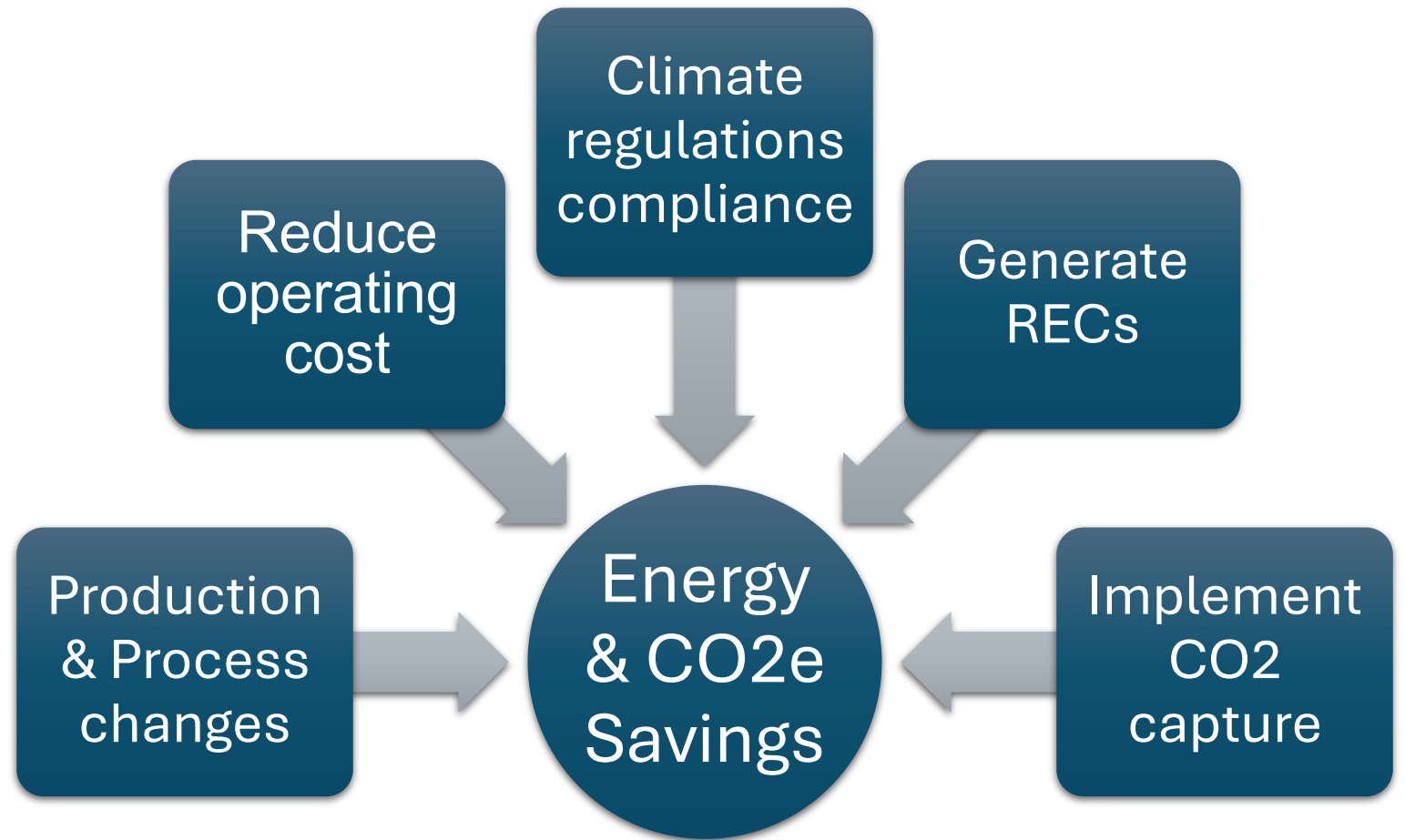




# Introduction

- Drivers for steam & CO2 emissions savings



# How to achieve energy & CO2e savings?

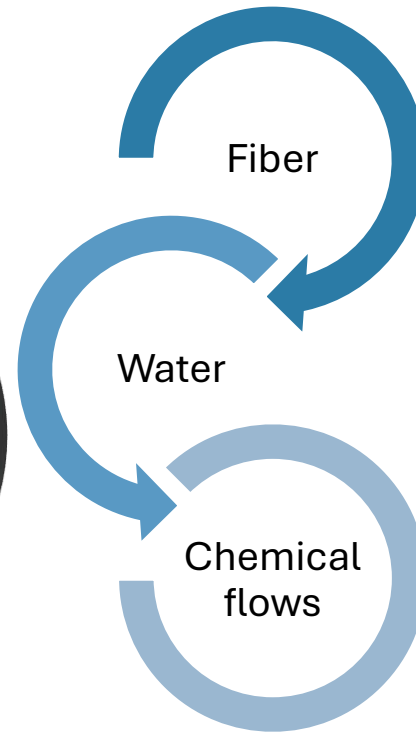
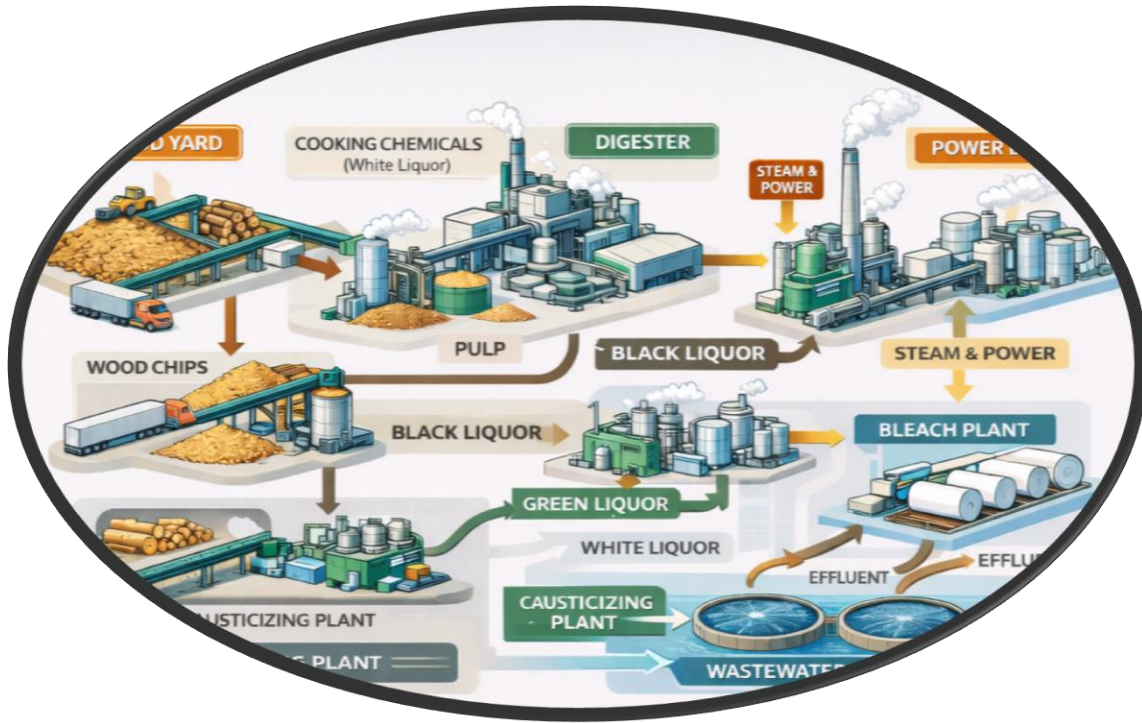
- Recover heat from the machine exhaust to heat air?
- Add a blow heat evaporator?
- Install a heat pump to upgrade flash vapor for high temperature water heating?
- Install a heat exchanger to heat demin water with evaporator vapor?
- Etc.....
- **Several options and technologies available!**
- The critical *question*:
  - **Which projects are the best for THIS mill?**
- **Answer:**
  - **Pinch analysis & Process Integration**

# Why choose Pinch analysis?



- Pinch generates a ***mill-specific target*** – tailored to your process
- It does ***not benchmark*** against other similar mills or BAT values
- Defines ***the best potential performance*** for your unique mill

# Analysis must be mill-wide



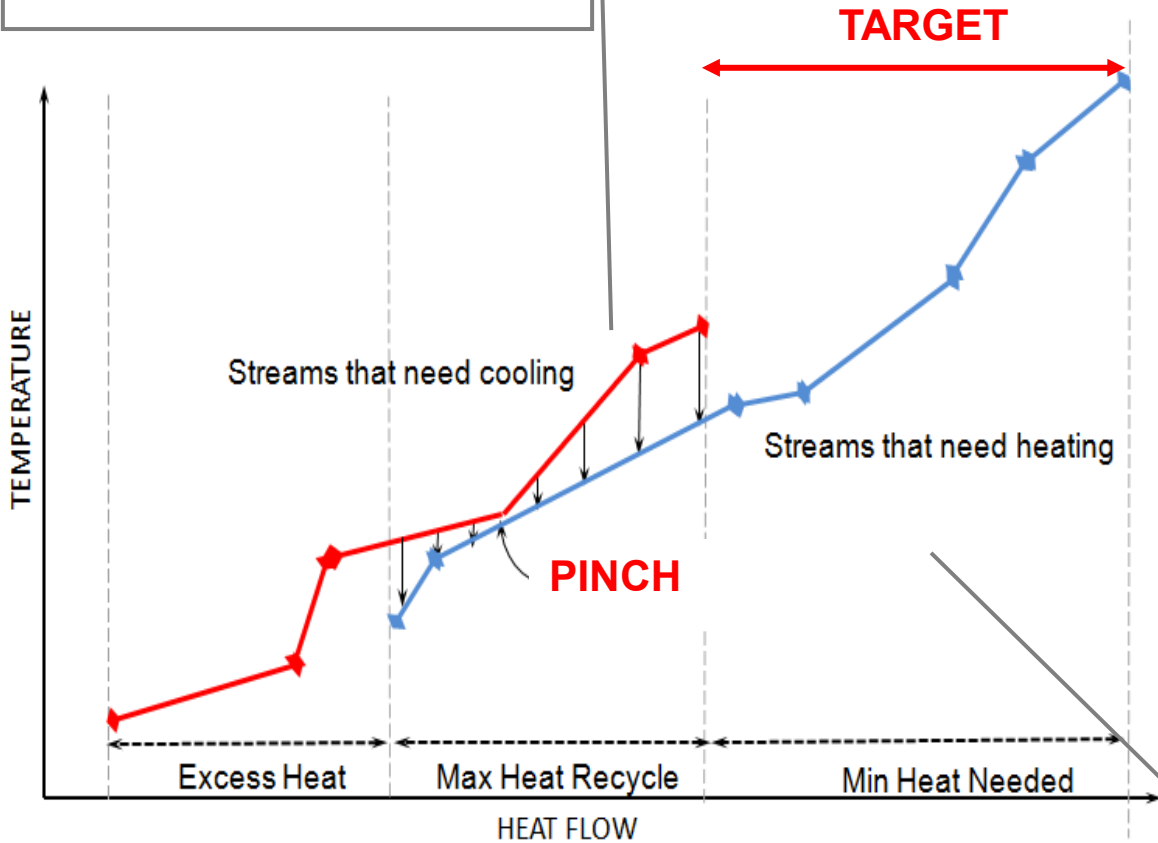
➤ Pinch examines the mill as a *whole*

➤ All synergies explored

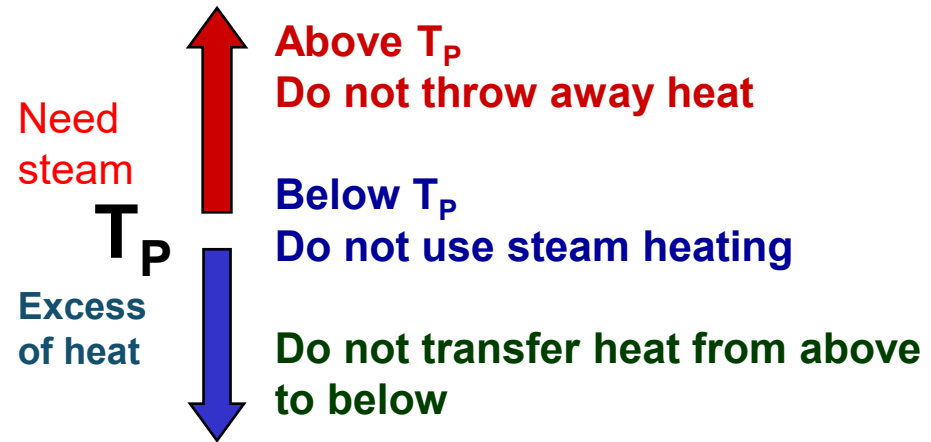
➤ No opportunity is missed

# Pinch Technology Concepts

*hot blow, accumulator hot water, machine exhaust etc.*

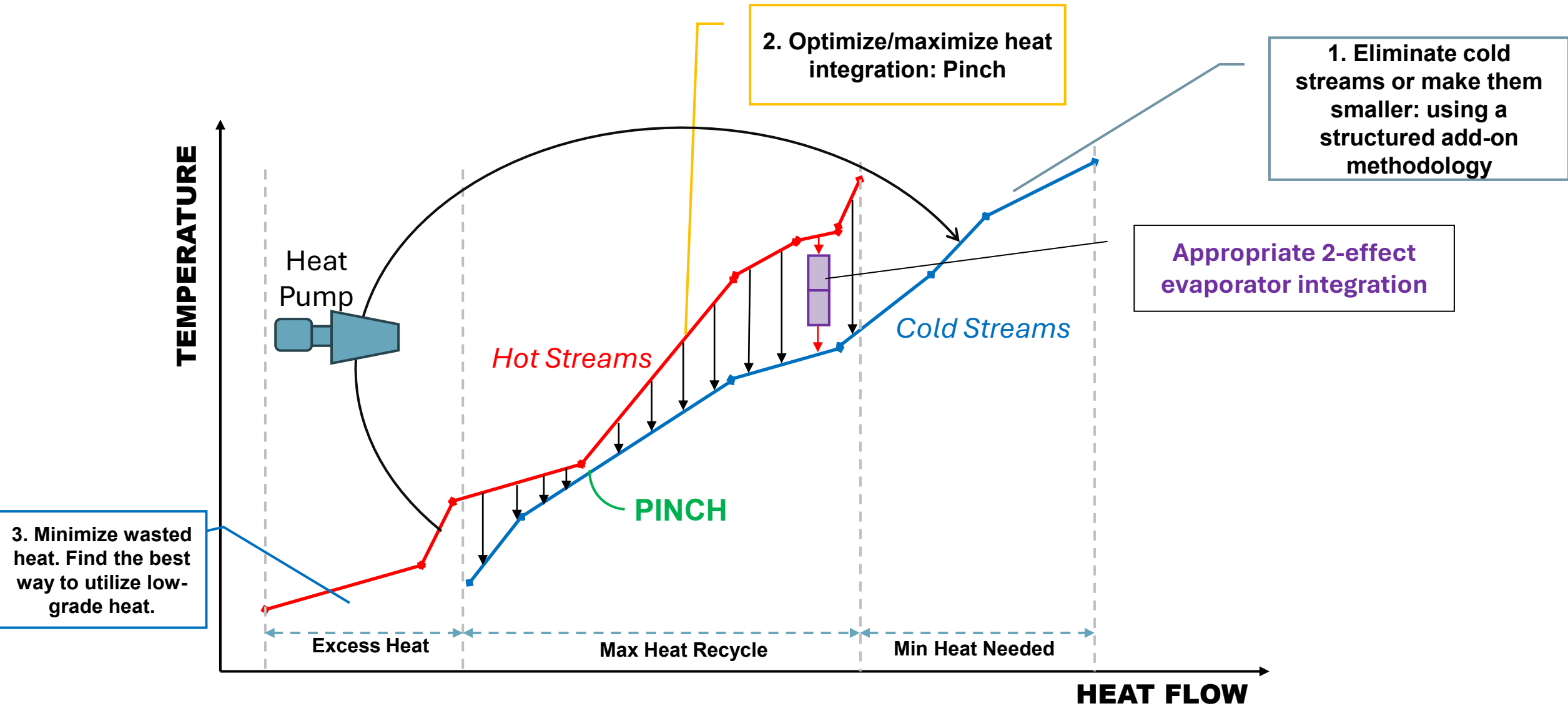


- Visualize the mill as a heat exchanger and discover where there is **excess heat** – where there is **heat needed** and
- Where is the critical temperature that defines the heat distribution **THE PINCH**.
- Then formulate project using the 3 simple rules:



*boiler feed water, white liquor heating, evaporator demand, etc.*

# How to work with Pinch



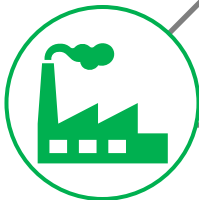
# What does it take to do a Pinch analysis?

Proven Pinch Experience



## Optimized Mill

Practical, good payback  
energy & CO2 reduction projects



Deep Pulp & Paper Know-How



Understanding of Economic Drivers

# Results from 500 API studies over 30 years

	Average steam savings	% of steam saved	Average specific steam savings	Fossil CO2 emissions reduction	Fossil CO2 emissions reduction	Project payback
Engineering Units	MMBtu/h	% of total	MMBtu/BD short ton	Metric tons per year	% of total	years
Average of all studies	104	17%	3.35	58,000*	46%	< 2

**+ significant water savings**

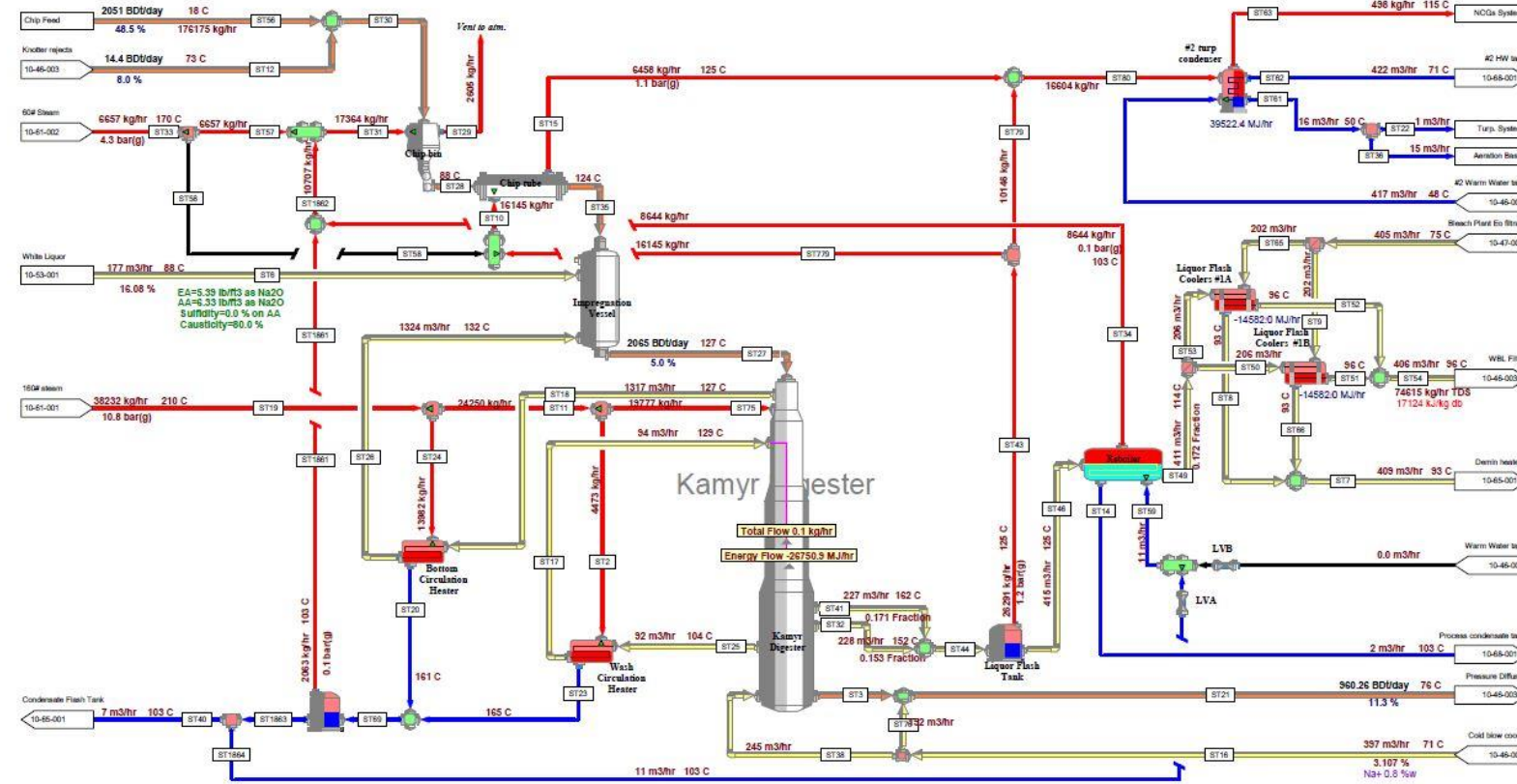
\* CO2 emissions normalized based on average steam savings, 80% Natural Gas boiler efficiency and CO2e factor of Natural Gas 0.05338 MT/MMBtu

# **Additional essential tools for Pinch studies**

# Simulation Modeling

## Importance of a mill-wide model

- Calculate missing data
- Identify erroneous measurements
- Create a reference point of average – normal operating conditions
- Allows evaluation of site-wide-impact of projects and changes
- Analysis of scenarios



Stream Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Description	ST196	ST197	ST198	ST199	ST200	ST201	ST202	ST203	ST204	ST205	ST206	ST207	ST208	ST209	ST210	ST211	ST212	ST213	ST214	ST215	ST216	ST217	ST218	ST219	ST220	
Flow	38232	84296.4	14576.2	80922.2	14227.6	38232.1	4948.42	57962.4	18956.8	3303.18	87222.2	96522.2	86595.4	77762.2	22319.6	280216.2	417340.2	12762.2	38994.2	9801.2	43800.2	53790.2	96928.2	24438.2	190302.2	190302.2
Temperature	210	170	88	132	127	127	123	127	127	123	127	127	123	127	127	127	127	127	127	127	127	127	127	127	127	127
Pressure	10.8	4.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

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DWG NO	REV
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# Capital Light Improvement using Pinch (CLIP)

- Examine the **cold** streams – the streams that need energy
  - Can we eliminate them by operational projects?
  - Can we make them smaller by operational projects?
  - Consult mill personnel before including them into the analysis
- Performed before developing capital projects
  - Both capital and energy is saved

## Key Tools of the methodology:

### **Benchmarking**

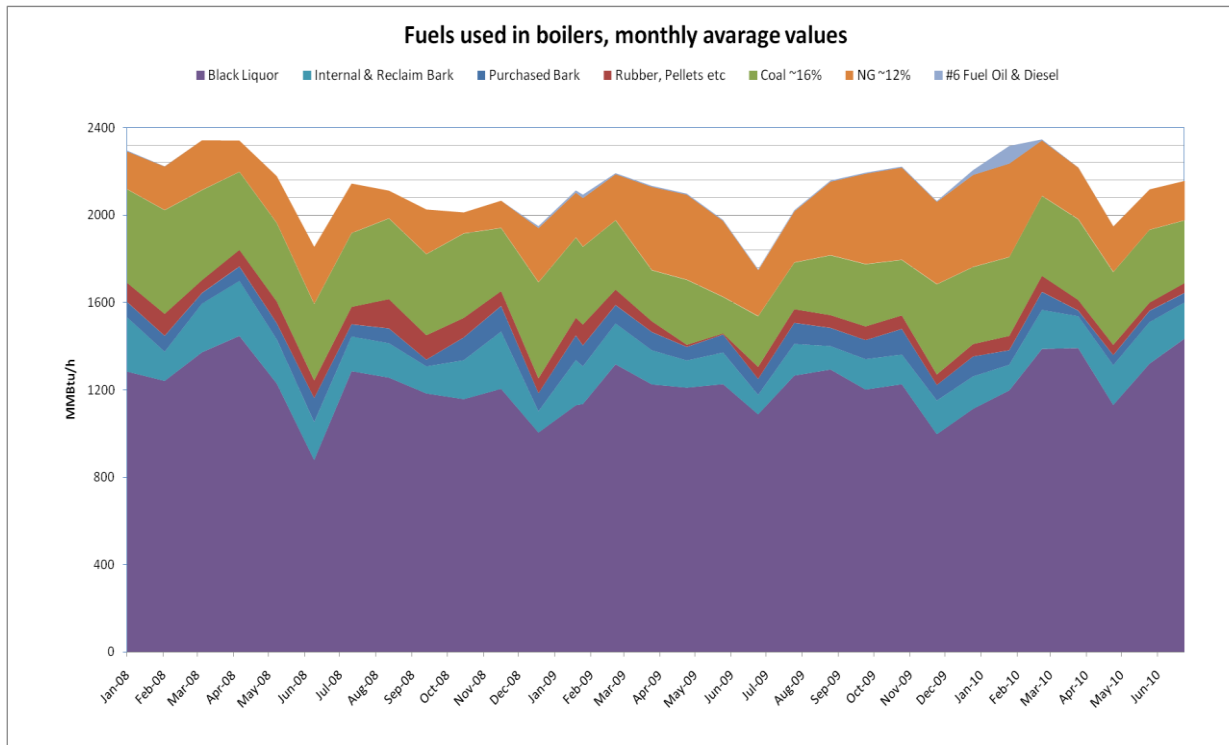
- Find out the overall and departmental energy performance of the mill – Key Performance Indicators

### **Industry best practices**

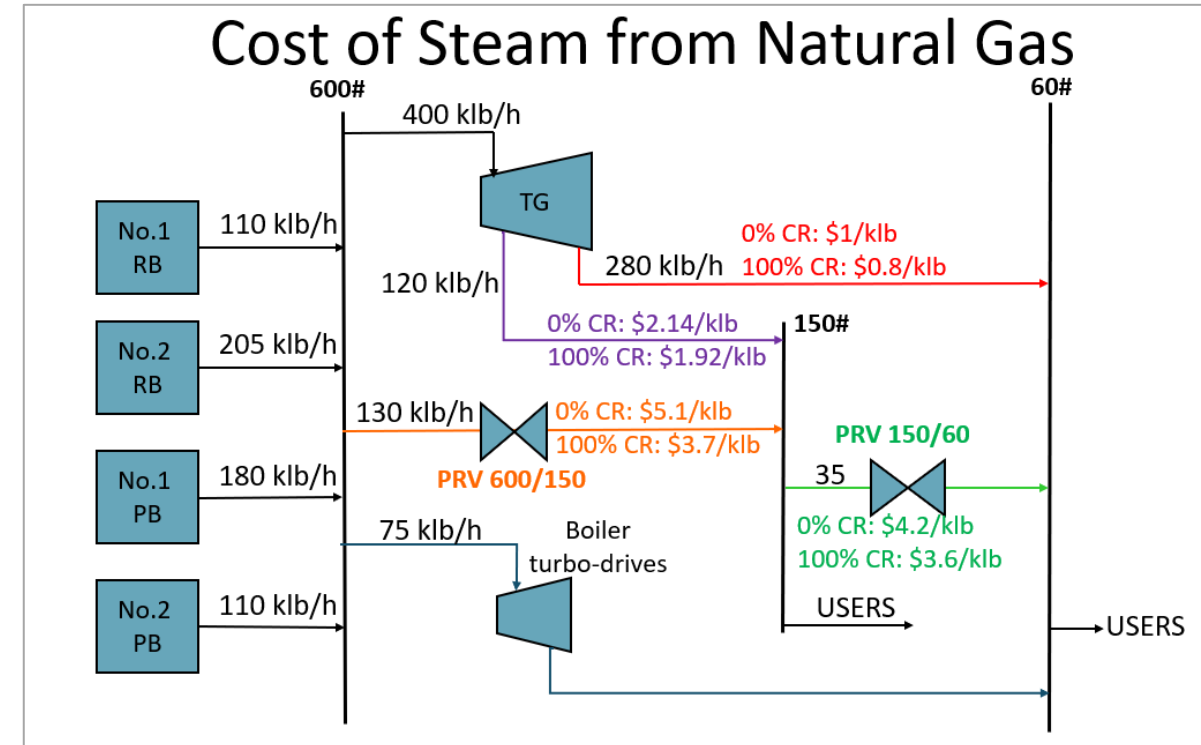
- Utilizing a large database of good industry practices as well as practical experience in pulp and paper industry

# Economic Scenario Analysis

## Steam origin



## Marginal cost of steam



# Thank you!

Lee Hill: [lhill@americanprocess.com](mailto:lhill@americanprocess.com)

Sofia Rouzinou: [srouzinou@americanprocess.com](mailto:srouzinou@americanprocess.com)

<https://americanprocess.com>