



Control Systems

Imagination at work

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Control Systems story:

ONCE UPON A TIME WATER TO WIRE



ONCE UPON A TIME WATER TO WIRE.....

At home



More power request to the grid



ONCE UPON A TIME WATER TO WIRE.....

At dispatching center

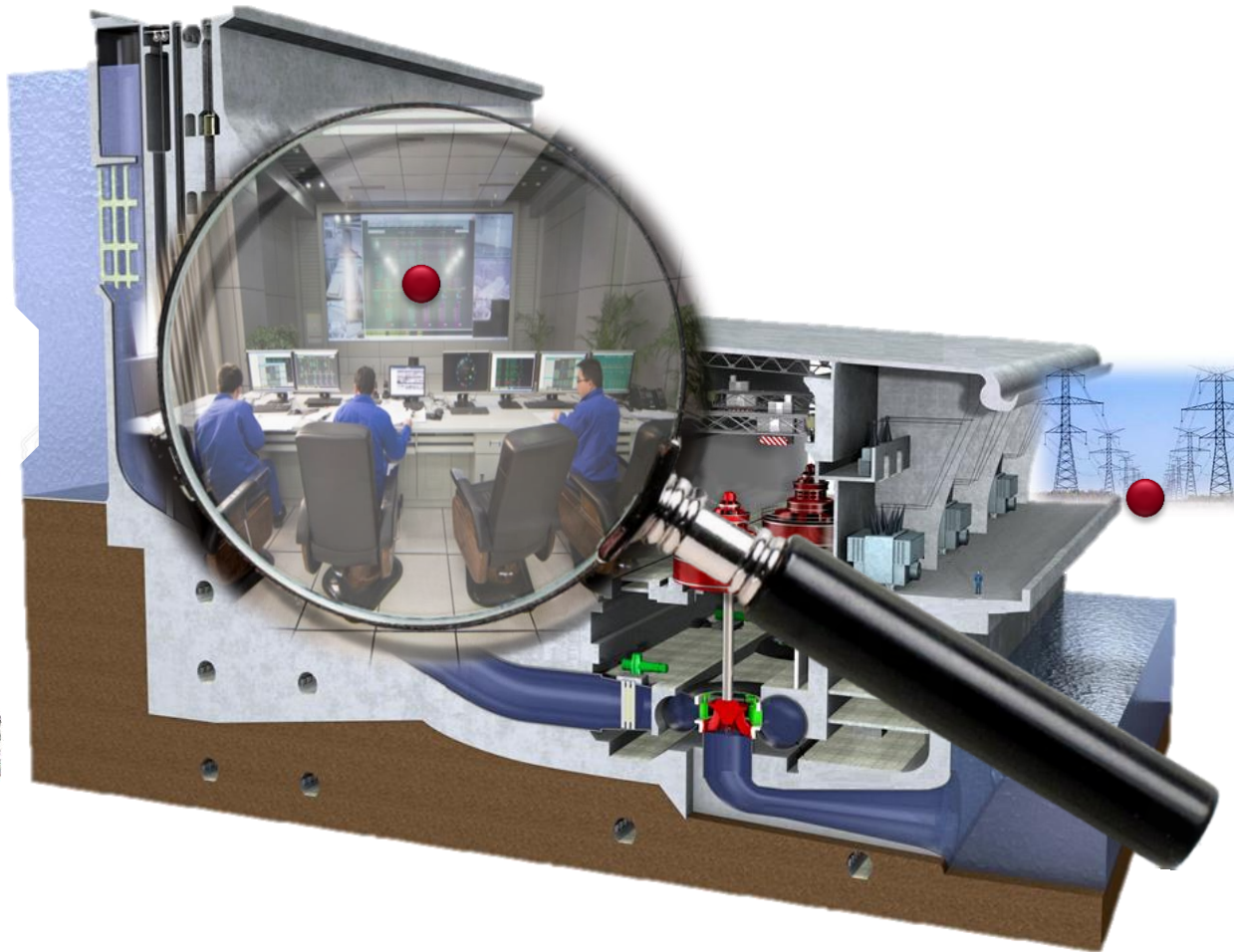


I need 150
MW more
on the grid



ONCE UPON A TIME WATER TO WIRE.....

At Power plant

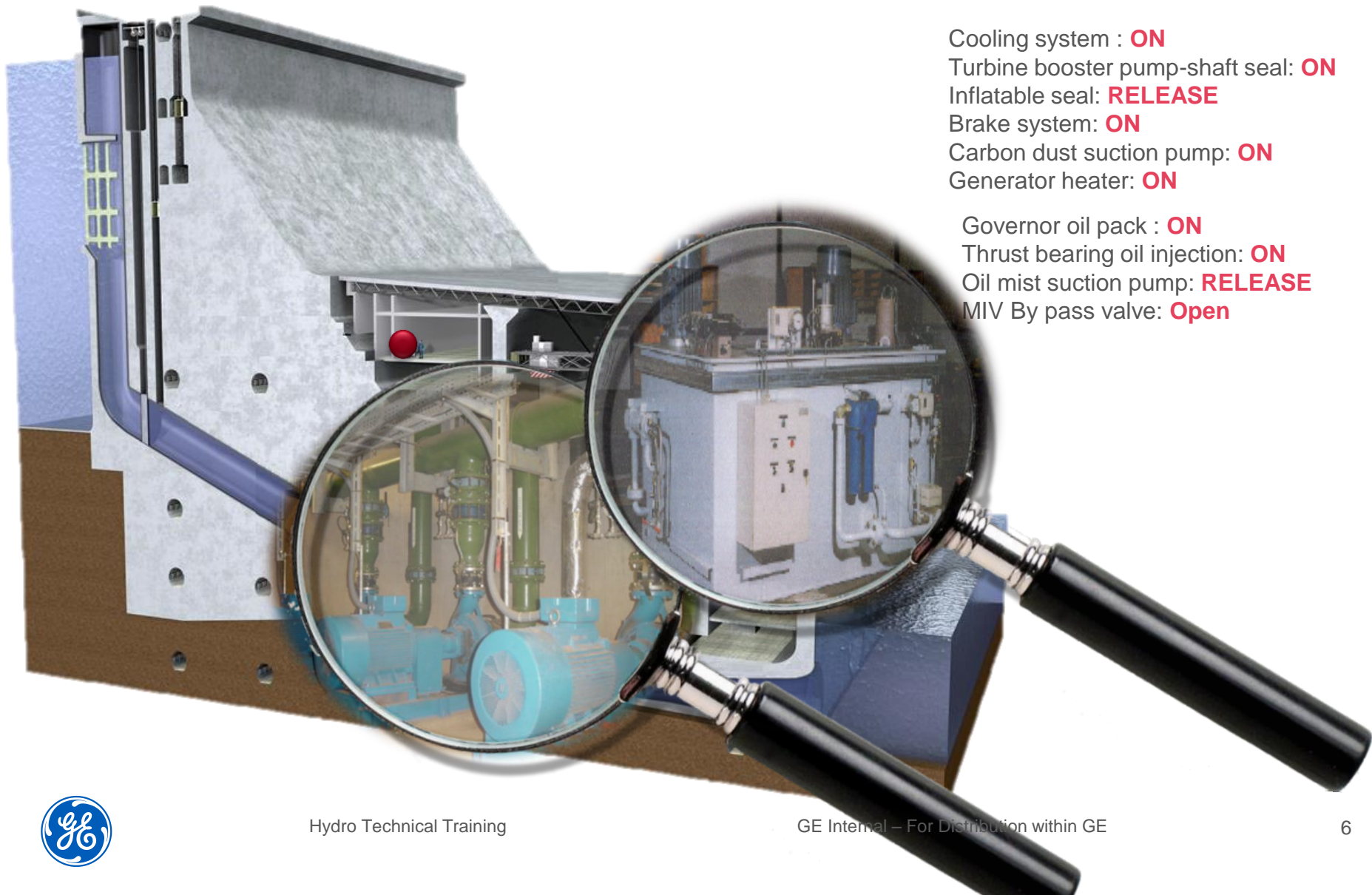


Order to start a unit with Set point



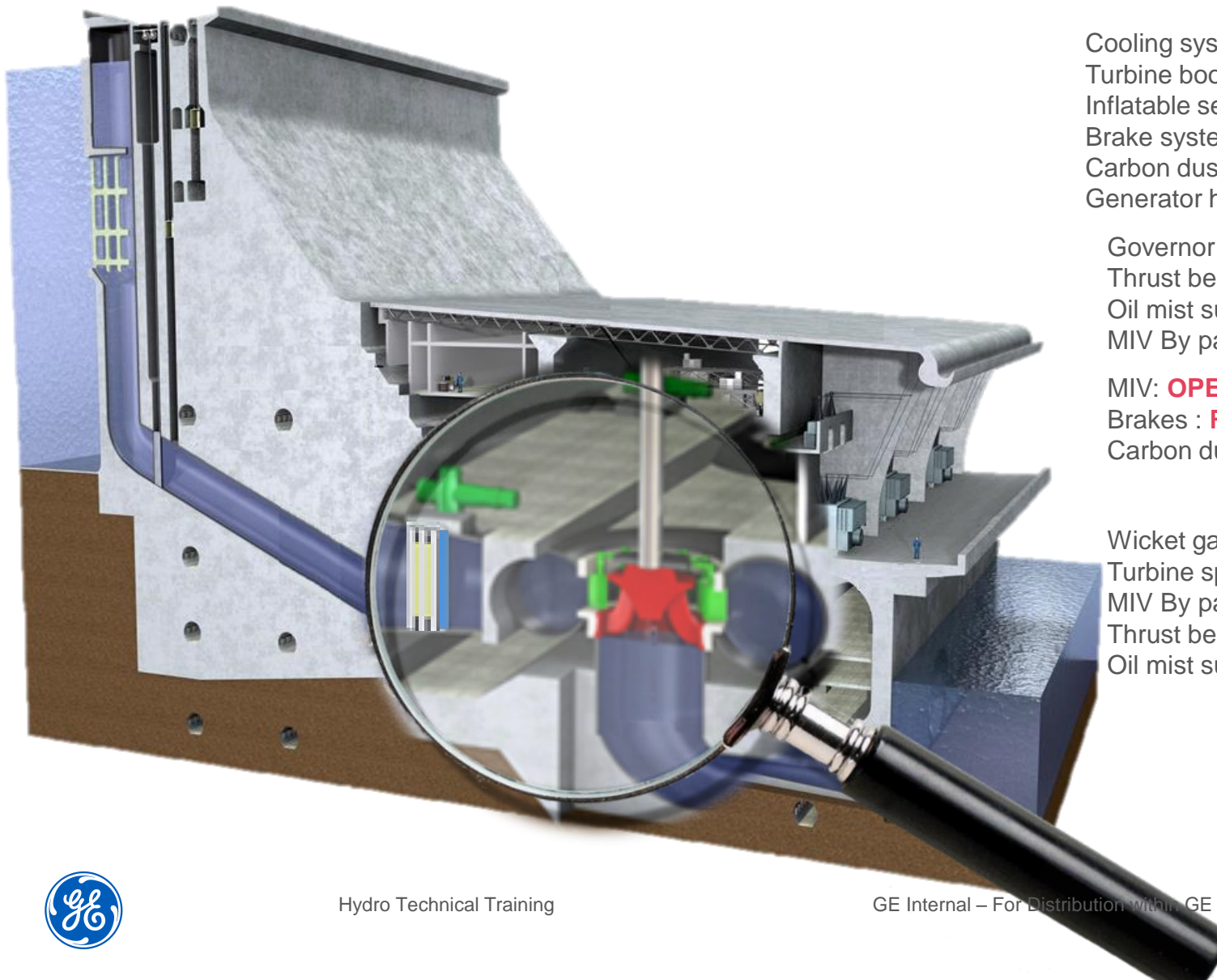
ONCE UPON A TIME WATER TO WIRE.....

Mode Stop to Speed No Load Not Excited



ONCE UPON A TIME WATER TO WIRE.....

Mode SNLNE to Speed No Load Not
Excited



Cooling system : **ON**
Turbine booster pump-shaft seal: **ON**
Inflatable seal: **RELEASE**
Brake system: **ON**
Carbon dust suction pump: **ON**
Generator heater: **ON**

Governor oil pack : **ON**
Thrust bearing oil injection: **ON**
Oil mist suction pump: **RELEASE**
MIV By pass valve: **Open**

MIV: **OPEN**
Brakes : **RELEASE**
Carbon dust suction pump: **OFF**

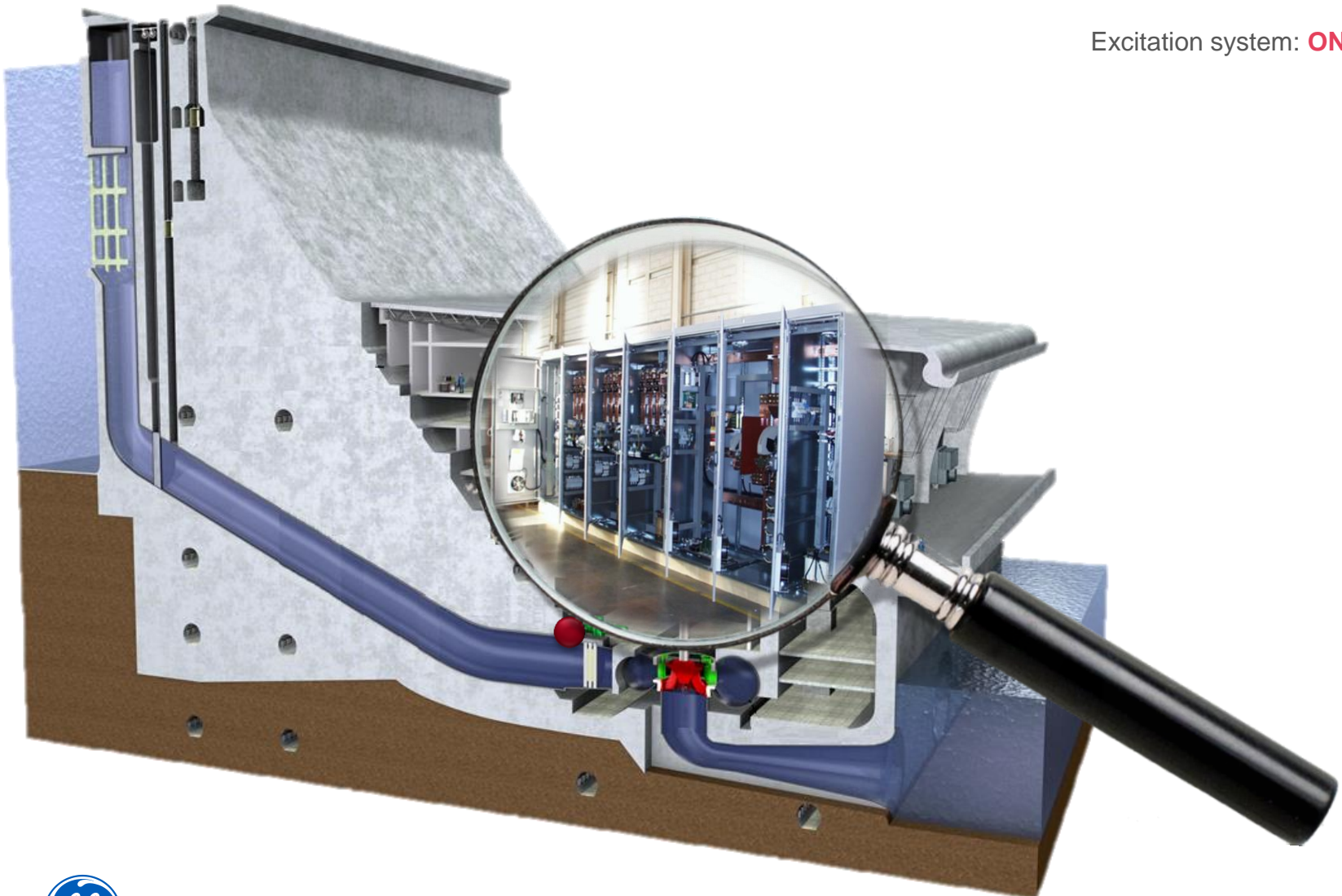
Wicket gates safety valve: **Energize**
Turbine speed load Governor: **ON**
MIV By pass valve: **Close**
Thrust bearing oil injection: **OFF**
Oil mist suction pump: **OFF**



ONCE UPON A TIME WATER TO WIRE.....

Mode SNLNE to Speed No Load Excited

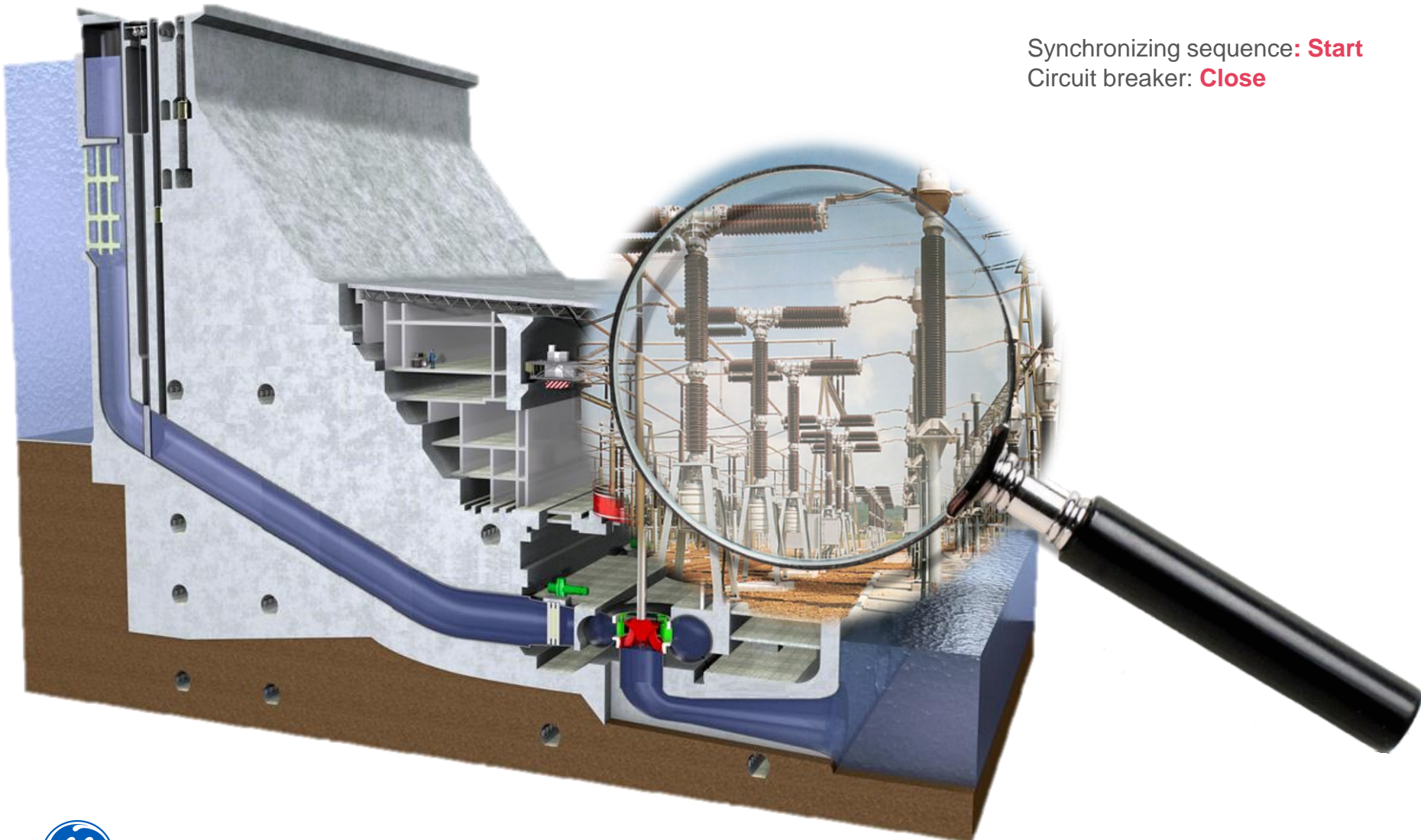
Excitation system: **ON**



ONCE UPON A TIME WATER TO WIRE.....

Mode SNLE to Generator

Synchronizing sequence: **Start**
Circuit breaker: **Close**



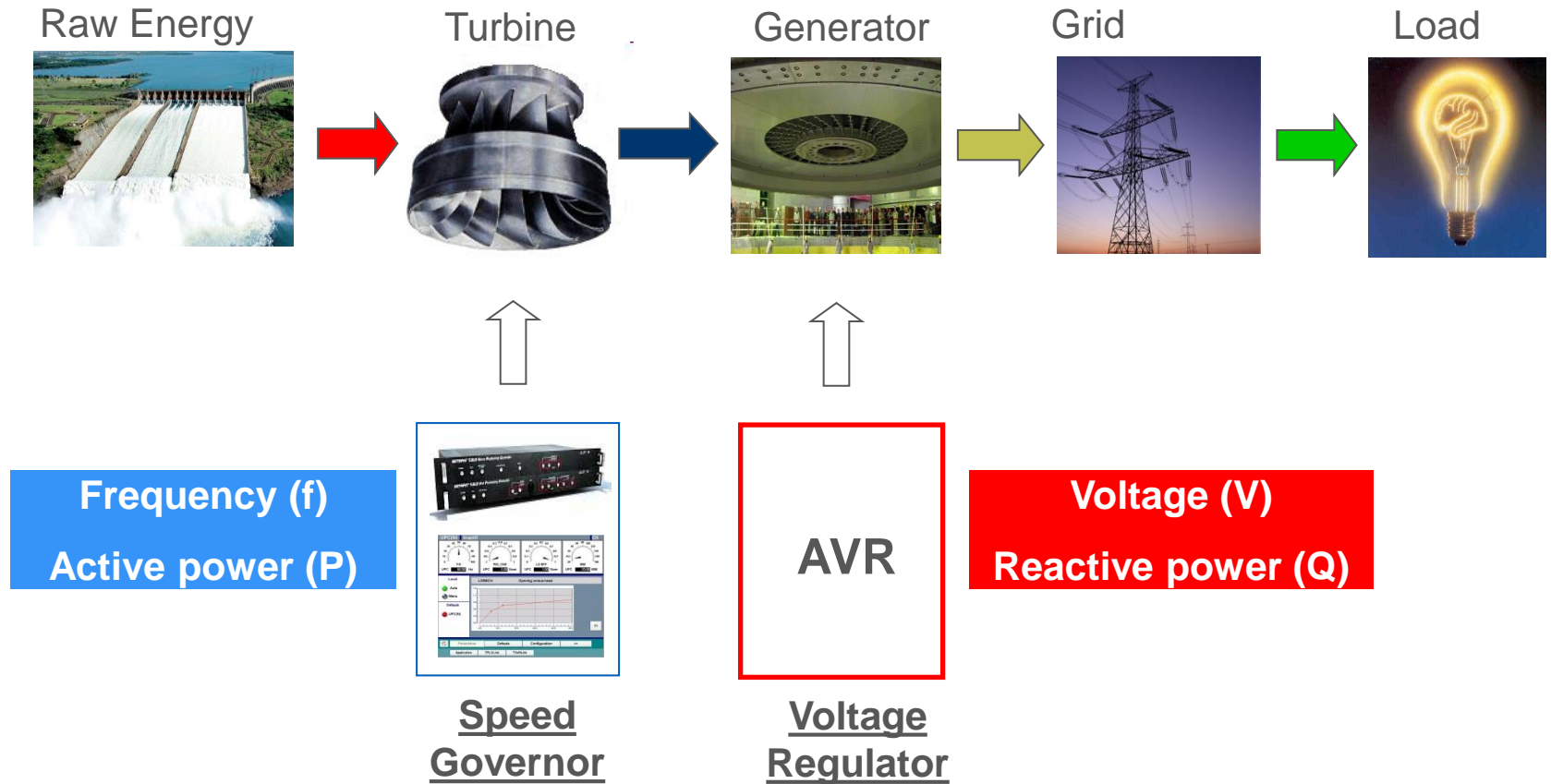
ONCE UPON A TIME WATER TO WIRE.....



General Overview



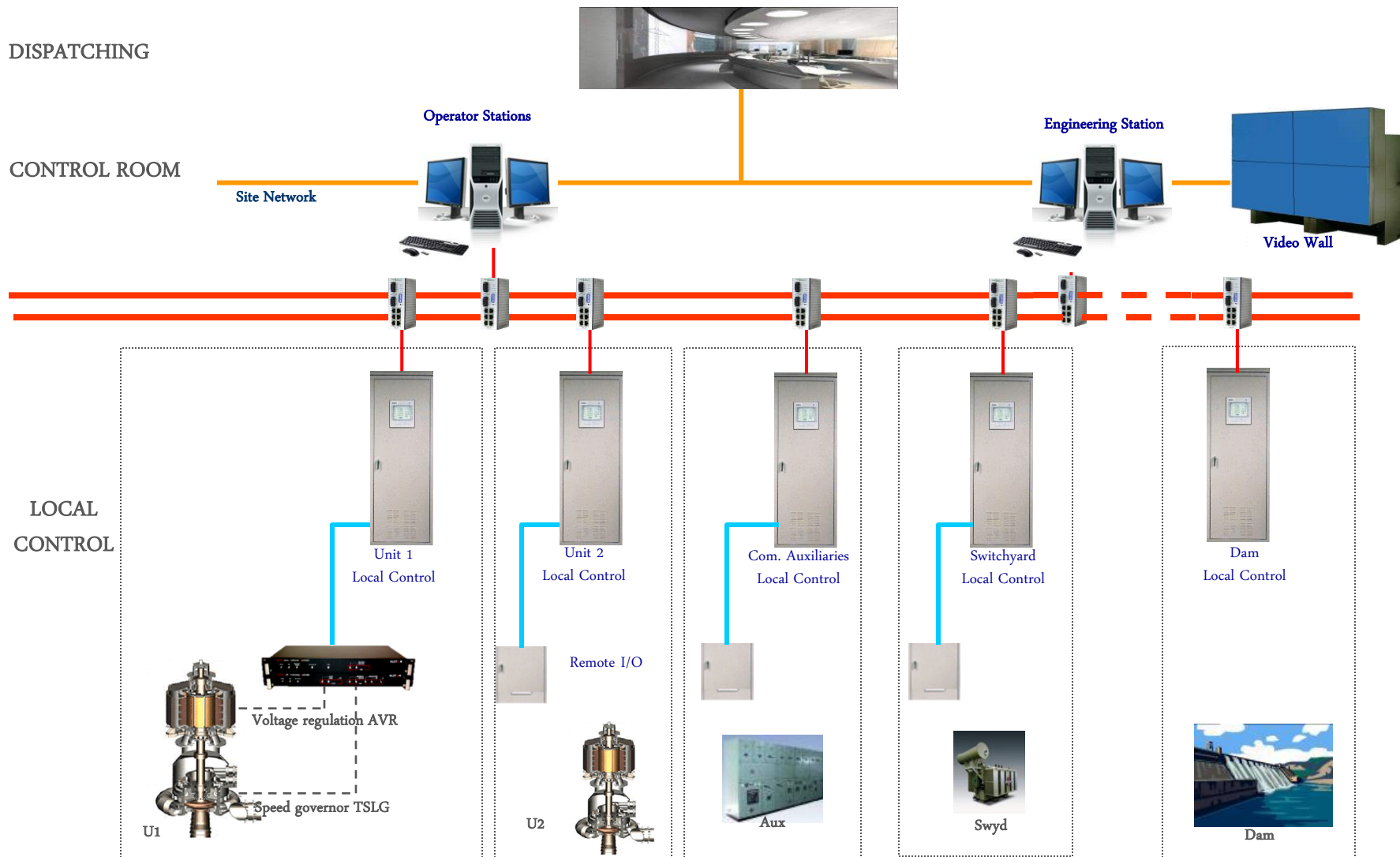
Hydraulic process



Control: Standard architecture

DISPATCHING

CONTROL ROOM



Control System lifecycle



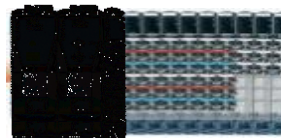
The lifecycle is mainly driven by PLC which are closed to PC lifecycle Very short compare to Turbine & Generator

Controls equipment is made with :

- Purchasing component from the market (PLC, electrical components, cubicle, cables,)
- Programming done internally (regulation models)
- Test (done internally)
- Commissioning (done at site)



Controller



Remote I/O



HUB



Control System Range of supplies



* Prices for material and engineering development.



Market Controls Overview – Competition

	Controls Only (without machine)	Turnkey (with machine)
Amount of project	K€	M€
Project Schedule	Few month	Few years
Number of competitors	5 to 10	3 to 5
Type of competitor	Major Hydro Players (Voith, Andritz) Major Automation Companies (ABB, Siemens, Emerson) Local Automation/ Engineering Companies	Major Hydro Players (Voith, Andritz) Consortium
Differentiator	<ul style="list-style-type: none"> • Plant integrator • Knowledge of Machine • Knowledge of Hydro Process 	



Market Controls Overview – Market Trends

- Customer drivers
 - Price
 - Performance
 - Systems Availability
 - More Flexibility & Reliability
 - Grid criteria evolution (strong contribution of Controls)
- Cybersecurity
- Remote Control
- Real time monitoring of the machine



