Single generator

economic generation ← max^m η

Load in MW

Alternator's Capacity

Aternator operates at 75% of rated Capated

High generation cost

12 am Midnight

Below rated Capacity

12 am midnight

Time in Hours

Poor Performance

Selection Of Units

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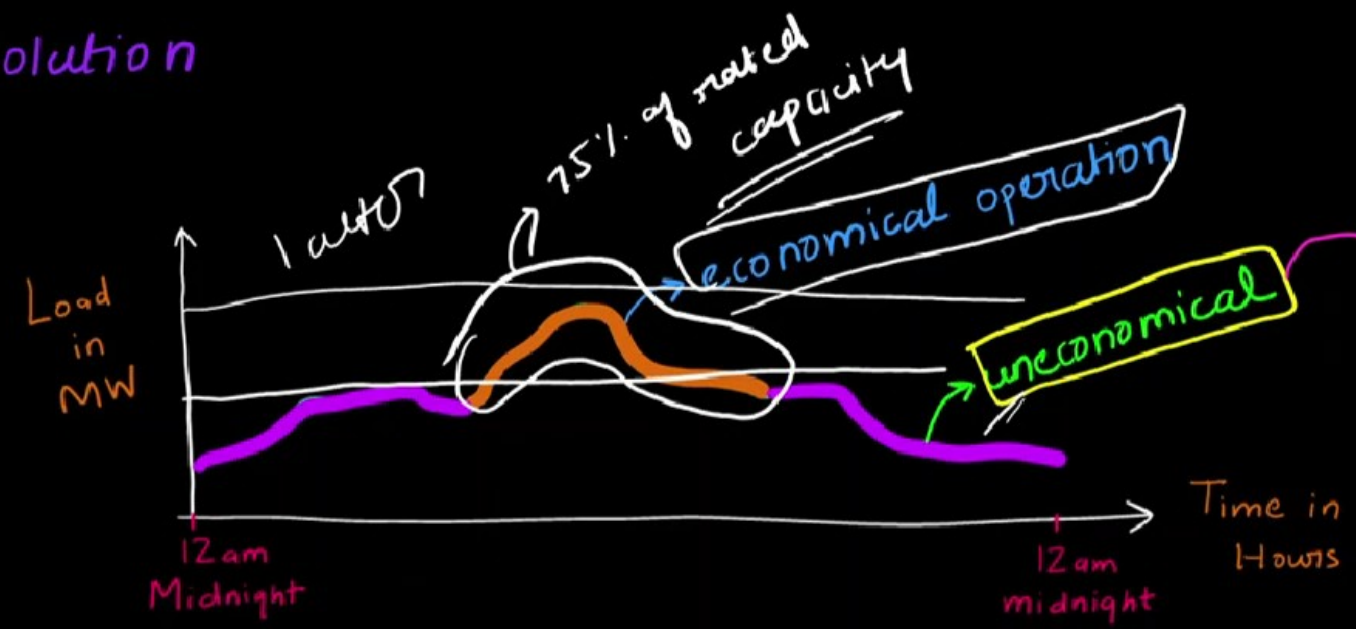
TechInsight

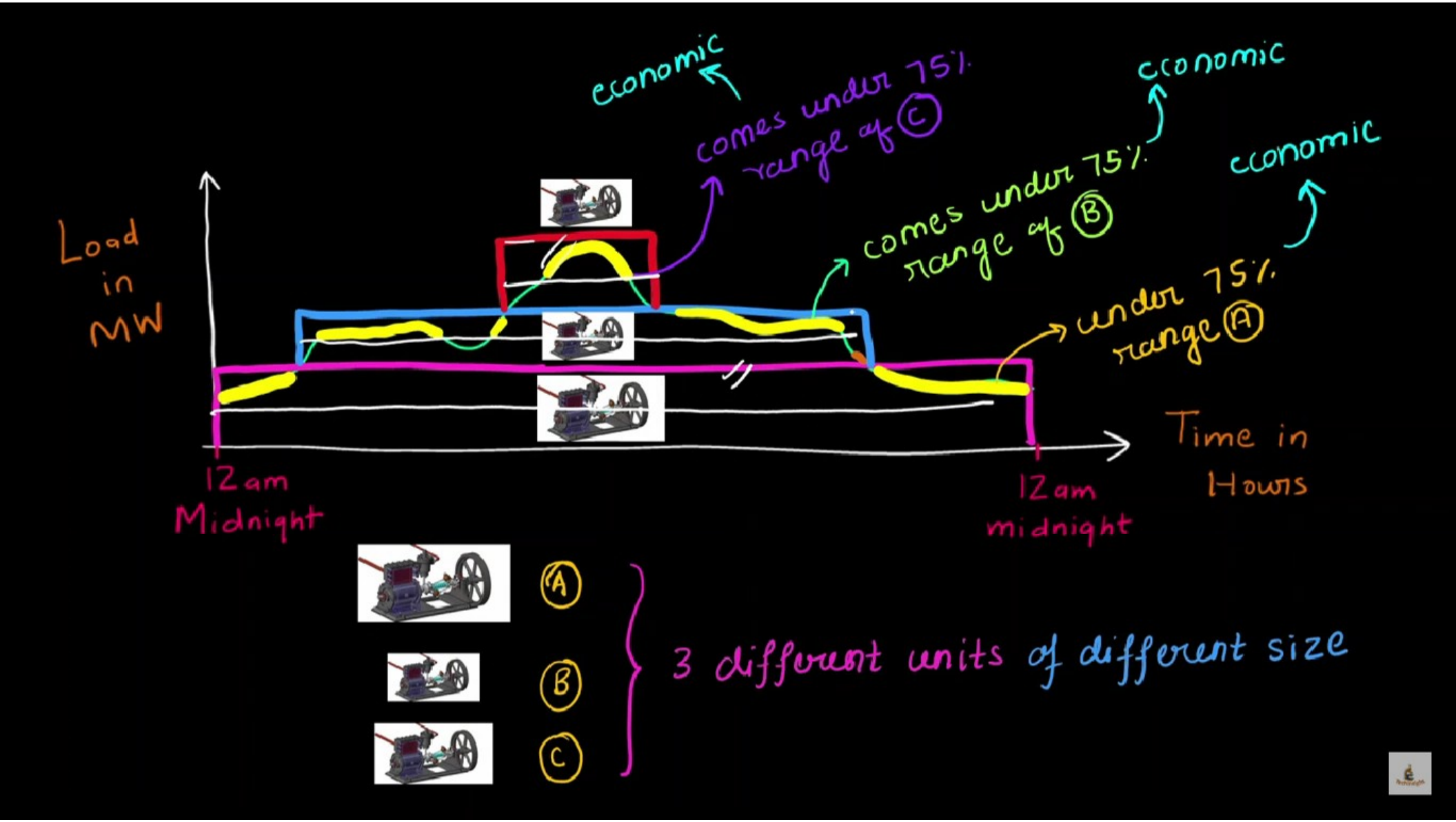
The solution

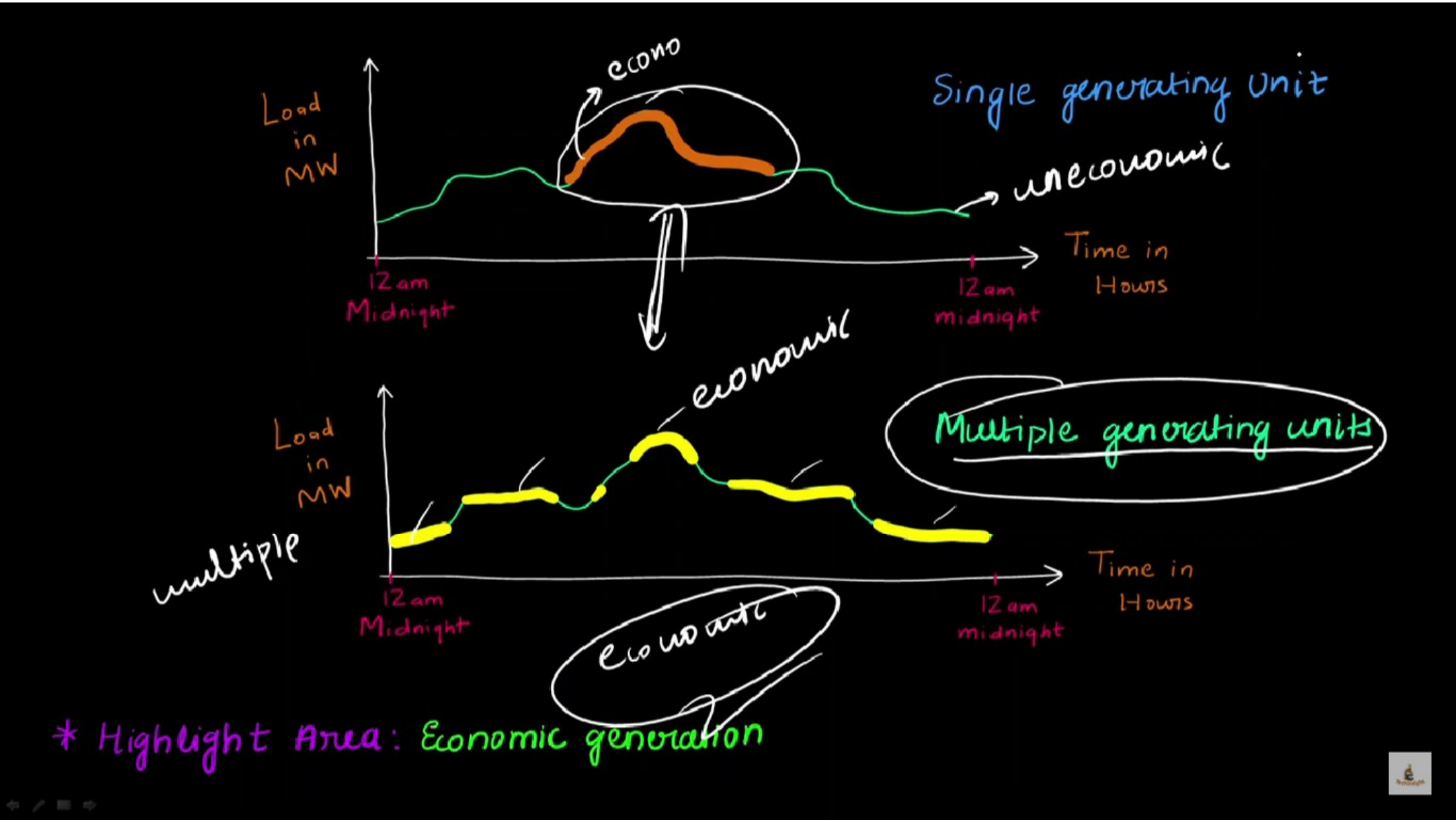


* We can't operate variable Load via single alternator economically

Differ in size

multiple generating units

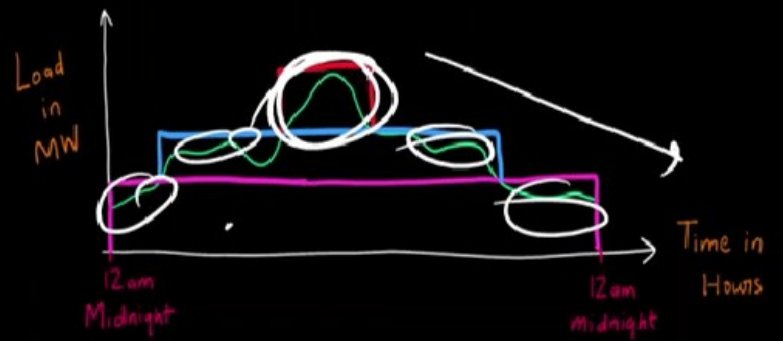

economic
comes under 75% range of C
economic
comes under 75% range of B
economic
under 75% range A
Load in MW
Time in Hours
12 am Midnight
12 am midnight
A
B
C
3 different units of different size


econo
Load in MW
Single generating unit
uneconomic
Time in Hours
12 am Midnight
12 am midnight
economic
Load in MW
Multiple generating units
multiple
Time in Hours
12 am Midnight
12 am midnight
economic
* Highlight Area: Economic generation

Selection Procedure

Cost per unit power

No. of units
Size of units
→ decided from "Annual Load Curve"



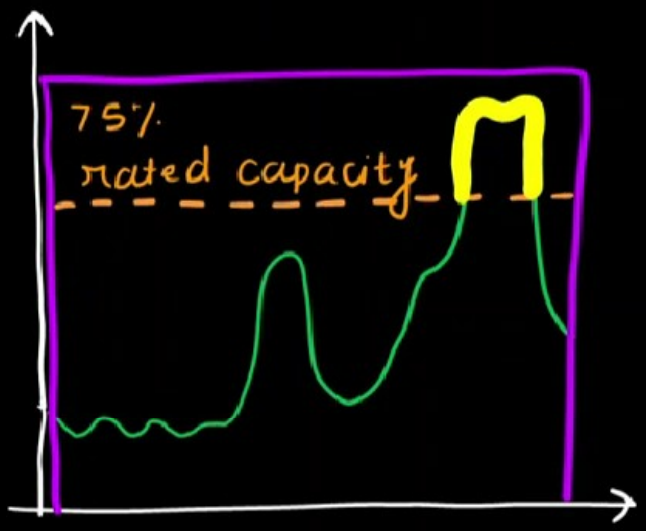
↓

They both are choosing in such a way that they correctly fit into the Station Load curve

* This selection will help the station to generate economical power with maxm η operation of generating units.

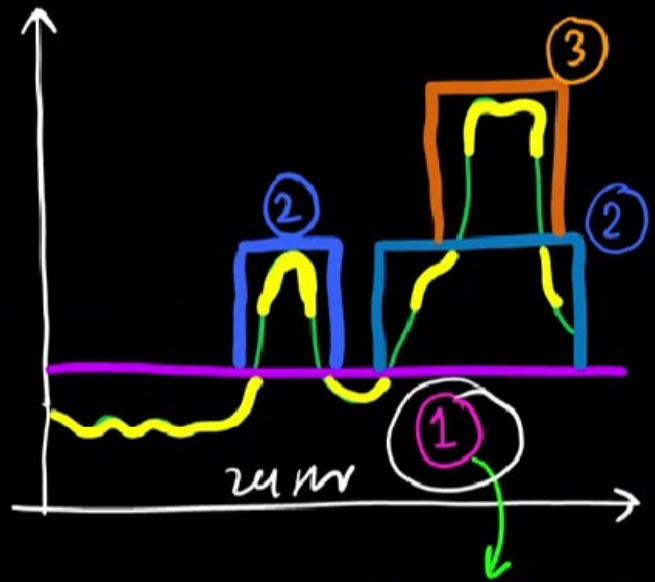
Plant - (A)

Single generating unit



Plant - (B)

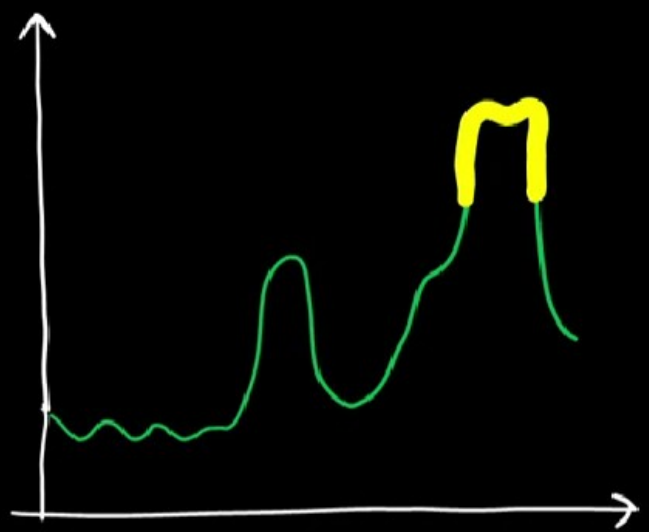
Multiple generating units



Act as Base load generator

* Highlight Portion: Shows cost effective generation

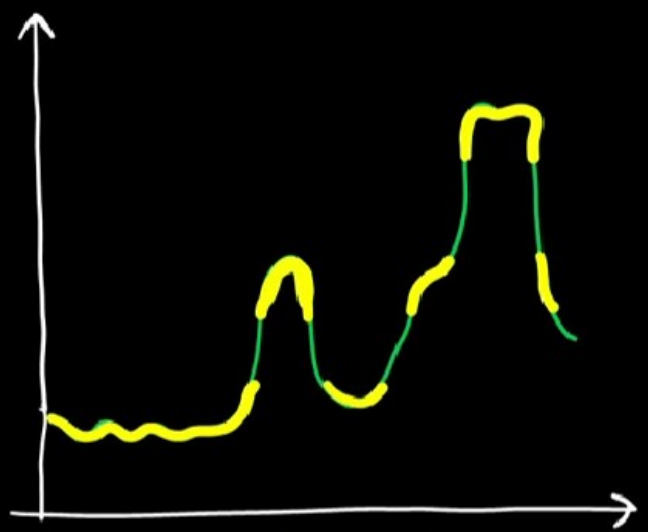
Plant - (A)



Costly generation

1 generatin unit

Plant - (B)



Cost - Effective generation

3 generating units

Important Points while selecting generating units

* Units selected preferably of different capacities.

* Capacity of plant → 15% to 20% more than max^m demand to meet future load demand.

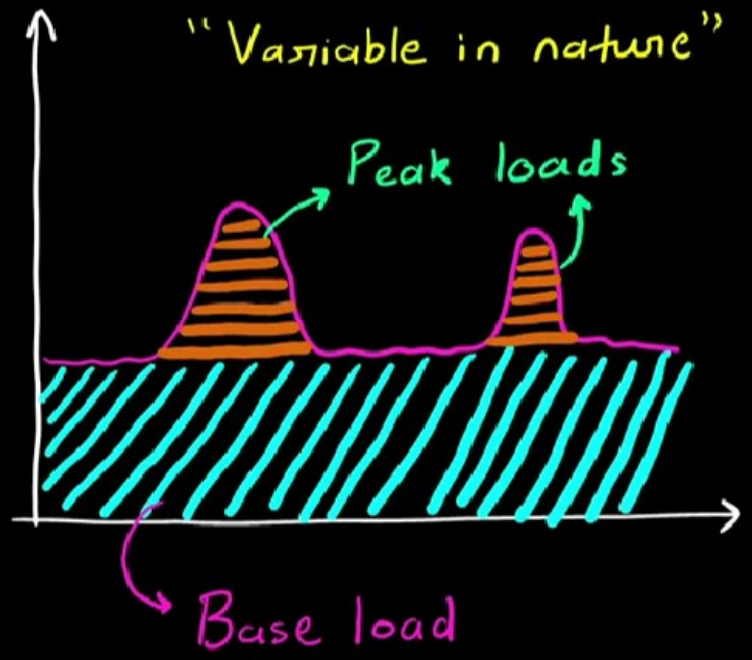
* Spare generating units → Repair and overhauling of working units can be carried out without discontinuity

Diesel engine

Capital cost.

* Avoid selecting large no. of units of smaller capacity in order to fit the load curve.

Load Profile

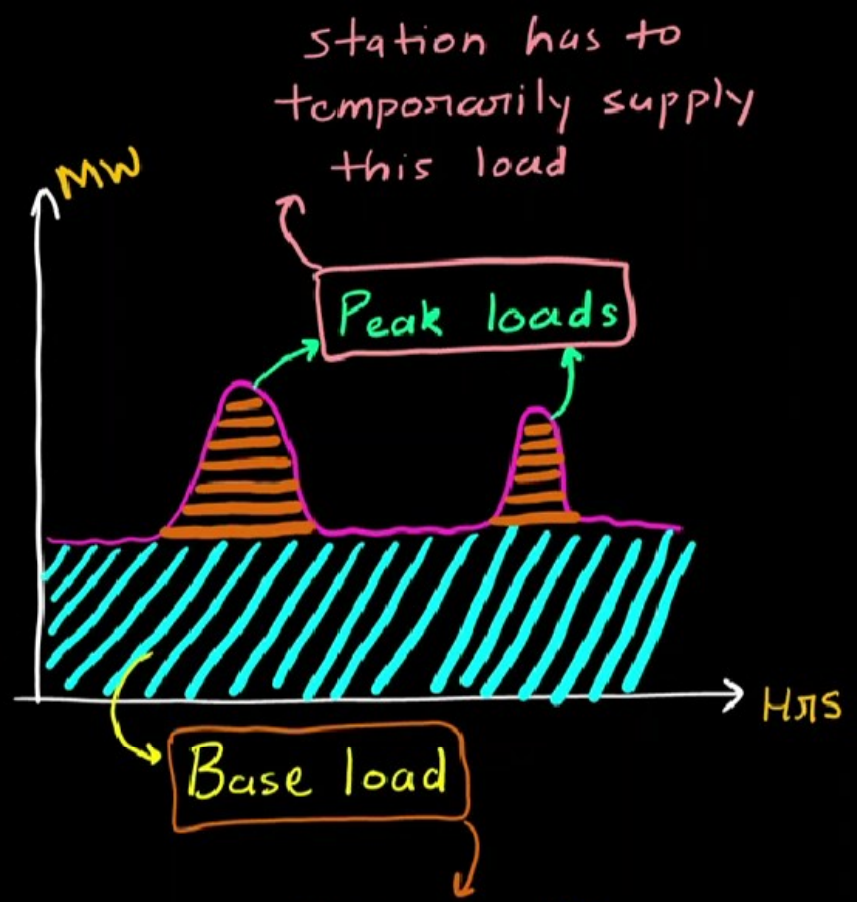



BASE & PEAK LOADS

Understanding Base and Peak Load

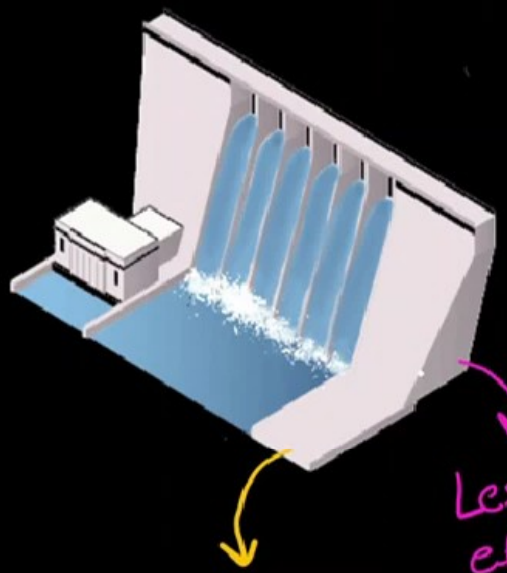
Load

- Base Load
  - Unvariable in nature
    - occur almost whole day
- Peak load
  - occur for short duration
    - Variable in nature



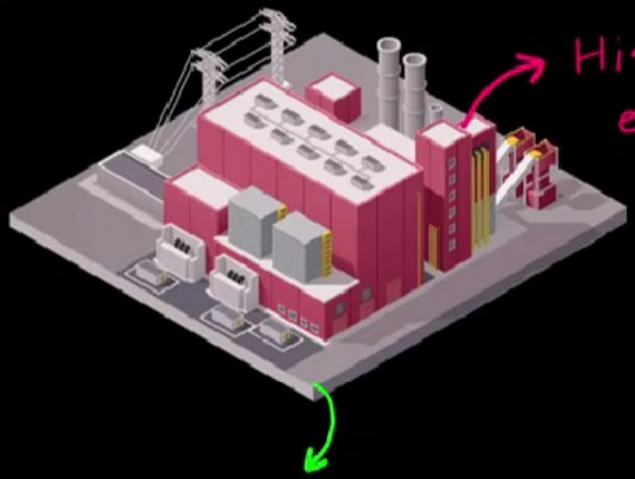
Best method to meet Base Load and Peak Load

"Interconnect 2 different stations"



Less efficient

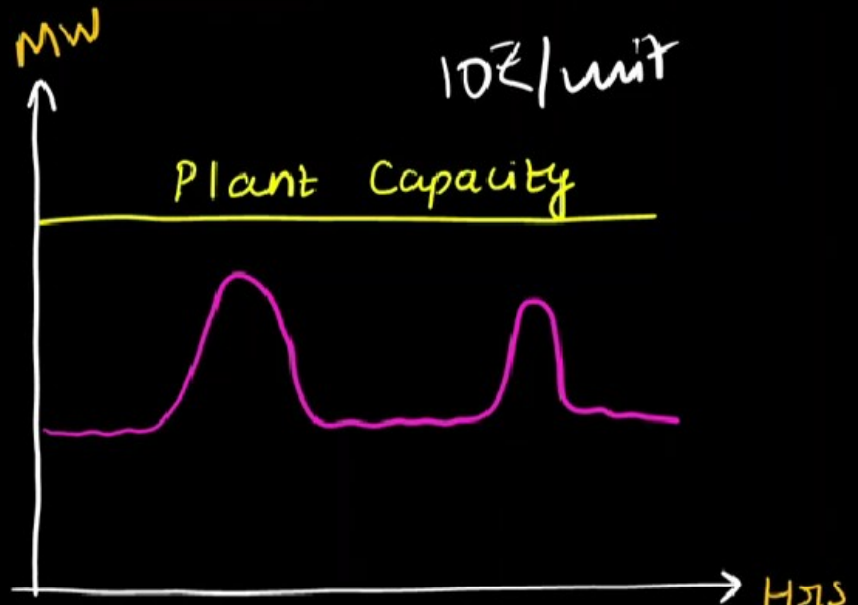
To Supply Peak load



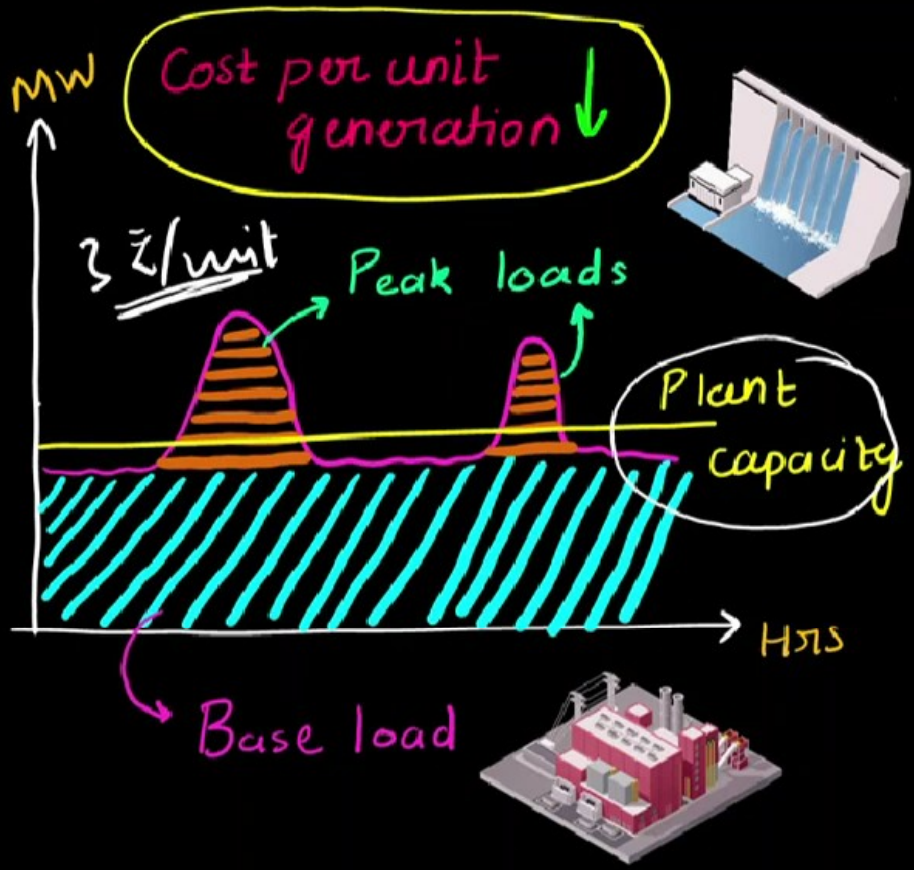
High efficient

To supply Base Load

How utilizing 2 different stations improves economics



"Single Plant"



" 2 different Plant"

Features required in Base load Power Plants

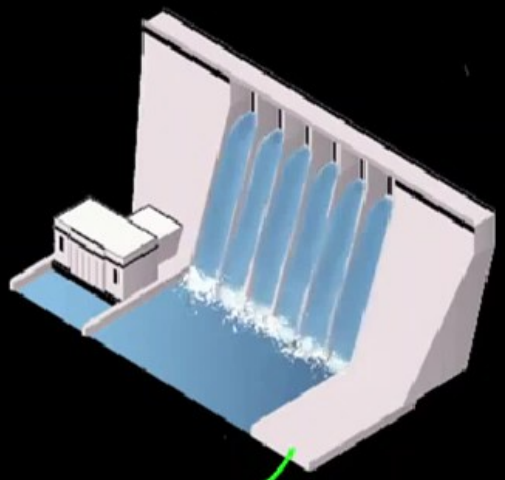
1. High Capacity, as they are designed to meet large base load.
2. Low operating cost
3. Slow Ramp-up and Ramp-down
   - Ramp-up → Increase in O/P
   - Ramp-down → Decrease in O/P

   as they are supplying Base Load [nearly constant in nature]
4. Long life span → typically around 40-60 years
5. High Reliability, with minm downtime or interruptions

Thermal, Nuclear, Some Hydroelectric

Features of Peak load Power Stations

1. Quick Ramp-up and Ramp down time
2. Low capacity
   - ↳ designed as "suplemental" source during peak time.
3. High operating cost, as they use more expensive fuel like, natural gas, oil to quick ramp-up.
4. High Reliability



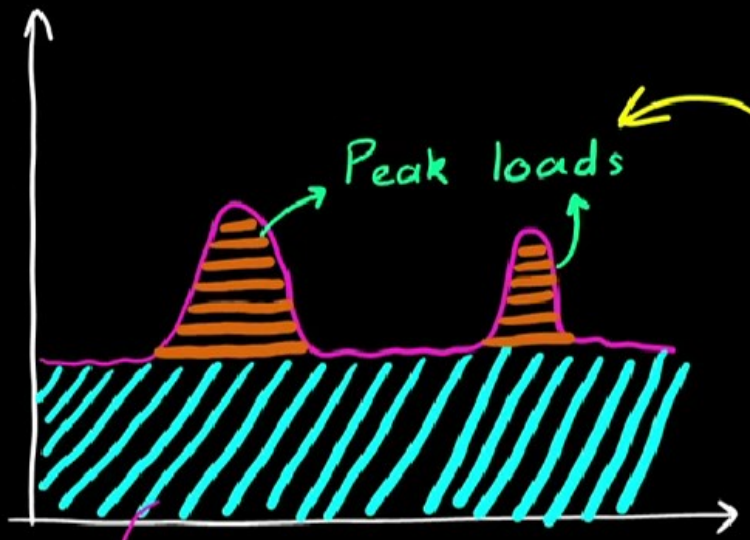
eg;

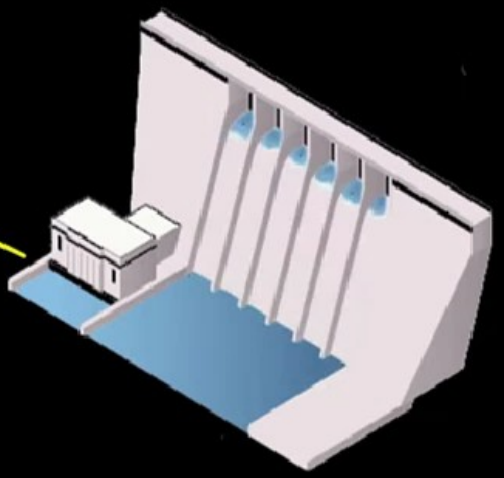
Natural gas Plant

Pumped Hydro

Diesel Power Plants

INTERCONNECTED GRID SYSTEM



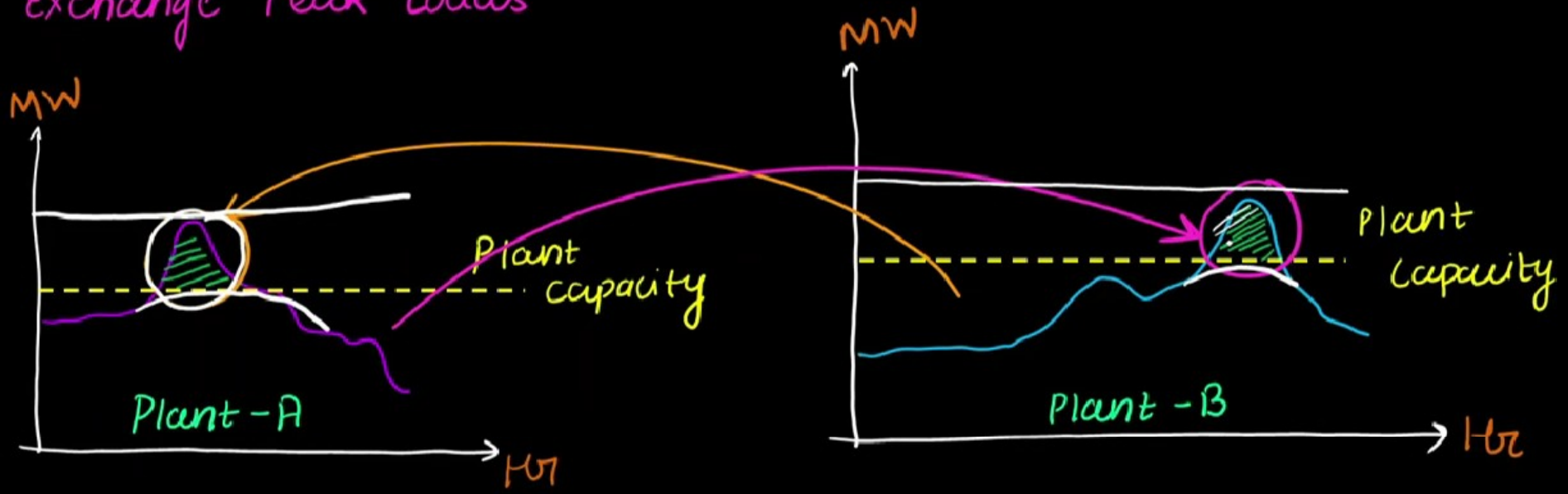


"The connection of several generating units in parallel"


INTERCONNECTED GRID SYSTEM

Advantages of grid integration

1. Exchange Peak Loads



* Low plant capacity
* Low cost per unit generation

2. Use of older and less efficient Power Plants

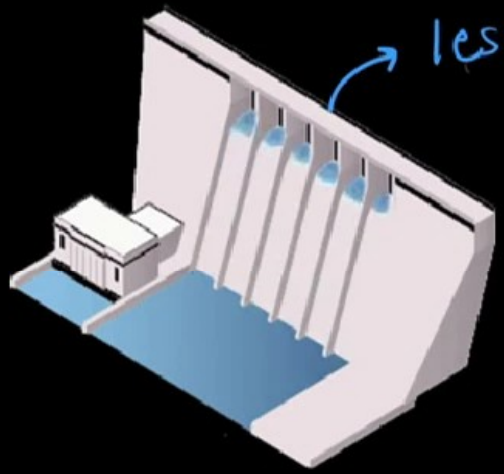
→ used to carry Peak loads for short duration

3. Economic Operations

a) allow efficient station to work throughout the year and less efficient to work during peak hours only.

more η

Run as base Load [24 Hrs]



less η

Run to supply only peak loads

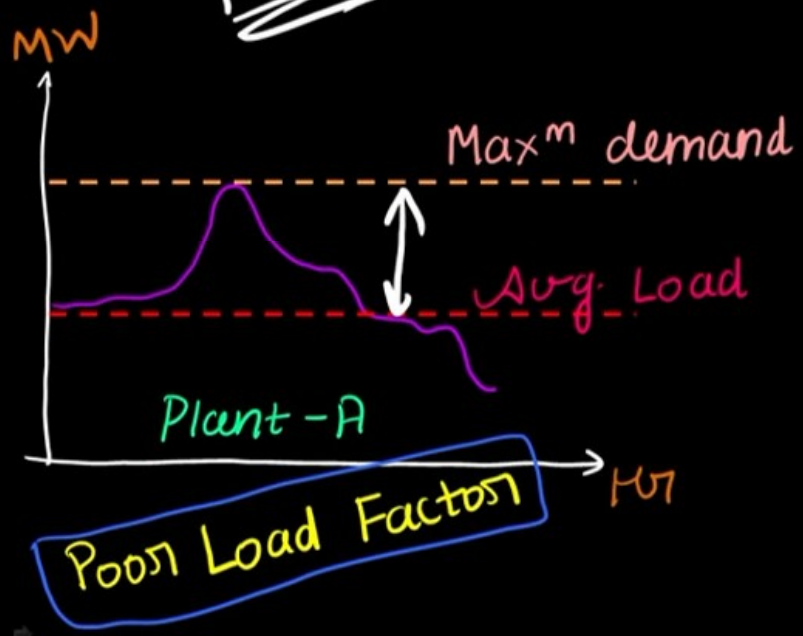
4. Improves Load Factor

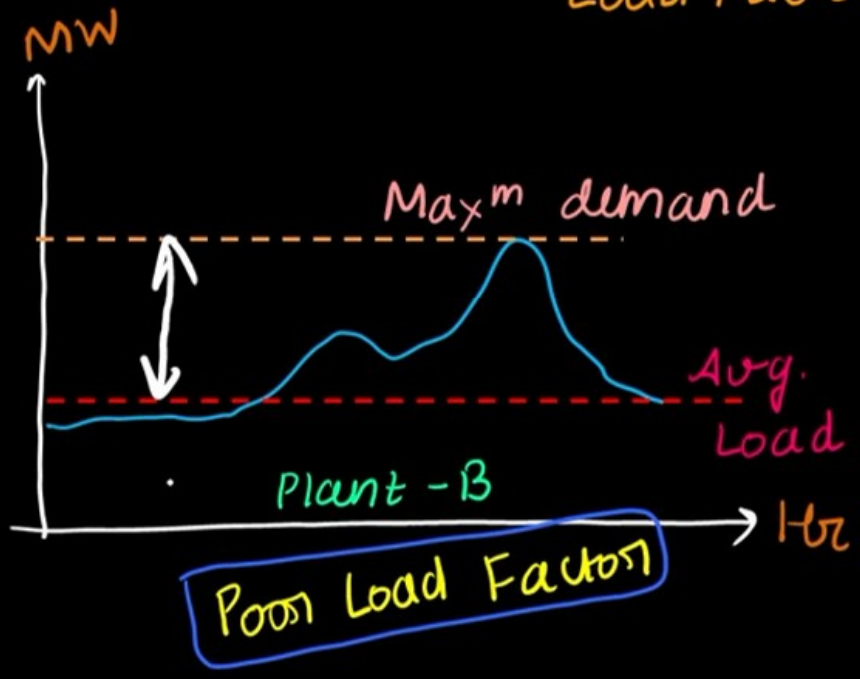
Load Factor = $\frac{\text{Average Load} \downarrow}{\text{Maximum Demand} \uparrow}$

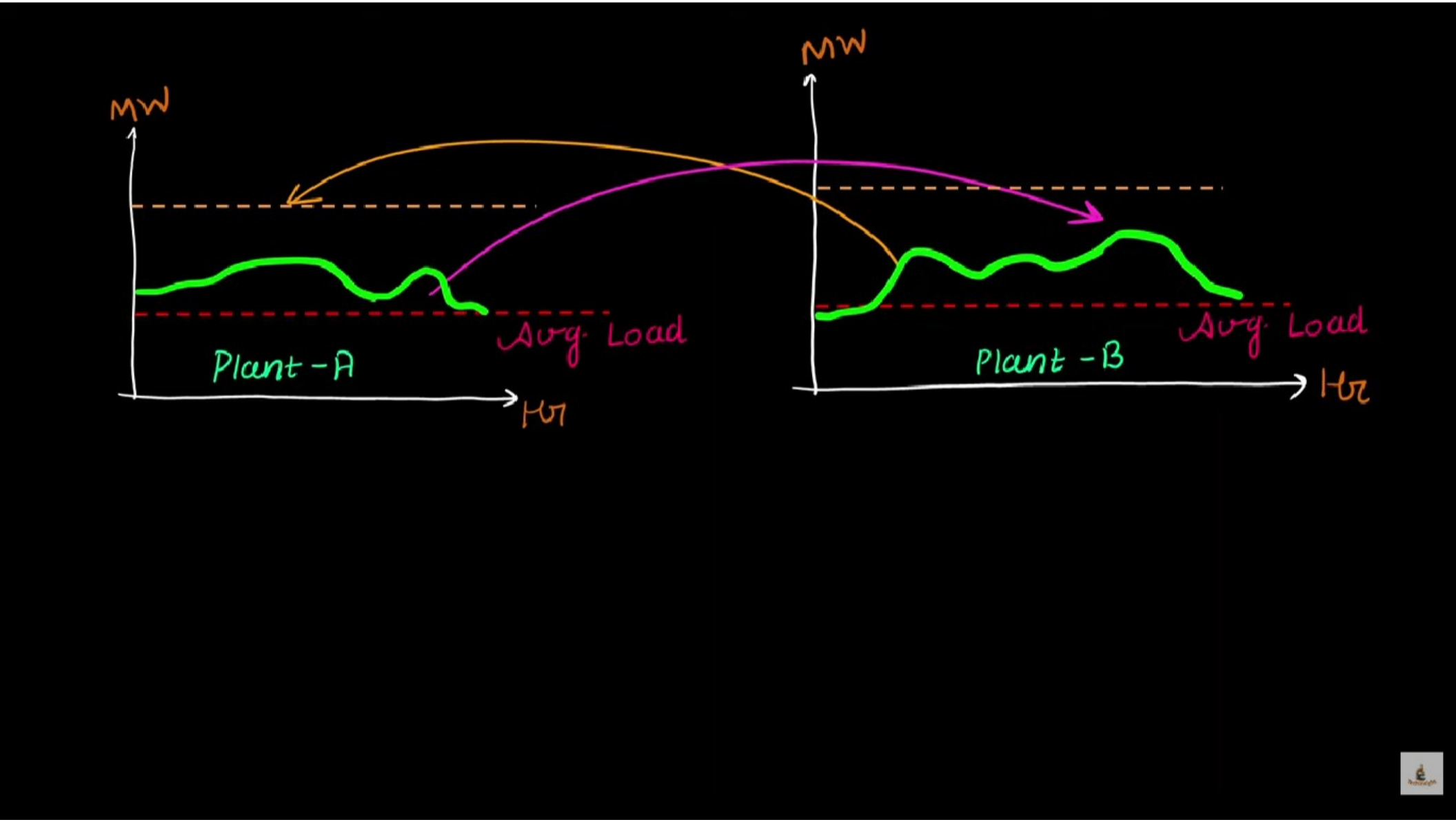
Poor

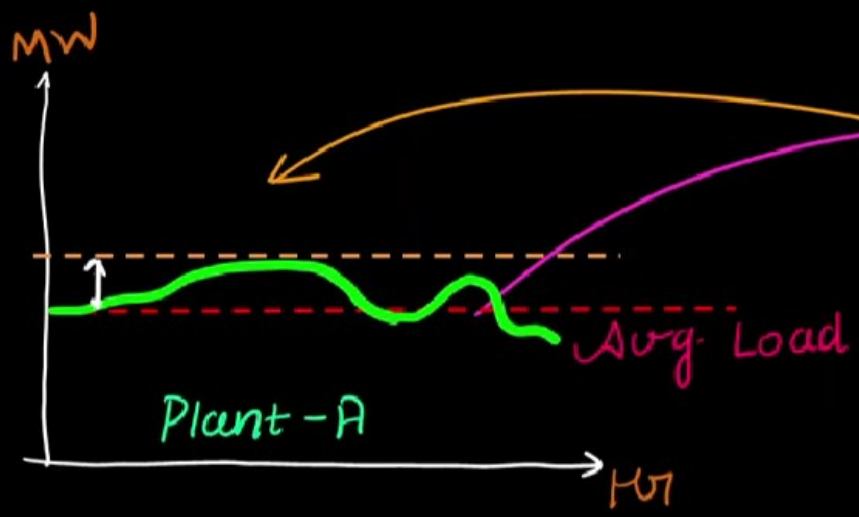
Higher the gap blw average load and max. demand

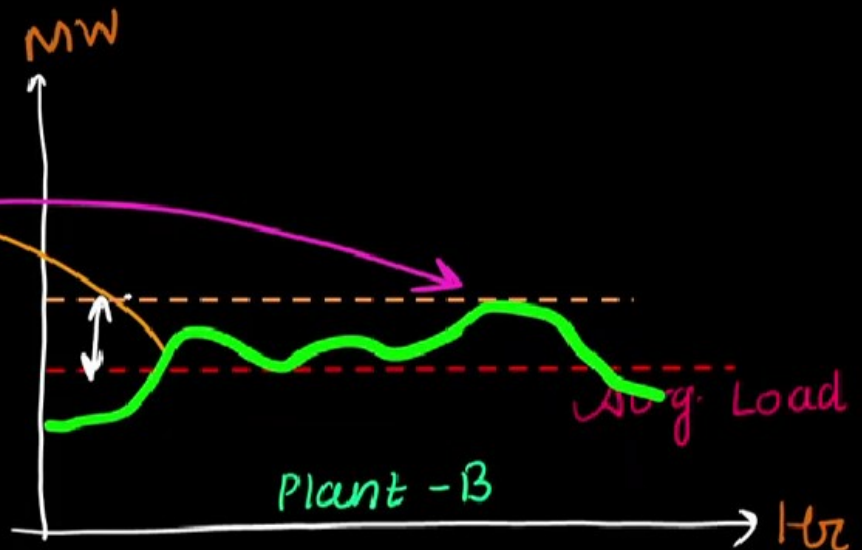
→ Poor the Load Factor






MW
Avg. Load
Plant - A
Hr
MW
Avg. Load
Plant - B
Hr





↑ Load Factor$_A$ = Avg demand ↑ / Peak demand ↓

↑ Load Factor$_B$ = Avg demand ↑ / Peak demand ↓

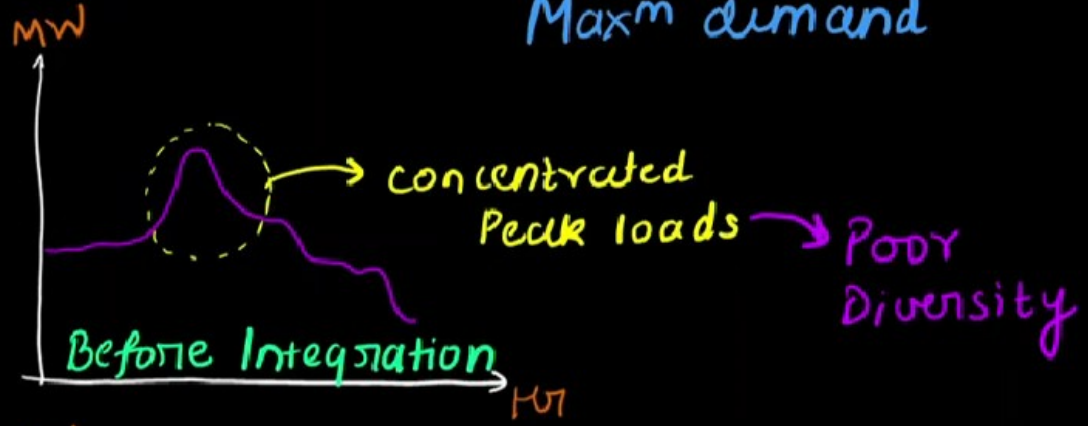
5. Increase Diversity Factor

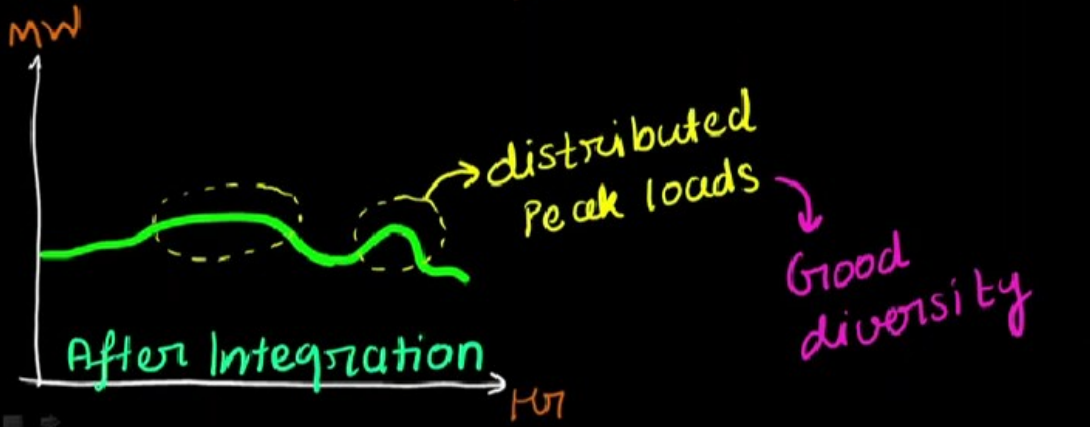
$$DF = \frac{\text{Sum of Individual maxm demand}}{\text{Maxm demand}}$$

→ depends on concentration of maxm demand

↓

Higher the concentration of peak load, Lower the diversity Factor, Poor the plant economy





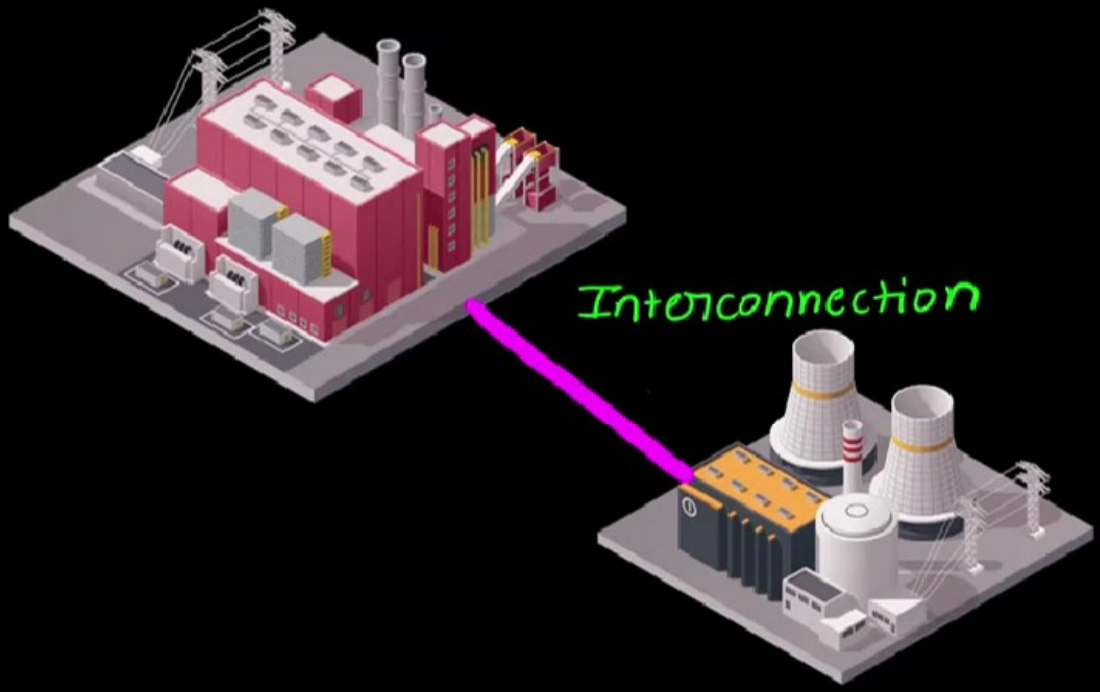
6. Reduce Plant Reserve Requirement

* **Reserve** → to meet sudden change in load demand or to meet peak load demand.

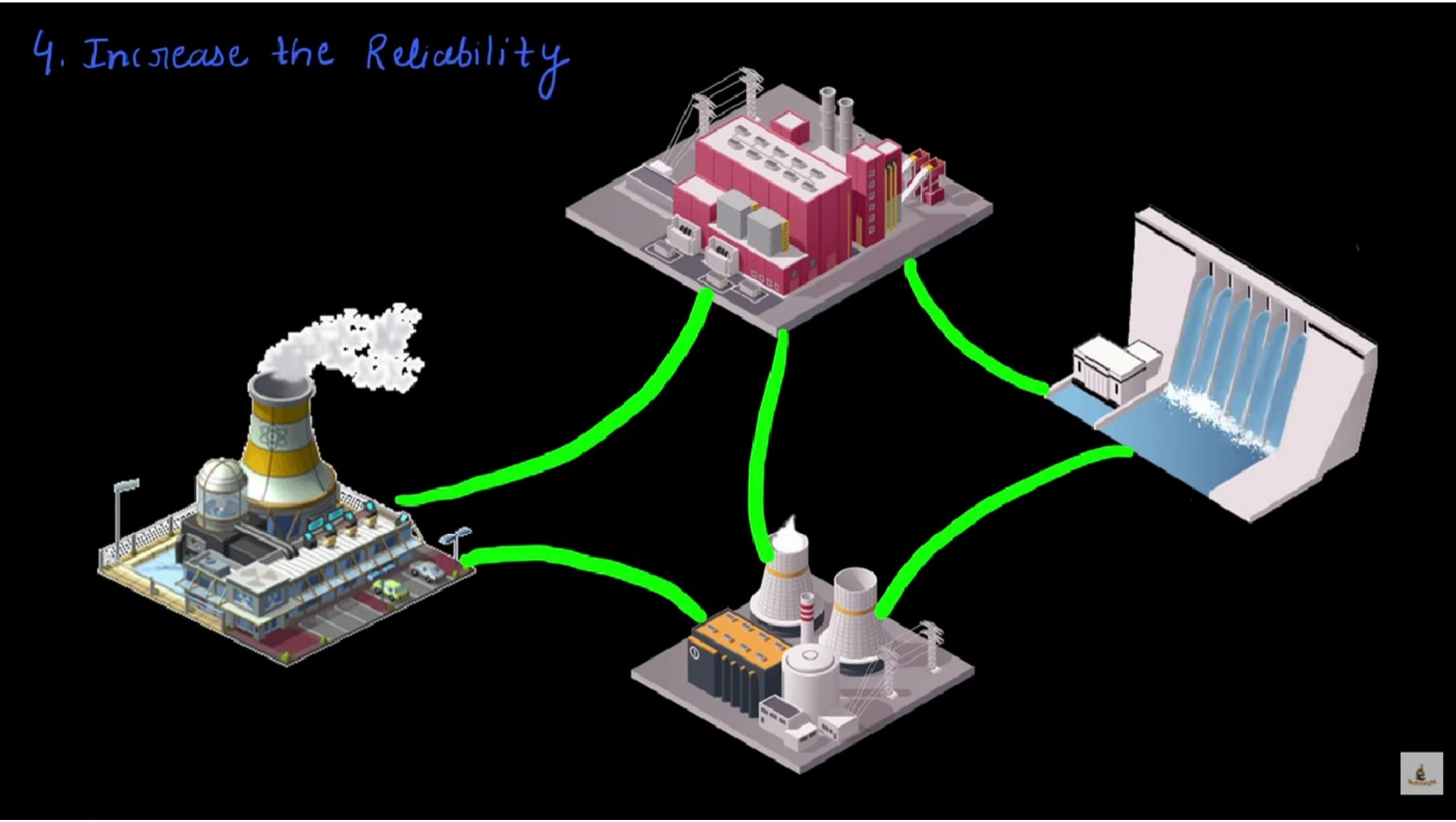
↓

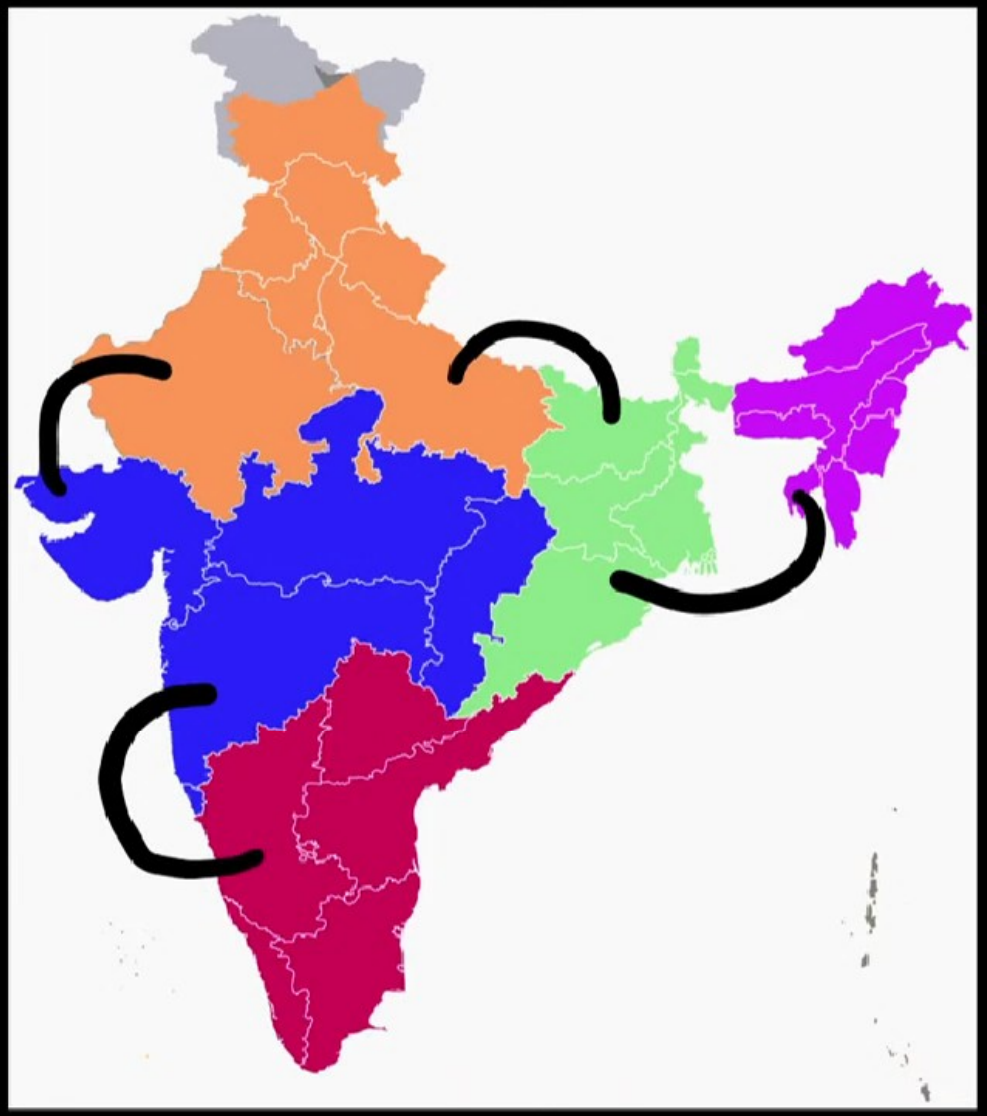
Fulfill by Interconnected System

As Reserve



4. Increase the Reliability





NATIONAL GRID INTEGRATION