4%, nitrogen, carbon dioxide & oxygen 8%. It has been superseded by natural gas for domestic and industrial use and is now used mainly for heating coke ovens. An important by-product of coal-gas manufacture was ammonium sulphate, used as fertiliser.

Coke

Is a greyish, porous and brittle solid containing about 80% carbon and produced as a residue from the destructive distillation of coal. An early use of coke was as a fuel in malt kilns, where the absence of sulphur and volatiles was essential to avoid tainting the product. Its first use in metallurgy is not known, although coke from the Cumberland Coalfield at Bolton, near Caldbeck was used at the copper smelter at Keswick in 1620.[10]

The old way of manufacturing coke was somewhat analogous to charcoal burning in that a large heap of coal was built around a stone chimney and ignited within or close to the chimney, either from the top or bottom. The hot zone was only a few inches deep and this progressed upwards or downwards as combustion of volatiles progressed. Air ingress was restricted by banking coke fines around the outside of the pile and, in some operations, wet coke fines were placed on the outer surface of the hot zone.[7]

The beehive coke oven was a direct development, where a dome-shaped stone or brick structure was used to control combustion.[1] Structures rather like limekilns were also used in the North of England for making coke.[11] These methods, together with heap coking, resulted in the complete loss of volatile matter and coal-gas which were flared off at the top of the kiln. All of these methods were in use during the mid-nineteenth century, despite the availability of more sophisticated and efficient designs of coke oven.

Later designs of coke oven captured the valuable volatile by-products, including coke-oven gas (the calorific value of coke-oven gas is about 500 B.Th.U. per cubic foot as compared to 550 for coal-gas). A scheme for supplying coke-oven gas produced at the Manvers Coal Preparation plant and other coking plants in South Yorkshire to local industry, via a grid of large diameter pipes, was proposed but not implemented. With the rationalisation of the iron and steel industry, many coking plants were closed during the 1980's and the few remaining in the UK are situated near large ironworks.

Coal tar

This is the thick black oily liquid (some 10-20 gallons per ton of coal) obtained as a by-product of coal-gas manufacture. Distillation and purification yields a number of other products, including benzene (used as the starting-point in the manufacture of a large number of organic compounds, especially dyes and drugs, such as aspirin), toluene (a hydrocarbon which occurs in coal tar and used as a starting-point in the preparation of dyes, drugs, saccharin and T.N.T. high explosives), xylene, phenol, naphthalene (used in the manufacture of organic dyes), creosote oil (used for the pickling and preservation of wood, especially for the railways), cresol (used as a disinfectant), anthracene (used in the manufacture of dyes), leaving pitch as the residue. Pitch was widely used as a sealant and binder for tarmacadam and refractories. Today, petroleum derivatives have widely replaced coal tar in most of its uses. The extremely carcinogenic nature of coal tar has resulted in recommendations for coal tars to be either recycled back to the coke oven or to be destroyed by incineration.

WEIGHTS AND MEASURES USED FOR COAL

Chaldron, Keel, Boll etc

In the 14th century when coal began to be shipped from the Great Northern Coalfield, principally from the Tyne and Wear, it was transported to the staithes in basket-shaped wagons called chaldrons (or chalder). Coal was loaded into 'keels' (flat-bottomed vessels) at staithes or piers, which projected into the river and was carried down-river to be loaded on to sea-going colliers, which would carry it to its final destination. The most important market was London. A keel had a capacity of 20 Newcastle chaldrons of coal and for some time a 'keel load' was one of the standard measures for the northern coal trade. In London, the coal was sold by London chaldron.

- The chaldron was a measure of coal by volume, no actual weighing of the coal was involved. The Newcastle and London chaldrons were used to calculate taxes, duties, rents and various other charges.
- In 1368 the Newcastle and London chaldrons were virtually identical in capacity, each comprising 32 bushels (or 32 cubic feet) of level measure. A chaldron thus had a weight of about 2,000 lb (approximately 17 cwt) of coal and a keel load of about 17 tons.
- In 1421 the load carried by a keel was limited, by statute, to 20 chaldrons of coal or just under 18 tons.
- In 1497, the bushels were heaped to increase their capacity by about 24%, which increased the weight of both the Newcastle and London chaldrons from 17 to 21 cwt.
- In 1530, the Mayor and commonality of Newcastle-upon-Tyne confirmed, by Act of Parliament, their sole right to ship coal from the River Tyne and the Newcastle chaldron was doubled in size, making a keel load of 21 tons, equivalent to 10 Newcastle chaldrons and the Newcastle 'ten' measure of coal came into being (a keel load then comprised 10 chaldrons, instead of the 20 chaldrons which it had been since 1368. Thus the terms 'ten' measure and 'keel-load' became synonymous.
- A further change to the Newcastle chaldron came in 1635 when King Charles II attempted to obtain a monopoly of the Newcastle coal trade. Pressure was brought upon the Hostmen (the Newcastle company who had had a monopoly of the shipping of coal on the Tyne from 1600) to make 'gift' coal and thus it was not uncommon for a keel to be rated at 8 chaldrons (for the purposes of payment and taxation) with 2 chaldrons free of tax. In effect, from 1635, 8 chaldrons were counted to a keel of 21 tons, making a Newcastle chaldron equivalent to 52½ cwt.
- In 1695, the size of the Newcastle chaldron was fixed, by statute, at a capacity of 53 cwt and the keel at 21 tons 4 cwt of coal. (So that a keel was the equivalent of 8 Newcastle chaldrons).
- At the beginning of the 19th century a Newcastle chaldron was equal to 53 cwt of coal and a London chaldron equal to 27 cwt. Repeated trials showed that 15 London chaldrons were equal to 8 Newcastle chaldrons (on this basis a London chaldron was equal to 28.3 cwt). The London chaldron varied in weight, variously estimated at ranging from 26.5 cwt in 1800 to 28.5 cwt in 1847.
- In 1832 the retail sale of coal by chaldron was finally abandoned for sale by weight.
- Not until the Coal Mines Inspection Act (1872), which stipulated that the amount of wages should be paid relative to the true weight of mineral produced (not a weight calculated from the volume of mineral mined) was coal universally weighed.
- Boll - this was a dry measure containing 9,676.8 cubic in, which equated to 2.35284 cwt; early wagon capacity was measured in bolls.