Demonstration of High Value Added Semi Coke From Yallourn Lignite by Pyrolysis

Fukuoka, Japan 6th October 2015

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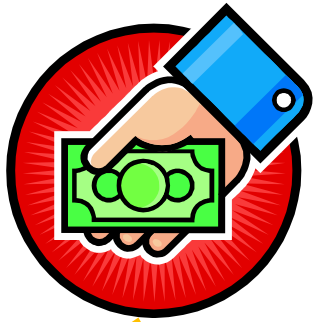
About CEA

- Coal Energy Australia (CEA) is an Australian company, recently awarded a $30m grant from the Australian and Victorian State governments, under the Advanced Lignite Demonstration Program (ALDP).
- This grant demonstrates the governments' confidence in CEA's Latrobe Valley project in Victoria.
- CEA will use these grant monies to assist in the construction and operation of its ALDP project.

Victorian Lignite

Clean Coal Technology



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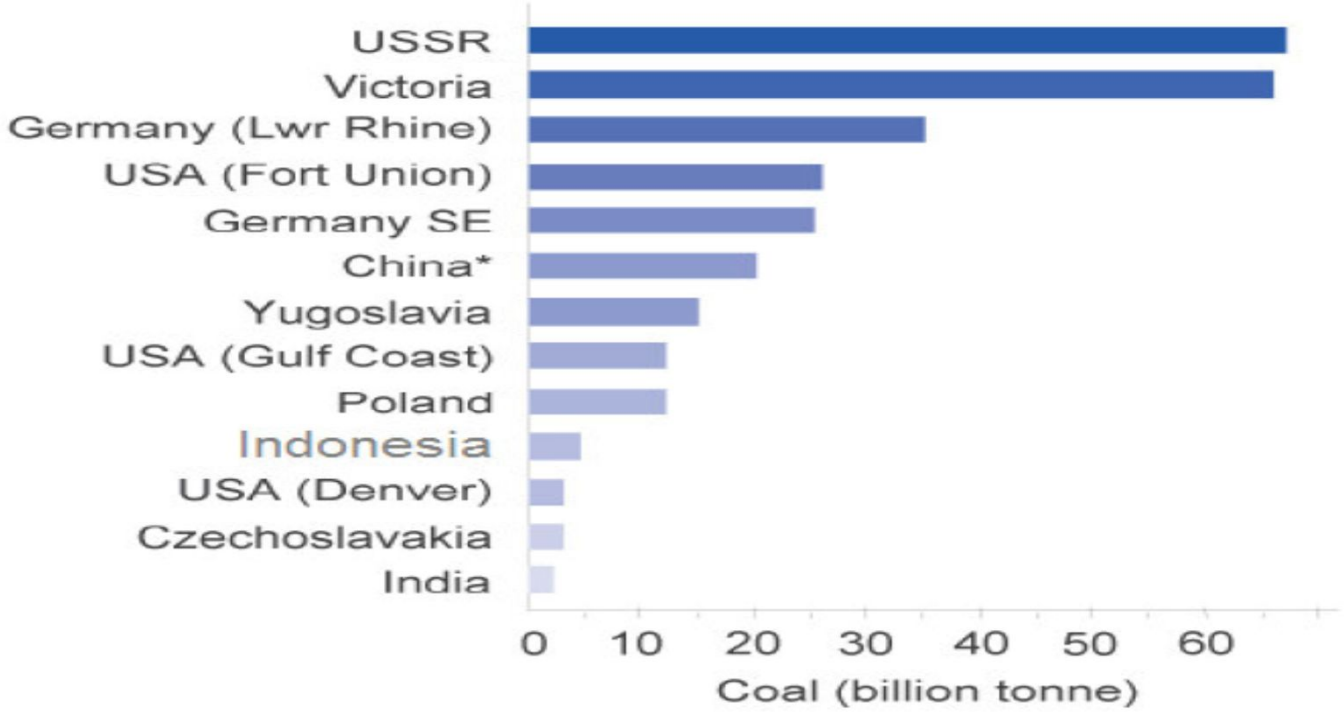
World Lignite Resources



Economically winnable lignite and brown coal based on Durie (1991).
*Values for China are estimates.

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Latrobe Valley Lignite Resource - Loy Yang Mine

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Latrobe Valley Lignite Resource – Cost Benefits

Latrobe Valley Lignite Resource is:

- Vast
- Shallow
- Thick seams

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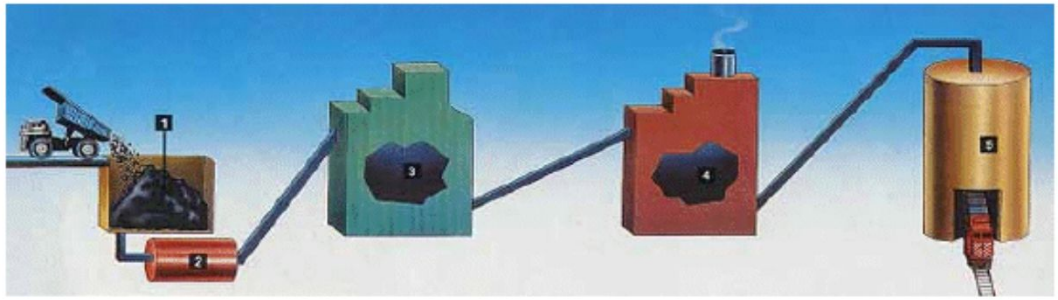
Advanced Lignite Demonstration Program

- Jointly funded ($45m Victoria / $45m Federal)
- Fit-for-purpose “coal upgrading” with low emission outcomes
- Commercial product stream
- Plausible pathway to market
- Maximise the benefits to Victoria



- Technologies most relevant to Victoria’s Latrobe Valley lignite

DEPARTMENT OF STATE DEVELOPMENT BUSINESS AND INNOVATION

State Government Victoria

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CEA's ALDP Project

The purpose of this project is to demonstrate, at commercial scale, its Advanced Pyrolysis technology to upgrade Victorian lignite into high-value energy products including semi coke and pyrolysis oil.

After successful demonstration at ALDP scale, CEA will proceed to build large scale plants in Victoria and, potentially, other locations which have large, accessible low rank coal reserves.

- The plant will be built on EnergyAustralia's site at Yallourn North in close proximity to the large Yallourn mine.
- CEA has entered into a long term raw coal supply agreement with EnergyAustralia Limited, owner of Yallourn mine, for its ALDP plant and future large scale plant.

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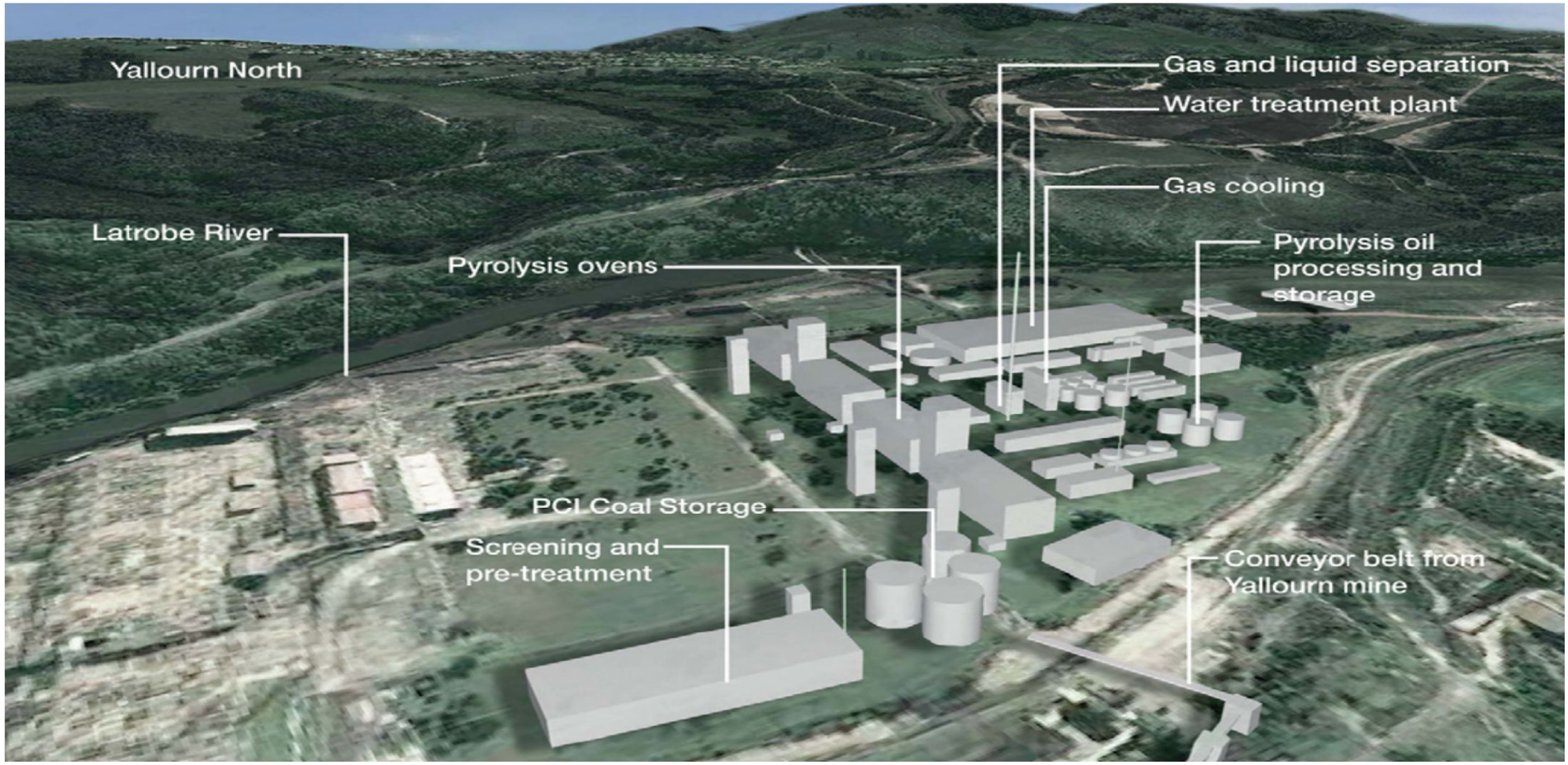
Bird's Eye View of CEA's Pyrolysis Plant



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CEA's Advanced Pyrolysis Technology

The upgrading of Victorian lignite by pyrolysis produces high-value energy products including semi coke, pyrolysis oil, coal gas and ammonium sulphate.

The two main pyrolysis products are **Semi Coke** and **Pyrolysis Oil**:

- Semi coke's highest value use is as a feedstock for high value energy products including Hydrogen, Acetylene and Calcium Carbide; also it is an ideal PCI type coal for steel making.as it has a high "coke replacement ratio".
- Pyrolysis oil (also known as coal tar) can be distilled into many higher value energy products, including light oils and phenols, and as a feedstock for high value chemical production.

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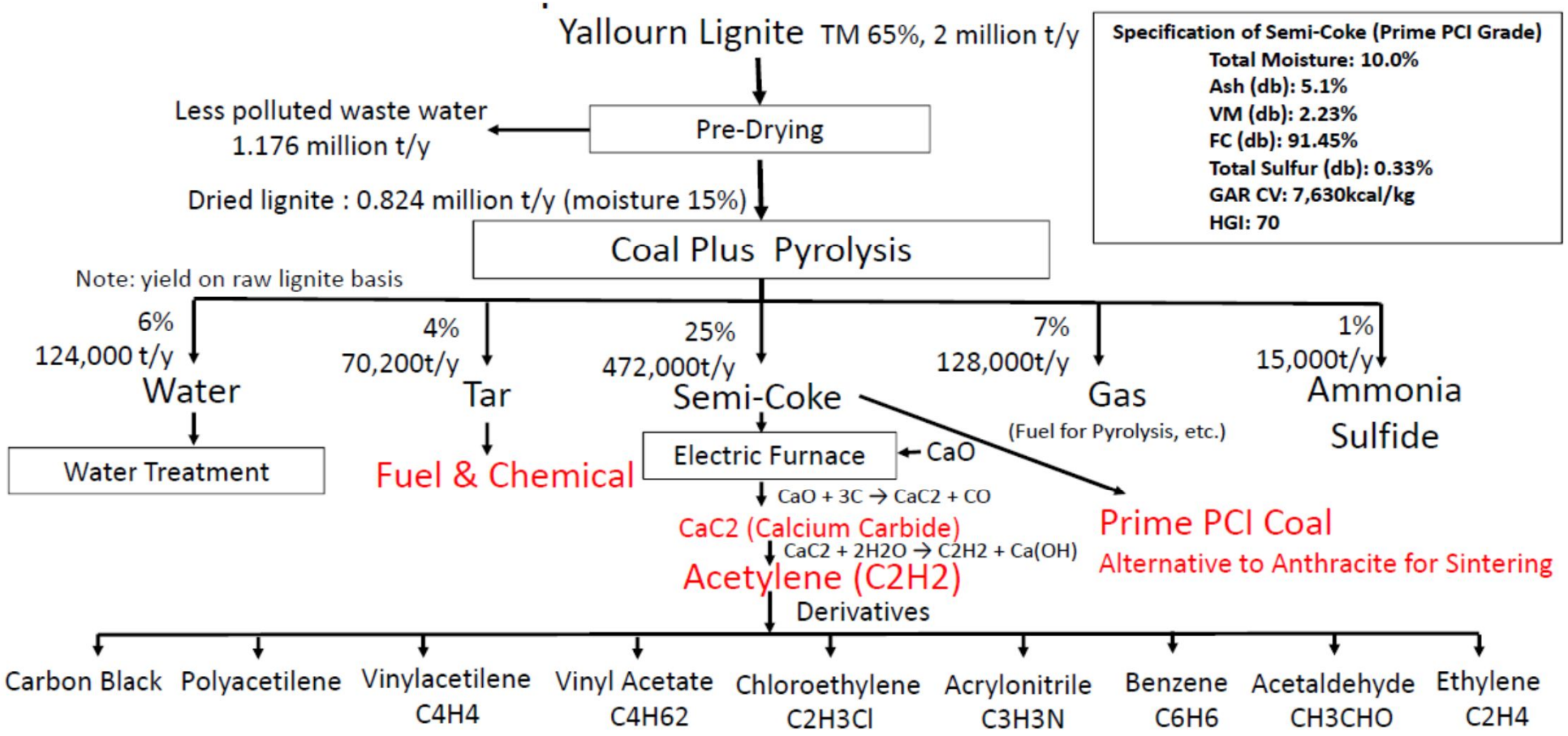
High Value Products Derived From CEA Semi Coke



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Pyrolysis Product 1.a – Semi Coke

Proximate Analysis	Comparison	
ITEM (basis)	CEA SEMI COKE	PRIME SEMI COKE REQUIREMENT
Total Moisture (arb)	0.6%	<10.0%
Ash (adb)	5.1%	<10.0%
Volatile Matter (adb)	2.2%	<5.0%
Fixed Carbon (adb)	91.5%	>85.0%
Total Sulphur (adb)	0.3%	<0.3%
Phosphorus in Coal (arb)	0.01%	0.13%

1. Zhengzhou Zhongneng Technology Development Co., Ltd
2. Prime semi coke specifications provided by Alibaba

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Pyrolysis Product 1.b – Prime PCI Coal

Proximate Analysis	Comparison	
ITEM (basis)	PRIME PCI	TYPICAL ULV PCI
Total Moisture (arb)	10.0%	10.5%
Ash (adb)	5.1%	10.5%
Volatile Matter (adb)	2.2%	11.7%
Fixed Carbon (adb)	91.5%	76.8%
Total Sulphur (adb)	0.3%	0.7%
Calorific Value (gar)	7,630 kCal/kg	7,600 kCal/kg
Phosphorus in Coal (arb)	0.01%	0.13%
Hardgrove Index (HGI number)	70	90

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Pyrolysis Product 2. – Pyrolysis Oil

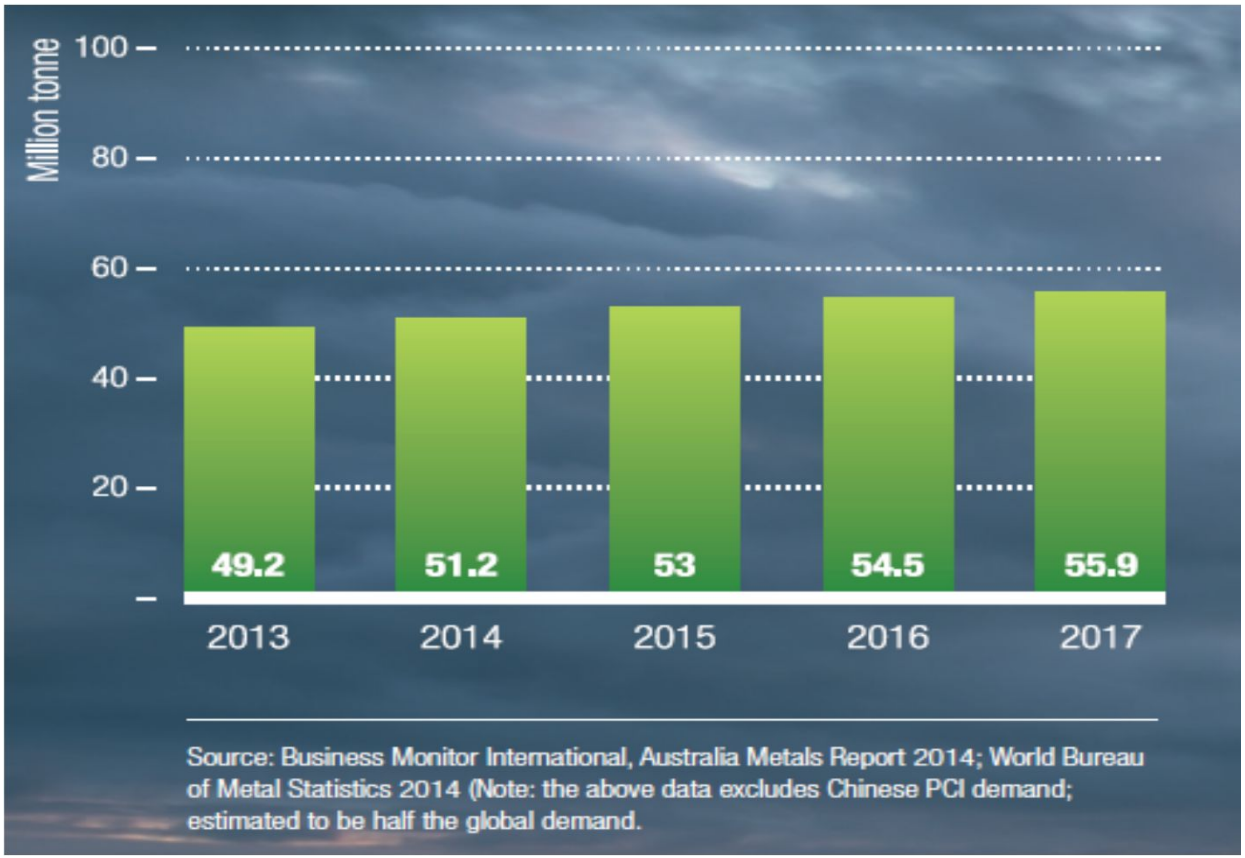
Characterisation of CEA's Pyrolysis Oil:

Element	Basis	Typical Range	CEA Sample
Carbon	Wt%	80.52 - 83 26	80.84
Hydrogen	Wt%	9.15 – 10.55	9.86
Sulphur	Wt%	1.97 – 2.03	0.64
Oxygen	Wt%	2.69 – 3.79	7.75
Nitrogen	Wt%	Variable	0.91

CEA Plant – Production Capacities

Production	Phase 1	Phase 2	Combined
Raw feed (Yallourn lignite)	2 mtpa	20 mtpa	22 mtpa
Prime Semi Coke / PCI Coal	470,000 tpa	4.7 mtpa	5.17 mtpa
Pyrolysis Oil	70,000 tpa	700,000 tpa	770,000 tpa
Coal Gas	128,000 tpa	1.28 mtpa	1.4 mtpa
Ammonium Sulphate	15,000 tpa	150,000 tpa	165,000 tpa

Global PCI Usage



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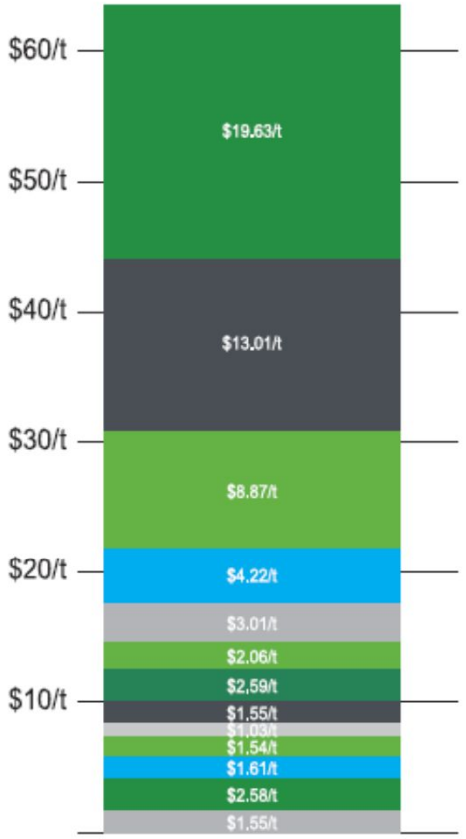
Operating Costs of ALDP Demonstration Plant

Cost Item	Unit Cost $/t Prime PCI equivalent
Coal Cost	$19.63/t
Labour Cost	$13.01/t
Transport Cost	$8.87/t
Storage/Landside Handling Costs	$4.22/t
Barging Costs	$3.01/t
Sundry Costs	$2.06/t
Power Costs	$2.59/t
Sulphuric Acid	$1.55/t
Flocculent	$1.03/t
Sludge Transport & Disposal	$1.54/t
Royalty Costs	$1.61/t
Plant O&M Costs	$2.58/t
Carbon Costs	$1.55/t
Total Opex per tonne Prime PCI equivalent	$63.24/t



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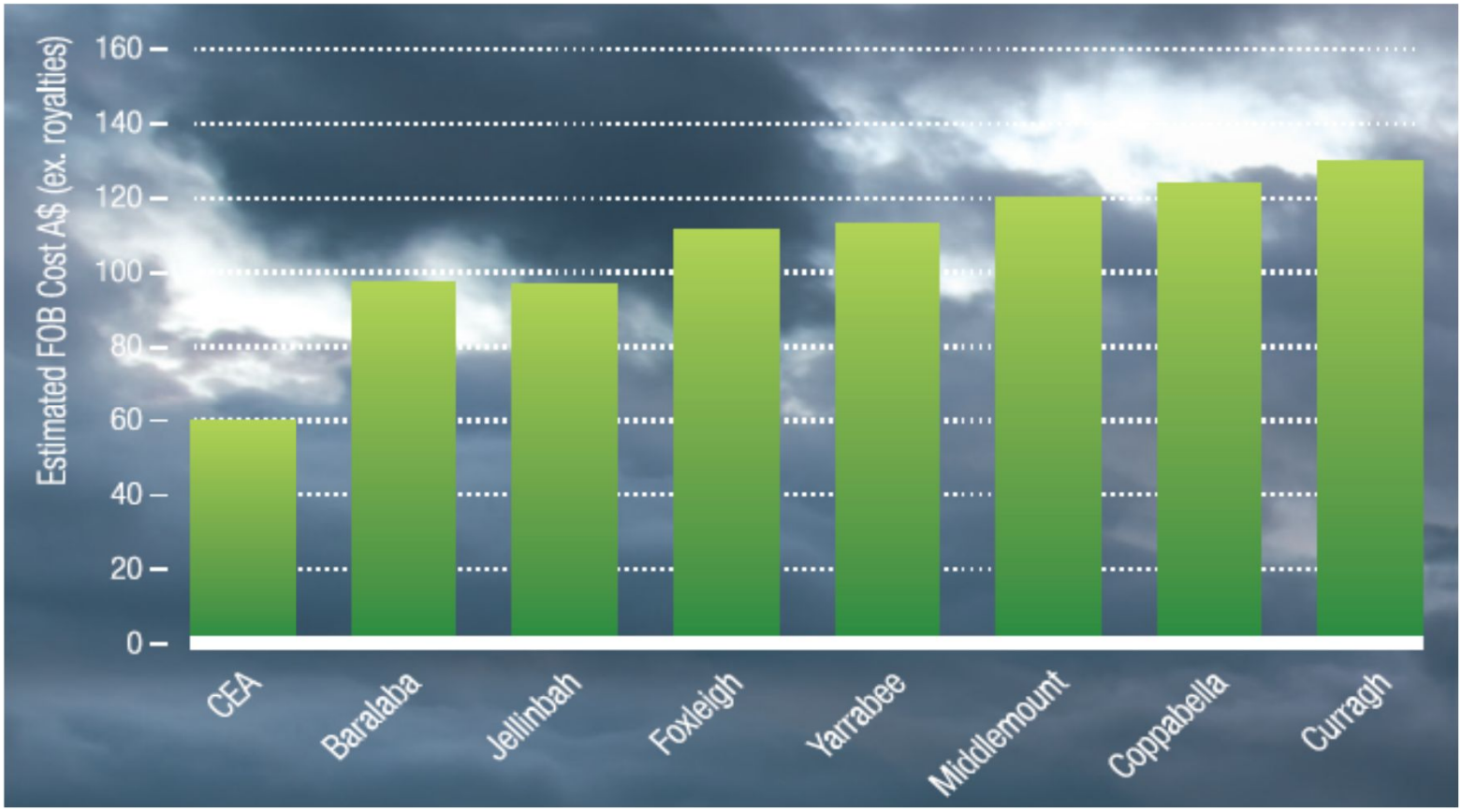
Estimated FOB Cost Prime Low Vol PCI Coal



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ALDP – Project Funding

CEA has succeeded in raising $44m via Strategic Investors

CEA will use Strategic Investor funds alongside its own capital and government funding to develop the ALDP Project at Yallourn North, Victoria

Strategic Investors will be rewarded with guaranteed off-take entitlements and automatic inclusion in future Large Scale Plants

Sources and uses of funds – A$m			
Sources	**A$**	**Uses**	**A$**
Strategic Investor provided funds	$44m	ALDP plant capex (2Mtpa raw feed)	$175m
ALDP grant funds	$30m	Operating costs	$18m
Pproject finance	$119m	**ALDP plant (total)**	**$193m**
Other equity/debt	$7m	Working capital	$7m
Total	**$200m**	**Total**	**$200m**

- Plant designed as “production modules”
- First large-scale plant of 20Mtpa raw feed capacity - estimated capital cost of ~A$1.1B
- Low-risk expansion through progressive addition of 2Mtpa modules

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Export Infrastructure Planning

- Victoria - a world class network of port, rail & pipeline infrastructures
- Significant potential for bulk commodity or product export
- Numerous opportunities for new ports & infrastructure
- Studies underway – including coal and product export

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Thank you from CEA

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