Integrated Transmission Planning Process

FERC Technical Conference
Charles Cates, SPP staff
March 19 - 21
Why do we need more transmission?

Improves access to lower-cost generation by reducing grid “bottlenecks”

May reduce electricity reserves, allowing more generation into regional energy market

Building “bigger” can be more cost-effective than building to meet minimum requirements

Helps add renewable wind and solar energy to grid

Improved reliability reduces high-cost of brown and blackouts

More efficient use of existing resources may reduce need for new generation

Diverse fuel usage increases reliability and flexibility

High voltage transmission “superhighways” would move more power more efficiently over long distances at lower costs

Lower voltage transmission “byways” still needed to move power to smaller distribution lines

Environmental and land use benefits

More efficient electricity delivery

New economic opportunities
What and where is transmission needed?

• Generation Interconnection Studies
  – Determines transmission upgrades needed to connect new generation to electric grid

• Aggregate Transmission Service Studies
  – Determines transmission upgrades needed to transmit energy from new generation to load
  – Shares costs of studies and new transmission

• Specific transmission studies
• Integrated Transmission Planning process
ITP: Economics and Reliability Analysis

Annual Near-Term plan
Reliability is primary focus
Identifies potential problems and needed upgrades
Coordinates with ITP10, ITP20, Aggregate and Generation Interconnection study processes

ITP10
Analyze transmission system for 10-year horizon
Establishes timing of ITP20 projects

ITP20
Develops 345 kV+ backbone for 20-year horizon
Studies broad range of possible futures
Who pays for these transmission projects?

- **Sponsored**: Project owner builds and receives credit for use of transmission lines
- **Directly-assigned**: Project owner builds and is responsible for cost recovery
- **Highway/Byway**: Most SPP projects paid for under this methodology

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Region Pays</th>
<th>Local Zone Pays</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 kV and above</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>above 100 kV and below 300 kV</td>
<td>33%</td>
<td>67%</td>
</tr>
<tr>
<td>100 kV and below</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>
What role do state regulators play?

• Regional State Committee - Retail regulatory commissioners from:
  - Arkansas
  - Nebraska
  - Oklahoma
  - Kansas
  - New Mexico
  - Texas
  - Missouri
  - Louisiana maintains active observer status

• Primary responsibility for:
  - Cost allocation for transmission upgrades
  - Approach for regional resource adequacy
  - Allocation of transmission rights in SPP’s markets
Integrated Transmission Planning in Action:

2012 ITP10
2012 ITP10 Methodology

- 10th year study (2022)
- Potential congestion
- Potential overloads and voltage violations
- Benefit measurements
- Transmission expansion plan
  - Project staging
- Stability analysis
2012 ITP10

- Two futures:
  - Directed by SPC
  - Supported by ESWG and TWG

- 2010 ITP20 plan tested in 2012 ITP10

- Categorized upgrades:
  - Reliability upgrades
  - Economic upgrades
  - Policy upgrades
2012 ITP10 ESWG & TWG Collaboration

• Stakeholder Driven Items
  – Futures
  – Sensitivities
  – Resource Plan
  – Fuel Prices
  – Metrics
  – 2012 ITP10 Process
  – 2012 ITP10 Report
  – Benchmark results

– Transmission solutions
– 40-Year financial analysis
– Staging & timing
– Constraints
– AC models
– Reliability scan results
– Transmission solutions
– Stability results
– Staging & timing
2012 ITP10 Futures

**Future 1**  
Business as Usual

**Future 2**  
EPA Rules with Additional Wind
Additional Sites
25 Wind
2 Combined Cycle
3 Combustion Turbine

Additional Capacity
1,410 MW Natural Gas

Total Wind Capacity
10,038 MW

Total Conventional Capacity
58,814 MW
Additional Sites
25 Wind
7 Combined Cycle
5 Combustion Turbine

Additional Capacity
4,270 MW Natural Gas

Total Wind Capacity
14,048 MW

Total Conventional Capacity
61,694 MW
## 2012 ITP10 Metrics

<table>
<thead>
<tr>
<th>Metric No.</th>
<th>Benefit Discussion</th>
<th>Unit(s)</th>
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<tbody>
<tr>
<td>CM1</td>
<td>Adjusted Production Cost Savings (APC)</td>
<td>$</td>
</tr>
<tr>
<td>1.1.1</td>
<td>Value of replacing previously approved projects</td>
<td>$</td>
</tr>
<tr>
<td>1.3</td>
<td>Reduced Losses</td>
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</tr>
<tr>
<td>1.6</td>
<td>Positive Impact on Losses Capacity</td>
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</tr>
<tr>
<td>10</td>
<td>Reduction of Emissions Rates and Values</td>
<td>$</td>
</tr>
<tr>
<td>1.1.2</td>
<td>Value of Improved Available Transfer Capabilities</td>
<td>MW &amp; %</td>
</tr>
<tr>
<td>6</td>
<td>Limited Export/Import Improvements</td>
<td>MW &amp; %</td>
</tr>
<tr>
<td>14</td>
<td>Ability to Serve New Load</td>
<td>MW &amp; %</td>
</tr>
<tr>
<td>2</td>
<td>Levelization of LMP's</td>
<td>Std Dev $ and %</td>
</tr>
<tr>
<td>3</td>
<td>Improved Competition in SPP Markets</td>
<td>Std Dev $ and %</td>
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</tbody>
</table>
2012 ITP10 Sensitivities

• Sensitivity analysis performed for variables having significant impact on recommended transmission plan

<table>
<thead>
<tr>
<th></th>
<th>Hi Demand</th>
<th>Mid Demand</th>
<th>Low Demand</th>
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</thead>
<tbody>
<tr>
<td>Hi Natural Gas</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mid Natural Gas</td>
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<td></td>
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</tr>
<tr>
<td>Low Natural Gas</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
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</tbody>
</table>

Performed upon Future 1 (Business as Usual) and Future 2 (Additional Wind w/ Carbon Constraint)

• Two additional sensitivities for only Future 2
  – High carbon tax of $54 per ton
  – Low carbon tax $14 per ton
2012 ITP10 Stability Analysis

- Transient stability – no unstable machines
- Load Pocket voltage stability – no voltage collapse
- Wind dispatch voltage stability – feasible
Portfolio Objectives

- Projects that synergistically provide value by optimizing
  - Reliability concerns
  - Provide economic benefits
  - Fulfill policy requirements
- Collaborate with stakeholders
- Determine project need by dates
Economic and Policy Project Inclusion Criteria

- **Reliability Projects**
  - Included upgrades that mitigate potential overloads

- **Economic Projects**
  - Included upgrades with B/C > 1.0 in both futures

- **Policy Projects**
  - Included any additional upgrades required to meet policy goals & mandates
Portfolio Summary

• 36 projects total
• 9 major projects
• 4 projects consistent with 2010 ITP20
• Primary driver for each project identified
  – Reliability
  – Policy
  – Economic
2012 ITP10 Proposed Expansion Plan

2011 E&C Costs
$1.475 Billion
Reliability: $980 Million
Economic: $206 Million
Policy: $289 Million

Miles of line:
- 345 kV – 786 miles
- 230 kV – 124 miles
- 161 kV – 17 miles
- 138 kV – 108 miles
- 115 kV – 73 miles

15 transformers
Project Staging

- Staging based upon primary need
- Most projects planned in-service starting 2018
Measuring the benefit of the portfolio

Multiple benchmarks ensure reasonable results
Transmission creates efficiencies that reduce emissions
Assessment of expected project life over 40-years
Potential reliability concerns mitigated
Potential impacts to system stability
states’ renewable goals or targets achieved

Following the strategic 20-year plan
Added together – how does this affect the ratepayer?
Services

TRANSMISSION PLANNING MAPS
Balanced Portfolio
Priority Projects

Projects (as of November 2010)

All SPP Transmission Expansion Plans are subject to change.

- Transformer Upgrade
- Single Circuit PP
- Double Circuit PP
- 230 kV
- 345 kV
- 500 kV
- Southwest Power Pool
- Entergy ICT

*Woodward District EHV
2010 ITP20 Plan
Approved by
SPP Board of Directors
January 2011

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All SPP Transmission Expansion Plans are subject to change.
2012 ITP10
Proposed Expansion
January 2012

Design Voltage
- 115 kV
- 138 kV
- 161 kV
- 230 kV
- 345 kV
- 500 kV

Upgrade Type
- Rebuild/Conversion
- New Line
- New Transformer

Footprints
- SPP
- Entergy

*Woodward District EHV
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All SPP Transmission Expansion Plans are subject to change.

SPP 2012 ITP10 Plan

ITP10
Projects Constructed 2005-2011
Projects with Notifications to Construct