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Driving Sustainability with Data: Reducing Carbon and Energy Use through Advanced Analytics

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Driving Sustainability with Data: Reducing Carbon and Energy Use through Advanced Analytics

Nikk King – Director, NZ Controls Ltd

Nikk leads a company specialising in control systems engineering, automation, and industry digitalisation. He champions a technology-agnostic approach, partnering with innovative technology solution providers to deliver value and adapt to evolving business needs, including the application of advanced analytics and other tools to drive value from data. With over 25 years of experience, Nikk is dedicated to deploying the latest technologies to help customers drive value and maximise assets.

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What We Do

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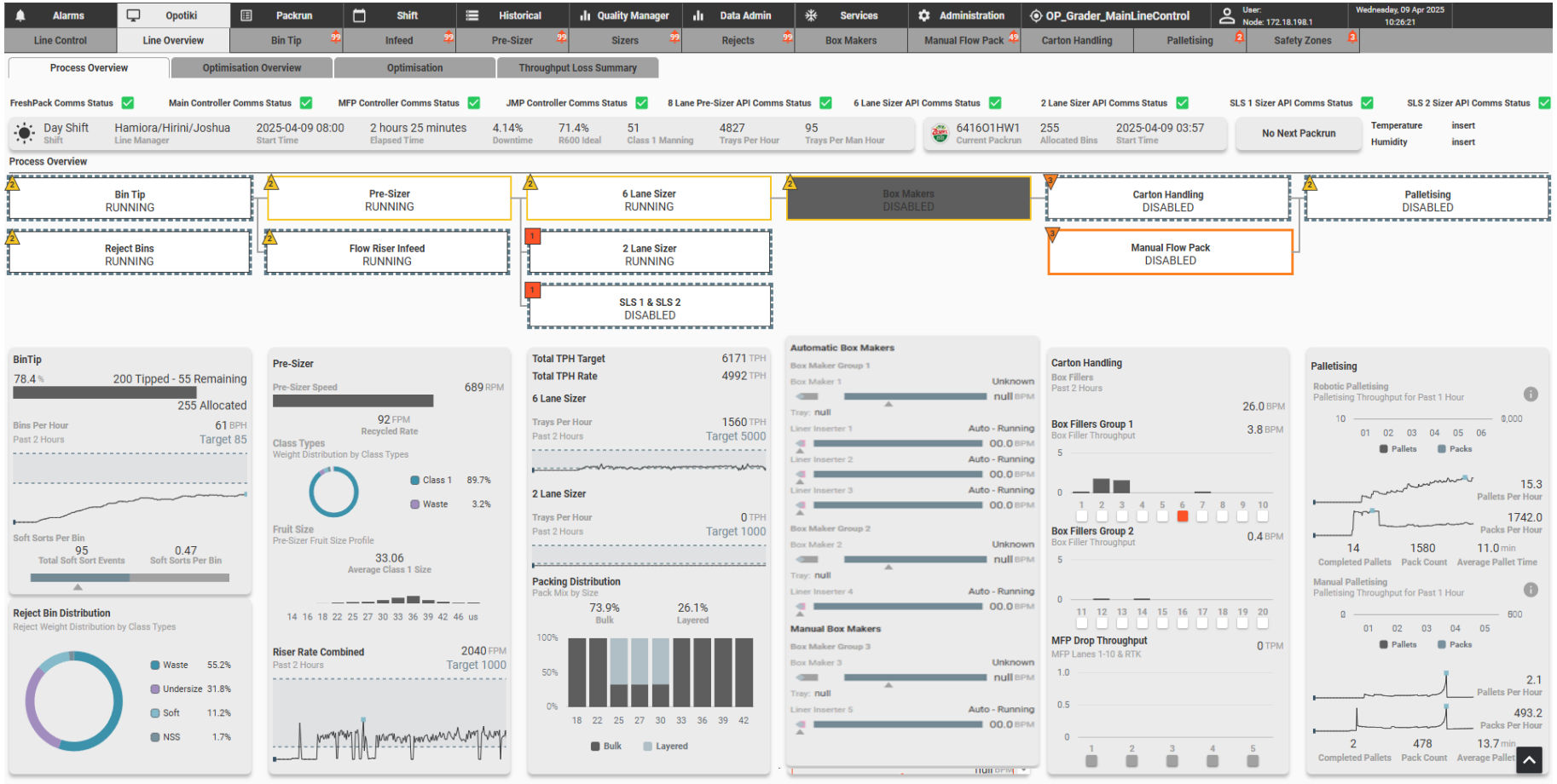
Provide electrical and automation engineering solutions. We collect Data … lots of data.

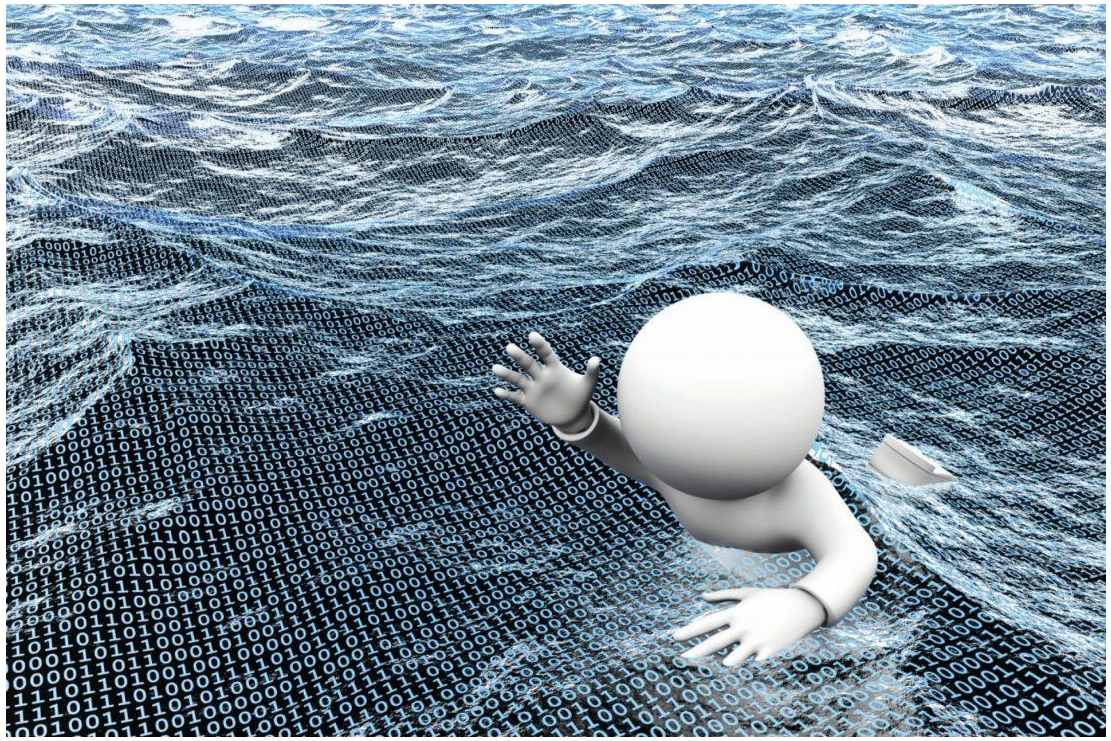


"Without data, you're just another person with an opinion."
W. Edwards Deming (statistician, engineer, and management consultant)

The Data problem

Drowning in data.

- Underutilised
- Lacking context
- Inconsistent naming (tags)
- Hard to find and sort
- Multiple ‘siloed’ data sources
- Basic tools don’t tell me much
- Need to get to the insights quickly
- Lack of accessible tools… ?



‘We are drowning in information and starved for knowledge’
John Naisbitt (author of Megatrends)

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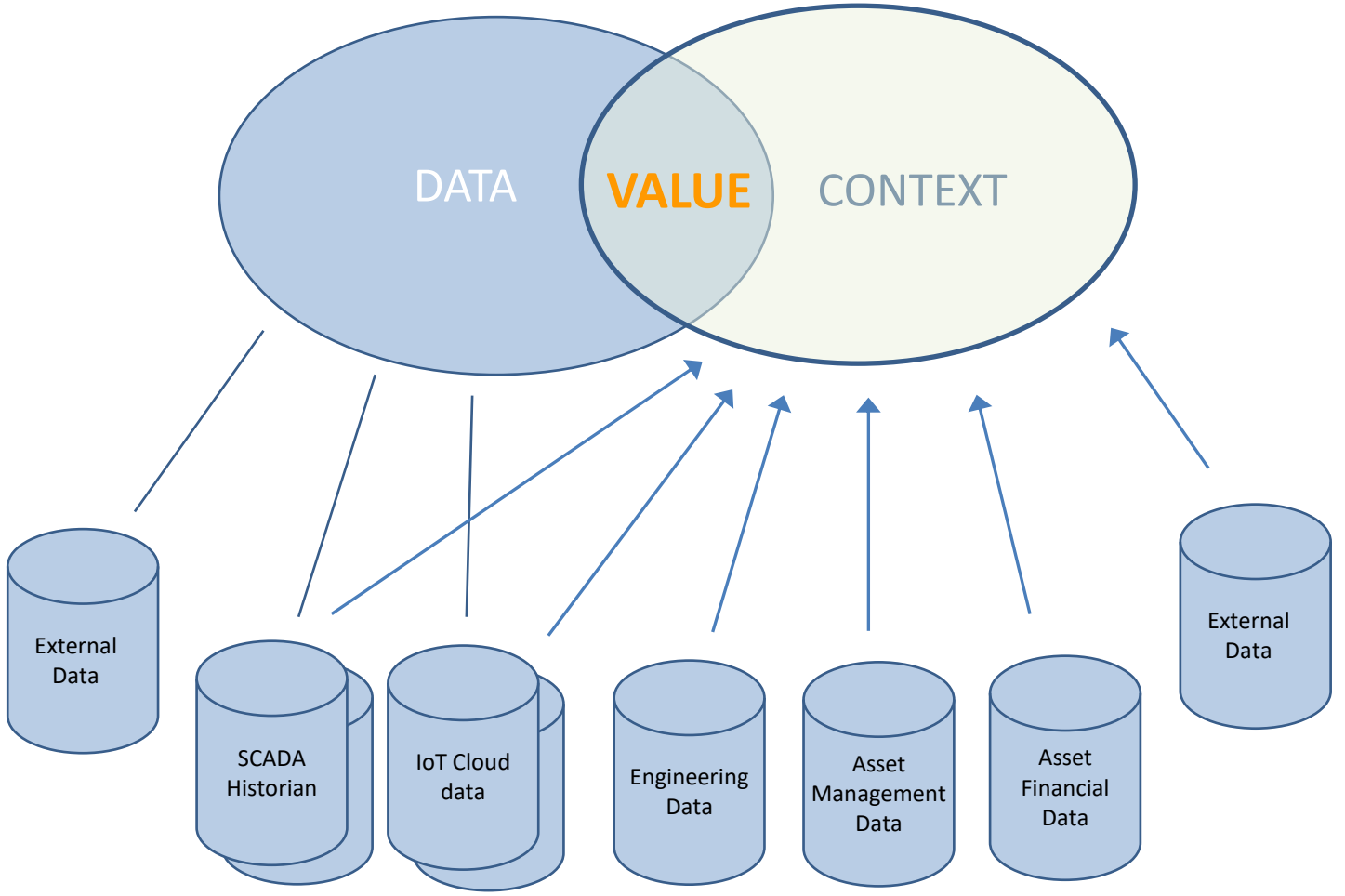
Find Context

The key to finding value is to provide context

Use modern tools to quickly get to the insights

Provide deep context to backup the insights



"The value of analytics is not in the data itself, but in the insights derived from it."
Michael Dell (founder Dell Technologies).

New breed of tools

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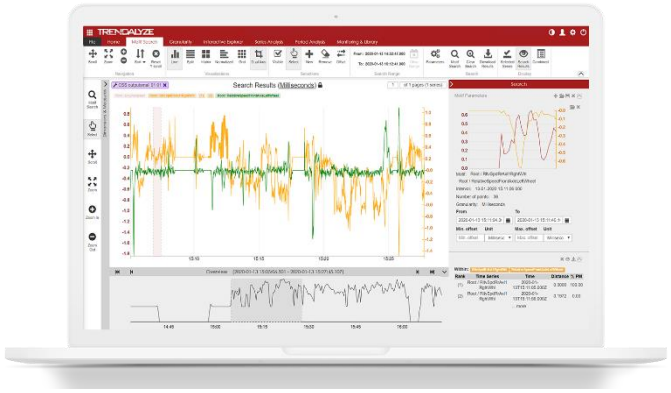
Modern software tools designed for engineers and subject matter experts.

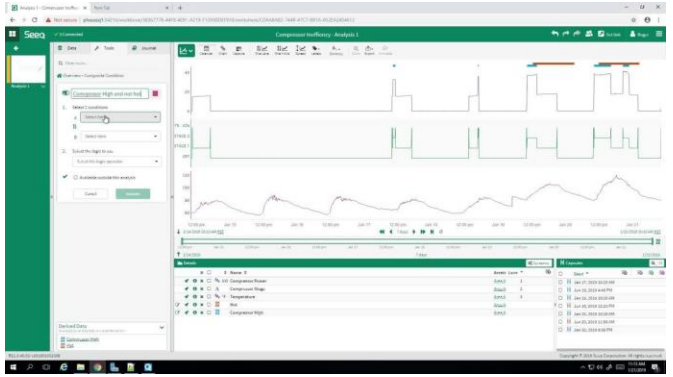
- Simple connectivity to multiple data sources.
- Optimised for time series data analysis.
- Data cleansing.
- Real time.
- Powerful yet accessible tools.
- Live dashboard and reporting.
- Open data connectivity for reporting.
- Scalable and extensible.
- Deep drill through to understand the insights

TrendMiner

TRENDALYZE



Seeq®



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Select the appropriate tool for your business

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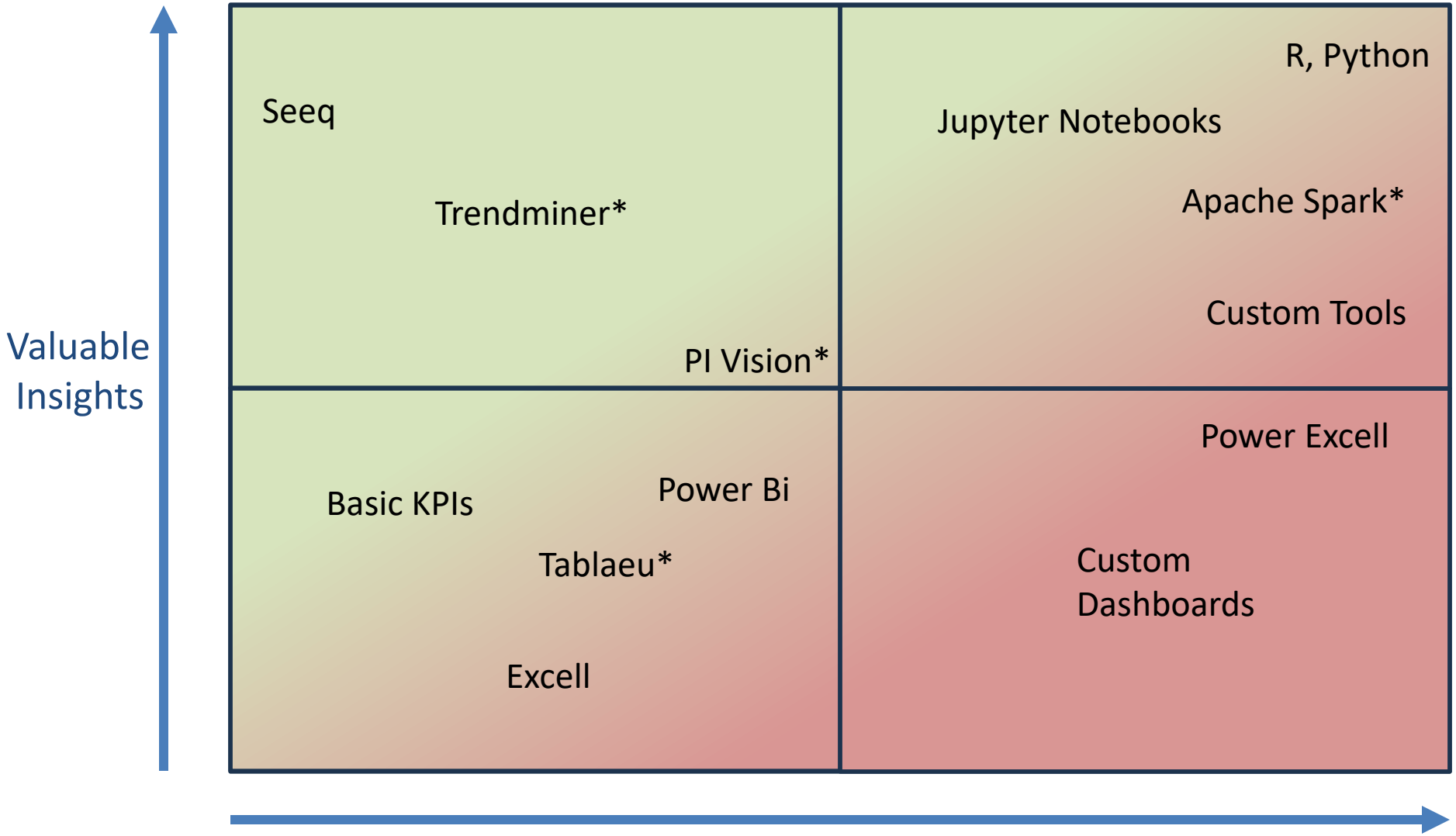

*example to represent a family of products and solutions.

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Chris Thomas – Business Development Manager, NZ Controls Ltd

Chris brings over 30 years of experience across the chemical, petrochemical, oil & gas, utilities, and manufacturing sectors. Currently serving as Business Development Manager at NZ Controls Ltd, he is a passionate advocate for Industry 4.0 and its transformative potential in driving energy efficiency and sustainability.

With a strong focus on advanced data analytics, Chris assists organisations unlock the power of smart manufacturing to measure, control, and ultimately reduce their carbon footprint through data-driven technologies that enhance operational performance, while advancing environmental goals.

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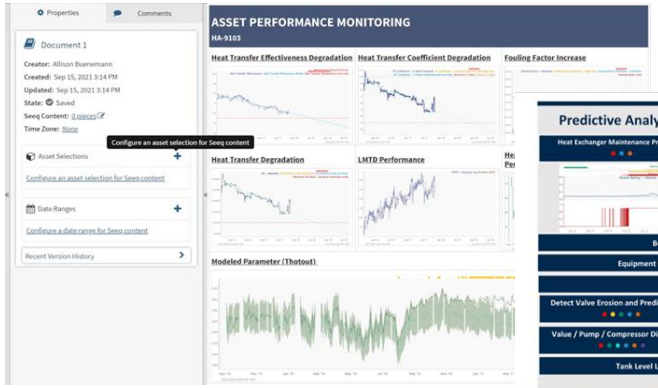
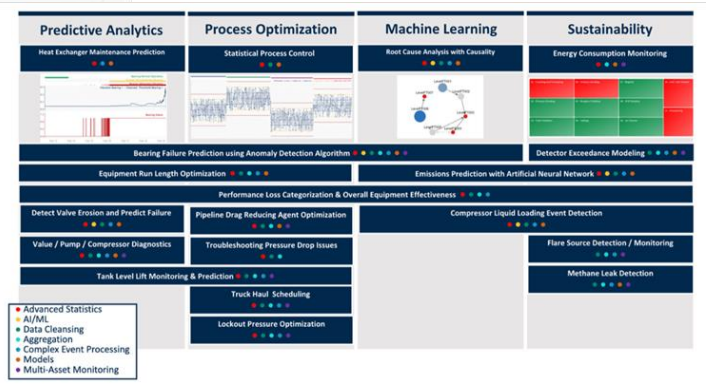
Advanced Analytics...We are currently seeing a maturing of technology in this space, we are starting to move away from the hype and starting to have real, practical and accessible tools become available where real value can be found. We are focussing on analytic tools that monitor multiple data sources and provide a wide range of functionality, rather than single-function applications. Today we will look at a few case studies in the following spaces...

- **Power** - Optimising renewable energy generation to 'save power'
- **Water** – Pumping water out of leaking pipes is a waste of energy
- **Manufacturing**: Optimising high energy assets and systems using data modelling
- **Predictive maintenance** over scheduled maintenance to save energy





Real-Time production potential calculation

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CHALLENGE

- For power generation operations, expected power is based on the manufacturer-provided turbine power curve, but the actual power produced may vary due to:
  - Age of components
  - Inaccurate anemometers
  - Turbulence

SOLUTION

- Real-Time Production Potential (RTPP) can easily and rapidly be calculated using Prediction Tools.
- Analytic tools definitively provide accurate predictions for the expected power of the operation's assets.

RESULTS

- Through advanced analytics, significant time was saved due to:
- Validation and fine-tuning of the RTPP model.
- More accurate RTPP is reported to the grid operator every 5 minutes, improving the grid operator's ability to maintain system reliability and balance load.

Wind Turbine Ramp Up

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CHALLENGE

- Reduction in power grid demand requires wind turbine generators to curtail production
- Once power is needed again, wind generation ramp up cannot occur immediately
- Generators can charge for lost generation during ramp up

SOLUTION

- Calculate wind generation potential based on wind strength and direction
- Compare potential verses actual power to identify ramp up period and quantify losses

RESULTS

- Calculate commercial losses during ramp up
- Enables generator to pass charges to the grid operator
- Analysis on a single turbine scaled to the entire fleet

Power Grid Load Shedding

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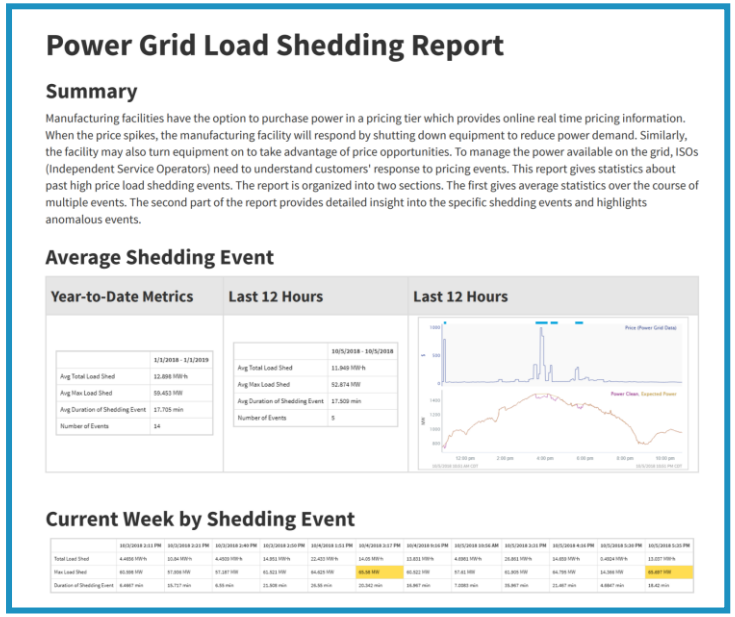

Power Grid Load Shedding Report

Summary

Manufacturing facilities have the option to purchase power in a pricing tier which provides online real time pricing information. When the price spikes, the manufacturing facility will respond by shutting down equipment to reduce power demand. Similarly, the facility may also turn equipment on to take advantage of price opportunities. To manage the power available on the grid, ISOs (Independent Service Operators) need to understand customers' response to pricing events. This report gives statistics about past high price load shedding events. The report is organized into two sections. The first gives average statistics over the course of multiple events. The second part of the report provides detailed insight into the specific shedding events and highlights anomalous events.

Average Shedding Event

Year-to-Date Metrics		Last 12 Hours		Last 12 Hours
	1/1/2018 - 1/1/2019		10/5/2018 - 10/5/2018	
Avg Total Load Shed	12.898 MW·h	Avg Total Load Shed	11.949 MW·h	
Avg Max Load Shed	59.453 MW	Avg Max Load Shed	52.674 MW	
Avg Duration of Shedding Event	17.705 min	Avg Duration of Shedding Event	17.509 min	
Number of Events	14	Number of Events	5	

Current Week by Shedding Event

	10/1/2018 2:01 PM	10/1/2018 2:21 PM	10/1/2018 2:40 PM	10/1/2018 2:50 PM	10/4/2018 1:51 PM	10/4/2018 3:17 PM	10/4/2018 9:16 PM	10/5/2018 10:56 AM	10/5/2018 3:31 PM	10/5/2018 4:16 PM	10/5/2018 5:26 PM	10/5/2018 5:31 PM
Total Load Shed	4.4898 MW·h	10.04 MW·h	4.4929 MW·h	14.892 MW·h	22.423 MW·h	14.05 MW·h	13.831 MW·h	4.0961 MW·h	26.861 MW·h	14.858 MW·h	0.4924 MW·h	13.037 MW·h
Max Load Shed	65.999 MW	67.006 MW	67.187 MW	65.823 MW	64.829 MW	65.58 MW	66.822 MW	67.61 MW	65.805 MW	64.796 MW	14.366 MW	65.687 MW
Duration of Shedding Event	6.4867 min	15.717 min	6.56 min	21.908 min	26.56 min	20.342 min	16.867 min	7.0883 min	39.867 min	21.467 min	4.6847 min	18.42 min

CHALLENGE

- Price swings on the power grid drive large load changes
- Operators need to manage power supply following load reduction events to prevent outages when the load returns to normal

SOLUTION

- Identify load change events and quantify event magnitude based on price changes
- Provide a load forecast model to the operators

RESULTS

- Prevent service disruptions and maintain high customer satisfaction
- Quickly identify load responses to high price events
- Operators able to anticipate power grid requirements following a high price event

Water/Waste - Water Pump Station Monitoring

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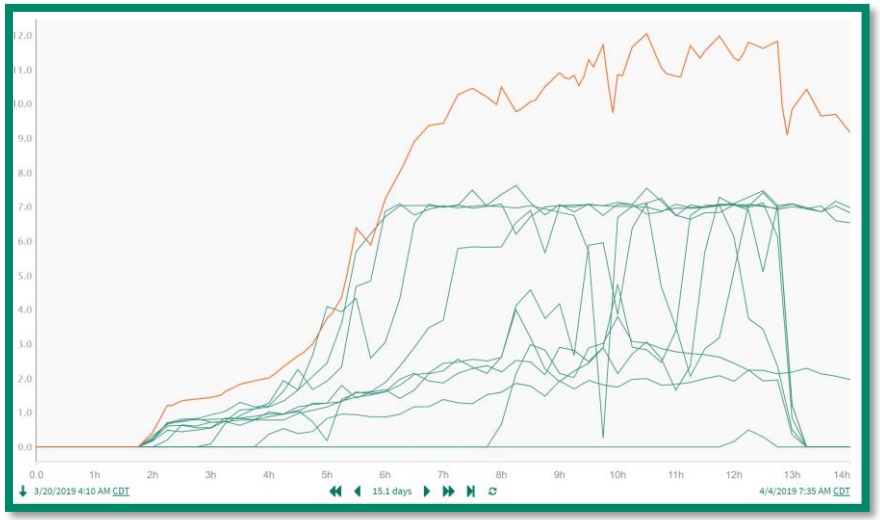

CHALLENGE

- Identifying blockages to avoid releasing untreated waste into waterways
- Processing huge data sets efficiently
- Identifying leaking pipes proactively (not public phone calls)

SOLUTION

- Implementation & adoption of data analytics tool
- Created profiles for normal pump station behavior based upon the day and time
- Monitor pump stations for deviation from normal profiles

RESULTS

- Deploy profiles in less than 1 month
- Improved early blockage detection by 13 hours
- Reduced frequency of untreated sewage saving costs in environmental cleanup
- Maintain good business reputation (not in the news)

Water - Treatment Monitoring and Reporting

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	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019
Ave Filtered Flow per Cycle	8450.7 kgal	8034.3 kgal	8452 kgal	10173 kgal	8407.1 kgal	8285.6 kgal	7327.1 kgal	6147.8 kgal	7490.9 kgal	7610.5 kgal	6035.2 kgal	8110.2 kgal	-
Ave Backwash Flow per Cycle	89.203 kgal	90.25 kgal	88.967 kgal	79.324 kgal	86.414 kgal	86.22 kgal	86.298 kgal	86.731 kgal	88.344 kgal	88.698 kgal	88.571 kgal	87.024 kgal	88.825 kgal
Ave UFRV	18292 gal/ft²	17390 gal/ft²	18294 gal/ft²	22021 gal/ft²	18197 gal/ft²	17934 gal/ft²	15860 gal/ft²	13307 gal/ft²	16214 gal/ft²	16473 gal/ft²	13063 gal/ft²	17554 gal/ft²	-
Average Cycle Time	111.25 h	119.33 h	115.68 h	87.563 h	59.708 h	47.667 h	42.382 h	44.188 h	78.675 h	100.71 h	81.028 h	87.906 h	-
Average Online Time per Cycle	79.625 h	76.25 h	76.571 h	73.688 h	50.958 h	42.85 h	38.691 h	37.484 h	60.05 h	66.536 h	57.111 h	72.781 h	-
Average Raw Water Turbidity	11.075	10.647	10.647	7.7516	5.8395	6.329	5.8446	5.7358	4.3733	5.3546	17.074	15.385	8.0495

CHALLENGE

- Improve sand filter consistency and fleet performance
- Automate regulatory compliance reporting
- Prioritise maintenance across a fleet of filters
- Reduce total clean water wasted in the backwash process & reduce operational energy costs

SOLUTION

- Contextualise data using data analytics
- Deploy models across the filter fleet
- Automate engineering and energy reports
- Provide Operations dashboards for real time performance and energy monitoring

RESULTS

- Engineering solution results in long term improvements
  - Increased filter performance consistency
  - Increased production to backwash ratios across fleet of filters
  - Reduced energy usage through filter optimisation

Water - Pump Health Monitoring

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CHALLENGE

- Inability to detect and anticipate pump performance issues can lead to prolonged shutdown, loss of revenue, and environmental/safety threats
- Bad pump performance increases energy use

SOLUTION

- Identify leading and lagging indicators of pump health
- Continuously monitor multiple pump health variables to detect poor performance and take corrective action

RESULTS

- Enables proactive engineering assessments
- Helps to identify risks and prioritise maintenance activities
- Optimised pump performance through continuous monitoring

Manufacturing – Reporting of Performance Losses

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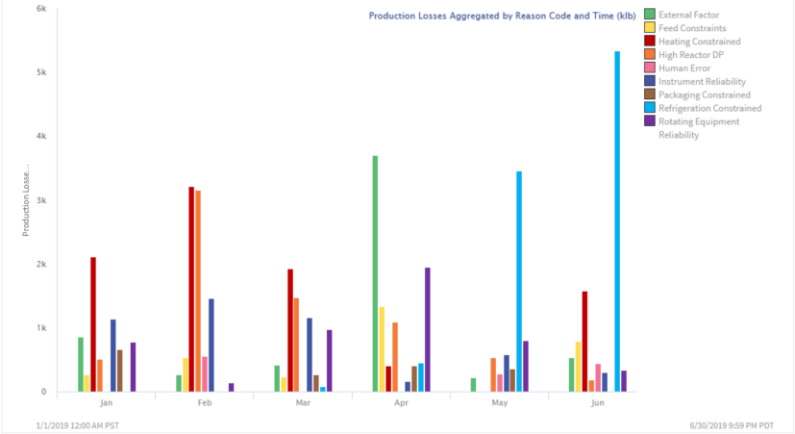
CHALLENGE

- Manufacturing companies need to track and categorise performance losses to identify bad actors and justify improvement projects
- Process Engineers can spend up to 12 weeks/yr aggregating this loss data for a single unit

YTD Losses by Reason Code - by month

Production Loss Reason Code	January 2019	February 2019	March 2019	April 2019	May 2019	June 2019
External Factor (klb)	862.78 klb	268.5 klb	413.09 klb	3698.6 klb	224.63 klb	532.95 klb
Feed Constrained (klb)	264.6 klb	533.9 klb	233.77 klb	1329.6 klb	0 klb	789.74 klb
Heating Constrained (klb)	2110.6 klb	3213.8 klb	1924.3 klb	403.02 klb	0 klb	1576.6 klb
High Reactor DP (klb)	507.72 klb	3152.1 klb	1471.8 klb	1088.7 klb	528.39 klb	191.47 klb
Human Error (klb)	0 klb	551.54 klb	0 klb	0 klb	275.54 klb	441.22 klb
Instrument Reliability (klb)	1142.6 klb	1465.3 klb	1157 klb	165.51 klb	578.21 klb	304.18 klb
Packaging Constrained (klb)	663.42 klb	0 klb	271.79 klb	400.47 klb	364.1 klb	0 klb
Refrigeration Constrained (klb)	0 klb	0 klb	84.214 klb	452.44 klb	3462.7 klb	5341.8 klb
Rotating Equipment Reliability (klb)	779.37 klb	133.89 klb	975.7 klb	1947.2 klb	798.47 klb	333.53 klb



SOLUTION

- Use analytics & conditions to logically identify and quantify performance loss events
- Use Scorecard Metrics and Histograms to aggregate losses based on time and loss categorisation

RESULTS

- Periodic Performance Loss Summary Reports with Color-coded scorecards and charts to draw attention to bad actors and deviations from expectations
- Auto-generated reports can return savings of 1-5 days of engineers' time per unit per month

Manufacturing – Advanced analytics & Visualisation

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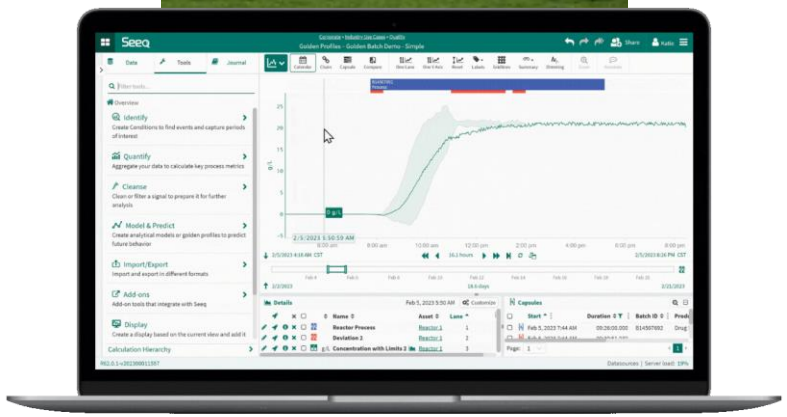

CHALLENGE

- Supply and deploy a tool for accessing and utilising vast amounts of data
- Many different users and user needs
- Change management
- Roll out and upskill training of large work force
- Ensure modern cyber risks were managed

SOLUTION

- Adoption of new cloud analytics solution
- Integrated to centralised historian data
- Extensive training of staff at different levels
- Localised support to ensure customer success utilising senior analytics engineers

RESULTS

- Successfully delivered a heavily utilised solution
- Provides process data, energy usage & access to time series data from across manufacturing sites in NZ and overseas to all stakeholders
- 1000+ users upskilled
- Huge savings in operational activities since adoption

Manufacturing – Syngenta Agriculture

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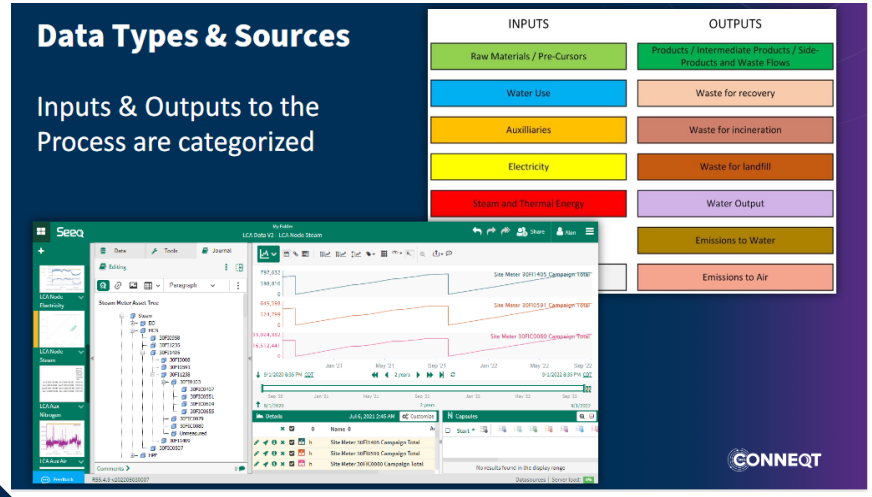

CHALLENGE

- Lower emissions throughout entire manufacturing and supply chains
- Reduce operational carbon footprints
- Continuous development of sustainability projects due to large data sets
- Cleansing data for analysis

SOLUTION

- Adoption of new cloud analytics solution
- Identified data types & sources
- Categorised processes to allow efficient analysis of Co2e
- Monitoring & visualisation of inputs and outputs, bringing sustainability metrics to the control room

RESULTS

- Top drivers of sustainability processes identified
- Overall Equipment Effectiveness (OEE) improvement
- Overall 'product to gate' carbon footprint benchmarked
- Monthly key performance indicators for energy, emissions, water and waste established
- Identification of new opportunities for sustainability

Manufacturing – allnex Energy Modelling

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CHALLENGE

- Across the board, leading manufacturing companies have goals to be net-zero, near-zero, or carbon-neutral by 2050
- The aggregation of many minor efficiency improvements across a system that can lead to overall energy reduction

SOLUTION

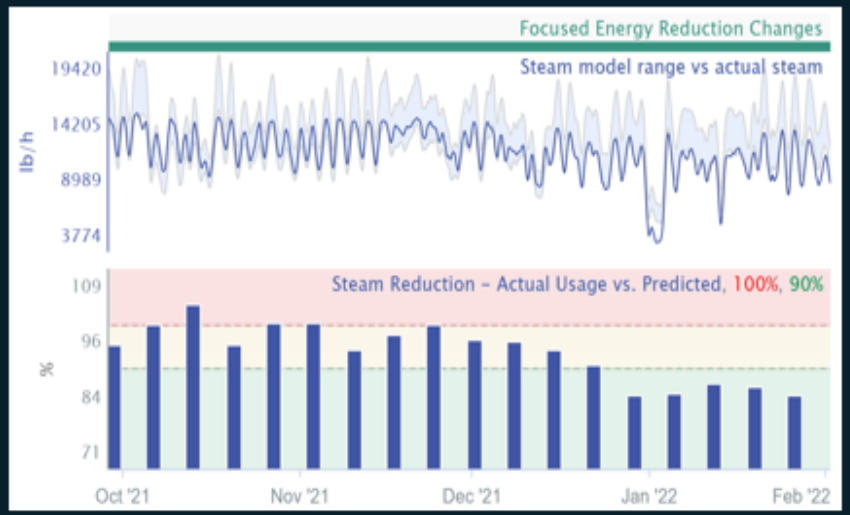
- Identify the overall energy consumption metric for a system and use all relevant inputs to model predicted energy consumption
- Use the model to inform continuous improvement efforts by creating a baseline to measure against and by quickly identifying bad actors across the entire system

RESULTS

- Reduced energy consumption through systematic improvements informed by data-driven energy models
- Increased awareness of good energy practices and near-real indicator of energy usage

allnex
The Coating Resins Company

*Allnex **reduced greenhouse gas emissions** equivalent to **1,095 passenger vehicles driven for one year** by using energy modeling in Seeq to inform continuous improvement efforts.*



Manufacturing – allnex Energy Modelling

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THANK YOU

Q & A