LANL Photovoltaic Array Proposal

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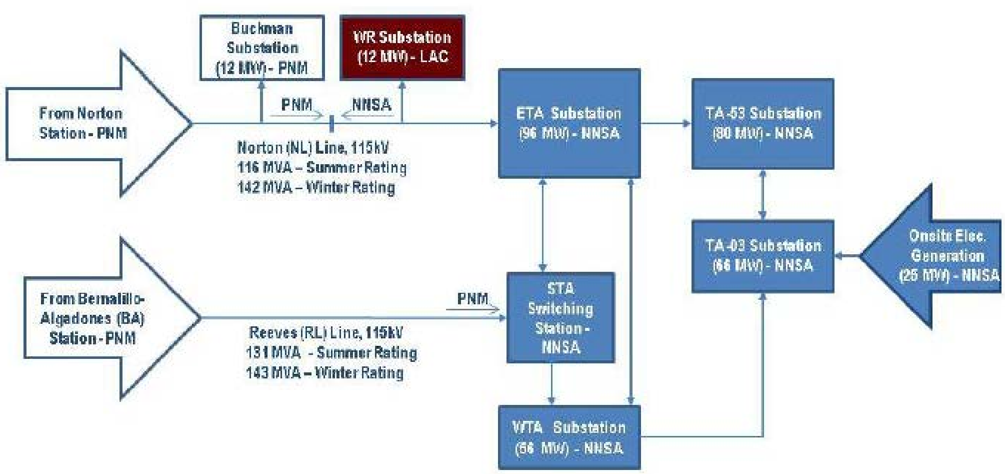
Introduction

In 1985 Los Alamos County and the Los Alamos National Laboratory formed a unique power pool arrangement including import power infrastructure from the PNM system (referred to as the import capability), and the internal transmission infrastructure that transmits and delivers imported and/or onsite generated power. The transmission system operates at 115 kilovolts (kV) while the distribution system operates at 13.8 kV.

There are two transmission lines that import power from the PNM system:

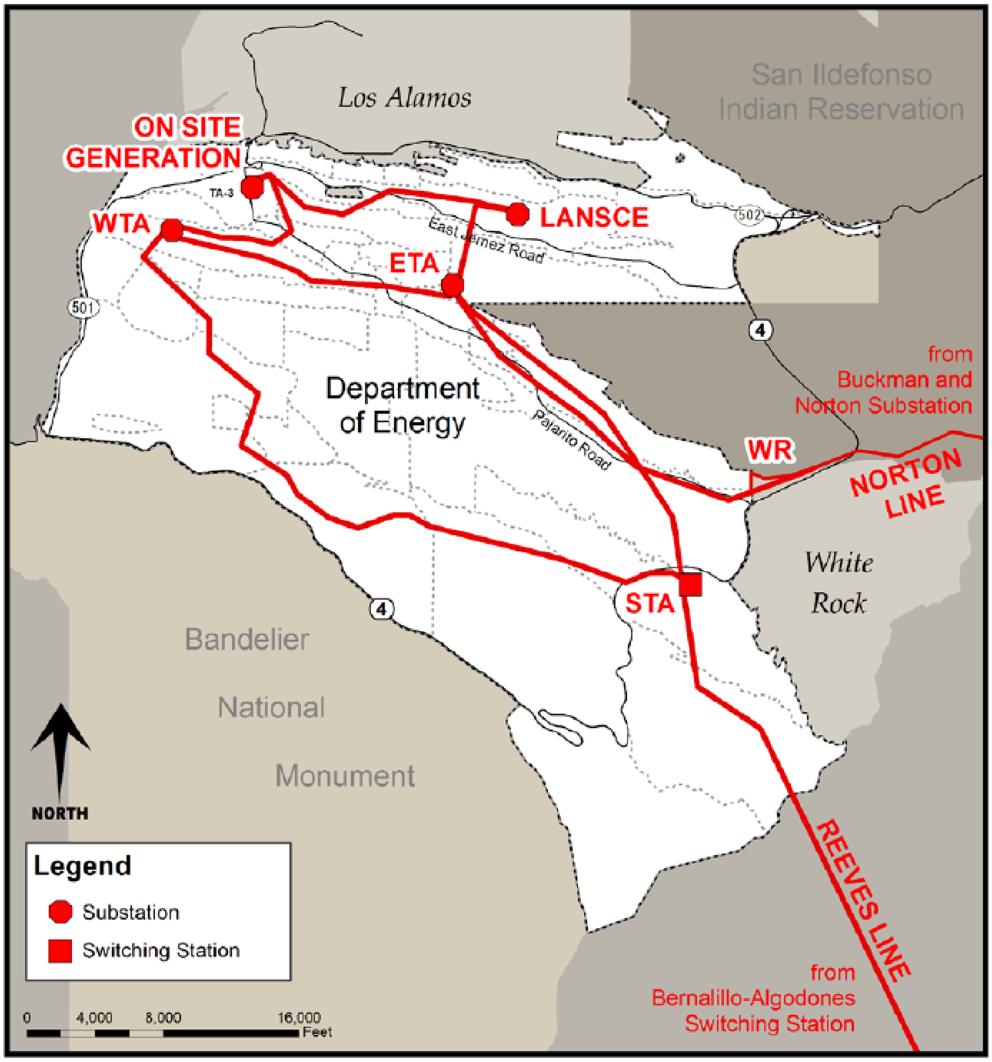
- Norton Line (NL) that originates from the Public Service of New Mexico (PNM) Norton Station in Santa Fe
- Reeves Line (RL) that originates from the PNM Bernalillo-Algodones (BA) Station north of Bernalillo



Existing Transmission System Block Diagram

The Norton Line is approximately 14 miles long, with a rated import capacity of 116 MW in summer and 142 MW in winter, originating at the PNM Norton Substation in Santa Fe and terminating at the DOE owned ETA substation. The ownership of the Norton Line is split between DOE and PNM. PNM owns a five mile portion (from the Norton Station to Structure No. 78) and DOE owns the remaining nine miles to the ETA substation.

The Reeves Line is approximately 40 miles long and has a rated import capacity of 131 MW in summer and 143 MW in winter.



Existing Transmission System Location Map

Note: PNM defines winter to be December, January and February. The remainder of the year is considered summer.

Existing Power Capacity and Demand Overview

During the past four years, demand has ranged from 84 to 88 MW and existing import capacity is 116 MW. On average, there is an additional 30 MW available for growth before the current import limit is reached.

Existing Import Capacity and Historical Peak Demand

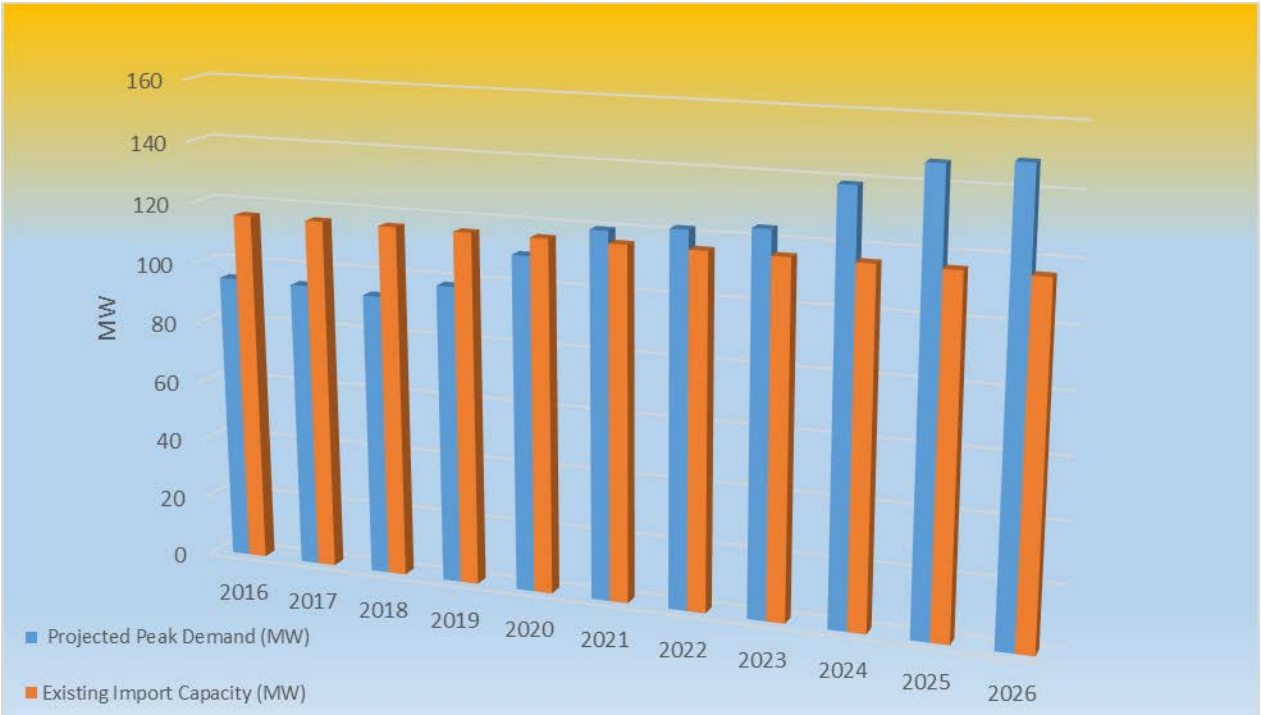
Methodology

The overall method used to develop this study is summarized in the two steps below:

- Projections: collect load growth data for existing and planned projects/programs
- Gaps: identify and document the gaps between existing capabilities and current/future requirements

Projections

The load growth at the Laboratory has been relatively flat and quite predictable over the past five years. In the next five to ten years, high performance computing platforms are expected and this additional demand will double the current electrical usage.

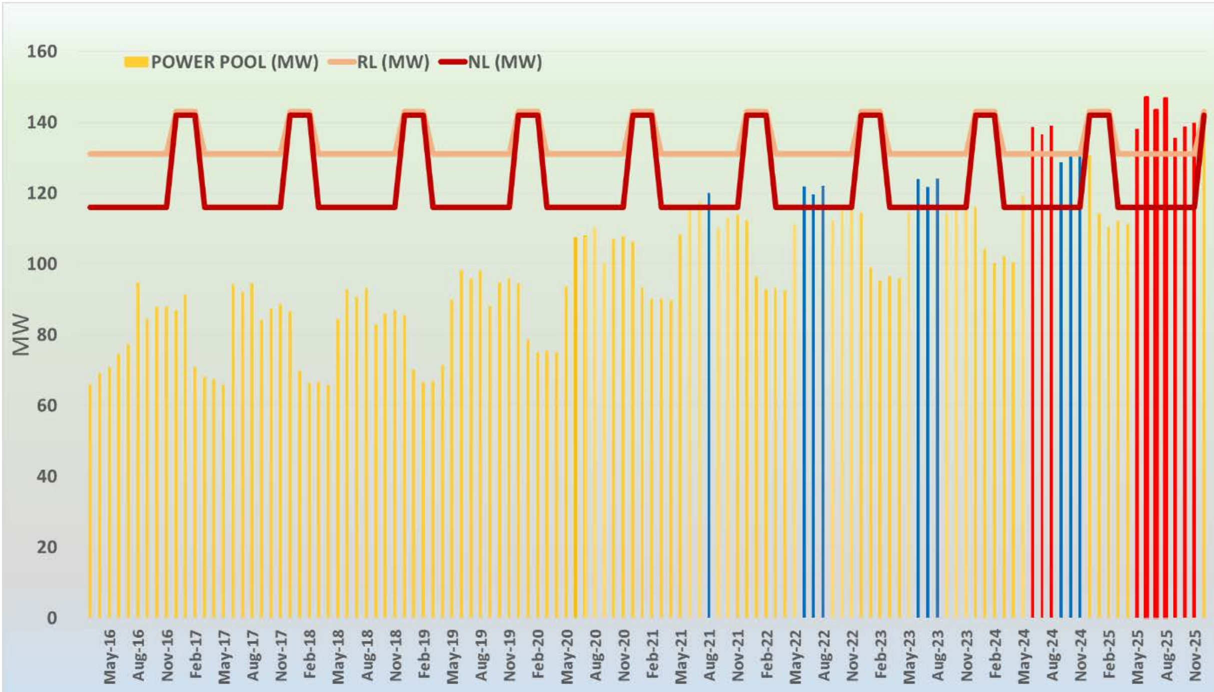


Existing import capacity and Projected Peak Demand

The analyzed projections for this study consider all of the proposed electrical loads from March 2016 to December 2025. The Laboratory will continue to make annual investments in energy conservation projects. The measured savings from the energy conservation projects was averaged and applied to the base load as a reduction factor.

Gaps

Based on these projections, the Los Alamos Power Pool load will exceed the Norton Line capacity in July 2021. In a more detailed monthly projection analysis we can see that from 2021, and during the summer months, the Norton Line capacity is exceeded and the Reeves Line capacity will be reached by July 2024.



Existing Import Capacity and Projected Monthly Demand

There is also uncertain availability of current Power Pool resources to support mission growth. For example, the possibility of the San Juan Generating Station availability in 2022 and the uncertain future of the Laramie River generating resource.

All potential power resource scenarios will be analyzed further in order to manage LANL's actual and potential generation resources through 2030.

In the long term there is no question that if the incremental projected supercomputing loads materialize, the existing transmission infrastructure and generation resources will not have the capacity to meet power demands and baseload on-site power generation will have to be installed or the transmission line expanded.

The Power Pool is exploring the need for a third transmission line to wheel additional power to satisfy future load growth. While this would be the traditional response to future increases in electrical demand, the inherent difficulty of permitting an additional line requires consideration of on-site generation and other options that would offer the same reliability.

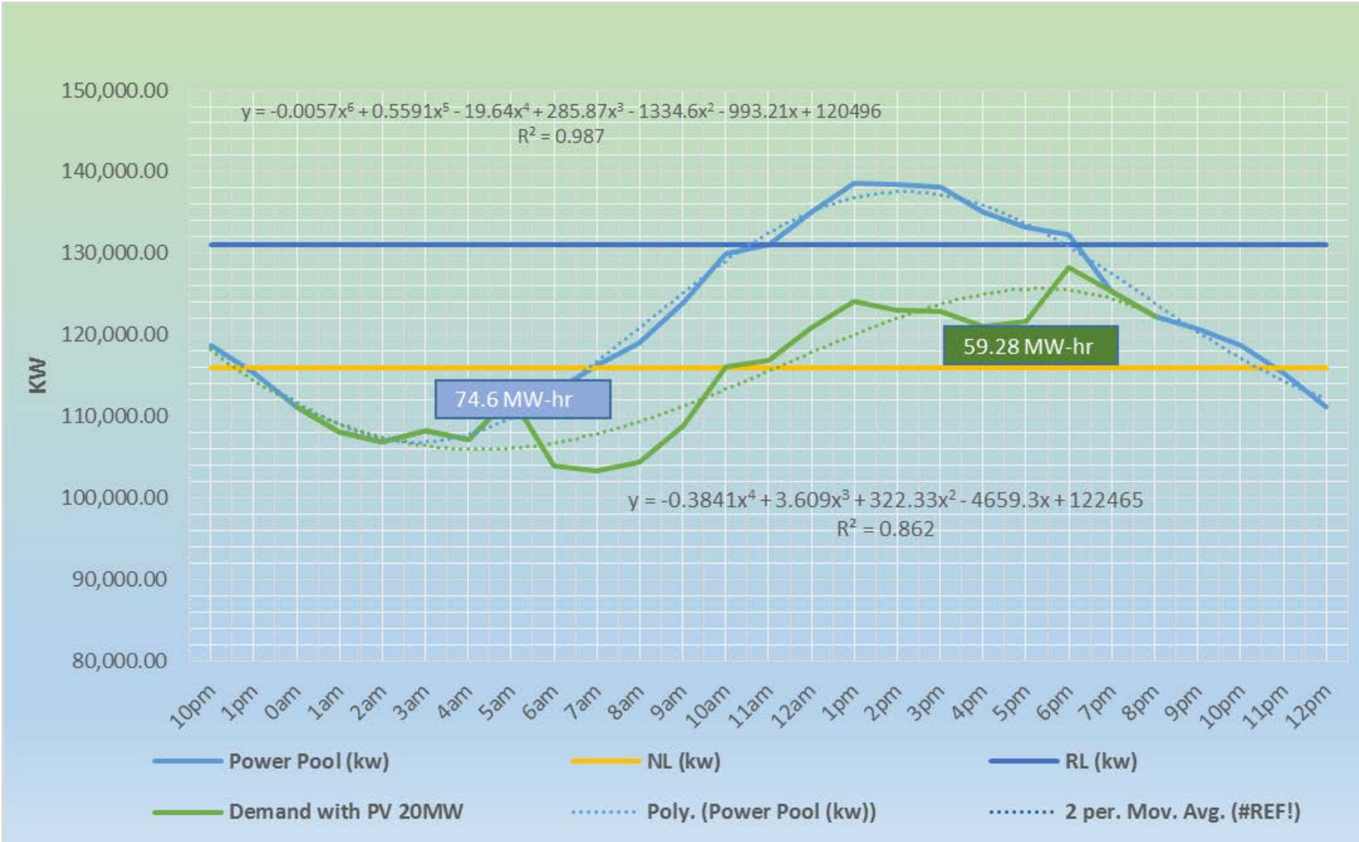
PV Alternative

In August 2015, the National Renewable Energy Laboratory (NREL) updated the initial 2008 LANL Renewable Energy Feasibility Report. The updated version included renewed economic analysis of PV options. The entire campus was considered in the updated NREL analysis and many potential system locations were identified.

The performance of grid-interconnected PV is generally measured in terms of annual power production and most PV generation occurs during the warmer months when days are longer and there is less cloud cover.

The next two graphs display the Peak Electric Demand considering a 10MW and a 20MW PV array installation.

July 2024 Hourly Peak Electric Demand and the potential Peak Demand reduction from a 10MW PV System-Average Day



July 2024 Hourly Peak Electric Demand and the potential Peak Demand reduction from a 20MW PV System-Average Day

These two scenarios were analyzed considering a day in July based on historical demand data and the PV output for 10MW (first graph) and 20MW (second graph) based on historical hourly PV performance data in a typical Santa Fe weather location. In both graphs, blue line represents the demand when there is not a PV array installed and green line represents the demand when the PV array is installed and generating.

The purpose of the PV array, as shown in the previous two graphs, is to maximize the peak load shaving. Peak load shaving becomes more effective from 10 am to 6pm as shown in the previous Figures. With a PV array installed, the peak load can be reduce by 10MW or 20MW (for a 10MW PV and 20MW PV respectively) during those hours.