a one-way connection, updating once per day.

Conclusions and Next Steps

The project has made significant progress in defining the necessary steps for implementing the digital twin and gathering the required data. ISKRA d.o.o. has continued to collect energy consumption and production data, including from the IK20/25 production line, external users, and electric vehicles. Additionally, data on energy production from sources like transformers and photovoltaics has been gathered.

Moving forward, the key next steps involve finalizing the process for real-time data collection and ensuring web services are in place for seamless data access. ISKRA d.o.o. has determined which production lines will be included in the digital twin for data collection. Energy consumption data will continue to be gathered from production lines and energy consumers such as electric vehicles and workplace lighting, with methods for accessing and sharing this data being finalized. This includes exploring options for hosting a server inside ISKRA and using VPN for secure remote access.

In terms of data security, protocols for accessing production line data will be fully implemented, ensuring that data confidentiality agreements are in place to protect sensitive information. A secure data transfer setup via VPN will be established to facilitate smooth and safe data exchange.

Finally, as part of the project’s next phase, DIGITEH will define the exact data needed for the digital twin and provide ISKRA with a document outlining these requirements. In parallel, sample graphs and documentation will be created for comparison and presentation to help ISKRA better understand the digital twin's expected outcomes. Once ISKRA finalizes the selection of production lines for inclusion, they will continue gathering the necessary data for analysis and integration into the digital twin model.

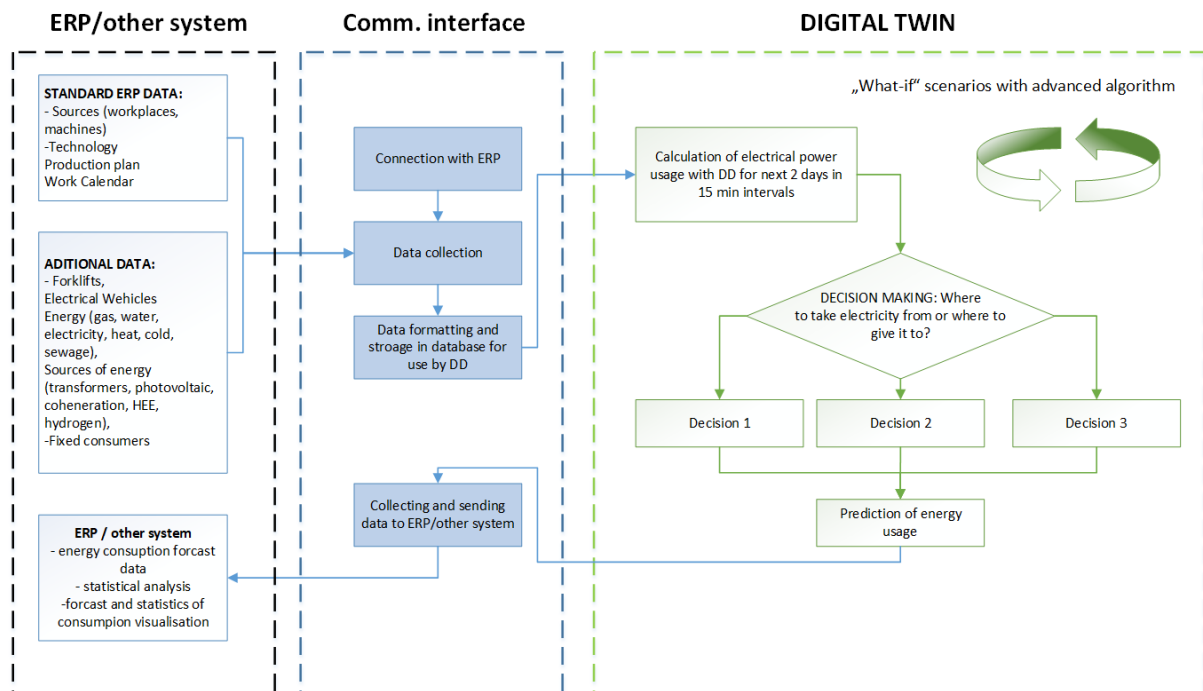


Figure 2: Block diagram - data path from ERP system to Digital Twin and back.