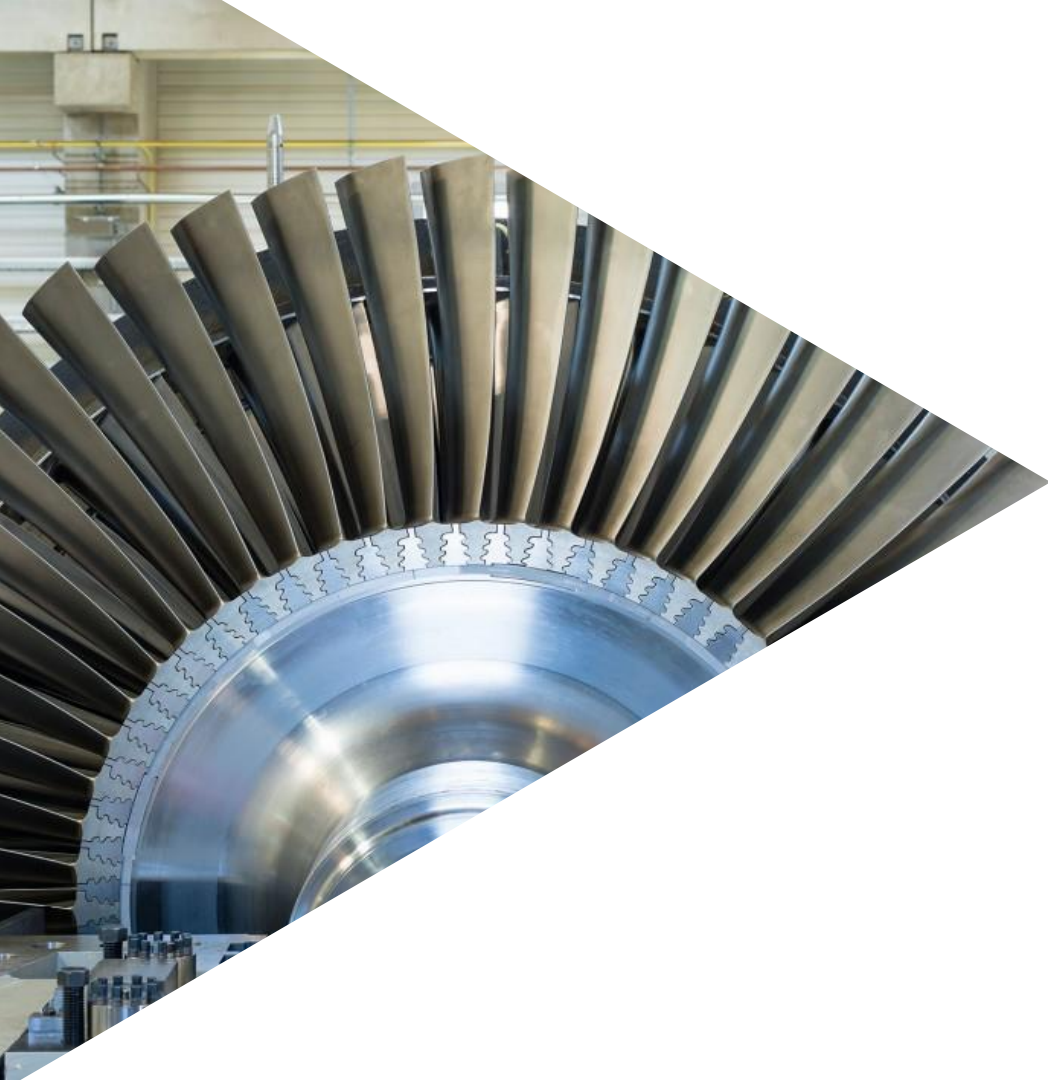


Steam Networks
Operation Assurance

inprocess

Simulation · Knowledge · Profit

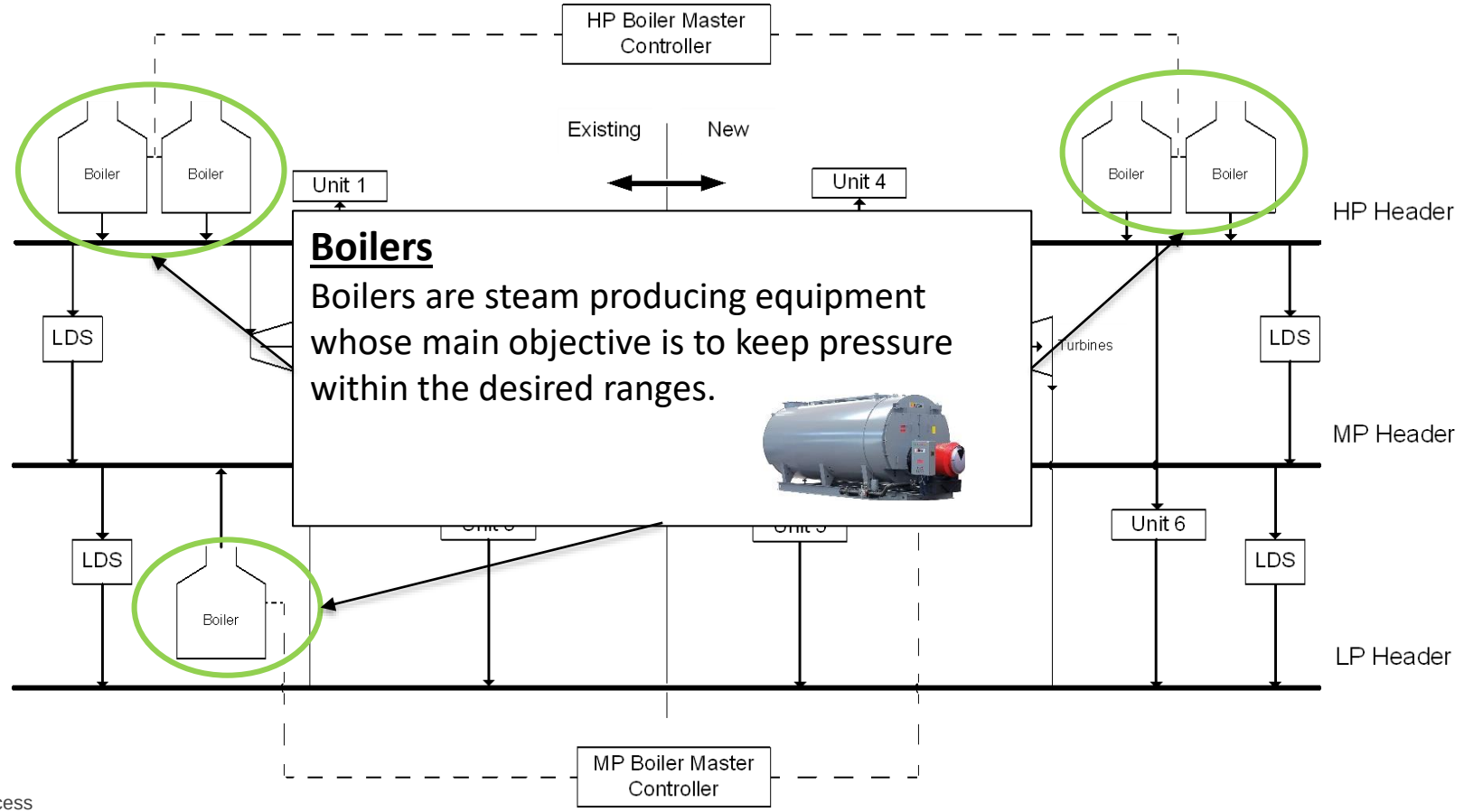
Introduction

Challenge: Avoid a turndown of the production or an emergency shutdown due to a spurious upset

Solution: Dynamic simulation, integrating the process control narrative, hydraulics and thermodynamics based on first principles

Benefits: Avoid economic losses by ensuring the operability of the steam network

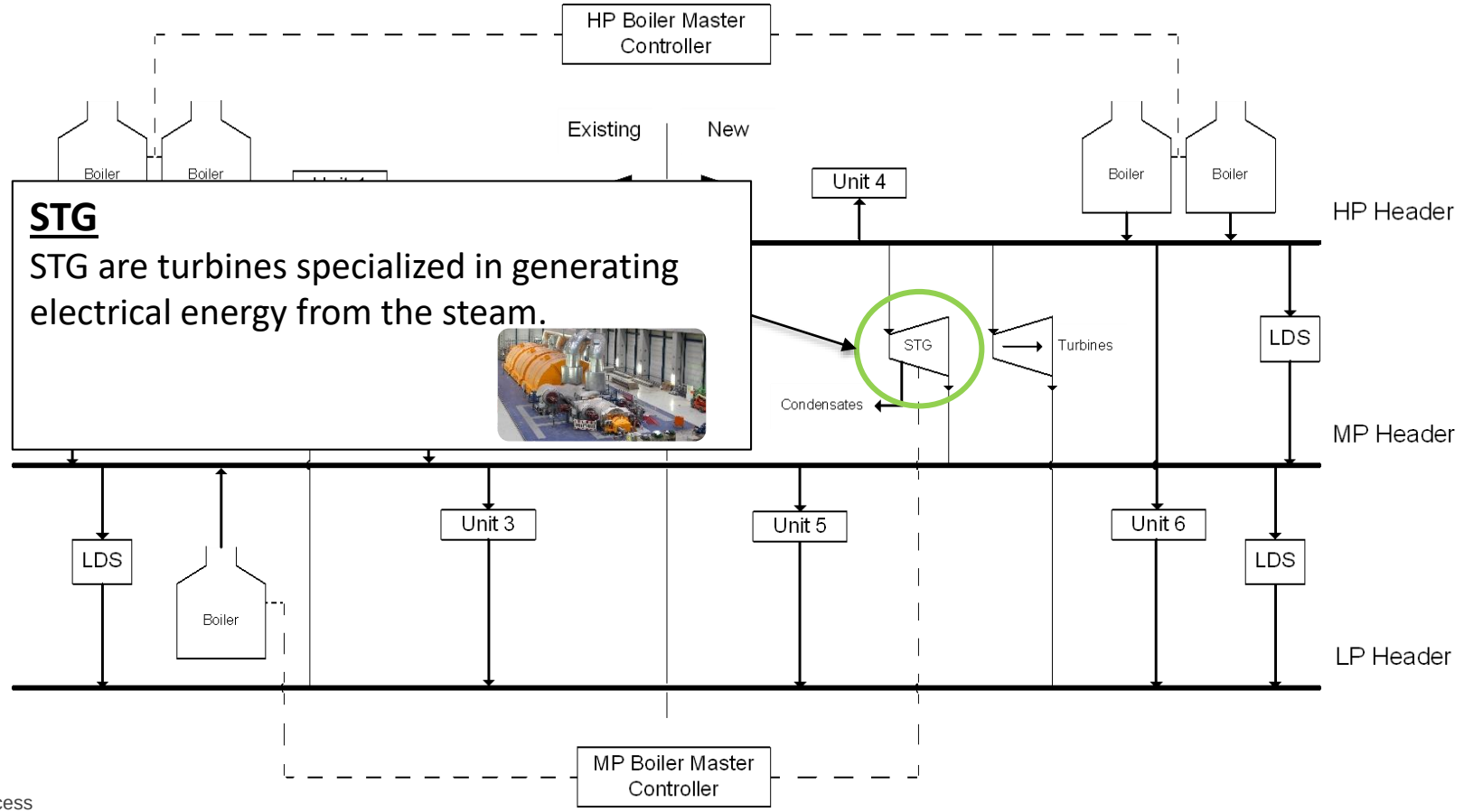
What is a Steam Network?



Boilers

Boilers are steam producing equipment whose main objective is to keep pressure within the desired ranges.

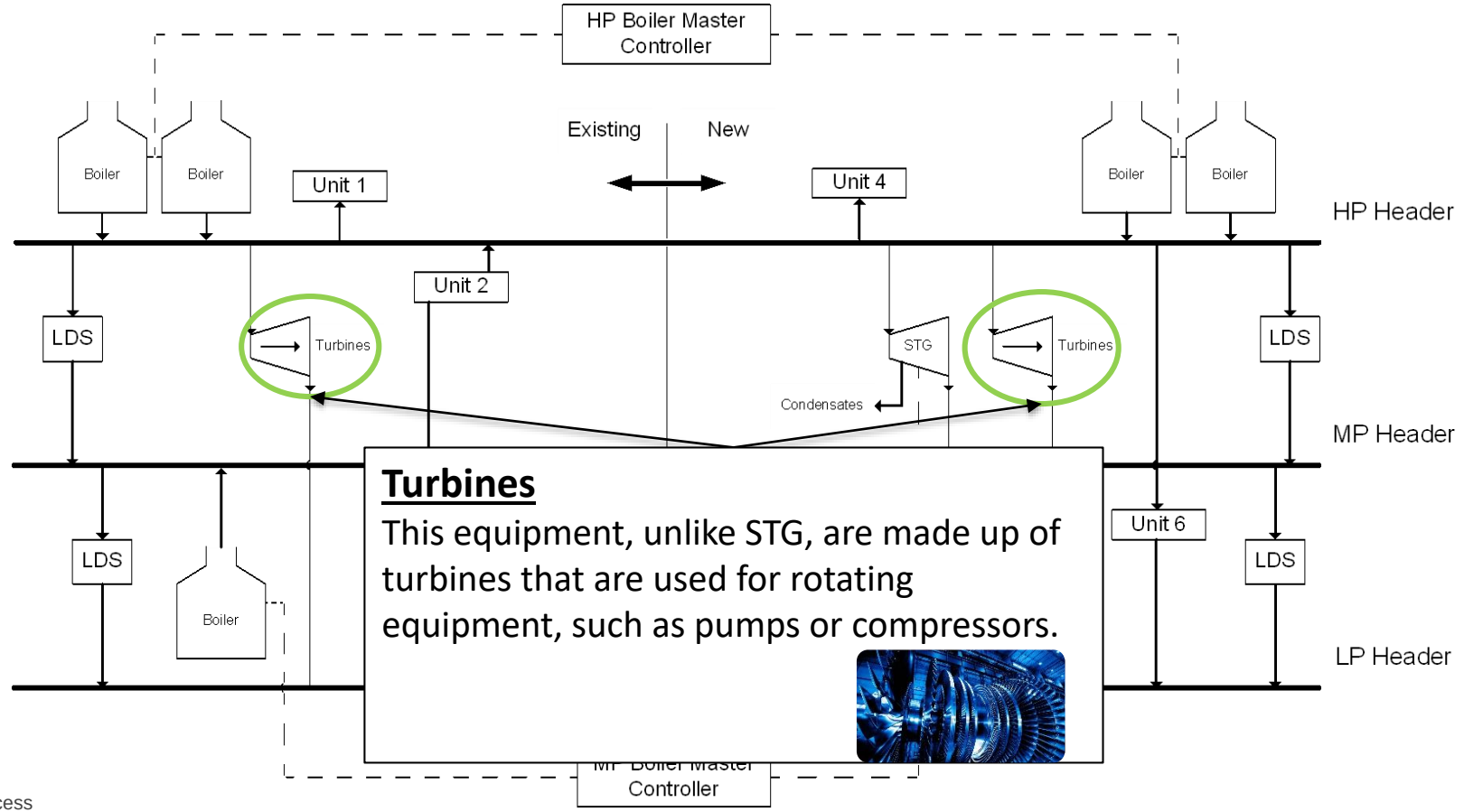
What is a Steam Network?



STG

STG are turbines specialized in generating electrical energy from the steam.

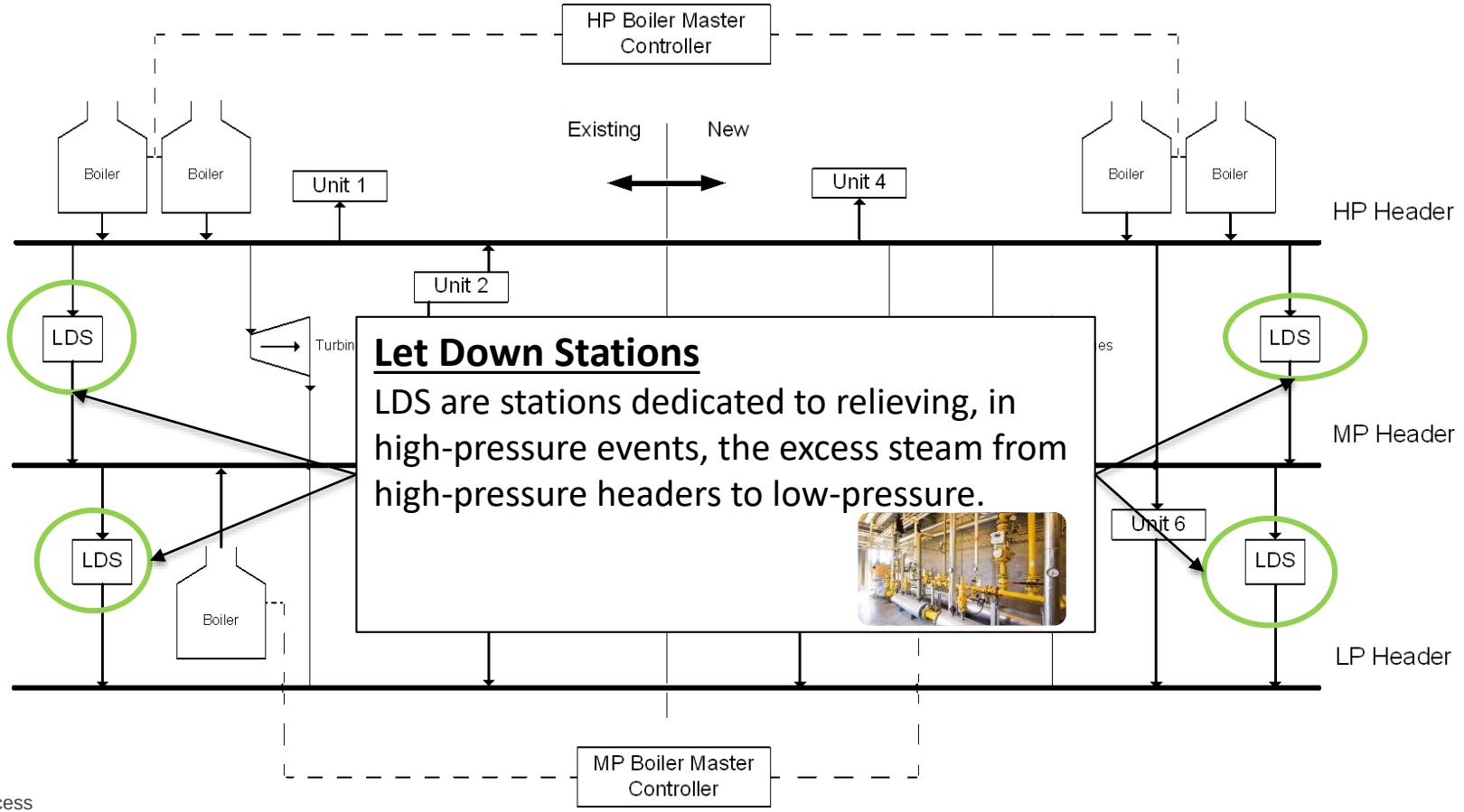
What is a Steam Network?



Turbines

This equipment, unlike STG, are made up of turbines that are used for rotating equipment, such as pumps or compressors.

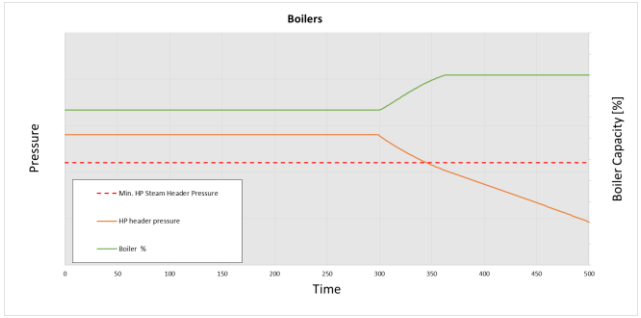
What is a Steam Network?



Let Down Stations

LDS are stations dedicated to relieving, in high-pressure events, the excess steam from high-pressure headers to low-pressure.

The challenge in context



Existing

New

LDS

Unit 1

Boilers

Unit 3

Boilers HP

Unit 2

Boilers HP

STGs

Unit 4

Unit 5

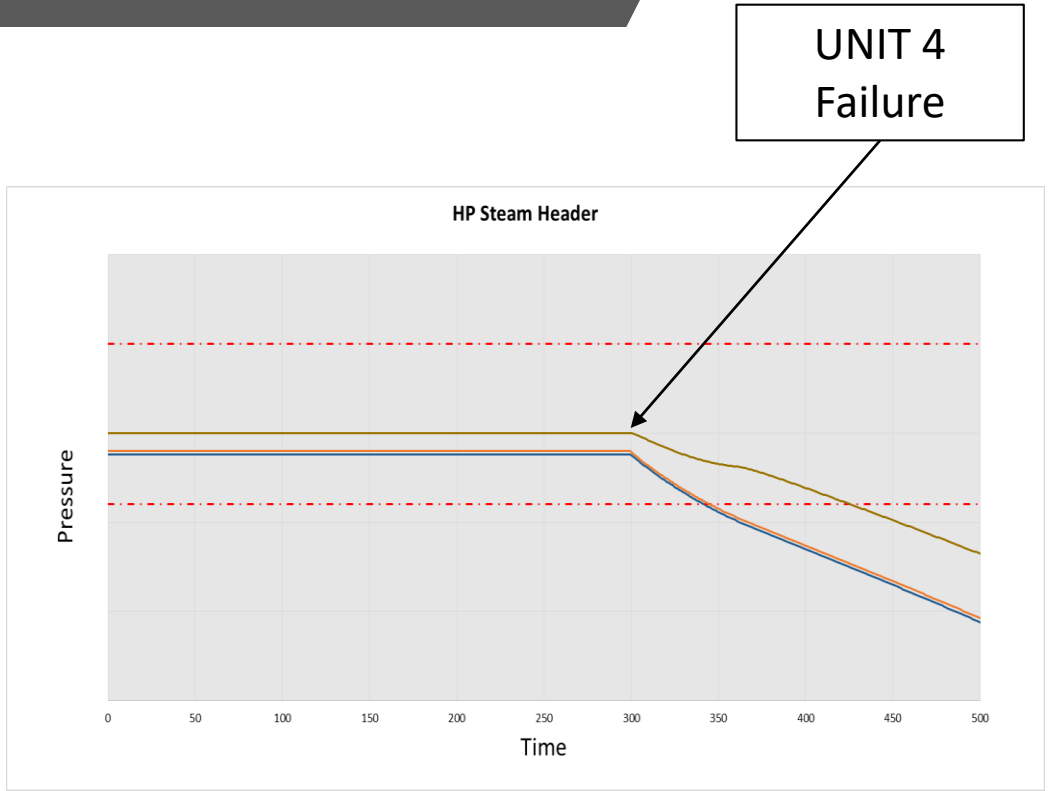
Unit 6

LDS

- Steam producer lost
- STG lost
- General Power Failure

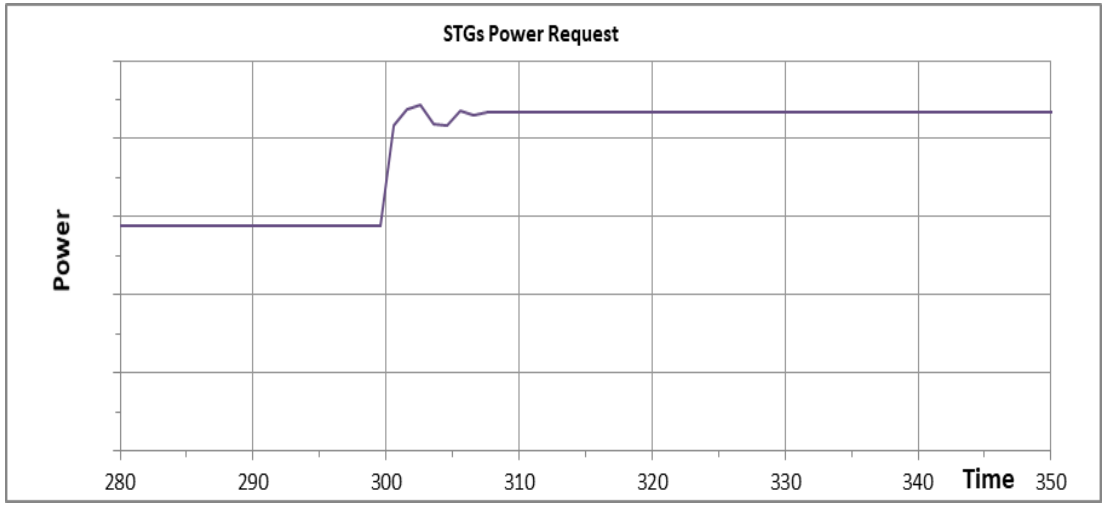
What happens if a steam producer is lost?

- The steam network tends to depressurize due to the lack of steam in the system
- Steam network control architecture should act and compensate it
- In case the control system does not respond quickly enough, or the system cannot supply that amount of steam, the network will depressurize down to minimum pressure values



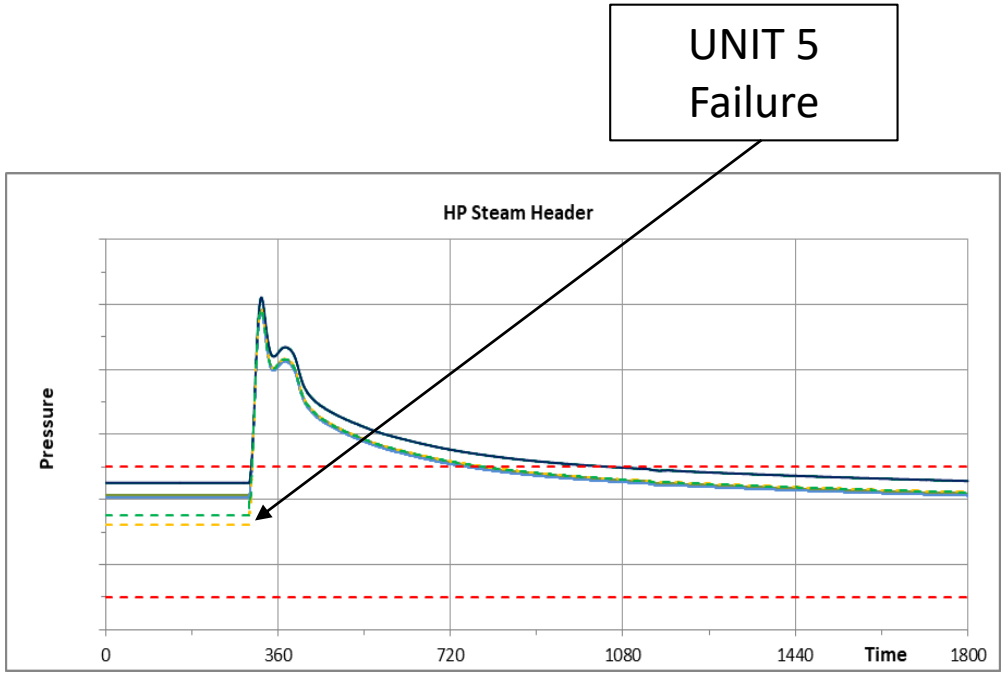
What happens if a STG is lost?

- The main effect of losing an STG is the loss of electrical energy production.
- Instabilities in the electrical network that the remaining STG may not be able to compensate for.
- A plant general power failure could happen if the system is not able to compensate the STG lost



What happens if a steam consumer is lost?

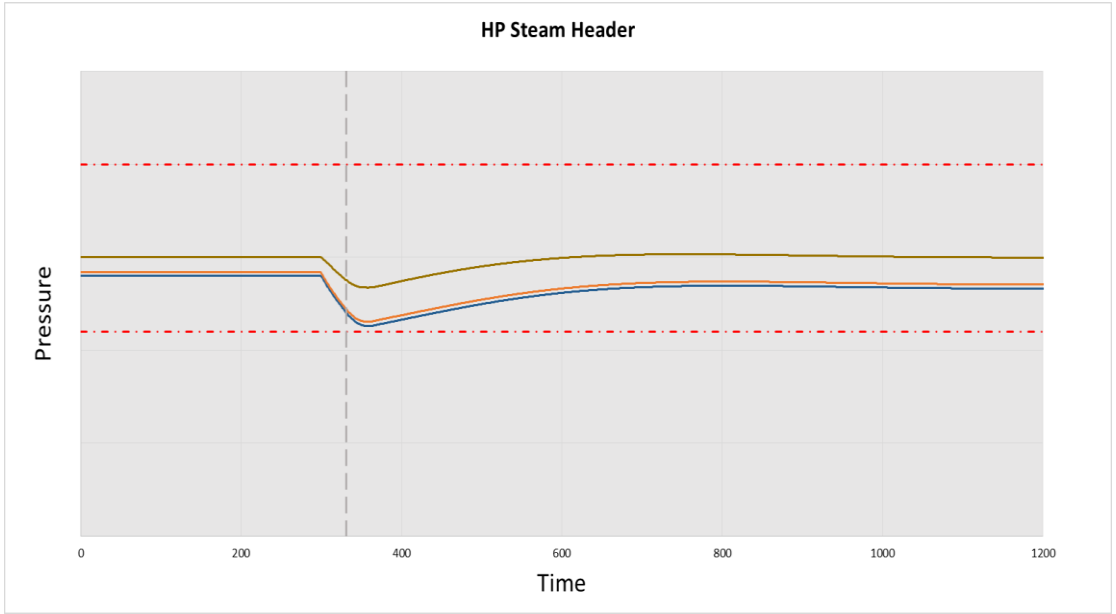
- The steam network has an excess of steam, increasing the network pressure.
- Control system has to redirect the excess to reduce the pressure (through let down stations).
- Boilers control should act reducing the production
- If let down stations and the boilers master controller have not been able to reduce the network pressure, high-pressure protection systems (vent controllers to atmosphere) will act.



What are the mitigations?

Dynamic simulation can analyze these side effects and each of the potential solutions

- Change the operating condition in the main header (HP)
- Check if other producers can replace the loss of the steam production
- Search the Set Point for the trip of one unit to maintain the pressure in the headers
- Improve the control narrative in order to mitigate the venting to the atmosphere or the flare



Why Inprocess?

Inprocess applies its huge experience using dynamic simulation to support Engineering and Operating Companies to minimize the impact of spurious upsets which could jeopardize the operability of your steam and electrical network

- Confirming that the system operates within the safety
- Guaranteeing the capability of control philosophy against process upsets
- Verifying the stability of the electrical network under STG's failures

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Thank you!!

Any Question?

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