PROCESS INTEGRATION
Part 1: Heat Integration

Chapter 5:
Maximum Energy Recovery (MER)

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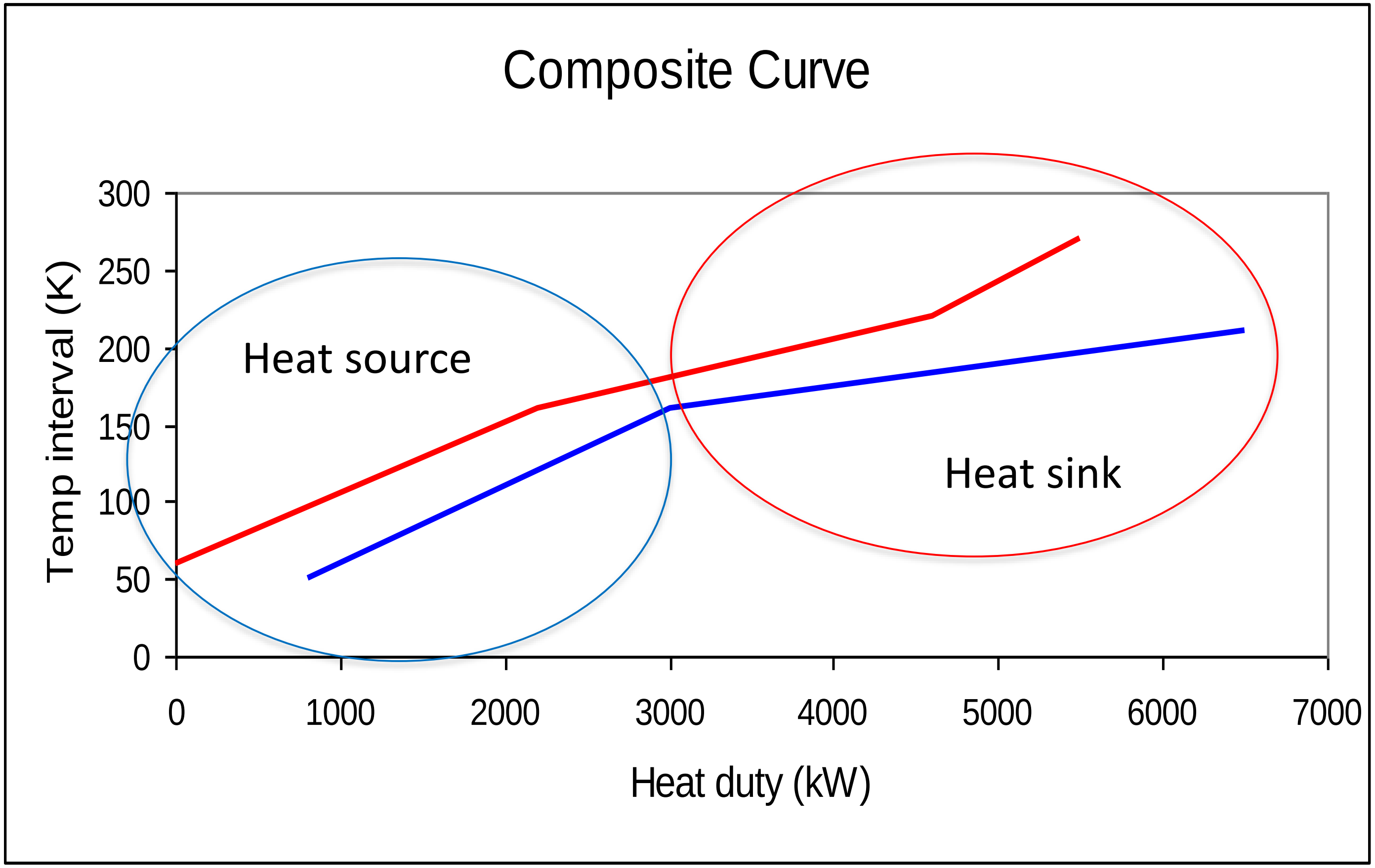
Chapter Description

- Aims
  - To estimate the maximum energy that can be recovered from the system
- Expected Outcomes
  - Students are able to evaluate existing system and then estimate the maximum energy recovery achievable

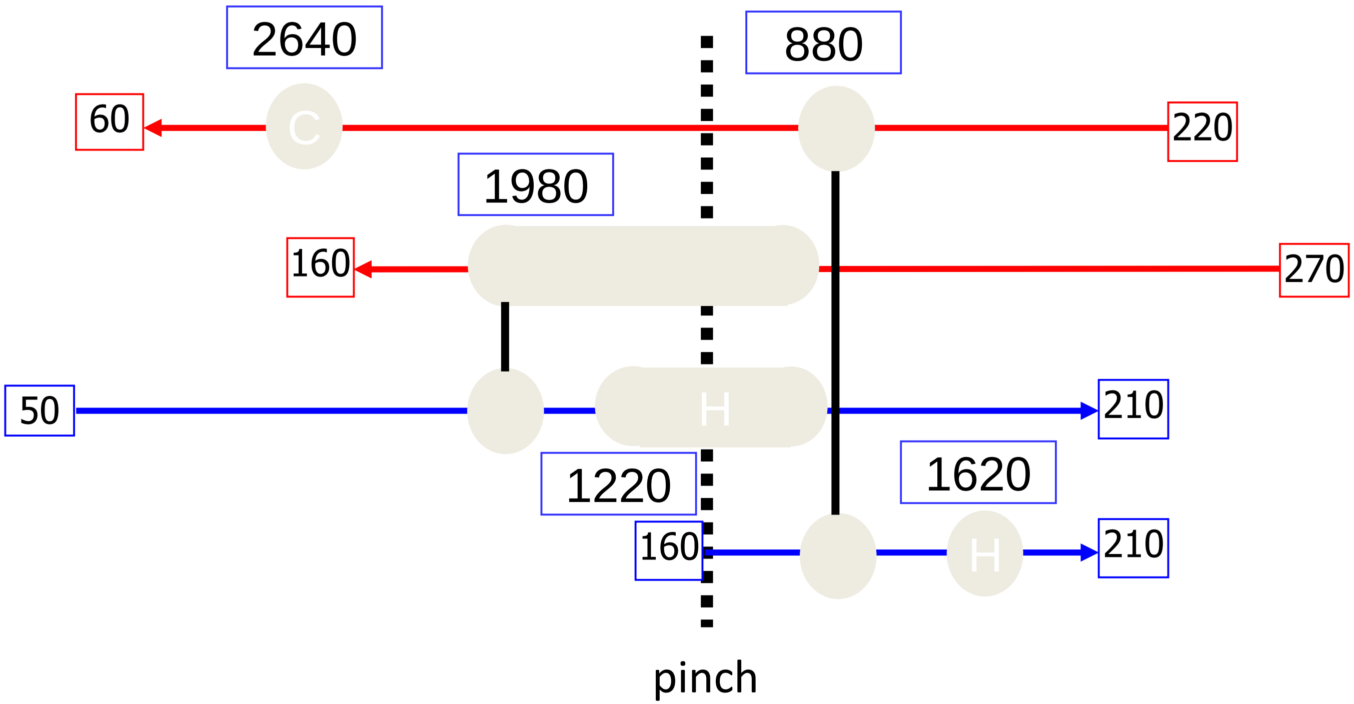
In this lecture we will learn how to estimate the maximum energy recovery

MER based on composite curve



Principle:
There is no heat across the pinch, hence heat is recovered only inside each region

Based on the base case



Heat recovery = 1980 + 880 = 2860 kW

Cold utility = 2640 kW

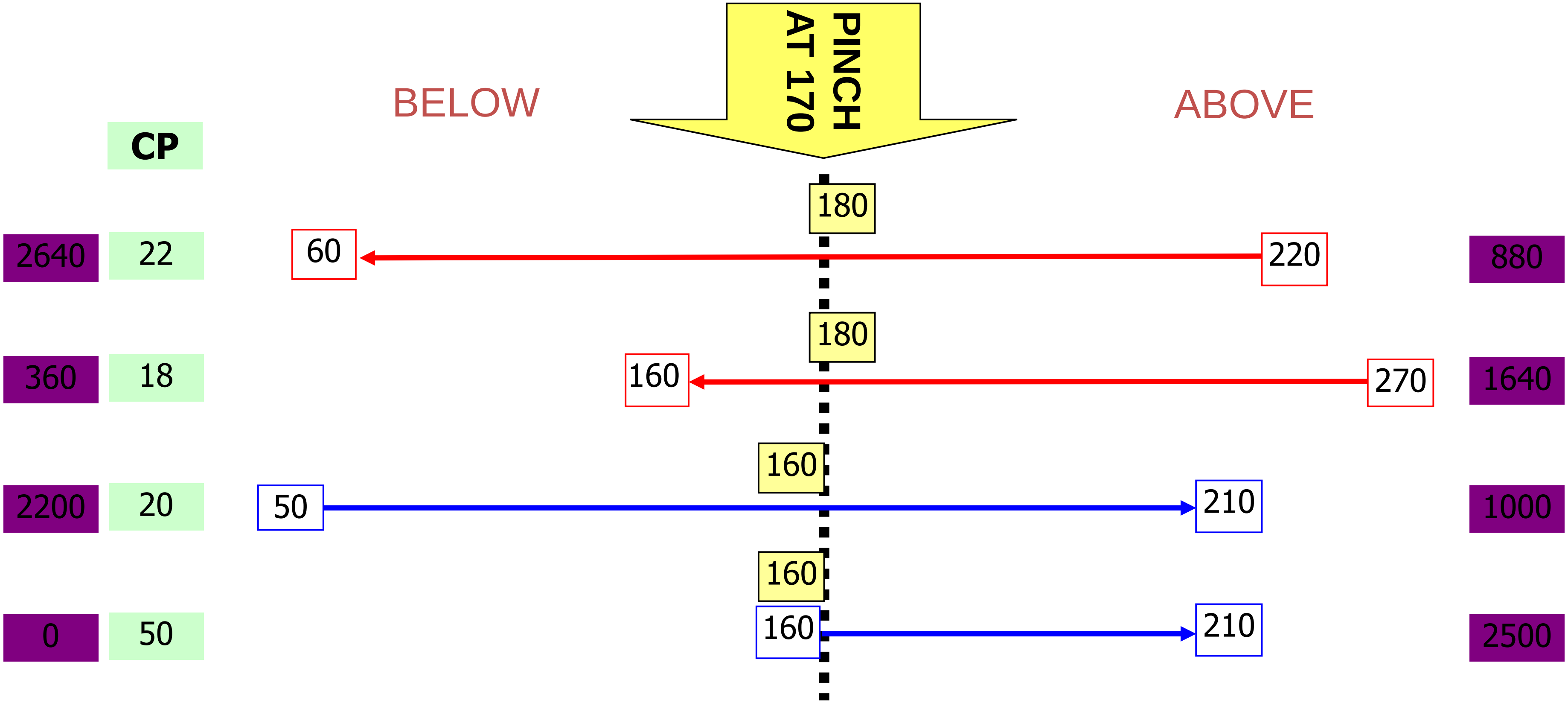
Hot utility = 1220 + 1620 = 2840 kW

Redesign the network

RULES

- CP in ≤ CP out
  - Start finding partners for streams OUT (with streams IN, away from pinch, or utility)
- N stream IN ≤ N stream out
  - If Ns IN > Ns OUT, split stream(s) OUT
- If CP in > CP out (no match), try to split stream(s) IN
- Set maximum heat recovery
- The remaining heat duty is covered by heater or cooler

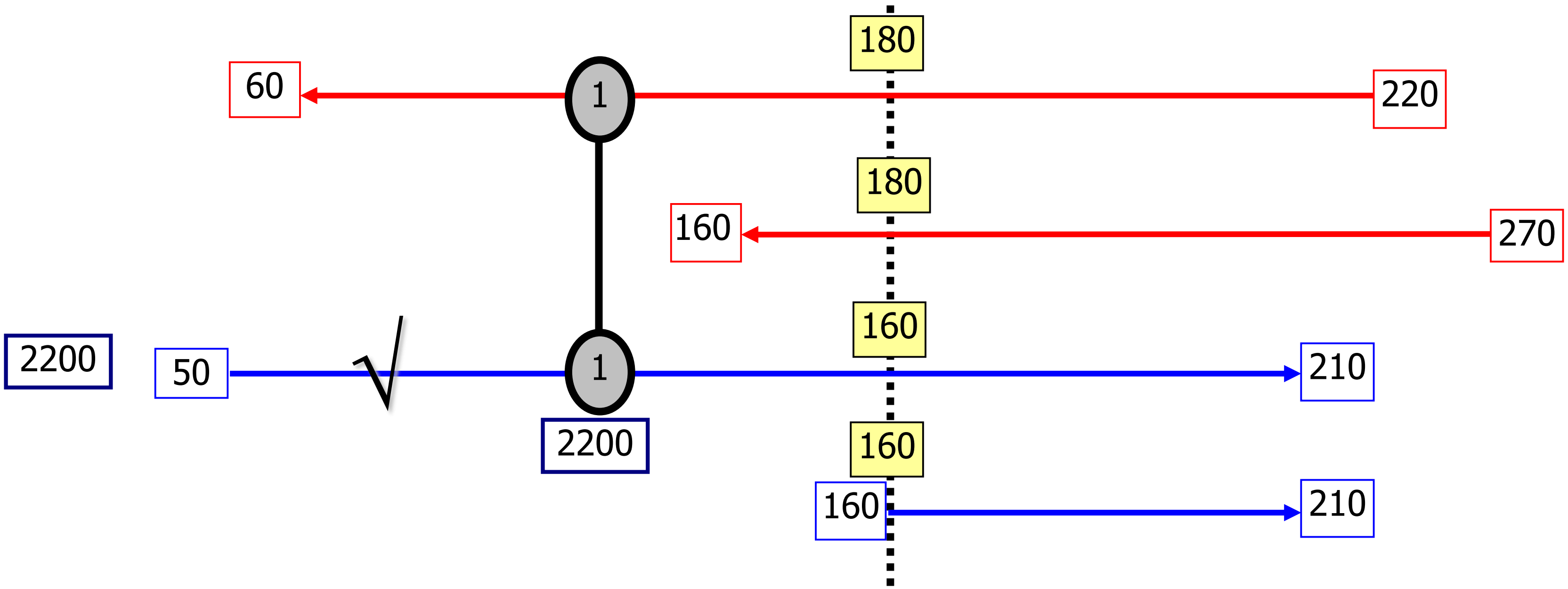
Let’s start from the pinch



Step 1: Below the PINCH

Connect S1(22) and S3(20)

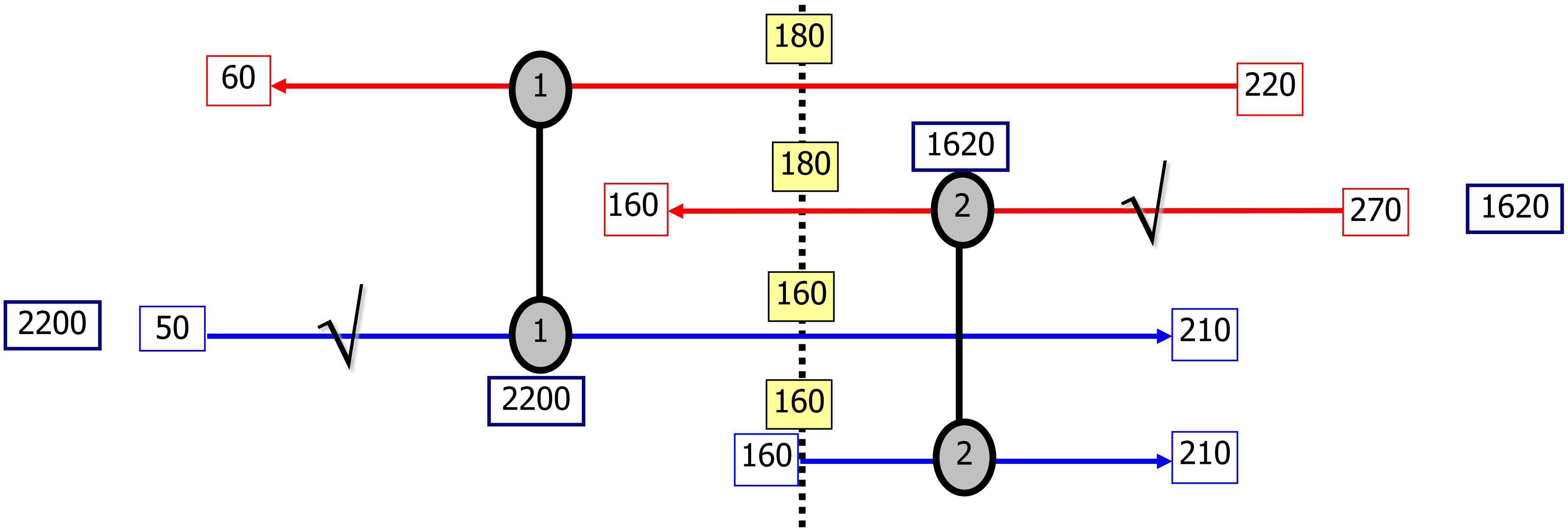
CP in < CP out



Step 2: Above the PINCH

Connect S2(18) and S4(50)

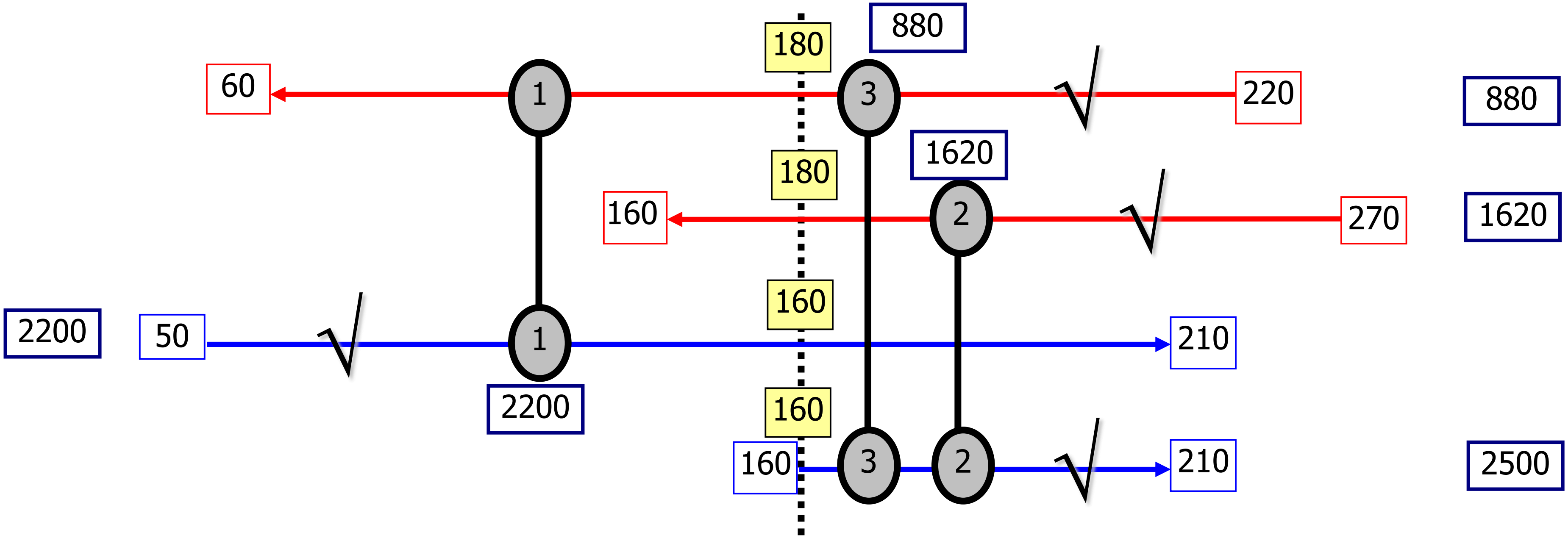
CP in < CP out



Step 3: Above the PINCH

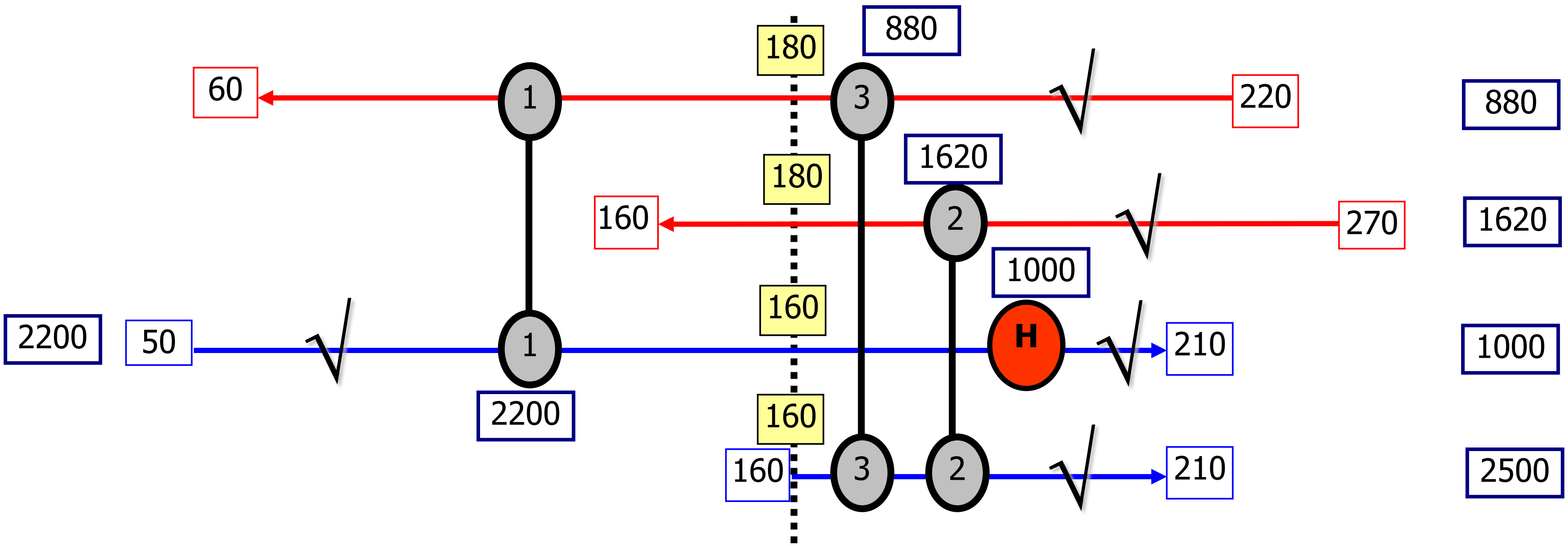
Connect S1(22) and S4(50)

CP in < CP out



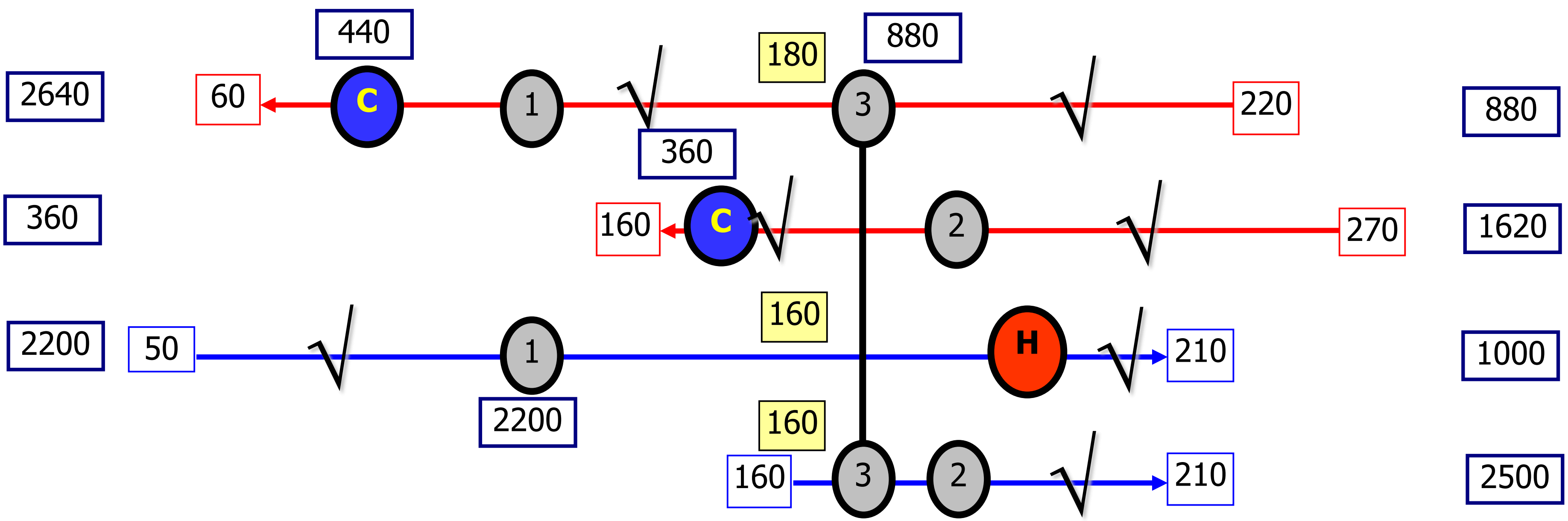
Step 4: Above the PINCH

Install Heater at S3(20)

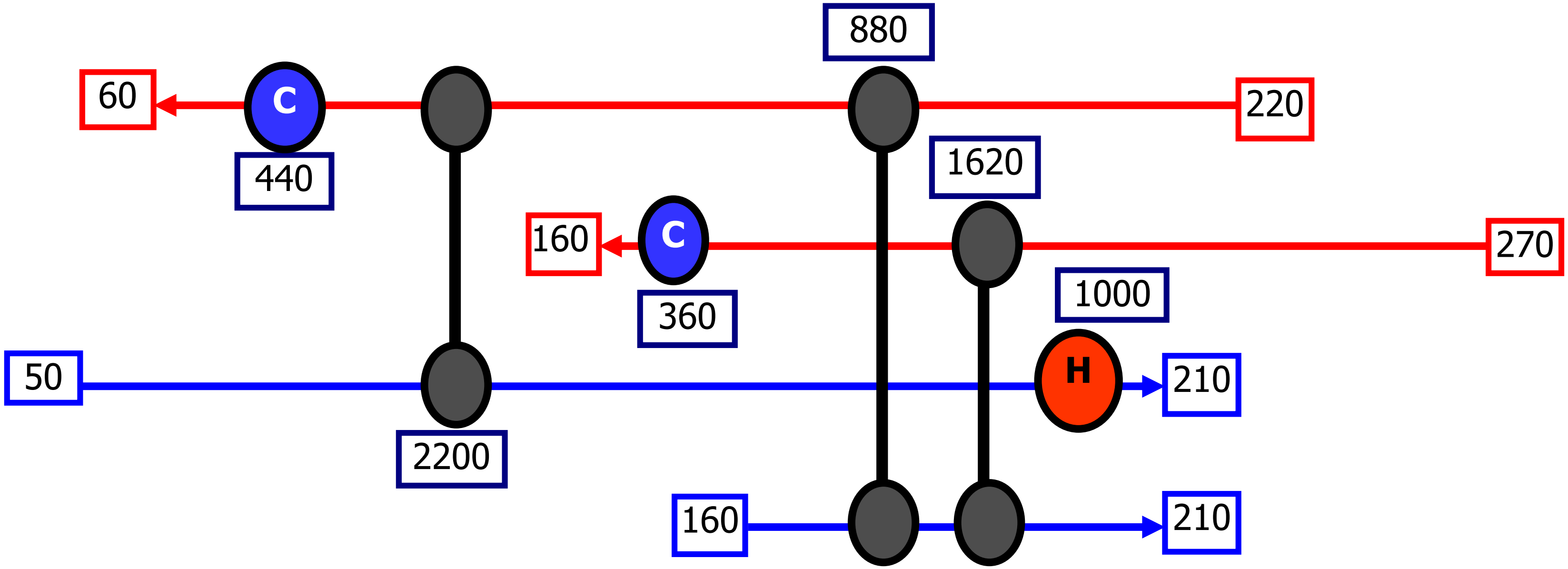


Step 5: Below the PINCH

Install Cooler at S1(22) and S2(18)



Finally .....



Maximum Energy Recovery (MER) = 2200 + 880 + 1620 = 4700 kW

Minimum cooling heat duty (Qc min) = 440 + 360 = 800 kW

Minimum heating heat duty (Qh min) = 1000 kW

Comparison

	Base case	Redesigned
MER	1980 + 880 = 2860 kW	2200 + 880 + 1620 = 4700 kW
Minimum cooling heat duty	2640 kW	440 + 360 = 800 kW
Minimum heating heat duty	1220 + 1620 = 2840 kW	1000 kW

Conclusion

- Energy recovered from the system increases by : %
- Savings from cold utility: %
- Savings from hot utility: %

Thank you