BOEM
Bureau of Ocean Energy Management

Microclimate Formation within Wind Turbine Arrays and Its Effects on Local Weather and Climate

February 12, 2008: Wake Clouds at Horns Rev Facility in the North Sea

Callie M. Hall
Oceanographer

Office of Renewable Energy Programs
callie.hall@boem.gov

BOEM
Bureau of Ocean Energy Management

Microclimate Formation within Wind Turbine Arrays and Its Effects on Local Weather and Climate

Information Needs

- Installation of turbine arrays (possibly composed of 100+ turbines) within small OCS areas could result in localized changes in area's microclimate
- Result of fog or "sea smoke" alteration to the area has environmental consequences that must be analyzed as part of NEPA process

BOEM
Bureau of Ocean Energy Management

Microclimate Formation within Wind Turbine Arrays and Its Effects on Local Weather and Climate

Background

- Microclimate = small, local area having distinct weather or weather effects. Most recently validated within wind turbine arrays when local meteorological conditions are favorable for artificial atmospheric vertical mixing caused by wind turbine generators and resulting in turbulence from this vertical mixing in the wake of the wind turbine array.

- Public comments from the Cape Wind Energy Project expressed concerns of microclimates that may occur in Nantucket Sound due to proposed wind turbine generators

BOEM
Bureau of Ocean Energy Management

Microclimate Formation within Wind Turbine Arrays and Its Effects on Local Weather and Climate

Objectives

- ✓ Determine the frequency of local meteorological conditions conductive to creating a microclimate within a wind turbine array and assess the environmental consequences resulting from wind energy facility installation
- ✓ Adapt regional climate model and use nested modeling method to develop a fine grid for assimilation of micro- and local climate regimes
- ✓ Develop and integrate numerical analysis of microclimate process into local climate model
- ✓ Generate and evaluate variation of local climate by installing wind turbine arrays within modeling runs

BOEM
Bureau of Ocean Energy Management

Microclimate Formation within Wind Turbine Arrays and Its Effects on Local Weather and Climate

Methods

- ✓ Determine local met conditions conductive to creating a microclimate within wind turbine array
- ✓ Determine the frequency and longevity of such conditions
- ✓ Analyze met variables of a microclimate resulting from the installation of a wind energy facility
- ✓ Analyze long-term weather and climatic impacts of microclimate formation