

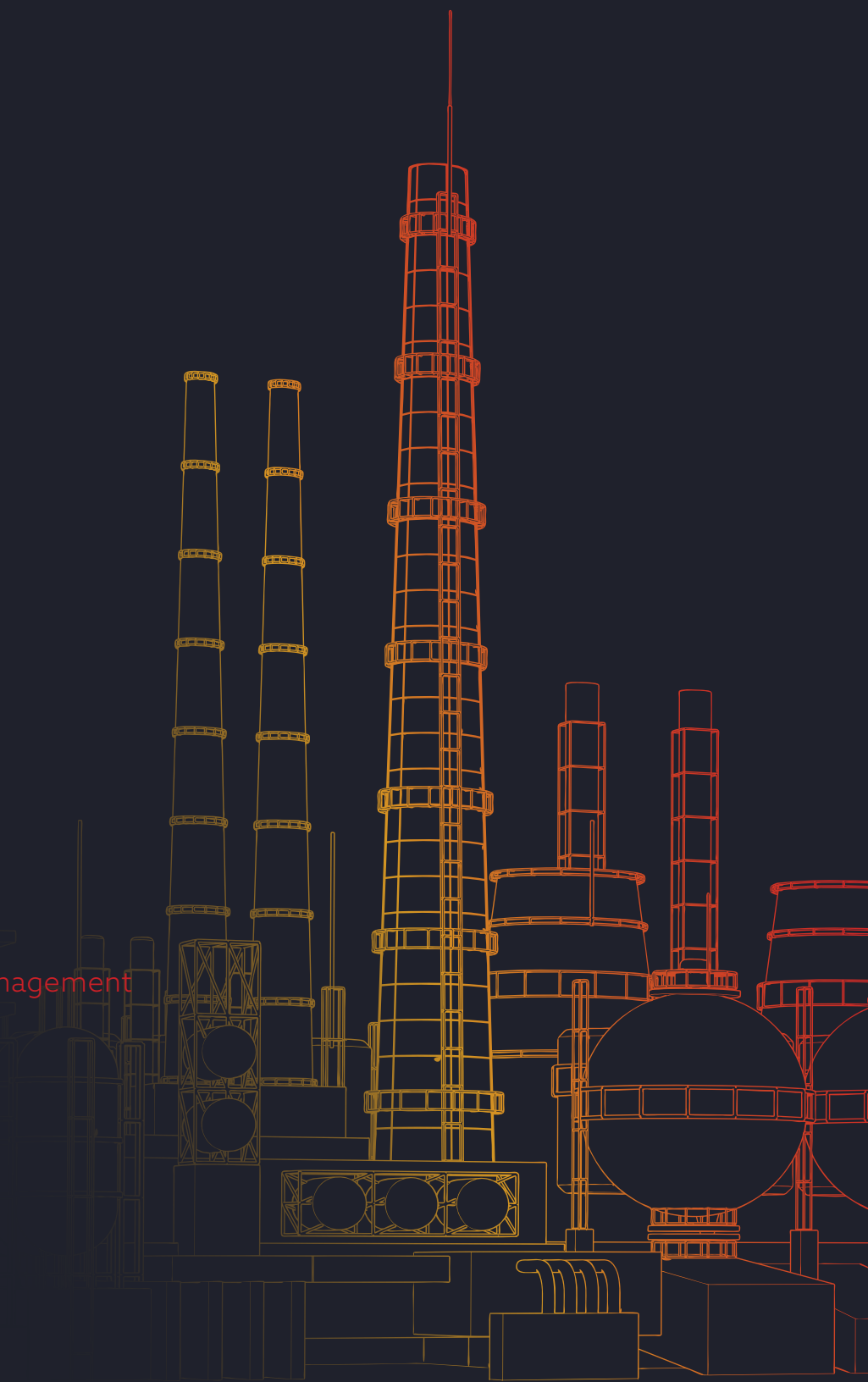


TOGETHER WITH **AVEVA**

DIGITAL THREAD STRATEGIES FOR THE ENERGY GRID TRANSFORMATION

A data-driven approach to industrial asset lifecycle management

EBOOK



The digital transformation of infrastructure industries, underpinned by comprehensive digital thread strategies, is essential for building a more efficient, sustainable, and resilient future.

Digital Transformation of Infrastructure Industries is a Societal Imperative

As Central Europe embarks on a critical journey to reshape its energy landscape, the need for sustainable and resilient infrastructure has never been more urgent. The Energiewende in Germany, with its ambitious goals for reducing carbon emissions and phasing out nuclear power, requires unprecedented levels of investment in grid modernization and renewable energy sources integration. Similarly, Austria and Switzerland are facing their own unique challenges in maintaining grid stability while increasing reliance on hydropower and other renewables.

Addressing these diverse challenges requires more than just infrastructure investments—it demands the integration of the digital thread, a powerful, data-driven framework that enhances collaboration and drives efficiency across energy projects. By ensuring seamless data flow and secure real-time access to accurate information, the digital thread empowers all stakeholders—from engineers and contractors to operators and regulators—to work together more effectively. This connected framework not only accelerates project delivery but also enables the implementation of advanced technologies such as IoT, AI, and predictive analytics, which are essential for optimizing asset management and reducing maintenance costs. Ultimately, the digital thread supports the sustainable development of energy infrastructure, aligning with the broader goals of the Energiewende and the strategic priorities of Austria and Switzerland.

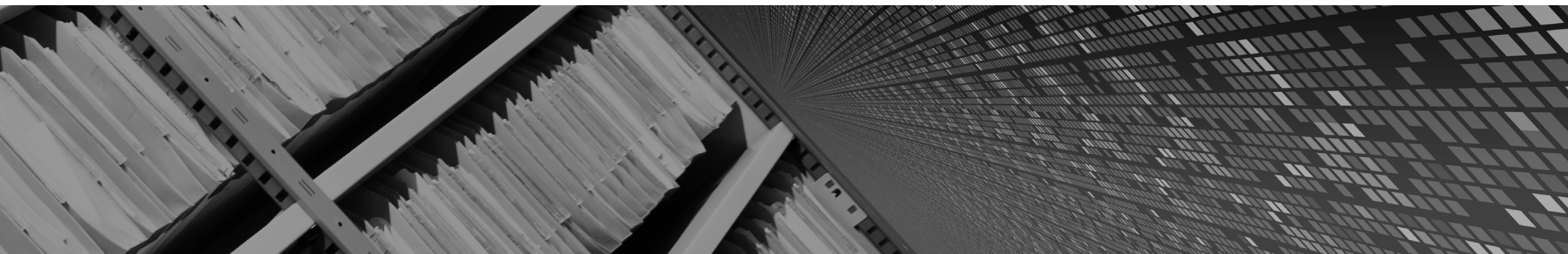
From Document-Driven To Data-Driven

As a starting point, the industry needs to transition from a document-centric approach to a data-centric approach. At the core of this transformation is centralized data management within a digital thread framework.

The digital thread centralizes all project data into a single, connected, unified framework that ensures that all key stakeholders, whether within the organization or external partners, have controlled access to the same up-to-date information. This unified approach eliminates the information silos that often plague document-centric processes, where data is fragmented across various documents and systems. Changes and updates to project data are instantly reflected across the entire system. This real-time synchronization reduces the risk of discrepancies and miscommunications, which are common in document-centric approaches where updates might lag and only reach certain stakeholders.

Digital threads dynamically link to live data sources ensuring that critical information assets, such as as-built Bill of Materials, operational guides as well as P&ID, stay current and accurate. Unlike static documents that quickly become outdated, dynamic information assets continuously evolve, reflecting the latest project developments and modifications. The use of automated data capture and integration provides information that is continually updated without the need for manual intervention.

This shift to a data-centric approach guided by digital thread thinking ensures that all project data is accessible, current, and reliable, fostering better collaboration, reducing errors, and streamlining project execution.

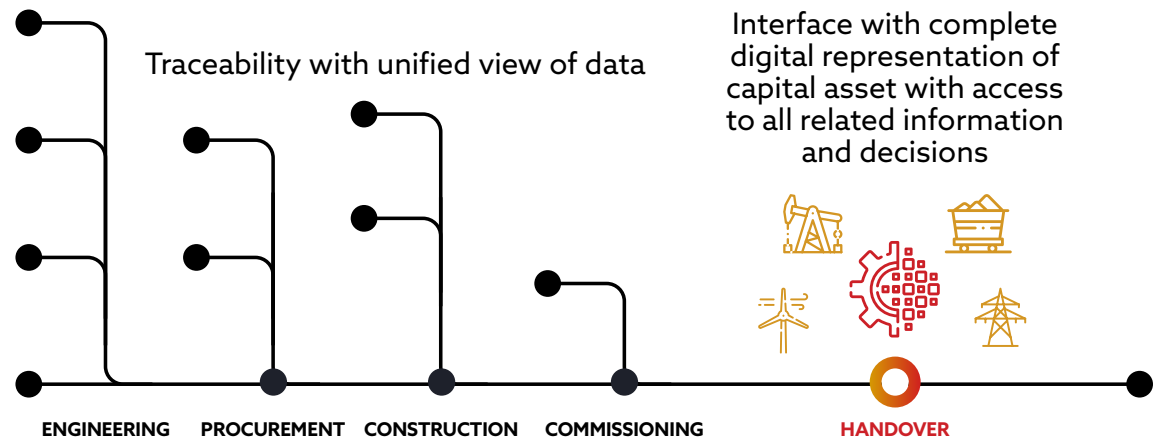


Empowering TSOs in the Energy Transition

As the energy landscape in Europe evolves with the integration of renewable energy sources, Transmission System Operators (TSOs) are playing a critical role in ensuring the stability and efficiency of the energy grid. After asset handover, the digital thread becomes an invaluable tool, enabling TSOs to manage lifecycles effectively, address issues promptly, and maintain compliance with stringent regulatory standards.

The digital thread offers real-time tracking and management of any issues identified during the handover process. This ensures that problems are swiftly documented, communicated, and resolved, minimizing disruptions and facilitating a seamless transition. With a comprehensive view of project data, stakeholders can make informed decisions quickly, ensuring the grid operates smoothly as new renewable energy sources are brought online.

Detailed asset registers within the digital thread simplify lifecycle management, allowing TSOs to optimize asset performance and extend their lifespan. The integration of IoT sensors and advanced analytics provides predictive maintenance insights, helping to identify potential issues before they escalate into failures, thereby reducing downtime and supporting the reliable integration of renewables into the grid.



A hybrid data platform highlights what is critical, even in remote locations or from geographically dispersed assets and IIoT devices. Aggregate data as needed and easily scale capacity using cloud. Visualize and monitor thousands of renewable energy resources in real time.

Additionally, the digital thread maintains a complete audit trail of all project activities, changes, and decisions, simplifying regulatory compliance and reporting. This transparency is crucial in a regulatory environment focused on sustainability and environmental impact. By automating compliance documentation, the digital thread reduces administrative burdens, ensuring that all necessary records are accurate and readily available for audits and inspections.

The Power of Digital Engineering in Grid Modernization

Modern digital engineering technologies, supported by a digital thread backbone, are transforming the design and engineering of energy infrastructure. As power grids undergo significant modernization to accommodate renewable energy sources, engineers leverage simulation tools, and system-level models to ensure projects are designed with a holistic, future-proof approach. Systems engineering principles, integrated into digital engineering processes, help manage the complexities of integrating wind, solar, and hydropower into existing grid infrastructures.

In addition to promoting sustainable design, digital engineering plays a crucial role in standardizing components and practices across grid modernization projects. This standardization allows for more efficient spare parts management and faster repairs, significantly reducing maintenance costs over the decades-long lifespan of grid infrastructure. Digital engineering tools enable detailed analysis of energy efficiency and material usage, ensuring that each upgrade not only meets environmental standards but also supports cost-effective, long-term grid operation. The digital thread integrates these sustainability and standardization efforts into every stage of the design process, creating a cohesive approach to building a greener and more durable energy grid.



Sustainable design is supported by digital engineering with new approaches for analyzing energy efficiency, optimizing material selection, and assessing environmental impact. The digital thread ensures that sustainability considerations are integrated throughout the design process, promoting greener and more efficient projects.

Building Transparent and Collaborative Supply Chains for Energy Projects

In large-scale energy infrastructure projects, effective supply chain management is critical to ensuring that all suppliers and subcontractors meet their contractual obligations. A digital thread provides a comprehensive solution for documenting and tracking every requirement outlined in contracts, from procurement to final delivery. This transparency allows various departments—such as procurement, legal, and engineering—to monitor compliance in real-time, ensuring that all materials and components meet project specifications and quality standards. When each contractual requirement is clear and accessible, the risk of costly mistakes is significantly reduced.

A robust supplier management solution within the digital thread framework enables grid operators to manage their relationships with suppliers more effectively, enhancing communication and collaboration. This solution allows for continuous monitoring of supplier performance, ensuring that any deviations from contract terms are promptly addressed. By maintaining this high level of oversight, TSOs can mitigate risks associated with non-compliance, avoid delays, and ultimately save costs by preventing rework and material waste.

Furthermore, the use of predictive analytics leveraging connected digital thread data can help identify potential supply chain disruptions before they occur. By analyzing historical and real-time data, EPC contractors can proactively address risks, such as supplier delays, quality issues, or logistical challenges, for a more resilient and reliable supply chain.



Activating Digital Twins

The digital thread is essential in managing the proliferation of digital twins and developing asset-level visualizations and configuration management for complex industrial systems. Digital twins are crucial for accurately representing as-built and as-maintained assets, ensuring that the digital model reflects the physical reality throughout the asset's lifecycle.

As digital twins become increasingly prevalent, the digital thread plays a crucial role in managing their complexity and volume. By linking various digital twins across different phases of a project—from design and construction to operation and maintenance—the digital thread provides seamless data integration and accessibility. This interconnected data flow prevents data silos and ensures consistency across all digital twins, making it easier to manage and utilize the extensive data generated.

The digital thread facilitates the creation and maintenance of asset-level digital twins by aggregating and contextualizing data from multiple sources, including design specifications, construction records to report data, and maintenance logs accurately. This integration provides a complete view of each asset, essential for accurately representing as-built and as-maintained conditions. With an asset-level digital twin, stakeholders can simulate various scenarios, predict potential failures, and optimize performance. The digital thread ensures that these digital twins are continuously updated with current data, reflecting the actual state of the physical asset.

Digitizing the Handover

The digital thread plays a pivotal role in streamlining the handover process from EPC / AEC contractors to TSOs , ensuring a seamless and efficient transition.

The digital thread facilitates the seamless transfer of all project data, documentation, and asset information to the TSO. This integration ensures that the Owner-Operator receives a complete and accurate digital twin of the entire asset, encompassing all design, construction, and operational data. This comprehensive dataset reduces the risk of information loss and miscommunication that often occur during traditional handovers.

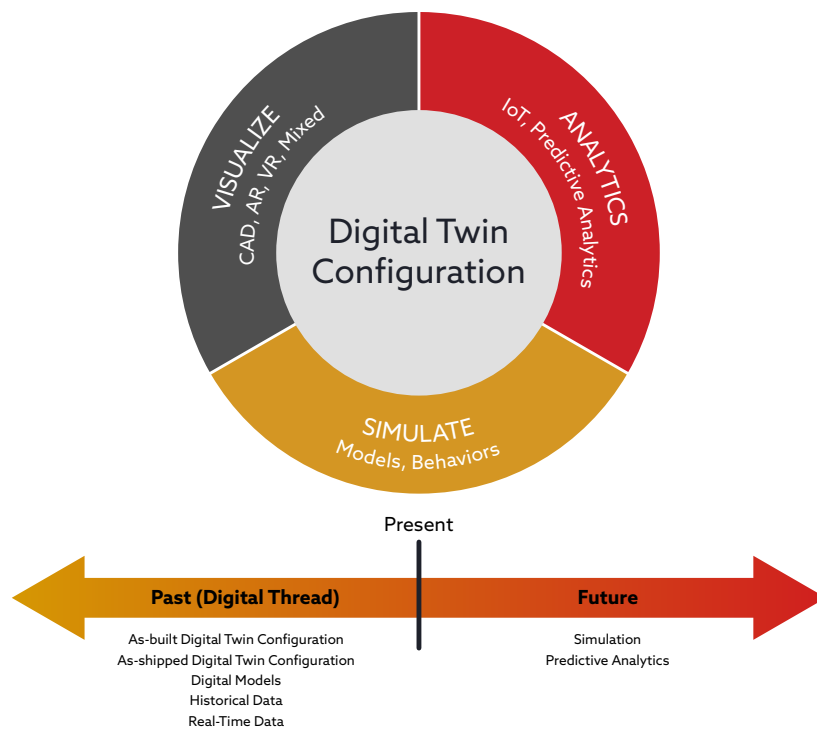
Automated workflows embedded within the digital thread guide the handover process, ensuring that all necessary steps are systematically completed and documented. These workflows can trigger reminders, approvals, and validations, streamlining the transition and ensuring compliance with contractual and regulatory requirements. This automation minimizes manual interventions, reducing errors and accelerating the handover timeline. The digital thread can include interactive training materials, such as 3D models and simulations, to aid in the training of the TSO 's personnel. These immersive training tools help operators better understand complex systems and processes, so they are well-prepared to manage and maintain the new assets.

Through the digital thread, operators have access to the entire project history. This historical data is invaluable for understanding design decisions, troubleshooting issues, and making informed maintenance and operational decisions. By having a complete project history at their fingertips, operators can quickly address any problems and optimize the performance of their assets without wasting time searching for information or outdated manuals.

The digital thread significantly enhances the readiness and validity of the handover, leading to smoother transitions and better long-term asset management by TSOs.



Maintenance and Refurb in the Energy Sector



A digital thread is essential for maintaining and refurbishing critical energy infrastructure, particularly as the DACH (Germany, Austria, Switzerland) region undertakes significant grid modernization efforts like the Energiewende. By integrating real-time and historical data, the digital thread ensures that all stakeholders have access to accurate, up-to-date information, enabling predictive maintenance through advanced analytics and IoT sensors. This standardized approach reduces unplanned downtime and extends the lifespan of key assets, ensuring that the grid remains reliable and resilient as new renewable energy sources are integrated.

The digital thread also facilitates standardized planning and scheduling of maintenance activities, utilizing detailed digital representations such as 3D models and simulations to identify, diagnose, and plan the right maintenance action, the right people, parts and tool. This reduces operational disruptions, ensures resource availability, and enhances collaboration among all parties by providing a single source of truth. In the complex environment of renewable energy integration, standardization through digital engineering minimizes variability and promotes consistent, cost-effective operations.

Additionally, the digital thread maintains comprehensive documentation and compliance records, capturing every action in a detailed audit trail. This is vital for meeting the stringent regulatory standards in Germany, Austria, and Switzerland. By providing standardized insights into asset performance, the digital thread supports refurbishment and upgrades, using virtual simulations to optimize new configurations. This approach enhances operational productivity, reduces costs, and ensures that energy infrastructure can meet future demands, making the digital thread indispensable for modern energy asset management.

Navigating Regulatory Compliance and Promoting Sustainability

The energy sector operates within a highly regulated environment where compliance is critical. The digital thread provides a streamlined approach to regulatory compliance, automatically generating and maintaining accurate documentation that meets all legal requirements. This reduces the complexity of compliance management, allowing energy companies to focus on delivering innovative and sustainable energy solutions.

At the same time, the digital thread integrates sustainability considerations into every aspect of energy project management. By tracking key environmental metrics, the digital thread ensures that projects not only meet regulatory standards but also contribute positively to the region's sustainability goals. This includes optimizing energy efficiency, reducing emissions, and promoting the use of renewable resources.

Moreover, the digital thread supports ongoing compliance by maintaining a comprehensive audit trail of all project activities. This ensures that energy companies can easily demonstrate their compliance with regulatory standards during audits and inspections, reducing the risk of penalties or delays. By integrating compliance and sustainability into a single, unified framework, the digital thread enables energy companies in the DACH region to achieve their strategic objectives while meeting the demands of a rapidly evolving regulatory landscape.

Transforming Energy Infrastructure with Aras Innovator

Managing large-scale energy projects with disconnected tools like Excel and SharePoint can lead to significant inefficiencies, communication breakdowns, and increased costs. Aras Innovator addresses these challenges by providing a unified platform that seamlessly connects all stakeholders, data, and processes across a product's lifecycle. At the core of Aras Innovator is the digital thread, which ensures that all project information is continuously accessible and up-to-date, fostering collaboration and informed decision-making across the entire asset lifecycle.

By eliminating silos and integrating data across design, construction, and operation, Aras Innovator helps energy companies mitigate commercial risks and avoid costly rework. The platform's robust change management capabilities ensure that all modifications are tracked and controlled, reducing the likelihood of errors and delays. This holistic approach not only improves operational efficiency but also ensures compliance with stringent regulatory standards, driving sustainability across all projects.

With Aras Innovator, companies can replace outdated, fragmented tools with a comprehensive, integrated solution that reduces total cost of ownership. The platform enables them to optimize project execution, enhance asset performance, and achieve strategic objectives with confidence, all while navigating the complexities of the energy transition.

AVEVA's asset lifecycle management (ALM) solution suite designed to take the powerful capabilities of PLM, established in discrete industries, and create (and ultimately expand) such, as built-for-purpose tools for asset lifecycle management in continuous industries such as plant creation.



AVEVA is a global leader in industrial software, sparking ingenuity to drive responsible use of the world's resources. The company's secure industrial cloud platform and applications enable businesses to harness the power of their information and improve collaboration with customers, suppliers and partners. Visit www.aveva.com to learn more and follow them on **YouTube**, **X**, **Facebook**, and **LinkedIn**.



About Aras

Aras is a leading provider of product lifecycle management solutions. Its technology enables the rapid delivery of flexible solutions built on a powerful digital thread backbone and a low-code development platform. Aras' platform and product lifecycle management applications connect users in all disciplines and functions to critical product data and processes across the lifecycle and throughout the extended supply chain. Visit www.aras.com to learn more and follow us on **YouTube**, **X**, **Facebook**, and **LinkedIn**.

Copyright © 2024 by Aras Corporation and/or its affiliates. All rights reserved. Aras and Aras Innovator are registered trademarks of Aras Corporation in the United States and other countries. Third party trademarks mentioned are the property of their respective owners. REQ-4518-2410