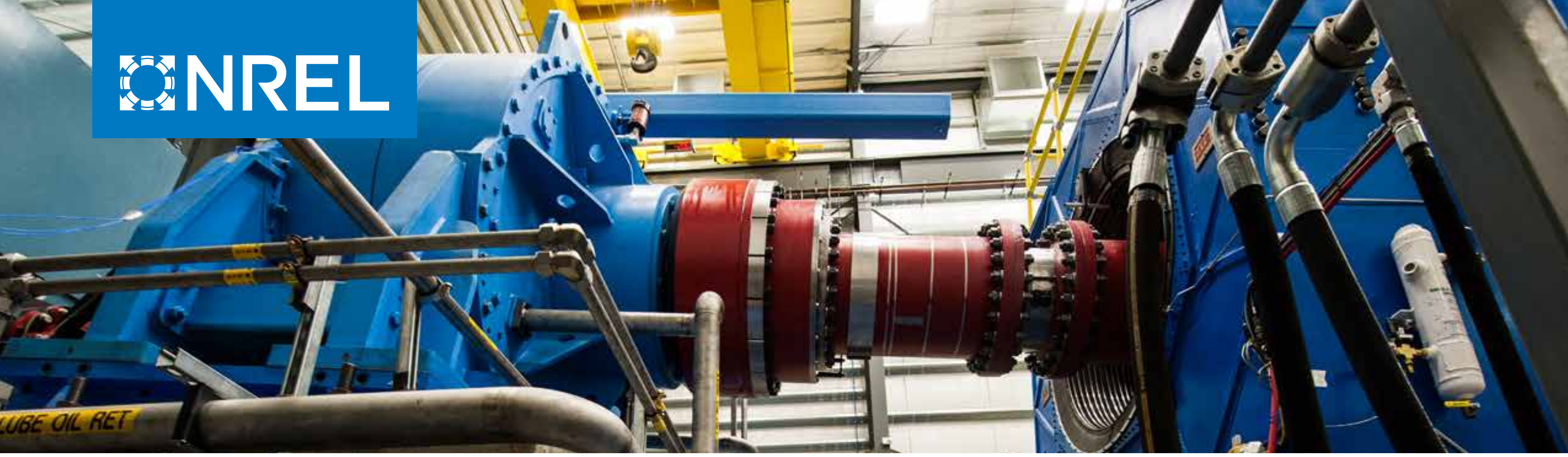

Photo by Werner Slocum, NREL 28250

Dynamometer Facts

The National Renewable Energy Laboratory's (NREL's) Flatirons Campus features four dynamometers that can perform research validation on wind turbine systems and ocean energy devices. These dynamometers can validate wave and water power systems over capacity ratings ranging from 1 kilowatt (kW) to 5 megawatts (MW) by replacing water with a controllable, electric motor. By combining these capabilities with other tools, such as the controllable grid interface (https://www.nrel.gov/grid/controllable-grid-interface.html), researchers can verify how their device interacts with the grid or integrates with other technologies.

The dynamometers simulate real-world conditions to test drivetrain designs and help improve the readiness of new innovations.

Refer to the specifications below for each of NREL's dynamometers, or visit NREL's website to learn more: www.nrel.gov/water/dynamometers.html.

		5-MW Dynamometer	2.5-MW Dynamometer	225-kW Dynamometer	40-kW Dynamometer
Facility	Test Bay	• 20 × 6-meter (m) (65 × 20-foot [ft]) test article footprint • 6.1 × 9.8-m (20 × 32.2-ft) steel anchor floor with rectangular pattern of threaded holes • Drive-through high bay for test article off load	• 12.2 × 15.2 × 9-m (40 × 50 × 30-ft) test article area • 3.7 × 6.4-m (12 × 21-ft) T-slotted anchor floor • 1.74 × 8.77 × 3.13-m (5.7 × 28.75 × 10-ft) direct-drive generator pit	• 12.2 × 15.2 × 9-m (40 × 50 × 30-ft) test article area • 3.7 × 6.4-m (12 × 21-ft) T-slotted anchor floor • 1.74 × 8.77 × 3.13-m (5.7 × 28.75 × 10-ft) direct-drive generator pit	• 12.2 × 15.2 × 9-m (40 × 50 × 30-ft) test article area • 3.7 × 6.4-m (12 × 21-ft) T-slotted anchor floor • 1.74 × 8.77 × 3.13-m (5.7 × 28.75 × 10-ft) direct-drive generator pit
	Lifting Capacity	• Dual 68,000-kilogram (kg) (75-ton) overhead cranes • 14-m (45-ft) maximum hook height	• 45,000-kg (50-ton) overhead crane • 9.14-m (30-ft) maximum hook height	• 45,000-kg (50-ton) overhead crane • 9.14-m (30-ft) maximum hook height	• 45,000-kg (50-ton) overhead crane • 9.14-m (30-ft) maximum hook height
	Cooling/ Heating	• Forced ventilation with outside air • Gas-heated test bay • Climate-controlled control room	• Forced ventilation with outside air • Gas- and electric-heated test bay • Climate-controlled control room	• Forced ventilation with outside air • Gas- and electric-heated test bay • Climate-controlled control room	• Forced ventilation with outside air • Gas- and electric-heated test bay • Climate-controlled control room

		5-MW Dynamometer	2.5-MW Dynamometer	225-kW Dynamometer	40-kW Dynamometer
Dynamometer	Prime Mover	• 6-MW (8,000- horsepower [hp]) alternating current (AC) induction motor • Variable-frequency drive (VFD) with full regeneration capacity, 350-hertz (Hz) torque response • 75:1 three-stage gear reducer	• 2.5-MW (3,351-hp) AC induction motor • VFD with full regeneration capacity, 350-Hz torque response • 51.4:1 three-stage gear reducer	• 225-kW (300-hp) AC induction motor • VFD with full regeneration capacity, 350-Hz torque response • Multiple gearboxes	• 40-kW hydraulic motor (integrated gearbox)
	Rated Power and Speed To Test Article	• 0–12 rotations per minute (rpm): torque limited to 4.6 mega-Newton-meters (MN·m) (41 thousand pound-inches [M lb·in.]) • 12–24 rpm: power limited to 5.8 MW continuous	• 0–24 rpm: torque limited to 1 MN·m • 24–44 rpm: power limited to 2.5 MW		• 20 kilo-Newton-meters (kN·m) (max.) • 0 to 50 rpm
	Drive Table	• 5° fixed inclination • 4-meter (m) (13-foot [ft]) height of output end of dynamometer drive shaft	• 3.66-m (12-ft) maximum height at 0° tilt • 0° to 6° tilt capacity	• Variable height and tilt	• Variable height and tilt
	Control System	• Torque and speed control modes • Ramp generation, arbitrary time series, and external command capacity • 100-Hz update rate • Custom scripting and programming	• Torque and speed control modes • Ramp generation, arbitrary time series, and external command capacity • 100-Hz update rate • Custom scripting and programming	• Torque and speed control modes • Ramp generation, arbitrary time series, and external command capacity • 100-Hz update rate • Custom scripting and programming	• Torque and speed control modes
Nontorque Loading		• Maximum yaw or pitch moment: 7.2 MN·m (64 M lb-in.) • Maximum radial force: 3.2 MN (730 thousand pounds [k lb]) • Maximum thrust: 4 MN (900 k lb)	• Radial capacity: 440-kN (100-kip) force, 152-millimeter (6-in.) stroke by 2 • Thrust capacity: 156-kN (35-kip) force • 254-millimeter (10-in.) stroke	• Radial capacity: 440-kN (100-kip) force, 152-millimeter (6-in.) stroke by 2 • Thrust capacity: 156-kN (35-kip) force • 254-millimeter (10-in.) stroke	• 1940-N max radial force • 2200-N max axial force
Data Acquisition		• 500-plus-channel, 24-bit, distributed data acquisition • Stand-alone power quality condition monitoring systems	• 500-plus-channel, 24-bit, distributed data acquisition • Stand-alone power quality condition monitoring systems	• 500-plus-channel, 24-bit, distributed data acquisition • Stand-alone power quality condition monitoring systems	• 500-plus-channel, 24-bit, distributed data acquisition • Stand-alone power quality condition monitoring systems

NREL

15013 Denver West Parkway
Golden, CO 80401
303-275-3000 • www.nrel.gov

NREL prints on paper that contains recycled content.

NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Operated under Contract No. DE-AC36-08GO28308

NREL/FS-FS-5700-92234 • August 2025