



PAPERWEEK CANADA  2024



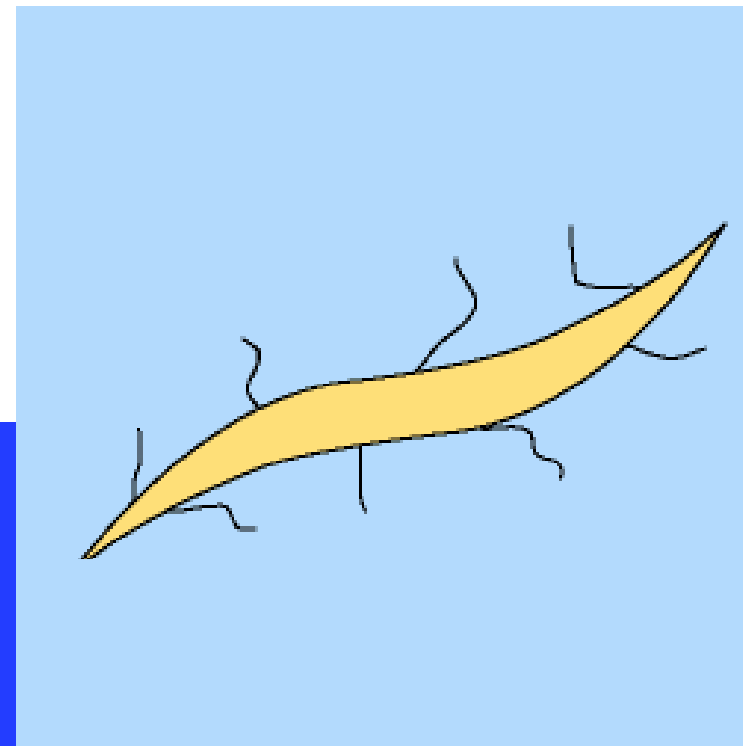
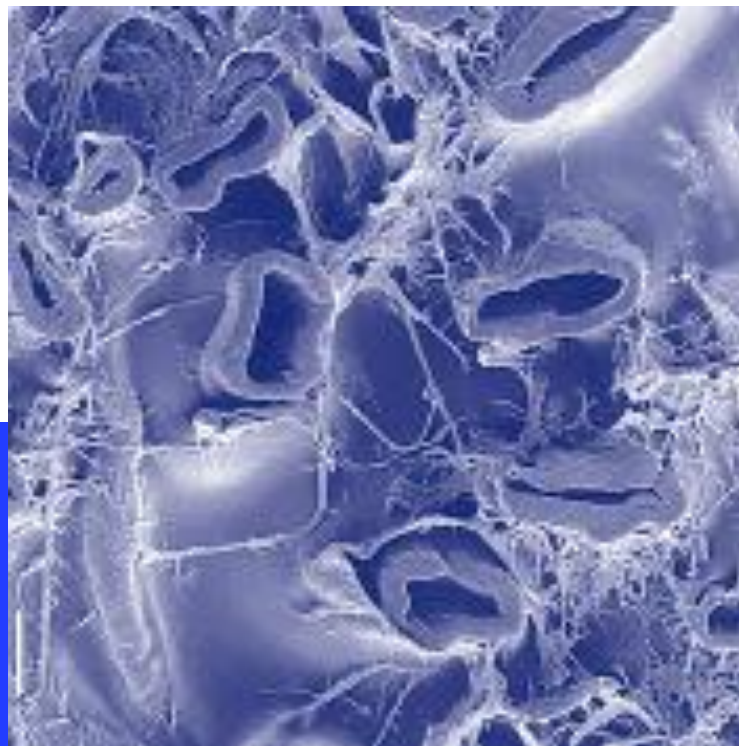
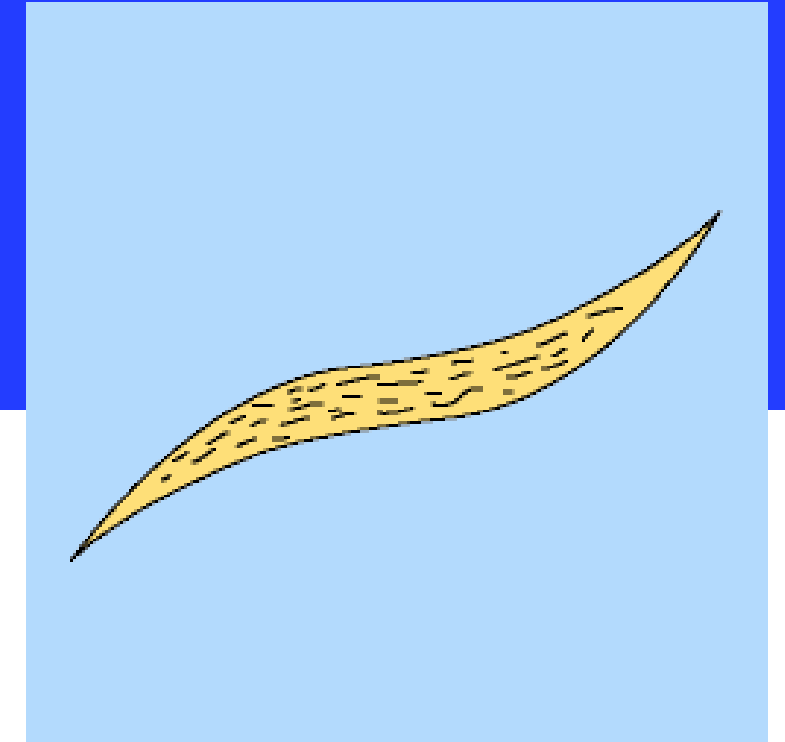
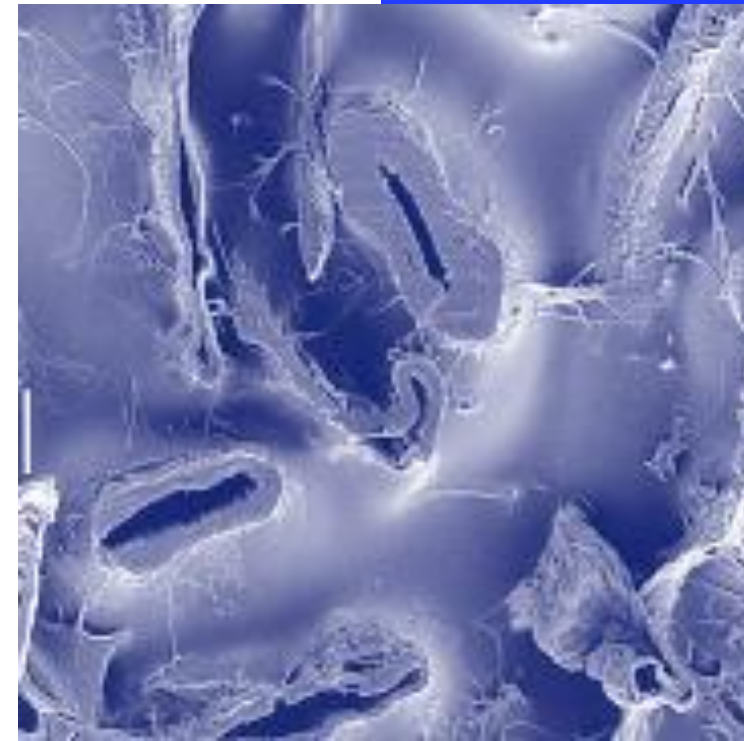
REFINER AUTOMATION THROUGH AI/ML

Arjunan PN, Dr. Przem Pruszyński, Ram Santhanam

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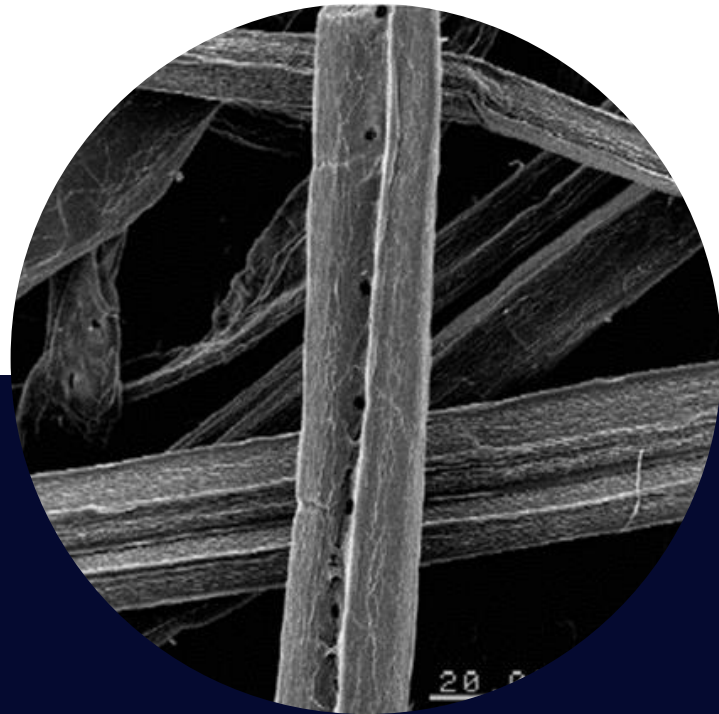


OBJECTIVE OF REFINING AUTOMATION



- Internal Fibrillation
- External Fibrillation

OBJECTIVE OF REFINING AUTOMATION



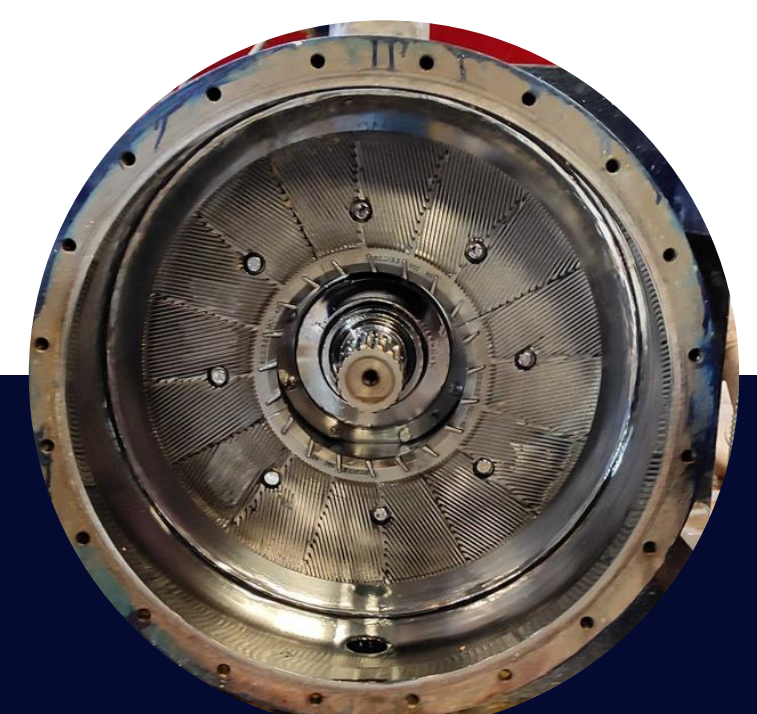
Consistent Freeness

Improvement in properties
and runnability



Energy

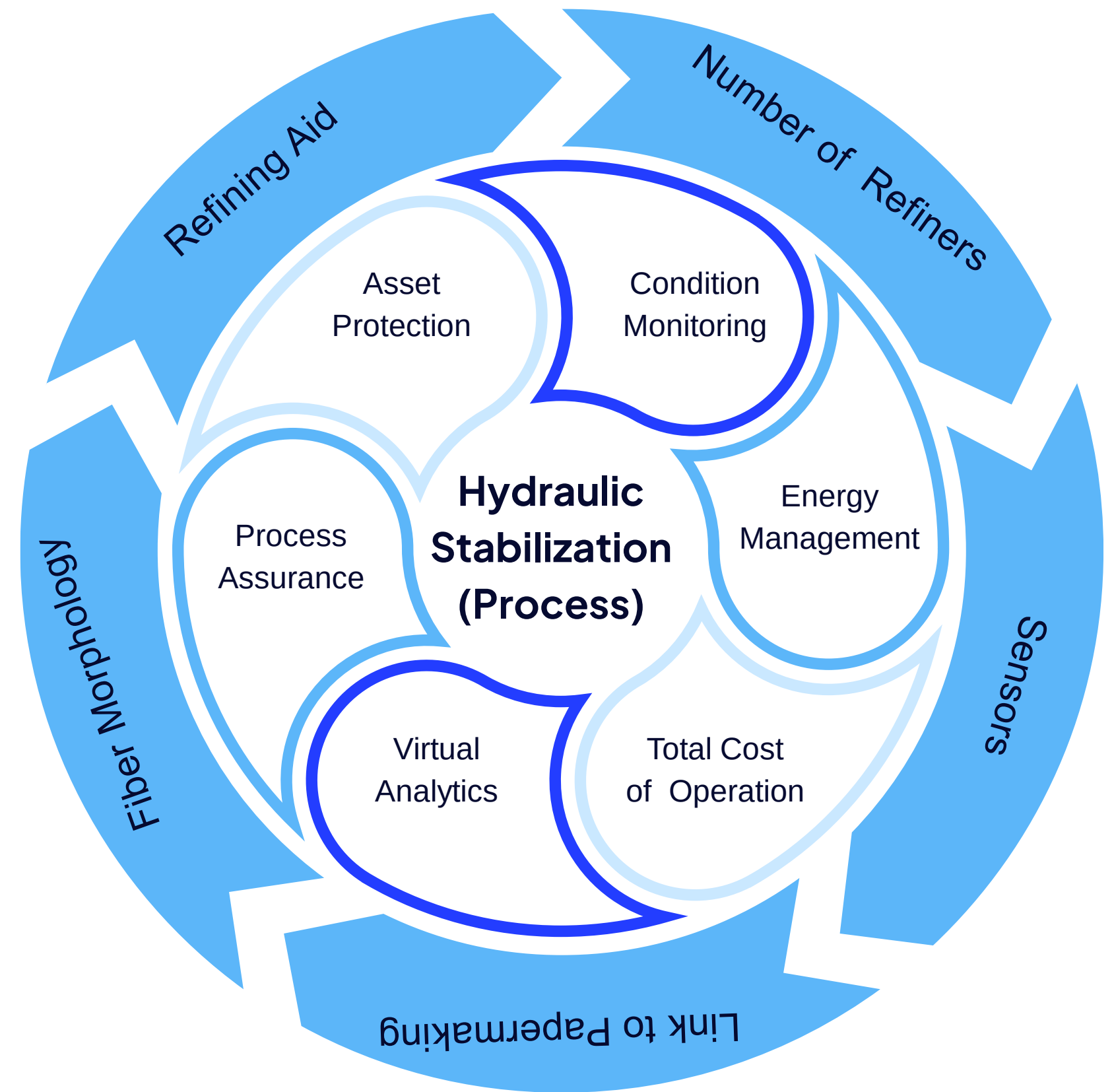
Savings in power by imparting
appropriate energy for
fibrillation



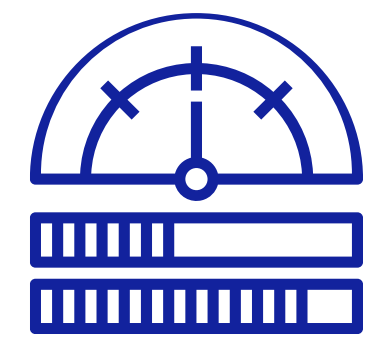
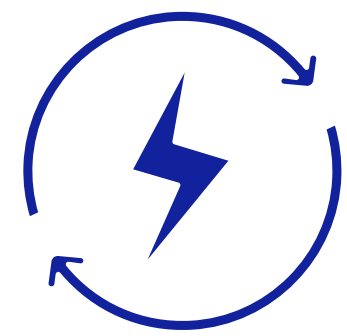
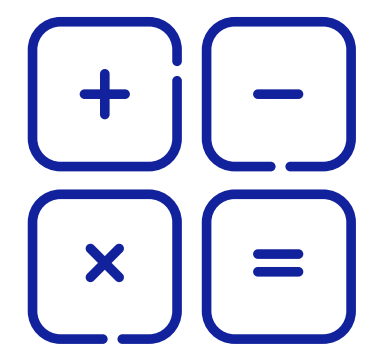
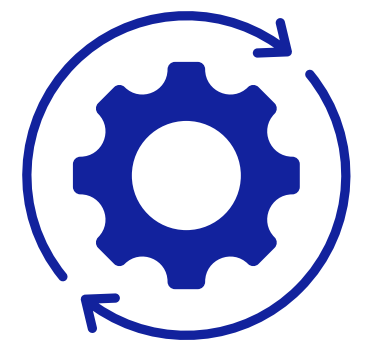
Tackle Life

Optimize life of tackles

INTRODUCING HABER REFINER MANAGEMENT SUITE



APPROACH TO REFINER MANAGEMENT SUITE



PROCESS STABILISATION

Inlet Flow,
Consistency % of pulp,
Pressure across refiner,
Recirculation Flow

INFLUENCERS

pH, Viscosity and, Strength

ENERGY OPTIMISATION

Evaluate optimum
Energy required (SEC)

MEASURE

Real-time Freeness

COMPREHENSIVE APPROACH

Monitor, Flag Input Variables

- Take Consistency Transmitter, Flow, Inlet and Outlet Pressure signals
- Take Power signal for Sp. Energy consumption

Track Segment Life Real-time

- Unique approach required – Direct measurement of gap
- Traditional Gap Sensors are available

Maintenance Aspects

- Bearing conditions
- Motor conditions

Process Control

- Online Freeness measurement
- Optional Fibre image analysis

VIRTUAL ANALYTICS – PROCESS ASSURANCE

Freeness within target bandwidth

Identify best throughput range

Identify best back pressure point

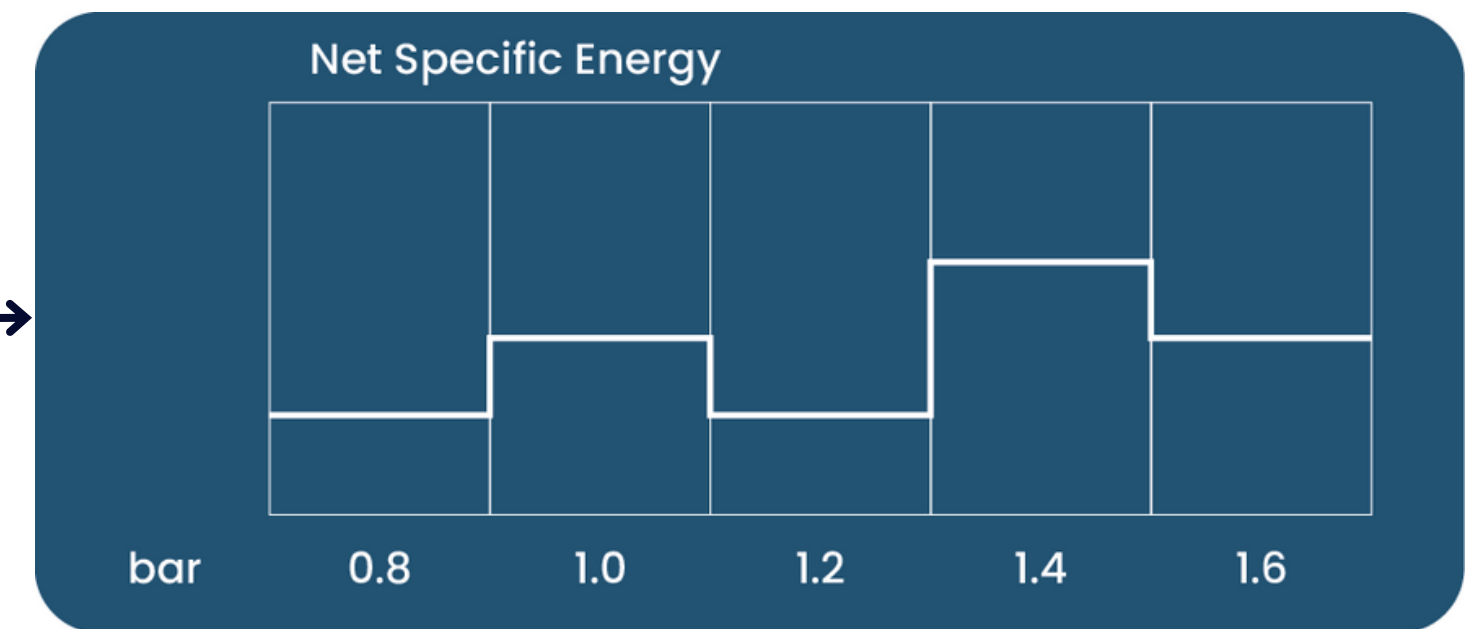
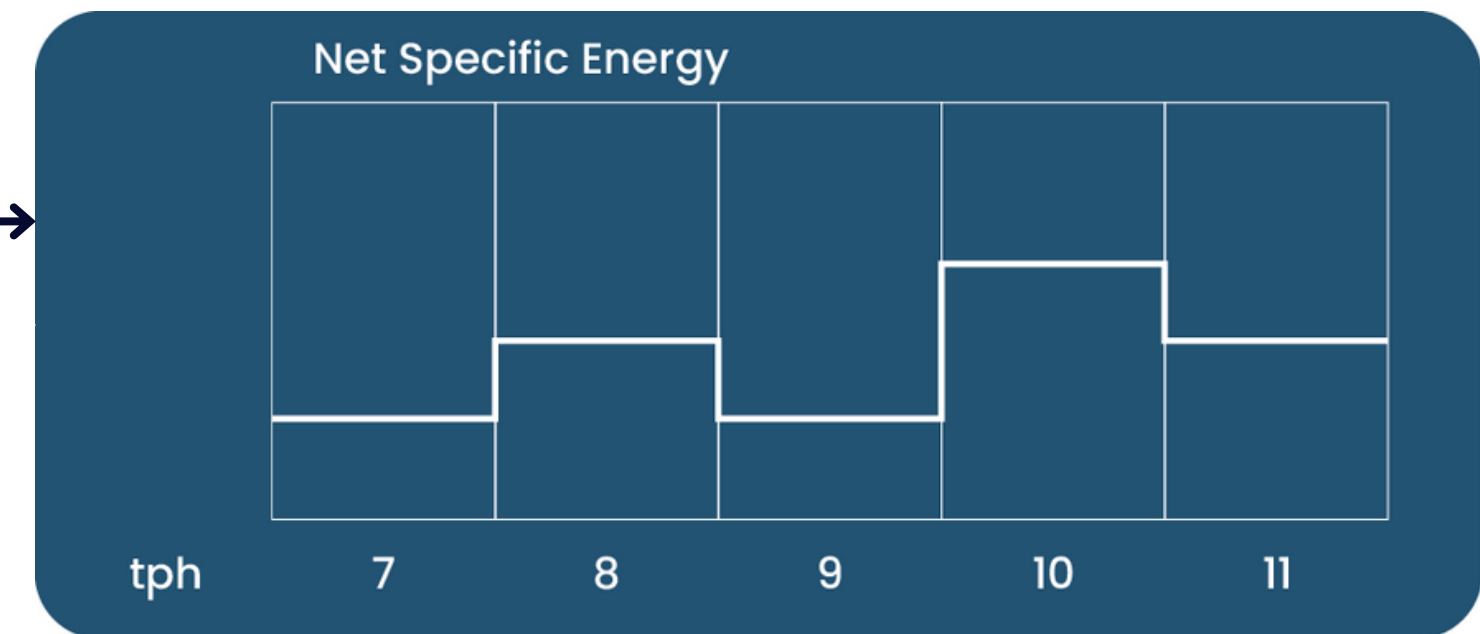
Freeness rise Vs Net specific energy

Gap Vs Segment Life trend

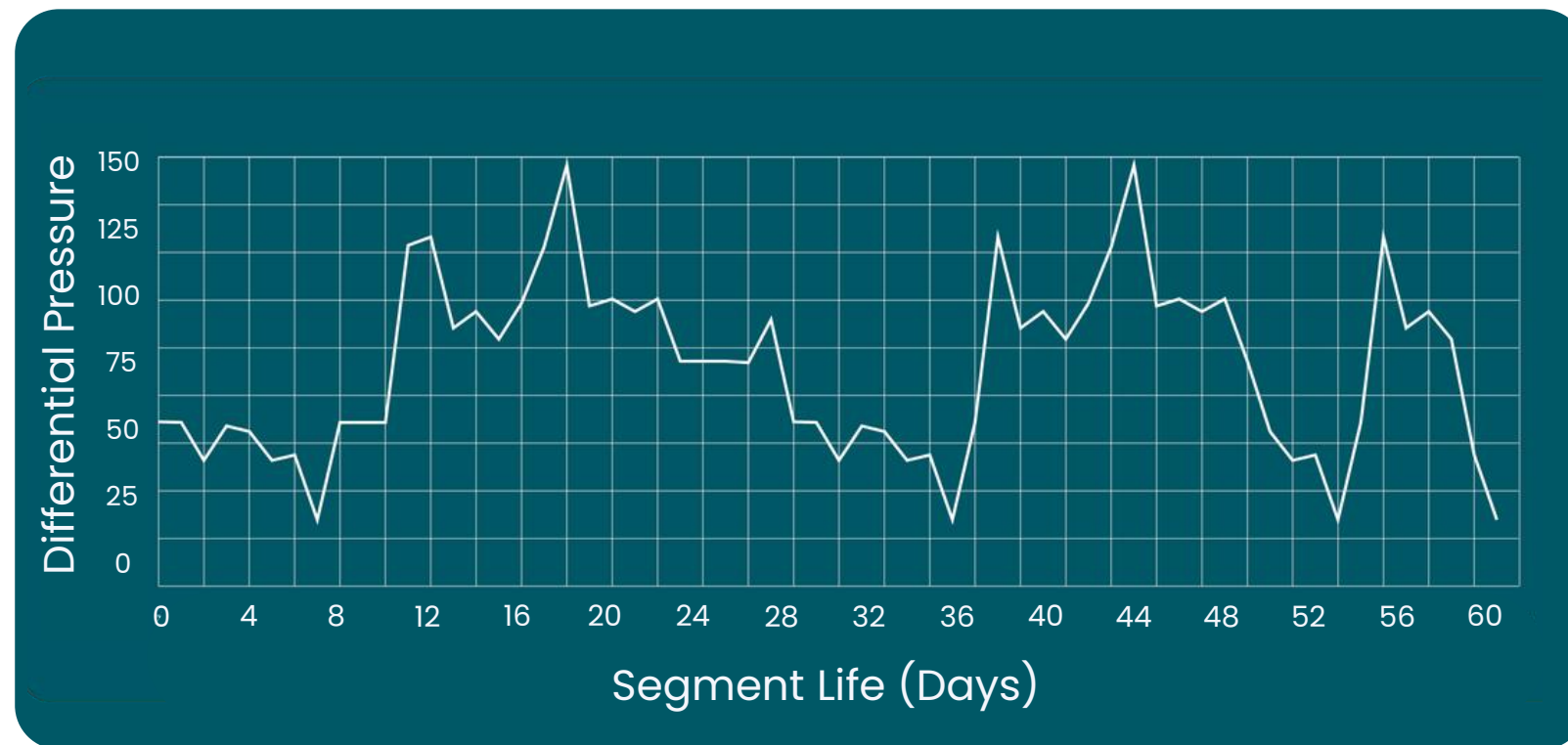
SEC Vs Segment Life trend

Extension of Segment Life per Refiner

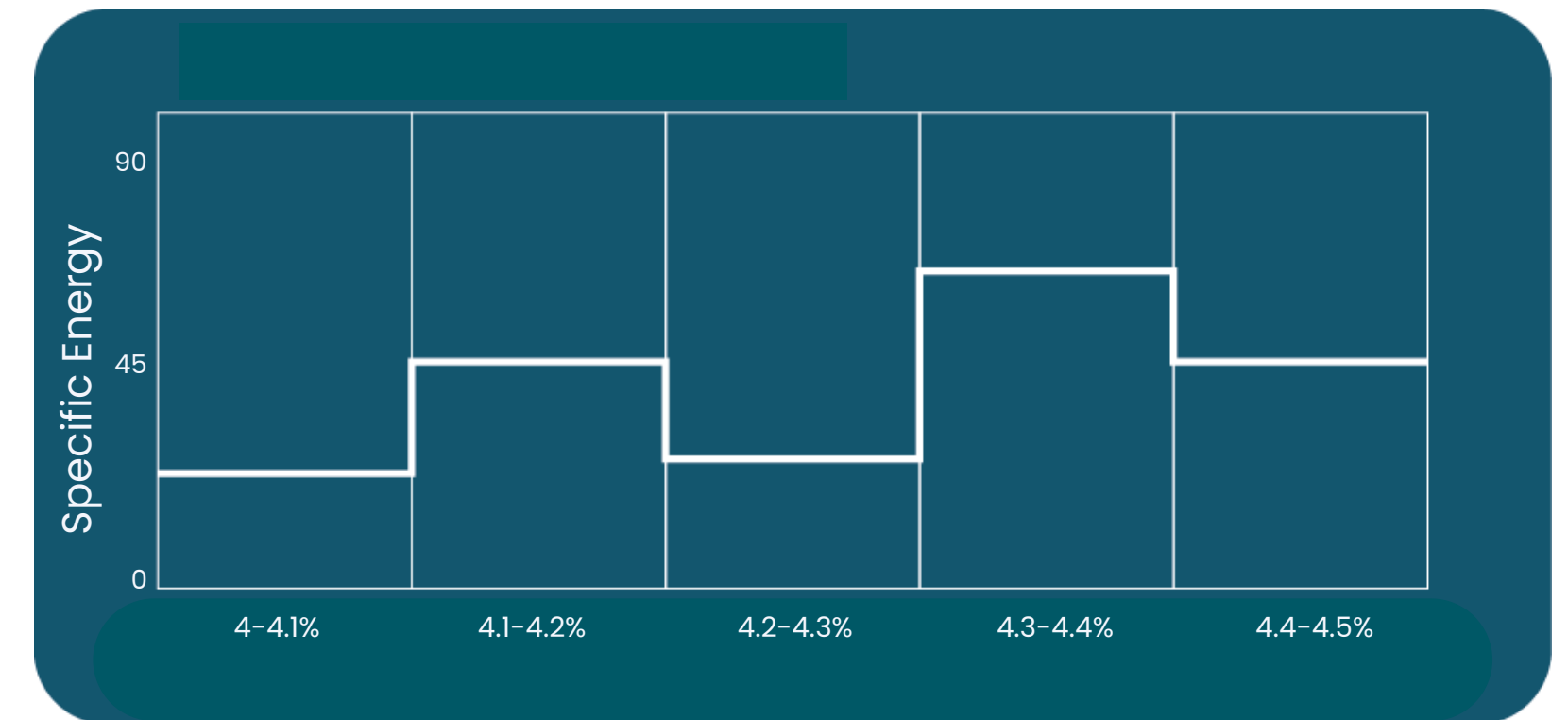
Operational Costs Savings



VIRTUAL ANALYTICS – PROCESS ASSURANCE

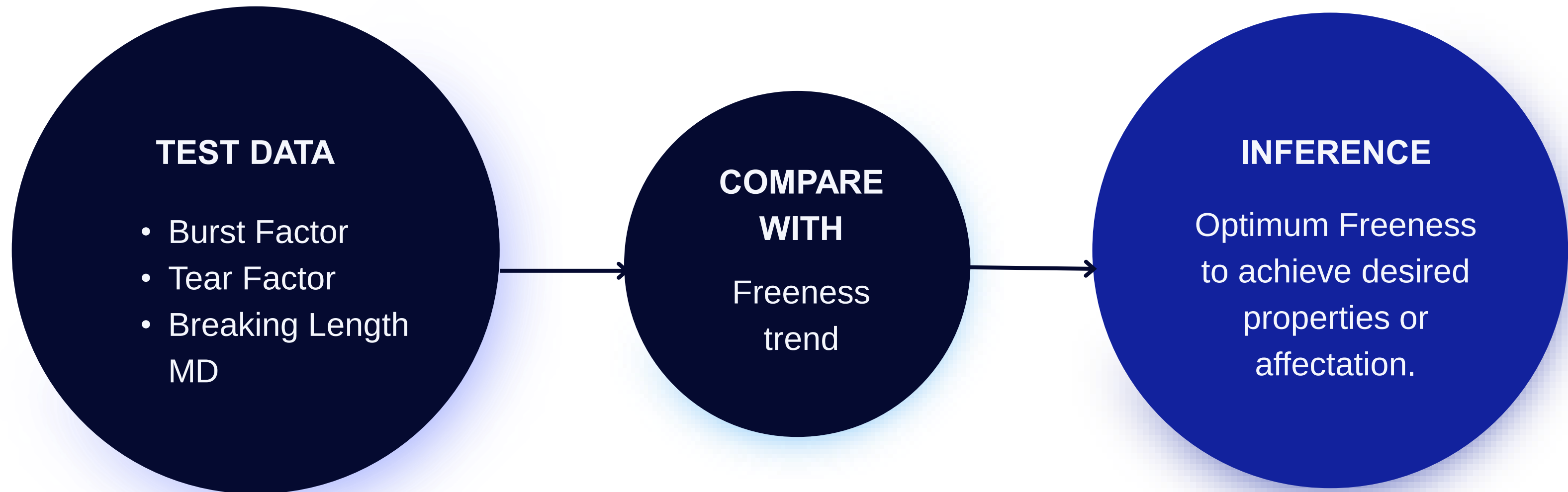


Differential Pressure Vs Segment Life



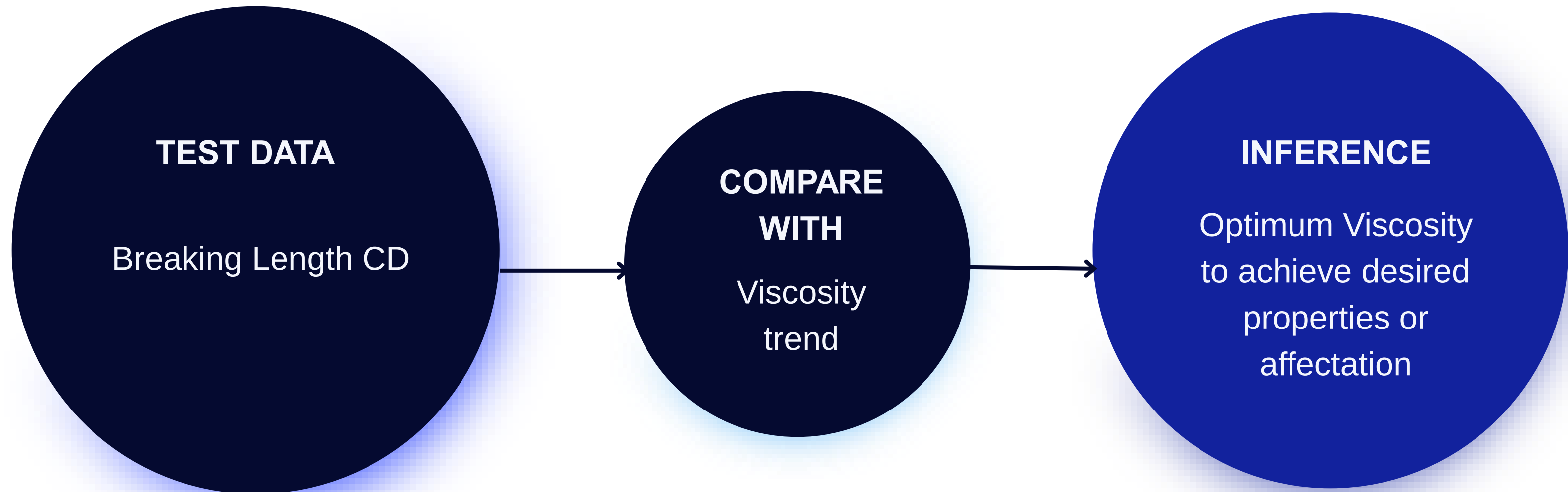
Identify best consistency range

PAPER PROPERTIES (OFFLINE DATA)



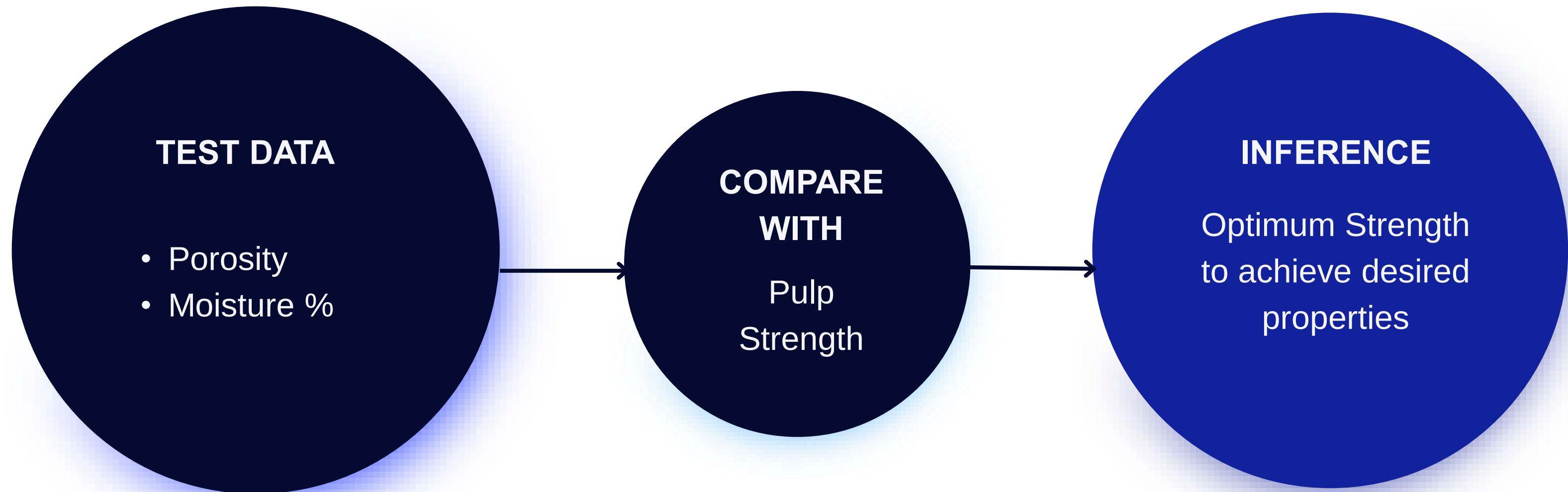
Data Generation: Once per Roll
Data Frequency: X rolls/Day (6X Data points per day)

PAPER PROPERTIES (OFFLINE DATA)



Data Generation: Once per Roll
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PAPER PROPERTIES (OFFLINE DATA)



Data Generation: Once per Roll
Data Frequency: X rolls/Day (6X Data points per day)

DATA TO INTELLIGENT INFERENCE

Optimum Freeness →

Grade
Properties
Freeness

Optimum Furnish →

Furnish type
Freeness
SEC

Optimum pH →

Pulp pH
Grade
Freeness

DATA TO INTELLIGENT INFERENCE

Optimum Viscosity →

Pulp Viscosity
Properties
Freeness

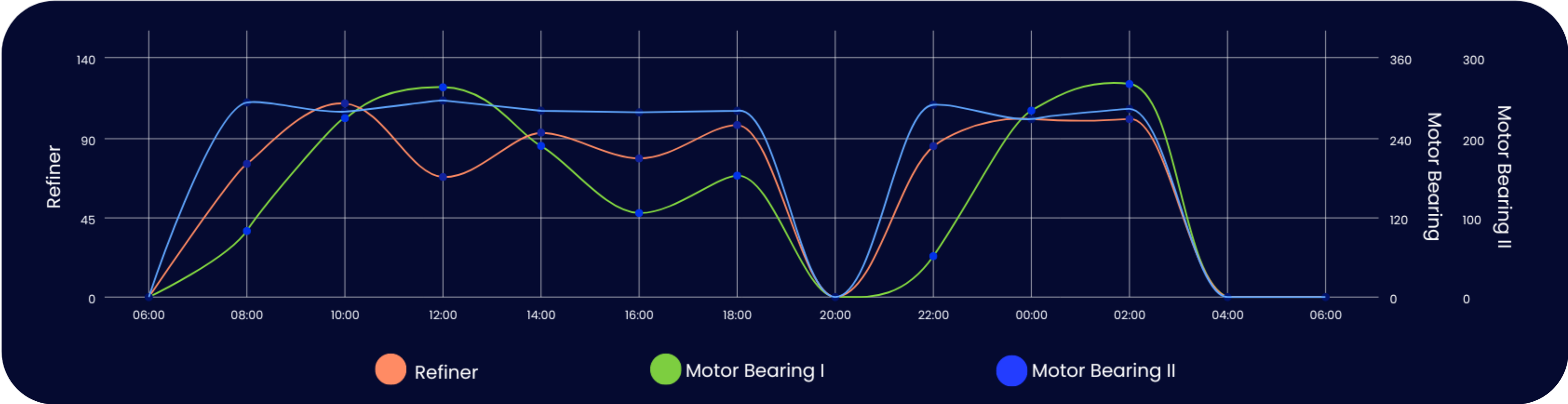
Minimum Strength →

Pulp Strength
Grade
Freeness

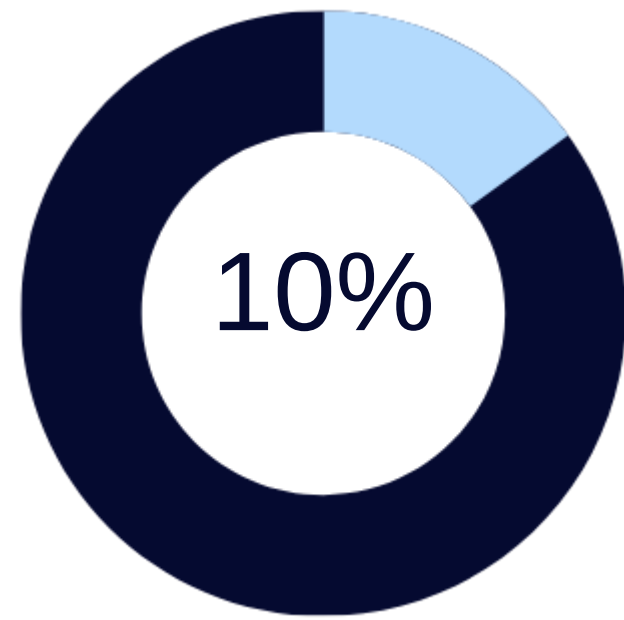
Minimum Energy
required →

Freeness
Throughput
SEC

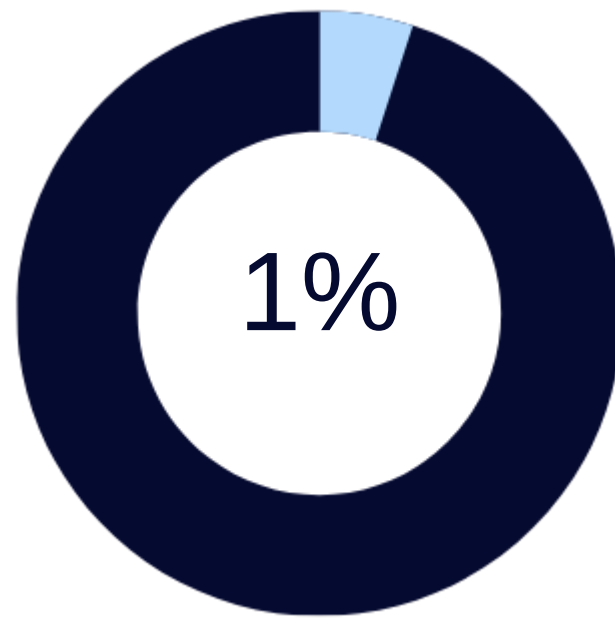
VIBRATION ANALYSIS TREND



RETURN ON INVESTMENT



Increase in Tackle Life

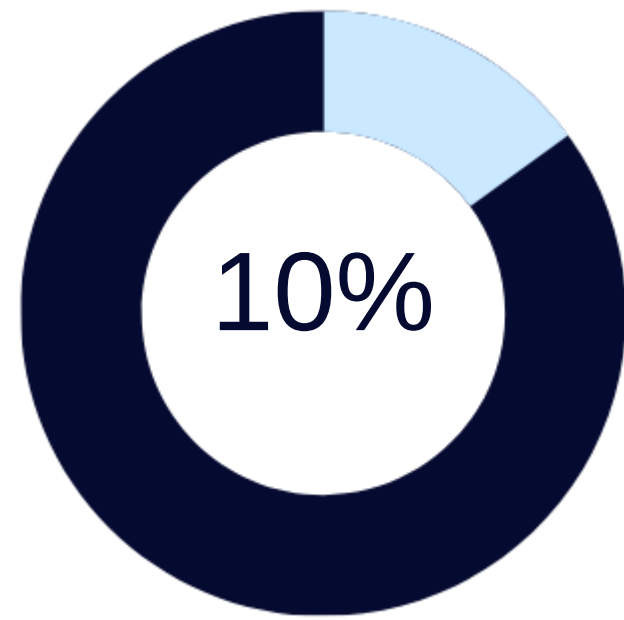


Increase in Sheet Ash

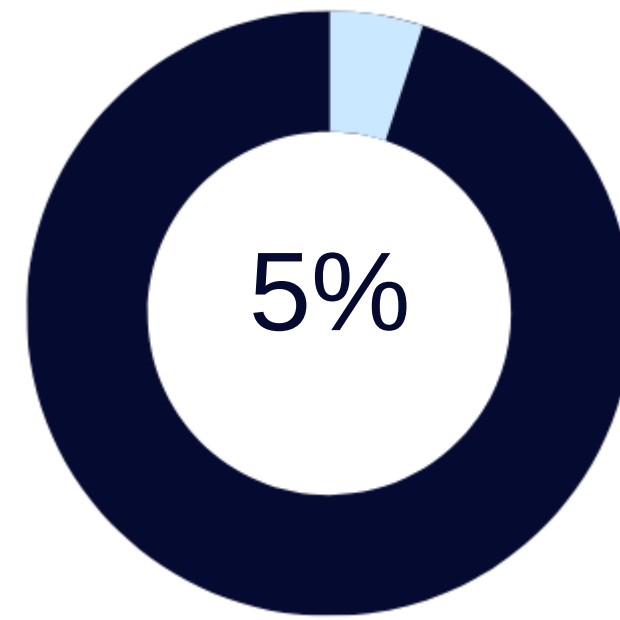


Increase Machine Efficiency

RETURN ON INVESTMENT



Decrease in Energy
consumption



Decrease in Steam
Consumption



Decrease in Quality
Rejects

ENERGY MODELLING

01

Learning

Learning the freeness behavior based on process parameters.

02

Predicting

Predicting the real-time freeness values

03

Comparing

Comparing the received freeness value with the desired freeness value

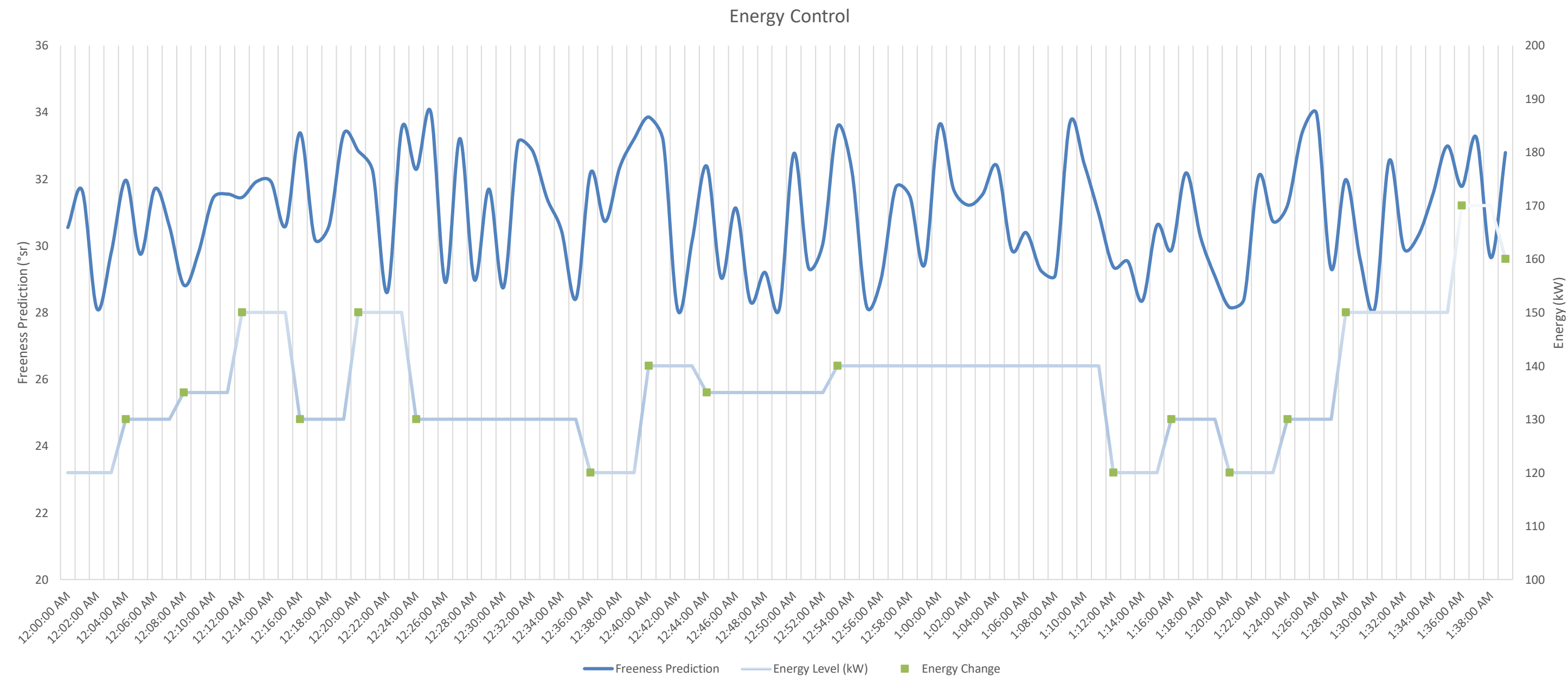
04

Estimating

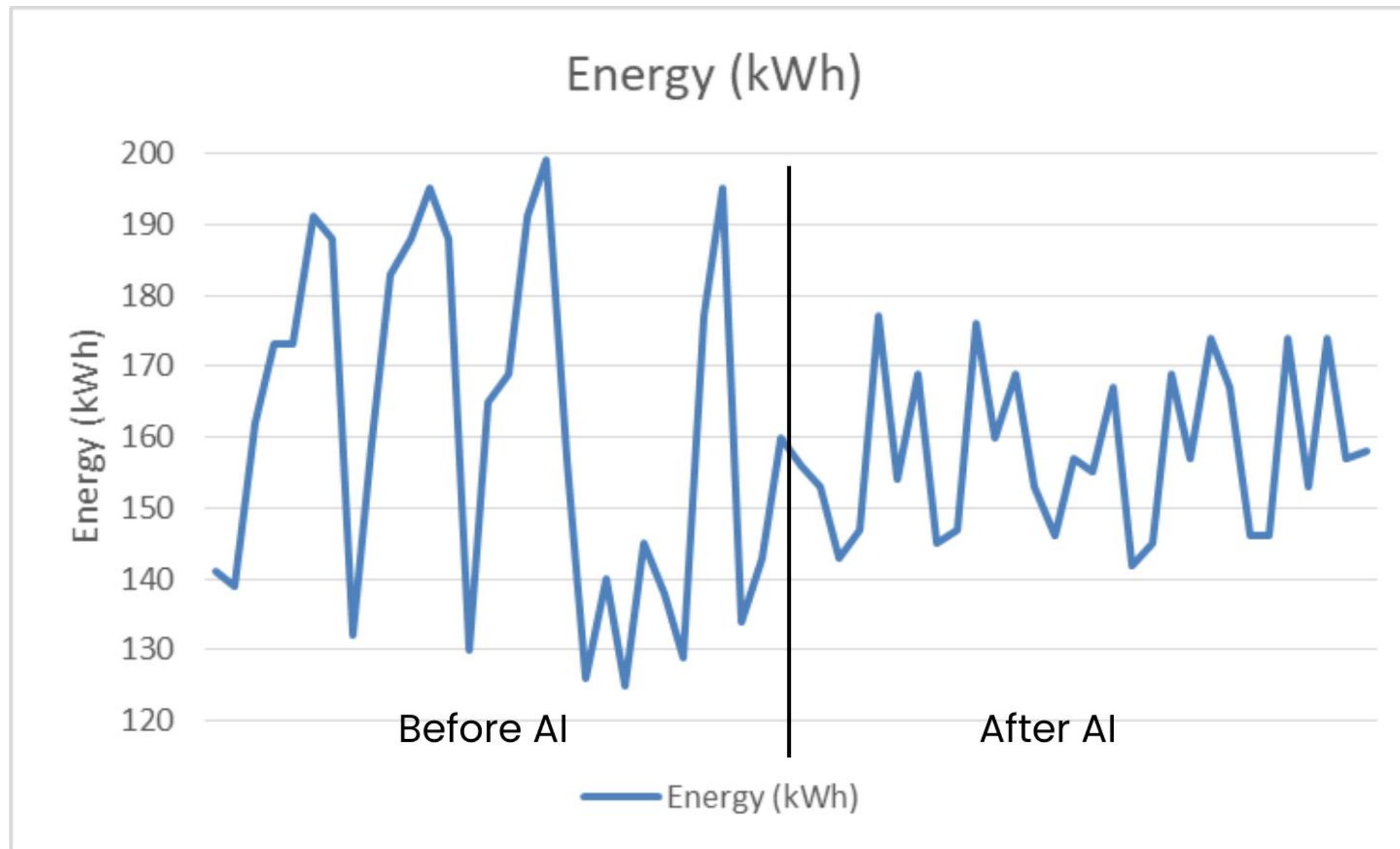
Based on past learning estimating energy required to reach desired freeness with present process conditions

Safety Measures: Control Limits, Eliminating Outliers, Gradual increament of energy, Fall Back Mechanism

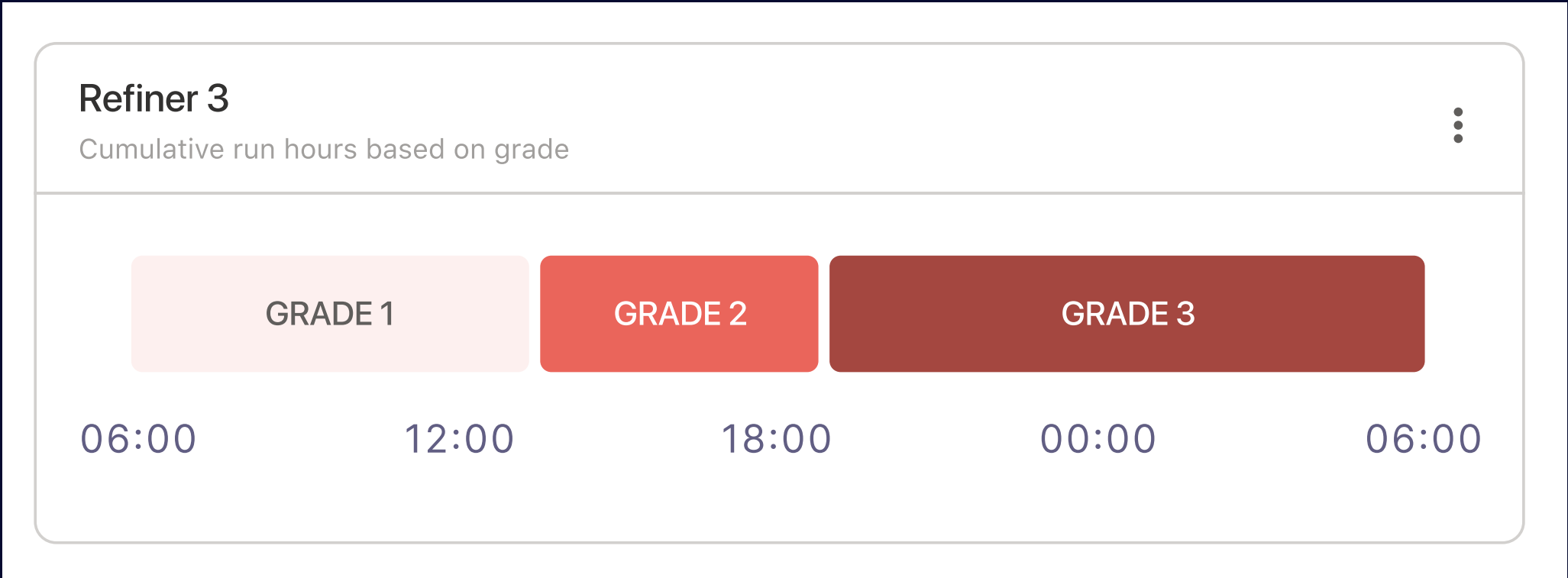
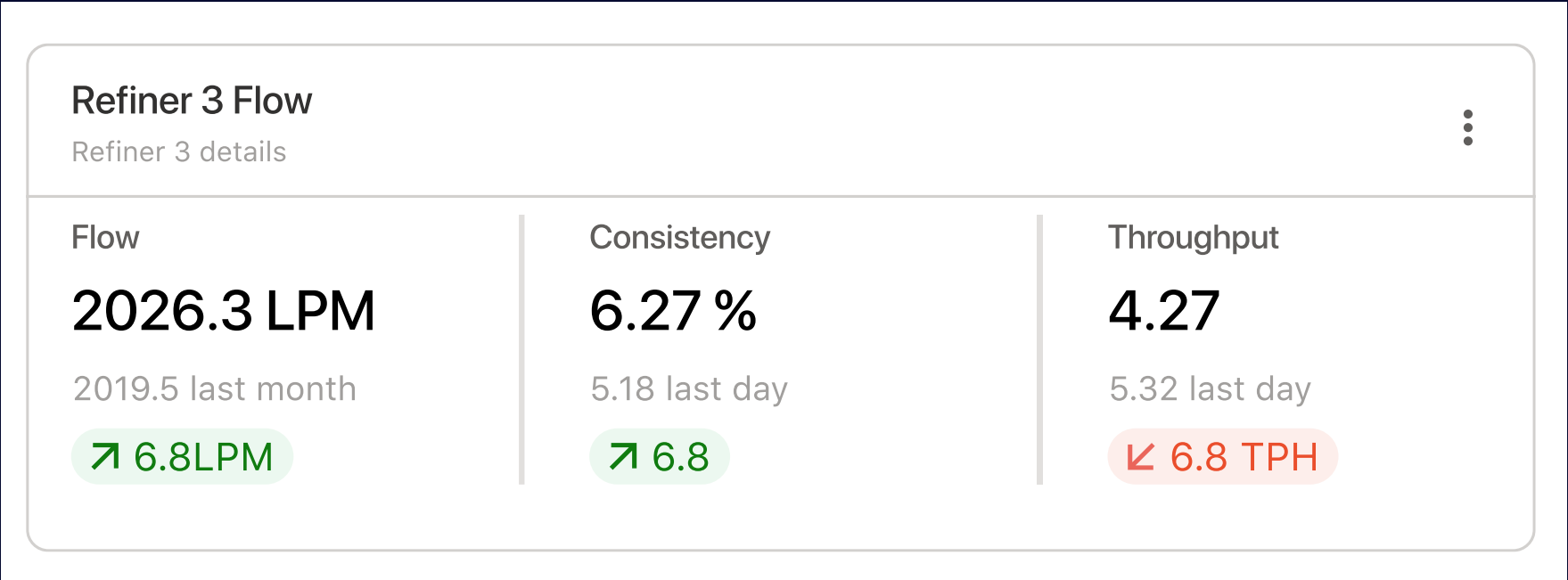
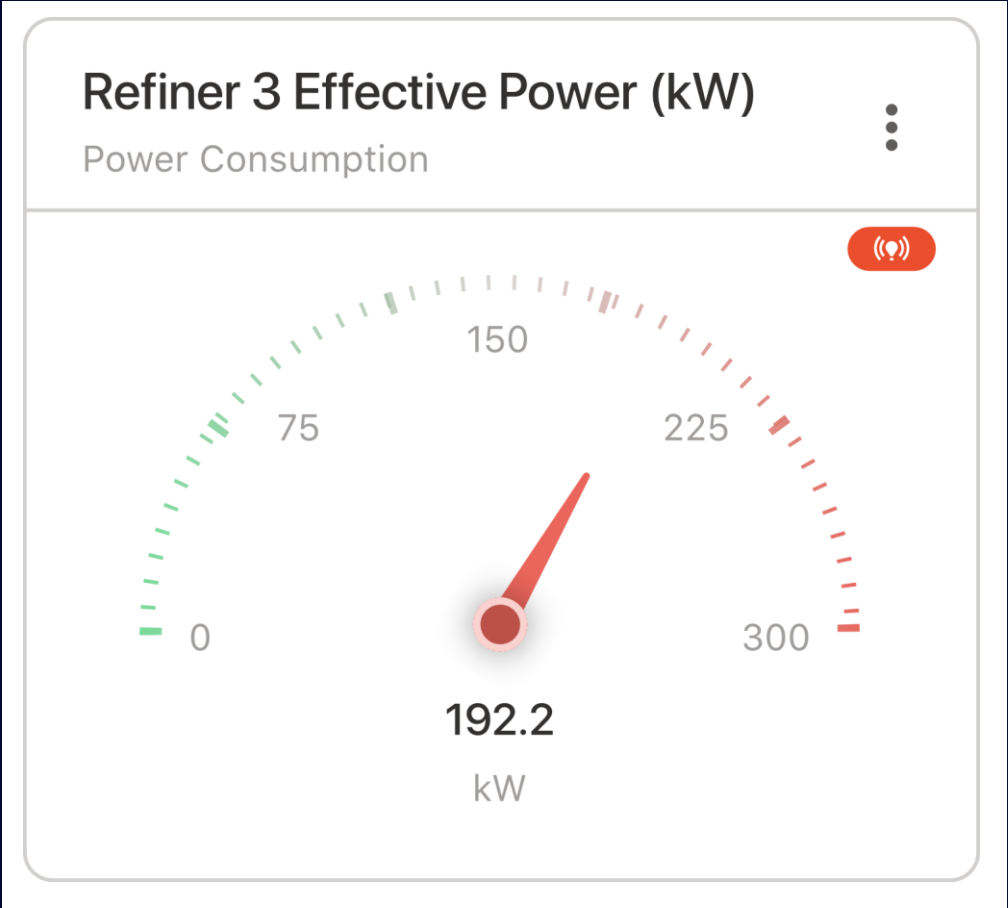
ENERGY MODELLING



ENERGY MODELLING



INSIGHTFUL DASHBOARD





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THANK YOU!



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