Panel Discussion

Factors Affecting the Future of the Ferrochromium Industry

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THE PANEL

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Dr H. J. R. Way, Johannesburg Consolidated Investment Company Ltd, South Africa

Mr L. A. Kok, Southern Cross Steel Co. (Pty) Ltd, South Africa

Mr W. H. Magruder, Union Carbide Corporation, United States of America

Mr R. Björklund, A/B Ferrolegeringar, Sweden

Mr H. Franke, Gesellschaft für Elektrometallurgie m.B.H., West Germany

Mr P. E. Streicher, Amcor Management Services (Pty) Ltd, South Africa.

The Chairman announced that several questions had been suggested, and he proposed putting the questions to the Panel as he was convinced that the audience would listen with interest to their answers and discussions.

If there was sufficient time available, he intended asking members of the audience to make brief comments on their views after the panel had concluded their discussions. He then proceeded with the first question received.

Question 1

There have been indications that the installed capacity of ferrochromium plants throughout the world is considerably in excess of production, possibly up to 50 per cent. Is this believed to be the case, and, if so, what should the future plans of the industry be?

Mr Kok

In considering the question of the utilization of installed capacity and as an introduction to this discussion panel, I would like to refer, very briefly, to a few statistics. According to published figures, in 1973 the total installed capacity was approximately 2,69 million tonnes per annum. Similarly, based on the latest published statistics, the production for the year 1973 was estimated at 1,68 million tonnes, indicating a utilization of between 60 and 65 per cent. To throw further light on the question of utilization, two other very important factors should be considered: firstly, the balance between the net import figure and the net export capacity, and, secondly, price trends from 1951 onwards.

The net export capacity and net imports should be in balance. The calculated figure of the available net export capacity is 246 000 tonnes for 1967.

The following totals are the published net import figures in tonnes for the period 1967 to 1972:

1967	173 000
1968	194 000
1969	234 000
1972	23 000.

Comparison shows that net imports are consistently below the net export capacity.

To the best of our knowledge, the production of the net exporting countries has not been cut back significantly in that period. Our own company experienced a build-up of high inventories, the value of which ran into several millions of Rands.

Price trends also confirmed under-utilization of installed capacity. *Metals Week* prices for U.S.A. local production have been taken throughout, and a close correlation was found in the price trends for low-carbon, charge chromium, and high-carbon. Because of the relative importance of high-carbon, I would like to refer briefly to the price trend for high-carbon ferrochromium only.

The price per pound of contained chromium was 25 U.S. cents in 1951. It increased to 29,5 cents in 1958, dropped back to 25 cents in 1962, and dropped further to 19 cents in 1965. The price then climbed to 28,7 cents in 1970 for a very short period, and then fell back to 23,7 cents in 1972. The oversupply position as indicated by the imbalance between imports and exports and as also reflected in the price history certainly offered no incentive to producers to improve the utilization of existing capacity, and any increase in production could only aggravate an already unsatisfactory position. A definite change in the supply-and-demand position was noticed during the last quarter of 1973, a change that was accelerated by the effects of the recent oil and electric-power shortages. Prices reacted almost immediately. *Metals Week* prices for the second week in April reflected, for domestic production, the following increases:

Low-carbon ferrochromium to	47 cents
Charge chromium to	28 cents
High-carbon ferrochromium to	32 cents.

Looking at the question against this background, it is clear that installed capacity throughout the world is in excess of production and that there was no incentive for producers to increase utilization, because it would only have aggravated an already unsatisfactory position, which lasted from 1964 to the third quarter of 1973.

Continued oversupply or shortage leads to unsatisfactory conditions for both consumers and producers.

Prices to producers have been low for many years. Referring to the price history of high-carbon, and ignoring the very low trough from 1965 to 1969, the price increased by only 7 cents over 24 years – from 25 cents in 1951 to 32 cents in 1974. Taken as a percentage of the price in 1951, the average increase in price was less than 1,2 per cent per annum. Considering increased costs to the industry over that period, tribute should be paid to the industry for ingenuity in combating the effects of inflation through improved productivity.

It is also not satisfactory for consumers to have either feast or famine. Consumers have been having a feast for a very long time, resulting in low prices to producers and no incentive to improve utilization or capacity.

In answer to the question of what the future plans of the industry should be, it is clear that every effort should be made to ensure a better balance between supply and demand. Consumers should give, to the best of their ability, indications of their expected growth in demand, and it is the duty of the producers to ensure that the demand can be met. Expansion must, however, be in an orderly manner so that a reasonable balance between supply and demand can be maintained. The key, therefore, to a bright future lies in good cooperation between producers and consumers as well as between producers themselves.

Mr Streicher

The point I wish to make, although not directly connected with furnace capacity, has a considerable bearing on the supply-and-demand situation of ferrochromium to the stainless-steel producer. The availability and price of stainless-steel scrap at any point in time have a very marked influence on the demand for ferrochromium. As we are concerned with the fluctuating demand for ferrochromium, we should also consider the fluctuating demand for stainless steel. In both cases it is either a feast or a famine. In my opinion, the fluctuation in demand for ferrochromium is caused by two factors:

(1) stainless steel is unfortunately still considered a luxury article, with the result that, as soon as the economy goes down, the demand for stainless steel drops rather sharply, and, with it, the demand for ferrochromium, and
(2) the availability of stainless-steel scrap, which determines the requirements for new chromium.

I intend to deal brieflv with this second factor, i.e., the availability of stainless-steel scrap. Whenever scrap is in plentiful supply, prices are low and then naturally consumers tend to use a very high percentage of scrap. Two years ago, when I was in the U.S.A., producers were using up to 80 per cent scrap in the manufacturing process, and the result of all this was that the demand and price for ferrochromium were very low. Obviously, the opposite also applies, and I think that this is what is happening today. I believe that it is in the interest of both the stainless-steel and the alloy producers to stabilize the supply-and-demand situation. In this regard, it might be of interest to the delegates present here to know how we regulate the supply of steel scrap in South Africa. Although I am referring to steel scrap, it could equally apply to stainless-steel scrap. At the moment, we have, in South Africa, only one stainless-steel producer, with the result that this producer has no specific problems as regards stainless-steel scrap.

All the main consumers of scrap here are organized in a company. We grant you that this solution might be against the Anti-Trust Laws in America. In any case, be that as it may, the consumers formed a company called Ferrous Scrap Distributors, and the main function of this company is to buy all the available steel scrap in South Africa for distribution to its shareholders. This company is a non-profit company. We naturally have problems in regard to the allocation and the respective quotas of the members. The prices paid to the suppliers of bulk scrap are negotiated in the same way as we negotiate the terms and conditions of employment with the trade unions in this country every so often, i.e., we haggle about it and we finally arrive at an agreement where factors like inflation, increased cost of production, etc., are taken into account. Whenever necessary, this whole procedure starts all over again. I can give you the assurance that this system has worked extremely well for the past fifteen years over here, and I wish to suggest that the same system be considered in your countries as well.

Dr Way

There are indications that the world demand for ferrochromium increased considerably in 1973 compared with 1972, with increases in the U.S.A. varying from 34 per cent for high-carbon to 17 per cent for low-carbon ferrochromium and 23 per cent for ferrochromium—silicon, with a weighted average of 26 per cent for the total. If these increases are taken as a guide, the world consumption and demand in 1972 and 1973 must be revised upwards – and very considerably. It is also expected that U.S. capacity will fall owing to the closure of some plants and cut-backs in others due to the enforcement of environmental-pollution standards. It is also understood that shut-down of smaller plants is proceeding in West Germany and Japan. With this new trend, utilization of the Western World's capacity can now be estimated as follows:

1972 about 53 per cent
1973 about 63 per cent
1974 about 87 per cent
1975 about 93 per cent,

with the consequent closing of the gap of excess capacity over demand much earlier than anticipated.

Mr Magruder

I would like to make one comment about excess production, capacity, and closing down of facilities. It seems as though, with the tightening of the market, there have been a number of people reconsidering the question of whether or not to close down facilities, and, with prices escalating as much as they have, there is some indication that the current pricing and the current shortage are sufficient to cause people to put pollution-control equipment on what are really antique facilities, so that factor also enters the question.

Question 2

Will the progressive installation of larger smelting furnaces effect such a saving in the costs of production that the smaller furnaces will be closed down and thereby help to reduce the gap between capacity and utilization?

Dr Nasu

I would like to make some comment about our situation. In 1960 in Japan, there was only one ferrochromium furnace of 20 MVA and the others were less than 10 MVA, and the total number of furnaces was 67. Now, in March 1974, we have 18 furnaces larger than 10 MVA, including one 40 MVA, and 15 furnaces smaller than 5 MVA, compared with 54 in 1960. It is clear that 39 furnaces smaller than 5 MVA have been closed down in these 14 years. As far as the consumption of electricity per tonne of ferrochromium is concerned, it now averages 3200 kWh (which includes the prereduction process), compared with around 6000 in 1960. This means the productivity has increased and production costs were very much reduced, and I personally had the same experience in our plant.

The Chairman commented that it appeared that larger furnaces would eventually replace smaller furnaces. He then asked Mr Franke if he would like to comment on this aspect.

Mr Franke

First of all, I should like to propose that, when talking of furnace size, one should name the MW supplied rather than the MVA installed, because this sometimes leads to misunderstanding. Coming to your question, I would like to say that, in our experience, there seems to be a borderline when exceeding 20 to 25 MW depending on whether the product is high-carbon ferrochromium or silicochromium. When exceeding this borderline, a number of technical difficulties crop up, e.g., induction currents in the hood and in the busbars, and higher attack on the mechanical parts of the furnace owing to high heat concentration. From the economics point of view, in our experience one cannot expect to save energy per tonne of product when using larger furnaces, but one has to expect greater maintenance and investment costs. All one can save is labour, but I think that the savings in labour will be made up by the points I have just mentioned. In addition to this, smaller units are more flexible in the production. Besides, it should be taken into account that the size of a furnace can influence the price of the electric power, namely in the case of a standstill, which cannot be avoided in practice. In Germany, for example, the costs of maximum power demand amount to about 50 per cent of the total power costs. Therefore, the costs of a standstill increase with increasing furnace size.

Mr Magruder

I should like to reinforce what Mr Franke said to a degree, and in so doing I should like to quote some high-carbon ferrochromium costs from some of our furnaces in past years in the United States. I go back to practically the turn of the century in terms of the origin of the first one. We had a 2 MW furnace in Holcum Rock, Virginia, and my costing is for 1950. The high-carbon from that unit was 12c per pound of chromium. At the same time we had 4 MW capacity in another location (Glen Ferris, West Virginia), and high-carbon ferrochromium from that plant (which had two 2 MW units) was 11 cents – one cent less. At the same time, at our Alloy plant, we had a single-phase 4MW unit, and the cost there, where the furnace was in a department with another four furnaces, was 10 cents. In another department in the same plant, we had a 12 MW unit, and the cost from that was 9 cents; so we see a progressive decrease in cost as furnaces get larger and larger. If we come into the early seventies and look at another plant, we have a 12 MW unit that is similar to the 12 MW at Alloy, and the cost of that unit was 15 cents. All the earlier units had prebaked electrodes, and this one has self-baking electrodes. At the same time, a 30 MW unit in the same plant in the same department was producing chromium at 14 cents. The point is that we seem to have just about reached the ultimate in terms of cost reduction as associated with the increase in size of furnace, and I think it verifies your point to a degree.

The Chairman, asked Dr Nasu to discuss his experience on furnaces of various sizes and to express an opinion on what he would consider the optimum size of a furnace.

Dr Nasu

As to the optimum size of furnace for the production of ferrochromium, it is very difficult to say what it should be. In my private opinion, if you can use proper hard, lumpy ore or well-pelletized or sintered ore, the bigger furnace would be better than the smaller one. According to my experience of the operation of 25 and 15 MVA furnaces, the 25 MVA furnace can be operated with as much as 35 per cent fines and 65 per cent lumpy ore as the burden. In the 15 MVA furnace, we can operate with 100 per cent minus 5mm fines, if the permeability of the burden is well controlled. Some types of ore have less permeability and have to be mixed with other ore. If the ore is properly prepared, the bigger furnace (40 to 50 MW) will be better, as mentioned before.

Mr Streicher

I wish to discuss one of the points raised, namely, the matter of labour costs. In our experience and under South African conditions, we find that labour cost forms about 10 per cent of the production cost of ferrochromium when using substantially big production units. Therefore, even if the labour cost doubles itself, it will not make a very significant difference to the production costs. The cost of electricity in South Africa is arrived at in more or less the same way as explained by Mr Franke, i.e., 50 per cent maximum demand cost and 50 per cent for unit cost. We at Amcor came to the conclusion that a furnace of 48 MVA is more or less the optimum size for the time being.

Question from the audience

One thing that has struck me all the way through this conference, although I am not a ferro-alloy producer – long way from it – is the remarkable difference of views about burden preparation. We have, on one hand, the Japanese, who have gone very far in this matter with very complete burden preparation, and a lot of friends here in South Africa who seem to have hardly started. May I ask the views of the panel on this question: Who are right and why?

Mr Streicher

The matter of burden preparation is entirely a matter of economics: it is a function of the price of the ore and various other factors. In other words, if it did not pay you to prepare the ore, you would not do so.

Mr Kok

To add to what Mr Streicher has said, the economics are extremely important, but so also is the availability. In answer to the question, we would say that we are now, in South Africa, entering the era where fine ore will have to be agglomerated. Until recently, our requirement was mainly for fines to produce low-carbon. As the demand for low-carbon fell, we had to change to charge chromium, which increased the demand for lumpy ore. Our reserve of lumpy ore is limited, so we shall have to start using fines for submerged-arc furnace operation, which will require treatment prior to use.

Question from the audience

I should like to go back to the question we were discussing just a minute ago about the size of the furnace and the effect it has on efficiency. Until I listened to these comments this afternoon, I was of the opinion that a larger furnace would give better power utilization, e.g., the kilowatt hours per tonne of a particular grade of ferrochromium produced in a large furnace would be less than the kilowatt hours per tonne of the same grade produced in a smaller furnace. So I should like to ask the panel to discuss it for me.

Mr Franke

The questioner's remark is correct if one compares, for example, a furnace of 4 MW with one of 12 or 15 MW. But in comparing a furnace of 15 MW with one of 25 MW, according to our experience, the saving of power is negligible.

Question 3

Is there still a surplus of plants suitable for the production of low-carbon ferrochromium in which the capital investment is virtually written off so that the alloy is being produced at low cost and with a higher margin per unit mass of chromium? May this be contributing to the present position of low-carbon production being about 50 : 50?

Mr Björklund

First of all, I doubt whether there is a surplus of plants producing low-carbon ferrochromium and, secondly, I do not think that the question of whether they have been written off or not enters the calculation of the ferro-alloy producer. I believe there is another thing that is mainly responsible for the present demand pattern for chromium alloys, whether it is 50:50 or 60:40, which I think we can leave for the time being. Personally I think that today it is rather 60:40. In my opinion, we come back to the question of the cycles in the steel industry, as well as to the question of how many installations for new steel-making processes have been made to date. We must not forget that, in the world as a whole, not just in one or two countries, there are still a considerable number of traditional electric-arc furnaces producing stainless steel, and, of course, these all require the traditional ferro-alloys in the form of not only low-carbon ferrochromium but also chromium — silicide. If we take the present situation, where we have a steel boom, and where we have, unfortunately, also quite a few breakthroughs in large production units producing high-carbon ferrochromium, the steel-makers will just have to take what chromium alloys there are available. At this particular moment, I can tell you, being a low-carbon-ferrochromium producer myself, that, if I could buy another 30 000 tonnes of low-carbon ferrochromium for this year, I could sell them at a profit. Scrap was mentioned here earlier. Of course, scrap is of absolutely decisive importance when we judge these matters. For some reason one often forgets this, but one must put oneself in the position of a steel-maker. The man who is going to make steel looks at the scrap as his absolutely cheapest source of raw material — and there the whole thing starts. The availability of scrap is, I would like to call it, the basis of all these considerations, and, to make a long story short, I would therefore say: 'No, the old plants that have been written off do not play any decisive role or any role at all. It is the famous raw-material cycle and the installations in which the steel is made today that guide the line.'

The Chairman remarked that control of stainless-steel scrap appeared to be very important to the ferrochromium industry and asked Mr Streicher if he would like to comment.

Mr Streicher

I think one should consider, as Mr Björklund pointed out, that the supply of chromium alloys should be seen together – this means that each chromium alloy has a specific function. In our experience, and in our assessment of the situation, we believe that the market for low-carbon will continue at a more or less constant rate, as at present.

We also believe that we can expect a slight growth in the demand for silicochromium, in view of its use as a reducing agent for chromium oxide in the slags formed in the newer stainless-steel processes. Our belief is that the demand for the cheapest possible chromium, i.e., the lower grades of charge chromium, will increase substantially in time to come.

Dr Nasu

In Japan, the production of low-carbon ferrochromium and high-carbon ferrochromium is not 50:50 but, as I explained during the presentation of my paper, high-carbon ferrochromium is about 75 per cent and low-carbon about 17 per cent and silicochromium is about 8 per cent (in 1973). In Japan, stainless-steel production has increased very rapidly in the past ten years, and we ferrochromium producers were obliged to install new furnaces that were all for the production of high-carbon ferrochromium, including charge chromium, owing to newly developed stainless-steel melting techniques.

Mr Kok

The balance between supply and demand for chromium alloys is also a very important factor. If there is a shortage of charge chromium, consumers are forced to use any chromium that they can get. As I said in my introductory remarks, we have moved out of the period of complete oversupply into a period where chromium is in short supply. Demand for low-carbon as a source of chromium has therefore increased, and will remain high until cheaper sources of chromium are again available.

The degree of utilization of older furnaces will be determined mainly by profit margin. The production cost of low-carbon is high compared with the cost of charge chromium, even though the amount of depreciation may be negligible, and I believe that the level of low-carbon production will be influenced primarily by price, which in its turn will be determined mainly by the balance between supply and demand.

Dr Way

I haven't very much to say on this point, but I should like to remark that the ratio at the moment is 64 per cent in favour of high-carbon ferrochromium for Western World consumption. This should also be about the same for Western World production. This ratio varied from 33 per cent in 1950 to 23 per cent in 1957 and now stands at 64 per cent for 1973. I suppose it is inevitable, in South Africa at least, that, as new capacities are established, it is highly probable that the ratio for production will swing in favour of high-carbon ferrochromium.

Mr Franke

I refer to the remark of Mr Björklund that whether an installation for low-carbon ferrochromium production is written off or not has no influence on the price. However, I would never encourage anybody to invest money in an additional new installation.

Mr Björklund

May I just round that off by saying that all the comments in this respect make me very reassured, because it does not seem that there is going to be any new capacity in low-carbon ferrochromium, and the few of us who are still old-fashioned enough to make it will soon be the only ones. Consequently, since there will always be some requirements, I think we shall have a rather secure future.

Question 4

In view of the more stringent requirements under anti-pollution laws, how applicable is present equipment to existing plants? Will the installation be prohibitively expensive?

Mr Hooper

Although the high-carbon-ferrochromium furnaces are no such polluters as the furnaces for other products, no doubt pollution-control regulations in most countries will enforce the installation of gas-cleaning equipment, and this is, of course, going to be very expensive. It will certainly affect the smaller and older furnaces because the high capital cost of pollution-control equipment will probably not be justified. Then, there is the matter of which type of equipment should be installed. Presumably, if it is to be a covered furnace, there will be wet gas-cleaning equipment. This could cause problems in South Africa if coal is used as a reducing agent, because it could cause problems in the venturis; so I think that, for the smaller furnaces, the installation costs could well be prohibitive.

The Chairman said that it appeared that many of the smaller furnaces would have to close down. He asked Mr Franke to comment.

Mr Franke

The amount of dust created by a furnace operation depends very much on how the furnace is operated and how the mix is prepared. You may have heard that we have installed a pelletizing plant in our Weisweiler works. Before we had this pelletizing plant, the mix for the production of high-carbon ferrochromium contained about 25 per cent of fine ore. At that time, the dust content in the off-gas amounted to 200 to 300 mg/Nm^3. Since the mix is 100 per cent lumpy, because the fines are pelletized, we have only 70 mg/Nm^3 dust in the off-gas, which is below the limit set by the government. This means that gas-cleaning equipment is not necessary. To come back to Mr Streicher's remark, that burden preparation is entirely a matter of economics, one should consider that, by preparing the ore, all expenses for gas cleaning can be saved.

Mr Streicher

I wonder whether we should not ask our overseas visitors, particularly those from the older alloy-producing countries, to tell us exactly how many furnaces have been closed down because of this particular problem. We should like to know to what extent the shortage of ferrochromium and other alloys was caused by the insistence of the authorities that producers should have proper gas-cleaning facilities.

Mr Björklund

I can tell you that, as far as Sweden is concerned, so far we at Ferrolegeringar have closed down one furnace out of six because of this, and Airco, our neighbours at Wargön, have closed down their ferromanganese operation also for this reason. I cannot tell exactly how many furnaces are involved, but they made medium- and low-carbon ferromanganese. I would like, however, to comment on what you said at the end of your question: whether the cost of this installation would be prohibitive. Let me give you an example from our own plant in Sweden. We have a 30 MW furnace in which we make chromium—silicide. We produce about 37 to 38 thousand tonnes per year. We have an electric precipitator of exactly the same type as Mr Lømo showed us on the Fiskaa ferrosilicon furnace this morning. We had the same trouble with the electrodes as they have, but we have overcome them. The investment cost for this filter is 5,6 million Swedish crowns, which is slightly less than one million Rands. The production cost per year is 900 000 Swedish crowns, which is more than R120 000 per year. The end result is that we have a cost of 25 Swedish crowns per tonne of produced chromium—silicide, or 1,6 per cent of the total cost for this precipitator.

The Chairman asked whether Mr Magruder had any information on American furnaces that had closed down because of antipollution costs.

Mr Magruder

I can give you some general information, and I think, if we really want to get specific, maybe Dr Person would be able to comment, but I should like to have a go at it generally to begin with. We and other producers have tended to close down some smaller facilities as we have installed big ones. We tend to build within an existing furnace room, for example, and, as we install a 30 MW furnace, we probably make two 15 MW ones obsolete. That is going on all the time. Specifically at our Ashtabula, Ohio, plant we have what we hope will be a 55 or 60 MW 50 per cent ferrosilicon furnace, which is due to come on-line probably between 15th July and 1st August. At the time that comes on, we would expect to phase out a 12 to 13 MW unit in the same furnace room just because we cannot handle all of the product if we keep it running. That is fairly typical of what happens. But to get a little more specific about actual closures. . . .

We have all had to file, with our various State Air Pollution Agencies, plans to get into compliance by mid-1975, and I think we, and other producers, when we filed these plans some years ago, were inclined to look at the phase-out of units that were rated at about 10 to 12 MW as a logical course of action. The present tight market situation and the very, very rapid escalation in construction costs is causing reconsideration; so I think the current situation is that most of these units are still operating. Not too many of them have been shut down. They may be operating under pollution control, or they need to have a plan for pollution control filed and a date to achieve control. I think probably there is consideration of putting the money into pollution-control equipment on some of these somewhat marginal furnaces. I could not tell you what an individual company would be deciding to do at this time.

The Chairman asked Dr Nasu what the position would be in Japan with respect to the shutting down of furnaces because of pollution control.

Dr Nasu

In Japan, nearly forty small furnaces were closed down on account of production cost, and not only production cost but also the cost of pollution control, which is very serious. We in Japan have a standard of 400 mg per normal cubic metre, but usually we have to make some effort to reduce this to 10 mg per normal cubic metre. If such a facility were installed, the expense of investment would be nearly 30 per cent of total investment, and the running cost about 3 per cent of the total production cost. It is very difficult to install dust-collecting equipment for every small furnace. We are now operating a large number of dust-collectors, mainly bag-filter systems, and venturi scrubbers for the closed furnaces.

Mr Magruder

The Ferro-Alloy Producers' Association in the U.S.A. reports monthly on power consumption, and, if we look at the gross figure, we see an increase over last year, for example, of some 10 per cent. So we are not losing our power integration; but this is a combination of new furnaces coming in and idle units being brought back on, so it is hard to tell you exactly what it means.

Mr Streicher

We have just completed the planning of a bag-filter system for our ferrosilicon furnace at Witbank. We find that, working out what we might call the 'dis-economies' of the scheme, for this furnace which is producing 25 000 tonnes of ferrosilicon per year, the cost for the filter system, including working capital, amounts to R2,25 million. With a production of 25 000 tonnes per year, and allowing interest on the capital as well as accepting a rather low profit margin on the moneys invested, it means that the ferrosilicon is going to cost the consumer at least R40 per tonne more than at present. I would like to know what the experience of our colleagues is in this regard.

Mr Magruder

I believe that our experience is quite similar, and the current situation, with very rapid escalation in raw-material prices, construction costs, and the like, has tended to drive home to us that current pricing does not come close to allowing us to get the type of return we need for these new modern installations with pollution control. I think we are living in a false world based on the fact that we had a lot of facilities that were virtually written off.

Mr Kok

There is considerable significance in the fact that many replacement units have been built in the States. There will not be a dramatic downturn as a result of smaller furnaces being taken out of commission. Capital-cost structures also have a major influence on decisions of whether older units can be closed down or not. This information re-emphasizes to me that we, as producers, when looking at the future of the industry (with the emphasis on the word INDUSTRY), have to look very closely at what is expected by way of the growth in demand and how to tailor our production to meet that demand and stay in step with it. If we do not stay in step, we shall be faced again with a turndown in prices, which makes it even more impossible to justify the erection of larger furnaces with cleaning equipment, ensuring a reasonable return on investment to our shareholders.

Mr Björklund

If we have some more time for this question, and since I made sure that Mr Boegman would not be here this afternoon, I take the liberty of trying to scare the life out of you here. You don't know yet in what a fool's paradise you are working. In Sweden we have a law according to which every ferro-alloy plant (also other industries, e.g. cement and so on) has to have a permit to continue operating. A new installation will also have to be subject to the permit. This permit is received after very thorough study by technicians from the authorities, who measure every emission and set up values. These values are sent to a court, and at a real court procedure the company is questioned, and either 'condemned to death' or set free. If you are set free – as we were, I am happy to say – it is very often on condition that 'by that time you have to improve this' and 'by that time you have to do that'. This refers to the whole ferro-alloys industry – to all new investments and to existing equipment. I just thought that I should mention this and that the guiding values that are set up are hard, but so far we have been able to cope with them. To give you an example, we are just now reconstructing a chromium—silicide furnace for the production of high-carbon ferrochromium, and the authorities have been there and studied it, and we are allowed to work it without a filter until measurements have been made. These measurements should establish that the total emission from the plant is not increased. If it is increased, we have to install a filter. It is the question of a 25 MW furnace producing between 50 000 and 60 000 tonnes of high-carbon ferrochromium, and we shall probably install a bag filter this time, if a filter is required. We reckon that this will cost between 5 and 6 million crowns, which is equal to R900 000.

Contribution from the audience

I just wanted to confirm the close correspondence between that R40 per tonne and the 60 dollars per net tonne from the U.S. Ferro-alloys Association's survey for high-silicon products.

Question 5

Throughout the world, there appears to be a worsening shortage of energy. How will this affect the industry, and will it lead to substantial changes in the present techniques for alloy production?

Mr Magruder

I would like to be very brief because I think I covered quite a bit on energy this morning, but I purposely stayed away from chromium then. I think that this energy shortage will definitely have an influence on future facilities and their construction – the types and where they are located. Take the U.S. as an example – and if we were looking seriously at new chromium installations there, I feel we might look very, very closely at a partial reduction process similar to what is being done in Japan, because energy obviously is getting more and more important. When you move close to the source of ore, as you can in South Africa, and you have abundant energy at a relatively cheap price – and if I may include Brazil in this area too (I think I overlooked Brazil when I was talking about potential power at a favourable price) – and there is a good marriage of chromium ore and power, I believe that we shall see a continuation of the present type of submerged-arc smelting. I do not think that we shall find it will be worth spending the money on preparation, for example.

Mr Kok

I agree with Mr Magruder that the position in South Africa differs significantly from that in other countries. I do not expect that, in the foreseeable future, any significant changes will take place in our approach to furnace design and process selection as a result of changes in energy availability. We have an abundance of coal suitable for electric-power generation. The deposits are of such a nature that they can be mined at reasonable cost, and the policy followed by the Electricity Supply Commission, to put the large power stations very close to the sources, will also help to keep the cost of power down.

Mr Hooper

I think that, as far as Australia or Tasmania is concerned, it is very similar to that of South Africa, where energy is not so critical because it is still fairly cheap and there is every indication that it will continue to be cheap for many years to come. Power is plentiful, and in Tasmania it is all based on hydro-electricity. There are many more resources still to be developed. I think that, in countries like Australia and South Africa, power is not so critical.

Dr Nasu

The energy problem is very serious in Japan. Two million tonnes of ferro-alloys are at the moment being produced by electric furnaces. More than 80 per cent of electric power comes from oil, the remainder from water and atomic energy, and, therefore, the ferro-alloy industry – the biggest consumer of electricity in Japan – is forced to cut its electricity, and the price of the electricity is going up enormously. In some parts of Japan it will be doubled. We are now in a very serious position in ferro-alloy production. I feel very envious about the favourable conditions in South Africa as far as energy is concerned.

Mr Björklund

In Sweden, the percentage of power produced from oil is between 30 and 40 per cent. Having, of course, just experienced the oil crisis in December and January, we have seen the writing on the wall, because there was a prepared rationing system that, although never put into force, clearly indicated what could happen if another crisis of the same nature occurred. We have been thinking, as you say, that this must lead to changes in production methods. One thing that we have been thinking of in this connection is to go a step further by pelletizing the fine chromium ore and mixing in reducing agents, because in this way we would save kilowatt hours. Of course, the oil crisis is a very complicated thing. It is not only that part of the power is based on oil; there are also other installations in a ferro-alloy plant that are oil-based – all kinds of kilns and similar equipment – so we really have to look at our plant very thoroughly and make up our minds where we save most by altering our production methods. Sweden is, however, in a much worse position than, for example, our neighbour Norway, where this does not occur. The percentage of oil-based power production, I would say, is negligible or non-existent in Norway. Finland is in a similar position to Sweden, and Finland and Sweden have an exchange of power up at the northern border that makes the conditions very much alike.

Mr Franke

As far as the situation in Germany is concerned, I have to say that electric power is extremely expensive compared with, for instance, South Africa or the United States; but I must say that, over the past six months, the increase in the price of electric power has been less than that corresponding to the normal inflation rate. On the other hand, the price for fuel oil has increased tremendously, and new processes like prereduction depend very much on the relationship between the different kinds of energy; and at this moment I would have to say prereduction would not be very economic, because of the increase of the fuel-oil price. But coming back to pelletizing, in our experience we did not only reduce the dust in the off-gases, but we also reduced the power consumption per tonne of high-carbon ferrochromium by about 20 per cent.

Question from the audience

Numerous references to the large reserves of South African chromium ore have been made during the proceedings of the Congress, varying from 2 to 16 thousand million tonnes. What is the cause of these differences? How many seams of chromium ore are there? Do the seams vary much in grade? Are they all mined? And how many producers are there?

Dr Way

The cause of the differences is that they have been based on different geological data. Strictly speaking, when one refers to reserves, one should qualify the statement with a brief summary of data on which they are based, such as the number of seams, average thicknesses, and limit of depth to which the calculations have been taken. There are 14 significant seams in the mafic zone of the Bushveld Igneous Complex, as follows:

Upper group 1 to 2
Middle group 1 to 4
Lower group 1 to 7 plus 6A

over a stratigraphical distance of approximately 600 metres.

The lower group No. 6 is locally known as the Steelpoort Main on the Eastern Sector of the Bushveld Igneous Complex. It averages between 1,1 and 1,2 metres and can go up to 1,3 metres. Its average chromic oxide content is 44 per cent and its chromium-to-iron ratio is 1,5. Other seams vary from 1,26 to 1,82 ratio and from 42 to 53 per cent chromic oxide. The ratio and chromium content tend to decrease from the bottom to the top, i.e., the richer seams are in the lower group. The seams dip between 8° to 25° radially inwards. The upper group No. 2 is about 150 metres below the Merensky Reef platinum horizon and is also platiniferous. Five of these seams have sufficient chromium contents, widths, and reserves to be economic. They are wide enough to be stoped entirely in chromite, i.e., just over a metre in thickness. The reserves of these five seams to a depth of about 1500 metres can be estimated at 16 000 million tonnes, of which about 18 per cent is in the lower group No. 6, that is the main Steelpoort seam. There are 9 main producers, of which about three export direct and are subsidiaries of foreign companies. The average size of a mine is about 3500 to 6500 tonnes per month. Most of these mines work the lower group No. 6, but one company mines the lower group No. 4, as mentioned in the body of my paper.

Question from the audience

What are the London quoted prices for Transvaal chromium ore, and how do these prices compare with those of other world ores and the prices realized for South African ore?

Dr Way

The London prices for chromium ore indicate a swing to the use of Transvaal ore, the quoted price of which for 44 per cent chromic oxide is 50 to 60 U.S. dollars per tonne c.i.f. at the moment. This is above that of Turkish (48 per cent and chromium-to-iron ratio of 3:1) at 34 to 49 dollars per tonne f.o.b., and also slightly above Russian (48 per cent grade and ratio 3,5:1) at 48 to 52 dollars per tonne c.i.f. The prices of the last two ores show decreases of 6,7 and 2,9 per cent respectively from January 1973 to April 1974. Thus, although the Transvaal ore is of low grade, the fact that it can now be used for the production of high-carbon ferrochromium and charge chromium, which, in turn, can be used in the new metallurgical processes, AOD, VOD, etc., to produce stainless steel, has raised the status of the ore and its price to those of the higher-grade ores. The Department of Mines' statistics show that realized prices for 44 to 48 per cent grade averaged R13,2 per tonne f.o.r. for local sales and R17 per tonne f.o.b. for export for the month of January 1974. Both these show increases of 89 and 41 per cent respectively over the similar prices for January 1973. Now 50 to 60 dollars per tonne is about R34 to R40, and the difference between this range and R17 realized is mostly due to the freight, insurance, and port charges.

Mr Björklund

I do not want to be impolite, but I must say that we have been buying, as a group, between 400 000 and 500 000 tonnes of chromium ore from all over the world for about 50 years now, and I do not think that any of us has ever paid any attention to the London quotation. I really do not think that it has any significance whatsoever with regard to chromium ore. With regard to other ores and other metals, it is different, but the chromium-ore quotation in London is, in my opinion, very artificial. I think there are other things that influence the price – the chromium-ore market is a rat race, just like the ferro-alloy market. For instance, today purchases of Transvaal chromium ore for shipment to the Scandinavian countries are something quite different from what they were before the energy crisis. The prices of bunker have increased more than 200 to 300 per cent, with tremendously increased freight rates as a consequence. These things, I think, are of much more importance than a quotation of the kind mentioned.

Question from the audience

What will be the effect of any significant advance in continuous steel-making techniques on the pattern of ferro-alloy production?

Mr Björklund

If we believe that there will be an entire switch-over to the new stainless-steel processes all over the world, then, as we have calculated, high-carbon ferrochromium of any kind will take over about 90 per cent of the chromium units used in the making of stainless steel.

Mr Streicher

Did the question refer to continuous steel-making? If it did, then frankly I have doubts, because the British, to my knowledge, have been talking about this steel-making process for at least fifteen years. I sincerely hope that they will make a breakthrough some time. We know that there are very many problems, but we are confident, nonetheless, that alloys will still have to be introduced into the steel-making process in one way or another. We, as alloy-makers, are willing to work out, together with the steel-makers, some gadget for introducing the alloys into the steel before the actual blowing with oxygen in the launders of the blast furnace, i.e., if this process materializes one day.

Mr Kok

In lighter vein, following on what Mr Streicher said, if we consider the time that elapsed from the development of the AOD process until its large-scale application in industry, it is difficult to conceive how the present pattern of alloy production will soon be changed by significant advances in steel-making techniques.

Question from the audience

In view of the large expansion scheduled in the ferro-alloy industry in South Africa, a shortage of skilled labour — for example, graduates and engineers — could be serious. Is this the case in other countries, and what can be done about it?

Mr Magruder

I feel that the shortage of engineers is a world-wide proposition, and we are probably in a poorer position in the United States than anywhere else in the world. We went through this era of almost a total do-good environmentalism, anti-pollution, and everything else, and taking an engineering degree at college was almost 'dirty work.' So the number of graduates that are coming out now is significantly reduced, particularly in the field of metallurgy. We have a reputation, as a ferro-alloys industry, of being in 'dirty' business. What you have done here in setting up this Congress is probably one of the best things that can help to get people interested or re-interested, and I believe all of us are going to have to work in the same direction. There is a resurgence, and, fortunately, those graduates who did take engineering turned out to be exceedingly good people. When you interview them, you find that almost all of them are good. To summarize, I believe there is a world-wide shortage.

Mr Björklund

I underline and fully agree with Mr Magruder's answer. The same situation exists in northern Europe, where the influence of what I call 'ecology' is tremendous at the age when young boys have to make a choice, and we have had the same experience. I do not know, but I have a feeling this will change, as all things do. Maybe in a couple of years it will be popular to become an engineer – at least, I hope so.

Mr Streicher

All it means basically is that the people who are represented here today will, in future, still have to work harder, because we 'just ain't got those people'.

Comment from the audience

It occurs to me that one of the reasons that there is a world-wide shortage of engineers of any kind in almost any country is the value that industrial countries seem to place on their engineers, and the value, on the whole, is a low one. You only have to open the newspapers anywhere, and you see pages and pages of what are known as prestige advertisements for staff. You can make comparisons between the kind of salaries offered for personnel described as 'Sales Managers' and people described as 'Professional Engineers'; in general terms, taking a world-wide picture, there appears to be a difference of the order of 30 to 50 per cent in salaries offered for commercial staff as compared with salaries offered for professional engineers, and I fear that, as long as society places that kind of discount on engineering services, society is going to be short of engineers.

Mr Magruder

Part of what you say is probably right. In terms of new graduates in the United States today, we and other corporations are paying a premium – we have been for several years – for the engineering graduate in terms of 10 to 20 per cent over that of some one with a business major or somebody like that. I think the potential flaw in your reasoning or in looking at the advertisements is that many of the engineers really aspire to become managers. If you take a look at the ferro-alloy companies here in South Africa, I think you will find essentially a group of engineers who have become managers at the top of virtually every one of them – and this is typical of our industry. So I believe that maybe the picture that you are presenting is a little bit distorted; but, in terms of the pure engineer who is doing pure engineering work, you are probably correct.

Question 6

As the chief outlet for ferrochromium is stainless steel, does the Panel feel that direct stainless-steel production will ever replace ferrochromium production?

Mr Streicher

This particular thought has worried ferro-alloy producers for quite some time; but, to our knowledge, the tests that were done in Japan with reduced chromium pellets did not prove practical. This does not mean, however, that this could not be successful in future. If this really happens one day, the solution will be for alloy producers to start producing stainless steel themselves. The saving grace of it all, however, is that the stainless-steel makers do not wish to be worried with large volumes of slag when trying to utilize their capacity at peak and so achieve the greatest economies. We also know that several problems were experienced in Japan as regards the electrical characteristics of furnaces when using a 100 per cent prereduced burden. The other important aspect is that it is not quite so easy to achieve 100 per cent reduction of chromium outside the submerged-arc furnace.

Dr Nasu

In Japan before the War, we had a lot of patents for direct stainless-steel production from chromium ore and silicochromium or, sometimes, some electrodes made from nickel metal. But now, with the production of stainless steel by the induction furnace, ferro-alloy producers produce 60 to 70 per cent very clean stainless-steel ingot containing about 0,01 per cent carbon and mixed with contaminated scrap steel to make some 18 per cent low-carbon ferrochromium. Now we have to discuss, with stainless-steel makers and ferro-alloy makers, how to get the cheapest stainless-steel ingot, starting say from the chromium ore; and we have now come to the conclusion that we ferro-alloy producers produce ferrochromium, whether charge chromium or high-carbon ferrochromium, and, by some new production technique of stainless-steel ingot, the molten-state ferrochromium is better charged in the vacuum furnace or AOD furnace.

Mr Björklund

As you have all realized by now, I am not a technical man. I seem to recall, however, that Armco in Baltimore used chromium ore in their stainless-steel production for years, but they have given it up. I do not think the question really is so significant when it comes to chromium, because the amount of chromium in stainless steel is of such a magnitude that what Mr Streicher says about slag is absolutely correct. I think, on the other hand, that, if this were a congress for other alloys like molybdenum and vanadium, the future would be regarded differently. I just want to stop with molybdenum, where the new stainless-steel-making techniques may even make it eventually possible to use molybdenum sulphide.

The Chairman regretfully announced that time had run out and, on behalf of all, he thanked the members of the Panel for their contributions to a most interesting and stimulating discussion.