

Thermal Power Plants and Hot Days

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on

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Depends on type of plant



Peaker—gas turbines



**Gas-fired combined-cycle
Gateway**

**Gas-fired steam plant
Haynes**



Depends on type of cooling system



Dry cooling—Otay Mesa



Hybrid cooling—Afton (New Mexico)



Wet (closed-cycle) cooling—Metcalf

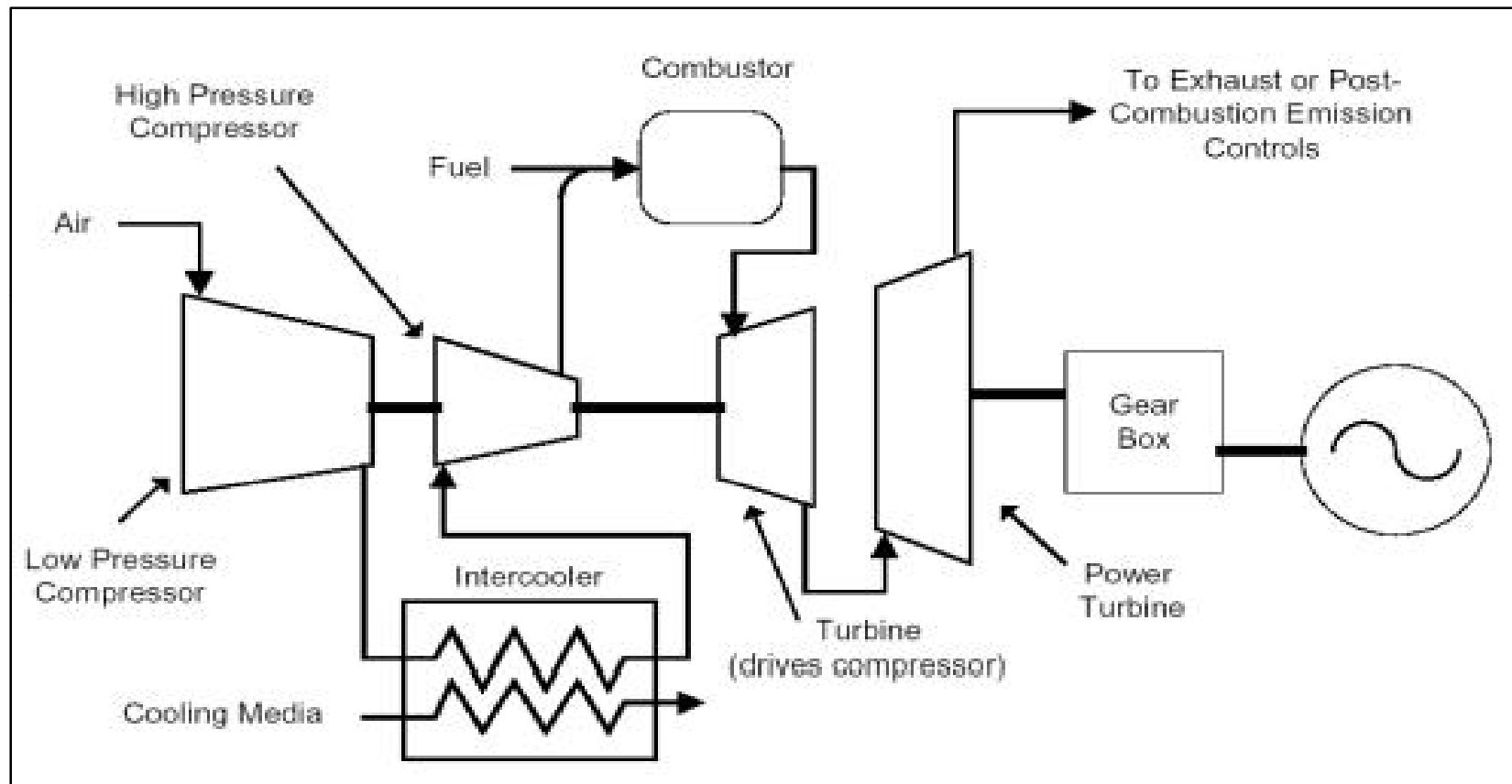


Once-through cooling—Moss Landing

California Focus

- Gas-fired plants
 - Combustion turbine peakers
 - Gas-fired combined-cycle
- Water-conserving cooling
 - Dry cooling—air-cooled condensers

Effect of hot days on gas turbines



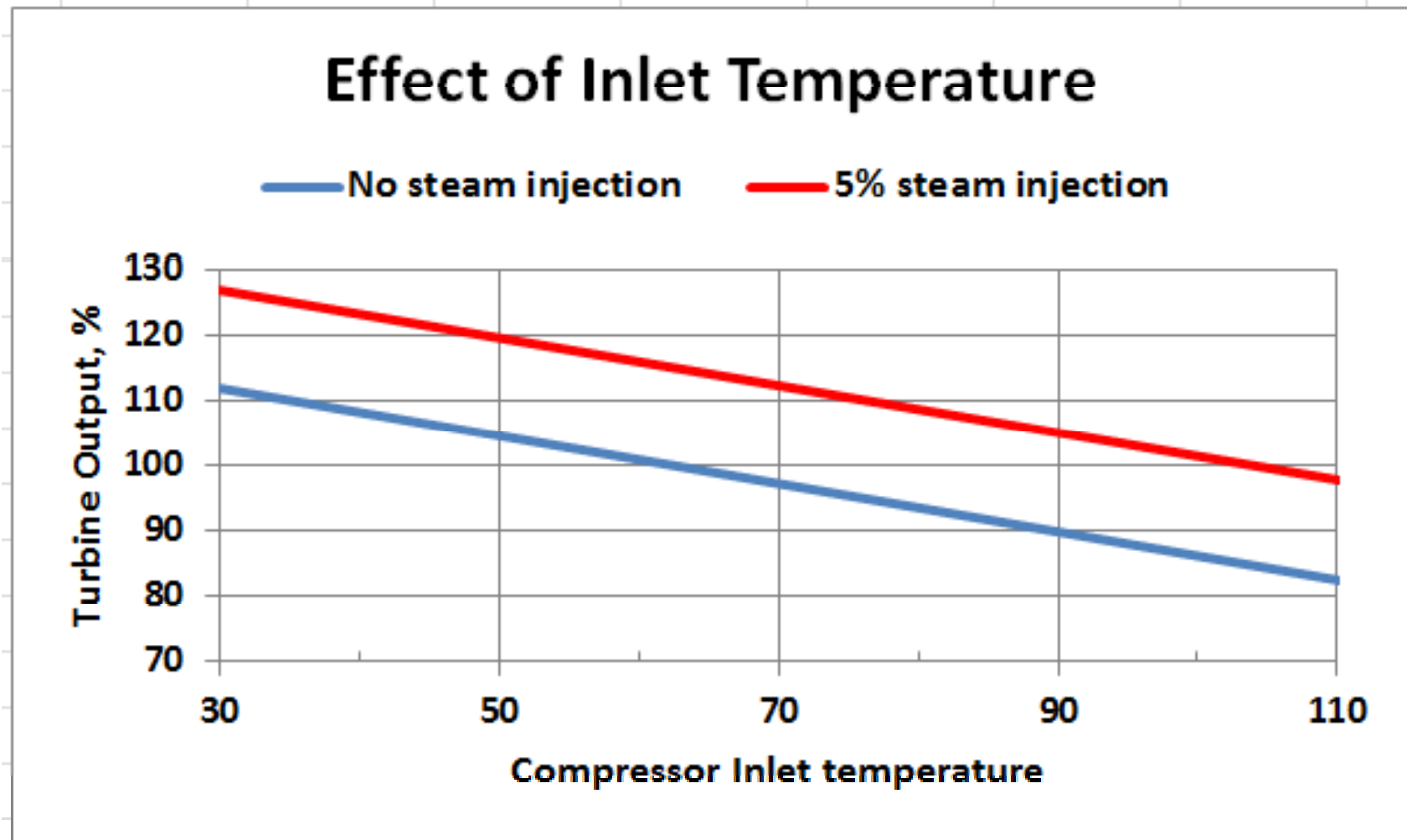
Constant volume flow----Air temperature



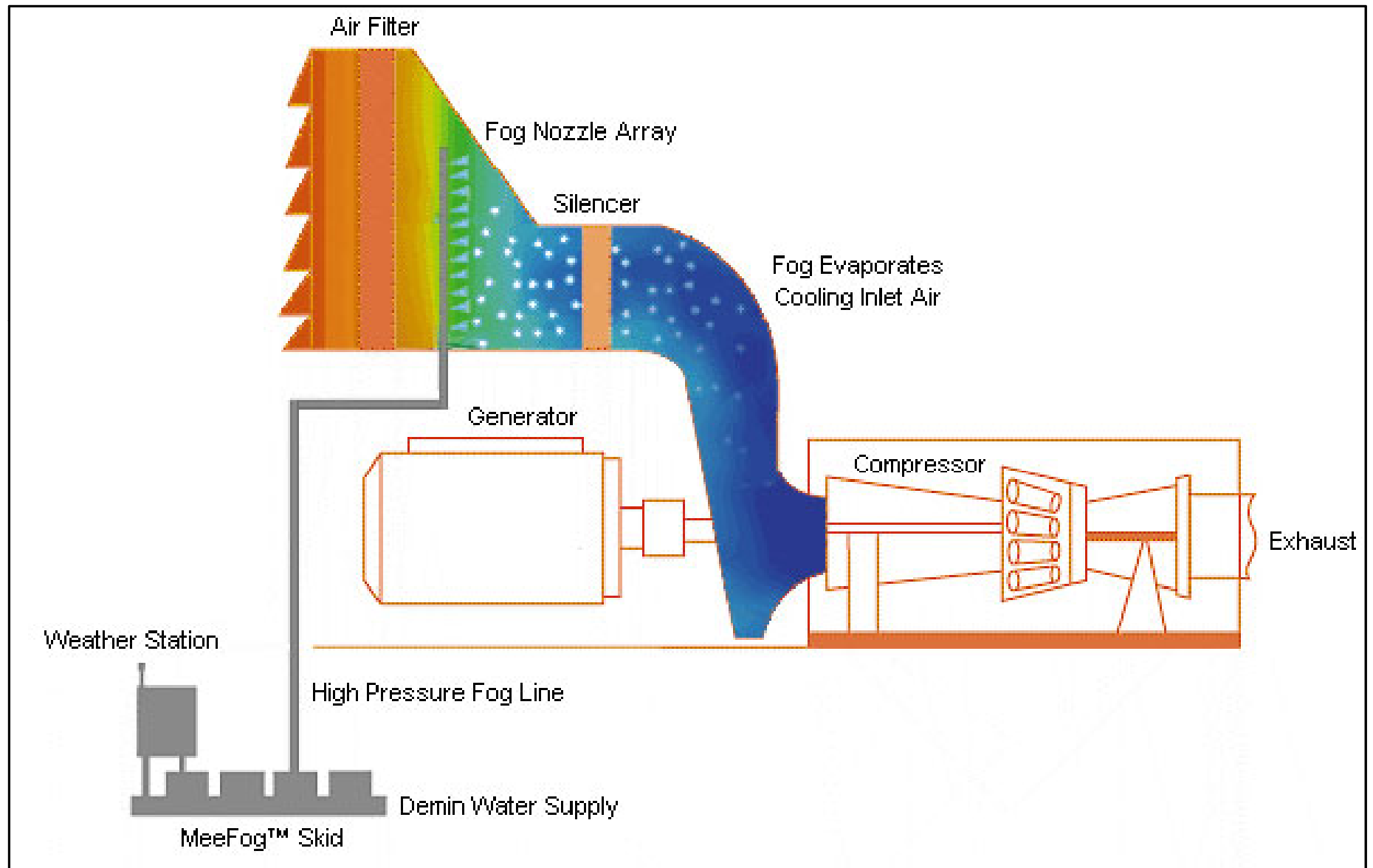
Mass flow and output



Combustion turbine performance



Inlet spray cooling

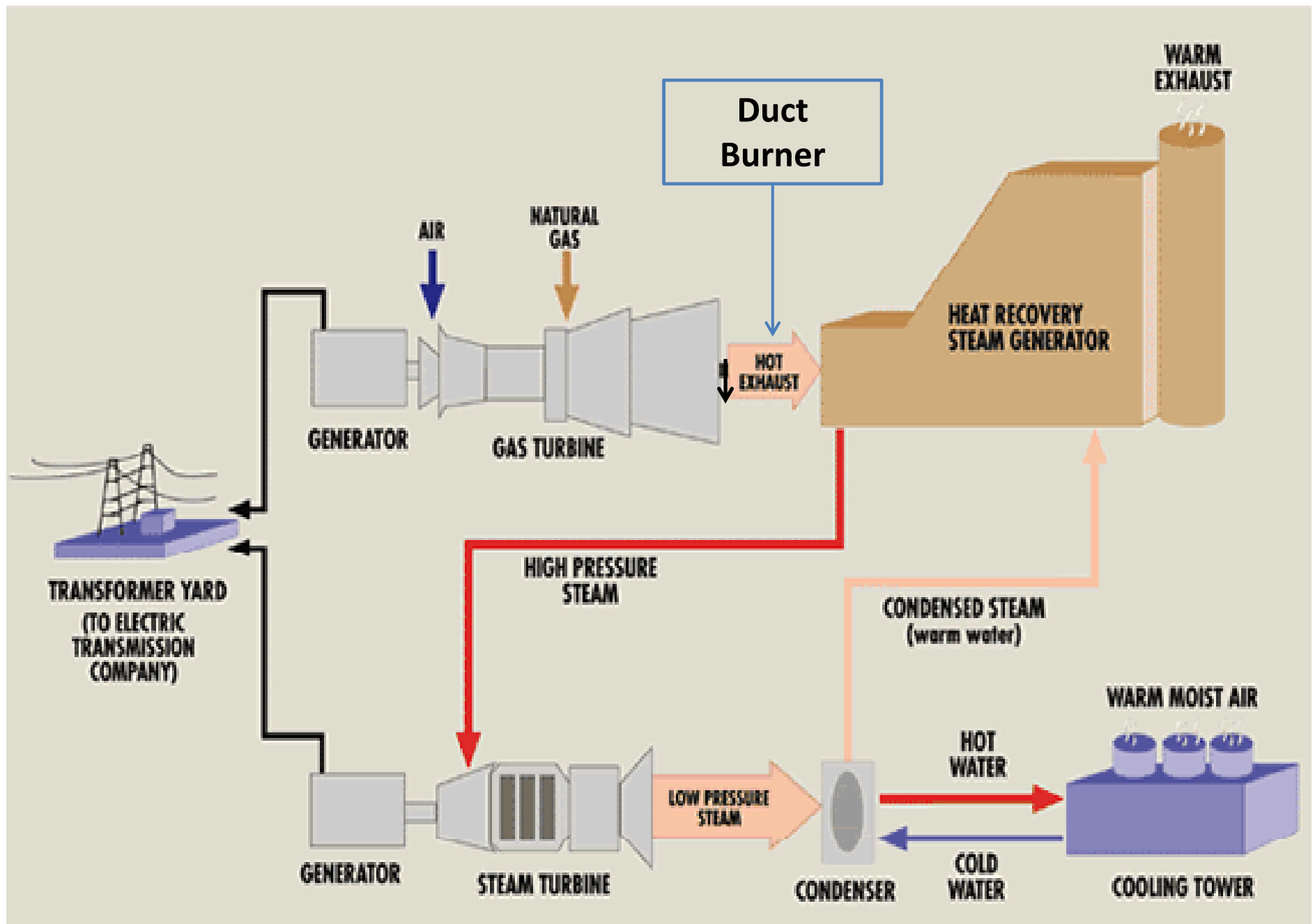


Inlet chiller



Combined-cycle plants

- Hot day problems
 - Reduced gas turbine output
 - Reduced energy input to steam cycle from CTs
 - Increased load on steam cycle from duct firing
 - Reduced steam turbine efficiency

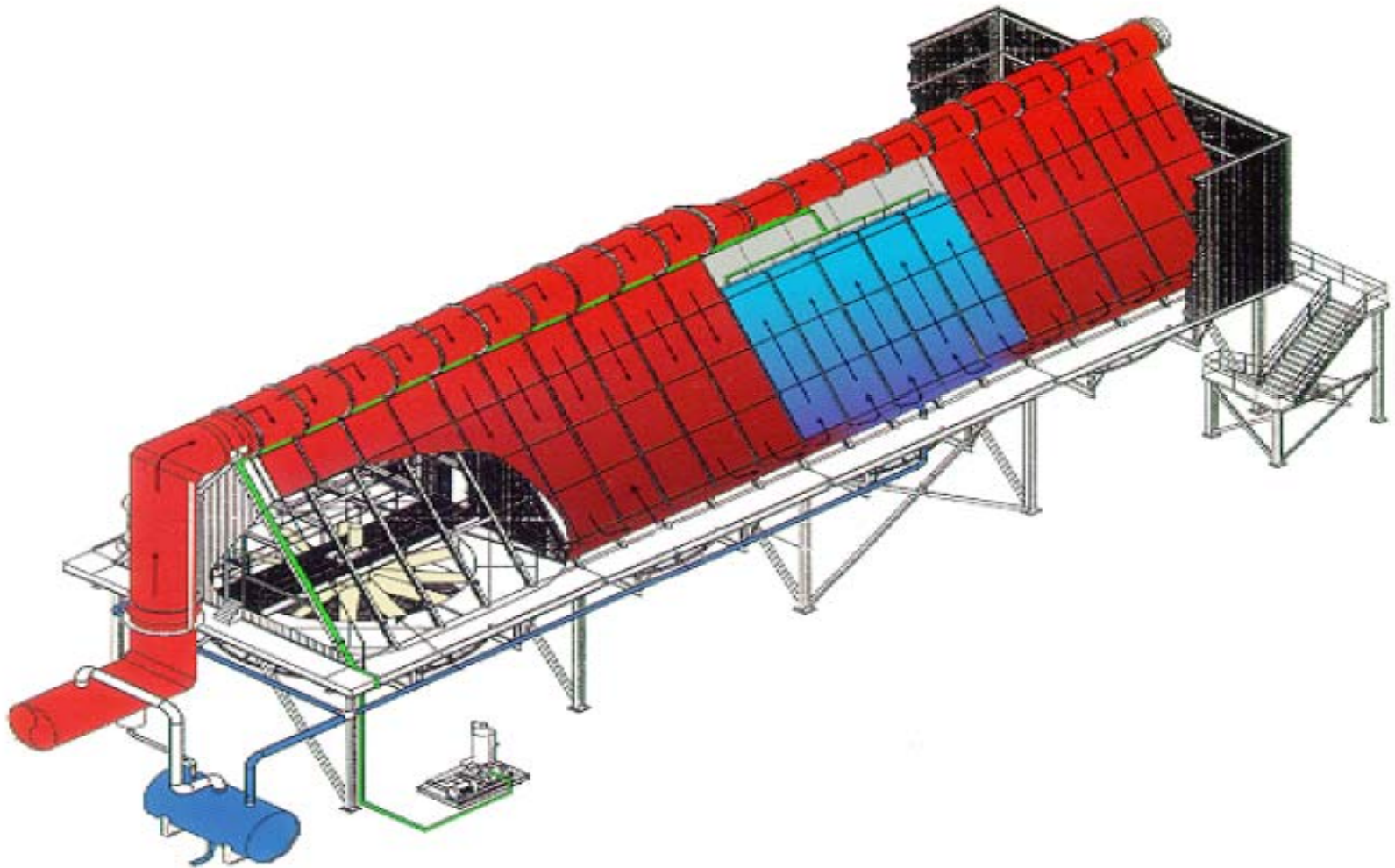


Enhanced hot day cooling

---Start with dry cooling---



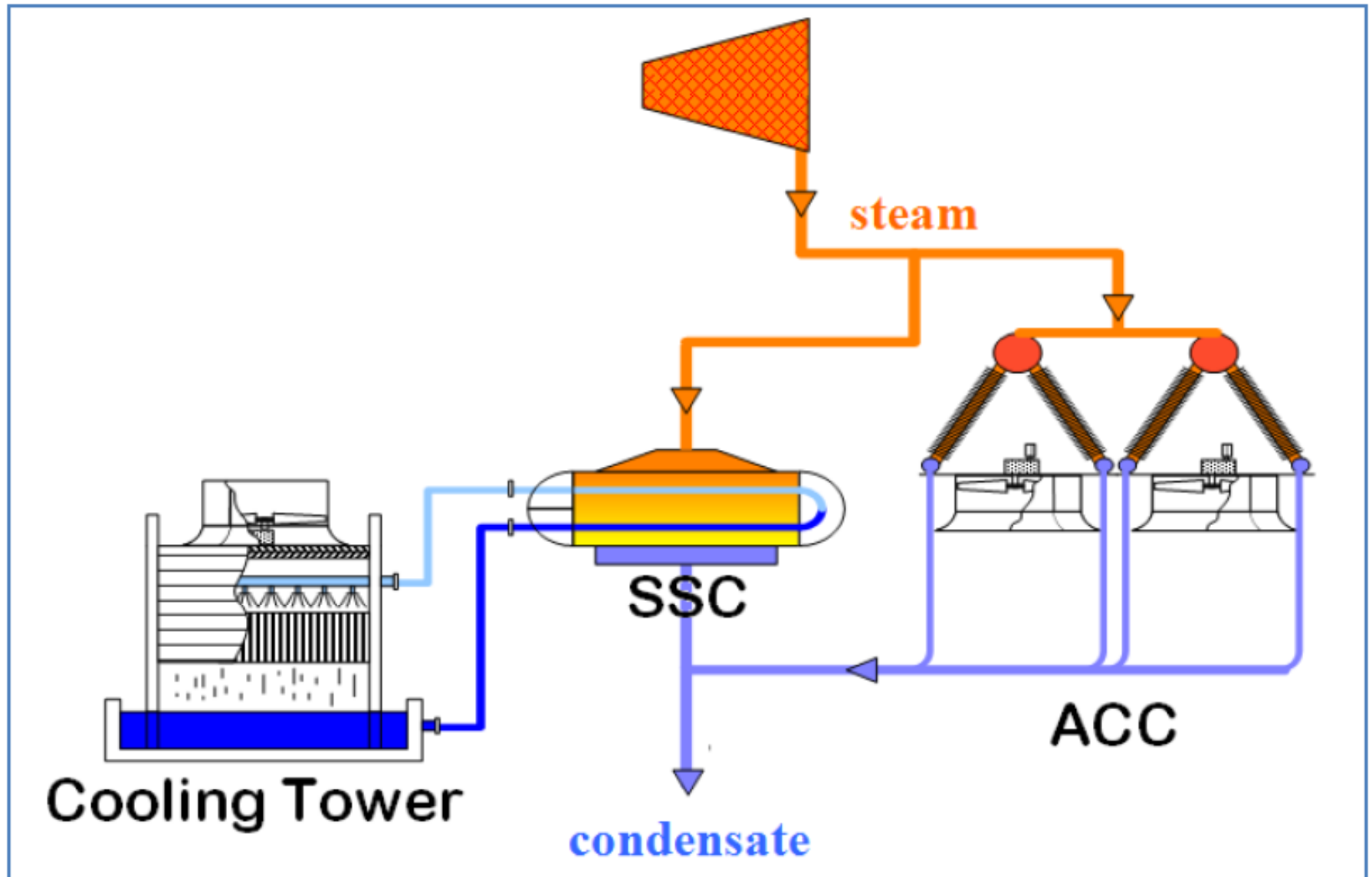
ACC Schematic



Things you can do

- Hybrid cooling
- Spray inlet cooling
- Wet enhanced dephlegmator
- Deluge supplementary cells
- Suppress wind effects

Hybrid (PAC) Cooling



Hybrid System---750 MW coal plant

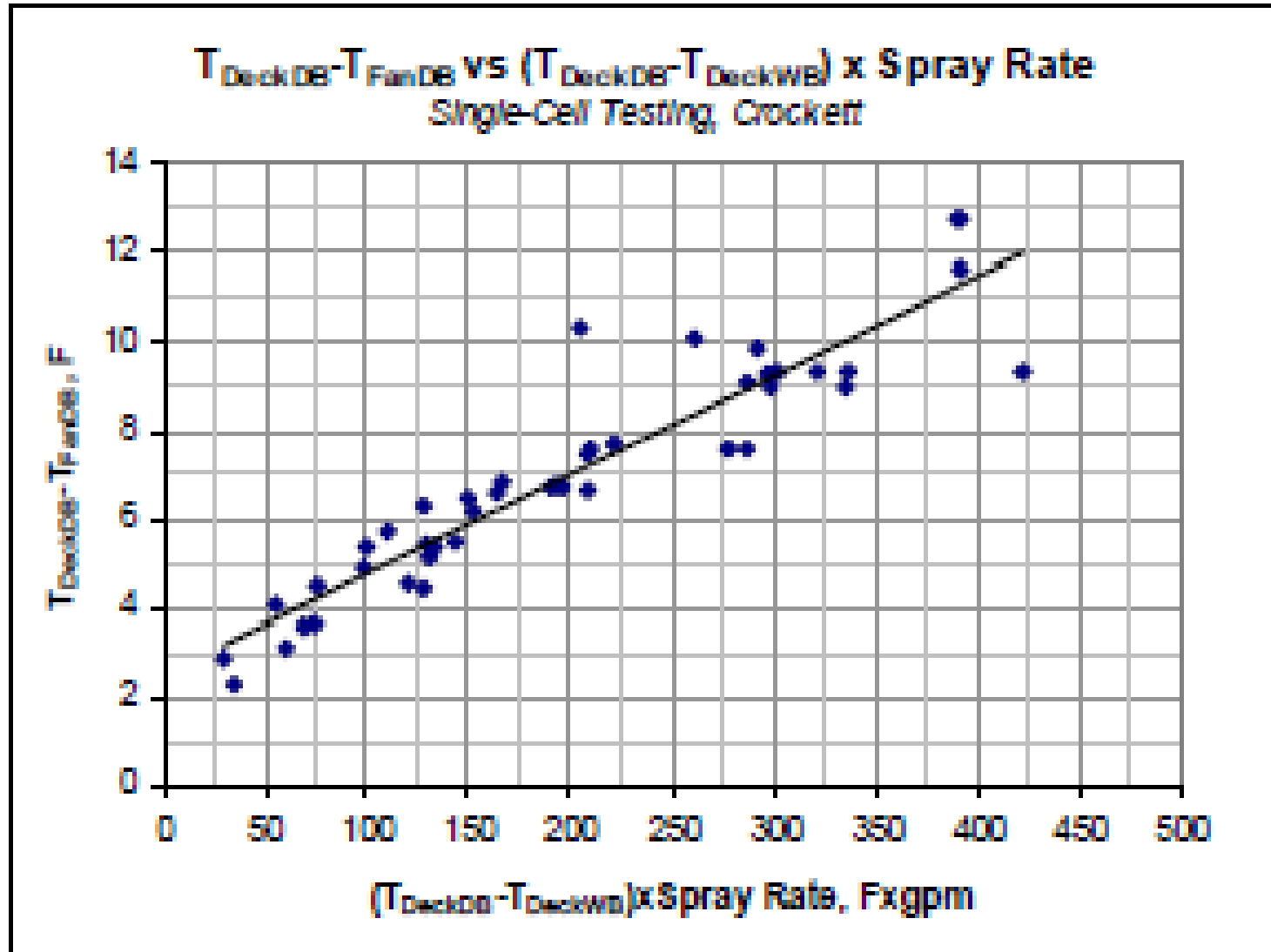


Inlet spray cooling—Crockett

CEC Publication: P500-03-109

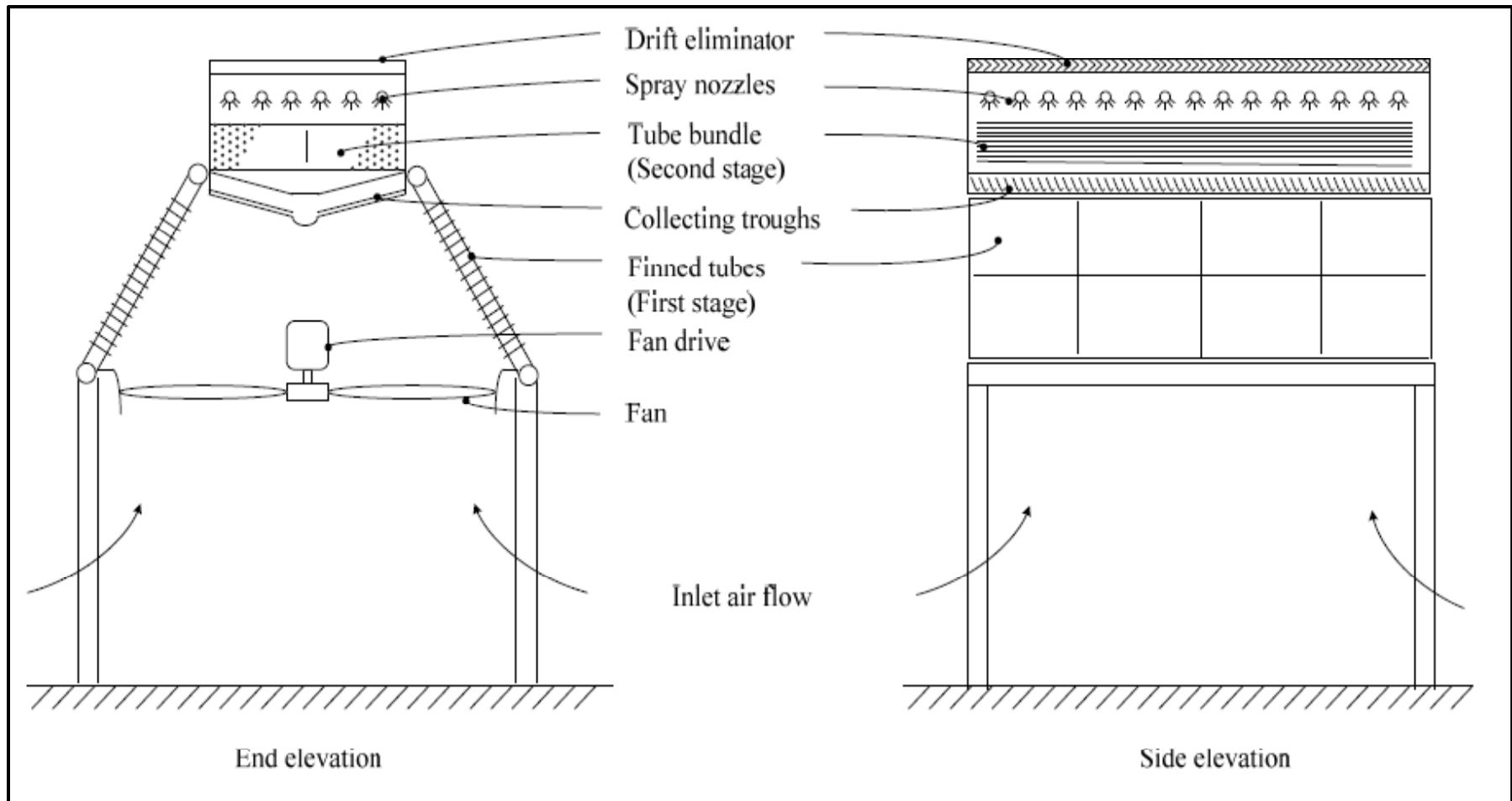


Prediction of Cooling Effect

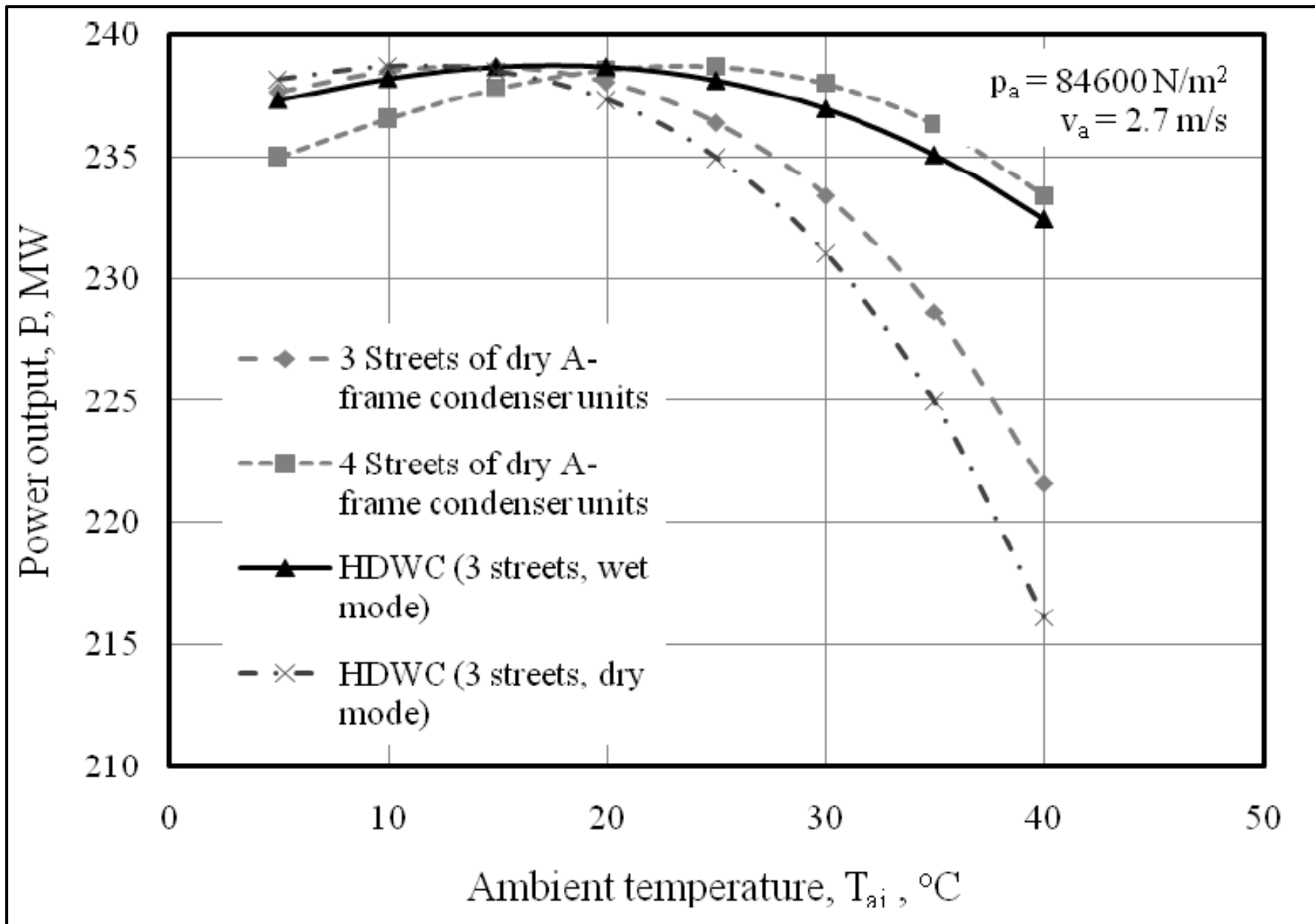


Wet Enhanced Dephlegmator

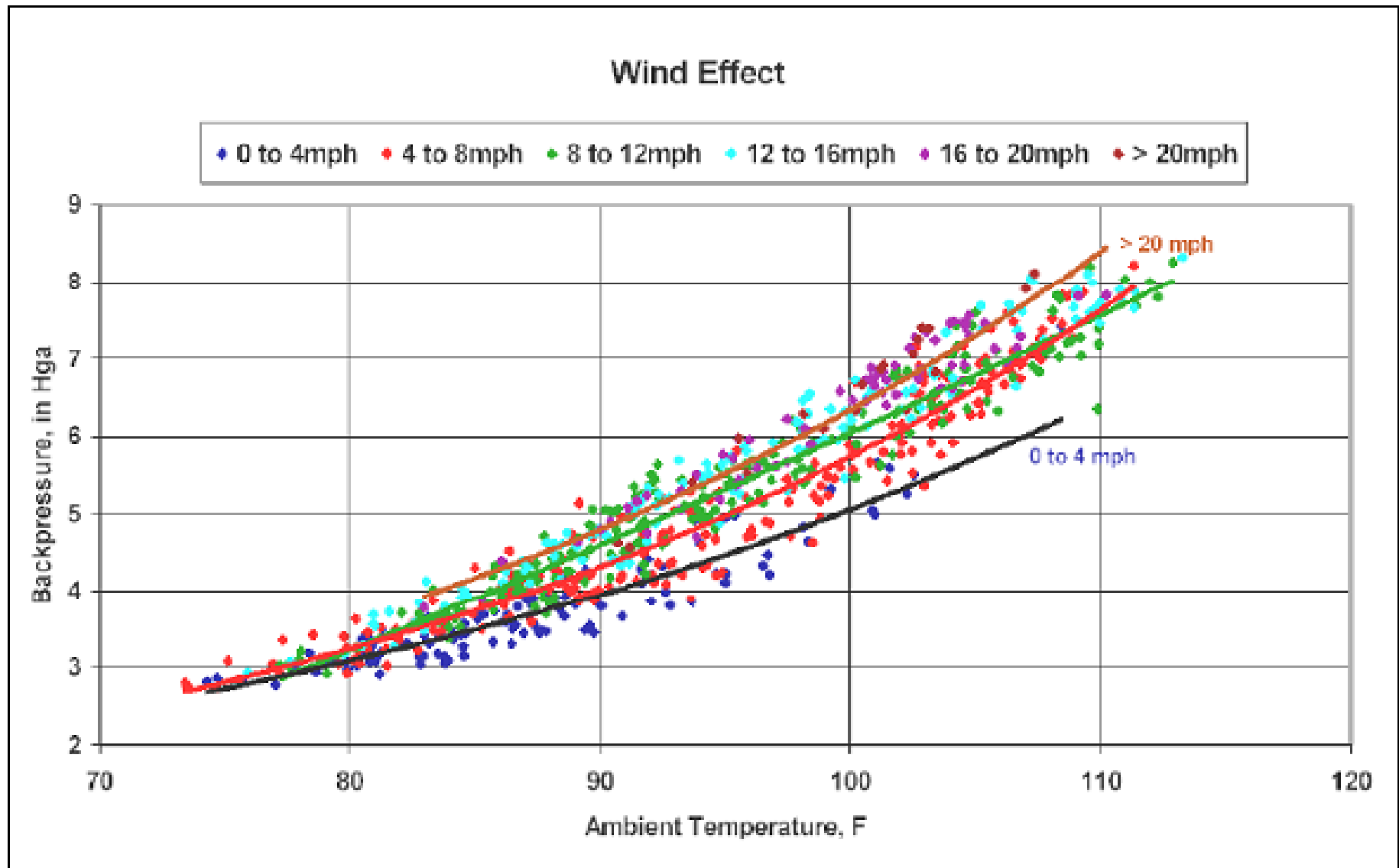
CEC Project 500-07-003



Comparative performance—Wet dephlegmator



Hot days can be windy



Suppress wind effects

CEC Project 500-07-003



Caithness Plant

PIR-11-024



Current Research



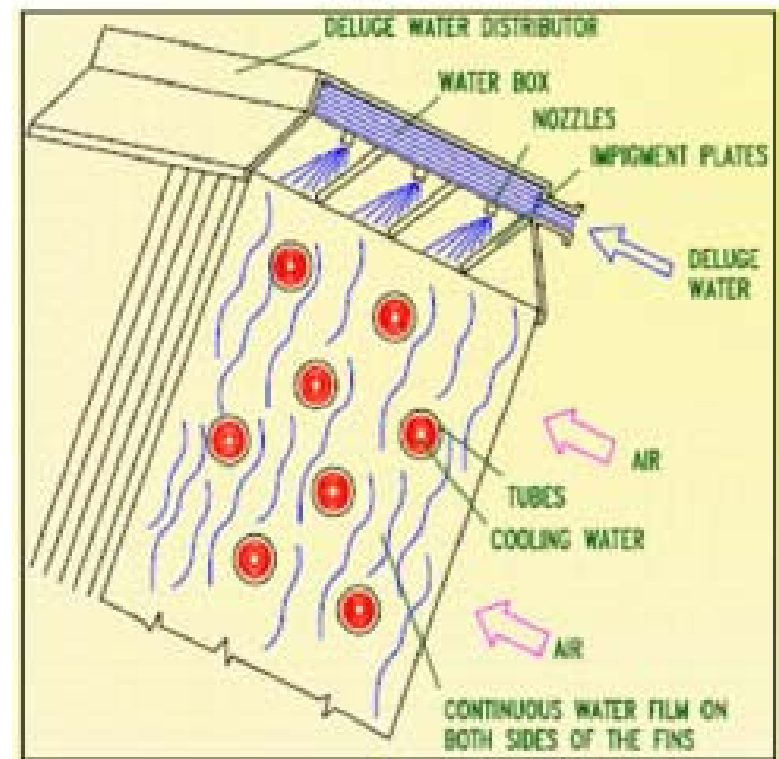
Summary

- Extreme hot days (are sometimes windy)
 - Reduce gas turbine output
 - Raise steam turbine exhaust [pressure
 - Reduce steam turbine output and efficiency
- Mitigating measures include
 - A little bit of water used in
 - Inlet sprays
 - dephlegmator enhancements
 - deluge coolers
 - Windscreens



Deluged Supplemental Coolers

EGI/GEA Engineering



Energy Sector Responses to Climate Change

My topic.....

Innovations to increase electricity output from thermal power plants during extreme hot events

COST AND VALUE OF WATER USE AT COMBINED-CYCLE POWER PLANTS

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California Energy Commission
Public Interest Energy Research Program

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Governor

PIER FINAL PROJECT REPORT

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