Austpac Resources (APG)

Buy

$0.21

Risk: High

APG/TOR joint venture agreement reached to commercialise ERMS technology

Monday, 10 July 2000
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Ref: APG070700

Issued Shares	**324M**
Market Cap	**$68M**
Cash	**$0.1M**
Debt	**nil**

- ***APG has moved a step closer to commercialising its patented process technology to upgrade ilmenite.***
- ***TOR has entered into a 50/50 joint venture with APG and will pay $3.0M to APG based on agreed milestones being achieved. In addition TOR will help fund APG's share of the development cost of the pilot plant located in India.***
- ***APG and TOR will each retain a 37% equity interest in AusRutile India Pvte Ltd. Indian Rare Earths (IRE) will hold 26%. AusRutile will construct and manage the pilot plant.***
- ***A commercial plant with a potential capacity of 200ktpa is expected to be constructed once the pilot plant is operating at design capacity.***
- ***APG process technology has the potential to revolutionise the way synthetic rutile is produced and could have the same impact on the mineral sands market as SX-EW had on the copper market.***
- ***Buy: We recommend APG as a Buy, but recognise the investment is high risk.***

Could revolutionise the processing of mineral sands

APG's principal aim is to rapidly progress the commercialisation of its patented Enhanced Roasting and Magnetic Separation (ERMS) process and Enhanced Acid Regeneration System (EARS). ERMS roasting and leaching process enables the upgrading of a wide range of ilmenite types (including current sub-economic resources) to produce high grade synthetic rutile feedstocks for use in chloride plants to produce titanium dioxide (TiO_2) pigments and metal. TiO_2 pigment is the brilliant white pigment used in the paint and plastic industries.

Commercialisation of the ERMS process key objective

- **Overview:** The joint venture agreement reached with TOR is a significant milestone for the company and should accelerate the commercialisation of APG's patented mineral sand processing technology. In August 1999, APG and Indian Rare Earths (IRE) reached an agreement on the commercial parameters for the development and operation of a 10-15ktpa start-up plant adjacent to the existing Orissa Sands Complex (OSCOM) facilities. If successful, a processing facility producing up to 200ktpa is to be constructed. APG will retain a 37% equity interest in this project. The joint venture agreement with TOR should accelerate the implementation and development of its technology on a commercial scale.

The joint venture agreement reached with TOR is expected to lead to the rapid commercialisation of the ERMS technology

The APG, TOR and IRE joint venture is expected to construct a commercial synthetic rutile plant to produce 100-200kt of titanium dioxide per annum in Orissa State, India

- **Recommendation:** Austpac has demonstrated an ability to pursue and conclude commercially-viable deals with larger companies. Although an investment in Austpac can be regarded as being speculative, BNP Paribas believes that application of its patented technology will allow it to grow substantially in the years ahead. The fact that Austpac's share of capital cost for the proposed Indian plants is to be carried by Ticor is a significant bonus.

Titanium dioxide market

- Titanium occurs as an oxide in a number of minerals, the most commercially important of which are ilmenite and rutile. These minerals are used to produce titanium metal and titanium pigment.
- The primary use of titanium is in the oxide form, TiO_2. The value of the TiO_2 market is currently US$7.0 billion per year and grows on average by 3%pa. The paint industry is the largest user accounting for roughly 55% of the world TiO_2 pigment production. The paper and plastics industries account for approximately 25% and 15% respectively.

The paint industry consumes 55% of TiO_2 pigment production

- Kerr–McGee has recently announced an Euro140/t price increase for pigment in Europe, an 8% increase in pigment prices. The outlook for titanium dioxide remains good with market likely to move into deficit by the middle of this decade.

Market prices are on the rise

TiO_2 production methods

- There are two commercial methods used to produce TiO_2; the sulfate and chloride routes.

Two methods are used produce TiO_2

- The chloride route was commercialised in 1958 and now accounts for 60% of world production of TiO_2 and is expected to reach 70% by 2010.

The chloride route now accounts for 60% of production

Chloride route- feedstocks

- Natural rutile which contains 92%-97% TiO_2,
- Synthetic rutile containing 88%-95% TiO_2, which is produced from ilmenite using either the Becher or Benilite process, and
- Titania slags which contain 80%-86% TiO_2, which are produced from ilmenite by electro-smelting

- Substantial resources of ilmenite are available worldwide. However, ilmenite concentrates produced from heavy mineral deposits have historically not been suitable for synthetic rutile production because they are chrome-rich or have high levels of silica and other impurities.

Substantial resources of ilmenite are available but a large proportion are sub-economic

- APG's ERMS technology can produce suitable feedstock from many of these sub-economic deposits of ilmenite.

ERMS technology a potential break through

Ilmenite upgrade technologies

- Titania slag production is limited to countries with low energy costs. Slags contain 80%-86% TiO_2.
- The Becher process reduces ilmenite by roasting at high temperatures (>1100°C) to metallise the iron, which is removed by oxidising in dilute ammonium chloride solution. The leached product is further purified with a sulphuric acid wash to produce a synthetic rutile containing 90%-93% TiO_2. This process is used to treat ilmenite produced by Ticor (TOR) and Iluka Resources (ILU) in WA.

Both ILU and TOR use the Becher process to upgrade ilmenite to synthetic rutile

- The Benilite process subjects ilmenite to a six-hour reduction roast in a rotary kiln at 800°C, followed by a multi-stage hydrochloric acid leach under pressure with a cycle of 12 hours or more. The leached product is calcined to produce a synthetic rutile containing 90%-95% TiO_2. Malaysian Titanium Corporation at Ipoh in Malaysia uses the Benilite process.

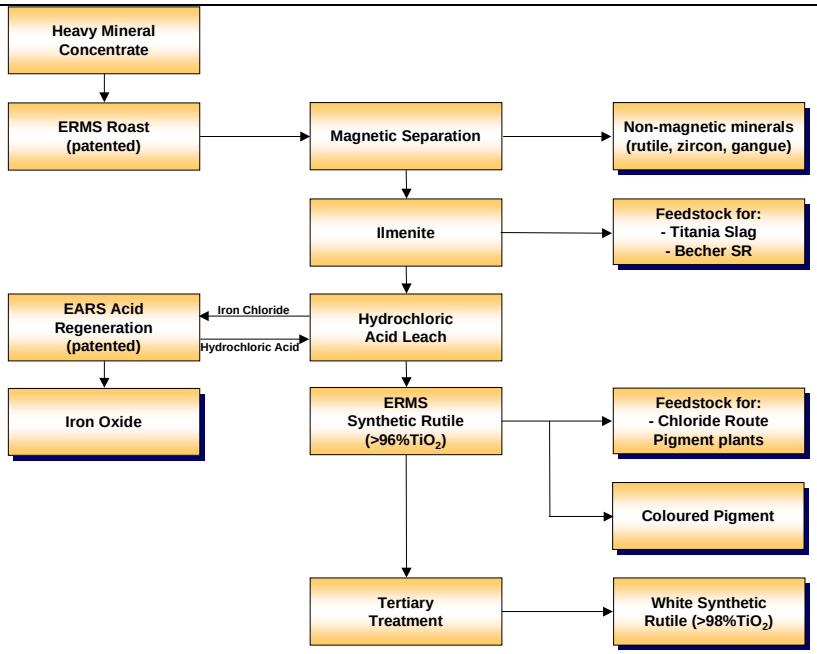
Malaysian Titanium Corporation use the Benilite process

Austpac's ERMS process

APG has successfully developed the ERMS and EARS technology to upgrade ilmenite to high grade synthetic rutile

- APG has successfully developed new mineral processing technology enabling the upgrade of ilmenite to a high grade synthetic rutile (96%-98% TiO_2) feedstock ideal for the manufacture of TiO_2 pigment. The technology processes used are Enhanced Roasting & Magnetic Separation (ERMS) and Enhanced Acid Regeneration System (EARS). The technologies, which have been developed and patented by APG, have tremendous potential.
- Chart 1 below shows the ERMS process flowsheet incorporating the EARS technology.

Chart 1: ERMS & EARS process flowsheet



Source: APG prospectus (30 March1999)

Low cost acid re-generation crucial

- The key to the economic viability of acid leach synthetic rutile processes, such as ERMS, is low cost acid regeneration.

Comparative advantage of ERMS

ERMS pilot plant work has produced high grade synthetic rutile from over 60 different ilmenites

- The Newcastle ERMS pilot plant has demonstrated that high-grade synthetic rutile feedstocks for use in chloride plants can be produced from a wide range of ilmenites. The company has tested over 60 ilmenites over a wide range of quality and in all cases has produced a good synthetic rutile (TiO_2 of >96%).
- The ERMS process has the following advantages over alternative methods of beneficiating ilmenite:
  - High recoveries of ilmenite,
  - efficient separation from contaminant minerals,
  - ERMS does not require elevated roasting temperatures or pressures in the leaching process,
  - the process is environmentally friendly and end-products are free of radioactivity associated with some alternative process,

- synthetic rutile produced has a grade >96% TiO_2, which is higher than the Becher (88%-93% TiO_2) or Benilite (90%-95% TiO_2) processes, and
- comparative capital and operating cost advantages (see Table 1).

Table 1: Competitive advantage

Process	TiO_2 content (%)	Capital cost[1] (US$/t)	Operating cost[2] (US$/t)
Becher[3]	88-93	400	110-140
Benilite[4]	90-95	620	180
ERMS	96-98	400	120

Source: APG prospectus(30 March 1999)

[1]US$/t of installed synthetic rutile capacity (on 100ktpa plant)

[2]US$/t cost to produce synthetic rutile, including acid regeneration but excluding ilmenite costs

[3]Requires ilmenite grade >57% TiO_2 and Collie WA coal

[4]No Benilite plants have been built in the last ten years

ERMS technology very competitive against other processes

- The ERMS process is very competitive with the Becher process on capital and operating cost basis. The advantage with ERMS is that it can treat ilmenite with TiO_2 grades <57%.

Austpac's EARS process

Significant quantities of HCl acid are required to produce synthetic rutile

Cost of acid is crucial to process economics

- The manufacture of synthetic rutile by leaching requires large volumes of Hydrochloric acid (HCl). A by-product of this process is large quantities of iron chloride, which can be regenerated to produce HCl. Current commercial regeneration processes require iron chloride solution to be heated to 800°C in a pyrohydrolysis reactor, so regenerating HCl acid. Large amounts of energy are required to superheat a reactor to remove water from the chloride solution. The cost of acid is crucial to the synthetic rutile process economics. Cheap sources of acid are essential to the economics of producing synthetic rutile.

APG's acid re-generation technology EARS could potentially halve capital and operating costs compared to similar systems

- The EARS process is based on evaporating the waste solutions at low temperatures to form iron chloride pellets, which are fed into the pyrohydrolysis reactor to regenerate HCl. The EARS system uses simple low temperature pelletising equipment in conjunction with a much smaller reactor. Pilot testing of the technology at the Newcastle plant indicates that this technology could potentially halve the capital cost significantly reduces the operating cost of acid re-generation.

Business development opportunities

Rapidly moving to commercialise ERMS and EARS

- The company is moving expeditiously to commercialise these technologies. To date the company has two major initiatives in place to commercialise its technology. These include:

South Africa

Licence agreements signed with Iscor to use ERMS and EARS

- In 1998 the company signed two licence agreements with Iscor, a steel and mineral sands producer. The licences are for both the ERMS and EARS technologies. The licence agreements followed extensive testing over the past two years by Iscor.

- The technologies will be used in conjunction with Iscor's US$300m Heavy Minerals project which includes a mine, mineral separation plant and a 250ktpa titania slag smelter at Empangeni, near Richards bay in KwaZulu-Natal province, South Africa. The Iscor royalty could have a value of between A$5-$10M to APG.

Technologies to be used in conjunction with Iscor's heavy minerals project nears Richards Bay in South Africa

India

- India's mineral resources are among the largest and least exploited in the world today. The country has a resource base of 278m tonnes of ilmenite or 20% of the worlds known ilmenite. It is believed that half of these resources are available for mining and that the deposits contain 20%-30% heavy minerals. Ilmenite constitutes up to 50% of the heavy minerals.

India's mineral sands deposits are among the largest and least exploited in the world

- Over 80% of India's ilmenite occur along the east coast in Tamil Nadu, Andhra Pradesh and Orissa states. Ilmenite contained in these deposits grades 50%-53% TiO_2 which is suitable feedstock for upgrading by acid leach but are uneconomic for the Becher process used by ILU and TOR.

Significant proportion of India's ilmenite resources are unsuitable for the Becher process

- The ERMS process is ideal for treating Indian ilmenite.

ERMS is ideal process

- The Indian Government mineral sands policy is to value add. This requires that ilmenite be upgraded to either synthetic rutile or TiO_2 pigment. The Government would like to develop a world class TiO_2 industry based on its vast resource base.

Indian government requires mineral sands to be valued added

Commercial agreement

- Indian Rare Earths (IRE) is the government owned agency, which controls most of the mineral sands operations in India. IRE became interested in the ERMS process in 1997 when it was demonstrated the technology could produce high grade synthetic rutile from ilmenite from three very large deposits controlled by IRE on the east coast of India. The deposits have an aggregate resource base of 120mt of ilmenite, or 8% of the worlds known ilmenite.

IRE became interested in ERMS in 1997 when it was demonstrated the ERMS technology could produce high grade synthetic rutile

- In mid 1998 and IRE agreed to investigate the feasibility of establishing an ERMS 10-15ktpa synthetic rutile plant in India using the existing ilmenite acid regeneration facilities at the Orissa Sands Complex (OSCOM).

IRE investigate the possibility of developing a 10ktpa plant

- By April 1999, Austpac and IRE had reached agreement on the commercial parameters for the development and operation of a 10ktpa start-up plant adjacent to the existing OSCOM facilities. If the start-up plant is successful, then a 100-200ktpa plant is expected to be constructed.

APG and IRE reach agreement on the commercial parameters to develop 10ktpa start-up plant

- In August 1999, a definitive joint venture agreement with APG and IRE was signed called AusRutile India Pvte Ltd. Equity is split APG 74% and IRE 26%. AusRutile will construct and manage the plant.

Definitive joint venture agreement signed with APG and IRE

- On 4 July APG enters into a 50/50 joint venture agreement with TOR. APG and TOR will have an equal 37% equity interest in AusRutile India Pvte Ltd. The AusRutile synthetic rutile project will commence with the construction of 10-15ktpa pilot plant at a capital cost of US$5-7M. If successful, a commercial plant with capacity of up to 200ktpa would then be constructed at a capital cost of approximately US$165M. The planned projects will be located adjacent to IRE's existing OSCOM mineral sands deposits and operations at Chatrapur, Orissa.

APG/TOR enter into a joint venture agreement to commercialise the ERMS and EARS processes.

APG will retain a 37% equity interest in the AusRutile India joint venture

Stage I: 10ktpa ERMS synthetic rutile plant at Orissa India

Stage I to use acid regeneration facilities at OSCOM

- This operation is expected to use existing ilmenite production and acid regeneration facilities at OSCOM to support the operation.

Plant construction expected to commence second half of 2000

- Construction of the plant is expected to begin in the second half of 2000. The capital cost of the project is estimated in the range of US$5.0-7.0M depending on planned capacity of between 10-15ktpa. Production is expected to commence by early 2002. Table 2 shows a summary of operating parameters.

Table 2: Stage 1 economics

Capital Cost incl working capital	US$5.0-7.0m
Operating costs	US$360/t
Synthetic Rutile	US$500/t
Revenue after commissioning (US$m)	5.0-7.5
Operating costs (US$m)	3.6-5.0
Depreciation (US$m)	0.3-0.4
EBIT (US$m)	1.1-1.5
APG share (37%)	0.4-0.6
EBIT Margin (%)	22
Tax 35% after year 6 (US$m)	0.3-0.4
NPAT (US$m)	0.8-1.1
APG's share (37%)	0.3-0.4
Ungeared IRR	18%

Source: BNPP & APG

US$5.0-7.0m required to develop Stage I

- APG share of the project capital cost will be funded by TOR, which will be repaid out of cashflow.
- The project is expected generate an EBITDA of US$1.4 to US$1.9M implying a project pay back of 4-5 years.

EBIT margin strong at 18%

- EBIT margin even on this small operation is 22%. IRR has been estimated at 18%.

Stage 2: 200ktpa ERMS and EARS plant

- Project economics improve substantially with a plant 10 times or greater the size. Table 3 summarises the operating parameters for a full-scale operation based on capacity of 200ktpa. The resource base at OSCOM could support a synthetic rutile plant with a capacity 200ktpa. The capital cost of building a 200ktpa plant has been estimated at US$165M. The second, full scale plant is expected to be commissioned in calendar year 2004.

Project economics improve significantly with large plant incorporating acid regeneration EARS technology

Resources at OSCOM could support a plant with a capacity of 200ktpa

Table 3: Stage 2 economics

Capital Cost incl working capital	US$165M
Operating costs	US$235/t
Synthetic Rutile	US$500/t
Revenue after commissioning (US$M)	100.0
Operating costs (US$M)	47.0
Other costs (US$M)	1.5
Depreciation (US$M)	11.0
EBIT (US$M)	40.5
APG's share (37%)	15.0
EBIT Margin (%)	40
Tax 35% after year 6 (US$M)	14.2
NPAT (US$M)	26.3
APG's share (37%)	9.7
Ungeared IRR	40%

Source: BNPP & APG

- The economics of this project are far superior. The project generates EBIT margins of 40% compared to 22% for the Stage I project. Forecast profits around US$26.0M before financing costs could be expected.

EBIT margins of 40% possible compared to 22% for Stage I

- Project IRR is very robust at 40%.
- It is envisaged that additional projects incorporating APG's patented technology would then be developed at other greenfields sites in India.

Other projects

- The signing of the TOR joint venture agreement has significantly enhanced the potential for the worldwide application of ERMS/EARS technologies. The technology has the potential to be applied to resources discovered in the Murray Basin region of NSW and Victoria. The ERMS technology has proved be very successful in processing Murray Basin mineral sands in test work.

The APG/TOR joint venture will evaluate and apply the ERMS/EARS technology at other greenfields projects

Murray Basin

- A number of companies including ILU have discovered heavy mineral sands deposits in the Murray Basin in Australia. The "strand line" of coarser grained deposits contain valuable heavy minerals, rutile and zircon as well as high-grade ilmenite >60% TiO_2. Test work at continuous pilot plant scale has demonstrated that, using the ERMS process, high-grade low ilmenite can be produced from chrome-rich high TiO_2 ilmenite concentrate. APG is well placed to possibly participate in the development of these assets.

Potential to utilise ERMS in Murray Basin

Corporate

- The current cash position of the company is around A$0.1M. TOR under the just signed joint venture agreement with APG will pay A$3.0M subject to the achievement of development milestones. TOR will also fund APG's share of the development cost for Stage I, which will be repaid to TOR out of cashflow.

TOR to pay APG $3.0m progressively as project milestones achieved

Project risks

- APG's success will be dependent on the successful implementation of its technology initially in India where significant potential exists to develop vast undeveloped mineral sands deposits. India is rapidly developing economy with a stable political process, but some caution is warranted.

Sovereign and political risk

- The government approval regulatory process in India can be slow which could delay the project development.

Regulatory process can be slow

- There are risks associated with scaling up projects to commercial size.

Company Directors

Alfred Paton (Chairman)	An Engineer with 50 years experience. Currently Chairman of Centennial Coal, Oldfield Holdings and Auiron Energy Ltd and a director of Care Australia.
Michael Turbott (Managing Director)	A geologist formerly a Director and Vice President of Kennecott Explorations (Aus) and directed programmes that led to the discovery of Lihir Gold deposit.
Harold Hines	Mr Hines has 50 years experience in operations, developments, management and consulting in the Mineral Sands and Alluvial mining industry.

Recommendation

- The company is progressing well with development and commercialisation of its patented ERMS and EARS technologies to treat ilmenite. The recent signing of an agreement with IRE and subsequently with TOR is a major breakthrough and opens enormous potential for the company to treat vast ilmenite resources in India. This investment is speculative but we recommend purchase for exposure to an emerging mineral sand producer in India using demonstrated new ERMS and EARS technology.

Speculative Buy

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