

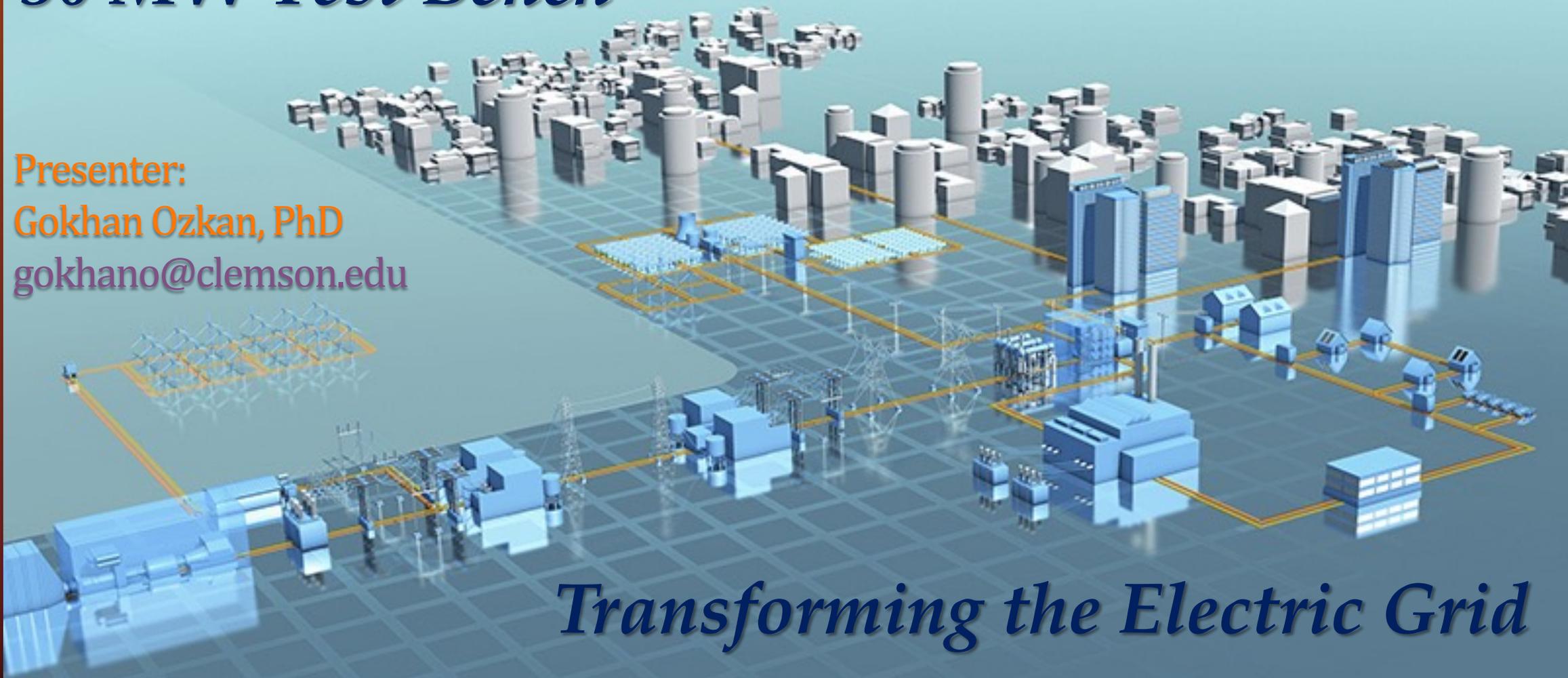


Driving economic growth, innovation,
and workforce development



30 MW Test Bench

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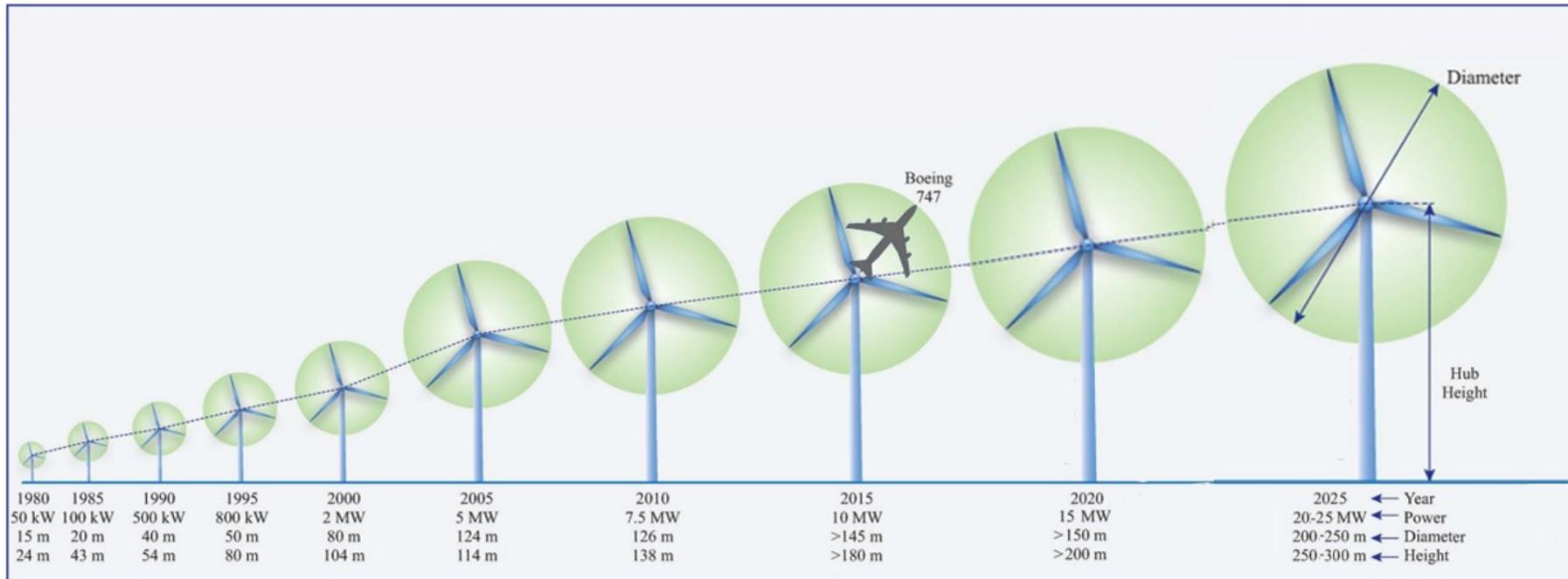


Transforming the Electric Grid



Wind Turbine Size Growth Driving Need

- » The US government's goal for 30-gigawatt offshore wind by 2030
- » With the 10 megawatts offshore turbine size, it requires 3,000 turbines
- » Each offshore turbine installation is costly and resource-intensive (boats, people)

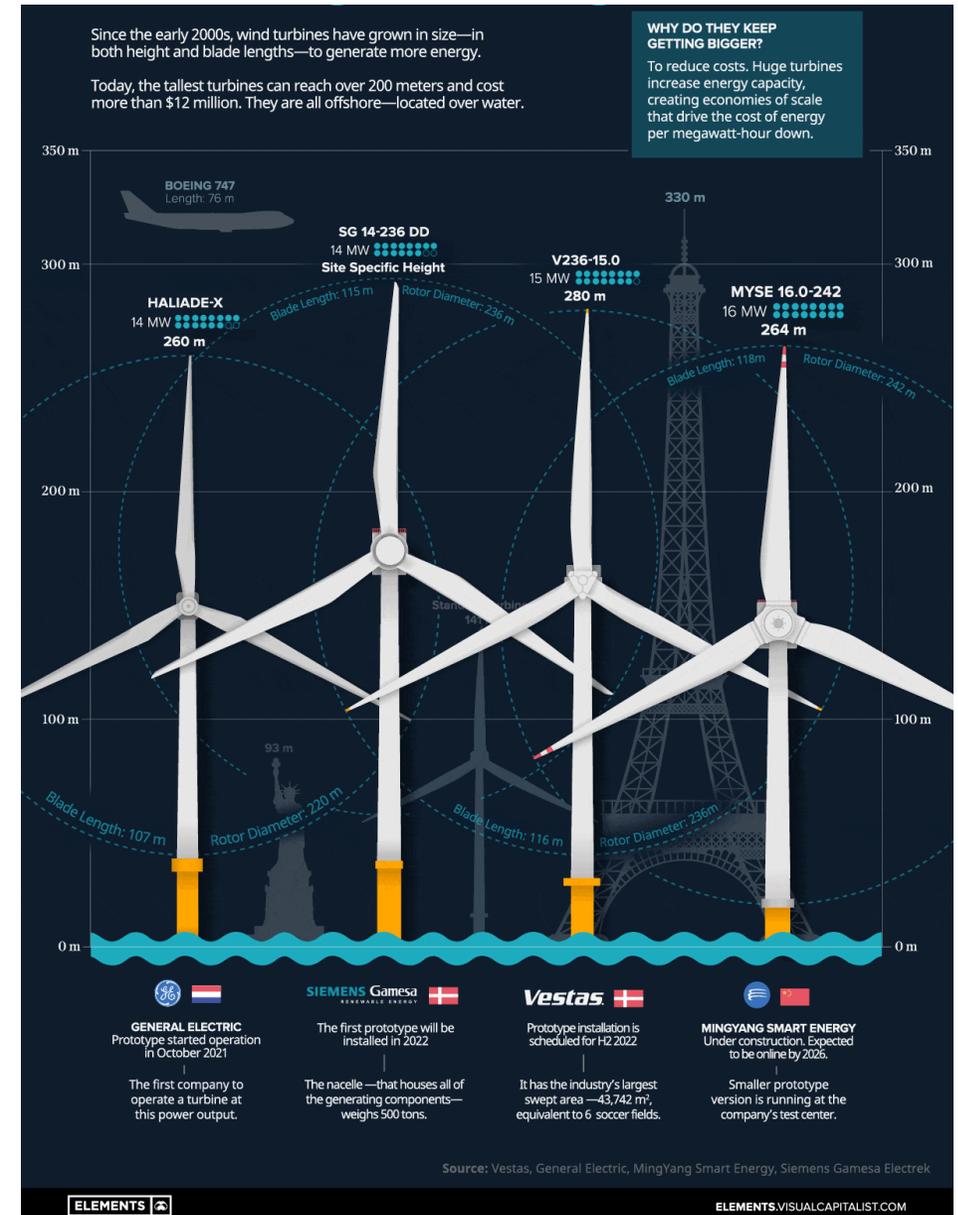


30-Megawatt Test Facility needed to support US Wind Industry



Current Offshore Wind Turbines

- » Around 15 MW capacity turbines built in 2022
- » **Siemens Gamesa** has announced a 14MW turbine
- » **GE** has announced a 14MW turbine
- » **Vestas** has announced a 15MW turbine
- » **Mingyang** announced 16MW turbine
- » **GE Research** won \$20 million federal grant to develop new wind turbine generators
- » **Several companies** have requested testing 15MW+ systems



source: visualcapitalist.com



Offshore Strategy Report Encourages Larger US Testing Capabilities



Offshore Wind Energy Strategies

Regional and national strategies to accelerate and maximize the effectiveness, reliability, and sustainability of U.S. offshore wind energy deployment and operation

January 2022

U.S. Department of Energy
Washington, DC, 20585

Table 4. Technology Innovation Initiatives

Initiatives	Specific Actions To Implement	Outcome
Upgrade U.S. test and validation capabilities to address reliability of new, larger wind turbines	<ul style="list-style-type: none"> • Increase the capacity of prototype, test, and demonstration capabilities to accommodate continued wind turbine growth at existing U.S. facilities, such as blade testing and drivetrain test facilities. • Develop advanced simulation and hybrid testing techniques to maximize development prior to more expensive large-scale physical testing. • Evaluate need and use case for floating lab and field research test sites to address topics such as physics validation, conflicting use mitigations, and component demonstration. 	<ul style="list-style-type: none"> • Higher reliability on first generations of larger wind turbines, resulting in lower operation and maintenance costs and market risk. • Ability to test and develop large components domestically, in support of a U.S. supply chain.

See [DOE Offshore Wind Energy Strategies](#), January 2022, p. 19.



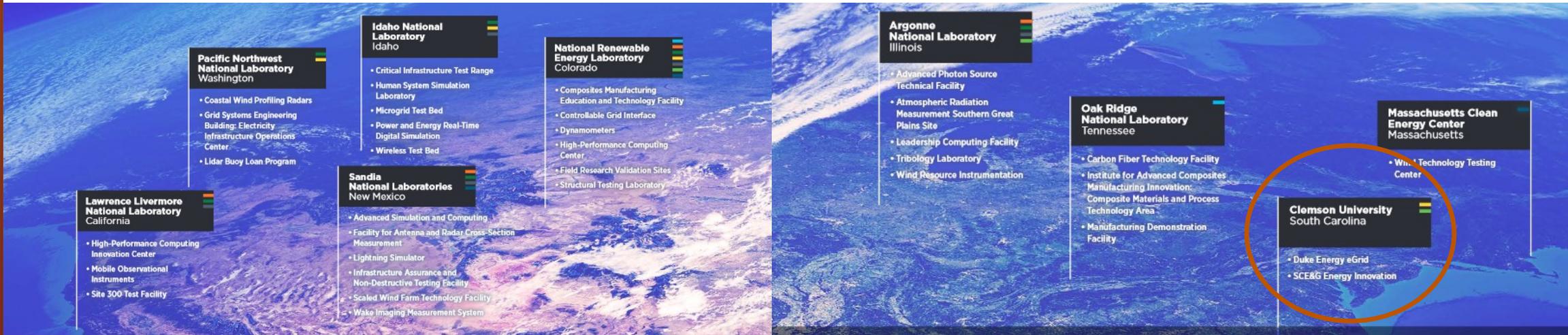
Clemson University Dominion Energy Innovation Center (EIC)



Facility is adjacent to deep water port and shipyard infrastructure, rail and road access



Clemson is the only University lab in DOE's Wind Facilities Portfolio



DEPARTMENT OF ENERGY WIND FACILITIES

ACCELERATING INDUSTRY ADVANCEMENTS

Testing facilities make it possible for wind technology companies and inventors to validate and commercialize their technologies. This guide represents the wind laboratory and testing facilities supported by the U.S. Department of Energy (DOE), which are available for industry use and that make it possible for industry players to increase reliability,

improve efficiency, and reduce the cost of wind energy.

DOE wind energy testing facilities are geographically diverse and possess unique capabilities that allow the nation to usher in new and innovative generations of wind energy technology.

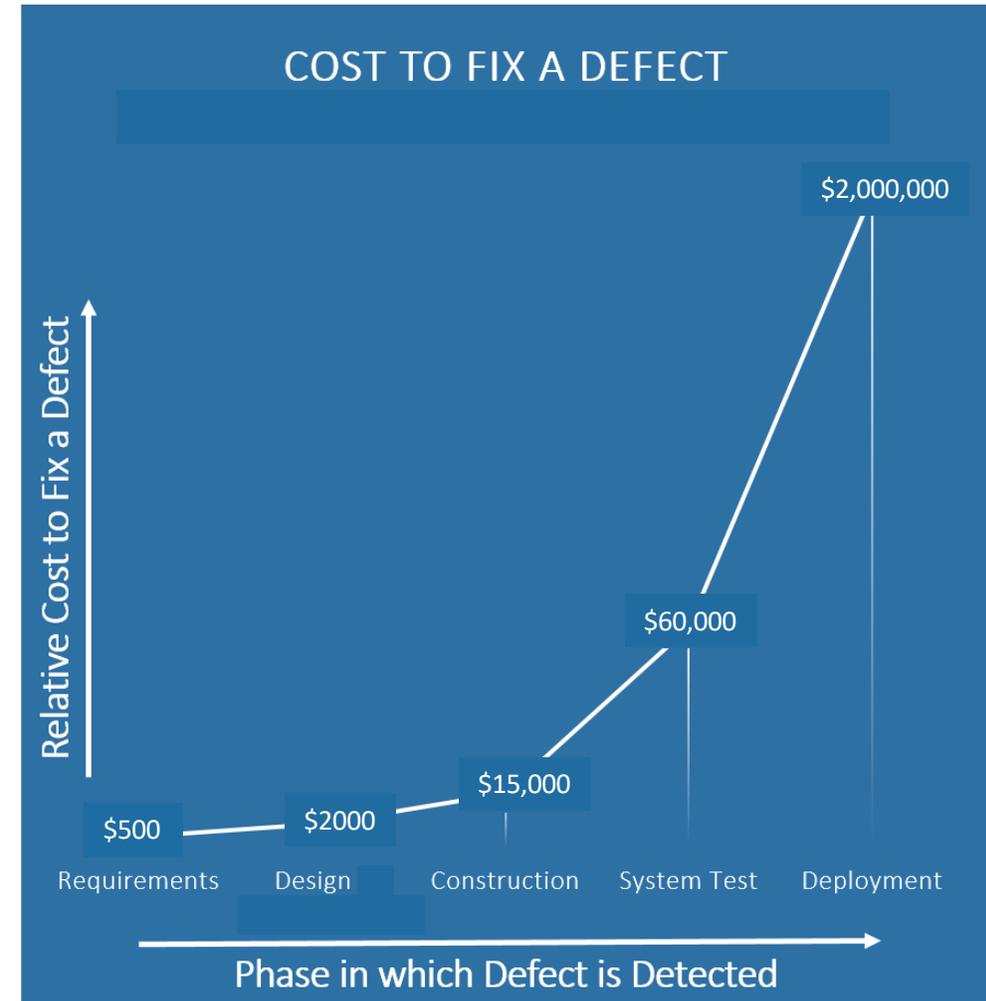
See: www.nrel.gov/docs/fy17osti/67743.pdf





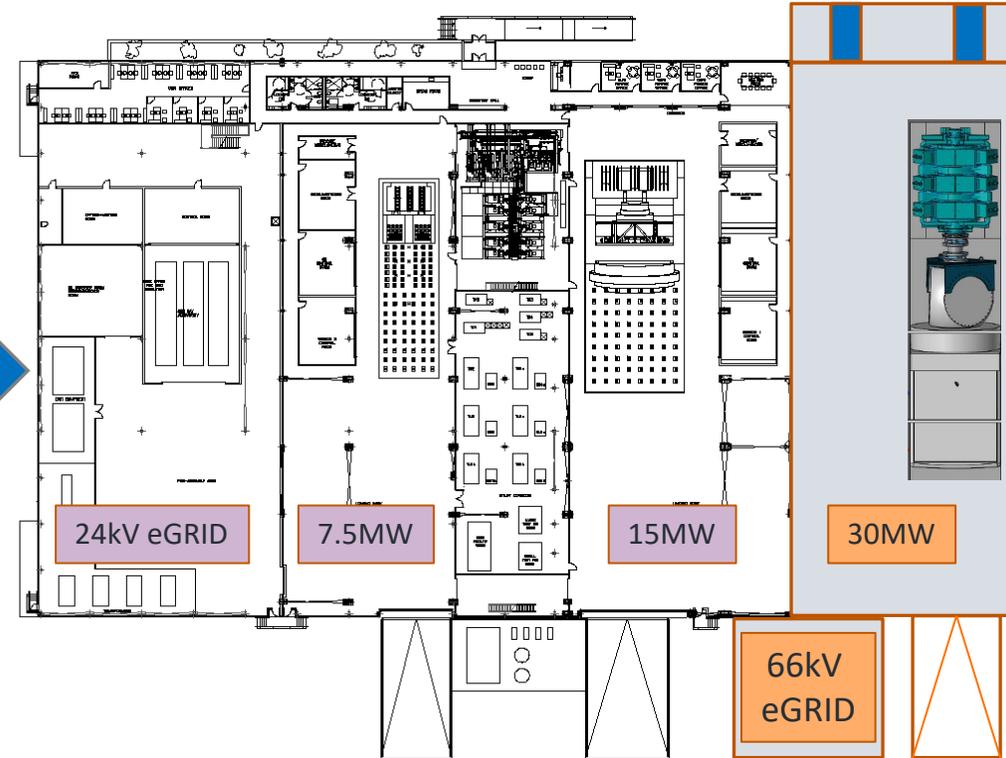
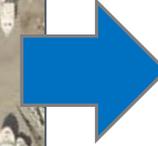
Benefit Testing Early

- » 30 megawatt test bay enables manufacturers to test full-scale before manufacturing thousands of units
- » The earlier an issue is found, the lower the cost to address
- » If no full-scale testing is available, must install field prototype(s) and update fleet when issue identified
- » Industry and investors would incur significantly higher total cost to reach 30 gigawatt offshore wind target





Facility Expansion



» 30MW Test Bay –
Planned location



30 MW+ Grid Emulator

Grid Emulator Specs	
Nominal Voltage	33 kV/ 66 kV
Maximum Voltage	140%
LVRT/ZVRT	Asymmetrical to 0%/phase
Voltage THD	<1% for 2-50 th Harmonics
Harmonic Injection	1 to 10% 2-20 th Harmonics
Subharmonic Injection	1 to 55 Hz
Frequency Change	100 Hz/s
Instantaneous Phase Shift	180 degrees



Thank You



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