GT New Horizons

Electricity

The **Energy Unit** (EU) is quite literally GregTech's unit of electrical energy. EU is used to power GregTech and IC2 machines. It is also compatible with machines from Applied Energistics 2 or machines that accept Redstone Flux (RF) power, converting at a rate of 1 EU to 3.6 RF. However, RF cannot be converted to EU.

Voltage and Amperage

EU in GregTech comes in a system of **Voltage** (Volts, V) and **Amperage** (Amps, A).

Energy is transfered as packages. The **Voltage** describes the size of the energy packages. The **Amperage** describes the number of packages. If one multiplies both one gets the power in units **EU/t** describing an energy produced, moved, or consumed per time.

Quick Tip

- If you have X generators of Tier Y, use cables that can handle X Amperes of Tier Y.

Voltage Tiers

Main Article: Tier

GregTech tiers its progression by different voltages. The voltage of a Generator (or for a multiblock generator, its Dynamo Hatch) determines the maximum amount of EU it will generate and put in each generated amp. **The voltage of a singleblock machine or Energy Hatch determines the maximum amount of EU that can be present in any drawn amp before the machine explodes.** The minimum voltage tier of a machine to process a recipe is listed next to the usage or voltage in NEI.

The EU Limit of each subsequent tier is usually 4 times the previous.

Note: When used as numbers in calculations, ULV Tier counts as Tier 0, LV Tier counts as Tier 1, and so on.

Acronym	Voltage Tier	EU Limit
ULV	Ultra Low Voltage	8
LV	Low Voltage	32
MV	Medium Voltage	128
HV	High Voltage	512
EV	Extreme Voltage	2,048
IV	Insane Voltage	8,192
LuV	Ludicrous Voltage	32,768
ZPM	ZPM Voltage	131,072
UV	Ultimate Voltage	524,288
UHV	Highly Ultimate Voltage	2,097,152
UEV	Extremely Ultimate Voltage	8,388,608
UIV	Insanely Ultimate Voltage	33,554,432
UMV	Mega Ultimate Voltage	134,217,728
UXV	Extended Mega Ultimate Voltage	536,870,912
MAX	Maximum Voltage	2,147,483,640

Amperage

Amps are pushed, not pulled. "Drawn" is synonymous with "requested" here.

Machines and energy hatches draw amps to fill their internal EU buffers. The capacity of the internal buffer is listed as "Capacity:" in the machine's or hatch's tooltip. When processing a recipe, a machine will draw from its internal buffer. The current contents of the internal buffer can be checked with the Portable Scanner.

The maximum amount of amps a machine can draw is either listed on its tooltip or recipe-dependent. A machine can draw up to a maximum of $\left\lfloor \frac{2 \times \text{Recipe Usage EU/t}}{\text{Voltage Tier EU Limit}} \right\rfloor + 1$ amps to fill its internal buffer. This means that if the machine isn't processing a recipe, it will draw 1 amp to refill the internal buffer. Recipe amperages listed in NEI are a recommended number to fill the internal buffer at a rate that breaks even against usage.

Several common amperages of GregTech machines can be found in the table below. "Drawing" means "draws up to", unless otherwise stated.

Output amps contain the maximum EU for the outputting machine's voltage tier.

Machine	Notes
Singleblock Generators	Output 1A of its tier
Energy Hatches	Draws 2A (second amp mostly for extra draw for loss)
Transformers Step-Up	Draws 4A lower voltage, outputs 1A higher voltage
Transformers Step-Down	Draws 1A higher voltage, outputs 4A lower voltage
Battery Buffers	Draws 2A per Battery, outputs 1A per Battery.
Battery Chargers	Draws 4-8A per Battery, outputs 2-4A per Battery correspondingly.
Arc Furnace	Most recipes require 3A to break even against EU/t usage
Thermal Centrifuge	Most recipes require 2A to break even against EU/t usage

Overclocking

Main Article: Overclock

Machines of higher tiers can receive overclocks to speed up their recipes.

Regular overclocks double the recipe's speed and total EU consumption, leading to quadrupled EU/t usage. For this reason, overclocking is also called 2/4 overclocking.

A perfect overclock instead quadruples the recipe's speed while keeping the total EU consumption the same. This still leads to quadrupled EU/t usage. For this reason, perfect overclocking is also called 4/4 overclocking.

Machines typically receive one overclock per voltage tier above the minimum required for a recipe.

Singleblock machines can only ever regular overclock.

Multiblock machines perfect overclock on a case-by-case basis; their tooltips contain information on how to achieve perfect overclocks or upgrade overclocks to perfect overclocks. If no information is mentioned, they will regular overclock.

Multiblocks with two energy hatches of the same voltage will always draw 4A to overclock a recipe to a tier higher than the energy hatch voltage (since 4A of the lower voltage contains the same EU as 1A of the higher voltage). This also allows them to run recipes with a minimum requirement of that higher voltage tier.

Cables and Loss

Main Article: Cable

GregTech EU can be transferred using GregTech Cables.

Rather than priority by destination, power priority is given by cardinal direction. Cables will push power in the following priority:

1. Down
2. Up
3. North
4. South
5. West
6. East

When producing power, each generator will always attempt to empty all of its internal buffer at once. This can cause one generator in a cable network to use fuel more rapidly than another, with order depending on tile entity processing and changing on chunk reloads.

All GT Cables have a max Voltage, max Amperage and a Loss/Meter/Ampere, indicated on their tooltip:

- **Cables which receive amps containing more EU than their maximum Voltage will catch fire and melt.**
- **Cables that have more amps travelling through them than their maximum Amperage limit will catch fire and melt.**
  Note that machines can request more Amperage than strictly required by their active recipe.
- Each energy packet travelling through a cable loses Voltage per block travelled. The amount of EU lost is indicated by the Loss/Meter/Ampere number.

Each Material has 1x, 2x, 4x, 8x, 12x, and 16x uninsulated Wires. Most of these have cable variants, except for the superconductor wires, graphene wires, and Infinity wire. **Note that Uninsulated Wires have twice the Loss/Meter/Ampere as Insulated Cables.**

For example:

- A 1x Tin Cable can handle 1A containing 32EU at a loss of 1 EU-Volt/Meter/Ampere. This means that 1 amp can travel 32 blocks before it dies.
- A 1x Tin Wire can handle 1A containing 32EU at a loss of 2 EU-Volt/Meter/Ampere. In this case, the amp can travel 16 blocks only.

Below is a table of the current properties of various types of cables in GregTech:

Material	Max Voltage (EU)	1x Insulated Cable Max Amperage (Amp)	Loss/Meter/Amp (EU)	Length until 0 Power (Meter)
Tin	32	1	1	32
Cobalt	32	2	2	16
Lead	32	2	2	16
Zinc	32	1	1	32
Soldering Alloy	32	1	1	32
Iron	128	2	3	43
Nickel	128	3	3	43
Cupronickel	128	2	3	43
Copper	128	1	2	64
Annealed Copper	128	1	1	128
Kanthal	512	4	3	171
Gold	512	3	2	256
Electrum	512	2	2	256
Silver	512	1	1	512
Blue Alloy	512	2	1	512
Energetic Alloy	512	2	2	256
Nichrome	2,048	3	4	512
Steel	2,048	2	2	1024
Black Steel	2,048	3	2	1024
Titanium	2,048	4	2	1024
TPV-Alloy	2,048	6	1	2048
Vibrant Alloy	2,048	4	2	1024
Aluminium	2,048	1	1	2048
Graphene*	8,192	1	2	8192
Osmium	8,192	4	2	4096
Platinum	8,192	2	1	8192
Tungstensteel	8,192	3	2	4096
Tungsten	8,192	2	2	?

Melodic Alloy	8,192	4	2	4096
HSS-G	32,768	4	2	16384
Niobium-Titanium	32,768	4	2	16384
Vanadium-Gallium	32,768	4	2	16384
Yttrium Barium Cuprate	32,768	4	4	8192
Stellar Alloy	32,768	6	4	?
HSS-E	32,768	6	2	?
Osmiridium	32,768	8	1	?
Naquadah	131,072	2	2	?
Trinium	131,072	6	4	?
Signalium	131,072	12	4	?
Naquadah Alloy	524,288	2	4	?
Duranium	524,288	1	8	?
Fluxed Electrum	524,288	3	1	?
Lumiium	524,288	8	16	?
Ichorium*	2,097,152	12	2	?
Bedrockium	2,097,152	2	1	?
HSS-S	2,097,152	6	4	?
Draconium	8,388,608	8	4	?
Nether Star	33,554,432	4	4	?
Hypogen	33,554,432	8	0	inf.
Quantium	134,217,728	2	4	?
Black Plutonium*	536,870,912	1	16	?
Awakened Draconium	2,147,483,640	1	16	?
Red Alloy	8	1	0	inf.
Redstone Alloy	32	1	0	inf.
Superconductor MV*	128	4	0	inf.
Superconductor HV*	512	6	0	inf.

Superconductor EV*	2,048	8	0	inf.
Superconductor IV*	8,192	12	0	inf.
Superconductor LuV*	32,768	16	0	inf.
Superconductor ZPM*	131,072	24	0	inf.
Superconductor UV*	524,288	32	0	inf.
Superconductor UHV*	2,097,152	48	0	inf.
Superconductor UEV*	8,388,608	64	0	inf.
Superconductor UIV*	33,554,432	64	0	inf.
Superconductor UMV*	134,217,728	64	0	inf.
Infinity	2,147,483,640	8,192	0	inf.
SpaceTime	2,147,483,640	1,000,000	0	inf.
Superconductor Base MV*	128	1	2	?
Superconductor Base HV*	512	2	8	?
Superconductor Base EV*	2,048	3	16	?
Superconductor Base IV*	8,192	4	64	?
Superconductor Base LuV*	32,768	6	256	?
Superconductor Base ZPM*	131,072	8	1,024	?
Superconductor Base UV*	524,288	12	4,096	?
Superconductor	2,097,152	16	16,384	?

Base UHV*	[illegible]	[illegible]	[illegible]	[illegible]
Superconductor Base UEV*	8,388,608	24	65,536	?
Superconductor Base UIV*	33,554,432	32	262,144	?
Superconductor Base UMV*	134,217,728	32	1,048,576	?

(*) No insulated version

Superconductors start from MV, and their amperages vary per tier.

Multi-Amp Generation

Main Article: Dynamo Hatch

Multiblock Generators use Dynamo Hatches to output power. These come in 1A, 4A, 16A, and 64A variants. These generators will always attempt to fill existing generated amps with EU before generating more amps.

Output Loss

Any GT Block outputting EU has an energy loss on output. This means there is no such thing as lossless power transfer. A power outputting singleblock will take $8 \times 4^{tier} + 2^{max(0,tier-1)}$ EU from its internal buffer and output 8×4^{tier} EU (which is always the maximum EU one amp of that voltage tier can hold). For example, a LV Combustion Generator draws 33 EU from its internal buffer to generate 1 amp holding 32 EU. The energy lost is therefore $2^{max(0,tier-1)}$.

Tier	Output (EU)	Loss (EU)	Loss (%)	Internal Buffer Consumption (EU)
ULV	8	1	12.5	9
LV	32	1	3.0303	33
MV	128	2	1.5384	130
HV	512	4	0.77519	516
EV	2048	8	0.38911	2056
IV	8192	16	0.19493	8208
LuV	32768	32	0.097561	32800
ZPM	131072	64	0.048804	131136
UV	524288	128	0.024408	524416

Transformers

Main Article: Transformer

Picture of a Transformer in default mode transferring 1 amp of HV into 4 amps of MV.

Transformers convert EU between voltage tiers. In Step Up mode, they draw up to 4 amps of a lower voltage to fill their internal buffers, and draw from their internal buffers to produce 1A of a higher voltage. This can allow lower tier amps to power higher tier machines which may only draw 1-2 A for a recipe. Similarly, in Step Down mode, they draw 1 amp of a higher voltage to fill their internal buffers, and draw from their internal buffers to produce up to 4A of a lower voltage. This allows use of higher tier power generators with lower tier machines while preventing explosions. Use a Soft Mallet to switch the mode.

The big dot with a plus is the high voltage side and is the front face, while the five smaller circles are the lower voltage sides. Regardless of mode, the big dot is *always* for the higher voltage. That means in Step Up mode, transformers have one output, five inputs, and in Step Down mode, they have five outputs, one input.

The output loss section above applies to transformer outputs as well.

Power Transformer and Hi-Amp Transformer

The Power Transformer and the Hi-Amp Transformer work like an ordinary transformer with one exception:

The Hi-Amp Transformer will accept 4 amps of higher voltage and turn it into 16 amps of lower voltage in its default mode. In inverted mode it will transform 16amps lower voltage to 4 amps of higher voltage.

The Power Transformer will accept 16 amps of higher voltage and turn it into 64 amps of lower voltage in its default mode. In inverted mode it will transform 64 amps lower voltage to 16 amps of higher voltage.

Active Transformer

The Active Transformer is a multiblock unlocked in ZPM tier that can transform to and from any voltage, accepting energy with an Energy Hatch and outputting energy with a Dynamo Hatch. **Wrenching or modifying the Active Transformer while it is running will cause it to explode.**

Trivia

- GregTech's current power system is called the GT Enet API (Enet).
- Since version 5.0 (for Minecraft 1.7.2), GregTech has its own Energy System since GregoriusT wasn't satisfied with IC2 Experimental's Energy System.

> The reasons of why I removed compatibility to the IC² Enet are that Cable Loss doesn't work, that the Network doesn't have Packets anymore and that it switched from Integer to Double (what is horrible for larger Energy Storages). Not to mention that it is very hard to have control over Energy flow without constantly registering and unregistering TileEntities.
>
> — GregoriusT

See Also

- Snagger's Electricity Guide for New Players
- Automatic Energy Toggle Guide

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GT New Horizons

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