

A photograph of an offshore wind farm with multiple wind turbines in a row, set against a blue sky and sea. The image is split vertically: the left side has a teal overlay, and the right side shows the actual scene. The text is overlaid on the teal section.

GOING DIGITAL IN OFFSHORE WIND

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

New Challenges For Wind Structures

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

The current pace of renewable energy development around the world is growing and will only continue to grow as the need for energy security and climate change goals accelerate. 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 are:



High Support
Structure Costs



Less Developed
Construction
Techniques



Environmental
Standards



Electrical
Infrastructure



Operation and
Maintenance
Costs

Addressing these infrastructure challenges and maintaining the operational availability of offshore wind turbines will become increasingly important as the reliance on offshore wind energy grows.

Going Digital in Offshore Wind Structures

*Some of the typical **digital challenges** in any large-scale project are also applicable to your offshore wind project during any stage.*



Complex
Project Execution



The Right
Tools



Information
Silos



O&M Decision
Support

There are many established and emerging companies involved in the offshore wind space, but these fields are typically in certain areas of the industry, such as design and manufacturing. What **Bentley** does differently is that we **provide digital solutions** across the lifecycle of the project, helping teams throughout the organization, from design and construction to project management and operations and maintenance.

Why Bentley?

For nearly 30 years Bentley has helped renewable power generation projects become nimble, sustainable, and innovative. With fully integrated, multidiscipline tools, Bentley software is cloud-based, scalable, flexible, and affordable.

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Future-Proofing Your Investments

We all want projects and assets that are **built to last**. With offshore wind projects, designers must consider weather, environment, and location, as an offshore structure can be greatly affected by operational conditions. With limited windows for conducting repairs due to the 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 have been working in the offshore structure space for nearly 30 years, **helping process and offshore wind projects** to achieve operational.



Project Management



Structural and Geotechnical



Analysis

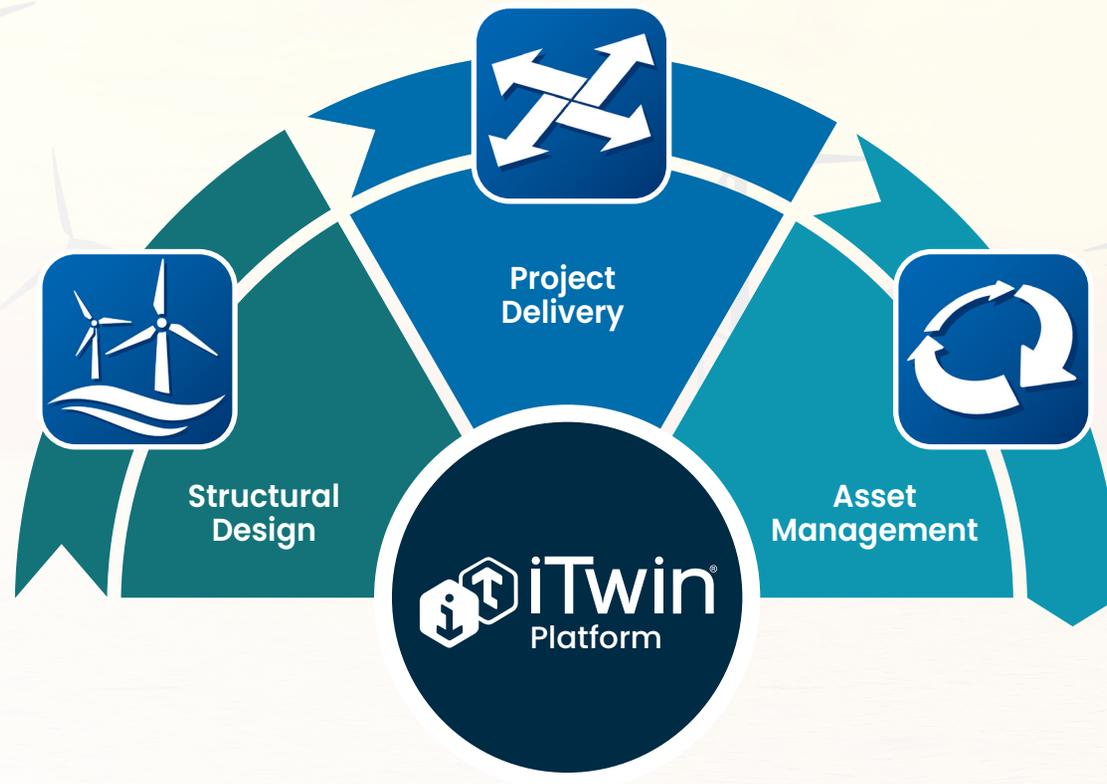


Digital Twins

Allowing owners and engineering firms to maximize asset value and minimize costs.

The 3 Stages of a Successful Project

Improving Project JV/SPV Collaboration



VIEW THE GOING
DIGITAL IN OFFSHORE
WIND STORY >>

*An Open Ecosystem as an ENABLER
for Services and Digital Integrators*

Harness the Power of OpenWindPower

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

It is important to 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 your structure will behave under a host of conditions, such as wind, wave, seismic, and ship impact loads for a full range of likely effects.

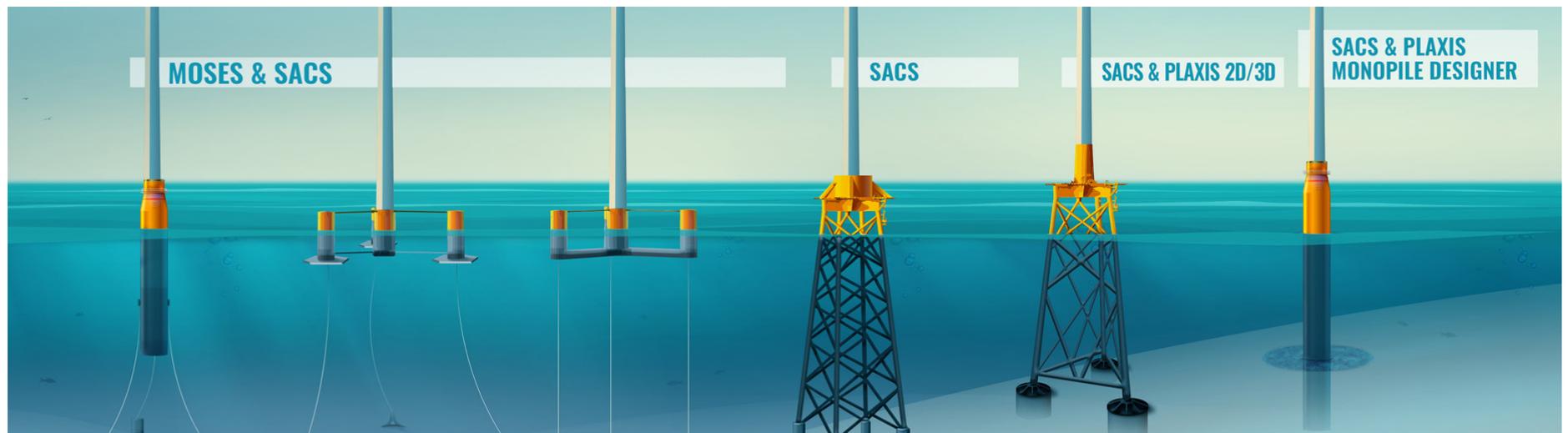
Built for ease of use and high performance, our structural design solutions can help you consider all aspects of your structure to produce the most robust and cost-effective design in the shortest time possible.

OpenWindPower

Explore design alternatives, predict performance, and deliver safe, cost-effective offshore wind farm structures.

- Analyze Dynamic Wave, Current, and Wind Loading
- Perform Coupled or Uncoupled Wind Turbine Analyses
- Predict Cyclical Damage with Fatigue Analysis

[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 industry 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
- Geotechnical Information Integration



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 a lot of information like piping and instrumentation diagrams, models, operations and maintenance (O&M) 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
- Having little insight into field performance

These challenges can be overcome in any offshore project by utilizing better **pre-construction planning, optimizing project execution, and enhancing visibility** into field performance with products like 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.

[WATCH VIDEO >>](#)

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 the iTwin.
- Leverage the powerful CPM scheduling engine and other scheduling tools.
- Slice and dice models into constructible components for quantity take-off and scheduling.

Accurate Information Across the Asset Life Cycle

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.

[WATCH VIDEO >>](#)

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

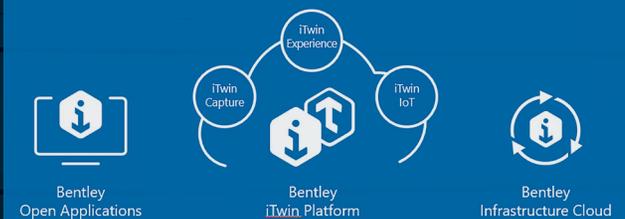
Digital Twin Technology

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 make it challenging to effectively manage. One way of managing and coordinating all this information in a single platform is with a digital twin.

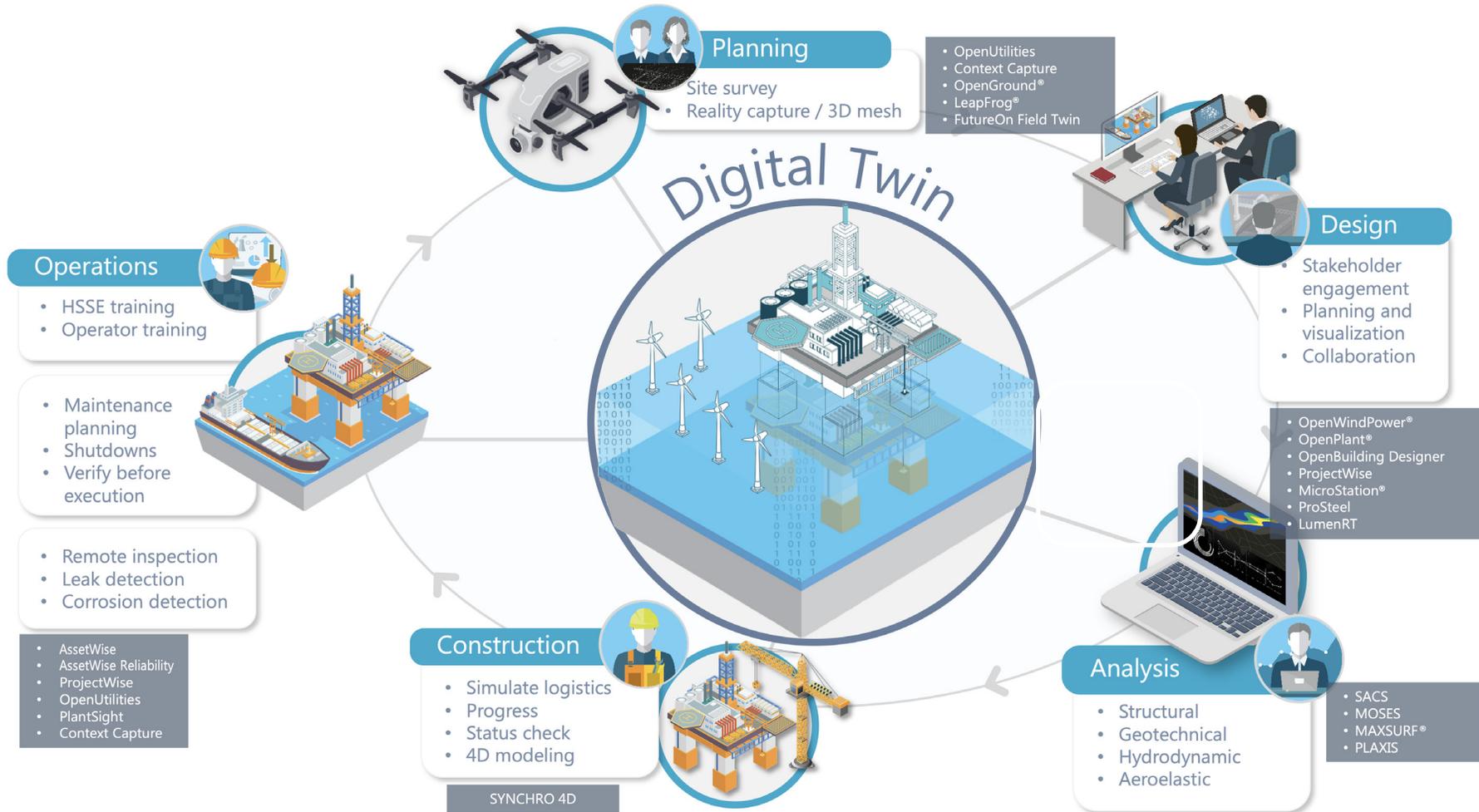
Digital twins have the potential to change offshore wind management and bridge the disconnect between the design and O&M stages. By creating a digital representation of a physical asset from a 3D or reality model, operations can overlay critical information—such as weather, wind, wave, vibration, IoT 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.

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Powered by 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.

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.



“ The effort put in by the Bentley OpenWindPower team to couple its post-processing capabilities with the hydrodynamic and aerodynamic modeling capabilities of other software systems has allowed for the first truly useful coupled analysis in the offshore wind industry. This has resulted in significant time and cost savings for the offshore wind foundation and sub-structure engineering community. ”

Benjamin Foley P.E.
General Manager, Offshore Renewables
Keystone Engineering Inc.

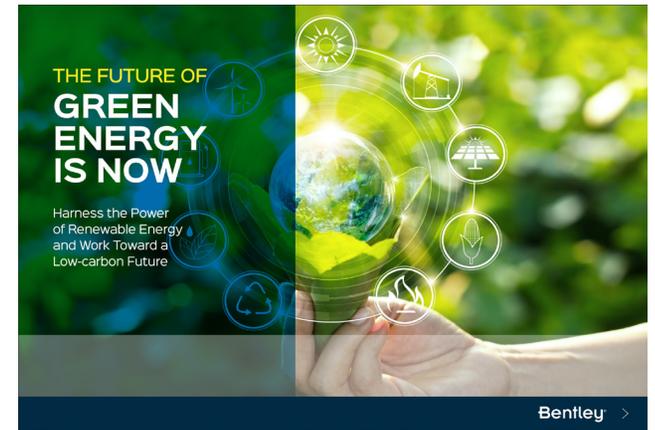
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Helping to Build and Advance the Future of Offshore Wind and Renewable Energy

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

For more information, contact renewableenergy@bentley.com



Learn more about our renewable solutions around the world!

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