

Going digital in offshore wind

Driving data-centric infrastructure digital twins across the offshore wind lifecycle.



Table of contents

Page

3	New challenges for offshore wind structures
4	Going digital in offshore wind structures
5	Future-proofing our investments
6	The three stages of a successful project
7	Harness the power of offshore simulation
8	Geotechnical engineering
9	Collaboration and project delivery
10	Construction information and management
11	Accurate information across the asset lifecycle
12	Digital twin technology
13	Complete offshore wind digital twin workflows
15	Helping to build and advance the future of offshore wind and renewable energy



New challenges for offshore wind structures

While accelerated growth and reliance on offshore wind operations bring benefits, there are common and unique challenges that come with it.

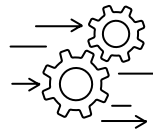
The current pace of renewable energy development around the world is growing and will continue to grow as the pressure to meet energy security and climate change goals builds. Offshore wind is proving to be a valuable and reliable energy source because of its low-carbon impact and high-capacity generation.

While the potential and growth are encouraging, the offshore wind sector still faces significant challenges, especially as turbines get larger in size and locations get deeper and more remote.

The challenges include:



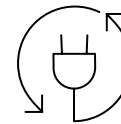
High support
structure costs



Less developed
construction techniques



Environmental
standards



Electrical
infrastructure



Operation and
maintenance costs

Addressing these infrastructure challenges and maintaining offshore wind turbine operations will become more important as the world becomes increasingly reliant on offshore wind energy.



Going digital in offshore wind structures

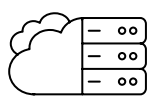
Some of the typical digital challenges that emerge in many types of large-scale projects are also present in every stage of offshore wind project development.



Complex
project execution



The
right tools



Information
silos



Operations and
maintenance
decision support

Why Bentley?

For over 40 years, Bentley has helped infrastructure projects become nimble, sustainable, and innovative. With fully integrated, multidiscipline tools, Bentley software is cloud-based, scalable, flexible, and affordable.

[Watch video](#)

There are many established and emerging companies involved in the offshore wind sector, but these typically specialize in certain areas, such as design and manufacturing. What Bentley does differently is to provide digital solutions across the lifecycle of the project, helping all teams and stakeholders, from design and construction to project management and operations and maintenance.



Future-proofing our investments

We all want projects and assets that are built to last. With offshore wind projects, designers must consider weather, environment, and location, as offshore structures can be greatly affected by operational conditions. With limited windows for conducting repairs due to the intermittent availability of transfer vessels, there is a greater need for turbines and structures to be designed to withstand different structural loads, forces on cables and blades, and other factors.

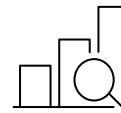
Bentley has a suite of products that can help optimize the development and operation of offshore wind projects.



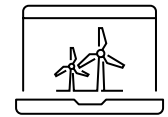
Project management



Structural and geotechnical



Analysis



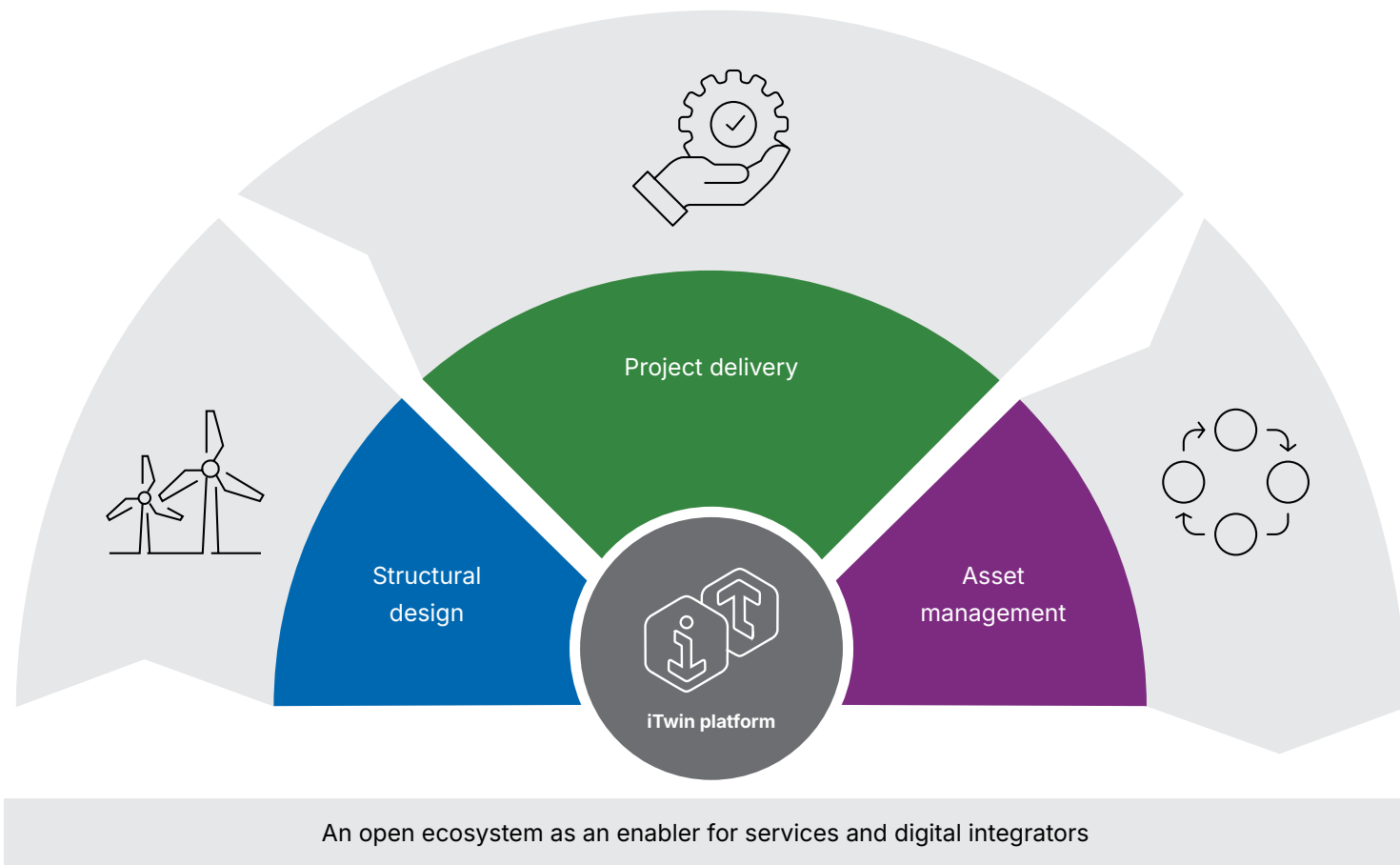
Digital twins

These products allow owners and engineering firms to maximize asset value and minimize costs.



The three stages of a successful project

Improving project collaboration



Harness the power of offshore simulation

Perform more robust analysis in less time for your fixed and floating structures.

Offshore wind engineers must optimize design to ensure compliance, understand behavior, and accurately predict the performance of all types of offshore structures to improve safety and reliability. Conducting comprehensive analyses is critical to predict how structures will behave under a variety of conditions, such as wind, wave, seismic, and ship impact loads, for a full range of possible effects.

Built for ease of use and high performance, our structural design solutions can help you consider all aspects of your structure to produce the most robust and cost-effective design in the shortest time possible.

With Bentley's offshore wind turbine design and analysis software, you can explore design alternatives, predict performance, and deliver safe, cost-effective offshore wind farm structures.

SACS™ Wind Turbine

- Analyze the static and dynamic behavior of offshore wind structures
- Assess the long-term durability of your designs
- Model wave and wind loading to optimize designs for real-world conditions
- Ensure compliance with regulatory requirements and standards

MOSES™ Wind Turbine

- Conduct advanced hydrodynamic simulations
- Perform coupled wind and wave loading analysis
- Model detailed hulls and mooring systems
- Optimize installation processes

[Read case study](#)



Geotechnical engineering

Reduce your risk with detailed subsurface insights to support wind farm decision-making.

For a clearer view of subsurface data, the wind sector needs to model outcomes quickly, preserve accuracy, and accelerate their innovation. Our solutions enable subsurface professionals to gain maximum value from their geological, geophysical, geochemical, reservoir engineering, and geotechnical data, supporting the production of safer structures and environments worldwide.

Learn more

Seequent® for Offshore Wind

Seequent, The Bentley Subsurface Company, helps you capture, analyze, model, and integrate geoscience data to support your transition.

- Analyze and run manual and automatic processes.
- Track and organize all files in one single, cloud-accessible location.
- Create continuous workflows through seamless collaboration.
- Communicate more effectively with 2D, 3D, and 4D visuals.

PLAXIS® for Offshore Wind

Complex 3D geotechnical analysis. Benefit from advanced and innovative capabilities for 3D geotechnical projects.

- Plan with trusted information.
- Conduct dynamic analysis.
- Access fully coupled flow-deformation analysis.
- Integrate geotechnical information.



Collaboration and project delivery

In any large wind project, time is money, and project delays can be costly. Having a collaborative approach to information sharing is essential.

Any successful project typically involves multiple partners, including owner-operators, manufacturers, and engineering companies. Their work generates significant information, such as piping and instrumentation diagrams, models, operations and maintenance data, plans, documents, and images. How can you ensure that this information is always up to date, accessible to those that need it as it moves across different stages and lifecycles, and most importantly, secure?

Seamless collaboration is key for any project to be successful and delivered on time, if not before. A collaboration platform, such as ProjectWise, can be utilized to build a unified design environment and data architecture, combined with authority control, so any complex project can be completed safely and efficiently.

ProjectWise®, powered by iTwin®

All-in-one control of project data, design reviews, contractual documents, and insights for any size design.

- Best-in-class design application integration
- One place for everything
- Workflow your way
- Power in transparency

Learn more



Construction information and management

Plan, construct, and track with digital twins

As wind projects continue to grow larger and more complex, contractors must implement digital solutions to stay ahead of the curve. From simplifying data collection on the job site to increasing project transparency and collaboration, leveraging technology to digitize and automate processes has now become crucial to ensure successful project outcomes.

Heavy construction challenges can come in many forms. The most common include:

- Optimizing project plans
- Keeping projects in control
- Limited insight into field performance

These challenges can be overcome in any offshore project by improving pre-construction planning, optimizing project execution, and enhancing visibility into field performance with products, such as SYNCHRO. By utilizing 4D/5D visualization technology, construction teams can take control with real-time progress updates and scheduling information while collaborating on project plans in a digital and interactive visual environment.

SYNCHRO™

The leading heavy civil construction management platform for managing heavy civil design data through to construction handover.

- A complete heavy civil construction management solution, powered by iTwin.
- Leverage powerful construction scheduling tools.
- Break design models into constructible components for quantity take-off and scheduling.

Watch video



Accurate information across the asset lifecycle

Combining operational and engineering information within a digital twin environment.

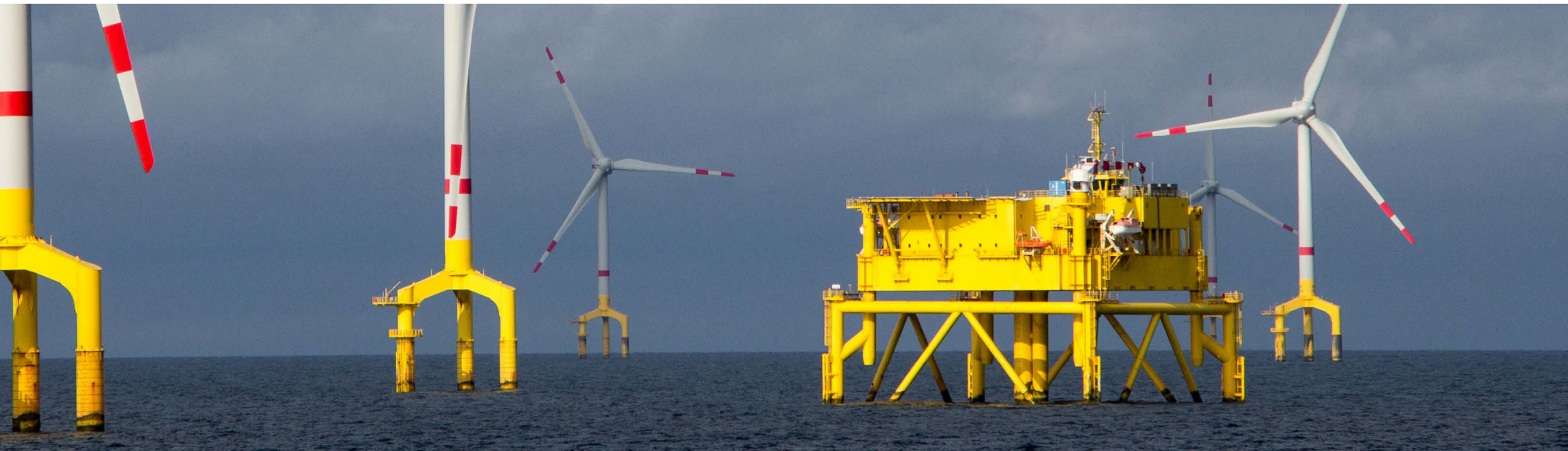
Effective asset management is crucial for optimizing the reliability and cost of energy from any renewable power generation facility, as remote locations make site access difficult and require obtaining information remotely via autonomous systems.

Bentley can offer a range of offshore wind asset management solutions that cover asset information, asset reliability, inspections, and analytical insights to ensure that you have the right asset management strategy and actions in place to match your specific needs. These services can also be part of your digital twin solution, so that asset, operational, and maintenance information can be accessed and visualized in context with the most up-to-date design and engineering information—all within one digital twin.

PlantSight and AssetWise®

Build your digital twin from existing sources of data and work in an immersive visual environment where you can trust your data to make fast and accurate decisions.

- Connect and visualize data.
- Manage an evergreen digital twin.
- Visualize asset performance management.
- Gain operational intelligence.

[Watch video](#)[Learn more](#)

Digital twin technology

Underpinned by the open, scalable, and flexible iTwin platform

Any wind project will have multiple user groups, from design to operations, that use multiple applications and different data sources, often located in separate servers or locations. These different sources and locations can become challenging to effectively manage. One way of managing and coordinating all this information in a single platform is to use a digital twin.

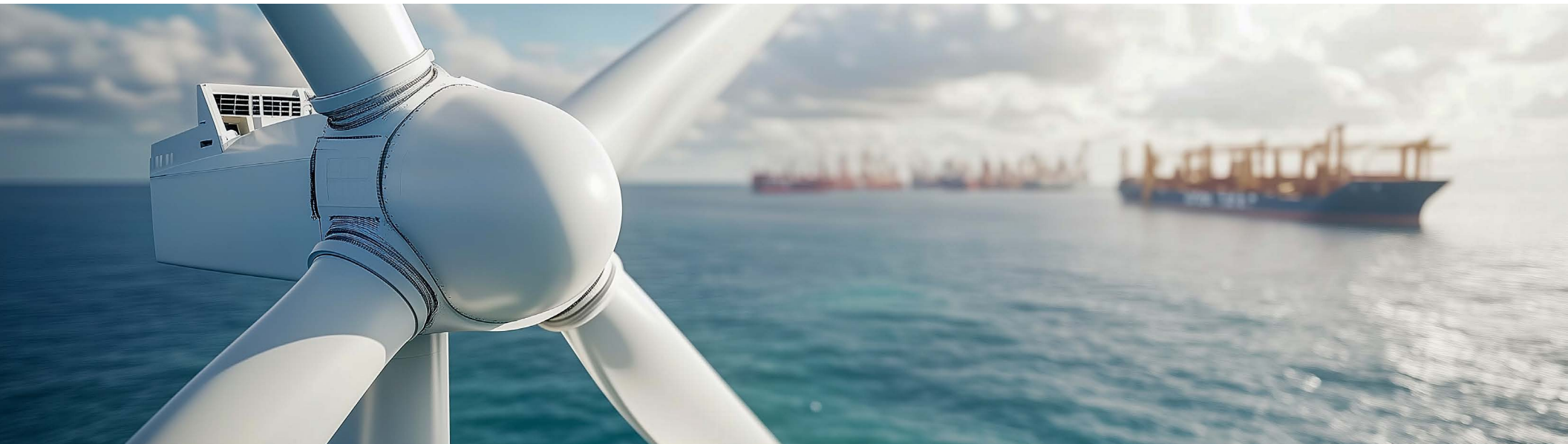
Digital twins can enhance offshore wind management and bridge the disconnect between design and operations. By creating a digital representation of a physical asset from a 3D or reality model, operations can overlay critical information—such as weather, wind, wave, vibration, Internet of Things (IoT) sensors, historical data, and inspection data—to gain insights into asset health and performance. Meanwhile, the design team can manage the engineering drawings and models and keep them up to date throughout the asset's lifecycle.

iTwin, with iTwin Experience, iTwin Capture, and iTwin IoT

Get the right information to the right people at the right time to make more informed and timely decisions. Create, curate, and use digital twins in engineering workflows, construction, operations, and maintenance.

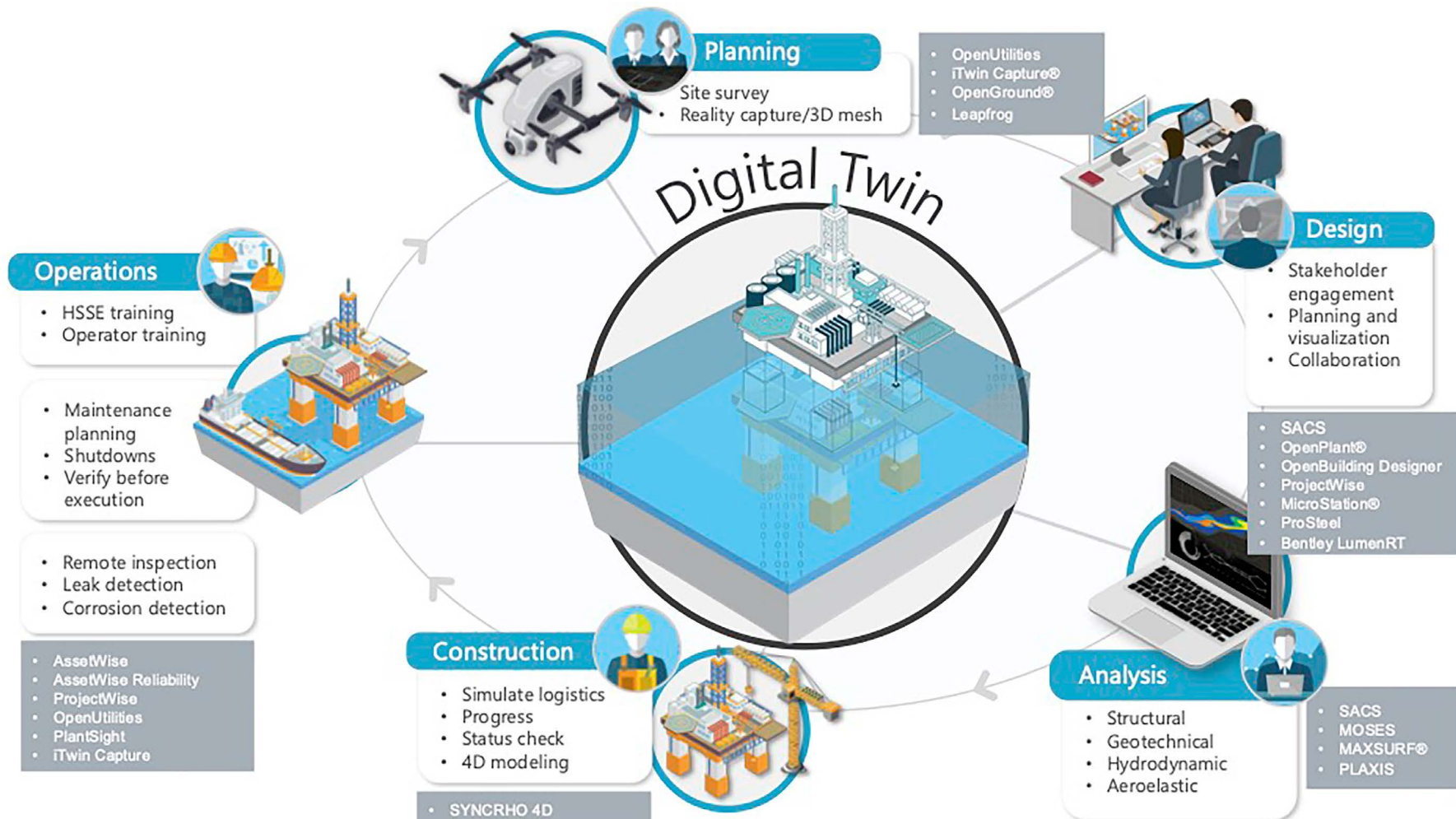


[Learn more](#)



Complete offshore wind digital twin workflows

A digital twin spans the entire asset lifecycle, enabling users at all stages to make better-informed decisions for better outcomes.



Bentley's software provided the basis for an integrated design system, shortening iterative design time by up to 50%.

“Faced with significant environmental challenges, we still realized the project with all designs based on Bentley's platform.”

Yu Li, POWERCHINA
Huadong Engineering Corporation Limited

[Read more](#)



Helping to build and advance the future of offshore wind and renewable energy

Bentley's proven multidiscipline software delivers groundbreaking solutions for complex offshore projects through a combination of engineering design and analysis software, coupled with a complete understanding of the terrain, environment, and geology on which the asset is to be built. Since Bentley's applications are fully integrated, cloud-based, open, and scalable, it is easy to get started with solutions that support your project's entire lifecycle.

To ensure seamless collaboration and delivery across the whole offshore wind enterprise, visit: www.bentley.com

Learn more

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