Using data to drive best practice and step change emissions reduction in the Pulp & Paper sector

February 2024

MAKING ZERO THE MOST PROFITABLE NUMBER

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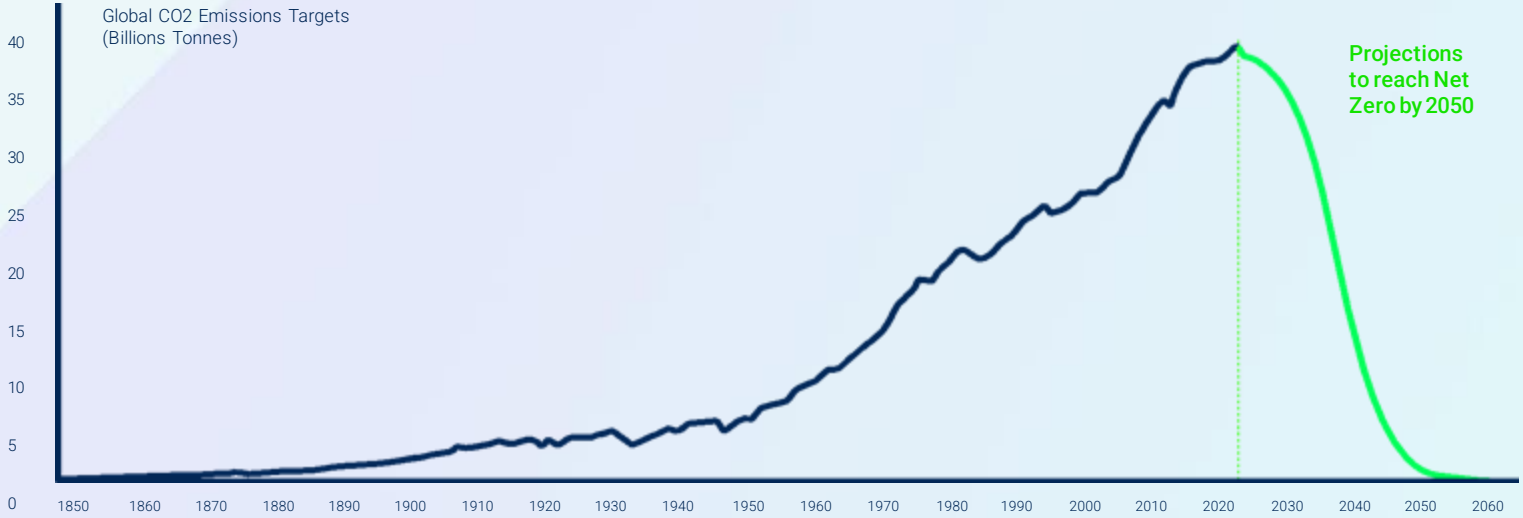
Targeting the Vast Decarbonisation Opportunity



Achieving Net Zero by 2050 is the goal of the century and is creating an enormous market opportunity

$4 trillion p.a. needed by 2030

to achieve Net Zero Emissions by 2050[1]

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Pressures and Constraints – Decarbonisation

EXTERNAL PRESSURES

Reputation

Customers and suppliers only want to work with firms moving towards sustainable operations

>90%

of S&P 500 companies publish ESG reports despite detailed disclosure not being mandatory across the US.

G&A Institute – Sustainability Reporting in focus

Regulation

Mounting climate laws and policies (Carbon border taxes, GHG disclosure requirements) are adding layers of complexity

3,127+

global climate laws and policies enacted as of 2023.

climate-laws.org (March 2023)

Talent Acquisition

Becoming an employer of choice now requires demonstrating a commitment to climate goals

c.60%

of Millennials and Gen Z fear business leaders are not focused on protecting the environment.

Deloitte Global Millennial Survey Report

Financing

Sustainability transformations open firms up to an entirely new category of ESG-only investors

c.10%

lower cost of capital experienced by firms with a better ESG score.

McKinsey – Why ESG is here to stay

INTERNAL CONSTRAINTS

"I have all of this data, but I don't know what it means"

"My ESG team is understaffed and inexperienced"

"How do I measure & communicate our climate achievements to the world"

"My costs are going out of control in a rising rate environment"

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Delivering Decarbonisation for the World's Most Complex Organisations

Decarbonisation is straightforward when your workplace looks like this

But what if your workplace looks like this

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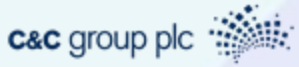
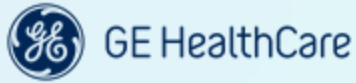
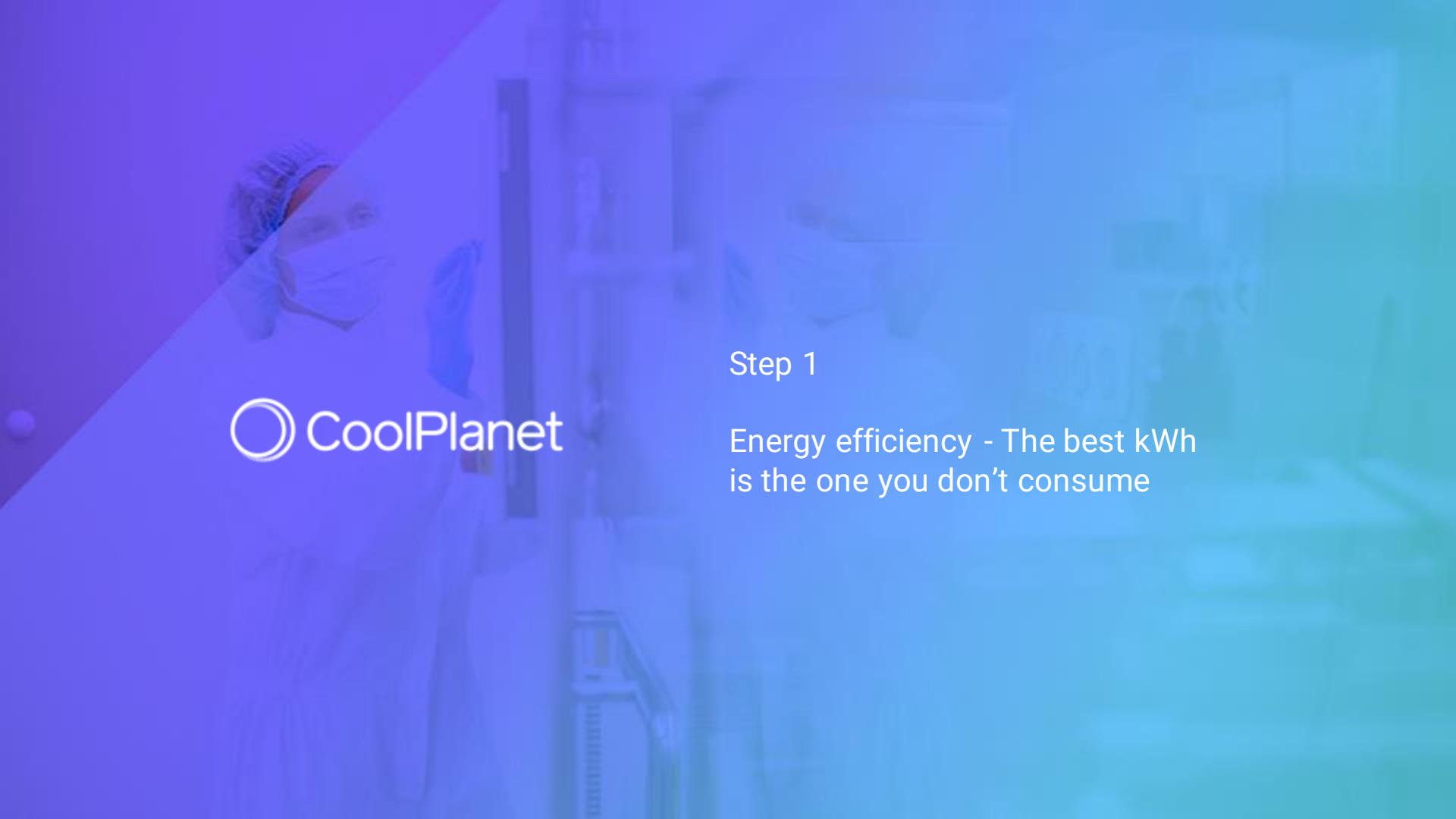
Trusted by the World's Biggest Brands for 15 Years







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Step 1

Energy efficiency - The best kWh is the one you don’t consume

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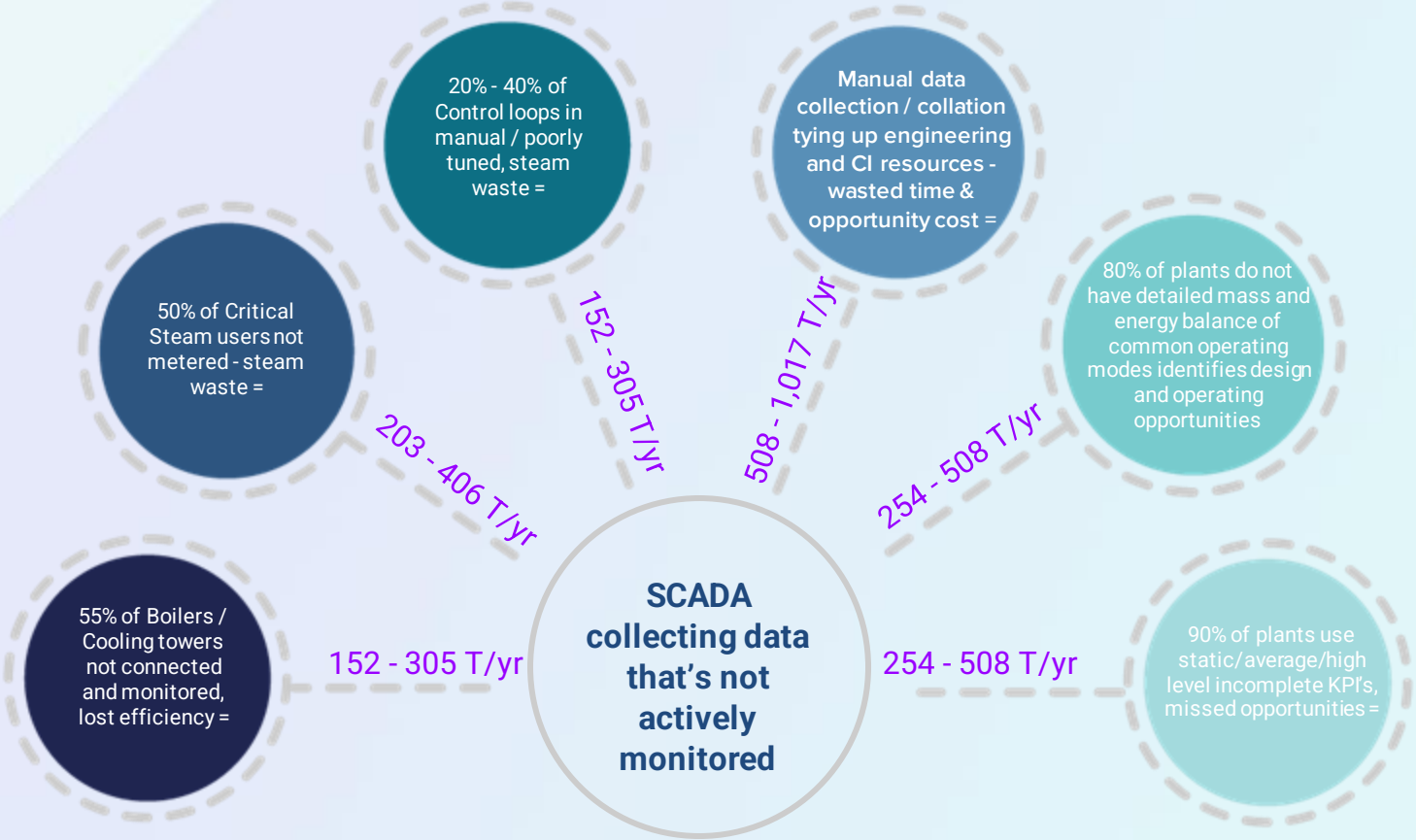
Cold hard facts! How much energy are you leaving on the table?



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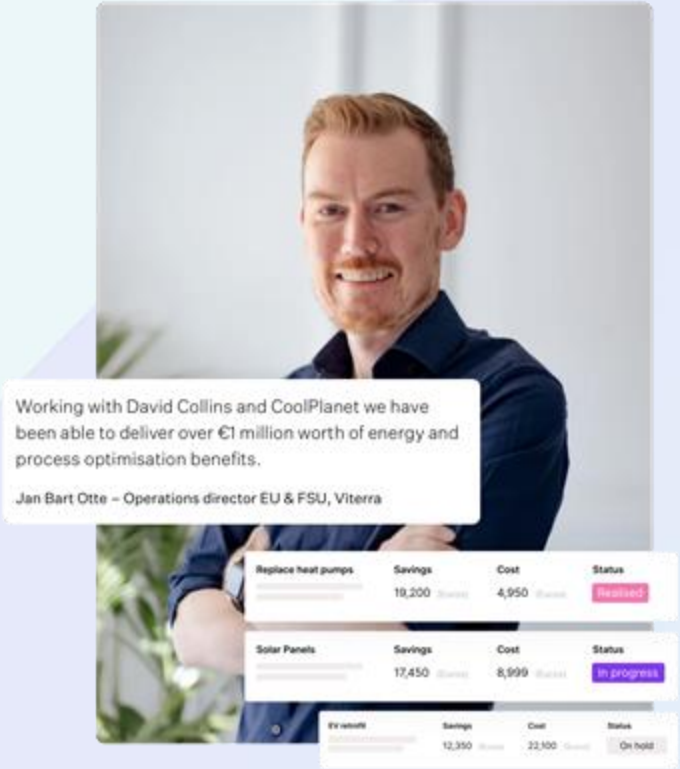
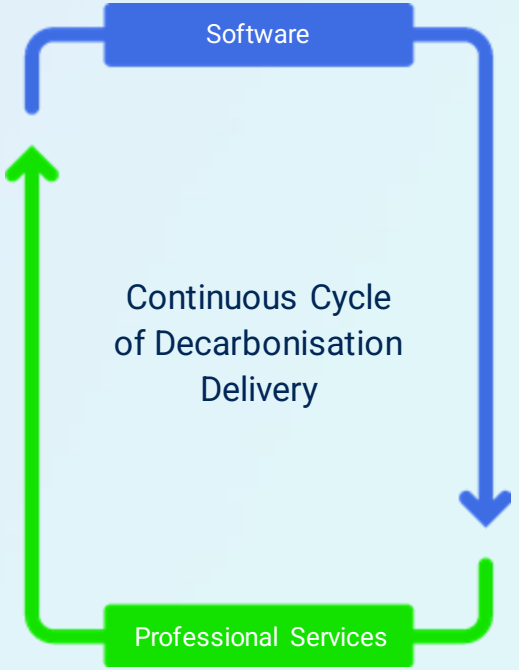
Over 10 years, we have built a team of the world's leading subject matter experts in decarbonisation



- Access consulting and project support across complex sectors to **enable the decarbonisation journey**
- Team of world-leading engineers, data scientists and subject matter experts **identify and implement opportunities surfaced in the software**
- Deliver on-site engineering support to **rapidly action identified decarbonisation opportunities**



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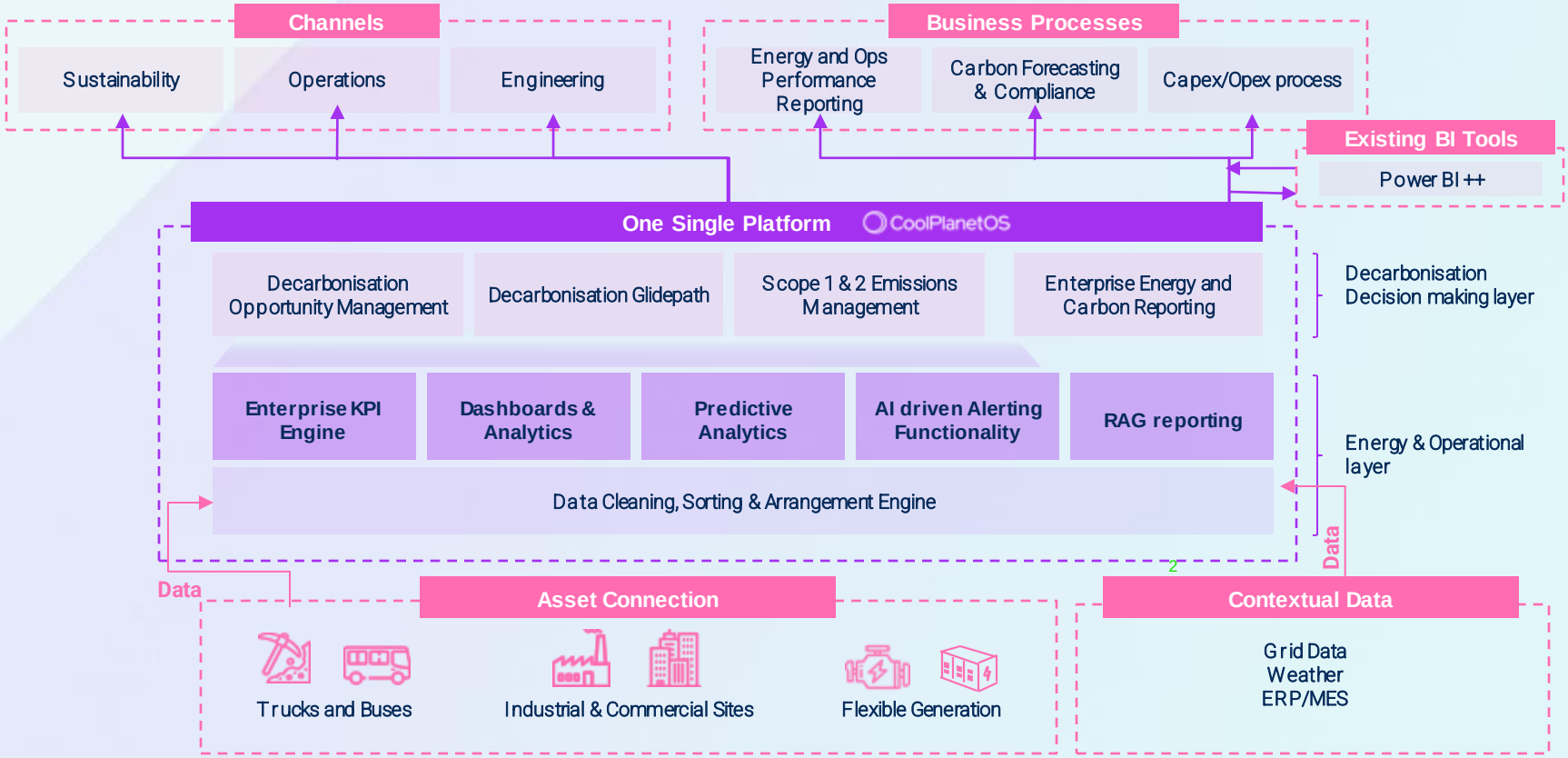
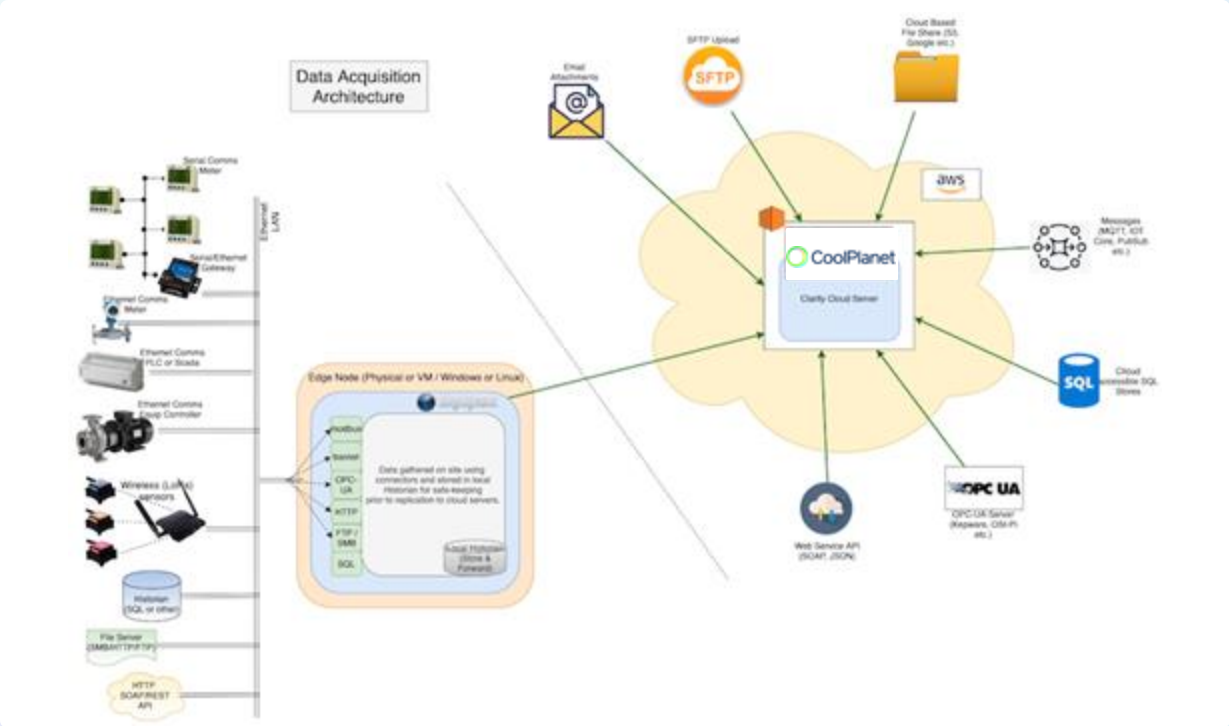
CoolPlanetOS Platform Visualization



Our integration toolkit



CoolPlanetOS is Hardware Agnostic, allowing us to integrate with a huge range of existing systems found in factories, industrial spaces and managed buildings.

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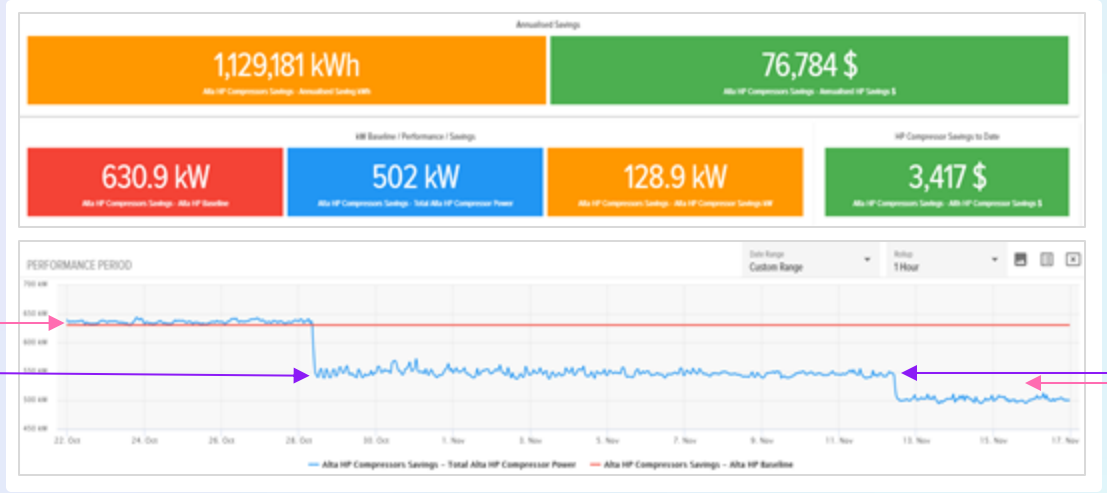
Compressed Air System at Glass Bottling Site

€65,000 savings

€65k annualised fuel savings

3 week payback



1. Operating Pattern (630kW Baseline) of High Pressure Compressors reviewed by CPCL team for anomalies

2. Controller Sharing Mode Settings reviewed and updated on site - 75kWe drop in Electricity Load!

3. Min Loading Settings per Compressor reviewed and updated on site. 54 kWe drop in Electricity Load!

4. 129 kWe reduction in Electricity Load sustained!

CoolPlanet

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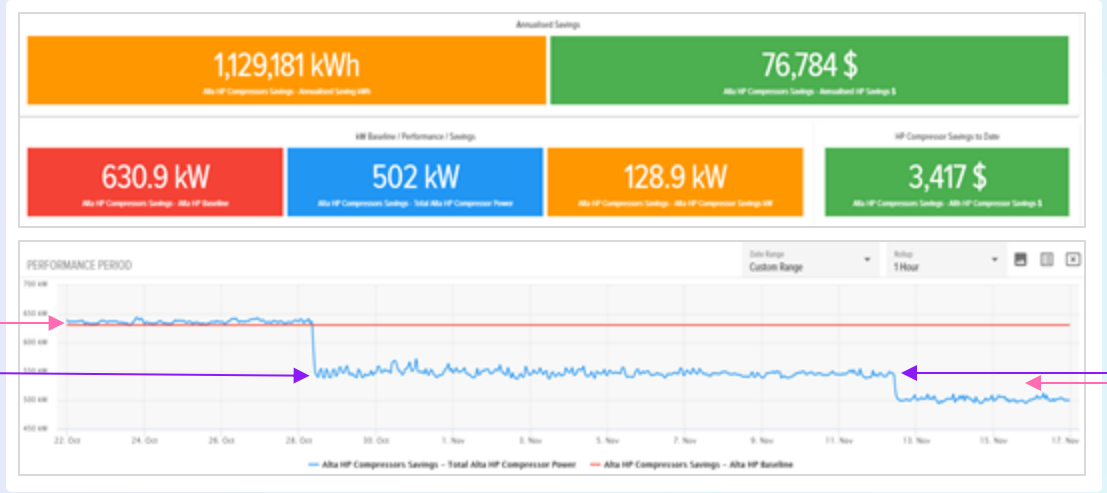

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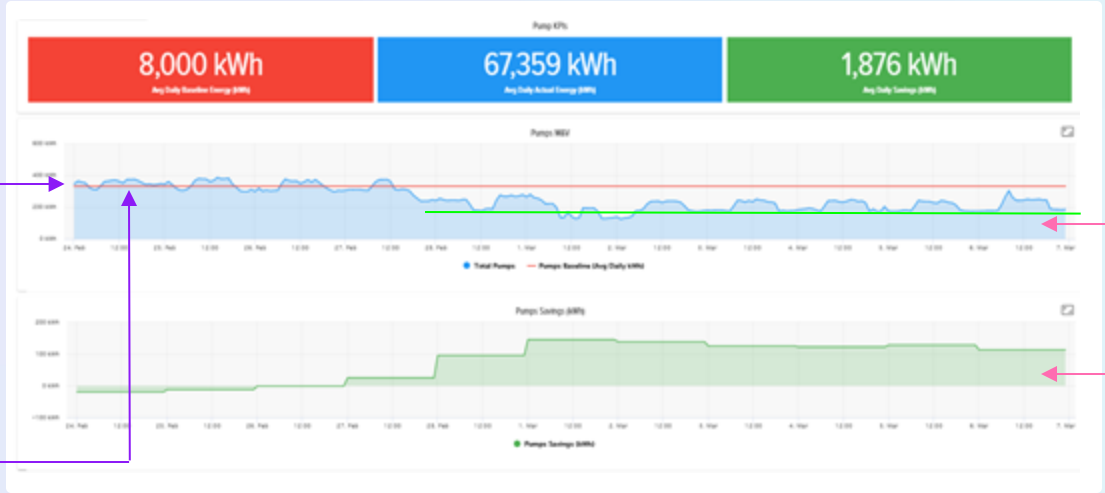
Glycol Pumps at Food Company in UAE

€40,000 savings

€60k annualised fuel savings

3 week payback



Site had 4 glycol pumps on existing VSDs but they were set manually at 50Hz

System appeared to be over pumping with low return pressures

We tested and installed the change yielding savings of on average 80kWe

Using CoolPlanetOS we optimised the frequency on the glycol pumps and set watcher controls

Optimising Existing 20MWe Cogen

€750,000 gas savings | 1 year payback

What was the problem?

A large cogen plant with 6 x engines was only achieving 65% overall efficiency - circa €1m lost heat energy requiring additional gas.

What was done?

CoolPlanet undertook analysis including full mapping of the process and identified significant opportunities to use more LPHW and increase steam recovery from HRSG
Full analysis of hot water (LPHW) system to identify opportunities for utilisation

What were solutions?

- Redesign of LPHW distribution systems and rebalancing of loads
- Upgrades in insulation of gas ductwork, HRSG etc.
- Improve HRSG control
- Redesign of air intake to provide cooler combustion air
- Performance management via CoolPlanetOS

Step 2

Digital Twins and Modelling

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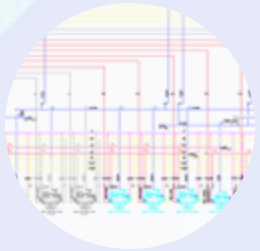
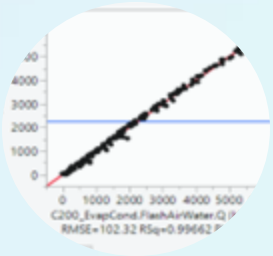
Distill Complex Processes Down to Live Targets





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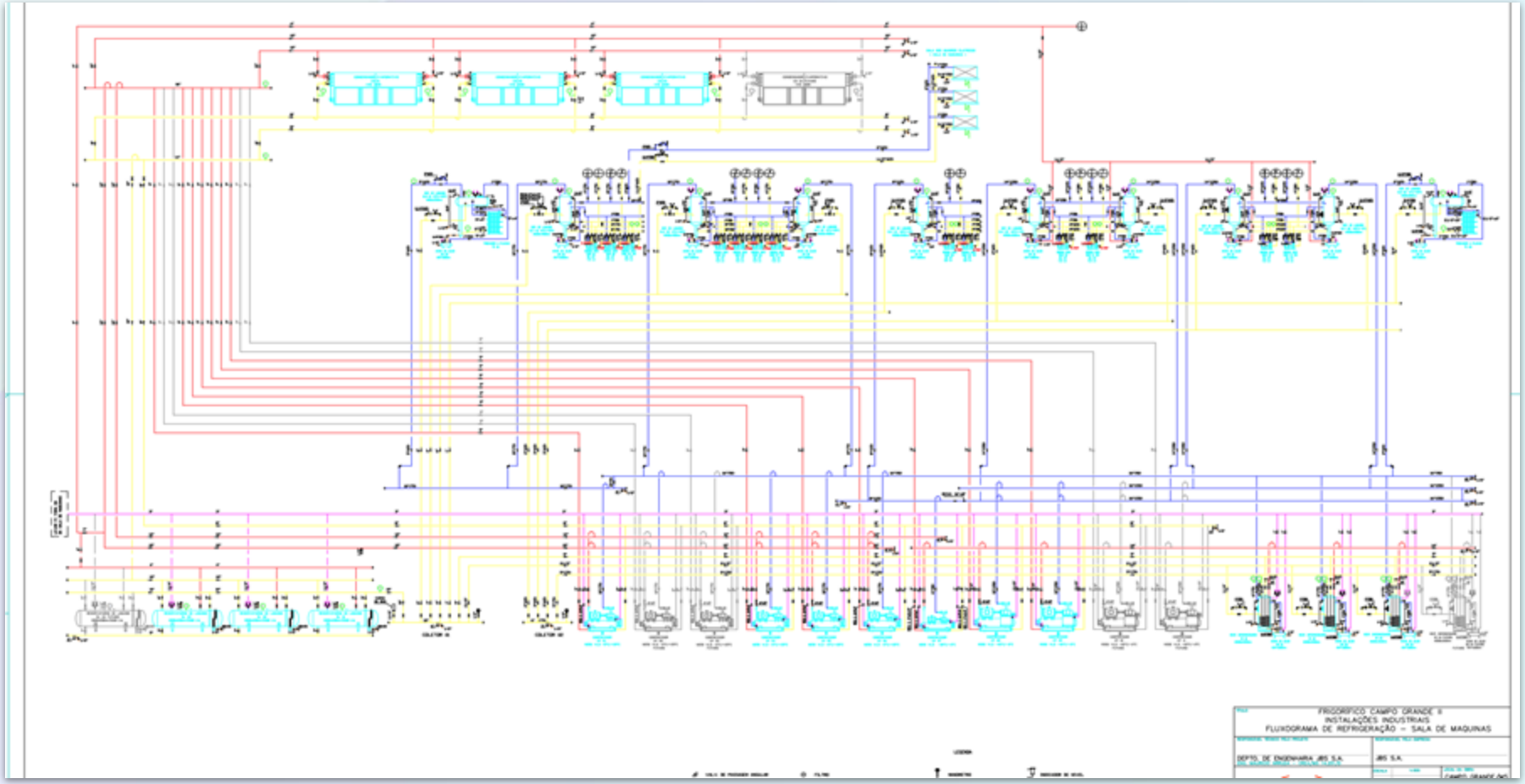
We take this...



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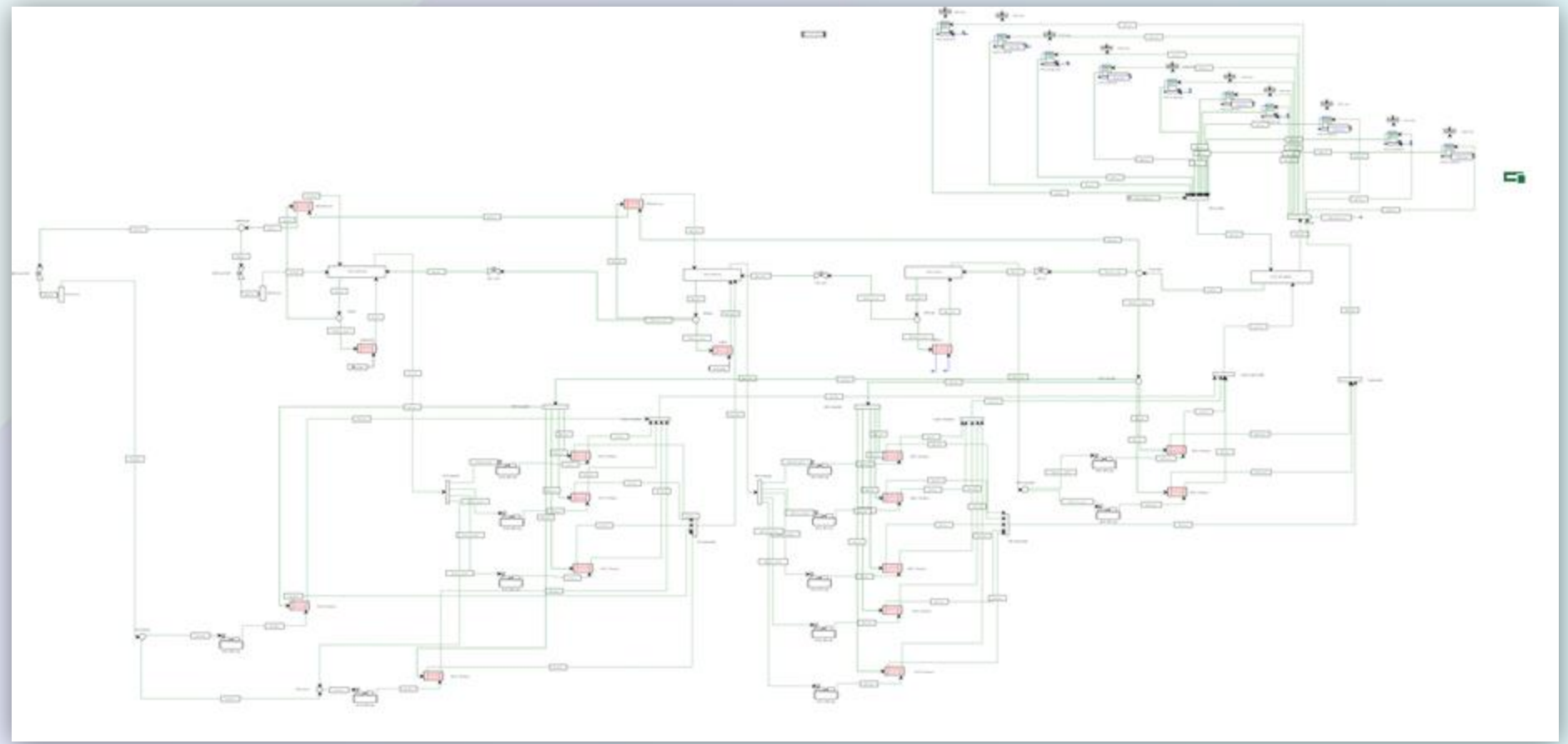
And turn it into this…



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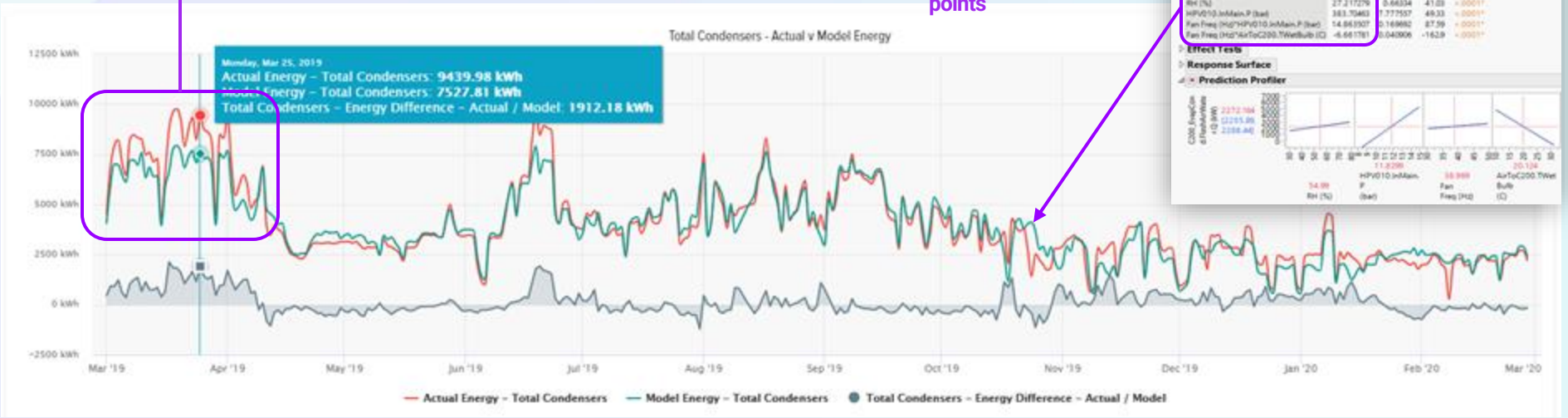
And then this….

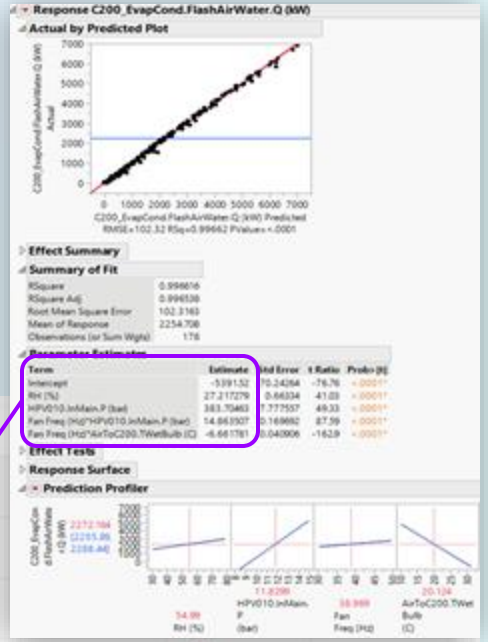
Component / Asset Model

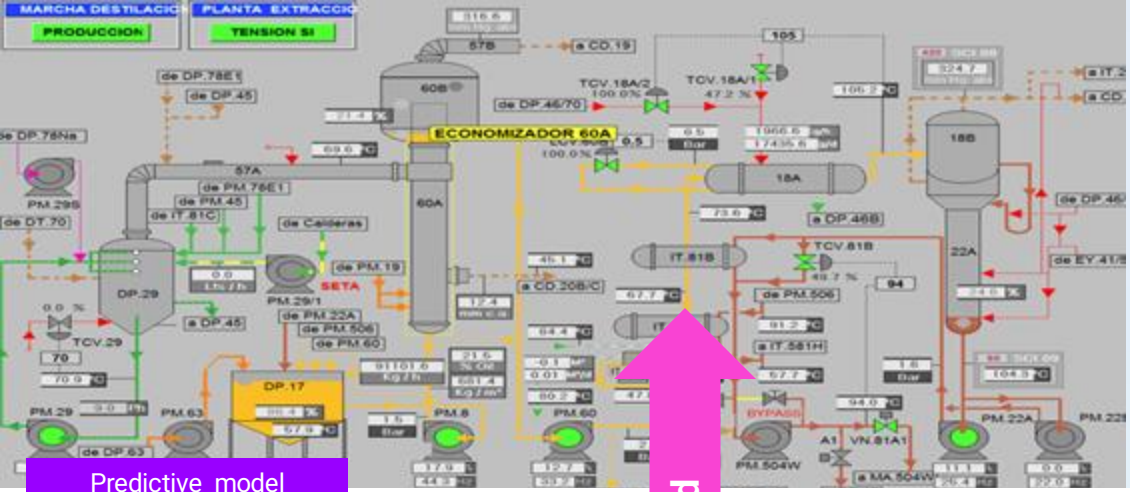
Below dashboard overlays a Energy model for ten Condensers based on an Aspen ACM model which takes environmental inputs and fan frequency to calculate energy use, on top of the actual condenser meter energy consumption.

The model highlighted a period of excess energy. An issue with air in the condensers was subsequently discovered and resolved mitigating losses of approx 2,000 kWh per day

Coefficients loaded to CoolPlanetOS equation builder to produce 'Model' data points





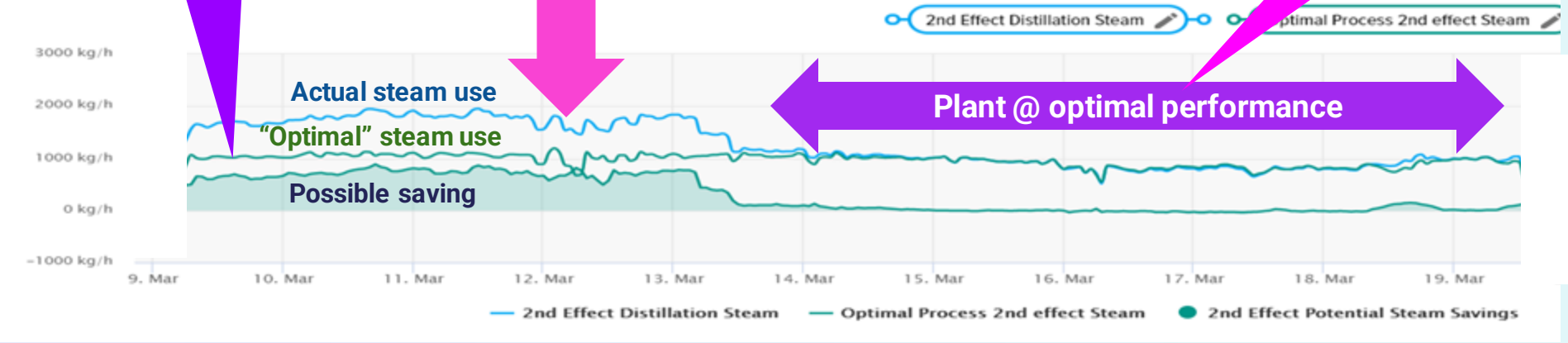


Because average / static KPI's just don't cut it anymore!

Predictive model accounts for production, weather etc.

Distilled

Convergence to optimum = zero savings



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Maintain and sustain peak plant performance…

KPI	06:00 Shift	14:00 Shift	22:00 Shift	All Shifts
Summary				
Seeds Crushed	361 ton	461 ton	462 ton	1,284 ton
Capacity Utilisation	75.2%	100%	100.2%	91.8%
Total Elec vs Seeds Crushed	29.4 kWh/ton	30.4 kWh/ton	29.4 kWh/ton	29.7 kWh/ton
Total Heat vs Seeds Crushed	130.88 MCal/ton	136.29 MCal/ton	134.16 MCal/ton	133.78 MCal/ton
Total Steam vs Seeds Crushed				
Crude Oil % of Seeds Crushed				
Extracted Oil % of Seeds Crushed				
Pressed Oil % of Seeds Crushed				
VSC				
Total Heat Demand				
Heat from Pressed Oil HR (21H2)				
Heat from Cooker Condenser (21HC1)				
Heat from Cooker Condensate (21H31)				
Recovered Heat				
Heat Provided from HR				
Seed In Temperature				
Seed Out Temperature				
Hours Seed Out Temp < 60°C				
Temp Diff Across Pressed Oil HR H/E				
Flakers				
All Flakers - Elec vs Seeds Crushed				
Seed In Temperature				
Heat Loss between VSC and Flakers				
Hours Seed In Temp < 58°C				

Shift Report - Compare metrics over shifts

KPI	19/09/2019 06:00 to 20/09/2019 06:00	Target	7 Day Average	30 Day Average	30 Day Std Dev.	Projected Annual Cost
Summary						
Seeds Crushed	1,382 ton		1,236 ton	1,277 ton	18.6%	
Capacity Utilisation	99.9%		89.4%	83.1%	39.2%	
Total Elec vs Seeds Crushed	31.3 kWh/ton	< 29	30.9 kWh/ton	31.2 kWh/ton	3.8%	
Total Heat vs Seeds Crushed	138.20 MCal/ton		136.20 MCal/ton	3470.93 MCal/ton	471%	
Total Steam vs Seeds Crushed	205.93 kg/ton	≤ 217	202.94 kg/ton	5171.78 kg/ton	471%	
Crude Oil % of Seeds Crushed	41.6%	> 43	40.8%	41.3%	6.4%	
Extracted Oil % of Seeds Crushed	11.9%	> 15	11.5%	12.3%	6.5%	

Daily Report - Compare against 7 day average, 30 averages, and 30 day standard deviation

KPI	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Week Average
Summary								
Seeds Crushed	1,383 ton	1,381 ton	1,383 ton	1,382 ton	1,387 ton	1,385 ton	660 ton	1,238 ton
Capacity Utilisation	100%	99.9%	100%	99.9%	100.3%	100.2%	47.8%	89.3%
Total Elec vs Seeds Crushed	32.3 kWh/ton	31.9 kWh/ton	31.3 kWh/ton	31.3 kWh/ton	30.6 kWh/ton	30.3 kWh/ton	29.6 kWh/ton	30.7 kWh/ton

Weekly Reports - Daily results, plus weekly average

KPI	Target	Sun 15th	Mon 16th	Tue 17th	Wed 18th	Thu 19th	Fri 20th	Sat 21st	7 Day Avg.	MTD
Summary										
Seeds Crushed		1,021 ton	1,382 ton	1,382 ton	1,382 ton	1,384 ton	1,386 ton	1,385 ton	1,332 ton	23,314 ton
Capacity Utilisation		73.9%	99.9%	99.9%	100%	100.1%	100.2%	100.2%	96.3%	80.3%
Total Elec vs Seeds Crushed	< 29	31.0 kWh/ton	32.1 kWh/ton	31.6 kWh/ton	31.3 kWh/ton	30.9 kWh/ton	30.4 kWh/ton	30.3 kWh/ton	31.1 kWh/ton	31.2 kWh/ton
Total Heat vs Seeds Crushed		140.65 MCal/ton	137.56 MCal/ton	139.36 MCal/ton	138.71 MCal/ton	136.93 MCal/ton	135.51 MCal/ton	135.36 MCal/ton	137.73 MCal/ton	5140.43 MCal/ton
Total Steam vs Seeds Crushed	≤ 217	209.58 kg/ton	204.97 kg/ton	207.65 kg/ton	206.68 kg/ton	204.04 kg/ton	201.92 kg/ton	201.68 kg/ton	205.21 kg/ton	7659.39 kg/ton
Crude Oil % of Seeds Crushed	> 43	38.3%	42.5%	41.9%	41.5%	41.6%	41.6%	41.8%	41.3%	41.4%

KPI	21/09/2019	Week to Date	Month To Date	Year to Date	Prev Year to Date
Summary					
Seeds Crushed	1,385 ton	8,301 ton	23,402 ton	301,902 ton	201,587 ton
Capacity Utilisation	33.3%	88.9%	77.4%	82.5%	54.9%
Total Elec vs Seeds Crushed	30.3 kWh/ton	31.3 kWh/ton	31.1 kWh/ton		
Total Heat vs Seeds Crushed	135.34 MCal/ton	137.21 MCal/ton	21719.89 MCal/ton		
Total Steam vs Seeds Crushed	201.66 kg/ton	204.45 kg/ton	32363.25 kg/ton		
Crude Oil % of Seeds Crushed	41.7%	41.9%	41.4%		
Extracted Oil % of Seeds Crushed	11.7%	11.8%	12.1%		
Pressed Oil % of Seeds Crushed	30%	30%	29.3%		
VSC					

YTD Reports - WTD, MTD and YTD

CoolPlanet …and get right to the point…

KPI	Target	06:00 Shift	14:00 Shift	22:00 Shift	All Shifts
Environmental Conditions					
Wet Bulb Temperature (°C)		23.3°C	22.8°C	21.5°C	22.5°C
Total Refrigeration System					
Total Refrigeration		19,415kWh	19,181kWh	15,577kWh	54,173kWh
+2 System					
+2 System Total Energy (K50+K60)		2,571kWh	2,939kWh	2,584kWh	8,094kWh
+2 System Pressure (BarG)	>4.74	4.01BarG	4.38BarG	3.99BarG	4.13BarG
CW Supply Temp		7.85°C	No Data	No Data	7.85°C
Ammonia Seperator Pressure (+2)		4.98bar	5.35bar	4.96bar	5.10bar
-6 System					
-6 System Total Energy (K70,80,90,100,110)		4,403kWh	4,194kWh	3,431kWh	12,028kWh
-6 System Pressure (BarG)	>2.54	2.49BarG	2.53BarG	2.52BarG	2.51BarG
Glycol Supply Temp		-2.50°C	-2.20°C	-2.30°C	-2.33°C
Ammonia Seperator Pressure (-6)		3.52bar	3.56bar	3.55bar	3.55bar
-38 System					
-38 System Total Energy (K140,150,160)		5,185kWh	5,541kWh	4,161kWh	14,887kWh
-38 System Pressure (BarG)	>-0.29	-0.32BarG	-0.33BarG	-0.27BarG	-0.31BarG
Tyfoxit H32 Flow Temp		-27.83°C	-28.15°C	-27.60°C	-27.86°C
Tyfoxit H33 Flow Temp		-28.58°C	-29.33°C	-28.51°C	-28.81°C
Tyfoxit Pump Inlet Pressure		0.62bar	0.60bar	0.53bar	0.59bar
Tyfoxit Pump Outlet Pressure		4.32bar	4.20bar	4.20bar	4.24bar
Separator S30 Pressure		0.65bar	0.64bar	0.70bar	0.67bar
-52 System					
-52 System Total Energy		1,413kWh	746kWh	7kWh	2,166kWh
-52 System Pressure (BarG)	>-0.58	-0.58BarG	-0.57BarG	-0.58BarG	-0.58BarG

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…keep on top of the regions (world!)…


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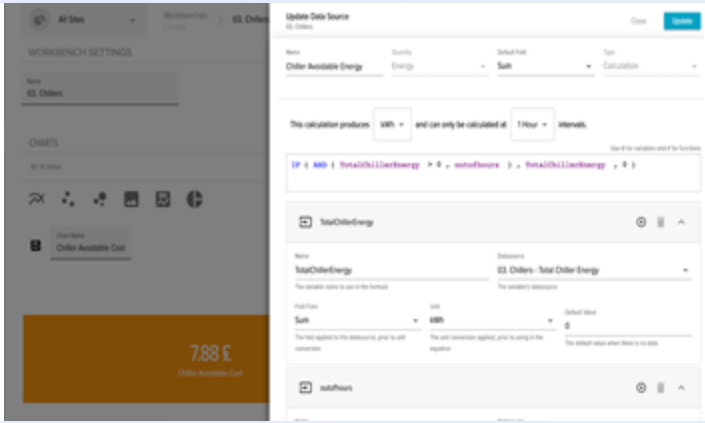
What if you have little data connectivity?

Proof of Concept - Quick wins based on Historical data

6K Savings within 2 hours

- No meters on Site before CoolPlanetOS
- Remote data audit carried out
- Started metering the heaviest users of energy first
- Opex options
- Solving the metering gaps is a means to an end for us
- Value is in the eventual data
- Equipment agnostic
- Bringing simple but impactful value.
- 2 hours of live system
- Only 18 data points out of 40 mapped across etc

Proof of Concept - Quick wins based on Historical data



27K Savings within 3 weeks

- 3 weeks of historical data
- Medium data availability onsite
- Data on one utility onsite
- CoolPlanetOS can ingest excel data sets at a consumer grade level
- Couple of hours to build dashboard demonstrating POV
- Basic modelling
- €27k savings

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Proof of Concept - Quick wins based on Historical data

144 K per year Savings
No Capex Required

- 1 year of historical data
- Example of Baseline modelling
- Insights to solutions that require no capex
- Huge savings achieved
- Control changes
- Power of the equation builder etc

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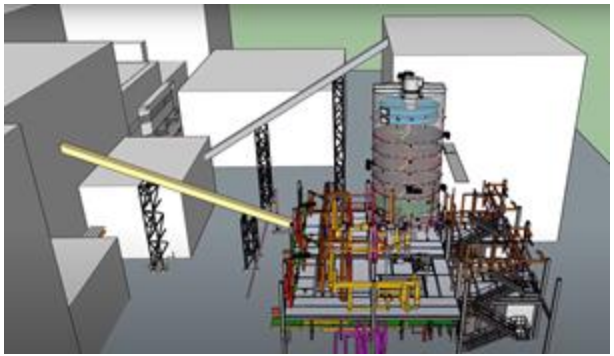
In the longer term...

€3.1 Million Savings



- 2 min short visualisation of saving solutions - 3D twin of the site
- High level of Data onsite

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Thinking Bigger?

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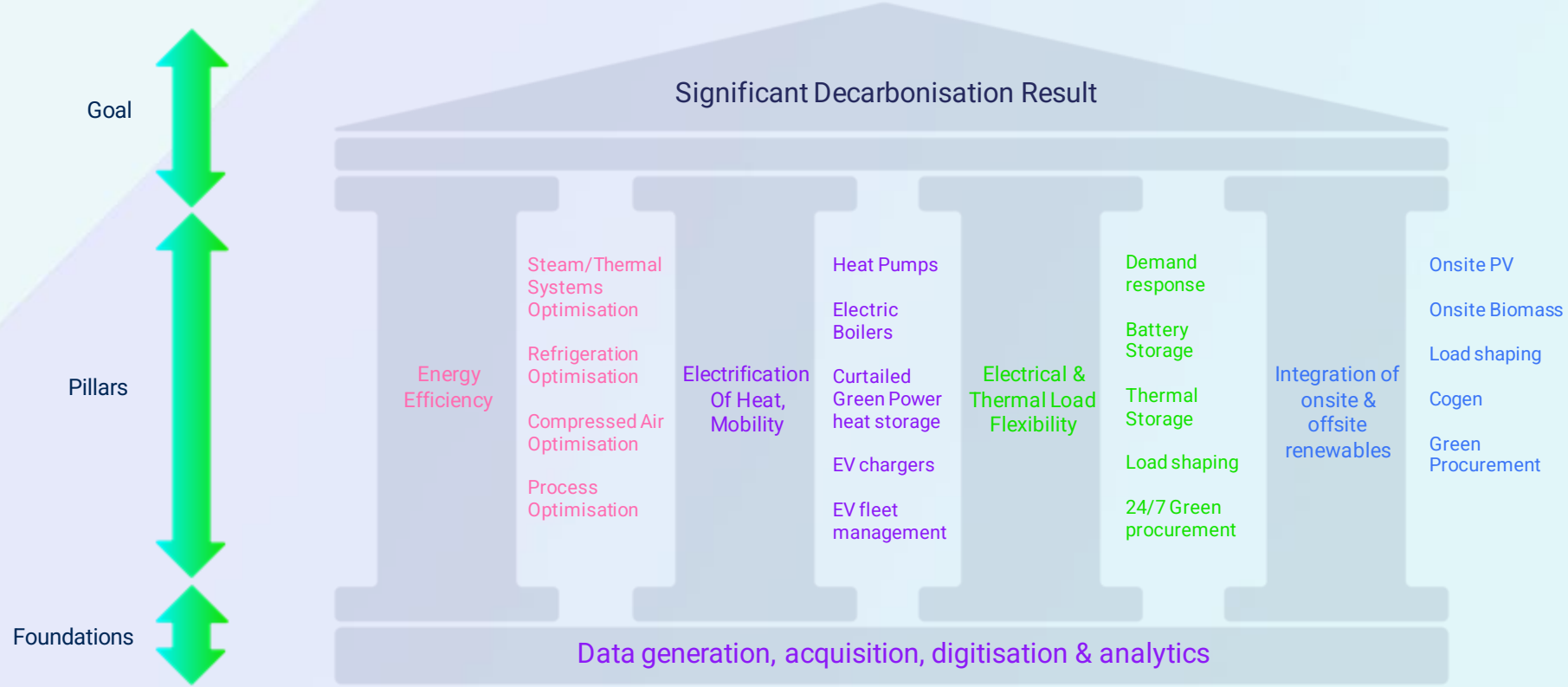
We Have Always Been Leaders in Energy Efficiency Which is Now Incorporated in our Overall Decarbonisation Solution



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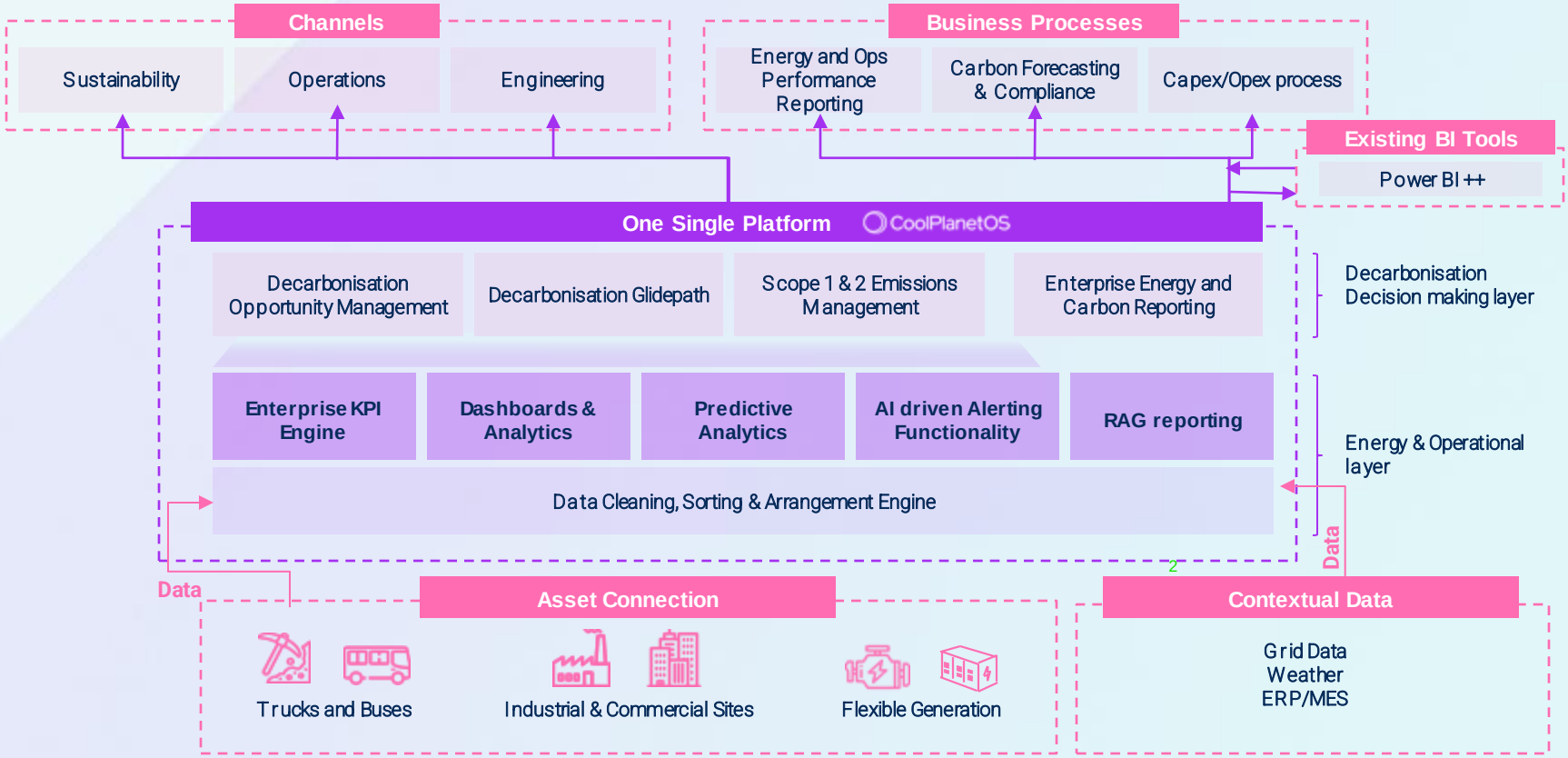
CoolPlanetOS Platform Visualization



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Would you like to know more?

Email:

Colin.martin@coolplanet.io

Thank you.