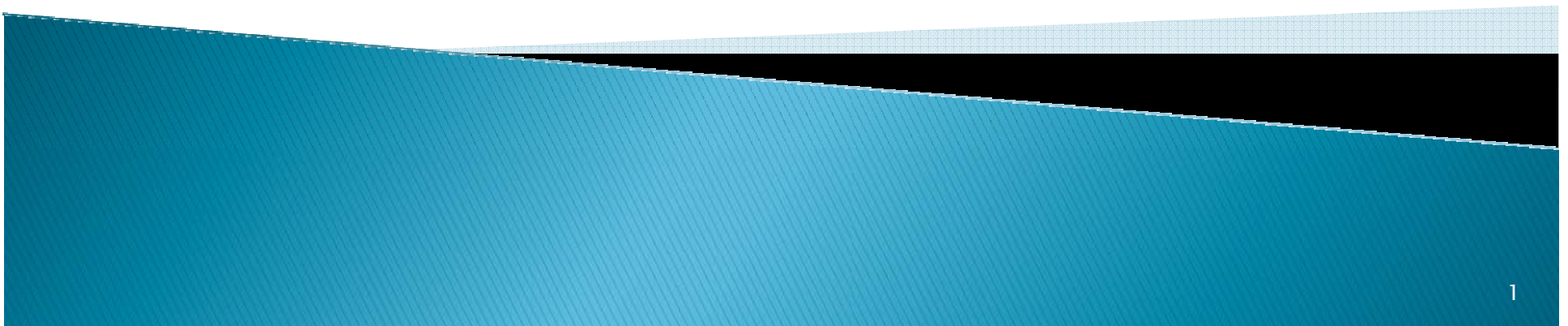


# Market Overview Phosphate Rock

Keren Paterson  
September 2008



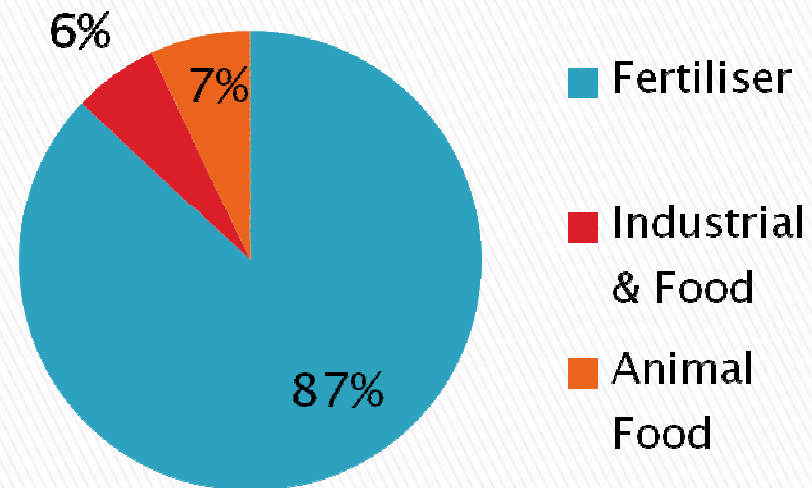
# Do we hop on the Band Wagon too?

*“The rise in phosphate prices is breathtaking even by recent commodity standards... Phosphate is being dubbed as the next mini resources boom.” AFR 2 June 2008*

# Background

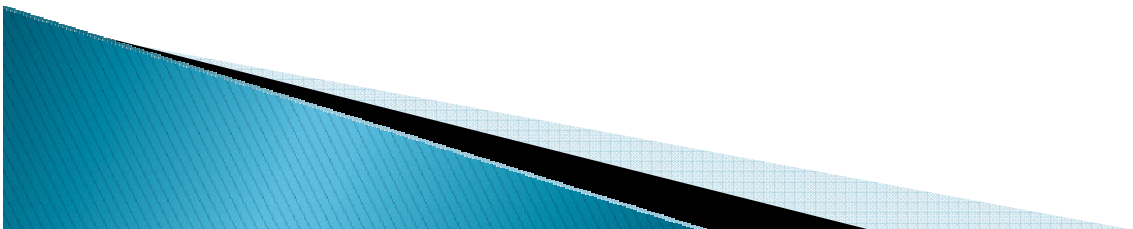
- ▶ Phosphate rock is an essential input for the production of phosphate based fertilisers. It's mixed with sulphuric acid to form phosphoric acid and then granulated with ammonia to create ammonium phosphate fertilisers eg – Super Phosphate.

**World Phosphate Usage**



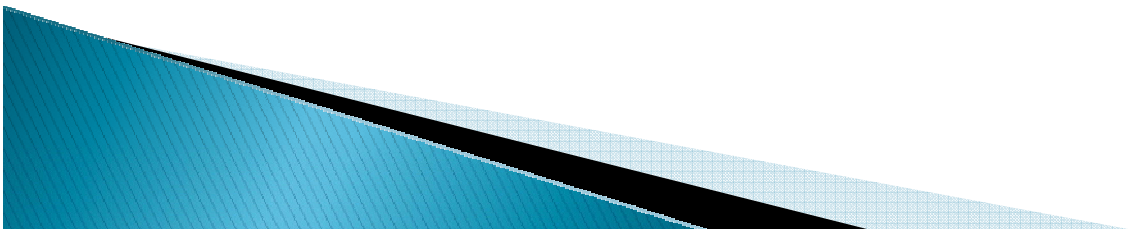
# Rising Fertiliser Demand

- ▶ Pressure from
  - Population growth
    - 19% growth by 2025
  - Changing diets
    - increasing in GDP/capita – increases demand for higher protein food
    - 1t beef requires 7t grain
    - 1980 Chinese meat consumption 15kg per person p.a.
    - 2003 Chinese meat consumption 55kg per person p.a.
  - Biofuels
    - Grain consumption for biofuel – around 5% of world demand
- ▶ Agricultural land is a depleting resource and fertilisers are necessary to increase yields.



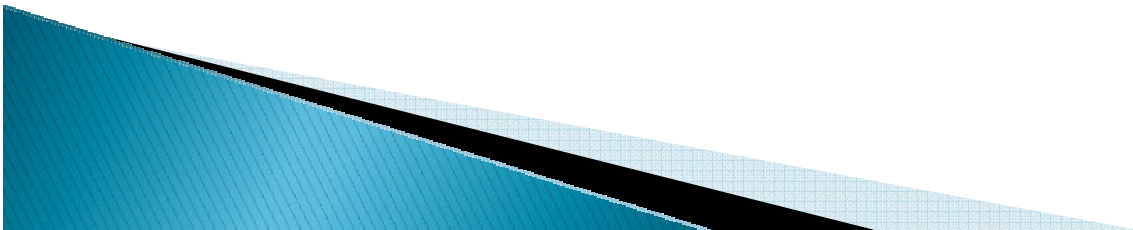
# Chemical Properties

- ▶  $P_2O_5$  Content
  - minimum 29%, preferably >32–33% (for direct shipping ore (“DSO”))
- ▶ Impurities
  - $CaO:P_2O_5$  ratio <1.55:1 indicator of sulphuric acid consumption required in the phosphoric acid production.
  - Silica <5% preferable but can be as high as 9–10% – wear issues
  - Iron & Aluminium – report to phos-acid stream instead of gypsum stream so the lower the better 5–6% ok for superphosphate production.
  - $MgO$  <1.5%, similar difficulties to iron and aluminium and carbonate
  - Fluorine <3–4% deleterious.
  - Chlorine <200–300ppm – corrosive. Higher grades needs corrosion resistant processing materials.
  - Heavy Metals – cadmium, fertilizer standards. Low cadmium can demand a premium <2ppm.
  - Organics – cause foaming problems C<1% preferable.
- ▶ Deleterious elements impact on price and beneficiation capex for producing DSO.



# Demand

- ▶ 2007 demand grew 4.1%, 2008 growing but at a slower rate.
- ▶ Most of the increase from China for fertiliser production for both domestic and export consumption.
- ▶ Global agriculture prices are strong and supporting an expansion in fertiliser use – America East Asia and European Bio-fuel production.
- ▶ Around 31Mt of rock is purchased in the international market.



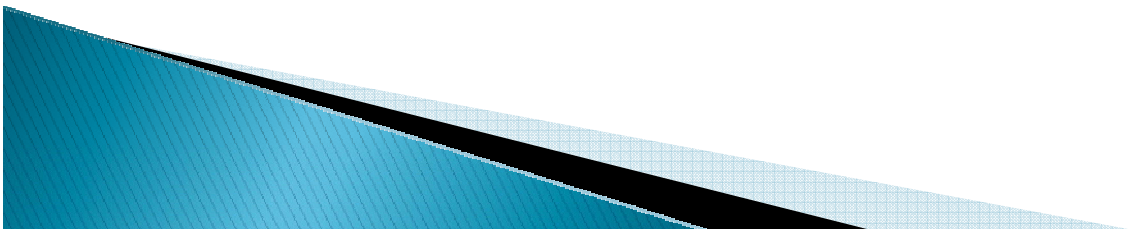


# World Phosphate Rock Consumption by Region (Mt)

	2006	2007	2008(e)	Change 06-07	Change 07-08
World Total	170.0	177.0	181.5	7.0	4.5
West Europe	6.4	6.8	6.8	0.4	0.0
Central Europe	2.9	2.9	2.7	0.1	-0.2
FSU	11.8	12.8	13.4	1.0	0.6
Africa	24.0	24.5	26.4	0.5	1.9
North America	34.0	34.8	34.4	0.8	-0.4
Central America	0.9	0.9	1.8	0.0	0.9
South America	8.1	9.1	9.4	1.0	0.3
Middle East	7.0	6.7	6.7	-0.3	0.0
South Asia	7.4	7.0	7.4	-0.4	0.4
South East Asia	3.9	3.8	4.0	-0.1	0.2
East Asia	60.5	64.4	65.0	3.9	0.6
Oceania	3.1	3.3	3.3	0.2	0.0

# Supply

- ▶ Global Phosphate production grew by 5.9Mt to an estimated 176.7Mt in 2007 and expected to increase to 182.1Mt in 2008.
- ▶ Growth in China accounted for the bulk of the increase, but this is expected to flatten.
- ▶ Record high prices has resulted in a number of new project announcements in Australia, Russia, Kazakhstan, Algeria, Egypt and Peru, although lead times can be up to 5 years.
- ▶ CRU expects that it is unlikely we will see a supply glut.





# World Phosphate Rock Production by Region (Mt)

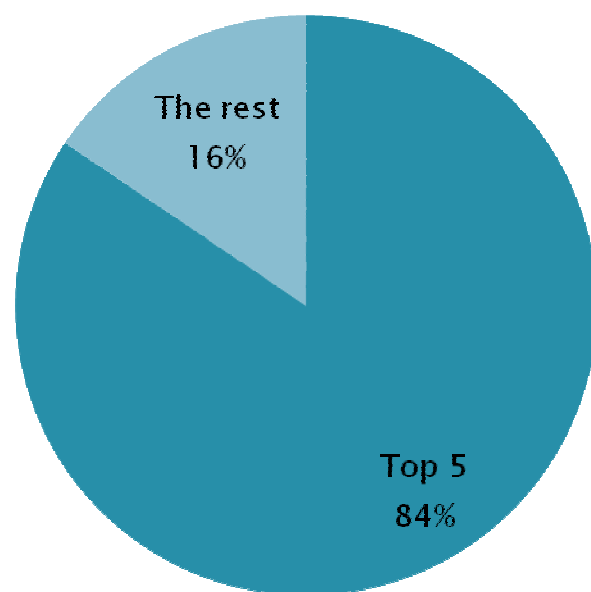
	2006	2007	2008(e)	Change 06-07	Change 07-08
<b>World Total</b>	<b>170.8</b>	<b>176.7</b>	<b>182.1</b>	<b>5.9</b>	<b>5.4</b>
West Europe	0.9	0.9	0.8	0.0	0.0
Central Europe	0.0	0.0	0.0	0.0	0.0
FSU	12.5	12.8	13.7	0.3	0.9
Africa	43.1	43.8	46.1	0.7	2.3
North America	31.0	30.9	31.6	-0.1	0.7
Central America	0.0	0.0	1.0	0.0	1.0
South America	6.2	6.4	6.9	0.2	0.5
Middle East	12.4	12.3	12.2	-0.1	-0.1
South Asia	1.6	1.8	1.8	0.2	0.0
South East Asia	1.2	1.3	1.5	0.1	0.2
East Asia	59.3	63.4	63.6	4.1	0.2
Oceania	2.6	3.1	2.9	0.5	-0.2

# International Trade

- ▶ International trade increase by 1.4Mt in 2007 to 31.0Mt. North and South America and West Europe recorded the largest gains in imports in 2007.
- ▶ International trade expected to fall slightly to 30.4Mt in 2008.
- ▶ In March 2008 China imposed a 35% export tariff on phosphate fertilisers, this is expected to reduce Chinese exports.
- ▶ Morocco is the world's largest exporter – 46% world trade.
- ▶ Record prices are causing some buyers to reduce purchases because of higher costs and slowing demand.
- ▶ In April Russia imposed a 6% export duty.
- ▶ Australis' likely market place – phosphoric acid and super-phosphate producers – south and southeast Asia, Australia, New Zealand, Malaysia and Indonesia (Palm oil).

# Top 5 Exporters

## Exporters



OCP (Morocco)	46%
JPMC (Jordan)	12%
Gecopham (Syria)	9%
Ferphos (Algeria)	5%
Phosagro (Russia)	4%

# World Phosphate Rock Imports by Region (Mt)

	2006	2007	2008(e)	Change 06-07	Change 07-08
<b>World Total</b>	<b>29.6</b>	<b>31.0</b>	<b>30.4</b>	<b>1.4</b>	<b>-0.6</b>
West Europe	5.6	6.0	6.0	0.4	0.0
Central Europe	2.9	2.9	2.7	0.1	-0.2
FSU	2.1	2.3	2.4	0.2	0.1
Africa	0.2	0.1	0.1	-0.1	0.0
North America	2.4	2.8	2.8	0.4	0.0
Central America	0.9	0.9	0.8	0.0	-0.1
South America	1.9	2.5	2.5	0.6	0.0
Middle East	1.8	1.6	1.6	-0.2	0.0
South Asia	5.8	5.7	5.6	-0.1	-0.1
South East Asia	2.8	2.8	2.5	0.0	-0.3
East Asia	2.2	2.0	2.1	-0.2	0.1
Oceania	1.3	1.5	1.3	0.2	-0.2

# World Phosphate Rock Exports by Region (Mt)

	2006	2007	2008(e)	Change 06-07	Change 07-08
<b>World Total</b>	<b>29.7</b>	<b>31.0</b>	<b>30.4</b>	<b>1.3</b>	<b>-0.6</b>
West Europe	0.0	0.0	0.0	0.0	0.0
Central Europe	0.0	0.0	0.0	0.0	0.0
FSU	2.7	2.8	2.7	0.1	-0.1
Africa	18.6	19.2	19.1	0.6	-0.1
North America	0.0	0.0	0.0	0.0	0.0
Central America	0.0	0.0	0.0	0.0	0.0
South America	0.0	0.0	0.0	0.0	0.0
Middle East	6.7	7.0	7.1	0.3	0.1
South Asia	0.0	0.0	0.0	0.0	0.0
South East Asia	0.1	0.1	0.0	0.0	-0.1
East Asia	1.0	1.0	0.6	0.0	-0.4
Oceania	0.7	0.9	0.9	0.2	0.0

# Prices

- ▶ Contracts are typically negotiated directly between the producer and consumer without a trader.
- ▶ Contracts can be between 6 months and several years, with the trend towards shorter contracts as a result of the recent price rises.
- ▶ Prices depend on company, grade, volume and destination of the buyer.
- ▶ Morocco's OCP is reported to have settled prices in the second quarter 2008 for \$350/t for low-to-medium grade and \$400/t for high grade.
- ▶ International exporters tend to follow OCP's price setting.
- ▶ Recent sudden price increases due to
  - Limited supply, increasing demand
  - Little interest in the commodity over the past decade – no new projects
  - Devalued USD.
  - Increasing cost inputs.
  - OCP's new western management team – A greater focus on high margins and low volumes – unlikely to return to days of large volume, low margins



OCP – Office Chérifien des Phosphates,  
Morocco



# Prices

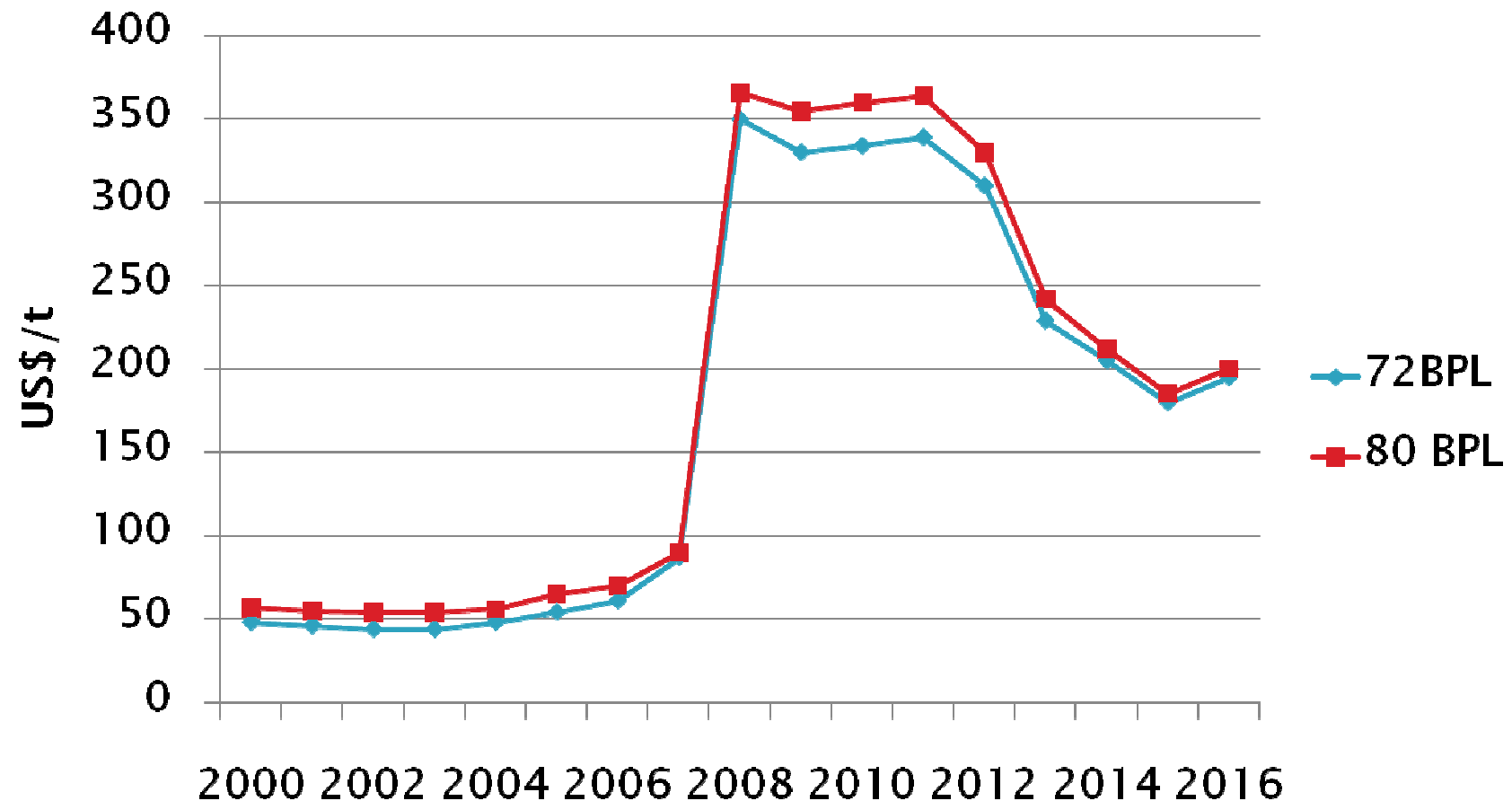
- ▶ Prices are stimulating interest in new phosphate rock and downstream phosphate projects.
- ▶ It appears that phosphate rock has been undervalued when compared to converted phosphate products.
- ▶ Due to increasing costs of production, a high concentration of production and increasing standards of living (demanding higher protein food) it is unlikely \$50/t will be seen again.
- ▶ Long-run equilibrium price forecast US\$150/t.
  - Worst case – US\$100/t.
  - Best case – US\$200/t.
  - The current price cycle is expected to peak in 2011 with prices easing from 2012 due to the expected increase in supply such as Legend (5Mt 2010), Vale (Bayovar 3.3Mt Peru 2010) and Ma'aden (Saudi Arabia 5Mt 2012) and reduced imports from India.

# Phosphate Rock Price Forecast, 2003 – 2016

% = BPL x 0.4567

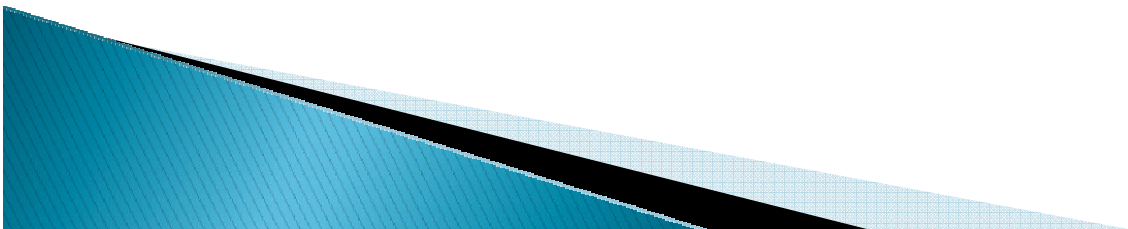
	MOROCCO Khouribga				MOROCCO Bou-Craa		TOGO		TUNISIA			
	70BPL (32%)		72BPL (32.9%)		80BPL (36.5%)		79 BPL (36.1%)		60/62 BPL (27.4–28.3%)		65/68 BPL (29.7–31.1%)	
	f.a.s Casablanca				f.a.s Laayoune		f.a.s Kpeme		f.o.b Sfax			
2000	42	45	42	48	52	57	40	48	30	33	32	35
2001	36	44	38	46	50	55	35	45	29	32	31	34
2002	34	42	36	44	44	54	35	45	29	34	30	37
2003	34	42	36	44	44	54	30	38	25	33	31	38
2004	34	44	38	48	44	56	32	36	25	35	33	44
2005	38	55	40	54	50	65	35	45	32	38	38	50
2006	44	59	50	61	54	70	35	50	33	40	39	50
2007	65	70	71	87	75	90	39	55	35	46	44	53
2008	240	330	260	350	264	366	231	331	186	263	198	286
2009	310	320	320	330	345	355	307	316	245	252	260	272
2010	315	325	324	334	350	360	316	326	250	259	268	281
2011	320	330	329	339	355	364	319	329	255	265	275	291
2012	290	300	300	310	320	330	285	296	230	239	247	261
2013	210	220	220	229	323	242	193	203	163	170	176	188
2014	185	195	195	205	202	212	169	178	138	146	152	162
2015	160	170	170	180	175	185	137	147	115	121	125	134
2016	175	185	180	195	190	200	158	168	129	136	140	149

# Price Forecast (Morocco)



# Operating Costs

- ▶ Average operating costs US\$40/t for mining and beneficiation to DSO grade. Lowest cost producers ~ US\$30/t.
  - Unit costs vary with
    - Head grade
    - Strip ratio
    - Recovery
    - Mining ratio
- ▶ Capital Costs depended on the deleterious elements and grade – the more contaminated the ore – the more expensive it will be to beneficiate.
- ▶ Beneficiation costs vary depending on
  - Head-grade in-situ
  - Dry vs wet separation
  - Dry wash screen vs flotation/magnetic separation.
- ▶ In Australia the first mover will have an advantage – establishing infrastructure access and placing sales contracts.



**“Cures for High Prices are  
High Prices”**

# Aust Phosphate Companies

- ▶ Legend International – SEC listed
  - Lady Annie – 1.4Bt @ 16% phosphate.
  - 5Mtpa beneficiation plant from 2010 via a slurry pipeline 300km to Kurumba port in the Gulf of Carpentaria.
  - 3Mtpa sales contract to Indian Farmers Fertilisers Co-operative.
  - US\$826.6M Capex – US\$228M beneficiation plant, US\$302M pipeline.
  - Operating cost US\$60/t.
- ▶ Minemakers
  - 72Mt @ 23% P<sub>2</sub>O<sub>5</sub> at a cut off of 15%.
  - 2–3Mtpa from 2010 at a total cost of A\$100/t
  - Expected Capex US\$40M – direct shipping.
  - Lychopodium pre-feas due end 2008.



# Aust Phosphate Companies

	Market Cap (US\$M)	Enterprise Value (US\$M)	Capital Adj EV (US\$M)	Project	Resource (Mt)	P <sub>2</sub> O <sub>4</sub> (%)	EV/ Resource Value	EV/ Prod. Value
<b>Developers</b>								
Legend International (SEC listed)	187.8	75.9	902.5	Lady Annie	1,463	16	0.001	0.493
Minemakers	62.5	68.8	108.8	Wonarah	72	23	0.011	0.094
<b>Average</b>	<b>125.2</b>	<b>72.3</b>						
<b>Explorers</b>								
Archer Exploration	5.6	0.6						
Mt Isa Metals	12.0	5.7		D-tree west	170	16	0.001	
Phosphate Aust	31.2	24.9		Highland Plains	82.6*	20	0.005	
South Boulder	5.3	1.6						
Syndicated Metals	8.0	4.0						
Uramet	5.1	2.2						
<b>Average</b>	<b>11.2</b>	<b>6.5</b>			<b>126</b>	<b>17</b>	<b>0.003</b>	

\* Non-JORC

# Do we hop on the Band Wagon too?

*The key to the phosphate market is continuing high oil prices and high food demand. Both oil and agricultural land are scarce and the world population continues to increase with an increasing standard of living.*

*It all points to a shift in the phosphate market in the long-term, but a bubble may be created in the short-term until new supply comes on stream in the next 3-5yrs.*

*Keren Paterson 19 September 2008*