LS Power

Southwest Intertie Project (SWIP) North

Overview of March 2016 ITP Submissions to
CAISO, NTTG & WestConnect

Bringing Energy Forward
LS Power is a power generation and transmission group.

**Power Generation**
- Over 32,000 MW of development, construction, or operations experience
- Active development of renewable and fossil generation resources

**Transmission**
- Over 470 miles of 345-500kV development, construction or operations experience
- Rate regulated transmission utility in the State of Texas
- Active development of high-voltage transmission throughout North America

**Acquisition**
- Over $6 billion in private equity capital dedicated to energy sector
- Acquired over 20,000 MW of power generation

**Functional Expertise**
- Project Development
- Transmission
- Licensing & Environmental
- Project Finance & Execution
- Regulatory, Legal & Compliance
- Power Marketing & Energy Management
- Engineering & Construction
- Operations Management
DesertLink (Harry Allen to Eldorado)

- 60-mile 500 kV transmission line near Las Vegas, Nevada
- Approved by California ISO as economic project in December 2014
- Released for competitive solicitation pursuant to FERC Order 1000 in January 2015
- LS Power affiliate DesertLink, LLC, selected as Approved Project Sponsor in January 2016
- Scheduled to be in service by 2020
- DesertLink selected based on low risk profile:
  - Recent experience permitting and constructing ON Line project which shares a terminus at Harry Allen
  - Advanced development progress including federal rights of way through congested corridor and state permit
  - Robust cost containment package
• 231-mile 500 kV transmission line in Nevada
• Operations began January 2014
• Partnered with NV Energy
  • LS Power owns 75% with capacity leased to NV Energy
  • Operates under NV Energy OATT
• 500/345 kV substation and 345 kV series compensation
• First ever connection between Nevada Power Company and Sierra Pacific Power Company
• Financing through the U.S. Department of Energy Loan Guarantee Program
• Midpoint to Robinson Summit 500 kV line (SWIP North)
  • ~275 miles
  • NEPA complete
  • BLM issued Notice to Proceed
  • 24 months Construction
  • Target In-service 2021

• Robinson Summit to Harry Allen 500 kV line (ON Line)
  • ~231 miles
  • Currently In service
  • 100% capacity NVE until SWIP North completion, capacity sharing thereafter

• Harry Allen to Eldorado 500 kV line (DesertLink line for CAISO)
  • ~60 miles
  • FERC Order 1000 competitive project
  • In service by 2020
Phase 1 - ON Line (231 miles, Robinson to Harry Allen)
- Co-ownership NVE and an LS Power affiliate
- 100% of cost related to ON Line borne by NVE
- 100% capacity to NVE, under NVE OATT

Phase 2 – SWIP North (275 miles, Midpoint to Robinson)
- New path from Midpoint to Robinson Summit
- Uprate of ON Line path
- Owned 100% by LS Power affiliate GBT
- 100% of cost related to SWIP North borne by GBT
- Capacity exchange on both segments, estimated to be:

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<thead>
<tr>
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<th>NVE Capacity (MW)</th>
<th>LSP Capacity (MW)</th>
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<tbody>
<tr>
<td>SWIP-N (Midpoint-Robinson)</td>
<td>700</td>
<td>1,000</td>
</tr>
<tr>
<td>ON Line (Robinson-Harry Allen)</td>
<td>1,000</td>
<td>1,000</td>
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*(actual value will be function of path rating, other factors)*
WECC Planning Regions

Region boundaries are approximate for illustrative purposes only.
SWIP North submitted as Interregional Transmission Project (ITP) to CAISO, NTTG, & WestConnect

- LS Power Submission Entities
  - Great Basin Transmission, LLC: CAISO, NTTG
  - Western Energy Connection, LLC: WestConnect
- Study as an economic/policy ITP with cost allocation
- Includes two new studies demonstrating substantial benefits estimated at >$200-$300 million per year
- Studies identify economic, policy and reliability benefits
- CAISO connection is via ON Line project at Harry Allen with DesertLink line in service as of 2020
- LS Power has ~1000 MW of available capacity on ON Line to match LS Power’s ~1000 MW on SWIP-North
- NV Energy responsible for full cost of ON Line, to be considered in cost allocation analysis
- Total path rating up to ~2000 MW
SWIP North One Line

- 2021 In-Service Date
- 500 kV AC Single Circuit
- 1590 ACSR Lapwing Conductor
- Guyed/Self-Supporting Steel Structures
- 35% series compensation at or near Midpoint 500 kV
- 35% series compensation at or near Robinson 500 kV
- Additional system upgrades on ON Line and 345 kV system TBD
SWIP North Development Status

• Federal Approvals
  • Federal NEPA process complete
  • BLM Rights-of-Way secured
  • Construction, Operation and Maintenance Plan Approved
  • Conditional Notice to Proceed with Construction Issued

• State and Local Approvals
  • White Pine County Special Use Permit and Development Agreement Approved
  • Key permits to be obtained
    o Elko County Special Use Permit
    o Public Utilities Commission of Nevada UEPA Permit

• Transmission Interconnection Requests Filed
  • Midpoint Substation – Idaho Power
  • Robinson Substation – NV Energy

• WECC Path Rating - Phase II draft report stage
Overview of SWIP North Benefits

SWIP North improves transfer capability between CAISO, PacifiCorp, NV Energy, Idaho Power, and BPA with many benefits:

- **Economic Benefits**
  - Energy Savings, Congestion Reduction & Producer Benefits
  - Capacity and Geographical Diversity
  - Increased EIM benefits

- **Policy Benefits**
  - Helps meet west wide RPS and GHG goals
  - Aids in over-generation management and reduces renewable curtailment

- **Reliability Benefits**
  - Helps prevent WECC NE/SE separation in the event of loss of COI lines
  - Addresses Northern CA bulk transmission overloads
  - Significant incremental transfer capability
  - Insurance against unforeseen events such as Aliso Canyon

- **Enhanced Benefits for CAISO/PacifiCorp integration**
  - Overcomes 776 MW transfer limit identified in E3 integration study
  - Resource procurement savings
  - Lower peak capacity needs
  - More efficient unit commitment and dispatch
• **CAISO**
  - Evaluated as regional economic project in 2015-16 annual plan
  - Helps resolve congestion on the Bulk System in Northern California
  - Benefits associated with access to out-of-state resources to achieve 50% renewables goal by 2030 need to be taken into account in future planning forums.
  - Considered a 3-region interregional project and therefore should be submitted as an ITP for future evaluation.

• **NTTG**
  - Evaluated as regional economic project in 2014-15 biennial plan
  - Not selected into the Draft Final RTP as a more efficient or cost-effective solution for the regional needs identified in that particular plan.

• **Low Carbon Grid Study**
  - [www.lowcarbongrid2030.org](http://www.lowcarbongrid2030.org)
  - SWIP North preferred path for WY wind to CAISO rather than the alternative of wheels through NV Energy or LADWP.
  - SWIP North flows are bi-directional both seasonably and diurnally and perform functions other than delivering WY wind to CA...renewable economy energy
SWIP North New Studies

• **CEERT/NREL Study**
  - Conducted by Center for Energy Efficiency and Renewable Technologies (CEERT) and National Renewable Energy Laboratory (NREL)
  - Performed production cost modeling with and without SWIP-North to quantify benefits identified in the Low Carbon Grid Study (LCGS)
  - Started with LCGS Phase II Target Conventional scenario (50% RPS in California)
  - TEPPC 2024 Common Case, with nodal analysis throughout WECC
  - Gateway West and Gateway South in service
  - Sensitivity case without Gateway South
  - 2,725 MW of Wyoming wind generation injection at Aeolus
  - 1,000 MW from Midpoint to Harry Allen available with no hurdle rate

• **Brattle Study**
  - Conducted by The Brattle Group
  - Quantitative and Qualitative analysis of benefits with reference to:
    - Previous studies that considered SWIP-North & CEERT/NREL Study
    - Previous Brattle studies
    - EIM studies
    - PacifiCorp/CAISO integration study
    - Various WECC reports/studies
• Results
  • Base Case ~$65 million (2014$) annual benefits by adding SWIP-North
  • Sensitivity Case ~$107 million (2014$) annual benefits by adding SWIP-North with no Gateway South
  • Gateway South sensitivity was included to examine the impact of any potential delays in the timing of construction of Gateway South.
  • Reduction in flows on COI & Path 26 were noted with SWIP North

• Analysis
  • Results are for a single plausible scenario in 2030
  • Many more sensitivities could be performed on various renewable portfolios, load assumptions, gas prices, carbon prices, etc.
  • Zonal analysis in LCGS performed many of these sensitivities showing robust flows on SWIP North
  • Allocation of benefits among the regions would require additional study
  • Capacity and reliability benefits were not quantified
  • PacifiCorp/CAISO integration would result in increased benefits from SWIP North
• Results

Brattle identified numerous categories of benefits, some of which were quantified in the study, resulting in the following estimates (in 2030 dollars).

- Energy Market Value = >$110-$150 million per year
- COI Congestion Relief = $23-$59 million per year
- EIM Benefits = >$26 million per year
- Wheeling Revenues = $28 million per year
- Load Diversity/Capacity Sharing = $15-$45 million per year
- Reliability Benefits = not quantified
- Insurance Value = not quantified

*Total Benefits estimated in excess of $200-$300 million per year.*

*Not building SWIP North will result in significant annual ratepayer costs that could otherwise be avoided.*
Brattle Study (cont.)

- Energy Market Value
  - Bookend estimate of production cost savings >$110-$150 million
  - Based on real time LMPs at Malin & Eldorado

*Historical and Projected Annual Energy Market Value and Estimated Production Cost Savings (2030$)*
Brattle Study (cont.)

- Energy Market Value
  - Low Carbon Grid Study shows SWIP-N highly utilized for wide range of future renewable portfolios and Northwest hydro conditions
• Energy Market Value
  • Low Carbon Grid Study shows SWIP-N provides notable ramping benefits, particularly CAISO daily afternoon transitions from high solar (south-to-north flow) to peak load (north-to-south flow)
  • Value of these additional benefits not quantified in this study
Brattle Study (cont.)

- COI Congestion Relief
  - 300 MW of congestion relief from SWIP North
  - CAISO’s normal simulation approach underestimates actual congestion
  - CAISO 2015-16 Plan estimates $0.3 million in 2025
  - Actual congestion costs $60-$150 million in 2012-2014
  - CAISO 2015-16 Plan found SWIP-N reduces congested hours by 39%
  - Benefits of 300 MW valued at $23-$59 million per year

- EIM Benefits
  - PacifiCorp EIM study showed $26 million per year for 400 MW increase in transfer capability
  - SWIP North will create >1000 MW of new transfer capability

- Wheeling Revenues
  - Each 1000 MW of p-to-p transmission service sold by NTTG or WestConnect utilities to access SWIP-North would generate an estimated $28 million per year
  - Current PacifiCorp tariff rates used as a proxy
Brattle Study (cont.)

- **Load Diversity/Capacity Sharing**
  - Interconnects regions with divergent load patterns
  - Reduced RA requirements by aligning coincident peaks
  - Used conservative estimates of avoided costs
  - Benefits valued at $15-$45 million per year
  - Additional benefits not quantified due to peak differences between IPC and PacifiCorp, estimated 600 MW of capacity sharing

- **Reliability Benefits**
  - Helps prevent WECC NE/SE separation in the event of loss of COI lines
  - Reinforces 345 kV system, shifts flows away from 345 kV constraints
  - Regional backbone to 500 kV system
  - Operational flexibility during outages
  - Benefits not quantified in this study
Insurance Value

- Mitigate energy price spikes associated with extreme events and market fluctuations
- Short Term Uncertainties such as extreme contingencies, constrained fuel supplies, weather conditions leading to operational variations and outages
- Long Term Uncertainties such as fuel pricing shifts, technology costs, environmental regulations, public policy changes

Examples:
- During 2012 energy price spike, energy market value of SWIP-North would have been $127 million vs. $53 million during normal conditions in the several years prior to and following 2012
- Aliso Canyon gas leakage
- North-South path outages

Benefits not quantified in this study