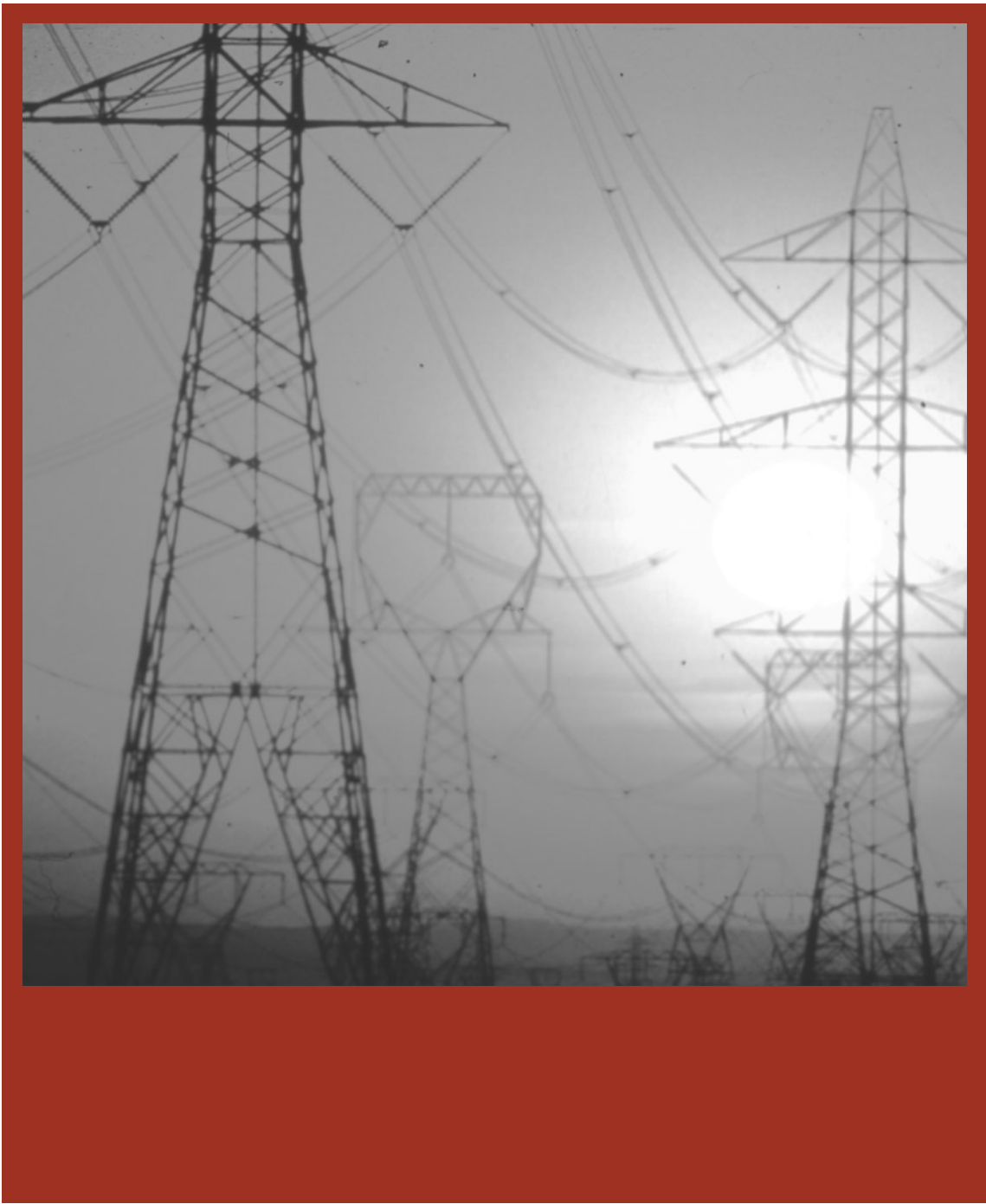


**Pacific Intertie:
The California Connection on the Electron Superhighway**



Executive Summary

For 33 years, electricity consumers on the West Coast have benefited from a unique arrangement that allows large amounts of power to be transmitted between the Pacific Northwest and the Desert Southwest. The high-voltage transmission lines that make this power-sharing possible collectively are called the Pacific Intertie.

The Intertie includes three alternating current (AC) lines and one direct current (DC) line. Together, they comprise the largest single electricity transmission program in the United States.

California enjoys the greatest benefit from the Intertie. In the last 15 years, for example, the Northwest has sent more electricity to the Southwest -- mostly to California -- every year than it has received. Power generated in the Northwest has saved Southwest utilities more than 2.8 trillion cubic feet of natural gas that would have been burned in power plants.

Because large amounts of Northwest power can be transmitted reliably to the Southwest, less power has been generated at fossil-fuel power plants -- an important benefit in a part of the country with chronic air pollution problems. Conversely, because the Northwest has been able to import power from California, particularly overnight when demand is low, water can be reserved in reservoirs that otherwise would be used to make electricity -- an important benefit in a part of the country where hydropower operations affect threatened and endangered species of fish. As well, money that southwestern utilities pay for power from the Bonneville Power Administration helps finance fish and wildlife restoration projects in the Columbia River Basin.

Recently, Bonneville announced it will spend \$35 million to modernize its portion of the DC line and related facilities. In combination with modernization efforts undertaken by the California partners, the DC line will maintain its 3,100-megawatt capacity far into the future. The equipment replacements are expected to be complete in November 2003.

Pacific Intertie: The California Connection on the Electron Superhighway

When the weather is hot in California and the Desert Southwest, it is comparatively cool in the Pacific Northwest. And when the weather is cold in the Pacific Northwest it is comparatively warm in California and the Desert Southwest.

For 33 years, electricity consumers on the West Coast have enjoyed a unique electricity transmission arrangement that takes advantages of those seasonal weather differences to share large amounts of power between the Desert Southwest and the Pacific Northwest. In the spring and summer, when generators generally have surplus power in the Northwest and temperatures climb in the Southwest, power -- in the spring, mostly power that is completely surplus to Northwest needs, and in the summer, on-peak deliveries subject to off-peak energy returns, -- is shipped south to help meet increasing demand, particularly for air conditioning. Conversely in the winter, when generators in the Southwest generally have surplus power and temperatures drop in the Northwest, power is shipped north to meet increasing demand, particularly for heating.

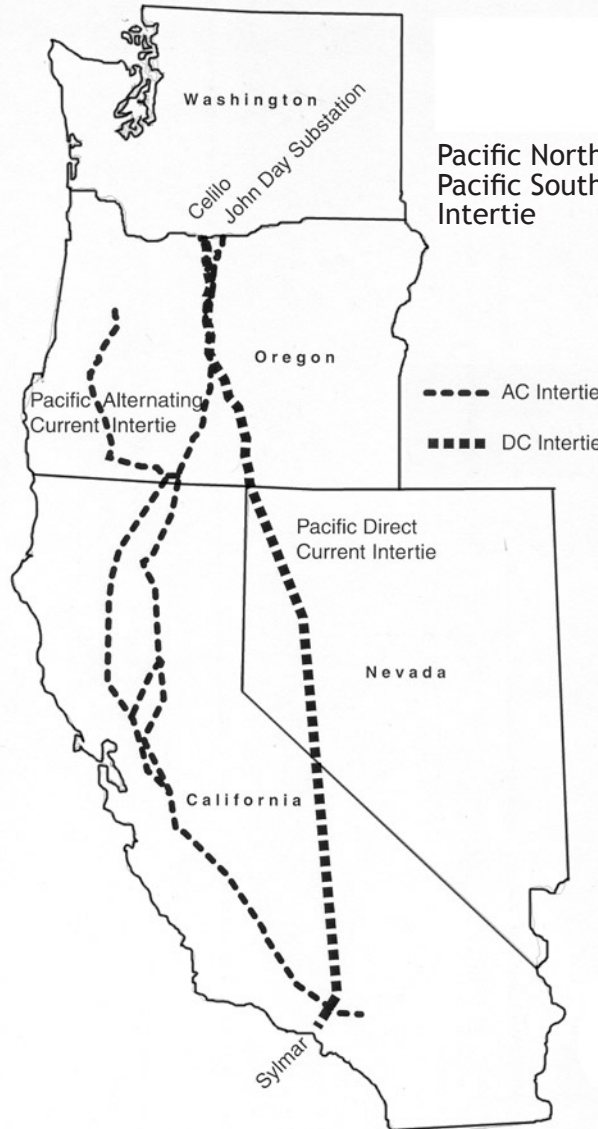
In the last year, as the West Coast copes with historic electricity shortages and high prices, the ability to transmit power between the two regions helped keep the lights on -- even though it wasn't enough to avoid periodic blackouts in California. At times, the Northwest/Southwest relationship has been tense, as neither region has much surplus to swap or sell and power purchase costs pushed some California utilities close to bankruptcy.

The transmission lines that make this power-sharing possible collectively are called the Pacific Intertie. The Intertie comprises three alternating current (AC) lines and one direct current (DC) line. Together, these lines comprise the largest single electricity transmission program in the United States.

The northern end of the DC line is at the Bonneville Power Administration's Celilo Converter Station, which is just south of The Dalles Dam about 90 miles east of Portland. The southern end is 846 miles away at the Sylmar Converter Station on the northern outskirts of Los Angeles. That station is operated by utilities including the Los Angeles Department of Water and Power (LADWP) and Southern California Edison. The AC lines follow generally the same path but terminate in Northern California.

Only a few parties actually own the Intertie, but numerous entities have contracts to share its transmission capacity. The Oregon/California border is a dividing line for Intertie ownership and capacity sharing. In Oregon, the DC line is owned by Bonneville and Portland General Electric Company, and Bonneville controls most of the transmission capacity.

PacifiCorp has a contract with Bonneville for a portion of the south-to-north capacity. In Nevada and California, the DC line is owned equally by Southern California Edison and the Los Angeles Department of Water and Power. Entities with transmission contracts include Pacific Gas & Electric, San Diego Gas and Electric and the California cities of Vernon, Pasadena, Burbank, Anaheim, Azusa, Banning, Colton, Riverside and Glendale.



The AC lines in Oregon are owned primarily by Bonneville. Other utilities with capacity rights and/or ownership include Portland General Electric, PacifiCorp, Puget Sound Energy, Seattle City Light, the Pacific Northwest Generating Cooperative, Snohomish Public Utility District and Tacoma Public Utilities. In California, the AC lines are owned and/or shared by Pacific Gas and Electric, Southern California Edison, San Diego Gas and Electric, the Western Area Power Authority, the California Department of Water Resources, the Sacramento Municipal Utility District, Los Angeles Department of Water and Power and a consortium of other utilities known collectively as the California-Oregon Transmission Project.

Depending on seasonal conditions, the Intertie is capable of transmitting up to 7,900 megawatts -- 4,800 AC (1,600 of this is in the California/Oregon Transmission Project, also known as the Third AC Line) and 3,100 DC. Over the past five years the limit has ranged between about 6,300 and 7,900 megawatts. At maximum, that's enough electricity for seven cities the size of Seattle. Most of the power transmitted on the Intertie is surplus to regional needs, but some firm power also is transmitted. For example, Bonneville sells about 1,900 megawatts of firm energy to customers in California via the Intertie.

Recently, Bonneville announced it will spend \$35 million to modernize the DC line. In combination with modernization efforts at Sylmar undertaken by the California partners, the DC line will maintain its 3,100-megawatt capacity far into the future. The equipment replacements are expected to be complete in November 2003.

In addition to seasonal power exchanges and help during power emergencies, the Intertie has other important benefits to West Coast electricity consumers. Because large amounts of Northwest power can be sold and transmitted reliably to the Southwest, less power has been generated at fossil-fuel power plants -- an important benefit in a part of the country with chronic air pollution problems. Fewer fossil-fuel power plants need to be built -- an important benefit in a part of the country with chronic air pollution problems. In the last 15 years, for example, electricity shipped south on the Intertie has saved Southwest utilities more than 2.8 trillion cubic feet of natural gas that would have been burned in power plants. As well, the money that California and southwestern utilities pay for Bonneville's power helps finance fish and wildlife restoration projects in the Columbia River Basin.

Because of the Intertie, the Northwest and Southwest enjoy a unique power-sharing relationship that has benefited both regions of the country since power first was transmitted on the lines in 1968.

The Intertie and the current West Coast Power Crisis

In the last year and a half, as the West Coast electricity shortage worsened and spot market prices for power abruptly shot to extremes never seen before, the Intertie played a critical role. Utilities in the Northwest were fighting their own battles of supply, demand and high prices, but when they had surplus power to sell, it was transmitted to power-starved California on the Intertie. Conversely, when California utilities had power to spare, particularly overnight when demand is lowest, it was shipped north on the Intertie.

As the crisis worsened in California, many Northwest utilities publicly worried about whether they would be paid for power they shipped south, even after the Clinton Administration and then the new Bush Administration ordered utilities outside California to sell their surplus power to utilities in the state. However, the Intertie provided the opportunity for a unique power-sharing arrangement between Bonneville and the major investor-owned utilities in California. No cash was exchanged. Bonneville sent power south during high-demand periods of daylight hours, and California sent power north overnight -- two megawatts for every one that Bonneville sent south. This allowed Bonneville to reduce hydropower generation at federal dams on the Columbia River and its tributaries so that reservoirs could refill. Both regions benefited and, as a result, the reservoir behind Grand Coulee Dam, Lake Roosevelt, remained one foot higher than it would have if the power-sharing arrangement had not been in place, Bonneville reported. That is a critically important accomplishment in a year shaping up as the second-driest of the last 60 and as snowpack runoff -- the "fuel" for about 75 percent of the electricity in the Northwest -- is expected to be only about 55 percent of normal.

The Intertie is not immune to impacts from the power crisis, as the power crisis might cause its ownership to change in California. In March, the state of California reached an agreement with Southern California Edison to buy the debt-ridden utility's transmission system -- including its ownership of a portion of the Intertie -- for \$2.76 billion and is negotiating with the state's two other investor-owned utilities, Pacific Gas and Electric and San Diego Gas and Electric, to take over their transmission, as well. The utilities are nearly bankrupt as the result of their accumulated debt from buying high-priced power on the wholesale market through short-term contracts, as required by power-purchase policies in the state's electricity deregulation law. If the transmission sales take place according to Governor Gray Davis' plan, the state would own most of the high-voltage transmission in the state,

including a portion of the Intertie. It is not clear what that might mean for future transmission prices.

Impacts of national electricity industry deregulation

The National Energy Policy Act of 1992, and the subsequent Orders 888 and 889 of the Federal Energy Regulatory Commission, began the steady deregulation of the nation's electricity industry. While wholesale price competition was encouraged by FERC in response to the Energy Policy Act, power plant developers were reluctant to commit large amounts of capital to new generating projects in the face of relatively low wholesale prices up until last year, and faced difficulties siting projects, particularly in California. Both are factors in the current high prices of wholesale power on the West Coast as demand steadily eclipsed supply.

Deregulation also had impacts on transmission of electricity, and therefore on the Intertie. In response to the Energy Policy Act, transmission owners began working to control their costs in preparation for competition and open access to high-voltage transmission, required by the FERC orders. Open access led to increased use of the Intertie, as power marketers made transactions and then sought transmission capacity to move the power. Bonneville responded by splitting its transmission off as a separate business unit. In the competitive wholesale market, other power marketers sometimes beat Bonneville to the use of its own lines for surplus power sales to and from the Southwest. Increased use of the Intertie also has required increasingly sophisticated computer controls and broader management oversight, especially following the August 1996 West Coast power outage.

Consequently, Bonneville now is investigating the costs and requirements for upgrading its transmission system, including its share of the Intertie. The largest West Coast problem is in California, however, where a transmission constraint near the city of Gilroy is a severe limit on the ability to move large blocks of power from the Southwest into Northern California and the Northwest.

In the Northwest, little transmission has been added to the grid since 1987, and little more is planned at the moment, yet Bonneville expects winter loads to grow by 12 percent through 2008 while new transmission is only expected to grow by 2 percent. Bonneville estimates it will need to invest an additional \$775 million -- beyond investments already planned -- between 2002 and 2006 to remove transmission constraints, meet new demand for transmission and integrate the generation from new power

plants under construction in the Northwest. These investments don't include needed upgrades in California.

Improved coordination of transmission was a central purpose of a December 1999 order (Order 2000) by the Federal Energy Regulatory Commission (FERC), which required utilities throughout the nation to examine the formation of regional transmission organizations (RTOs) in order to improve the efficiency of high-voltage transmission systems and lower electricity rates, which reflect transmission prices. Transmission systems, while interconnected, charge separate rates for each segment of ownership. This "pancaking" of rates, as it is called, can add to the cost of transmission from one part of the country to another. RTOs, in theory at least, could reduce or eliminate pancaking through uniform rates and, as a result, lower the cost and improve the efficiency of transmission.

In October 2000, eight western utilities and Bonneville filed a proposal with FERC to create a regional transmission organization, which would be called RTO West. While it would not control all high-voltage transmission in the West, RTO West would serve eight western states and control nearly 52,000 miles of transmission, including the Oregon portions of the Intertie. California investor-owned utilities' transmission systems are controlled by the California Independent System Operator (ISO). Southwestern utilities have created a third western RTO called Desert STAR. There has been some encouragement from FERC for a single westwide RTO.

The initial filing for RTO West includes a role for the consortium to plan and add transmission, but the organization is not planned to begin operating until 2004. Because new transmission lines require at least five years to be designed, approved and built, Bonneville hopes to move more quickly in addressing transmission needs in the Northwest.

History of the Pacific Intertie

While the Intertie is proving its value during the current crisis, power shortages have occurred before on the West Coast. In fact, concerns for power shortages were part of the rationale for constructing the Intertie in the first place.

Consider this familiar-sounding scenario:

Pacific Gas and Electric Company, a major California utility, finds itself facing blackouts because it seriously underestimated demand for power and didn't build enough generating capacity. Facing a looming power shortage -- perhaps the largest to hit a single

area in U.S. history -- the governor orders electricity use cut by 20 percent in PG&E's service territory. Meanwhile in the Pacific Northwest, utilities are bracing for a severe shortage of peaking power -- the electricity that utilities rely on during emergencies of cold or hot weather, when demand peaks.

That could be a description of current events, but actually the year was 1948, and the events were described in a report by the power manager for the Sacramento regional office of the Bureau of Reclamation. In that year, central California experienced a drought. Power production was severely curtailed as a result, and the power manager made the point that an intertie to the Northwest could have prevented the energy shortage in California and also helped the Northwest avoid its peaking power shortage.

1948 also was the year a California congressman proposed diverting a portion of the Columbia River to California for water supply and power production. Other politicians, including many in the Northwest, saw the proposal as a thinly veiled water-grab.

The Northwest Public Power Association also opposed the idea, and recommended instead that high-voltage power lines be built that could carry surplus power from the Northwest to California. Even in 1948, however, the idea of linking the Northwest and Southwest with high-voltage power lines was not new. It dates to a proposal by University of Washington engineering professor Carl Magnusson in 1919. In the 1930s, President Franklin Roosevelt included the idea of linking the major population centers of the Northwest, Great Basin and Southwest with high-voltage power lines in his rationale for creating the Bonneville Power Administration.

The California drought of 1948, however, spurred new interest in building the Pacific Intertie. During the next five years, the idea gained momentum and the Intertie was seen as a means of helping alleviate power shortages in both regions, providing power for emergencies, reducing California's dependence on oil-burning power plants and helping serve the power demand of national defense-related industries during the Korean War.

Meanwhile in Congress, the Intertie proposal bogged down in requirements for feasibility studies, opposition to federal involvement in the project (it was being pushed primarily by the Bureau of Reclamation, Federal Power Commission and the Defense Electric Power Administration), and by others who questioned whether it really was necessary. These critics included Northwest Governors, who feared the Intertie might carry power away that otherwise could be sold in their states.

During the administration of President Dwight Eisenhower, the role of federal agencies in public works projects was reduced in favor of private industries and non-federal government agencies. There even was a shadow of anti-Communist, McCarthy-era fervor over the Intertie proposal. In 1951, the Idaho Public Utilities Commission denounced the proposal as "a major element in the plan of those people who are attempting to build a socialist power empire and who have contemplated for 15 or 20 years such an empire embracing the entire western part of the United States."

The proposal languished through the early and mid-1950s, but sprang back to life late in that decade in response to the rising cost of fuel oil for power plants in California (from \$1 to \$2.50 per barrel), a decline in the aluminum market and Bonneville's first budget deficits, which were caused by reduced sales of surplus power as the result of competition from newly constructed, non-federal power plants in the Northwest. In 1958, Pacific Gas & Electric Company proposed constructing a high-voltage transmission line between California and Oregon in conjunction with the California-Oregon Power Company (this company later merged with Pacific Power and Light Company of Portland). Specifically, the two utilities proposed to extend a line into California that already ran through central Oregon to Klamath Falls. Bonneville was interested because of the potential to sell surplus power to the Southwest.

Congressional committees continued to hold hearings, and more studies were conducted into the early 1960s. In addition to political concerns, there were engineering concerns about the practicality of long-distance transmission of electricity.

Several related efforts came together in 1964 that led to construction of the Intertie. These were 1) ratification of the Columbia River Treaty between the United States and Canada, 2) completion of the Pacific Northwest Coordination Agreement, which specified how the dams would be operated under the treaty; 3) congressional approval of the Pacific Northwest Consumer Power Preference Act, and 4) congressional approval of budget appropriations to build the federal portion of the Intertie lines in Oregon.

The Columbia River Treaty resulted in the construction of three dams in British Columbia, Mica, Keenleyside and Duncan, and these were completed by the late 1960s. Eventually, a fourth Treaty dam, Libby, was completed on the Kootenai River in Montana. The effect of the Treaty dams is to maximize power generation downstream in the Columbia River system. The Treaty

authorized British Columbia to share equally in the additional power generation.

While Canadian Prime Minister John Diefenbaker and President Dwight Eisenhower signed the Treaty in January 1961, British Columbia refused to agree to its ratification, as required under Canadian law, before it could go into effect. As a result, Canada would not ratify the Treaty until 1964.

The province wanted some assurance that half of the additional power, which under the treaty belongs to British Columbia, actually would be sold in the United States as planned. The province did not want to try to sell the power in British Columbia, where it was not needed.

Recalling that time of tension between the province and the Canadian federal government -- one of many in the province's history -- Hugh Keenleyside, then chairman of B.C. Hydro, said in a speech to the Vancouver Board of Trade in February 1964, "B.C. argued that if the treaty were ratified, the province would be committed to proceed with the building of the dams but would have no assurance of a purchaser for our downstream power. ... [The province] took the position that the ratification could only be accepted if accompanied at the same time by a specific undertaking on the part of the United States to purchase the Canadian entitlement at an agreed price and for an agreed term."

Thus, British Columbia wanted to shop its share of the additional firm power in the United States, where there were willing buyers. In fact, the official name of the Intertie was changed to the Pacific Northwest-Pacific Southwest Intertie because the City of Phoenix, Arizona, asked for some of the power Canada would be selling.

This was acceptable to the two countries, and a non-profit corporation, the Columbia Storage Power Exchange, was created to buy the Canadian share of the additional generation. This was necessary because Bonneville officials and others believed Congress would not provide money to buy power from British Columbia for resale in the United States. Without access to the Canadian power, however, California would not support construction of the Intertie.

"It was the Canadian entitlement power that made the Intertie possible," Charles Luce told author Gene Tollefson in an interview for his book, "BPA and The Struggle for Power at Cost." Luce was administrator of the Bonneville Power Administration when the treaty was signed. "The Northwest wanted to sell only secondary [surplus] power [on the Intertie]. California would consent to the Intertie only if they could get firm power. We didn't

need the Canadian power in the Northwest. There was no political opposition to selling Canadian firm power in California. So all of a sudden, what seemed to us to be a problem and a liability, namely how to market this Canadian power, became an asset and an opportunity."

Meanwhile, the Pacific Northwest governors also wanted assurances -- assurances that the Intertie would not siphon firm power generated on the Columbia River in their states to the power-hungry Southwest. Surplus power, of course, was another matter. These concerns were addressed in the Pacific Northwest Consumer Power Preference Act of 1964, signed by President Johnson on August 31. The Preference Act required that Bonneville sell firm energy first to electric utilities in the Northwest and that any surplus would be available for sale outside the region. The law also required that the cost of transmitting power over the privately built portion of the Intertie be no higher than if the lines had been built by the federal government.

Earlier that August, on the 14th, Congress approved the Public Works Appropriations Bill of 1965 -- the coming fiscal year -- with \$42.2 million for Bonneville and \$3.3 million for the Bureau of Reclamation to construct the federal portion of the Intertie, which is in Oregon. The California portion would be built by California utilities, primarily the Los Angeles Department of Water and Power. In all, the construction cost would top \$700 million.

Finally, on September 15, the Bonneville Power Administration, Corps of Engineers and U.S. Northwest utilities that own hydropower dams signed an agreement officially entitled, "Coordination of Operations Among Power Systems of the Pacific Northwest," known today as the Pacific Northwest Coordination Agreement (PNCA). The PNCA responds to language in the Treaty that commits BC Hydro and Bonneville to coordinate operations of their Columbia Basin power systems to produce the optimum amount of firm power, as needed to meet demand, and surplus power. The PNCA expires on June 30, 2003, but has been renegotiated to establish a later expiration date.

The initial Intertie consisted of two 500,000-volt AC lines and two 800,000-volt DC lines (there are two wires, but they operate together and are considered a single line) linking Oregon with Los Angeles. In Oregon, Bonneville built 267 miles of one AC line and 88 miles of the other, and 265 miles of the DC line. The northern end of the AC Intertie is at the John Day Substation, 30 miles east of the DC terminus at the Celilo Substation. Two AC lines run south from John Day to Lugo, east of Los Angeles.

These lines went into service in 1968 and 1969, at a combined total capacity of 2,500 megawatts. A third line from The Dalles Dam to Tesla, east of San Francisco, was completed in 1993 and brought the total AC capacity to 4,800 megawatts. The DC line was energized in 1970 at 1,440 megawatts. It was upgraded to 2,000 megawatts in 1985, and to 3,100 in 1989.

A month after signing the Northwest Consumer Power Preference Act, which cleared the way for construction of the Intertie, President Johnson addressed the Intertie Victory Breakfast in Portland on Sept, 17, 1964. He arrived in Portland from Blaine, Washington, on the border with British Columbia, where he proclaimed the Columbia River Treaty a day earlier in a ceremony with Canadian Prime Minister Lester Pearson in front of an estimated 10,000 people. Canada had ratified the Treaty recently after working out its differences with British Columbia; the United States had ratified the Treaty three years earlier.

At the Blaine ceremony, Johnson presented Pearson with a check for \$254 million, the calculated value of the Canadian entitlement to the additional generation for 30 years, as required by the Treaty and negotiated by the province and the two federal governments. BC Hydro used the money to build its three Treaty dams.

Johnson’s remarks at the Intertie Victory Breakfast are as relevant today as they were in 1964:

“This system is proof of the power of cooperation and unity. You have proved that if we turn away from division, if we just ignore dissention and distrust, there is no limit to our achievements.”

Table 1: An electron superhighway

Year	Net Transfer to the Southwest in Average Megawatts	Energy Equivalent in Billion Cubic Feet of Natural Gas
1986	3,155	281.9
1987	2,339	208.9
1988	1,379	124.8
1989	1,483	132.5
1990	2,826	252.5
1991	2,672	238.7
1992	889	79.4
1993	106	9.4
1994	306	27.3
1995	1,174	104.8
1996	3,788	338.4
1997	3,947	352.6
1998	2,204	196.9
1999	3,345	298.8
2000	2,019	180.4
Total	31,632	2,827.3

Table 1. An electron superhighway

Thousands of megawatts are transmitted on the Pacific Intertie every year between the Northwest and Southwest. The imports help reduce the amount of power generation in each part of the country. Every year since 1986, more power has been transmitted from the Northwest to the Southwest than in the other direction. The following table expresses net annual transmission (combined north-to-south and south-to-north) on the Intertie, AC and DC combined, in terms of cubic feet of natural gas.

