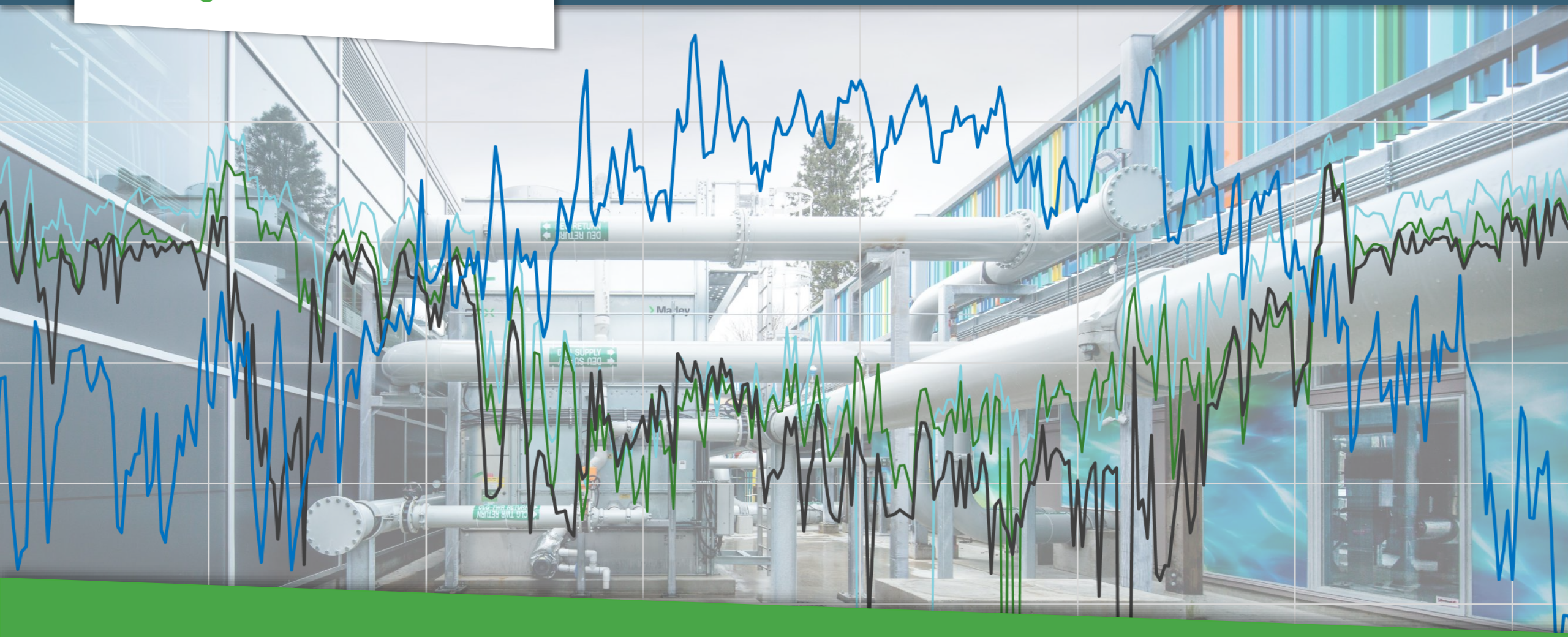
KERR WOOD LEIDAL
consulting engineers

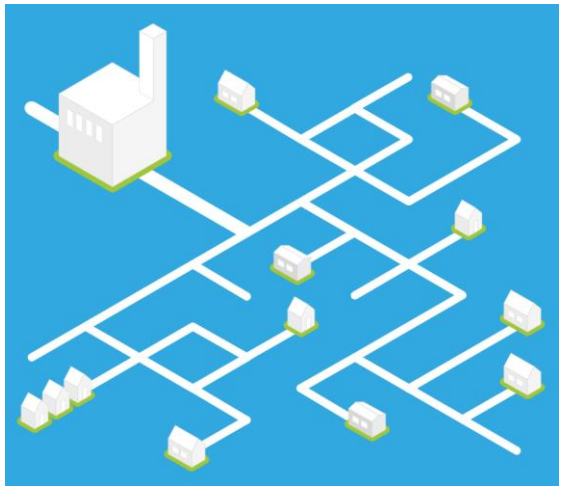


Data Informed Decision Making

Laura Christensen, P.Eng.

June 2019







What are you doing with that data?

Is it useful? Is it VALUABLE?

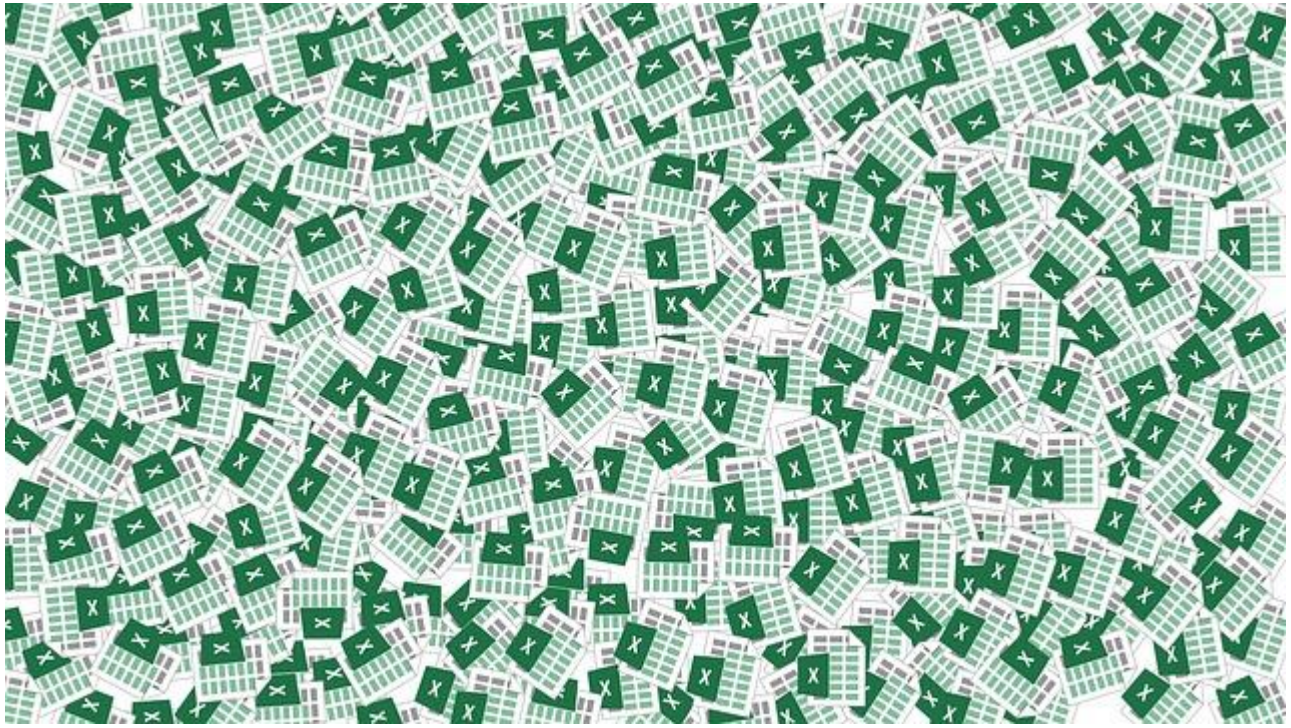
Optimization

Efficiency

Reliability

Background

Data Requests →

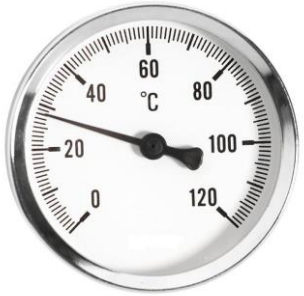


Kinds of Data

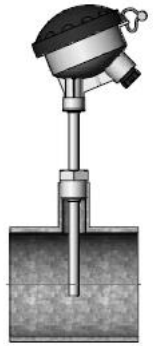
- Flow Rate (L/s, m^3/min, gpm)
- Temperature (differential, absolute, Celsius, Fahrenheit)
- Power (kW, hp) or Energy (kWh, btu)
- Pressure (kPa, psi)
- Valve position
- Equipment information
- Flue gas
- Fuel or energy consumption
- Outdoor temperature, windspeed, humidity
- …more?















The VALUE of DATA depends on the QUALITY

Quality: "the standard of something as measured against other things of a similar kind"

The quality of data you need is driven by the purpose

- Billing
- Controls
- Decision making



Data Quality

The Wrong Type of Data

Thermodynamics – Specific Heat Capacity

$$Q = mc\Delta T$$

Temperature

Head/Pressure Loss Equations

Mass/Volume Flow

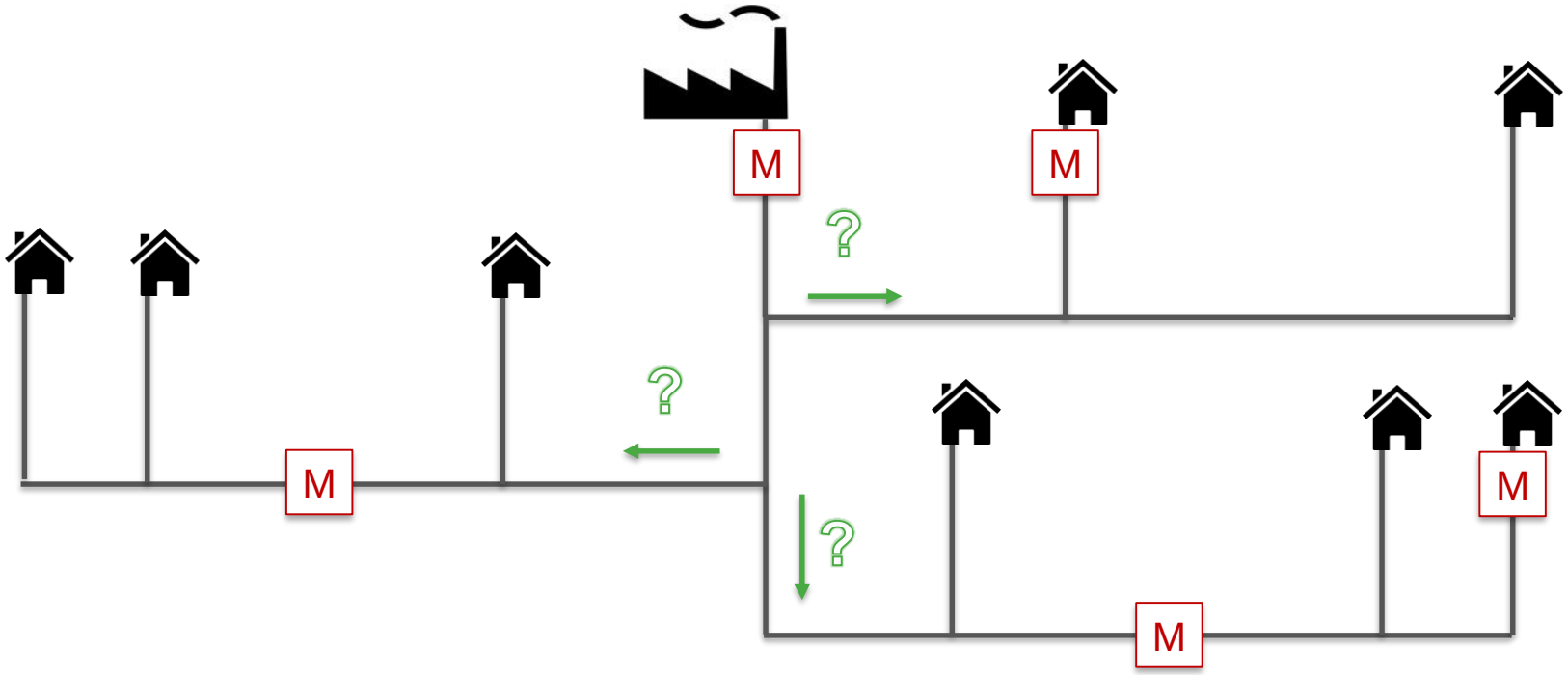
$$\frac{\Delta P}{L} = f_D \frac{\rho}{2} \frac{v^2}{D}$$

$$v = C\sqrt{\frac{D}{4}\frac{\Delta P}{L}}$$

Pressure

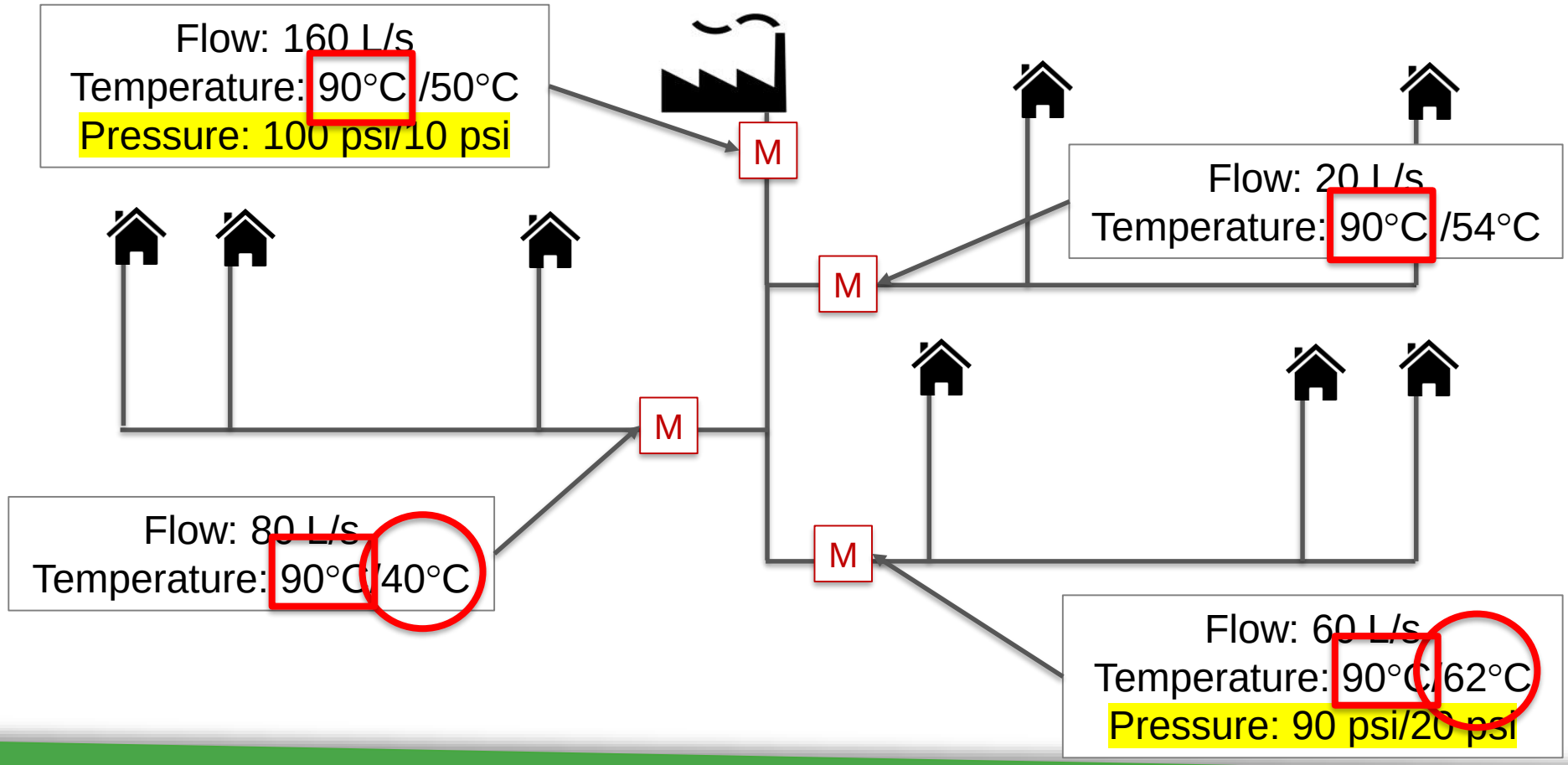
Data Quality

The Wrong Location



Data Quality

The Ideal Data

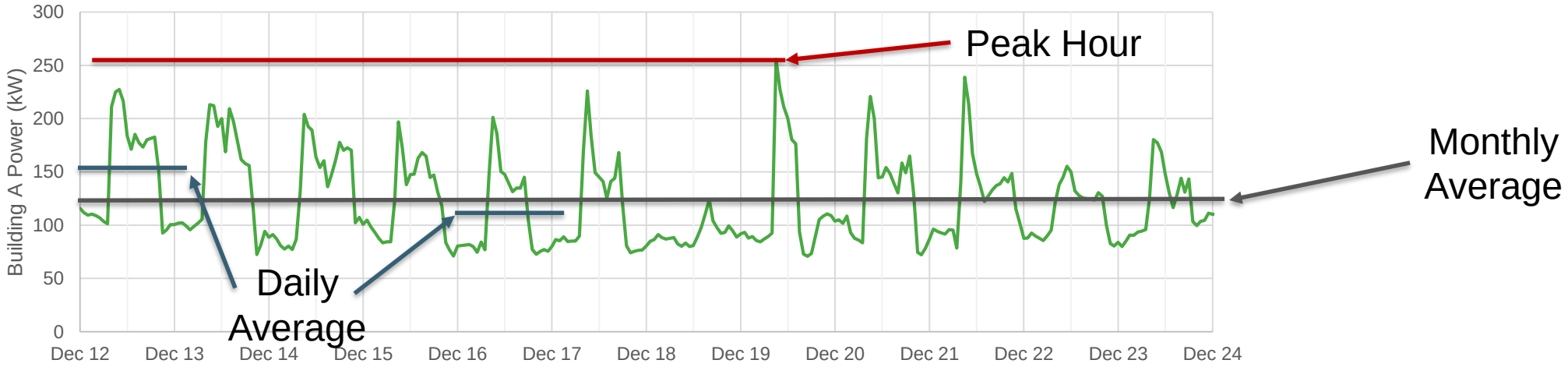


Data Quality

The Wrong Time

- Cumulative vs Instantaneous
- Peaks vs Average

Month	Building A Energy Consumption (MWh)	Building B Energy Consumption (MWh)
November	71	198
December	86	257
January	79	234
February	73	211
March	68	182



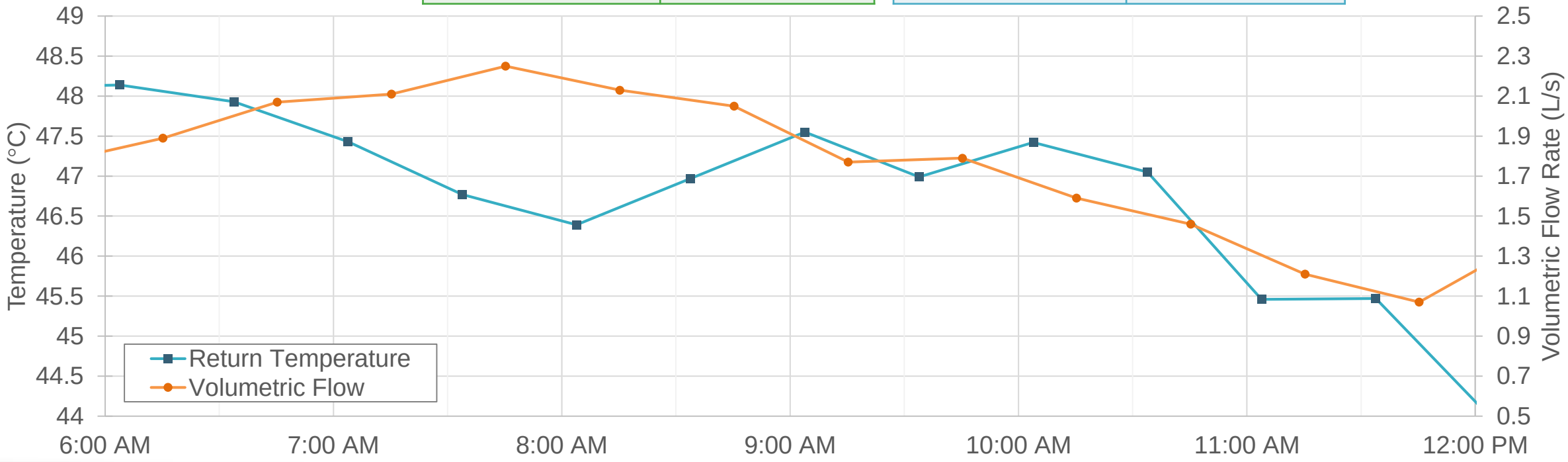
Data Quality

The Wrong Time

- Sampling Rate
- Sampling Time

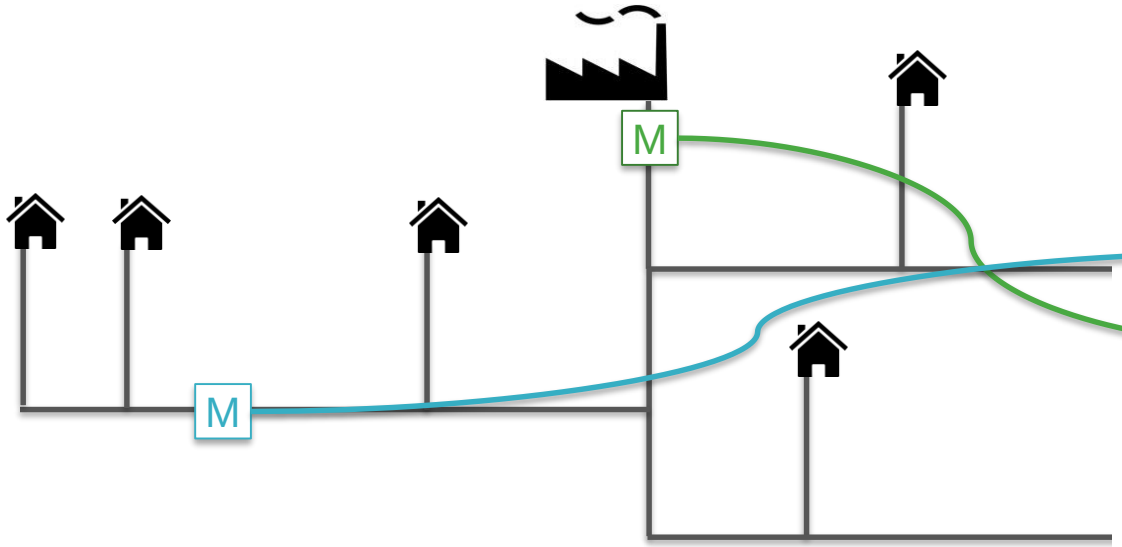
Sample Time	Volumetric Flow Rate (L/s)
Oct-29 16:46	1.55
Oct-29 17:16	1.66
Oct-29 17:46	1.64
Oct 29 18:16	1.42

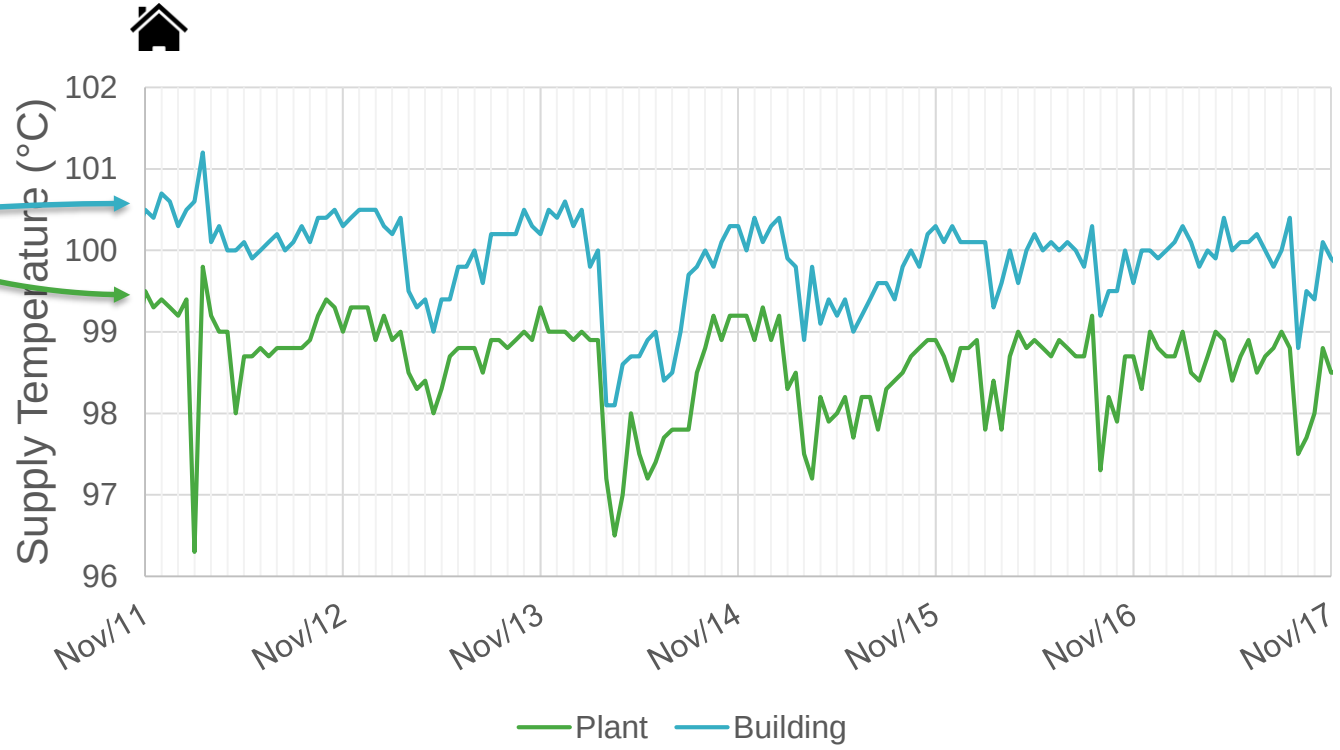
Sample Time	Return Temperature (°C)
2018-09-28 16:01	40.56
2018-09-28 16:31	46.61
2018-09-28 17:01	45.59
2018-09-28 17:31	44.37



Data Quality

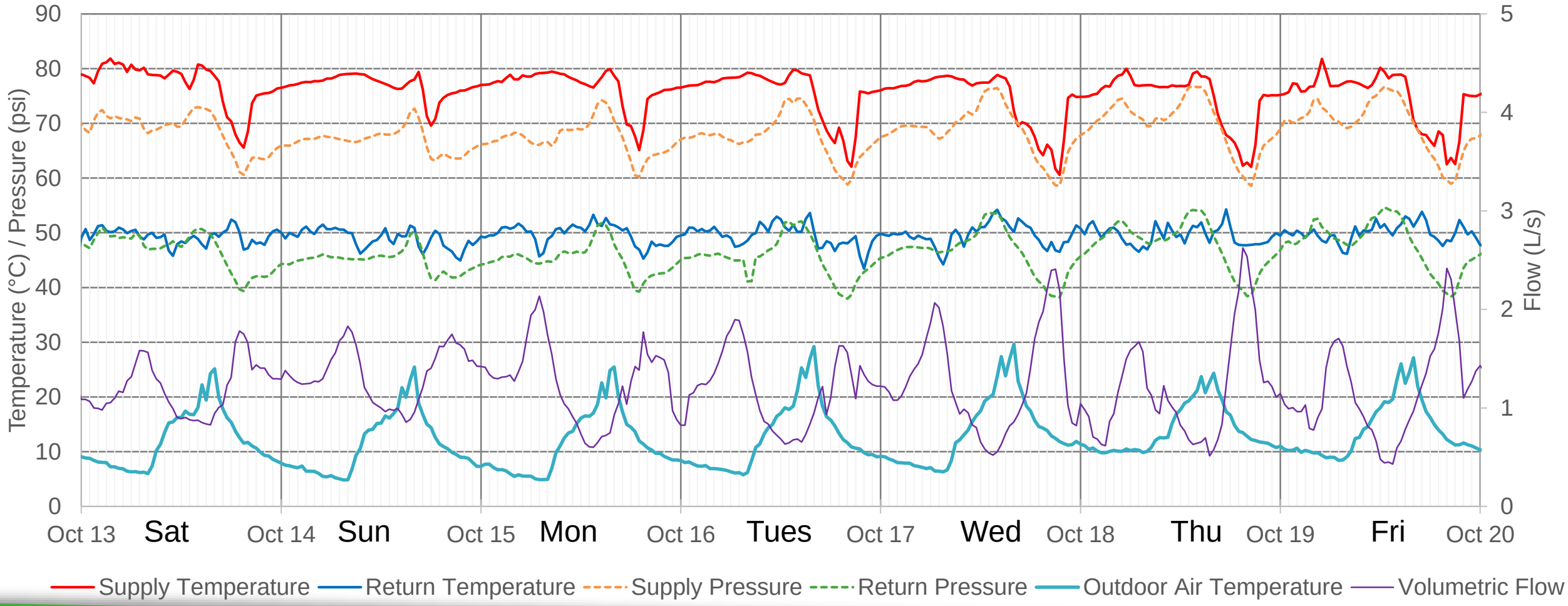
The Data is just WRONG





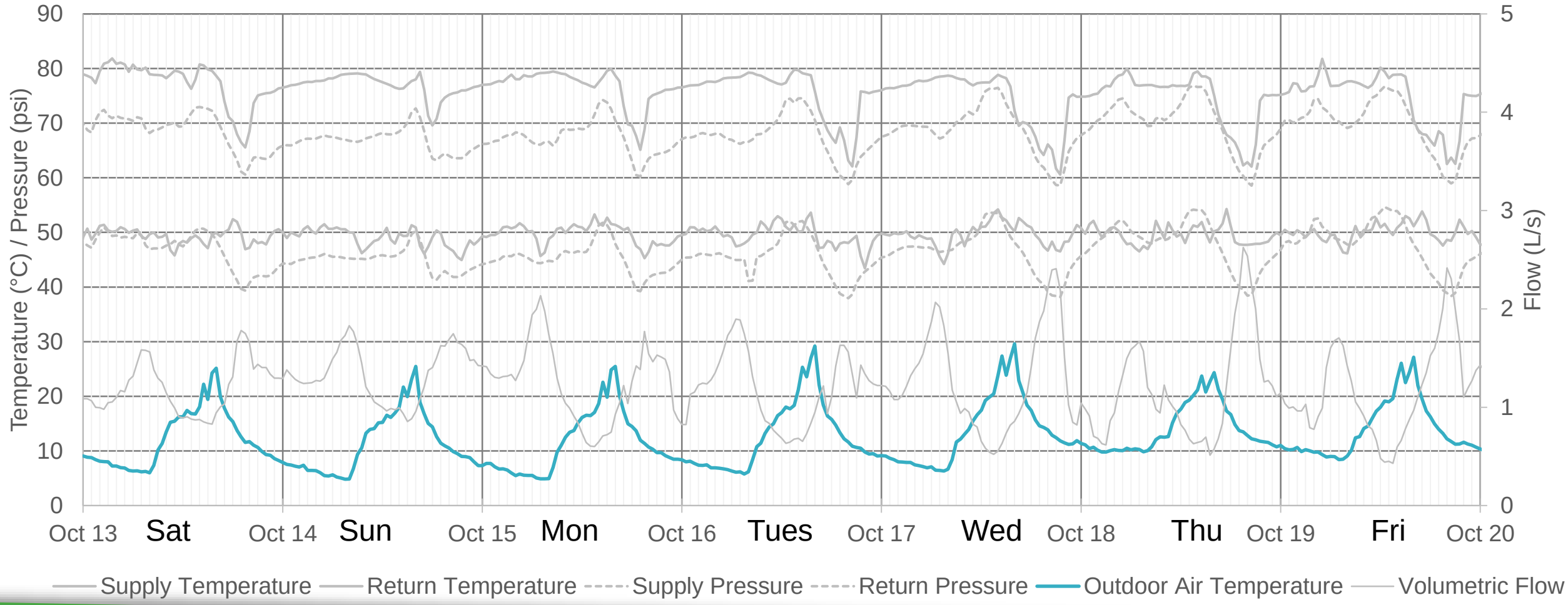
Data Quality

“Good” Data



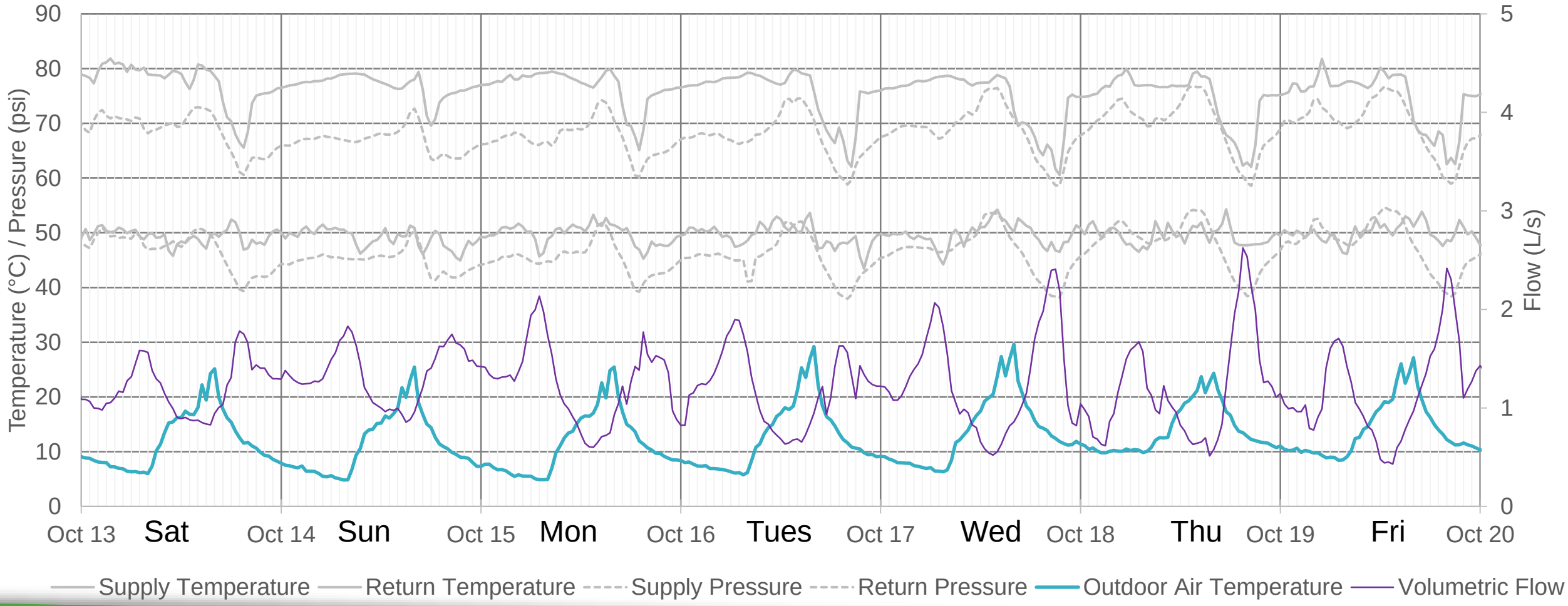
Data Quality

“Good” Data



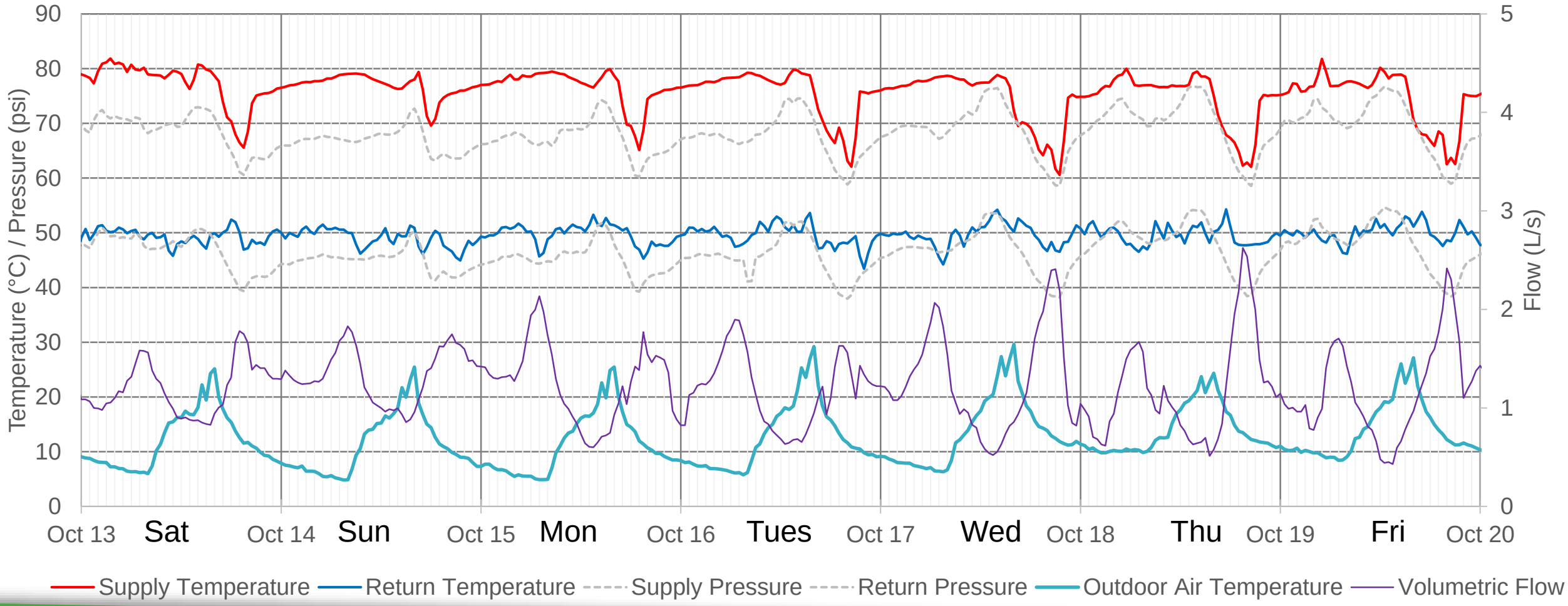
Data Quality

"Good" Data



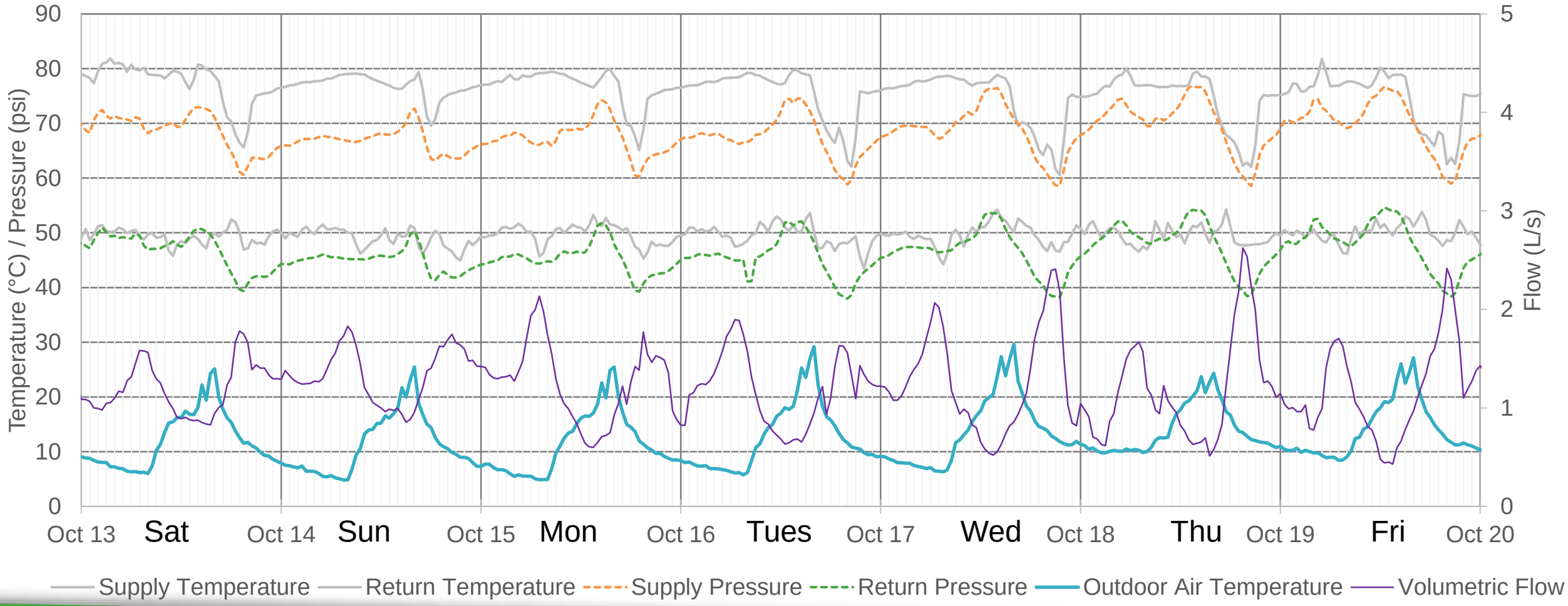
Data Quality

“Good” Data

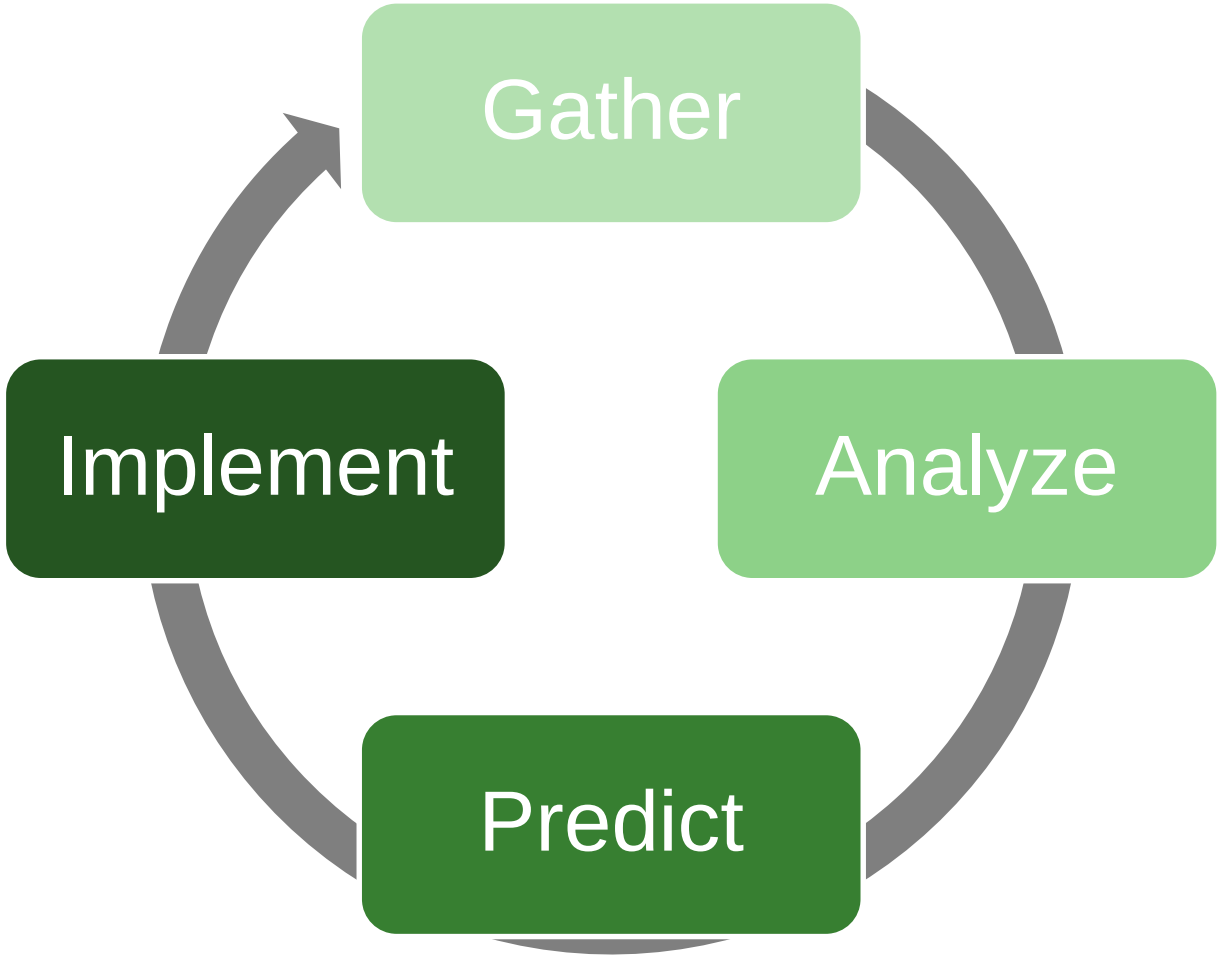


Data Quality

“Good” Data



Cycle of Data



Gather

Inventory & Calibrate

- Improve current sensors
- Remove redundancy

Install New Equipment

- Balancing Cost / Accuracy / Maintenance

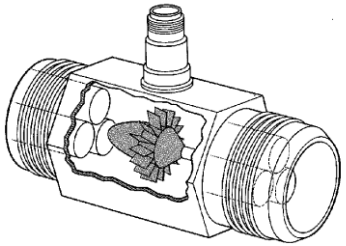
Record & Archive

- Centralized storage with back-up
- New cloud based storage with analytics & web based access

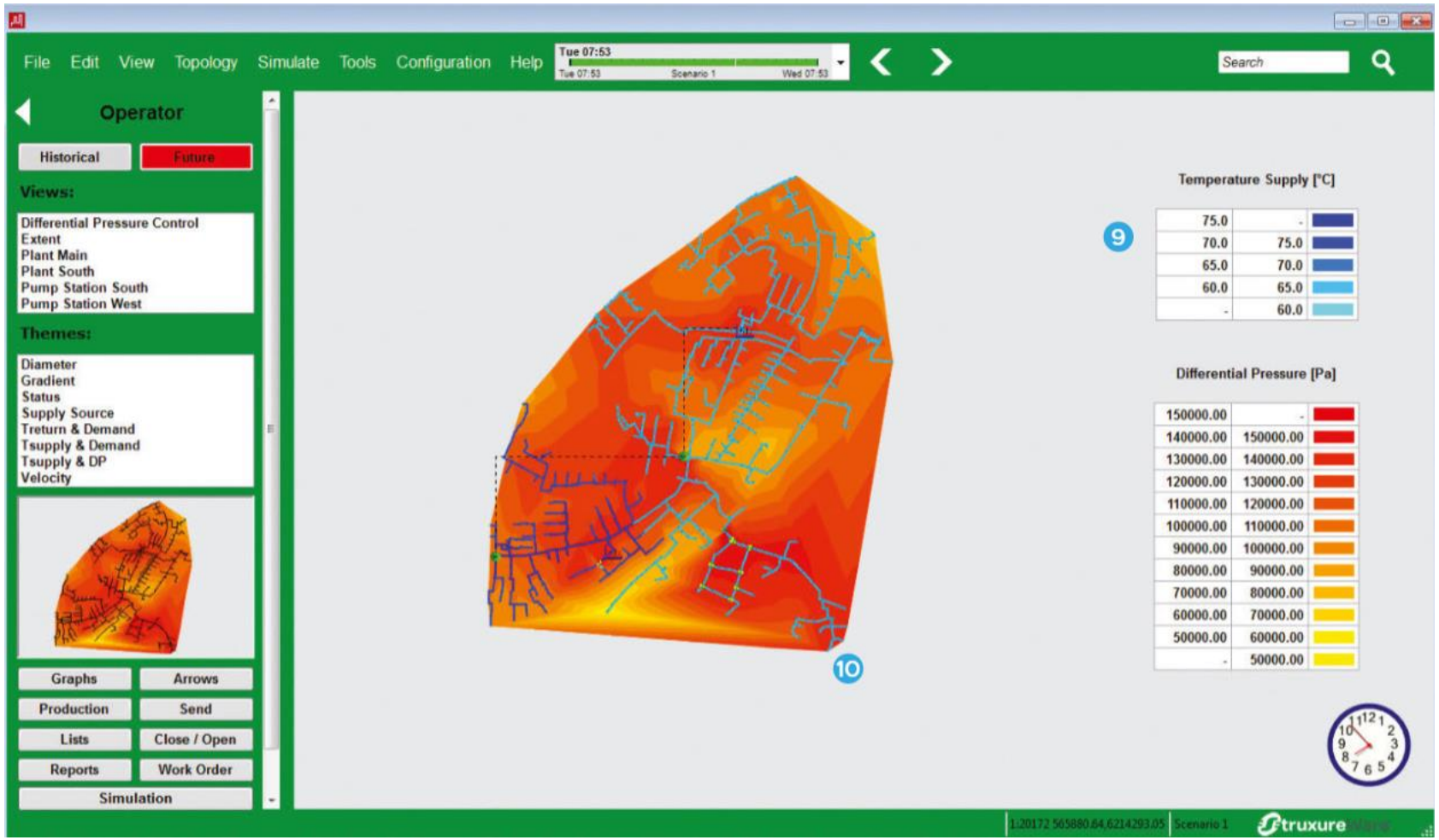








Analyze



- Build an understanding of the system
- Create a thermal-hydraulic model

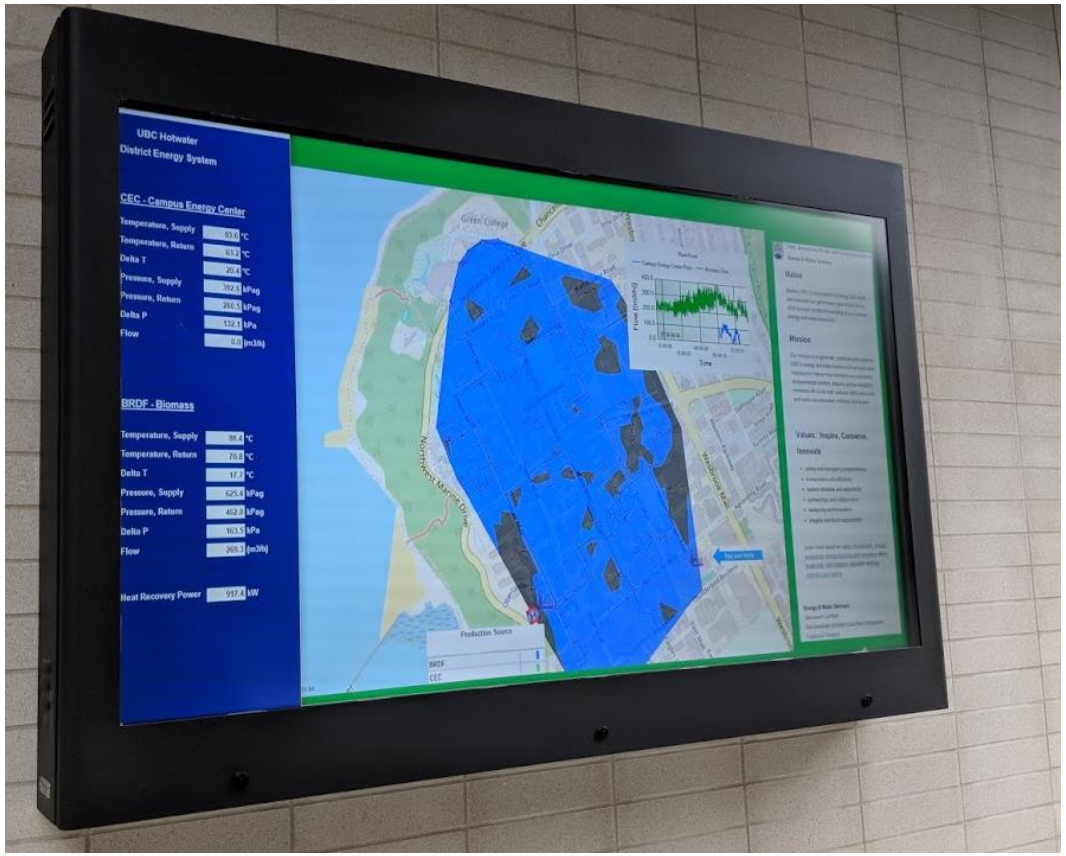
Predict

- Identify losses / inefficiencies
  - Leaks & heat loss
  - Building performance
  - Locate & quantify
- Solve operational challenges
  - Low/insufficient pressure areas
  - Cycling equipment



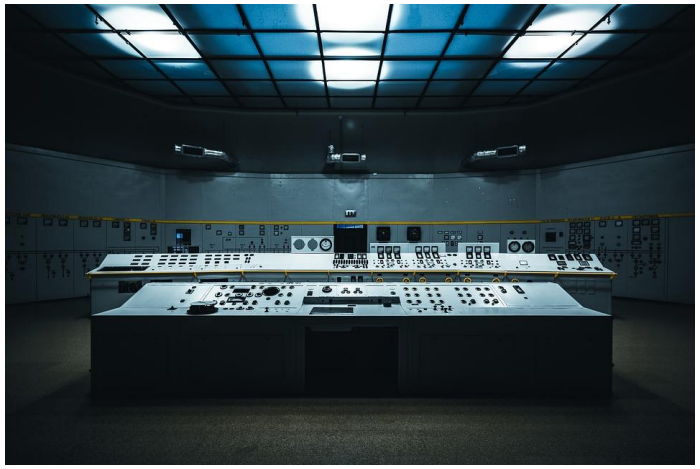
Predict

- Plan for future expansion
  - Design pipes & pumps
- Real-time monitoring
- Predictive modelling
  - Plan preventative maintenance
  - Optimize equipment dispatch & staging
  - Reduce heat loss by up to 10%
  - CO_2 emissions by 2-5%

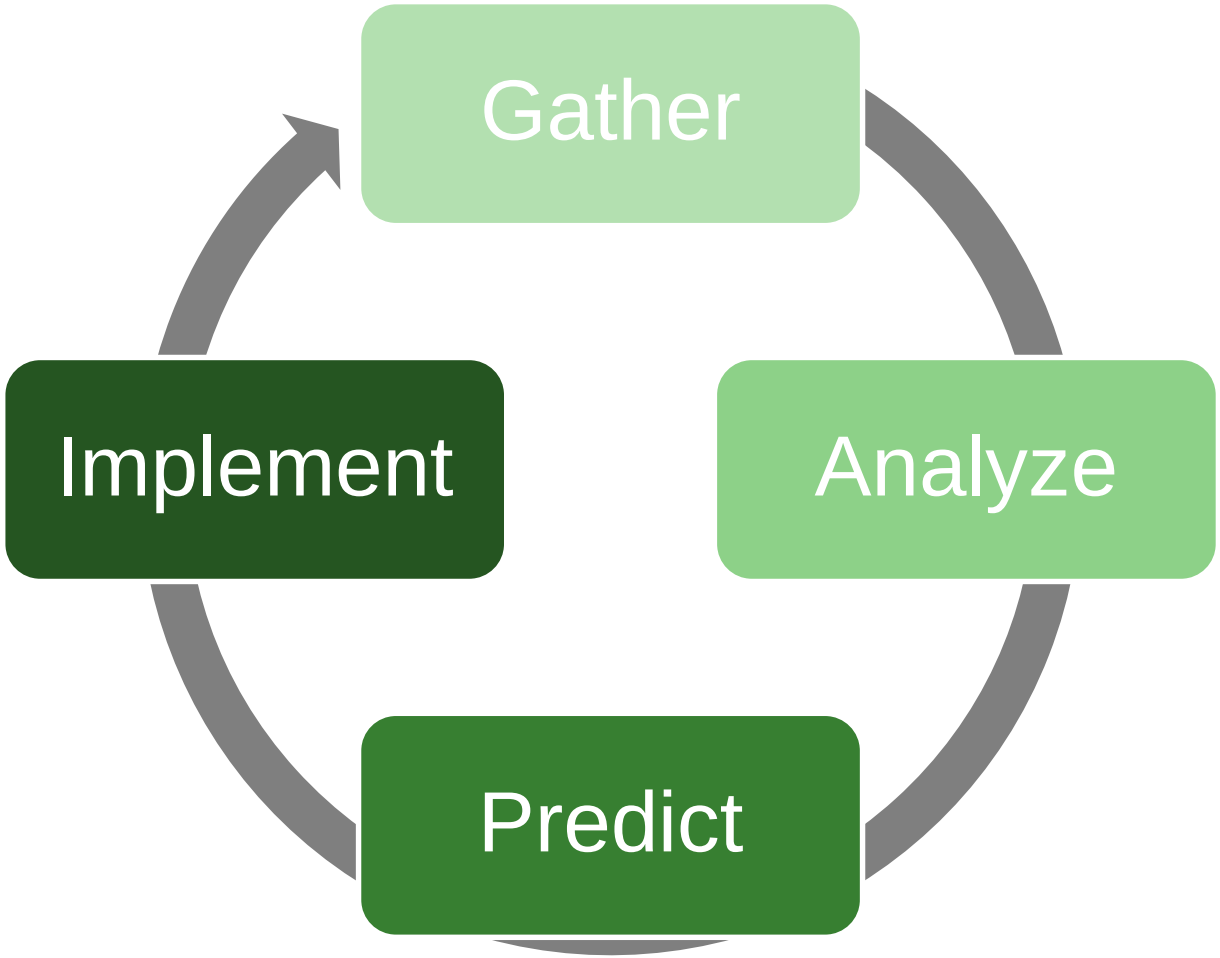


Implement

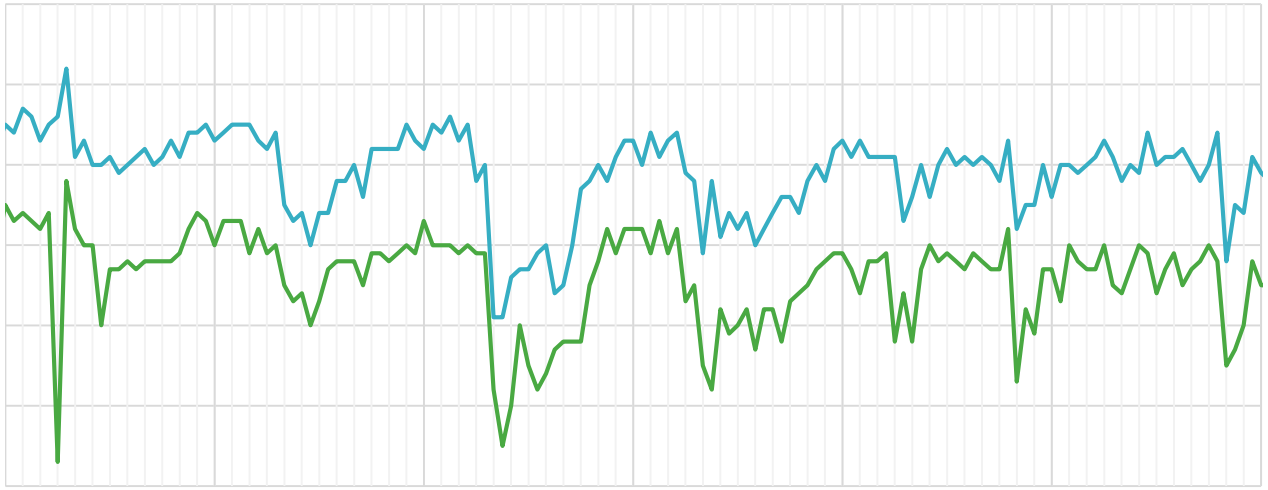








Summary

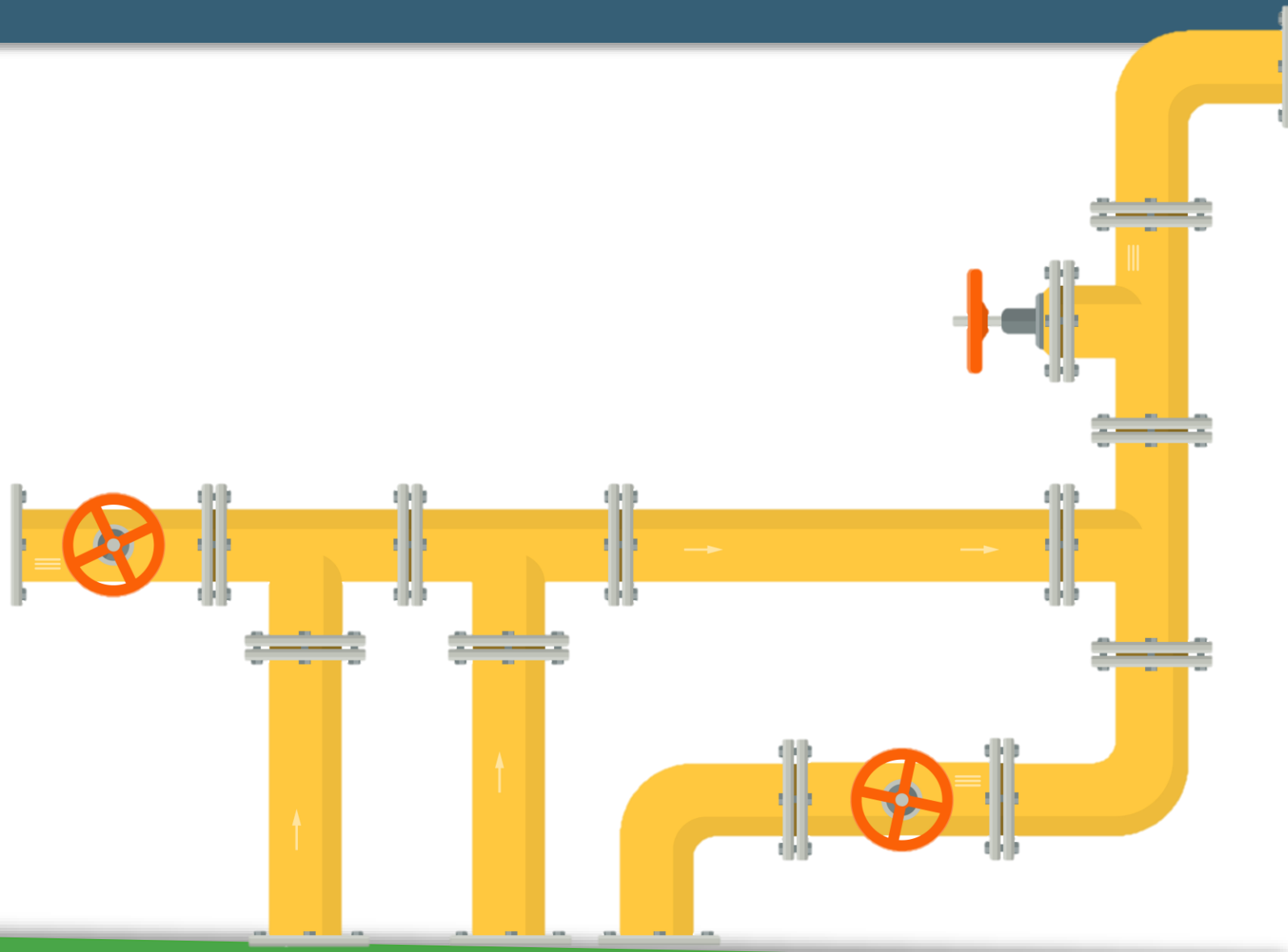


Optimization

Efficiency

Reliability

Questions?



lchristensen@kwl.ca