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The devastating suddenness of the energy crisis in the western United States in 2000–2001 and its decimating cause of the shutdown effect on the aluminum smelters in the Northwest should not have been a surprise to the industry. Indeed, while portentous signs of such a probability were apparent for more than a generation, they were overlooked or disregarded. In specific, the case of Kaiser Aluminum's smelter at Chalmette, Louisiana, provides an instructive example of how changes in energy supply can lead to the shutdown and dismantling of one of the world's largest aluminum reduction facilities of its time. Will similar dismantlement be the fate of any of the Northwest aluminum smelters presently in a shutdown, standby status?

INTRODUCTION

What would it cost, at this turn of the new millennium into the 21st century, to build a typical aluminum reduction plant with an annual production capacity of 250,000 tonnes? Based on the most recently completed plants, an estimated $1.5 billion would be required. Add to this the requirement that this new smelter have its own electricity-generating facilities to service it. This would increase the installation cost by $300 million to $406 million. All of this assumes that a suitable site location can be found with the necessary support services. Today, in the United States, it would take several years to get the required permits and clearance. This would involve the need for environmental impact reports, hearings with regulatory agencies and local and national governments, with no guarantee that final approval would not be challenged by appeals to court jurisdictions.

Such cumulative considerations, when combined with the availability of needed energy at a competitive price, lend some credence to the often heard statements that another aluminum smelter will not be built in the United States. Hopefully, a successful breakthrough in the ongoing research to develop an inert anode and a more efficient electrolytic cell technology with greatly reduced energy usage will challenge this projection.

Many of the issues challenging today's U.S. aluminum smelter, including the preliminary danger signs, are epitomized in the birth, life, and dismantlement of the Kaiser Aluminum smelter at Chalmette, Louisiana. It was located on the Mississippi River, seven miles downstream from New Orleans.

Today, the plant is a rusted skeleton (Figure 1). A generation ago, it was a state-of-the-art plant. For a long time, it was the largest aluminum smelter in the world, at 275,000 annual tonnes (Figure 2), before being shut down in 1983. The principal reason was an impending major price escalation of its energy source, natural gas, supplied to it under a 30 year contract, which was

Figure 1. The plant as it looks today.

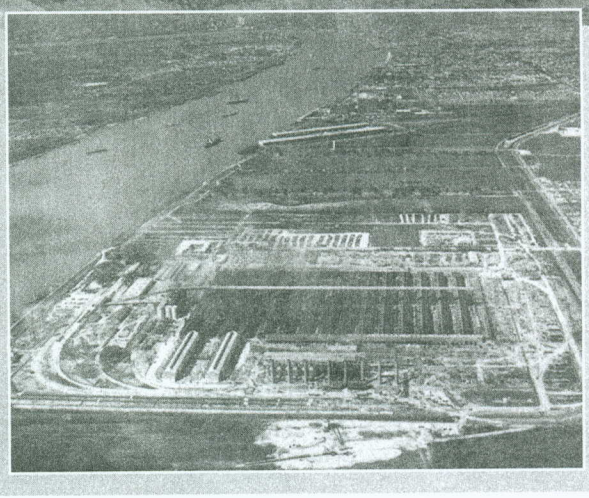

Figure 2. The plant as it looked in August 1953.

nearing expiration. This was not to be just a temporary cessation of operations until natural gas prices would decline, or aluminum market demand would increase resulting in a rise of aluminum prices. It was not to be kept on "standby" status as happened periodically with other marginal U.S. smelters when market demand declined, the so-called Lazarus plants. It was a total closure and dismantlement.

An examination of the associated circumstances that led to its rise and fall can provide constructive insight.

THE BIRTH AND LIFE OF CHALMETTE'S PLANT

If no new plants are on the horizon, then what is the future of the existing plants in the United States as they confront extraordinary pressures from myriad fronts, not the least of which is energy supply, particularly in the Pacific Northwest?

The Chalmette plant was planned in 1950, soon after the outbreak of the Korean conflict hostilities. The United States was experiencing a deficit in aluminum availability for military purposes, and the government encouraged existing U.S. companies to construct additional reduction plant facilities. Kaiser Aluminum, already in an expansion mode, proposed a greensite plant, with four potlines, 100,000 annual tonnes capacity. Initially, it hoped for a Northwest location where Bonneville hydroelectric power would be available. But the Secretary of the Interior, Oscar Chapman, together with the Federal Munitions Board, demurred on the location. A variety of reasons was proffered, not the least of which was that the availability of Bonneville power was already in short supply. Also, there was opposition to another aluminum plant in the area by the resident representatives who wanted an industrial operation that would provide more jobs per consumed kilowatt hour than another aluminum smelter.

The secretary of the interior, somewhat forcefully, "suggested" that the new reduction plant be located in the Texas or Louisiana coastal region, where a plentiful supply of cheap natural gas was available. He advised that he would immediately approve such a location.*

The government had considerable leverage. The incentive it offered involved a five-year amortization of loans and a guarantee of purchasing for the government stockpile all of the plant's surplus aluminum production that the general market would not absorb. In other words, such incentive plants could be operated at full production capacity for seven years with a guaranteed customer, the U.S. government stockpile, at the going market price. The government ultimately reached several hundred thousand tonnes and proved to be disruptive to the market in later years, when the government periodically sold portions off to bidders who typically paid market price.

The Chalmette plant construction began in February 1951 by Kaiser Engineers (an affiliate but separate company), and the first metal was tapped on December 11, 1951—barely

THE ENERGY CRISIS ERA: 1974–2001

It was in 1974 that the Middle East oil embargo initiated a worldwide energy crisis. People in the United States were admonished in full-page newspaper and billboard advertisements to "FIGHT BACK–DRIVE 55." The clear implication was that, at lower highway speeds, fuel utilization was more efficient and contributed to conservation and extending oil supplies. Another popular newspaper advertisement at that time proclaimed "WE'VE GOT MORE COAL THAN THEY HAVE OIL." The implication was clear—substitute the energy in coal for that in oil in major use applications.

The oil embargo, while resulting in higher fuel prices, also impacted the cost of natural gas. Even Alcoa idled smelting capacity at facilities using high-price natural gas because the cost of product at the then existent metal prices could not be justified. Fortunately for Kaiser's Chalmette smelter, its existing 30 year gas supply contract insulated it from such a problem. Also, by 1976, the Northwest's Bonneville Power Administration was already notifying its hydroelectric customers that during the following decade it would have to curtail the distribution of available power and also restructure rates in an upward direction.

The Coal Alternative

The aluminum industry's immediate reaction to the oil embargo was a somewhat hectic effort to design equipment that would permit the use of finely pulverized, powdered coal as a direct substitute for oil and gas in combustion operations, including turbines. This approach raised apprehensions about the potential for deleterious effects on subsequent aluminum product quality, especially in melting-casting operations.†

The earlier industry call for development of abundant U.S. coal and nuclear energy resource potential appeared to receive a favorable response for additional facilities by the late 1970s. However, the encroaching imposition of Environmental Protection Agency (EPA) regulations restricting atmospheric emissions was given impetus by the "acid rain" concerns in the eastern United States and Canada. A direct-result effect of the seemingly ever-restrictive emission levels is exemplified by the remarks made by the invited guest speaker at the popular Light Metals Division luncheon held in conjunction with the 1994 TMS annual meeting. The aluminum industry executive declared that the imposed restrictions "eliminated the use of a 300 year supply of coal in the eastern United States." This required the expensive transport of low-sulfur coal from the western United States to fuel the electric power plants that generated the supply for all the eastern-area electricity users—domestic, commercial, and industrial—at the inevitable higher costs.

The Nuclear Alternative

The long and extended expectation that the nuclear industry would supply a considerable portion of the U.S. electric power requirements has been a major disappointment. There was great promise in the late 1970s with the beginning of construction of five nuclear plants near the Hanford, Washington facilities. Investment bonds were sold to the public to finance the plants. The first plant was completed and operated to supply six percent of the state's power. The remaining plants, already under construction, were never completed because of unresolved environmental and safety questions. The unfinished plants, which resulted in severe financial losses for their bondholders, are said to be

* The primary reason cited by the 1950 government agencies for not approving Kaiser's preferred Northwest location was the shortage of Bonneville power in the area. In retrospect, this is somewhat perplexing when additional reduction plants were later built or substantially expanded in the area. Notably, these were at Wenatchee in 1952, the Dalles in 1958, Columbia Falls in 1955, Ferndale in 1966, and Goldendale in 1979, together with expansions at the Vancouver and the Longview facilities.

ten months after groundbreaking. This was an amazing construction record of achievement for that period.

The dedication ceremony and the first pour of metal involved the U.S. Director of Defense Mobilization, Charles E. Wilson, a national figure who, for the previous ten years, had been president of the General Electric Company. He and the indomitable and irrepressible Henry J. Kaiser, both of them with eye shields and asbestos gloves, pulled the crucible tilt lever to start the first metal flow from the new facility (Figure 3). Ultimately, millions of tonnes of aluminum would be produced during the plant's comparatively short lifetime.

The plant represented the first green-site endeavor of the Kaiser Aluminum and Chemical Corporation. The company invited 500 guests from around the United States to the dedication ceremony and related events. Eight airliners were chartered for the guests' transport. Present were the Louisiana governor, both Louisiana senators, the entire congressional delegation, church leaders, the president of General Motors, and essentially everybody who was anybody in industry and government. The mayor of New Orleans, deLesseps S. Morisson, declared "Kaiser Aluminum's new plant here is the greatest thing since the Battle of New Orleans in 1815." The young, not quite five year old Kaiser Aluminum, wanted to make a statement and it certainly did.

The planned 100,000 tonne, four-potline capacity was doubled to 200,000 tonnes and then to 275,000 tonnes and nine potlines before construction was completed.

The Chalmette Plant was built with the Söderberg cell technology (Figure 4), a decision that was later to be lamented. However, in the early 1950s, the Söderberg cell was considered to offer lower operating costs and a higher metal purity than the alternative choice, the pre-bake cell. Söderberg's notorious atmospheric emissions were not a concern at that time. The other U.S. producers, Alcoa and Reynolds, were also installing Söderberg cells in expanding their reduction facilities during that period. Indeed, Alcan in 1954 installed vertical stub Söderberg cells at its new Kitimat smelter in Western Canada.

While the Söderberg cells emitted copious fumes, no initial effort was made to collect and dispose of them. In 1956, a $6 million, 170-meter tall smokestack (Figure 5) was built and incorporated into the plant process to collect atmospherically dispersed cell emissions. By 1976, due to continuing regulatory restrictions, the stack became obsolete and was replaced by a dry scrubber system that cost $32 million.

Today, the 152 m smokestack still stands. This one-time symbol of industrial prowess now serves as a mounting tower for the area's burgeoning cell phone usage and is a source of revenue to the St. Bernard Port Authority.

THE DEMISE OF CHALMETTE'S PLANT

When the Kaiser Chalmette smelter was built, it produced its own electricity. The first two potlines used 11-cylinder Nordberg radial natural gas engines since these were immediately available during the hectic mobilization at that time. As subsequent potlines came into operation, the preferred steam turbines powered the electric generators. At the time of the smelter closure, 85% of its electric power was by the steam from a boiler plant fueled by the natural gas. While the pending expiration of a very favorable natural gas supply

obsolete by 2000 standards.

A further example of nuclear power problems is afforded by the Tennessee Valley Authority actions in shutting down its nuclear plants in the mid-1980s because of safety concerns. An additional power soberness was the experience at Canada's Ontario Hydro, the biggest electric utility in North America with extensive nuclear power production. By 1991, fully one third of its operating reactors were shut down, representing 5,000 megawatts of capacity, because of various safety concerns.

With all of the North American worries about nuclear power generation, it seems somewhat of an anomaly that France is able to derive 85% of its electric power needs from nuclear plant sources.

The Aluminum Industry's Public Posture

One of the industry's outspoken representatives with regard to the energy and regulatory issues was Cornell C. Maier, former president and chief executive officer of Kaiser Aluminum, who served as chairman of the Aluminum Association in 1976–1977. He was a forceful, direct, and frank critic of the U.S. energy crisis and the lack of policies associated with it. He publicly declared to all who would listen that the United States needed a comprehensive national energy policy and advocated the building of more plants for increased energy supply. His admonitions were not heeded. This is mentioned in reflective context because during the 2000–2001 energy crisis, one of the U.S. presidential candidates was espousing the very same needs for a national energy policy and more supply plants.

The 1970s energy crisis and the price increases associated with it resulted in an inflation scare. The federal government formed a Council on Wage and Price Stability to assess the problem. In 1976, the council issued a 241-page report of its findings. One of the topics addressed was the suggestion that the aluminum industry was too concentrated. This implied the ability to manipulate prices. The 1976 presidential campaign office seekers, Jimmy Carter and Walter Mondale, gave a pseudo-endorsement of this council's concern. It is interesting to speculate what that council's finding would be about the U.S. aluminum industry in 2002 with considerably less integrated producers as a result of mergers, acquisitions, takeovers, and bankruptcies. The same rationale can be applied to that other energy sector, the oil companies. With the oil embargo in the 1970s, there were anguished cries to break up the oil companies, while in 2002 the continuing consolidation of the oil companies is an accepted norm.

† The author had no reservations about the quality effect because of his earlier experience. His first aluminum job assignment was in a direct chill ingot casting plant employing 16 dual-hearth melting furnaces, all coal fired, where the products of combustion, including the fly ash, impacted directly on the molten metal in the hearth. Aircraft quality products subjected to restrictive ultrasonic quality specifications were successfully made there. It was a dirty, smoky operation, hauling in the coal, tending the stoker firebox, pulling and transporting the resultant hot ashes, but good quality metal was produced. Subsequent conversion to oil, and then gas, seemed like a gift from heaven from an operations standpoint.

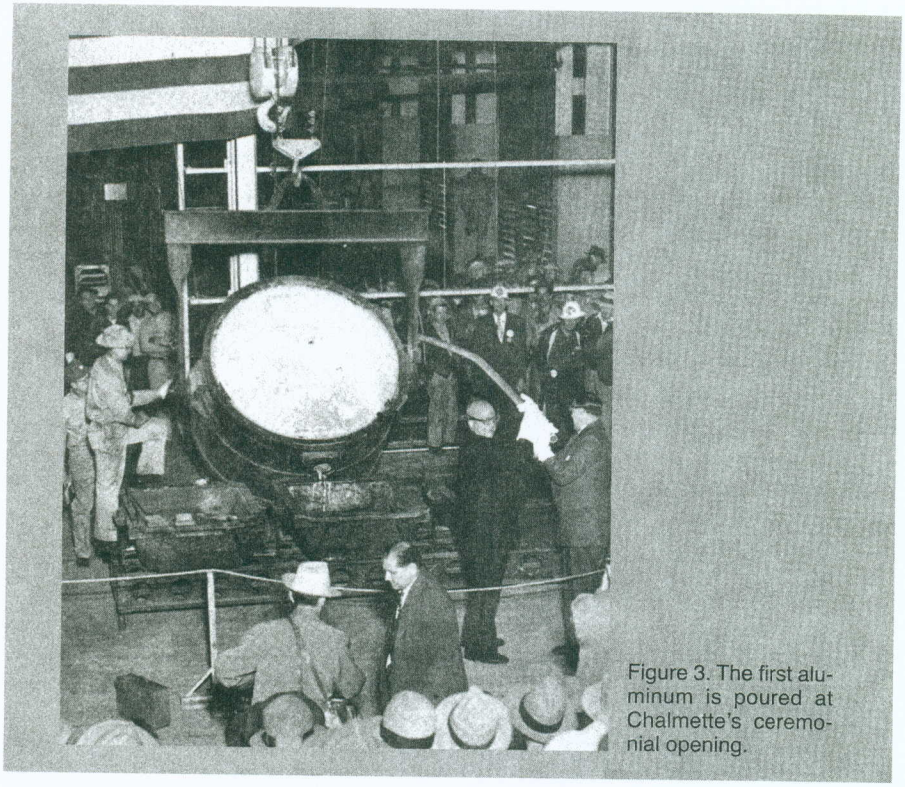

Figure 3. The first aluminum is poured at Chalmette's ceremonial opening.

contract was a major element in Kaiser Aluminum's decision to close the Chalmette smelter in 1983, there obviously were other considerations involved, including a generally rough economic period for the aluminum industry. Such business actions are never single-element, straightforward black and white decisions. Still, in relation to current events pertinent to energy supply for today's U.S. aluminum producers, the energy equation with regard to Chalmette's situation is intriguing. Certainly there was energy supply available to extend the contract, but the new rate would have been enormously, perhaps prohibitively, expensive. All the physical assets of the plant represented a replacement cost approaching $2 billion. Add to this the investment costs in a highly skilled work force. A few years remained on the natural gas contract, and Kaiser was able to negotiate a favorable supplier buyback of it for a very substantial sum of money.

One also wonders why Kaiser didn't install a coal-fired steam plant to replace the use of natural gas. Kaiser owned coal properties and cheap transport river barges could get the coal from the Midwest down the Mississippi River to the Chalmette riverside dock facilities. After all, in the 1900s Alcoa built aluminum smelters with adjacent coal-fired power plants at Warrick, Indiana, and Rockdale, Texas and they have operated quite successfully ever since.

Additional speculation concerns natural gas supply. In the mid-1970s, Kaiser Aluminum was a supplier of massive welded prismatic aluminum tanks, which were placed into the holds of specially built ships. The intent was to transport liquid natural gas (LNG) from Africa to the United States. The special ships were built, the aluminum tanks were installed, sea trials were conducted, but the commercial operation was never completed. From a technical standpoint it would seem straightforward to bring such a ship's cargo directly to the existent Chalmette slip (dock), which can accommodate several ships. (It should be mentioned for the readers' information that such ship deliveries of LNG into the harbor at the city of Boston have been routine operations for years.)

The Chalmette smelter, built with the latest post-World War II state-of-the-art technology in 1950, was barely 30 years old at the time of its closure, basically in the adolescent period of its projected life. By comparison, the Alcoa reduction plant at Badin, North Carolina continues to operate 85 years after purchase of the facility from the Southern Aluminum Company.

AFTER CHALMETTE

By the mid 1980s, the aluminum industry executives and the Aluminum Association were railing at the U.S. imports of both metal and fabricated products. There was a short-lived profitability respite in 1988, when smelter metal prices reached over $1 per 0.5 kg. But by the early 1990s, the massive metal imports from Russia had

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THE SOCIAL COSTS OF A PLANT SHUTDOWN

In 1989, the St. Bernard Parish Port District purchased the Chalmette plant site from the new owner of Kaiser Aluminum. Ongoing efforts have been directed at developing the property as an industrial park. As this article's photos illustrate, most of the old smelter's buildings have been demolished. After ten years of effort, there were in 2001 a total of 40 small enterprises employing a total of 500 people. This contrasts sharply with the 3,000 people who were employed when the aluminum smelter was operating.

Upon entering the site's administration building, a visitor immediately notices, behind the receptionist's desk, a very large glass-framed enclosure of a newspaper's front page and its accompanying story. The bold headline proclaims, "KAISER'S MEMORY HURTS." It vividly describes the various unpleasant conditions that existed a decade after the smelter's shutdown. A sub-headline proclaims "THE HUMAN COST" and details the ongoing struggles of workers who lost their jobs. The difficulties of such former direct employees is typically reported in the American media. But too often the plight of neighboring people and businesses is overlooked and unpublicized.

With regard to the energy-associated shutdowns of the aluminum smelters in the Northwest United States, the social ramifications extend well beyond the immediate employees who are out of work. In the summer of 2001, the author visited several of the Northwest plant community locations at Troutdale and the Dalles in Oregon, and at Goldendale and Spokane in Washington. Informal chats were held with non-employee residents about the shutdowns of the aluminum smelters. Invariably, their responses were complaints and laments about the unpleasant effects on the local economics, schools, businesses, and communities in general. There should be a way to establish a monetary cost of the cumulative secondary effects on locales where plant shutdowns occur, and this should be added to the primary costs of the plant closures themselves.

Binczewski *(Continued from page 26.)* a destabilizing effect on the worldwide aluminum industry and this required the intervention of the governments of aluminum-producing countries. This resulted in the signing of the Memorandum of Understanding (MU). Integrated U.S. producers actually reported financial losses during this period. By the late 1900s, the aluminum business was again languishing. Shortly afterward, major U.S. integrated producers, Reynolds and Alumax, relinquished control of their corporate entities and agreed to be acquired by Alcoa. In Europe, an attempted consortium of Alcan, Alusuisse, and Pechiney was thwarted by European antitrust considerations, which allowed only the Alcan-Alusuisse combination. Even now, other consolidations among European corporations are being discussed. While the influence of the changing energy component is seldom mentioned, its effect is present and substantial.

Meanwhile, the aluminum industry's incessant complaints about the edicts of the regulatory agencies and other regulations was given some apparent relief when the state of California deregulated its utility power industry in 1998. The subsequent business deal-making among energy brokers and energy providers created real or artificial shortages and enormous price increases of magnitudes ten times, or in some cases, 100 times. California was the primary victim and some businesses closed, several utilities were forced into bankruptcy, and power shortages in the state resulted in repeated power blackouts in many areas. It is beyond the scope of this paper to analyze this ongoing dilemma and it is mentioned because of its associated effects on the aluminum industry.

The associated energy shortages and the resultant high prices in the west provided an opportunity for the Northwest aluminum smelters to market their contracted Bonneville electric power to the highest bidders. This was an opportunistic move on the part of the smelters who saw more profit in shuttering the plants, laying off their workers, and selling their relatively low-cost contract power. In some cases, hundreds of millions of dollars were involved in the transactions. Such actions were entirely legal, but the ethics involved have been questioned. A public outcry was that the aluminum plants obtained cheap government power and profited exorbitantly at the expense of the taxpayers whom will bear the final bill. This is a public-relations disaster and will be mentioned time and again in future years, especially when new power contracts are negotiated and the evolving energy conditions are analyzed and reanalyzed over the years.

The state of California has had to borrow nearly $40 billion to obtain guaranteed energy supplies for its citizens and industries. Final costs will be borne by the taxpayers. It will be years before events associated with this occurrence are resolved. There are those who maintain that this is the result of a California legislature action and the state alone should bear the financial burden that has accrued. As simplistic as this may sound, the problems are quite profound and will involve the entire United States. It is well to remember that one out of every eight people in the United States lives in California. Also, the California economy is the fifth largest in the world, behind only the United States as a whole, Japan, Germany, and Great Britain. It will wield considerable influence in resolving the energy problems. By the end of 2001, there is already a surplus of electricity available to California, and the state is selling some of its expensively acquired contract power at a considerable loss. The building of some planned energy supply plants has been placed on hold.

Figure 4. The Chalmette plant potroom in August 1953.

Figure 5. The smokestack, added in 1956 to disperse emissions, now stands as a silent sentinel to a long-gone industrial giant.

CONCLUSION

The ironies and commonalities between the circumstances that led to the dismantling of the Chalmette reduction plant and the existing conditions in the aluminum industry's northwest U.S. plants is striking. Hopefully, this cumulative historical experience will provide the basis for avoiding such adverse dilemmas in the future.

George J. Binczewski is with S C Systems in Moraga, California.

For more information, contact G.J. Binczewski, S C Systems, P.O. Box 6154, Moraga, California 94570; (925) 284-5007; fax (925) 376-1654; e-mail binski@hotcoco.infi.net.