Pennsylvania Anthracite: Not Any Ordinary Coal

Atlantic Coal plc
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Anthracite

1. What is it?
2. Mining it.
3. Using it.
4. Selling it.
Anthracite: What Is It?

“The cleanest burning solid fossil fuel.”
Anthracite – What Is It?

The cleanest burning solid fossil fuel

• A premium clean burning, hard coal with the highest carbon content of any coal.

• Cleaner and more energy efficient heat than softer coal, it even burns smoke free.

• The highest quality metallurgical coal available.

• Although it is classified as a coal, it is not just another fuel source, and should not be confused with ‘ordinary’ bituminous coal.

“Black diamonds”
Anthracite is an almost pure form of carbon. It has a very high heat value, and very low levels of sulphur and other impurities. This makes it not only the most sought after home heating fuel but a much sought after, high quality component for a number of industries.

**Anthracite Qualities**

High Heat Value | Low Volatiles
---|---
High Carbon | Low Ash
Low HGI* | Low Sulphur

*Hardness measure – the lower the index, the harder the coal
Stockton Mine Anthracite Specifications

Typical Analysis
Proximate Analysis as Received

% Carbon          84.85
% Hydrogen         1.88
% Nitrogen         1.27
% Sulphur          0.64
% Ash              9.83
% Oxygen           1.53
% Moisture         0.97
Dulong Value       13545 BTU/lb (7,525 kcal/Kg)
Hardgrove Grindability 29.54 HGI

Full certified analysis can be supplied on request.
Anthracite: Mining It

“Anthracite has been mined in Pennsylvania for over 200 years but millions of tons of high quality economically recoverable reserves still remain to be exploited.”
Mining Pennsylvania Anthracite

- The Pennsylvania Anthracite Coalfields are America’s oldest coalfields with a mining history going back over 200 years and leaving a wealth of geological and historic underground mining information. This legacy provides a high level of certainty for new mining projects.

- Previous deep miners left behind at least 35% of the in situ coal for roof support although a combination of geological and mine engineering considerations means that the % coal remaining is invariably well in excess of 35% and usually in the region of 45 to 50% over a mine area.

- The relatively shallow depth and the amount of coal remaining means that surface mining ratios are low and this, together with the high value of anthracite makes surface mining an attractive economic proposition.
Below is an example of an old underground workings plan (Highland Number 5 Colliery) which illustrates how much anthracite the underground miners left and which still remains to be exploited. Here the % original coal remaining is approx. 65%
Pennsylvania anthracite is usually found in synclinal basins, some shallow but some over 1,000 feet deep. In the Eastern Middle Field where Stockton Mine is located the basins are relatively shallow so the full section can be worked by surface mining.

In this field the “target seams” are either the Mammoth or the Buck Mountain which are around 20 feet thick but often much more. There are, however, other seams lying above these, for example here at Stockton where the Diamond, Orchard and Primrose seams are recovered yielding substantial quantities of high quality anthracite.
Traditionally, draglines have been used for both overburden excavation and coal recovery. While efficient movers of overburden, coal recovery was poor with increased rock dilution in the recovered coal and inability to recover thinner but still valuable seams. We have phased out the use of draglines entirely at Stockton and use a combination of large and small hydraulic excavators and dumptrucks to maximise both overburden excavation efficiency and coal recovery.
As well as perfecting more modern mining methods, it is vital to have the right equipment which consistently delivers results. In 2014/2015 equipment at Stockton Mine was the subject of a major modernisation with ten new Komatsu HD785 (100-ton) haul trucks, a Komatsu PC3000 hydraulic excavator and other ancillary mining equipment.

The new haul trucks have already demonstrated a 33% improvement in availability compared with the trucks they replaced and the PC3000 excavator has a production capacity 33% greater than the PC2000 model it replaced. This enables us to maximise production and efficiency in a competitive market.
“Our product is relatively scarce and highly versatile, leading to growing domestic and international demand”
Anthracite has many properties which make it a premium product compared with ordinary bituminous coal. Basically its uses depend upon its qualities as a pure form of carbon and its high heat value and clean burning properties although these two qualities are often used at the same time.

**Carbon**
- Steel industry
- Metals industry
- Sugar production
- Carbon products
- Water purification and filtration

**Heat**
- Home heating
- Public Buildings heating
- Greenhouse heating
- Electricity generation
The industry most commonly associated with anthracite is steel. Within the steelmaking industry, anthracite is used in three processes in particular:

1. Pulverised coal injection
2. Basic Oxygen Steel
3. Electric Arc Furnaces
The most common application of anthracite in steelmaking is in Pulverised Coal Injection (PCI) – a secondary stage of most steelmaking processes. Anthracite is injected directly into the furnace along with hot air. Using anthracite reduces the amount of coking coal needed in the first stage, and improves the quality of metal produced.
In Basic Oxygen Steelmaking coke produced from metallurgical coal is used as a reducing agent to take out metal oxides. Replacing small amounts of coke with anthracite saves up to 30% in costs demonstrating the cost advantages of anthracite over coke.
In Electric Arc Furnaces anthracite is again used as a reducing agent, added to the furnace alongside the charged material to take out metal oxides. Its low cost per lb of fixed carbon, plus the all important low sulphur content, make it a sought after material in this process.
The US sources 70% of its sugar requirement from its own sugar beet production.

Anthracite has a major market in this industry primarily in the production of calcium oxide and carbon dioxide from limestone. Calcium oxide and carbon dioxide are used in the purification and filtration of raw sugar beet juice.

Anthracite is also used as a clean burning, high efficiency fuel to evaporate sugar beet juice to produce sugar crystals.
Other industrial uses of anthracite include:

- As fuel in the blast furnace process for iron manufacture
- Water purification and filtration
- As a process carbon in the manufacture of bricks, wire, silicon and glass
- In Pennsylvania refuse dumps from underground anthracite mining are removed for use as a power station fuel and thereby reclaiming old derelict mine lands
- In countries such as Ukraine and Vietnam anthracite fuels power stations for electricity generation.
Historically anthracite kept most of the North East USA warm in winter and there is still a major market for this high heat value, clean burning fuel throughout the north eastern states for homes, public buildings and greenhouses.
Ideal qualities for home heating:

- It is a very efficient fuel, providing a very high heat value as it burns.
- It burns slowly and consistently, making it ideal for safely heating homes.
- It is a clean-burning fuel natural fuel source, producing no smoke or sooty residue. It is therefore convenient, with little maintenance or cleaning needed.
- It is low ash with low clinkering qualities making for easy maintenance.
- For the large population not on the gas grid anthracite presents the most cost effective option for heating.
Anthracite: Selling It

“A high quality product which consistently sells at a high premium over other coals”
Anthracite is a premium source of both carbon and heat and it is scarce. It makes up just 1% of the global coal market.

It is found in only a very few locations:

- China – the largest producer but also now major importer
- Vietnam – second largest producer but ceased exports due to high home demand
- North Korea – major producer – home use and exports only to China
- Russia – exports currently hit by sanctions
- Ukraine – major producer and exporter until current troubles – now major importer
- Pennsylvania USA – major proven reserves and production capability – stable political environment
• Our Stockton Sales Team have identified on a company by company basis, USA and Canada potential demand for anthracite of approx. 2.2 million tons.

• Current Pennsylvania production (excluding refuse banks for local electricity generation) is a little over 1 million tons.

• Our Stockton Mine can sell every ton we produce. Our only constraint on selling more is production capacity which, with only one mine, is finite.
• In recent years anthracite exports from Pennsylvania have been hit by cheap exports from Ukraine, Russia and Vietnam often at prices below the cost of production.
• Ukraine and Vietnam have now exited the export market.
• Ukraine is now a major importer but constraints on supply, including Pennsylvania miners, means they are struggling to source sufficient anthracite to fuel their power stations.
• We are experiencing a major flow of enquiries from Europe, Brazil, Africa, India and Ukraine for anthracite but are currently unable to supply due to insufficient production capacity.
Anthracite: Prices

- Anthracite consistently sells at a premium over other coals.

  Pennsylvania Anthracite $125 -160 per ton
  Appalachian Bituminous Coal $70 - 80 per ton
  Wyoming Powder River Basin Bituminous Coal $12 per ton
  (*mine gate prices)

- Anthracite is much less affected by market shifts than bituminous coal.
Stockton has always been able to obtain high prices for its product, indeed, Pennsylvania’s Eastern Middle Anthracite Coalfield where Stockton Mine is located contains the highest quality anthracite in Pennsylvania.

Currently we are achieving $160/ton for Stove anthracite.
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