OFFSHORE WIND ACCELERATOR
PROJECT WEBINAR SERIES

Making History With VolturnUS
Dr. Habib Dagher, University of Maine - Orono

July 11, 2013
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This webinar is being recorded and will be made available after the call at www.cleanenergystates.org under Events. Previous webinar recordings are also posted.
Today’s Agenda

• Presentation by Dr. Habib Dagher, founding Director of the Advanced Structures and Composites Center at the University of Maine - Orono
• Time for questions
Please Submit Questions

Questions submitted from webinar participants will be addressed following the presentation. Please type your questions in the webinar console's Question box at any time during the broadcast.
Clean Energy States Alliance

CESA is a non-profit organization working with states, federal agencies, and municipalities to advance the renewable energy sector through:

- Information Exchange & Analysis
- Partnership Development
- Networking and Collaboration

www.cleanenergystates.org
Offshore Wind Accelerator Project

OWAP Objective: Address key challenges facing offshore wind in five focus areas

1. Ensure cooperation and communication among stakeholders and government leaders on priority problem-solving.
2. Improve regulatory approaches to support smart siting while reducing review costs & timelines.
3. Advance investment through power procurement collaborative networks and use of new financing mechanisms.
4. Advance opportunities, strategies, and collaboration to build a domestic OSW industry.
5. Implement a communication effort to ensure public education and stakeholder access to objective information.
Stay connected to OWAP!

• Offshore Wind WORKS campaign website: http://www.offshorewindworks.org

• Like us on Facebook: http://www.facebook.com/offshorewindworks

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Today’s Presenter

Dr. Habib Dagher

Dr. Dagher joins us from the University of Maine’s Advanced Structures and Composites Center, where he oversees 40 associated faculty and full-time staff and 150 graduate and undergraduate students. The University of Maine recently launched the U.S.’s first grid-connected floating offshore wind turbine, the VolturnUS prototype, which Dr. Dagher will discuss today.

Dr. Dagher received his doctorate in structural engineering from the University of Wisconsin-Madison. He holds two masters degrees in structural engineering and in engineering mechanics.
Thank you!

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Making History with VolturnUS

OWAP Webinar

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July 11, 2013
Outline

• The UMaine Composites Center
• Maine 5 GW by 2030 Plan
• 1:50 scale testing program
• VolturnUS 1:8 development
• DOE Advanced Technology Demo. Project
Advanced Structures and Composites Center

180 personnel
87,000 ft² space
15 years

Composites Industry

Construction Industry
Advanced Structures and Composites Center
World Leader in Composites Materials Development, Design and Testing

- 2007 ACMA Best of Show
- 2007 ACMA People’s Choice
- 2009 ACMA Most Creative Composites Product
- 2010 ACMA Most Creative Composites Product
- 2011 ASCE Pankow Innovation Award
Longest Composite Bridge in the World, 540ft (Maine, 2011)
Composite Pilings

✓ **Spinoff company:** Harbor Technologies, Brunswick, ME

✓ **Technology:** FRP tubes designed and developed at UMaine

✓ **Pilot line:** built and now selling product throughout the world.
"Bridge-in-a-Backpack"

**Technology:** Hybrid bridge system combining benefits of high-performance composites with cast-in-place concrete.
Penobscot Narrows Bridge, Maine

CFRP Strands
Composite Ship Structures
MAKO Composite Patrol Craft
“Family Energy”\textsuperscript{1,2} = 50\% Transportation
40\% Heating
10\% Electric Power

\textsuperscript{1} Source:, Dr. George Hart, UMaine
\textsuperscript{2} Based July ’08 energy costs
\textsuperscript{3} Assumes that health care costs do not grow past
30\% of the average family budget in 2008-2018
Maine Plan: 5GW Floating 2030

- Maine's 5GW by 2030 plan
- $/kWh

Can Floating Turbines Compete?

- DeepCwind Technology Roadmap
  - Floating Design Competition
  - 1:50 Scale Testing (April - May 2011)
  - 1:3 Scale Testing (July 2012, 2013)
  - 25 MW Pilot Farm (2017)
  - 0.5-1GW Floating Farm (2020)
- UMaine Deepwater Test Site
- UMaine Offshore Wind Laboratory

- OFFSHORE WIND
  - $20 billion, 15,000 jobs

- LAND-BASED WIND
  - $7 Billion

- HOME HEATING
  - Save 40-60%
  - Weatherize, 30 years
  - Heat pumps, 30 years
  - $1 Billion revolving loan

- Smart Grid

- TRANSPORTATION
  - Save 40-60% PEHV, 30 years

- Maine
  - Export to NE
Maine Timeline: 5GW Floating by 2030

Maine Just Won 2 of 7 DOE FOAs Pilot Farms.

Phase 1 - 1:50 Scale

Phase 2 - 1:8 Prototype

Phase 3 - Pilot Farm: 12 MW

Phase 4 - 500 MW Farm

Phase 5 - 5 GW by 2030
Challenges & Opportunities for Offshore Wind in the Northeast US

#1 Challenge: 
Reduce Cost of Offshore Wind

Supply Standard Offer - Historic and Projected - BHE

Challenging Goal: 10 cents/kWh in 2020’s @ Grid?

Source: Jake Ward, UMaine
Maine PUC data - Not inflation adjusted

Dr. H. J. Dagher, (207) 581-2138 hd@umit.maine.edu
Land-based

- Shallow < 30 m
- Transitional 30-60 m
- Deepwater > 60 m
Gulf of Maine Region Lacks Heavy Offshore Construction Assets
Gulf of Maine Region Lacks Heavy Offshore Construction Assets
Normalized Annual Production in Gulf of Maine: Hilltop, Near-shore, and Far Offshore Sites

Hill Top Near Shore Far Offshore

Sites Considered (12 years of data)
3 Hulls, 60 Metocean Conditions

All viable!
Choice depends on local conditions
1:50 Scale Test Results

Low Nacelle Surge Acceleration

Low Tower Bending Moment

Wave Energy

$H_s = 7.1 \text{ m}$

$H_s = 10.5 \text{ m}$
VolturnUS 1:8 Scale

1. UMaine Fabrication
2. Brewer Assembly-Launch
3. Castine Testing:
   1:8 scale wave environment
   Downsize turbine
Construction of VolturnUS 1:8 at UMaine Offshore Wind Lab
Completed VolturnUS 1:8 Hull at UMaine Offshore Wind Lab
DOE FOA DE-FOA-0000410

**Advanced Technology Demonstration Projects**

**Grid Parity Goal**

2013 – 50% design
2014 – 100% design, costs
2015 – Start construction
2016 – 1st turbine connect grid
2017 – 2nd turbine connect grid

New England
**Aqua Ventus I**
2x6MW = 12MW
UMaine Monhegan Island Test Site

- Established by Maine Public Law 270
- 9.2 m/s winds at 90 meters.
- 12 years of metocean data.
- Bottom characterization/core sampling.
- Fish, bird, bat, benthic invertebrate and marine mammal pre-deployment monitoring accomplished.
- FONSI received for scale project in 2011.

UMaine Deepwater Offshore Wind Test Site at Monhegan Island in the Gulf of Maine.
Summary

• Maine 5GW by 2030 plan
• VolturnUS:
  – Unique semisubmersible concrete & composite materials
  – Can be manufactured dock-side
  – No jack-up barges, No heavy cranes offshore
  – Reduce O&M costs, extend life beyond typical 20-25 years
• VolturnUS development:
  – 1:50 scale tests of 3 designs (2008-2009)
  – 1:8 scale VolturnUS (2013); deepCLIDAR (2013)
  – Full-scale demo 12 MW DOE FOA (2016)
  – Commercial farm 500 MW (2020’s)
• Data Collection on VolturnUS 1:8, about 1 year
Acknowledgments

DOE, NSF, UMaine, MTI, State of Maine
In Castine, Maine, on June 13, 2013, at noontime, the first offshore wind electrons started to flow into the US electricity grid.