Energy Joules (J)

The capacity to do **work**
effort
action

Law of conservation of Energy.

1. cannot be created
2. cannot be destroyed.

] total energy in universe constant.

3. can move from object to object
4. can change from type to type
5. can dissipate. into the environment

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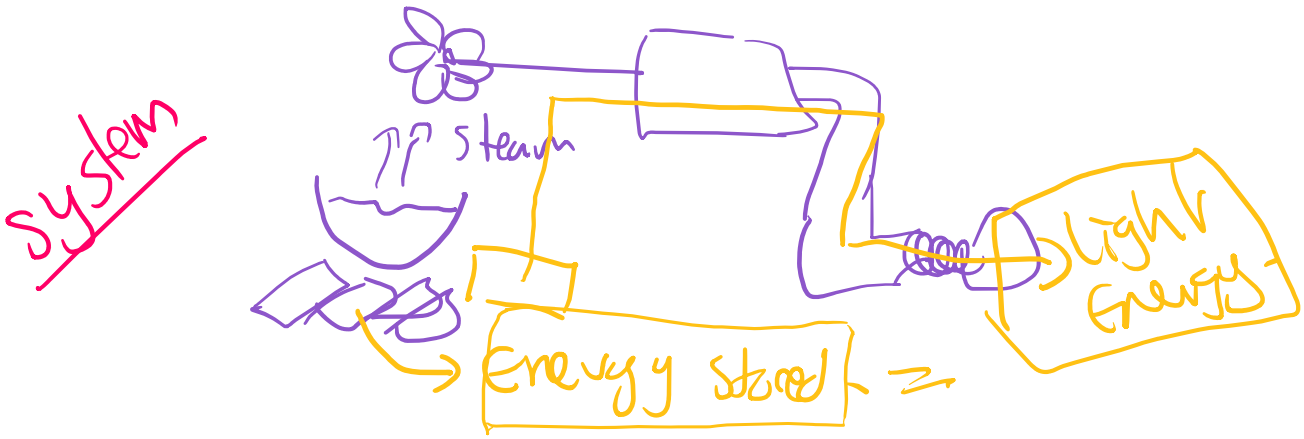
1 and 2 total energy in a **System** remains constant



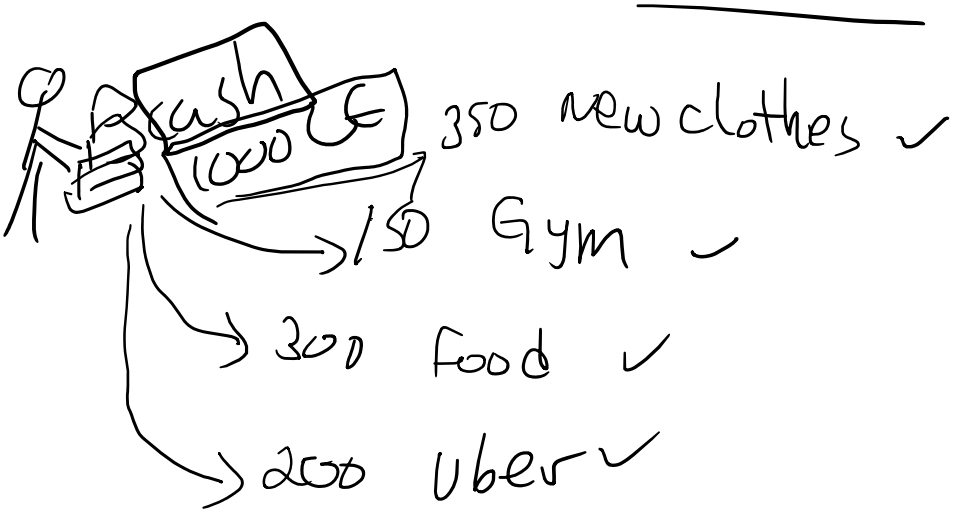
Total Energy IN = Total energy out

③ can be moved by doing work.

- mechanical ⇓ moving objects
  - $W = f \times d$ ← moved
  - moment = f × d perpendicular
- waves ⇓ carry Energy Light, sound,
- electric ⇓
  - $W = IUt$
- Thermal.
  - conduction
  - convection
  - radiation

Types of Energy

⇒ Uses of cash



④ can change from type to type.

Types:

① Kinetic Energy :- motion - speed - vibration rotation - temperature.

② Gravitational potential energy - distance - height - depth

③ chemical energy - chemical reaction: - fuel food - batteries -

④ Nuclear Energy - Nuclear fusion - N. fission

⑤ Electric Energy - Electric current

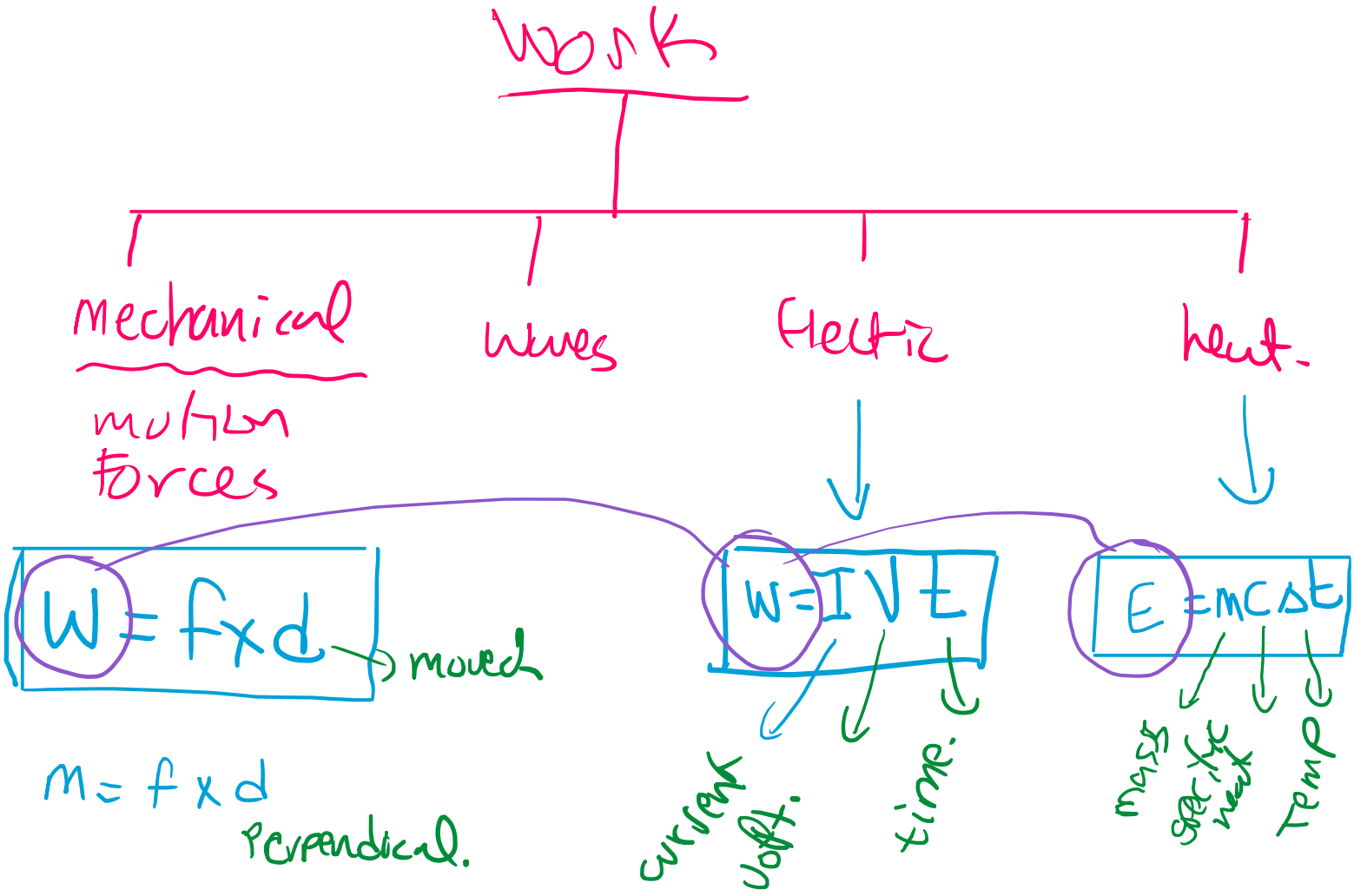
⑥ magnetic Energy - magnets

⑦ Elastic Energy - Stretching (Tension) - compressing - bending (stress) - twisting (Torsion)

⑧ Thermal Energy - heat
↓
internal Energy
↓

5 Energy can be dissipated.

moves out of an object & spreads out into the environment & becomes not useful


Work
mechanical
waves
Electric
heat.
motion
forces
W = f x d
moved
W = I V t
E = m c Δt
m = f x d
perpendicular.
current
volt.
time.
mass
specific heat
temp

Example A car Engine produces 3000 N of thrust. If the car moves a distance of 100 m, what is the work done?

$W = F \times d = 3000 \times 100 = 30{,}000\ J$

If 1 liter of petrol delivers 35×10^6 J how much fuel is used?

$$\text{Fuel used} = \frac{30000}{35 \times 10^6} \times 1 \text{ liter}$$

$$= 0.00085 \text{ liters}$$

How fast was the car at the end of 100 m? If mass = 2500 kg?

$$E = KE = \frac{1}{2} m v^2$$

$$30000 = \frac{1}{2} \times 2500 \times v^2$$

$$v = \sqrt{\frac{2 \times 30000}{2500}} = 4.9 \text{ m/s}$$

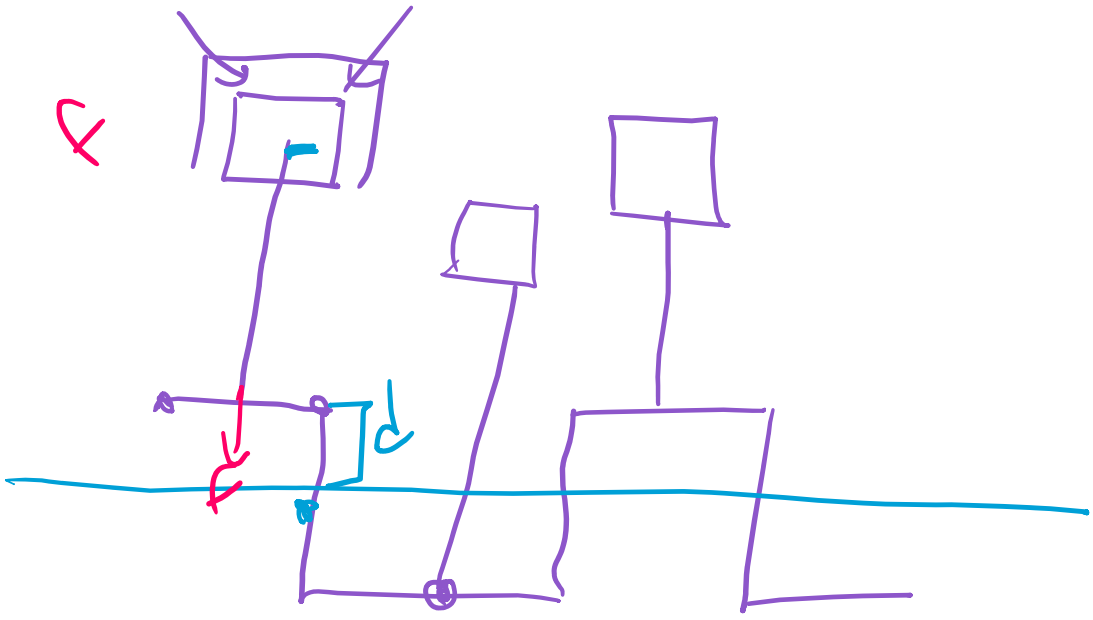
what is the Spad in km/hr?

4.9 m/s $\frac{60 \times 60}{1000}$ = 17.64 km/hr

If the torque of the car is 300 Nm, what is the size of the crankshaft.

$m = f \times d$

$300 = 3000 \times d$ $d = \frac{300}{3000} = 0.1$ m



Calculate the acceleration. if it takes 1,3 seconds to complete 100 m.

$$a = \frac{v-u}{t} = \frac{4.9}{1.3} = 3.77\ m/s^2$$

Calculate the power of this engine.

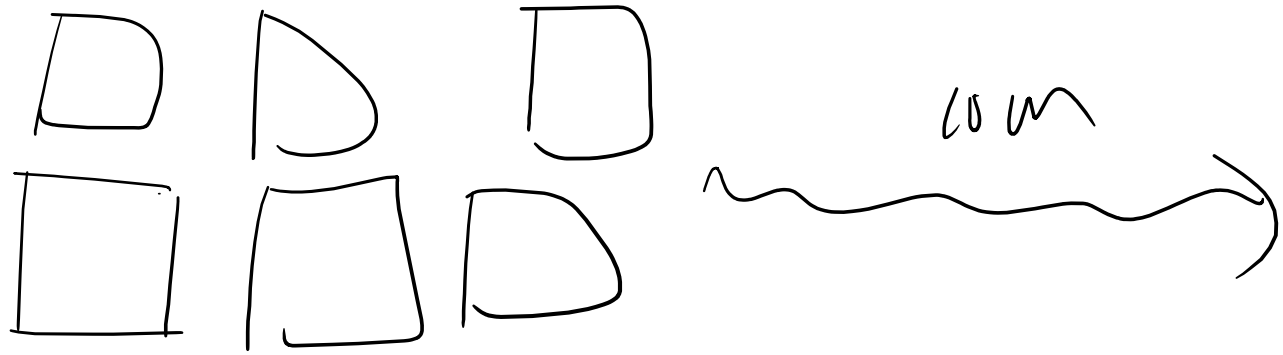
Power = rate of doing work

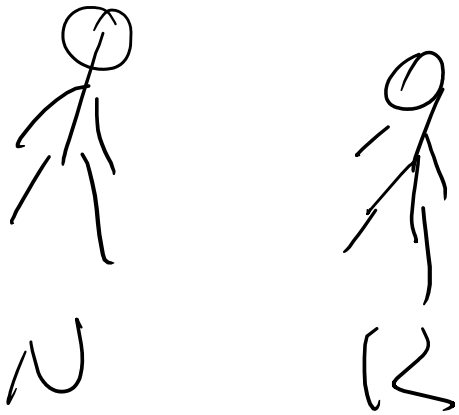
$$= \frac{\text{work}}{\text{time}}$$

$$= \frac{30000}{1.3} = 23000\ W$$

$$\text{in HP} = \frac{23000}{745.7} = \boxed{30\ HP}$$

745.7





Each box weighs 1N
they are moved 10m to the right

How much work is needed?

1N X 6 X 10 = 600 Nm (Joules)

if Nour moves them 1 at a time
& Karim moves them 3 at a time

calculate total work & power for each. if each journey needs 3 seconds.

Nour $W = 1N \times 10m = \boxed{10\ Nm}$ per chair

total $W = 10 \times 6 = \boxed{60\ Nm}$

$P = \frac{10}{3} = \boxed{3.34\ watts}$

Karim $W = 1N \times 3 \times 10m = (30\ Nm)$

2 journeys total $W = 30 \times 2 = \boxed{60Nm}$

$\boxed{P} = \frac{30\ Nm}{3} = \boxed{10\ watts}$

$$\uparrow KE = \frac{1}{2} m v^2 \uparrow$$

$$KE = \frac{1}{2} \times 2500 \times (10)^2 = 125\ KJ$$

$$= \frac{1}{2} \times 2500 \times (20)^2 = 500\ KJ$$

$$= \frac{1}{2} \times 2500 \times (100)^2 = 12500\ KJ$$

$$GPE \uparrow = m\ g\ \Delta h \uparrow$$

Example an Electric motor of power 5000 W lift an elevator 30m up. If the elevator mass is 1000kg. what is the GPE at the top?

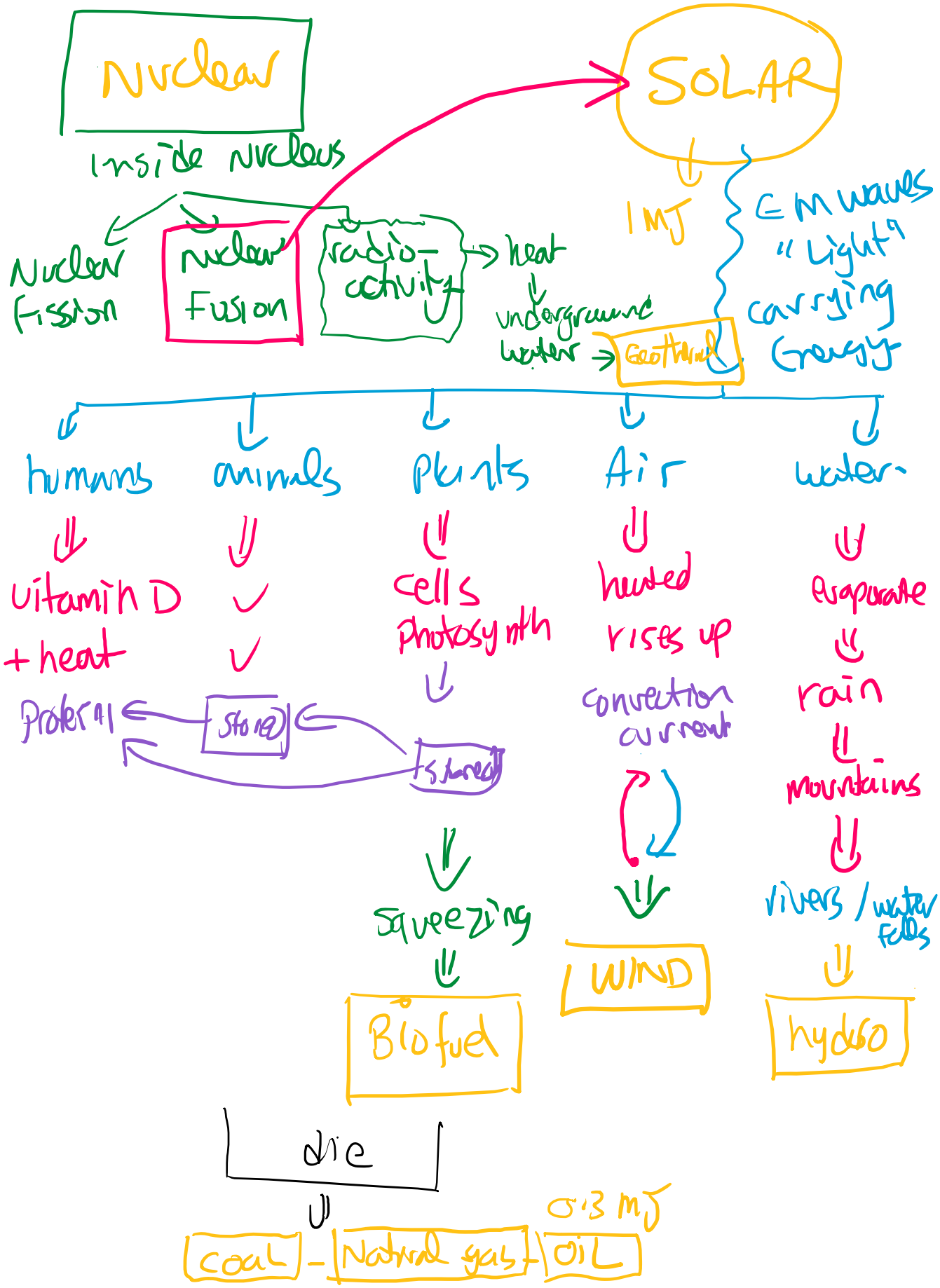
$$GPE = 1000 \times 9.8 \times 30 = 294\ KJ$$

how much time does it take?

$$P = \frac{E}{t} \qquad t = \frac{E}{P} = \frac{294 \times 10^3}{5000}$$

$$= 58.8\ sec.$$

Energy Resources



Energy Sources

Renewable

can be renewed within 1 human lifetime

- Solar
- Wind
- Hydro
- Biofuel
- Geothermal

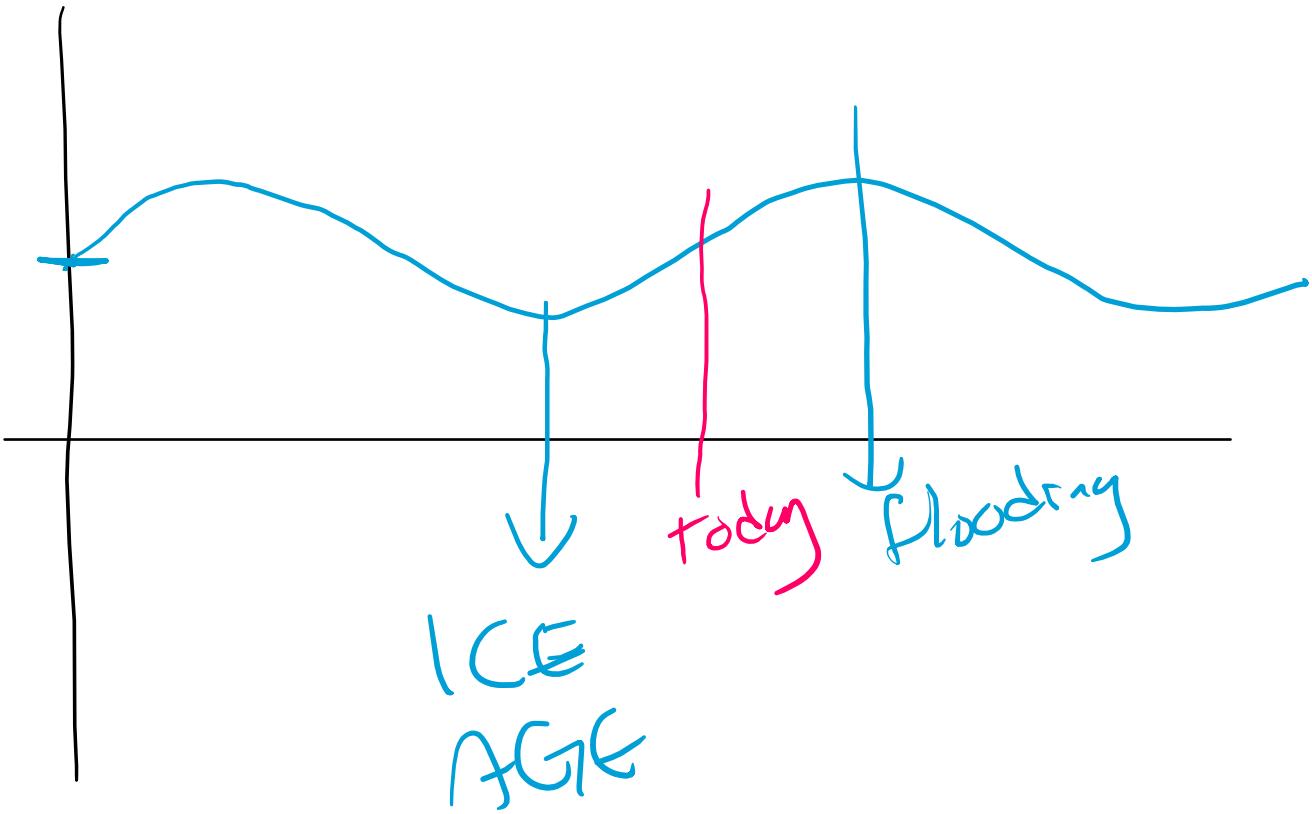
non-renewable

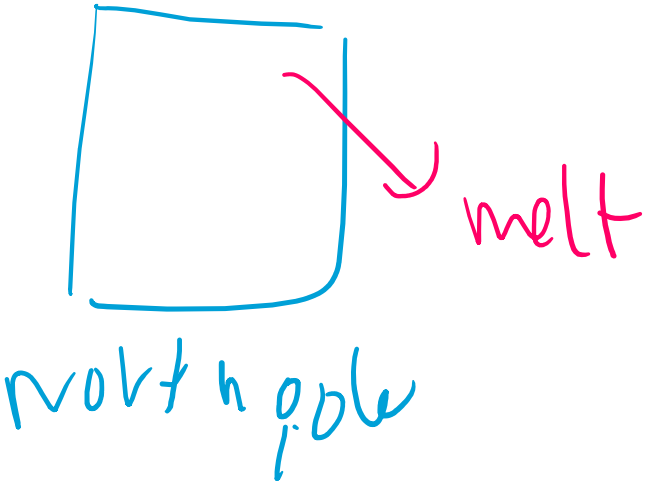
cannot be renewed in 1 lifetime

- Nuclear
- Coal
- Gas
- Oil

(Coal, Gas, Oil: fossil fuels)

Energy Source	PRO	Cons
Renewable	- never runs out - free to use- - No pollution	- unreliable. - Expensive to set up - low Energy density
non-Renewable	- Reliable. - cheap to set up - high Energy density	- will run. out - - Expensive to use. - causes pollution-


today
flooding
ICE
AGE


melt
north pole