

Welcome to the BOEM-Oregon Science Exchange



March 16, 2016 - 10:00 am

Audio: call toll free 1-877-612-1641, passcode: 5729109

We will begin shortly!

If you are having audio difficulties,
please send us a chat message on WebEx.

Dave Ball



Dave Ball is the Pacific Region Historic Preservation Officer and Regional Tribal Liaison for the U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM). Dave joined the BOEM Gulf of Mexico Region office in 1999 and transferred to the Pacific Region office in 2010. He received a Bachelor of Arts degree in anthropology from Sonoma State University in 1992 and a Master of Arts degree in anthropology from Florida State University in 1998. Dave currently serves as an elected Officer for the Advisory Council on Underwater Archaeology, an international advisory organization supporting underwater cultural heritage preservation. He has managed the important visual evaluations study for the Pacific Region.



Renewable Energy Visual Evaluations: *Visual Impact Evaluation System for Offshore Renewable Energy (VIESORE)*

Argonne National Laboratory and
Center for Advanced Spatial Technologies



Dave Ball

Pacific Region Historic Preservation Officer



BOEM Information Need:

A tool to assess the potential visual impacts associated with offshore wind energy projects.

“Visual impacts are defined as changes to the scenic attributes of the landscape brought about by the introduction of visual contrasts (e.g, development) and the associated changes in the human visual experience of the landscape.”

From: Sullivan and Meyer (2014:17) *Guide to Evaluating Visual Impact Assessment for Renewable Energy Projects*
<http://visualimpact.anl.gov/npsguidance/>



The primary sources of visual contrast associated with operating offshore wind energy facilities include:

- Vertical line contrasts associated with the wind turbine towers;
- Color contrast from the white or light gray tower and blade structures, generally seen against a sky backdrop when viewed from shore but occasionally viewed against a water backdrop from elevated onshore locations;
- Form contrast from the array as a whole;
- Motion of the wind turbine blades;
- Color contrast from aviation obstruction lighting at night; and
- Color contrast from marine navigation lighting at night.

From Sullivan and Meyer (2014:55)



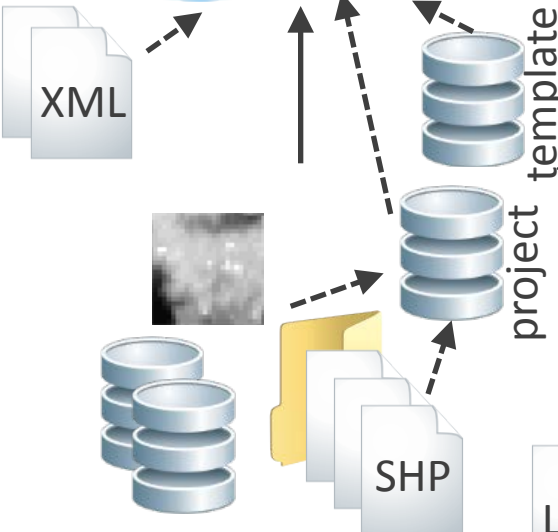
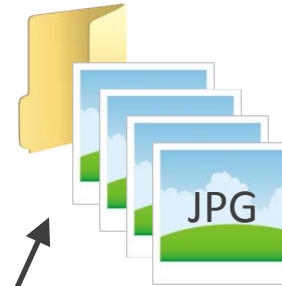
System design

ArcGIS 10.1
friendly interface

ArcGIS 10.1
Script tools

Renders

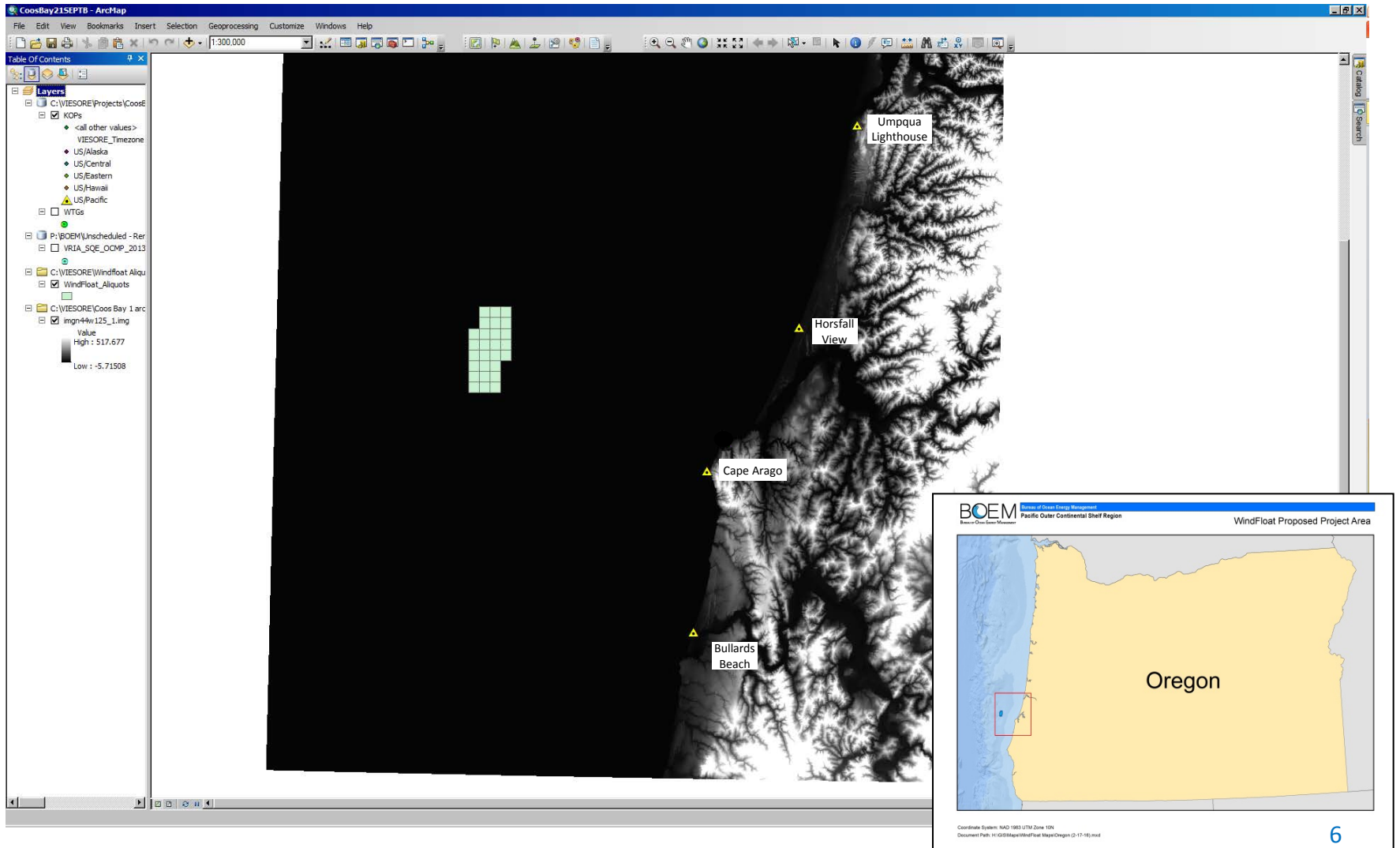
Reports



Import Digital Elevation Model (DEM) into ArcGIS 10.1

The screenshot displays the ArcGIS 10.1 interface. The main map area shows a grayscale Digital Elevation Model (DEM) of a coastal region. The Layers panel on the left shows the project structure, with the DEM file 'imgn44v125_1.img' selected. An inset map in the bottom right corner shows the location of the project area within the state of Oregon, with a red box indicating the specific geographic area being evaluated.

Create Known Observation Points (KOPs)



Add Wind Turbine Generator (WTG) locations

The screenshot displays the ArcMap interface for a project named 'CoosBay21SEPT18'. The main map area shows a grayscale topographic map of the Coos Bay region. Several locations are marked with yellow triangles and labeled: Umpqua Lighthouse, Horsfall View, Cape Arago, and Bullards Beach. A callout box with a white background and black text reads 'For demonstration purposes only' and is connected to a specific area on the map by blue lines. A dashed blue arrow points from the 'WTGs' layer in the Table of Contents to the VIESORE window. The VIESORE window is open, showing a grid of green cells with a red circle around one cell. The window title is 'VIESORE' and it contains a 'Value' section with 'High : 517.677' and 'Low : -5.71508'. The Table of Contents on the left lists various layers, including 'KOPs', 'VIESORE_Timezone', and 'WTGs'. The VIESORE window is also visible in the bottom right corner of the map area.

For demonstration purposes only

Umpqua Lighthouse

Horsfall View

Cape Arago

Bullards Beach

BOEM Bureau of Ocean Energy Management Pacific Outer Continental Shelf Region

WindFloat Proposed Project Area

Oregon

Coordinate System: NAD 1983 UTM Zone 10N
Document Path: H:\GIS\MapServer\Fuel Maps\Oregon (0-17-16).mxd

Renewable Energy Visual Evaluations: VueGen Module

VueGen Module:



VIESORE VueGen | CoosBay21SEPT8

KOPs

- 1 - CapeAragoLight
- 2 - BullardsBeach
- 3 - CapeAragoNorthCove
- 4 - HorsfallViewpoint
- 5 - UmpquaLight

Beach

Beach color

- White
- Medium beige
- Dark beige

Rock size

- No rocks
- 10-12 inches
- 8-12 feet
- 1-2 inches
- 2 feet
- 20-30 feet

Weather

Wind speed

- Calm
- Gentle breeze
- High wind

Wind direction

- North
- South
- East
- West

Cloud cover

- Sunny 0% clouds
- Sunny 20% clouds
- Cloudy 60% clouds
- Cloudy 100% clouds

WTGs

Nacelle Model

- WindFloat-Siemens
- Mono-Siemens
- Mono-Senvion

Nacelle orientations

- With wind
- Random

Number of randomly facing nacelles

1 10 100

Degrees randomness left or right side of wind direction

1 10 180

Queue

SCENE 1 - KOP #3 (CapeAragoNorthCove)

Beach color: Medium beige
 Rock size: 10-12 inches
 Wind speed: High wind
 Wind direction: West
 Cloud cover: Sunny 20% clouds
 Haze level: None
 Fog level: None
 Nacelle model: WindFloat-Siemens
 Nacelle orientations: With wind
 Number of random nacelles: N/A
 Nacelle degrees randomness: N/A
 Simulation date: 7/1/2015
 Simulation time: 08:00 PM
 Render quality: Final
 Camera orientation: Center of turbine array

SCENE 2 - KOP #3 (CapeAragoNorthCove)

Beach color: Medium beige
 Rock size: 10-12 inches
 Wind speed: Gentle breeze
 Wind direction: West
 Cloud cover: Sunny 20% clouds
 Haze level: None
 Fog level: None
 Nacelle model: WindFloat-Siemens
 Nacelle orientations: With wind
 Number of random nacelles: N/A
 Nacelle degrees randomness: N/A
 Simulation date: 7/1/2015
 Simulation time: 08:00 PM
 Render quality: Final
 Camera orientation: Left edge of turbine array

Edit Cancel Remove

Save Config Load Config ?

Viewer's Perspective

Camera orientation

- Left edge of turbine array
- Center of turbine array
- Right edge of turbine array
- By bearing

By bearing

N of W	N of E
<input type="checkbox"/>	<input type="checkbox"/>
S of W	S of E
<input type="checkbox"/>	<input type="checkbox"/>

Rendering

Simulated date: 7/ 1/2015

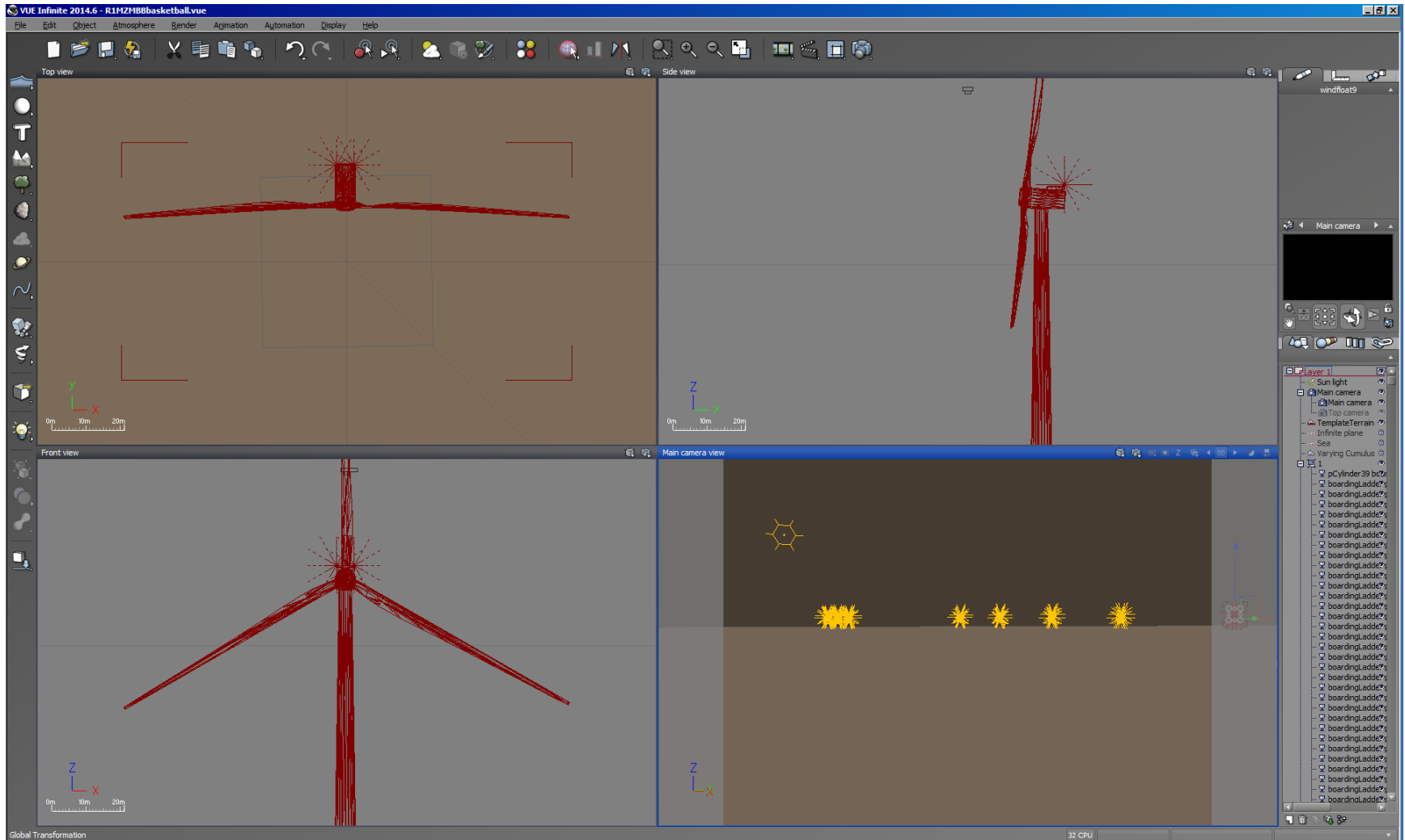
Simulated time: 08:00 PM

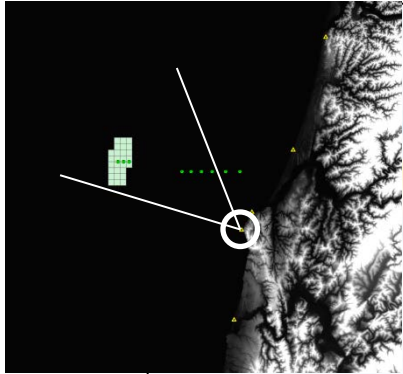
Render quality: Preview Final

Add to Queue >>

Quit Render

Rendering in Vue Infinite





Proposed
Windfloats:
16.5-17.5
miles



10.3 miles



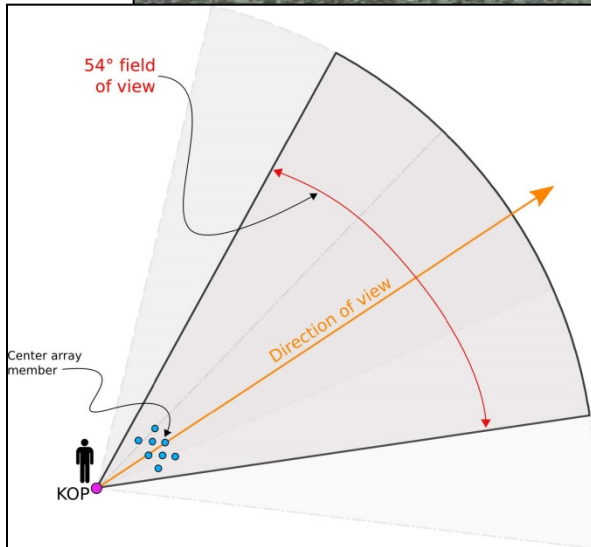
9.5 miles



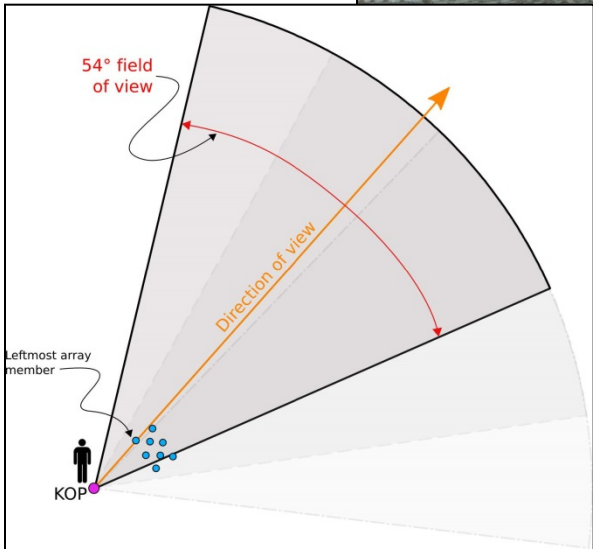
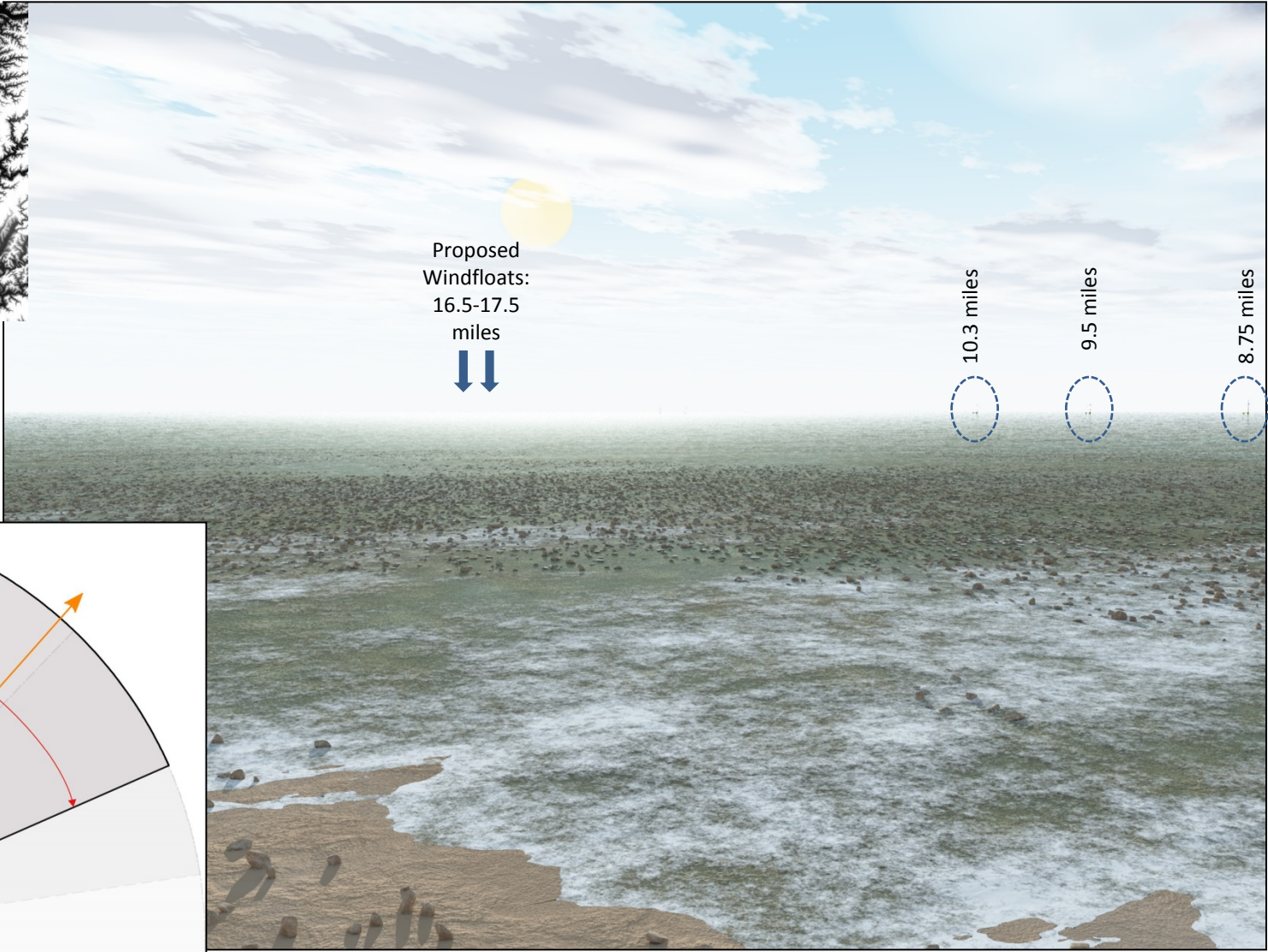
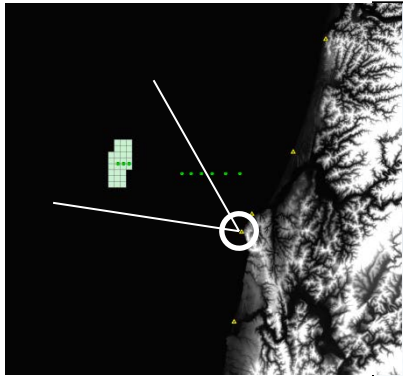
8.75 miles



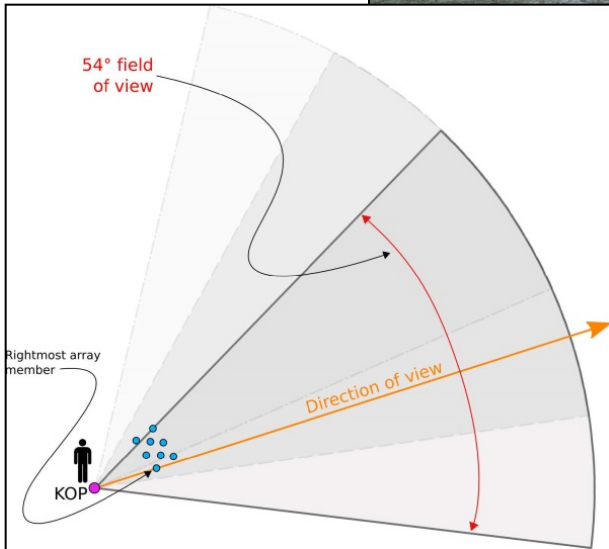
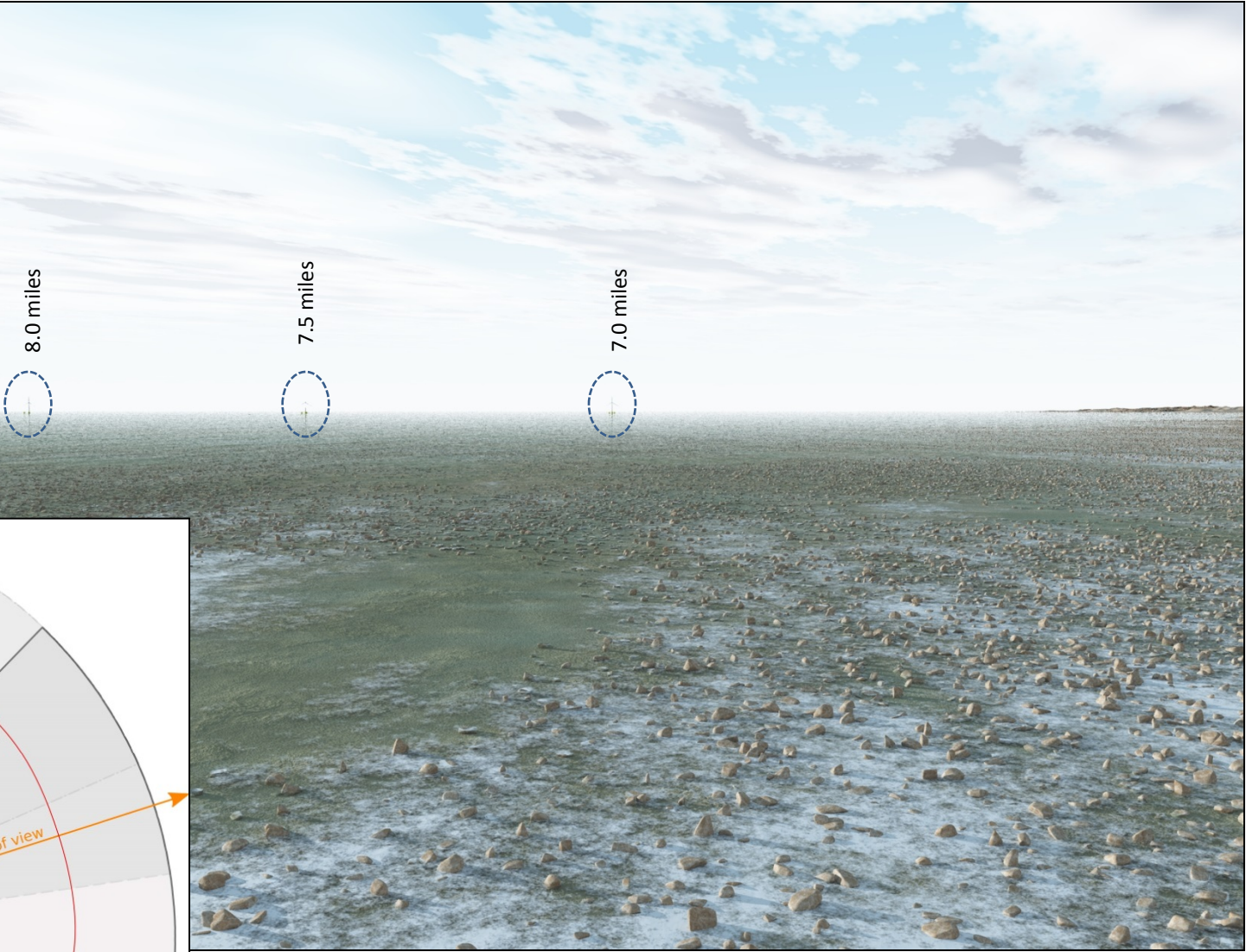
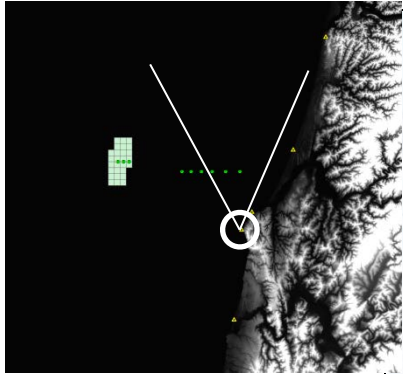
8.0 miles



Renewable Energy Visual Evaluations: Left Perspective



Renewable Energy Visual Evaluations: Right Perspective



The formula for calculating the horizontal field of view (FoV) is:

$$FoV = 2 \arctan \frac{w}{2f}$$

Where:

- *FoV* is the horizontal field of view in degrees (54.4 degrees for VIESORE)
- *w* is the width of the image (or camera sensor in a digital camera; 36 millimeters for VIESORE)
- *f* is the lens focal length in millimeters (35 millimeters for VIESORE)
- *arctan* is a standard mathematical function, with the result expressed in degrees

The formula for calculating the correct viewing distance is:

$$V = \frac{i}{2} / \tan \frac{FoV}{2}$$

Where:


- *V* is the correct viewing distance
- *i* is the width of the displayed image
- *FoV* is the horizontal field of view in degrees
- *tan* is a standard mathematical function

Visual Resource Analysis
at Argonne National Laboratory
Advancing informed visual impact analysis and mitigation

Offshore Wind Turbine Visibility and Visual Impact Threshold Distances

Field observations of offshore wind facilities in the United Kingdom revealed that the facilities may be visible at distances of 26 mi (42 km) in daytime and 24 mi (39 km) in nighttime views, and may be a major focus of visual attention at distances of up to 10 mi (16 km).

- Online Database
- Google Earth KMZ (04/12, 4/18)
- Publication (PDF, 8/08)



Thames Offshore Wind Facility, Kent, U.K.

The potential visual impacts that development of offshore wind facilities may have on coastal lands has emerged as a major concern in the United States and Europe. The visual impacts to seascapes associated with offshore wind facilities are without precedent; the facilities are very large, with structures of enormous height having colors and a geometry that contrast strongly with natural seascapes. The synchronized swaying movement of the massive blades during the day and the synchronized flashing of the lighting at night contribute to the facilities' visibility over very long distances.

As additional projects are proposed, visual impacts will certainly be a key issue in determining the ultimate success of offshore wind projects in the United States, as the need to protect local interests and landscape quality is balanced with the need to respond to changing energy policies that promote renewable energy development.

Optimal siting of offshore facilities requires accurate knowledge of the relationship between the distance of turbines from coastal viewpoints and their visibility. Past assessments of offshore wind turbine visibility were based on the smaller turbines and facilities in use at the time; thus, the studies may underestimate visibility for current projects, which use greater numbers of larger turbines. Although the effect of distance on the visibility of offshore wind turbines from onshore locations in both daytime and nighttime settings is poorly understood, it is a key factor in determining potential impacts to onshore locations from offshore wind facilities. As there are no offshore commercial wind facilities in operation in the United States, field observations must be conducted in other countries.

Study Summary

As part of a [larger study](#) sponsored by the U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM), Argonne National Laboratory's Environmental Science Division (EVS) and the University of Arkansas Center for Advanced Spatial Technology (CAST) conducted a preliminary assessment of the visibility of offshore wind facilities in the United Kingdom. Study objectives included identifying the maximum distances at which the facilities could be seen in both daytime and nighttime views and assessing the effect of distance on the visual contrast associated with the facilities. Observations were made by either two or three observers, including staff from EVS, CAST, and BOEM. Facility visibility was rated on a numeric scale and keyed to text descriptions of apparent contrast levels.

The observed facilities were located in the Irish Sea near Liverpool, the North Sea near Egersund, and in or near the Thames Estuary. The facilities ranged in size from 25 to 140 turbines and were located within 3.4 to 32.3 mi (5.6 to 52 km) of the viewpoints. Elevations for the viewpoints varied from near sea level to 840 ft (256 m).

Study Results

A total of 48 daytime observations of 11 offshore wind facilities were made from 28 onshore locations, and 6 additional observations were made at night.

Results showed that under favorable viewing conditions, small to moderately sized facilities were visible to the unaided eye at distances greater than 26 mi (42 km), with turbine blade movement visible up to 24 mi (39 km). At night, aerial hazard navigation lighting was visible at distances greater than 24 mi (39 km). The observed wind facilities were judged to be a major focus of visual attention at distances up to 10 mi (16 km), were noticeable to casual observers at distances of almost 16 mi (26 km), and were visible with extended or concentrated viewing at distances beyond 26 mi (40 km).


The preliminary assessment fieldwork was conducted in 2011. Study photographs and associated data are available through an [online database](#) and a [Google Earth KMZ file](#) (04/12, 4/18). Interim and final study results will be incorporated into project reports and a [publication](#) (PDF, 8/08).

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For More Information

To learn more about EVS visual resource analysis projects, contact:

Robert Sullivan
(830) 252-4182
rsullivan@anl.gov



http://visualimpact.a... Information for Using the ...

File Edit View Favorites Tools Help

Observed Wind Facilities

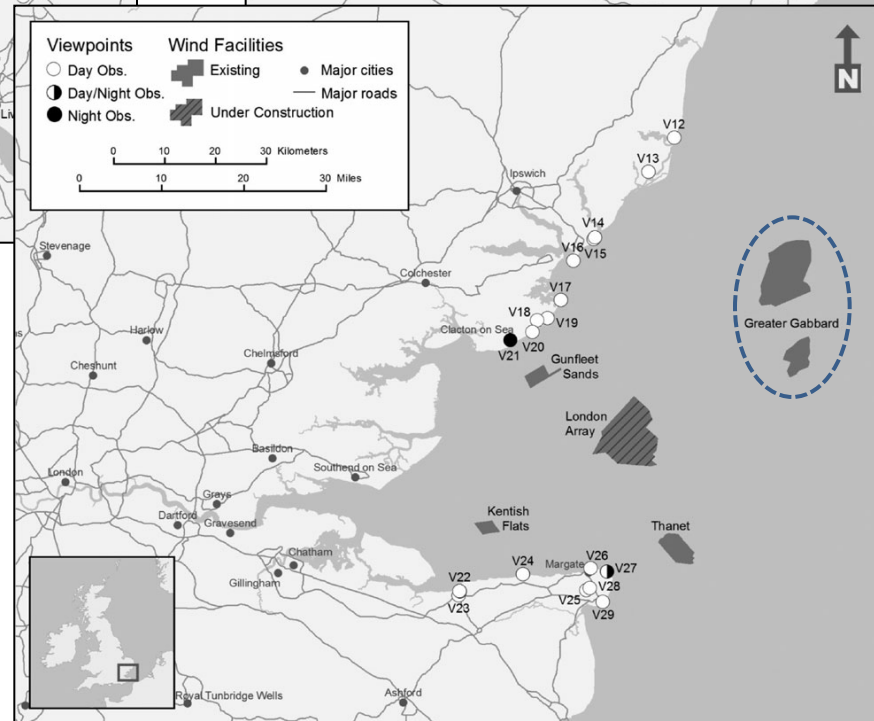
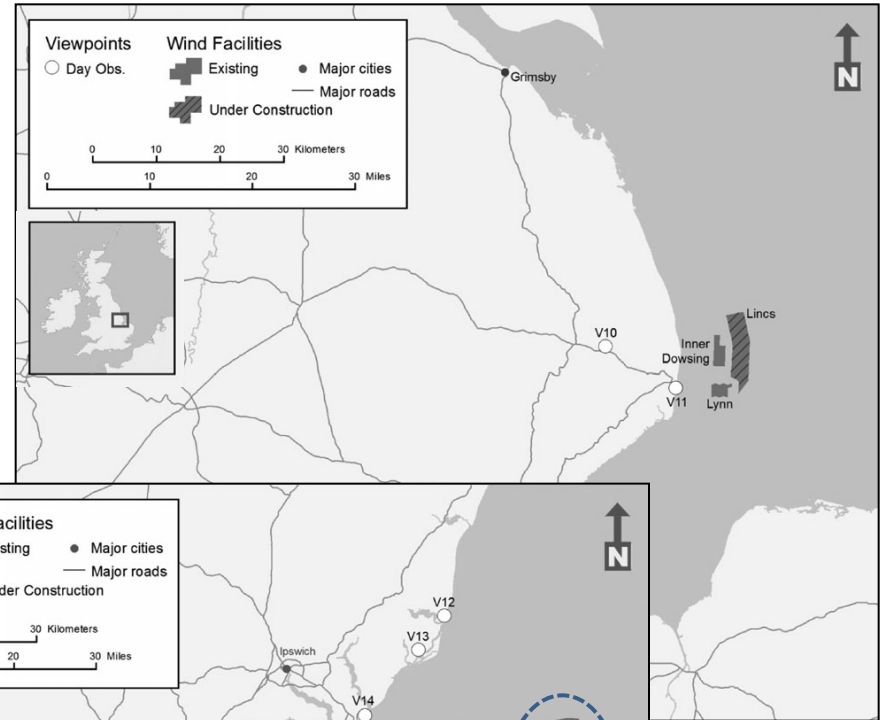
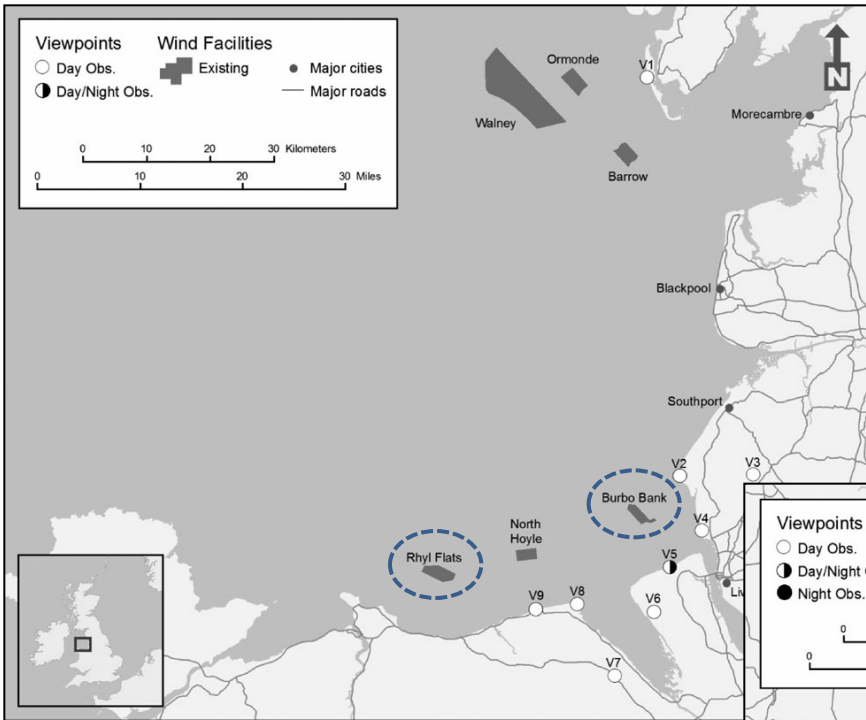
The offshore wind facilities that were observed in the study, along with facility descriptions and onshore viewpoints, are listed below.

Wind Facility	Description	Viewpoints/Distance to Facility/Elevation ²
Barrow	30 Vestas V90/3000; 3.0 MW 75-m hub height; 90-m rotor diameter 90 MW total installed power 1 offshore substation	V1: Walney Island/11.5 km/10 m
Burbo Bank	25 Siemens SWT-3.6-107; 3.6 MW 83.5-m hub height; 107-m rotor diameter 324 MW total installed power	V2: Formby Point/8.2 km/4 m V3: Clieves Hill/18.4 km/57 m V4: Crosby Marina/7.4 km/7 m V5: Leasowe Castle/7.9 km/17 m V6: Thurston Common/14.1 km/85 m V7: A55 Footbridge/24.6 km/256 m V8: Point of Ayr/16.7 km/8 m V9: Prestatyn Nova Center/21.9 km/5 m
Greater Gabbard	140 Siemens SWT-3.6-107; 3.6 MW 78-m hub height; 107-m rotor diameter 504 MW total installed power	V12: Greater Gabbard Viewpoint/31.0 km/6 m V13: Orford Castle/29.7 km/13 m V14: Felixstowe Seaford/34.2 km/8 m V15: Felixstowe Road/34.4 km/9 m V17: Naze Tower/41.0 km/48 m
Gunfleet Sands	48 Siemens SWT-3.6-107; 3.6 MW 75-m hub height; 107-m rotor diameter 172.8 MW total installed power One substation	V13: Orford Castle/43.9 km/13 m V14: Felixstowe Seaford/27.8 km/8 m V16: Landguard Fort Beach/22.2 km/4 m V17: Naze Tower/14.1 km/48 m V18: Great Holland/10.1 km/21 m V19: Greensward, Friston-on-Sea/10.9 km/13 m V20: Great Holland County Park/7.7 km/8 m V21: Clacton Pier Area/6.8 km/13 m V24: Reculver Castle/Towers/38.6 km/ 6 m V25: Coldwood Road/42.3 km/ 47 m
Kentish Flats	30 Vestas V90/3000; 3.0 MW 70-m hub height; 90-m rotor diameter 90 MW total installed power	V22: Bayview Road/Windmill Road/12.8 km/ 48 m V23: Clapham Hill/13.5 km/62 m V24: Reculver Castle/Towers/10.4 km/ 6 m V28: Haine Road Roundabout/Margate/22.5 km/ 54 m
Lynn and Inner Dowsing ¹	54 Siemens SWT-3.6-107; 3.6 MW 85-m hub height; 107-m rotor diameter 194.4 MW total installed power	V10: Candlesby Hill/16.9 km/59 m V11: Skegness Beach Lagoon Walk/5.5 km/4 m
North Hoyle	30 Vestas V80/2000; 2.0 MW 67-m hub height; 80-m rotor diameter 60 MW total installed power	V2: Formby Point/25.7 km/ 4m V5: Leasowe Castle/21.1 km/17 m V9: Prestatyn Nova Center/7.9 km/5 m
Rhyl Flats	25 Siemens SWT-3.6-107; 3.6 MW 75-m hub height; 107-m rotor diameter 90 MW total installed power	V2: Formby Point/39.2 km/4 m V5: Leasowe Castle/34.1 km/17 m V6: Thurston Common/32.0 km/ 85 m V9: Prestatyn Nova Center/13.9 km/5 m
Thanet	100 Vestas V90/3000; 3.0 MW 70-m hub height; 90-m rotor diameter 300 MW total installed power One offshore substation	V24: Reculver Castle/Towers/28.6 km/ 6 m V26: Fort Lower Promenade/15.3 km/ 11 m V27: Fyreness Hotel/12.3 km/ 20 m V29: Marina Road, Margate/15.8 km/20 m
Walney Island	102 Siemens SWT-3.6-107; 3.6 MW 80- to 90-m hub height 107- to 120-m rotor diameter 367.2 MW total installed power	V1: Walney Island/17.0 km/10 m
Ormonde	30 REpower 5M; 5.0 MW 90-m hub height; 126-m rotor diameter 150 MW total installed power	V1: Walney Island/9.5 km/10m

¹ Two neighboring developments combined into one by Centrica Renewable Energy Limited.
² Viewpoint elevation; includes two meters added to ground elevation to account for observer height.

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Renewable Energy Visual Evaluations: Threshold Distances



Visual Impact Distance Analysis:

- 11 Facilities (Irish Sea, North Sea, Thames Estuary);
- 29 Observation Points
- 49 Daytime Observations;
- 6 Nighttime Observations

Renewable Energy Visual Evaluations: Threshold Distances

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Field observations of offshore wind facilities in the United Kingdom revealed that the facilities may be visible at distances of 26 mi (42 km) in daytime and 24 mi (39 km) in nighttime views, and may be a major focus of visual attention at distances of up to 10 mi (16 km).

- [Online Database](#)
- [Google Earth HIVE](#) (HTML, AVI, etc.)
- [Publication](#) (PDF, DOCX)



Thanel Offshore Wind Facility, Kent, UK

The potential visual impacts that development of offshore wind facilities may have on coastal lands has emerged as a major concern in the United States and Europe. The visual impacts to seacoasts associated with offshore wind facilities are without precedent; the facilities are very large, with structures of enormous height having colors and a geometry that contrast strongly with natural seacoasts. The synchronized swaying movement of the massive blades during the day and the synchronized flashing of the lighting at night contribute to the facilities' visibility over very long distances.

As additional projects are proposed, visual impacts will certainly be a key issue in determining the ultimate success of offshore wind projects in the United States, as the need to protect local interests and landscape quality is balanced with the need to respond to changing energy policies that promote renewable energy development.

Optimal siting of offshore facilities requires accurate knowledge of the relationship between the distance of turbines from coastal viewpoints and their visibility. Past assessments of offshore wind turbine visibility were based on the smaller turbines and facilities in use at the time; thus, the studies may underestimate visibility for current projects, which use greater numbers of larger turbines. Although the effect of distance on the visibility of offshore wind turbines from onshore locations in both daytime and nighttime settings is poorly understood, it is a key factor in determining potential impacts to onshore locations from offshore wind facilities. As there are no offshore commercial wind facilities in operation in the United States, field observations must be conducted in other countries.

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The observed facilities were located in the Irish Sea near Liverpool, the North Sea near Ringnes, and in or near the Thames Estuary. The facilities ranged in size from 26 to 142 turbines and were located within 3.4 to 32.3 mi (5.5 to 52 km) of the observers. Elevations for the viewpoints varied from near sea level to 340 ft (104 m).

Study Results

A total of 48 daytime observations of 11 offshore wind facilities were made from 28 onshore locations, and 8 additional observations were made at night.

Results showed that under favorable viewing conditions, small to moderately sized facilities were visible to the unaided eye at distances greater than 26 mi (42 km), with turbine blade movement visible up to 24 mi (39 km). At night, aerial hazard navigation lighting was visible at distances greater than 24 mi (39 km). The observed wind facilities were judged to be a major focus of visual attention at distances up to 10 mi (16 km), were noticeable to casual observers at distances of almost 18 mi (29 km), and were visible with extended or concentrated viewing at distances beyond 26 mi (42 km).

The preliminary assessment framework was conducted in 2011. Study photographs and associated data are available through an [online database](#) and a [Google Earth HIVE file](#) (HTML, AVI, etc.). Interim and final study results will be incorporated into project reports and a [publication](#) (PDF, DOCX).

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For More Information

To learn more about EVIS visual resource analysis projects, contact:



Robert Sullivan
830-262-6112
sullivan@anl.gov



Google Earth

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Search:

Get Directions History

Places

- My Places
- Sightseeing Tour
- Temporary Places
- Offshore Wind Turbine VITD Analysis

Make new 3D Buildings layer is checked

Table/Disclaimer

Instructions

Burbo Bank

Greater Gabbard

Gunfleet Sands

Inner Dowsing

Kentish Flats

Offshore Wind Turbine Visual Impact Threshold Distance Analysis

<http://visualimpact.anl.gov/offshorevtd>

INSTRUCTIONS: This file contains data and photographs for the Offshore Wind Energy Facility Visibility and Visual Impact Threshold Distance Study conducted as part of the Visual Impact Evaluation System for Offshore Renewable Energy (VITD) development project at the Offshore Wind VITD study with additional data available, as are important [public data and user feedback](#). The database is now available through a [Google Earth HIVE](#).

Select one or more search criteria below to narrow study observation data and wind facility photographs. Records may be selected by facility name, distance, date, time of day, heading, a variety of lighting and weather conditions, average visibility rating, and view direction. Follow the links in the returned records to retrieve detailed observation forms and photographs.

Facility: All
 Burbo Bank
 Greater Gabbard
 Gunfleet Sands
 Inner Dowsing
 Kentish Flats
 Llyn
 North Hoyle
 New Fire
 Thanet
 Wylfa

Distance from observation point to facility: From: Miles To: Miles Not a distance

Turbine Lighting: Front
 Back
 Side
 None
 Other

Time of Day: Day Night

Click to look around

24.7 mi | SOP 302 | Thanet - 7.6 mi

26 mi

SOP 303 | Thanet - 9.8 mi

51°24'33" 50° N, 1°31'16.47" E elev: 48 ft

Eye alt: 15.66 m

Google earth

RESEARCH ARTICLES

Offshore Wind Turbine Visibility and Visual Impact Threshold Distances

Robert G. Sullivan, Leslie R. Kirchner, Jackson Colburn, Snow L. Winters

Potential visual impact on coastal lands has emerged as a major concern in the development of offshore wind facilities in the United States and Europe. Optimal siting of offshore facilities requires accurate knowledge of the relationship between distance and the visibility of wind turbines. Past assessments of offshore wind turbine visibility were based on smaller turbines and facilities in use at the time and underestimate visibility for current projects, which use more and larger larger turbines. This study is a preliminary assessment of the visibility of offshore wind facilities in the United Kingdom. Study objectives included identifying the maximum distances the facilities could be seen in both daytime and nighttime views and assessing the effect of distance on visual contrasts associated with the facilities. Results showed that under favorable viewing conditions, small to moderately sized facilities were visible to the unaided eye at distances greater than 26 mi (42 km), with turbine blade movement visible up to 24 mi (39 km). At night, aerial hazard navigation lighting was visible at distances greater than 24 mi (39 km). The observed wind facilities were judged to be a major focus of visual attention at distances up to 10 mi (16 km), were noticeable to casual observers at distances of almost 18 mi (29 km), and were visible with extended or concentrated viewing at distances beyond 26 mi (42 km).

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Environmental Practice Page 1 of 17

The Energy Policy Act of 2005 provided the United States (US) Department of the Interior's Bureau of Ocean Energy Management with the authority to issue

46410.01275146640641200464

Offshore Wind Turbine Visibility 1

Offshore Wind Turbine Visibility and Visual Impact Threshold Distances: Online Databases

Average Visibility Rating by Distance

Obs. ID	SOP ID	Date	Time	Facility	SOP Distance	Weather	Backdrop	Lighting Quality	Turbine Lighting	Marine Lighting/Paint Visible	Avg. Visibility Rating	Details
301	301	8/31/2011	2:07 PM	Thanet	9.0	Partly Sunny	Sky	Even Sun	Frontlit	Yes	3.75	View Details
302	302	8/31/2011	3:42 PM	Thanet	7.6	Partly Sunny	Sky	Even Shade	Shade	Yes	5.00	View Details
303	303	8/31/2011	5:18 PM	Thanet	9.8	High Cirrus	Sky	Even Sun	Frontlit	Yes	4.82	View Details
304	302	9/1/2011	7:16 AM	Thanet	7.6	Partly Cloudy	Sky	Even Sun	Backlit		5.00	View Details
308	302	9/1/2011	10:50 AM	Thanet	7.6	Partly Cloudy	Sky	Even Sun	Sidelit	Yes		View Details
311	311	9/1/2011	3:27 PM	Thanet	17.8	Fair	Sky	Even Sun	Frontlit		3.00	View Details

Offshore Wind Visual Impact Threshold Distance Analysis Study Database

Argonne

This interactive database contains data and photographs for the Offshore Wind Energy Facility Visibility and Visual Impact Threshold Distance Study (Offshore Wind VITD), conducted as part of the Visual Impact Evaluation System for Offshore Renewable Energy (MIESORE) development project. An [Introduction](#) to the Offshore Wind VITD study with additional links is available, as are important [study details and usage limitations](#). The database is also available through a [Google Earth KMZ](#) file.

Select one or more search criteria below to retrieve study observation data and wind facility photographs. Records may be selected by facility name, distance, time of day, backdrop, a variety of lighting and weather conditions, average visibility rating, and view direction. Follow the links in the returned records to retrieve detailed observation forms and photographs.

Facility: Barrow
 Burbo Bank
 Greater Gabbard
 Gunfleet Sands
 Inner Dowsing
 Kentish Flats
 Lynn
 North Hoyle
 Thanet
 Wainey

Distance from observation point to facility: From: 3 miles To: 28 miles
 Include records without a distance

Turbine Lighting: Frontlit
 Sidelit
 Backlit
 Shade
 [Blank]

Time of Day: From: 7:00 AM To: 7:00 PM

Date: From: 08/24/11 To: 09/01/11

Facility Backdrop: Sky
 Sky/Ground
 [Blank]

Lighting Quality: Even Shade
 Even Sun
 Part Sun/Part Shade
 [Blank]

Weather: Fair
 High Cirrus
 Mostly Cloudy
 Partly Cloudy
 Partly Sunny
 [Blank]

Marine Lighting/Paint Visible: Yes
 No
 [Blank]

Average Visibility Level: From: 1 To: 5
 Include records without an average visibility level


Direction of View: N NNW NW W WSW SW SSW S SSE SE ESE E ENE NE NNE NN N

Questions/Comments? Contact the [Webmaster](#).

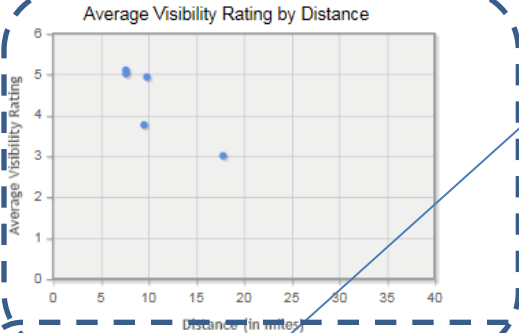
Offshore Wind Visual Impact Threshold Distance Analysis Study Database

[Search Form](#)

Offshore Wind Visual Impact Threshold Distance Analysis Study Database Search Results



Average Visibility Rating by Distance




Obs. ID	SOP ID	Date	Time	Facility
301	301	8/31/2011	2:07 PM	Thanet
302	302	8/31/2011	3:42 PM	Thanet
303	303	8/31/2011	5:19 PM	Thanet
304	302	9/1/2011	7:16 AM	Thanet
308	302	9/1/2011	10:50 AM	Thanet
311	311	9/1/2011	3:27 PM	Thanet

Questions/Comments? Contact the [Webmaster](#).

Offshore Wind Visual Impact Threshold Distance Analysis Study Database

[Search Form](#)

SOP 302



Facility:	Thanet
Latitude:	51.387693°
Longitude:	1.437141°
Distance:	7.6 mi
Direction:	ENE
Description:	Thanet - Fayreess Hotel

Observation(s) at SOP 302

Obs. ID	Date	Time	Facility	Obs. Distance	Weather	WTG Backdrop	WTG Lighting Quality	WTG Lighting Angle	Avg Visibility Rating	Details
302	8/31/2011	3:42 PM	Thanet	7.6 mi	Partly Sunny	Sky	Even Shade	Frontlit	5.08	View Details
304	9/1/2011	7:16 AM	Thanet	7.6 mi	Partly Cloudy	Sky	Even Sun	Backlit	5.00	View Details
308	9/1/2011	10:50 AM	Thanet	7.6 mi	Partly Cloudy	Sky	Even Sun	Sidelit Right	Not rated	View Details

Questions/Comments? Contact the [Webmaster](#).

Offshore Wind Visual Impact Threshold Distance Analysis Study Database

[Search Form](#)

SOP 302

Facility:	Thanet
Latitude:	51.387693°
Longitude:	1.437141°
Distance:	7.6 mi
Direction:	ENE
Description:	Thanet - Fyreness Hotel

Observation(s) at SOP 302

Obs. ID	Date	Time	Facility	Obs. Distance	Weather	WTG Backdrop	WTG Lighting Quality	WTG Lighting Angle	Avg Visibility Rating	Details
302	8/31/2011	3:42 PM	Thanet	7.6 mi	Partly Sunny	Sky	Even Shade	Frontlit	5.08	View Details
304	9/1/2011	7:16 AM	Thanet	7.6 mi	Partly Cloudy	Sky	Even Sun	Backlit	5.00	View Details
308	9/1/2011	10:50 AM	Thanet	7.6 mi	Partly Cloudy	Sky	Even Sun	Sidelit Right	Not rated	View Details

Questions/Comments? Contact the [Webmaster](#).

Offshore Wind Visual Impact Threshold Distance Analysis Study Database

[Search Form](#)

Observation 304

Observation ID / (Obs. # from form):	304 / (36)	SOP ID:	302
Date:	Sep. 1, 2011	Time:	7:16 AM (BST)
Facility:	Thanet	Direction:	ENE
Observation Distance:	7.6 mi	Location Description:	Thanet - Fyreness Hotel
Weather:	Partly Cloudy	Visibility:	Good
GPS Coordinates:	51.387700°, 1.437000°		
Vertical Angle of View (VAV) Descriptor:	Approximately Level		
Wind Turbine Generator (WTG) Backdrop:	Sky		
WTG Backdrop Lightness:	Light		
WTG Backdrop Contrast:	High		
WTG Backdrop Color:	Very light orange		
Approximate % WTG tower height visible:	100%		
Solar Azimuth:	89°	Solar Elevation:	10°
WTG Lighting Quality:	Even Sun		
Calculated WTG Lighting Angle:	Backlit		
Turbine Lighting:	Backlit		
WTG Apparent Spacing:	Mix		
WTG Apparent Height:	Regular		
Blades Visible?	Yes	Blade Movement Visible?	Yes
Blade Orientation:	Forward		
Glinting, shadow flicker or other transitory effects visible?	No		
Aviation Obstruction Lighting Visible?	No		
Marine Obstruction Lighting/Painting Visible?	No		
WTG Component Details Visible:	No		
Other Observations:			
Average visibility rating:	5.00		

Photos

Please Note: The preview photos have been resized and compressed. They are only intended as a rough approximation of the image. Only the high-resolution images should be used for analysis. High-resolution images vary in size up to 9MB. To determine correct viewing distance for photographs at each focal length, click the Calculate link under Viewing Distance. Enter desired image display size (e.g., your monitor width), and click Calculate.

Facility	Focal Length	Focal Length in 35mm Format	Caption	File Name	High-Resolution	Viewing Distance
Thanet	15.0 mm	27 mm	Thanet	DSC_3473.JPG	Download	Calculate
Thanet	25.0 mm	37 mm	Thanet	DSC_3404.JPG	Download	Calculate
Thanet	35.0 mm	57 mm	Thanet	DSC_3407.JPG	Download	Calculate
Thanet	52.0 mm	75 mm	Thanet	DSC_3392.JPG	Download	Calculate
Thanet	75.0 mm	112 mm	Thanet	DSC_3431.JPG	Download	Calculate
Thanet	105.0 mm	157 mm	Thanet	DSC_3434.JPG	Download	Calculate

Panorama

Interactive Panoramas require the free [Adobe Flash Player](#).

Facilities	Caption	Low-Resolution	High-Resolution
Thanet	180 Deg	Interactive Panorama JPEG	Interactive Panorama JPEG

Visibility Rating Forms

Observer	Visibility Rating	Adjusted Rating	Visibility Form
RGS	5	5.00	View Complete Form
SLW	5	5.00	View Complete Form
DAB	5	5.00	View Complete Form

Questions/Comments? Contact the [Webmaster](#).

Renewable Energy Visual Evaluations: Threshold Distances

Facility	Focal Length	Focal Length in 35mm Format
Thanet	18.0 mm	27 mm
Thanet	25.0 mm	37 mm
Thanet	38.0 mm	57 mm
Thanet	52.0 mm	78 mm
Thanet	75.0 mm	112 mm
Thanet	105.0 mm	157 mm



Offshore Wind Turbine Visual Impact Threshold Distance Analysis
http://visualimpact.anl.gov/offshorevitd

INSTRUCTIONS
This file contains data and photographs for the Offshore Wind Energy Facility Visibility and Visual Impact Threshold Distance Study conducted as part of the Visual Impact Evaluation System for Offshore Renewable Energy (VIESORE) development project.

IMPORTANT: See study details and usage limitations at <http://visualimpact.anl.gov/offshorevitd>

These instructions assume the use of Google Earth. If you are using another viewer, the menu options may vary.

VIEW SOPS AND DATA
Use this file to view study observation points (SOPs), data forms, and wind facility photographs. Choose SOPs from the map or the left side menu (View > Sidebar). Click white bullseye icons to view SOP information and link to observations. Click blue bullseye icons to view observation summary forms with individual observation data. Follow links on data forms to photos, observation details, and visibility ratings. Not all forms have photos or visibility ratings.

VIEW PHOTOGRAPHS
Click blue bullseye icons for individual observation data. Observations with photos include preview images and a View Photos link. Click the links for observation details or individual photos. Roll cursor over Download links to view preview images. Click Download links to view unenhanced high-resolution JPEG files. View at 100% to see full details. Some forms have links to stitched panoramas.

HIDE THESE INSTRUCTIONS
Show the left side menu (View > Sidebar). Uncheck the box to the left of Instructions in the Places menu.

FOR HELP/INFORMATION
Robert Sullivan
sullivan@anl.gov
Environmental Science Division
Argonne National Laboratory

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National Ocean and Atmospheric Administration

LEGEND

- SOP Summary
- Observation Summary
- Wind Turbine

DISCLAIMER
Display problems and other errors may occur when viewing the data in this file. The data may contain errors and inaccuracies.

Imagery Date: 12/13/2015
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat

53°03'10.54" N 0°52'18.33" W elev 181 ft
Eye alt 369.47 mi

Observation Summary (311: Thanet)

Observation ID:	311	SOP ID:	311
Date:	September 1, 2011	Time:	3:27 PM (BST)
Facility:	Thanet		
Obs. Distance:	17.8 mi	Direction:	ENE
Weather:	Fair		
WTG Backdrop:	Sky		
WTG Lighting Quality:	Even Sun		
Calculated WTG Lighting Angle:	Frontlit		
Turbine Lighting:	Frontlit		
Average visibility rating:	3.00		

[View Photos](#) [Observation Details](#) [Visibility Rating Forms](#)

DSC_9906.JPG (52.0 mm): Thanet

Kentish Flats SOP 313: KF - 7.9 mi SOP 312: KF - 8.4 mi
SOP 314: KF - 7.9 mi





Dave Ball

Pacific Region Historic Preservation Officer
Bureau of Ocean Energy Management
805-384-6340
David.Ball@boem.gov

*For an overview of selected BOEM research informing
renewable energy offshore Oregon, go to:*

[**www.boem.gov/Oregon**](http://www.boem.gov/Oregon)