



The Modernization of ILHA SOLTERIA HPP and JUPIA HPP in Brazil

August , 2018

The Modernization of ILHA SOLTERIA HPP and JUPIA HPP in Brazil

- Overview of CTG Brazil and Jupia and Ilha solteira power plant
- Main design considerations
- Key techniques and new viewpoints
- Conclusion and outlook

CTG Brasil

CTG has an installed capacity of 8,27GW



Created in
2013



2015

Acquisition of 49% of
11 Wind Parks: 161 MW
100% Salto (GO)
and Garibaldi HPP (SC): 308 MW
and TNE (Triunfo Negócios de Energia)

2014



Acquisition of
50% of Santo Antônio do Jari HPP (PA):
187 MW
50% of Cachoeira Caldeirão HPP (AP): 110
MW
33,3% of São Manoel HPP (MT): 233 MW

2016



Acquisition of Jupia and Ilha Solteira
HPP: 4.995 MW

Acquisition of Duke Energy Brasil
operations: 2.274 MW

CTG Brasil

Present in 10 Brazilian States

- **Headquarter and 2 regional offices**
- **17 Hydropower plants**
- **11 Wind Farms**

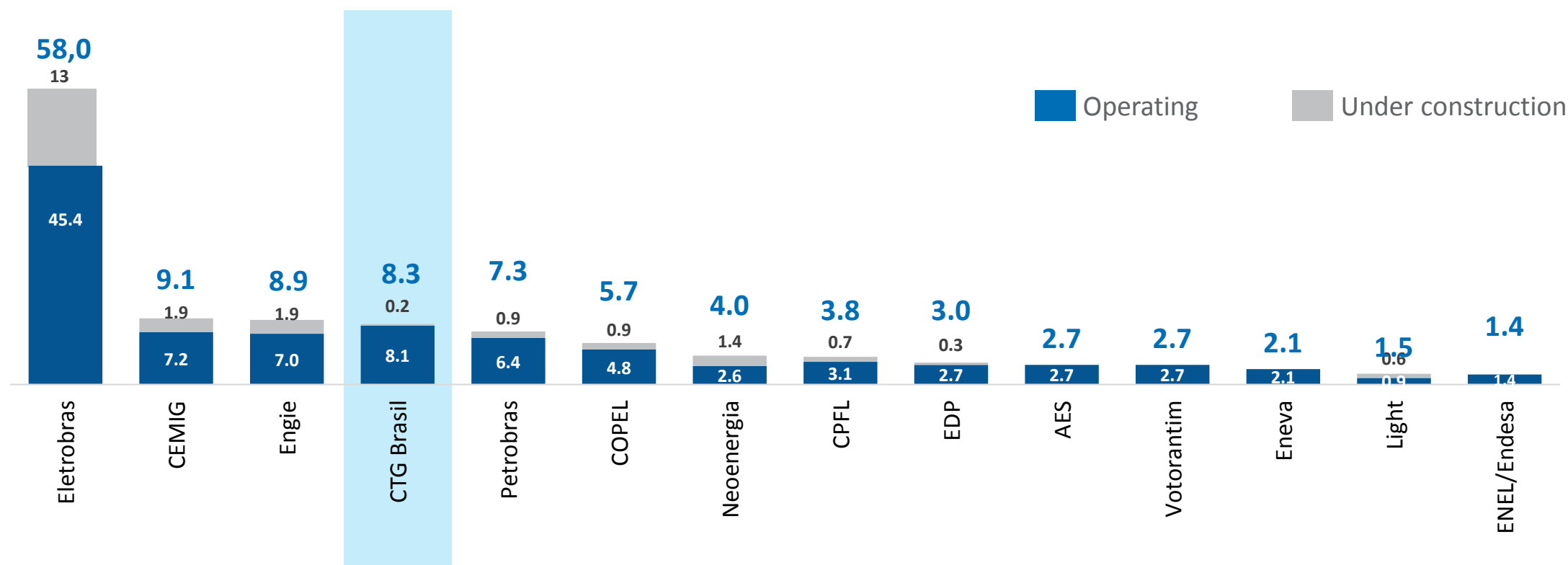


CTG Brasil

Ranking of generation companies in Brazil

CTG has become the second largest private energy producer in Brazil

Ranking of Generation Capacity (GW)



CTG Brasil



Mission

To provide clean energy to people through projects in harmony with the planet



Vision

To become a top tier clean energy group in Brazil



Values

Safety, Respect, Integrity, Happiness, Dedication, Simplicity and Excellence



CTG Brasil

Ilha Solteira Hydro Power Plant



Location

Paraná River, between SP and MS states



Installed Power Capacity

3.444 MW



Operations Beginning

July 1973



Concession Period finishing time

2046



Together with Jupiá power station, they form the **largest hydroelectric complex in the Southeast and Midwest**, with a total installed capacity of 4,995.2 MW



It produced, in 2017, energy to supply a city of about **4.2 million people**

CTG Brasil

Usina Hidrelétrica Jupia



Location

Paraná River, between SP and MS states



Installed Power Capacity

1.550 MW



Operations Beginning

1969



Concession Period finishing time

2046



It produced, in 2017, energy to supply a city of about **2.5 million people**



CTG Brasil



CTG Brasil

Jupiá and Ilha Solteira Modernization Plan

General Context

Jupia and Ilha Solteira HPPs: 45 years in operation

Jupia: since 1969

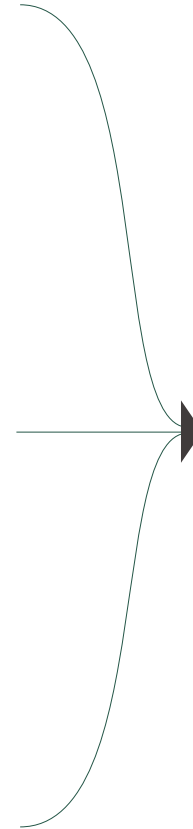
Ilha Solteira: since 1973

Few investments in the last 15 years

Inadequate investments: both OPEX and CAPEX

Obsolete assets with no reposition alternatives in the market

Rotating excitation system, Electromechanical protection system and governors, etc.

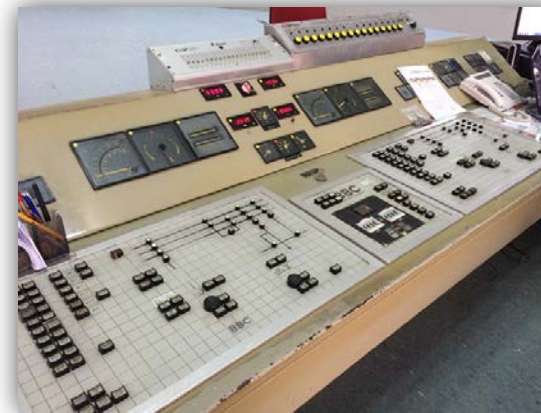
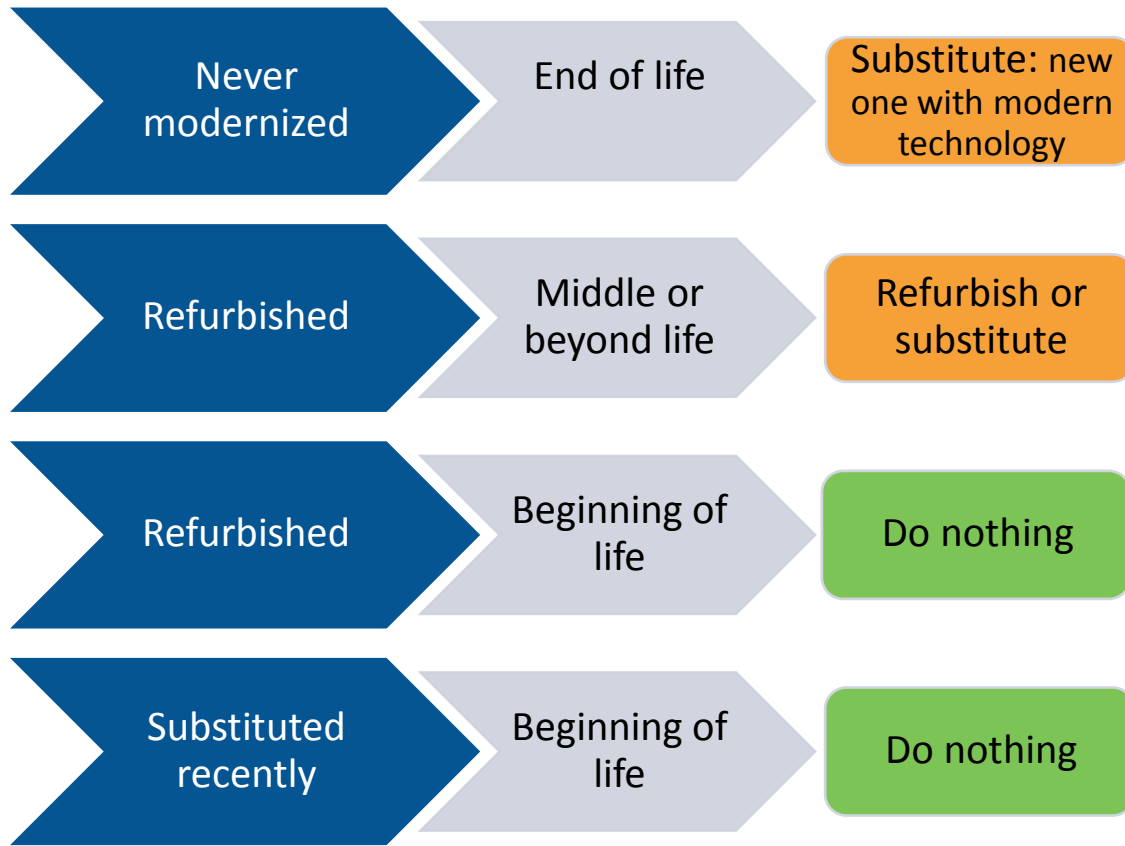


High Risk of Failure
Impact in the availability index (Regulatory)
Financial loss due to strict penalties

Jupiá and Ilha Solteira Modernization Plan

General Context

Systems, components and equipment have been technically evaluated to identify the modernization extension.
General criteria:



JUPIA AND ILHA SOLTEIRA MODERNIZATION PLAN

History about the HPP automation

Jupiá and Ilha Solteira

1. HPP original installation
 - Wall mimic and control table used for operation.
 - Analog control room, thousand of cables from power house to the operation room.



JUPIA AND ILHA SOLTEIRA MODERNIZATION PLAN

History about the HPP automation

Jupiá and Ilha Solteira

HPP original installation

- Conventional relay logic for start/stop units. Electromechanical protection system and governors.



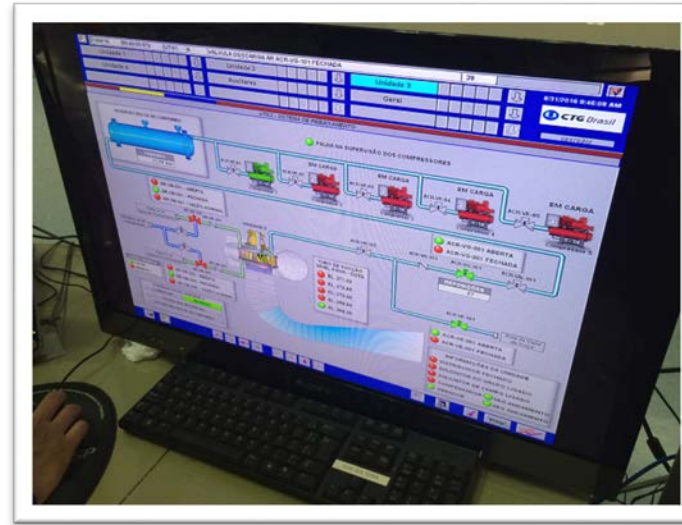
JUPIA AND ILHA SOLTEIRA MODERNIZATION PLAN

History about the HPP automation

Jupiá and Ilha Solteira

Isolated automation systems and modernization of protection system and governor

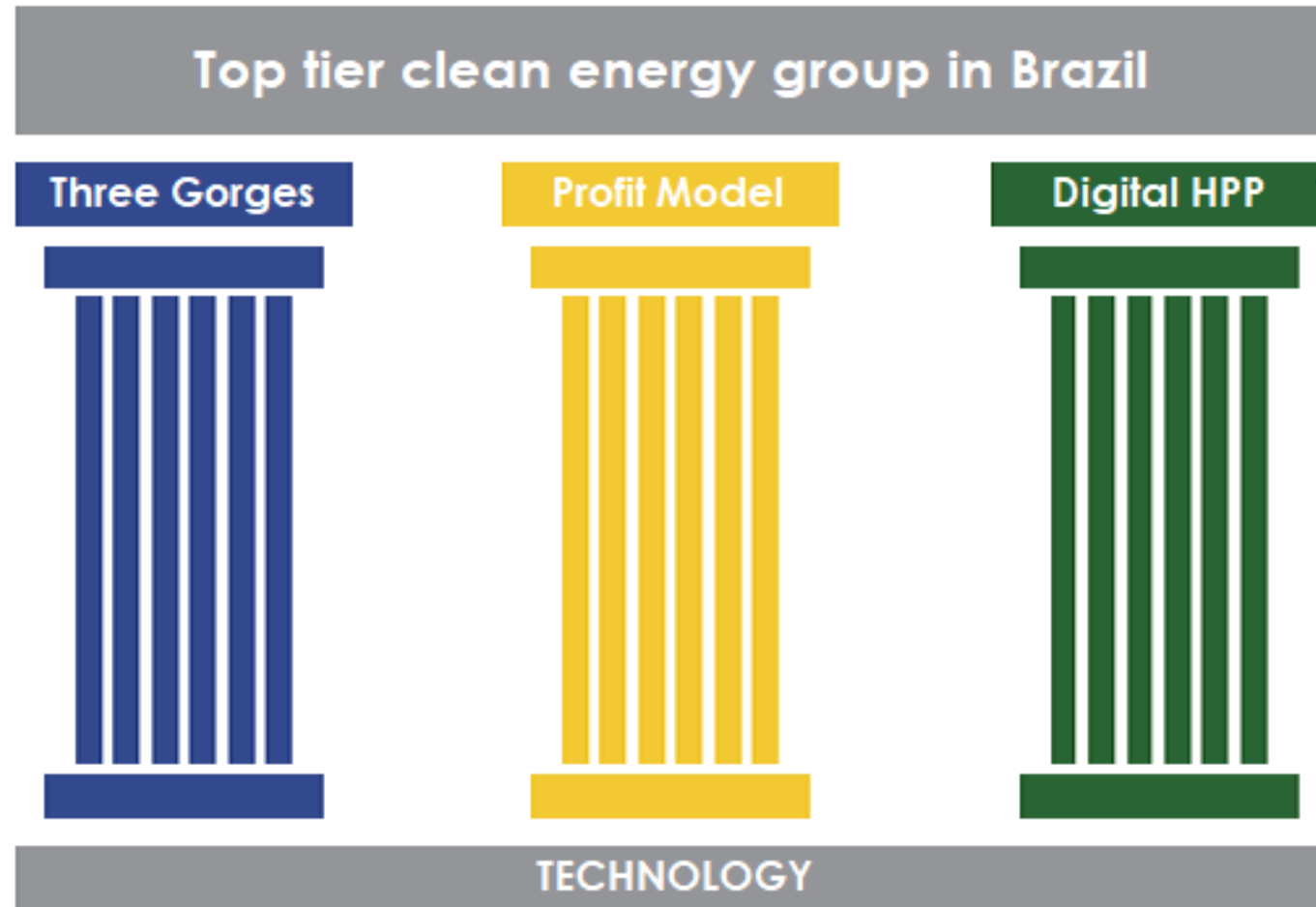
- Digitalization of some sub systems, such as Emergency Gate, Blow Down system, Temperature supervision system, reservoir level monitoring, etc.



JUPIA AND ILHA SOLTEIRA MODERNIZATION PLAN

Main Design Considerations – Highlights

Organization Strategy



JUPIA AND ILHA SOLTEIRA MODERNIZATION PLAN

Main Design Considerations – Highlights

Organization Strategy

CTG Brazil is the spokesman of the Three Gorges Group in Brazil for the technology, quality and brand.

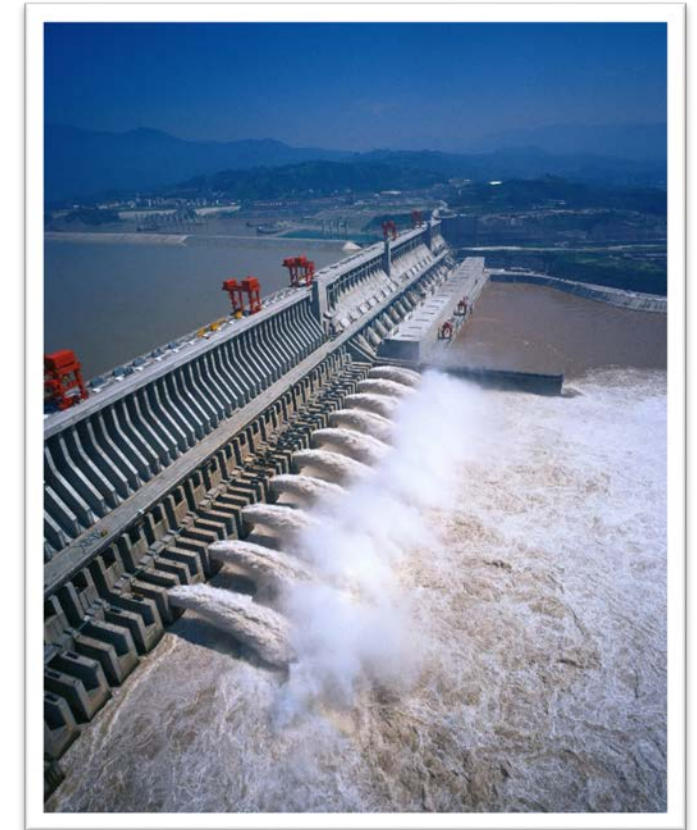
Diagnosis Operation

Analyze the operation trend, finding potential equipment defects

Lean Maitenance

Determines the maintenance scope and frequency base on equipment status

“Zero Unplanned Outage”

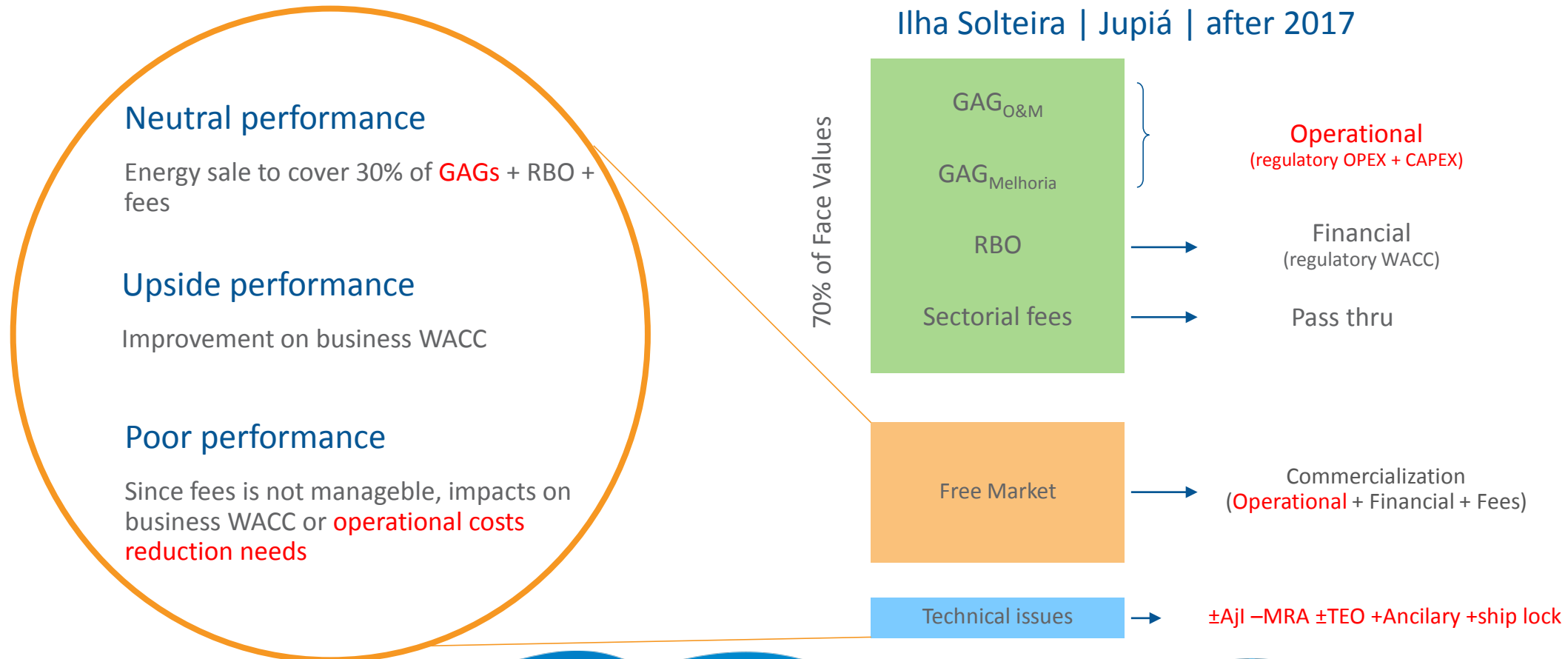


JUPIA AND ILHA SOLTEIRA MODERNIZATION PLAN

Main Design Considerations – Highlights

Organization Strategy

The profit model of the Brazilian electricity market determines that the company's profit growth point comes from improving efficiency and reducing unnecessary expenses.



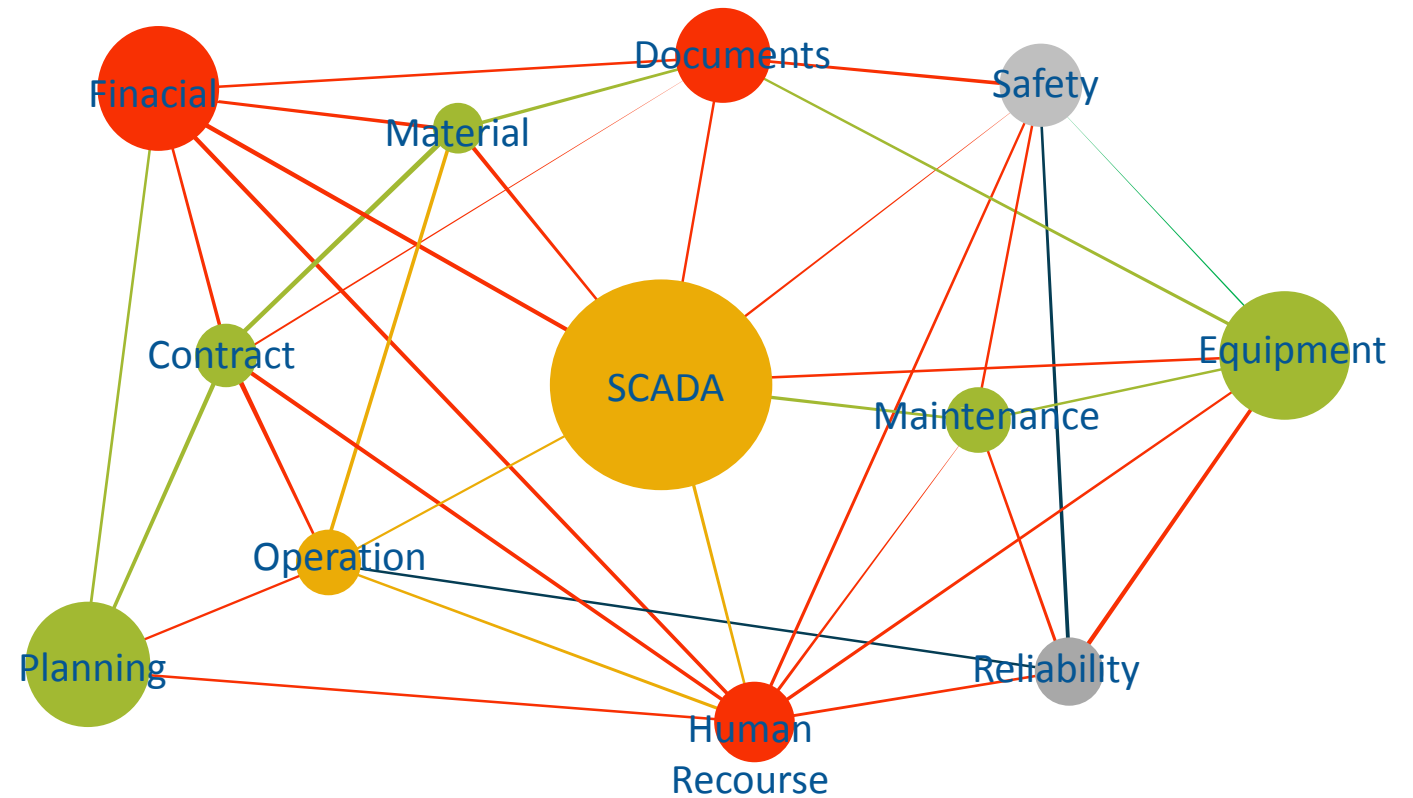
JUPIA AND ILHA SOLTEIRA MODERNIZATION PLAN

Main Design Considerations – Highlights

Organization Strategy

The digital HPP digitalization and modernization will promote the overall management efficiency of the company.

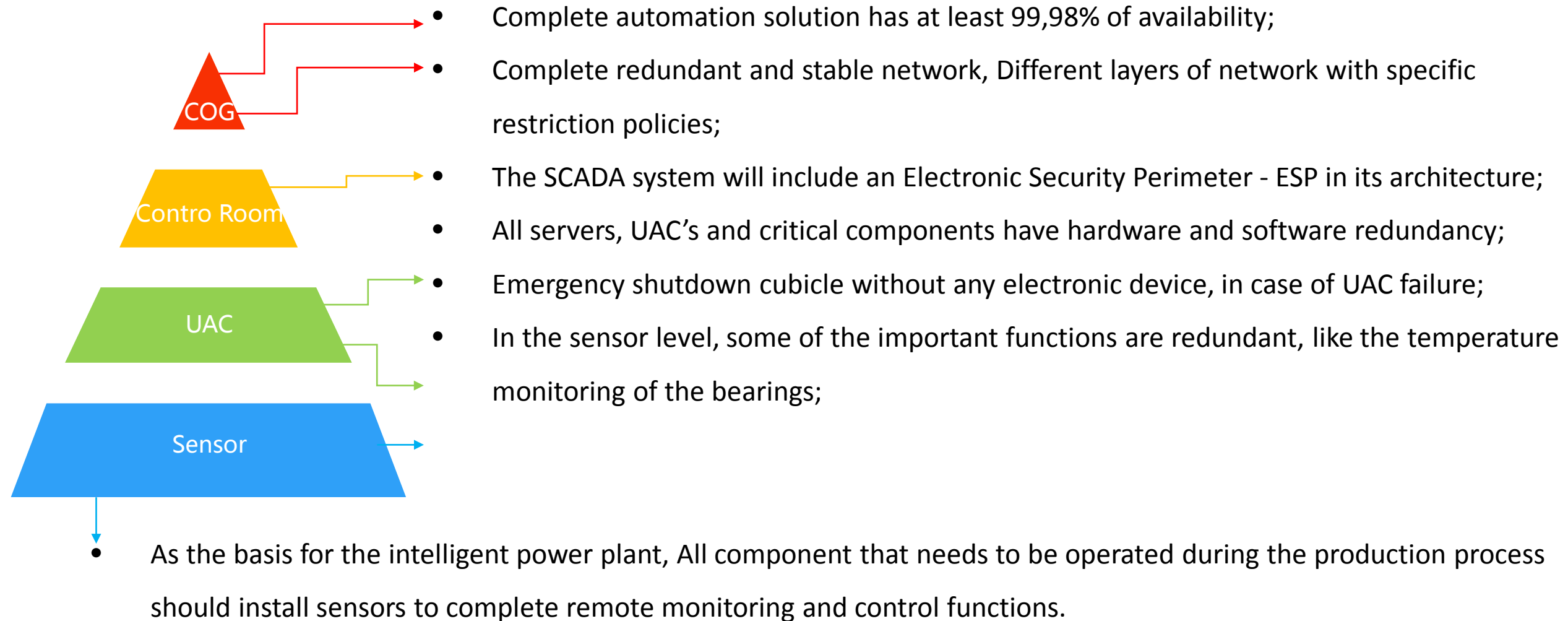
As the main data source platform for power production, the SCADA system will continuously provide comprehensive and accurate data for the company, establish a consistent relationship between site-operation and the company operations, and build a bridge between IT and OT.



JUPIA AND ILHA SOLTEIRA MODERNIZATION PLAN

Key techniques and new viewpoints

High reliability and network security of the Digital-based SCADA system



Key techniques and new viewpoints

Intelligent Management

The target is to reduce the labor intensity of personnel and improve operational efficiency through the implementation of intelligent monitoring and control functions, For Instance:

- Convenient tool kit for the operation;
- One button start / stop unit;
- Automatic power and voltage adjustment through AGC/AVC;
- Automatically switch redundant devices periodically;
- Joint control with fire-fighting system and CFTV system;
- Automatic alarm management,
- The analysis report is automatically generated and sent to the relevant person's mailbox.
- Etc.

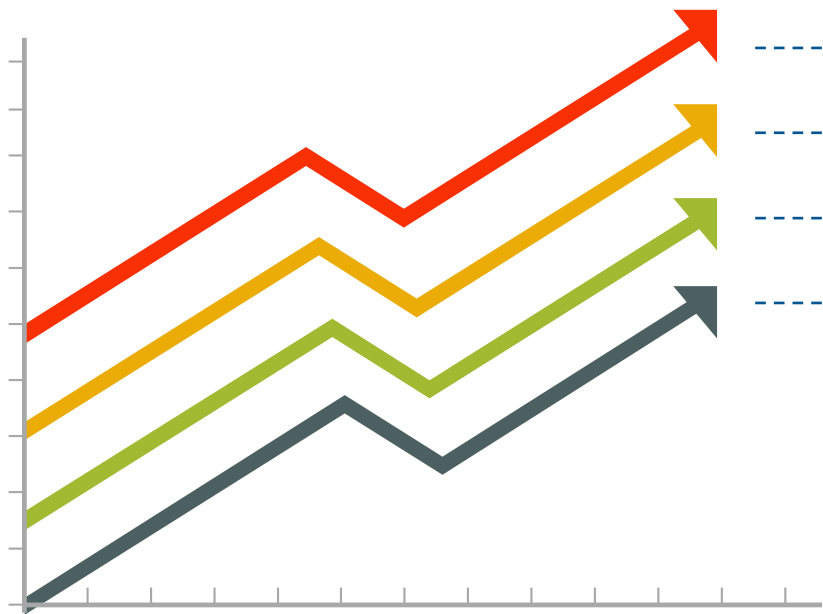


JUPIA AND ILHA SOLTEIRA MODERNIZATION PLAN

Key techniques and new viewpoints

Trend Analysis System

Guided by multiple experienced experts, the System can be used to remotely monitor, diagnose and analyze correlation data online for hydro power plants, prompts users the causes and relevant measures to take. Now some basic analytical methods have been implemented:



- Unit runout signal correlation analysis;
- Unit temperature and power relation analysis;
- Comprehensive oil and water level analysis;
- Pump device analysis.

Current diagnostic methods commonly applied in the field of hydropower are as follows: Rule-based , fault tree, **Bayesian** network, **neural** network, gray theory and so on.

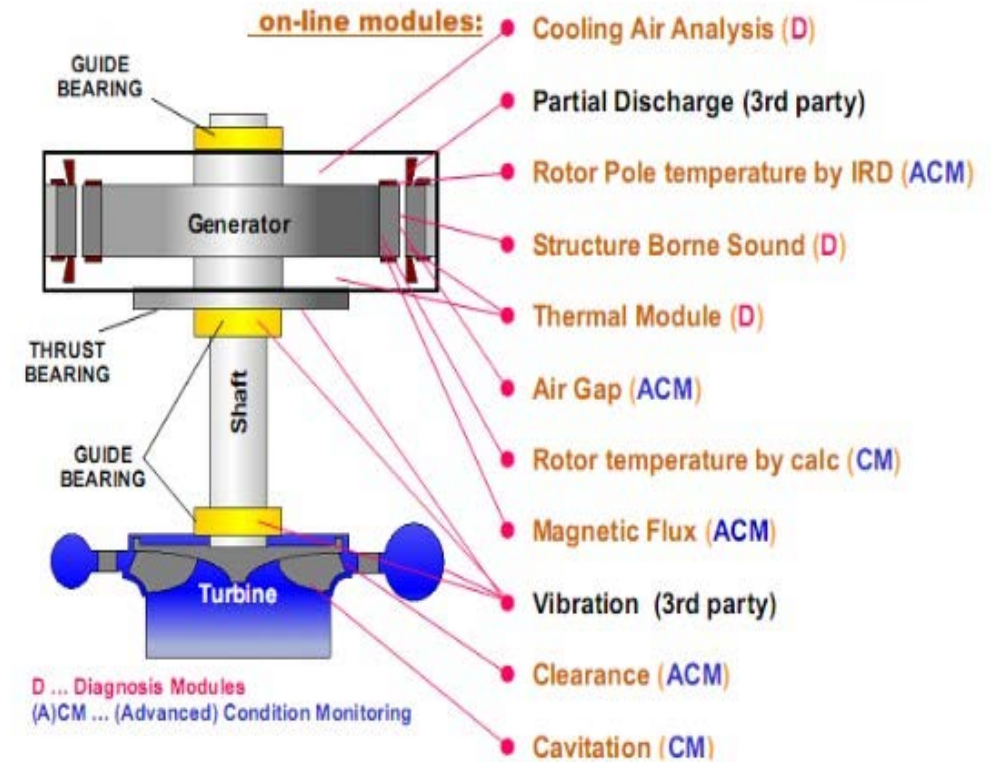
JUPIA AND ILHA SOLTEIRA MODERNIZATION PLAN

Key techniques and new viewpoints

Status Monitoring

- Vibration stability online monitoring
- Insulation and partial discharge monitoring
- Generator air gap and magnetic density monitoring
- Turbine efficiency online monitoring
- Main transformer gases in oil monitoring
- Turbine rotator infrared temperature monitoring

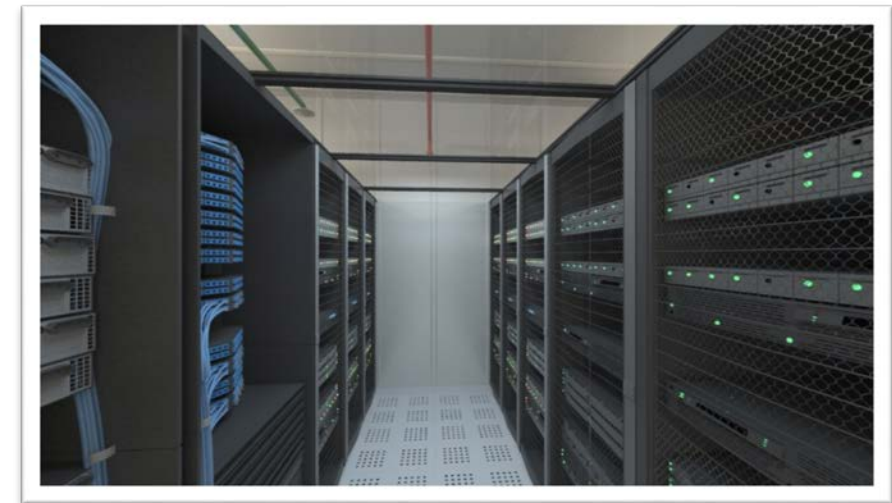
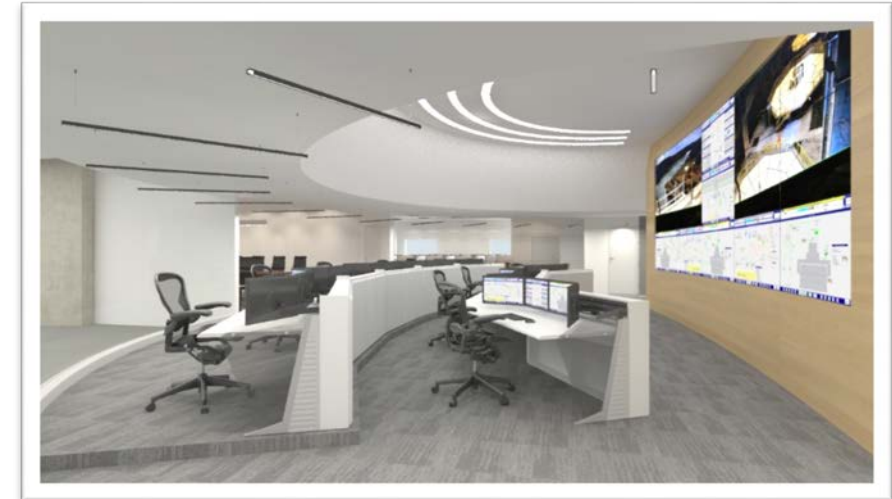
M&D Modules



JUPIA AND ILHA SOLTEIRA MODERNIZATION PLAN

Conclusion

- Improve the safety and stability of the production management and equipment of HPP;
- Realize the seamless connection between the various systems;
- Realize the data by establishing an integrated system information platform;
- Improve the intelligent coordination and safe operation level between the systems;
- Improve the intelligent coordination level between the power grid and the power plant;
- Realize intelligent decision-making and optimize operation.





Thank You!
Obrigado!
Gracias!

www.ctgbr.com.br