

Coal Basis Conversion

Basis of Analysis

Definitions	
As Received (ar):	includes Total Moisture (TM)
Air Dried (ad):	includes Inherent Moisture (IM) only
Dry Basis (db):	excludes all Moisture
Dry Ash Free (daf):	excludes all Moisture & Ash

The Proximate Analysis of any coal i.e. the % content of Moisture, Ash (A), Volatile Matter (VM), Fixed Carbon (FC) - also Sulphur (S) and Calorific Value (CV) - can be expressed on any of the above bases.

Conversions			
To obtain: <i>multiply</i>	Air Dry	Dry Basis	As Received
ar by:	$\frac{100 - IM\%}{100 - TM\%}$	$\frac{100}{100 - TM\%}$	—
ad by:	—	$\frac{100}{100 - IM\%}$	$\frac{100 - TM\%}{100 - IM\%}$
db by:	$\frac{100 - IM\%}{100}$	—	$\frac{100 - TM\%}{100}$

[For daf, multiply db by $100/(100-A)$]

Example:

	ar	ad	db	daf
TM	11.0	–	–	–
IM	2.0	2.0	–	–
Ash	12.0	13.2	13.5	–
VM	30.0	33.0	33.7	39.0
FC	47.0	51.8	51.8	61.0
Sulphur	1.0	1.1	1.12	–

Mass

Units:

Metric ton (t) = tonne = 1000 kilograms (= 2204.6 lb)

Imperial or long ton (lt) = 1016.05 kilograms (= 2240 lb)

Short (US) ton (st) = 907.19 kilograms (= 2000 lb)

Conversions:

From long ton to metric ton multiply by 1.016

From short ton to metric ton multiply by 0.9072

Mt million tonnes

Mtce million tonnes of coal equivalent (= 0.697 Mtoe)

Mtoe million tonnes of oil equivalent

Calorific Values (CV)

Units:

kcal/kg kilocalories per kilogram

MJ/kg* Megajoules per kilogram

Btu/lb British thermal units per pound

* 1 MJ/kg = 1 Gigajoule/tonne (GJ/t)

Gross & Net Calorific Values

Gross CV or 'higher heating value' (HHV) is the CV under laboratory conditions.

Net CV or 'lower heating value' (LHV) is the useful calorific value in boiler plant. The difference is essentially the latent heat of the water vapour produced.

Conversions - Units

From kcal/kg to MJ/kg multiply kcal/kg by 0.004187

From kcal/kg to Btu/lb multiply kcal/kg by 1.8

From MJ/kg to kcal/kg multiply MJ/kg by 238.8

From MJ/kg to Btu/lb multiply MJ/kg by 429.9

From Btu/lb to kcal/kg multiply Btu/lb by 0.5556

From Btu/lb to MJ/kg multiply Btu/lb by 0.002326

Conversions - Gross/Net (per ISO, for As Received figures)

kcal/kg: Net CV = Gross CV - 50.6H - 5.85M - 0.191O

MJ/kg: Net CV = Gross CV - 0.212H - 0.0245M - 0.0008O

Btu/lb: Net CV = Gross CV - 91.2H - 10.5M - 0.34O

- where M is % Moisture, H is % Hydrogen, O is % Oxygen (from ultimate analysis*, also As Received).

**Ultimate analysis determines the amount of carbon, hydrogen, oxygen, nitrogen & sulphur.*

For typical bituminous coal with 10% M and 25% Volatile Matter, the differences between gross and net calorific values are approximately as follows:

260 kcal/kg 1.09 MJ/kg 470 Btu/lb

Power Generation

1 MWh = 3600 MJ

1 MW = 1 MJ/s

1 MW (thermal power) [MWth] = approx 1000 kg steam/hour

1 MW (electrical power) [MWe] = approx MW (thermal power)

A 600 MWe coal-fired power station operating at 38% efficiency and 75% overall availability will consume approximately:

- Bituminous coal (CV 6000 kcal/kg NAR*): 1.5 Mt/year

- Brown coal (CV 2250 kcal/kg NAR*): 4.0 Mt/year *Net As Received