Designing Energy Solutions without Borders

Energy, Environmental Policy, & the Recession

Impact of Proposed Federal Policies
Illinois State University – April 30, 2009

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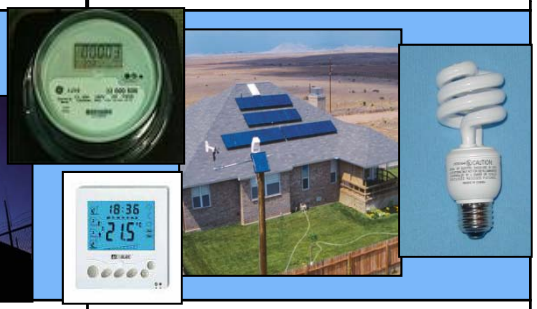
AEP AMERICAN ELECTRIC POWER

American Electric Power

Strength & scale in assets & operations

- 5.1 million customers in 11 states.
- Largest Transmission Owner in the US with 2,100 miles 765kV

Asset	Size	Industry Rank
Domestic Generation	~38,400 MW	#2
Transmission	~39,000 miles	#1
Distribution	~208,000 miles	#1

Generation	Transmission	Distribution	Customers
			

• Environmental Projects
• Wind
• IGCC
• Carbon Capture & Storage
	• I-765™
	• Electric Transmission Texas JV
	• Electric Transmission America JV
	• AEP-ABB Alliance
		• Distribution automation
		• Self-healing distribution circuits
		• Advanced metering
		• Communications infrastructure
		• Mobile workforce
		• Internal energy efficiency
		• Integration platform for advanced visualization and analytics
		• Distributed generation and energy storage
			• Customer programs and incentives
			  • Energy efficiency
			  • Direct load control
			  • Peak demand reduction
			• Energy storage

Existing generation and transmission control systems	**gridSMART℠**: bridging the gap to provide integrated two-way communications & control across the electricity value chain	Home energy automation

National Landscape

Challenges

- Increasing focus on renewable sources of energy has highlighted the weakness in the existing system and in the planning processes used to develop new transmission
- Concerns over the environmental impact of burning fossil fuels will continue to challenge the industry
- Existing transmission system:
  - aging and in need of upgrades
  - was not built to support competitive regional markets and is not adequate to meet future demand growth and integrate potential renewable generation resources
  - not designed to be adaptive to major changes in the generation supply mix

Opportunities

- Strategic expansion of the transmission grid, including development of a robust national EHV transmission system can better prepare the United States to address these challenges in a timely, cost effective and efficient manner.

National Landscape: EHV Transmission Vision

Not All Transmission Solutions Are Created Equal…

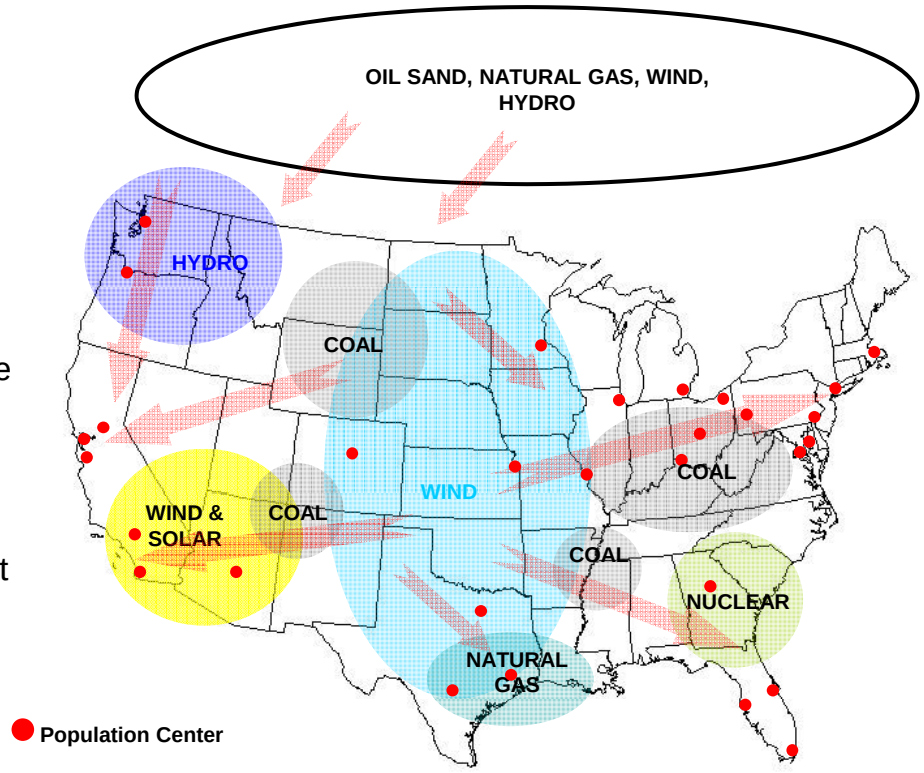
- Extra-high voltage (EHV), high-capacity, highly efficient interstate transmission system provides unique benefits that sets it apart from lower voltage solutions:
  - Increases transmission performance and reliability for large geographic regions, across multiple states and regions
  - Enhances reliability, operational performance, reduces congestion and decreases costs to consumers
  - Integrates large-scale renewable generation in remote areas and facilitates efficient movement of energy to load centers
  - Provides long-term system benefits and avoids reliance on "Just in time" transmission planning

AEP's Vision for an Interstate Transmission System would establish EHV as the backbone of the US Transmission System

National Landscape: Resources on Wires

Accessing America's Resources

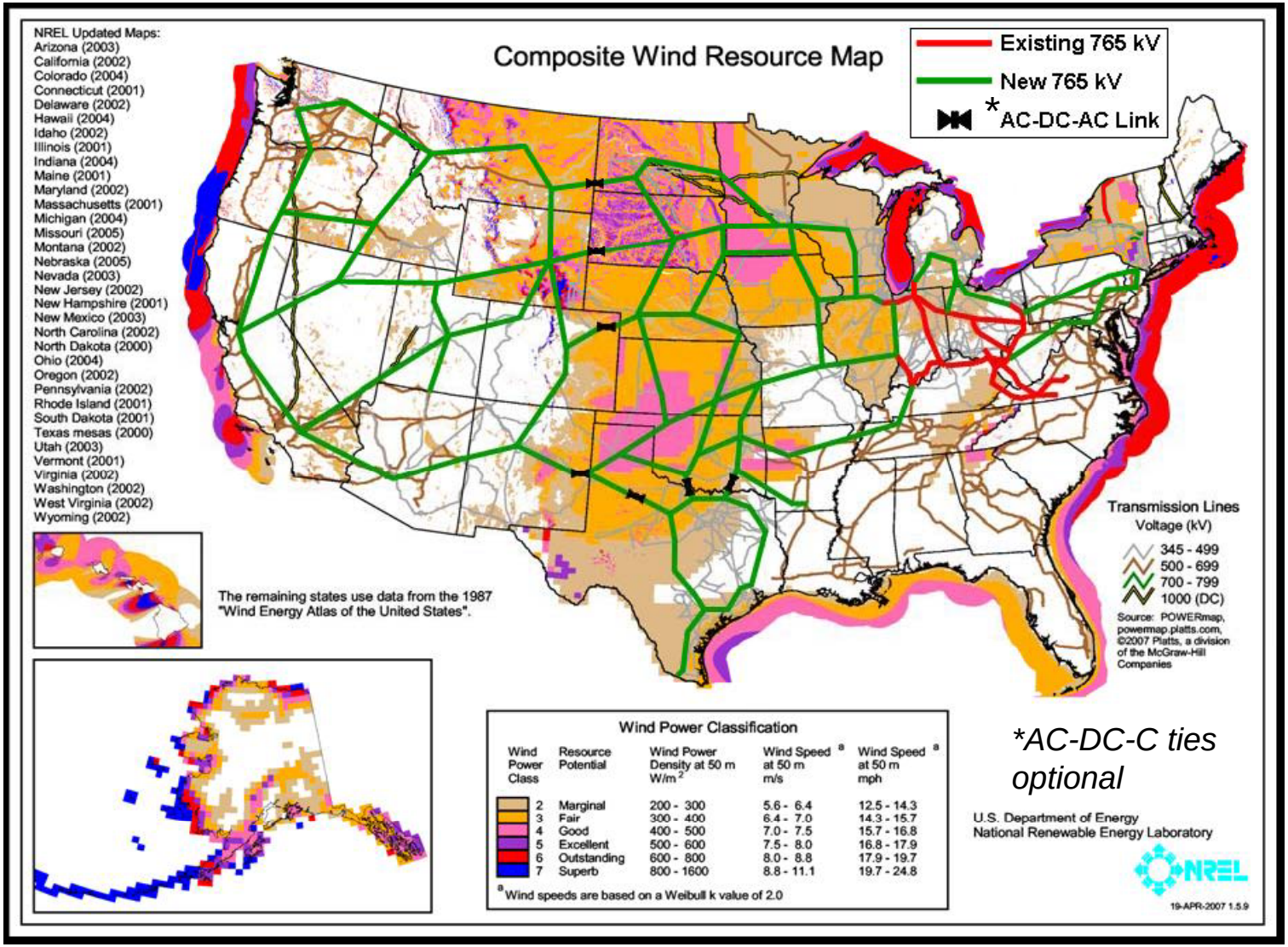
- Optimal use of renewable and fossil fuels are constrained due to insufficient transmission infrastructure
- Investment in a EHV transmission system extending coast to coast will enable the US to use its resources when and where it may be needed in the future
  - Remove barriers to access renewables and improve the diversification in our fuel supply
  - Lowers system losses
  - Broader sharing of reserves
  - Adds to energy security, reduces environmental impact and ultimately allows continued growth of the US
- Economic growth remains closely tied to energy and climate related initiatives, requiring policies which understand these interdependencies.



"We need a true nationwide transmission version of our interstate highway system; a grid of extra-high voltage backbone transmission lines reaching out to remote resources and overlaying, reinforcing, and tying together the existing grid in each interconnection to an extent never before seen." *Suedeen Kelly-Commissioner FERC*

Vision of The Next Interstate: EHV Transmission

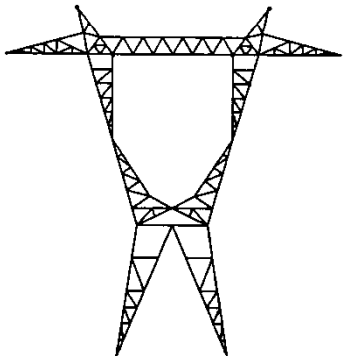
Conceptual 765-kV overlay for wind integration can save 20 GW of supply.



Vision of the Next Interstate: Benefits of EHV

Weak Backbone

- Reliance on local, high cost generation
- Higher reserve requirement
- Higher system losses
- Greater need for additional right-of-way
- Higher "coincident" peak loads
- Lower system efficiency



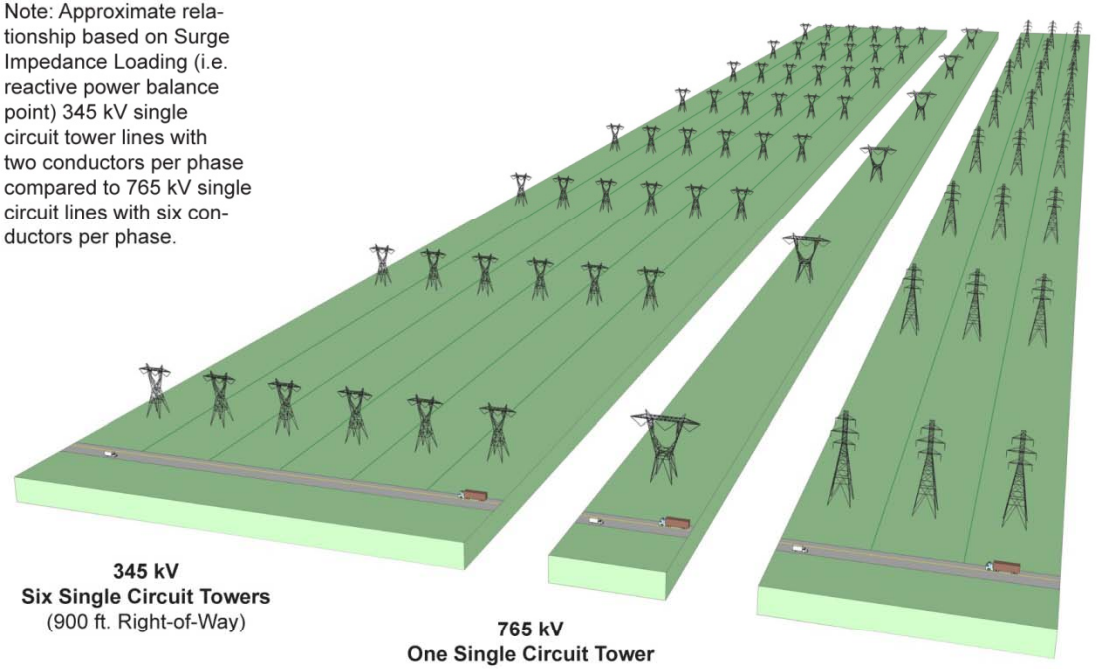
Robust Backbone

- True generation diversification (cost, supply, geography)
- Lower reserve margin
- Lower system losses
- Less right-of-way consumption
- Greater access to large-scale renewables
- Compliment to smart-grid initiatives
- Decreases "coincident" peak loads
- Higher system efficiency
- Increased reliability

A 765 overlay would provide for connection of up to 400 GW of wind, improve the US supply portfolio, provide for environmental sustainability and cultivate an opportunity for growth

EHV Transmission: Environmentally Sensible

Note: Approximate relationship based on Surge Impedance Loading (i.e. reactive power balance point) 345 kV single circuit tower lines with two conductors per phase compared to 765 kV single circuit lines with six conductors per phase.



345 kV
Six Single Circuit Towers
(900 ft. Right-of-Way)

765 kV
One Single Circuit Tower
(200 ft. Right-of-Way)

345 kV
Three Double Circuit Towers
(450 ft. Right-of-Way)

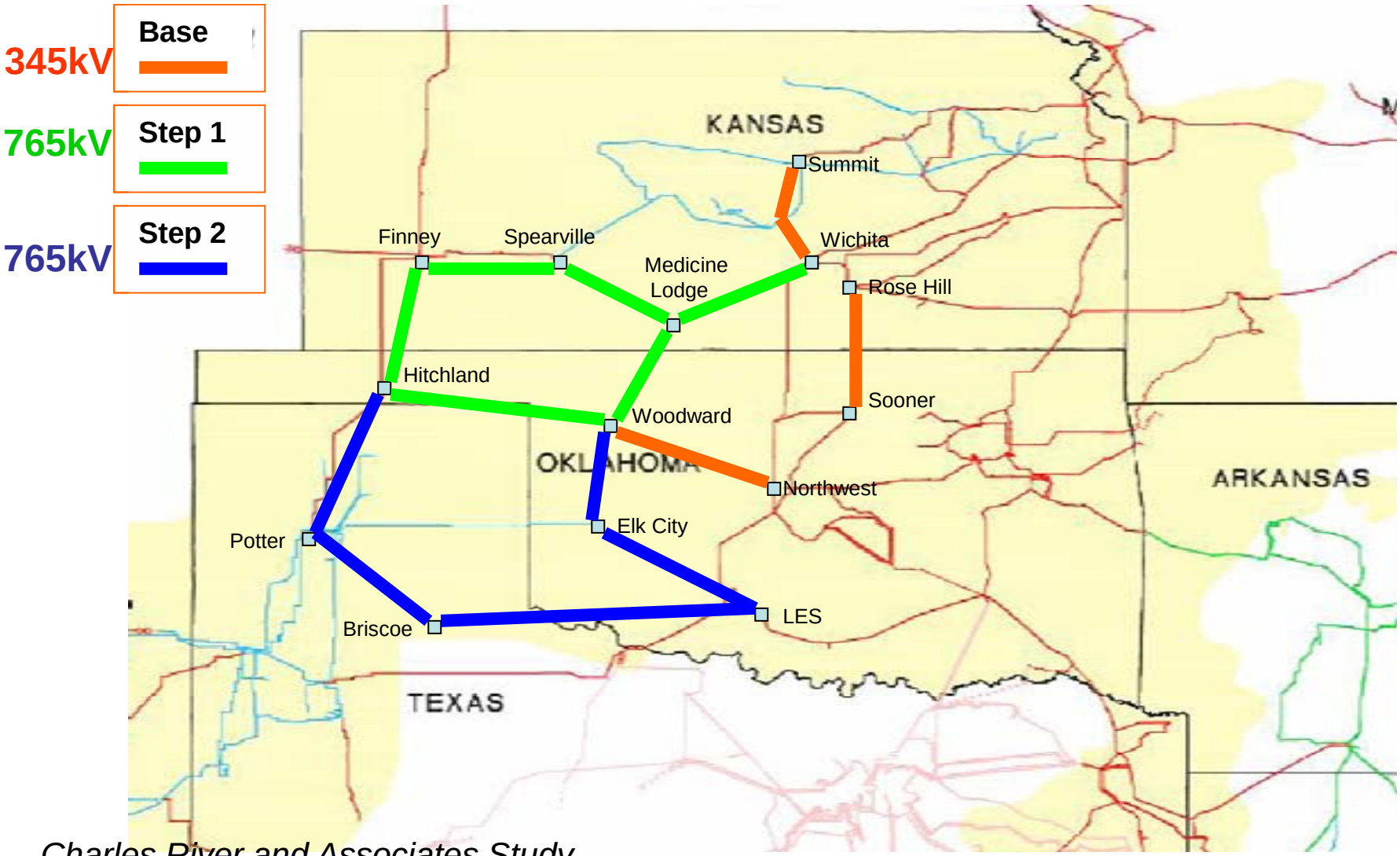
Wind Turbines and Transmission Towers
Average Height of Structures

National Landscape: Strengthening the Network

An EHV overlay provides the most benefit to the existing system.

- Natural choice for overlaying existing 345 kV and below grid.
- Lower impedance increases transmission "**reach**", allowing large power transfers over greater distances.
  - Enables variable generation resources to "lean on" dispatchable plants located far away.
  - May allow for reduction in generation reserve margins.
- Unloads the lower voltage transmission system.
  - Frees them to serve local area load.
  - Alleviates or defers upgrades to local systems.
  - Provides margin for growth and reliability.

Case Study: SPP Western Loop 2016



Charles River and Associates Study

Case Study: Benefits by State

- Benefits quantified include power supply costs in SPP, reduction in losses, economic incentives for construction of new wind power, CO2 reductions, locals jobs, earnings, taxes and economic output.

Estimated Annual Power Supply Cost Benefits

	Benefits (M$ 08)
Arkansas	34.6
Kansas	196.3
Louisiana	12.6
Missouri	218.6
New Mexico	30.3
Oklahoma	428.8
Texas	110.9
Total	**1127.9**

Construction Period

	Kansas	New Mexico	Oklahoma	Texas
New Jobs (4-yr avg)	4,131	351	3,247	2,497
Earnings (M$)	536	45	388	410
Economic Output (M$)	1,818	129	1,315	1,255

Operating Period (annual impacts)

	Kansas	New Mexico	Oklahoma	Texas
New Jobs	1,955	269	1,610	1,654
Earnings (M$)	76	10	69	74
Economic Output (M$)	182	20	129	165
Property Taxes (M$)	--	2	34	21

Source: Charles River and Associates Study 10/2008

Case Study: Summary of Benefits and Costs

❖ Benefits:

- **SPP Power Supply Cost Benefits**: $2.8 billion (08$) annually
  - **CO_2:** Nearly 30 million tons of CO_2 emissions per year avoided
- **Losses:** Additional $100 million benefit in reduced power losses in SPP
- **Renewable Development:** Assumed 14GW of wind generation
- **RPS:** More than 20% of SPP demand supplied by renewable energy.
- **Local impacts:** Over 10,000 SPP jobs during construction, and 5,000 during operation; $60 million per year in property taxes, and $500 million per year in economic output.

❖ Costs:

- **Cost of the EHV:** $400 to $500 million per year
- **New wind costs:** $1.75 billion per year net of production tax credit

CRA concluded that the Two Loop project yielded substantial net benefits to SPP.

Issues Shaping Transmission Policy

21rst Century System Requires a 21rst Century Vision

- Recognition that EHV transmission is a unique class of infrastructure that provides unique benefits and drives the need for EHV policy development including:
  - Clear delineation between state and federal jurisdiction to foster EHV investment and its associated benefits
  - Federal siting of EHV lines
  - Cost allocation methodology which recognizes the broad system benefits associated with EHV development
- Recognize that "Efficiency Improvements" and "Grid Modernization" can be best secured by designing an efficient robust transmission grid

Issues Shaping Transmission Policy (continued)

21rst Century System Requires a 21rst Century Vision

- Evolution in EHV Transmission planning
  - Planning Transmission Systems not Transmission Lines
  - "Common language/rules" for EHV planning
  - Transmission should be as transparent as possible to generation
- EHV planning is needed both "within and between" traditional planning regions

"Change is the law of life. And those who look only to the past or present are certain to miss the future." *John Fitzgerald Kennedy*

References

- **'A 21rst Century "Interstate Electric Highway System" –Connecting Consumers and Domestic Clean Power Supplies' Susan F. Tierney, Analysis Group, October 31, 2008**

  http://www.analysisgroup.com/analysisgroup/interstate_electric_highway.aspx

- **First Two Loops of SPP EHV Overlay Transmission Expansion, Analysis of Benefits and Costs, Charles River and Associates October 2008**