



# Units and Naming Conventions

## Understanding units and naming conventions in CLEWs

This resource provides guidance on units and naming conventions for those who have completed the OL course 'Introduction to CLEWs', available at [CCG OpenLearn: CLEWs](#), and are now working on the 'My First CLEWs Country Model' worksheet.

## Understanding and Using Units

Units are an important part of building your CLEWs model. This is mainly because you need to use the same units throughout your model to avoid any mismatches within data and ultimately avoid the model potentially failing. For example, if you decide to use  $10^3\text{km}^2$  for land in one parameter, you must use that unit for all Land related parameters (etc.).

### The metric system prefixes:

- K (or k) means *kilo*, a thousand, or  $10^3$
- M means *mega*, a million, or  $10^6$
- G means *giga*, a billion, or  $10^9$
- T means *tera*, a trillion, or  $10^{12}$
- P means *peta*, a quadrillion, or  $10^{15}$
- E means *exa*, a thousand times more than peta, or  $10^{18}$

Example:  $10^3 = 10 \times 10 \times 10 = 1,000$

- In words:  $10^3$  could be called "10 to the third power", "10 to the power 3" or simply "10 cubed"

Example:  $10^4 = 10 \times 10 \times 10 \times 10 = 10,000$

- In words:  $10^4$  could be called "10 to the fourth power", "10 to the power 4" or "10 to the 4"



## Part 1: Units for Energy

### Basics

The **watt (W)** is a measure of *electric* power (power is the rate of doing work or producing or expending energy.) One watt is equal to 1 joule (J) per second. A **megawatt (MW)** is one million watts.

The **joule** is a measure of energy, or the ability or capacity to do work. Other measures of energy are:

- **Kilowatt-hour (kWh), a thousand watts of power produced or used for one hour, equivalent to 3.6 million joules (MJ).**
- **One quadrillion joules (PJ) = 278 million kWh.**

When a 1-MW (*maximum rate of energy generation*) wind turbine produces at 25% of that capacity as averaged over a year, its annual output is  $1 \text{ MW} \times 0.25 \times 365 \text{ days} \times 24 \text{ hours} = 2,190 \text{ MWh}$ .

- British thermal unit (Btu), equivalent to 1,055 J or 0.293 Wh.
- Million (MM) Btu = 1,055 MJ = 293 kWh.
- Quadrillion Btu = 1,055 PJ = 293 billion kWh = 293 TWh.

In the production of electricity from thermal sources, however, only a third may be converted to electrical energy, the rest to heat. Therefore, *1 quad Btu* may also be expressed as equivalent to only 98 billion kWh, averaging the efficiency of various generators.

- Million tonne oil equivalent (mtoe) is equivalent to 41,868 MJ or 11,630 GWh.

### OSeMOSYS User Interface (UI)

- 1000 TJ = 1 PJ
- 1000 Ktoe = 1 Mtoe
- 1 Gigawatt-hours (GWh) is equal to 10,00000 Kilowatt-hours (kWh).

You could also use this link: [Energy conversion-calculator](#).

## Part 2: Units for Land

### Basics

- Hectare: unit of area in the metric system equal to 100 ares, or 10,000 square metres, and the equivalent of 2.471 acres in the British Imperial System.



- Square Kilometer: a square kilometer is kilometer × kilometer, which is written km<sup>2</sup>.
  - ⇒ A kilometer is a thousand meters, so a square kilometer is also: 1,000 m × 1,000 m = 1,000,000 m<sup>2</sup> (square meters).
  - ⇒ In other words a square kilometer is one-million square meters.
  - ⇒ Square kilometers are commonly used to measure large areas of land.
  - ⇒ [Hectares to Square Kilometers](#).
  - ⇒ [Convert 1,000 Square Kilometers to Square Meters](#).

## OSeMOSYS Interface

- 1,000,000 m<sup>2</sup> = 1 km<sup>2</sup>
- 1000km<sup>2</sup> = 1, 10<sup>3</sup>km<sup>2</sup>

## Part 3: Units for Crops (Weight)

### OSeMOSYS Interface

Multiple	Name	Kilograms (kg)
10 <sup>0</sup>	tonne	1,000 kg
10 <sup>3</sup>	Kiloton (KTon)	1 million kg
10 <sup>6</sup>	Megaton (MTon)	1 billion kg

- One Kiloton is equal to 1000 tonnes.
- One Megaton is equal to 1000 kilo tonnes.

## Part 4: Units for Water (Volume)

### OSeMOSYS Interface

- 1m<sup>3</sup> (cubic meter)



- $10^3\text{m}^3 = 1,000\text{m}^3$
- $10^6\text{m}^3 = 1,000,000\text{m}^3$
- $10^9\text{m}^3 = 1,000,000,000 \text{ m}^3$  (cubic kilometer:  $1\text{km}^3$ )

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## Understanding and Using Naming Conventions

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Naming conventions are an important part of your model. Firstly, this is so that when producing results each technology and commodity are represented singularly. Secondly, if they are incorrect the model/cloud may not recognise them, and it could either fail or just produce incorrect results. Make sure they are spelt correctly with no extra 'spaces/gaps' when entering them into the UI.

These naming conventions are especially necessary when using the [OSeMOSYS Cloud](#) to produce results. The table of naming conventions below, outline which you should use for each technology and commodity that you add to the model.

Any issues do not hesitate to reach out on the [Google group](#).

### Examples:

- Commodity: BIO
- Technology: MINBIO
- Technology: PWRBIO
- Commodity: CRPMAI
- Technology: LNDMAIHR (rainfed)

Code	Name	Colour
BIO	Biomass/Biofuels	forest green
COA	Coal	black
CRU	Crude oil	red
DSL	Diesel	orange
ELC	Electricity	grey
GEO	Geothermal	purple
GSL	Gasoline	violet
HFO	HFO	brown



LFO	LFO	firebrick
HYD	Hydro	blue
JFL	Jet fuel	firebrick
LNG	LNG	purple
LPG	LPG	gold
PCK	Petroleum coke	red
NGS	Natural gas	firebrick
OHC	Oil products	grey
PET	Petroleum products	red
SOL	Solar	gold
URN	Nuclear	grey
WAS	MSW	green
WAT	Water	blue
LND	Land	green
WND	Wind	violet
CP01	Barley	red
CP02	Cereals	green
CP03	Coffee	brown
CP04	Maize	orange
CP05	Oilseeds	pink
CP06	Other crops	red
CP07	Pulses	magenta
CP08	Sorghum	purple
CP09	Tea	black
CP10	Teff	grey
CP11	Wheat	gold
AGR	Agriculture	brown
BAR	Barren land	grey
FOR	Forests	forest green
GRS	Grassland & woodland	orange
BLT	Built-up land	black
OTH	Other uses	gold
PWR	Power sector	red
PUB	Public supply	gold
EVT	Evapotranspiration	green
PRC	Precipitation	blue
GRC	Groundwater recharge	orange
GWT	Groundwater	purple
SUR	Surface water run-off	red



IRR	Irrigation	brown
REN	Other renewables	green
OIL	Oil	firebrick
GAS	Gas	purple
LPG	LPG	pink
KER	Kerosene	violet
RES	Residential	blue
TRA	Transport	black
IND	Industry	grey
COM	Commercial & services	green
ELC_IMP	Electricity imports	pink
PWR_WAT	Power sector (consumptive use)	light blue
PWR_WITH	Power sector (withdrawal)	dark blue
ELC_EXP	Electricity exports	pink
ELC_NET	Net electricity imports	pink
MIG	Mining	orange
PCK	Petroleum coke	red
JET	Aviation fuels	dark blue
NAP	Naptha	blue
LVSPRDALL	Livestock	purple
LVS	Livestock	purple
LVSL01	Cattle	red
LVSL02	Horses	black
LVSL03	Donkeys/Mules	brown
LVSL04	Camels	gold
LVSL05	Sheep	grey
LVSL06	Pigs	red
LVSL07	Chicken	magenta
TLU	Livestock	purple
REC	Recharge + Run-off	red
NPA	Natural pastures	yellow green
IPA	Mixed Pastures	dark green
COF	Coffee	orange
IRR	Irrigation cropland	dark blue
RAI	Rainfed cropland	light blue
NAM	NAMA	grey
FLU	Forests	forest green
BGS	Biogas	dark green
COF	Coffee	brown
COT	Cotton	grey



GRO	Groundnut	brown
MAI	Maize	orange
RCD	Dryland rice	light green
RCP	Wetland rice	dark green
SOY	Soybean	purple
SGC	Sugarcane	violet
TEA	Tea	black
WHE	Wheat	gold
BRL	Barley	pink
SOR	Sorghum	red
RYE	Rye	maroon
MTP	Pearl millet	grey
MTF	Foxtail millet	grey
OAT	Oat	brown
BUC	Buckwheat	orange
PTW	Potato	dark blue
PTS	Sweet potato	light blue
CAS	Cassava	grey
YAM	Yam and Cocoyam	forest green
SGB	Sugarbeet	dark green
BEA	Phaseolus bean	brown
CHI	Chickpea	grey
COW	Cowpea	brown
PEA	Dry pea	orange
GRM	Gram	light green
PIG	Pigeonpea	dark green
SUN	Sunflower	purple
RAP	Rapeseed	violet
OIL	Oilpalm	black
OLI	Olive	gold
JAT	Jatropha	pink
CAB	Cabbage	red
CAR	Carrot	maroon
ONI	Onion	grey
TOM	Tomato	grey
BAN	Banana	brown
CIT	Citrus	lime
CON	Coconut	dark blue
COC	Cocoa	light blue
FLA	Flax	grey
TOB	Tobacco	forest green



ALF	Alfalfa	dark green
TEF	Warm C4	grey
MIS	Miscanthus	brown
SWI	Switchgrass	orange
REE	Reed canary grass	light green
BMX	BMX	light green
RUB	Rubber	grey
ARE	Arecanut	black
CER	Cereals	orange
CRD	Cardamom	dark green
FRU	Fruits	red
VEG	Vegetables	blue
INL	Heavy industry	black
INH	Light industry	grey
BLD	Buildings	brown
BIT	Bituminous coal	grey
HRS	Horses	black
SHP	Sheep	purple
GOT	Goats	grey
CTL	Cattle	red
CML	Camels	brown
PGS	Pigs	pink
CHK	Chicken	gold
YAK	Yaks	slate grey
CNS	Construction	brown
DEG	Degraded land	grey
PRT	Protected land	green
FOD	Fodder crops	grey
RFO	Fuel oil	crimson
WST	Waste	olivedrab
PKR	Palm Oil Kernels	pink
POM	Palm Oil Mill Effluent	gold
CPO	Crude Palm Oil	slate grey
EFB	Empty Fruit Bunch	brown
BDS	Biodiesel	grey
ETH	Ethanol	green
BET	Bioethanol	grey
BBG	Bio-blended gasoline	crimson
BAG	Bagasse	olivedrab
PAS	Pastures	olivedrab
HAZ	Hazelnuts	chocolate





SHE	Sheep-equivalent	pink
OTC	Other crops	red
BEF	Beef	red
PRK	Pork	pink
DAI	Dairy	grey
CMB	Combined dairy and beef	brown
OTL	Other livestock	purple
CHC	Charcoal	black
RIC	Rice	lime
MAZ	Maize	orange
L01	Cattle	red
L02	Horses	black
L03	Donkeys/Mules	brown
L04	Camels	gold
L05	Sheep	grey
L06	Pigs	red
L07	Chicken	magenta
TLU	Livestock	purple
TEF	Teff	grey
HMG	Home gardens	lime
NUC	Nuclear	grey
CSP	CSP	orange
BST	Unserviced energy	black
PVU	Solar PV - Utility	orange
PVR	Solar PV - Rooftop	gold
PVF	Solar PV - Floating	yellow