Chapter 11

The war-time powerhouse

Conventional history states that the U.S. won the war against Germany and Japan by superior airpower, and the airplanes that destroyed Axis factories, ships and cities were built with aluminum produced by dozens of brand new refineries, smelters and fabricating plants. While the U.S. Defense Plant Corporation built aluminum plants around the nation, the Pacific Northwest stood out as a big producer. In 1943, at the peak of World War II production, Pacific Northwest aluminum plants produced 252,000 tons of aluminum out of a total of 920,200 tons for all U.S. producers. This was a substantial increase from 1939, when no aluminum was produced in the Pacific Northwest and total U.S. production was only 163,500 tons. By 1944, five smelter plants were in operation in Washington and Oregon with a combined capacity of 316,000 tons or 27% of the U.S. total. The plants included the Alcoa plant in Vancouver, Wash., the Reynolds plant at Longview, Wash., and three government-owned operations at Troutdale, Ore., Spokane, Wash. and Tacoma, Wash. Alcoa ran the government-owned operations in Troutdale and Spokane, and the Olin Corporation ran the government-owned operation in Tacoma. In addition, the U.S. government built a large aluminum rolling mill in Trentwood near Spokane. [1]

The Pacific Northwest aluminum plants were not located there for isolation. Except for Spokane and Trentwood, the plants were located near the Pacific Coast. The choice was based on abundant hydropower. During the Great Depression, the federal government embarked on a big dam-building project in the Columbia River Basin, particularly in Washington State at the Grand Coulee and Bonneville sites. The prime purpose was to create jobs and help reduce massive unemployment, according to Carleton Green's 1954 history of the regional aluminum industry. A secondary purpose was to help develop the natural resources of the region and stimulate the regional economy. Few people anticipated that dam building would result in a huge aluminum industry in the Pacific Northwest. The importance of the resulting hydroelectric power system created complex political issues with numerous adversaries fighting over control over what some feared could turn into a monopoly. The political fighting took place in various arenas – public versus private, local government versus federal government, residential and agricultural versus industrial, and big industrial versus small industrial. [2]

Four important factors served to aggravate the political situation: 1) continuous conflict between proponents of power development, river navigation, flood control, land reclamation and the protection of fish life; 2) arguments over how fast development should take place, and the use of delaying tactics by opponents to particular projects; 3) Congressional control over financing, leading to political maneuvering among Washington politicians during budget negotiations; and 4) regional versus national interests, with the federal government taking the position since the 1930s that the Columbia River Basin was "national power." Further complicating these issues, in 1930 the states of Washington and Oregon approved the creation of public utilities, quasi-public organizations that could acquire power facilities from private utilities through condemnation procedures. This left private utilities on the defensive, according to Green. Furthermore, these public utilities justified and perpetuated their existence by broadening their markets through larger and larger distribution systems. While this expansion effort brought electric power to isolated rural areas and raised the living standards of the region, the public utilities aggravated a potential power shortage problem while contributing no power generation or transmission lines to the system as residential use climbed. [3] In 1936, a growing movement to create public power utilities led to the creation of 15 public utility districts in Washington State, mostly based on county structures. [4] By 1941, thirty public utilities had been established in Washington, Oregon and Idaho serving more than 40,000 customers in rural areas. [5]

Initial regional energy planning

Franklin Roosevelt had promoted hydroelectric power projects as governor of New York in the 1920s and promoted similar projects when campaigning for president in 1932. Regional planning commissions were established in 1934 to investigate river basin planning. [6] In 1927, the Army Corps of Engineers began a comprehensive study of the development potential of the Columbia River Basin. The 308 Report recommended 10 major hydropower plants along the main stem of the river starting at Bonneville, 146 river miles upstream from the mouth, and ending at Grand Coulee, 597 river miles from the mouth. The report was published in 1932 and was the first official plan for large-scale comprehensive development of the river basin. [7] In 1933, after Roosevelt was elected president, Congress authorized construction of both the Bonneville Dam and the Grand Coulee Dam as federal Public Works Administration projects under the National Industrial Recovery Act. [8] The Bonneville Dam was completed in 1938, and the Grand Coulee Dam was completed in 1941. [9] Grand Coulee Dam's three powerhouses were capable of generating 6,200 megawatts, equivalent in modern terms to the generating capacity of five large nuclear power plants. [10]

Not everyone in Washington, D.C. supported the effort to generate power in Eastern Washington's desert country, while others worried about what was being created, according to Vera Springer's 1977 history of the Bonneville Power Administration. In 1935, as hydroelectric projects on the Columbia River were underway, critics described the dams as "white elephants in the wilderness" and questioned their worth. Colliers Magazine published two articles on the projects, "Dam of Doubt" and "Power in the Wilderness." At the same time, politicians wrestled with ideas about how the new federal power system should be managed. Sen. James Pinckney Pope of Idaho introduced a bill into Congress that would have created a Columbia Valley Authority modeled on the Tennessee Valley Authority. The bill met opposition by those already opposed to the TVA. Another bill was introduced into Congress that would have given the U.S. Corps of Engineers the authority to market the power from Bonneville Dam and given the Bureau of Reclamation the authority to market power from Grand Coulee Dam. The bill also would have offered cheap power to industries that located adjacent or very close to the dams. Major arguments against this second bill were that there would not be a widespread distribution of power to rural and domestic customers. [11]

On Dec. 29, 1935, the Pacific Northwest Regional Planning Commission issued a report suggesting the creation of an independent federal agency to market power from both the Bonneville and Grand Coulee dams. The general idea of such an agency went back as far as the 1920s with the call to provide electrical power to rural areas at a "postage stamp" rate. The Commission recommended that power from the Bonneville and Grand Coulee dams be sold at the cost of generation, not at a market rate, and that preference be given to public utilities for the federally generated power. [12] In 1936, at Roosevelt's request, the Commission issued a report on how to manage the new power plants on the Columbia River. The report recommended a central grid linking the principal locations of existing and future power generation, including Spokane, Puget Sound and Portland. Over time, the commission identified all the policies that later were included in the Bonneville Project Act of 1937, and a map of the Commission's 1938 master plan mirrored the reality of the region's power grid 40 years later, according to Springer. The Commission's plan, however, was modified in Congress. The proposal to create an independent corporation to manage power was dropped in favor of creating a new bureau in the Department of the Interior. The new bureau was also given the authority to build and operate the transmission lines forming the power grid. Key players in passage of the act in Congress included Professor C. Edward Magnusson, Sen. Charles Linza McNary of Oregon, and Rep. Mike Mansfield of Montana. [13]

On Aug. 20, 1937, following three years of debate, President Roosevelt signed the Bonneville Project Act, creating the Bonneville Power Administration under the Interior Department as the agency to sell energy generated at the Bonneville and Grand Coulee dams. Revenue from sales of hydroelectric power would be used to repay the U.S. Treasury for loans that financed power projects on the Columbia River. The Bonneville Project Act established "preference customers" for power sold by the BPA – primarily public utility districts, electric cooperatives and municipal utilities. Power allocation was set up according to priority classes. Power that was surplus to the needs of preference customers could be sold by the BPA to investor-owned utilities (IOUs). Any remaining power could be sold to direct-service industries (DSIs) – large industrial customers, such as aluminum plants. No power could be sold outside the Pacific Northwest unless it was surplus to the needs of the region. By 1940, there were 29 public utility districts in Washington State and the public-power movement's success provided support for pro-preference forces in Congress, according to Peter D. Cooper's 1986 account. [14] The Bonneville Power Project was renamed the Bonneville Power Administration in 1940. [15]

Initially, the Bonneville Power Administration oversaw sales and distribution of electric power from the Bonneville Dam. The administrator was instructed to build transmission lines and other transmission equipment to existing and potential markets, and to other federal or publicly-owned power generating facilities, in order to "encourage the widest possible use of all electric energy that can be generated and marketed" and to "prevent the monopolization thereof by limited groups" of this new source of power. The administrator was also instructed to "give preference and priority to public bodies and cooperatives" so that the dam operated "for the benefit of the general public, and particularly of domestic and rural customers." Up to 50% of the power from the dam would be made available to public utilities and power cooperatives through Jan. 1, 1942, and the administrator was instructed to provide "reasonable opportunity and time" for the creation of public utilities and cooperatives within an economic transmission distance from the dam. The only customers allowed to resell power provided by the BPA were public utilities, cooperatives and private utilities, and the BPA was allowed to purchase "unused excess power" from public or private power systems "for the purpose of economical operation or of providing emergency or break-down relief." Schedules for wholesale power rates were to be prepared by the administrator, and they became effective upon approval by the Federal Power Commission – now called the Federal Energy Regulating Commission. Rates would be established in order to recover the costs of producing and transmitting power as well as for the amortization of the capital investment. [16]

The Bonneville Project Act encouraged the widest possible use of all the energy that could be generated and marketed, and to prevent monopolization. Wholesale power rates were set in 1937, and provisions were made to review the rates at five-year intervals beginning on Dec. 20, 1939. The first two wholesale rate increases were an average of 3% in 1965 and an average of 27% in 1974. [17] The agency's mission statement included: 1) federal dams would generate power whenever possible; 2) preference in the sale of electrical power would be to residential customers through public agencies and cooperatives; 3) power would be sold at the lowest possible rates for which costs could be recovered; 4) power would be sold in such a way as to encourage widespread use and to prevent monopolization; 5) power would be delivered to the nearest convenient point for handling; and 6) the BPA would act as a unified marketing organization for federal power, but income from power sales would go to the U.S. Treasury and additional funding would require Congressional approval. [18]

Subsequent legislation and executive acts over the decades enlarged the role of the BPA to act as the marketing agent for 29 federal dams in the Pacific Northwest, and the agency became part of the Department of Energy. The BPA was never a dam builder. The dams were built and operated by the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation, and the dams served multiple purposes – flood control, navigation, irrigation, water supply, pollution control, recreation and power generation, among other uses. Transmission lines and substations were designed by the BPA, and their construction was contracted out. By Sept. 30, 1977, federal investments in the Federal Columbia River Power System totaled $7.7 billion including transmission systems, generating plants, irrigation, navigation, flood control, recreation and other facilities at federal dams. [19]

Promoting regional development

President Roosevelt named James Delmage Ross, a strong advocate of public power and the "Father of Seattle City Light," as Bonneville's first administrator in October 1937. [20] Immediately afterwards, the first BPA Advisory Board was established with representatives from the Departments of Interior, War and Agriculture and from the Federal Power Commission. The board focused on issues of costs, rate schedules and transmission system funding. Rates were to be set by the administrator, under authority of the Interior Secretary and subject to approval by the Federal Power Commission. The Bonneville Project Act required that rates be uniform throughout the area in order to extend the benefits of an integrated transmission system. Under the so-called "postage stamp" rate system, power purchased 200 to 300 miles from Bonneville Dam cost the same as that sold to a customer 15 miles from the dam. Customers within 15 miles were given a special rate. Initial rates set by the BPA were $14.50 per kilowatt-year for sites within 15 miles of the dam and $17.50 per kilowatt-year for any other customers. The $17.50 rate did not change until 1965. [21] The Federal Power Commission approved the BPA's initial power rates on June 8, 1938. [22] Ross also obtained $10.75 million from the Rural Electrification Administration in 1938 to build transmission lines linking the Bonneville Dam to nearby towns and to Grand Coulee itself. [23]

On Jan. 4, 1939, Ross issued the first annual report of the BPA. Citing words from the Bonneville Project Act, Ross believed power from the hydroelectric dams on the Columbia River offered "the promise of a richer standard of living to the people of the

Pacific Northwest" as well as "the ability to solve the social and economic problems of the area." Other than the Bonneville Dam, no major power-generating facilities had been built in the Pacific Northwest during the 1930s, and the growth of installed capacity lagged behind demand at "an alarming rate," Ross said. The BPA forecasted that over the next seven years, average household consumption would increase from 800 to 2,800 kilowatt-hours, and the number of consumers would increase by 10% to 20%. This increase in demand was equal to 55% of the total planned capacity of the Bonneville Dam, and the same amount of growth was forecasted for the subsequent seven years. Rising demand was driven by low electrical prices, which led to the increasing use of electric ranges, refrigerators, water heaters and space heating. "One of the greatest possibilities in this field is the development of complete electric house heating," he said. In the industrial sector, Ross forecasted that the distribution of cheap electrical power would promote industries that used the natural resources of the region to manufacture value-added products. Long distances and mountain barriers isolated the Pacific Northwest from industrial centers in the Midwest and the East, but a national trend toward "industrial self-sufficiency" supported his forecast, he said. [24]

Ross noted in his first annual report that industrial development and national defense would be important uses of electricity produced by the dam – but he didn't mention aluminum. Ross didn't favor aluminum smelting because it consumed large amounts of power but employed fewer people than other industries. He said he preferred to see the aluminum industry stay out of the Pacific Northwest until Grand Coulee Dam was completed, which took until 1941. Congress, however, had tough questions about low revenues for the Bonneville Power Project in 1938 and early 1939. Aluminum smelting could be the answer, members of Congress thought. [25] But the Great Depression wasn't the only global economic factor driving politics – inevitable signs of a future war filled the news. In the fall of 1938, the BPA suggested speeding up construction of the power plant at Bonneville Dam in anticipation of a national emergency. On Sept. 8, 1939, President Roosevelt declared a limited national emergency, adding urgency to the situation. In 1941, Roosevelt declared, "Airplanes are the key to victory" – and airplane manufacturing relied on aluminum. [26]

Ross died in March 1939, and President Roosevelt appointed a temporary replacement, Frank Banks, from the Bureau of Reclamation in May 1939. Banks was a conservative Republican with ties to business that made him unpopular with New Deal Democrats and public power advocates, according to a 2011 Northwest Power Council account. Banks went on to play a role in the construction of the Grand Coulee Dam before Roosevelt appointed Paul J. Raver as permanent administrator in September 1939. [27] Raver recognized that the agency's building program was well advanced but that few power contracts had been signed. He shifted the agency's attention to power marketing, with a special assurance that consumers would benefit from low wholesale rates. The economy of the Pacific Northwest, once focused primarily on logging and agriculture, was considered by the BPA to be "ripe for industrial growth." According to A.G. Mezerik, in his book "The Revolt of the South and West," the BPA under Raver was "unrelenting in its efforts to encourage a peacetime development by which the natural fertility of this land can be enhanced" and "reached out to Chambers of Commerce, labor unions, colleges and granges in an effort to build up relationships for mutual benefit." [28]

In the BPA's third annual report, Raver noted that sales of power to industry were accelerating because of the "quickened emphasis on national preparedness" and the likelihood of large government purchases of electrochemical and electrometallurgical products – in other words, aluminum. By the end of fiscal year 1940, a total of 97 industrial firms had approached the BPA about purchasing power, and new industrial demand had reached 350 megawatts. According to Raver, "It was apparent that the broad purposes of the Bonneville Act could best be served by developing a long-range program of industrialization in the Pacific Northwest, which in the past had been more or less handicapped by its dependence on agricultural and forest products." The BPA conducted studies on how to prod industrial development along, including research on new ways of using electricity to produce steel, to surveys of ideal industrial sites and the location of regional minerals. [29]

The Pacific Northwest goes to war

On Sept. 1, 1939, Germany invaded Poland, starting World War II. On Dec. 20, 1939, Raver signed the BPA's first industrial contract to supply power to Alcoa's new aluminum smelter in Vancouver, Wash. The initial 20-year contract called for providing 32.5 megawatts. The transmission line from the Bonneville Dam to Vancouver was completed about the same time. [30] Five days later, the Vancouver Columbian's front-page headline read, "Alcoa to build huge plant here, Three million dollar Christmas present is given to Vancouver." The announced aluminum plant was the first large industrial customer for BPA-supplied power in the Pacific Northwest. The first aluminum smelter west of the Mississippi, the Vancouver plant marked the birth of the Pacific Northwest aluminum industry. The plant was built in the Vancouver Lake Lowlands close to the Columbia River. [31] First metal was produced in September 1940, and the plant produced 5,000 tons of aluminum that year.[32] Executives were active in civic affairs, and unionized workers earned good wages. "So dominant was this industrial citizen that, well into the 1980s, Alcoa and Vancouver were practically synonymous," Michael Zuzel reported in the Vancouver Columbian in 2002. [33]

Once the U.S. began supporting Great Britain in the war effort, Alcoa decided to increase the size of the Vancouver plant to five potlines, with provisions for a sixth. In early 1941, with the German air force winning air and ground battles in Europe, the U.S. government approached Alcoa about having the company build more aluminum plants. Alcoa was the only aluminum producer in the U.S., and the Vancouver plant was the company's most modern. The Vancouver design was used in eight other aluminum smelters built in the U.S. for the war effort. [34] Alcoa built seven aluminum smelters for the U.S. government during the war using a prebake cell design called the Alcoa N-40. This design was developed at Alcoa's Niagara Falls smelter and was a 50,000-amp, end-riser, center-work design. The smelters using this design were at Vancouver, Spokane, Troutdale, Brooklyn, N.Y., Massena, N.Y., Riverbank, Calif., and Jones Mills, Ark. [35] After expansion, the Vancouver plant had five 50,000-amp potlines with a 85,000 ton-per-year capacity and employed 1,100 workers. Alumina was transported by rail to the plant from Mobile, Ala. [36]

The Reynolds Metals Co. entered the aluminum industry on its own initiative but with good loans from the U.S. government. In the Pacific Northwest, the company chose to build at a site on the Columbia River about 40 miles north of Vancouver in Longview, Wash. [37] By August 1941, the BPA was providing power to its second industrial customer with a 20-year contract. [38] Reynolds Metals completed construction and began operating the 31,000 ton-per-year aluminum smelter in September 1941. The plant cost about $6.5 million and was financed by a loan from the U.S. Reconstruction Finance Corporation. [39] The Longview plant consisted of three pot rooms, and the buss work connecting the reduction pots was made of copper because of the war-time aluminum shortage. [40] By 1950, the expanded plant had three 40,000-amp Soderberg-type potlines capable of producing 70,000 tons of aluminum per year and employed 430 workers. Alumina was transported to the plant by rail from Reynolds's alumina refinery in Hurricane Creek, Ark. [41]

The U.S. Defense Plant Corporation constructed three aluminum plants across the Pacific Northwest during the war with the idea that multiple communities could benefit from employment and the plants could be sold after the war, according to an online account by the Northwest Power and Conservation Council. The smelters primarily bought their power from the BPA, and Boeing's aircraft plants in Seattle were the primary customers of the finished metal. One estimate is that the electricity from the Grand Coulee Dam alone provided the power to make the aluminum in one-third of the planes built during World War II. [42] During the war, the U.S. government appropriated $2 billion to increase the generating capacity of the federal dams along the Columbia River by six-fold. The increased power enabled Alcoa to run new government-owned aluminum smelters at Spokane, Tacoma and Troutdale. [43]

In November 1941, the Defense Plant Corporation broke ground near Spokane for construction of the $71 million Mead aluminum smelter – less than a month before the Japanese attack on Pearl Harbor that drew the U.S. into the world war. Grand Coulee Dam provided the necessary power, and the rural site was far enough from the Pacific Coast to be safe from attack. [44] The Mead plant began operating in 1942. The smelter eventually occupied 1,200 acres of land, with eight potlines, an anode fabrication plant with baking ovens, and a coke calciner. At full capacity the plant produced 219,000 tons of aluminum per year. [45] The Defense Plant Corporation smelter at Troutdale was located about 15 miles upstream from Alcoa's plant in Vancouver. The plant had four 50,000-amp potlines and employed 775 workers. Alumina was transported to the plant by rail from Reynolds's alumina refinery in Hurricane Creek, Ark. [46] In 1942, a Defense Plant Corporation-financed aluminum smelter on the Puget Sound tide flats in Tacoma was built by the Olin Corporation and operated by Olin until 1945. [47] The smelter had three 25,000-amp Soderberg-type potlines capable of producing 24,000 tons of aluminum per year, about 3% of the total U.S. capacity, and employed about 300 workers. Alumina was transported by rail to the plant from the alumina refinery in Baton Rouge, La. [48]

In June 1941, Raver issued the BPA's fourth annual report to the Secretary of the Interior. Defense efforts dominated the agency's work by that time, but Raver believed these efforts proceeded without impairment to the agency's long-term plans for development of the Pacific Northwest. During the past fiscal year, he reported, nearly 30,000 tons of primary aluminum was produced using BPA power, and new aluminum plants had been built that were capable of producing enough metal to build one-fourth of the military planes scheduled for completion. To meet that rising demand, Raver called for accelerating the completion of the powerhouses at the Bonneville and Grand Coulee dams. [49] In September 1941, a 54-megawatt generator was installed at the Bonneville Dam years ahead of schedule. By December 1941, another generator was installed at Bonneville. Between October 1941 and spring 1942, three 108-megawatt generators were installed at Grand Coulee Dam. In March 1942, the War Production Board directed that two 75-megawatt generators earmarked for the Shasta Dam in California be sent instead to Grand Coulee. The two generators were operating by the spring of 1943. More units were installed at Bonneville in the next few years. By the end of World War II, decades of long-range planning for power development in the Columbia River Basin had been squeezed into five years, according to Green. The accelerated development was in response to the war-time emergency need for power to run aluminum smelters in the Pacific Northwest. [50]

The growing power economy of the Pacific Northwest by 1942 included the BPA, private utilities, public utilities, rural electrical cooperatives, aluminum plants and other large industrial plants, along with private generators in the region. In 1942, a voluntary effort was made to create a planning agency for electric power produced in the Pacific Northwest called the Northwest Power Pool. The organization was formed as a result of War Production Board Order L-94, which directed the nation's utilities toward maximum cooperation and coordination in order to increase efficient power distribution for the war effort and civilian uses. In the Pacific Northwest, 10 public and private utilities merged with the Federal Columbia River Power System to make better use of the BPA's transmission grid. [51] The BPA sold 26 million megawatt-hours of power during the war. Municipal utilities in Seattle and Tacoma, which had been unable to expand during the Great Depression, were able to utilize the BPA power and keep the war effort going. This effort was enhanced by the Northwest Power Pool, especially during an unprecedented drought in 1942. [52] After World War II ended, the BPA sponsored a conference in Tacoma to further that effort, which led to the formation of the Pacific Northwest Utilities Conference Committee. The regional committee included representatives from public and private utilities, direct-service industries and the BPA, and the Committee often served as a place for the BPA to announce policies and for the BPA to hear customer views on these policies. [53]

The nationwide aluminum industry

No alumina refineries were built in the Pacific Northwest – the U.S. aluminum industry's bauxite came from Arkansas and South America during the war, and refining reduced the weight of raw materials by about two to one as bauxite was turned into alumina. It made sense to locate the nation's alumina refineries in the South along the Gulf Coast or the Mississippi River to reduce shipping costs. Alcoa's 600 million ton-per-year Mobile, Ala., refinery was built in 1938. [54] The Mobile refinery used bauxite from Dutch Guiana. By 1943, the refinery produced about 34% of the alumina used by the U.S. wartime aluminum industry. [55] In 1942, Alcoa built an alumina refinery for the U.S. government at Hurricane Creek, Ark., and operated the plant for the government during the war. The new refinery incorporated a full-scale operation of the Alcoa Combination Process that made possible use of low-grade domestic bauxite. The refinery was capable of producing 750,000 tons of alumina per year when processing high-grade bauxite but was unique in that it could economically handle low-grade bauxite ores with 15% silica by using its lime-soda-sinter process facilities. Alcoa also built a Defense Plant Corporation refinery in Baton Rouge, La. in 1943 capable of producing 750,000 tons of alumina per year. The refinery also was equipped with lime-soda-sintering process facilities for handling low-grade bauxite ores. [56] The Baton Rouge plant was built by Alcoa using its Mobile refinery as a model. The government's decision to site the plant where it did was likely because of the nearby location of other war-related chemical plants, including an Exxon oil refinery originally built in 1916 that produced caustic soda. [57]

New aluminum reduction plants were also built around the U.S. during the war – sometimes in locations that made no sense once the war was over. The logic might have been to disperse the nation's vital smelting capacity so it would be more difficult to destroy by enemy attack, but as with past decisions about building smelters, the best answer is that war-time smelters were built near large electrical power supplies – even if it meant metropolitan areas. When the Pittsburgh Reduction Co. went looking for power in the late 19th century, it went to Niagara Falls. In 1942, the company began building an aluminum reduction plant in Massena, N.Y., near another reduction plant Alcoa had been operating since the beginning of the century. Called the St. Lawrence plant, the new plant had a rated capacity of 54,000 tons per year and cost nearly $20 million to build. It operated until 1944. That same year, Alcoa built and operated an aluminum smelter for the U.S. government at Jones Mills, Ark. [58]

The length to which the federal government was willing to go in order to build up the aluminum industry and win the war is evident in the case of the Maspeth, N.Y., smelter on Long Island. In 1942, Alcoa ordered twelve 12.5 megawatt 138 kilovolt power transformers for the new aluminum smelter at Maspeth. There was a shortage of copper at the time, so the U.S. Treasury provided the General Electric Large Power Transformer Plant in Pittsfield, Mass., with 75 tons of silver worth $1 million in 1942 dollars to build the transformers. The silver remained the property of the Treasury, and extraordinary precautions were taken during its handling and transportation. U.S. Treasury guards armed with machine guns escorted each 25-ton railroad carload of silver as it traveled to Pittsfield. Treasury guards also were present during fabrication of the transformer windings, and all scraps of silver had to be accounted for. The transformers were in operation for one and a half years. [59]

On Aug. 19, 1941, the Defense Plant Corporation financed construction of an aluminum smelter in Riverbank, Calif., which was designed and built by Alcoa and operated from 1942 through 1944. The site was chosen for its proximity to a rail line and hydroelectricity from the Hetch Hetchy power transmission line. Similar in layout to Alcoa's smelter in Vancouver, the plant had 27 buildings, including a rod plant and six pot rooms containing 384 reduction cells capable of producing 48,000 tons per year. Because of the shortage of both aluminum and copper, the buss bars connecting the reduction pots were made from silver on loan from the U.S. Mint. The Riverbank plant was phased out of aluminum production in August 1944, by which time most of the World War II air fleet had been constructed and the war in Europe was nearing an end. Another factor in shutting down the plant was a damage suit brought by nearby farmers in 1944 alleging that fluoride emissions had damaged crops and adversely affected livestock. The Riverbank plant was eventually declared surplus, and the aluminum production equipment was bought by Kaiser. The silver from the buss bars was sent back to the U.S. Mint in Denver, Colo. The empty buildings were converted during the Korean War to a manufacturing plant for military ammunition, and the site was reactivated again during the Vietnam War. The 172-acre site was still producing ammunition as the Riverbank Army Ammunition Plant in 1984. [60]

War-time investments in the aluminum industry were also underway during the war in Canada. In 1939, work began to expand the capacity of Aluminium Ltd.'s Arvida smelter in Quebec. Aluminium Ltd. began operating a sheet rolling and extrusion facility in Kingston, Ontario, in 1940; built a second aluminum smelter in Shawinigan in 1941; constructed the Beauharnois smelter in Melocheville in 1942; built a smelter in La Tuque in 1942; and began work on the Isle-Maligne smelter in Alma in 1943. During this time, Aluminium Ltd. completed construction of a hydroelectric plant at Shipsaw, Quebec; established a research center at Kingston, Ontario; and began sand casting at the Etobicoke plant in Ontario. [61]

By the end of World War II, Aluminium Ltd. had increased its aluminum production capacity to 500,000 tons from just 87,500 tons in 1939, making it the largest producer of aluminum ingot in the world. The company enjoyed the benefits of extremely low power costs – about half a cent per pound of aluminum ingot. The company was capable of producing primary aluminum at a cost of 7 to 8 cents per pound, compared to 10 to 11 cents per pound for U.S. companies. During the war, the U.S., British and Australian governments supplied Aluminium Ltd. with advances and loans to build the Shipsaw hydroelectric facility and to increase aluminum smelting capacity. The U.S. Metals Reserve Co., a government agency, advanced $68.5 million interest-free to Aluminium Ltd. in 1941 and 1942 on contracts providing for the delivery of 700,000 tons of Canadian primary aluminum. [62]

The number of aluminum fabrication plants in the U.S. likewise increased to meet the war-time demand. In 1938, Alcoa built an aluminum fabrication plant in Vernon, Calif., near Los Angeles. The U.S. Secretary of War was authorized to take over operation of the Vernon plant, which produced aluminum sheet for aircraft production during World War II. [63] By 1943, Alcoa was operating aluminum fabricating plants in New Kensington, Pa., Alcoa, Tenn., Detroit, Mich., Edgewater, N.J., Bridgeport, Conn., Fairfield, Conn., Newark, Ohio, Cressons, Pa., Trentwood, Wash., Massena, N.Y., LaFayette, Ind., Cleveland, Ohio, Garwood, N.J., Vernon, Calif. and Buffalo, N.Y. [64]

In 1942 through 1943, United Engineering & Foundry Co. of Pittsburgh built an aluminum sheet rolling mill for the Defense Plant Corporation in Trentwood, Wash. [65]

Reynolds already operated aluminum fabricating plants in Louisville, Ky. and Listerhill, Ala. [66] In 1941, the Defense Plant Corporation built a $7 million aluminum rolling mill on 253 acres of vacant land in Torrance, Calif., and contracted with Bohn Aluminum and Brass Co. of Detroit to operate the plant on a seven-year lease. The 375,000-square-foot Torrance plant with the largest extrusion presses in the U.S. opened in late summer 1942 at a final cost of $8.1 million and employed 1,000 people during World War II. The plant's products went straight to nearby aircraft manufacturers, and when the war ended, the plant went idle. [67] In April 1942, the Defense Production Corporation contracted for the construction of a 750,000-square-foot aluminum fabrication plant in Adrian, Mich., to be run by Bohn Aluminum. The goal was to produce aluminum material for aircraft. Some workers were German prisoners of war. [68]

By July 1945, primary aluminum plants in the U.S. included: Alcoa owned – Alcoa, Tenn. 175,000 tons per year; Badin, N.C. 53,000 tpy; Massena, N.Y. 134,000 tpy; Niagara, N.Y. 38,000 tpy and Vancouver, Wash. 180,000 tpy; Reynolds Metals owned – Listerhill, Ala. 101,000 tpy and Longview, Wash. 63,000 tpy; Defense Production Corporation owned and Alcoa-managed – Burlington, N.J. 108,000 tpy; Jones Mills, Ark. 144,000 tpy; Los Angeles, Calif. 180,000 tpy; Queens, N.Y. 288,000 tpy; Riverbank, Calif. 108,000 tpy; St. Lawrence, N.Y. 108,000 tpy; Spokane, Wash. 144,000 tpy and Troutdale, Ore. 144,000 tpy; and DPA owned and Olin Corp. managed – Tacoma, Wash. 41,000 tpy. The Burlington, Los Angeles, Queens and St. Lawrence smelters were not operating by July 1945. Alumina refineries in the U.S. by July 1945 included: Alcoa owned – East St. Louis, Ill. 840,000 tons per year and Mobile, Ala. 1.3 million tpy; Reynolds owned – Listerhill, Ala. 200,000 tpy; DPA owned and Alcoa managed – Hurricane Ridge, Ark. 1.5 million tpy and Baton Rouge, La. 1 million tpy. [69]

Rolling mills for sheet, strip and plate included: Alcoa owned – Chicago, Ill. 144,000 tons per year; DPA owned and Alcoa managed – Trentwood, Wash. 144,000 tpy; Reynolds Alloys Co. owned – Listerhill, Ala. 39,000 tpy. Rolling mills for rod and bar included: Alcoa owned – Newark, Ohio 150,000 tpy; Reynolds Alloys Co. owned – Listerhill, Ala. 30,000 tpy. Extrusion and tube drawing plants included: Alcoa owned – Phoenix, Ariz. 37,000 tpy; Bohn Aluminum & Brass Co. owned – Adrian, Mich. 18,000 tpy and Los Angeles, Calif. 5,400 tpy; Extruded Metals Inc. owned – Grand Rapids, Mich. 5,400 tpy; Revere Copper & Brass Co. owned – Halethorpe, Md. 5,400 tpy; Reynolds Metals Co. owned – Louisville, Ky. 24,050 tpy. Sand casting plants including cylinder heads included: Delco Remy-General Motors owned – Bedford, Ind. 5,100 tpy; National Bronze & Aluminum owned – Cleveland, Ohio 6,600 tpy; Alcoa owned – Kansas City, Mo. 21,000 tpy; Ford Motor Co. owned – Dearborn, Mich. 15,050 tpy; General Motors-Buick owned – Flint, Mich. 21,600 tpy; National Aluminum Cylinderhead Co. owned– Cleveland, Mich. 7,200 tpy; Chrysler-Dodge (aircraft) owned – Chicago, Ill. 12,000 tpy; and Wright

Aeronautical Corp. (aircraft) owned – 23,150 tpy. Forging plants included: Alcoa owned – New Castle, Pa. 10,500 tpy; Canonsburg, Pa. 37,400 tpy; Monroe, Mich. 21,000 tpy; Erie, Pa. 7,800 tpy; General Motors-Chevrolet owned – Anderson, Ind. 18,750 tpy; Saginaw, Mich. 56,500 tpy; and Reynolds Metals Co. owned – Louisville, Ky. 1,200 tpy. [70]

Shutting down the war machine

The expansion process went in reverse once the war ended. Aluminum plants were shut down and eventually dismantled and sold off as surplus. In some cases, plants were left intact and sold off as surplus in an effort to finally break Alcoa's monopoly. There was also a lot of recycling – the U.S. government was faced with the problem of disposing of thousands of surplus aircraft. The U.S. had paid for 294,000 aircraft through the war. Of those, 21,583 or 7.34% were lost in the U.S. to test flights, ferrying troops, training accidents and other causes and 43,581 were lost en route to the war and during overseas operations. In 1944, the U.S. Foreign Economic Administration began a program to scrap certain obsolete, damaged and surplus military aircraft that were still overseas, which was estimated after the war to be as much as 150,000 aircraft. The idea of trying to store many of the planes was looked at, but the cost was believed to be too great. Some overseas aircraft were considered not worth the cost to return to the U.S., so they were buried, bulldozed or sunk at sea. Most of them were returned to the U.S. for storage, sale or scrap. Within the first year after the war ended, about 34,000 aircraft were moved to 30 locations across the U.S., and the War Assets Administration and the Reconstruction Finance Corporation handled their disposal. [71]

By the summer of 1945, at least 30 sales-storage depots and 23 sales centers were in operation for disposing of the war-time aircraft. In November 1945, an estimated 117,210 aircraft were transferred as surplus. A study of whether to dismantle the aircraft found it was too costly, so a system of "salvage and melt" was adopted. Main components, such as engines, armament, instruments and radios were removed, and the remainder of the aircraft was cut into pieces and pushed into a large furnace or smelter. Aluminum was the sought-after metal, and it was poured into ingots for sale. Some aircraft were used to build up post-war airline companies, including DC-3 and C-54 planes. Other planes went to civilian ownership or to the air forces of allied nations. A few notable planes went to museums, such as the Enola Gay and the Bockscar. [72] In 1945, Alcoa re-melted aluminum from surplus World War II aircraft and other military applications at its facilities around the U.S. During the remelting process, some of the aluminum was lost to dross and skim, as oxidized aluminum metal reacted with the flux used for remelting, usually metal chloride salts. During a short period in 1945, about 18,500 tons of dross was sent to Alcoa's East St. Louis Works for reprocessing to recover the aluminum. The process used at the East St. Louis Works was similar to alumina refining, but it was not continued due to high cost. [73]

As World War II came to an end, aluminum production crashed and the Defense Plant Corporation's smelters in the Pacific Northwest were eventually sold at low prices to encourage competition in the aluminum industry. Reynolds Metals and Kaiser Aluminum joined Alcoa to create the Big 3 U.S. aluminum producers. [74] Marketing of BPA power to the aluminum industry began in earnest in March 1945 when Raver testified before a Senate Small Business Committee in support of creating new aluminum producers. The BPA also loaned their chief of market analysis to the Senate committee. [75] Production in the Pacific Northwest slowly rebounded, from about 36% of the nation's supply in 1946 to 40% in the 1950s. [76] By 1950, five aluminum smelters in the Pacific Northwest produced about 44% of all U.S. aluminum. Only 10 years earlier, not a pound of aluminum was being produced west of the Mississippi River. The speed and the magnitude of this development were mostly attributable to war-time demands. The five Pacific Northwest aluminum smelters used about 5.5 million megawatt-hours of electrical power per year, about 40% of power delivered by the BPA. In 1950, firm power was sold by the BPA to the aluminum companies at $2.00 per megawatt-hour, compared to the $2.70 rate paid by Alcoa in a 1937 Tennessee Valley Authority contract and the $4.30 rate paid by Reynolds in a 1949 TVA contract. [77]

But the five Pacific Northwest aluminum smelters faced higher freight costs, with the result that the cost for alumina represented about 35% of the total cost of operation, carbon products about 10% to 15%, and fluoride or other chemicals about 5%. While electric power was a surplus commodity in the Pacific Northwest in 1940, growth in demand by 1950 created a shortage of firm power in the region. From 1940 to 1950, the population in Oregon and Washington increased about 37.3% and in Idaho by 11.7%. The region also saw a sharp increase in residential and industrial power use. But electrical power used for aluminum smelting didn't create many jobs – according to U.S. Census data, the aluminum reduction industry required 814 kilowatt-hours per wage earner, compared to 5.4 for the textile industry, 5.3 for the steel and iron industry and 7.0 for aluminum fabrication. [78]

Furthermore, most of the aluminum produced in the Pacific Northwest was shipped elsewhere for fabrication. Kaiser's Trentwood rolling facility in Spokane was the only aluminum rolling mill west of the Mississippi River and was capable of producing 150,000 tons per year. While new hydroelectric dams were planned for the Pacific Northwest, three developments threatened the growth of the regional aluminum industry: 1) Alcoa's new three-potline smelter in Port Lavaca, Texas, would be the first aluminum smelter in the world to run on electricity generated with natural gas, opening up a new avenue for smelter power; 2) new hydroelectric plants were proposed near industrial centers along the St. Lawrence River, where Alcoa already had a large smelter at Massena; and 3) atomic-powered generating plants were expected to compete with hydroelectric plants. [79]

Following World War II, the Reynolds Metals Co. acquired the government-owned aluminum plant in Troutdale, and the Kaiser Aluminum Co. acquired the government-owned aluminum reduction plants in Spokane and Tacoma, along with the government-owned aluminum rolling mill in Trentwood. The aluminum industry suffered a brief market decline in 1945 and 1946, but demand increased significantly as new civilian uses for aluminum appeared. In the late 1940s, most of the increase in aluminum production took place in the Pacific Northwest – by 1949, more than half of the aluminum produced in the U.S. came from plants in Washington and Oregon. With the outbreak of the Korean War in 1950, another period of expansion began, and Alcoa built a new aluminum smelter at Wenatchee, Wash. [80]

As power shortages appeared in the Pacific Northwest, aluminum production moved to the Ohio Valley, where coal and natural gas were used to produce the electrical power needed for aluminum smelting. The Midwest region also benefited from proximity to increased production of alumina and bauxite from the Caribbean. By 1958, only 30% of the aluminum produced in the U.S. came from the Pacific Northwest. Cheap electrical power in the Pacific Northwest, once a drawing factor for aluminum companies, became short in supply and increased capacity meant increased electrical power costs after 1950. [81] Through the 1950s and 1960s, however, the U.S. aluminum industry prospered, and the number of smelters in the Pacific Northwest eventually grew to 10, employing about 11,000 workers at full operation. That was a small percentage of the region's workers, but the jobs paid well. The BPA benefited from the regional smelters because they consumed large amounts of power at steady rates, thus providing significant revenue for the BPA and operational consistency for the dams. Local communities also benefited. The region's 10 smelters by the late 1960s accounted for 40% of aluminum smelting capacity in the U.S. and 6% to 7% of global capacity. [82]

A temporary surge in aluminum use occurred immediately after the war ended as the U.S. financed the reconstruction of Europe under the Marshall Plan. But the surge drew controversy as aluminum purchases benefited Canada rather than the U.S. On July 1, 1949, Reynolds Metals Co. Executive Vice President Marion M. Caskie wrote to Sen. James Murray of Montana complaining about the use of U.S. government money by the Economic Cooperation Administration to purchase aluminum from Aluminium Ltd. of Canada to rebuild Europe under the Marshall Plan. Caskie pointed out that Aluminium Ltd. produced the largest quantity and the cheapest aluminum in the world, and that the U.S. government had assisted Aluminium Ltd. to expand during World War II. [83] On July 6, 1949, William C. Foster, the administrator of the Economic Cooperation Administration, wrote to Murray explaining why his agency bought aluminum from Aluminium Ltd. – the ECA was obligated to pay the lowest price it could for materials to rebuild Europe, and that wasn't U.S. aluminum. [84]

The matter didn't end there. In May 1959, Sen. Murray addressed the Senate Appropriations Committee during a hearing on the Economic Cooperation Administration budget bill. The U.S. government had loaned $68 million to Aluminium Ltd. to build aluminum plants and hydroelectric dams that didn't require security and were low interest until they were investigated by the Truman Committee and a 3% interest was placed on the loans. Meanwhile, the Reynolds Metals Co. paid 4% interest on Reconstruction Finance Corporation loans for its plants. As a result of U.S. aid, Aluminium Ltd. became the owner of the largest aluminum smelter in the world and could sell virgin aluminum at 3 cents per pound less than U.S. producers. Sen. Murray noted that the ECA paid Aluminium Ltd. about $50 million to $60 million for aluminum – about the same as the total amount paid by U.S. aluminum producers in taxes and rental of U.S war-surplus plants. U.S. aluminum producers paid about $40 million in taxes, and Reynolds and Kaiser paid about $14 million to rent U.S. government aluminum plants. A recession was currently underway, Sen. Murray pointed out, and ECA funding directed toward U.S. aluminum producers instead of Canada would keep aluminum workers employed and trained up – ready to run the potlines in case of a defense emergency. [85] Two things happened in the 1950s that affected the impact of these findings – the growth of the post-war U.S. economy spurred aluminum consumption, and another war led to U.S. government support to the aluminum industry in the form of loans and stockpile incentives.

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