

# Plains & Eastern Clean Line

*Delivering Economical Clean Energy to the South*

Southern Legislative Conference 2011

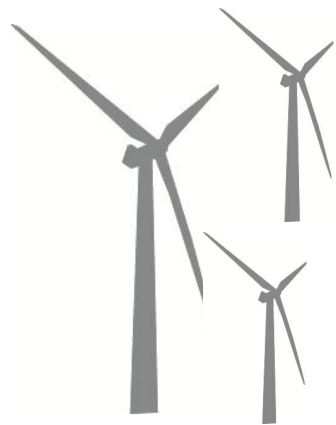


# Introduction to Clean Line Energy

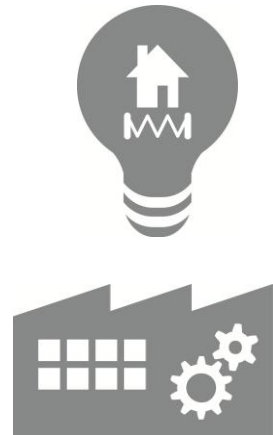
Connecting renewable energy to demand

- Clean Line Energy focuses on building transmission lines to connect renewable resources to load centers
- Clean Line seeks to develop, own and operate long haul, high voltage direct current (HVDC) transmission lines across the United States, helping solve one of the most vexing challenges to a cleaner energy future
- Clean Line's principals, partners and investors bring unique perspective, experience and focus to transmission development along with a track record of success in energy project development

Strong wind resources



Large demand centers

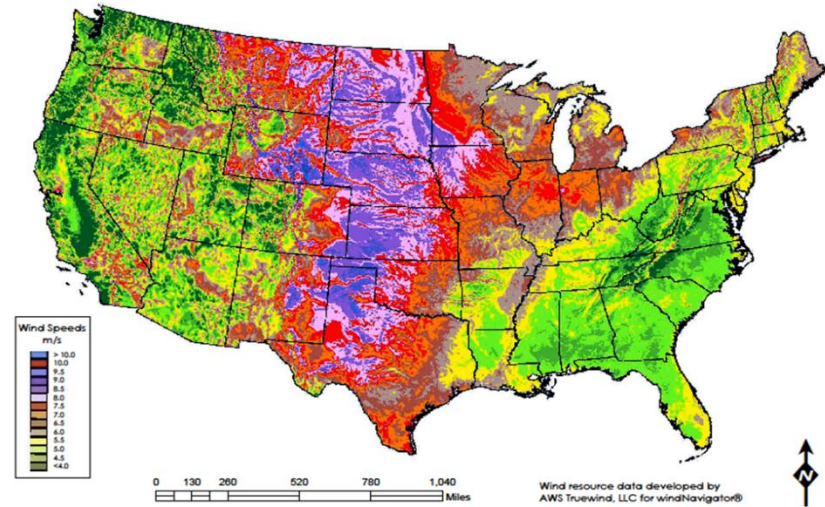


***HV→DC***

**Integrating large clean energy sources with demand centers**

# Why Do We Need New Transmission?

Best wind resources are in central spine of the United States away from distant population centers



## About This Map »

Click on the links below to switch layers on and off.

### EXISTING LINES

- 345-499 kV
- 500-699 kV
- 700-799 kV
- 1,000 kV (DC)

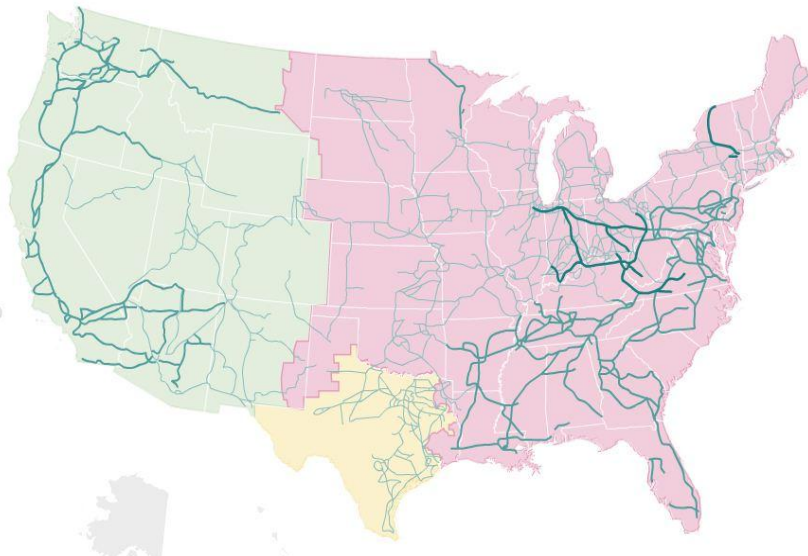
### PROPOSED LINES

- New 765 kV
- AC-DC-AC Links

### INTERCONNECTIONS

Major sectors of the U.S. electrical grid

- Eastern
- Western
- Texas (ERCOT)



...with limited access to robust transmission systems



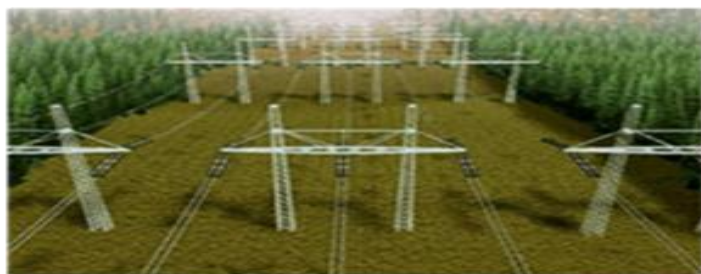
# Why HVDC?

- Efficient—Due to lower losses, DC is most efficient solution to move large volumes over long distances
- Smaller footprint—Less complex siting because DC requires narrower ROW than AC to move equivalent amounts of power
- Improved reliability—Enhances system stability, controls power flows, lowers integration costs in resource area

AC

3000-4000 MW Capacity

DC



Three 500 kV lines

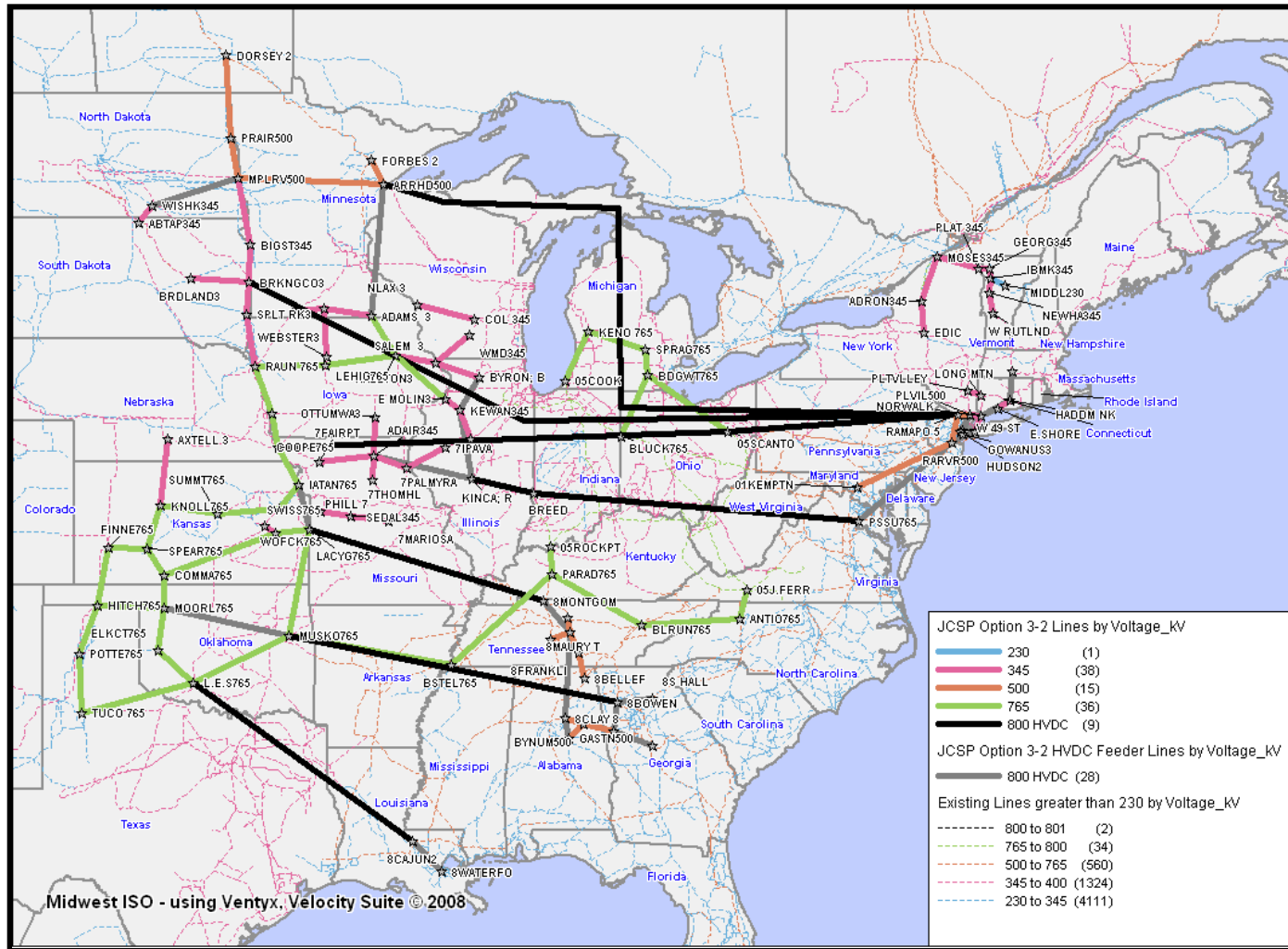


One  $\pm$  500kV bipole

Source: ABB

- Technological advances—Improved HVDC technology will help reduce costs over the long term
- Simpler commercial structure—HVDC enables “toll road” model, but also work in a world of cost-allocated transmission

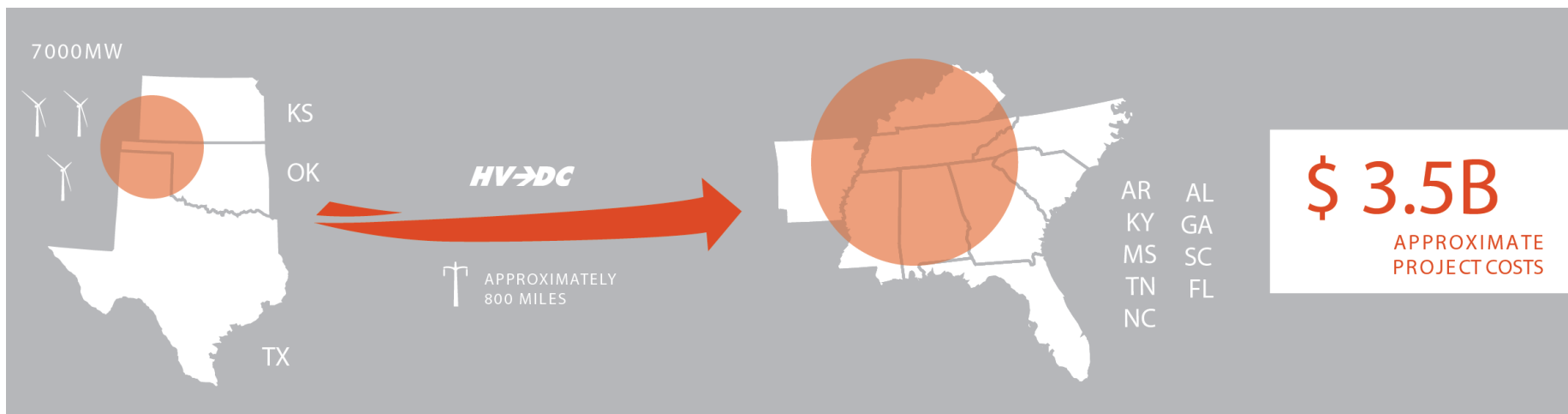
# Joint Coordinated System Plan: Identified Seven HVDC Lines to Move Wind Energy to Market



Source: Joint Coordinated System Plan 2008

# Plains & Eastern Clean Line will Deliver Wind Energy from Kansas, Oklahoma and Texas to TVA and the Southeast

## PLAINS & EASTERN CLEAN LINE



### Project Specifications

Transmission Capacity	7,000 MW
Technical Configuration	Two $\pm 600$ kV bipole transmission lines
Approximate Length	800 miles
Target Utilization Rate	50+%
Approximate Capital Cost	\$3.5 billion
Construction Jobs	10,000
Operations Jobs	1,000

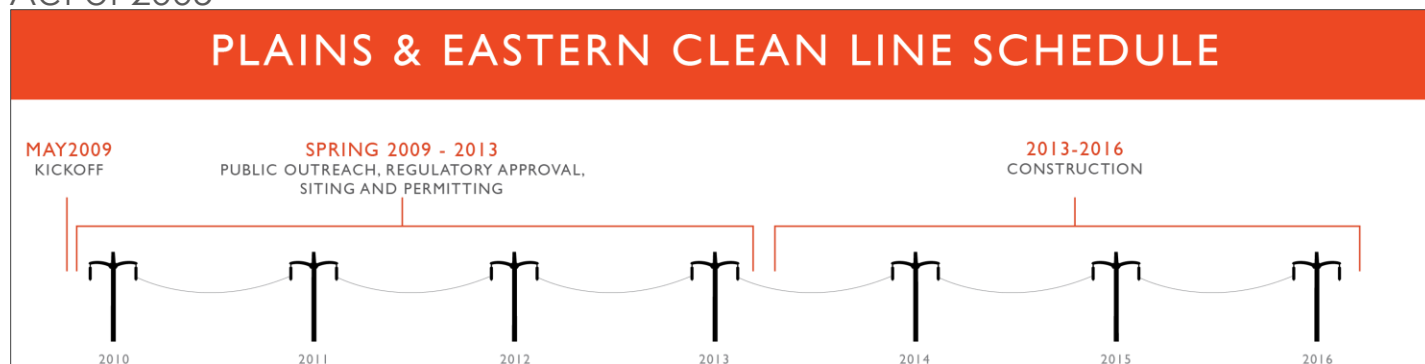
# Plains & Eastern is Pursuing Permits and Siting on State and Federal Levels

## State

- Filed for utility certification in OK and AR
  - Oklahoma Corporation Commission's staff, the Attorney General and ALJ are supporting Clean Line's application for utility status
  - Following established precedents, but outcome is not a given and support from wind generators and manufacturers is important
- Plan to obtain Certificate of Environmental Compliance and Public Necessity (CECPN) in Arkansas
- Contracted Ecology & Environment (E&E) as lead environmental consultant for work on routing, environmental assessment work, and National Environmental Policy Act (NEPA) (including public involvement)

## Federal

- Will carry out NEPA Environmental Impact Statement
- Potential partnership with Southwestern Power Administration/DOE under Section 1222 of Energy Policy Act of 2005





# Wind Energy Coming of Age





# A Typical 2.0 MW Turbine uses 8,000 Individual Components, Roughly 90% Steel and can Weigh Anywhere from 200 to 400 Tons

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## Tower:

Tower  
Ladder  
Lift

## Rotor:

Hub  
Nose Cone  
Blades  
    - Composites  
    - Blade Core  
Pitch Mechanisms  
Drives  
Brakes  
Rotary Union

## Nacelle:

Nacelle Cover  
Nacelle Base  
Heat exchanger  
Controllers  
Generator Power  
Electronics  
Lubricants  
Filtration  
Insulation  
Gearbox  
Pump  
Drivetrain  
Ceramics  
Shaft

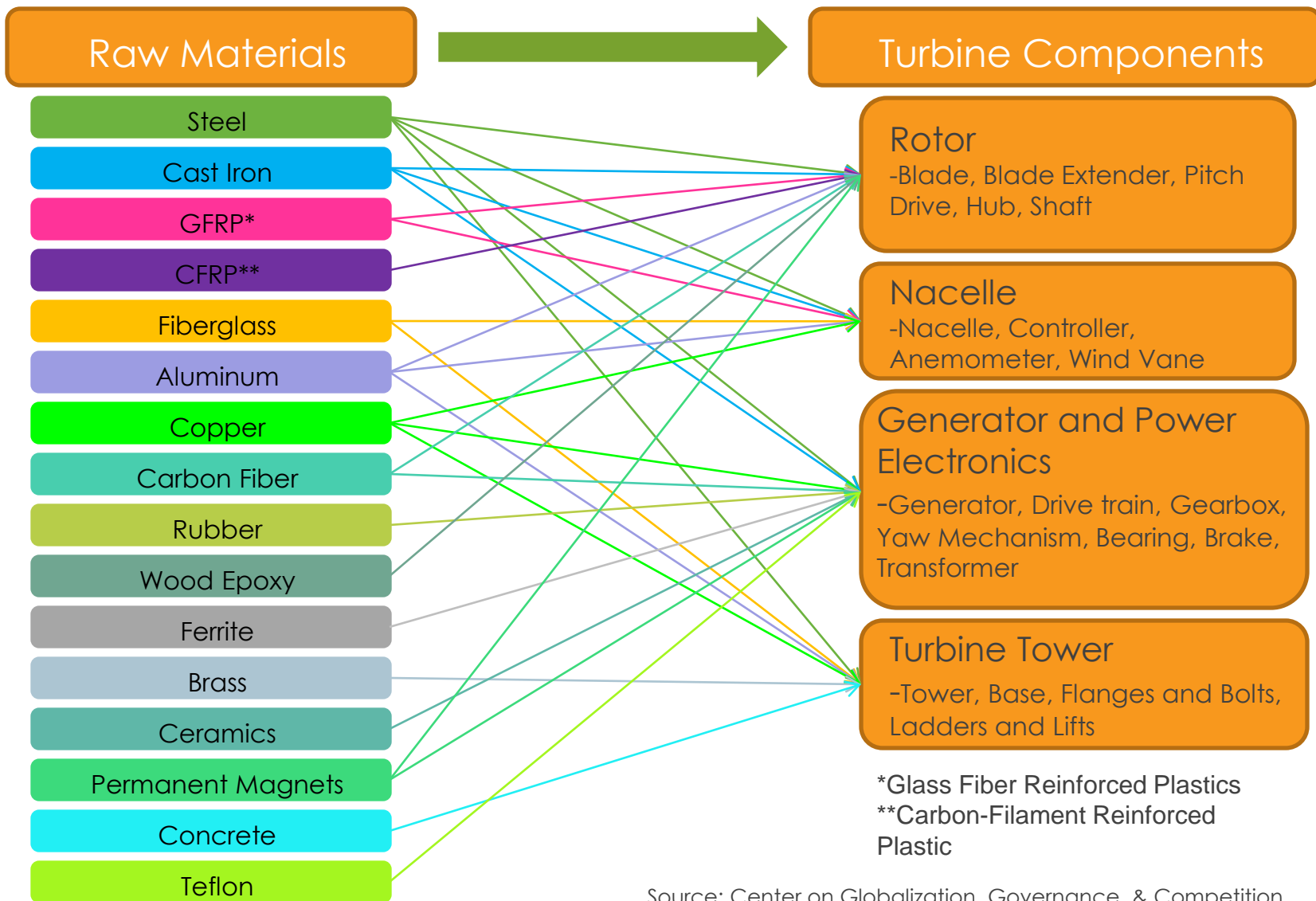
## Foundation:

Rebar  
Concrete  
Castings

## Other:

Transformers  
Bolts/Fasteners  
Wire  
Paints and Coatings  
Lighting  
Steel Working/Machining  
Communication Devices  
Monitoring Equipment  
Electrical Interface  
Electrical Connection  
Batteries  
Bearings

# The Raw Materials in Wind Turbine Components



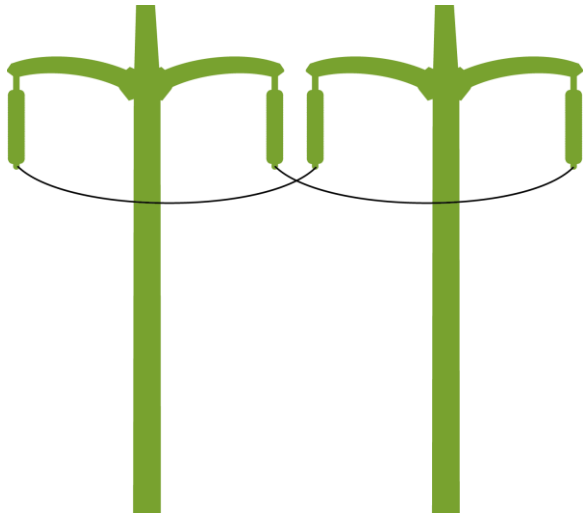
Source: Center on Globalization, Governance & Competition

# Plains & Eastern Clean Line will Open Supply Chain for Wind Energy in the Southeast



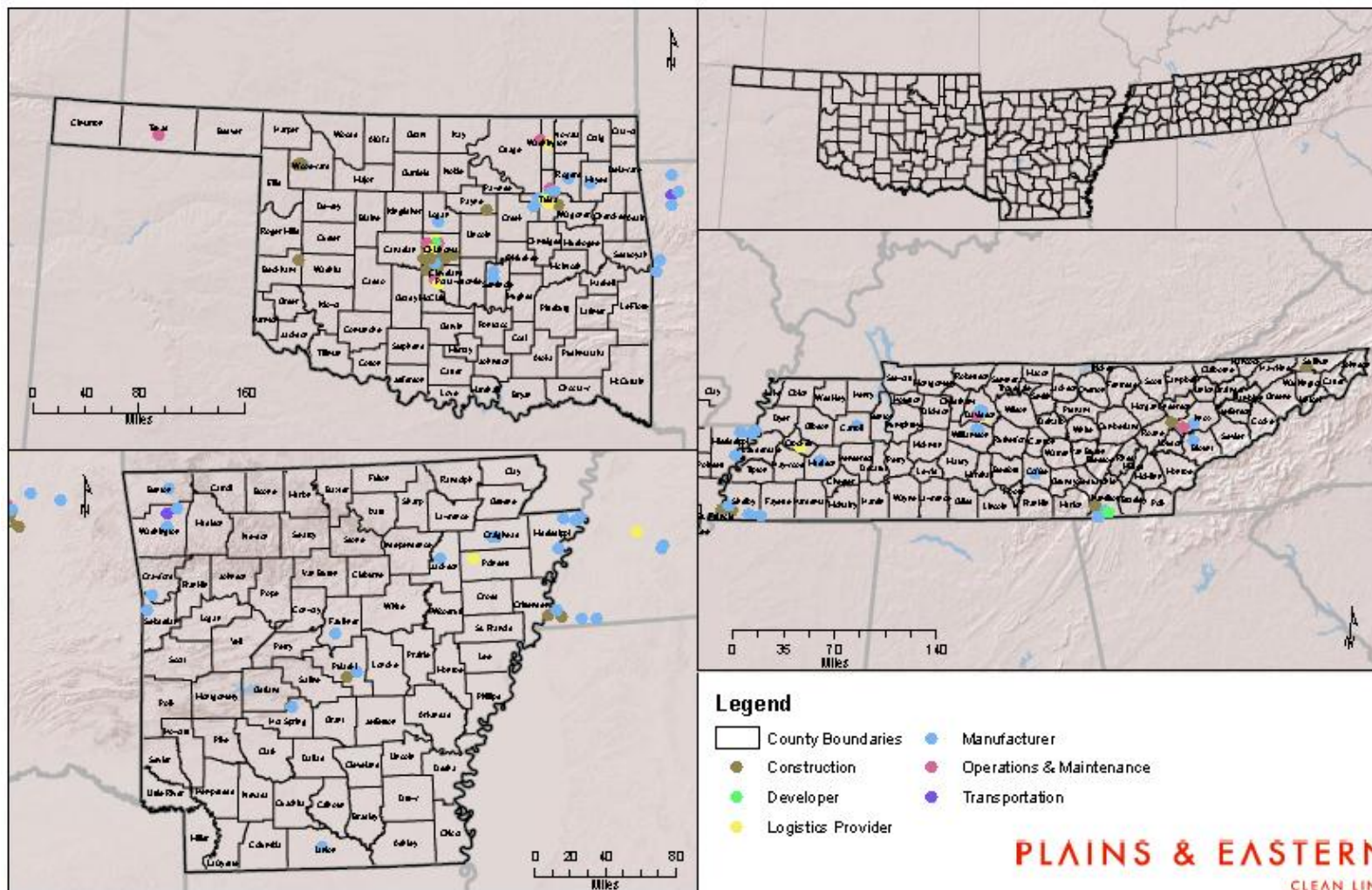
- Approximately **3,500 wind turbines** will be used to generate 7,000 MW of clean energy delivered by Plains & Eastern Clean Line.
  - **28,000,000 wind turbine components**
  - **1,050,000 tons of steel**
  - **10,500 blades**
- In addition to the turbine components, wind farms require:
  - Underground cable
  - Concrete for roads and foundations
  - Gravel for lay down yard
  - Steel for substation

# Plains & Eastern Clean Line will Open Supply Chain for HVDC Transmission in Southeast



- Approximately **4,693 steel monopole structures** with approximately **26.7 million feet of conductor** (+8.4 million feet for the metallic return) will be used for the Plains & Eastern Clean Line.
  - Around **35,000 – 40,000 pounds of steel** per transmission structure
  - Approximately **40 cubic yards of concrete** per structure with a larger foundation of **200 cubic yards of concrete** every 5 miles
- Plains & Eastern will create opportunity for:
  - **164,255,000 pounds of steel** for the structures
  - **219,200 cubic yards of concrete** for foundations
  - **11.2 million pounds of steel** and **67 million pounds of aluminum** for the conductor and metallic return

# Oklahoma, Arkansas, and Tennessee Companies are Positioned to see Increase in Jobs from Plains & Eastern Clean Line





# Clean Line Energy's Strategic Partnerships

Alliance with local vendors stimulate economic development in the states where we do business

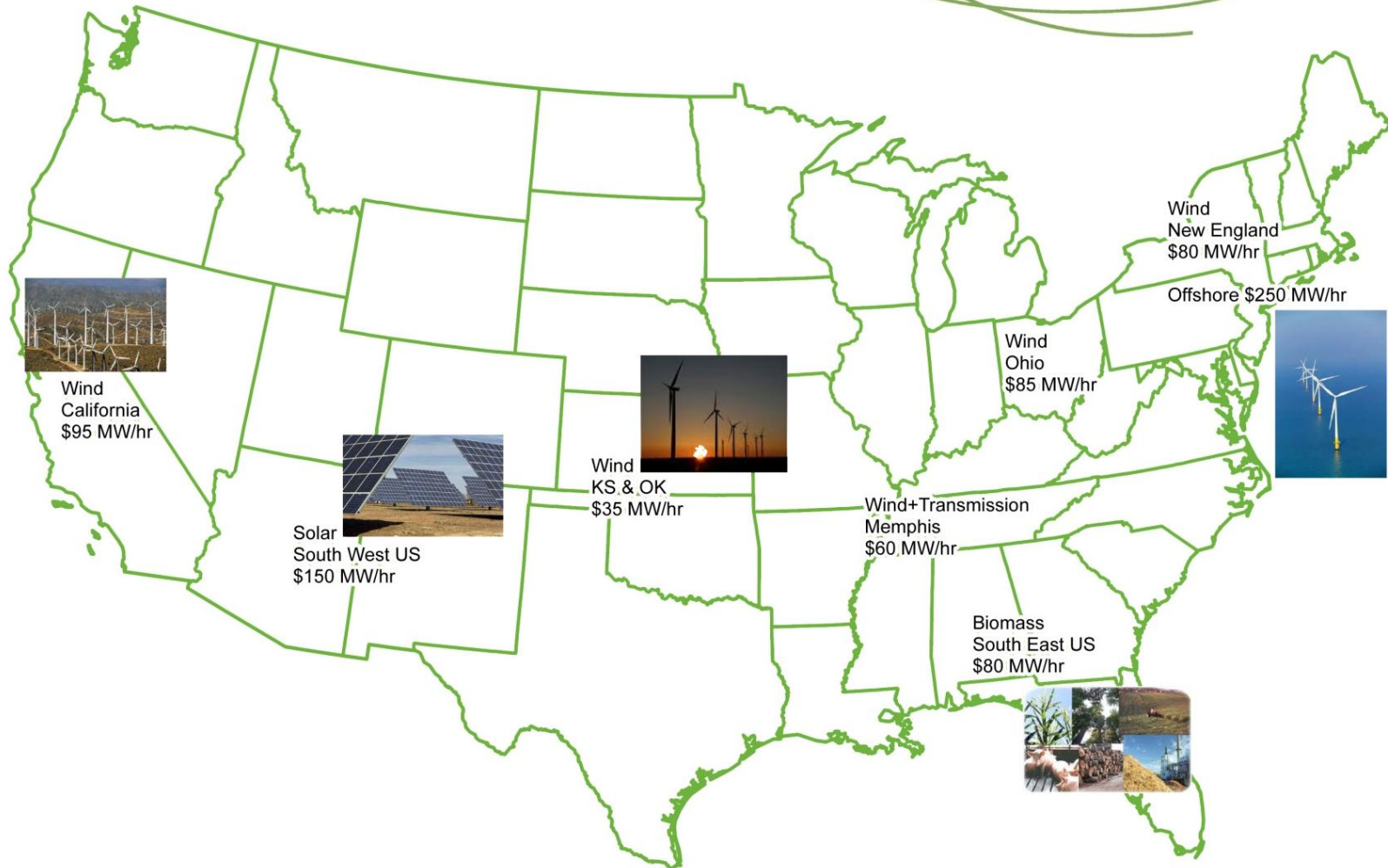
**SIEMENS**

 **General Cable**

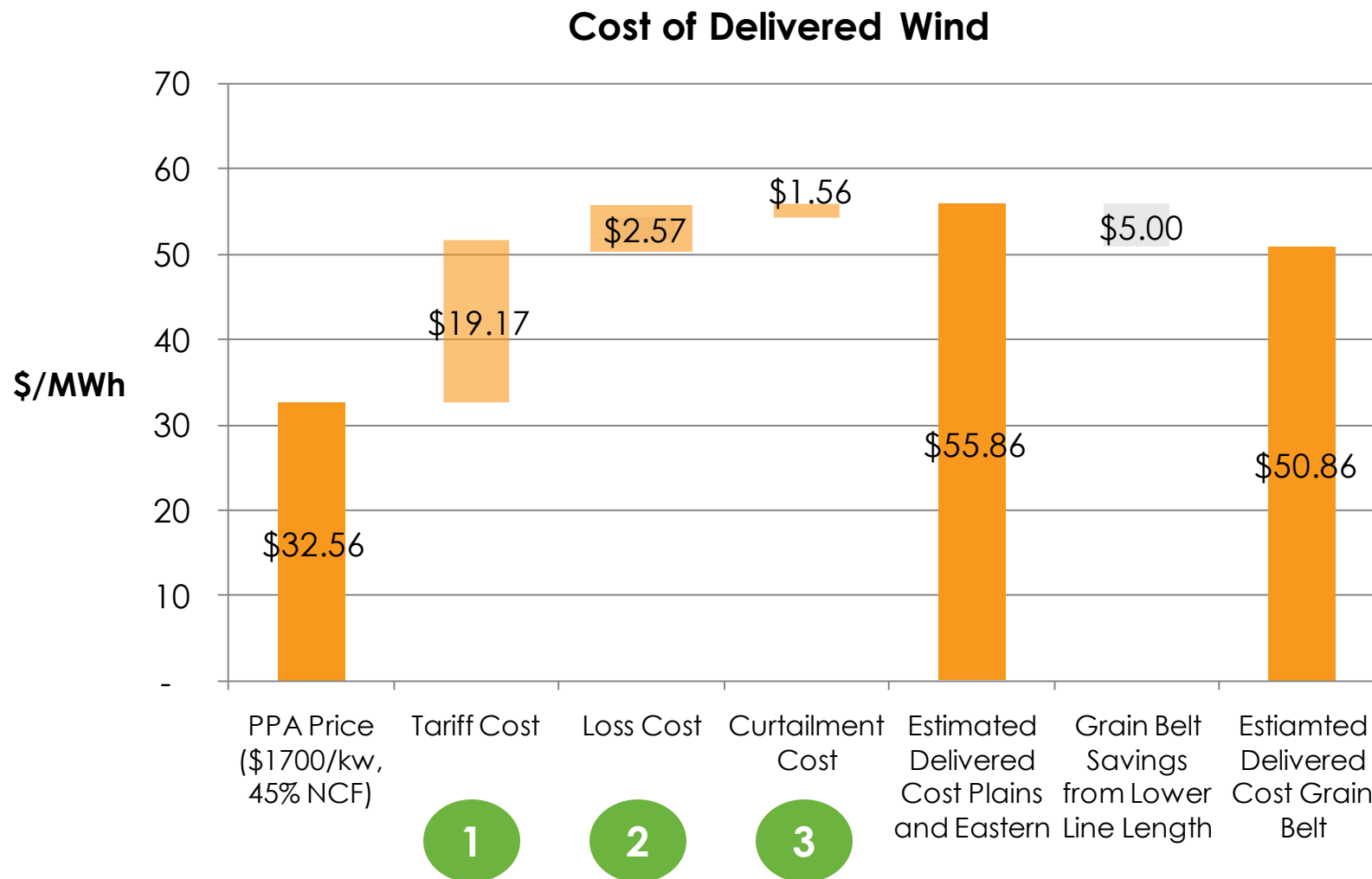


# Wind Energy is the Most Cost-Effective Form of Renewable Energy even when Paired with Transmission

CLEAN LINE  
ENERGY PARTNERS



# With a 45% NCF, Delivered Price Could be \$51-56/MWh



Source: Clean Line Energy

# Cost Competitiveness

## Levelized Cost (\$/MWh, nominal)

	<i>Fixed Cost</i>	<i>Fuel Cost</i>	<i>Total Cost</i>	<i>Comments</i>
Wind in high class II site	30-40	0	30-40	Typical resource in IA, OK, KS, TX, eastern NM
Wind in low class II site	50-60	0	50-60	Typical resource in IN, IL
Clean Line delivered product	55-70	0	55-70	Includes \$25-30/MWh of transmission
Gas combined cycle	15	50	65	Based on 7,000 heat rate, \$6/mmBTU real (\$7 nominal)
Wind in class III site	65-75	0	70-80	Typical resource in OH, NY, CA
Nuclear	80-120	5	85-125	Costs are highly uncertain
Solar PV	110-130	0	110-130	Costs are declining, but have a long way to fall
Solar thermal	120-150	0	120-150	

Source: EIA, Clean Line

# Integration Costs

- 3 scenarios:
  - Scenario 1: 7,000 MW delivered to TVA
  - Scenario 2: 3,500 MW delivered to TVA
  - Scenario 3: 3,500 MW to TVA; 3,500 MW to neighboring balancing areas (Southern Company, Duke Energy, Entergy)
- 3 times the standard deviation of the variations of net load (load minus wind) represents ramps occurring approximately 24 times every year

	<b>Net Load 3 Sigma Variation (MW) w/o Wind</b>	<b>Net Load 3 Sigma Variation (MW) w/Wind</b>	<b>Additional Net Load Variation (MW)</b>	<b>Additional Net Load Variation (% of Peak Load)</b>
Scenario 1	2326	3307	981	2.9%
Scenario 2	2326	2658	332	1.0%
Scenario 3	4989	5210	220	0.3%

Source: AWS



# TVA, Southern and the Southeast United States is a Strong Market for Plains & Eastern Wind Power

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- MOU signed in 2009 with TVA provides for technical evaluation of the project
- Over last two years, TVA has been the largest wind buyer in the Eastern Interconnect, signing over 1,500 MW of PPAs
- TVA announced it will retire 19 old coal units by 2017
- As a federal agency, TVA is sensitive to the environmental impacts of its energy procurement – must comply with NEPA
- TVA's 500 kV transmission system allows wheeling to Progress, Duke, Southern, and others
- Southern's Alabama Power is requesting approval of a wind PPA from Oklahoma – “lower than avoided cost” “will put downward pressure on retail prices for the life of the PPA”

**PROJECT ECONOMICS**

**PUBLIC ACCEPTANCE AT THE LOCAL LEVEL**

**PLENTY OF FINANCING**

**PROVEN TECHNOLOGY**

**ADEQUATE WIND RESOURCES**

**FERC'S NEGOTIATED RATE STRUCTURE**

**NO CURTAILMENT DUE TO CONGESTION**

**ANTIQUATED STATE SITING LAWS**

**NO FEDERAL SITING LAWS**

**LACK OF FEDERAL LEADERSHIP**

**LACK OF RULES AROUND HVDC INTERCONNECTION**

**INCUMBENTS SANDBOX**

**INTEGRATION CONCERNS BY UTILITIES**

**LACK OF MOTIVATION BY DOE**

# Clean Line Energy

[www.cleanlineenergy.com](http://www.cleanlineenergy.com)

