The North American Ferroalloys Industry at the Crossroads into the New Millennium-Challenges or Stumbling Blocks on the Road?

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Introduction

For the purpose of this paper, the definition of North America will comprise Canada, the United States, and Mexico, i.e., the three countries that are manufacturing certain types of ferroalloys and are furthermore bound together by the North American Free Trade Agreement (NAFTA). Obviously we have the predominance of the US industry in this geographic area but important silicon metal and ferrosilicon capacity has been existing in the east of Canada, all of it in the province of Quebec, as well as a considerable ferromanganese production down in Mexico, now concentrated in one single company, Minera Autlan.

1. Historic development of the ferroalloys industry in North America

In the now highly industrialized countries of the world, iron and steel has been a major base industry allowing the manufacture of industrial goods and the creation of an infrastructure for further industrialization. Over the centuries, steel production as per the traditional route, using coal and iron ore to convert it into hot metal and then further into steel of various grades, was focused on locations where one or the other of these two ingredients was available.

Basically the ferroalloys industry was a type of support industry to iron- and steelmaking but, instead of using cokified coal for smelting energy, it required electrical power for this purpose. Cheap electric power as a prerequisite for cost efficient production of ferroalloys was therefore one criterion determining the location of ferroalloys plants; reasonable distances to the main consumers or inexpensive transportation costs was the other one. Both favoured locations along river systems where hydropower could be generated and where barge transportation allowed access to customers.

The map of the location of the US ferroalloys industries shows the concentration along the Ohio-Tennessee-Mississippi river system as well as more recent locations in Alabama and in the west, in the states of Washington and Oregon, these latter ones built to service the much younger light metals industry. Figure 1, which was presented at the Infacon 7 meeting three years ago, still is the most up-to date information on plant locations.

The Mexican ferroalloys production is based on locally mined manganese ore and covers high and medium carbon ferromanganese, nitrided medium carbon ferromanganese, as well as silicomanganese in the states of Veracruz and Puebla, and in the Gomez Palacio plant in the state of Durango, reactivated at the end of 1995. Altogether, there are ten furnaces running that have a combined capacity of 200,000 mtpy.

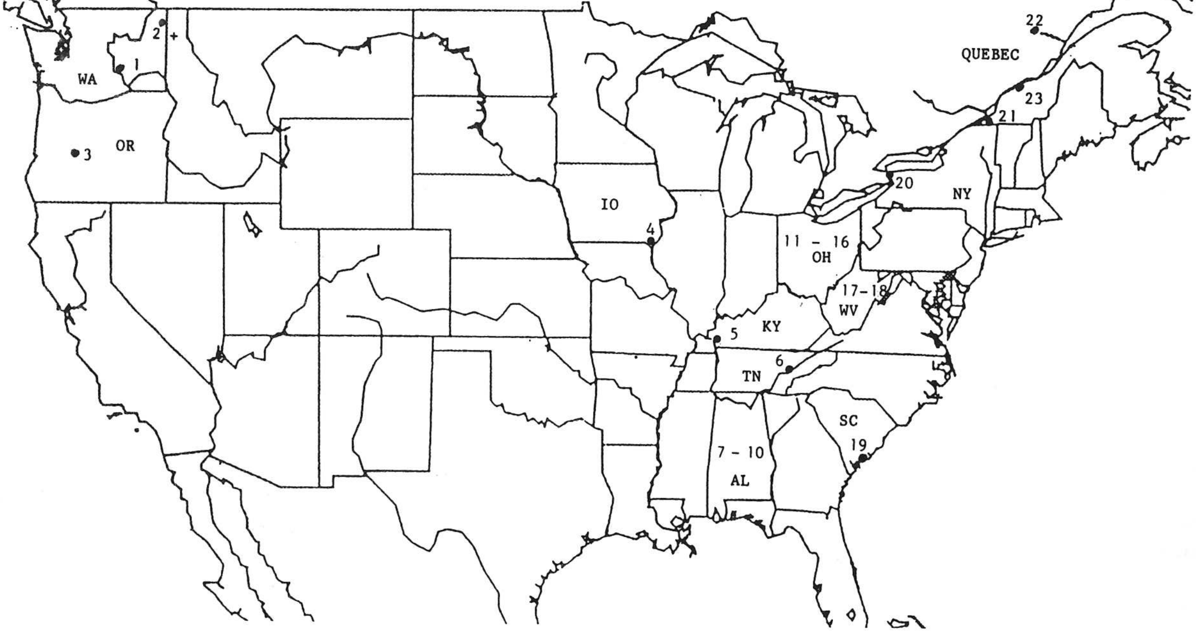
Canada's ferroalloys industry is located along the St. Lawrence and Saguenay rivers in Quebec and has been entirely based on hydroelectricity.

2. The ferroalloys industry of today compared to 1994 - no apparent change or many changes?

When we take another look at the map and the names presented three years ago, at the first view nothing seems to have changed. No new plant was built as greenfield investment, even though various projects were discussed when ferroalloys business was booming. Projects in the west of the United States and Canada have been studied as well as in the extreme east of Canada, but nothing got close to an investment decision. All these plans have common bases: the presumed or factual availability of cheap hydropower and the market prospective for growth in silicon metal. The increasing needs both in the light metal industry and in the silanes production for chemical and electronic applications have been the driving forces not only for temporarily intensive studies of new projects but also for further furnace conversions to silicon metal or brownfield additions.

Figure 2 covers more closely the area in which changes have occurred, and Table 1 lists up the changes and additions in the ferroalloys industry during the last three years, as become known to the author. Globe's Niagara Fall plant, NY, is now a mere silicon metal plant with probably the lowest power costs in North America. Elsewhere, as seen in Table 1, capacity increases or diversifications have taken place.

Figure 1 - Locations of the North American Ferroalloys Industry



1. Wenatchee, WA
2. Addy, WA +
3. Springfield, OR
4. Keokuk, IO
5. Calvert City, KY
6. Kimball, TN +
7. Bridgeport, AL
8. Lister Hill, AL +
9. Montgomery, AL
10. Selma, AL
11. Philo, OH +
12. Marietta, OH
13. Powhatan Pt., OH +
14. Ashtabula, OH (+)
15. Brilliant, OH +
16. Beverly, OH
17. New Haven, WV
18. Alloy, WV
19. Charleston, SC
20. Niagara Falls, NY
21. Beauharnois, QC +
22. Chicoutimi, QC
23. Bécancour, QC

Figure 2 - US Center - East Concentration of the Ferroalloys Industry

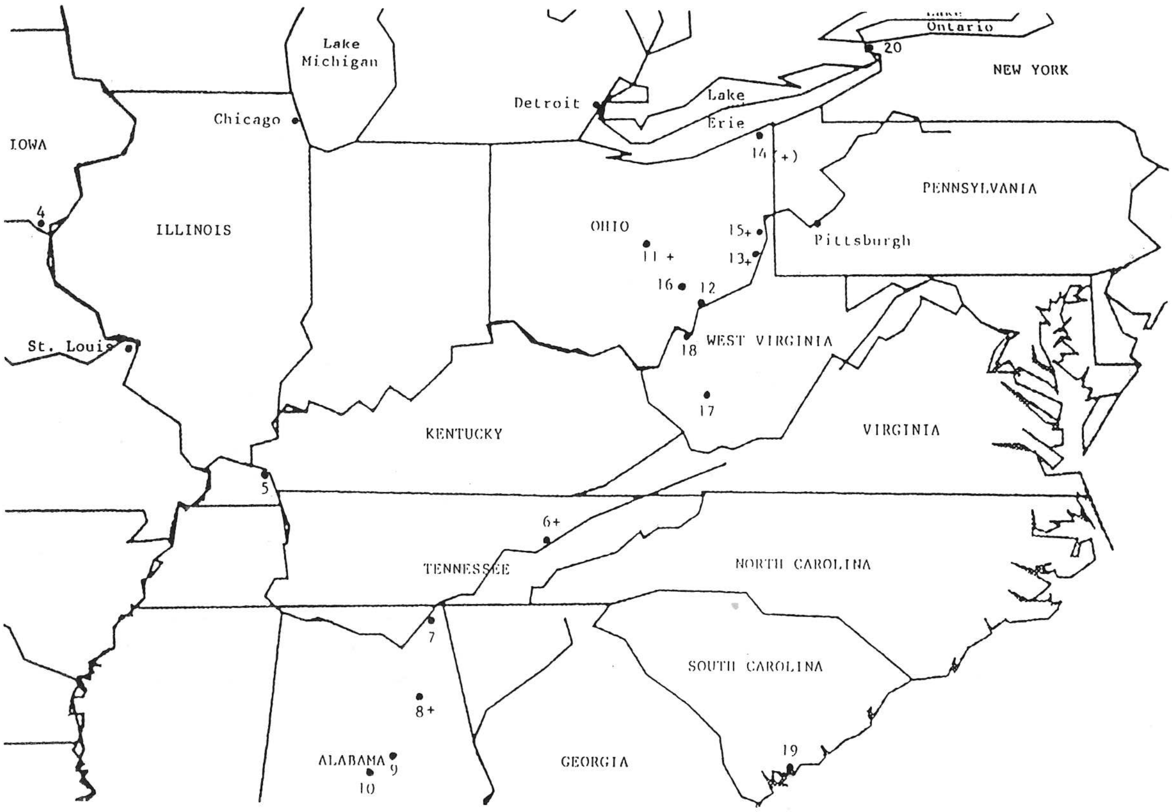


Table 1

Conversions, Reactivations and Additions of Furnaces in North America Presently in Operation or Under Construction

Company name	Plant location	Furnaces added or converted	Total MW	Added annual capacity (mt
Globe	Niagara Falls, NY	1 converted	21/24 MW	14,000 / 16,500 SiMet
Simcala	Montgomery, AL	1 reactivated	20 MW	13,000 SiMet
Elkem	Alloy, WV	1 (SiMet no.15) under construction	21 MW	14,000 SiMet
		1 (FeSi no. 9) in reactivation	18 MW	18,000 FeSi 75
SKW Metals & Alloys	Calvert City, KY	1 (FeSi proprietary alloys) reactivated	12 MW	11,000 / 18,500 FeSi proprietary alloys

Substantial changes, not visible on any of these figures, occurred in the last few years to improve the cost structure, particularly in silicon metal production. Most of these ameliorations were centered on the reduction of electrode consumption and/or electrode costs as well as improvements in power efficiency through closer furnace controls. A major technological change took place at SKW Canada, as it completely abandoned prebaked electrode utilization for the production of high grade silicon metal and replaced it by compound electrodes. Optimization of power transmission losses and electrode diameter appear to have a major impact on low specific electrode and power consumption. As a result of this, not only the metal output of existing capacities was boosted, but also all work to minimize yield losses definitely improved the cost structure of, in particular, the silicon producing facilities.

Granulation of silicon metal for the direct synthesis to methylchlorosilanes in the Rochow process is a further example of technological development successfully implemented at SKW Canada in late 1995. Meticulous control of many parameters, usually not regulated or monitored in conventional flat mold casting, is a prerequisite to avoid violent instantaneous H_2 combustion which can result in severe explosions. Compared to the working routine prior to silicon granulation, a fundamentally different attitude is imperative now for every single worker to ensure successful and hazard free operation, as he is responsible for controlling and adjusting molten silicon metal properties and manipulating liquid silicon containing ladles until its return to the furnace taphole in order to receive the next heat.

Modernization or upgrading of existing capacities to improve reliability of operations as well as the need to meet stringent environmental requirements resulted in substantial investments in plants to make them reliable sources of metal for more and more demanding consumers in the US and elsewhere.

Quality requirements have become increasingly rigourous, and this not only as regards chemical and physical properties of the alloy but also with respect to full customer service. Meeting delivery schedules or just-in-time (JIT) requests that allow the customer access to electronic monitoring of product transportation and ultimately even to production and quality reports of the producing plant in on-line service are just a few examples of the progress implemented when it deals with outstanding customer / producer relations. Obviously, only long-term relations and volume commitments justify and allow such cooperation. Certification of quality control like the ISO 9000 series will be and are the minimum requirements that most of the North American producers satisfy. It is my belief that these specific services cannot be offered by metal traders - and if they are offered, critical scrutiny may be wise!

3. Electricity deregulation and its impact on power costs in North America

Free market economies will essentially allow that demand and supply determine the price for a merchandise and that government regulatory bodies only interfere when abuse or distortion occurs or poses economic risks beyond reasonable control of any business player. In the light of this credo, the United States, and on its heels Canada, are moving into deregulation with the consequence that regional monopolies for power supply and thereby price dictates will discontinue. The costs of power generation, the network to transport power from the place of generation in high voltage transmission lines to substations, and the distribution from substations to the consumers will be the three elements making up future power costs. Access to transportation systems will be available under a set-up that separates power transportation from power generation. What will this mean to the ferroalloys industry?

There is no doubt that alternative sources to contract power will come up while at present, because of regulation, only one source exists in each case. Ferroalloys locations, however, have been historically close to power generating units or have contracted power from sources where generating costs are low so that even a substantial distance from the generating source still resulted in very favourable power costs. Obviously price dictates or substantial price increases will be more difficult to enforce by power companies under deregulation, but access to transportation lines may have power producers look into alternatives to supply elsewhere at better prices rather than to provide ferroalloys producers with electricity. It is the author's opinion that we will see changes towards lower power prices only in cases where local or regional power producers were not forced to make efforts to control their costs, and thereby charge high power prices. High load factors, as the ferroalloys producers usually guarantee to the power supplier, may be an attraction for producers who look for these base loads, but overall consumption even of big ferroalloys plants is relatively modest. So it is my expectation that deregulation will not bring lower power costs to North American ferroalloys producers but we may rather see a leveling of power prices on the continent in fully deregulated markets.

4. The impact of the Kyoto 1998 environmental protocol on the future of the North American ferroalloys industry

Because of the huge publicity given to environmental matters that affect or may affect the long-term living conditions on our planet, I am sure that since the Earth Summit Conference in Rio in 1992 at least, everyone is aware of the issue of global warming and CO_2 emissions. The protocol of the results of the Kyoto 1998 conference commits the signatories to undertake all reasonable efforts to cut back, by the end of 2005, greenhouse gas emissions to the level of 1990.

The ferroalloys industry has been and will be a substantial source of CO_2 emissions, the gas considered to be mostly responsible for global warming. This is a problem of the industry world wide but may be aggravated in North America by the fact that a portion of electricity used for ferroalloys production is generated by combustion of fossil fuels. Consequently any levy or tax like the heavily discussed CO_2 tax - if applied to all and any sources generating or emitting CO_2 - could hit twice those ferroalloy producers who depend on power from fossil fuels. If power costs should be driven up by such an action, the blow would be felt most in the south and southeast of the continent.

Alternative sources of power, free of a CO_2 levy, for existing industries to salvage plant locations could be a response and actually one of the few positive developments of the deregulation, always expecting that, in general, power costs will go up. Because of regulatory measures with respect to inevitable CO_2 generation, the major long-term threat to the North American ferroalloys industry will be a political move charging it with costs that may not be imposed elsewhere in the world. Once more this could become a burden for an industry that over the past 20 years enjoyed neither healthy bottom lines during most of that period nor political support and protection on government level.

From an economic point of view, a reasonable proposal deals with the establishment of a system of environmental bonds used to trade commitments or environmental liabilities on a market. I believe that this system can only be successful if applied world wide, but it is more than doubtful that such agreements are reached soon. Most likely, developing countries and those in economic transition will not follow such a pattern. Should the North American industry, as a consequence of such unilateral application of cost-driving regulation, find itself at an unacceptable economic disadvantage faced with the competition of other countries, efforts should be undertaken on the political level to get a just compensation in the market.

The North American ferroalloys industry has proven over the long run that its plants are keeping up at least with technological development elsewhere, and environmentally responsible operation is not strange to them. However, when it came to a situation where regulations were applied unilaterally thereby threatening the existence of the industry or manufacturing practices for specific alloys or metals, the industry was able to raise its voice. The most striking example was the issue of manganese vapours in the processes for the manufacture of ferromanganese, silicon manganese and, in particular, manganese metal. Undoubtedly the production technologies do not fundamentally differ for producers in the various places of the world so that any exposure to health hazardous vapours or other emissions would occur wherever such material is produced. The North American ferroalloys industry undertook substantial efforts and entered into huge amounts of costs to learn about and understand the risk hazards related to manganese. Restrictions and limitations threatening or affecting health of human beings should be established as international standards because there is no reason to believe that a North American worker needs to be protected and not exposed to a given amount of manganese vapour concentration at his workplace whereas, for instance, a worker in Russia or China can be exposed to it. This should become a field for implication of the World Health Organization (WHO) so that no distortion of competitiveness will result from substantially different standards for health and safety protection. I am fully aware that this appears to be wishful thinking for the time being, but a conference like this is the opportunity to focus on these subjects.

5. The "global village" of the ferroalloys business - trade restrictions or sanctions: GATT and the Uruguay Round

Supply and demand of ferroalloys in North America has been unbalanced since the major shake-out in our industry in the early 80s. Even limited growth rates for the typical steel- and foundry-related commodity ferroalloys can only be covered by additional imports from sources outside the continent. Whereas in the United States a substantial portion of the foundry ferrosilicon alloys and, in particular, nodulizers and proprietary alloys are produced domestically as well as some qualities of high purity ferrosilicon from a few sources, the remaining ferrosilicon producers like Aimcor, Keokuk Ferrosil, and American Alloys cover only a small portion of the needs of the steel industry. Imports of ferrosilicon in the form of FeSi 75 and also FeSi 50 make up for the deficit in the United States and Canada as well as Mexico.

Considering the situation of silicon metal demand and supply, the North American capacities correspond to the gross consumption of silicon metal for chemical applications, whereas silicon metal for the aluminum industry needs to be imported - this on a mere summary calculation basis! Figures for the demand and supply of ferrosilicon and silicon metal during the most recent years are shown in Table 2. It should be noted that these tables refer to the situation in the United States and Canada.

Because of the substantial deficit in ferroalloys production in North America, imports have always played a role in the past decades and will continue to have their place. As long as these imports were offered at market prices and in volumes commensurate to the actual needs, the United States had been the open market for fair competition between domestic producers and importers.

With the collapse of the communist system in the world and the rapid increase of ferrosilicon and silicon metal export capacities, first in Brazil and then in China, huge amounts of these products were offered at steadily decreasing prices, with probably the only target to cash in US dollars or other hard currencies for whatever could be sold. These practices caused price levels on the US market to collapse and consumers were only willing to conclude business at prices far below the level of full cost of even the most competitive North American producers. Because of this development, the US industry of silicon metal and silicon alloys had to take recourse to legal actions to protect itself against competition from various countries of the world where costs were either only partly known or pushed aside.

Democratically established rules and regulations distinguish fair from unfair trade practices and were the basis for imposing antidumping duties on individual producers of ferrosilicon and silicon metal in Brazil, Argentina, Venezuela and - lacking identification of individual producers or because of sales effected by export organizations - on China. Antidumping or countervailing duties will compensate for undue advantages foreign producers have and use to dump products into certain markets and cause injury to existing producers. It has to be clearly said and understood that these antidumping duties are not targeted to cover inefficient or high cost producing companies in the US but to protect the industry as a whole from imports at prices that do not allow to recover costs in the company or the country of production of such material.

It is not the place here to discuss whether or not the actual amounts of import duties assessed by the competent authorities are correct or contain errors, but I want to focus on two issues:

a) Antidumping measures are temporary measures, subject to certain revisions. These revisions have taken place and resulted from time to time in adjustments, lately allowing some of them to be reduced to zero.

b) Rules and regulations determined by international trade organizations, as the ones lately set in the Uruguay Round, fix a maximum length of time under which such restrictive actions can be conserved. Political opinion in the United States tends to put more and more pressure on legislation to have a final so-called "sunset review" before the turn of the century for all trade restrictions presently in place. In the interest of not only the North American ferroalloys industry it is to be hoped that progress in correctly assessing costs, in particular raw material including energy and labor costs, and granting work conditions in certain ferroalloys plants equivalent to the standard in mature industrial countries will lead to metal prices of such levels that both consumers and producers of these metals can live with and competition on a world-wide scale be re-established. As the representative of a producer who acts in a market without any restriction and exports most of its production, I want to encourage everyone to show responsibility and far-sightedness in his business practices so that protective measures will not be necessary beyond the turn of the century.

6. Energy availability in the global village - from glut to crisis, and its impact on our industry

Forecasts of the future development of our industry usually follow sectional patterns and are also biased occasionally by strategies of the main consumers. On a global basis, we all heard that steel and foundry products will see a growth of only 1 or 2% p.a., stainless steel may have a zero growth on the short term but will soon pick up again. Silicon metal is the only product of our industry for which ongoing - more than marginal - growth of consumption is forecasted. This goes hand in hand with an expected 3% p.a. growth rate of the aluminum industry and its increasing demand for alloys containing high silicon that mostly stems from a growing demand for lightweight individual or mass transportation equipment. As aluminum in turn is highly energy intensive and therefore requires low cost energy, efforts will be made in North America to develop further hydropower projects. The east and the west of northern Canada are areas where untapped hydropower could become available. However, environmental issues and also ecological influences will make development of new projects more lengthy and costly than those elaborated in the past. Obviously when such projects materialize, they can mean low cost power for a ferroalloy or silicon plant as well. On the other hand, ecologists become more active opponents of major hydropower projects which require widening of river valleys, permanently flooding useful soil and taking away living ground of even very poor people. It is my belief that a hydroproject like the Chinese Three Gorges would not be ecologically feasible in North America.

A study for the long-term energy consumption in the world reaching out until the year 2060 shows that while the total energy consumption will triple during that period, hydropower availability will almost remain constant until 2020, and all added energy consumption (50% increase over today) will come from fossil fuels.

This brings us back to power generation on the basis of fossil fuels - a source on which hardly any additional ferroalloy capacity will be based in North America.

Furthermore, it can be seen from the energy consumption graph that renewable energies on the world scale will not play any visible role even at the beginning of the next millennium.

Solar energy as one of the future sources of renewable energy will technically rely on silicon metal; and current growth forecasts are between 15% to even 40% per year, but their totals will still remain in the PPB levels of world energy consumption. For sure, electricity generated by solar cells will have a restricted application but may become more widespread in areas where no network for power distribution is or can be established. At first sight it appears bizarre that cheap energy is used to produce silicon and then to generate expensive electricity out of it, but we should not forget that this solar energy will be renewable and not cause any environmental burden. Major R&D work will be required to increase efficiency of energy conversion in solar cells. However, all this will not affect significantly our industry and its dependence on low cost energy sources but rather support the ongoing growth in demand for silicon metal.

7. Conclusions

North America's ferroalloys industry is not and will not become poised for capacity growth. The present industry, however, seems to have good chances to continue its existence in a competitive world. Further brownfield expansion may occur as the importance of a solid and well-established operating know-how and routine for a reliable exploitation of investments has become obvious. Imports, in particular in the silicon alloys field, will have to cover most of the additional customer demand for alloys and metals. Transportation costs of suitable raw material to the producers as well as distribution costs from there to the customers will gain in its relative importance - and this will be valid ultimately for electricity, too! Substantial emphasis will have to be laid on further improvements in the yield of energy utilization to smelt metals and alloys. Heat recovery systems as well as low temperature energy conversion need to be developed to allow the industry to produce more metals and alloys without increasing its total energy demand.

Pressure on our industry to increase its environmental friendliness will continue, and recycling or reprocessing by-products or residuals will become more and more important. This will require efforts in process development and costs for R&D. It is here where I foresee growing problems: qualified engineers and chemists devoted to our industry are more and more difficult to find and recruit! The industry has not only to think about its future but make itself visible and, hopefully, even attractive to young talents. To achieve this, we need to further develop it and have it play its part in the industrial world.

In concluding this contribution, I have to mention that my forecast is based on macro-economic factors but, at the same time, I must admit that other criteria of micro-economic relevance, i.e., considering individual plant or political strategies, might come to some different results.