Supplementary Submission by CSIRO to the House of Representatives' Standing Committee on Industry, Science and Resources Inquiry into Value-Adding to Australia's Raw Materials

July 2000

Executive Summary

The submission comments on the research and development (R&D) issues raised in the Committee's first Report - *Of material value?*

It suggests the Committee consider:
- the implications for the future of value adding industries of the current decline in business R&D expenditure;
- the need to increase Commonwealth support for CSIRO as the Government's major vehicle for strategic and applied research;
- the importance of scientific research to sound Government policy decisions; and
- the economic and environmental sustainability of industries as an integrated assessment criterion for Government consideration of development options.

Specific input on the case study industries being considered by the Committee (Magnesium, Aluminium, Wine and Dairy) is at Attachment A.

Comments on First Report of the Inquiry - *Of Material Value?*

- Strategic R&D Investment

CSIRO is pleased the Committee recognises the vital role that R&D plays in promoting the development of raw materials processing and that this R&D is often the very key to investment in these industries (Report 6.32).

R&D is as important to mature industries as it is to emerging industries. The perception that these industries are somehow not high technology is misleading when one considers the importance of biotechnology to agricultural-based industries and advanced exploration and processing technologies to the minerals sector. Our specific input concerning the individual case study industries at Attachment A illustrates this point.

The Committee's conclusion that Australia cannot expect to have a comparative advantage across the full spectrum of raw materials processing areas and needs to concentrate "on those areas in which it can compete on world markets" (Report 5.27) is consistent with CSIRO's Research Assessment Framework which considers:

i. Return to Australia
   - Attractiveness - *Potential Benefits and Ability to Capture*
   - Feasibility - *R&D Potential and R&D Capacity*

ii. CSIRO's Role and Investment Strategy

CSIRO's draft Strategic Research Plans for the 22 Sectors in which it operates for the 2000-03 triennium are at Appendix 1. (These plans are an extract from the CSIRO 2000-03 Strategic Research Plan, which should be available in August/September 2000.) At Appendix 2 is a summary publication *Investing in the Future: CSIRO Strategic Directions for the 2000-01 to 2002-03 Triennium*.

- The Plans show the Sector context, dynamics and outlook and identify issues in respect of the R&D environment, the uptake of R&D, priorities and planned achievements.
- The Plans were developed with the assistance of CSIRO's 22 Sector Advisory Committees, and in consultation with industry, Government and other research users. The Committees comprise 230 external representatives, with 70% of members associated with private companies and industry associations.

It was clear throughout the planning period for the 2000-03 triennium that CSIRO could do much more to support innovative and export oriented Australian raw material processing industries given the necessary resources. In making the investment decisions CSIRO looked particularly for signs of good feedback loops between market or community demand and the opportunities offered by science and technology. The effectiveness of the planning process and market signals through commercial interactions ensure the relevance of CSIRO's research to the needs of users.

CSIRO PLANNING FRAMEWORK

CSIRO's planning and resourcing framework is based on 22 Sectors:

Agribusiness
- Field Crops
- Food Processing
- Forestry, Wood and Paper Industries
- Horticulture
- Meat, Dairy and Aquaculture
- Textiles, Clothing and Footwear

Manufacturing, Information and Services
- Chemicals and Plastics
- Integrated Manufactured Products
- Pharmaceuticals and Human Health
- Information Technology and Telecommunications
- Built Environment
- Measurement Standards
- Radio Astronomy
- Services

Minerals and Energy
- Energy
- Mineral Exploration and Mining
- Mineral Processing and Metal Production
- Petroleum

Environment and Natural Resources
- Biodiversity
- Climate and Atmosphere
- Land and Water
- Marine

- Research Investment and the Market

CSIRO agrees that further processing in Australia must be encouraged in a way that "does not negatively impact on other sectors of the economy but rather works to maximise overall national income" (Report 5.25). The examples quoted about tariffs, subsidies and other special treatments for particular industries that divert resources from activities in which Australia has a comparative advantage are important, as is the emphasis on market forces as the primary driver for the development of raw materials processing plants in Australia.

That said, there is a legitimate role for Government in fostering certain industries and the magnesium industry is a strong example. Please refer to the case study on magnesium at

Attachment A and the importance of timely Government funding for larger costs associated with 'proof of concept' or 'demonstration' stage of work. Similarly, incentives for private sector R&D and direct investment in public sector R&D are essential to address situations where the market fails to see the opportunities or accept the risk.

In this context, there is an urgent need to address the decline in business expenditure on R&D (BERD). Recently, the Australian Bureau of Statistics reported that R&D undertaken by Australian businesses decreased for the third consecutive year in 1998-99. In current price terms it was down 9 per cent compared to 1995-96. BERD as a proportion of Australia's gross domestic product (GDP) fell from 0.86% in 1995-96 to 0.67% in 1998-99. Most OECD countries increased their BERD/GDP ratios over the same period.

Commonwealth support for science and innovation as a proportion of GDP has fluctuated over the past 10 years from 0.63% of GDP in 1990/91 up to 0.77% in 1995-96 and then back down to 0.65% in 1999/2000. However, over the same period, Commonwealth support for CSIRO as a proportion of GDP has declined by 24% (ie: from 0.10% of GDP in 1990/91 to 0.08 % in 1999/2000). Funding for CSIRO as a proportion of total Commonwealth support for science and innovation has declined from 16.6% in 1990-91 to 12.3% in 1999/2000.

In contrast, since 1990/91 (in constant dollars):

- support for higher education research increased by some 70% to $1.8 billion per annum.
- business innovation support doubled between 1990 and 1995, and then dropped sharply. It is has now recovered to be just over 50% higher than the 1990 level.
- health and medical S&T programs increased by 60%, with further major increases to come from the Wills Report.
- the Cooperative Research Centres Program was initiated and reached a steady level of funding at about $130-140M per annum.
- funding for civil science agencies, in general, was flat.

Consequently, over the past 10 years, CSIRO's staff numbers have declined by 806 or 11.7% (equivalent fulltime) and more staff cuts are expected. Factors impacting on CSIRO's capacity to continue to deliver national benefits include the need for more sophisticated and expensive equipment to undertake leading edge research, the competitiveness of CSIRO's salary structures, the gap between actual salary and other price increases and the rate at which the Government indexes CSIRO's appropriation, and cut backs in external investment in CSIRO by certain industry sectors.

The implications for value adding industries are important because CSIRO is the Government's major vehicle for strategic and applied research.

- Importance of Research to Environmental Management and Regional Development

The Report discusses the impact on investment of environmental regulations and the importance of "an open and efficient regulatory framework and transparent and consistent ground rules" (Report *xx*), with greater uniformity across State and Territory boundaries (Report 6.80). It calls for Governments at all levels to encourage the "development of environmentally sensitive options which can potentially contribute to the achievement of Australia's long term environmental objectives while also helping the development of

regional areas" (Report 6.49). Similarly, the Committee has raised issues concerning access to resources particularly for the timber industry, which raises the broader issue of the sustainability of industries based on raw materials.

Government decisions in all of these issues must be based on sound scientific advice. This advice in turn must be underpinned by research that addresses the often unique challenges posed by Australia's natural resources and geography.

Whilst CSIRO scientists are actively involved with government at all levels to help achieve good policy outcomes, the increasing demand for independent and timely advice illustrates the importance of continuing research underpinned by adequate and secure Government funding for public good research.

- CSIRO has made 50 submissions to Government inquiries in the past 3 years and regularly contributes to working groups on special topics such as Regional Forest Agreements and to the Government's Action Agendas. It provides the scientific basis for many Government guidelines and standards in areas such as food safety.

In assessing various options for encouraging further raw material processing, the Committee suggests the Government would need to take into account a full range of factors including impact on consumers and other industries, revenues, employment, training and economic issues (Report 1.20). **CSIRO would encourage the Committee to add, as an assessment criterion, the economic and environmental sustainability of industries as an integrated formula.** As we have seen with the forest and mining industry and with the impact of salinity on agriculture, the two issues go to the heart of the longevity of the industries and access to resources. Local and global community concerns are not going to go away and need to be addressed by Government and individual industries.

This would be consistent with the broad national perspective the Committee has adopted.

A recent publication on '*Creating wealth in Australia's regions*' is at Appendix 3.

- Ability to Capture Benefits

The Committee, at the hearing involving CSIRO on 18 October 1999, discussed the importance of capturing the benefits of Australian R&D for Australia. In particular, members expressed concern that taxpayer funds could be used to develop technologies that could eventually be owned by multinationals and used in competing countries. The Committee specifically referred to the Hlsmelt technology developed by CSIRO in collaboration with Rio Tinto Ltd.

The ability to capture benefits is fundamental to CSIRO's research planning and all aspects of CSIRO's commercialisation strategy, especially the choice of the *route to market* and customer and the management of intellectual property rights. It is a key consideration in CSIRO's Research Assessment Framework.

There are however legal and commercial limitations on the extent to which CSIRO may influence the future use of its technology, especially when private companies, operating in a global market, have taken the risk and invested in its development.

CSIRO's relationships with its customers is therefore vital to successful research commercialisation. The best technology can fail if the customer is unable to bring the new product or process to the market.

The desirable characteristics CSIRO looks for in a customer are:

- has a strong commitment to benefiting Australia
- is committed to growth and continuous improvement
- has culture which is conducive to the application of research
- has the skills, the resources and the drive to exploit new technology
- has high ethical standards.

CSIRO also considers the customer's management skills, marketing capabilities and financial and legal status.

In this context, Hlsmelt is an interesting example of where the flow of benefits from Australian research needs to be considered in terms of the international nature of some industries. In May 2000, Rio Tinto Ltd announced an agreement with Nucor Corporation and Lurgi Metallurgie to further commercialise the Hlsmelt technology. A scaled-up, 600,000 tonne per year Hlsmelt plant is to be installed at a Nucor facility in the United States. Nucor is the second largest steelmaker in the USA and Lurgi is a leading international engineering contractor. If successful, Hlsmelt plants have the potential to add value to Western Australia's Pilbara region iron ores. The technology is capable of processing ore that is unsuitable for current iron and steel technologies. In addition, Western Australia has been targeted for the larger scale commercial plant capable of producing over 1.5 million tonne per year. Please refer to the press release by Rio Tinto Ltd at Attachment B.

Specific Input to Individual Case Study Industries

Information contributed by CSIRO Divisions on the Magnesium, Aluminum, Wine and Dairy case study industries is at Attachment A.

CSIRO
July 2000

References

- *Of Material Value?* First Report of Inquiry into increasing the value added to Australian raw materials (House of Representatives' Standing Committee on Industry, Science and Resources, March 2000)
- Science and Technology Budget Statement 2000-01 (Commonwealth of Australia, May 2000)
- *Research and Experimental Development, Business Australia 1998-99* (Australian Bureau of Statistics, 8104.0, 3 July 2000)

Attachments

A. Specific Input to Individual Case Study Industries
B. Rio Tinto Limited Press Release - Hlsmelt (R) moves closer to commercialisation (11 May 2000)

Appendices

1. (Draft) CSIRO *Strategic Research Plan 2000-01 to 2002-03 - Section Two: 22 Sector Plans* (CSIRO, July 2000)
2. *Investing in the Future: CSIRO Strategic Directions for the 2000-01 to 2002-03 Triennium* (CSIRO, March 2000)
3. *Creating wealth in Australia's regions* (CSIRO, 2000)
4. *CSIRO - Solutions for Greenhouse: An overview prepared for the Australian Greenhouse Office* (CSIRO, June 1999)
5. *Delivering the goods: returns on Australia's investment in CSIRO* (CSIRO, 1999)
6. *The Australian Wine Industry - Success through Industry Leadership, Planning and Innovation* (Prime Minister's Science, Engineering and Innovation Council, 26 November 1999)

Further Information

- *CSIRO Connections* a snapshot of CSIRO's extensive and integrated linkages with the Australian Innovation System and specific information on CSIRO's work in industry and environmental sectors is available on the CSIRO web page at www.csiro.au

Other Recommended References

- *Exporting Australian Processed Foods: Are we competitive?* (A study commissioned by Agriculture, Fisheries and Forestry - Australia, Instate Pty Ltd, 2000)
- *Chains of Success : Case studies on international and Australian food businesses cooperating to compete in the global market* (Commonwealth of Australia, 1998)

Specific Input to Individual Case Study Industries

Case Studies : Magnesium

Magnesium provides an example of how a new, vertically integrated value adding industry can be created. CSIRO has been instrumental in this process, notably in the development of upstream technologies which process magnesite ore and produce light metal and in downstream magnesium die-casting processes.

magnesite → magnesia → magnesium billet → magnesium die cast products

A feasibility study is underway for a $1billion commercial plant near Rockhampton, which is to produce 90 000 tonnes per year or 20% of world supply. The plant is underpinned by a contract with Ford to supply half of this output - worth some $2 billion over ten years. Attention is also being given to establishment of die-casting plants – including location of multinational companies in Australia to manufacture magnesium die cast products, primarily for the automotive market. The 1999 report "Magnesium: Opportunities in Australia" provides an effective analysis of the relevant markets and industrial opportunities.

The involvement of CSIRO followed the discovery in 1985 by Queensland Metals Corporation (QMC) of the world's largest deposit of cryptocrystalline magnesium carbonate (magnesite) at Kunawarara, Queensland. In 1986 QMC approached CSIRO about processing the magnesite, with a view to processing and value-adding to the magnesite before sending it overseas. Following technical investigations, including technologies in place overseas, the decision was made to develop an alternative technology path. In 1991 a business plan from QMC and CSIRO was prepared, which was the basis for a decision by the Federal and Queensland governments to put in a combined $25 million, on a 50/50 funding basis with industry partners to develop the new technology.

This has provided the basis for a continuing relationship with CSIRO since that time, in a cross divisional and cross disciplinary effort. Researchers from CSIRO's Minerals Division have been primarily focused on the up-stream feedstock preparation, and have also been involved in work with CSIRO Building Construction and Engineering on magnesium smelting cell design and operation. Research on downstream processing has been undertaken by CSIRO's Manufacturing Science & Technology Division. (CSIRO's 13-year exclusive R&D agreement with QMC for work in this field dates from December 1988).

The final stages of pre-commercialisation R&D have been critically dependent on the funding from the Federal and Queensland governments for a demonstration plant for magnesium production. **These funds helped to fill the gap between the original applied R&D and the much larger costs associated with the "proof-of-concept" or "demonstration" stage of the work. This is an effective demonstration of government involvement that has been essential for the success of projects in the past, and is likely**

to continue to be in the future (for example: in the emerging area of titanium metal production).

CSIRO continued to play a critical role in the demonstration plant through its staff serving on the Plant Review team, and it has also been called in to provide critical-path R&D as commissioning and operational issues in the plant emerged. This was only possible due to the existence of a core team of scientists and engineers in CSIRO who were kept "on tap" throughout the process through ongoing Government appropriation funding.

Equally there has been sustained interaction in relation to development of die casting processes so as to pave the way for an economic high quality local magnesium die-casting industry.

An essential feature of the success (to date) of this project has been the nature of the long-term relationship between CSIRO and QMC/AMC. This has been characterised by a sense of trust, openness, ownership and commitment on both sides.

Case Studies : Aluminium

CSIRO has a longstanding record of support for the local aluminium industry. An ABARE report has looked into the economic pay-off from aluminium industry research and found for a cost of approximately $100 million, total net social benefits of some $500 million were assessed, including cost reductions to Australian producers and improved competitiveness in their markets, and consumer gains through cheaper bauxite, alumina and aluminium, but excluding any environmental benefits. The net benefit for the industry was estimated in the study as $260 million.

CSIRO has contributed significantly in areas of:

- TiB2 production for wetted cathode cells
- inert anodes
- low temperature electrolytes
- carbothermic reduction
- processing of dross and spent pot lining
- evaluation of smelting behaviour of agglomerated ESP alumina dust
- laser-based long-path HF monitor for use in smelter pot rooms (commercialised through Dynamic Light) and
- reflux refining of super-pure aluminum

The growing importance of greenhouse gas emissions is a new driver for research in the industry. **With increased government and industry focus on Greenhouse issues there is scope to assist industry to refocus its activity on the longer-term issues of step-change technology development to produce significant changes in GHG emissions.** Appropriate targets for this industry could be:

i. improved current efficiency and reduced emissions of existing Al production technology, and/or
ii. the development of fundamentally new processes for Al production.

Of note is a recent initiative by the US Department of Energy to provide around $8 million over the next three years (matched by $8m of industry funding) to fund a number of high priority aluminium projects addressing this issue.

References:

- *Search* (Industry, Science and Resources, No. 36, March 2000, pp3-7)
- *Beyond Science: Managing Projects for Success* (CSIRO, 1998)
- *Magnesium : Opportunities in Australia* (David Lewis and Associates, Industry, Science and Resources, 1999)
- *The Economics of CSIRO Aluminium Research* (ABARE, 1991)

Case Studies : Wine Industry

1. Why do research to add value in Australia?

*Because history shows we **can** lead*

For example, CSIRO's association with the Australian viticultural industry is longstanding – dating back to the 1920s. Since then our viticultural research has generally been closely attuned to and has facilitated progress in the industry in our areas of expertise. This kind of focus is necessary for research to anticipate the needs of a developing industry.

To gain an advantage

Setting the pace can keep Australian industry in front of their competitors. It also ensures that innovation and improvement are continual processes and that Australian researchers are included in international industry and science dialogue. Some Australian industries now have a record of keeping ahead of, and cost competitive with, others because of their connection to R&D in Australia.

2. How important is strategic research?

Organisations such as CSIRO have been among the few that have the capacity, and brief, carry out longer-term strategic science. Strategic research is essential to gain fundamental knowledge of plant physiology, dynamic systems and processes. In most cases 5 -10 years is needed to assess the impact of new cultivars, new management practices, environmental changes etc. In the last 5 years the wine industry has been reaping benefits from research initiated decades ago, the citrus industry has been able to move from juice to fresh fruit and a macadamia industry has been established in Australia.

3. Why should the public pay?

There is always a public benefit

CSIRO's charter states that our research must benefit Australian industry and society. In the horticulture industries this may manifest as better quality of produce, international reputation, reduction in environmental impact through more efficient use of chemicals and water.

Freedom of thought by scientists

Public funding ensures that a proportion of research for industry can be independent of potential constraints imposed by funding bodies or investors. There are good examples of

work that has been carried out by CSIRO with little or no initial interest from the industry until the benefits were obvious.

4. What is the evidence for return on this kind of research?

A few examples from the wine industry:

a. Mechanical hedging and minimal pruning

Systems which facilitate the mechanisation of pruning have their genesis in basic physiological studies undertaken by CSIRO dating back to the late 20's, but more importantly, to the work done in Merbein and Adelaide in the 60's and early 70's on the relationship between vine fruitfulness, pruning levels and trellis systems. **It is estimated that about 65% of Australian wine grapes are pruned mechanically, either by hedging or minimal without a negative impact on quality.** The technologies for mechanisation show that the vine has considerable capacity for self-regulation of growth and production. **At an average cost saving of $600 per hectare this equates to $32 million.**

b. Mechanical harvesting

Mechanical harvesters were introduced by CSIRO in the late 1960's for trial under Australian conditions. Today, around 80 percent of wine grapes are mechanically harvested. Major advantages include:

- economical harvest, particularly of premium varieties with small bunches. Cost savings to the industry are calculated to be in the order of $80 million per annum
- capacity to harvest large quantities at night while fruit temperatures are low
- capacity to harvest large areas ad quantities at optimal maturities
- facilitated development of tall trellises and light pruning systems for mechanical pruning which could not be economically hand picked
- planting of new vineyards in area where labour is not readily available

A major proportion of the rapid expansion in the Australian industry would not have occurred without mechanical harvesting.

At a saving of $30 – 200 per tonne the savings amount to between $25 and $150 million per annum.

c. Nematode tolerant rootstocks

The introduction by CSIRO of nematode tolerant rootstocks has made a critical contribution to the productivity of wine grapes in regions with light soils. Current work by CSIRO Plant Industry focuses on developing new rootstocks which enhance quality, are tolerant of nematodes, phylloxera, salinity and have high water use efficiency. **There is a resultant increase in productivity of about 25% in major wine grape varieties grown on rootstocks, adding $14 million per annum to the value of the Chardonnay crop, $9 million to the value of the Shiraz crop, $6 million to Cabernet and $3 million to Semillon.**

5. Why are we doing gene technology?

Outcomes from this research has already resulted in new techniques for identifying pests and diseases, rapid methods of detecting contaminants, and reliable identification of varieties. It is enabling smarter and faster development of new varieties.
This is possible due to a better understanding of physiology, biochemistry and other processes at the molecular level.

When GMOs are judged to be safe and beneficial there will be modifications to existing varieties that make them resistant to diseases, pests and stresses caused by salinity or other factors.

6. How do we stand internationally?

For a relatively minor force, Australia is well situated to be a part of and even influence scientific progress in viticulture. We have good collaborative links with the US, France, Italy, Germany and South Africa. We are participants in a major viticultural research consortium and have selected strategic areas in which to concentrate our efforts and develop intellectual property.

Further Information:
- *The Australian Wine Industry - Success through industry leadership, planning and innovation* (Prime Minister's Science, Engineering and Innovation Council, Fourth Meeting, 26 November 1999) at Appendix 6.

Case Studies : Dairy

Example 1: Food Science Australia (a joint venture between CSIRO and Afisc)

Dr Mary Ann Augustin's research for the dairy industry over the last ten years has helped generate millions of dollars in sales of specialised dairy products.

Dr Augustin has created an understanding of the chemistry of the milk system that allows modification to develop specialised milk powders and improve the performance of liquid milk products as food ingredients.

The most extensively used of Dr Augustin's innovations is a technology that allows milk powder manufacturers to guarantee that their product will be stable during subsequent processing in the manufacture of recombined products. This technology is now providing a substantial competitive edge for Australian companies. Export sales of these milk powders are estimated at over $150 million a year and use of this technology has also helped Australian manufacturers to secure a new Middle East market of over $30 million a year.

The detailed understanding of the properties and behaviour of milk generated by Dr Augustin has also resulted in a range of other premium value dairy ingredients.

These have the potential to be used in a variety of foods such as ice cream, yoghurt, chocolate, sauces, soups and bakery products and include:

- powders for use in chocolate manufacture;
- cream powders for use in several processed foods;
- acidified milk ingredients with enhanced gelling properties for use in confectionery, bakery products and desserts;
- milk ingredients with enhanced foaming, steam frothing and emulsifying properties for use in cappuccinos; and
- new yoghurt bases with improved quality.

Dr Augustin leads the world in her field, both in her strategic studies and in their application in industry. This has been recognised in Australia by the award of the Loftus-Hills Silver Medal of the Dairy Industry Association of Australia in 1997, an award given annually for the most significant Australian contribution to dairy science and technology.

Example 2: - CSIRO Livestock Industries

CSIRO Livestock Industries has developed a range of feed technology options that result in value adding options for the dairy industry. Technology has been developed that allowed the reduction of the saturated fatty acid content of milk fat by up to 25% by feeding special dietary supplements to dairy cows. Dairy products were developed from this milk with improved nutritional and physical characteristics.

For example, the consumption of these new dairy products resulted in:

1. a reduction in cholesterol in humans; and
2. the production of butter that was spreadable from the refrigerator, comparable to dairy spreads and soft margarines. These developments had the obvious advantage that they were produced by the cow and hence could be marketed as milk, butter, etc.

A further development is being made to incorporate omega-3 fats from marine origin into milk as they have a number of potential health benefits for humans.

The commercialisation of this technology has been difficult and slow, due to in part the inability of the Australian dairy industry to adapt their processing technology to allow the collection and processing of milk from dairy farmers. The local industry needs to invest in this technology if it is to capture the benefits for Australia.

11 May 2000

Rio Tinto Limited

HLSMELT(R) MOVES CLOSER TO COMMERCIALISATION

Rio Tinto announced today that it has signed a Memorandum of Understanding with Nucor Corporation of the USA and Lurgi Metallurgie to form a joint venture which, subject to a definitive cost study, will install a Hlsmelt plant at a Nucor facility in the United States.

Following comprehensive testing of the process at Hlsmelt's demonstration plant in Kwinana, Western Australia, Rio Tinto is supporting further investment to commercialise the technology. The proposed Hlsmelt plant at Nucor will be capable of producing around 600,000 tonnes per year of hot metal and is a major scale-up from the Kwinana plant. Assuming the successful performance of this plant, it is anticipated that the Hlsmelt technology will be further scaled up to plants capable of producing over 1.5 million tonnes per year.

If successful, Hlsmelt plants have the potential to add value to Western Australia's Pilbara region iron ores and provide significant benefits to Australia. The technology is capable of processing ore that is unsuitable for current iron and steel technologies. In addition Western Australia has been targeted for the larger scale commercial plant.

The Chief Executive of Rio Tinto Iron Ore, Mr Chris Renwick said, "This agreement represents another important step along the road to commercialisation. We are committed to following a carefully measured path of development to ensure any investment is sound and sustainable."

Nucor, which has a reputation as an innovative producer, is the second largest steelmaker in the USA. It operates nine steelmaking plants in the USA with a combined annual production of about 12 million short tons per year. The addition of a Hlsmelt plant to Nucor's portfolio would strengthen its position as a technology leader and highly efficient low cost steelmaker.

Lurgi, based in Germany and a leading engineering contractor and process technology provider to the world iron and steel industry, is the exclusive licensed engineer for the Hlsmelt technology.

Mr Renwick said, "The objective of the Rio Tinto/Nucor/Lurgi partnership is to commercialise the Hlsmelt technology to compete in the world market. This will be achieved by capitalising on each partner's strengths in process technology, steelmaking and engineering."

The Hlsmelt process converts iron ore to liquid pig iron through the injection of non-coking coal and fine iron ore into a molten iron bath. Because the process eliminates the need for sinter/pellet plants and coke ovens, Hlsmelt's environmental impart is more favourable than traditional blast furnace technology.

For further information please contact:

Bruce Larson
GENERAL MANAGER
Group External Affairs (WA)
Phone: 08 9327 2574
Mobile: 0417 903 280