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Optimizing Large Wind Farms

Team from U.S. and Belgium Calculates Best Spacing for Turbines is Farther Apart
Presentation at Fluid Dynamics Meeting Today in Long Beach, CA

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EMBARGOED for release until 4:30 p.m. Eastern time (U.S.) on Tuesday, Nov. 23, 2010

Contact: Jason Socrates Bardi,
American Institute of Physics
301-209-3091, office
858-775-4080, cell
jbardi@aip.org

WASHINGTON, D.C., November 23, 2010 -- Wind farms around the world are large and getting larger. Arranging thousands of wind turbines across many miles of land requires new tools that can balance cost and efficiency to provide the most energy for the buck.

Charles Meneveau, who studies fluid dynamics at Johns Hopkins University, and his collaborator Johan Meyers from Leuven University in Belgium, have developed a model to calculate the optimal spacing of turbines for the very large wind farms of the future. They will present their work today at the American Physical Society Division of Fluid Dynamics (DFD) meeting in Long Beach, CA.

"The optimal spacing between individual wind turbines is actually a little farther apart than what people use these days," said Meneveau.

The blades of a turbine distort wind, creating eddies of turbulence that can affect other wind turbines farther downwind. Most previous studies have used computer models to calculate the wake effect of one individual turbine on another.

Starting with large-scale computer simulations and small-scale experiments in a wind tunnel, Meneveau's model considers the cumulative effects of hundreds or thousands of turbines interacting with the atmosphere.

"There's relatively little knowledge about what happens when you put lots of these together," said Meneveau.

The energy a large wind farm can produce, he and his coworkers discovered, depends less on horizontal winds and more on entraining strong winds from higher in the atmosphere. A 100-meter turbine in a large wind farm must harness energy drawn from the atmospheric boundary layer thousands of feet up.

In the right configuration, lots of turbines essentially change the roughness of the land -- much in the same way that trees do -- and create turbulence. Turbulence, in this case, isn't a bad thing. It mixes the air and helps to pull down kinetic energy from above.

Using as example 5 megawatt-rated machines and some reasonable economic figures, Meneveau calculates that the optimal spacing between turbines should be about 15 rotor diameters instead of the currently prevalent figure of 7 rotor diameters.

The presentation, "Optimization of turbine spacing in the fully developed wind turbine array boundary layer is at 1:42 p.m. on Tuesday, November 23, 2010 in the Long Beach Convention Center Room: 102B. ABSTRACT:
http://meetings.aps.org/Meeting/DFD10/Event/134047

This work is funded by the National Science Foundation's "Energy for Sustainability" program.

NOTE: An image is available to accompany this story. Contact jbardi@aip.org

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MORE MEETING INFORMATION
The 63rd Annual DFD Meeting is hosted this year by the University of Southern California, California State University Long Beach, California Institute of Technology, and the University of California, Los Angeles.

It will be held at the Long Beach Convention Center, located in downtown Long Beach, California. All meeting information, including directions to the Convention Center is at:
http://www.dfd2010.caltech.edu/

USEFUL LINKS
Main meeting Web site: http://www.dfd2010.caltech.edu/
Search Abstracts: http://meetings.aps.org/Meeting/DFD10/SearchAbstract
Directions to Convention Center: http://www.longbeachcc.com/

PRESS REGISTRATION
Credentialed full-time journalist and professional freelance journalists working on assignment for major publications or media outlets are invited to attend the conference free of charge. If you are a reporter and would like to attend, please contact Jason Bardi (jbardi@aip.org, 301-209-3091).

ONSITE WORKSPACE FOR REPORTERS

A reserved workspace with wireless internet connections will be available for use by reporters in the Promenade Ballroom of the Long Beach Convention Center on Sunday, Nov. 21 and Monday, Nov. 22 from 8:00 a.m. to 5:00 p.m. and on Tuesday, Nov. 23 from 8:00 a.m. to noon. Press announcements and other news will be available in the Virtual Press Room (see below).

VIRTUAL PRESS ROOM
The APS Division of Fluid Dynamics Virtual Press Room will be launched in mid-November and will contain dozens of story tips on some of the most interesting results at the meeting as well as stunning graphics and videos. The Virtual Press Room will serve as starting points for journalists who are interested in covering the meeting but cannot attend in person. See: http://www.aps.org/units/dfd/pressroom/index.cfm

GALLERY OF FLUID MOTION
Every year, the APS Division of Fluid Dynamics hosts posters and videos that show stunning images and graphics from either computational or experimental studies of flow phenomena. The outstanding entries, selected by a panel of referees for artistic content, originality and ability to convey information, will be honored during the meeting, placed on display at the Annual APS Meeting in March of 2011, and will appear in the annual Gallery of Fluid Motion article in the September 2011 issue of the American Institute of Physics' journal, Physics of Fluids.

This year, selected entries from the 28th Annual Gallery of Fluid Motion will be hosted as part of the Fluid Dynamics Virtual Press Room. In mid-November, when the Virtual Press Room is launched, another announcement will be sent out.

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ABOUT THE APS DIVISION OF FLUID DYNAMICS
The Division of Fluid Dynamics of the American Physical Society (APS) exists for the advancement and diffusion of knowledge of the physics of fluids with special emphasis on the dynamical theories of the liquid, plastic and gaseous states of matter under all conditions of temperature and pressure. See: http://www.aps.org/units/dfd/

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