Practical and Accurate Measurement of Cogenerated Power E_{CHP}

Solving a long-standing issue in science, operations, statistics, policy, regulation

5 September 2016

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Identify E_{CHP} quantities of CHP activities

Case 1: plant cannot reject heat to environment: $E_{CHP} = E_{plant}$

Case 2: CHP activity is partial: $E_{CHP} < E_{plant}$ and E_{CHP} **not measurable**

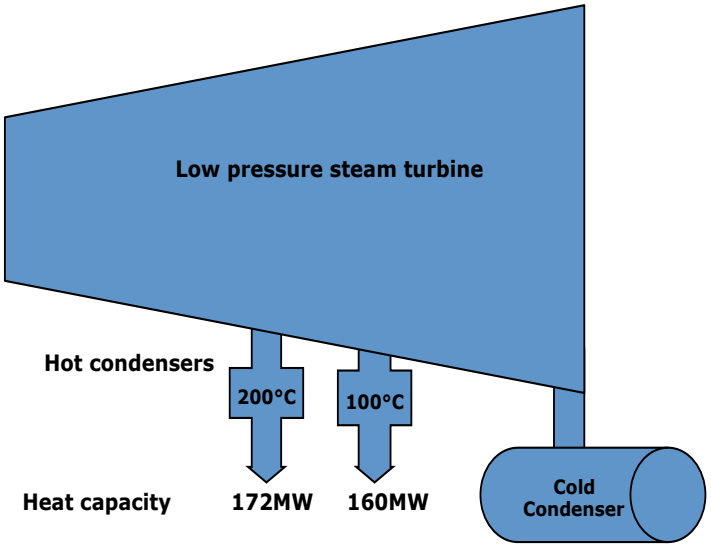
Calculator needed, based on: $E_{CHP} = \sigma \cdot Q_{CHP}$

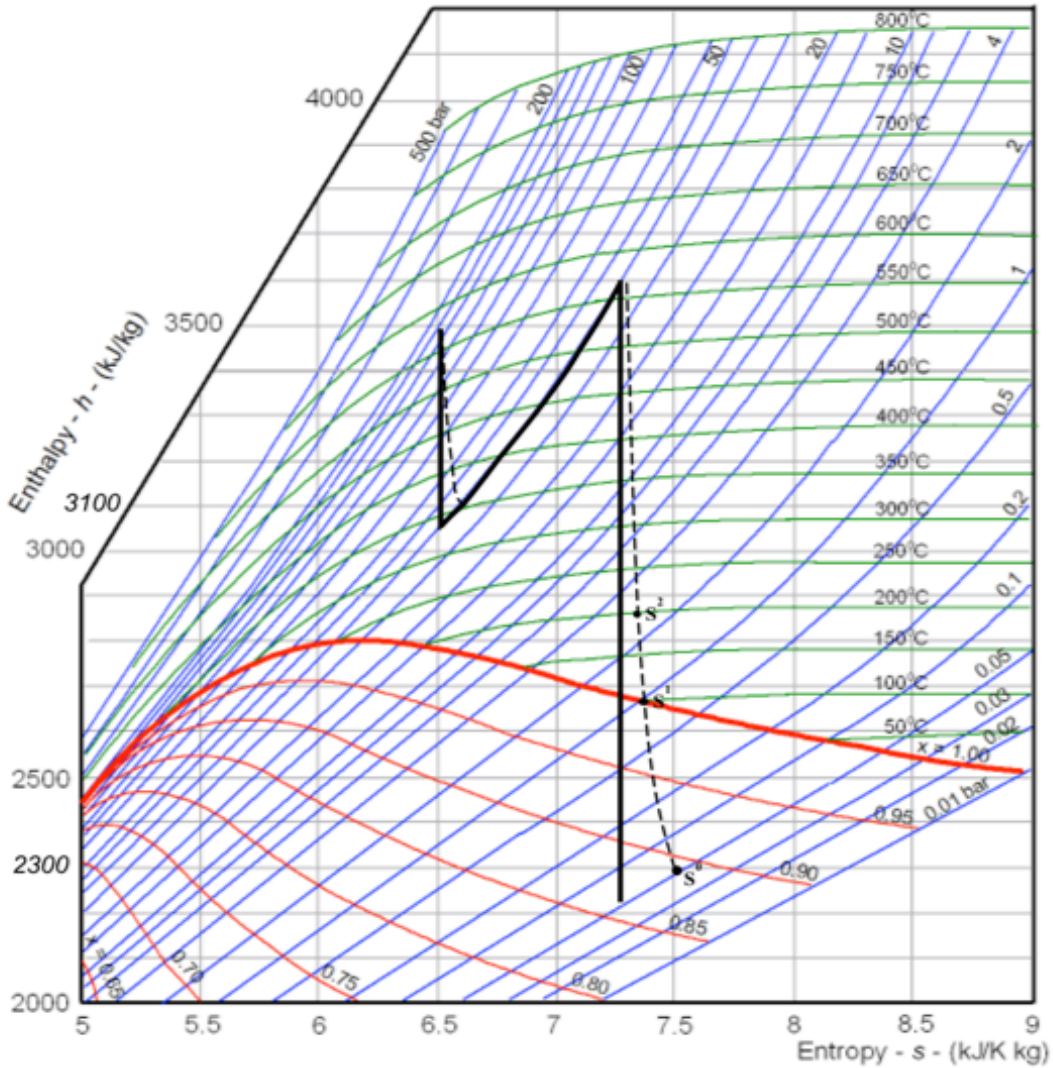
- Q_{CHP} = amount of heat recovered by CHP activity [measured flows]
- σ = power-to-heat ratio [WHICH VALUE? ! Enigma ! Circular logic by EU Commission, CEN-CENELEC, academics in journal articles; USA DOE puzzled, etc.]

SOLUTION: σ is a design parameter of **every CHP activity**

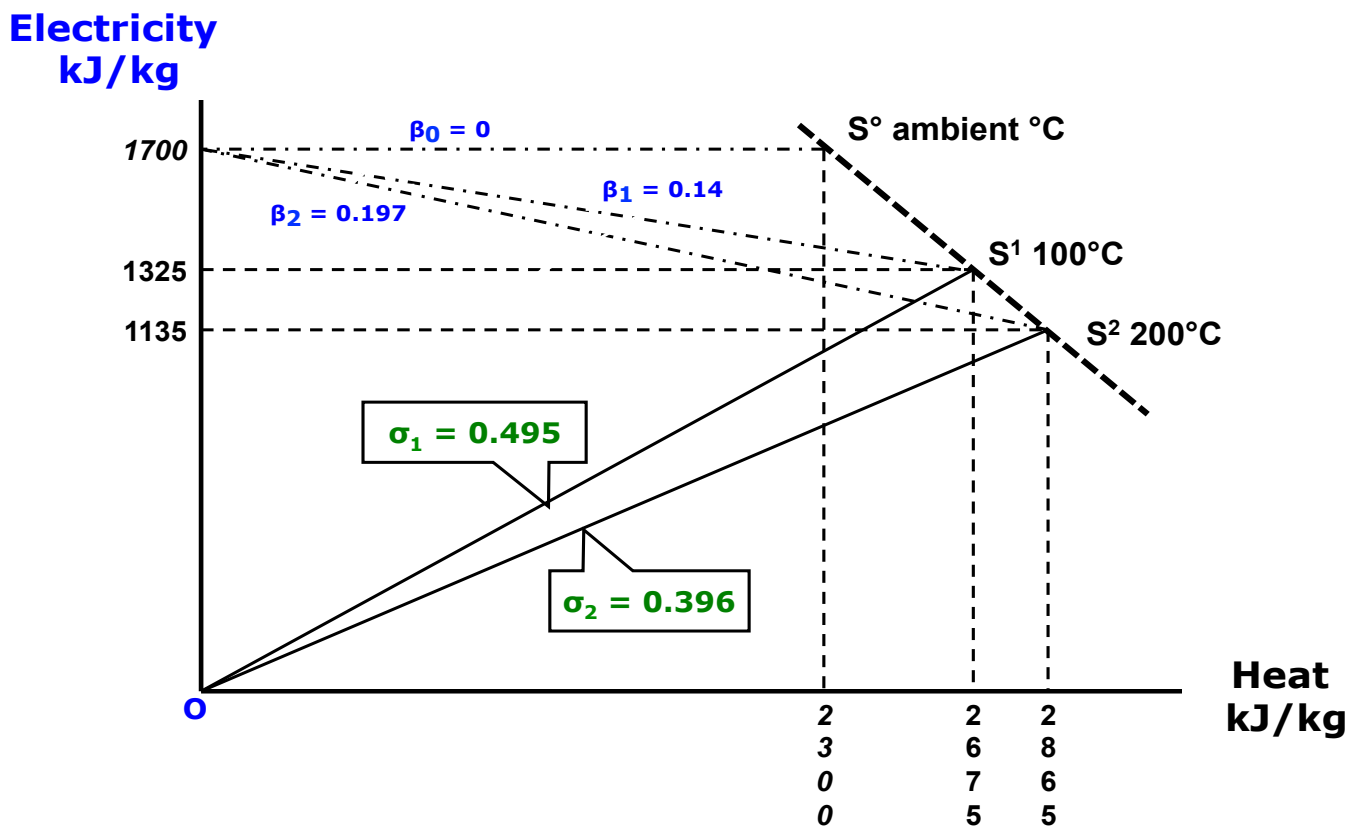
σ is affected by power loss factors β in steam turbines

Extraction-condensing steam cycle with two CHP activities

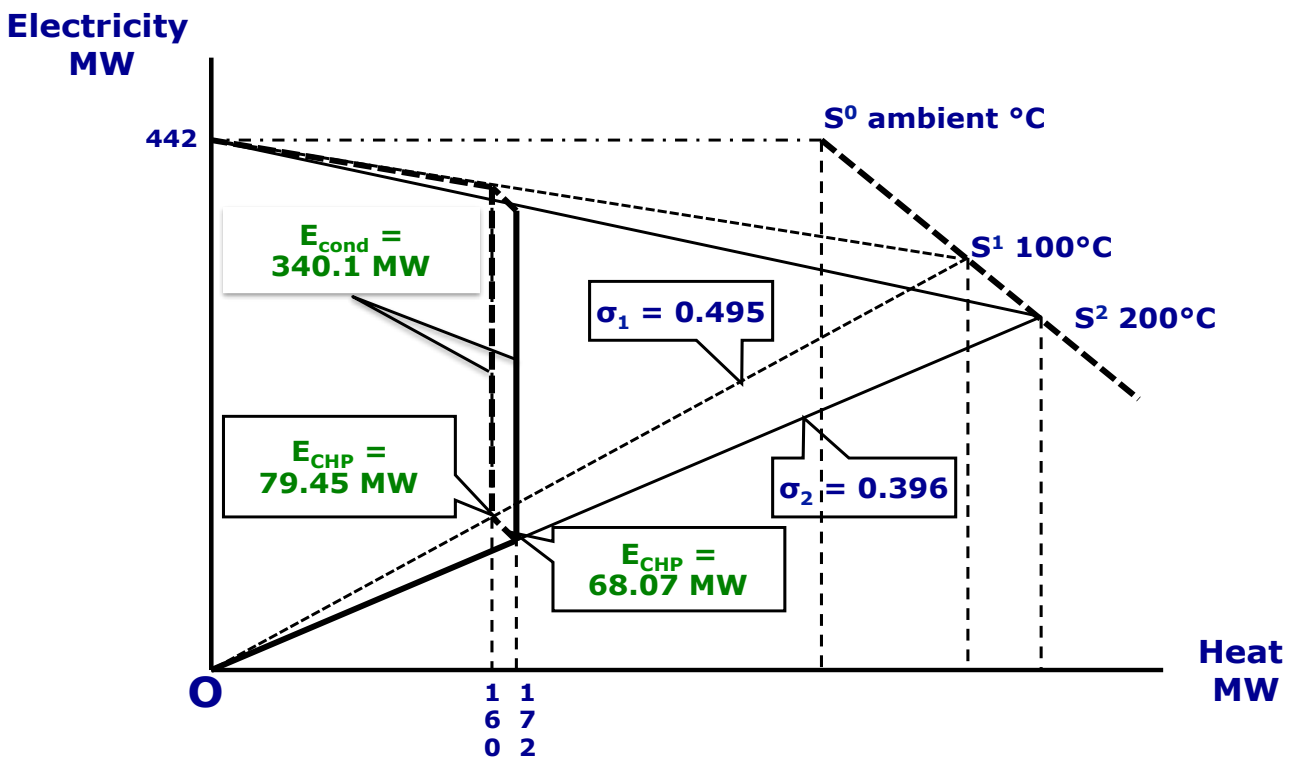




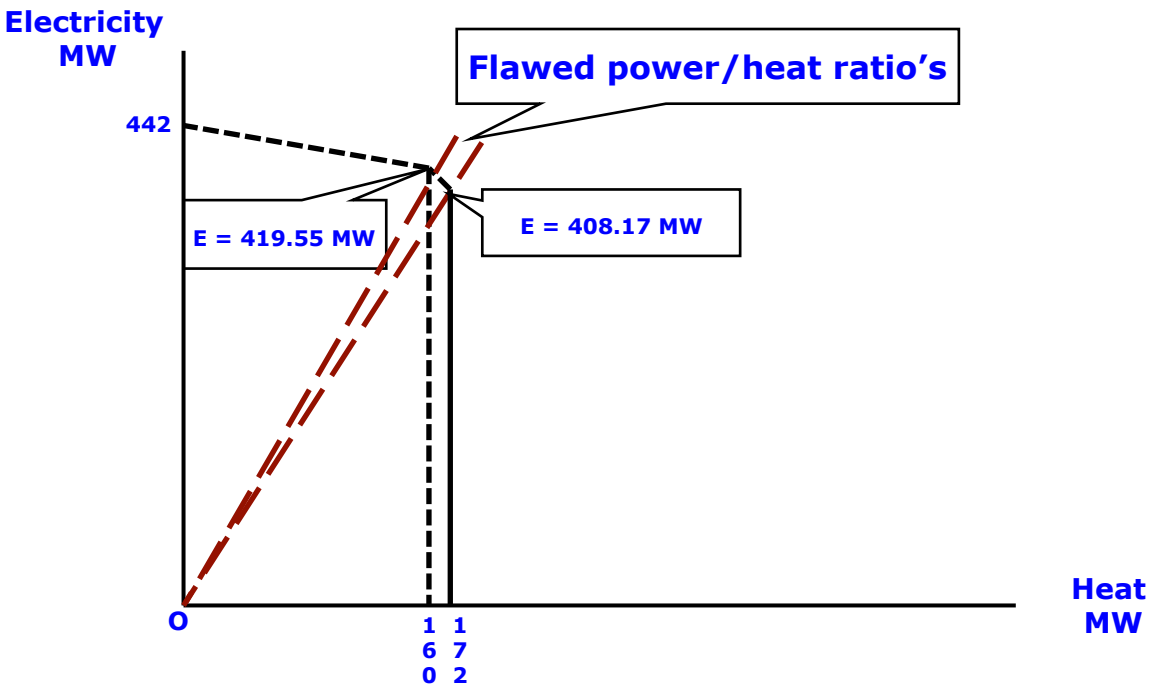
Unit mass analysis in Electricity-Heat plane



Truncating feasible {E - Q} set by capacity limits on the two Q_{CHP} extraction activities



Flawed solutions for σ been suggested



Conclusion

Long-standing issues solved + more clarity about CHP by

- Proper identification & vocabulary, e.g. CHP activity embedded / added
- Design power-to-heat ratio **σ** per CHP activity
- $\mathbf{E_{CHP}}$ is correct indicator of CHP merit (external benchmarks are perverse)
- Maximizing $\mathbf{E_{CHP} = \sigma \, . \, Q_{CHP}}$ holds the right incentives:

  Maximize design **σ** (*quality* of process)

  Maximize $\mathbf{Q_{CHP}}$ (*quantity* of recovered heat)

Thank you for your attention!

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