

MODERNISATION OF COOLING TOWERS IN TPP BITOLA

Presenter:

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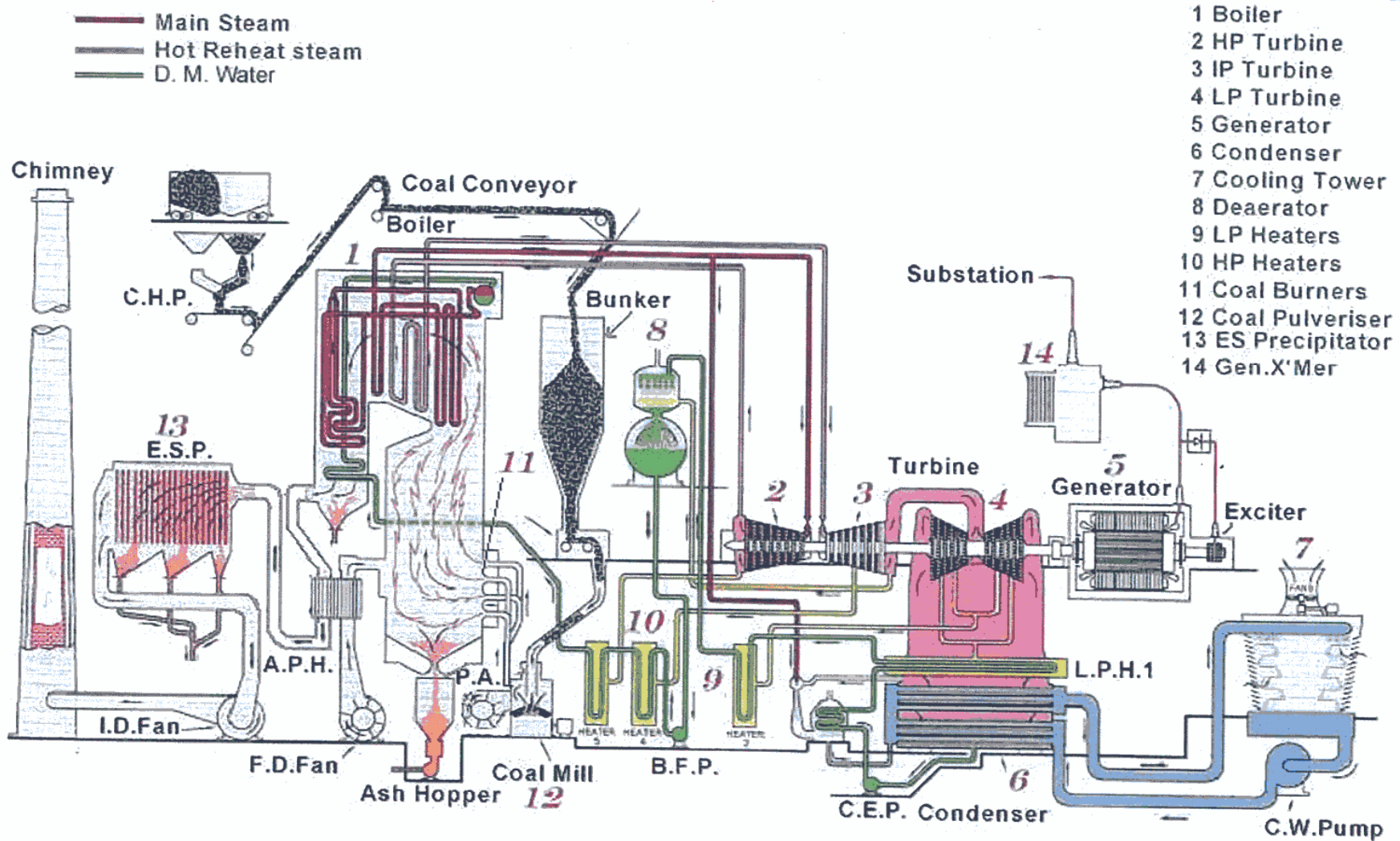
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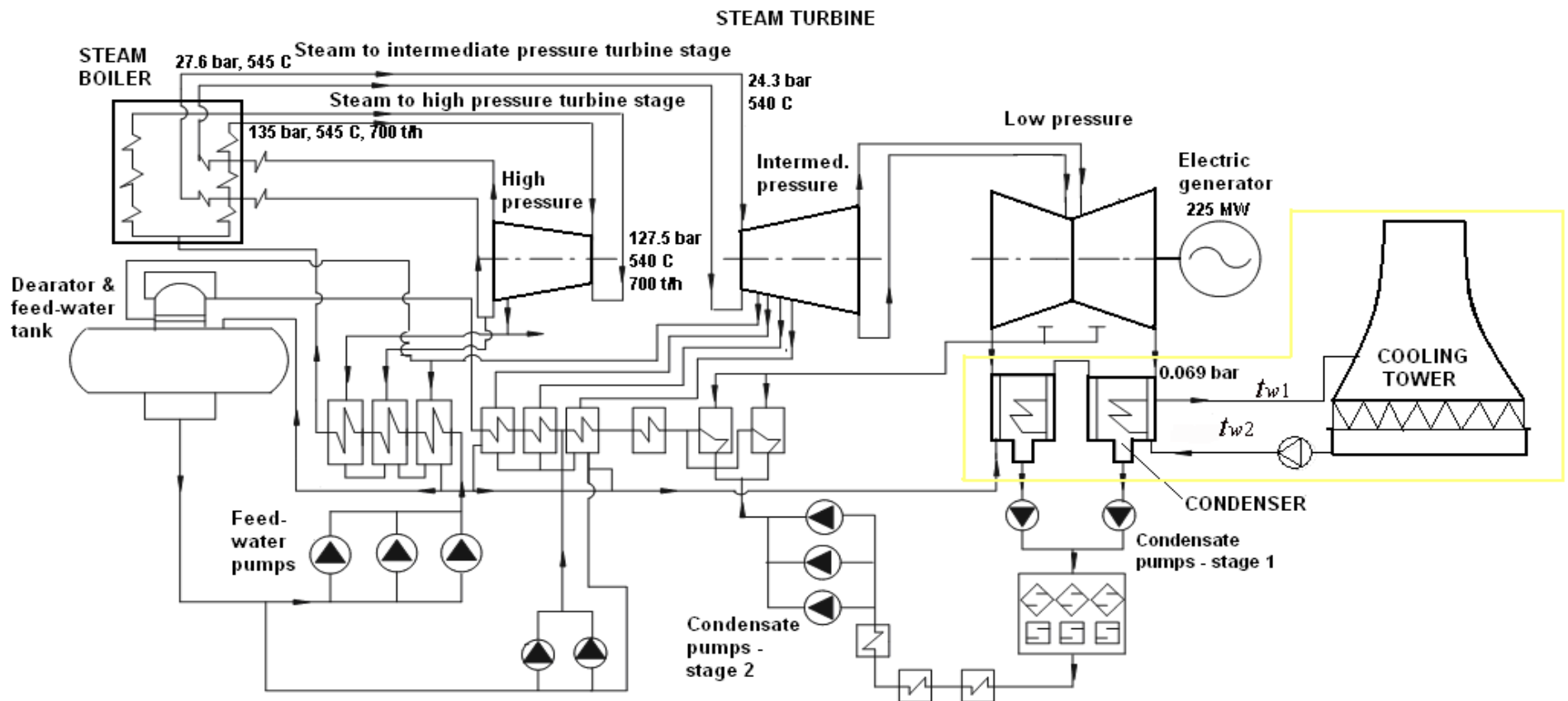
PROJECT TEAM

- ELEM - TPP Bitola**
 - Mr Jani Radivchev
 - Ms Daniela Mladenovska
 - Mr Goce Nikolovski
- Senior experts**
 - Prof. Ilija Petrovski
 - Prof. Risto Filkoski
- J. consultant**
 - Mr Igor Mishevski
- Norsk Energi and CCC**
 - Mr Hans Borchsenius
 - Ms Ann Iren Glimsdal
 - Ms Bojana Stanojevska

COAL TO ELECTRICITY PROCESS



INTRODUCTION TO PROJECT

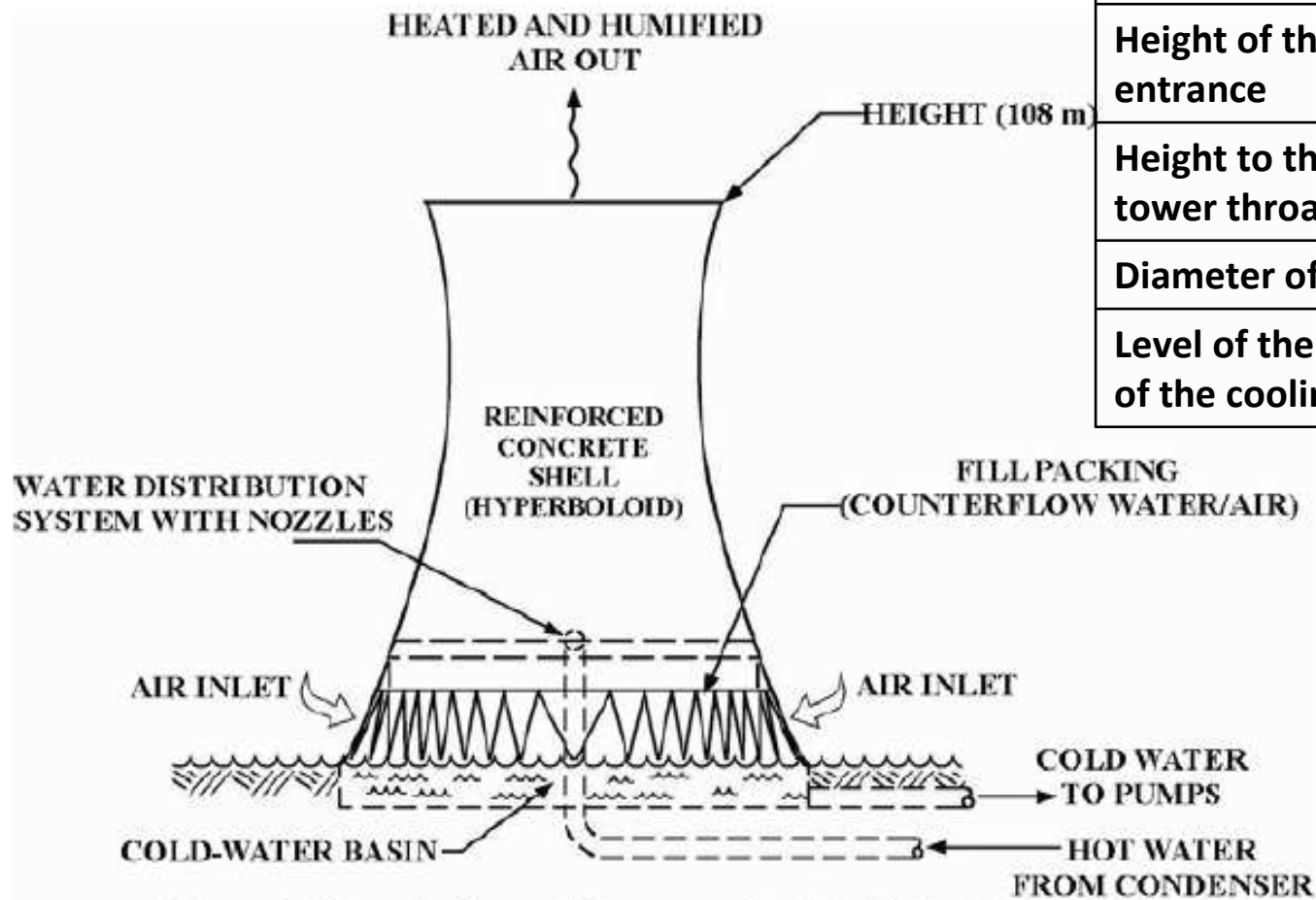


Schematic representation of the main equipment of TPP Bitola unit

Hyperbolic natural-draft cooling tower of the TPP Bitola Unit

Geometry data

Parameter	Value
Height	108 m
Diameter – top of the tower	51.5 m
Height of the opening for air entrance	6.5 m
Height to the level of the tower throat	81 m
Diameter of the tower throat	46.4 m
Level of the load-bearing grid of the cooling fill	5.57 m



INTRODUCTION TO PROJECT

☐ SUBJECT

- To improve the energy efficiency of the TPP Bitola

☐ SCOPE OF THE PROJECT

- Remove the old cement-asbestos fill, fill supports, drift eliminators in the cooling towers
- Installation of new fill and addit. elements: supports, drift eliminators, spray nozles, etc.

☐ EXPECTED ACHIEVEMENTS

- Decreased cooling water temperature
- Decreased condenser pressure
- Increased steam turbine technical work
- Reduced coal consumption
- Increased overall power plant energy efficiency

CCEI – Reduced CO2 emission (potential for CDM project)

PERFORMED CALCULATIONS

□ PERFORMED CALCULATIONS FOR ENERGY EFFICIENCY, FINANCIAL AND ENVIRONMENTAL BENEFITS

CASE 1. VERY CONSERVATIVE APPROACH

- Before the cooling tower modernisation: $p_{cond,1}=0.069$ bar, $t_{cond,1}=38.8^{\circ}\text{C}$
- After the cooling tower modernisation: $p_{cond,2}=0.0645$ bar, $t_{cond,2}=37.5^{\circ}\text{C}$

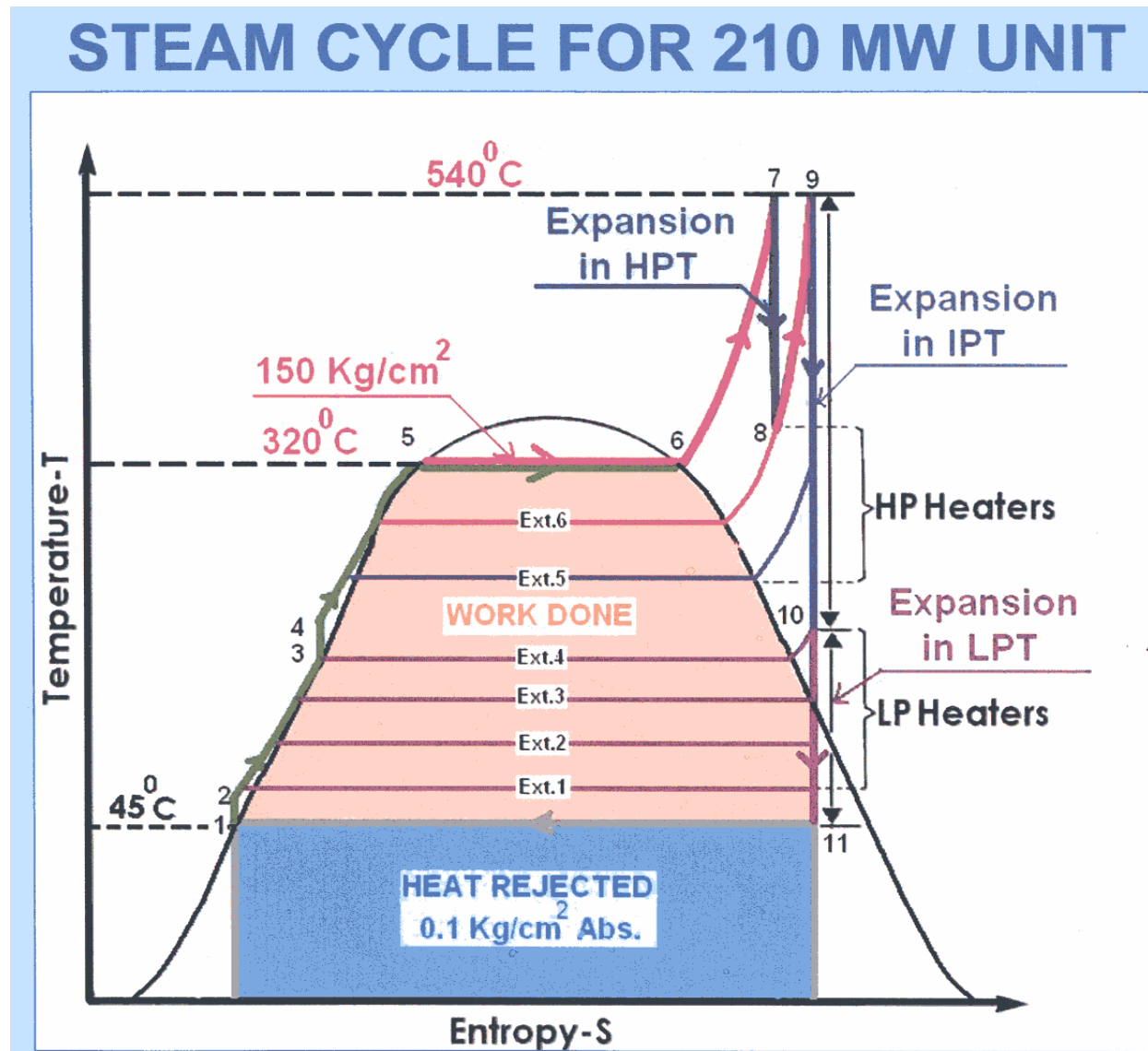
CASE 2. MODERATE APPROACH

- Before the cooling tower modernisation: $p_{cond,1}=0.072$ bar, $t_{cond,1}=39.5^{\circ}\text{C}$
- After the cooling tower modernisation: $p_{cond,2}=0.0645$ bar, $t_{cond,2}=37.5^{\circ}\text{C}$

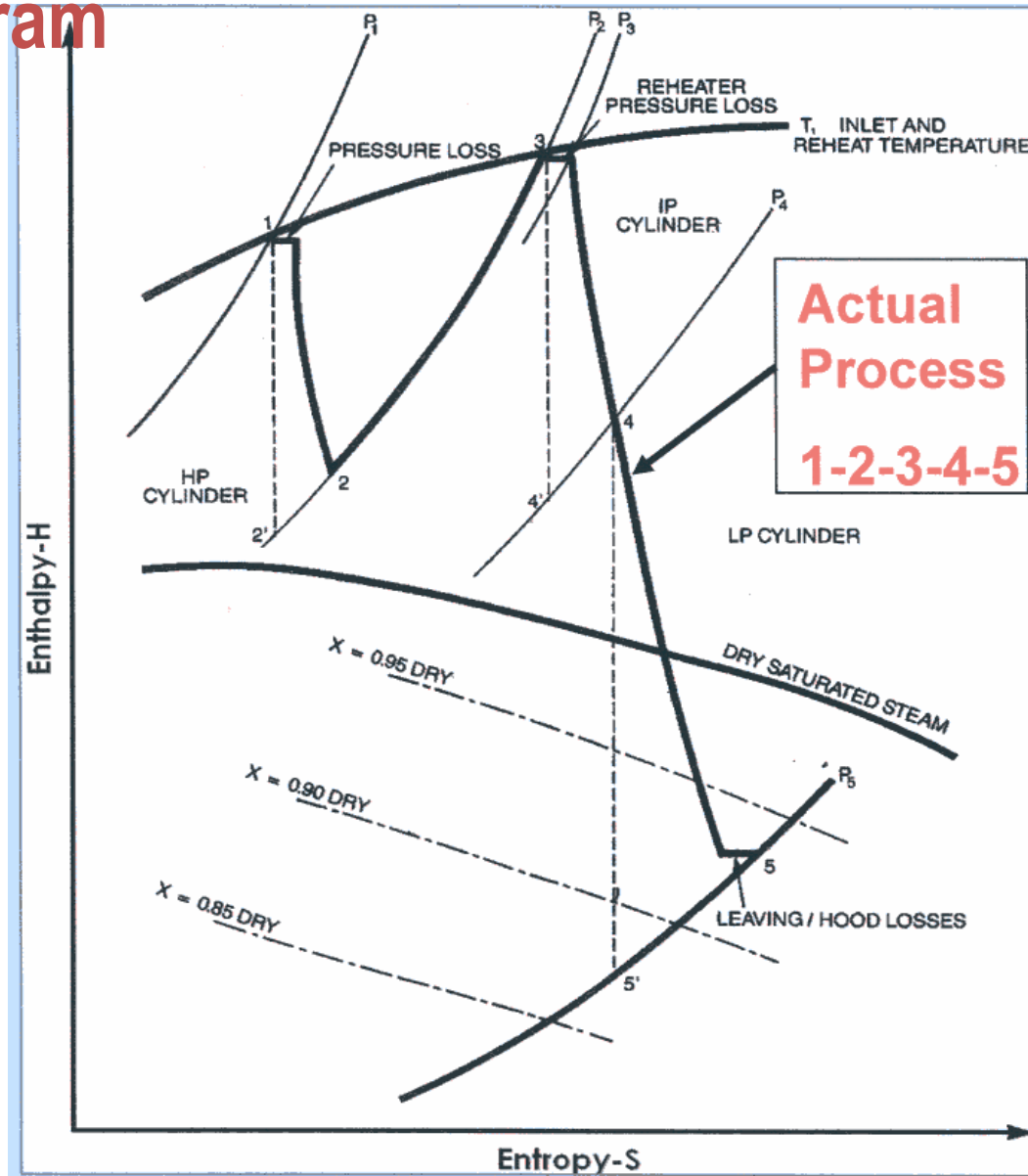
CASE 3. OPTIMISTIC APPROACH

- Before the cooling tower modernisation: $p_{cond,1}=0.072$ bar, $t_{cond,1}=39.5^{\circ}\text{C}$
- After the cooling tower modernisation: $p_{cond,2}=0.0627$ bar, $t_{cond,2}=37^{\circ}\text{C}$

Ideal reheat Rankine cycle in T-s diagram



Actual steam expansion in HP, IP and LP turbine cylinder, *h-s* diagram



TECHNICAL FINDINGS

Parameter	Value
Condensing pressure change, p_{cond} : before / after cooling towers modernisation, bar	0.072 / 0.0645
Dew point change, t_{cond} , °C	39.5 to 37.5
Power plant efficiency change, before/after modernisation, %	30.93 / 31.12
Fuel saving, %	0.62
Fuel saving, t/year	43470
GHG reduction, 1000 tCO ₂ /year	32 -34
Financial effect due to fuel saving	960155 €/year
Financial effect, due to CDM	~ 272000 €/year

CLEAN DEVELOPMENT MECHANISM ELIGIBILITY

- The project has a potential for CDM and registration should be pursued
- There is an ongoing CDM project on modernisation of REK Bitola
- The cooling towers modernisation should be included in the ongoing CDM initiative to facilitate proper monitoring and verification

GHG EMISSION REDUCTION

- The total reduction of CO₂ emission, calculated on a basis of the fuel consumption, with the IPCC emission factor for lignite EF=101 t CO₂/TJ on a net calorific value, is 32,050 t CO₂/year
- The CO₂ emission reduction, calculated using the country specific emission factor, including carbon combustion efficiency of 98 %, is 34,600 t CO₂/year

INVESTMENT PARAMETERS

Activity	Investment in Euros
Project preparation and project management	330.000
Equipment and installation costs	6.600.000
Waste disposal costs	3.000.000*
Contingency	700.000
Total investment	10.630.000

* To be further analysed

CONCLUSIONS

- The overall efficiency of the power plant will improve from 30.93 % to 31.12 %**
- Investment approx. 10 mill. EUR, including installation of new fill and additional equipment, as well as disposal of asbestos**
- The project should pursue CDM registration, possibly within the ongoing project for modernisation of TPP Bitola**