VERSION 6.3 KEY UPDATES & ACTIVITY

- Updated Category 1 and 2 Baseline Environmental Layers
- Consulted with TNC and Added NGO Environmental Layer
- Performed Review of WY/NM Wind Polygons
- Updated Technology Inputs, all resources
- Updated Interconnection Costs
- County Environmental and Siting Restrictions Review
RPS CALCULATOR V6.3
LAND & ENVIRONMENTAL UPDATES - RESULTS
LAND & ENVIRONMENTAL INTRODUCTION AND KEY FINDINGS
BACKGROUND / PROCESS UPDATE

• Input provided by REAT agencies to update land use screens used in the RPS Calculator Category 1 & 2
  • Last updated in 2015 as part of RPS Calculator V6.2 process
  • Received updated versions of National Monument and Vernal Pool Datasets

• Input provided by The Nature Conservancy and Non-Government Organizations for new Environmental Layer
  • Received input from TNC, Sierra Club and Defenders of Wildlife on additional datasets for inclusion in RPS Calculator
  • Selected most relevant and available datasets for inclusion in an Enhanced Environmental Layer
ENVIRONMENTAL CATEGORY 1 & 2
**KEY FINDINGS, RELATIVE TO PAST CURVES**

<table>
<thead>
<tr>
<th></th>
<th>Category 1</th>
<th>Category 1&amp;2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected Acreage</td>
<td>+0.2%</td>
<td>+0.3%</td>
</tr>
<tr>
<td>Impact on Solar PV Resource</td>
<td>-0.2%</td>
<td>-0.7%</td>
</tr>
<tr>
<td>Impact on Wind Resource</td>
<td>0%</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Impact on Solar Thermal Resource</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

- Only wind and solar resources are impacted
- Remaining resource after new Category 1 Exclusions Applied
  - Solar (discounted): 109 GW
  - Wind (discounted): 17 GW
  - Solar Thermal: 63 GW
- Largely unchanged from V6.2

Considerable potential within the state; process has recognized key development locations through land use screens and CREZ development.
Incremental area of updated layers:
~60k Acres, Category 1
~140k Acres, Category 2
# NATIONAL MONUMENTS UPDATE – CATEGORY 1

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Additional Area (Acres)</td>
<td>57k (Solar)</td>
<td>+0.2% (Solar)</td>
</tr>
<tr>
<td></td>
<td>59k (Wind)</td>
<td>+0.2% (Wind)</td>
</tr>
<tr>
<td>New Impacted Wind Resource</td>
<td>0 MW</td>
<td>0%</td>
</tr>
<tr>
<td>New Impacted PV Resource</td>
<td>3.7 GW</td>
<td>- 0.2%</td>
</tr>
<tr>
<td>New Impacted Solar Thermal Resource</td>
<td>0 MW</td>
<td>0%</td>
</tr>
</tbody>
</table>

*All solar GW estimates are pre-discounted values in these tables, to correspond to area. Discount (95%) is applied in the aggregate supply curve analysis later.*
**VERNAL POOLS ADDITIONS – CATEGORY 2**

<table>
<thead>
<tr>
<th></th>
<th>Area (Acres)</th>
<th>Percent New</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Additional</strong></td>
<td>143k (Solar)</td>
<td>+0.4% (Solar)</td>
</tr>
<tr>
<td></td>
<td>140k (Wind)</td>
<td>+0.3% (Wind)</td>
</tr>
<tr>
<td><strong>New Impacted Wind</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resource</strong></td>
<td>27 MW</td>
<td>-0.2%</td>
</tr>
<tr>
<td><strong>New Impacted PV</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resource</strong></td>
<td>6.5 GW</td>
<td>-0.4%</td>
</tr>
<tr>
<td><strong>New Impacted Solar</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Thermal Resource</strong></td>
<td>0 GW</td>
<td>0 %</td>
</tr>
</tbody>
</table>

*All solar GW estimates are pre-discounted values in these tables, to correspond to area. Discount (95%) is applied in the aggregate supply curve analysis later.*

Updated existing Central Valley Vernal Pools to Holland 2012, added Modoc, South Coast and San Diego datasets.
RECOMMENDED FUTURE UPDATES

- National Wetlands Inventory
  - Required input from FWS on the CAT 1/2 specific layers for the NWI—not received in time

- Williamson Act Land
  - Latest version in calculator 2010
  - 2012 available online, will use Prime Farmland Only
  - 2014 conducted, not all counties have uploaded

- Update Critical Habitat

- Move DRECP DFAs, pending final ruling
COUNTY DATA UPDATE

- Received input from TNC on a number of county references
  - Recommendations of data from the CEC Planning Grants for 7+ counties
  - Will require greater future investigation to translate to RPS Calculator impacts
- DVBE performed a more detailed review of county planning work
  - Documented work performed and sources of data for future investigations
- B&V looked into updates to key topics from 2015—no changes justified at this time due to data limits
  - Northern CA avian restrictions
  - Solar restrictions Inyo
  - San Diego GIS data
NGO ENVIRONMENTAL INPUTS
### KEY FINDINGS, RELATIVE TO V6.3 BASELINE

<table>
<thead>
<tr>
<th></th>
<th>NGO Exclusion Category 1</th>
<th>NGO Exclusions Category 1 &amp; 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected Acreage</td>
<td>+6%</td>
<td>+18%</td>
</tr>
<tr>
<td>Impact on Solar PV Resource</td>
<td>- 2%</td>
<td>- 13%</td>
</tr>
<tr>
<td>Impact on Wind Resource</td>
<td>- 4%</td>
<td>- 14%</td>
</tr>
<tr>
<td>Impact on Solar Thermal Resource</td>
<td>- 1%</td>
<td>-14%</td>
</tr>
</tbody>
</table>

*Values compare to v6.3 RETI CAT 1/2 base layers*

- Only wind and solar resources are impacted
- Remaining resource after new **NGO CAT 1 &2** exclusion is applied
  - Solar (discounted): 64 GW
  - Wind (discounted): 8 GW
  - Solar Thermal: 36 GW

*Percentages are based on baseline Category 1 & 2 discounted potential*
INCLUDED DATASETS

• Category 1
  • Protected Areas Database of the United States – USGS
    • National Monument
    • Research Natural Area
    • Historic Cultural Area
    • Private Conservation Land
    • State Forest
    • Wildlife Management Area
  • National Conservation Easement Database
  • The Nature Conservancy Wildlands Database

• Category 2
  • Protected Areas Database of the United States – USGS
    • Reserves
  • California Rangeland Conservation Coalition, Priority 1 Area
  • California Sage Grouse Priority Areas
NGO ENVIRONMENTAL UPDATES – SOLAR

Largest Impact
NGO Category 1
- National Conservation Easement Database
- Private Conservation Lands

NGO Category 2
- California Rangeland Conservation Coalition (CRCC)
- Sage Grouse Solar Exclusion
NGO ENVIRONMENTAL UPDATES – WIND

Largest Impact
NGO Category 1
National Conservation Easement Database
Private Conservation Lands

NGO Category 2
California Rangeland Conservation Coalition (CRCC)
Sage Grouse Wind Exclusion

NGO Cat 1 Layers
- wCat1_PADUS_NationalMonument
- wCat1_PADUS_ResearchNaturalArea
- wCat1_PADUS_HistoricCulturalArea
- wCat1_PADUS_PrivateConservLand
- wCat1_PADUS_StateForest
- wCat1_PADUS_WMA
- wCat1_NCED_Easements
- wCat1_TNC_Wildlands

NGO Cat 2 Layers
- wCat2_PADUS_Reserves
- wCat2_NVCA_A#MPA_SageGrouse_Wind
- wCat2_CCRC_Priority1

2016 Base Layers
- RETI 2016 Solar Cat1
- RETI 2016 Solar Cat2
- RETI 2016 Wind Projects
KEY DATASETS, ENVIRONMENTAL LAYER

• Category 1
  • National Conservation Easement Database
    • Records of land owner conservation easements from land trusts and public agencies throughout the United states
  • Private Conservation Lands (TNC)
    • Privately owned land dedicated as a conservation area

• Category 2
  • California Rangeland Conservation Coalition, Priority 1
    • Protected private rangeland
  • California Sage-Grouse Conservation
    • Greater sage-grouse in the northeastern corner of the state are in the Northern Great Basin Management Zone
OOS UPDATES
BACKGROUND

• QRA Boundaries created during WREZ Phase 1

• WREZ L&E Group Identified Exclusions and Avoided Lands

• Process:
  • Exclusions list removed from resource data set.
  • QRA selected to aggregate potential (min 1500 MW)
    • For areas like WY only highest quality wind included.
  • Avoidance list layered on to Developed QRA and provided to states.
  • States given opportunities to eliminate QRA.

http://www.westgov.org/component/content/article/102-initiatives/219-wrez
PROCESS UPDATE

• Added CAISO SB350 Regionalization Study No Go Land
  • National Parks, National Forest, BLM Wilderness and ACECS, State Parks, Military
  • Used Ventyx - Energy Velocity “Federal Lands” dataset

• Added Sage Grouse Exclusions
  • Received a number of various Sage Grouse Datasets (BLM, data basin, WY Game and Fish Dept.)
  • Used 2015 WY Sage Grouse Core Areas (closely aligned with BLM Priority Areas for Conservation)

• Reviewed impacts to wind resource in key QRA boundaries and updated capacity estimates
NEW MEXICO - MAP
WYOMING - MAP
### RESULTS

<table>
<thead>
<tr>
<th>QRA</th>
<th>Capacity RPS Calculator V6.2</th>
<th>Raw Capacity V6.3 No Exclusions (No Haircut)</th>
<th>Raw Capacity + V6.3 Exclusions (No Haircut)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CF</td>
<td>MW</td>
<td>CF</td>
</tr>
<tr>
<td>NM_EA</td>
<td>39.4%</td>
<td>15,087</td>
<td>44.3%</td>
</tr>
<tr>
<td>NM_SE</td>
<td>37.2%</td>
<td>1,462</td>
<td>41.0%</td>
</tr>
<tr>
<td>WY_EA</td>
<td>42.0%</td>
<td>7,603</td>
<td>44.5%</td>
</tr>
<tr>
<td>WY_EC</td>
<td>41.8%</td>
<td>4,006</td>
<td>44.8%</td>
</tr>
<tr>
<td>WY_NO</td>
<td>41.3%</td>
<td>4,825</td>
<td>45.1%</td>
</tr>
</tbody>
</table>

- Major impact to WY_EC CREZ
- Exclusions had little impact to New Mexico wind resource
- Remove previous 50 % haircut in each of these regions; net impact leads to greater wind resource in the Calculator
  - Represented unknown environmental development challenges—better understanding now of overall potential
- Updates to wind CFs addressed with wind stakeholders
RPS CALCULATOR V6.3
TECHNOLOGY UPDATES - RESULTS
TECHNOLOGY UPDATES
INTRODUCTION
TECHNOLOGY UPDATES

- **Wind**
  - Updated In-State (CA)/ Out of State (OOS) Capacity Factor and Capital Costs
  - Added Repowering Sites

- **Solar PV**
  - Updated CA Capital Cost Fixed/Tracking
  - Updated CA O&M Cost

- **Geothermal**
  - Updated CA/OOS Capital Cost

- **Biomass/Solar Thermal**
  - Escalated CA/OOS Capital Cost

- **Hydro/Energy Storage**
  - No change, did not escalate

- **Updated CA Interconnection Costs**
## TECHNOLOGY UPDATES – V6.3 RESULTS SUMMARY

<table>
<thead>
<tr>
<th>Technology</th>
<th>V6.2</th>
<th>V6.3</th>
<th>Delta (V6.3-V6.2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>max</td>
<td>min</td>
<td>average</td>
</tr>
<tr>
<td><strong>Wind</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap Cost In-State</td>
<td>$2,248</td>
<td>$1,739</td>
<td>$2,045</td>
</tr>
<tr>
<td>Cap Cost OOS</td>
<td>$2,166</td>
<td>$1,793</td>
<td>$1,943</td>
</tr>
<tr>
<td><strong>Solar</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap Cost In-State, Fixed</td>
<td>$2,360</td>
<td>$2,360</td>
<td>$2,360</td>
</tr>
<tr>
<td>Cap Cost In-State, Tracking</td>
<td>$2,470</td>
<td>$2,470</td>
<td>$2,470</td>
</tr>
<tr>
<td><strong>Solar Thermal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap Cost In-State, Storage</td>
<td>$8,365</td>
<td>$8,365</td>
<td>$8,365</td>
</tr>
<tr>
<td>Cap Cost In-State, No Storage</td>
<td>$6,121</td>
<td>$6,121</td>
<td>$6,121</td>
</tr>
<tr>
<td><strong>Biomass</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap Cost In-State</td>
<td>$6,292</td>
<td>$4,766</td>
<td>$5,691</td>
</tr>
<tr>
<td>Cap Cost OOS</td>
<td>$8,568</td>
<td>$5,712</td>
<td>$6,696</td>
</tr>
<tr>
<td><strong>Geothermal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap Cost In-State</td>
<td>$10,058</td>
<td>$5,416</td>
<td>$6,633</td>
</tr>
<tr>
<td>Cap Cost OOS</td>
<td>$18,437</td>
<td>$5,671</td>
<td>$8,664</td>
</tr>
</tbody>
</table>
WIND TECHNOLOGY UPDATES
REVISED METHOD – RESULTS OF IEC WIND TURBINE CLASS ASSUMPTIONS

- Priorities for Geospatial IEC class designation logic:
  - V6.2: Maintain adherence to IEC design standards
  - V6.3: Maintain adherence to industry trends

<table>
<thead>
<tr>
<th>IEC Wind Turbine Class</th>
<th>2015 (m/s)</th>
<th>2016 (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&gt; 8.75</td>
<td>&gt; 9.00</td>
</tr>
<tr>
<td>2</td>
<td>8.75 – 7.75</td>
<td>9.00 – 8.25</td>
</tr>
<tr>
<td>3</td>
<td>&lt; 7.75</td>
<td>&lt; 8.25</td>
</tr>
</tbody>
</table>

Conventional IEC standards recommend IEC III for winds below 7.5 m/s and IEC II for winds below 8.5 m/s. Developers today commonly push the limits closer to the above when possible.
CAPACITY FACTOR REVISIONS

- Discovered that the distribution used and presented in May 2016 was overestimating capacity factors
  - Applicable to all projects across all classes
  - Caused by an unintentional offset of wind speed distributions applied to power curves by 0.5 m/s
- Related to Power Curves reporting point values and applying those values to distribution bins
- The revision has been completed and the impacts relative to the recent update are shown on the subsequent slides
  - While projected capacity factors will still be higher than V6.2, the impact will not be as great as originally projected
VISUALIZATION OF REVISION (\(\bar{U} = 7.50\) M/S)
REVISED NET CAPACITY FACTORS
WYOMING – EAST/CENTRAL

V6.3 R0

Avg. CF = 48.3 %

V6.3 R1

Avg. CF = 44.8 %
REVISED NET CAPACITY FACTORS
NEW MEXICO – EAST

V6.3 R0
Avg. CF = 48.0 %

V6.3 R1
Avg. CF = 44.3 %
REVISED NET CAPACITY FACTORS
TEHACHAPI

V6.3 R0
Avg. CF = 35.6 %

V6.3 R1
Avg. CF = 31.5 %
CAPITAL COST METHODOLOGY

• Added Cost Considerations due to Turbine Classification

• Base Resources
  • Wind Vision 2015 (Appendix B, Section H)
  • NREL 2014 Cost of Wind Energy Review (Pg. 28)
  • Internal B&V documentation

• Sourced studies found that Turbine Costs per kW are correlated to Turbine Specific Power

\[
\text{Cost per kW} = \text{Specific Power} \times \text{Constant}
\]

• Other Considerations:
  • Assumed no decline in average pricing since 2015, based on Black & Veatch industry analysis
  • Costs Reported Converted to 2016 $
PROPOSED APPLICATION OF COST

• As wind speeds increase:
  • Turbines likely applied have smaller rotors and produce greater kWs
  • Therefore pricing tends to decrease with increasing specific power

• Proposed Cost Assignments (CAPEX ONLY):
  • IEC III: $1,775/ kWac
  • IEC II: $1,628/ kWac
  • IEC I: $1,558/ kWac

• CAPEX includes:
  • Turbines Capital Cost
  • Balance of System Cost

• Does not include full project installed costs; these factors will be applied in the final estimates
HANDLING REGIONAL VARIATION

- Previous Slide Corresponds to Interior Region
- 2015 B&V Multipliers will be kept for added granularity

Multipliers will be normalized to align with Wind Vision 2015
- Max = 1.40
- Min = 0.85
## COST COMPARISON, V6.2

- Analysis compared to V6.2:

<table>
<thead>
<tr>
<th></th>
<th>WY_EC (IEC I)</th>
<th>NM_EA (II)</th>
<th>CA_WE (III)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V6.2</td>
<td>$ 1,843/kW</td>
<td>$ 1,847/kW</td>
<td>$ 2,156/kW</td>
</tr>
<tr>
<td>V6.3</td>
<td>$ 1,779/kW</td>
<td>$ 1,861/kW</td>
<td>$ 2,194/kW</td>
</tr>
</tbody>
</table>
2016 REPOWERING OPPORTUNITIES

- Reviewed USGS and FAA databases for built structures
- Compared online years of turbines identified
- Only areas with existing 20+ year old projects are considered
- Those areas that have turbines > 20 years old and have not been build upon to date considered available

- Repowered
- Repowered
- New Build/Life Not Met
REPOWER OPPORTUNITIES

• The average nameplate capacity of existing turbines capable of repowering was 124 kW

• Total number repower candidate turbines were summed
  • 5,333 total turbines identified

• Average nameplate applied to totals to estimate capacity
  • Solano: 7 MW
  • Altamont Pass: 270 MW
  • Tehachapi Ranges: 383 MW
  • San Gorgonio: 22 MW

• Total repower capacity for consideration: 682 MW

• Cost and performance estimated by:
  • Assumption of applicability of V6.3 performance equivalents
  • Adding generic decommission and salvage estimations V6.3 costs

Need to determine how to incorporate into V6.3—do existing units need to be shutdown?
SOLAR TECHNOLOGY UPDATES
Solar PV costs were updated using a bottom-up cost buildup based on several recent equipment quotes from major suppliers and B&V experience developing detailed design and EPC estimates.

Equipment costs have continued to decline. All-in capital costs in V6.3 for California projects:

- Tracking: $2,300/kWac
- Fixed: $2,180/kWac
- Rooftop: $4,430/kWac

Industry continues to drive costs down, as reflected in future cost forecasts.
SOLAR PV O&M COST CHANGES

- Solar PV O&M costs were updated based on B&V experience and Solar PV market reports

- O&M costs have dropped in the past years, it appears for a number of reasons:
  - O&M market is quickly maturing: development of best practices, more competition, and better O&M programming and management
  - Larger EPCs/owners are achieving economies from fleet-wide management practices
  - More efficient and consistent plant designs may lead to more efficient O&M practices

- O&M Costs have declined due to industry experience, competition, design improvements, and equipment life
  - Tracking: $26/kWac-yr
  - Fixed: $22/kWac-yr
  - Rooftop: (unchanged)
**SOLAR PV COST COMPARISON**

- V6.2 and V6.3 Comparison

<table>
<thead>
<tr>
<th></th>
<th>V 6.2</th>
<th>V 6.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracking CC</td>
<td>$2,470/kWac-yr</td>
<td>$2,300/kWac</td>
</tr>
<tr>
<td>Tracking O&amp;M</td>
<td>$36/kWac-yr</td>
<td>$26/kWac-yr</td>
</tr>
<tr>
<td>Fixed CC</td>
<td>$2,360/kWac</td>
<td>$2,180/kWac</td>
</tr>
<tr>
<td>Fixed O&amp;M</td>
<td>$33/kWac-yr</td>
<td>$22/kWac-yr</td>
</tr>
<tr>
<td>Rooftop CC</td>
<td>$4,430/kWac</td>
<td>$4,430/kWac</td>
</tr>
<tr>
<td>Rooftop O&amp;M</td>
<td>$33/kWac-yr</td>
<td>$33/kWac-yr</td>
</tr>
</tbody>
</table>

Capital cost estimates came down 7-8% from 2015 primarily due to equipment costs.
### SOLAR PV V6.3 COST DECLINES

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>2016</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>2020</td>
<td>95%</td>
<td>82%</td>
<td>96%</td>
<td>82%</td>
</tr>
<tr>
<td>2025</td>
<td>90%</td>
<td>74%</td>
<td>93%</td>
<td>73%</td>
</tr>
<tr>
<td>2030</td>
<td>85%</td>
<td>70%</td>
<td>89%</td>
<td>68%</td>
</tr>
</tbody>
</table>
Following the release of RPS Calculator 6.2, CPUC received feedback from the geothermal industry that the geothermal capital costs were too high.

RPS Calculator geothermal resource costs are meant to reflect the following key attributes:

- Forward looking, reflecting current and estimate future costs of development
- New greenfield plants

Solicited feedback from the industry to determine appropriate assumptions and references to use:

- Questions distributed to stakeholders on 31 May 2016
GEOTHERMAL COST UPDATES

• After receipt of feedback, modifications made to capital and operating cost

• Estimate basis:
  • Parties concurred that recent PPA data is a good indicator of current costs for new geothermal facilities
  • GEA supported geothermal project LCOEs in the $90-100/MWh range, Ormat presented information on recent PPAs in the $70-99/MWh range, and US Geothermal stated that PPA prices should be “at least” $90/MWh and “typically higher than that for most binary power plants”
  • Prices in the $90-100/MWh range are consistent with aggregated data from recent utility RFOs
GEOTHERMAL COST UPDATES

- Cost Update Approach – Began with V6.0 of the RPS Calculator
  - Capital cost: Represents data originally reported by GeothermEx in 2008, escalated to current dollar costs, prior to any modification from V6.2 reference sources. Range is now $4,900-6,369/kW (was $6,488-$8,343/kW in V6.1 and V6.2)
  - Operating cost: Adjusting 2008 estimates for the current capacity factors assumed in the model led to lower operating costs, $190-210/kW-yr (down from an average of $257/kW-yr)
# GEOTHERMAL COST UPDATES

## V6.3 Inputs and Comparison

<table>
<thead>
<tr>
<th>State/Province</th>
<th>V6.3 Capital Cost ($/kW)</th>
<th>V6.3 Operating Cost ($/kW-yr)</th>
<th>V6.3 LCOE</th>
<th>V6.0 LCOE</th>
<th>V6.1 and 2 LCOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>5,165</td>
<td>200</td>
<td>84</td>
<td>94</td>
<td>117</td>
</tr>
<tr>
<td>ID</td>
<td>5,942</td>
<td>202</td>
<td>94</td>
<td>105</td>
<td>132</td>
</tr>
<tr>
<td>NV</td>
<td>6,369</td>
<td>202</td>
<td>102</td>
<td>111</td>
<td>140</td>
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<tr>
<td>OR</td>
<td>4,953</td>
<td>200</td>
<td>81</td>
<td>91</td>
<td>113</td>
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<tr>
<td>UT</td>
<td>5,269</td>
<td>190</td>
<td>84</td>
<td>93</td>
<td>117</td>
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<tr>
<td>BC</td>
<td>5,593</td>
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<td>92</td>
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<td><strong>Weighted Average</strong></td>
<td><strong>89</strong></td>
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<td><strong>99</strong></td>
<td></td>
<td><strong>124</strong></td>
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</table>
GEOTHERMAL COST UPDATES

• Future Follow-Ups:
  • Finalize discussions with industry to explain all capital and operating cost assumptions. Work to obtain consistency in assumptions being used in this and other studies.
  • Determine if cost adjustments need to be made between states (especially Nevada)
OTHER TECHNOLOGY UPDATES
SOLAR THERMAL & BIOMASS COST UPDATE

- No significant changes were identified in technology costs from V6.3.
- Technology costs escalated 3.14 percent from Jan 2015 to Jun 2016 based on Consumer Price Index.
IN STATE INTERCONNECTION COST UPDATE

- Updated interconnection cost from 2015 IOU Per Unit Values to 2016 IOU Per Unit Values
- Corrected anomalous Gen Tie Equipment from V6.2 update, (eliminated 2015, 25 percent increase, of 69 kV and 115 kV equipment costs)
- Changes in equipment cost from V6.3 to V6.2:

<table>
<thead>
<tr>
<th></th>
<th>Gen-tie Costs ($/mile)</th>
<th>New Breaker Position</th>
<th>New Switching Station</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 100 kV</td>
<td>115 kV</td>
<td>230 kV</td>
</tr>
<tr>
<td>PG&amp;E</td>
<td>-25%</td>
<td>-25%</td>
<td>-17%</td>
</tr>
<tr>
<td>SCE</td>
<td>-34%</td>
<td>-16%</td>
<td>11%</td>
</tr>
<tr>
<td>SDG&amp;E</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
</tr>
</tbody>
</table>

https://www.caiso.com/informed/Pages/StakeholderProcesses/ParticipatingTransmissionOwnerPerUnitCosts.aspx
Building a **world** of difference.

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