

SYDNEY MINING CLUB

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ERMS Synthetic Rutile: Ultra High Grade Feedstock for the TiO₂ Industry

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WHAT ARE AUSTPAC'S TECHNOLOGIES?

- **Enhanced Roasting and Magnetic Separation - (ERMS)** Proprietary roast to selectively magnetize ilmenite and enhance its leachability.
- **Enhanced Acid Regeneration System - (EARS)** Proprietary process to regenerate acid from waste iron chloride.

Austpac's Roasting Processes

- Selective roasting to remove deleterious minerals
- High temperature roast for chloride route feedstock
- Low temperature roast for sulfate route feedstock
- Continuous pilot plant operation testwork
- Producing high TiO_2 , low chrome ilmenite from the Murray Basin
- First commercialisation underway (BeMaX)

TYPICAL RECOVERIES

	TiO ₂ Grade %	Cr ₂ O ₃ %	TiO ₂ Recovery %
<u>Ilmenite 1</u>			
Before roasting	60.3	2.02	
Product	65.6	0.12	88.00
<u>Ilmenite 2</u>			
Before roasting	57.3	0.60	
Product	59.5	0.07	92.0

EARS Acid Regeneration

- Unique two stage process –pelletise FeCl_2 , pyrohydrolysis
- Regenerates acid to +25% strength
- Low capital cost
- Low operating cost & energy efficient
- Can use a range of fuel types, including coal
- By-product iron oxide pellets (magnetite)
- Applications – SR, pickle liquor

ERMS/EARS FLOW SHEET



Mineral separation plant



Heavy mineral concentrate



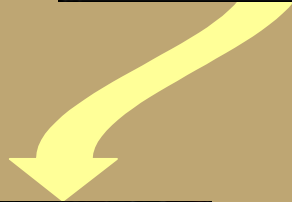
Magnetic separation



ERMS roaster



Roasted ilmenite



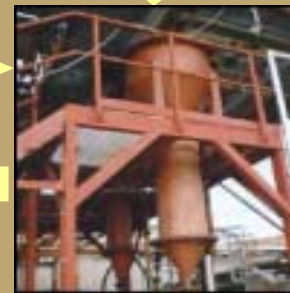
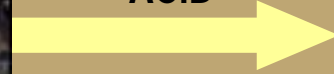
REGENERATED ACID



Inert oxide pellets



EARS acid regeneration plant



ERMS batch leach vessels



Synthetic Rutile (>97% TiO₂)



■	TiO ₂	97.50%
■	Fe ₂ O ₃	0.82%
■	Fe + Mn	0.71%
■	SiO ₂ (Total)	0.77%
■	Cr ₂ O ₃	0.02%
■	Al ₂ O ₃	0.13%
■	CaO	0.02%
■	MgO	0.01%
■	U+Th	<15ppm

ERMS SR

Typical Chemical Analysis

UNIQUE PILOT PLANT

- Located at Newcastle
- Fluid Bed Roasting (ERMS)
- Magnetic Separation
- Bulk Leaching
- Fluid Bed Calcining
- Agglomeration
- Acid Regeneration (EARS)



**OVER 70 DIFFERENT TYPES OF ILMENITE
SUCCESSFULLY TESTED**

THE TiO₂ MARKET

Where does ERMS SR fit?

THE TiO₂ INDUSTRY

- TiO₂ pigment provides hiding power or opacity
- Uses – paint, plastics and paper
- US\$8 billion industry - oligopolistic & mature
- 3% annual growth over last 25 years
- Dominated by USA (in production, consumption and pricing)
- Technological barriers to entry – chloride and sulfate processes
- High capital cost of new plants

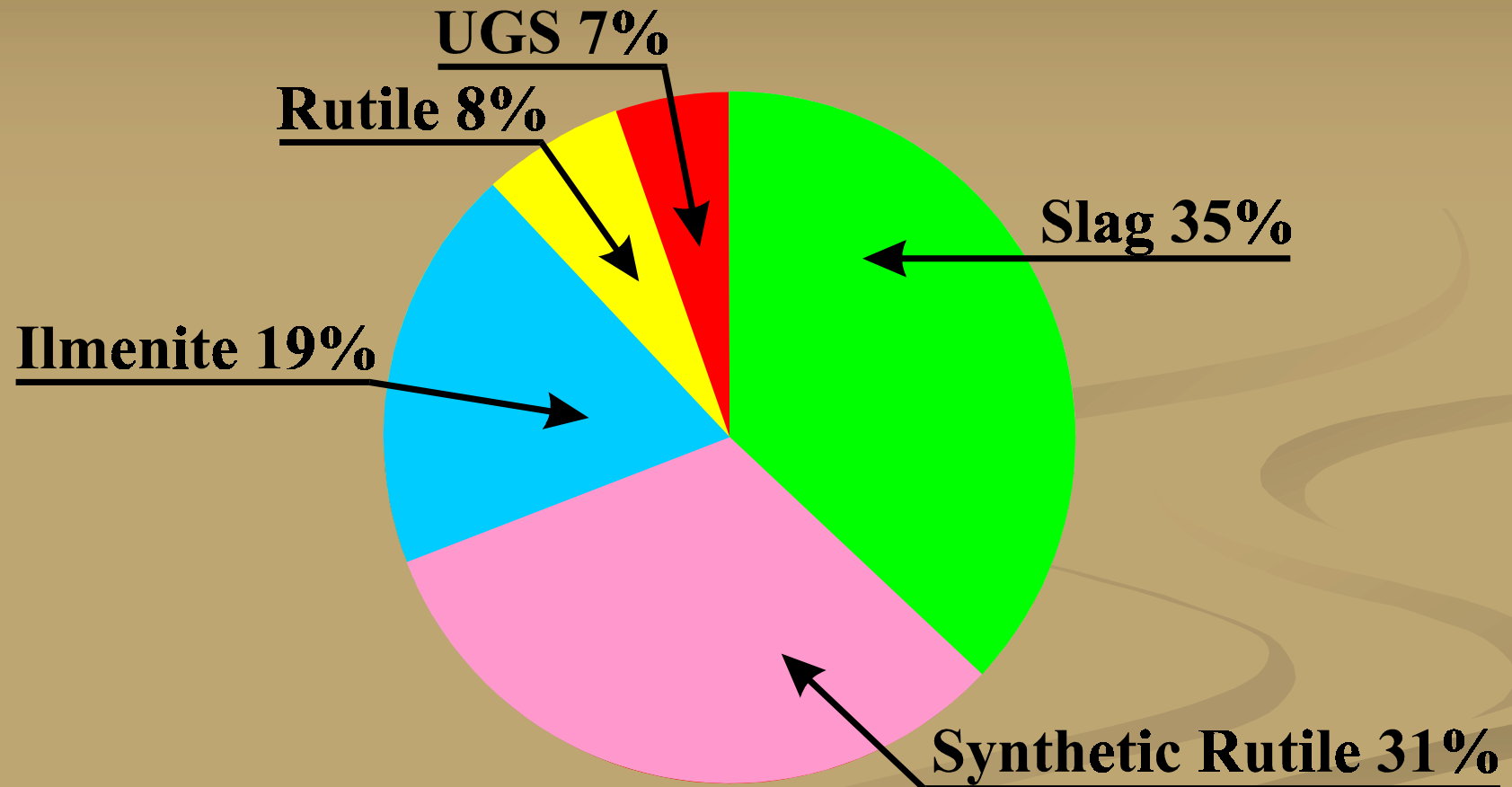
CHLORIDE vs SULFATE

- Top 5 producers - 74% of global capacity
- Chloride (60%), Sulfate (40%)
- Chloride growing at expense of sulphate: newer process, more efficient, cost effective, better product, less waste, wider end use
- Chloride route proprietary, entry barrier

BUT

- Chloride process requires high grade feedstock

Chloride Route Feedstocks



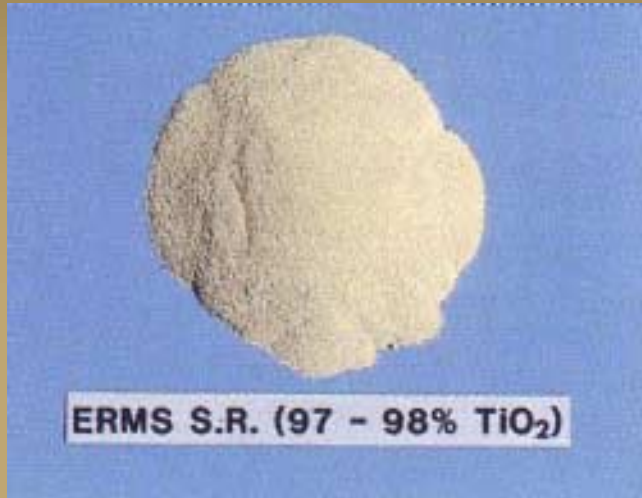
Ilmenite Upgrading Processes

Process	Ilmenite Feedstock	Impurity Removal	Economic Limitations
Ti Slag	High iron	None	Power Cost
Becher SR	Altered ($>57\%$ TiO_2)	Some Mn (with sulfur additn.)	Coal (highly reactive)
Benilite SR	Wide Range	Mg, Ca, U+Th	HCl cost
ERMS SR	Wide Range	Mg, Mn, Ca, U+Th, Cr, V	nil

THE QUALITY DIMENSION

<u>Chloride Feedstock</u>	<u>% TiO₂</u>
- ERMS synthetic rutile	>97%
- Upgraded slag (“UGS”, Rio)	>94%
- NewGenSR (Iluka)	>94%
- Synthetic rutile – Benilite	>93%
- Synthetic rutile – Becher	>90%
- Slag	>85%

QUALITY - ENVIRONMENT



- ERMS SR is a premium feedstock for TiO₂ pigment producers; titanium metal production



Minimum environmental impact – no liquid effluent, saleable iron oxide by-product

CAPITAL COSTS

(in US \$/t of installed capacity)

<u>Process</u>	<u>Capital Cost</u>
ERMS SR	450
Becher SR	550
Benilite SR	750
Slag	970
UGS (Rio)	1000

OPERATING MARGINS (in US \$/t)

<u>Process</u>	<u>Revenue</u>	<u>Operating Cost</u>	<u>Margin</u>
ERMS SR	420	130	300
Becher SR *	400	150	250
UGS (Rio)	450	250	200
Slag	380	190	190
Benilite SR	420	260	160

Note: * *The Becher process is ore and coal specific.*

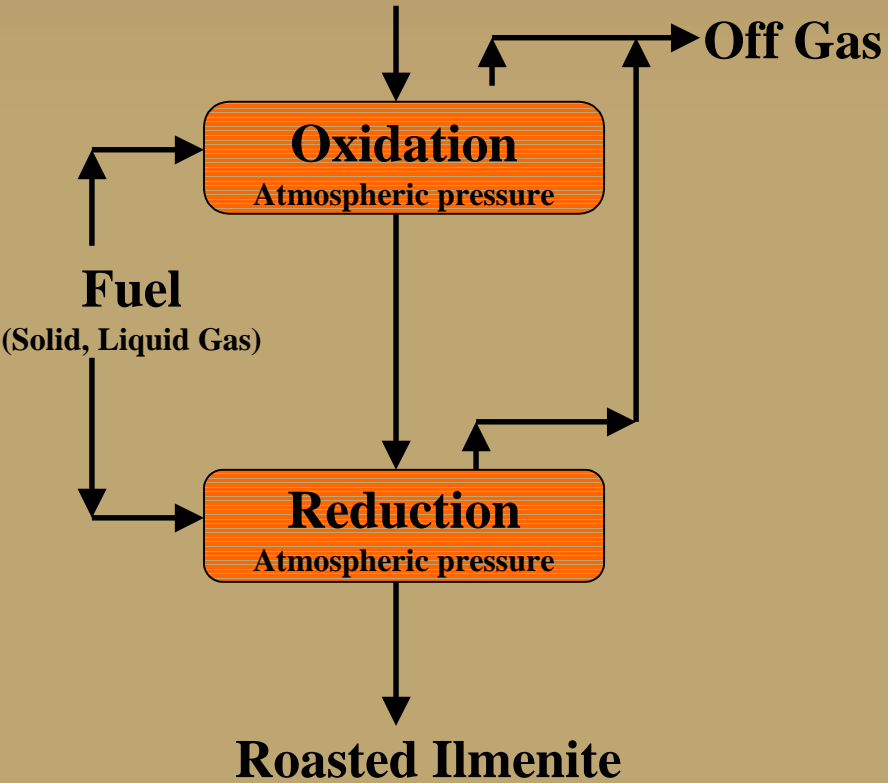
NEW CHALLENGE TO ERMS SR?

- Iluka and Outokumpu/Lurgi have exclusively developed the “NewGenSR” process - potentially for use in the Murray Basin
- Evolved from the Becher Process – costs unknown – technical comparison possible
- The ERMS SR Process has been verified under continuous operation to produce the highest quality SR in the world

Roasting Flowsheet

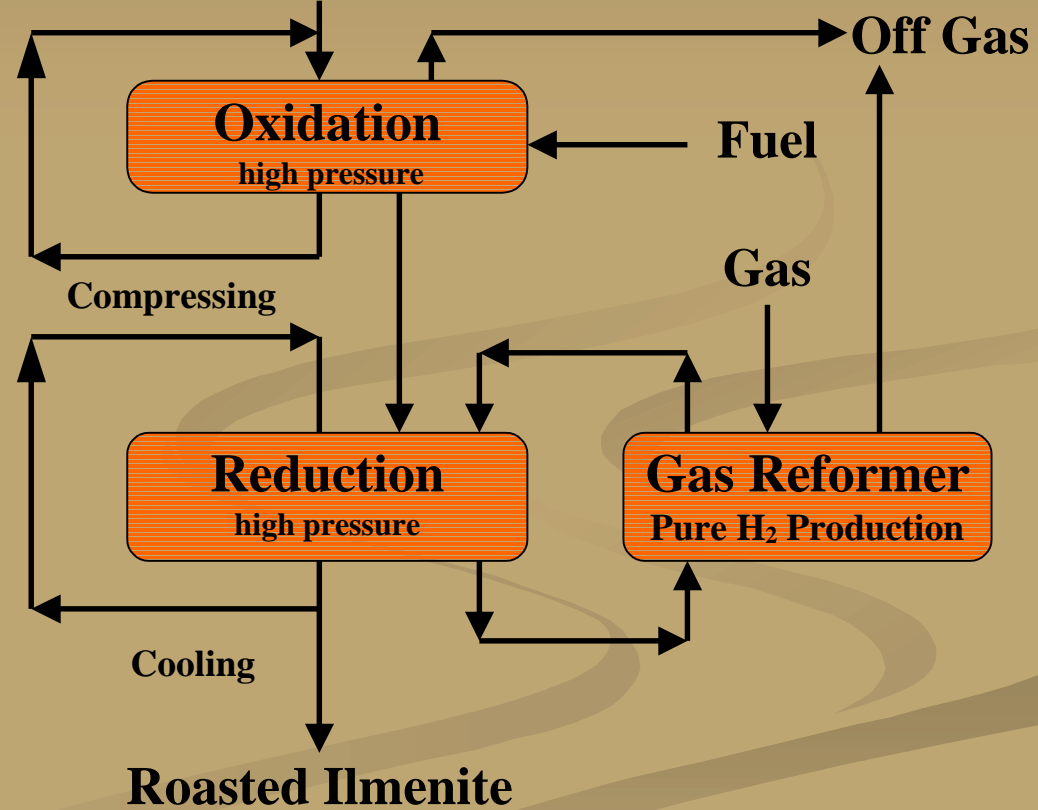
ERMS SR

Ilmenite
Concentrate



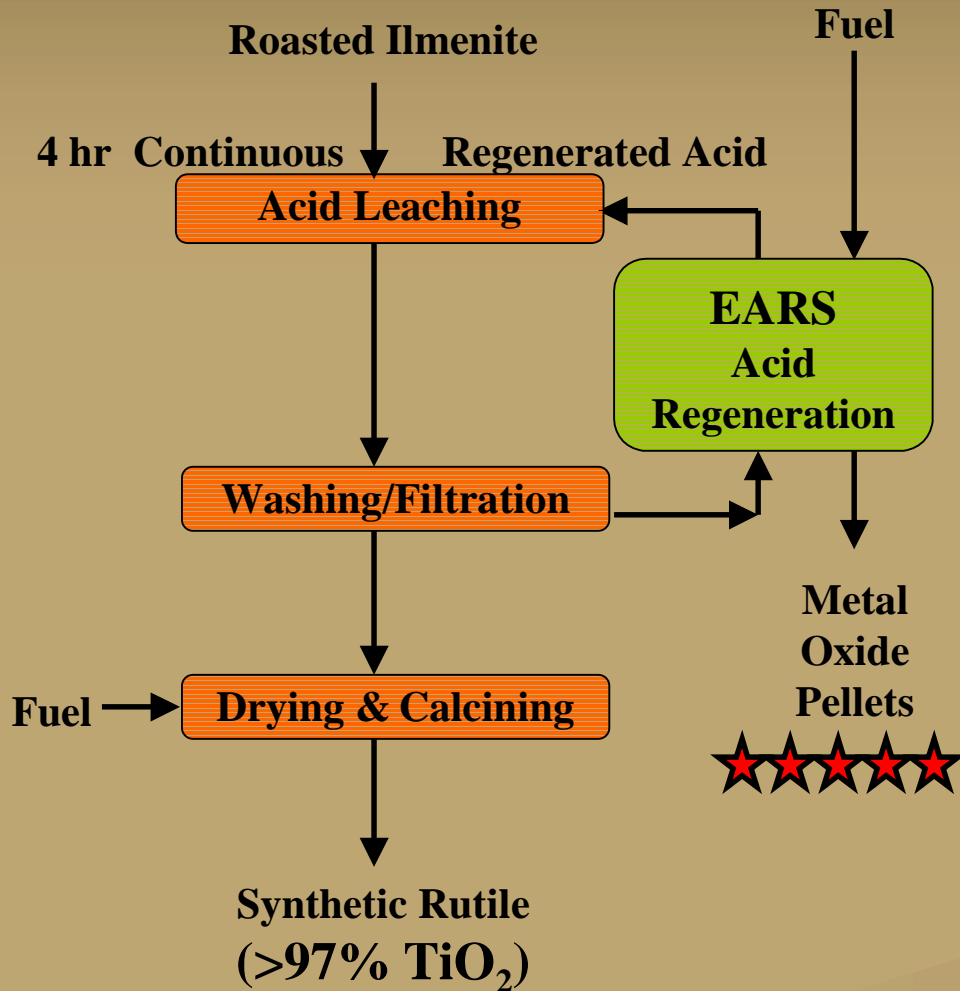
NewGenSR

Ilmenite
Concentrate

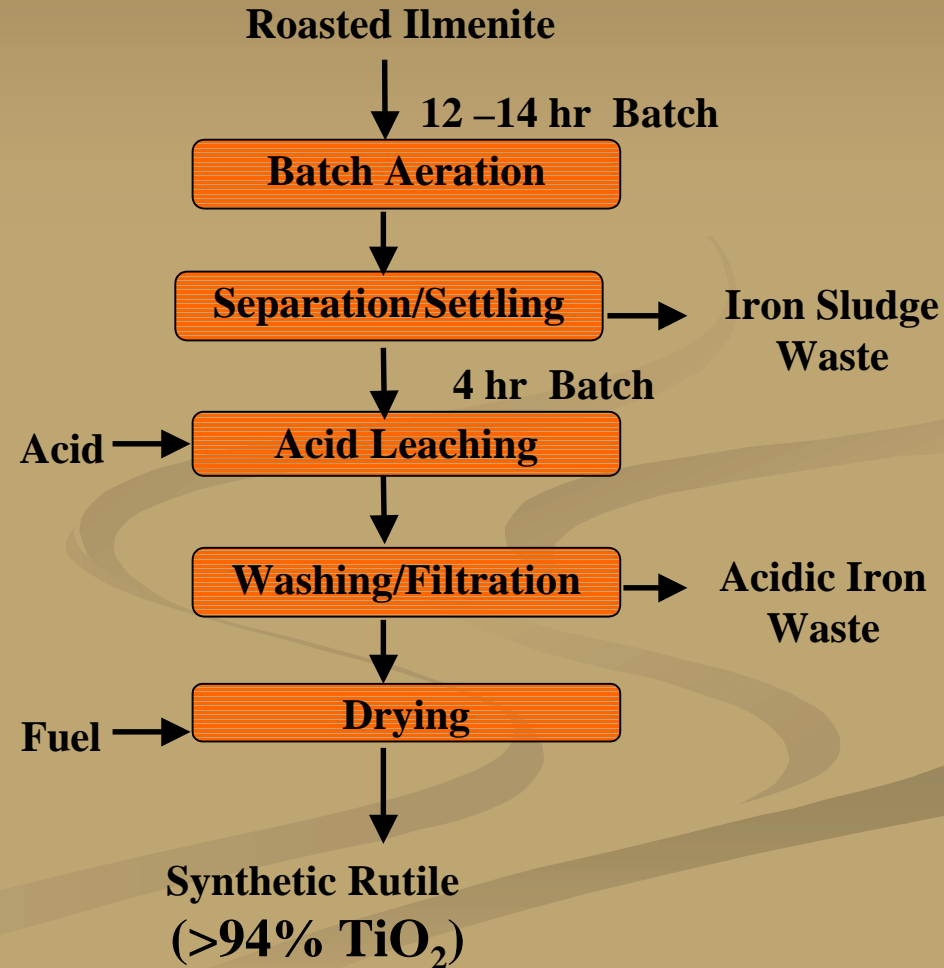


Leaching Flowsheet

ERMS SR



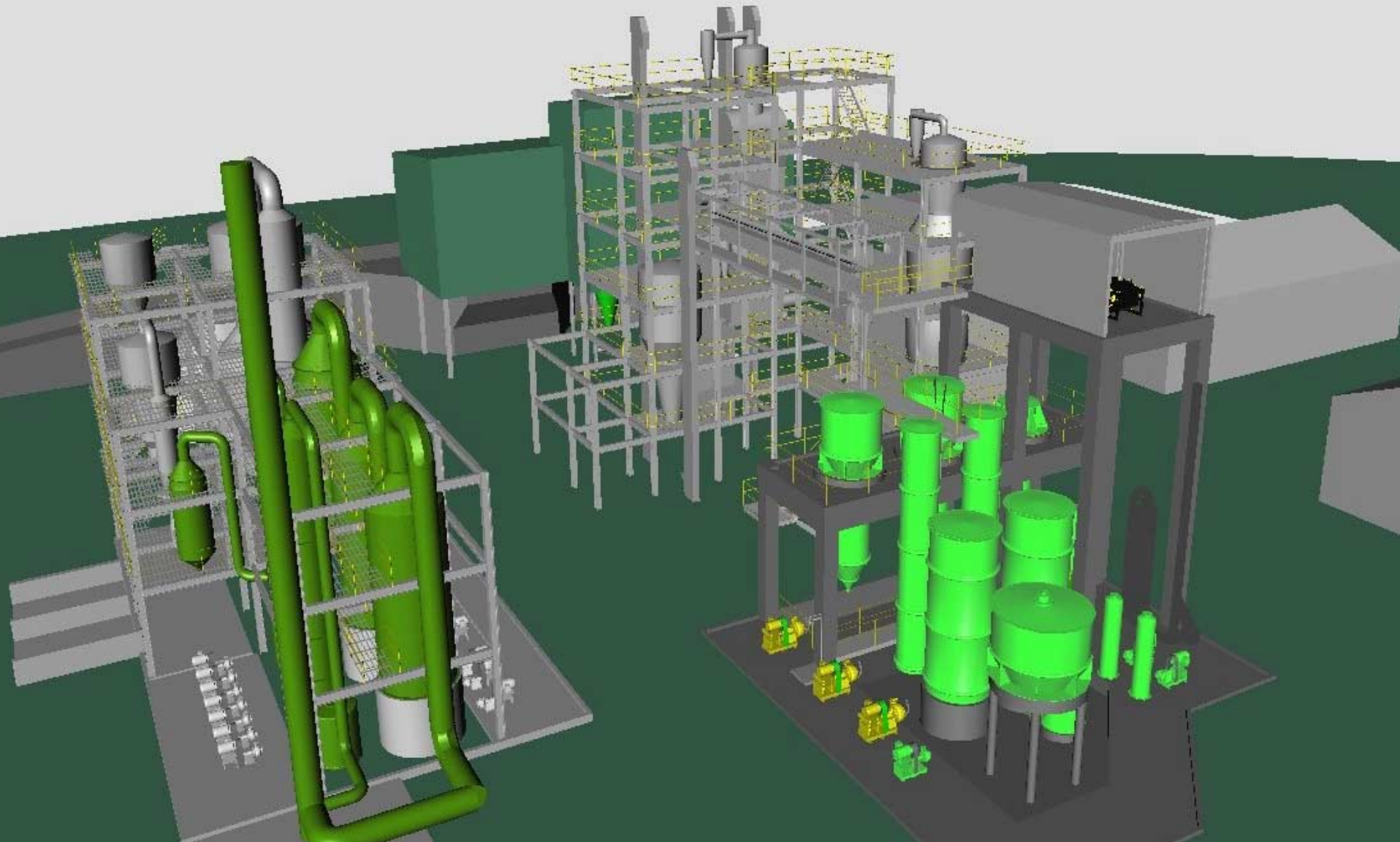
NewGenSR



THE COMPETITIVE ADVANTAGE OF ERMS SR

- Technology applicable to all grades of ilmenite
- Technology uses existing equipment and is simple cost-effective, low risk and environmentally friendly.
- Ultra high quality synthetic rutile product
- Low capital cost
- Low operating cost
- High margin business

SCHEMATIC VIEW OF ERMS & EARS PLANT



AUSTPAC'S PROJECTS


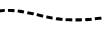


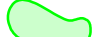
■ AUSTRALIA

Murray Basin

- Ilmenite beneficiation
- ERMS SR complex
- WIM 150

■ INDIA

AusRutile JV (Ticor, IRE)

-  River
-  Railway
-  Major Town
-  Mineral Sands Prospects
-  Murray Basin Outline



**MURRAY BASIN
HEAVY MINERAL DEPOSITS**



100 km

WIM150

SA

NSW

VIC

BROKEN HILL

MENINDEE

RENMARK

MILDURA

BALRANALD

ADELAIDE

OUYEN

KERANG

BORDERTOWN

NHILL

BENDIGO

HORSHAM

NARACOORTE

BALLARAT

MELBOURNE

HAMILTON

PORTLAND

GEELONG

Murray

Darling

River

AUSRUTILE JOINT VENTURE

(37% APG, 37% TOR, 26% IRE)

- Very large, high grade HM deposit
- >23 M.t. ilmenite
- Long term plan for 100K tpa ERMS SR plant



Where to from here?

- Technology proven at Pilot Plant scale
- Commercially demonstrate technology in order to finance large plant (~100K)
- Obtain product sales contracts for large plant
- Confirm assured supply of low cost ilmenite
- Lock in large resource base for long term production from world class SR plant

AUSTPAC - 2002 ONWARDS

- Provide market parcels of SR to prospective customers - > 20K tonnes needed
- Evaluating minimum economic size for ERMS SR plant - 25K tpa and up
- Tie down long term, low cost supply of ilmenite
- Complete site study on selected location
- Commit to construction for production in 2004

CONCLUSIONS

APG is an exciting TiO₂ play because:

- Technology widely applicable/patented
- Value adding – can unlock vast, lower grade ilmenite resources (Murray Basin, India)
- Process has lower capex, higher operating margins, is environmentally friendly
- ERMS SR – ultra high quality SR feedstock for chloride pigment and Ti metal production
- Involved with major players in India

**SIGNIFICANT & SUSTAINABLE
RETURNS FOR INVESTORS**