May 2014

Directorate for Trade Policy and Economic Governance

Transparency of Dutch Thermal Coal Supply Chain

Executive Summary

Wood Mackenzie has analysed the commercial aspects of requiring Dutch power producers to publically disclose the names of thermal coal mines they use to supply their coal-fired power stations. We have conducted the analysis based on limited consultation with industry participants.

We have assessed the physical and contractual supply chains to understand the complexities involved in providing the disclosure, workable solutions and potential commercial implications resulting from the additional requirement. We conclude that for the Netherlands the detail is theoretically possible to provide by imposing a requirement on the Dutch customs authorities to require arriving coal vessels to produce the necessary documentation. However, the practical implementation of such a requirement would likely be challenging when considering the complexity of the Amsterdam-Rotterdam-Antwerp (ARA) port region.

The commercial consequences of the requirement could be non-compliance from some, but not all, international coal sellers, potentially leading to a decrease in the amount of available thermal coal supply available for Dutch power producers. Consequently reducing the supply from complying coal sellers/producers could potentially lead to an increase in price. Intuitively, the degree of competition for compliant coal supply into the Netherlands would increase and trading companies with the ability to structure longer term off-take agreements on a speculative basis could strategically position themselves against the Dutch power producers. Specifically, by buying particular qualities of compliant coal that is publically disclosed to be required by Dutch power producers would allow intermediaries to potentially restrict the Dutch market even further of compliant coal and then raise the price of these coals when sold to the Dutch utilities.

Conversely, another potential ramification is an adverse impact on the trading community from providing the information, compared to mining companies who will inherently be in a better position to comply by having more control over the supply chain. Finally, the ability of the Netherlands to implement the regulation without affecting the German seaborne coal imports that are predominantly sourced through the ports in Netherlands is likely to be legally challenging.

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Disclaimer

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Wood Mackenzie prepared this report based on its industry knowledge, in-house database, independent third-party reports, and publicly available data from reputable industry organisations. Where necessary, Wood Mackenzie visits companies operating in the industry to gather and synthesize information about the market, prices and other relevant information.

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Contents

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Abbreviations & Glossary

APX	Amsterdam Power Exchange
ARA	Amsterdam-Rotterdam-Antwerp
BEE	Black Economic Empowerment
Bt	Billion (Metric) Tonnes
Btpa	Billion (Metric) Tonnes per Year
CCS	Carbon Capture and Storage
CFR	Carriage and Freight
CHPP	Coal Handling and Preparation Plant
CIF	Carriage, Insurance and Freight
CMC	Coal Marketing Company
CO_2	Carbon Dioxide
CSR	Corporate Social Responsibility
CSR	Corporate Social Responsibility
CWE	Central and Western Europe
DBT	Dry Bulk Terminal
DES	Delivered Ex-Ship
DWT	Deadweight Tonnage
EC	European Commission
ETS	EU Emissions Trading Scheme
EU	European Union
FGD	Fuel-gas Desulphurisation
FOB	Free on Board
GAR	Gross as Received
GW	Gigawatt
IED	Industrial Emissions Directive
ILB	Illinois Basin
kcal/kg	Kilocalories per kilogram
LCPD	Large Combustion Plant Directive
Mt	Million (Metric) Tonnes
Mtpa	Million (Metric) Tonnes per Year
MW	Megawatt
NAR	Net as Received
NOx	Nitrogen Oxide
OTC	Over-the-Counter
PRB	Powder River Basin
PWCS	Port Waratah Coal Services
RBCT	Richard's Bay Coal Terminal
SCoTA	Standard Coal Trading Agreement
SDCT	South Dunes Coal Terminal company
SO_2	Sulphur Dioxide
TLC	Trilateral Market Coupling

1.0 Introduction

Wood Mackenzie has engaged with the Directorate for Trade Policy and Economic Governance, a division of the Ministry of Foreign Affairs, belonging to the Government of the Netherlands to provide an independent review of Dutch thermal coal market, the transparency of its sourcing and potential implications from enhancing its monitoring. Specifically, as a further Corporate Social Responsibility (CSR) measure, we have assessed the possibility of Dutch power producers to provide more detailed public disclosure regarding the sourcing and procurement of thermal coal, and the potential commercial ramifications.

We have approached the topic from two theoretical perspectives:

1) Are Dutch power producers in a practical position to make the sources of their coal public to an individual mine level of granularity, given the complexity of the thermal coal supply chain, and

2) What are the potential commercial consequences of this level of public disclosure to Dutch power producers and other parties involved in the coal supply chain

The report is divided into three sections. Firstly, to provide sufficient context to the reader we have assessed the global demand and supply for thermal coal, including the position of the Netherlands. We have described the specifics related to the Dutch coal market and its relation to the power market where it is mostly consumed.

The second section comprises the supply chain for coal from a physical and contractual perspective to aid in understanding the potential intricacies in tracing the source of the coal. We have examined the physical supply chain each individual component at a time to identify the potential costs or barriers associated. Strongly linked to the physical components is the contractual structure of coal sourcing, which has historically not generally catered for identifying individual mine sources, and therefore may create further commercial problems in creating a structure to allow for the disclosure of source mines.

In the final section, the physical and contractual supply chain together informed our analysis of the potential commercial consequences arising from obligating Dutch power producers to publically disclose the individual mines thermal coal supplying their coal-fired power stations.

1.1 Thermal Coal Basics

The process of coal development is called carbonisation or “coalification.” Coal is extracted from the ground through mining and is used primarily to generate electricity (thermal coal or to produce steel (metallurgical coal). Currently coal is the largest generator of electricity worldwide at roughly 40% of total, and is used in 70% of steel production.

The process of coalification begins from peat (dead plant material) which is accumulated and pushed beneath the surface of the earth over millions of years and as it is pushed farther down, the temperature and pressure increases. This pushes out any water present while the organic matter releases gases and liquids, condensing into coal. Time and temperature are the most important aspect of the subsidence in forming different types of coal. Physical and chemical changes occur in the original plant material depending on the geological history of the peat deposit. Buried for a sufficient time, at sufficient temperature, under confining pressures causes the change from peat to lignite. Further compression and time leads to lignite to turn into bituminous, which in turn converts into sub-bituminous and eventually anthracite.

As the coalification progresses the rank of the coal increases with peat being the lowest rank and anthracite being the highest rank. Low rank coals are typically softer, friable materials with a dull, earthy appearance; they are characterised by high moisture levels and a low carbon content, and hence a low energy content. Conversely, higher rank coals are typically harder and stronger and often have a black vitreous lustre. They are characterizes by a rise in the carbon and energy contents and a decrease in the moisture content of the coal. The main coal types are:

- **Peat –** The initial stage in the transition from plant matter to coal. Not actually coal, but damp organic matter which can be used as a low-grade fuel

- **Lignite –** Also known as brown coal, it is found at shallow depths and is physically weak with a high moisture content. It is used for power generation and domestic heating with small, but increasing amounts are being sold on the seaborne market

- **Sub-bituminous –** Used primarily for power generation with increasing amounts being sold on the seaborne market

- **Bituminous –** Also known as black coal, it is the most sought after coal for commercial purposes. Used in a variety of commercial practices depending on its quality and characteristics: steam and power generation, heating, coal-to-gas and coal-to-liquid applications, chemical production, and coke making

- **Semi-anthracite/Anthracite –** Most advanced coalification process. This coal is brittle and hard, because most of the volatile matter (VM) and moisture has been expelled from prolonged pressure and temperature. Used in steel making and the manufacturing of electrodes, inks and tiles

The international coal market is similar to those for other commodities in many respects. Unlike most other commodities, however, coal is a heterogeneous product, with significant quality differentiation based on rank, type and mineral content. Quality is therefore often the initial criterion for coal buyers.

Thermal coals can be sub-divided into different market tiers based on energy content (Calorific Value). Other important quality parameters include moisture, ash, sulphur and volatile matter content.

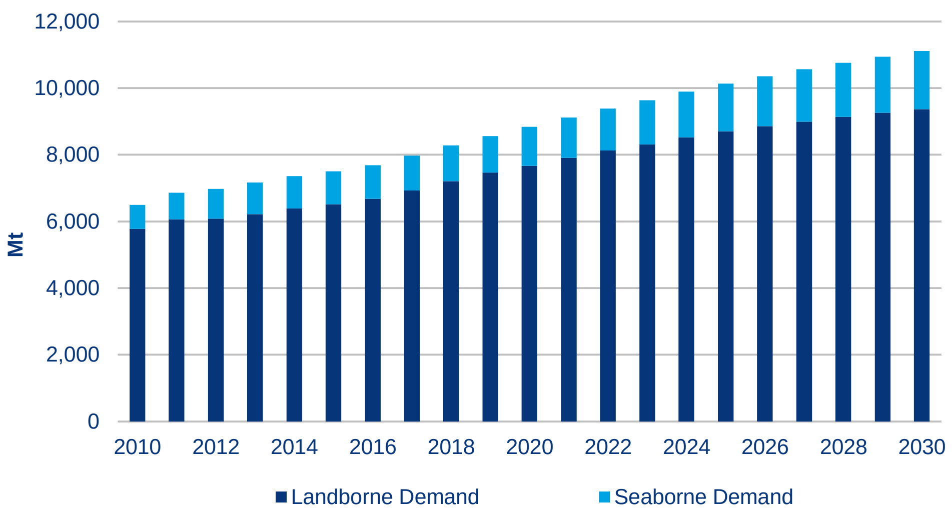
Thermal Coal Types

Coal type	Calorific value (GAR)
Low rank	<4,400 kcal/kg
Sub-bituminous	4,400–5,300 kcal/kg
Low energy bituminous	5,300–6,100 kcal/kg
High energy bituminous	6,100–7,200 kcal/kg
Anthracite	>7,200 kcal/kg
Generic Classifications	
Low rank & Sub- bituminous	<5,300 kcal/kg
Bituminous	>5,300 kcal/kg

2.0 Global Thermal Coal

Wood Mackenzie forecasts global demand for thermal coal to continue to expand at an average rate of 2.6% from 7.2 Billion Tonnes per Year (Btpa) today to 11.1 Btpa by 2030. Most of this coal is produced and consumed domestically and in 2013, seaborne trade amounted to just 950 Mtpa, 13% of total global coal demand. However, we expect seaborne trade of thermal coal between countries to increase to 1.74 Btpa by 2030, accounting for 16% of total demand.

Figure 1 Global Thermal Coal Demand



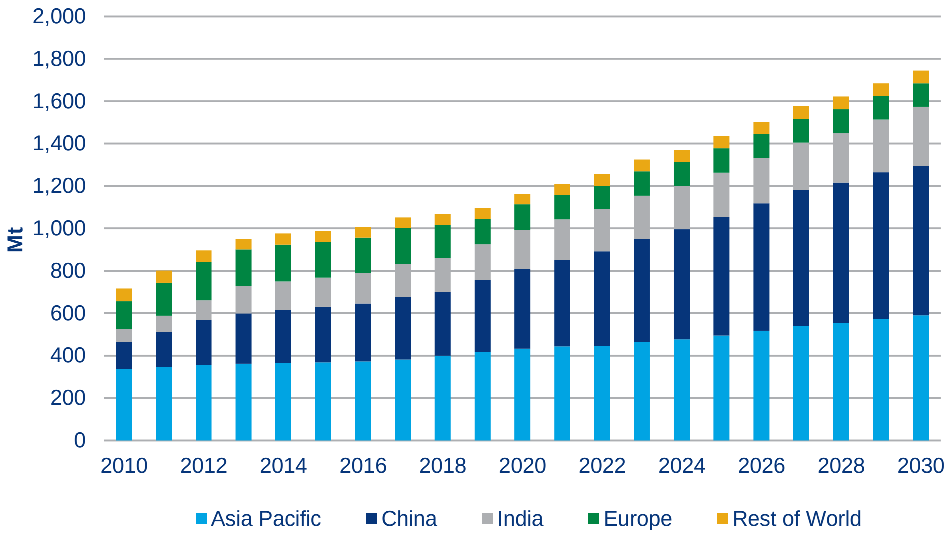
Source: Wood Mackenzie

The increases in global demand are expected to be predominantly driven by continued economic expansion in Asia: Nearly half (45%) of this growth will be required to fuel electricity generation in China as it continues to urbanise and expands its grid networks to electrify rural regions. Another 20% of the growth will be required in China to fuel industrial expansion in such market segments as cement, fertiliser and coal conversion projects. Combined, we forecast that thermal coal consumption in China will increase by 2.4 Btpa between 2014 and 2030 of which 181 Mtpa are seaborne imports.

We also forecast India to experience a large expansion in thermal coal demand of 1.1 Btpa for the corresponding period, much more heavily weighted to electrification or rural regions and urbanisation rather than to industry. Together, China and India will account for 4.0 Btpa of the 4.7 Btpa global demand increase in thermal coal. Much of the remaining growth will be focussed in Southeast Asia, notably Malaysia, Philippines, Thailand and Vietnam. Thermal coal demand will decline in Europe from 170 Mtpa in 2014 to 110 Mtpa by 2030 on the back of combustion and industrial plant policy acts, and carbon policy which will ensure that more coal plants are decommissioned than constructed. In North America, the shale gas revolution is keeping gas prices low thereby limiting coal consumption while environmental policy and the current US administration has indicated the introduction of a carbon tax expected in the early 2020s which will discourage further developments in coal fired power sector.

Globally, concern about CO_2 emissions from coal will begin to erode coal's competitiveness as more stringent CO_2 and particulate emission controls are introduced. Growing environmental awareness in Asia, especially in China, could eventually cause limits to coal growth as nations act to limit other emissions such as SO_2, NOx and particulates. In China, the government continues to set targets that lower the growth in coal consumption in favour of other fuels. The current government targets are likely to be unachievable, but pressure to reduce emissions will continue.

Figure 2 Seaborne Thermal Coal Demand by Region



Source: Wood Mackenzie

In the Atlantic Basin that includes Europe, coal-fired power generating capacity is dominated by North America, but as it is a self-contained market there is little need for imports. The majority of power generation output that requires import coal is based in Europe, the Mediterranean Rim countries and South America. The former two categories account for 93% of all Atlantic Basin seaborne import demand and we anticipate this remaining stable until 2018 before declining and staying at around 85% for the rest of the forecast period to 2030. Imports into the region are highly dominated by bituminous coal - generally at or above 6,000 kcal/kg NAR.[1] Small import volumes of sub-bituminous and lignite coal for contract obligations in Spain, Italy, Turkey and Mexico are present and these are supplied by the US Powder River Basin (PRB), Russia and Indonesia.

The main theme in the near-term continues to be an abundance of oversupply of seaborne thermal coal exports and export capacity in the Atlantic Basin, leading to persistently low European and global coal prices. These prices, in combination with low emissions costs, resulting from a grossly oversupplied EU Emissions Trading Scheme (ETS), provide no economic case for fuel switching from coal to gas in the power sector. However, despite our view of European coal prices being weaker than before, there is a limitation to the amount of generation from existing units, given that: overall electricity load in Europe - particularly Western Europe - is still declining; high utilisation factors of existing units prevent a large degree of upside in supply and the amount of renewable additions provide a ceiling on any incremental coal-share.

Carbon prices saw a very short-term lift following their fall to €3/tCO_2 earlier in 2013 September. The European Commission (EC)'s decision to reduce the volume of free ETS allowances available to industrial energy users to ensure the desired level of annual allowance supply is achieved in 2013 prompted prices to rise above €5.6/tCO_2, their highest level since January 2013. Putting the price in perspective though, to support switching back to natural-gas fired generation one would still need a theoretical €60/tCO_2 to make the economics work outside of the UK - where the Carbon Price Floor is in place. Even in the UK though, the Carbon Price Floor will not be high enough in the next two years to incentivise a switch from coal to gas-fired burn in the second largest market for thermal coal imports. The UK's aging coal fleet and the impact EU pollution control legislation will prove to have a far greater influence on coal's contribution to the country's power supply.

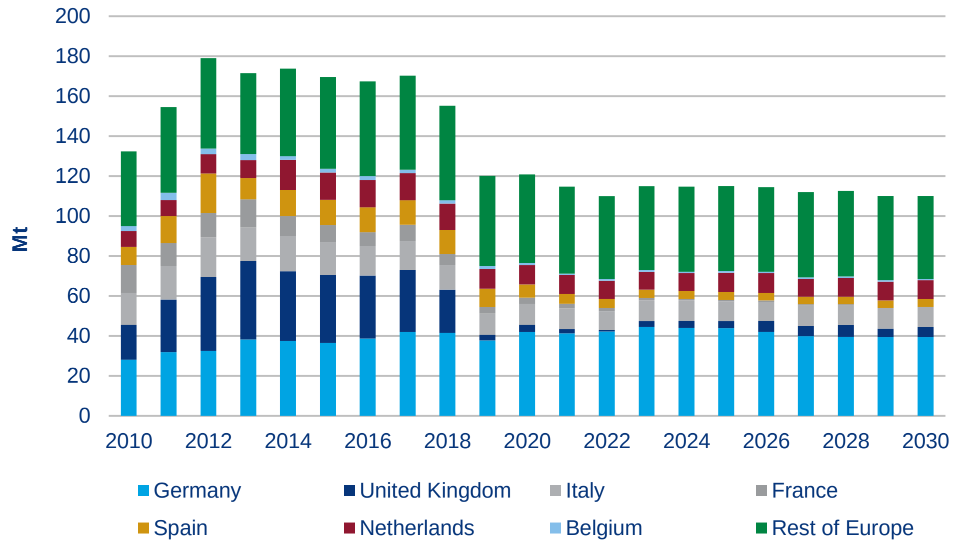
Reduced output from coal-fired power plants "opted out" of the Large Combustion Plant Directive (LCPD) is precipitating some decline in coal demand but, from an import perspective, upside is also apparent due to weak domestic coal production. Overall for Europe, Wood Mackenzie forecasts seaborne import demand to remain relatively stable around 170 Mtpa range to 2017, but then, under the influence of the Industrial

[1] NAR – Net as Received

Emissions Directive (IED), falling substantially to 120 Mt in 2019, mainly driven by retirements in the UK, and then beginning to flatten off at around 110 Mtpa after that.

Long term coal-fired generation is associated with over 70 GW of hard coal plant retirements from European major consumers, a further 12 GW of domestic lignite retirements and only 25 GW additions post-2015. Half of these are planned plants, the other half generic/grid support additions and a small number of Carbon Capture and Storage (CCS) equipped commercial demonstration projects.

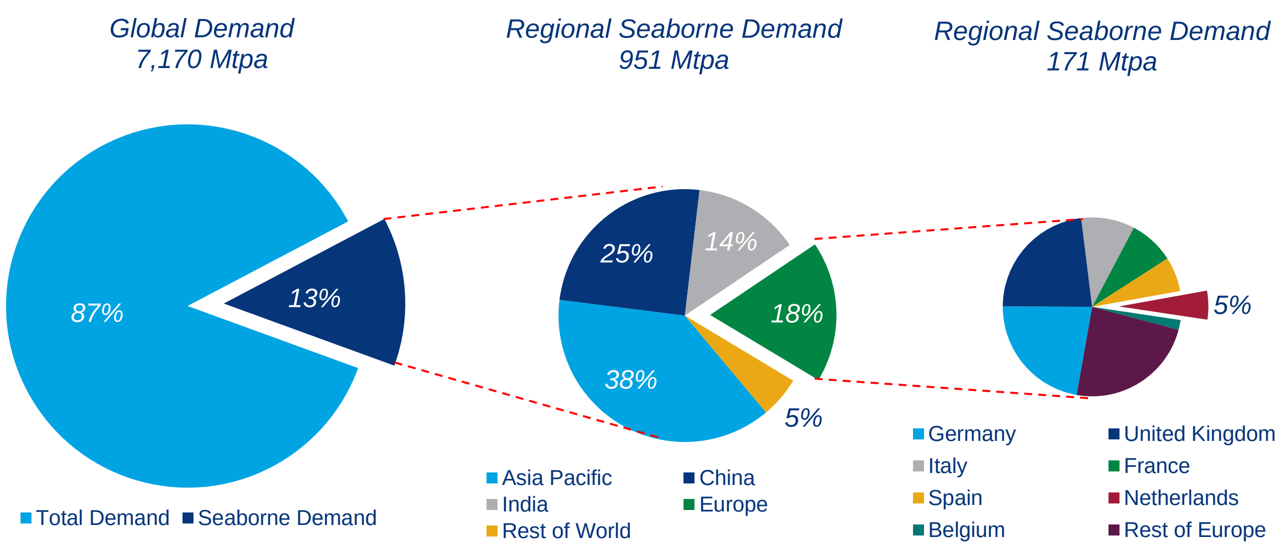
Figure 3 European Seaborne Thermal Coal Demand by Country



Source: Wood Mackenzie

In general, Europe plays an increasingly small role in the seaborne thermal coal market: Global seaborne thermal coal demand accounted for 13% of total world demand (7.2Btpa) in 2013. Of total seaborne demand, 18% of this was delivered to Europe and further of which 5% was consumed in the Netherlands.

Figure 4 Global, Regional and European Thermal Coal Demand – 2013



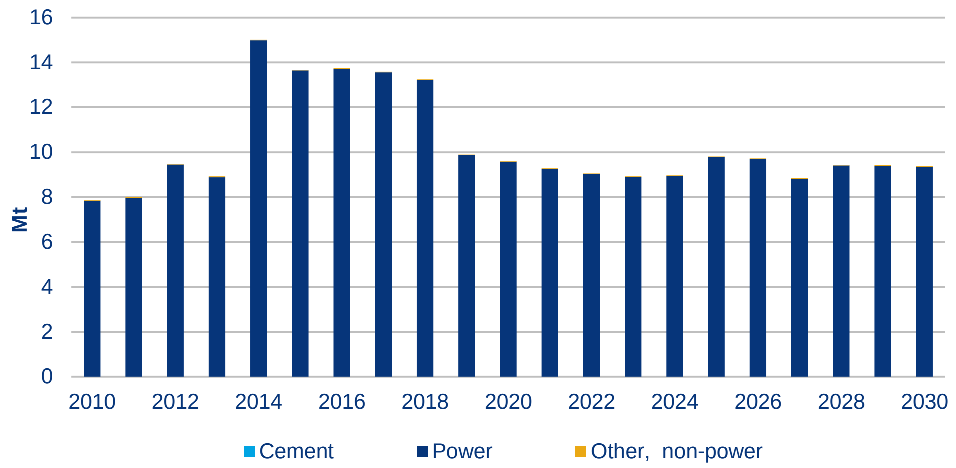
Source: Wood Mackenzie

3.0 Dutch Thermal Coal Market

3.1 Thermal Coal Demand

Thermal coal demand in the Netherlands is entirely attributable to power generation, a feature Wood Mackenzie expects to continue. Historically, thermal coal demand has remained relatively flat at approximately 8-9Mtpa but a significant increase is forecast in 2014 as new coal-fired generation is brought online.

Figure 5 Dutch Thermal Coal Demand by Sector



Source: Wood Mackenzie

Electricity demand in the Netherlands increased steadily in the early 2000s, driven to a large extent by strong growth in the commercial sector. Recent changes in demand can be attributed to the following factors:

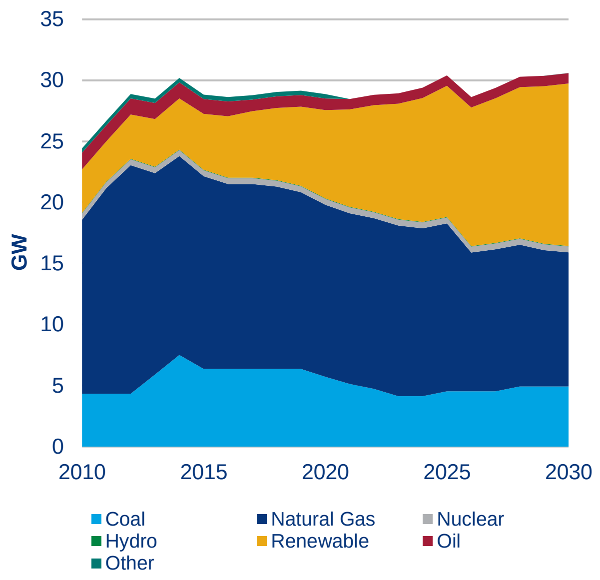
- **Industry's exposure to external competition**: the industrial sector was heavily impacted by the recession, resulting in a 14% decrease in power demand in 2009. The sector then saw some recovery in 2010, with demand increasing by around 8%. Consumption remained fairly flat in 2011 but declined by over 10% in 2012 as shown in Figure 7. Such a decline can be attributed to a general weakness in the economy and the closure of several large consumers. Energy intensive companies have become increasingly exposed to higher energy prices in recent years. More specifically in the Netherlands energy intensive companies (including phosphorus production and aluminium smelting plants) have highlighted the higher electricity prices they pay in comparison to those charged to their competitors in Germany.

- **High levels of efficiency**: over the last decade, the Netherlands has achieved significant efficiency gains, typically above the EU average in the industrial and residential sectors. Despite this, electricity use for appliances and lighting remains above the EU average. Electricity intensity in the commercial sector also remains high. Pursuit of further efficiency gains and reduced consumption provides an element of downside risk to the forecast, particularly in the residential and commercial sectors.

We expect to see growth in demand during the second half of this decade, but at slower rates than previously seen. Growth rates are expected to reduce over the period as energy efficiency improvements take effect.

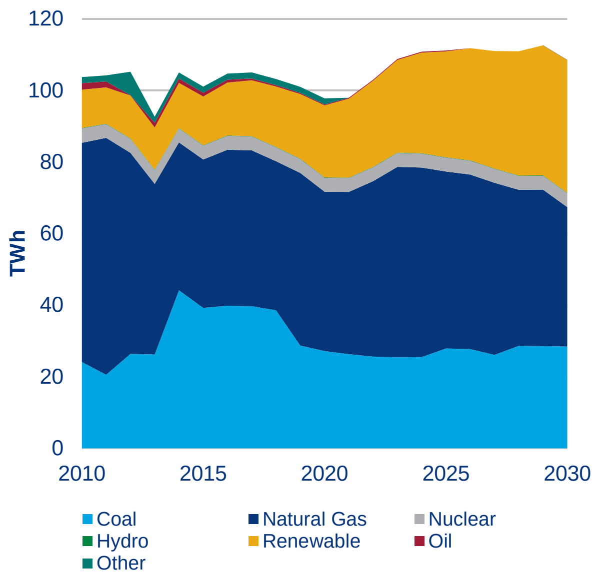
Figure 6 describes how generation capacity in the Netherlands is currently (2013) dominated by gas at 19.1GW and holding a 61% (Figure 6) share of the market, followed by thermal coal at 19%. Recent significant capacity additions have all been gas-fired, although a number of new coal plants are under construction and will be commissioned during 2014, taking coal generation from 5.9GW to 7.5GW.

Figure 6 Installed Capacity by Fuel Type (GW)



Source: Wood Mackenzie

Figure 7 Power Generation by Fuel Type (TWh)

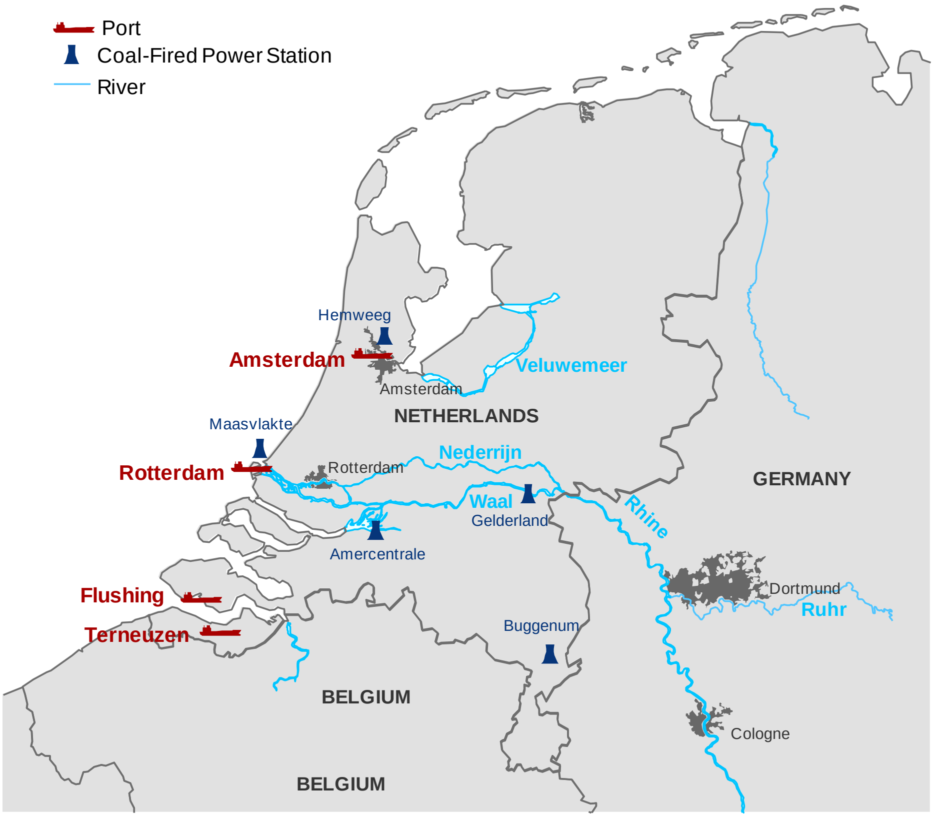


Source: Wood Mackenzie

There are several coal-fired plants currently under construction and due to be commissioned early in 2014. The addition of further unabated (non-CCS) coal capacity has been proposed, although the progress of these projects has slowed and there is considerable opposition to such developments from environmental groups. The 1.6 GW coal-fired plant currently being commissioned by RWE at Eemshaven has experienced a number of setbacks - in August 2011, three environmental groups filed a petition to stop construction with immediate effect. However RWE later received approval from the Dutch administrative courts to continue work.

The tightening of limits on emissions of NOx and SO2 to be introduced as part of the Industrial Emissions Directive (IED) in 2016 is likely to have an impact on some of the Netherlands' older, less-efficient coal-fired power plants. We assume that 1.6 GW of capacity will be opted-out of the Directive and close at the expiry of either their 17,500 hour derogation allowances, or by the end of 2023, whichever comes first.

Although recent progress on CCS in the Netherlands has been slow, we expect the availability of fuel supplies and ready access to potential storage facilities to prompt the commissioning of 800 MW of CCS-equipped commercial-scale demonstration facilities by the end of our outlook in 2030.



3.2 Power Producers

Dutch power production is dominated by Electrabel (a subsidiary of GDF Suez), E.ON Benelux, Essent (RWE) and Nuon (Vattenfall). Electrabel and E.ON entered the market following deregulation in 1999, taking over Dutch generators EPON and EZH, respectively. In 2009 Nuon was acquired by Sweden's Vattenfall, while RWE has taken over Essent. These latter takeovers followed a failed merger between Nuon and Essent in 2007.

As a significant proportion of the Netherlands' energy intensive industry is located near a few key ports (Amsterdam & Rotterdam), a relatively large proportion of power demand is met by auto producers (industrial consumers with the ability to generate electricity primarily for their own consumption). Around two-thirds of new generation capacity is expected to be built at these port clusters, which include the ports of Amsterdam, Rotterdam, Eemshaven and Europoort.

Around 30 companies are active in the Netherlands' retail electricity market - Essent, Electrabel, Nuon, E.ON, Eneco and Delta hold the largest market shares. The liberalisation also gave rise to a competitive wholesale electricity market: the Amsterdam Power Exchange (APX). APX; a subsidiary of TenneT, resembles the NordPool market in Scandinavia and is structured around firm bilateral contracts. Two organised markets are operated - a "day-ahead" contracts market and an "hour-ahead" balancing market. There are a number of long-term contracts in the Dutch power market but these are currently traded on the basis of Over-the-Counter (OTC) bilateral contracts rather than via the exchange.

The Dutch electricity market is well integrated and interconnected with a number of other European systems. In 2006, market coupling between the Dutch, Belgian and French electricity markets was launched - the Trilateral Market Coupling (TLC) initiative. TLC proved a success, significantly increasing cross-border trading between the three markets and, in 2010, wider market coupling in Central and Western Europe (CWE) - comprising the Netherlands, Germany, France, Belgium, Luxembourg and Austria - was introduced. APX-ENDEX, separated into two companies in 2013, operate both spot and futures markets in the Netherlands. Finally, the NWE market coupling initiative - which will couple CWE markets with Denmark, Estonia, Finland, Great Britain, Latvia, Lithuania, Norway, Poland and Sweden – began in February 2014.

As a result of these developments, the Netherlands has been a significant net importer of power for a number of years, with Germany being a major source of cross-border supplies.

3.3 Thermal Coal Supply

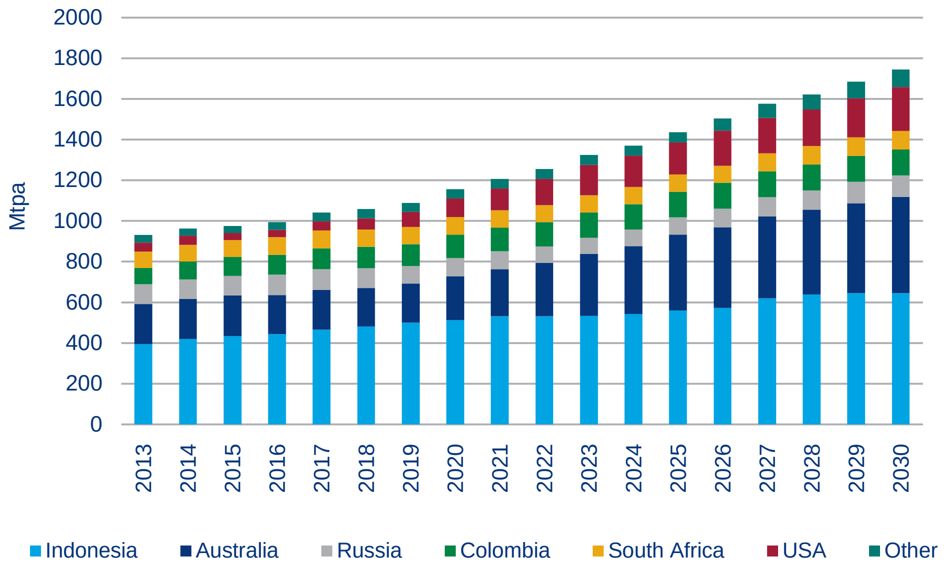
The global seaborne thermal coal market is highly oversupplied keeping prices low and discouraging investment. Wood Mackenzie expects the glut of thermal coal to continue over the next six years unless supplier discipline is enforced. Rationalisation of supply will be delayed by the intensely competitive environment and by take-or-pay infrastructure contract obligations that discourage supply reduction.

With slowing economic growth, even in Asia, the export coal industry finds itself significantly overbuilt: Everyone in the industry "bet on China" and its continued high level of growth by developing significant new supply and when Chinese growth slowed somewhat the industry found itself suddenly oversupplied. Adjusting for this oversupply is proving to be costly and slow with many Australian coal suppliers already fighting increasing costs and weakening productivity which has them moving up the supply cost curve. This has led to many miners entering into "take-or-pay" infrastructure contracts which force them to produce coal even at a loss since the alternative is to lose even more money due to the contract provisions. The primary impacts of this long-lasting oversupply are low prices and serious supplier competition. Investors are consequently likely to remain out for years (also because of the current problems raising either equity or debt capital for mining) and little capital will be spent except when it is essential to improving productivity or lowering cost. Declining margins will force more creativity on the part of suppliers. This creativity may include increased sales of lower-priced, high ash coal and unusual rail and port logistics arrangements, where they are possible. Without creativity, rationalisation might shift trade flow patterns.

Nonetheless, major suppliers in today's thermal market will remain major suppliers throughout our forecast. The bulk of the 990 Mt of global seaborne thermal coal supply in 2013 will be sourced from Indonesia (396 Mt or 40%) and Australia (196 Mt or 20%). Most of the remainder will be provided by Russia (98 Mt or 10%), Colombia (80 Mt or 8%) and South Africa (79 Mt or 8%). Ten countries share the remaining supply led by the US, which will maintain a high thermal export level for yet another year (44 Mt or 5%).

By 2030, total supply is expected to reach 1.8 Btpa with changes in the supply mix: While Indonesia is expected to remain the largest supplier of thermal coal throughout our forecast, increasing its seaborne exports by 249 Mtpa to 644 Mtpa, its share of total seaborne supply will fall to 32%. Indonesia will grow its exports strongly to 639 Mtpa exports by 2028 and then stabilize as domestic demand pressures continue to weigh on future export supply growth. The lower growth rate coincides with the development of US west coast export facilities and the expansion of US Powder River Basin coal into the Asian market. PRB coal competes well with Indonesian coal for the North Asian market during this period. Australia will increase is market share to 26% of the market increasing exports by 278 Mtpa to 474 Mtpa. The US will become the third largest world supplier by 2022, increasing its share of the world supply to 10% from 4%.

Figure 8 Global Thermal Coal Seaborne Supply



Source: Wood Mackenzie

Trade patterns for European coal imports are likely to change as well. As Colombia expands its market share in the short-term, both the US and Russia will have to cede market share or work on their infrastructure chain to lower costs below where they have been currently negotiated. Particularly in Russia, domestic transportation adds a large cost component to virtually all exports. As overall demand diminishes, we expect South Africa exiting Europe in the early 2020s to serve the Indian market for higher prices, along with Colombia also shifting volumes to higher priced Pacific markets post-2025.

This leaves Russian coal as the largest supplier into Europe with potential growth for the US in the long-term. US Illinois Basin (ILB) coal is the most cost-competitive coal source from the US on an energy-adjusted basis. It may be able to hold a low level of market share, but there are issues in certain countries with the high-sulphur product it exports. Those countries that have Fuel-gas Desulphurisation (FGD) equipment for their remaining fleet following the retirements enforced by the IED (mainly all of NW Europe) should be able to take high-sulphur coal up to 2-2.5% sulphur (with limited blending needs). Morocco and Turkey however, have country limitations, which means ILB coals will need to be blended down heavily with lower sulphur coals, if used at all.

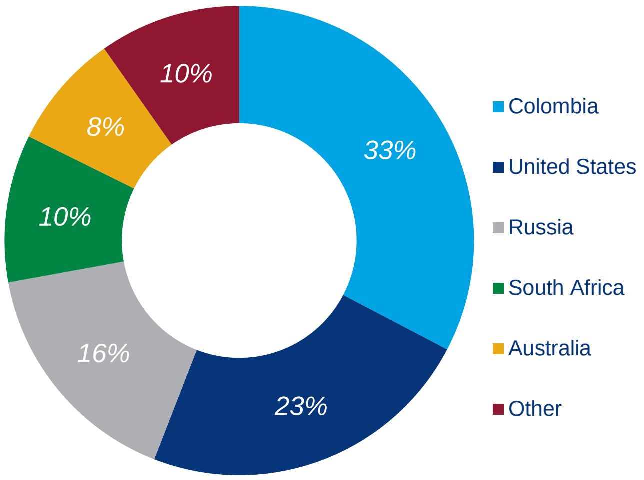
Despite the heavy trade, most global thermal coal is produced and consumed locally. In 2013, inter-country trade amounted to just 13% of total global coal demand but we expect trade this to 18% by 2030.

The Netherlands provides a coal transit facility for neighbouring nations in the form of the Ports of Amsterdam and Rotterdam - two of the three ports that make up the 'ARA' European coal trading hub. The Netherlands imports a combination of thermal and metallurgical coal. The sources of both thermal and metallurgical imports will change over the forecast. Energy content of thermal imports averages at approximately 6,300 kcal/kg.

All of Dutch thermal coal is imported from other coal-producing countries due to the lack of commercial domestic deposits. In 2013, most coal imported into the Netherlands was from Colombia, the USA and

Russia. Although the Netherlands has a relatively small domestic thermal coal demand, representing only 0.94% of global seaborne demand, it is one of the most significant global regions in terms of coal handling and trading for physical seaborne coal and associated paper traded derivative contracts.

Figure 9 Dutch Coal Imports – 2013 (including re-exports into Germany)



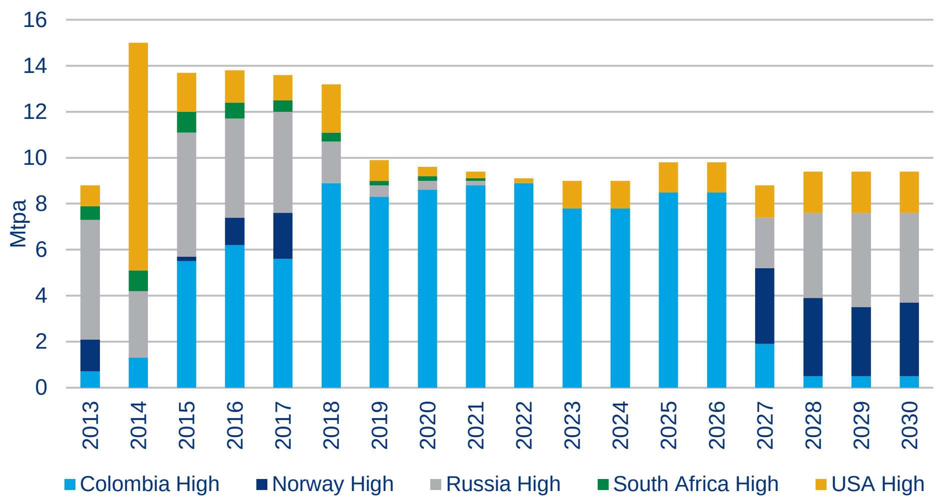
Source: GTIS

Wood Mackenzie forecasts the supplier mix into the Netherlands and the main expected suppliers are the focus of this report. In the medium term, Wood Mackenzie forecasts Colombia to become a considerably larger supplier of thermal coal into the Netherlands, temporarily squeezing out Russian and South African supplies. As mentioned, the reason is primarily due to the cost-competitiveness of Colombian mining, combined with relatively low domestic transportation costs compared to the other competing suppliers. This is particularly relevant to Russia, where coal often travels thousands of kilometres from mines on train before reaching ports able to deliver the coal into European markets. Rail-transportation, compared to seaborne transportation tends to be more expensive per tonne of coal transported.

In addition to falling behind Colombian supply in cost-competitiveness, Wood Mackenzie expects South African coal to yield more profitable results in Asia, particularly in India which suffers from chronic shortages of thermal coal supply of sufficiently high coal quality rank.

Finally, we forecast Norwegian coal to re-emerge towards the end of the 2020s along with Russian coal as Colombian exports are expected to get pulled into the Asian markets due to higher prices.

Figure 10 Dutch Thermal Coal Supply Forecast to 2030



Source: Wood Mackenzie

3.4 Coal Producers

Focusing the discussion on the main thermal coal producer relevant to the Dutch coal market, the following section describes the operating landscape for Colombia and Russia, expected to remain the largest suppliers. We have discussed each supplier in turn.

3.4.1 Colombia

Colombia as a large thermal coal producing country is particularly relevant to the European market, with annual marketable production of approximately 86Mtpa in 2013. Colombian thermal coals are generally considered to have good thermal combustion characteristics with most of the coals being medium/high volatile content with medium to high specific energy and low sulphur. Most of the coals produced in Colombia are low ash except coals from the Cerrejon mine which are in the 11% to 13% ash content range. Sulphur content generally varies between 0.69% and 1.10% except for thermal coals produced at the Cordoba mine which have higher sulphur content.

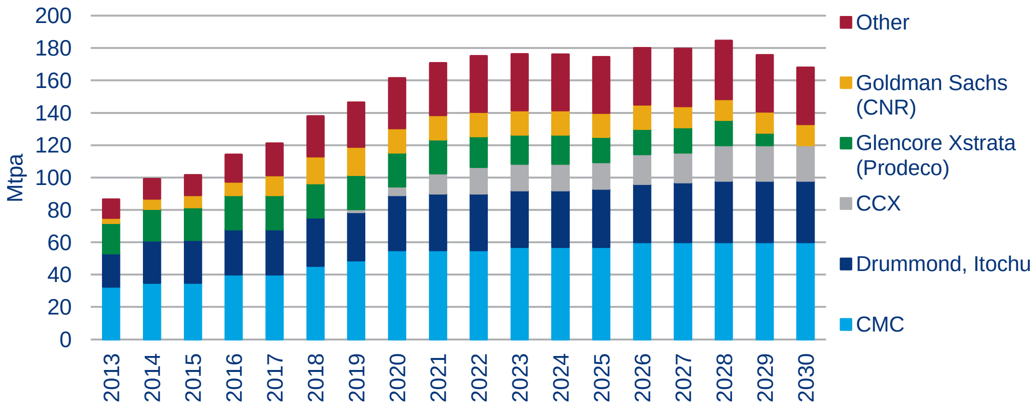
Wood Mackenzie estimates that cost of thermal coal production in Colombia is among the lowest globally. For example total cash cost on an energy-adjusted basis, which excludes shipping costs to delivery market, for the Cerrejon mine was US$48/t.[2] In contrast, the corresponding cost for a Russian mine ranges from $65/t to over $100/t and $50 to nearly $70 for US Illinois Basin mines.

Coal Marketing Company (CMC), owned by Anglo American, BHP Billiton and Glencore Xstrata, was the largest producer in Colombia during 2013 with 32Mtpa of production mostly from the Cerrejon mine in the Guajira region. The three partners have approved an expansion plan for the mine and related transportation and port infrastructure to increase production to 40Mtpa.

CMC was followed by Drummond as the second largest producer at 21Mtpa. The company is upgrading its Puerto Drummond facility to accommodate a new direct-loading setup that will lower port costs and improve safety. This change will also allow for the elimination of barging coal, which recently caused trouble for Drummond when a fully-loaded barge overturned. This incident resulted in the closure of Puerto Drummond for nearly a month. A strike followed not long after the reopening of the port and lasted for 53 days before ending.

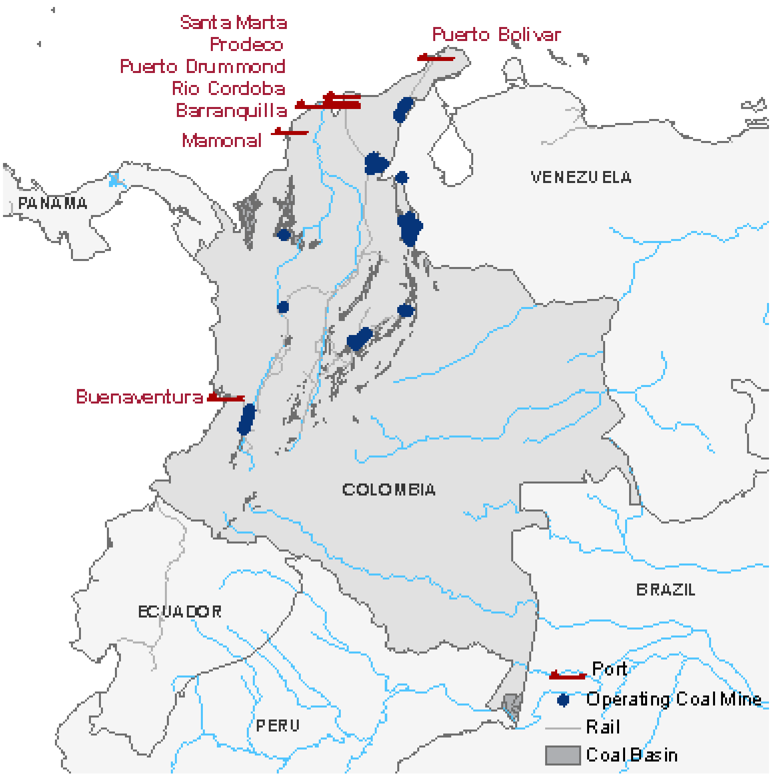
The Prodeco mine owned by Glencore Xstrata has finished construction on its Puerto Nuevo port and has begun loading coal from its Calenturitas and La Jagua mines. This new port will increase loading efficiency and lower port charges for the company. Glencore Xstrata is also embarking on expansion projects for its mines, aiming to grow production to nearly 40Mtpa by 2020.

Figure 11 Marketable Coal Production by Company



Source: Wood Mackenzie

[2] The total cash cost associated with the mining, processing and transport of the marketable product. It also includes general and administration overhead costs directly related to mine production as well as royalties, levies and other indirect taxes.



Wood Mackenzie's analysis estimates total marketable reserves of 4.4 billion tonnes. Marketable reserves are defined as the total forecast future marketable coal production over the life of each identified mine and project. Colombia has more than 8.3 billion tonnes of measured and indicated resources, half of which are located in the departments of La Guajira and Cesar.

The majority of marketable coal reserves in Colombia are thermal, representing 87% of the total reserves. Cesar and La Guajira departments contain 36% and 40% of the total marketable reserves, respectively. As a result, Colombia is, and is likely to remain, a large coal exporter reliant on its seaborne infrastructure.

We forecast Colombian nominal port capacity to increase from 105 Mtpa in 2013 to 136 Mtpa in 2020. The bulk of the growth in port capacity will come from the construction of Puerto Nuevo as a replacement for Puerto Prodeco (27 Mtpa for the two ports combined), the new CCX port on the Caribbean Sea (20 Mtpa) and the expansion in Puerto Bolivar (11 Mtpa). Despite these developments, we believe there will be no available capacity for additional production in the near term, as the ports are controlled by the country's major producers; CMC, Drummond and Glencore are dedicated to their operations.

Infrastructure is a major challenge facing the Colombian coal industry. While producers in La Guajira and Cesar departments have access to good infrastructure, any future development from the interior departments will require major investment in rail and port infrastructure to allow coals to be shipped to the ports at a reasonable cost. Coals from Cerrejon in La Guajira and from the major producers in Cesar are transported using railroads while all coals from the interior departments are currently transported by trucks.

The two main railroads are the Cerrejon railroad linking the Cerrejon mine to Puerto Bolivar and the Fenoco railroad linking the mines in Cesar to the ports in Cienaga and Santa Marta. The two main ports are Puerto Bolivar and Puerto Drummond, which together accounted for approximately 66% of Colombian coal export capacity and nearly 69% of coal exports in 2011.

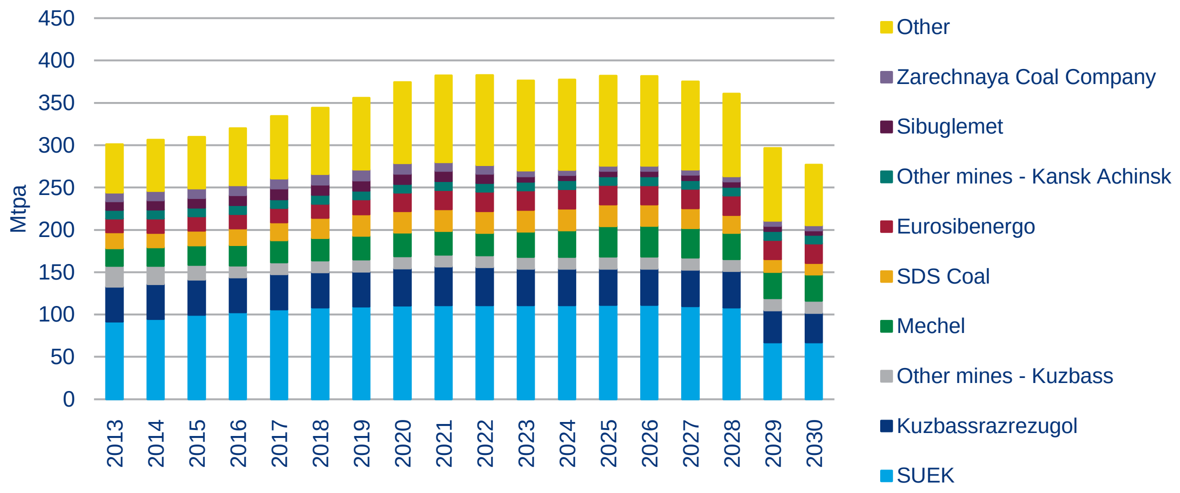
Overall, Colombian thermal coal production is composed by established major, international players with a significant resource base yet to be produced. In addition, costs are very competitive on global standards and infrastructure is sufficient for a small relatively small country, contributing to low production costs. Wood Mackenzie expects Colombia to remain a large supplier of thermal coal into the European markets for the medium term.

3.4.2 Russia

Russia is one of the world's largest coal producers at 301Mtpa in 2013 and with an estimated 12 billion tonnes of marketable reserves. In the short term, Wood Mackenzie expects growth in marketable production to continue at a slow rate, between 1 to 2% per annum, reaching 316 million tonnes in 2016. Russia's domestic coal requirements are only growing modestly, and production growth for export is being constrained by infrastructure bottlenecks and a depressed market in Europe.

Wood Mackenzie expects the five largest Russian producers to account for 59% of Russian production in 2013. SUEK is by far the largest producer of coal in Russia accounting for 30% of total Russian production; while the corresponding share for the second largest producer, Kuzbassrazrezugol, is 14%. SUEK and Kuzbassrazrezugol are expected to remain Russia's largest producers in 2020 although with the ramp up of the Elgaugol project, Mechel will start to close the gap.

Figure 12 Marketable Coal Production by Company



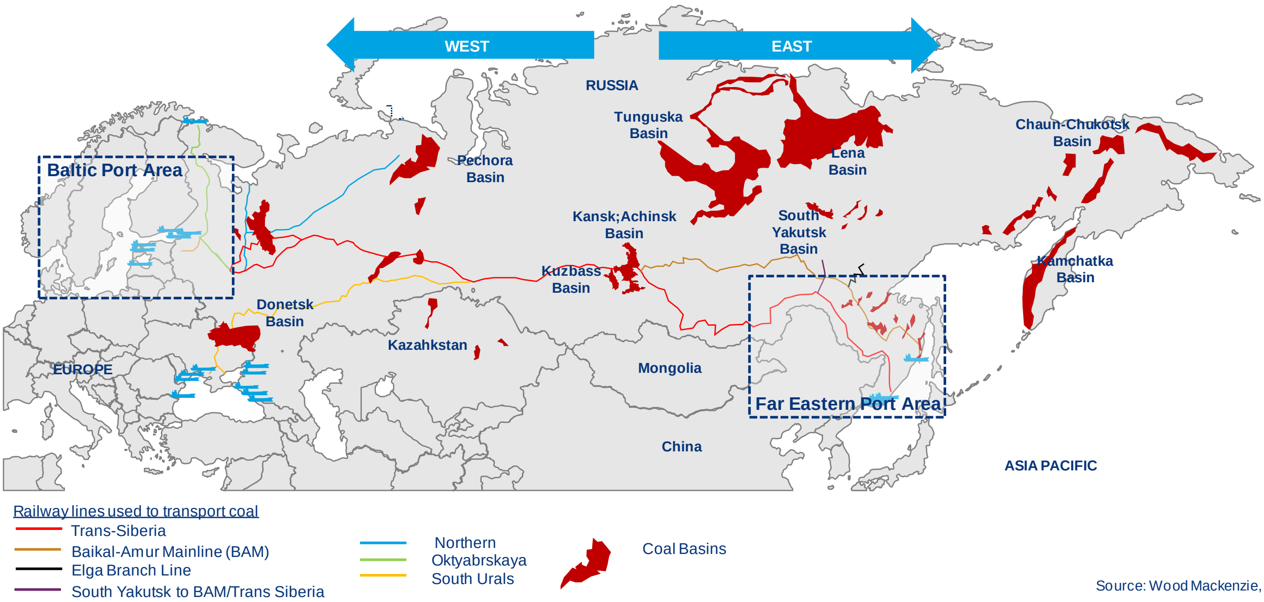
Source: Wood Mackenzie

Wood Mackenzie estimates Russia contains over 12 billion tonnes of marketable reserves within its operating coal mines and highly probable projects. Thermal coal accounts for 80% of marketable reserves with metallurgical reserves accounting for the remaining 20%.

The Kemerovo region is the largest holder of reserves in Russia containing approximately 5 Bt - 42% of the total and 76% of all metallurgical marketable reserves. All of Kemerovo's reserves are located in the Kuznetsk Basin (Kuzbass). The second largest reserve holding region is Krasnoyarsk. The region's vast lignite deposits contain around 2.4 Bt of coal, 22% of total marketable reserves. All marketable reserves in Krasnoyarsk are thermal coal.

On top of marketable reserves from operating mines and highly probable projects, we estimate an additional two billion tonnes of marketable reserves could potentially come into production from projects that we categorise as probable and possible. Metallurgical coal accounts for 62% of these. Of key interest is the Ulug-Khem basin, where several large scale coking coal projects are being proposed.

Exports of Russian coal are almost totally dependent on rail and commercial sea ports. Exporting sea ports are divided into Western and Eastern ports to serve both European and Asian markets with additional capacity in the Black Sea. As demand for thermal coal shifts towards the Asian markets in particular China, Eastern ports are increasing in importance while Western ports remain underutilised. Historically, rail has carried around 98% of Russian coal production with the remainder transported by road, river or marine routes.



Coal export infrastructure in Russia faces a number of unique challenges: The remoteness and length of rail infrastructure, severity of temperature variation, increased capital and operating expenditure and decreased availability. Despite Russia's access to vast coastlines, ice, remoteness and shallow depth all restrict port capacities. The extent of Russia's coal exports will be determined by the availability of timely and cost effective transport infrastructure. We forecast Russian nominal port capacity to increase from 152 Mtpa in 2012 to 204 Mtpa by 2025, of which 34 Mtpa will be added in the Far East of Russia.

Ports in the Far East are running at full capacity, with port utilisation of 101% in 2012 compared to 92% for 2011. There is a limited amount of port capacity expansion occurring in the short term. The port expansions that are taking place will be driven by owner operated port developments. The port of Vanino will increase capacity with expansions at SUEK Muchke and Vanino terminals. These expansions cannot take place until the restrictions on the BAM rail line leading into the port are overcome. The project to increase the capacity of the rail approach to Vanino is currently underway. Construction of the Kuznetsovsky tunnel, which is a major part of this project, was completed ahead of schedule in late 2012. By 2015, the additional 25 kilometres of track upgrade will allow to increase the throughput capacity into the port of Vanino to 36 Mtpa.

With global coal demand shifting to the Pacific markets, Russian producers are beginning to focus infrastructure spend more on the Eastern ports.

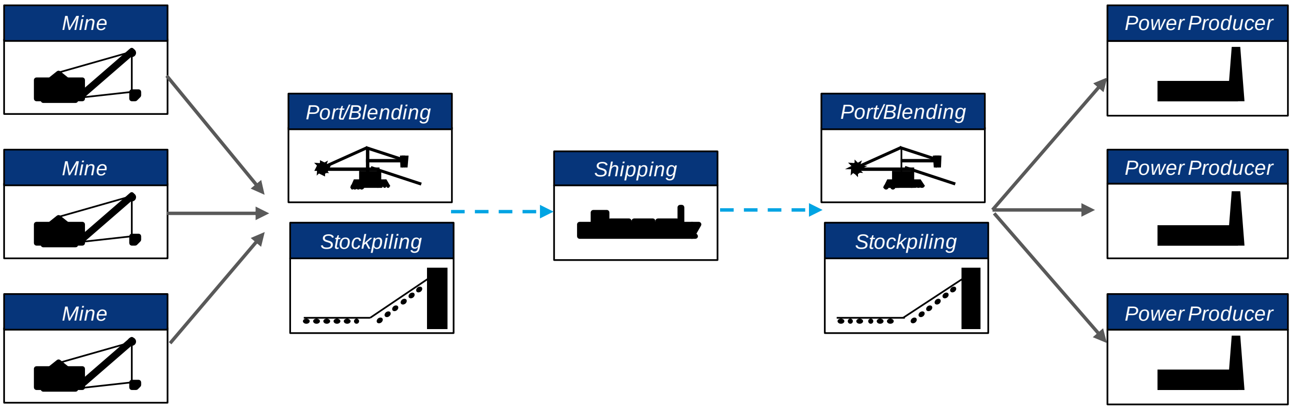
4.0 Supply Chain

Addressing the possibility of public disclosure of source mines and the potential commercial concerns involved should centre on inspecting the physical and contractual supply chain of thermal coal into the Netherlands. We have examined both the physical supply chain to understand the practicalities in tracing the source of coal up to the individual mine, and the contractual structures to draw out potential complexities.

4.1 Physical Supply Chain

The physical supply chain for thermal coal begins at the coal mine and finishes at the consuming coal-fired power plant, often crossing country boundaries in the process as shown in Figure 13. Coal mining is conducted either through open cut (above ground) or underground activities. Thermal or metallurgical coals do not differ in the methods they are mined and are often mined in a single group of deposits (seams) in a single mine but sold as separate products. We have analysed each section in turn to identify the specific commercial concerns and potential obstacles from tracing the source mine.

Figure 13 Physical Supply Chain - Thermal Coal



Source: Wood Mackenzie

Mine – Handling and Preparation

After thermal coal is mined and before leaving the mine, coal may be beneficiated through up to four main processes:

- **Sizing** – coal is reduced in size depending on end-use
- **Screening** – assists to grade products for commercial markets
- **Wet concentration** – to separate the acceptable matter from the rejects
- **Dewatering** – helps remove a significant amount of the moisture that is added at prior stages of beneficiation

Raw coal can be contaminated by a number of impurities (predominantly incombustible ash in the form of in-situ or natural mineral matter and dilution by non-coal mineral mater during the mining process) which reduces the energy value of the coal when burnt in a coal-fired power plant. Coal can be beneficiated at a washer or at a Coal Handling and Preparation Plant (CHPP) to remove these contaminants (ash) by separating the mineral matter content from the coal. Where the contaminant is contained within the coal, washing the coal will not remove the matter. The coal washing process effectively removes incombustible ash and increases the energy content. However, this process also reduces the volume, which makes it easier and cheaper to transport at a higher calorific value.

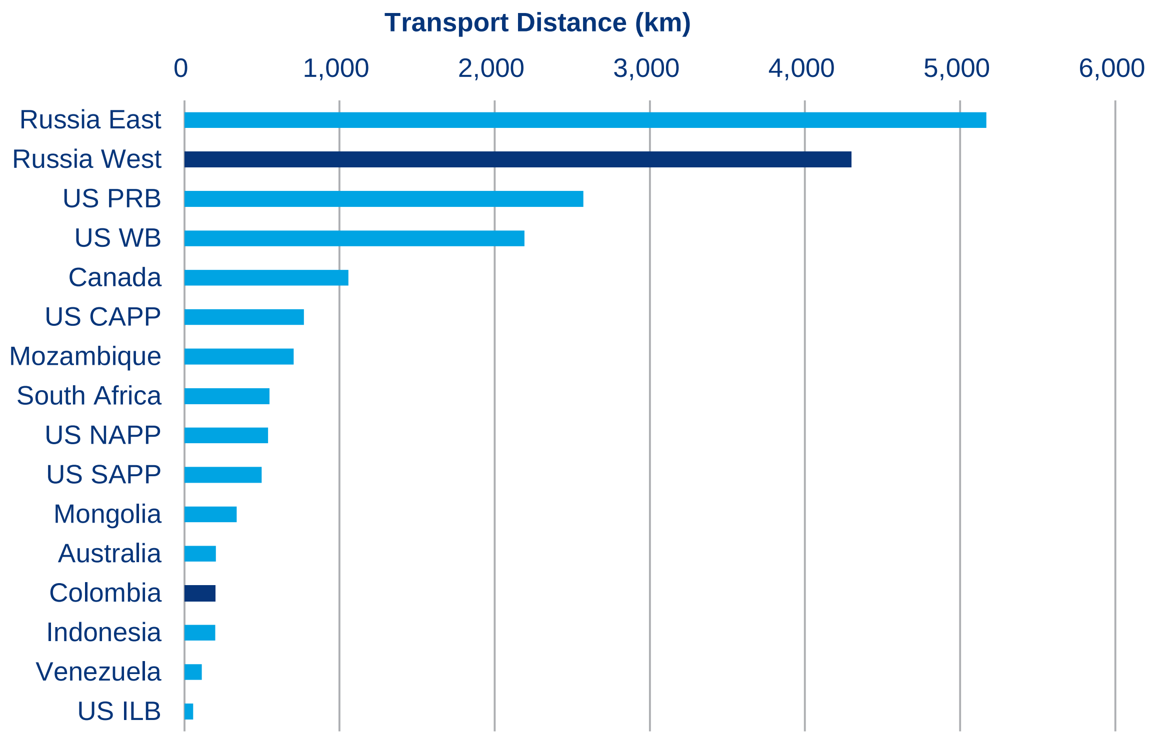
At this point of the supply chain, there should be very little uncertainty in identifying the source of the coal since handling and preparation is mostly done at the mine site.

Transportation

Globally, rail is the most common form of domestic transportation for coal from the mine to the domestic export markets. However, transport distances for rail vary dramatically as shown in Figure 14; Russian average rail distances from mines to both Eastern and Western ports are over 5,000km while in Colombia the corresponding average distance is only approximately 200km. Compared to shipping, the economies of scale for railing are not as beneficial and therefore longer distances increase the costs per unit of coal in the favour of sea transport. These factors tend to tip cost-competition often in the favour of countries with mining operations located closer to the exporting ports.

Rail transport systems vary for the main supplying countries to the Netherlands: Russia maintains a state-owned model where rail networks are owned, operated and maintained by Russia Railways. In Colombia, the privately owned Fenoco is the main rail company for the coal industry. None of these companies are owned by coal producers but rather act as service providers to the coal mining companies and other local industries. While this adds a disconnect to the supply chain and potentially adds to the complexity of identifying the source of coal at the loading port, contracting parties (i.e. coal producers) with rail companies generally have robust procedures in place to identify their products for commercial reasons alone by tracking coal on a rail car basis. For example in Russia, where trains travelling to loading ports make several stops on the way, there are obvious commercial reasons to be able to segregate each producer's product when unloading the train at the loading port. Even in cases where coal originates from several mines operated by the same producer, varying equity interests for the mine are likely to require the operator to be able to distinguish its products by mine once being unloaded at the port.

Figure 14 Average Domestic Rail Distances for Coal Producers



Source: Wood Mackenzie

Stockpiling

As most coal from producing countries is exported rather than consumed domestically, stockpiling is usually located close to exporting ports and tends to contain coal from several different coal mines within the country unless the port is dedicated to a certain mining company. The purpose of stockpiling is to allow mining companies manage the physical selling of their product to end users or intermediaries. Demand for coal in producers' target markets fluctuates in the short term based on a number of factors such as amount of available supply, international prices, season, contracting and prices of competing fuels, which requires mining companies to manage their inventories accordingly to achieve the highest value.

In addition, most coal mining operations involve a degree of product blending at the load port stockpile facility, which enables the miners to differentiate the product qualities based upon the customers' requirements as an attempt to achieve better prices. The amount of load port blending a miner or trader can undertake is highly dependent upon the size and sophistication of the load port facility and the coal qualities available. Depending upon the prevailing market conditions, a miner or trader may modify the coal export products based on a forward view of market supply and demand for specific grades.

For example, Australian mining companies often switch between maximising high energy/low ash thermal coals targeting the Japanese and Korean markets to low energy/high ash in higher volumes to target the Chinese markets depending on their view of maximising profit. Producers therefore attempt to balance the trade-off between price and total volume by varying their products qualities. The changes in product coal qualities can be achieved by either further washing of an existing coal, removing impurities and increasing the energy content or it can be done by blending a higher energy content coal to increase the overall energy content.

In cases where coals from different mines are blended, identification issues may arise. In the Australian example, the mining companies may, and often do, use coal supplies from various mines to achieve a certain blend. The sources of the individual coals may be lost in this process, as the coals effectively form a new product. In some cases, the new product could then be further blended with another blend to achieve another product. Unless records are kept, the contracting participants could find it difficult to identify the original sources.

Theoretically, petrographic testing could be used to identify a coal's rank and maceral composition, which in turn could be used to identify the chemical composition of a matching coal deposit. In practice however, the testing would of limited use because vitrinite reflectance (a measure of the rank of the coal) may vary both vertically and laterally within a single mine lease. In some coalfields, such as the Hunter Valley in Australia for example, there is only subtle difference in rank and maceral composition, if any, in a region that contains numerous mines. The exercise would also require a global database of the petrography of coal deposits and the facilities available to conduct the testing. In addition to the unreliability, the cost liability of testing each shipment of coal would have to be agreed between the buyer and seller.

Loading Ports

For the majority of exported coal, seaborne loading ports/terminals can be broadly categorised into three types:

1) Dedicated facilities restricting access to the owner of the port such as Puerto Drummond or CMC in Colombia;

2) Multi-user facilities such as Richard's Bay Coal Terminal (RBCT) in South Africa (Until 2002) that are in some sense formed as Joint Ventures (JVs) where each user contributes to operating and capital costs according to their respective ownership; and

3) Open access facilities for available for any user such as those operated by Port Waratah Coal Services (PWCS) in Australia, where access is granted against a fee and the operator of the terminal or port is often different to the mining company.

The type of port is important from a practical perspective in establishing the source of the coal components. For **Dedicated facilities**, this exercise is theoretically less complex as the port is built for the sole usage of the mining company, resulting in more internal control of the supply chain. The US-based coal producer Drummond operates the Pribbenow and El Descanso mines in Colombia and has a dedicated loading port Puerto Drummond for exporting the coal.

Multi-user facilities are operated for the benefit of their owners and tend to restrict access to third parties. The Russian coal mining company SUEK is an example of this type with ownership for the Port of Murmansk. The port is one of the main West Russian exporting ports into Europe and is one of only two

Russian coal ports that are ice-free all year round, the other being Vostochny in the Far East. SUEK, Mechel, Sibuglemet and Coelerici are the main users of the Port of Murmansk.

Open access facilities are generally operated by service companies who are separate to the mining companies served. Wood Mackenzie estimates that PWCS in Australia serves 11 different companies and nearly 40 mines. In South Africa, the Port of Richards Bay contains two terminals that export coal: RBCT and the Dry Bulk Terminal (DBT). RBCT is operated by a conglomerate of coal companies and was a multi-user facility JV until 2002, when it began to converge more into an open access model. DBT on the other hand is operated by the state-owned Transnet. Transnet is also the national port authority for South Africa, controlling and regulating the development of port facilities at the Port of Richards Bay. At the expanded capacity level of 91 Mtpa, some 28 distinct companies have access allocations at RBCT. The companies fall into four broad groups:

- The original shareholders of the terminal are established large-scale coal mine operators and hold the bulk of capacity;

- A second access regime, named Quattro, began in 2002 with the aim of providing capacity to small, emergent Black Economic Empowerment (BEE) coal companies; it is available to users typically exporting volumes below 0.25 Mtpa;

- A third group, shareholders in the South Dunes Coal Terminal company (SDCT) were allocated capacity at RBCT following the commencement of the Phase Five expansion of the terminal. The SDCT was originally planned as an independent export terminal, designed to break the monopoly of RBCT over coal exports, but it was eventually integrated with the existing RBCT facility; and

- A further selection of BEE companies was awarded capacity in 2007 under a subscription tonnage arrangement.

Overall, multi-user facilities are more complex than dedicated ports/terminals simply as a result of the number of parties involved and disconnects in the supply chain. Coal storage facilities are in some cases separated based on ownership but in some cases the coals are blended when stored, which may make tracing the origin difficult. For the main Dutch suppliers, Colombian ports are theoretically less complex due to being mostly dedicated facilities to e.g. Drummond or Glencore Xstrata (Prodeco) while Western Russian ports are often multi-user facilities. To enable full tracing of all coal exported to the Netherlands up to the respective mines should require physical and contractual restructuring of the Russian port facilities and storage structures.

Shipping

After unloading and stockpiling at the loading port, the product is either sold to an intermediary such as a coal trader or directly to the end-user (through its trading entity). Depending on the contracting terms, coal is sold either at the load port or at the discharge facility. The appropriate vessel sizes for a coal shipment are determined largely by the physical capacity of the loading and unloading ports comprising of draft and reach of loading/unloading equipment, size of the shipment, shipping rates and vessels physically available for contracting. Also taken into consideration is the frequency and amount of coal required by the buyer. In general, economies of scale apply, with larger vessels yielding lower shipping costs per tonne of coal, however this is dependent upon the relative market dynamics of chartering the different sized vessels which varies on a seasonal basis (e.g. outside of the grain harvest season in the US, the panamax 60-90,000 dwt vessels charter prices can fall significantly below capesize 150-180,000 dwt vessels). In the case of the ports of Amsterdam and Rotterdam, capesize or panamax vessels are mostly used for coal shipments from Colombia and Russia.

In the case of ocean transport there are already a number of shipping documents that go part way in helping identify the source of the coal. For example every coal shipment exported from Australia and most other major export countries requires a Certificate of Origin. This certificate specifies the brand name, loading port and exporting company. Unfortunately it does not specify the individual mines. Coal shipments may be composed of a blend of numerous coals at the port and these are not specified individually on the Certificate of Origin. Other shipping documents, such as the Bill of Lading and Certificate of Analysis similarly may not indicate the source of the individual coals.

Most importing countries also have customs import documentation for every shipment of coal that arrives at the discharge port or rail head. This documentation normally specifies the origin and brand of the coal as well as the price for calculating import duties. Again it may not mention the individual mines or producers, or the proportion of each coal mine used for the blend. A potential solution could be to require all ships arriving to the port to produce additional customs documentation that identifies the origin (country of origin, producer and mine name) for all imports before customs approval is granted. However, the solution is merely theoretical and the implementation of this additional requirement would likely be practically challenging and would face opposition from the key stakeholders.

Table 1 Typical Shipping Vessel Types

Type of Vessel	Deadweight Tonnage (DWT)
Handysize	10,000 – 35,000
Handymax	35,000 – 59,000
Panamax	60,000 – 90,000
Capesize	150,000 – 180,000

Source: Wood Mackenzie

When coal is sold through an intermediary, rather than the mining company, the likelihood of the shipment containing a blend of coals from mines owned by different mining companies is higher than buying directly from the producer. Producers (e.g. in Colombia or Russia) often operate several mines and are capable of achieving the desired energy content and other specifications by using coals from their internal mines and will often find using internal mines less costly. Coal for independent intermediaries (traders) however, is all third party product and there is little incentive or relevance for intermediaries to prioritise coal blends exclusively from (for example) Glencore Xstrata mined coals. Theoretically, a coal blend bought directly from a mining company that has used coals only from its internal mines is less complex to trace back to the supplying mines compared to a trader who has used a number of different coals, sourced from different mines and companies to create a similar blend.

The obvious method for a power producer to trace its supplies more easily is to source coal directly from mining companies rather than from intermediaries. The potential downside of this method is a restriction on the number of suppliers, which theoretically could lead to an increase in the cost of coal for power producers.

Unloading Port / Stockpiling

Once received at the unloading port, depending on the buyer and intended use, coal is stockpiled at the port, used at a nearby power plant or transported further to the end-users. At the ports of Amsterdam and Rotterdam, the majority of thermal coal is re-exported using barges or trains to Dutch and many German power plants.

The ports of Amsterdam and Rotterdam comprise of a number of coal terminals operated by stevedoring companies that are responsible for physically moving coal from the ship onto a stockpile or barge/train. The terminals are owned by the stevedoring companies who are mostly third party service providers to the coal buyers and sellers. A notable exception in ARA for this is three terminals at the Port of Amsterdam operated by Amstuv BV, which in turn is owned by EDF Trading. In these cases where a power producer is affiliated with the port there is likely to be less uncertainty about the individual coals stockpiled and blended at the unloading port, and therefore less ambiguity about the origin of an individual coal. It is important to note however, that EDF Trading does only exist for the purposes of supplying coal to its coal-fired power stations around Europe but also trades coal for proprietary trading purposes with other power producers or traders. In essence, all coal arriving to an EDF-affiliated terminal would not necessarily be destined for burning at an EDF-operated power station.

Overall, unloading ports in the ARA region are likely to introduce another level of blending for imported coals. ARA is well-suited for secondary trading between participants and the ability to trade coal shipments closer to the consuming plant allows power producers additional flexibility to manage their operations. For example, a Dutch power producer could purchase coal but realise, before receiving the shipment at the plant, that it no longer requires the coal. Secondary trading would then allow the power producer to either re-sell the coal directly to another buyer or blend it with another coal to make the coal more appealing to buyers and achieve a higher price. Clearly this would add further complexity around the origin of the coal.

Summary

The physical tracking of coal from its source mine to when received by the seller is hindered by the fact that coal is rarely sold from a single mine directly to a consuming power station. There is nearly always an element of blending required to suit the technical specification of a power station. In addition, the amount of trading that takes place throughout the supply chain creates further blending opportunities, increasing the complexity of tracing the coal to its source mine(s).

Establishing the origin of a coal product is, however, theoretically possible by requiring ships arriving to the port and carrying coal for the Dutch market to produce documentation that provides sufficient disclosure of the individual mines sources. The ease of producers to provide this level of disclosure would vary with for example Russian producers, who share large parts of the exporting infrastructure, could find this difficult at the loading port. Moreover, most parties would likely find compliance with the disclosure requirements even more difficult at the discharging port at ARA, taking into consideration the multiple discharge points, coal handling, trading and shipping companies who often have different owners and clients. In summary, the solution is theoretically possible but the practicalities arising from the number of parties involved, blending and secondary trading of coal would make this solution difficult to implement.

4.2 Contract Structures

Coal contract structures between two parties are either done on a spot market basis or as long term contracts. Spot market contracting involves transactions where pricing is negotiated on a cargo by cargo basis in the open market with no security of long term off-take. It is unusual for a mine to only sell tonnage via the spot market due to the volatility involved. Long term contracting, which often extends over multiple years, allows buyers such as utilities to lock in their coal pricing structure and supply for pre-determined volumes and delivery periods (e.g. regular shipments delivered on a monthly, quarterly, annually, etc.).

The items are relatively universal and are generally negotiated based on a Standard Coal Trading Agreement (SCoTA) originally authored Global Coal Limited, but can be modified in any way to which the counter-parties agree. It is important to note however, that long term contracts often are agreed for multi-year deliveries. Any amendments to the contract terms and conditions during the contract tenor would require agreement from the seller and buyer and would generally have to be in the benefit of each of the counterparties concerned.

In either spot or long term contracting, a typical coal contract contains the following main terms:

- ***Commodity*** – The type of commodity for delivery is generally defined as either thermal or metallurgical coal or as a particular blend such as Russian thermal coal or Hard Coking Coal (HCC). It is rare that a contract will specify a specific mine name, however it will be of a particular quality (i.e. Glencore Xstrata D55 is a 5,500 NAR kcal/kg thermal coal sold from Richard's Bay in South Africa)

- ***Quantity and Timing*** – Quantity of the commodity, generally in metric tonnes, is defined as a single shipment (i.e. spot sale) or recurring shipments (i.e. long term contract) depending on the type of contract. In most cases, the quantity grants either the seller or buyer the option to deliver or accept the agreed volume within a certain range, usually +/- 10% of the shipment. The option is occasionally referred to as a shipping tolerance to allow flexibility to the final volume loaded to the vessel.

- ***Specification*** – Related to the type of commodity, the coal specification defines the technical parameters of the commodity to ensure the correct quality is delivered. For thermal coal, factors such as moisture content, calorific value and volatile matter are very important, as they influence the energy content of the coal or its compatibility at a specific power plant.[3] Thermal coal is priced

[3] globalCOAL's Standard Coal Trading Agreement (SCoTA) specifications for coal delivered to ARA are listed in Appendix 1

predominantly by its energy, ash and sulphur contents and material deviations from the defined terms would result in pre-determined adjustments to the final price. The technical variables are often defined as typical or indicative, which the seller intends to deliver and as a maximum/minimum limit where exceeding the limits allows the buyer the option not to accept delivery. Non-material deviations within the confines of the limits are addressed with price premiums and penalties as described below.

- ***Unit Price*** – The defined unit price is virtually always quoted as US dollars per metric tonne and is predominantly based on a specific pricing benchmark most relevant to the market the coal is sold to and the negotiated terms between the seller and buyer. For example, a South African seller who has agreed to deliver the coal to the domestic loading port, where risk and title transfer at loading, a benchmark such as Richards Bay for 6,000 NAR kcal/kg could be applied. Where the seller has agreed to deliver the coal to the unloading port (e.g. Amsterdam), a ARA for 6,000 NAR kcal/kg benchmark would likely be applied.

- ***Premium/Penalty*** – This is normally a formula-driven amendment to adjust for the final quality delivered versus the agreed contract quality (i.e. the difference to the indicative quality specifications). In many cases, a maximum/minimum tolerance is defined in the contract and breach of these limits would result in a material contractual breach.

- ***Origin*** – The origin of the coal is generally defined either at the company, port or country level. For instance, a seller could refer to the origin as "*Port of Newcastle, Australia*" or as "*Peabody operated mines in the Powder River Basin, USA*" but would rarely specify the individual mine(s). The level of detail is largely done for practical reasons, given the majority of global load ports are multi-user facilities with non-dedicated stockpile facilities. However, in some coal-exporting countries such as Colombia where the rail and port infrastructure is dedicated to a specific company's mine (or group of mines), it is theoretically feasible to clearly identify the source. In addition, the buyer would generally not be likely to consider more detailed disclosure relevant for their purposes, provided the coal meets the desired contractual specifications.

- ***Quality Determination*** – Defines the responsibility over sampling of the product to ensure the product arriving or leaving a port is within the confines of the contractual specification limits. However, the source of the coal is mostly irrelevant for these purposes, since the focus is on the technical characteristics of the thermal coal, not the origin of it.

- ***Laycan*** – Defines either the loading window (FOB) or discharge window (CFR/DES) for a specific vessel. In long term contracts these can be theoretically pre-determined up to one year in advance.

- ***Loading Terms*** – Defines the terms and conditions for loading the vessel and the transfer of risk and ownership. Coal sales contracts are predominantly concluded on a load port or discharge basis that determine which party is responsible for chartering a vessel and the transfer point of title and risk. One of the key elements of the contract outside of price is the point of transfer for title and risk. Title means the ownership of the goods, normally a seller will not release the title to a buyer until it receives confirmation of payment. Risk refers to the liability of the goods. For example, if the chartered vessel for a particular voyage sinks during the counterparty holding the risk is responsible for the financial and operational damages. The main loading terms used for ARA, also known as Incoterms, are listed in Table 2.

  Historically, mining houses have sold coal on a Free on Board (FOB) basis, where the seller transfers responsibility (shipping, title and risk) to the buyer at the sellers load port facility. This is largely because mining companies have been reluctant to get involved in the shipping of goods due to potentially significant reputational and financial losses if a chartered vessel encounters any significant problems.

  However, the coal industry has continued to evolve in terms of trading complexity leading to a greater number of sales being concluded on a Carriage and Freight (CFR) or Carriage, Insurance and Freight (CIF) basis, where the seller is responsible for the delivery of coal to the buyer's nominated terminal/port. The final most common delivery type (Incoterm), is where the seller is responsible for delivering the coal to the buyer's nominated discharge facility, taking responsibility for shipping/carriage, insurance, These thermal coal shipments are quoted either in Gross as Received (GAR) or Net as Received (NAR). GAR reflects the gross amount of heat generated from burning the received coal, while NAR subtracts the amount of heat attached to the water vapour in coal burning and therefore always holds a lower calorific value.

Table 2 Main Loading Terms (Incoterms)

Delivery Term (Incoterm)	Title – Point of transfer	Risk	Shipping	Insurance
FOB	Loading Port	Loading port	Buyer	Buyer
CFR	Loading Port	Loading port	Seller	Seller
CIF	Loading Port	Loading Port	Seller	Buyer
DES	Discharge Port	Discharge Port	Seller	Seller

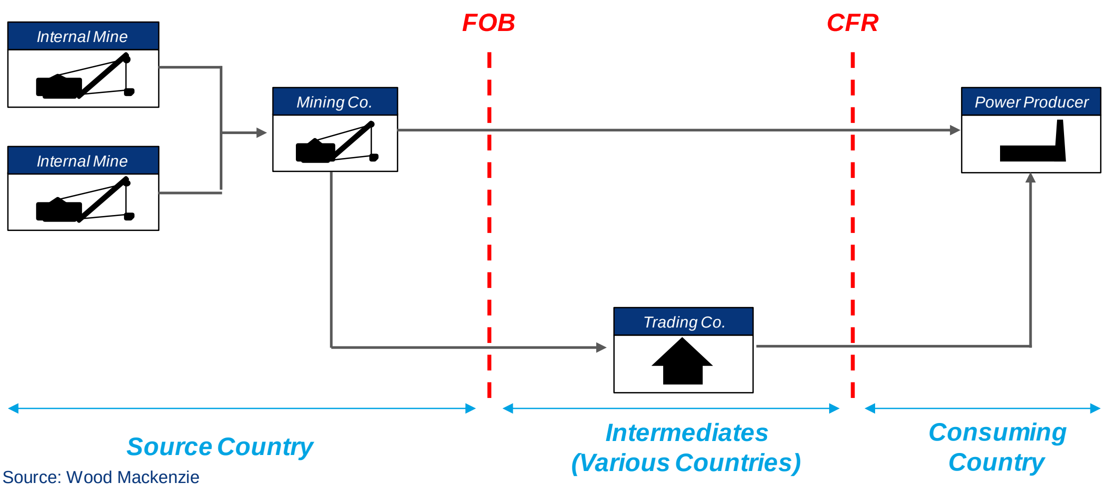
Source: Wood Mackenzie

In summary, the common factor to most of these terms is the distinction between product coal and coal from a specific coal mine. Product coal is defined in a contract and does not generally define the mine source but where the focus is solely on the contractual coal specification such as calorific value, ash content and moisture. From a trading and procurement perspective, thermal coal from a particular mine is generally not defined. This is largely because the desired commodity bought is required to conform to the technical specification the buyer requires for using in its power plants or because the specifications happen to attract a premium in further trading. The product coal is very often achieved by blending different coals from various mines before reaching the end-user (i.e. power plant). The contractual specification is hence driven more by the end-user's type of power plant, requiring a certain type of blend, often not met by the coal initially mined from an individual mine.

4.3 Contracting Supply Chain

From a supply chain perspective, coal contract structuring from the mine to power production traditionally involves a buyer, seller and an optional intermediate trader as depicted in Figure 15. The mining company has sourced coal from its own internally operated mines. Sales contracts are made either directly with the power producer (i.e. bilateral contract) or sold to an intermediary such as a trading company or broker who would then on-sell the appropriate product/blend to its client base of end consumers. Under a conventional contract structure, the ability of power producers to trace the source of coals to the individual mines was theoretically possible without considerable costs because of the simplicity. The exception was a trader or broker, who was able to source coal from various mining companies.

Figure 15 Conventional Structure - Coal Procurement



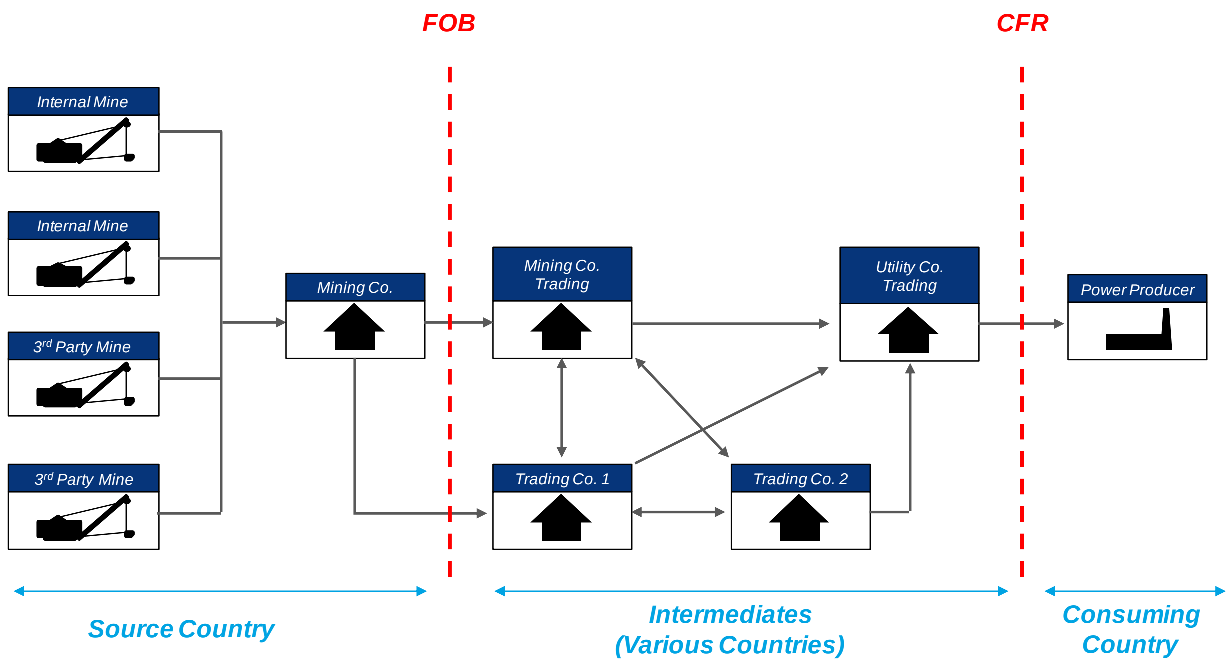
Source: Wood Mackenzie

Since the 2000s, coal contracting and procurement has evolved into a more complex structure with the number of parties and transactions increasing as shown in Figure 16. Mining companies have become more involved in trading and sourcing coal from other third party mines, to be able to sell a particular blend. Similarly, trading/marketing firms for utilities and power producers have established trading/marketing firms to optimise the company's natural commodity positions, which are "*long*" for miners and "*short*" for power producers, manage contractual agreements and to ring-fence risks. In the majority of cases, trading arms will also be involved in third party proprietary trading positions, which intends to enhance the company's income. The buying behaviour of power producers has resultantly changed to purchasing coal from an increasing number of sellers, and to purchasing based on market fundamentals rather than on solely supplying their own demand. For example, a utility-owned trading company may buy a certain blend of coal above and beyond its short-term operational needs if it foresees increasing price volatility and is able to store the coal for subsequent use or for further trading.

The consequence of the more recent trading structure is added complexity in tracing the origin of the coal eventually burnt by the power producer. In addition to the often several intermediaries blending coals based on their inventories, forward market views and pricing strategies, the trading arm for the utility/power producer often perform further blending. At the end of supply chain, the power producer would receive a blend that conforms to its technical boiler requirements (i.e. acceptable energy, ash and moisture content) but the coal blend could, at one extreme, be a composition of a number of other blends, each of which could in turn be blended from coals originating from several mines not necessarily from the same producing country. In such a case, tracing the coal to the supplying mines would likely be a costly and time-consuming process.

Power producers may still purchase directly from the mining companies, although the transactions take place between the trading companies of the counter-parties, rather than the actual operating companies. In these cases, however, the coal product would likely be less blended and power producers are theoretically better positioned to trace the origin of the coal. Ultimately the type of contracting the power producers employ depends on their corporate strategy for procurement, cash flow management, proprietary trading practices and forward market views.

Figure 16 New Structure - Coal Procurement



Source: Wood Mackenzie

The more recent structure is particularly relevant to the Netherlands and the ARA port region, which has certain distinctive characteristics compared to other European coal importers:

- Firstly, the ports of Rotterdam and Amsterdam act as gateways to other European markets and particularly to the German coal market. In fact, from the approximately 50 Mt of coal imported into the Netherlands 31 Mt was transhipped to Germany in 2012.

- Secondly, the amount of coal transit to the Dutch ports has attracted significant secondary trading of coal by proprietary commodity traders, and by subsidiaries of European power producers who partly trade for operational reasons and partly for profit-seeking motives. Power producers are able to leverage their buying power to achieve lower coal prices and typically stockpile over and above their operational commitments depending on expected coal price movements.

- As a consequence of the above factors, the Dutch ports have vast stockpiling capacities to facilitate trading, storage and blending of coals and therefore allow traders to take advantage of price fluctuations or for coal users to retain/increase inventories as required. For trading purposes, storage and stockpiling areas are especially relevant for spot trading.

The increased complexity of a more multi-faceted contracting structure in ARA clearly introduces fundamental changes to a conventional producer-user coal trading structure, which may make the trading of coal more efficient and possibly lower the cost of coal for end-users. Specifically, with the number of participants increasing, the buying or selling power of any individual participant is likely to decrease. Most likely, the new trading structure has come to being from the primary concern of the industry; namely to what degree the thermal coal burnt is compliant with the required technical characteristics. The consequence of this has been less of a concern over the actual origin of the coal, the number of sources and the amount of blending required to create the desired blend. With a more competitive market formed by the increase in intermediaries, coal sellers are likely to continue devising innovative methods of delivering the desired specification to a power producer at the most competitive price, thereby lowering the effective price paid by the end-user.

5.0 Potential Implications

5.1 Introduction

Following the discussion about the complexities of the supply chain, Wood Mackenzie has assessed the potential commercial implications from the hypothetical scenario where Dutch power producers would be obligated to publically disclose their thermal coal sources up to an individual mine level to allow a higher degree of transparency from a Corporate Social Responsibility (CSR) perspective.

Our discussion is based on the theoretical commercial and contractual complexities examined in the previous sections. As a result, the hypothetical scenario of coal source disclosure and its implications also remain theoretical. Wood Mackenzie has formed our views based on our industry knowledge and experience.

5.2 Theoretical Consequences

The immediate commercial concern relating to the public disclosure (of supplying coal mines) from Dutch power producers is the cost of providing the information. In our view the most workable, albeit at this point hypothetical, solution would be for Dutch customs authorities to require incoming coal ships to produce sufficient documentation to establish the source of the coal up to the individual mines used for the blends. However, the precise implementation and concerns regarding the process would require extensive industry consultation with the various parties.

The cost of producing this documentation and linking it to the power producers would have to be agreed between the participants but would not likely to be a significant cost item. The difficulty would be identifying coals that are sold by intermediaries who effectively have little control over the physical supplying mines and may have bought a blend to begin with.

From a more contractual point of view, power producers could agree to limit their suppliers to those mining companies or traders of mining companies who could guarantee that the coal is delivered from only their internal mines, rather than being blended with coals from third party mines. The advantage of this approach of applying a corporate-level source would be that the number of potentially supplying mines would be limited to the mines operated by the companies. This in turn could lower the cost of verifying the source of coal blends and providing the necessary documentation to customs authorities. The disadvantage could be an increased cost of coal supply for power producers because, as discussed, even long term contracts typically sell coal based on the technical specification, which could be sourced from third party mines and internal mines to lower the cost of the blend. In addition, the supplying mines for the same blend may change over time based on the availability from the mines and cost of supply, making verification more complex.

Requiring mining companies or their trading arms to adhere to the corporate-level restrictions could impinge on their ability to provide their lowest cost blend and therefore potentially increase the cost of coal for a Dutch power producer. These cost implications are highly dependent on the coal blends used by their plants and their ability to source compatible coal blends from sellers able to comply with the disclosure requirements. The requirement could also make it difficult for traders to provide assurances and certifications of the source of the coal they have bought to on-sell to power producers. Clearly the trading community serves a purpose by increasing competition among sellers, evidenced by its existence, and restricting them out of as suppliers to power producers due to their inability to provide verification of the source of their coal could even further increase the cost of coal.

Continuing on contractual issues, contracts in general are negotiated and agreed by all parties involved in the transaction. Power producers suddenly intending to add an additional verification clause, whether to identify the source of the thermal coal up to an individual mine level or company level, would be likely to face a number of problems: In the short term, a live SCoTA coal contract could be supplemented with an addendum to legally guarantee verification of their coal sources but the suppliers would not be under any legal obligation to agree to the addendum. In the long term when long term contracts expire, coal sellers (particularly independent traders or the trading arms of power utilities) could simply deem the cost of compliance in excess of forgoing the opportunity to supply the Dutch power producers and sell their coal elsewhere. Realistically, coal sellers would be unlikely to refuse to supply Dutch power producers outright but would rather attempt to negotiate to pass at least a proportion of the cost of compliance onto the buyer.

In fact, coal sellers in the form of intermediaries could potentially take advantage of a situation where coal supply into the Netherlands is restricted to only producers able to comply with the disclosure requirements. Specifically, a lower amount of coal available would lead to higher competition over the remaining eligible supply. If Dutch power producers were to publically disclose information of coal mine sources, intermediaries may be able to take strategic contractual positions, buying more of the remaining complying coal from the producers and therefore restricting the amount of supply available to the power producers even further. They could then sell the coals to the Dutch utilities, but at a higher price compared to their non-Dutch competitors, who would be less restricted in their coal sources and thereby less vulnerable to these strategies. In addition, the compliant coal sold to Dutch power producers would be less likely to be blended from various mines to allow sellers to verify the source. As a result, the amount of coal commercially available that would meet the required technical specification for Dutch power producers would be even lower, creating potentially even more challenging purchasing conditions.

In general, we believe these strategic positions, albeit more likely, would be difficult to implement particularly under the current market conditions where supply is outstripping demand. Coal sellers would likely conform to the increased administration to be able to secure term contracts with Dutch utilities. However, should market conditions change to narrow the current global surplus of thermal coal to a more balanced market, due to unanticipated reductions in seaborne supply and/or increases in demand in other regions, this situation could potentially lead to producers or traders opting to bypass increased restrictions in Dutch supply requirements which could potentially lead to a increases in domestic prices relative to other European destinations. Quite clearly, this would be to the disadvantage of Dutch power producers.

Moreover the propensity of coal sellers to negotiate on price or to sell outside of the Dutch market is a function of global supply and demand dynamics for thermal coal. Wood Mackenzie expects the global oversupply of coal to continue until 2021, adding downward pressure on coal prices and therefore leaving sellers in an unfavourable position to negotiate terms. In essence, the main Dutch coal supplier countries are unlikely to be able to find an alternative destination in the short/medium term to sell thermal coal, given the high freight costs to the Asian growth markets (in particular China and India) and the more price-competitive, existing Asian suppliers such as Indonesia and Australia. Over time, Wood Mackenzie expects Asian demand to outstrip the supply from nearby countries, creating an opportunity for suppliers closer to the end market such as Colombia to fill in the gap, although it should be noted that this depends upon the pricing of the freight market at the time. At this point after 2020 it is likely that the suppliers would have already become accustomed to the administrative process. However, trading companies could continue to face the inherently difficult task of verifying the source of coal they have bought potentially from various sellers to form a particular blend. This could lead to traders finding it difficult to sell certain products into the Netherlands although the likely outcome would be a modification of their products and processes to accommodate the required verification.

The Netherlands is the main access to the German and Austrian imported coal markets, predominantly barges taking thermal coal to consuming power stations down the Rhine River. The thermal coal, whether destined to the German hinterland or Dutch power stations, will therefore arrive through the ARA ports. Requiring additional verifications and administrative work to trace the source of coal for consumption in one market, while other coal destined for re-exporting, but shipped through the same port, creates the potential for a large number of loop-holes and unintended consequences which could have significant commercial consequences to Netherland’s position in the global coal market. Ultimately, the Netherlands' role as a global coal trading hub could be reduced and coal shipments could be diverted into alternative locations to supply the European markets.

Finally, requiring German power producers to abide to the same rules or regulations as their Dutch equivalents would nearly certainly be legally very challenging, despite both countries being part of the European Single Market. In effect, the result could be that coal sellers selling coal for consumption in the Netherlands would be disadvantaged by being liable for potentially costly and difficult disclosure compared to selling into other nearby European countries. Particularly selling coal into Germany but transiting through the Netherlands would create difficulties in interpreting the disclosure requirements.

6.0 Conclusion

Global seaborne thermal coal trade accounted for 13% of total thermal coal demand in 2013. The Netherlands in turn comprised less than 1% of the seaborne trade, which Wood Mackenzie expects to reduce as the Asian market continues to grow and the European markets gradually move away from coal as a fuel source. Despite the Dutch thermal coal demand representing a relatively small amount of global seaborne demand, the ARA port region of the Netherlands remains Europe's largest gateway for coal by volume, importing approximately 50 Mt of coal in 2012, and is a globally significant thermal coal trading benchmark for physical and paper/derivative deliveries. Most of the thermal coal however, transits into the German hinterland predominately for coal fired power generation.

The main suppliers of coal into the Netherlands are Russia, Colombia and the USA. Wood Mackenzie forecasts the share of these countries increase to approximately 90% by 2019 with Colombia expected to take a very prominent position as the main coal supplier.

Beyond the source country, the mine specific source of the coal is typically not discussed in more detail by coal buyers and sellers. In some cases, coal is sold as a certain mining company's coal, which in theory restricts the coal source to the mines and deposits the company operates. Further detail of individual mines is not required for commercial reasons – coal is sold and priced on the basis of its technical characteristics such as energy, ash and moisture content, making the source, with the exception of calculation shipping costs, largely irrelevant.

The Dutch Directorate for Trade Policy and Economic Governance engaged Wood Mackenzie to explore the possibility and potential commercial consequences of introducing a requirement, for Corporate Social Responsibility (CSR) reasons, for Dutch power producers to disclose the names of the mines used to supply their coal-fired power stations.

We examined the viability and potential complexities involved in publically disclosing this information by examining the physical and contractual supply chain of thermal coal from mine to market. While tracing coal throughout the physical supply chain back to its mine source is theoretically possible, the practical hurdles and complexities for producers in some countries are challenging. The coal mining industry and infrastructure is in most countries physically built to serve a number of mining companies but are required to share the available infrastructure for exporting. The monitoring of the original source during the exporting process is complex with opportunities to mix coal and lose track of the original source.

From a contractual point of view, the fundamental concern in the tracing of coal sources is the way coal is transacted globally: Thermal coal is often sold as a blended product – a product that coal sellers (miners and traders) create to maximise the attractiveness to particular buyers based on their views of current and forward demand for particular quality characteristics and price (e.g. predominately based on energy content, ash levels, moisture content and sulphur) and therefore to achieve a better price. The distinction between product coal (or blend) and coal from a specific coal mine is integral to the discussion. A product coal or blend is not specific to any individual mine and very little commercial concern is placed on the original source if the characteristics of the coal are within its contractual limits and no technical problems arise from the burning of the coal. However, the majority of power generators will pay a small premium for a particular coal grade (or from particular mining companies) grades due to perceived quality, operational performance, contractual (reliability/flexibility) performance, logistics, contracting terms and ease of doing business.

Changing both the physical and contractual structures in place would not be a feasible option to allow further disclosure. Alternatively, we believe disclosing this information is theoretically possible by authorising customs authorities in the Netherlands to require arriving vessels to produce documentation that provides the relevant source information. The difficulty is in implementing the process, considering the trading structure of ARA, which can be highly complex and focuses largely on specifications rather than sources. Traders not involved in producing coal could be squeezed out of the market by their inability to comply with the disclosure requirements. The potential knock-on effect could be a reduction of the role of the Netherlands as a global coal trading hub and some volumes could be diverted to alternative locations. Finally, in a European Single Market and for the Netherlands that transits most of Germany's imported thermal coal, imposing these restrictions on one country would nearly certainly cause legal opposition.

Power producers could attempt to negotiate a company-level sourcing practice with their suppliers where coal supplied by a mining company is contractually guaranteed to originate from only that mining company's mines, reducing the cost of verifying the source. Some mining companies could agree to this depending on their ability to sell elsewhere but some companies would not necessarily agree to comply and therefore drop out as suppliers. The exact amount of suppliers not complying is inherently difficult to quantify but a small reduction in coal supply into the Netherlands would not be likely to cause significant price volatility due to the relatively low thermal coal demand in the Netherlands compared to the amount of available supply from producing countries.

However, a similar restriction resulting from disclosure requirements applied across the European Union, including German coal transited through the Netherlands could have more serious effects on the price of coal until, and if, Europe reduces its reliance on coal. The exact effect on price is difficult to estimate but the presence of this risk is very important to remain aware of.

Appendix 1 – SCoTA Coal Specifications Delivered Ex-Shipping (DES) ARA

For cargos originating from:	Aus	Col	Pol	Rus	SA	USA
Calorific Value Basis (kcal/kg NCV)	6,000	6,000	6,000	6,000	6,000	6,000
Calorific Value Min (kcal/kg NCV)	5,850	5,850	5,850	5,850	5,850	5,850
Max Total Moisture (ARB)	15.0%	14.0%	14.0%	14.0%	12.0%	12.0%
Volatile Matter (ARB)	24–35%	31–37%	25–32%	26–35%	22% min	27–35%
Max Ash (ARB)	15.0%	11.0%	15.0%	15.0%	15.0%	14.0%
Max Sulphur (ARB)	0.75%	0.85%	1.0%	0.75%	1.0%	1.0%
HGI	45 – 70	45 – 70	45 – 70	45 – 70	45 – 70	45 – 70
Nominal Topsize	50 mm	50 mm	50 mm	50 mm	50 mm	50 mm
IDT (degrees Celsius)	1,250 min	1,200 min	1,150 min	1,250 min	1,250 min	1,430 min
Calcium Oxide in Ash (DB)	7.0% max				12.0% max	
Chlorine (ARB)						0.15% max

Source: globalCOAL