MARITIME COLLEGE
STATE UNIVERSITY OF NEW YORK

The Center of Excellence for Offshore Energy at State University of New York Maritime College and The Maritime Industry Museum at Fort Schuyler

OFFSHORE WIND POWER

Planning for America's Ocean Energy

Offshore Energy Work Force Training, Certification and Education Initiative

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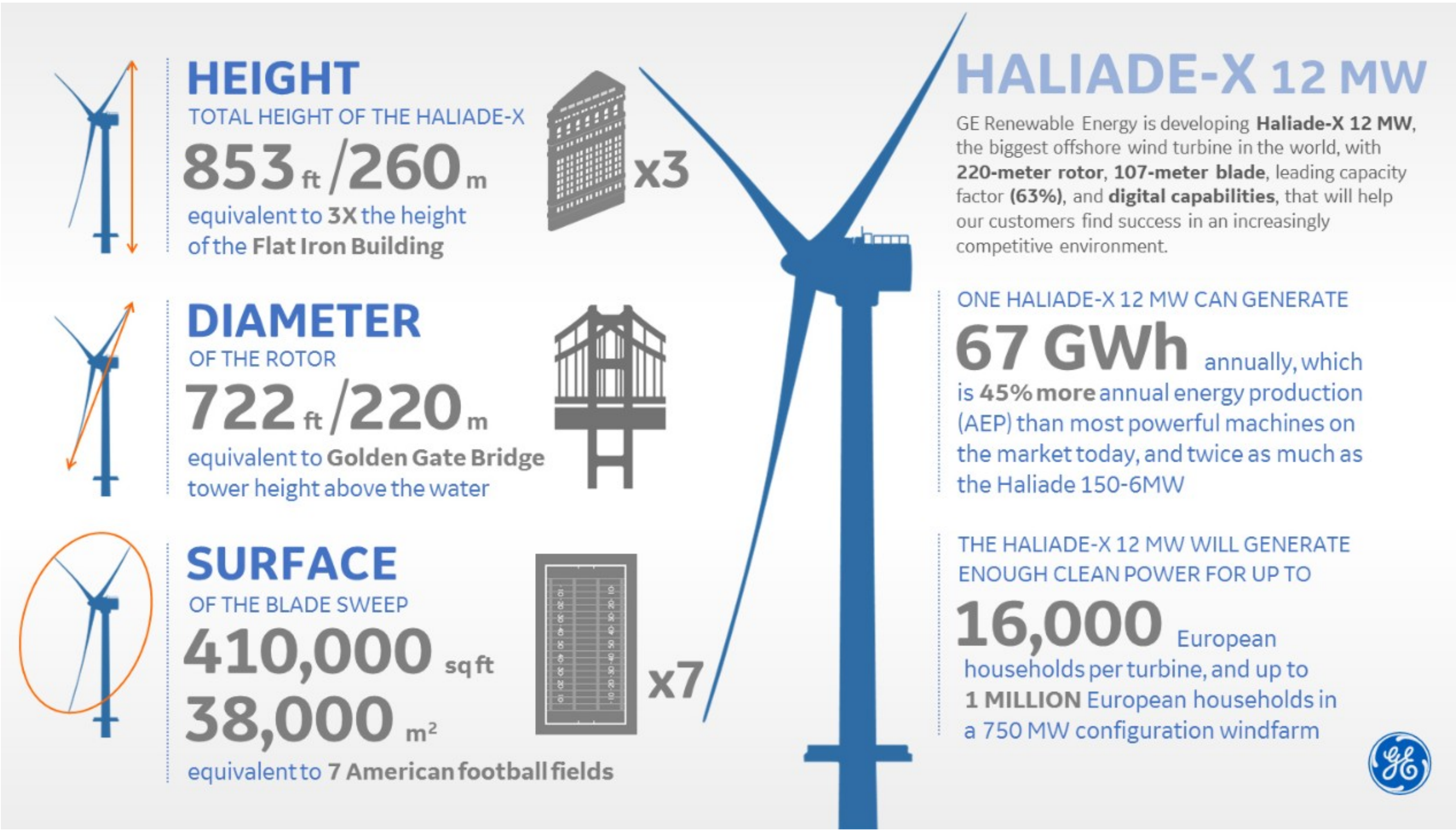
Background: Lillgrund Wind Farm, Sweden

Visual Background

Haliade X 12 MW Characteristics



Overview of the Offshore Wind Farm Installation Process

- Accommodating Workforce Skills

Port Logistics 1

- To the extent possible, turbine components have to be pre-assembled onshore.
- In the construction phase, staging ports need to be able to accommodate the pre-assembly and storage of foundation and turbine components.
- In the O&M phase, service ports have to enable quick loading of spare parts and 24/7 departure to the wind farm site.

Foundation Installation 2

- Method depends on foundation type. The most widely-used monopiles are driven into the seabed by large pile hammers, often by the same vessel used for turbine installation.
- Much heavier gravity-based and tripod-type foundations require vessels with heavy lifting capability.
- Floating turbines are pre-assembled onshore and towed to the site by tugs.

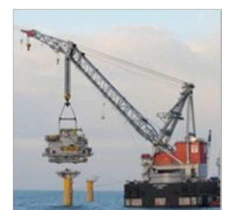
Transition Piece 3

- The transition piece is connecting the most widely-used monopile foundations with the turbine tower.
- They are typically installed by the same vessels as turbines themselves.
- Other foundation types are already fitted with transition pieces prior to installation (e.g. tripods), or do not require transition piece at all (e.g. jackets, gravity-based structures).

Turbine Installation 4

- Turbine installation can take several forms. Smaller turbines can be installed in one piece by heavy-lift vessels.
- The largest turbines are assembled piece by piece, typically by using purpose-built TIVs.
- Medium-sized turbines are typically assembled by using either the "bunny-ear" or the "rotor star" configurations (pictured).

Substation Installation 5



- Substations are pre-assembled onshore and installed at the site as a single unit, typically by a heavy-lift vessel, or by a jackup vessels with heavy-lifting capabilities.
- Substation foundations are also heavier than those used for turbines.
- Larger wind farms have multiple substations (roughly one for each 250 to 400 MW of installed capacity).

Cable laying Operations 6

- Array cables connect wind turbines with each other and the substation, export cables connect the substation to the onshore grid. Both array and export cables are installed by specialized cable-lay vessels.
- Offshore cables are typically buried under the seabed, either via trenching and burial, or via less costly rock dumping.

Objectives

- Develop in-class/online courses and programs for offshore renewable energy
  - Credit/non-credit courses leading to certificates and degrees
- Foster Maritime College curriculum change and innovation
  - Offshore renewable energy: production, installation and maintenance
- Provide collaborative research opportunities for faculty and students

Entities Seeking OSW Skills

- OSW industry
  - Producers
  - Designers
  - Installers
  - Operators
  - Maintenance
  - Developers
- Regulators & Government
  - Legislators
  - Inspectors

Government Stakeholders

- NYSERDA:
  - Wind Farm Port Working Technical Group
  - Wind Farm Job Workforce Technical Group
- NYSDOS: Marine Working Technical Group
- NYC Waterfront Advisory Group
- US Army Corps of Engineers Port Resilience Project Technical Advisory Group

Target Audience

Individuals seeking to be a part of the OSW program that require academic level or training skills, including:

- College graduates without OSW energy industry skills
- College students who want to have a career in the OSW energy industry
- Individuals who plan to join the OSW energy industry
- Individuals in the OSW energy industry who need an upgrade of skills or retraining

Workplan

Phase I: **OSW Farm Framework** (Year 1)

- Background and characteristics of the OSW farm and its industry
- Identify all the stakeholders and their interests in OSW
- Identify the subjects to be covered and cluster them into courses for certificates and degrees

Phase II: **Course Content Buildup** (Year 2)

- Identify material, models, and equipment including labs and simulators
- Populate the courses identified in Phase I with the material
- Seek partners in higher education to share the teaching and training
- Provide research

Phase III: **Partners** (Year 3)

- Identify partners which could include:
  - Industry (OSW, maritime, ports, others)
  - Government agencies (local, national and international)
  - Teaching institutions (universities, community colleges, high schools, vocational schools and others)
- Delegate the education requirements between the partners

Events: (all years)

- Ongoing events
  - Conferences
  - Workshops

Methodology

Program development is a work in Progress; therefore:

- Develop
  - OSW program(s)
  - course content
  - simulation programs
  - manuals
  - research problem statements
- Prepare
  - reports
  - visuals

Programs

- Degree
  - Standard college courses in:
    - Marine Transportation, operations and safety
    - Engineering: electrical, mechanical, naval architecture
    - Management: supply chain, logistics, port and terminal management
- Certificate
  - Courses tailored to industry & government needs:
    - To be determined and developed with industry input

Courses

There are no standards for training and certification for OSW in the US; therefore:

- **<u>Perform gap analysis</u>** using **GWO** (Global Wind Organization) and **STCW** (Standards for Training, Certification and Watchkeeping) for Seafarers to develop courses for degree and certification, such as:
  - Basic Safety Training Refresher Standard
  - Basic Technical Training Standard
  - Advanced Rescue Training Standard
  - Advance Rescue Training Refresher Standard
  - Enhanced First Aid Standard
  - Enhanced First Aid Refresher Standard
  - Blade Repair Standard
  - Slinger Signaler
- Dynamic Positioning Training
  - Coordinating with OSVDPA

Example of Course Offering

<u>Introduction course</u>

Introduction to clean energy with an emphasis on wind, specifically OSW. Topics include:

- Wind
- Solar
- Geo
- Hydro

The course content includes aspects from engineering, operations, management and safety.

Example of Course Offerings

Global Wind Organization (GWO) (the European certifying group) requires 12 competency tests in Basic Technical Training (BTT) in Electrical Module to be certified.

- **Total hours: 9.9.**

SUNY Maritime College for BTT certification also uses:

- U.S. Coast Guard requirements
- ISO Code
- ANSI Code

- **Total hours: 19.5.**

Remember

“*As the offshore wind industry continues to grow, training venues must not only keep pace with demand but also continuously update training modules to reflect advances in technology and lessons learned*.”

SUNY Maritime College Prposed Time Schedule for Offshore Wind BTT Electrical Module					
				Duration	
				GWO	SMC
	Lesson		Elements	Min.	Min.
1	Introduction	1.1	SAFETY INSTRUCTION AND EMERGENCY PROCEDURES		
		1.2	Facilities		
		1.3	Introduction (isntructor and individual delagate)		
		1.4	Aim and objectives		
		1.5	On-going assessment		
		1.6	Motivation		
			total	30	60
2	Introduction to electricity	2.1	Direct Current		
		2.2	Ohm's Law		
		2.3	Alternating Current		
		2.4	AC/DC		
			total	70	150
3	Electrical Safety	3.1	Why Electric Safty		
		3.2	Classification of voltages		
		3.3	PE and GFCI/RCD		
		3.4	Stored Energy		
		3.5	Static Electricity		
		3.6	Safety Signs		
		3.7	Types of PPE		
		3.8	The importance of approporiate Isolation		
			total	70	150
4	Electrical Components	4.1	Resistors		
		4.2	Batteries		
		4.3	Swithes		
		4.4	Contactors		
		4.5	Relays		
		4.6	Diodes		
		4.7	Bridge Rectifiers		
		4.8	Capacitors		
		4.9	Transformers		
		###	Generators and Motors		
		4.1	Fuses and circuit Breakers		
		4.1	processors and controllers		
			total	100	240
5	Sensors	5.1	Introduction to sensors		
		5.2	Wind Sensors		
		5.3	Temperature Sensors		
		5.4	Position Sensors		
		5.5	Other Sensors		
			total	90	180
6	Electrical Measuring	6.1	Symbols and settings on Measuring Instruments		
		6.2	How to use Electrical Measuring Instruments		
		6.3	Measuring Points (Nodes)		
			total	70	120
7	Electrical Circuits	7.1	Symbols and diagrams		
		7.2	Assembly of an electrical circuit		
			total	120	180
8	Review of theory	8.1	Summary		
		8.2	Test		
			total	30	60
9	Evaluation	9.1	Practical Test	15	30
			Total for BTT Electrical Modul in minutes	595	1170
			Total for BTT Electrical Modul in hours	9.92	19.5

Example of Course Offerings: Material Needed for BTT Electrical Module

- Personal Protective Equipment (PPE)
  - Insulating gloves, goggles, safety boots, and suitable clothing
  - Lockout Tag out equipment
  - Measuring devices
- Standard electrical circuit components
  - Power Supply or a transformer and a bridge rectifier
  - Electrical protection
  - Appropriate electric wires
  - Different value resistors
  - Lamps
  - Capacitors
  - Switches
  - Diodes
  - Terminals for rails
  - Normally Open (NO) and Normally Closed (NC) pushbutton
  - Contactors
  - Relays
  - Emergency Stop Button
  - PT 100 sensors

Potential Industry Partners

- Vineyard Wind
- Ørsted
- Equinor
- GE
- Atlantic Shores Offshore Wind
- US Offshore Wind Network
- Offshore Wind Business Network
- Global Wind Organization (GWO)
- OSVDPA
- Lloyd's Register
- Atlas
- Maersk Training
- DNV
- NYSERDA
- NYCEDC

Events/Workshops Participation

- Workboat Show – New Orleans, LA
- AWEA Conference – New York City
- NYSERDA: Wind Farm Port Working Technical Group
- NYSERDA – Wind Farm Job Workforce Technical Group
- NYSDOS: Marine Working Technical Group
- NYC Waterfront Advisory Group
- US Army Corp of Engineers Port Resilience Project Technical Advisory Group
- Farmingdale State College
- Norwegian Embassy event
- 3D Web Technology Wind Farm STEM Training (Providence Rhode Island)

Ongoing Activities

- Collect information from institutions and industry
- Attend meetings and conferences
- Prepare program funding needs to develop and offer the program (Identify external funding resources)
- Identify external partners to offer the skills required
- Review foreign (mostly European) programs on offshore wind
- Prepare/Respond/Initiate research needs by industry and regulators. Example: Vessel navigation safety margins in an OSW farm

Questions?

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