Silo AI Pilots Smart, Data-driven Asset Optimization Service for Water and District Heating System Operators in Finland

Leveraging the iTwin Platform Reduced Network Visualization Efforts by 50% to Improve Asset Maintenance Planning and Energy Efficiency

- *Silo AI developed and piloted a smart, data-driven asset optimization solution for city pipeline operators.*
- *Known as Silo Flow, the service can predict pipeline leakages and identify the potential cooling upside of district heating systems.*
- *Leveraging the iTwin platform facilitated data integration and provided a holistic visualization of the entire pipeline network.*
- *Silo Flow will increase energy efficiency, performance, and productivity of customer networks by several percentages.*

Capitalizing on Artificial Intelligence to Optimize City Pipeline Infrastructure Systems
As the largest private artificial intelligence (AI) lab in the Nordics, Silo AI develops customizable, AI-driven solutions and products to enable intelligent monitoring and forecasting in city infrastructure, energy, and logistics. To improve performance, reliability, and energy efficiency of Finland's water and district heating networks, Silo AI initiated a project to develop a smart, data-driven asset optimization service for city pipeline operators. "A significant portion of water and district heating networks are expiring, and water leaks are causing high costs to network operators and society, as well as discomfort for pipeline network customers," said Harri Kaukovalta, business development executive at Silo AI. The inefficient network performance and leakages increased fuel consumption and water wastage, that was not only detrimental from a business perspective but also from an environmental one.

Silo AI set out to pilot their solution in cooperation with Helsinki Environmental Services Authority HSY and one of the biggest grid operators in Finland, enabling these system operators to offer more sustainable energy services, which would optimize performance of district heating assets and eliminate pipeline leakages. "The reliability of heating and water access has an immediate impact on people," said Kaukovalta. Known as Silo Flow, the system optimization service will help predict network failures and prioritize proactive asset maintenance to avoid costly repairs and potential network shutdowns, ensuring efficient and reliable service while minimizing environmental impact.

Scattered Data Prevents Holistic Network Overview
Finland maintains over 16,000 kilometers of district heating pipelines. "Despite good care of district heating systems in Finland, there is one leakage a year per every 10 kilometers of network on average," said Kaukovalta. The same applies to water networks. Silo AI sought to use artificial intelligence and data analytics to pinpoint areas prone to leakage and prioritize pipeline maintenance renovations. However, pipeline optimization and pipeline operations require a combination of numerous data sources and data formats, where the data and results analyzed from these data

sources are not visualized, or are visualized using various tools resulting in partial and inaccurate representations of the network. With scattered sources of information, it is difficult to gain a holistic view of the pipeline network, leading to limitations in investment planning and untimely leak detection that happens only after the leakage occurs.

"Prioritization of the maintenance renovations needs to be pinpointed to areas where the leaks are most probable to occur," said Kaukovalta. Yet, the multisourced, disparate data and manual workflows prevent operators from accurately identifying potential risks and proactively addressing them before they become costly, environmentally damaging problems, leading to shutdowns and interrupted service. Furthermore, the operators needed to visualize the network in its entirety to predict and prioritize pipeline maintenance. Silo AI realized that they needed a user-friendly, web-based interface to integrate the multiple pipeline data sources and visualize their advanced data analysis to provide operators a comprehensive overview of asset health, systematically identifying and addressing leakages before they occur.

Developing an iTwin-based Prediction Model
To predict pipeline maintenance needs and optimize network management, Silo AI developed its smart Silo Flow prediction model based on the iTwin Platform. The solution combines Silo AI's advanced data analytics with Bentley's cloud-based interface for easy, accessible visualization of the pipeline data and assets. "[The] iTwin [platform] framework offered a simple and straightforward way to visualize data and data analysis results," said Kaukovalta. Combining advanced data science with cutting-edge visualizations, district heating and water network operators can pinpoint assets in need of maintenance prior to leakages or asset failure. They can optimize their network, investing in the right locations, at the right time, to guarantee safe and reliable customer service while promoting energy efficiency and carbon neutrality.

As the foundation for Silo Flow, the iTwin platform integrated the multisourced data into a living digital twin and aligned it with reality data, sensors, and artificial intelligence without any additional equipment needed by the network operators. The combined solution can consolidate and analyze data into an understandable, valuable format facilitating data-based decisions. Working within a fully accessible visual interface, operators can achieve comprehensive insight into asset health, and analyze and predict where better cooling can bring savings and more efficient productivity, optimizing heat balance in district heating as well as water flows throughout the network.

Smart Solutions Drive Energy Efficiency, Savings, and Sustainability
Bentley's flexible iTwin Platform was easy to use and visualize the new data analysis capabilities implemented by Silo AI. With the iTwin Platform, Silo AI could visualize the various data sources and the results of data analysis simply and very cost efficiently. The flexibility and interoperability of Bentley's application shortened the project time, and any needed additions were easy to add to the digital platform. Using iTwin reduced visualization efforts by 50% and significantly reduced delivery time for the AI solution for leakage predictions and flow optimization. "The project was delivered in a record time just because [the iTwin model] was so easy to use and make great visualizations real with [the] iTwin Platform," said Kaukovalta.

Having easy accessibility to the data and visually analyzed results, network operators can improve pipeline operations. Maintenance needs and possible risk areas were clearly identified and visualized.

The iTwin-based smart solution predicts pipeline maintenance needs to ensure customer satisfaction and sustainability, avoiding unwanted shutdowns of the grid, environmental damage, and waste from leakages. Silo AI decreased their customer's district heating network supply temperature by three degrees, improving energy efficiency while decreasing fuel consumption. "Silo Flow adds predictability and restores control over your system. It also helps you to optimize energy production," said Kaukovalta.

With 1 degree cooling improvement providing 1% to 1.5% increase in the district heating network energy performance, network operators can deliver more sustainable service and increase ROI through pipeline system optimization, preventing leakages, eliminating lost resources, and budgeting future maintenance and network investments. The solution is currently being scaled up for multiple customers and pipeline types.
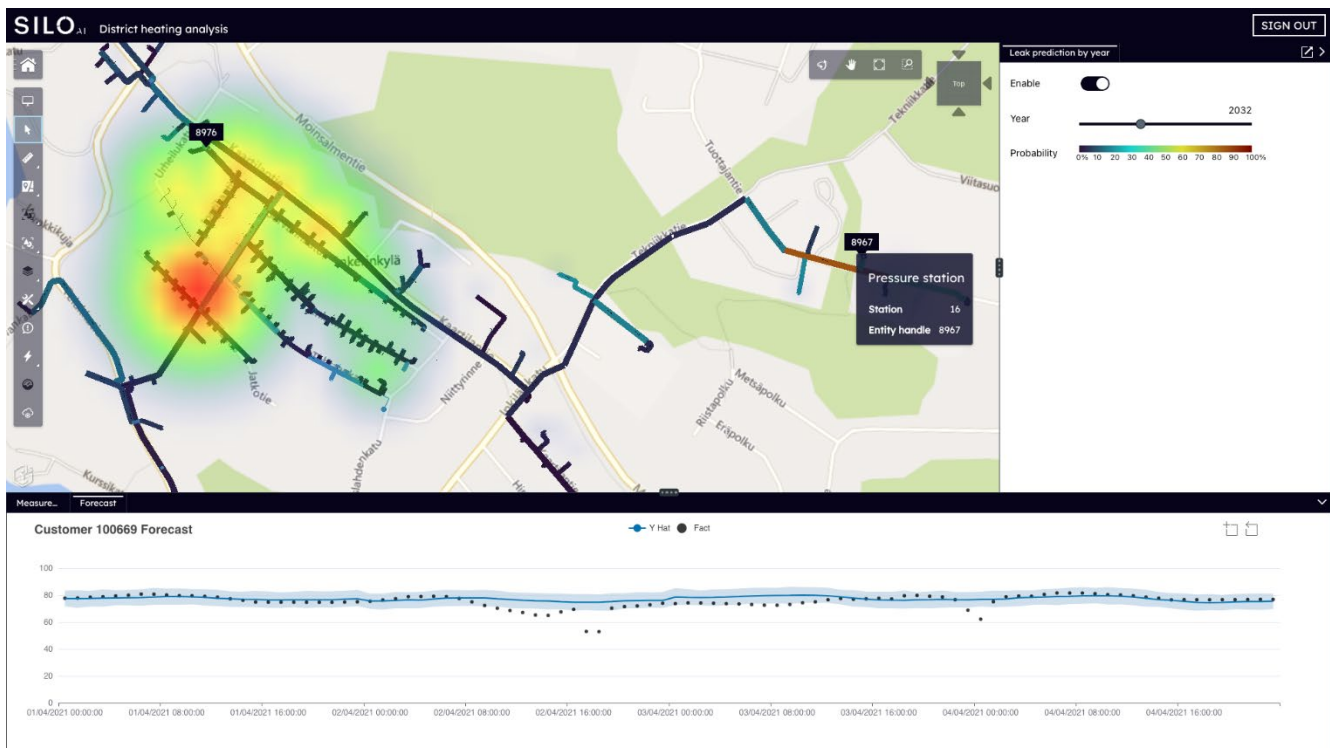
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Image Caption: With the iTwin Platform, Silo AI could visualize the various data sources and the results of data analysis simply and very cost efficiently. *Image courtesy of Silo AI.*

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