Icebreaker

LEEDCo

Lake Erie Energy Development Corporation

Creating Jobs and Economic Prosperity

Generating "Locally Grown" Clean Energy

County Council Presentation

September 27th, 2016

Clean Energy Purchase

Ronn Richard
Cleveland Foundation

Lorry Wagner, Ph.D
LEEDCo

Pål Gjesdal
Fred. Olsen Renewables

Lake Erie Energy Development Corporation

A non-profit, public private partnership created to build an offshore wind power industry

Our Motivation

-525,000

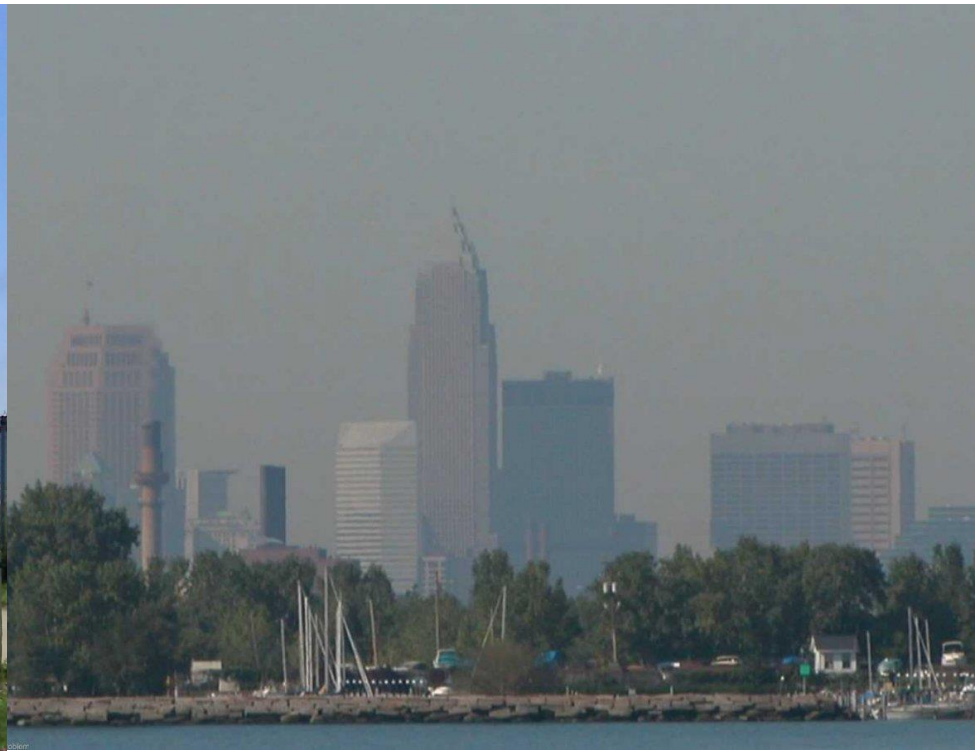
-113,119

2000-2010

- Ohio added the smallest share of jobs out of the 38 states from 2007 to 2015.
- Cleveland is the No. 1 most economically distressed large city in America, with 53 percent of adults not working,
- Iowa is more than 30% wind, attracting 12 major manufacturers and the latest $3.6 billion project will propel the state toward 100% renewables

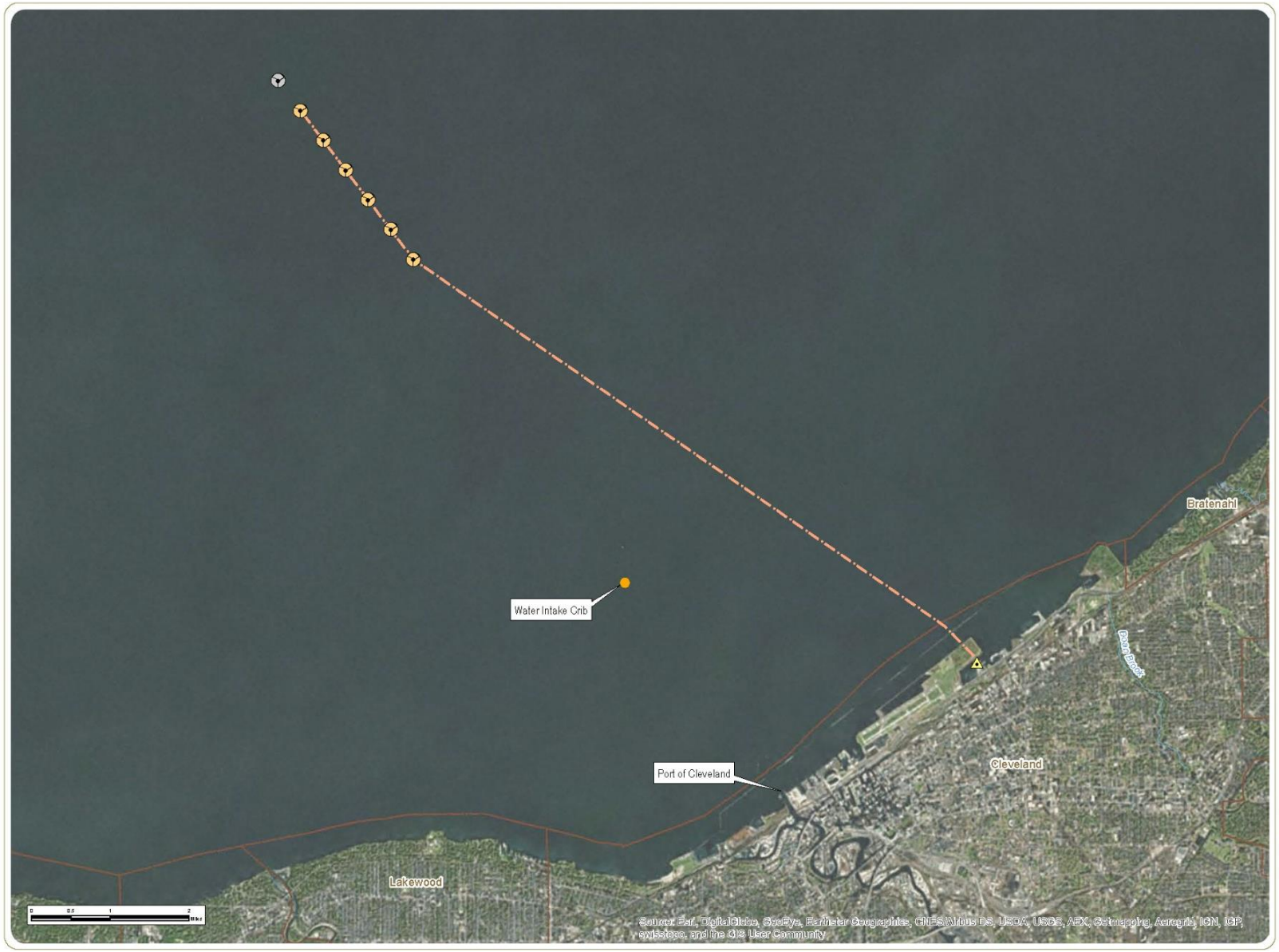
Source: Business Insider/Washington Post

Our Motivation



- Cleveland's air quality among worst in nation despite improvements
- Cuyahoga County received an "F" grade for ozone and a "D" for particle pollution
- **Kids Suffer Most:** 1 in 6 Prevalence in poor children; 1 in 10 for non-poor kids

Source: cleveland.com/American Lung Association



Project Icebreaker

Lake Erie, Ohio

Proposed Wind Farm Layout

April 2016

- Wind Turbine
- Alternate Wind Turbine
- Cleveland Public Power Substation
- Transmission Line
- City/Town Boundary

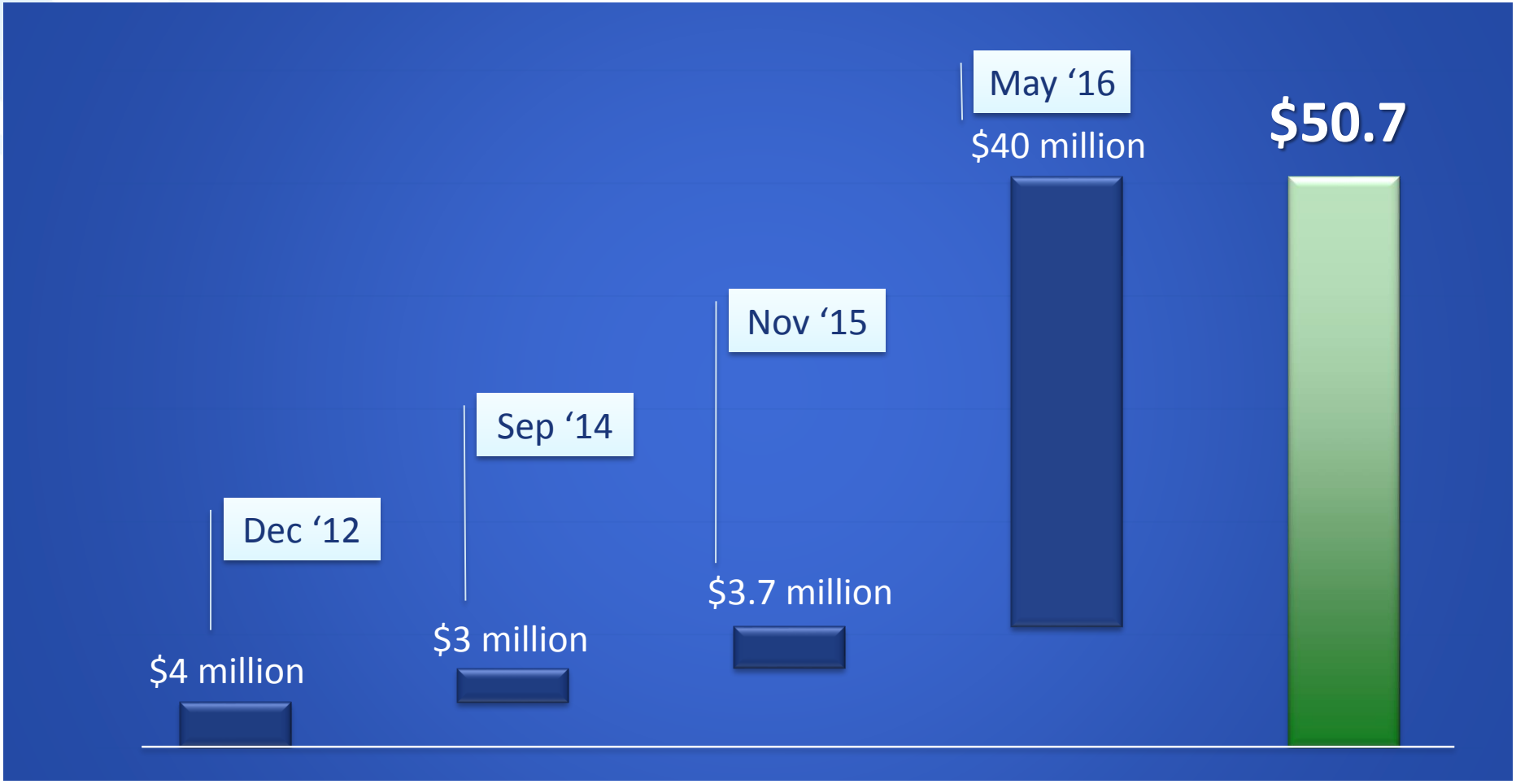
Notes:
1. Basemap: ESRI ArcGIS "World Imagery" Map Service and ESRI StreetMap North America, 2008.
2. This is a color graphic. Reproduction in grayscale may misrepresent the data.

LEEDCo
Lake Erie Energy Development Corporation

N W E S

edr
www.edrdpc.com

DOE Funding to Cuyahoga County



Icebreaker Direct Benefits

- 500 Jobs
- $168 million life cycle investment
- Community Benefits Agreement, MOU 2/26/2013
  - Written into the PPA
  - CBA for a Major Project
  - Workforce information with Project Contractors
  - Aspirational Goals – 15% MBE, 7% FBE, 20% CLE, 40% CUY
- Environmental and Health Benefits
- Union Labor/Prevailing Wage

Endorsements & Support

Lakefront Communities

- The City of Cleveland
- The City of Avon Lake
- The City of Euclid
- The City of Lakewood
- The Village of Bratenahl
- The City of Lorain

Environmental Organizations

- Ohio Environmental Council
- The Sierra Club
- Environment Ohio
- Mom's Clean Air Force
- Earth Day Coalition

Organized Labor

- International Brotherhood of Electrical Workers
- International Order of Masters, Mates, and Pilots
- Pipe Fitters Local 120
- IN-KY-OH Regional Council of Carpenters
- Building Laborers Local 310

Designed for Manufacture in the USA

Lowest Cost Foundation in the U.S. Offshore Industry

4 of the 5 Icebreaker Bidders are in the Midwest

Fred. Olsen Renewables

Bonheur ASA *(listed Oslo Stock Exchange)*

Offshore drilling	Renewable energy	Shipping/Offshore wind	Cruise	Other investments
				
51,9%	100%	100%	100%	
Fred. Olsen Energy ASA (listed OSE)	Fred. Olsen Renewables AS Windfarm assets: 582 MW operating. 2GW under devt. USA Subsidiary: Fred. Olsen Renewables USA Cleveland, Ohio	Fred. Olsen Ocean Ltd. Subsidiaries: Fred. Olsen Windcarrier Global Wind Service Universal Foundation	Fred. Olsen Cruise Lines Ltd.	NHST Media Group AS (54.0%) Koksa Eiendom AS (12.6%) Various

Fred. Olsen Renewables (FOR)

- First renewable activities mid-1990s with focus to date on onshore wind
- ”Cradle to grave” with all key disciplines managed in-house
  - Site Investigation
  - Development
  - Construction
  - Operation and Decommissioning
- Development pipeline of 2,200 MW
- Delivered 8 industrial scale windfarms with 582 MW capacity
- Largest Independent Power Producer in UK; 5th largest in Europe
- Over $1 billion investment to date

LEEDCo Partners with Fred. Olsen

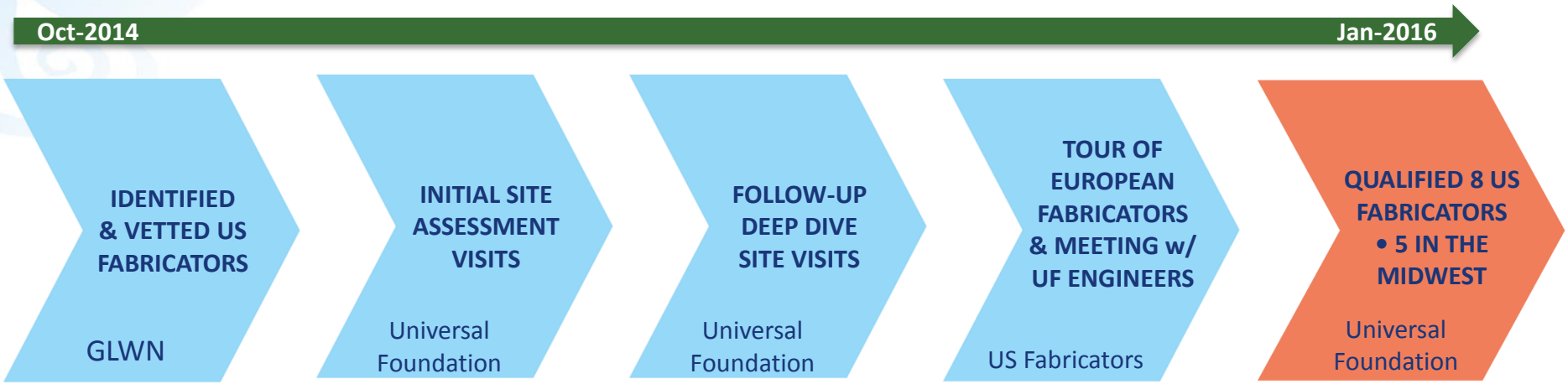
- A Multi-Billion $ Company Picks Cleveland
  - FOR USA, the development company is headquartered in Cleveland, Ohio
  - Icebreaker Windpower Inc., the project company is headquartered in Cleveland, Ohio
- A Commitment to CBA and Local Sourcing
  - Written into the PPA
  - CBA to be crafted by Jeffrey Appelbaum – PMC
  - Supervised by LEEDCo
- LEEDCo will cultivate supply chain opportunities & lead public engagement

Thank You!

Where is Icebreaker Today?

- Transition to FOR USA
- Permitting
  - Submerged Land Lease Obtained
  - NEPA Scoping Session (9/28) / Local Hearing on EA
  - OPSB Permitting Process / Public Information Meeting / Local Hearing
  - USACE Permits Required
  - Other Permits Required
- 4Q2018 Operation

US Supply Chain Development



UF made 4 trips to US to assess and educate US fabricators

UF worked with US fabricators to harmonize material and fabrication specs

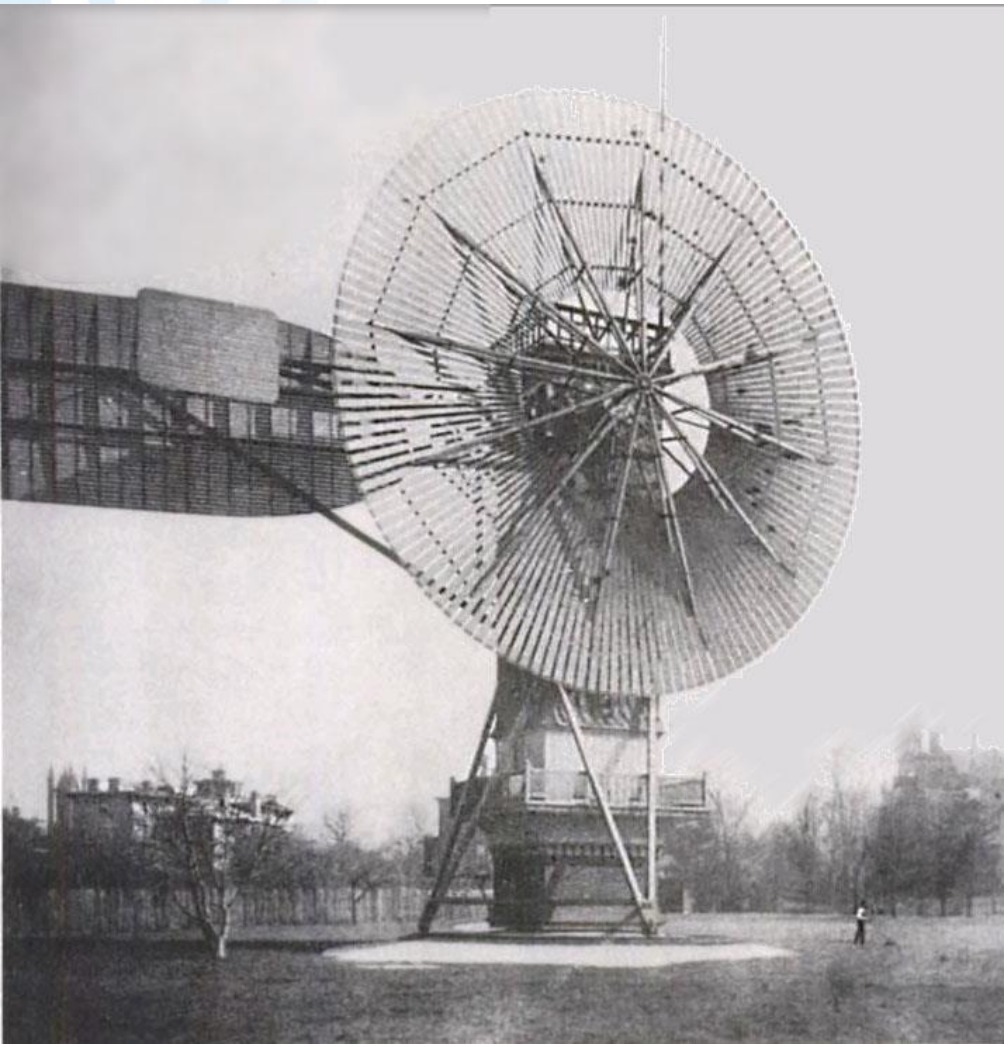
Jobs & Businesses that will grow

This work ... / ...employs these skills.	Environmental	Data/Surveys	Permitting	Procurement	Electric Grid	Financial Close	Construction	O & M	Re-Powering	Decommission
Banking				X		X	X		X	X
Civil Engineering	X				X					
Project Development	X	X	X	X	X	X	X		X	
Electrical Engineering	X				X					
Environmental Consulting	X	X	X	X	X	X	X	X	X	X
Geotechnical Consulting		X					X			
Health/Safety Specialist	X	X	X	X	X	X	X	X	X	X
Installation Contractors							X		X	X
Insurers and Underwriters				X		X	X		X	X
Lawyers	X	X	X	X	X	X	X	X	X	X
Marine Biologists	X	X					X			
Meteorological Specialist	X	X	X	X	X	X	X	X	X	X
Offshore Construction Contractors							X	X	X	X
Offshore Design Engineering				X			X			
Offshore Technical Consulting	X	X	X	X	X	X	X	X	X	X
Operation and Maintenance								X	X	
Project Management	X	X	X	X	X	X	X	X	X	X
Quality Control/Certification Consulting					X	X	X	X	X	X
Subsea Turbine Cable Installation							X		X	X
Systems Design Engineering					X		X		X	
Turbine Vessel Operation	X	X					X	X	X	X

Long-Term Vision

- $16 Billion/year industry in Europe
  - Development of local supply chain from design to decommission.
- Jobs (55,000 in Europe OSW Industry)
- Environmental and Health Benefits
  - Harmful Air Pollutants reduced
  - Climate Pollution reduced
  - Mercury and Lead reductions
  - Improved Air Quality

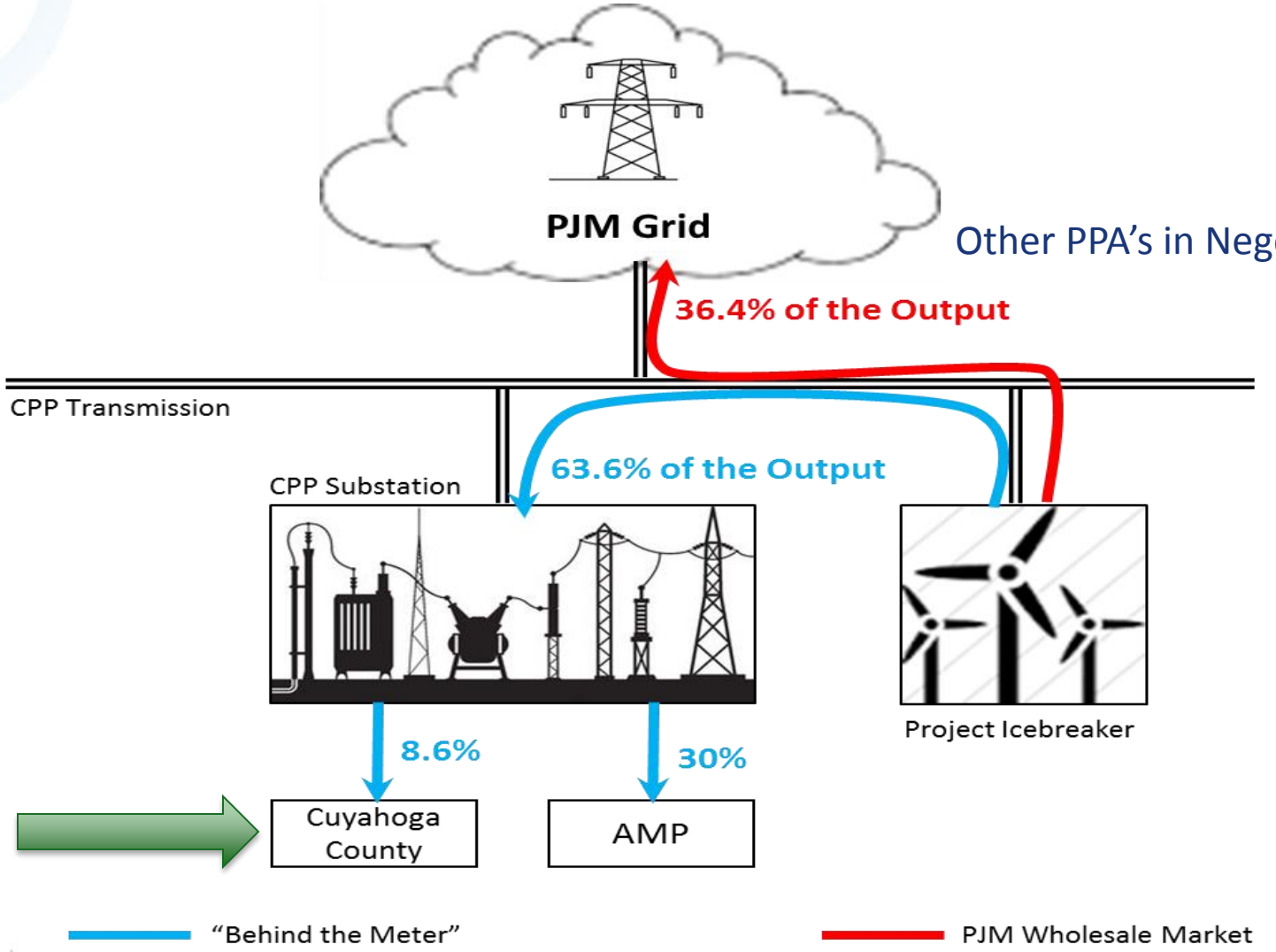
We Have Led the World Twice



1887

1977

Icebreaker Power to Cuyahoga County



Other PPA's in Negotiation

Cleveland wind project awarded $40 million DOE grant to develop Lake wind farm

By John Funk, The Plain Dealer
Follow on Twitter
on May 27, 2016 at 1:20 PM, updated May 28, 2016 at 12:13 AM

Print
Email

CLEVELAND, Ohio -- The U.S. Department of Energy is awarding $40 million to the Lake Erie Energy Development Corp. to build a six-turbine pilot wind farm in Lake Erie by the end of 2018.

The award caps a 10-year struggle that began as an idea in the mind of Cleveland Foundation President and CEO Ronn Richard upon his arrival in Cleveland.

The money will be delivered in three $13.3 million grants,

U.S. Rep.Marcy Kaptur said the Cleveland-based project to build a pilot wind farm eight to 10 miles offshore in Lake Erie could be the beginning of a wind corridor running from Buffalo to Erie to Toledo and extending points west and east. Kaptur announced that the U.S. Department of Energy is awarding $40 million to the Lake Erie Energy Development Corp. to build the first-ever fresh-water wind farm in the Lake.

Steve Katich

Stakeholder Engagement

- General Public
- Organized Labor
- Water-Use Organizations
- Elected Officials
- Supply Chain
- Civic Organizations
- Universities/Schools
- Business Community
- Regulatory Officials
- Environmental Groups
- Lakefront Communities
- Wind Industry
- Lakefront Property Owners

400+
Public Engagements Since 2006

200
in Last 3 Years

Political Support

Ohio

- Senator Brown (D)
- Senator Portman (R)
- Rep. Kaptur (D)
- Rep. Joyce (R)
- Rep. Fudge (D)
- Rep. Ryan (D)

Pennsylvania

- Kathy Dahlkemper – Erie Co. Exec., Former Rep. (D)
- Senator Wiley (D)
- Rep. Kelly (D)
- Rep. Thompson (R)

Other

- Betty Sutton – St. Lawrence Seaway Director, Former Ohio Rep. (D)
- Cleveland Mayor Frank Jackson (D)
- Ohio Governor John Kasich (R)
- 4 Ohio Lakefront County Commissioners (D&R)

The Power Pledge

15,000+ Homes Visited – 92% Support Icebreaker

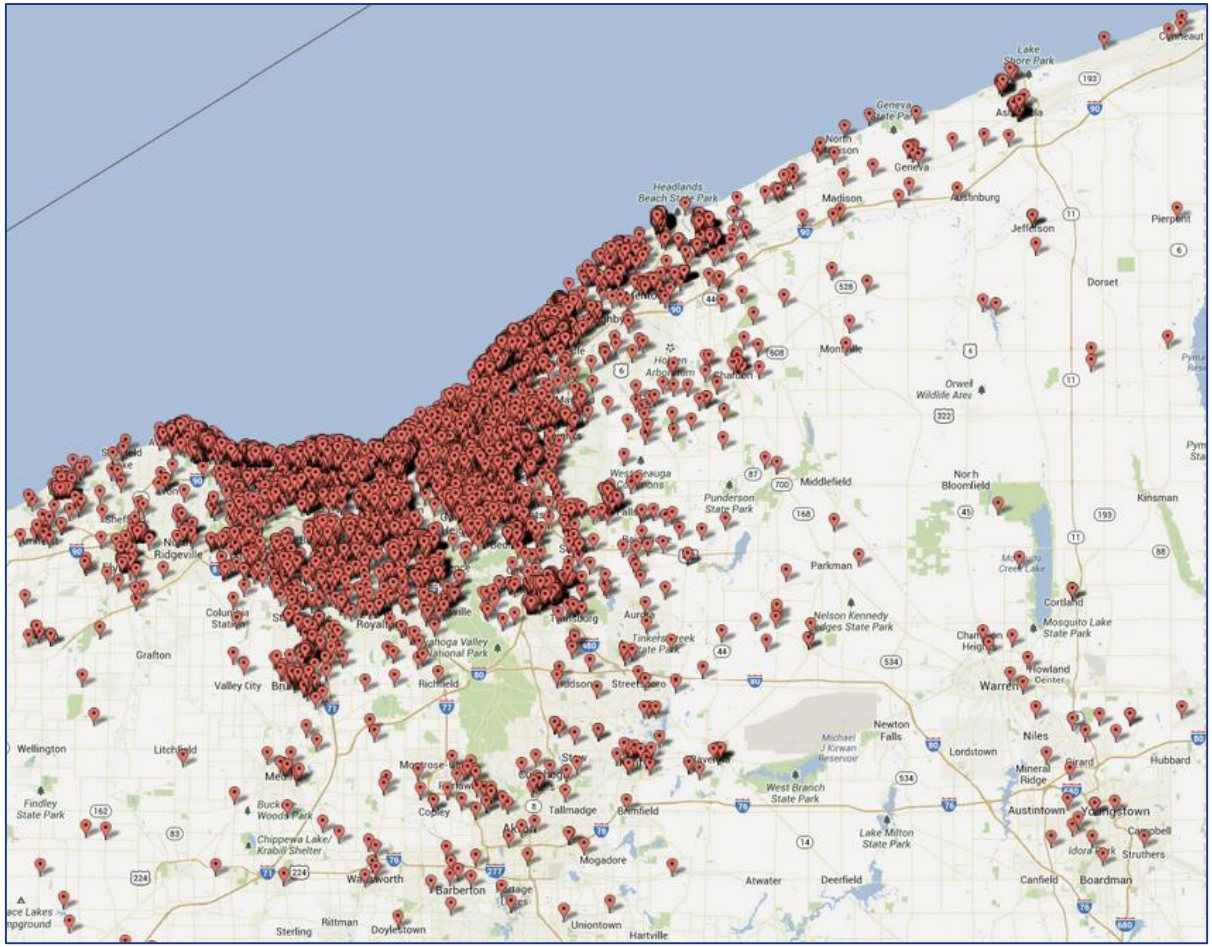
"I pledge to buy a portion of my electricity from the Great Lakes' first offshore wind project. I want this premium source of electricity and would be willing to pay an additional $_____ per month."

7,931
Pledges Collected

92%
Support the Project

$12.72
Average Pledge

60%
Signed the Pledge



Reinstating Ohio's Energy Efficiency and Renewable Energy Standards Would in 2017 Help Avoid:

16,900	2,230	120	100	230	140
LOST WORK DAYS	ASTHMA ATTACKS	ASTHMA EMERGENCY DEPARTMENT VISITS	HOSPITAL ADMISSIONS	HEART ATTACKS	PREMATURE DEATHS

Between 2017-2029, the Reinstated Standards Would Help Avoid at Least:

335,770	44,390	2,420	2,060	4,470	2,820
LOST WORK DAYS	ASTHMA ATTACKS	ASTHMA EMERGENCY DEPARTMENT VISITS	HOSPITAL ADMISSIONS	HEART ATTACKS	PREMATURE DEATHS

Source: Environmental Law & Policy Center, League of Conservation Voters, NRDC, Ohio Environmental Council

Thorough Regulatory Review

The U.S. Army Corps of Engineers	The U.S. Fish and Wildlife Service	The U.S. Coast Guard
U.S. Department of Defense	The Federal Aviation Administration	The Ohio Department of Natural Resources
ODNR Coastal Zone Management	ODNR Division of Wildlife	ODNR Division of Soil and Water Resources
ODNR Division of Watercraft	Ohio Power Siting Board	Ohio Department of Health
Ohio Department of Agriculture	Ohio Development Services Agency	Public Utilities Commission of Ohio
Ohio Environmental Protection Agency	Ohio Department of Transportation	The International Joint Commission
Ohio Historic Preservation Office (SHPO)	The Department of Homeland Security	

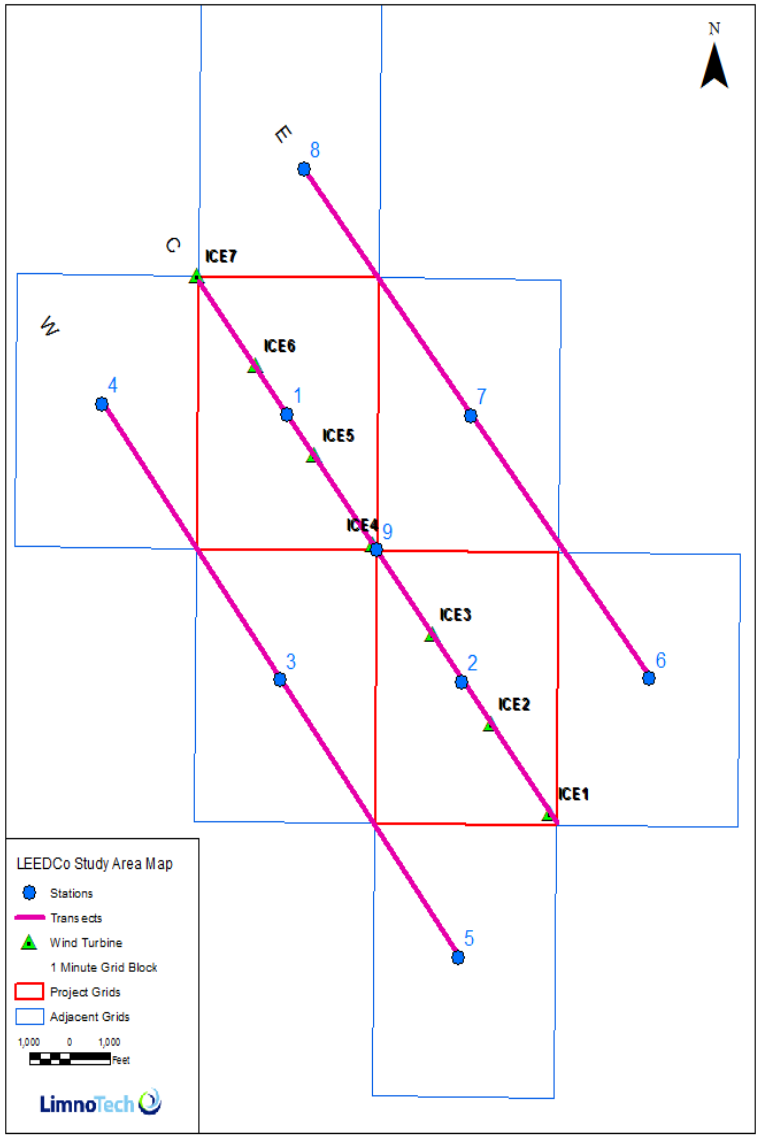
Icebreaker Site Specific Analyses

- Risk / Benefits
  - Lake Erie bird studies (ODNR airplane survey, etc.)
  - European offshore wind experience
  - Bird/Bat/Fish population patterns in Lake Erie
  - Lakefront Onshore wind in North America
- Nexrad Weather Radar
  - 5 years of data (spring and fall)
- Marine Surveillance Radar (Merlin)
  - Equipment located onshore and at the Cleveland Water Intake Crib
- Visual Surveys
  - Boat based
  - Land based
- Acoustical Surveys
  - Microphones located onshore, Cleveland Water Intake Crib, Icebreaker site

Permitting – Aquatic Sampling

Group	Task Description	May	Jun.	Jul.	Aug.	Sep.	Oct.
Fish Community							
	Hydro acoustic		x	x			x
	Larval Fish	x	x	x			
	Juvenile	x			x		x
	Zooplankton	x	x	x	x	x	x
	Phytoplankton	x	x	x	x	x	x
	Benthos	x					x
Physical							
	Chemistry (discrete)	x	x	x	x	x	x
	Chemistry (continuous)	d	m	m	m	m	r
	Substrate Mapping						
	Hydrodynamic	d	m	m	m	m	r
Fish Behavior							
	Acoustic	d	m	m	m	m	r
	Fixed Acoustic						
	Noise	d	m	m	m	m	r
	Aerial Surveys	x	x	x	x	x	x
Estimated days to complete		10	5	5	4	4	6

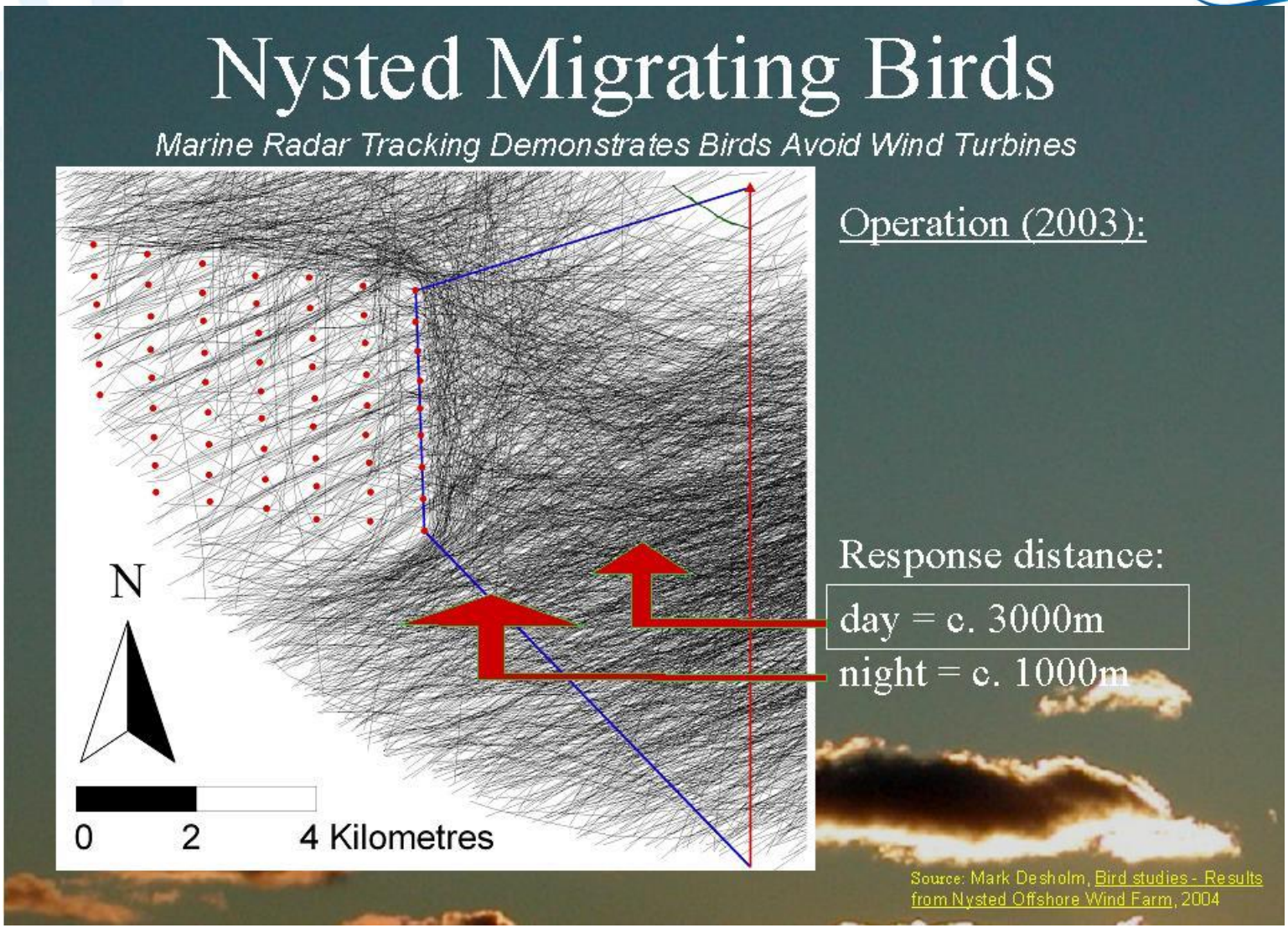
d=deploy, m=maintain, r=retrieve, x=sample, blank=no sample needed



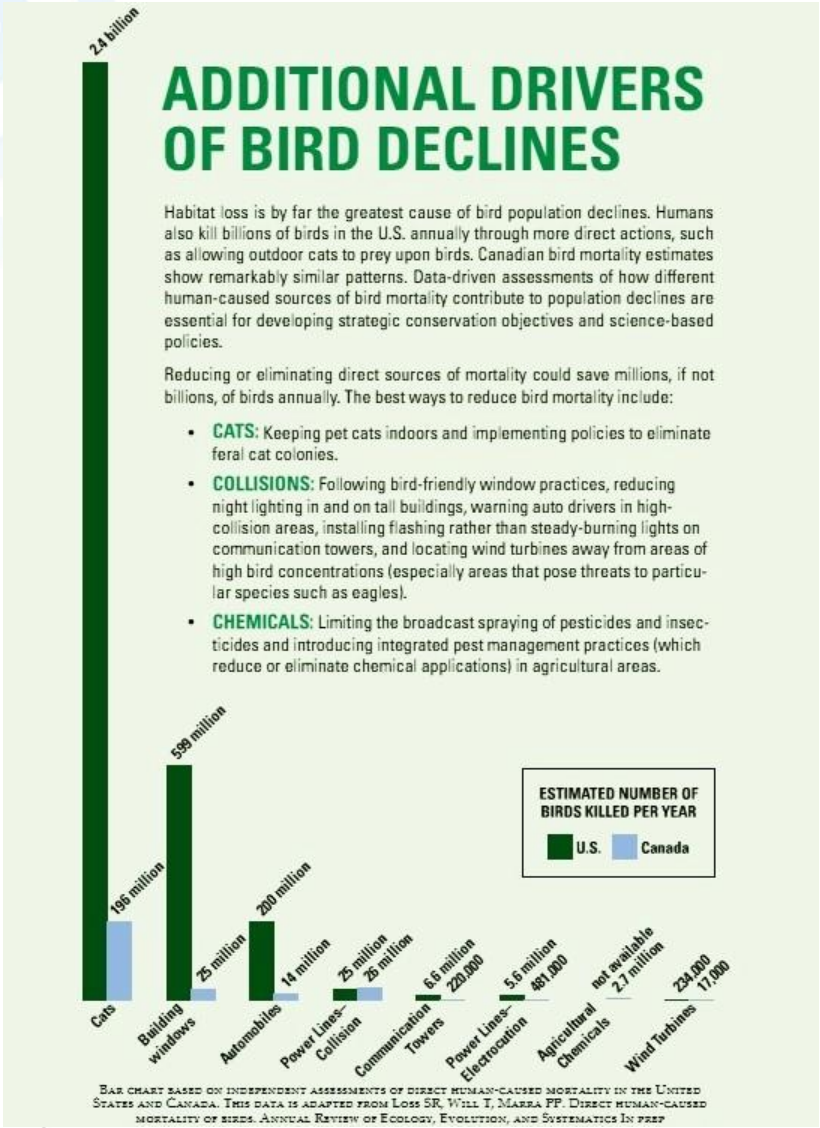
Environmental Impacts are Minimal

- Aquatic Life Should Improve
  - Aquatic species & water quality studies underway
  - European offshore wind farms display positive benefits
  - Old Browns stadium multiplied fish by 60 X
- Risk to bird population is minimal
  - Studies ongoing from 2008 – boat, airplane, radar, etc.
  - New studies being developed with ODNR
- Post-Construction studies under design
  - Fisheries and water quality
  - Bird and bat conservation strategy

Real Data


Nysted Migrating Birds
Marine Radar Tracking Demonstrates Birds Avoid Wind Turbines
Operation (2003):
Response distance:
day = c. 3000m
night = c. 1000m
N
0
2
4 Kilometres
Source: Mark Desholm, Bird studies - Results from Nysted Offshore Wind Farm, 2004

More Real data



LEEDCo

The Cornell Lab of Ornithology

nabci

Rocky Mountain Bird Observatory

The Nature Conservancy
Protecting nature. Preserving life.

USGS
science for a changing world

Ducks Unlimited

Smithsonian Institution

Klamath Bird Observatory

Audubon

University of Idaho

Association of Fish & Wildlife Agencies

North American Waterfowl Management Plan

Forest Service U.S. Department of Agriculture

American Bird Conservancy

Point Blue Conservation Science

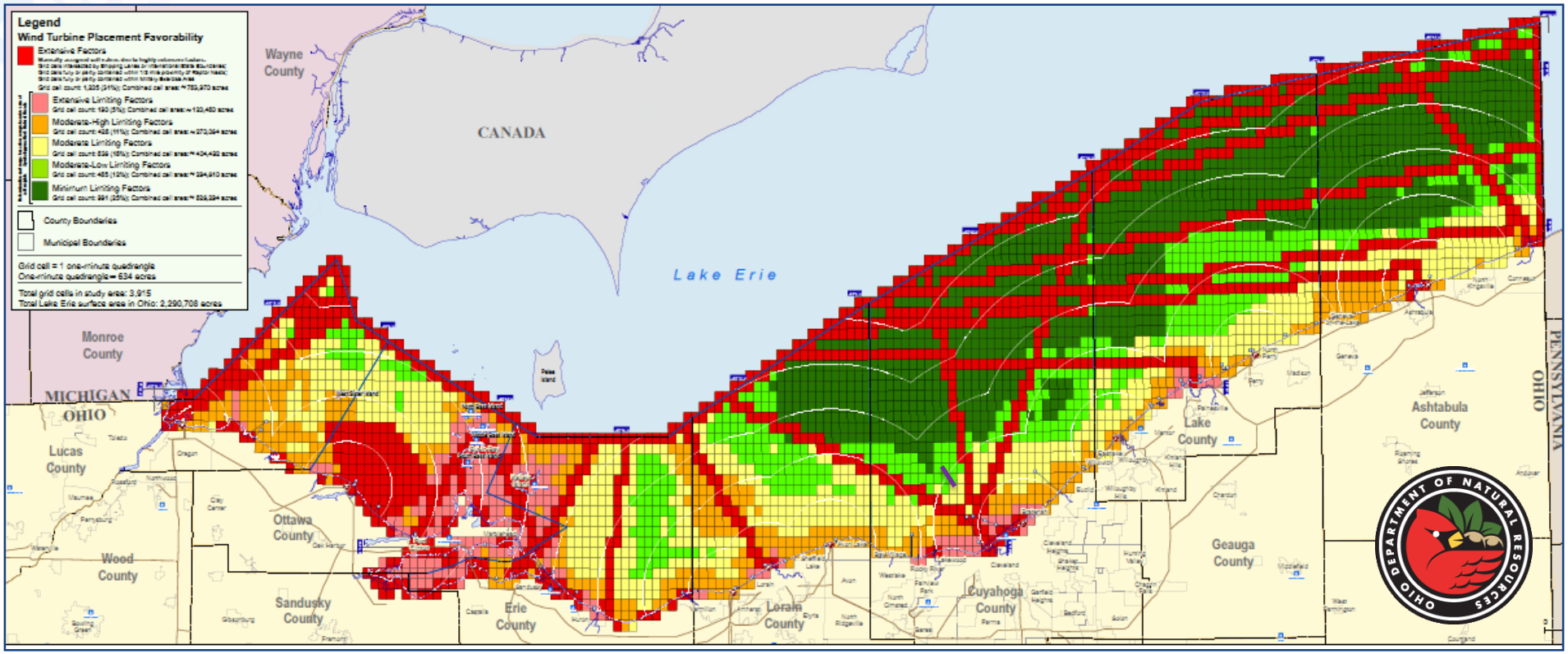
United States Shorebird Conservation Plan

National Park Service

Environment Canada

Environnement Canada

ODNR Offshore Wind Favorability

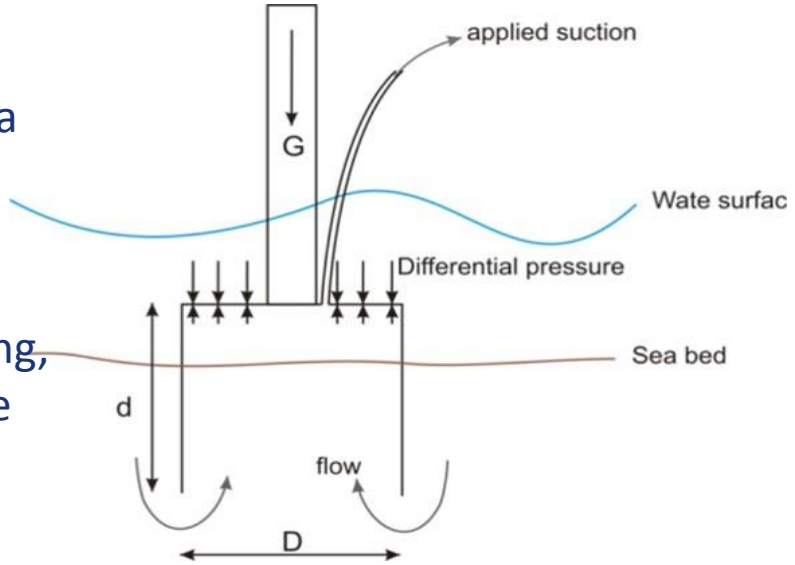


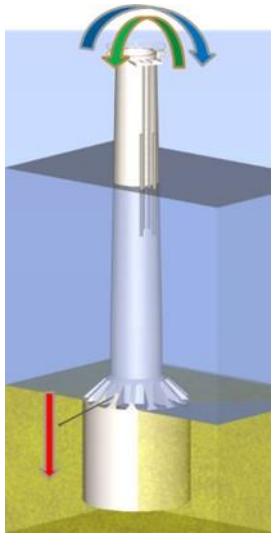
The Mono Bucket Concept

The development phase of the Mono Bucket concept started in the late '90's with the aim of constructing a foundation specifically designed for offshore wind turbines.

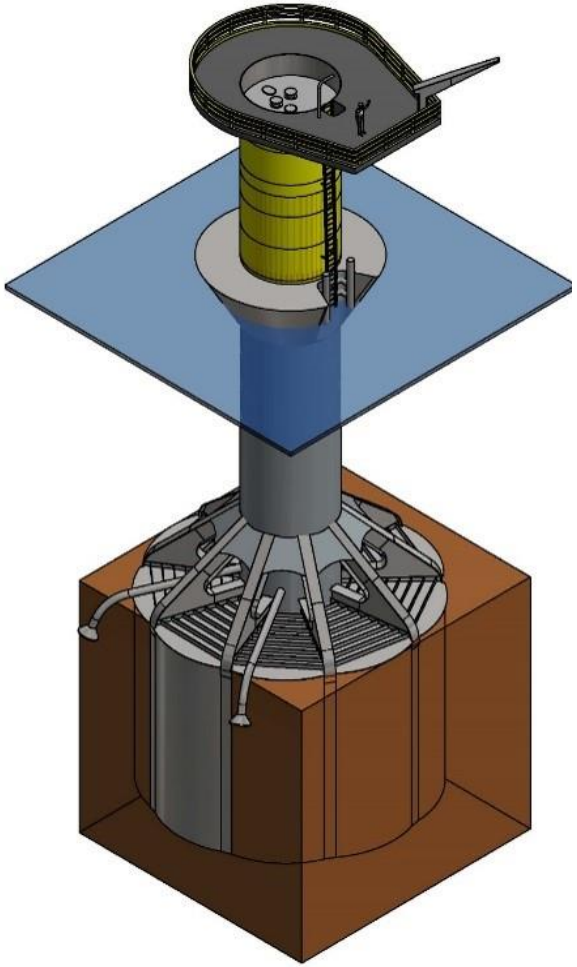
No design guidelines covered the field in the beginning, so the first step was to define design procedures base on traditional geotechnical standards.

New optimized procedures were developed over the years backed by numerous laboratory/site tests, trial installations, design reports and journal articles.





Mono Bucket



3 MW Vestas V90 Prototype on Mono Bucket since 2002

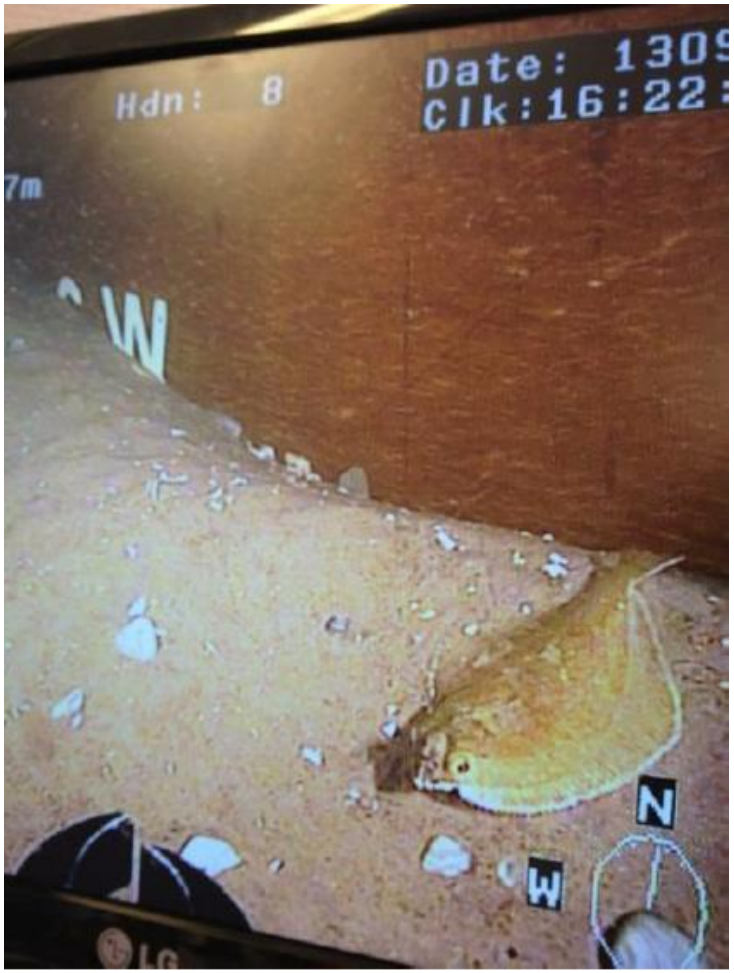
25% lighter than Monopile
40% lighter than Jacket

TRL 7 – 16 years R&D, numerous trials & installations, Demo Ready

Eliminates pile driving; 1 day installation; minimizes LCOE

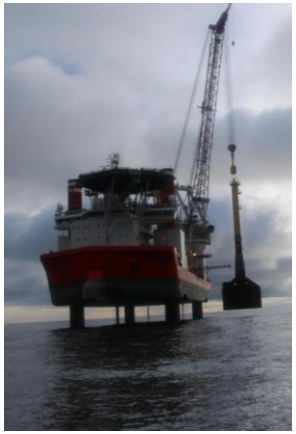
Mono Bucket in Action

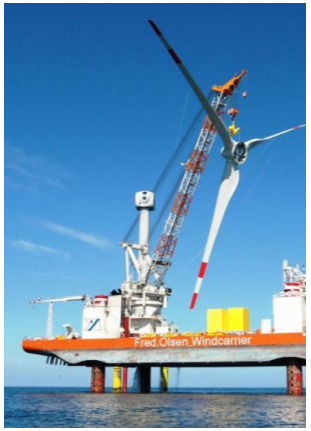
The Quiet & Gentle Foundation



Fred. Olsen Windcarrier

- OSW Transport and Installation
  - Brave Tern and Bold Tern
- More than 200 WTGs + O&M
- Working in US: Block Island project
- Installed all of recent MB projects





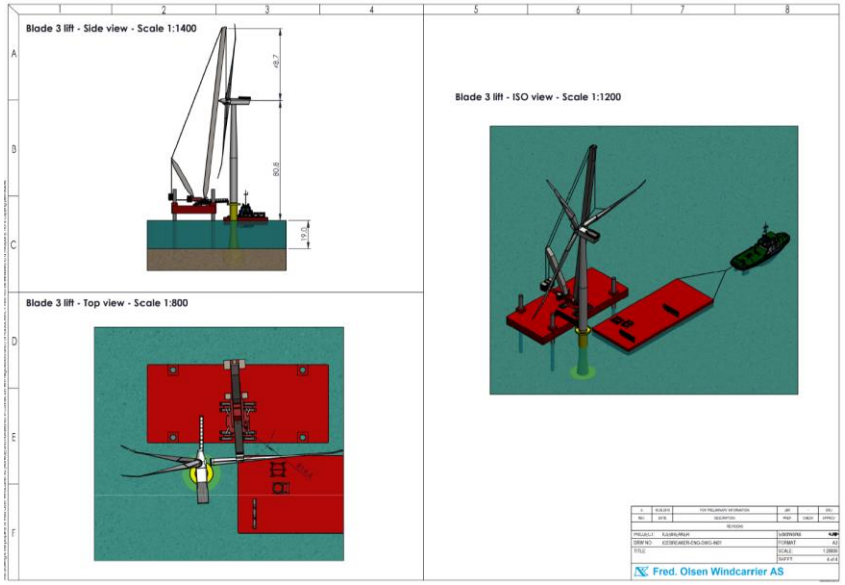
Installation Strategy

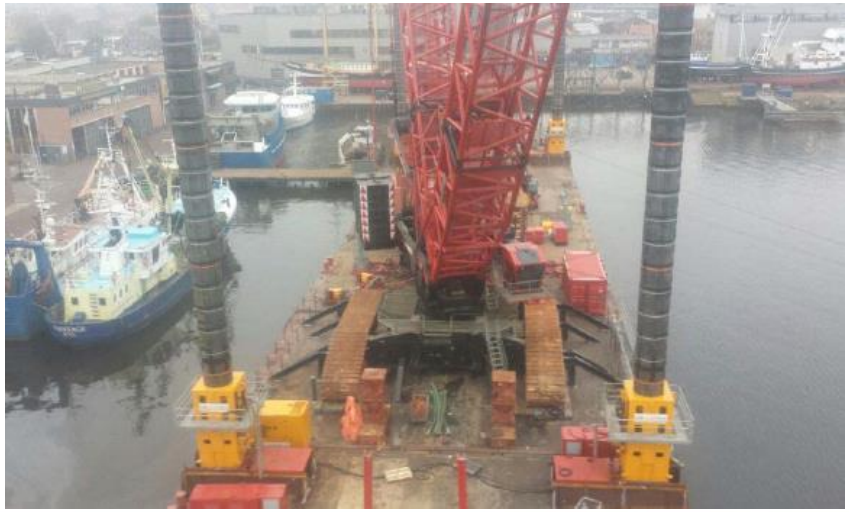
Heavy lift vessel for MB and WTG

1. Convert an existing US barge
   - Jacking system installed to accommodate lifting operations from a fixed platform
   - Crawler crane to be mobilized onboard
   - American built & flagged vessel would allow both transport of cargo and lift operations

OR

2. Re-build an existing non-US barge, lift operations only
   - Several barges have been evaluated & deemed suitable



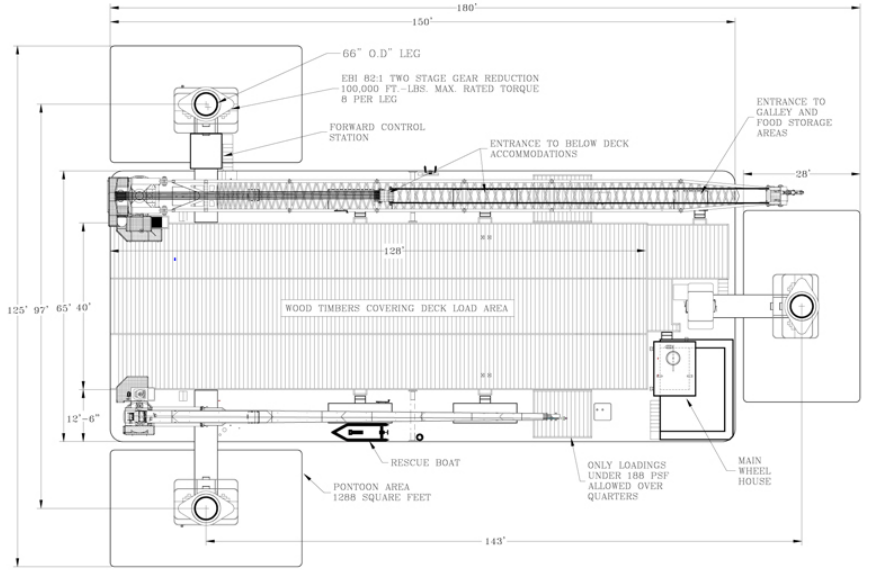


Use of existing vessels

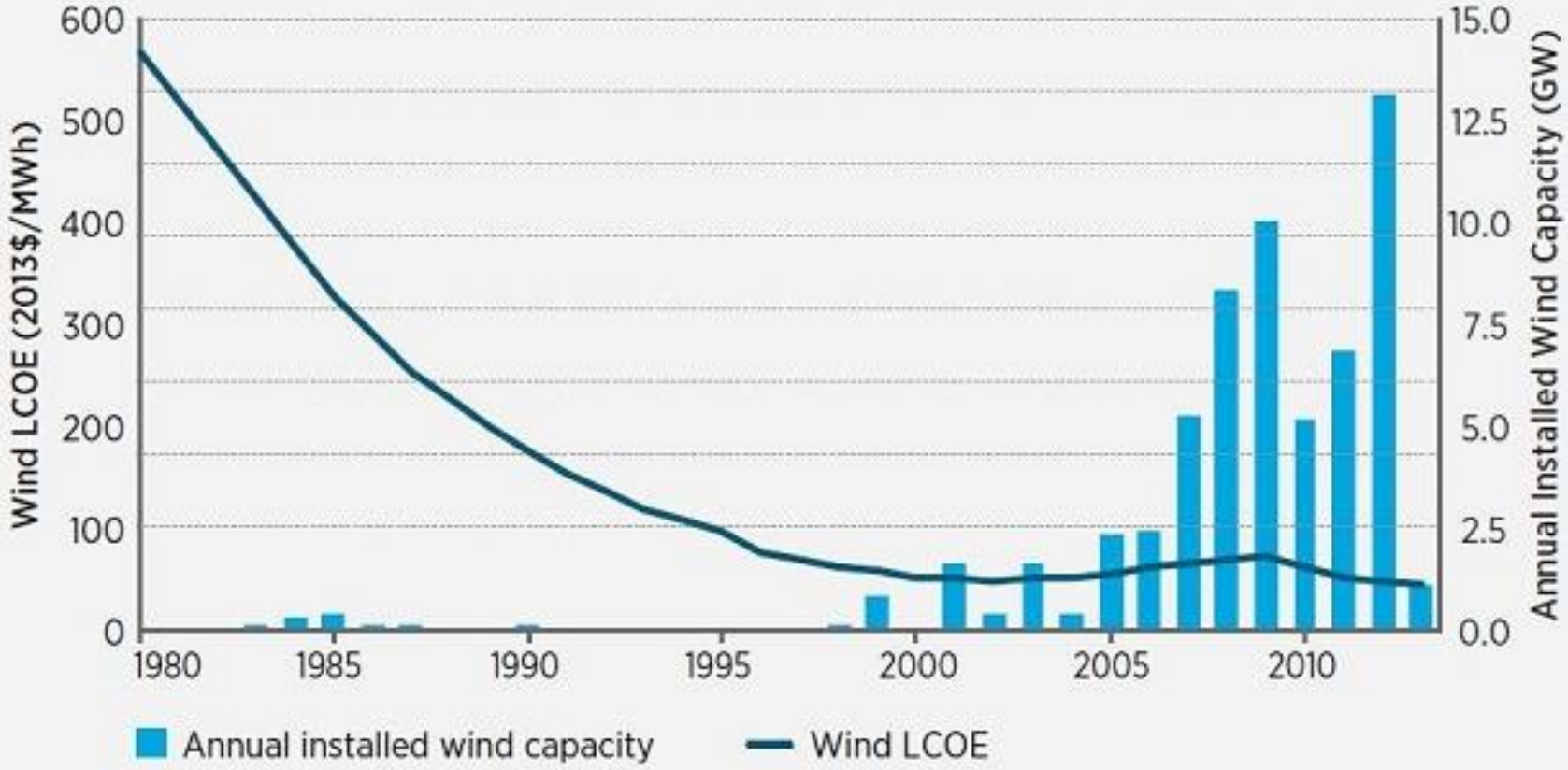
- Reduces risk regarding Class Approval
- Proven concept

Installation Strategy

- Combifloat add-on jack up system
  - 4 x 75'' elevating spud wells including hydraulic jacking mechanism
  - Containerized power unit & control system for horizontal simultaneous jacking
- Jack up WTG feeder barge
  - ***Mammoth Elevator*** would be a suitable vessel



US Wind Industry: Costs Are Declining

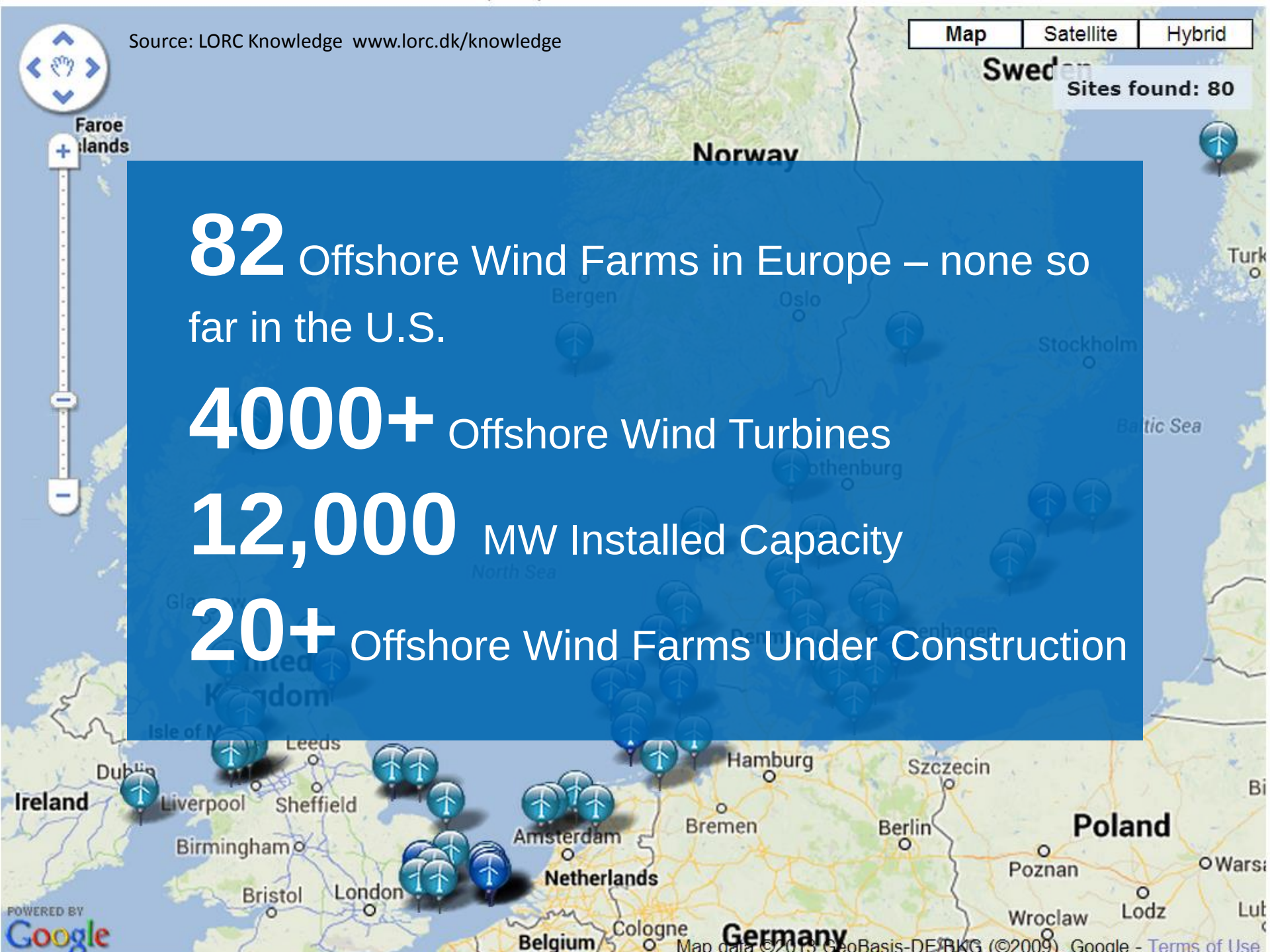


Note: In the *Wind Vision*, 'good to excellent sites' are those with average wind speeds of 7.5 meters per second (m/s) or higher at hub height. LCOE estimates exclude the PTC.

Source: Adapted from Lawrence Berkeley National Laboratory 2014 data [23]

Offshore Wind Costs Are Declining

- Swedish power company Vattenfall has turned the offshore wind industry on its head
- Vattenfall announced that it had won the Danish Near Shore Wind Tender (DNS), submitting its final bid of $0.067/kWh
- This marks the cheapest offshore wind bid, 20% below the previous record low set by DONG Energy in July


Source: LORC Knowledge www.lorc.dk/knowledge
Map
Satellite
Hybrid
Sites found: 80
82 Offshore Wind Farms in Europe – none so far in the U.S.
4000+ Offshore Wind Turbines
12,000 MW Installed Capacity
20+ Offshore Wind Farms Under Construction
Norway
Sweden
Faroe Islands
Bergen
Oslo
Stockholm
Baltic Sea
North Sea
Ireland
Dublin
Liverpool
Leeds
Sheffield
Birmingham
Bristol
London
Amsterdam
Netherlands
Belgium
Cologne
Germany
Bremen
Hamburg
Berlin
Szczecin
Poland
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Warsaw
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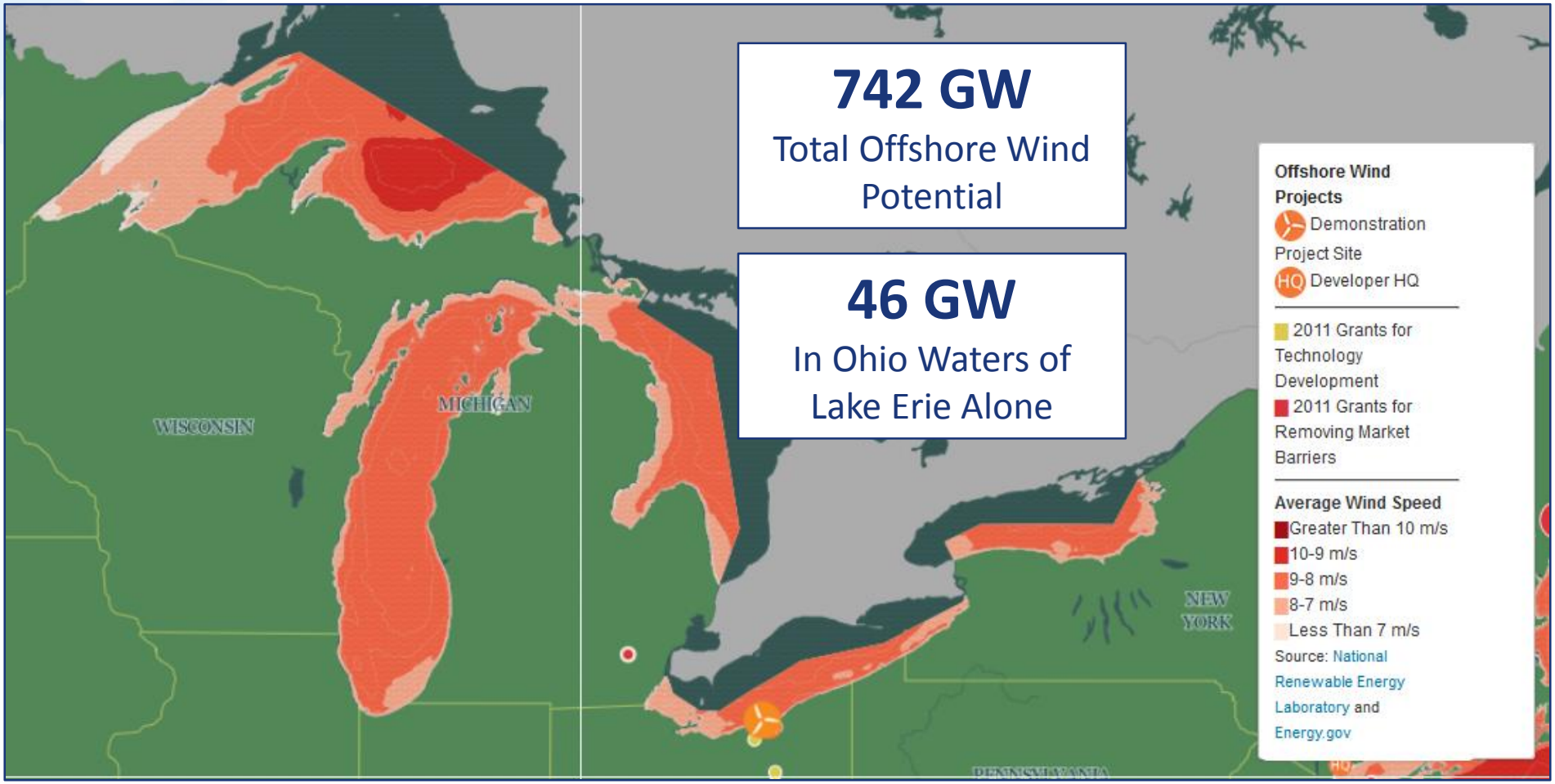
Wind Energy Technical Potential



Source: National Renewable Energy Laboratories