Transmission Planning

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Transmission Planning Overview

- Historical Generation and Related Transmission
- EHV Transmission Additions to meet Load Growth
- Southeast Arizona Transmission Planning Coordination
- Planning under conditions of Uncertainty
- Renewable Transmission Projects
TEP Resource Base and Transmission System Has Evolved

- Peak Demand MW
- Cumulative Capacity
- Annual Peak
- Total Local Generation

Key Events:
- 1973 - San Juan to Vail
- 1990 - Springerville Vail Express
- 1997 - South to West Wing
- 2003 - Saguaro to Tortolita
- 2008 - Hassayampa to Pinal West
- 2013 - Pinal Central to Tortolita
- Decision Point

Local Area Generation
EHV Transmission Additions

- Navajo 1974
  - 169 MW
- Four Corners 1969
  - 110 MW
- San Juan 1973
  - 322 MW
- Springerville 1985-1991
  - 800 MW
- Luna 2005
  - 190 MW
- TEP Resources
  - Remote Coal: 1,410 MW
  - Sundt Coal: 125 MW
  - Sundt Gas Steam: 266 MW
  - Tucson Combustion Turbines: 217 MW
  - Luna Energy: 190 MW
  - 2008 Peak Operating Capacity: 2,208 MW

Lines:
- 345 kV
- 500 kV
Rate of Growth & Precise Location of Economic Development is Uncertain

- Cumulative Capacity
- Annual Peak
- Total Local Generation

Forecast Uncertainty

- 1950 - 1954
- 1958 - 1962
- 1966 - 1970
- 1974 - 1978
- 1982 - 1986
- 1990 - 1994
- 1998 - 2002
- 2006 - 2010
- 2014 - 2018
- 2022

- 1973 - San Juan to Vail
- 1990 - Springerville Vail Express
- 1997 - South to West Wing
- 2013 - Pinal Central to Tortolita
- 2008 - Hassaympa to Pinal West
- 2003 - Saguaro to Tortolita

Local Area Generation

Rate of Growth & Precise Location of Economic Development is Uncertain
Transmission Providers: APS, SWTC, TEP & WAPA
Transmission System Serves Significant Loads in Addition to TEP

SATS 20 Year Peak Demand Forecast

~3,000 MW needed in 20 years
~1,500 MW needed in 10 years

Transmission System Serves Significant Loads in Addition to TEP
Long Range Transmission Strategy

- **Reliable Service**
  - Complies with North American Electric Reliability Corporation (NERC) Planning Standards

- **Flexible Strategy that Responds to Uncertainty**
  - Load Growth
  - Major Transmission and Generation Projects
  - Regulatory Approval & ROW Acquisition

- **Public Policy**
  - Support for Renewable Energy Development
Southwest Potential Renewable Resources and Possible Transmission Additions

**Arizona – New Mexico – South California – Nevada**

**POTENTIAL RENEWABLE GENERATION AND TRANSMISSION ADDITIONS**

<table>
<thead>
<tr>
<th>State</th>
<th>2008 Load</th>
<th>2018 Load</th>
<th>% Load Increase</th>
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</thead>
<tbody>
<tr>
<td>Arizona</td>
<td>8631</td>
<td>1205</td>
<td>15.5%</td>
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<tr>
<td>IID</td>
<td>925</td>
<td>1363</td>
<td>33.0%</td>
</tr>
<tr>
<td>Nevada &amp; Sierra</td>
<td>8192</td>
<td>1117</td>
<td>36.9%</td>
</tr>
<tr>
<td>New Mexico &amp; El Paso</td>
<td>3678</td>
<td>4702</td>
<td>27.8%</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>AZ</th>
<th>IID</th>
<th>NM</th>
<th>NV</th>
<th>Total</th>
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<tbody>
<tr>
<td>Wind</td>
<td>3977</td>
<td>1530</td>
<td>1084</td>
<td>1985</td>
<td>7588</td>
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<tr>
<td>Solar</td>
<td>4745</td>
<td>776</td>
<td>2188</td>
<td>7586</td>
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<tr>
<td>Biomass</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>40</td>
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<tr>
<td>Geothermal</td>
<td>35</td>
<td>2000</td>
<td>-</td>
<td>456</td>
<td>2481</td>
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<tr>
<td>Total</td>
<td>9927</td>
<td>13645</td>
<td>4332</td>
<td>29904</td>
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</tbody>
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**Load Increase**

- Arizona: 15.5%
- IID: 33.0%
- Nevada & Sierra: 36.9%
- New Mexico & El Paso: 27.8%

**Region**

- Arizona: 18631 MWh
- IID: 1025 MWh
- Nevada: 8192 MWh
- New Mexico & El Paso: 3678 MWh

**Transmission Additions**

- **Wind**: 3977 MWh
- **Solar**: 4745 MWh
- **Biomass**: 40 MWh
- **Geothermal**: 35 MWh

**Existing Transmission Elements**

- **Power Plant Substation**
  - 500kV DC
  - 500kV
  - 345kV
  - 230kV

**10 Year Plan Transmission Elements**

- **Potential Renewable Energy Transmission Elements**
  - Bulk Renewable Power Plant at a New Substation
  - Bulk Renewable Power Plant at an Existing Substation / Power Plant Substation

- **Solar Resource**
- **Wind Resource**
- **Biomass Resource**
- **Geothermal Resource**
National Renewable Energy Laboratory (NREL)
Solar Power Prospects in Arizona

<table>
<thead>
<tr>
<th>Power Plants*</th>
<th>Solar Resources kWh/m²/day</th>
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<tbody>
<tr>
<td>Coal</td>
<td>8.0 - 8.2</td>
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<tr>
<td>Natural Gas</td>
<td>7.5 - 8.0</td>
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<tr>
<td>Solar</td>
<td>7.0 - 7.5</td>
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<tr>
<td>Uranium</td>
<td>6.5 - 7.0</td>
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<tr>
<td>Water</td>
<td>6.0 - 6.5</td>
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<td>Wind</td>
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<td>Geothermal</td>
<td>Transmission Lines*</td>
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<td>Biomass</td>
<td>735kV - 999kV</td>
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<td>Other</td>
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<td>345kV - 499kV</td>
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<td></td>
<td>230kV - 344kV</td>
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<td>Below 230kV</td>
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* Source: POWERmap, ©2007 Platts, a Division of the McGraw-Hill Companies
BTA Order 70635

Each Commission-regulated utility, either alone or in cooperation with other utilities, and by 10/31/09:

- Identify the top three potential “renewable” transmission projects
  - Utilities agreed to use RTTF forum to identify RTPs
- Develop plans and propose funding mechanisms to construct the top three “renewable” transmission projects
RTTF / Arizona Renewable Energy Zones of Potential Interest to UNS