MARKET SHEET

OWENS Toolset

Offshore Wind Energy Simulation (OWENS)

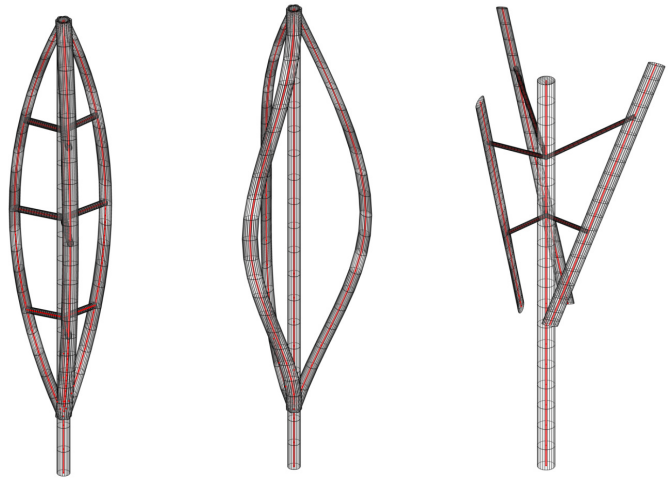
Sandia National Laboratories

Offshore Wind Energy Simulator (OWENS) is a software toolset for the analysis, design, and certification of offshore, land-based, or marine hydrokinetic vertical-axis wind turbine systems.

Commercial Software

Technology Readiness Level: 7-8

The OWENs toolset has the required physics models for coupled analysis of aero-hydro-servo-elastic simulations necessary for design and certification of wind energy systems. Written in the Julia programming language, the toolset is comprised of the following modules:



OWENS combines the modules into a continuous analysis workflow from basic parametric inputs to response outputs for steady, transient, and modal analyses. While it has been tuned for stability and accuracy, it also makes a wide range of fidelity and solution parameters accessible to the user for case-specific tuning. This driver also includes the ability to modify control inputs or specify additional control elements or methods.

VAWTAero consists of steady and unsteady analysis methods for aerodynamic load prediction of three-dimensional VAWT models using either the Double Multiple Streamtube or the Actuator Cylinder methods. Dynamic stall models are included for capturing unsteady aerodynamic effects and an improved solution procedure is an option which enables faster than real-time aerodynamic calculations of full turbines.

GyricFEA solves the elastic response of a rotating system defined by a finite element mesh using Timoshenko beam elements. There are multi-fidelity solution options including linear and nonlinear transient analysis, reduced order modes analysis, steady state analysis, and modal analysis with centrifugal stiffening. The program validates well against higher fidelity models even for high deflections (>20% of length).

Additionally, direct coupling to the **OpenFAST Hydrodyn, Moordyn, and InflowWind** modules have been integrated to enable simulations with wave and current forcing on floating platforms and simulation with turbulent inflow. Pre-processor capabilities include mesh generation of user-defined floating platforms and calculation of hydrostatic properties, hydrodynamic coefficients, and pre-service stability analysis.

U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA-0003525. SAND2022-10794 M

MARKET SHEET

OWENS Toolset

Offshore Wind Energy Simulation (OWENS)

Sandia National Laboratories

The full suite of OWENS enables designers to:

- Prescribe a free-form finite element mesh to represent arbitrary structures and generate elastic solutions.
- Complete aero-hydro-servo-elastic unsteady non-linear time domain analysis with atmospheric turbulence for prescribed metocean conditions.
- Perform floating system modal analysis including platform and mooring properties calculated using parameterized inputs.
- Optimize systems using algorithmic gradients.

Industries & Applications

- Offshore wind turbines
- Land-based wind turbines
- Distributed wind systems
- Marine hydrokinetic turbines and cross-flow turbines
- Turbine OEMs
- Wind plant development

Next Steps

Sandia National Laboratories is seeking commercial partners to license the OWENS Toolset. To learn more, contact the Licensing and Technology Transfer office.

Contact Us SCR# 1617

ip@sandia.gov ip.sandia.gov

U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA-0003525. SAND2022-10794 M