

**ELECTRICAL TRANSMISSION AND DISTRIBUTION SYSTEM**

**Basic Description of System:** The Hanford Site transmission and distribution system is comprised of 53 miles of 230 kilovolts (kV) transmission line, 120 miles of aerial distribution lines, and 19 miles of underground lines. The system has three active 230 kV and one active 115 kV substations, namely:

- Substation A8 (251-W), 230 kV, serves the Central Plateau
- Substation A6 (251-E), 230 kV, serves the WTP
- Substation A9 (151-KE), 230 kV, serves the 100 Area
- Substation 451-B (B5-S2), 115 kV, serves the 300 and 400 Areas.

The Hanford Site electric transmission system is part of the national and regional electric power grid. In 2007, DOE became required to comply with electrical reliability standards in the *Energy Policy Act of 2005* (EPAct 2005). The EPAct 2005 requires integrity to prevent disruptions to the electric grid system. DOE is subject to sanctions for failure to comply with these requirements.

Hanford Site peak electrical demand was about 35 MW in FY2015 and is projected to be 71 megawatts (MW) by FY2027. Approximately 95% of the power is purchased directly from the BPA; the other 5% is supplied directly from the City of Richland to facilities in North Richland (HAMMER, PTA, 300 Area, etc.). LIGO receives power from the Benton County Public Utility District via a distribution line from the Hanford 451-B (B5-S2) Substation in the 400 Area.

Attributes for the Electrical System are provided in Table 3.1 along with projects to attain or sustain the desired conditions. For more detail, also refer to Appendix H – Attributes List. Significant upgrades to support mission requirements through FY2021 are defined in the *Electrical Utilities Master Plan, HNF-6608*. The upgrades support new load and configuration requirements of the waste feed delivery system for WTP.
<table>
<thead>
<tr>
<th>Table 3.1 Electrical Attributes</th>
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<tbody>
<tr>
<td><strong>Electrical System Attributes</strong></td>
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</table>
| **Operate Safe & Regulatory Compliant Electrical System** | • Meets or exceeds applicable Energy Policy Act (Epact 2005), WECC, NERC, and FERC requirements.  
• Compliant with DOE Order 430.2A and Washington Administrative Code 269  
• Enhances safety program tailored to electrical utility systems. |
| • L-612 230 kV Transmission System North Loop System Reconditioning and Sustainability Repairs.  
• L-707 Advanced Electrical Metering.  
• L-815 Upgrade Transmission/Distribution Access Roads.  
• L-792 2400V to 13.8kV Electrical Conversion. |
| **Availability, Right-Size & Reduce Active Site Footprint** | • Minimize cost and support out-year cleanup.  
• Increased capacity for Central Plateau.  
• Downsize 400 Areas.  
• Long-Term Stewardship.  
• Master Plan over 10-year horizon integrated with ISAP.  
• Enhanced succession planning to retain core competencies.  
• Planning focus – Central Plateau: WTP and Tank Farms. |
| • L-801, SCADA upgrades.  
• Metering system upgrades.  
• L-791 RFL Transfer Trip Upgrades.  
• Removal of unnecessary transformers, power lines and ancillary electrical infrastructure. |
| **Sustainability & Minimize Impact to Environment** | • Lamp and ballast disposal.  
• Scrap metal recycling.  
• PCB and non-PCB oil and contaminated equipment disposal.  
• Alternate power – fuel cells, solar |
| • L-612 230kV Transmission System North Loop System Reconditioning and Sustainability Repairs (DFLAW High Priority).  
• L-789 Distribution Refurbishments  
• L-861 Single-Circuit Distribution Pole Replacement. |
| **Reliability** | • Engineered solutions to aging systems: Meters and relays, breakers, transformers, pole and pole lines including conductors and hardware.  
• Enhanced unplanned outage response. |
| • L-612 230kV Transmission System North Loop System Reconditioning and Sustainability Repairs (DFLAW High Priority).  
• L-789 Distribution Refurbishments |
| **Maintainability** | • Enhanced predictive, preventive and corrective maintenance.  
• Execute MSA Maintenance program 5 Year Plan Strategies and Section 6.0 of the Electrical System Master Plan.  
• Implement Wood Pole Replacement Program. |
| • L-789 Distribution Refurbishments |

FERC= Federal Energy Regulatory Commission.  
PCB= polychlorinated biphenyl.  
WECC= Western Electricity Coordinating Council.  
WTP = Waste Treatment and Immobilization Plant.  
NERC= North American Electric Reliability Corporation.
**Current Condition FY2017:**

- **Condition:** Fair overall, with a few major components in poor condition because of age.
- **Capacity:** 110MW (compared to peak demand at 38.4 MW).
- **Reliability:** 99%+ except for planned outages and during wildfires.
- **Population Served:** 6,328. All site areas covered except ENW in 600 Area and 300 Area.
- **Areas Served:** Entire Hanford Site excluding 300 Area, HAMMER and PTA.

**Table 3.2. Electrical Demand:**

<table>
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<tr>
<th>Building No.</th>
<th>251-E</th>
<th>251-W</th>
<th>151-KE</th>
<th>251-WA</th>
<th>251-EA</th>
<th>451-B</th>
<th>Total Peak Demand (MW)</th>
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<tbody>
<tr>
<td>Substation</td>
<td>A-6</td>
<td>A-8</td>
<td>A-9</td>
<td>A-10</td>
<td>A-11</td>
<td>B5-S2</td>
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<tr>
<td>Summer / Winter Cap</td>
<td>25 / 25 - 62 / 70</td>
<td>33 / 40 - 50 / 60</td>
<td>17 / 20</td>
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<td>33 / 40</td>
<td>20 / 20</td>
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**100 Area Electrical:** The 100 Area is served by the A9 substation. The demand for the 100 Area is about 3MW in FY 2017, and should remain steady over the next 10 years. The major loads are the water pumping and distribution from 100 B and 100 D areas, K Basin cleanup and groundwater pump-and-treat cleanup activities. In response to a need to shift power toward the Central Plateau, the A-9 substation may be relocated in 2026 timeframe or one of the other options studied in the HNF-6608, Revision 4 report, and the load from the 100 Areas will be shifted to A-8.

The 230kV “North Loop” transmission line is in need of repair. EU replaced all the armor rod on the metal structures on 3.8 miles of line which goes in and out of 100 K Basins in 2015. EU also investigated 10 percent of the wooden structures on the remainder of the North Loop to assess the condition of the armor rod and associated hardware. An engineering study concluded the north loop needs to be replaced.

**200 Area Electrical Serving the Central Plateau:** Demand on the A6 substation (251-E) is 3.2 5 MW in FY2017, growing to 22.8 in FY 2019 and 28.2 in FY 2020 when WTP LAW starts commissioning and operation. During the FY2020 Vision era, adjustments to CT settings will increase the substation’s winter capacity from 20 MVA to 70 MVA. Loads are expected to stay at that level until WTP HLW commissioning and operation start beyond the forecast period. Additional LAW melters or other equipment are also outside the forecast period.
The A-8 substation (251-W) was renovated in FY2006 as part of Project L-325. Demand on A-8 is currently about 29.2 MW (see table 3.2), and its winter capacity is about 40 MW. Based on RPP-5228, the collective loads from cleanup projects are expected to exceed current capacity of A-8 in the FY2031 timeframe; while FY2031 is beyond the ISAP rolling 5-year planning horizon, projects to re-evaluate power capacity and distribution throughout the Hanford site must be initiated within the next few years.

A significant upgrade to the 200E electrical distribution lines was completed in FY 2016. The Office of River Protection is considering a proposal by the Tank Operations Contractor (TOC) to tailor the requirements of IEEE 765, *Standard for Preferred Power Supply for Nuclear Power Generating Stations* for WTP. If adopted, this standard may require a redundant and physically independent electrical source to the WTP safety-class bus. When a decision is made on how to implement this standard, the TOC will communicate its requirements through the ICD-11 process and EU will determine how to implement an engineered solution. See Appendix E, Table E-1 for the decision tracking.

**300 Area Electrical:** The B3-S4 substation (351) was removed in FY2014. The service to permanent facilities in the 300 Area was transitioned to City of Richland. The temporary deactivation and decommissioning facilities in the 300 Area and 618-10 Burial Ground were transferred to the B5-S2 substation (451-B). Line C5L20 from 451-B serves 3 remaining air monitoring stations that are identified for transition to alternate power supply as part of footprint reduction.

**400 Area Substation:** The B5-S2 (451-B) substation, built in the early 1980’s, is rated at 30MW and is underutilized and in need of upgrades. The 400 Area demand was 2.8 MW in FY 2016 from 618-10 remediation, 6224-A building, N-910 services loads MASF, FFTF, FEMF and the Laser Interferometer Gravitational Observatory (LIGO). A new fire station is to be constructed in the 400 Area in the FY 2017-2019 timeframe, which will be served by 451-B through the duration of cleanup. An options analysis for the 400 Area power has recommended divesting of 451B.

The protected area around the FFTF is not scheduled for closure until 2030, although some facilities outside this protected area will complete deactivation sooner. The planned versus actual closure dates for the 400 Area require RL decisions predicated on funding all component facility moves and demolition required to reduce electrical demands. A reevaluation scheduled in the future may recommend transferring remaining loads to an alternative service provider in lieu of funding expected upgrades to the 451-B substation. An alternative connection for LIGO/Benton PUD from the other 451-B 13.8kV bus was completed in FY2016.

**End State FY2022:**

To meet the FY2022 end state, the equipment will be operating at a peak demand of 59MW and maintained in fair condition. Projections past the FY 2022 end state suggest that the A8 substation is inadequate to meet demand when cleanup activities in the 200 Areas are brought online, and evaluation is underway to understand and meet the challenges.

- **Condition:** Fair overall, with a few major components in poor condition because of age.
- **Capacity:** 110MW.
- **Reliability:** 99%+ except for planned outages and during wildfires.
• **Population Served:** 6,668. All site areas covered except ENW in 600 Area and 300 Area.
• **Areas Served:** Entire Hanford Site excluding 300 Area, HAMMER and PTA.

**Existing Gaps:** See Appendix D, Gap Summary.

**Cost Avoidance Proposals:** Estimated energy savings for FY2017 is approximately 740,000 kWh, with an annual cost savings of approximately $30,000 annual. The Site program expects to receive allocated energy conservation incentives from BPA for partial funding of selected projects in the range of $200,000 to $230,000 total.

Completed cost avoidance and cost savings proposals during FY2017 include:

- WRPS facility lighting retrofits for 23 buildings saves 280,000 kilowatt hours.
- WRPS phase 4 modifications to 2750E completed with a savings of 76,000 kilowatt hours.
- 2704HV lighting retrofit completed with a savings of 161,000 kilowatt hours.
- CHPRC warehouse lighting retrofits with a savings of 135,000 kilowatt hours.
- MSA EU downsizing of 15 transformers with undetermined target savings.
- MSA facility HVAC replacement has an estimated savings of 10,000 kilowatt hours.
- MSA lighting retrofits at three facilities saving an estimated 70,000 kilowatt hours.

Active proposals going forward beyond FY2018 include:

- Other EU system large projects over the next 2 to 3 years with an undetermined target savings.
- Continued facility lighting retrofits, with the largest opportunity ahead in parking lot lighting conversions to LED type fixtures.

**Major Actions/Decisions Needed:** Funding to transform the North Loop 230 kV transmission line to meet the site needs for the duration of the cleanup mission of Hanford. Decision and path forward for the 400 Area.

**Date Revised:** September 11, 2017
Figure 3.1 - Electrical System Roadmap

Electrical Roadmap

- Peak demand: 31.2 MW
- Nominal capacity: 117 MW
- Extend 2000 13.8kV line – 80m
- L-756 has been funded with developed scope in FY16 to address long-term needs including L-400
- Defined 3 new projects during FY18 Master Plan updates

2017

- BPA Midway Sub-1
- Power Generation
- BPA Midway Bus 1
- Power Generation
- Ryno Condenser Cleanup
- Tank Farm
- Mission Support
- Mission Support
- Mission Support
- Mission Support
- WTP Treatment Plant
- Tank Farm
- Mission Support
- Mission Support
- Mission Support
- Mission Support
- BPA Borken

END STATES 2022

- 100 & 200 Areas served from 157KE (A6) & 251W (A8) substations
- Peak demand: 59.6 MW
- Nominal capacity: 112 MW
- 100 Area served from 157KE (A6) substation
- Downsize 100 Areas and remove remaining loads from RL distribution system
- Downsize other areas—Isolate distribution as loads are no longer needed
- BPA to bypass RL 230kV system with new circuit
- Execute long-term strategy for 451B per study results to direct 451B

Major Programs
- RL Owned Substation
- BPA Owned Substation
- Demolished/Transferred
- RL Owned 1200/2300kV Line
- RL Owned 800/2300kV Line
- RL Owned Distribution
- BPA Owned 115 or BPA 230kV Line
- BPA Borken 230kV Line
- Energy Northwest Columbia Generating Station

Project Descriptions

<table>
<thead>
<tr>
<th>Description</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
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<tr>
<td>L-653, 230kV Transmission System Recabling and Sustainability Repairs (EPWAR High Priority)</td>
<td>•</td>
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<td>L-758, Distribution System (Distribution) 13.8kV (BPA)</td>
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<td>L-759, Multi-Transmission/Distribution Access Points</td>
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<td>L-761, PVI Transfer Trip Uplinks</td>
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Design - Construction —

22 Project years are based on Reliability/Project Investment Portfolio List version 3rd Qtr. 2017