SMES power storage

*A mod to keep busy “powerplayer” near endgame level*

*(also possible dictionary-compatible superconductor recipe for IC2 replacement, teeheehee)*

# Introduction :

Some mods require a lot of power to achieve their endgame item (IC2 iridium, AE2 pylons, …)

Power storage is usually 50MRF per block (mekanism’ ultimate or TE’s energy cell) which have the property to be “movable powerstorage”

SMES would be a static powerstorage, with a limitless capacity.

check wiki : SMES are magnets using superconductors, they could store near-infinite power losslessly

# Item list :

## Components :

* YBCO alloy ingot : Yttrium-Barium-Copper-Oxygen alloy used to craft the supermagnet
* NbSn alloy pellet : Niobium-Tin alloy to craft superconductor wire
* Yttrium pellet : material for YBCO alloy raw recipe
* Barium pellet : material for YBCO alloy raw recipe
* Niobium pellet : material for NbTi alloy raw recipe

Those component have a purity NBTdata, a double value between 0 and 1, to be printed in percentage. By default, the purity is near 0.550000000D (55%)

## Machine :

* Rare metal extractor : machine to extract Yttrium pellet or Niobium pellet out of high amount of vanilla stuff
* Rare earth extractor : machine to extract Barium out of high amount of causal item
* ALD unit : machine to purify the raw elements. *This is the key machine to keep busy the powerplayer* : takes two item as inputs and create one as output with better purity.
* CSD unit : machine to create the YBCO alloy or NbSn alloy. CSD stands for “chemical solution deposition”. Final purity is the average of the used raw element’s purity.
* Simple Cryocooled case : machine to receive the supermagnet. Power can be pushed and pulled from any side, like any powerstorage block. require power to work : superconductor state is available only at 18°K.
* *Multiblock cryogenic plant and power conversion : a big multiblock structure to meet the cooling requirement of the power converter, and the power converter having multiple inputs/outputs*

## Items :

* Superconductive wire : crafted with NbSn alloy and silver (silver acts as pipe).
* Supermagnet : using the wire and YBCO ingot. The final power storage capacity of the supermagnet is as follow : **=(1/(1-purity)^1.25)\*25000000** , unit : RF

## Recipe :

*Yellow highlight mean this item require the NBT data purity stored.*

* Yttrium pellet : 1400 saplings (any tree) +1.4MRF into Rare metal extractor = 1 pellet, 55% purity
* Barium pellet : 10 nether quartz + 50KRF into Rare earth extractor = 1 pellet, 55% purity
* Niobium pellet : 50 000 cobblestone + 500KRF into Rare metal extractor = 1 pellet, 55% purity
* YBCO alloy ingot : 1 Yttrium pellet + 1 Barium pellet + 1 Copper dust + 500KRF into CSD unit = 1 YBCO alloy ingot, purity is average of input pellets
* NbSn alloy : shapeless craft, 1 niobium pellet + 1 tin dust = 1 NbSn alloy, purity is same as niobium pellet
* Superconductive wire : shaped craft, 6 silver ingot top-bottom, 3 NbSn alloy= 8 superconductive wire, purity is average of NbSn alloy
* Supermagnet : shaped craft, 8 superconductive wire around 1 YBCO alloy ingot, purity is average of all component’s purity used.
* enhancing purity of <samekind> pellets : <first> pellet + <second> pellet + 500KRF into ALD unit = 1 final pellet. Formula for final purity is **=(purity\_first+purity\_second)/(2-(1-(purity\_first+purity\_second)/2))**
* Machine recipe : well, let’s not make something really tough.
  + Rare Metal extractor : 1x chest, 1x furnace, 2x piston, 2x diamond, 1x iron block
  + Rare Earth extractor : 1x chest, 2x furnace, 2x piston 2x emerald, 1x bucket
  + ALD unit : 1x redstone block, 1x piston, 1x diamond, 3x furnace, 3x glass
  + CSD unit : 2x bucket, 1x emerald, 3x glass, 2x piston, 1x redstone block
  + Simple Cryocooled case : 4x iron block, 1x furnace, 3x glass, 1x redstone block
  + Multiblock cryogenic plant and power conversion, see next chapter

# Efficiency Table (balance) :

*This table use the math formula to get the final purity after multiple steps in the ALD unit.  
The tooltip for final power storage capacity must be able to show TRF (tera RF) !*

|  |  |  |  |
| --- | --- | --- | --- |
| Supermagnet  final purity (rounded) | Power storage  capacity (RF) | NbSn (or YBCO) re-purification step needed | Power required to reach the purity |
| 55,0000000% | 67 830 398 | 1 | 2,050 MRF |
| 70,9677419% | 117 311 068 | 2 | 4,100 MRF |
| 83,0188679% | 229 341 004 | 4 | 8,200 MRF |
| 90,7216495% | 488 204 232 | 8 | 16,400 MRF |
| 95,1351351% | 1 094 212 149 | 16 | 32,800 MRF |
| 97,5069252% | 2 523 602 066 | 32 | 65,600 MRF |
| 98,7377279% | 5 908 793 114 | 64 | 131,200 MRF |
| 99,3648553% | 13 942 773 897 | 128 | 262,400 MRF |
| 99,6814159% | 33 030 103 691 | 256 | 524,800 MRF |
| 99,8404538% | 78 402 876 473 | 512 | 1049,600 MRF |
| 99,9201632% | 186 288 590 017 | 1024 | 2099,200 MRF |
| 99,9600657% | 442 850 360 694 | 2048 | 4198,400 MRF |
| 99,9800288% | 1 053 018 718 105 | 4096 | 8396,800 MRF |
| 99,9900134% | 2.5 TRF |  |  |
| 99,9950065% | 5.9 TRF |  |  |
| 99,9975032% | 14.1 TRF |  |  |
| 99,9987516% | 33.6 TRF |  |  |

# Discussion / remark :

## Trade and barter :

* Players could sell their old supermagnet of “low” RF capacity for massive amount of mats/cobble, thanks to Extrautils compressed cobblestone and AE drives.
* We could sets up an NPC that deal good purity pellets against TE cell / Mek cube as an incentive for players to reduce their amount of cell clusters.

## Cross-Mod integration :

* This mod can provide a way for “instant massive amount of energy usage” for future endgame ideas.
* Currently endgame feature that need massive energy instantaneously : AE2
* Power capacity : most mods only accepts <int> as power capacity or numberformat. I suggest to only answer 2147483647 (the max positive int value) if the storage capacity or power availability is above.

## Multiblock :

*a bit too inspired from bigreactor ^^*

* Since the superconductivity need serious cooling (18°K), a multiblock structure could fits nicely
* Suggested : 2 different multiblock structure, one for the cooling process, the other for the supermagnet storage and power conversion with the various powertaps (in/out)
* Parts of the power conversion multiblock
  + Containment block (base wall)
  + Input powertap
  + Output powertap
  + Controller
  + Supermagnet storecase
  + Coolant input
  + Coolant output
* Parts of the cooling plant multiblock
  + Cooling wall (base block)
  + Coolant output pump
  + Coolant input pump
  + Coolant valve (initial filling, refill)
  + Controller
  + Heat exchanger
* Multiblock shape : they both doesnt need to be a rectangle. “Freeform” with prerequisites (like : heat exchanger need to have at least one side touching cooling wall) could be interesting.

## Balancing

* I expect a solo player to reach 98% purity. It requires around 50k saplings, 2M cobble and 640 quartz. The storage would be 3.3 GRF
* There is a “flaw” in the recipe : high purity niobium is easier to get than YBCO (niobium need cobble, YBCO need saplings and quartz). And thanks to the final average, a 97% YBCO mixed with a 99% This is an incentive for people to avoid humongous laggy treefarm : they should be advised to do a cobblefarm, much less laggy with extratutil mod.