High-Voltage Direct Current Test Center

In 1970, BPA completed the nation's first and longest extra-high-voltage direct current transmission line. It was one of BPA's greatest engineering feats, made possible by the research conducted at the High-Voltage Direct Current Test Center in The Dalles, Oregon. Energized on Nov. 4, 1963, the test center made BPA a world leader in research and paved the way for transmission technology that once staggered the imagination of electrical engineers. BPA retired the test center in 1996. It was demolished two decades later to make room for new transmission facilities.

AC vs. DC: The war of currents

In the late 1880s, a bitter rivalry ensued between inventor Thomas Edison and his former employee Nikola Tesla. Edison believed direct-current transmission, where the electric charge flows continuously in one direction, was superior to the alternating current that Tesla favored. Edison argued DC was a safer, more efficient and cost-effective way to transmit power over long distances. But with AC transmission, it's easier and cheaper to change voltage levels, which makes it better for power distribution. Tesla won the "war of currents," and today's electric systems predominately use AC.

BPA proves DC's worth

Even as BPA built out its high-voltage AC transmission system in the first half of the 20th century, its engineers understood the benefits of DC. DC technology could connect regions and allow them to use power resources more efficiently. But nobody had invented a way to convert high-voltage AC to DC and back.

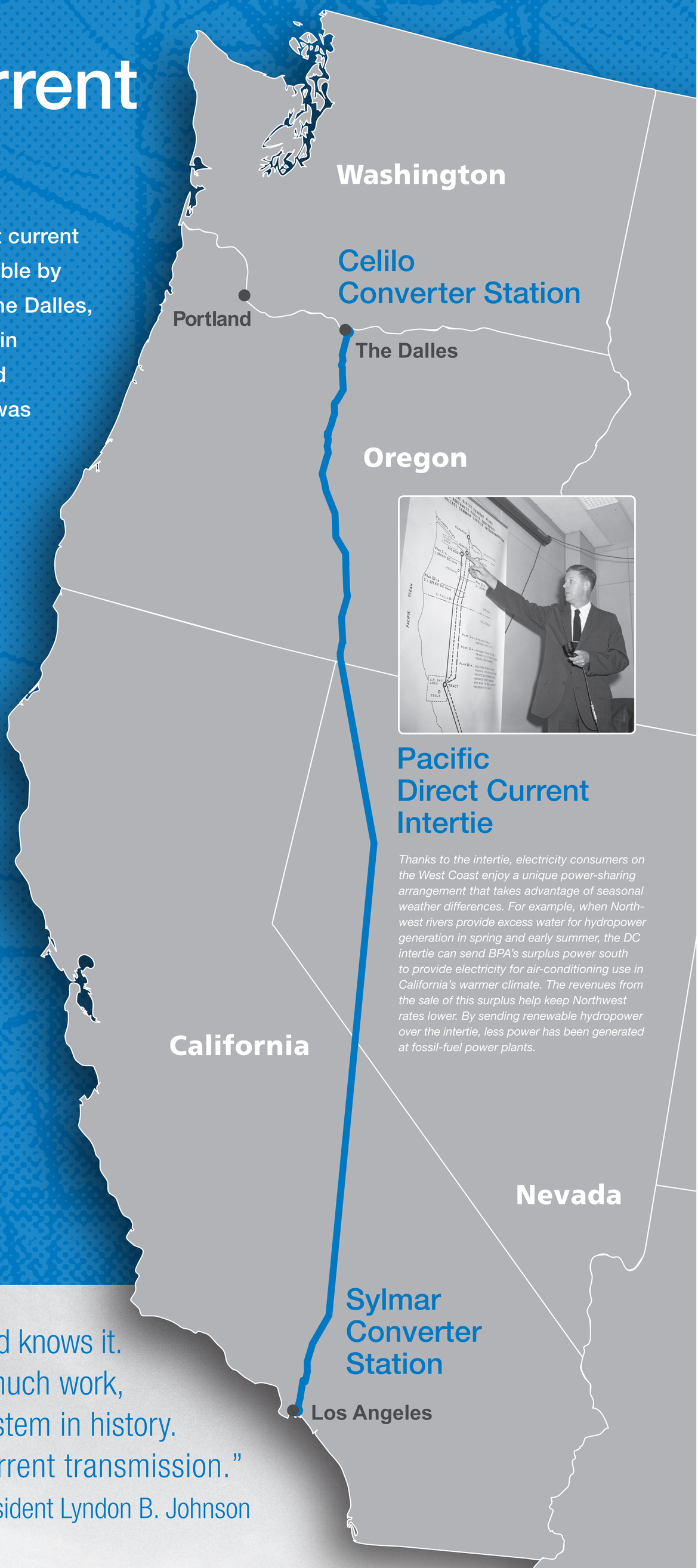
The original test center was a giant inflatable dome made of polyvinyl fabric — a design chosen in part for its low cost. Wind damaged the "bubble" a short time after construction, and BPA replaced it in 1963 with a more durable wood-framed barrel-vaulted structure.

That changed in the 1950s with the development of large-scale convertors. Around this time, BPA was discussing the idea of a nearly 900-mile intertie — a transmission link between the Pacific Northwest and Southwest — that would allow BPA to sell its surplus hydropower to California. BPA engineers concluded DC transmission would be more economical for a line that long. They knew that power losses across DC transmission lines are lower than on AC lines, so more power could be delivered.

But would it be safe and reliable? The technology needed testing.

With authorization from Congress, BPA built the $1.6 million test center — the only experimentation facility of its kind in the U.S. Engineers tested the effects of contamination and climate, radio interference, electrical discharge (called corona), the noise level and other safety, efficiency and aesthetic factors.

With the knowledge gained through the test center, BPA moved forward with the 800-kilovolt DC intertie. Converter stations at both ends of the line convert AC electrical power to DC and then back again. It can carry up to 3,100 megawatts, enough to serve three million households. Upon its completion in 1970, the DC intertie carried a higher voltage than any similar transmission line in the world. Today, thanks to further advancements, the DC line operates at 1,000 kilovolts.



Thanks to the intertie, electricity consumers on the West Coast enjoy a unique power-sharing arrangement that takes advantage of seasonal weather differences. For example, when Northwest rivers provide excess water for hydropower generation in spring and early summer, the DC intertie can send BPA's surplus power south to provide electricity for air-conditioning use in California's warmer climate. The revenues from the sale of this surplus help keep Northwest rates lower. By sending renewable hydropower over the intertie, less power has been generated at fossil-fuel power plants.

"Here, in the Northwest, America is moving again. And all the world knows it. This intertie, which is the result of so many brains and so much work, and such great efforts, is the most exciting transmission system in history. It makes us world leaders in direct current transmission."

—President Lyndon B. Johnson