

## (1) Main SI units

Quantity	SI unit	Unit applicable with SI unit
Angle	rad	...(degree ), '(minute), ''(second)
Length	m	
Area	m <sup>2</sup>	
Volume	m <sup>3</sup>	ℓ (liter)
Time	s (Second)	d (day), h (hour), min (minute)
Frequency, vibration	Hz (Hertz)	
Mass	kg	t(ton)
Density	kg/m <sup>2</sup>	
Force	N (Newton)	
Pressure	Pa (Pascal)	bar (bar)
Work, energy	J (Joule)	eV (electron voltage)
Power	W (Watt)	
Thermodynamic temperature	K (Kelvin)	
Quantity of heat	J (Joule)	

## (2) Prefix of SI system

Multiple to the unit	Prefix	
	Name	Symbol
10 <sup>18</sup>	Exa	E
10 <sup>15</sup>	Peta	P
10 <sup>12</sup>	Tera	T
10 <sup>9</sup>	Giga	G
10 <sup>6</sup>	Mega	M
10 <sup>3</sup>	kilo	k
10 <sup>2</sup>	hecto	h
10	deca	da
10 <sup>-1</sup>	deci	d
10 <sup>-2</sup>	centi	c
10 <sup>-3</sup>	milli	m
10 <sup>-6</sup>	micro	μ
10 <sup>-9</sup>	nano	n
10 <sup>-12</sup>	pico	p

## (3) Typical conversion factors

1. Basic Energy Units	
1J (joule )=0.2388cal	
1cal (calorie )=4.1868J	
1Btu (British )=1.055kJ=0.252kcal	
2. Standard Energy Units	
1toe (tonne of oil equivalent )=42GJ=10,034Mcal	
1tce (tonne of coal equivalent )=7000Mcal=29.3GJ	
1 barrel=42 US gallons≈159 ℓ	
1m <sup>3</sup> =35,315 cubic feet=6,2898 barrels	
1kWh=3.6MJ ≈860kcal	
1,000scm (standard cubic meters )	
of natural gas=36GJ (Net Heat Value )	
1 tonne of uranium=10,000-16,000toe(Light water reactor, open cycle)	
1 tonne of peat=0.2275toe	
1 tonne of fuelwood=0.3215toe	

## (4) Coal gasification reactions

(Coal Pyrolysis)			
Coal	→ CH <sub>4</sub> + C(char/coke)+(Generated heat)	(1)	
(Chemical reaction with oxygen)			
C + O <sub>2</sub>	→ CO <sub>2</sub> +	97.0kcal/mol	(2)
C + $\frac{1}{2}$ O <sub>2</sub>	→ CO +	29.4kcal/mol	(3)
(Chemical reaction with carbon dioxide)			
C + CO <sub>2</sub>	→ 2CO -	38.2kcal/mol	(4)
(Chemical reaction with steam)			
C + H <sub>2</sub> O	→ CO + H <sub>2</sub> -	31.4kcal/mol	(5)
C + 2H <sub>2</sub> O	→ CO <sub>2</sub> + 2H <sub>2</sub> -	18.2kcal/mol	(6)
CO + H <sub>2</sub> O	→ CO <sub>2</sub> + H <sub>2</sub> +	10.0kcal/mol	(7)
(Chemical reaction with hydrogen)			
C + 2H <sub>2</sub>	→ CH <sub>4</sub> +	17.9kcal/mol	(8)
CO + 3H <sub>2</sub>	→ CH <sub>4</sub> + H <sub>2</sub> O +	49.3kcal/mol	(9)

## (5) Standard heating value for each energy source

Energy source	Unit	Standard calorific value	Standard calorific value on a Kcal basis	Former standard calorific value	Remarks	
<b>Coal</b>						
Coal						
Imported coking coal	kg	28.9 MJ	6904 kcal	7600 kcal	Temporary value	
Coking coal for coke	kg	29.1 MJ	6952 kcal	—		
Coking coal for PCI	kg	28.2 MJ	6737 kcal	—		
Imported steam coal	kg	26.6 MJ	6354 kcal	6200 kcal		
Domestic steam coal	kg	22.5 MJ	5375 kcal	5800 kcal		
Imported anthracite	kg	27.2 MJ	6498 kcal	6500 kcal		
Coal product						
Coke	kg	30.1 MJ	7191 kcal	7200 kcal		
Coke oven gas	Nm <sup>3</sup>	21.1 MJ	5041 kcal	4800 kcal		
Blast furnace gas	Nm <sup>3</sup>	3.41 MJ	815 kcal	800 kcal		
Converter gas	Nm <sup>3</sup>	8.41 MJ	2009 kcal	2000 kcal		
<b>Oil</b>						
Crude oil						
Crude oil	ℓ	38.2 MJ	9126 kcal	9250 kcal	Formerly NGL	
NGL, Condensate	ℓ	35.3 MJ	8433 kcal	8100 kcal		
Oil product						
LPG	kg	50.2 MJ	11992 kcal	12000 kcal		
Naphtha	ℓ	34.1 MJ	8146 kcal	8000 kcal		
Gasoline	ℓ	34.6 MJ	8266 kcal	8400 kcal		
Jet fuel	ℓ	36.7 MJ	8767 kcal	8700 kcal		
Kerosene	ℓ	36.7 MJ	8767 kcal	8900 kcal		
Gas oil	ℓ	38.2 MJ	9126 kcal	9200 kcal		
A-heavy oil	ℓ	39.1 MJ	9341 kcal	9300 kcal		
C-heavy oil	ℓ	41.7 MJ	9962 kcal	9800 kcal		
Lubrication oil	ℓ	40.2 MJ	9603 kcal	9600 kcal		
Other heavy oil product	kg	42.3 MJ	10105 kcal	10100 kcal	Formerly other oil products	
Oil coke	kg	35.6 MJ	8504 kcal	8500 kcal		
Refinery gas	Nm <sup>3</sup>	44.9 MJ	10726 kcal	9400 kcal		
<b>Gas</b>						
Flammable natural gas						
Imported natural gas (LNG)	kg	54.5 MJ	13019 kcal	13000 kcal	Formerly LNG Formerly natural gas	
Domestic natural gas	Nm <sup>3</sup>	40.9 MJ	9771 kcal	9800 kcal		
City gas	Nm <sup>3</sup>	41.1 MJ	9818 kcal	10000 kcal		
<b>Electric power</b>						
Generation side						
Heat supplied to power generator	kWh	9.00 MJ	2150 kcal	2250 kcal	Efficiency 39.98%	
Consumption side	kWh	3.60 MJ	860 kcal	860 kcal		
Heat produced from electric power						
<b>Heat</b>						
Consumption side						
Heat produced from steam	kg	2.68 MJ	641 kcal	—	100°C, 1 atm Saturated steam	

Clean Coal Technologies in Japan  
January 2007

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