Chapter 24

The war and consumer economies

The diverse uses of aluminum increased rapidly across the construction, transportation, electrical, packaging, machinery industries and other sectors of the economy during the 1950s and 1960s. Aluminum was found in automobile transmissions, engines, trim, electrical systems, air conditioning, brakes and paint. Large commercial aircraft utilized more aluminum, as did new urban rapid-transit systems. In the food manufacturing industry, aluminum was increasingly used for packaging and canning. During the period following World War II, growth in aluminum production outpaced growth in the American gross national product by a ratio of two to one. [1] In 1900, the total worldwide annual output of aluminum was 8,000 tons. By 1946, it was 681,000 tons. Overall, aluminum had been commercially produced for 144 years, while copper, lead and tin had been produced and worked for thousands of years. Despite its late start, aluminum eventually surpassed other nonferrous metals in both volume and weight. [2]

Paralleling that growth in new uses was the rapid expansion in the number of U.S. aluminum fabricators. The number of companies engaged in casting, extruding, shaping, processing and consuming aluminum, magnesium and titanium grew from 14,000 in 1949 to 24,000 by 1955. [3] That included 6,900 light-metal fabrication plants in the U.S. Most sheet, plate, foil, wire and cable was produced by the major integrated aluminum companies, but extrusions, drawn tubing, forgings, powder and paste were mostly produced by independent companies. [4] By 1957, a total of 26,000 companies in the U.S. fabricated aluminum products, compared with only 4,500 companies in 1945. [5] Aluminum use was distributed across the American economy. In 1950, 24% of aluminum consumption in the U.S. marketplace went to consumer durables, 19% went to building materials, 17% went to transportation equipment, 16% went to machinery and equipment, 6% went to containers and packaging, 6% went to power transmission, 2% went to construction and 10% went to other uses. [6] New standards were created by the industry to account for all these uses. On Oct. 1, 1954, U.S. primary aluminum producers formerly adopted a new uniform aluminum alloy designation system that had been introduced earlier by the Aluminum Association to help avoid confusion in the sales of alloyed materials. [7]

Primary aluminum producers in the U.S. posted their third record-production year in 1954 with 1.45 million tons, an increase of 16% over 1953. Producers predicted continuing gains in the future. Despite dips in some consumer demands, aluminum producers shipped about 1.3 million tons to non-military consumers, about 50,000 tons

more than in 1953. The most significant consumer market for aluminum was in construction, where aluminum was used in exterior walls, windows and various architectural applications. A growing use was in automatic transmissions for automobiles. On average, U.S. automobiles used 35 pounds of aluminum per vehicle, a four-fold increase since the end of World War II. Other increasing uses of aluminum outside of the military were found in street and traffic poles, electrical conductors, food packaging and irrigation pipe. Backing up the growing market for aluminum was a government stockpiling arrangement made in response to the Korean War and increasing concerns about the Soviet Union. The federal government was obliged to buy at the going market price any unmarketable aluminum produced by facilities built during the Korean War program. [8]

Aluminum goes to war – again

The Korean War began on June 24, 1950. Recognizing the importance of strategic metals, particularly aluminum in recognition of its importance during World War II, Congress passed the Defense Production Act on Sept. 8, 1950. The Act created a National Production Authority to control production, distribution and prices for certain materials, including aluminum. Any aluminum left after national defense needs were met was distributed on an historical basis – purchasers were limited to a percentage based on their average monthly use calculated for the time period Jan. 1, 1950 through June 30, 1950. The program was administered under the Controlled Materials Plan and later the Defense Materials System. Under the latter plan, about 10% of U.S. primary aluminum production went to the military and the atomic energy system. Aluminum prices were controlled from Jan. 26, 1951 through Feb. 28, 1953, during which time two price increases were allowed. By Sept. 30, 1955, Alcoa was obligated to supply more than 1 million tons of aluminum to the government, Reynolds was obligated to supply 900,000 tons and Kaiser was obligated to supply more than 1.1 million tons. [9]

Under the Defense Production Act's authority, President Harry Truman established the Office of Defense Mobilization, instituted wage and price controls, strictly regulated production in heavy industries such as steel and mining, and ordered the dispersal of wartime manufacturing plants across the U.S. There were three major sections to the Act. The first authorized the President to require businesses to sign contracts or fulfill orders deemed necessary for national defense. The second authorized the President to establish mechanisms, such as regulations, orders or agencies, to allocate materials, services and facilities to promote national defense. The third authorized the President to control the civilian economy so that scarce or critical materials necessary to the national defense effort were available for defense needs. The Act played a vital role in the establishment of domestic aluminum and titanium industries in the 1950s. Under

the authority of the Act, the Department of Defense provided capital and interest-free loans and directed mining and manufacturing resources as well as skilled labor toward the aluminum and titanium industries. While the Act was periodically reauthorized and amended, it remained in force as late as 2014. [10]

Truman created the Office of Defense Mobilization under Executive Order 10193 on Dec. 16, 1950. The office was led by a presidentially-appointed director who was subject to confirmation by the Senate and was a member of the National Security Council. The office was an independent agency tasked with planning, coordinating, directing and controlling all wartime mobilization activities of the government, including manpower, economic stabilization and transportation. One of the most powerful agencies in the federal government from 1950 through 1953, the office later merged with other federal agencies to become the Office of Civil and Defense Mobilization from 1958 through 1961. The supporting logic behind the need for such an agency was the nature and threat of nuclear war. The basic structure was created under the National Security Act of 1947. When North Korea invaded South Korea on June 25, 1950, Truman quadrupled the defense budget to $50 billion and implemented controls on prices, wages and raw materials. Inflation soared, followed by shortages of food, consumer goods and housing, but by October 1950 inflation had abated and shortages eased. [11]

China's intervention unraveled Truman's efforts and panicked the public. Inflation jumped from 1.3% to 7.9%. Many intelligence experts expected World War III to break out. Truman declared a national emergency on Dec. 16, 1950, and named Charles Wilson, president of General Electric and a government mobilization chief during World War II, to head the Office of Defense Mobilization. Wilson soon became one of the most powerful people in the U.S. government, and the press nicknamed him "co-president." Wilson quickly took control of the economy, rationing raw materials to the civilian population. Production quotas were set, and companies that could not meet them were threatened with seizure by the Office of Defense Mobilization. Defense plants that were located near existing manufacturing centers, where power was plentiful, were dispersed to the Southeast and Deep South. Investments in new plant equipment were restricted so investments could be made in plants that contributed to the war effort. By 1951, inflation had fallen back to 1.9%. Wilson resigned on March 31, 1952, in protest over how Truman had supported the steel union during a strike. [12]

The federal government reacted much the same way as it did at the onset of World War II – defense needs for aluminum skyrocketed and federal stockpiles dwindled. The government lured American industry into aluminum production with tax write-offs and contracts that guaranteed the entire output of new plants would be purchased by the government at 1950 market prices until 1955. [13] The Defense Production Act authorized

the government to speed up development of critical war-time industries through accelerated amortization for tax purposes, guaranteed loans, subsidies to offset high power costs and by ensuring a market for all metal produced. By October 1950, one month after the Act was signed, the government called for a 500,000 ton-per-year increase in aluminum production nationwide, doubling the pre-Korean War capacity at a cost of about $500 million for aluminum smelting alone. A difficult hurdle was the need to produce 1,500 megawatts of electrical power. Potential sources of new power included natural gas-fired generating plants in the Texas Gulf region or new hydroelectric dams in the Pacific Northwest. By September 1952, more than $500 million in new defense production facilities had been certified for construction in the Pacific Northwest, representing 230 certificates for 158 different firms. [14]

The Canadian aluminum solution

The government's response to the Korean War was, in some ways, similar to how it handled the Axis threat on the eve of World War II – slow, disbelieving and ill-prepared. On Aug. 3, 1951, Montana Sen. James Murray's son and secretary, Charles Murray, wrote to Dewey Anderson, executive director of the Institute of Public Affairs, about a meeting he had recently attended on the development of the U.S. aluminum industry under the defense mobilization effort. The meeting was hosted by Rep. Emanuel Celler of New York, chairman of the House Judiciary Committee's Anti-Trust Subcommittee. Established in 1943, the Institute of Public Affairs described itself as an independent, non-profit public-policy think tank with the goal of preserving and strengthening the foundations of economic and political freedom. Charles Murray said he was not impressed by the meeting, in particular by the "easy-going attitude" of a representative from Defense Mobilizer Charles Wilson's office. Murray said the nation needed enough aluminum to build 95 Air Force groups, from 2,200 to 4,500 planes, or even 150 groups, from 2,600 to 7,200 planes, in which case "we definitely would not have the aluminum if such an expansion was required." [15]

On July 31, 1951, Dewey Anderson wrote to Interior Secretary Oscar Chapman about the development of the U.S. aluminum industry, which he called "hit and miss developments to date." Anderson added, "Frankly, it is uneconomic in the extreme to tie up any great additional quantity of hydroelectric power to a low-cost user like aluminum reduction. That applies particularly to the Northwest." Anderson instead recommended that the U.S. turn to outside sources for aluminum, such as Aluminium Ltd. in Canada, the company Alcoa spun off in 1928. Anderson said he would support the entry of independent aluminum producers in the U.S. if it didn't cost too much and they could survive the competition, but he was more interested in supporting the 17,000 independent fabricators that needed competitive low-cost sources of aluminum

metal. Anderson recommended the U.S. government completely review its relationship with Aluminium Ltd. in light of past anti-trust actions with Alcoa. [16] On April 3, 1952, Rep. Celler wrote to Samuel W. Anderson, the deputy administrator at the Defense Production Administration, expressing his support for increasing aluminum imports from Canada for use by U.S. fabricators. Celler compared the oligopoly that dominated the U.S. aluminum industry to dominance in the copper industry, where 70% of the copper industry was controlled by the Anaconda Company and Kennecott Copper. Celler expressed concern that aluminum produced by Anaconda in the future would go to Anaconda fabricating plants. He also noted that whereas Anaconda had no plans to refine alumina, the Harvey Machine Co. was making plans to do so. Celler said "new blood" would be desirable in the U.S. industry, but without direct U.S. government assistance, it "would be highly improbable if not impossible." [17]

On May 16, 1952, Samuel Anderson sent a 27-page memo to Sen. Murray reporting on options for developing the U.S. aluminum industry and increasing imports from Canada to meet defense mobilization needs, stockpiling and fair use by civilian uses. Anderson expected to see defense needs met through the first quarter of 1953 but that they might decline in 1954. "During the next few years of military build-up, it is the established policy of the government to attempt to supply to the civilian economy sufficient materials so an active and healthy civilian business can be carried on," he wrote. Setting aside the current economic recession and assuming 600,000 tons per year for civilian uses, the U.S. industry would need to produce 1.6 million to 1.7 million tons per year, which would be reached by the second quarter of 1953, Anderson said. U.S. aluminum production was expected to reach 2 million tons per year in 1954, including 100,000 tons of subsidized production, he said. In that case, Anderson did not recommend providing any more federal financial assistance for developing further aluminum development. He noted that the maximum aluminum use during World War II was 1.245 million tons in 1944, at which time about 80% of military aluminum went into aircraft. But by 1952, only 55% of military aluminum was going into aircraft. Anderson forecasted that in event of an all-out war, the U.S. would need 2.25 million to 2.5 million tons of aluminum per year in the second or third year. He said he believed aluminum imported from Canada could significantly improve U.S. needs. He noted that he was providing approximate figures that would need to be refined later. [18]

Samuel Anderson also favored stockpiling as a way to save huge amounts of power usage. Anderson noted that 1.5 million tons of virgin aluminum took 30 billion kilowatt-hours to create, or 6% of all U.S. generation in 1954. Anderson pointed out that during World War II, the Allies bombed generating plants as a way to defeat their enemy, and stockpiling would address that threat. He estimated that a 2.5 million ton stockpile would cost the U.S. government about $900 million in 1952 prices, but to build

aluminum refineries and smelters to make that much aluminum would cost $1.6 billion. While the specific stockpiling goal was a classified secret, Anderson suggested 2.5 million tons, based on using per capita consumption figures to calculate civilian aluminum needs and on his estimates for a growth rate of 5% per year. Current U.S. government contracts for aluminum from the Big 3 producers was for 3 million tons over five years, but a main reason for guaranteeing aluminum purchases was to provide a means for the Big 3 to finance new production capacity. [19]

Samuel Anderson noted that Aluminium Ltd. had been in talks with the Defense Production Agency, and while the Canadian company would normally export about 100,000 tons to the U.S., it was willing to double that amount. Aluminium Ltd. was not a fabricator, so the many U.S. fabricators felt they could trust the Canadian company to supply them with aluminum over the Big 3, which had fabrication plants of their own. Anderson recommended that two-thirds of aluminum imported from Canada be provided to U.S. fabricators in the first five years of an expansion plan. He expected Canadian aluminum to remain the cheapest, even with duties. Anderson noted that the Defense Production Administration had put out a press release on April 4, 1952, announcing it was interested in knowing if any U.S. businesses wanted to break into the U.S. aluminum industry, but the intent of the press release was to gauge their interest as an alternative to imports from Canada. He noted that DPA Administrator Manly Fleischmann had said he'd prefer to see new companies if there was any expansion in the U.S. aluminum industry, and the DPA press release had led to several businesses showing their interest – businesses that would likely work out, Anderson noted. Meanwhile, the Big 3 had shown an interest in expanding their capacity, including Alcoa's proposed Taiya project in Alaska, where water would be diverted from British Columbia and the Yukon Territory to a hydroelectric dam in Alaska with a smelter built next to the dam. Anderson concluded his memo by saying that "evidence is quite clear that we do not have enough aluminum in sight today" to establish a 2.5 million ton stockpile while meeting military and civilian needs. He recommended further talks with Aluminium Ltd. about a contract for up to 175,000 tons per year and authorizing U.S. fabricators to receive up to 80,000 tons per year of the imports. [20]

Rep. Celler also received a memo calling for increasing Canadian aluminum imports to help meet defense mobilization needs that was supported by Sen. Murray, Defense Mobilizer Charles Wilson, and staff from the Labor, Commerce, State and Justice departments. The memo said Aluminium Ltd. had proposed to increase aluminum exports to the U.S. to assist U.S. fabricators and pointed out that contrary to new companies entering the U.S. aluminum industry, Aluminium Ltd. needed no subsidies, no cash outlays and no advances. The Canadian company, however, wanted assurances that it would not be shut out of U.S. aluminum markets. The memo referred to the

evolving outcome of the Alcoa anti-trust case – the dissolution of common stock from both Alcoa and Aluminium Ltd., which was held by a small group of people, was currently taking place under Justice Department supervision. The memo noted that in his ruling in the anti-trust case, Judge John C. Knox had said the only real competition Alcoa faced in supplying U.S. fabricators came from Aluminium Ltd. The memo also noted that the same tactics used in 1950 to stop Canadian aluminum imports were being used again: "Selfish interests, then as now, using delaying tactics (by issuing misinformation and misleading statements)." [21]

Balancing domestic needs

In November 1950, at the U.S. government's request, Alcoa reactivated its aluminum smelters at Badin, N.C., and Massena, N.Y. Together the smelters were capable of producing 79,000 tons per year, and the government agreed to purchase a total of 336,250 tons from these plants. By Sept. 30, 1955, the Badin smelter was capable of producing 47,150 tons of per year and the Massena smelter was capable of producing 112,250 tons per year. [22] The federal government also announced in November 1950 that non-military use of aluminum would be cut by 35% starting Jan.1, 1951. The announcement was taken as proof of aluminum's significance in the modern U.S. economy. Since 1940, aluminum sheet production had increased nearly 700%, aluminum shapes and tubes by 800%, aluminum foil by 500%, and aluminum electrical conductors by 300%. [23] In December 1950, the Office of Defense Mobilization announced rules governing the primary aluminum industry under the Controlled Materials Plan. Aluminum producers were authorized to increase capacity under accelerated five-year amortization certificates that would cover 85% of the cost for new investments. All primary aluminum output from the new investments that could not be sold in the commercial marketplace would be purchased by the government for stockpiling at published prices. Aluminum producers were required to meet government requirements before selling to commercial markets. [24]

The aluminum supply in the U.S. was tight from 1950 to 1953 as restrictions were placed on civilian use until 1953 and the percentage of military use increased from 5% in 1950 to 28% in 1952. With government financial incentives to increase production, a total of 613,000 tons of new capacity was added from 1951 to 1954. [25] In 1952, the President's Materials Policy Commission issued a report titled "Resources for Freedom" on the aluminum industry. Demand for aluminum was forecasted to increase five times by 1975, both in the U.S. and the rest of the world. In the U.S. alone, consumption by 1975 was forecasted to reach 3.6 million tons, and the commission saw no problems in attaining that level. Plentiful supplies of bauxite were thought to exist in the Caribbean and Africa. "Compared to older basic materials, such as steel, copper and wood, the

aluminum industry is still in its infancy," the report said. "Its relatively short history presents a picture of constant development of new uses and a rapid spreading of these throughout the economy." [26]

The Korean War armistice was signed on July 27, 1953, but national defense concerns persisted. On Jan. 10, 1956, the Office of Defense Mobilization gave priority purchase authority for steel, copper and aluminum to users directly connected with military and atomic energy programs. The effect of the order was to limit supplies of those metals to civilian markets. ODM was acting to head off a run on claims for special priority status by various organizations, including the St. Lawrence Seaway Development Corporation, which had obtained priority status with the Defense Department but not with ODM. Other claimants included shipyards and freight car manufacturers. [27] On July 30, 1957, Sen. Abasalom Willis Robertson of Virginia publicly criticized major U.S. aluminum producers for trying to sell surplus aluminum to the government stockpile while continuing to purchase aluminum from Canada. General Services Administration chief Franklin G. Floete confirmed part of Robertson's complaint by noting that the GSA had purchased 200,000 tons of aluminum from Alcoa and Kaiser under Korean War contracts. Floete added that he had worked out a tentative agreement with Alcoa and Kaiser to deduct much of their imports from Canada when determining how much surplus aluminum they had produced. The Korean War contracts were scheduled to expire soon, but Floete estimated that the federal government could be forced in the future to purchase about 680,000 tons of aluminum at a cost of $340 million. In response to the allegations, Alcoa executives pointed out that the contract between Alcoa and Aluminium Ltd. was made in 1953 when aluminum supplies were short and a war-time situation prevailed. The imported aluminum augmented U.S. production while Alcoa built new domestic primary aluminum smelters that were paid for entirely by Alcoa. [28]

As the Cold War matured following World War II, military uses of aluminum for missiles rapidly increased. In 1957, the Soviet Union launched the first artificial satellite into orbit. Sputnik 1's hull was made of two separate aluminum hemispheres joined together. [29] By mid-1958, the growing use of aluminum for missiles in the U.S. defense effort created a sizeable increase in the market demand. Light in weight, aluminum enabled an increased missile payload, with one pound saved producing a gain of 1,800 feet in altitude or one mile in range. Aluminum was also mass produced and cost less than other materials. The largest potential lay in smaller tactical missiles, where aluminum was used for structural components, propellant and missile transportation. The Air Force's Mighty Mouse missile used only 2 pounds of aluminum, but contracts for the missile ran into the millions. The Army's Dart anti-tank missile used aluminum bobbins for its guidance wire, while the Air Force's 100-ton 100-foot tall Titan had an

aluminum skin. The Navy's Vanguard missile used 3,700 pounds of aluminum, while the Army's Redstone missile used 4,500 pounds of aluminum, representing 90% of its frame. The Air Force's Snark intercontinental cruise missile used 3,900 pounds of aluminum. As a propellant, very fine aluminum powder could be combined with a conventional polymer binding and encased in an aluminum firing chamber, as in the Navy's Polaris submarine-fired missile. The Army's Hawk surface-to-air missile used a solid fuel propellant consisting of 15% aluminum powder. The Navy's Sidewinder missile was transported in aluminum containers with vibration isolators. The Air Force's Falcon missile and the Navy's Petrel air-to-surface missile also were shipped in aluminum containers. [30]

In 1959, Congress passed a revised Defense Production Act, which listed aluminum as one of four high-priority "controlled metals," along with copper, steel and nickel alloys. The revised act created a Defense Materials System to administer the supply of these materials. The system's goal was to ensure the availability of these materials for any emergency requiring a rapid mobilization of the defense industry. One way the system accomplished its goal was to require aluminum companies to provide set-asides for aluminum that was not delivered to the stockpile but which could be made available to the government in case of an emergency. Shipments to the stockpile stopped in 1963 when the supply reached nearly 2 million tons. From 1963 on, the government began to release aluminum from the stockpile to the marketplace. In 1966, the government dumped 326,000 tons of aluminum on the market, nearly a tenfold increase. In 1973, the government dumped 730,500 tons on the market, and in 1974 it dumped 510,500 tons. By 1976, the stockpile had fallen to only 31,500 tons, where it remained until 1980. By 1980, the set-asides required by the defense system amounted to 62,500 tons per quarterly period, and in May 1980, the Federal Emergency Management Agency recommended restoring the stockpile to 700,000 tons. [31]

Alcoa expands capacity

Between 1947 and 1958, real gross national product in the U.S. grew from $470 billion to $700 billion. Competition between the vertically-integrated Big 3 – Alcoa, Reynolds and Kaiser, as well as Aluminium Ltd. (Alcan) and a few independents – helped expand established markets and development of new markets. Per capita consumption of aluminum doubled during this time period. The Korean War and the Cold War fed this market expansion, but growth in the civilian market was what really established the future of the aluminum industry, according to George David Smith's 1988 corporate history of Alcoa. [32] According to an October 1951 letter from Interior Under Secretary R.D. Searles to Montana Rep. Mike Mansfield, the Big 3 aluminum producers had major expansion plans in place across the U.S. New or expanded smelter projects included

Alcoa, Washington, 85,000 tons per year at a cost of $60 million; Alcoa, Texas, 85,000 tons with a power plant, $115 million; Alcoa, Texas, 35,000 tons, $34 million; Kaiser, Louisiana, 100,000 tons with a power plant, $70 million; Kaiser, Louisiana, 100,000 tons with a power plant, $75 million; Kaiser, Washington, 20,000 tons, $12.8 million; Reynolds, Texas, 75,000 tons with a power plant, $79.7 million; Reynolds, Arkansas, 23,000 tons, $14.3 million; Reynolds, Oregon, 2,000 tons, $475,000; and Reynolds, Washington, 20,000 tons, $10 million. The increased capacity totaled 545,000 tons and a cost of $471.2 million. This list did not include refineries needed to supply alumina to the smelters. [33]

New aluminum companies with smelters that were built in the U.S. during the 1950s included the Anaconda Aluminum Co. in Columbia Falls, Mont., the Harvey Aluminum plant in The Dalles, Ore., and the Ormet plant in Hannibal, Ohio. Dozens of small independent aluminum fabricators appeared by the mid-1950s. U.S. aluminum production grew from 750,000 tons per year in 1955 to 1.3 million tons by 1959, which led to an oversupply problem and price slashing. A general economic slowdown in the early 1960s compounded the problem. [34] By 1952, the cost of building a new aluminum plant had increased by a factor of 1.9 over the cost in 1940. [35] By 1955, the cost of building a new aluminum smelter plant was estimated to be $1,500 per ton of capacity. This figure reflected the costs from ore to ingot. Based on that estimate, the $60 million 60,000 ton-per-year AAC smelter in Columbia Falls would have cost $90 million. The construction cost for a smelter in 1939 was one-quarter of the 1955 estimate, or about $375 per ton of capacity, even though the price of aluminum had increased by only 20% from 1939 to 1955. As a result, finding financing for the construction of new smelter plants in the U.S. was becoming more and more difficult. [36]

Between 1950 and 1951, Alcoa undertook a substantial expansion of its aluminum producing capacity at cost of about $360 million. Nearly three-quarters of that expansion was for aluminum covered by government supply contracts. The expansion included new smelters and a new alumina refinery, along with expansion of existing smelters and an existing alumina refinery. Bauxite operations in Dutch Guiana were also expanded. Alcoa did not call upon the government to guarantee any loans the company obtained, but certificates of necessity were issued in the name of national defense, allowing Alcoa to amortize $265 million of the cost of the expansion over a five-year period. [37] By 1958, Alcoa had quadrupled its smelter capacity from 1939 levels, when it held a monopoly in the U.S. From 1946 to 1958, Alcoa's gross revenues trebled from $298 million to $869 million and its net profit sustained a 10% average. Alcoa's smelters were generally older than those owned by Reynolds and Kaiser, so following the end of World War II Alcoa invested in building new capacity and upgrading old plants, beginning with a $300 million investment in 1949 and a $360 million investment in

1951. Alcoa increasingly looked toward new sources of energy other than hydroelectricity, such as oil, gas and coal. The company recognized that it might be cheaper to purchase electricity, but it wanted to maintain control over the power it used, according to Smith. [38]

A gas-fired power plant and smelter at Point Comfort, Texas, and new fabricating facilities in Davenport, Iowa, and Vancouver, Wash., were all operating by 1949. A new smelter was built in Wenatchee, Wash., using hydroelectricity from the Bonneville Power Administration. A coal-fired power plant and smelter was built in Rockdale, Texas. Potlines were added at the Massena plant, where the company's aging hydroelectric plant was shut down and the company turned to the New York Power Authority for power. By 1957, the Warrick Works smelter was under construction in Evansville, Ind., using electricity from a coal-fired power plant. A new alumina refinery was built at Point Comfort, Texas, to replace the aging alumina plant at East St. Louis, Mo., which closed down after 54 years. [39] In February 1949, Alcoa abandoned and scrapped out its smelter in Niagara Falls, N.Y., which had been producing 20,000 tons per year. [40] Alcoa expected to have its new smelter at Point Comfort running by 1950. The smelter was expected to produce 57,000 tons of aluminum per year. [41] In 1952, Alcoa completed construction of two new potlines at the Point Comfort smelter. By 1955, the Point Comfort plant was capable of producing 95,000 tons of aluminum per year. Another new potline was added in 1956 providing an additional 20,000 tons per year in capacity. [42]

In November 1952, the first aluminum was cast at Alcoa's Rockdale aluminum smelter. [43] Adjacent to the facility, Alcoa built a steam-powered electric generating plant using lignite coal as fuel. By 1955, the smelter's four potlines were capable of producing 100,000 tons of aluminum per year. Two new potlines were added in 1956 providing an additional 50,000 tons per year in capacity. [44] Alcoa believed that coal could be an inexpensive source of energy, and the nearby Sandow lignite coal mine provided fuel for the facility's power plant. Alcoa owned and operated the mine and power plant until 1989. [45] In 1998, with six potlines, the Rockdale plant was producing 315,000 tons per year of aluminum. [46] Construction of a new smelter in Indiana was announced by Alcoa on April 17, 1956. The 150,000 ton-per-year smelter facility would include a 375-megawatt power plant in Warrick County. Alcoa expected the plant would cost $80 million, be in operation by 1957 and reach full production by 1958. [47] First metal was poured on June 9, 1960. Soon after, construction began on adjacent rolling mills, and the first fabricated products were produced at the Warrick Operations facility in 1964. [48] By 1998, the Warrick plant was producing 300,000 tons of aluminum per year. [49] Alcoa also beefed up capacity in Tennessee. Between 1955 and 1957, Alcoa began work on a new hydroelectric power plant on the Little Tennessee River estimated to cost about

$13 million. By 1955, the aluminum smelter at Alcoa, Tenn., was capable of producing 157,000 tons of aluminum per year. [50]

Bauxite and alumina production was also expanded. In 1949, Alcoa required 1.4 million tons of bauxite per year for its smelters. The company owned limited bauxite deposits in Arkansas, and much of the low-grade ore made its way to the company's alumina refineries. About 73% of Alcoa's bauxite came from Dutch Guiana, where a 30 million ton deposit of high grade ore existed. Alcoa held outright ownership of only part of the deposit. The remainder was held by a concession to the Dutch government, and eventually Alcoa was forced to revise its agreement in favor of the Dutch. Alcoa also held a concession with the government of the Dominican Republic, where an 11 million ton deposit of bauxite existed. [51] Between 1950 and 1951, Alcoa built a new alumina refinery in Bauxite, Ark., with a capacity of 401,500 tons per year and added new facilities to the company's existing alumina refinery at Mobile, Ala., with a capacity of 170,000 tons per year. The Bauxite refinery was designed to handle low-grade ore from Arkansas. By 1955, Alcoa was entirely self-sufficient in alumina production for its own smelters. On April 7, 1956, Alcoa announced plans to spend more than $45 million building a new alumina refinery near Point Comfort with a capacity of 500,000 tons per year. Alcoa's bauxite reserves in Dutch Guiana were estimated to be sufficient to supply the company through Dec. 31, 1988, at which point the concessions were set to expire. The low-grade bauxite reserves held by Alcoa in Arkansas were estimated to be sufficient to meet the demands of the Bauxite alumina refinery for 40 years. [52]

Global bauxite production in 1955 included Alcoa at 28%, Alcan 26%, Reynolds 16%, Kaiser 11%, Pechiney 5%, Alusuisse 2% and others at 12%. Global alumina production included Alcoa at 25%, Alcan 27%, Reynolds 17%, Kaiser 12%, Pechiney 5%, Alusuisse 4% and others at 10%. Global aluminum production included Alcoa at 20%, Alcan 26%, Reynolds 15%, Kaiser 15%, Pechiney 6%, Alusuisse 4% and others at 14%. [53] New developments, however, were opening up the bauxite and alumina industry. In 1956, vast bauxite deposits were discovered in the Weipa area of Northeast Australia and in the Pinjarra area of Western Australia. In 1957, Alcoa began making plans with the Dutch Guiana government for a $150 million hydroelectric plant and smelter called the Brokopondo Development. The hydroelectric plant was designed for a city of 2 million people in a nation with only 350,000 people, and it included a 45-mile long road from the dam site at Afobaka to Paranam, where an 85,000 ton per year smelter would be built by 1960. After leaving international investments to Aluminium Ltd. in 1928, Alcoa was back building vertically integrated mine-to-metal ventures. In 1958, Alcoa joined the Furukawa Electric Co. in building an aluminum smelter in Japan called Furalco. But by 1958, despite all of Alcoa's investments, its market share shrank as Reynolds and Kaiser invested more aggressively. Reynolds led the way in marketing with aluminum

toys, rowboats, home freezers, golf clubs and home products. The average American by that time was more familiar with the name Reynolds than Alcoa, according to Smith. [54]

Reynolds and Kaiser

Reynolds had acquired several surplus wartime aluminum plants owned by the federal government in 1946. Besides purchasing the Hurricane Creek, Ark., alumina refinery, Reynolds leased a $44-million sheet mill in Chicago, leased an extrusion plant in Grand Rapids, Mich., and paid $7 million for the $20-million sheet, rod and bar mill Reynolds had run during the war at Listerhill, Ala. Reynolds had entered the wartime aluminum industry in 1941 with smelter plants of its own in Listerhill and Longview, Wash. Reynolds had lost money producing ingot aluminum during the war but had made a net profit of $18 million after taxes from 1940 through 1945, twice its earnings for the six years prior to this period. By 1946, the company owed $34 million for loans from the Reconstruction Finance Corporation and had begun scouting for new bauxite deposits in Haiti and Jamaica, where it claimed to have found a hundred-year supply. [55] From 1950 through 1955, Reynolds substantially expanded its aluminum facilities in order to meet three government supply contracts totaling 80,000 tons of aluminum per year. Reynolds' expansion cost about $194.6 million and included new smelters and a new alumina refinery, along with expansion of existing smelters and an alumina refinery. Bauxite operations were also expanded. The government guaranteed $76.75 million in loans to Reynolds for the expansion, and the loans were repaid by July 1955. Some of Reynolds' new facilities were certified as necessary to the national defense, allowing Reynolds to amortize 81.7% of the total cost of the expansion over a five-year period. [56]

In 1952, Reynolds completed construction of a new potline at its smelter in Jones Mills, Ark. By 1955, the smelter was capable of producing 97,000 tons of aluminum per year. In 1954, Reynolds completed construction of a new smelter in Corpus Christi, Texas, with a capacity of 80,000 tons per year. The facility included a power generating plant and cost $80 million. By 1955, the smelter was capable of producing 80,000 tons of aluminum per year. In 1954, Reynolds completed construction of a new aluminum smelter in Arkadelphia, Ark., with a capacity of 55,000 tons per year at a cost of $34 million. By 1955, the Listerhill smelter was capable of producing 50,000 tons of aluminum per year, and Reynolds announced plans to build a new smelter plant at Listerhill with a capacity of 100,000 tons per year. Beginning in 1957, the new plant was expected to supply between 32,000 and 82,000 tons per year of aluminum to the nearby Ford Motor Co. plant for a 10-year period. [57] In 1959, Reynolds began operating a new aluminum smelter in Massena on the south shore of the St. Lawrence River. [58]

Reynolds also increased its bauxite and alumina supplies. In 1949, Reynolds required 883,000 tons of bauxite per year for its smelters. Following World War II, Reynolds had

relied on bauxite deposits in Arkansas, but the company began to turn to foreign deposits. Reynolds owned 40 million tons of high grade bauxite in Jamaica, had access to another 40 million tons held by others in Jamaica and Haiti, and had a contract with Billiton for bauxite from Dutch Guiana. Reynolds spent $1 million acquiring these foreign reserves but was apprehensive about spending the additional $12 million necessary to develop the Jamaican properties. Fortunately for Reynolds, the Economic Cooperation Administration, as part of the Marshall Plan, was prepared to advance nearly $6 million to Reynolds to facilitate development of the Jamaican reserves. The Alcoa alumina refinery in Mobile and the Kaiser alumina refinery in Baton Rouge, La., were equipped for ocean-going ships carrying bauxite from Jamaica. [59] In 1953, after two years of construction, Reynolds began operating a new alumina refinery at Corpus Christi with a capacity of 365,000 tons per year that cost $43 million. Much of the alumina was used locally at the Reynolds San Patricio Reduction Plant in Corpus Christi. Reynolds also expanded the capacity of its Hurricane Creek alumina refinery by 110,000 tons per year at a cost of $3 million. By 1955, Reynolds was entirely self-sufficient in production of alumina for its own smelters. In March 1956, Reynolds began enlarging its alumina refinery at Corpus Christi by 182,500 tons per year. Reynold's proven bauxite reserves in Jamaica, Arkansas, British Guiana and Haiti were expected to last the company for 75 years. [60]

Kaiser also expanded its aluminum producing operations between 1950 and 1957. The total cost was more than $250 million and included a new smelter, expansion of two existing smelters and modification of an existing alumina refinery to handle enlarged bauxite operations in Jamaica. Kaiser did not call upon the government to guarantee any loans, but it obtained certificates of necessity that allowed the company to amortize about 81% of the total cost over a five-year period. [61] In 1950, following the outbreak of hostilities in Korea, Kaiser began planning for construction of a smelter in Chalmette, La., on the Mississippi River about seven miles downstream from New Orleans. Kaiser's plans for its first greenfield plant called for four potlines and a 100,000 ton per year capacity. The federal government offered a five-year amortization of loans and a guarantee that it would purchase all of the new plant's surplus aluminum production for the government's stockpile. Construction of the new plant at Chalmette began in February 1951, and first metal was tapped about 10 months later on Dec. 11, 1951. [62] By 1955, the total cost of the facility was $150 million and the smelter was capable of producing 200,000 tons of aluminum per year. In 1955, Kaiser announced plans to add a new potline at the Chalmette smelter, expanding the plant's capacity by 27,500 tons. [63]

On Sept. 5, 1955, Kaiser announced it intended to spend $280 million to expand its production capacity by 50%. The company's plans included spending $120 million to build a 220,000 ton-per-year aluminum reduction plant in Ravenswood, W.Va., $60

million to build an alumina refinery in Gramercy, La., and $100 million to build chemical refining plants and milling facilities across the U.S. The program was scheduled to get underway by April 1956, with production scheduled to begin as early as July 1957. Upon completion of the overall expansion program, it was expected that Kaiser would become the second largest aluminum producer in the U.S., overtaking Reynolds. Kaiser executives expected U.S. aluminum consumption to more than double by 1965. The Ravenswood plant would receive 450 megawatts of electrical power from coal-fired plants through a 40-year contract with the American Gas and Electric Co., the largest single power contract in U.S. history. [64]

The selection of Ravenswood as the site for its large smelter signaled a major move away from traditional power sources used by aluminum smelters – oil, gas and water. The plant was located near the Ohio River, which provided cheaper transportation costs for bulk materials. Alumina refined in Kaiser's Baton Rouge plant could be transported by barge to Ravenswood. In addition, about 70% of the U.S. aluminum market was located within a 500-mile radius of the Ravenswood site. The West Virginia plant would employ between 1,500 and 1,700 workers. [65] By May 1958, Kaiser's $216 million rolling mill at Ravenswood went into full-time operation. The facility included an $8 million 168-inch reversing breakdown mill capable of rolling 10,000-pound ingots into 3-inch slabs at 300 to 600 feet per minute, the first step in the overall production of plate or foil. The machine was believed to be the largest of its kind in the world. At the other end of the process, hot-rolled coil one-tenth of an inch thick came out of other rollers at the rate of 1,250 feet per minute. With the mill in full operation, the Ravenswood facility became a fully integrated smelter and fabrication center. [66]

Like Alcoa and Reynolds, Kaiser also invested in expanding its bauxite and alumina supplies. In 1949, Kaiser was nearly totally dependent on other companies for the 520,000 tons of bauxite it required annually for its smelters. The company purchased 92% of its bauxite from Alcoa and 8% from the U.S. government. To remedy the situation, Kaiser began exploring sites in Dutch Guiana and British Guiana, but the prospects were not promising. In 1948, Kaiser held options on 4,640 acres of land in Jamaica thought to be rich in bauxite, and on July 8, 1949, the company decided to purchase the land and begin construction of a pilot alumina refinery at Baton Rouge to test the Jamaican ore. [67] By 1951, plans were underway to increase alumina refining capacity at Baton Rouge to 800,000 tons per year. Kaiser also planned to increase bauxite production at its Jamaican mines. The General Services Administration agreed to buy 545,000 tons of the bauxite per year to meet needs during the Korean War. [68] Kaiser's bauxite reserves in Jamaica were expected to last 35 years. By 1955, Kaiser was entirely self-sufficient in production of alumina for its own smelters. Then in December 1955, Kaiser announced plans to build a new alumina refinery at Gramercy with a

capacity of 430,000 tons per year. The Anaconda Aluminum Co. signed a 15-year contract for a minimum of 850,000 tons of alumina from the Gramercy refinery at the rate of 130,000 tons per year. [69] In April 1957, Anaconda announced in its 1956 annual report that it was canceling its alumina supply contract with Reynolds and would advance $17 million to Kaiser for use in upgrading its Gramercy refinery. [70] Kaiser began operating its Gramercy refinery in 1959. [71]

Pacific Northwest smelters

Two of the three new aluminum producers in the 1950s built their smelters in the Pacific Northwest and relied on Bonneville Power Administration power. From its inception in 1937 through World War II and the post-war years to 1951, the BPA sold $101 million worth of electrical power to aluminum plants in the Pacific Northwest, about 45% of total revenue from all classes. Power sales to aluminum plants in the early 1950s included $13.3 million in 1952, about 33% of the total power that BPA sold in the region; 1953, $13.5 million, about 34%; 1954, $15.9 million, about 35%; 1955, $16.9 million, about 32%; and 1956, $20 million, about 33%. In 1956, the BPA sold 1.6 million megawatt-hours to Alcoa in Vancouver; 985,000 megawatt-hours to Alcoa in Wenatchee; 896,000 megawatt-hours to the Anaconda Aluminum Co. in Columbia Falls; 3.1 million megawatt-hours to Kaiser at Spokane; 342,000 megawatt-hours to Kaiser's rolling mill at Trentwood, Spokane; 620,000 megawatt-hours to Kaiser at Tacoma; 1 million megawatt-hours to Reynolds at Longview; and 1.4 million megawatt-hours to Reynolds at Troutdale. [72]

The marketing of BPA power to the aluminum industry began in earnest in March 1945 when BPA Administrator Paul J. 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. In 1951, the BPA increased the availability of interruptible power to the aluminum producers of the Pacific Northwest. Interruptible power referred to power generated by hydroelectric dams when streamflows exceeded historical minimums and was subject to curtailment at any time. Statistics through 1978 showed that interruptible power was available from 70% to 75% of the time since it first was introduced by the BPA. The Pacific Northwest aluminum industry made good use of interruptible power in 1951 by producing 800,000 tons of primary aluminum, and this production record was seen as a demonstration of the practicality of such power for production purposes. By 1952, the Pacific Northwest aluminum industry had built up a $300 million investment in plant facilities. Between 1940 and 1952, the region produced an estimated $1.4 billion in metal and paid out more than $200 million in wages and salaries. [73]

In 1952, the Big 3 aluminum producers – Alcoa, Reynolds and Kaiser – employed more than 7,600 workers in Pacific Northwest aluminum industry – jobs that did not exist prior to late 1940. About 65% of those workers were engaged in smelting operations, and the rest worked in fabrication of aluminum into sheet, cable, wire and rod. The first major fabrication plant in the Pacific Northwest was the Kaiser rolling mill at Trentwood near Spokane. Built by the Defense Plant Corporation during World War II, it was operated by Alcoa during the war and then sold to Kaiser after the war ended. In 1954, Alcoa had plans to install a $5.5 million extrusion facility at its Vancouver plant with additional capacity for wire and cable. About the same time, Reynolds announced plans to build fabrication facilities in the Pacific Northwest, and Harvey Aluminum planned on building fabrication facilities at its new plant at The Dalles. Traditionally, fabrication plants were not always located near smelters for several reasons: 1) pig and ingot aluminum could be shipped at lower freight costs than fabricated products; 2) pig and ingot aluminum did not require expensive packaging; 3) pig and ingot aluminum was not susceptible to damage during shipment as were fabricated products; 4) trimmings and scrap at fabrication plants could be recycled back into the fabricating plant's furnaces so a smelter was not needed; and 5) technical problems could be more readily addressed if the final customer was located near the fabrication facility. [74]

Construction of the first Pacific Northwest aluminum smelter was announced by Alcoa in 1939. Built on a tidewater sand flat on the Columbia River near Vancouver, the plant began operating with a 20-year power contract with the BPA. In 1940, the plant produced 5,000 tons of aluminum. By 1950, the plant had five 50,000-amp potlines with a capacity 85,000 tons per year and employed 1,100 workers. Alumina was transported by rail to the plant from Mobile, Ala. [75] By 1955, the Vancouver plant was capable of producing 95,000 tons of aluminum per year. In 1953, Alcoa completed construction of an aluminum smelting plant in Wenatchee using power from a nearby dam on the Columbia River. By 1955, the new smelter was capable of producing 100,000 tons of aluminum per year. [76]

The Reynolds Metals Co. built an aluminum smelter at Longview that fired up in 1941. This marked the entry of the first new producer of primary aluminum in the U.S. since Alcoa. [77] Reynolds cut back production at the Longview plant in 1947 because of an oversupply of aluminum. [78] In 1952, Reynolds expanded capacity at Longview by 20,000 tons per year at a cost of $12 million. Financing for the smelter was a government loan with 4% interest to be paid with aluminum produced by the plant over a five-year period. By 1955, the Longview plant was capable of producing 50,000 tons per year. [79] On July 18, 1946, Reynolds took over operation of the Troutdale, Ore. smelter from the U.S. government. Alcoa had built the plant in 1941 and run it during World War II. [80] Reynolds began by leasing the Troutdale smelter from the War Assets Department and

completed purchase of the smelter by 1949. [81] Reynolds had a 20-year power contract for the plant with the BPA. By 1950, the Troutdale 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. [82] In 1952, Reynolds completed construction of a new potline at Troutdale. By 1955, the smelter was capable of producing 82,500 tons per year. [83] The plant's capacity was increased again in 1956, 1957, 1961, 1962, 1967, 1971 and 1972, and a new casting house was built. [84]

In 1946, Kaiser Aluminum and Chemical Co. took over the Mead smelter in Spokane and signed a 17-year power contract with the BPA. The Defense Plant Corporation built the smelter during World War II. By 1950, the smelter had six 50,000-amp potlines, was capable of producing 108,000 tons, about 15% of the total U.S. capacity, and employed about 1,100 workers. In 1951, Kaiser began purchasing 101 megawatts of interruptible power from the BPA to energize 140 new pots purchased from the war-surplus smelter at Riverbank, Calif., which increased the plant's capacity by 20,000 tons per year. Alumina was transported by rail to the plant from Kaiser's alumina refinery in Baton Rouge. Kaiser's Trentwood facility near Spokane was the only rolling mill west of the Mississippi River and was capable of producing 150,000 tons of rolled aluminum per year. [85] In June 1951, Kaiser announced plans to spend more than $1.15 million to expand operations at the Trentwood rolling mill. Once completed, pigs that were normally shipped from the Mead smelter to Kaiser's rod and bar mill in Ohio would instead stay and be rolled at Trentwood. [86]

Kaiser purchased the Tacoma smelter from the War Assets Administration in 1947. Olin Industries Inc. had built the smelter for the U.S. government in 1942 and ran it until 1945. The plant sat idle until 1947 when industrialist Henry J. Kaiser bought it for $3 million. [87] By 1950, the Tacoma smelter had three 25,000-amp Soderberg-type potlines supplied with BPA power, was capable of producing 24,000 tons of aluminum per year, about 3% of total U.S. capacity, and employed about 300 workers. Alumina was transported by rail to the Tacoma plant from Kaiser's alumina refinery in Baton Rouge. [88] In 1952, Kaiser completed work at Mead and in Tacoma that expanded capacity by a total of 28,200 tons per year. By 1955, the Mead smelter was capable of producing 175,000 tons per year, and the Tacoma smelter was capable of producing 33,200 tons per year. In 1955, Kaiser announced plans to expand the Mead plant by another 1,000 tons per year. [89] Kaiser closed the Tacoma plant in 1958 because of weak demand in the aluminum market. In July 1964, as demand increased, the company announced it would restart the plant. Analysts looked at the setbacks in the U.S. aluminum industry during the late 1950s as a result of overexpansion, not weak demand. [90]

On Sept. 13, 1955, the Harvey Machine Co. signed a contract with the federal General Service Administration's Emergency Procurement Division calling for prompt construction of a $65 million aluminum smelter near The Dalles, Ore. The proposed plant would produce 54,000 tons per year, and the company would be obligated to sell 270,000 tons to the federal government by June 30, 1963. A letter of intent to build the plant was given to Harvey by the GSA in 1953. [91] The plant was expected to begin production in January 1958. Harvey obtained certificates of necessity allowing the company to amortize 85% of the cost of the plant over a five-year period. Harvey also obtained government guarantees for loans to construct the plant and a BPA power contract. By 1955, Harvey had a net worth of slightly less than $25 million, and its net sales for 1955 were approximately $34 million. [92]

Harvey became the fifth aluminum producer in the U.S. after Anaconda's plant in Montana began operating in 1955. Financing for Harvey's project came from private sources "with such assistance as is necessary being given under the Defense Production Act by means of loan guarantees and advance payments for aluminum production." The government had first call on production from the plant. The contract was signed immediately after Harvey entered into an agreement with the BPA to pay for transmission lines and power. Harvey would provide more than $2 million in material and equipment in lieu of cash to cover the cost of the new transmission lines. [93] The smelter at The Dalles began operating on July 28, 1958. The plant had a rated capacity of 82,000 tons per year. [94] The plant used 300 vertical-stud Soderberg cells and cost more than $40 million to build. [95] The plant ran at full capacity through the economic recession in 1958-1959 and was expected to begin making money in 1960. [96]

The Midwest and Canada

By 1956, the development of new aluminum smelting plants in the Ohio River Valley proved that the industry no longer had to rely on hydropower, as in the Pacific Northwest, or on atomic energy, gas or oil for electrical power. The Kaiser smelter planned for Ravenswood, W.Va., and the Olin Mathieson smelter planned for Hannibal, Ohio, each $120 million projects, would be powered by coal-fired generating plants. Electrical power in the Pacific Northwest cost about $2.20 per megawatt-hour, compared to $4 in the Ohio River Valley, but the advantages of cheap river transportation for raw and finished materials offset the energy cost difference and made coal a competitive source of energy. Furthermore, technical improvements had reduced the amount of coal needed to produce electricity from 1.29 pounds per kilowatt-hour in 1946 to 0.96 pounds in 1955. Behind the decision to build the two large smelter plants in the Ohio River Valley was a six-year study by the American Gas &

Electric Co. that found costs for operating gas-fired power plants were expected to increase while most practical hydroelectric sites already had been developed. [97]

In 1955, the Olin Company, a manufacturer of chemicals, paper products, small arms and ammunition, and aluminum extrusions, announced plans to enter the aluminum production industry. The plans included building a $20.5 million alumina refinery with a capacity of 230,000 tons per year, a $32.2 million smelter with a capacity of 60,000 tons per year, and a $36.3 million rolling mill with a capacity of 64,000 tons per year, all to be located on the Ohio River. The company obtained certificates of necessity allowing 85% of the cost of the refinery and smelter and 50% of the cost of the rolling mill to be amortized over a five-year period. Olin signed long-term contracts for bauxite from Dutch Guiana with deliveries to begin in January 1957. [98] On Aug. 2, 1955, the Revere Copper and Brass Co. applied for a certificate of necessity from the government for construction of an aluminum smelter with a capacity of 60,000 tons per year and an alumina refinery with a capacity of 120,000 tons per year. At about the same time, the government terminated its program to assist in the expansion of the U.S. aluminum industry, and Revere decided to delay its plans. Revere was a fabricator of non-ferrous and steel products with a net worth of $74.3 million. [99] Paul Revere had founded a copper and brass fabricating business in 1801 that merged with five other companies to form Revere Copper and Brass Inc. in 1928. [100]

In August 1956, Olin and Revere announced the creation of a new company called the Olin Revere Metals Corp., or Ormet, for the purpose of entering the aluminum producing industry. The new corporation announced plans to build a 350,000 ton-per-year alumina refinery at Burnside, La., a 180,000 ton-per-year smelter at Hannibal, Ohio, and an electrical power plant across the Ohio River at Cresap, W.Va. Bauxite for the alumina refinery would be supplied by Billiton from its mines in Dutch Guiana. The Ormet plans would cost about $231 million. The American Smelting and Refining Company (ASARCO) owned about 36.2% of Revere. [101] The Hannibal smelter began operating in the midst of the 1958 recession. Through most of 1959, when many U.S. aluminum producers were stockpiling inventory in anticipation of a labor strike, Ormet was still working on its break-in costs. By the end of 1959, when Ormet was finally ready to operate at full capacity, a steel strike caused a general economic slow-down. Ormet expected its first profits as late as 1960. [102]

At least three other companies contemplated getting into the U.S. aluminum industry in the 1950s but didn't follow through. In 1951, the Apex Smelting Co. obtained a letter of intent to supply aluminum to the government along with a certificate of necessity to build aluminum producing facilities in the Texas Gulf area. The company intended to build a smelter with a capacity of 54,000 tons, an alumina refinery with a capacity of

125,000 tons and a gas-fired electrical generating plant. Apex's plan continued right up to the final contract stages when it decided to abandon the entire project. Apex was founded in 1923 and produced 70,000 tons of secondary aluminum per year in Chicago and Cleveland. In March 1953, the Wheland Co. obtained certificates of necessity covering 85% of the cost for a proposed facility to include an aluminum smelter with a capacity of 50,000 tons per year, an alumina refinery with a capacity of 219,000 tons per year and a power generating plant. The entire facility would have cost about $57.7 million, but Wheland was unable to obtain financing and had to abandon the project. The Wheland Co. was a manufacturer of oil field equipment, sawmill machinery, automotive castings and artillery supplies. On May 16, 1955, the St. Joseph Lead Co. and the Pittsburgh Consolidation Coal Co. jointly applied to the U.S. government for a certificate of necessity for the construction of an aluminum smelter in Josephtown, Pa. The plant would have a capacity of 66,000 tons per year, include its own generating plant and cost about $36.2 million. At about the same time, the government terminated its program to assist in the expansion of the aluminum industry, and the project was abandoned. [103]

Competing with the Big 3 and the three newcomers on the North American continent in the 1950s was the Canadian-based Aluminium Ltd. By 1950, the company was the largest aluminum producer in the world. Most of its production facilities were located in Canada, but the company also owned plants in Norway, Sweden, Italy and India. In 1948, despite water shortages that caused electrical shortages, Aluminium Ltd.'s Canadian plants produced 367,000 tons of primary aluminum. Nathaniel V. Davis, president of the company, estimated the company's total capacity at 496,000 tons per year. Unlike Alcoa, Reynolds and Kaiser, Aluminium Ltd. was essentially a supplier of ingot aluminum, not fabricated products. The company was in a strong financial condition and had improved its facilities and operations since its inception. By 1950, the company's plant costs had fallen to the point where its aluminum was cheaper than Reynolds' or Kaiser's despite a 2-cent per pound tariff. The Canadian plants enjoyed both cheap electric power and cheap transportation costs. Out of 400,000 tons of aluminum produced by Aluminium Ltd.'s Canadian plants, 55,000 tons were consumed in Canada and 80,000 tons were shipped to the U.S., mostly to Alcoa. [104]

Alcoa signed a contract to purchase 150,000 tons from Aluminium Ltd. between April 1, 1948 and March 31, 1950. Alcoa explained that anticipated rapid growth in demand would outstrip Alcoa's production capacity. Aluminium Ltd. in turn needed an outlet for its primary aluminum, and neither Reynolds nor Kaiser was in a strong enough financial condition to enter into such a large contract. [105] On Feb. 11, 1960, Alcoa announced that an agreement had been reached to cancel a contract for delivery of 59,000 tons of aluminum in 1960 and 1961 from Aluminium Ltd. of Canada to Alcoa. The amount was

equal to 10% of the 600,000 tons originally contracted by Alcoa in 1953. Alcoa explained that it was completing construction of new primary aluminum production plants in the U.S. to augment its supply. Alcoa agreed to pay Aluminium Ltd. $9 million in 1960 to cancel the order. [106]

In 1951, Aluminium Ltd. began work on a $500 million project to build an aluminum smelter in British Columbia, the largest public-private partnership in Canada's history to that time. The British Columbia provincial government had invited Aluminium Ltd. to look at the potential of building a smelter at the mouth of the Kitimat River on the Pacific coast. The project included construction of a smelter in Kitimat, which started producing aluminum in 1954, construction of a 112-megawatt hydroelectric plant at Kenamo, and construction of a 51-mile long transmission line. [107] By 1955, Aluminium Ltd.'s smelters in Canada were capable of producing 650,000 tons of aluminum per year. A new smelter was under construction at Isle Maligne, Quebec, with a capacity of 22,000 tons per year, and the company announced plans to expand production at its Kitimat smelter by 240,000 tons per year in successive stages through 1959. The company also was negotiating with the government of Quebec to obtain enough hydroelectric power to expand capacity at its Saguenay operations by 120,000 tons per year. A new company entered the Canadian aluminum industry in 1955 when the Canadian British Aluminium Co. Ltd. announced plans to build a new aluminum smelter at Baie Comeau in Quebec. The company was owned by the British Aluminium Co. Ltd., an integrated producer and fabricator of aluminum in the United Kingdom, and the Quebec North Shore Paper Co., a subsidiary of the Chicago Tribune group of companies. The new smelter would have a capacity of 179,200 tons per year. [108]

Supply and demand problems

The U.S. aluminum smelting industry went through a roller coaster ride in the 1950s as a result of changing markets and overcapacity. Construction of new smelters or expanded capacity could take several years and cost large amounts of money – producers couldn't just flip a switch and start producing more aluminum, and the decision to invest in new smelting capacity was not taken lightly, assuming a company could find sufficient financing at all. Market changes were driven by a combination of new and uncertain consumer uses along with new and different competition both in the U.S. and in the world. U.S. aluminum production reached a record high in 1955 for the fourth year in a row, but still production could not keep up with demand. Industry experts expected that facilities still under construction might provide sufficient new capacity by 1956. Between new producers and expansion plans by existing producers, the U.S. aluminum industry expected to increase capacity by 43% by 1959, but the growth of the aluminum market

in so many directions by January 1956 fostered doubt in some experts about sufficient supplies. [109]

Primary production in the U.S. in 1955 was 1.55 million tons, more than double production in 1950. Output in 1955 was also 17,000 tons over the industry's theoretical capacity, as estimated by the Office of Defense Mobilization in autumn 1955. Producers began to estimate production based on "installed capacity" rather than based on a system that took into account variations caused by seasonal effects on hydroelectric power and other factors. [110] The month of August 1955 saw a record output in U.S. aluminum production at about 138,000 tons, while the month of September was higher than the previous September by 10,000 tons. Production for the first nine months of 1955 was 75,000 tons higher than the same period in 1954. [111] December 1955 was another record month with 140,000 tons produced. By March 1956, production rose to nearly 146,000 tons for the month. [112]

Five companies had announced plans to produce aluminum for the first time by 1958, including the Harvey Machine Co., the Olin Mathieson Chemical Corporation, Revere Copper & Brass Inc., and a joint venture between the St. Joseph Lead Co. and the Pittsburgh Consolidation Coal Co. The five companies were expected to create 681,000 tons of additional primary aluminum capacity by the end of 1958. To match the growth in primary production, additional fabricating facilities were planned, and new markets for aluminum were being created. One important development was reported by the Aluminum Specialty Co. of Manitowoc, Wis. – a way to color aluminum by anodizing. The company was a major fabricator of aluminum for appliance manufacturers and retail chains. The company reported that refrigerator manufacturers wanted ice trays colored "ice blue," stove and oven manufacturers wanted gold- and pastel-colored trim, and Cadillac was offering gold-anodized grilles. [113]

Record production, however, was not meeting record demand. By March 1955, U.S. aluminum consumers were complaining about serious shortages of primary and scrap aluminum. The problem was believed to have evolved from the abundance of aluminum earlier in 1954 that led to several unexpected market conditions – an increase in aluminum consumers, such as fabricators; a dwindling aluminum inventory by older consumers; a re-routing of Canadian metal to other markets, such as Europe; and the sale of surplus aluminum to the U.S. defense stockpile. The shortage seemed to be only in primary and scrap aluminum, but not in semi-finished mill products such as sheet, foil, tubing and other extrusions. Major aluminum producers were seeking a sharp reduction in their commitments to the U.S. defense stockpile, and the Office of Defense Mobilization was believed to be ready to announce a substantial cutback in federal purchasing for the rest of 1955. Aluminum industry insiders also expected some kind of

government action to curb the export of scrap. Shortages in scrap were also causing serious and unnecessary harm to the developing U.S. aluminum industry, aluminum industry insiders contended. To compound the supply problem were worries about upcoming labor negotiations and possible shortages of electric power in the Pacific Northwest by autumn 1955, which would severely curtail aluminum production there. [114]

In 1956, U.S. aluminum companies produced record amounts for the fifth straight year and finally caught up with rising demand. Despite labor strikes at certain plants in the summer of 1956, U.S. production reached 1.68 million tons, an increase of 7.5% over 1955, also a record year. Sharply reduced purchases of primary aluminum by the federal government's defense stockpiling program also freed up aluminum to meet rising demands. In 1956, the Office of Defense Mobilization reduced stockpile purchases by 650,000 tons. Primary producers increased their annual capacity in 1956 by 125,000 tons to a total of 1.76 million tons. Associated with this growth were increases in bauxite mining in Jamaica, Dutch Guiana, British Guiana and soon Haiti, and new alumina refineries were expected to raise capacity by 1.35 million tons. New products for aluminum included curtain walls for office buildings, which was gaining wider acceptance, as well as transportation, residential construction and consumer durables. [115]

On May 15, 1956, Alcoa announced plans to spend $600 million over the next five years expanding and improving its aluminum facilities in order to meet rising demands. The majority of the money would be spent on new smelting facilities, but a substantial amount would be spent on fabricating plants. Recent smelter expansions were expected to raise Alcoa's capacity to 942,500 tons per year, about 40% of the U.S. total. The company was also obligated to retire about $165.7 million in debt by 1964. Between 1945 and 1955, Alcoa earned about 8% on its investments, with 1955 being a peak year, earning Alcoa about 10.14%. The company hoped to make 10% on its investments every year, but the increasing cost of building new facilities made that more difficult, and new facilities were needed to keep up with rising demand. About $8.5 million of Alcoa's proposal would go to research and development in 1956 to discover new uses for aluminum. The company projected consumption of aluminum in 1975 to be 5 million tons per year, compared to only 2 million tons in 1956. Part of the increase in future demand would result from a general rise in the standard of living, which would create more uses for aluminum. One new market was the use of aluminum in beverage and other cans. [116]

In August 1956, U.S. aluminum industry experts forecasted price increases for primary aluminum as a result of new labor contracts currently under negotiation. Strikes closed

several aluminum plants in July 1956 and prevented aluminum producers from posting a record high for the third quarter. If prices increased by 1.5 cents to 27.4 cents per pound as expected, that would be the highest price for primary aluminum in 30 years. Aluminum producers had not made an official forecast, but fabricators looked at the situation as inevitable. Prices for primary aluminum had increased 11 times since the end of World War II, when ingot sold for 15 cents per pound. Producers were expected to attach price increases not only to higher labor costs but also to increases in the cost for materials and services. Costs for building new facilities to meet rising demand were rising as a result of higher steel prices among other things. Total capacity in 1956 was about 1.737 million tons per year, with nearly 650,000 tons in expansion underway. [117]

The clash of increasing supply outstripping demand became evident in 1957, when the U.S. aluminum industry found itself with surplus production and a 38% increase in capacity coming online in the near future. When completed, the new plants would add 720,500 tons per year to the existing 1.88 million tons in total capacity. New aluminum producing plants cost about three to five times as much as new steel plants. U.S. primary aluminum producers had curtailed production by 2% from 1956 levels, but some of that resulted from cut backs in hydroelectric power. The major U.S. aluminum producers said they were not worried about the oversupply because they believed the industry was young and growing, and new markets could always be created to absorb surplus production. “To speak of oversupply or overproduction in an industry that is growing like ours is a contradiction in terms,” Reynolds Metals Co. President Richard S. Reynolds Jr. said. “This supply compels the industry to sell aluminum, rather than deliver it, as is the case in time of shortage. This pressure to sell in turn accelerates the industry’s progress toward future markets.” [118]

The major U.S. aluminum companies continued to enjoy one big advantage over other industries – under emergency defense contracts made during Korean War, the government was obligated to purchase surplus aluminum for stockpiling. Much of the industry’s surplus in 1957 was siphoned off in this way, but the defense surplus contracts were set to expire in 1958 and 1959. New markets for aluminum were being developed each year, including new uses in automobiles, homes, commercial structures and oilfield equipment. In highway construction, aluminum was showing up in lighting standards, bridge railings, signs and fencing. Aluminum cans for motor oil and foods appeared in 1957, and 80,000 tons of aluminum foil went into food packaging. Sales of aluminum foil were predicted to increase by 10% in 1958. New aluminum alloys were found in missiles, aircraft and marine materials, chemical tanks, heat-transfer fabrications and in atomic energy reactor systems. [119]

Impacts of the recession

A general economic recession in 1957 to 1958, however, hurt the Big 3 U.S. aluminum producers, who were in the midst of major expansion programs. Alcoa was in the middle of a $600 million program launched in 1956. By 1960, Alcoa's profits had dropped to their worst level since 1950, when the company was recovering from the economic regrouping following the end of World War II. In 1962, the U.S. aluminum industry finally absorbed the 56% increase in capacity created during the expansion from 1956 through 1961, and a balance was struck between supply and demand. But by 1964, Alcoa's market share had dropped to 29.4%, compared to Reynolds' 22.4% and Kaiser's 20.1%. Aluminum price discounting, which Alcoa had introduced to the industry in 1958 as a way to get rid of excess capacity, led to a price war by 1965. As the industry moved to stabilize prices and bring them up in line with production costs, it found itself a scapegoat for inflation caused by the Vietnam War. [120]

By August 1957, labor costs at most U.S. primary aluminum plants had increased by 15 to 20 cents per hour as a result of industry-wide labor contracts signed during the summer of 1956. Combined with the effects of increased costs for freight and raw materials, the mid-1957 price of 25 cents per pound for primary aluminum was expected to rise by 0.5 to 1 cent per pound. [121] By late September 1957, it had become apparent that a serious decline in U.S. demand for aluminum was affecting the industry. Production of primary aluminum for 1957 was about the same as for 1956, but fabricators were putting out less product. The Anaconda Aluminum Co. plant in Columbia Falls cut back production by 25% during the summer rather than build up unsold inventory. The company predicted a stronger market and considered restarting idled capacity by January 1958. Alcoa had reduced output at two of its Pacific Northwest plants by 25% because electrical power shortages. A general recession already had hurt other nonferrous industries. Widespread price-cutting and layoffs had taken place in the copper, lead and zinc industries, with companies calling for higher tariffs. [122]

The problem of oversupply, which affected the copper and zinc industries, did not affect the aluminum industry in the same way because much of the excess aluminum production was purchased by the federal government under defense contracts. At the same time new primary aluminum producing plants were expected to be on line by 1958, and experts were worried where all the new production would go. Many aluminum industry executives were bullish on the future, expecting that new uses would utilize increased aluminum production. Alcoa was beginning a five-year marketing program to develop new uses for aluminum in people's homes, including building exhibition homes in 23 cities across the nation. Alcoa estimated that only 40 pounds of aluminum went into a typical U.S. home but forecasted that would increase

to 1,000 pounds within five years. Kaiser demonstrated an all-aluminum tugboat, and Reynolds announced a contract to provide 35 million quart-sized oil cans to the Esso Standard Oil Co., considered a foot in the door of the huge can industry. Reynolds also built an all-aluminum railroad boxcar with an order for 1,000 more. Other products included oil and gas pipelines, industrial doors, food packaging and road signs. [123]

In 1958, aluminum demand in the U.S. dropped 8% to 1.8 million tons chiefly because of curtailed output of consumer durables, and production dropped about 6% from 1957 levels. This was the second year in a row of decreased production. Despite the general recession and economic setback, aluminum producers proceeded as confident as ever, increasing capacity by 14% in 1958. Two new aluminum producers entered the market, Ormet and Harvey. By 1960, additional expansion would be completed, increasing total capacity nearly 21% to 2.6 million tons per year. Some industry observers continued to worry about oversupply hurting the market, noting that 18% of the industry's supply went into government stockpiling contracts, the last of which would expire in 1959. Major aluminum producers argued that continuing expansion was necessary to keep up with new market demands created by designers and manufacturers. [124]

In a flash of optimism, aluminum producers claimed that if automobile manufacturers were to make bumpers out of aluminum, the amount of surplus would be significantly reduced. Richard S. Reynolds pointed out that aluminum was being used in structural components for bridges as well as military equipment such as tanks and ships. He estimated the aluminum industry would spend $30 million for research and development in 1959 to assure a steady growth of new markets, along with $35 million in advertising. D.A. Rhoades of Kaiser forecasted that automobile manufacturers would increase use of aluminum by 50% in 1959 in both functional and decorative ways, including engine blocks, wheel and brake drums, and radiators. He also predicted that total aluminum demand in the U.S. by 1965 would reach 4 million tons. Alcoa President Frank L. Magee pointed to the growth of prefabricated homes using from 1,400 to 3,000 pounds of aluminum apiece, compared to only 100 pounds in conventional homes built in 1958. [125]

Analyzing the Pacific Northwest's shrinking share

In 1957, J. Granville Jensen took a second look at the Pacific Northwest aluminum smelting industry in light of changes since his book in 1950. The region's aluminum industry had grown by 1949 to account for 50% of the nation's smelting capacity largely because of war-time needs and low-cost firm electrical power, but practically all raw materials were transported to the region by rail, including alumina from Alabama, Louisiana and Arkansas and petroleum-carbon from California. This amounted to 50% to 55% of production costs for regional aluminum smelters. Jensen was optimistic about

alumina refineries being built in the Pacific Northwest in the future, utilizing newfound bauxite deposits found in Hawaii and Southeast Asia. Meanwhile, for many reasons, the Pacific Northwest's share of aluminum smelting capacity had declined from 50% in 1949 to a forecasted 27% by 1958. New smelters had been built in Wenatchee, Wash., Columbia Falls, Mont. and The Dalles, Ore., but while capacity in the Pacific Northwest doubled from 1949 to 1957, U.S. capacity had more than tripled. [126]

Jensen provided several reasons for this shift. One, firm electric power had become gradually less available to the aluminum smelting industry in the Pacific Northwest. Firm power contracts held by aluminum smelters with the Bonneville Power Administration declined from 83% of the companies' requirements in 1950 to about 60% in 1957. The prospect of having to rely on nonfirm power for 40% of power needs was a significant influence on the decision for aluminum companies to turn to other regions. Two, through the 1940s, aluminum companies tended to look for low-cost hydropower for their smelting plants, but beginning in the 1950s, they began to consider other power sources. Three, rising freight rates were impacting raw material costs for Pacific Northwest aluminum smelters. The cost to ship one ton of alumina from Alabama or Arkansas to the Pacific Northwest had increased by about $3 from 1950 to 1957. Four, major technical improvements had made power generated from coal or natural gas competitive with hydropower. While power costs in the Pacific Northwest were expected to increase by the late 1950s, power costs for coal or natural gas plants had fallen sharply. Alcoa had built a large aluminum smelter with a coal-fired plant in Rockdale, Texas, while three more plants were being considered in Indiana, Ohio and West Virginia, he noted. Recent estimates indicated that coal-fired plants could produce electrical power at $3 to $3.50 per megawatt-hour. By 1958, as a result of all these changes, hydropower would account for about 47% of U.S. aluminum smelting, oil and gas in Texas, Louisiana and Arkansas about 26%, coal in the Ohio Valley about 22%, and coal in Texas about 6%. [127]

By 1958, according to a report by the Federal Reserve Bank of San Francisco, the capacity of aluminum smelters in the Pacific Northwest would total 629,000 tons per year while the capacity in the Ohio Valley would be 475,000 tons. The relative decline of the Pacific Northwest's share of aluminum capacity could be explained by a number of reasons, starting with raw materials. Of all nations in the world, only France possessed domestic bauxite deposits sufficient to supply its aluminum industry. By 1958, nearly 80% of the bauxite used in the U.S. came from South America and Jamaica. No bauxite was shipped to the Pacific Northwest for refining into alumina. Three of the U.S.'s alumina refineries were on the Gulf Coast, two were in Arkansas and three were under construction along the Gulf Coast. The Harvey Machine Co. planned to import alumina from Japan for its aluminum smelter at The Dalles, Ore. Other raw materials were

needed to produce alumina. For every ton of alumina produced, 4,000 tons of high-grade bauxite was needed along with 160 pounds of soda ash, 120 pounds of lime and 9,000 cubic feet of natural gas or 0,7 tons or coal. Even if bauxite was shipped to the Pacific Northwest for refining, the other raw materials also would be needed. Freight costs for alumina were estimated at about 1 cent per pound of aluminum produced, while freight costs for carbon paste and other chemicals amounted to about 0.4 cents per pound. In addition to the costs of shipping alumina to Pacific Northwest smelters, ingots needed to be shipped to fabrication plants. In 1956, about half of the ingots produced in Pacific Northwest smelters was shipped to industrial centers in California and the East, adding about 1 cent to the cost of a pound of aluminum produced. [128]

The main advantage for smelting aluminum in the Pacific Northwest had been low-cost electrical power, the Federal Reserve noted. Every pound of aluminum metal produced in a smelter required 1.91 pounds of alumina, 0.6 pounds of carbon past for anodes, 0.03 pounds of cryolite and 8 to 10 kilowatt-hours of electrical energy. By 1955, the U.S. aluminum industry consumed more than 30 billion kilowatt-hours, about 5% of all the power generated in the U.S. But over the history of the aluminum industry, the amount of power needed to produce aluminum had declined from 14 kilowatt-hours per pound to 8.5 kilowatt-hours. In the early history of the U.S. aluminum industry, production migrated from the Northeast to Tennessee, North Carolina and the Pacific Northwest for low-cost hydropower. After World War II, the aluminum industry migrated to the gas fields of the Texas Gulf and then the coal fields of Texas and the Ohio Valley. Power costs in the Pacific Northwest remained the lowest for aluminum producers in 1955, at about $2 per megawatt-hour compared to $4 in Tennessee and the Texas Gulf and $3 to $4 for the Ohio Valley. But an increase in the efficiency of coal-fired plants and limitations on locating future hydropower plants, the cost differential was expected to change. [129]

When combining freight costs with power costs, the Pacific Northwest continued to have a net advantage over Tennessee and the Ohio Valley. Future changes in power generation were expected to change this balance. Power generation in the U.S. had been doubling every 10 years, but hydropower sites were nearly exhausted and power companies were turning to thermal plants fired by coal, gas or oil. The efficiency of coal plants had increased from 3.2 pounds of coal per kilowatt-hour in 1919 to 0.95 pounds. With increasing demand and increased efficiency, consumption of coal-fired power by electrical utilities had increased 250% from 1928 to 1958. Three new aluminum smelters were planned or nearing completion in the Ohio Valley, the Federal Reserve reported, with 550,000 tons per year total capacity. Meanwhile, an Army Corps of Engineers study concluded power rates in the Pacific Northwest would increase significantly as additional generating capacity was connected. In conclusion, the Federal Reserve report

stated, “As total aluminum smelting capacity continues to expand, the Pacific Northwest will not share proportionately in its increase. Although present low power rates compensate for a good part of the other cost disadvantages of location in the Pacific Northwest, additions to capacity in this area can only be supplied by higher cost power that will make them higher cost plants than those located more advantageously with respect to assembling raw materials or marketing the finished product. The Pacific Northwest will, however, continue to supply an impressive fraction of the national aluminum output in the foreseeable future.” [130]

The booming consumer economy

Market and industry conditions began to remarkably improve in 1959. Exports of primary aluminum from the U.S. more than doubled from 1958. Shipments totaled 121,000 tons compared with 52,500 tons in 1958. The United Kingdom was the U.S. aluminum producers’ biggest customer, taking 45%. [131] U.S. aluminum producers increased shipments by 37% over 1958, surpassing the record set in 1956 by 19%, and primary production in 1958 increased by 25%. The figures were provided by the Business and Defense Services Administration, which attributed the increase to greater use of aluminum in construction, automobiles, appliances and consumer goods. [132] Domestic primary aluminum production for 1959 was estimated at 1.9 million tons, about 25% above the level for 1958 and on schedule with expectations. Production slipped in November to about 80% of installed capacity. The scrap aluminum market for 1959 was up by 25% over 1958. The average long-term rate of growth in the U.S. aluminum industry was about 10% per year, while the economy averaged only 3%. Imports of primary aluminum for 1959 were a little below the level for 1958 at about 13% of domestic production. Imports from Canada dropped off by 21% while imports from France, Austria, Norway, Italy and other countries increased. Imports of semi-fabricated aluminum nearly doubled in 1959 over 1958, including plate, sheet, bar, rod, foil and other shapes. Domestic primary aluminum capacity was estimated at 2.3 million tons at the end of 1959, an increase of 141,500 tons over the previous year. Another 269,000 tons of primary capacity was expected to be installed in 1960. [133]

New uses and new alloys of aluminum were developed in 1959 – a new compact automobile had an aluminum engine; sales of prefabricated homes containing significant amounts of aluminum were up; new kinds of aluminum building sheet were introduced; a large order for aluminum gondola railroad cars had been placed; new types of aluminum cans were introduced; and new military applications for aluminum were developed. Forecasts for 1960 included an increase in aluminum shipments to consumers by 10% to 15%. Automobiles were expected to use 13% to 15% more aluminum in 1960 and, coupled with a forecasted increase in automobile production by

22%, this could mean an increase in aluminum use in the automobile industry by 40%. Construction in 1960 was expected to remain the same, but more aluminum would be used. Appliances and other consumer goods were expected to be produced at a higher rate in 1960, and they would contain more aluminum. More aluminum packaging also was expected in 1960. [134]

Possibly the most significant new use of aluminum was in beverage containers. In 1958, Kaiser and the Adolph Coors Co. of Denver joined together to create the first aluminum beer can. [135] In January 1959, Coors began selling beer in 7-ounce aluminum cans packaged eight to a carton. Research in the use of aluminum for beer cans began in 1954 as a joint effort between the Beatrice Foods Co. and Coors. The cans were made by a machine which extruded aluminum disks into cans at the rate of 3,600 cans per hour. [136] In 1958, virtually all beverage cans in the U.S. were made of tin-plated steel. Alcoa entered the market in 1961 by selling 8 million pounds of aluminum for the ends of citrus fruit cans. In 1962, Alcoa began selling aluminum ends for tin-plated beer cans. The big change for consumers came with the invention of the pull-tab opener, which could only be offered in aluminum cans. The Dayton Reliable Tool Co. offered the first design, called the "Easy Open," which had an integral rivet that cut consumers' fingers. This was followed by a design from Continental Can that utilized a ringed pull-tab. In 1962, Schlitz Brewing began selling pop-top aluminum cans that drew in other beer manufacturers. By 1963, aluminum ends were on 40% of the beer cans in the U.S., and by 1968 that figure reached 80%. [137] Coca-Cola and Pepsi began to sell their soda drinks in aluminum cans in 1967. [138]

The aluminum industry after World War II and through the 1950s was often labeled an oligopoly – a market structure common in other large industries through U.S. history. Supporters of anti-trust legislation and prosecution believed oligopoly market prices resulted from tacit collusion between the top producers and tended to rise above the producers' marginal costs in a non-competitive way. In another view, a key characteristic of an oligopoly market was price leadership, where a larger company set prices that smaller companies tended to follow. This situation existed in the U.S. aluminum market through 1958, according to Smith, at which point over-capacity created the need for discount pricing below published prices. By 1958, three newcomers had entered the U.S. aluminum industry, but the newcomers accounted for only 12% of U.S. primary aluminum production and did not disturb the basic oligopolistic structure of the industry. [139]

By early 1960, Alcoa accounted for 818,250 tons per year of aluminum produced in the U.S.; Reynolds accounted for 688,000 tons; Kaiser accounted for 609,500 tons; and the Little 3 of Ormet, Anaconda and Harvey accounted for a total of 294,000 tons. The three

smaller aluminum producers benefited from the efforts of the three larger companies, which developed new markets for aluminum. The Big 3 continued to expand capacity despite setbacks in other metal markets. Experts forecasted that total aluminum production in the U.S. in 1960 would top 2 million tons for the first time in history. With so much capacity and expansion, market watchers wondered why the Little 3 had entered the industry. Experts believed the decision had to do with significant periods of shortages following World War II that encouraged new companies to break into the industry. In the case of Anaconda and Harvey, the companies no longer wanted to purchase primary aluminum for use in their fabrication plants. According to the Aluminum Extruders Council, the larger aluminum producers tended to raise the price of their primary aluminum but not their fabricated products, thereby squeezing the profits of the independent extruders and fabricators. The council accused the Big 3 of "deliberately trying to force the independent extruder out of business" and using similar methods to a lesser degree against fabricators. [140]

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