

# Coal Conversion Facts

## 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:-	Air Dry	Dry Basis	As Received
- multiply 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:

TM	ar	ad	db	daf
	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	52.8	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)

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**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 - 50.6**H** - 5.85**M** - 0.191**O**

MJ/kg: Net CV = Gross CV - 0.212**H** - 0.0245**M** - 0.0008**O** Btu/lb: Net CV = Gross CV - 91.2**H** - 10.5**M** - 0.34**O**

– 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

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1 MWh = 3600 MJ

1 MW = 1 MJ/s

1 MW (thermal power) [MW<sub>th</sub>] = approx 1000 kg steam/hour  
1 MW (electrical power) [MW<sub>e</sub>] = approx MW (thermal power)  
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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

*Sources: GWC Coal Handbook & IEA Clean Coal Centre*

## PINEX MINERALS

pinexminerals@yahoo.in [www.pinexminerals.com](http://www.pinexminerals.com)

