

**TRESAMIGAS** LLC  
*UNITING THE NATION'S ELECTRIC POWER GRID*

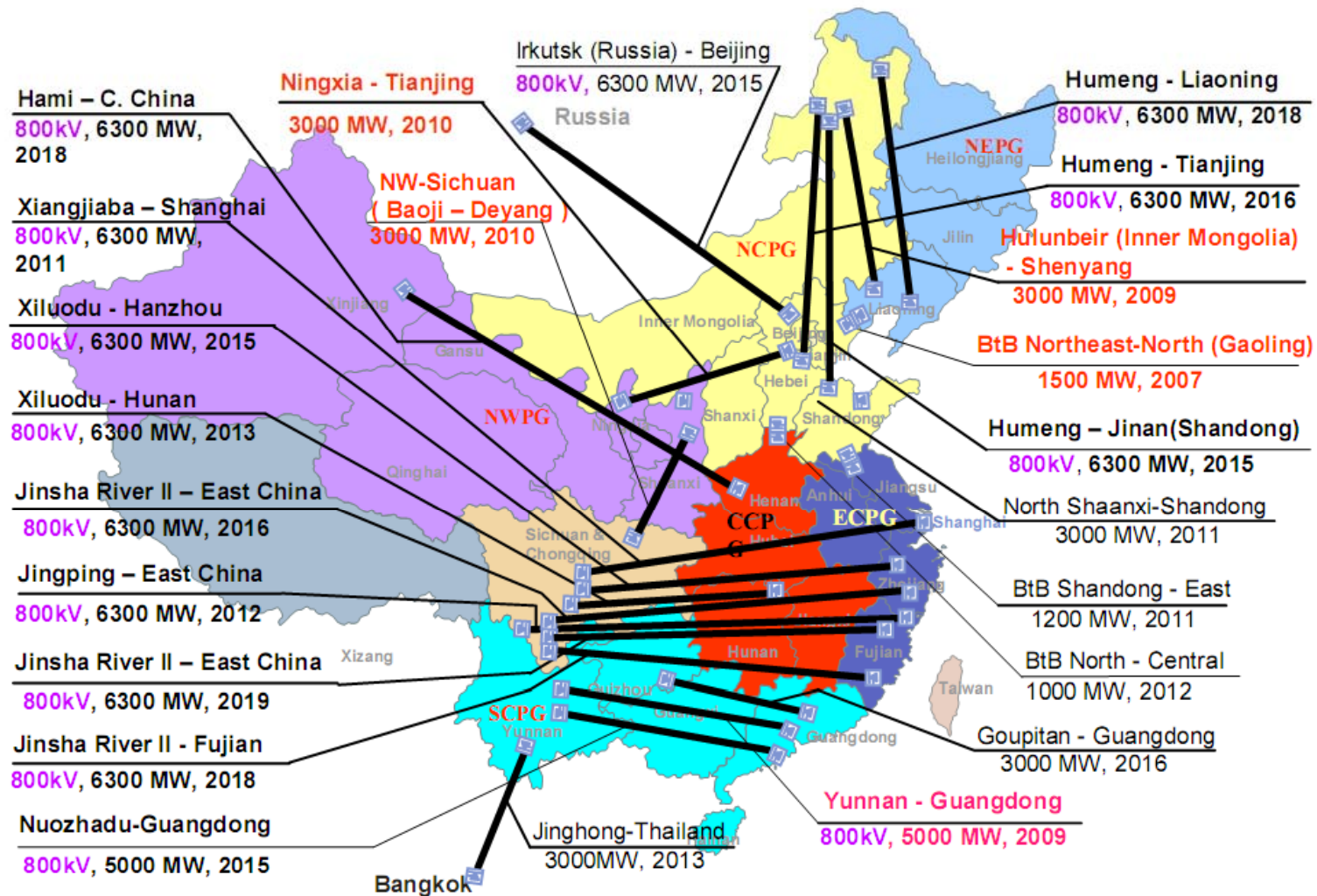
# **THE TRES AMIGAS SUPERSTATION PROJECT**

*Clovis Chamber of Commerce Legislative Breakfast*

*December 9, 2009*

# STATUS OF GLOBAL TRANSMISSION DEVELOPMENT

# China: Current HVDC National Grid Plan

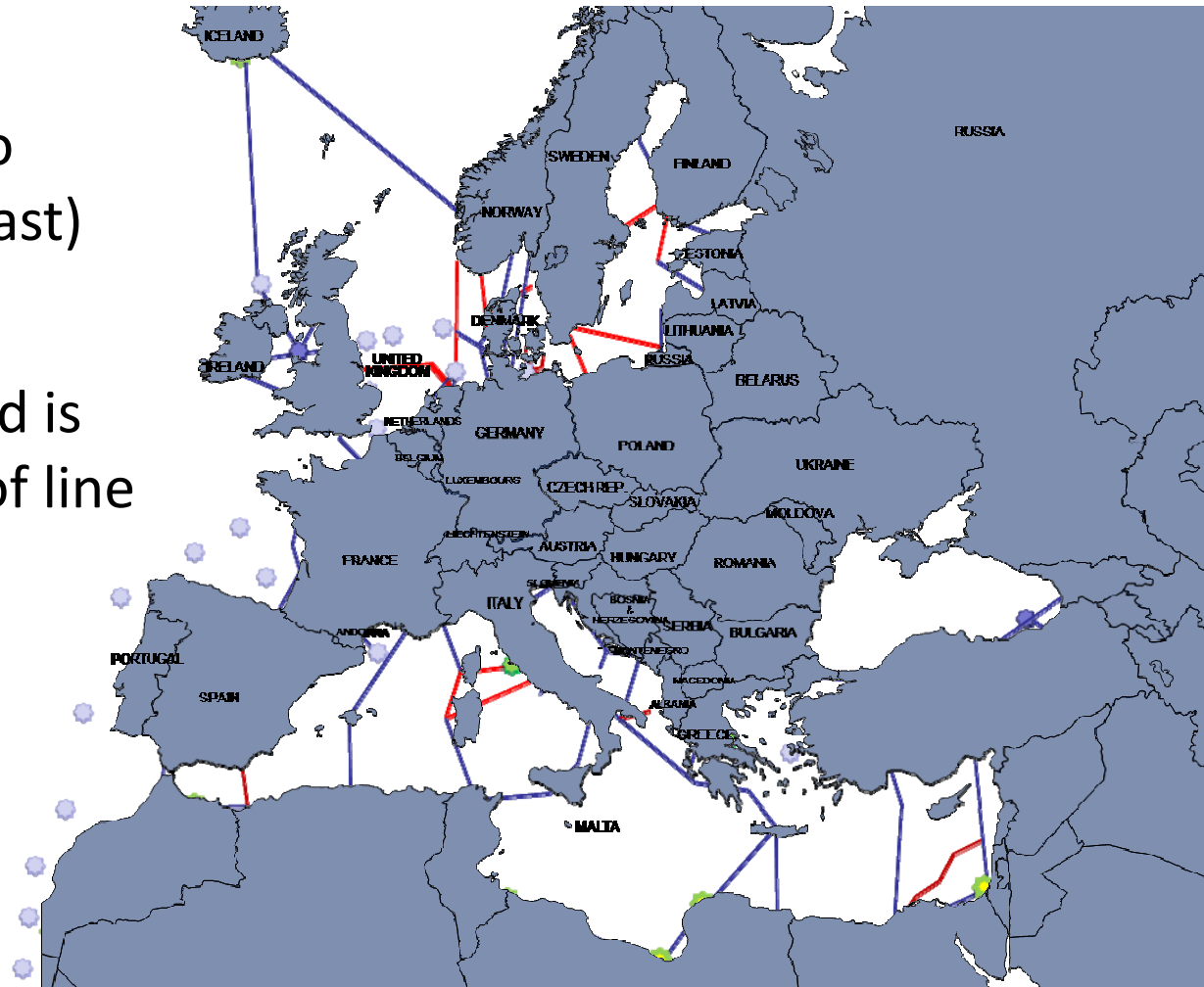




# Europe: Extended Grid Plan

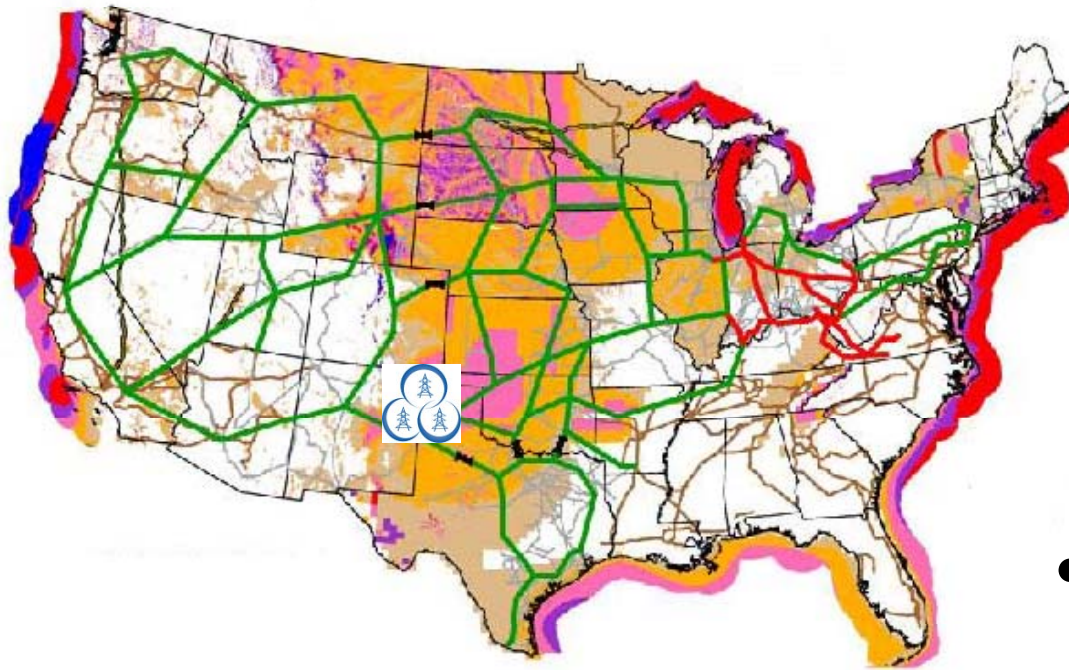
- From Iceland (Northwest) to Israel (Southeast) = 3,200 mi
- Concept of grid is 25,000 miles of line

- Solar Power
  - Wind Power
  - Geothermal
  - Hydro
  - Biomass
- Connections already in place or planned
- Vision of ABB and DLR



The new high-voltage network would range from the Sahara to the polar cap. The concept calls for main lines that are 40,000 kilometers long. And parts of it already exist.

# U.S.: National Grid Concept



- Concept of DOE National Renewable Energy Laboratory and American Electric Power Company
- DC and 765 KV AC lines

# WHY IS TRES AMIGAS A SUPERSTATION?

# Why Is Tres Amigas a SuperStation?

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## Tres Amigas will:

- Connect the three U.S. asynchronous power grids through a DC Hub that can regulate the direction and level of power flows between the grids, thereby improving the efficiency of the transmission systems in all regions
- Provide economic incentives to further drive the growth of the nation's transmission grid by expanding opportunities for efficient transactions across currently inaccessible market regions
- Optimize the value of existing AC infrastructure by utilizing state of the art technology
- Provide reliable and cost effective transmission services consistent with NERC standards and regional reliability requirements

*Tres Amigas Will Present Significant Opportunities for the Grid*

# Why Is Tres Amigas a SuperStation?



## Tres Amigas will:

- Enable the buying, selling and physical delivery of electricity between participants in multiple grids
- Optimize the performance of renewable energy sources by offering or creating options to firm intermittent power across a broad geographic area
- Promote the development of renewable energy projects by creating an opportunity for such projects to connect to multiple high demand load areas
- Enable renewable energy to follow hourly demand fluctuations throughout a large portion of North America
- Integrate large scale renewable resources by providing the capability to manage real-time power fluctuations that would otherwise exceed the capability of many existing balancing authorities

*Tres Amigas Will Present Significant Opportunities for Renewables*



# WHAT WILL THE SUPERSTATION LOOK LIKE?

# The Tres Amigas SuperStation



Transmission Lines from Western Interconnection

Transmission Lines from Eastern Interconnection

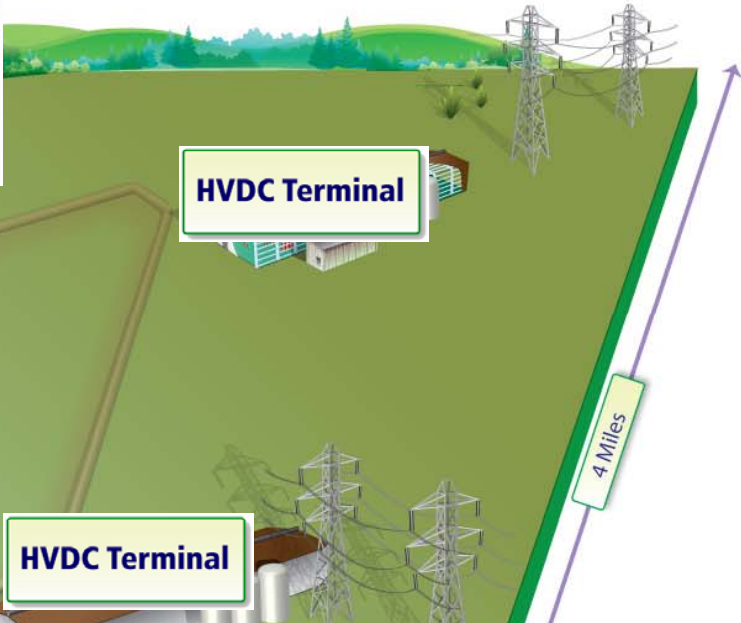


Transmission Lines from ERCOT

One or more transmission lines from the Texas Interconnection (see the U.S. Grid Interconnections box) connect to this HVDC terminal.

## HVDC Terminal

When bringing power into the Tres Amigas SuperStation, the HVDC terminals convert alternating current (AC) power in the transmission lines to direct current (DC) power and then send that power through superconductor pipelines. When supplying power from Tres Amigas, the HVDC terminals convert the DC power on the superconductor pipeline back to AC power suitable for the transmission line that will be carrying it to distant electrical demand centers. Power transfer between any of the transmission lines connecting at Tres Amigas can only be accomplished through this conversion process.



## HVDC Terminal – What's Inside

Each HVDC terminal looks like a standard utility substation with the addition of a building that houses the actual HVDC converter. Inside the converter building are high voltage power electronics that convert electricity back and forth between AC and DC (direct current) power. Tres Amigas SuperStation uses what are known as Voltage Source Converters (VSC), which enable the unique three-way grid interconnection. The substation also houses cooling equipment for the power electronics and the superconductor pipeline.

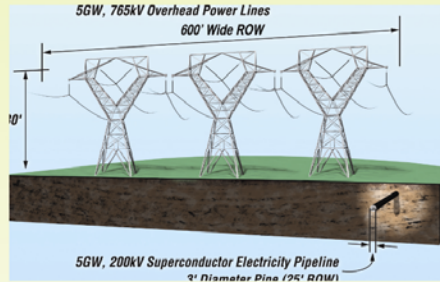
## DC Superconductor Ring

Key to the Tres Amigas SuperStation is an underground pipeline of direct current (DC) superconductor cables less than three feet in diameter capable of carrying more than 5,000,000,000 watts (5 gigawatts) of electricity with no electrical losses; enough electricity to power 2.5 million homes. Superconductor cables:

**Enhance efficiency:** When the station is running at full power, the superconductor pipeline can save as much as 60,000,000 kW-Hrs of energy annually compared with conventional transmission technology. That's equivalent to the electricity usage of 30,000 homes and a 40,000 ton reduction in CO2 emissions.

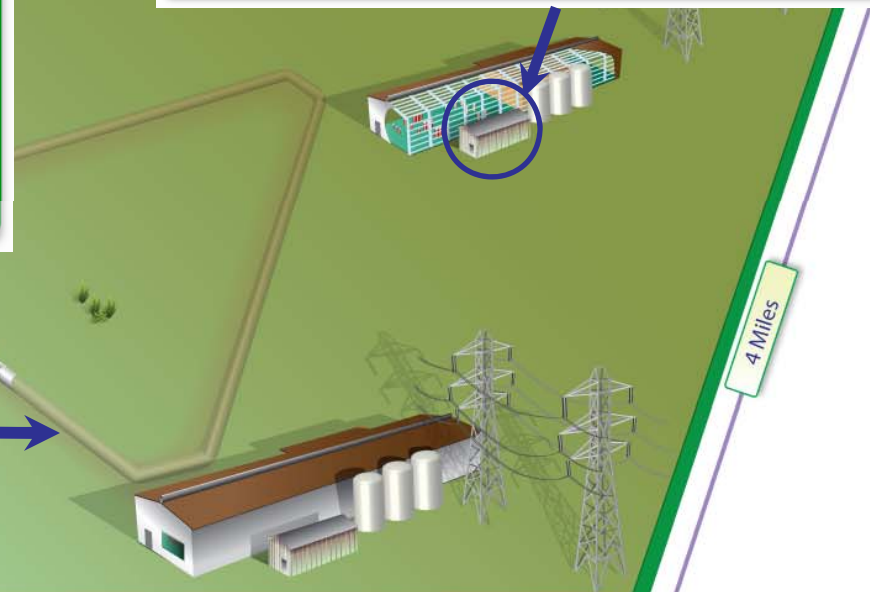
**Are out of sight:** A single, underground superconductor pipeline can carry as much power as three, 765kV AC overhead transmission lines (see figure).

**Increase power security:** Unlike overhead lines, underground cables are virtually immune to weather-related outages, the most common cause of power disruptions. Similarly, underground placement makes them less subject to vandalism and other forms of willful attack.



## Energy Storage Battery

Each HVDC terminal is equipped with an advanced battery system to provide both back up to the renewable energy purchased by Tres Amigas to run the facility and to provide what are termed "ancillary services" support to the connecting AC systems.

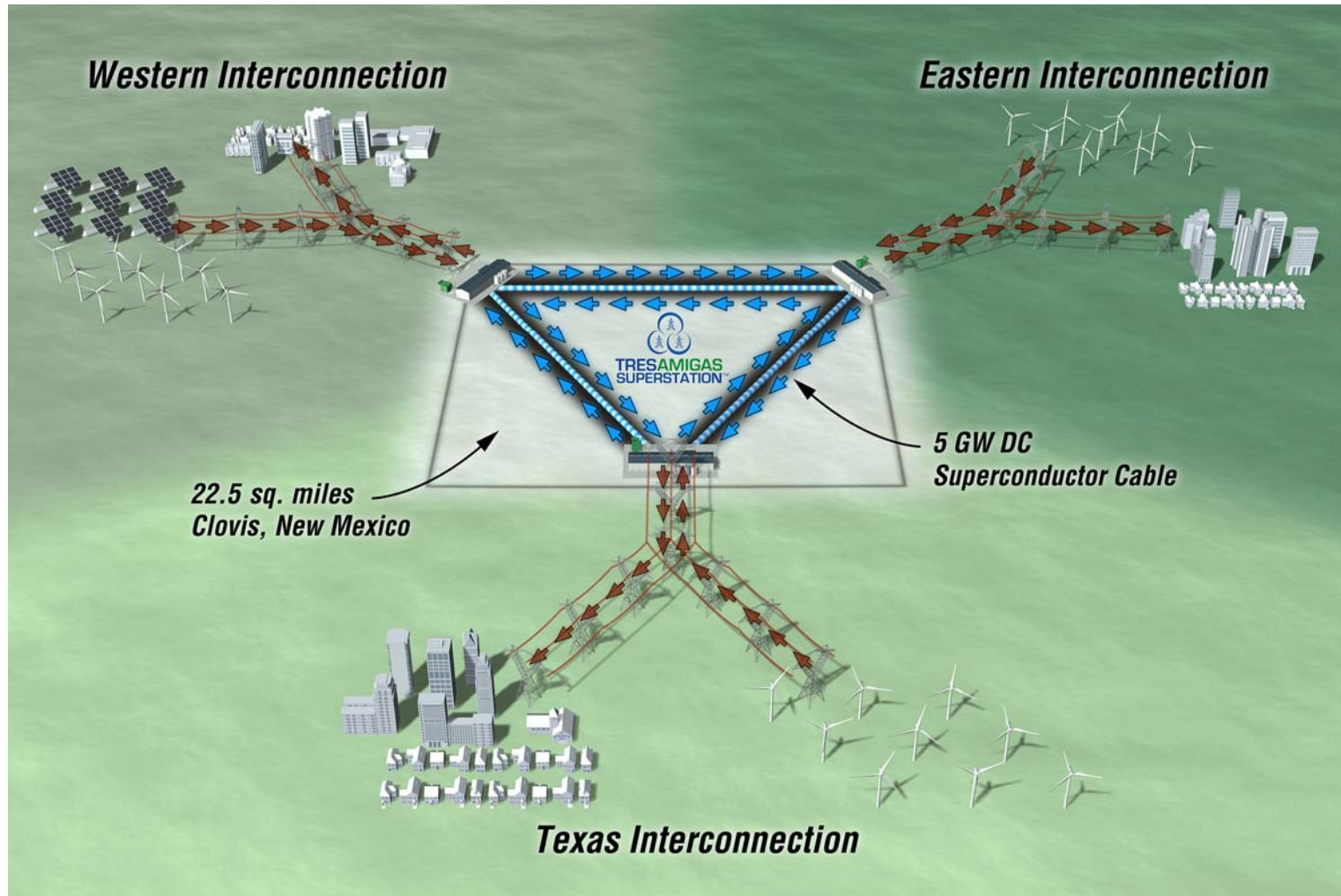


## What are Superconductors?

A superconductor is a perfect conductor of electricity; it carries direct current with 100% efficiency. When properly cooled, superconductor wires provide significant advantages over conventional copper and aluminum wires because they can transmit 150 times more electricity than conventional wires of the same size.

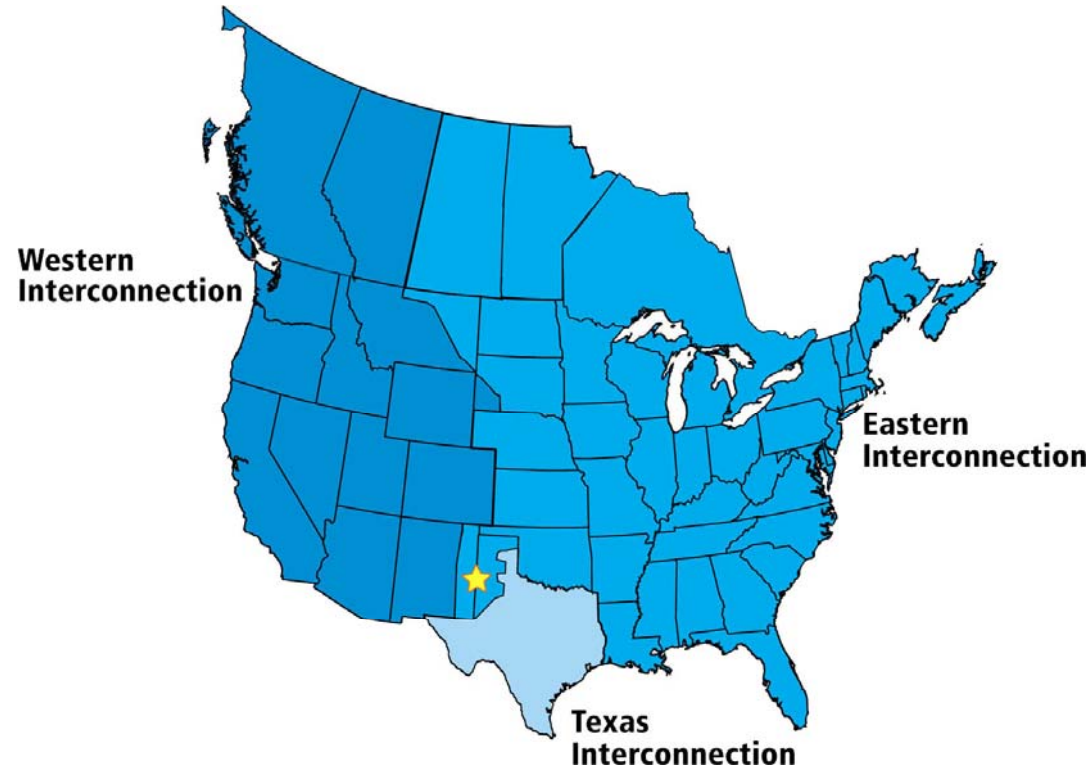


# The Tres Amigas SuperStation



# THE LOCATION

# The Location



*Tres Amigas Is Ideally Situated in Eastern New Mexico Near the Borders of CO, OK and TX Serving as a Three-Way Interconnection of WECC, Eastern Interconnect and ERCOT*

# The Location: Clovis, NM

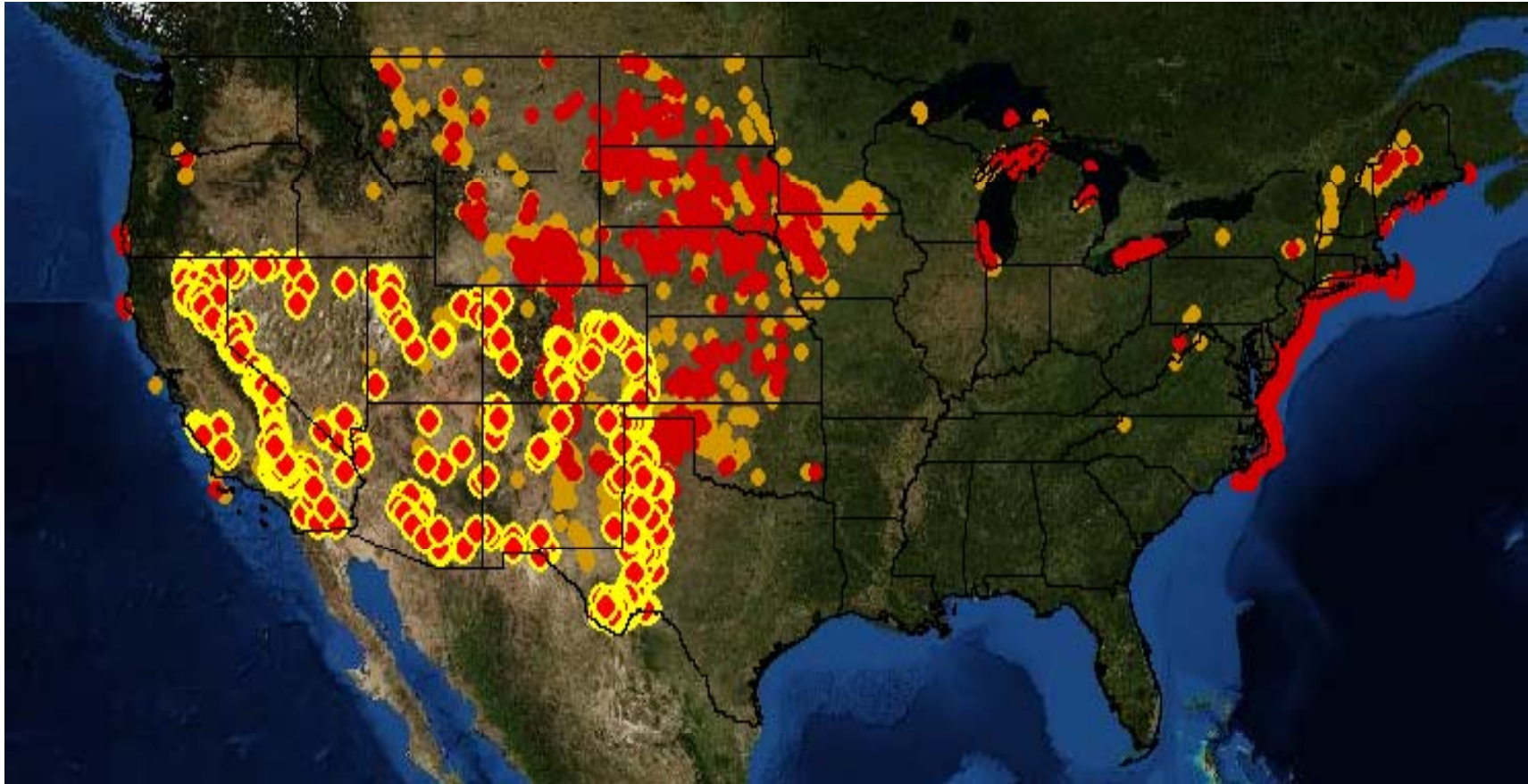
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- The Tres Amigas SuperStation is located in an area of the country rich in renewable resources
- The New Mexico State Land Office has granted Tres Amigas, LLC an option to lease 14,400 acres (22.5 square miles) for this purpose



# The Location: Regional Renewable Resource Potential



*Significant Regional Wind & Solar Capacity Factors in Excess of 35%*

# IMPACT ON NEW MEXICO

## Economic Impact: NM Potential

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- Study commissioned by the Western Governor's association ranked New Mexico's potential at #1 for renewable energy generation capacity at 27 gigawatts
- New Mexico could produce 70,573 gigawatt hours of renewable energy annually

*New Mexico Has Tremendous Renewable Potential Being Limited by Transmission Constraints*

# Economic Impact: Requires Transmission



- Western Governors' Association did a study to determine renewable potential under different transmission situations

WGA Wind Task Force Scenarios  
Wind Development Potential (MW)

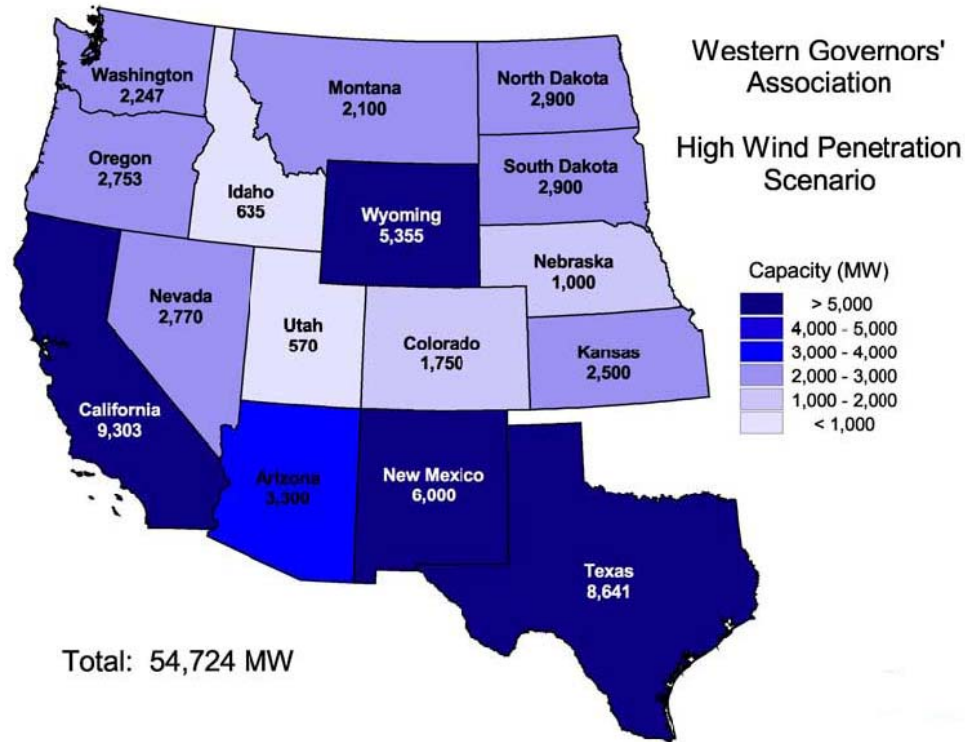
	Limited Transmission Expansion	Full Transmission Expansion	Transmission Investment Impact
Arizona	2,800	3,300	500
Colorado	1,000	1,750	750
<b>New Mexico</b>	<b>200</b>	<b>6,000</b>	<b>5,800</b>
Texas	3,641	8,641	5,000
Utah	100	570	470

Source: NREL/CP-500-41808/June 2007

*New Mexico Has the Most to Gain from Transmission Expansion  
~ 5,800 MW of Potential Wind Development ~*

# Economic Impact: Untapped Potential

*With Investment in Transmission New Mexico Has 69% of the Wind Development Potential of Texas*



*But NM Only Has 6.7% of the Installed Capacity of TX Today*

# Economic Impact: Ripple Effect

Illustrates Ripple Effect if 6.0 GW of Wind Is Developed by 2015



# THE TECHNOLOGY

## **The latest proven technology in converters - Voltage Source Converter (VSC) technology will be used**

- The VSC converters make power control flow changes rapidly and accurately
- Dispatch control is significantly improved and simplified thereby improving the performance and efficiency of the interconnected AC networks



# Technology Breakthroughs: HVDC Cable

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- Tres Amigas has partnered with American Superconductor Corporation ("AMSC")
  - A pioneer in the development of superconducting technology, including power cables
- AMSC's "Superconductor Electricity Pipelines" were chosen for Tres Amigas because:
  - Only superconductor HVDC cable can handle multi-gigawatt power with no electrical losses in the cable
  - Underground placement of the cable increases system security and reliability
  - The superconductor HVDC cable will initially be designed to carry five gigawatts of power per cable and can easily be expanded
- AMSC will be responsible for the engineering and manufacture of the superconductor cable system

- Tres Amigas will be utilizing energy storage batteries of proven design that will complement the transfer of energy with optional ancillary services
  - Fast, dynamic response to system changes
  - Ability to handle the large number of charge-discharge cycles associated with intermittent renewable energy sources
  - Has the ability to provide reactive support which may be critical to grid reliability and power quality

# Technology Breakthroughs: Green Design

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- Tres Amigas will contract with local renewable generators to purchase energy for the SuperStation
- The renewable energy will be used to charge the on-site storage batteries
- This green design will allow for:
  - Zero emissions
  - Back-up generation
  - Black Start capabilities
  - “Firming” of renewable intermittent resources used for station power

# TRANSMISSION SYSTEM IMPACTS

# Potential Beneficiaries in WECC

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- High Plains Express (HPX)
  - Will connect the states of Arizona, New Mexico, Colorado, and Wyoming.
  - 1250 miles long and have 3500- 4000 MW of transmission capacity
  - It is expected to be operating in 2017
- New Mexico Wind Collector
  - PNM plans to expand its current transmission system to accommodate large amounts of proposed wind generation in eastern New Mexico
  - Various expansion alternatives are still being developed
- SunZia
  - Independent Project Developers
  - Transmission line between southern New Mexico and southern Arizona
  - Up to two 500 kilovolt (kV) transmission lines approximately 460 miles in length

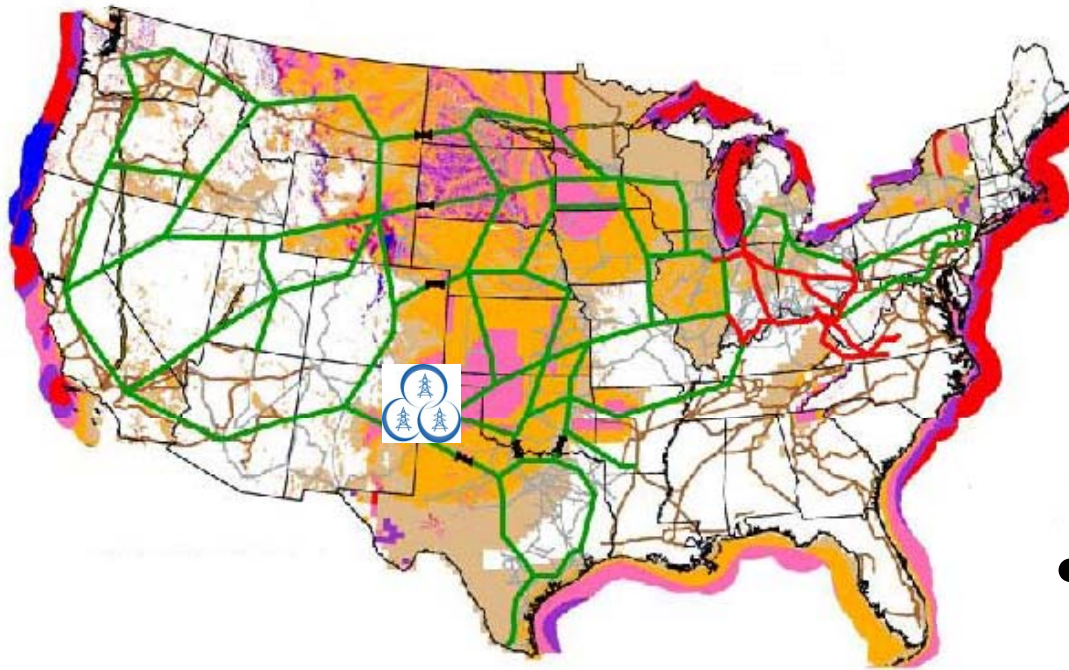
# Potential Beneficiaries in ERCOT

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- Public Utility Commission of Texas approved 2400 miles of transmission to be constructed in five CREZ regions by the end of 2014. Included are:
  - Sharyland Utilities: Construct approximately 250-300 miles of new electric transmission facilities located in the Texas Panhandle and South Plains
  - WETT: Constructing a network of power transmission lines in northern and central Texas that will connect wind generation projects in West Texas with major power markets such as Dallas.
  - LCRA: Construct own, and operate about 600 miles of new and existing transmission lines and facilities

# U.S.: National Grid Concept



- Concept of DOE National Renewable Energy Laboratory and American Electric Power Company
- DC and 765 KV AC lines

# NATIONAL BENEFITS



# National Benefits

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## **Tres Amigas will:**

- Enhance the reliability of the national grid by connecting ERCOT, Eastern, and the WECC electrical grids through a robust interconnection station
- Promote the National Corridor Transmission System by providing added value to other planned transmission developments
- Accord load serving entities and customers an economic benefit through sourcing energy from any of the three grids

*Tres Amigas Will Enhance the National Grid*

# National Benefits

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## Tres Amigas will

- Support current public policy by enabling the integration and the development of new, clean, renewable power sources
- Support national goals by being a green design with the station energized with renewable energy – onsite storage batteries will be charged with renewable energy for back-up generation
- Enable other benefits such as reserve sharing pools across asynchronous grids

*Tres Amigas Will Help the Nation Achieve its Renewable Goals*

# CONCLUSION

# Conclusion

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Tres Amigas Is an Integral Component to the Future of  
the Nation's Grid and the Integration of Our  
Renewable Energy Resources

# Senior Management Team

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**Phil Harris, Managing Partner and CEO:** Phil has extensive experience in the electricity sector . He has worked across the nation with various entities associated with the investment , regulatory, and utilities side of the business to advance the evolution of the energy market. His years as the CEO of the PJM ISO have primed him for a leadership role in public relations and nation-wide policy development.

**Ziad Alaywan, Managing Partner, COO:** Ziad has over 22 years of project experience in the energy sector; primarily in transmission, generation and market operations. He founded ZGlobal Inc., an engineering & consulting firm, after working for almost a decade with Pacific Gas & Electric as Manager of Real Time Grid Operation. Ziad was the first CAISO employee and successfully led the implementation of the CAISO market & grid system in 12 months. Ziad was Managing Director of CAISO Market & Grid Operations until 2004.

**Russ Stidolph, Managing Partner and CFO:** Russ is the founder and a Managing Director of AltEnergy, LLC a private equity firm focused on alternative energy investing. Prior to founding AltEnergy, Russ was a Principal at J.H. Whitney & Co., LLC a middle-market private equity firm. Currently, Russ is the Chairman of the board of directors of Viridity, Inc, and sits on the board of directors of Tres Amigas, LLC; American Heartland Development, LLC; AgriSol Energy, LLC and GRP Funding, LLC. He received a Bachelor of Arts degree from Dartmouth College.

*Please Contact Us with Questions Regarding Tres Amigas:*

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**TRESAMIGAS** LLC

Tres Amigas SuperStation....

Uniting the Electric Grid