SYDNEY MINING CLUB

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ERMS Synthetic Rutile: Ultra High Grade Feedstock for the TiO_2 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_2O_3 %	TiO_2 Recovery %
Ilmenite 1			
Before roasting	60.3	2.02	
Product	65.6	0.12	88.00
Ilmenite 2			
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

ERMS roaster

Magnetic separation

Roasted ilmenite

REGENERATED ACID

SPENT ACID

EARS acid regeneration plant

Inert oxide pellets

ERMS batch leach vessels

Synthetic Rutile
(>97% TiO_2)

ERMS SR

Typical Chemical Analysis

TiO_2	97.50%
Fe_2O_3	0.82%
Fe + Mn	0.71%
SiO_2 (Total)	0.77%
Cr_2O_3	0.02%
Al_2O_3	0.13%
CaO	0.02%
MgO	0.01%
U+Th	<15ppm

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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 TiO_2 MARKET

Where does ERMS SR fit?

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THE TiO_2 INDUSTRY

- TiO_2 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

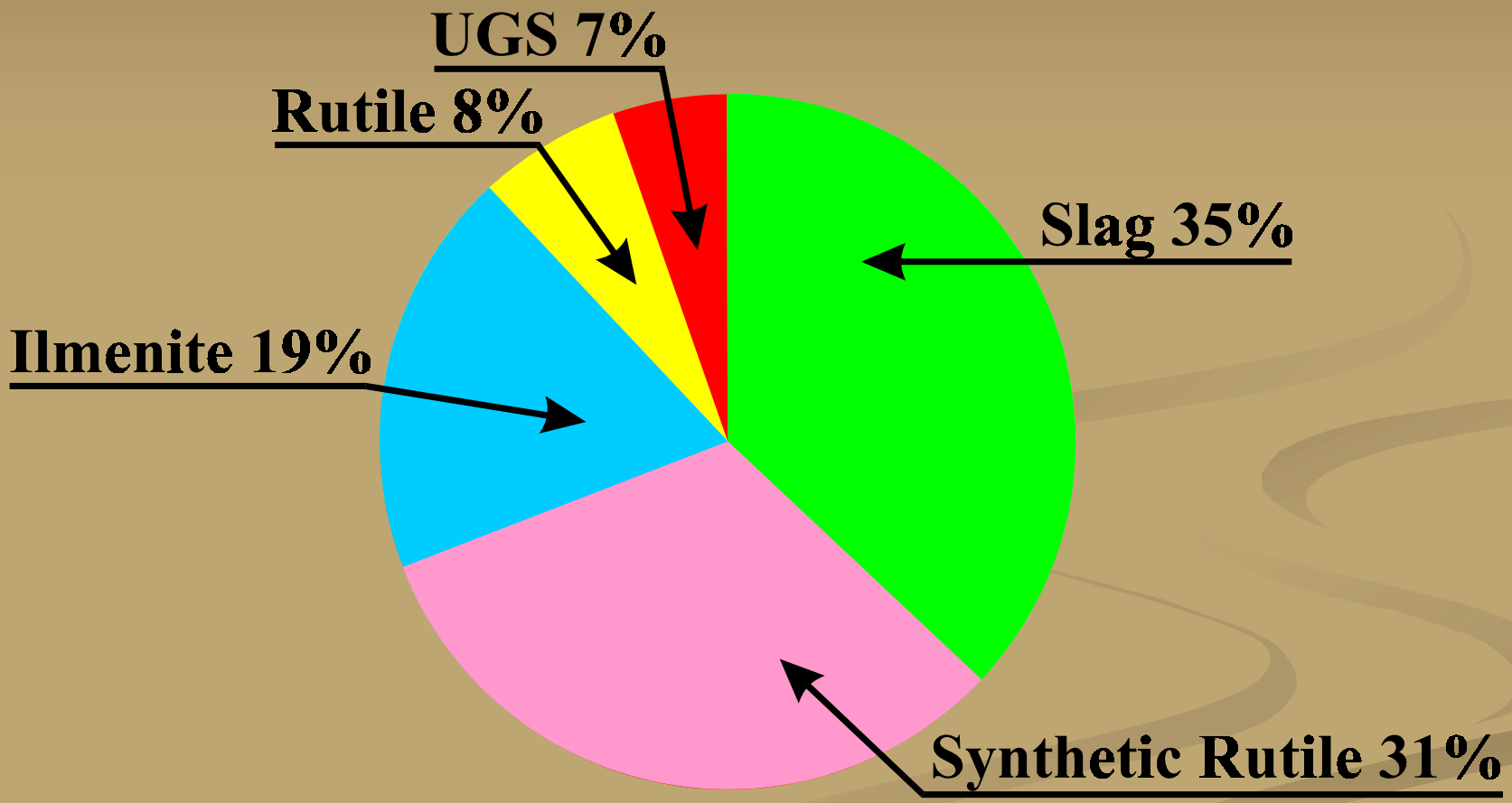
CHLORIDE vs SULFATE

- 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



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Source: Mineralex Agencies

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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

Chloride Feedstock	% TiO_2
- **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 TiO_2 pigment producers; titanium metal production**

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

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CAPITAL COSTS
(in US $/t of installed capacity)

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

OPERATING MARGINS (in US $/t)

Process	Revenue	Operating Cost	Margin
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.*

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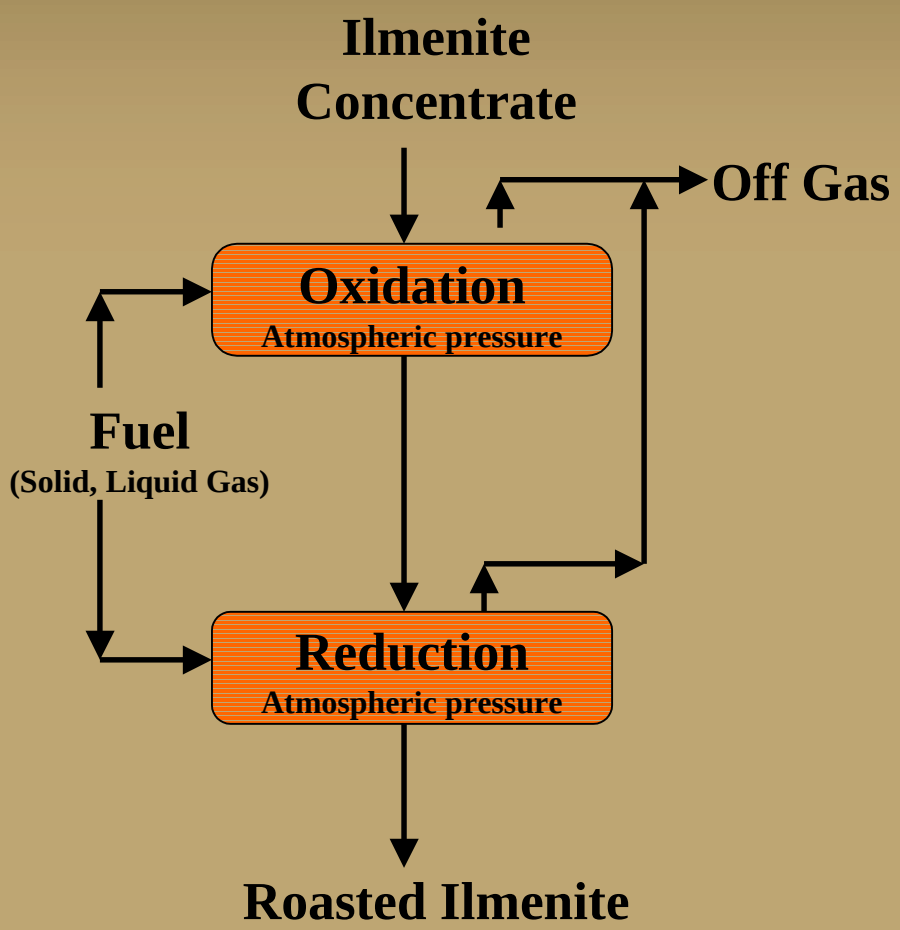
NEW CHALLENGE TO ERMS SR?

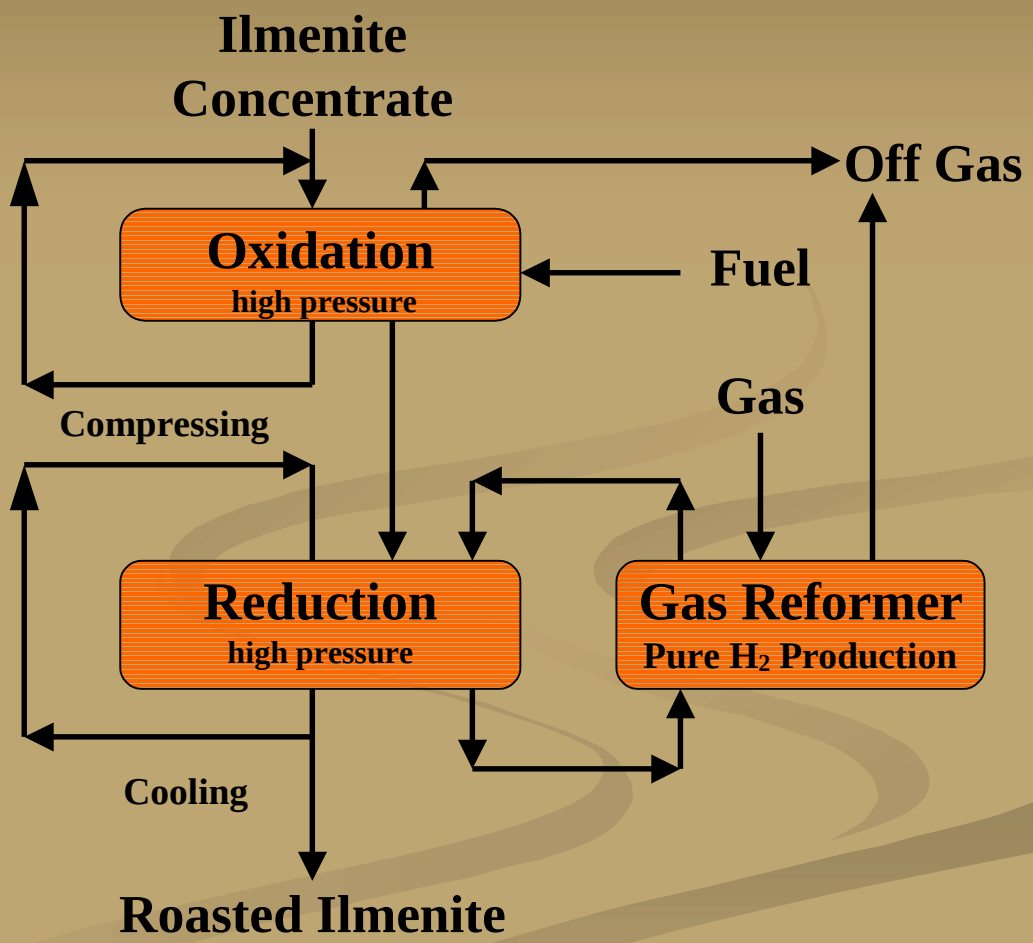
- Iluka and Outukumpu/Lurgi have exclusively developed the “NewGenSR” process - potentially for use in the Murray Basin
- Evolved from the Becher Process – costs unknown – technical comparison possible
- The ERMS SR Process has been verified under continuous operation to produce the highest quality SR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

Roasting Flowsheet

ERMS SR



NewGenSR



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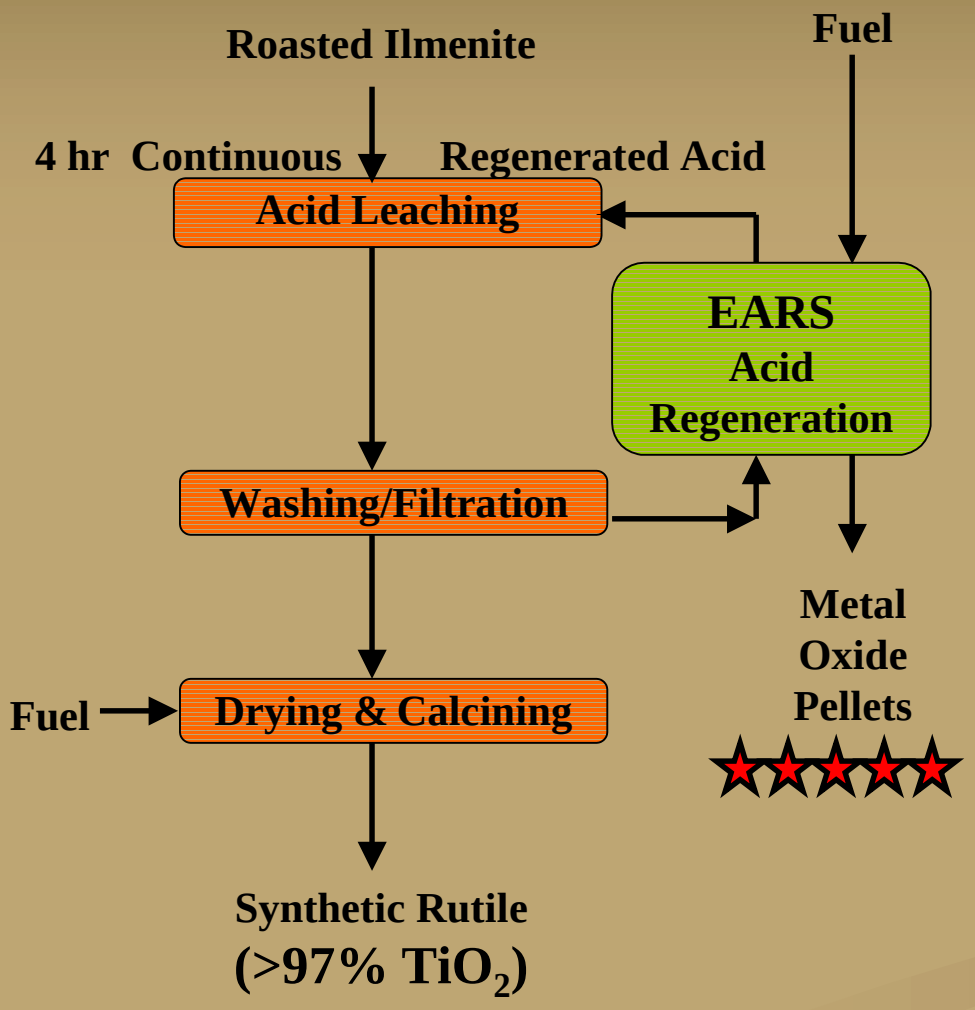
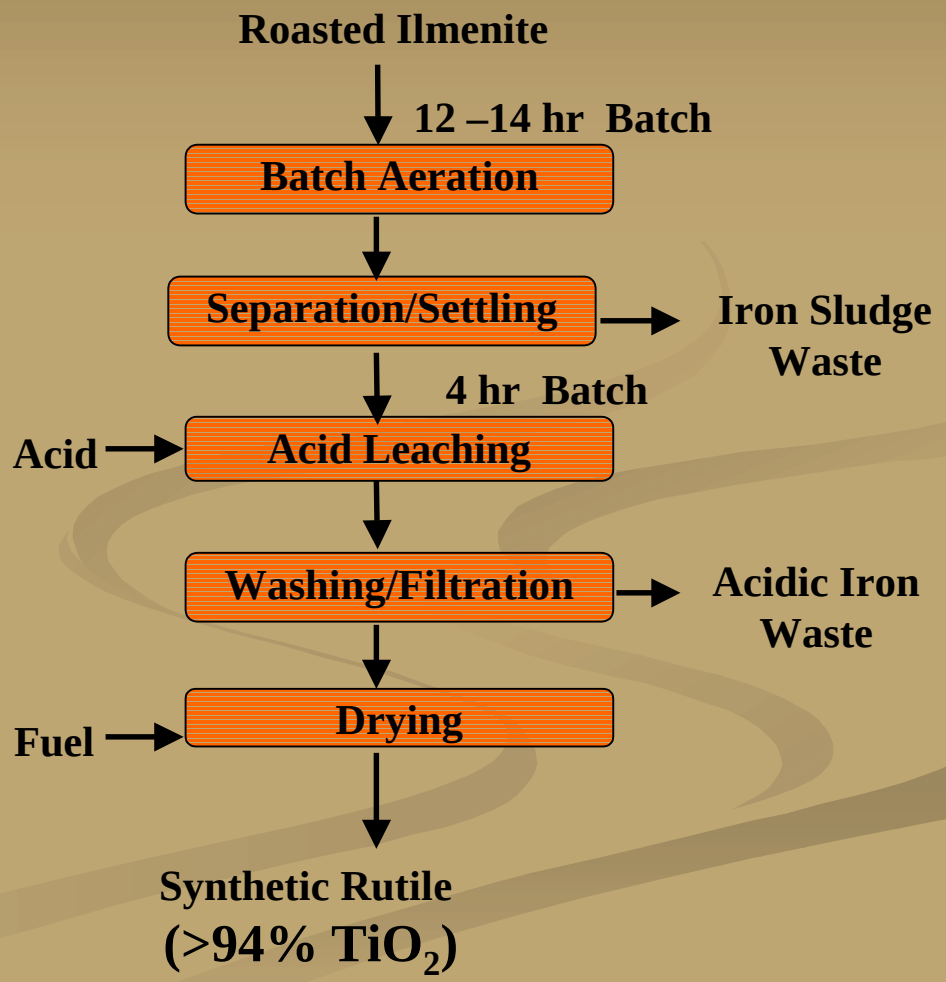
Leaching Flowsheet

ERMS SR



NewGenSR



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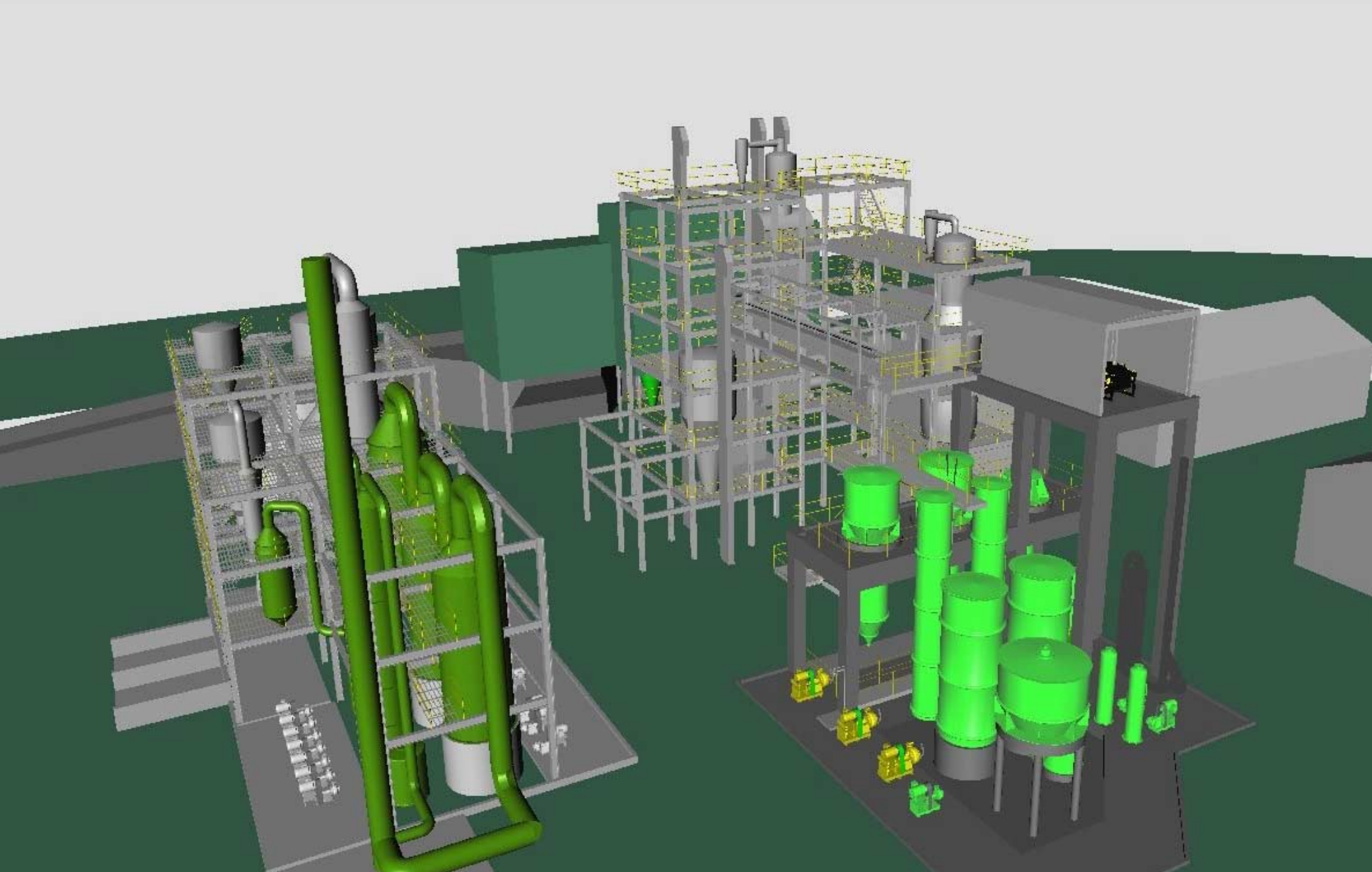
THE COMPETITIVE ADVANTAGE OF ERMS SR

- 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)

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River
Railway
Major Town
Mineral Sands Prospects
Murray Basin Outline
BROKEN HILL
River
MENINDEE
Darling
S A
N S W
RENMARK
Murray
MILDURA
River
BALRANALD
ADELAIDE
OUYEN
KERANG
NHILL
BORDERTOWN
HORSHAM
BENDIGO
NARACOORTE
WIM 150
VIC
BALLARAT
MELBOURNE
HAMILTON
PORTLAND
GEELONG
N
100 km
MURRAY BASIN
HEAVY MINERAL DEPOSITS

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

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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 TiO_2 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