CPECS

The Central Plant Energy Control System

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Agenda

- What is CPECS?
- Product Development
- Refined Optimisation Approach
- Hardware & Network Architecture
- Typical Competitor Analysis

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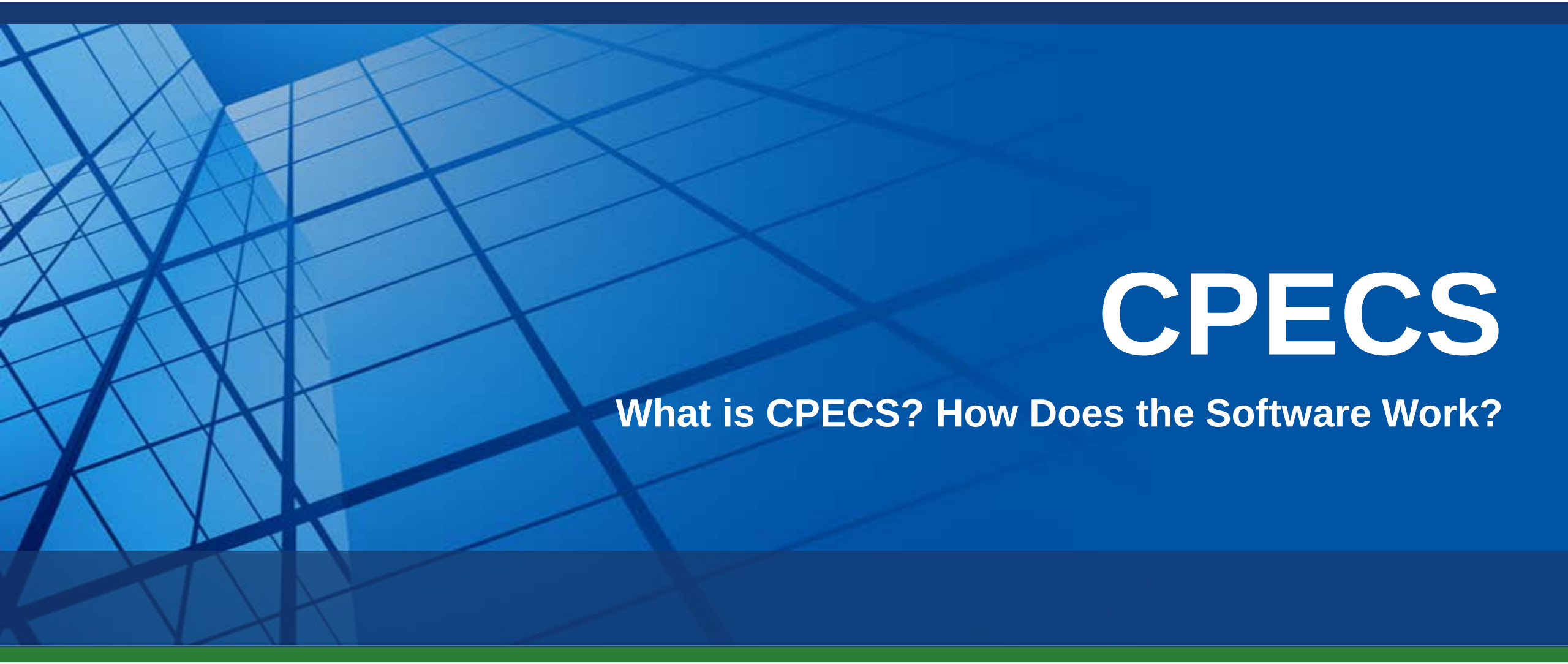

CPECS

What is CPECS? How Does the Software Work?

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What is CPECS?

The Central Plant Energy Control System (CPECS) aims to;

- Enable customers to take control of their central plant operational costs, eliminating unnecessary energy usage
- Drive the creation of improved key energy performance targets
- Provide equipment and plant level analytics to maximize asset value

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CPECS Core Optimisation Methodology

- CPECS uses an open protocol, simulation and performance model based approach to optimisation, called **Brute Force Optimization (BFO)**

- BFO aims to find the system control variables, such as set-points and sequences that result in the lowest possible energy consumption for the real time conditions

- The result is a continuous commissioning approach that accounts for real time variables in the software decision making process

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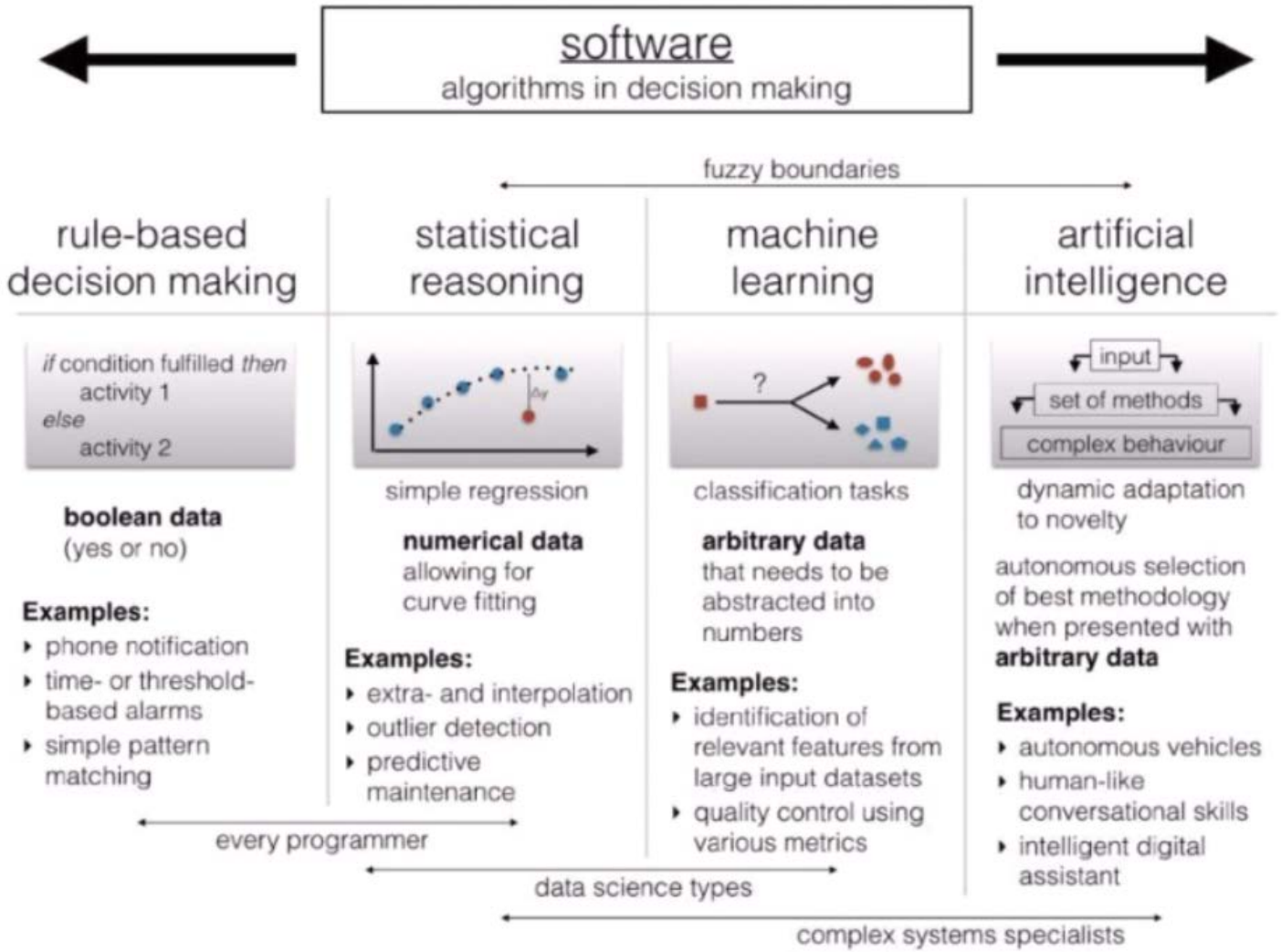
CPECS Understanding the Software Position



CPECS lives between Statistical Reasoning and Machine Learning, bordering with some features on Artificial Intelligence.

Typical BAS / BMS solutions live in the rule based decision making category.

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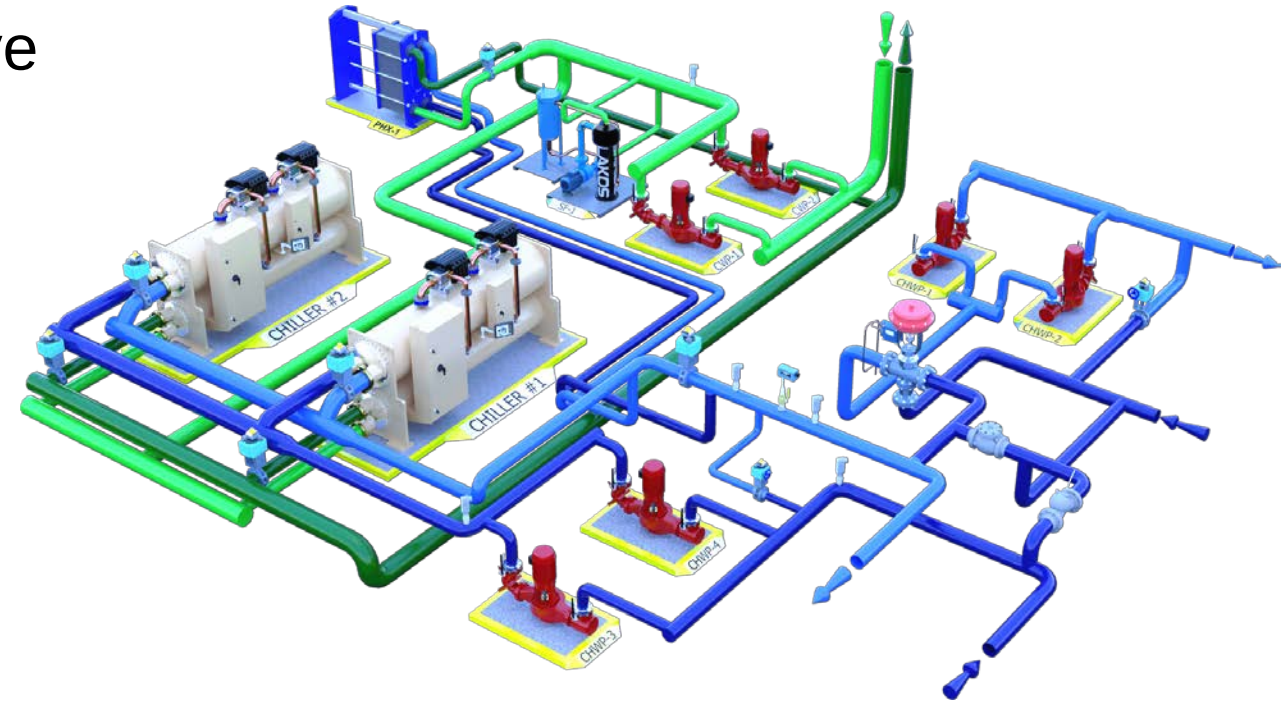
CPECS What Does it Optimise?

- The BFO will optimise;
  - Chillers (Water, Air and Evaporative Cooled)
  - Condenser Water Pumps
  - Cooling Towers

- The CPECS product as a whole will also optimise;
  - Chilled Water Pumps
  - System Bypass and Isolation Valve(s)



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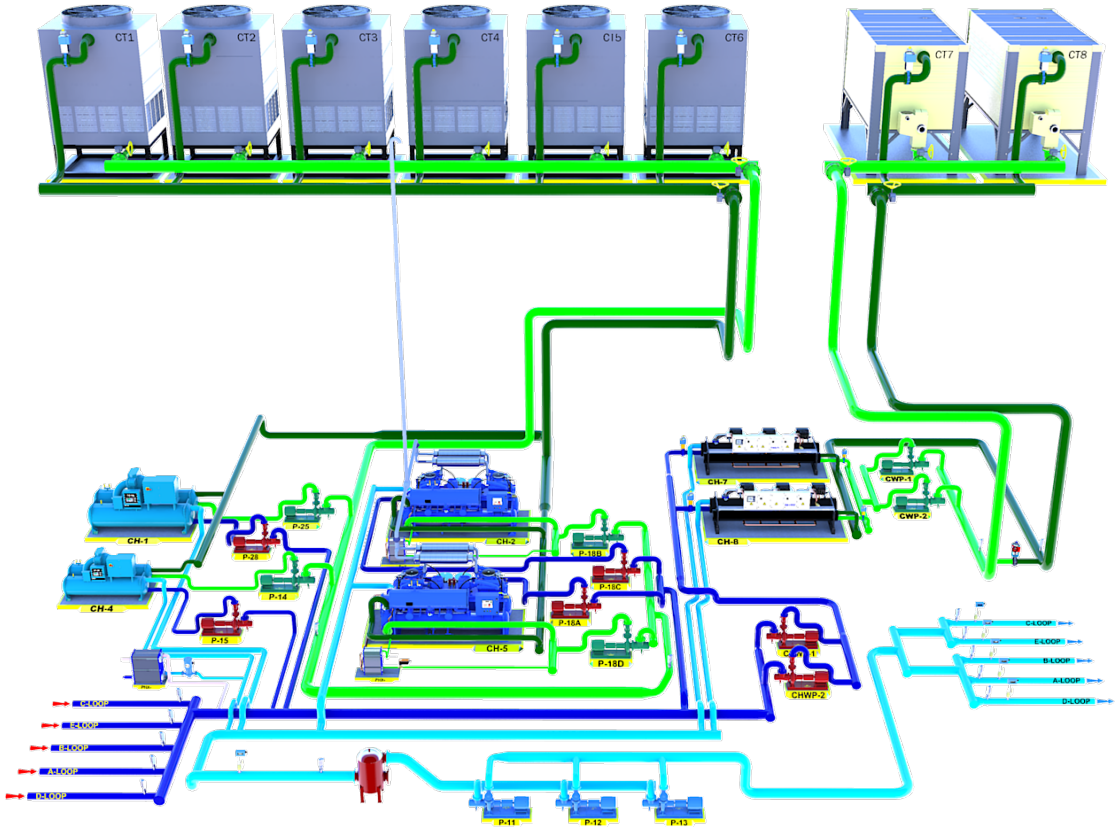
CPECS History

- There has been several iterations of CPECS, BFO is the most recent, and continued core optimisation methodology

- CPECS has always been intended to be brand agnostic, and has been deployed on plants that vary in type, size and equipment selections successfully



So…. What Did We Do?

- CPECS has been built as a solution that aims to provide;
  - The most simple central plant optimisation system to implement, commission and maintain in the global market
  - Market leading optimisation of central plant systems
  - Market leading central plant equipment analytics
  - Market leading visualisation
  - A simple way to generate on-going revenue through service based offerings and on-going equipment sales
  - A globally supported solution

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Product Development Goals

CPECS 2.0 Development Goals Overview

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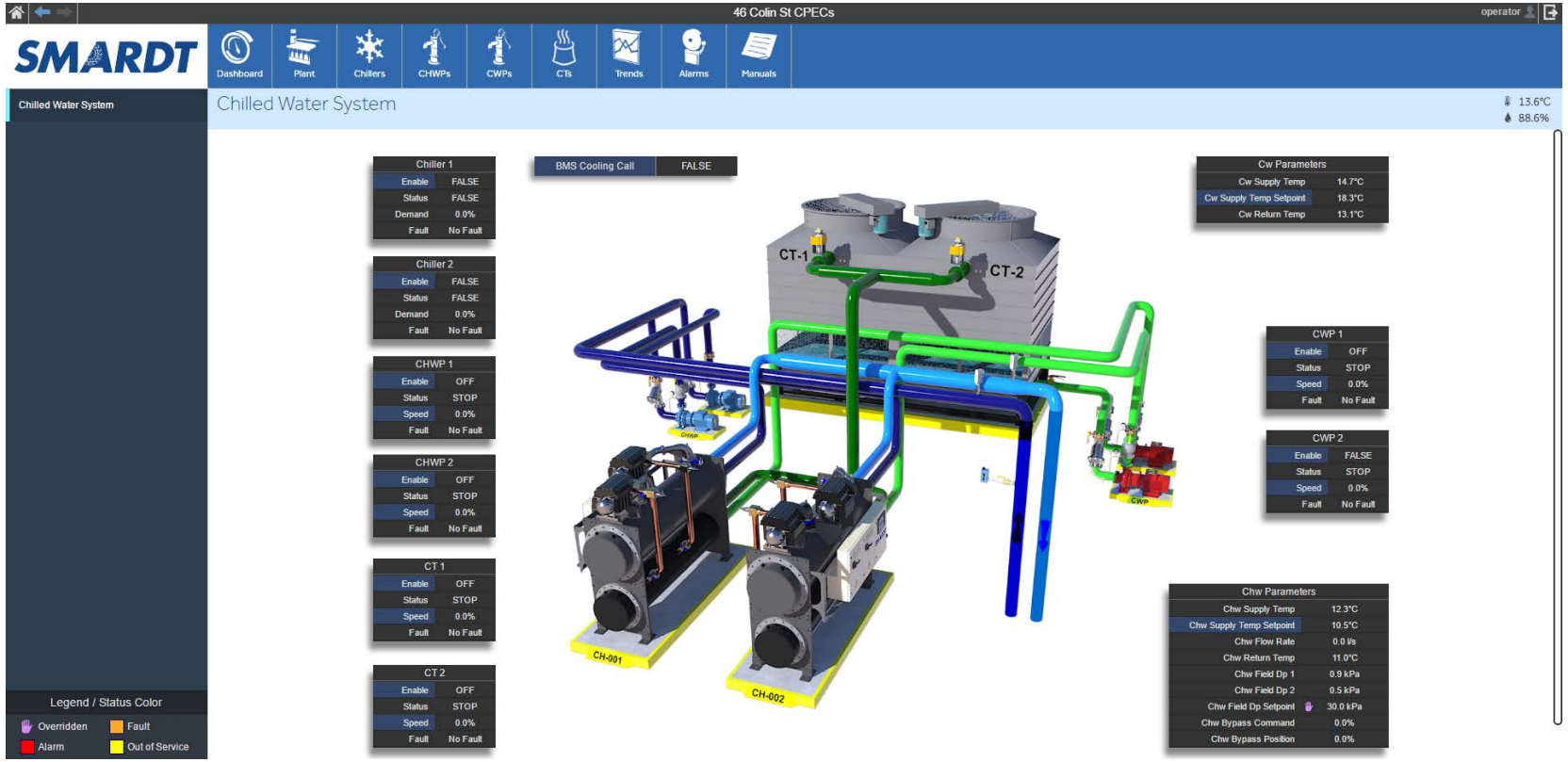
CPECS 2.0 Product Development Goals

- Visualisation through an Advanced HTML5 GUI that aims to create a feel of familiarity to the user



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GUI Preview

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CPECS 2.0 Product Development Goals

- Standardised software approach to ‘typical’ projects
  - Goal of 90% standard logic, 10% customisation for region and site specific requirements
- Identification of what types of projects are standard and what projects would require greater customisation

Market	Weighted Score	Standard Solution	Customised Solution
Office	4.5	X	
Education	4.3	X	
Data Centre	3.7		X
Hospital	3.7		X
Hotels	3.4	X	
Retail	2.9	X	
Process	2.7		X
District Cooling	1.7		X
Lab	0.9		X
Military	0.9		X

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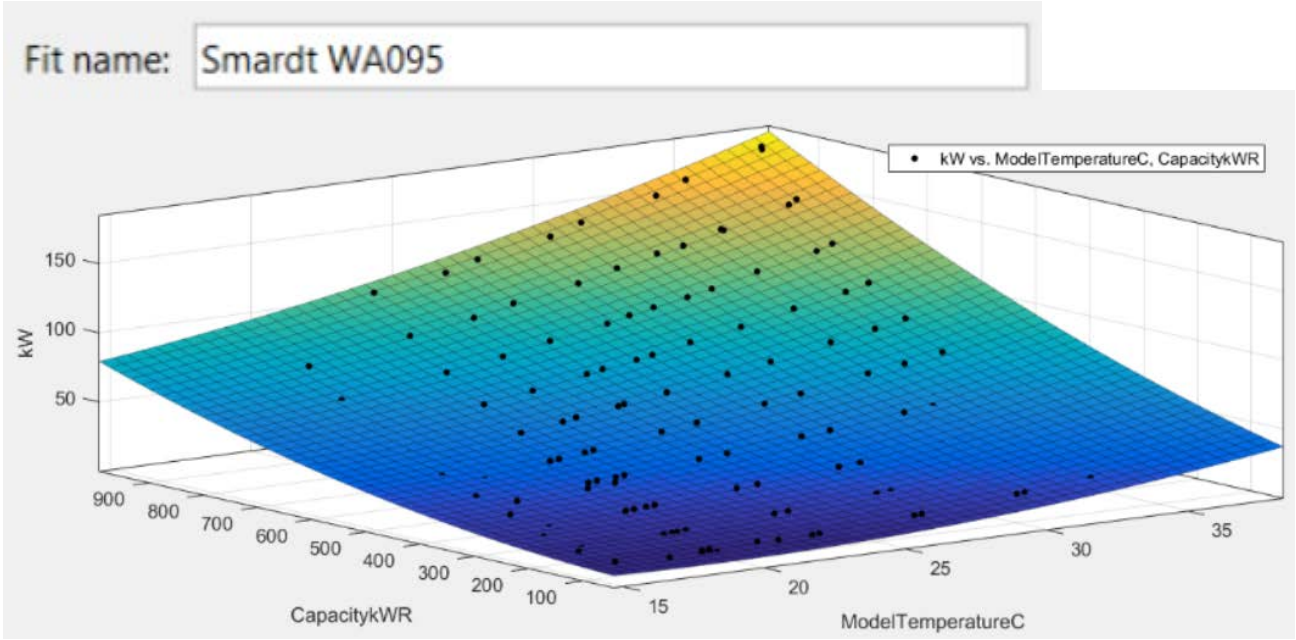
CPECS 2.0 Product Development Goals

- Improved equipment performance models that are tunable via logged field data

- Refined optimisation engine that applies heuristic (search and rank) functions to speed up the optimisation process and increase the performance capability



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Focused Development Program

- Utilising CPECS we have seen condenser side optimisation yield savings of 20-30% on total plant energy usage
  - However, if done incorrectly, it can actually penalise total plant performance by up to 15-20%

- Variable chilled water flow has limited savings at the chiller level (2-4% on average)
  - It does however bring significant savings at the chilled water pump level, potentially >30-40%

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Refined Optimisation Approach

New Approach to Achieve Brute Force Optimisation

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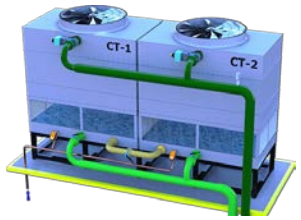
CPECS 2.0 Optimisation Approach

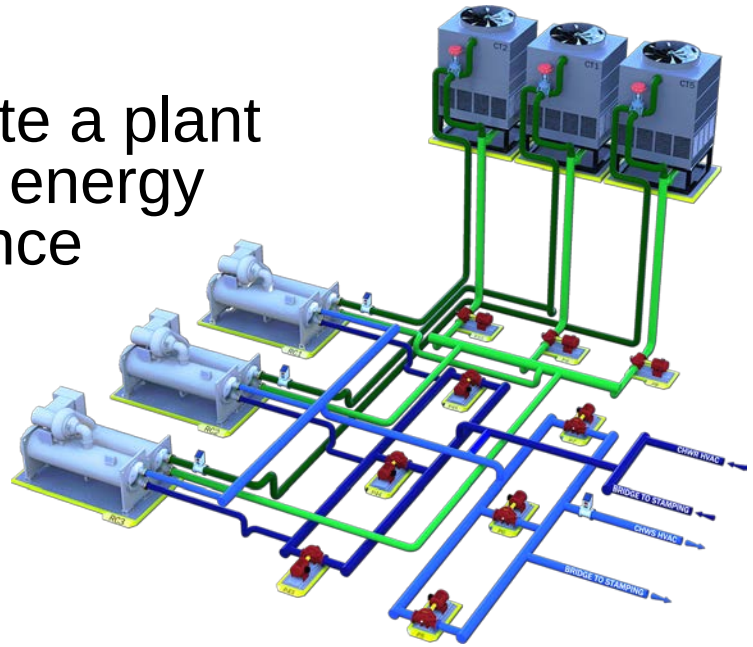
STEP 1

- Isolate the functions that need to be optimised
- Deploy and tune each optimisation function separately



STEP 2

Create a plant wide energy balance



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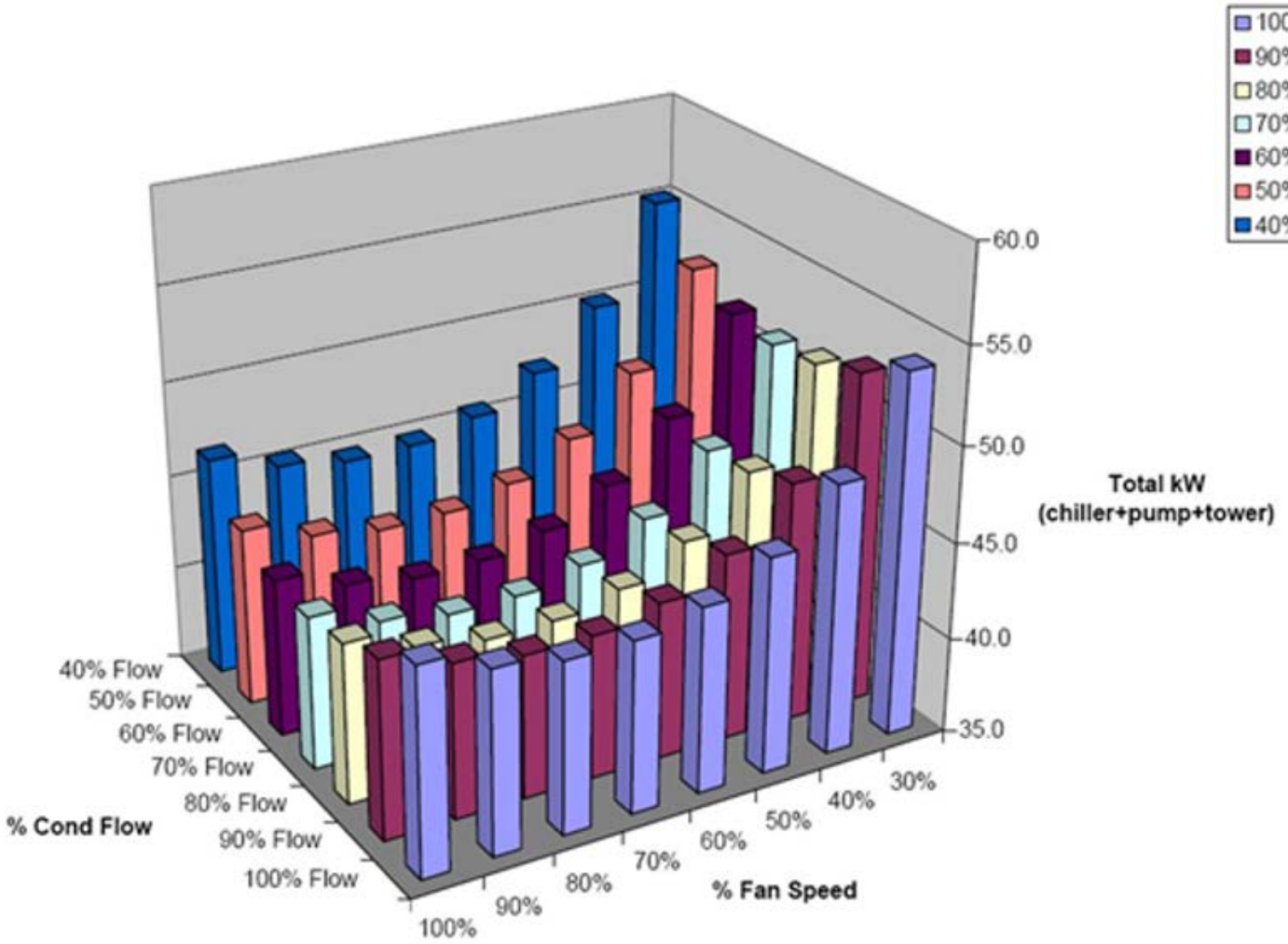
CPECS 2.0 Optimisation Approach



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Chiller Optimisation

- Field Tunable Chiller Performance Models

- Optimised Chiller Staging
  - Iterative equation based on required flow and estimated/modelled energy performance at the live operating conditions
  - Lowest power consumption possible based on possible chiller sequences

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Pump Optimisation

- Equation that builds live system operating point
- Hydraulic power required, pump efficiency, motor efficiency and VSD efficiency
- Can be utilised in dedicated or parallel pumping arrangement

Cooling Tower Optimisation

- Algorithm that chooses ideal condenser water set-point
- Based off cooling tower efficiency (design vs actual)
- Equation takes into varied wet bulb considerations

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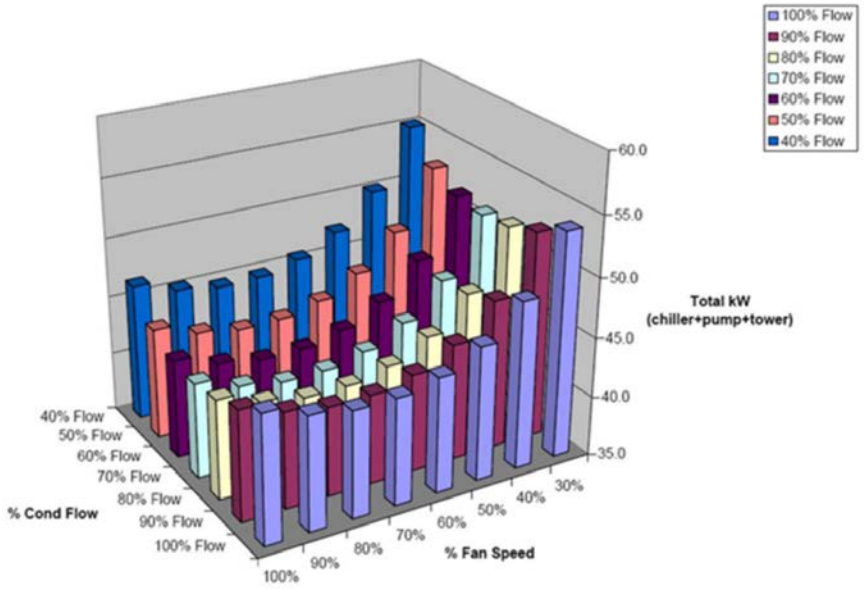
Energy Balance

- Maintaining a tight range on plant heat balance
- A balance between meeting cooling needs at the heat absorption level (field cooling) and optimising the heat rejection cycle to work in harmony
- Iteration of pump, chiller and cooling tower power based on real-time conditions



Energy Balance

- Let’s watch the Energy Balance Iteration actually work !!
- Video from 80 Collins St project in Melbourne

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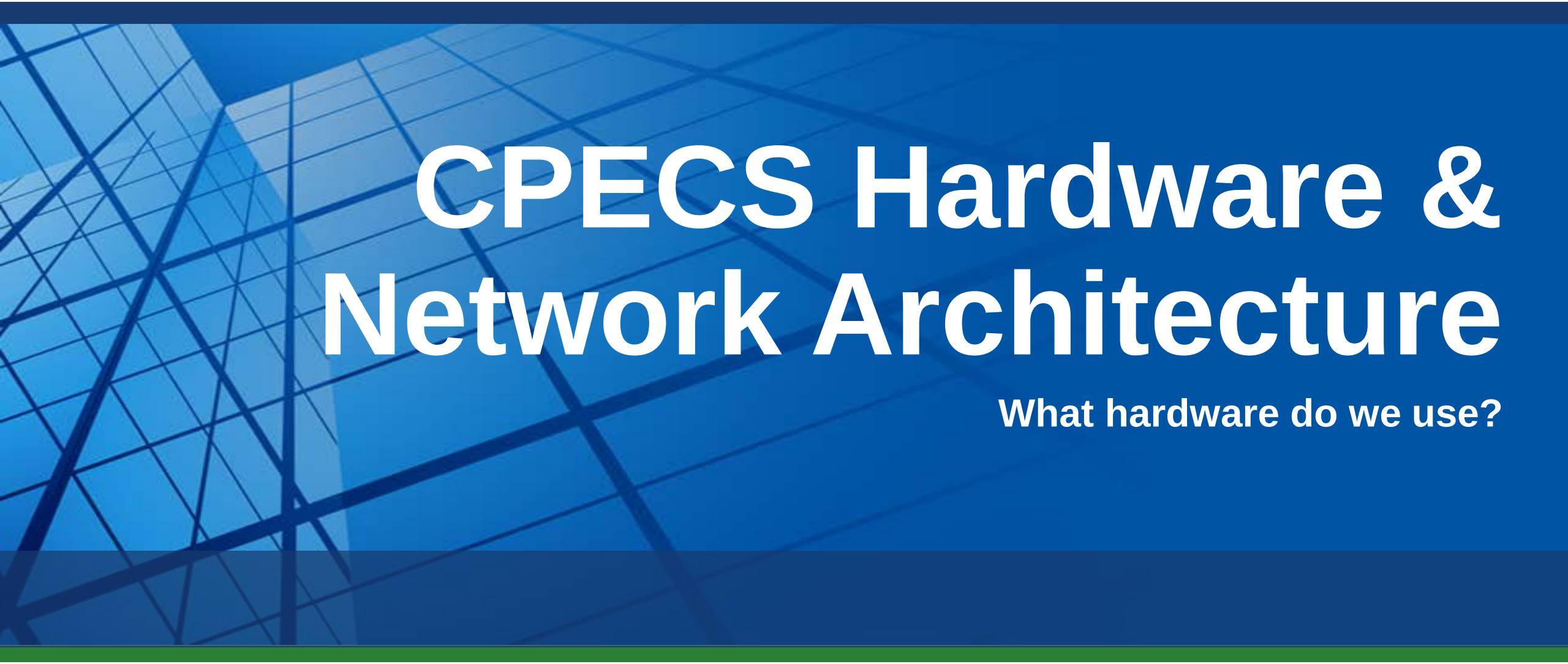

CPECS Hardware & Network Architecture

What hardware do we use?

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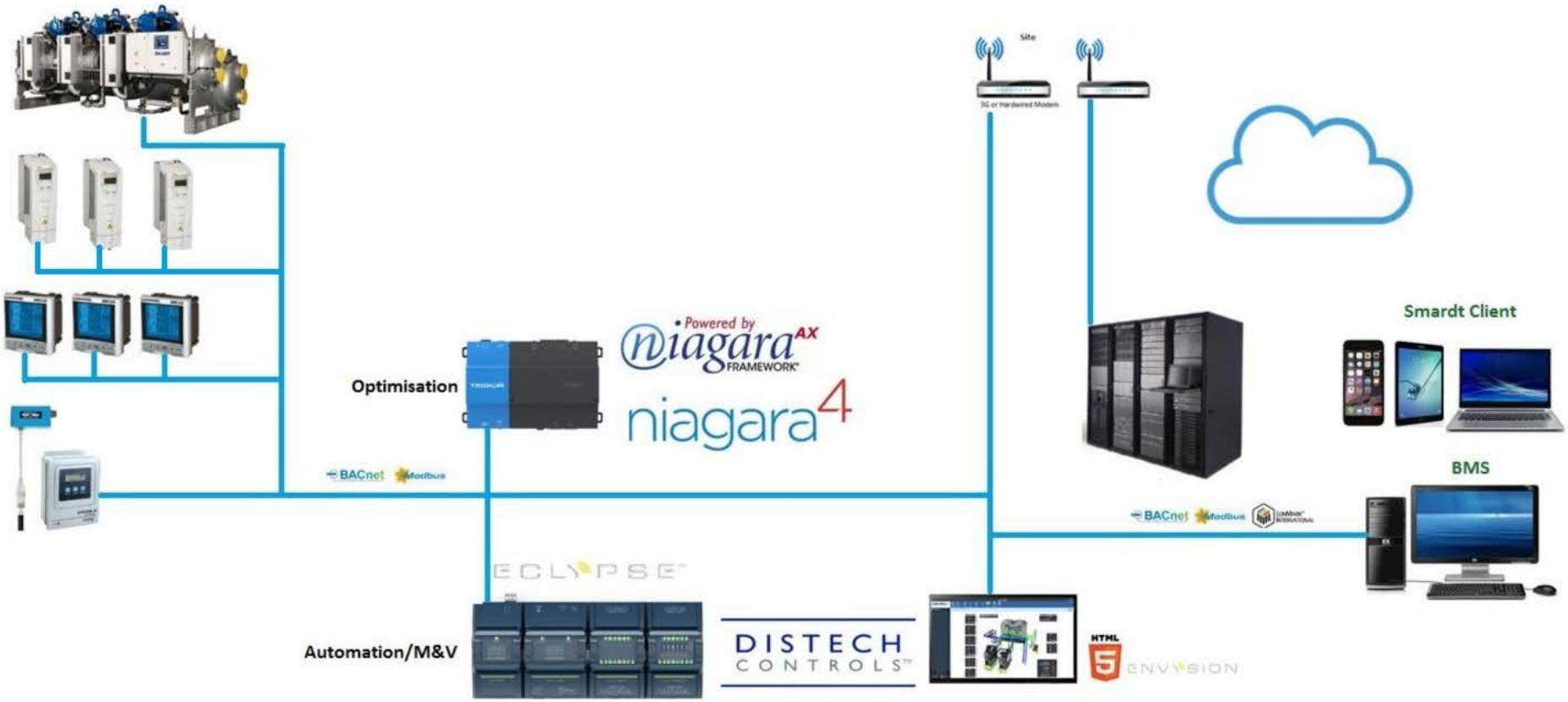
CPECS Hardware and Network Architecture

Modular, multi layered approach
No single point of failure



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Automation

- Distech controls “Eclypse” series internet enabled controller provides the base layer of automation;
  - Thus making the day to day operation of the plant and equipment stable, robust and reliable.

Automation

- Modular design allows for the addition of multiple input output modules;
  - Scalable and expandable to suit the project requirements.

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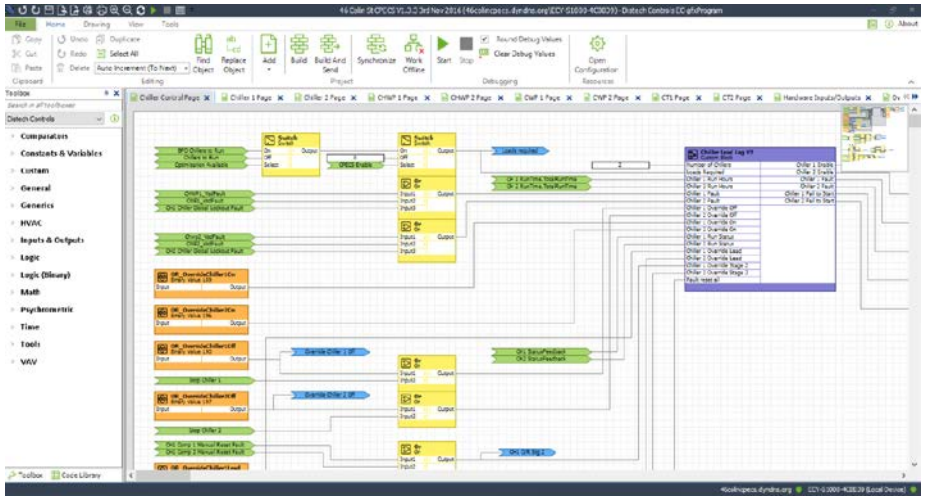
Measurement & Verification

- Alternatively the input/output modules can be removed to provide an internet enabled measurement and verification platform

The Why for Distech

Distech's programing tool EC-GFX program offers,

- Remote programming capabilities through the Eclypse web server
- Flexible and intuitive programing environment
- Easily repeatable and scalable programs allowing for reduced programing time
- Extensive pre developed code libraries

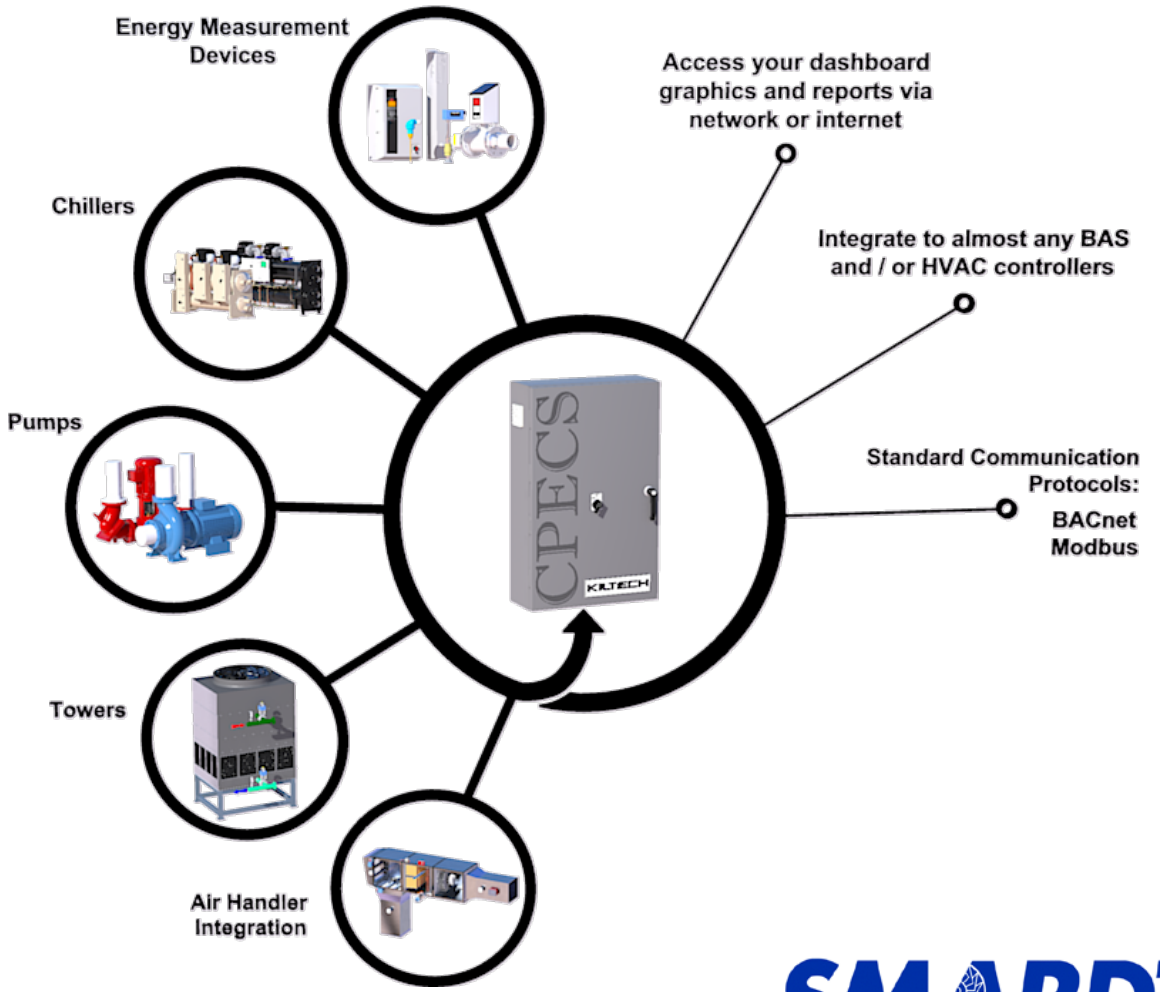


Optimisation

- A Tridium JACE 8000 controller harnessing the power of the Niagara framework, runs the BFO.
- The automation and optimisation layers are networked together seamlessly via a BACnet IP network

Integration

- Quick, simple integration utilising standard automation communication protocols (BACnet, Modbus, etc)
- Device and equipment connection is not brand limited



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The Why for the Network & Architecture

- Flexible deployment model
  - Full Automation Panel, Supervisory Overlay, Optimisation Overlay & Measurement & Verification
- Scaleable to suit to required application, yet able to be deployed as a standard package
  - Create the most appropriate value proposition per project, and/or
  - Form the basis of the system design intent

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Typical Competitor Analysis

Competing Products & Key Differentiators

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Typical Competitive Approach Overview

- Most optimisation platforms will focus on trying to reduce ‘lift’ directly at the chillers
- With this, there are fundamentals to be followed;
  - Temperature available from the towers influenced heavily by outside air conditions
  - No point aiming for temperatures that are not achievable and wasting energy at the cooling towers
- Colder condenser water is not always the answer to optimising the plant

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Key Differentiators of CPECS

- Focus on functions that make the most difference
- Energy balance creates a truly harmonious balance of individual equipment vs total plant performance
- Equipment models, including performance limits customised to the plant and operations
- Scaleable optimisation modules from smallest plant to largest plant for simple deployment over multiple sites

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Thank-You & Questions?

Brendan Vos & Simon Peisley

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