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**THE DEVELOPMENT OF THE NEW ZEALAND EXPORT COAL INDUSTRY**

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**Introduction**

Solid Energy has been an exporter of unique quality coals for over 20 years. The tonnages have been small by world standards and the coals have been marketed to specialist users who are well placed to utilise the special properties of the coals. The company is now entering a new phase with a plan to increase output over the next few years and this will bring with it the need to identify more 'main stream' customers for the coals.

The company currently exports approximately 1.8 million tonnes to Asia, Europe, South Africa and South America. Recent changes will increase this by 0.4 million tonnes, with a further 2 million tonnes planned over the next 4 years. This expansion will require significant capital expenditure on infrastructure and mining equipment. Two new opencut and one new underground mine will be developed. The coal quality types will be expanded from the current low ash coking coal, semi soft coking coal and high-energy thermal coal to a very low ash PCI coal and another quality low ash coking coal.

Port developments will be reviewed and in addition to the current Panamax port at Lyttleton an expansion to capesize is possible in the future. Other producers are likely to be involved in the port developments.

**Coal Deposits**

The coal deposits developed by Solid Energy International are found in the South Island of New Zealand. They occur in the Paparoa Basin, a coal bearing structure, which has been significantly altered by mountain building forces occurring with the movement of the Australasian and Pacific plates. The coal has been subjected to significant erosion and the reserves are normally held in deposits that are relatively small by world standards. They are however, large enough to enable long term exports at the planned increased levels.

The coal generally occurs in thick seams, ranging from 3metres to 14 metres. The seams are mined by a range of methods, including open cut 'up-dip' and underground hydraulic mining. The seams are generally steeply dipping due to the highly structured mountainous area. The coal blocks mined, are generally clear of major faulting, although the blocks tend to be rather small by international standards.

**Coal quality**

The coals cover a wide rank range from semi anthracite material that is not currently mined to sub bituminous coal that is used mainly in the domestic market. These coals have two characteristics that are found in all areas and coal types. The coals

are extremely low in ash content. Raw coal products less than 1% ash are possible using selective mining of sections of the seams. This is carried out for some customers that have special requirements. The coal is generally very low in phosphorus content, although some of the coal low in the seam sequence is has normal levels for a Southern hemisphere coal.

The most outstanding feature of the coal is the vitrinite content. The coal is almost all vitrinite, with a range of 89-96%. This results in the coal having outstanding cokemaking potential for all coals in the coking range. The coals are not suited for single coal use, but have the capability of significant blend improvement with small additions. The coke made from the single coals tends to be very low density and the coke 'fingers' tend to be smaller in diameter than coke made from coals with higher proportions of inert macerals.

Another factor that must be recognised is the effect of vitrinite content on the volatile matter of the coals. Most coals are a mixture of exinite (very high volatile matter), vitrinite (high volatile matter), semi fusinite (medium volatile matter) and completely inert macerals, which have low volatile matter. As the New Zealand coals are almost completely vitrinite, the volatile matter is higher than normally expected for the reflectance of the coal. Users of the coal recognise this property and use the New Zealand coals in blends which use increased proportions of lower volatile coals.

The coke indicates high CSR and very low CRI. The CRI is lower than indicated for the CSR level determined on the coke. Calculations of CSR using formulae derived from a very wide range of cokes produced in commercial and laboratory operations indicate a higher level than actually determined. These calculations indicate the highest CSR of any traded coal with a value >80. These results have been supported by laboratory testing of blends with low CSR coals.

As no coal is perfect the New Zealand coals are higher in sulphur than most traded coals with values ranging from 1.5-2.5% in the hard coking coal. The semi soft qualities are lower, as are the PCI coals.

#### **Use In Coke Oven Blends**

The New Zealand coals, due to the very low ash and extremely high vitrinite content, have a very significant impact on the quality of coke oven blends. It is well known that the main control of coke quality is blend rank. Either the Mean Maximum Reflectance or Mean Random Reflectance value best indicates this. Where a change to the blend rank or vitrinite content is required, the use of a coal, which is almost entirely vitrinite, has a much greater impact than even a 'high vitrinite' coal. In simple terms, where the blend has a normal vitrinite content of 60%, the effect of a 95% vitrinite coal addition is twice that of another 'high vitrinite' coal with vitrinite content of 75%. This indicates that the use of New Zealand coal to modify 'blend reactives' will be twice as effective as other coals.

Whilst it is difficult for a coal producer to acquire this information, the record of long term purchase of this coal by specialist cokemakers and steel companies with ash and reactivities control difficulties indicates the accuracy of this assumption. The New Zealand hard coking coals are sold to five countries and six companies.

#### **Semi Soft Coals**

The New Zealand semi soft coal shows the same attributes as the coking coals. The coal has a similar rank to coals from the Newcastle area of Australia, with the added advantage of the 'normal' New Zealand attributes of very low ash and very high vitrinite content.

### PCI Coal

The development plans for the New Zealand coalfields indicate the commencement of mining a new area for a PCI product. This coal has the same attributes, with low ash, high vitrinite and very low phosphorus. The coal has very high energy levels and low oxygen content.

When the data is entered into formulae designed to indicate the coke replacement efficiency of coals, it shows up as the best of all high volatile coals in all three formulae known to the author.

NEW ZEALAND COAL TYPES					
COAL TYPE	HARD COKING	SEMI SOFT 1	SEMI SOFT 2	Low Ash Thermal	THERMAL
Total Moisture %	8	10	9	10	10
Ash %	2	5	3	2.5	3
Volatile Matter %	31	37	38	31	31
Sulphur %	1.5-2	0.9	1.2	1.2	2
CSN	9	5	5	2	1
ddm	500	15	500	n/a	n/a
Vitrinite%	96	90	93	92	90
RoMax	1.2	0.7	0.7	1	1.1
Phosphorus %	0.005	0.03	0.015	0.005	0.005
Specific Energy kcal/kg (adb)	8000	7100	7600	8000	7900

CURRENT EXPORT PRODUCTION PLAN										
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Hard Coking	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
semi soft 1	0.5	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.3	1.3
semi soft 2			0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Low Ash Thermal			0.2	0.3	0.3	0.3	0.3	0.3		
Thermal	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.5	0.5
Total	1.9	2.5	2.9	3.4	3.5	3.5	3.5	3.5	3.5	3.5

*The New Zealand coals are unique in the world coal trade. They have properties unknown anywhere else. As production expands over the next 5 years the international steelmaking companies will evaluate these qualities. It is expected that the special qualities will be recognised as offering significant benefits in cokemaking and PCI.*

