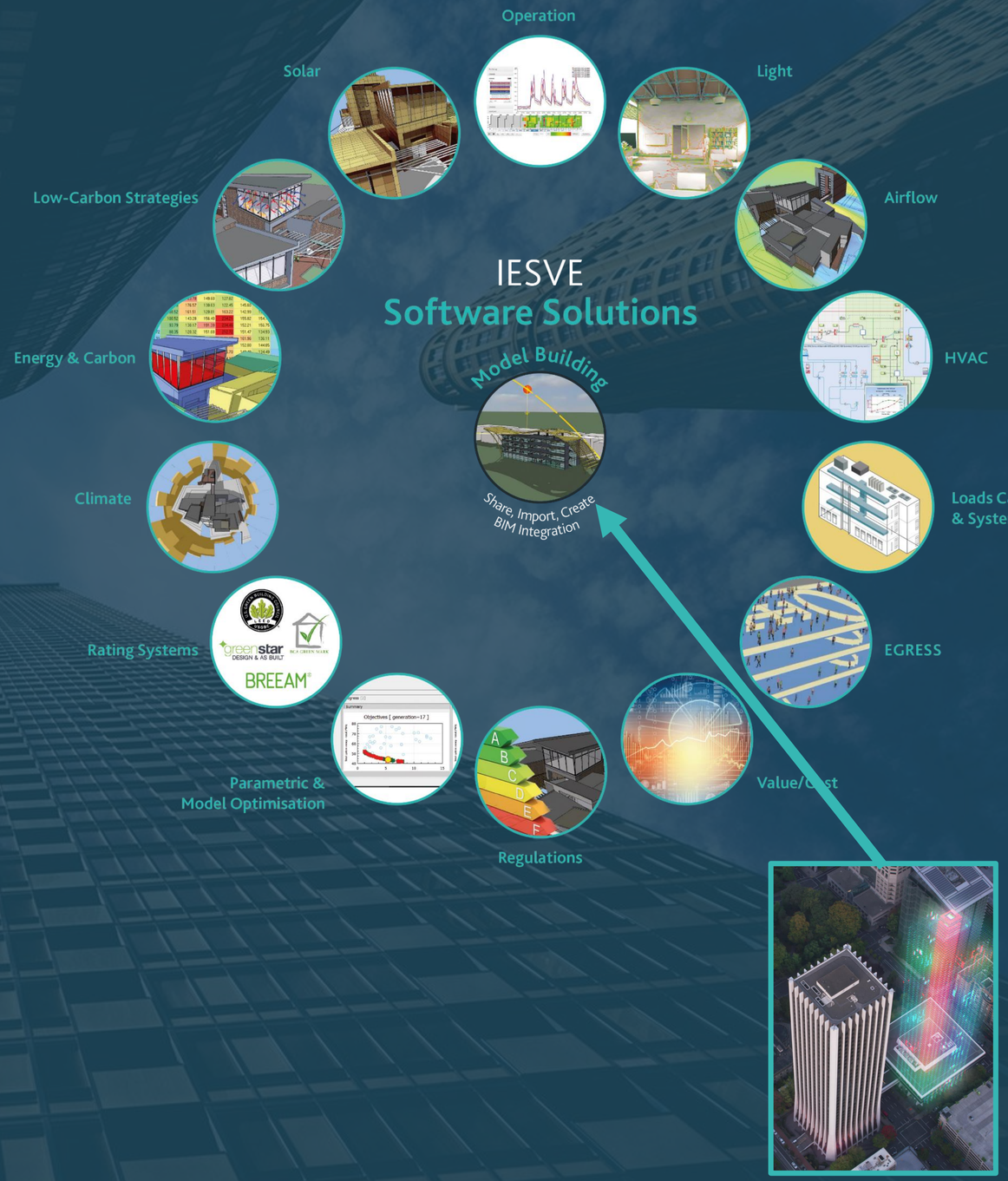
Towards intelligent and efficient communities through modelling and data

Dr. Valeria Ferrando

For the last 25 years our technology has helped make over 900,000 buildings more energy efficient.

However one building at a time is too slow...

So we need to address any Community and its operational performance.



What’s the plan for today?

- The challenge
- A vision- intelligent communities and the Digital Twin
- A nice story - NTU Ecocampus
- Open questions and final thoughts

The challenge for the building industry

- Buildings and cities have a strong impact on the environment
- The building industry is fragmented
- we're slow to pick up and embed new energy efficiency technologies
- Technology is available.
- Buildings have changed but the way we design, handover and operate them hasn't

So, why are our buildings not as smart as our cars?

The industry needs to shake off its 'slow to change' malaise and catch up with other industries in their use of digital technology and data

END GOAL- MAKE THE BUILT ENVIRONMENT MORE SUSTAINABLE

The concept of the Digital Twin

Truly understand the performance of your community

Import time-series sensor data to **investigate operational problems using AI and machine learning** providing alarms and alerts

Generate missing data to fill data gaps in information from buildings

Improve operational decisions with more accurate calibrated information

Scenario simulation - test ways to improve your community

Create and share visually informative information to **facilitate decision making**

AI to help learn from the past to **optimise** the present and future sustainability of your community


Resource Analysis & Control
iVN
Masterplanning & Urban Design
iCD
Collaboration Cloud
iCIM iPIM
iSCAN
Building Operation & Control
VE
New Design & Retrofit

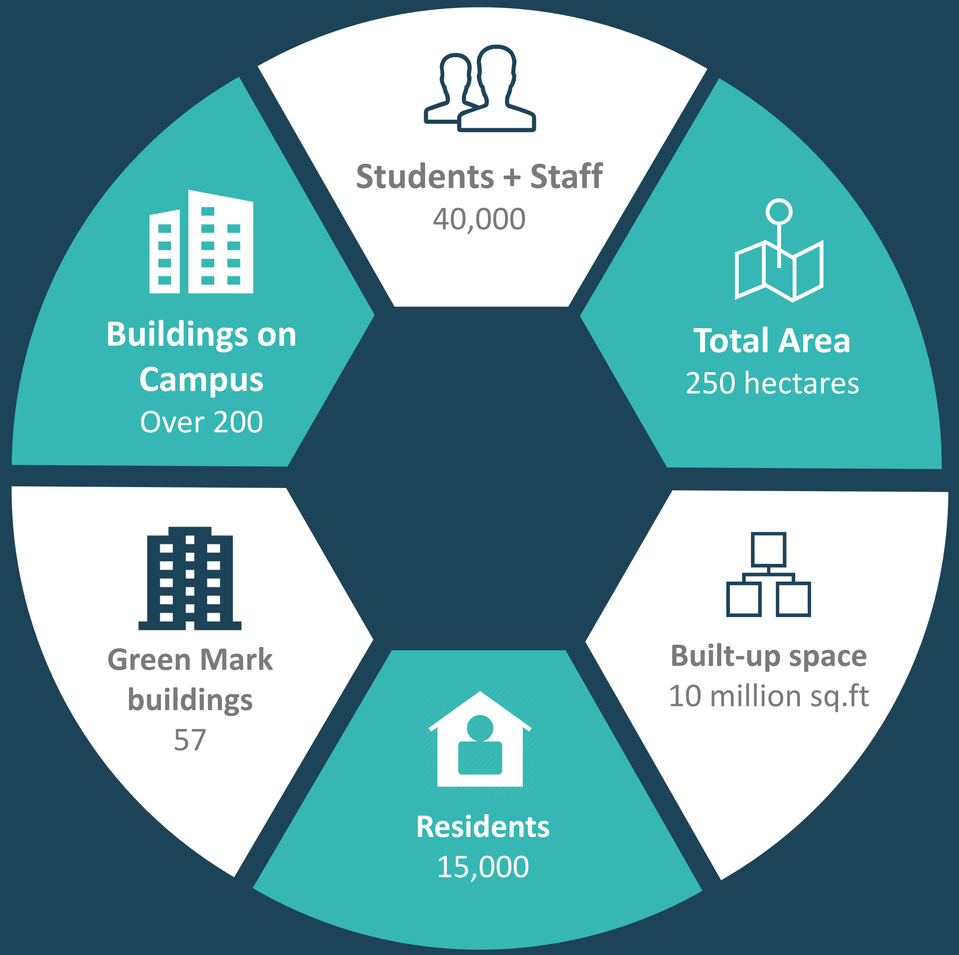
A nice story
Nanyang Technological University (NTU) Singapore EcoCampus

NTU Singapore

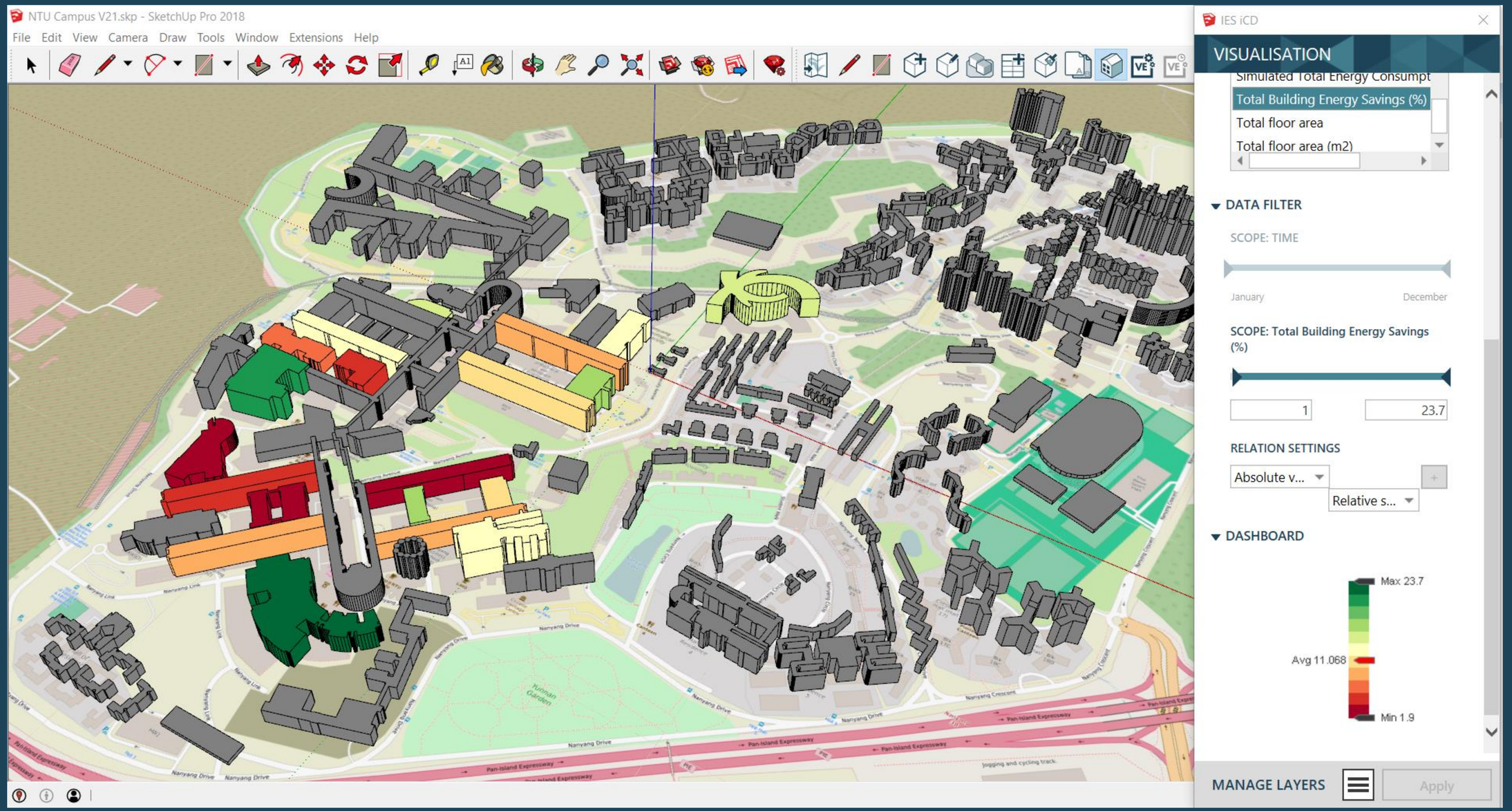
Vision
To be the greenest campus in the world

Goal
To reduce energy, water and waste footprints by 35% by 2020 based on the 2011 baseline.

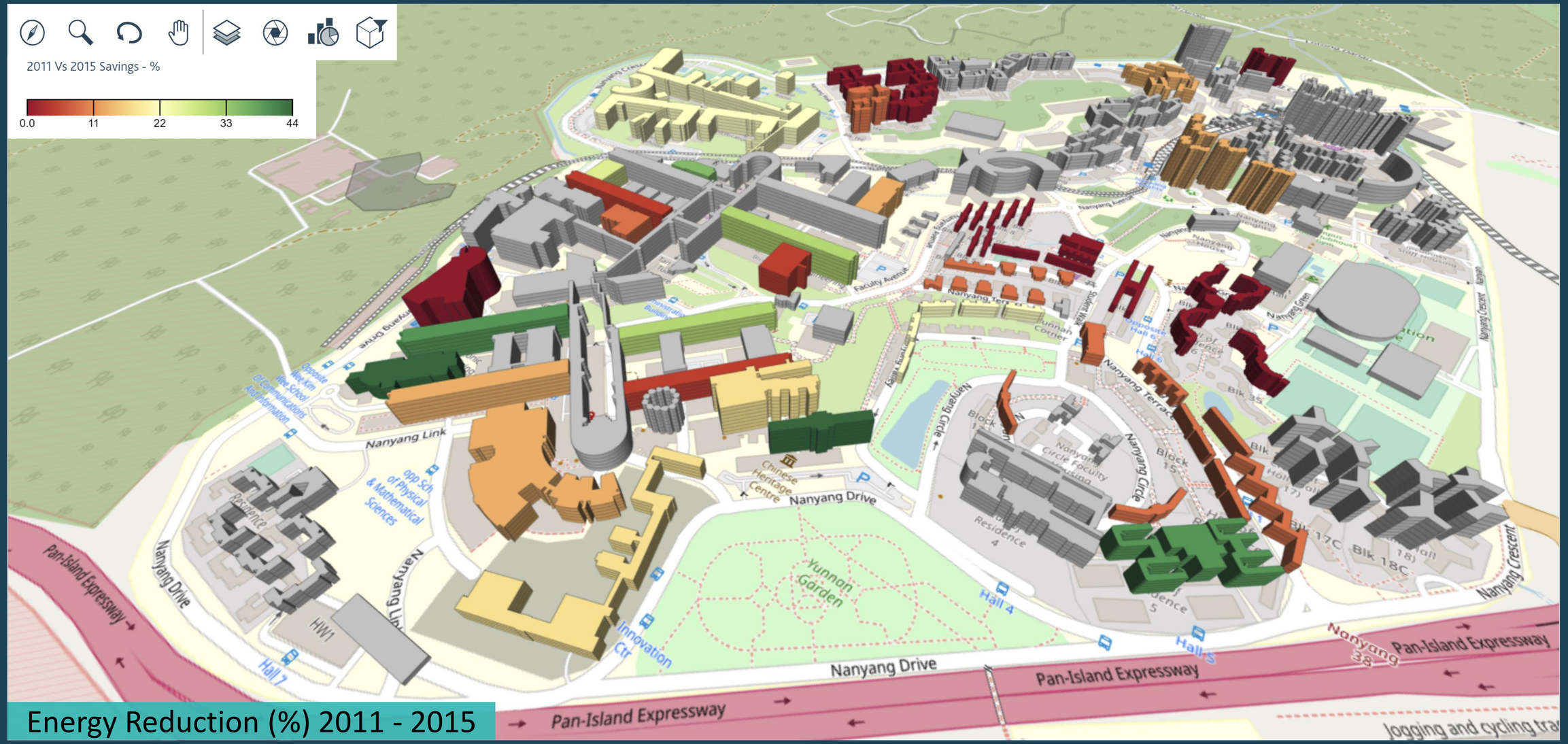
Process: Ci² (Collect, Investigate, Compare, Invest)
Ci² process to be used to identify energy savings.



NTU Singapore – Initial Masterplan Analysis (iCD)



NTU Singapore – Campus Information Model (iCIM)

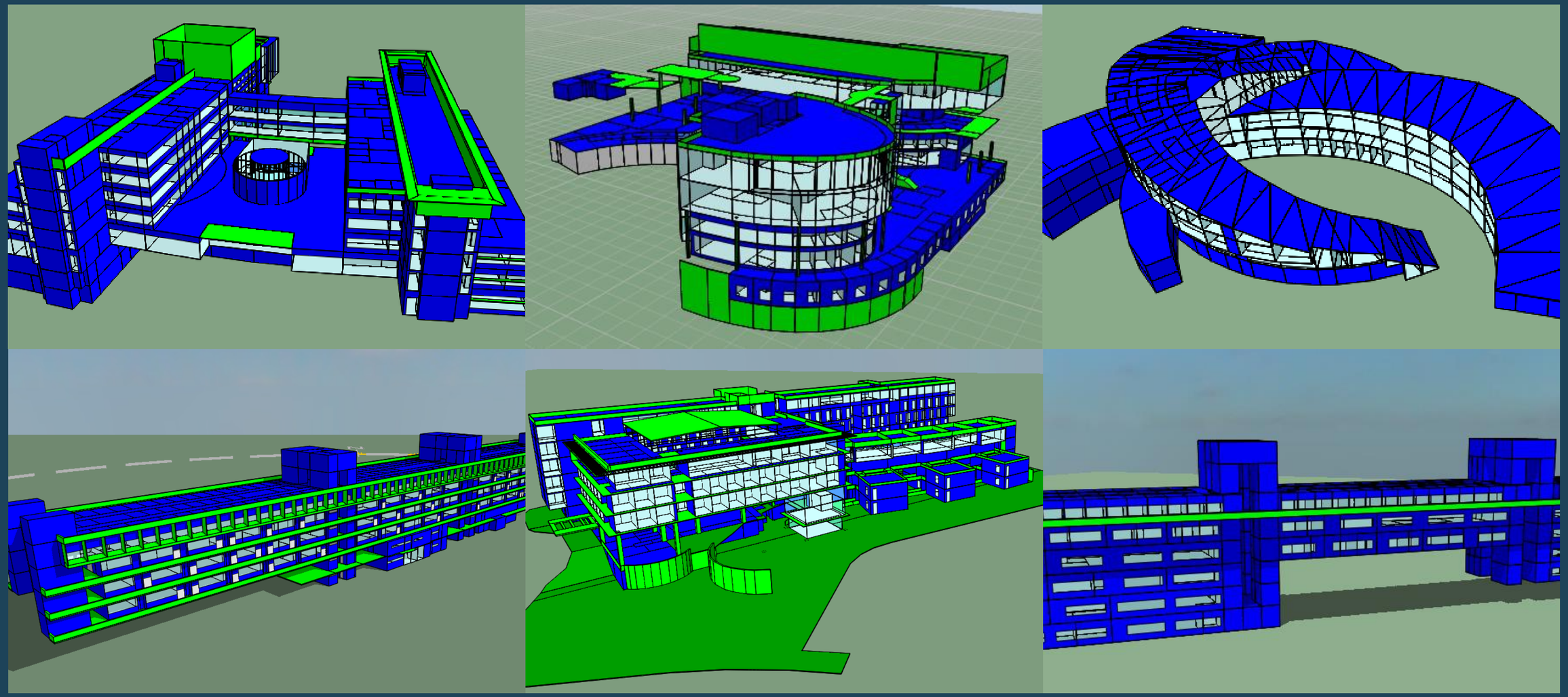


Energy Reduction (%) 2011 - 2015

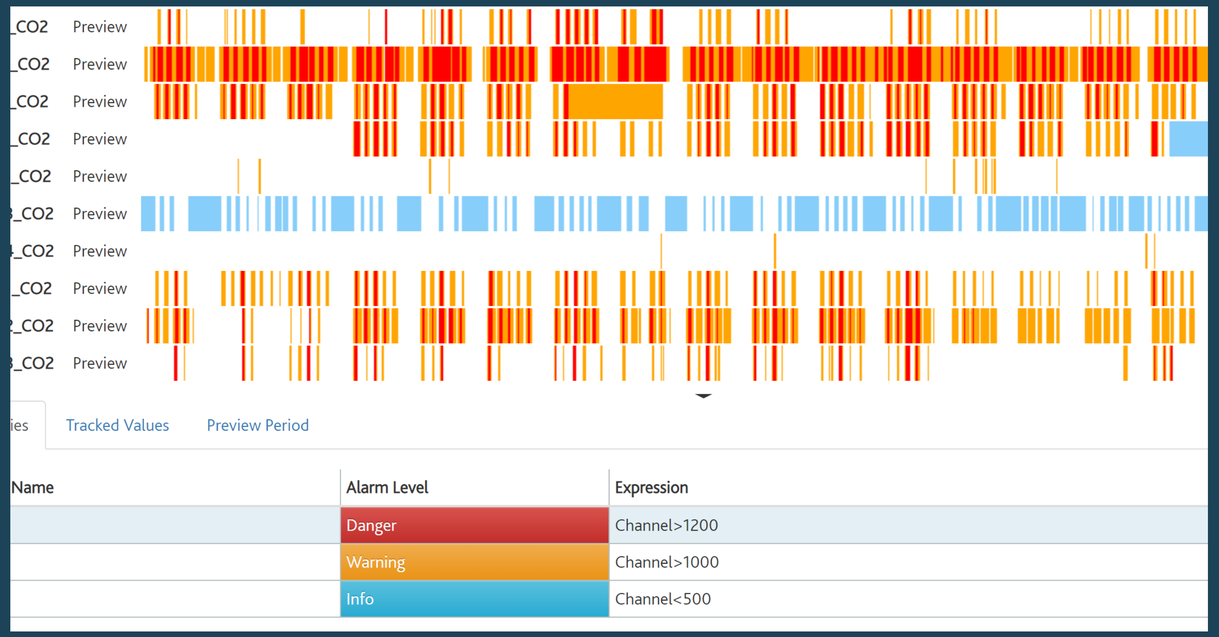
Phase 1 Results

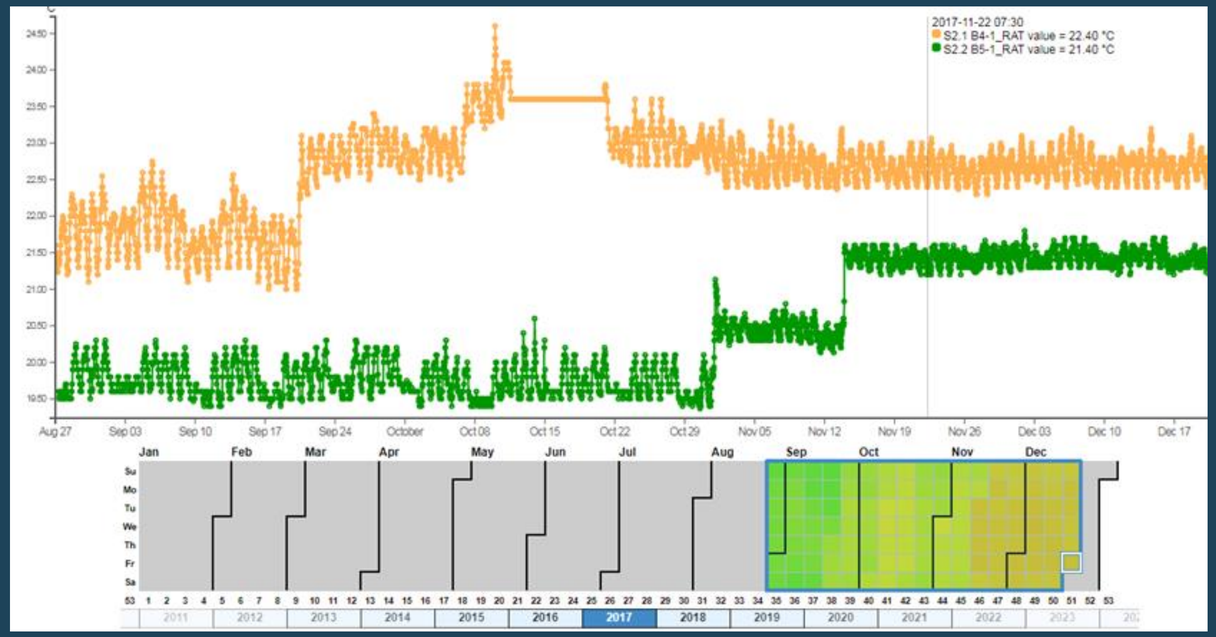
10%	Campus Energy Consumption reduced
8.2kt	Carbon Savings
S$3.9M	Financial Savings (Singapore Dollars)

NTU Singapore – Detailed Digital Twins of 21 buildings (VE)



NTU Singapore – Collect and Investigate data





Collect Operational Data:

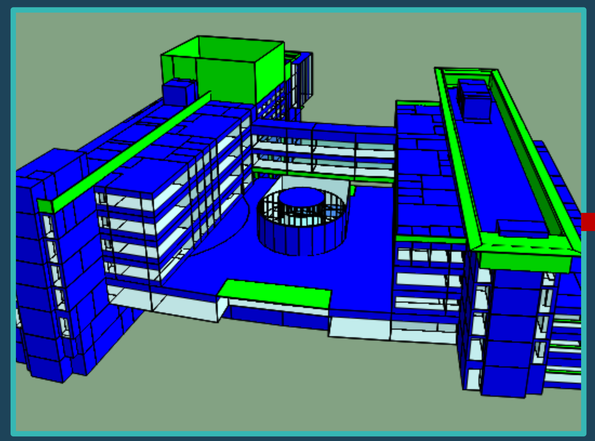
- Utility Bills
- Automated Meter Readings (AMR)
- BMS Data
- Operational information

Investigate (using iSCAN):

- Interrogate time series data
- Set alerts and alarms to help to rapidly interrogate multiple channels
- Discovered hidden energy savings

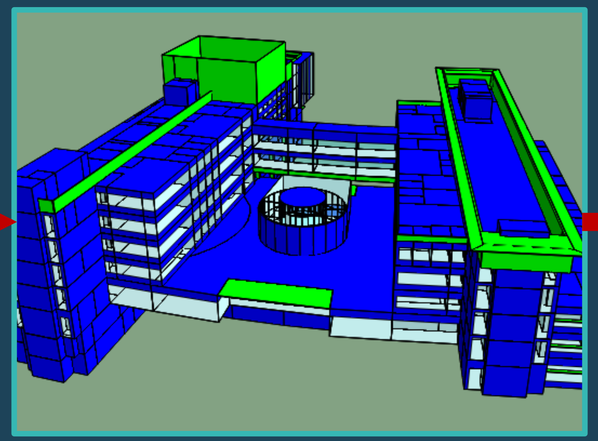
NTU Singapore – Compare & Invest (VE, iSCAN and Calibration)

VE Digital Twin



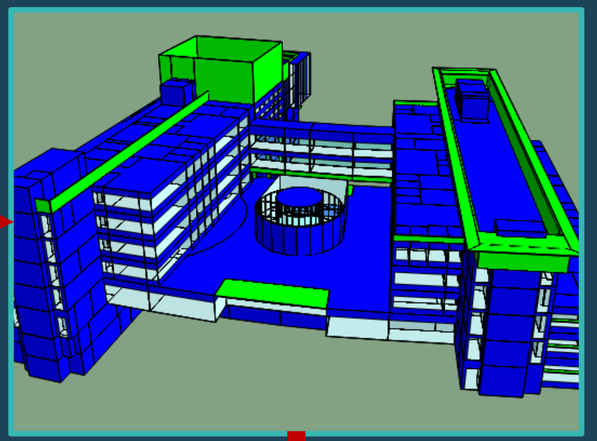
Assign time-series data from iSCAN

Hybrid Model

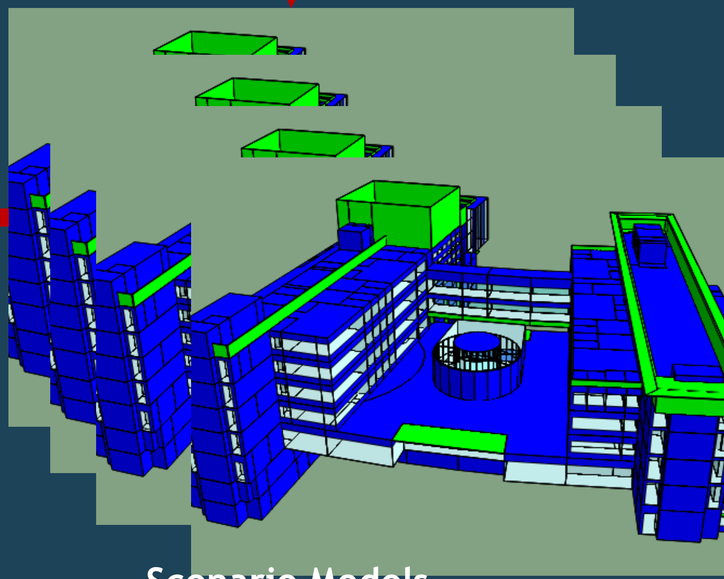


M&V calibration test

Hybrid Calibrated Model

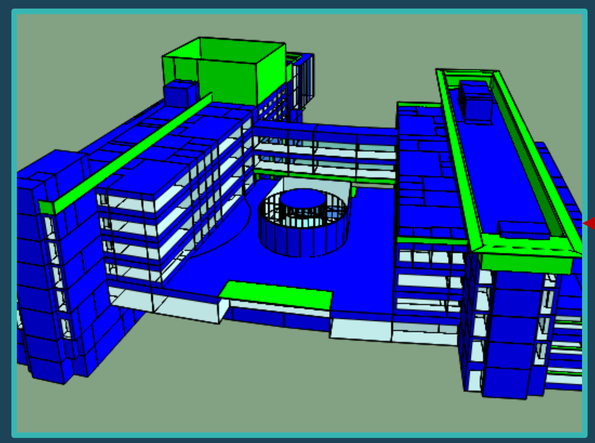


Simulate 5 options



Scenario Models

Compare scenarios



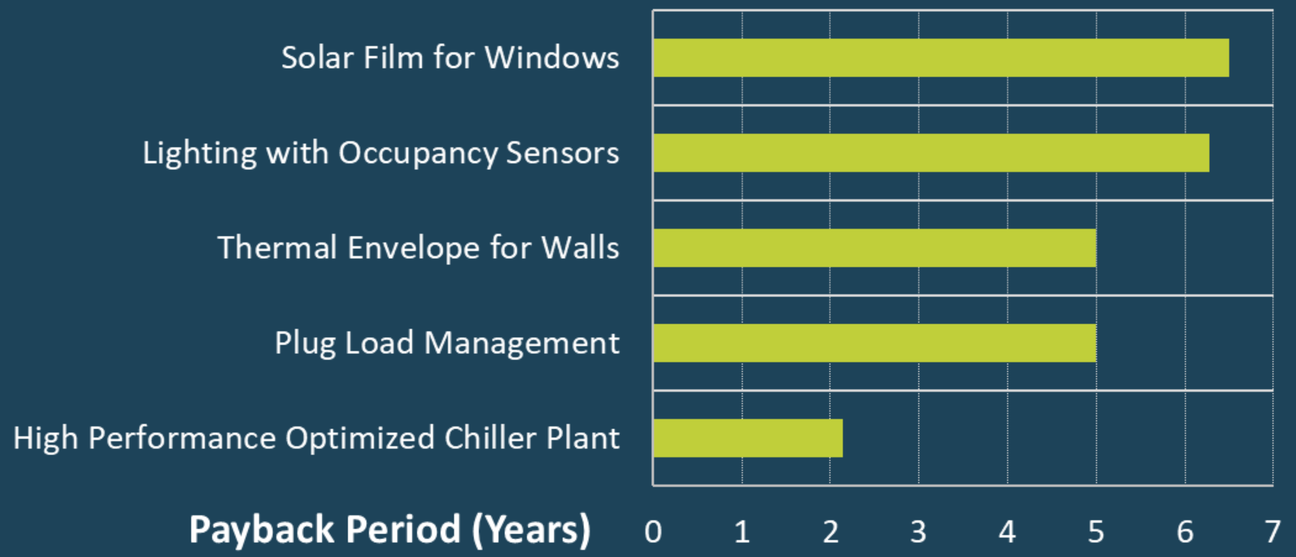
Identify best option

Invest: Monitor savings

Phase 2 Results

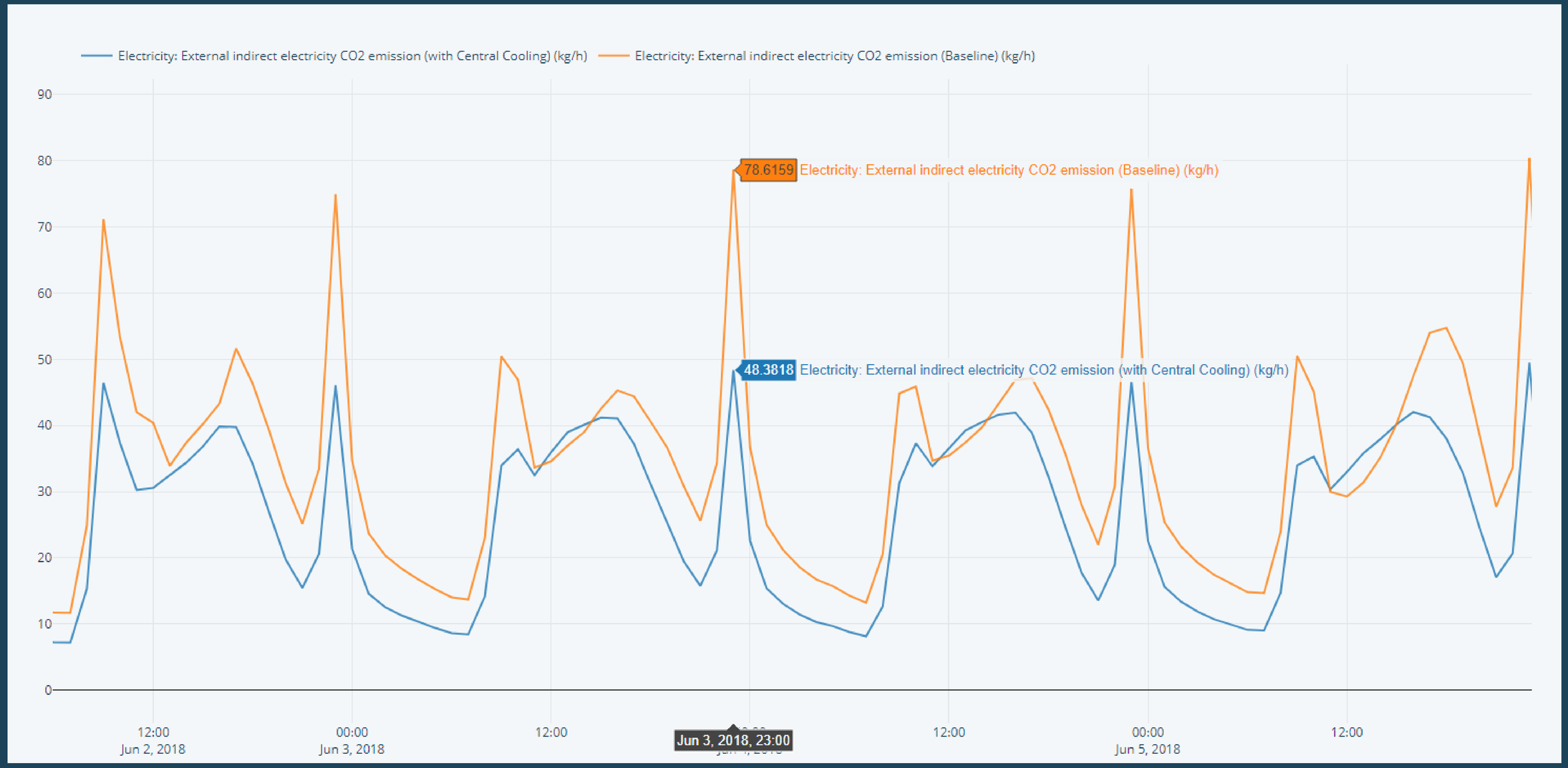
31%	Campus Energy Consumption reduced
9.6kt	Carbon Savings
S$5M	Financial Savings (Singapore Dollars)

Payback Periods

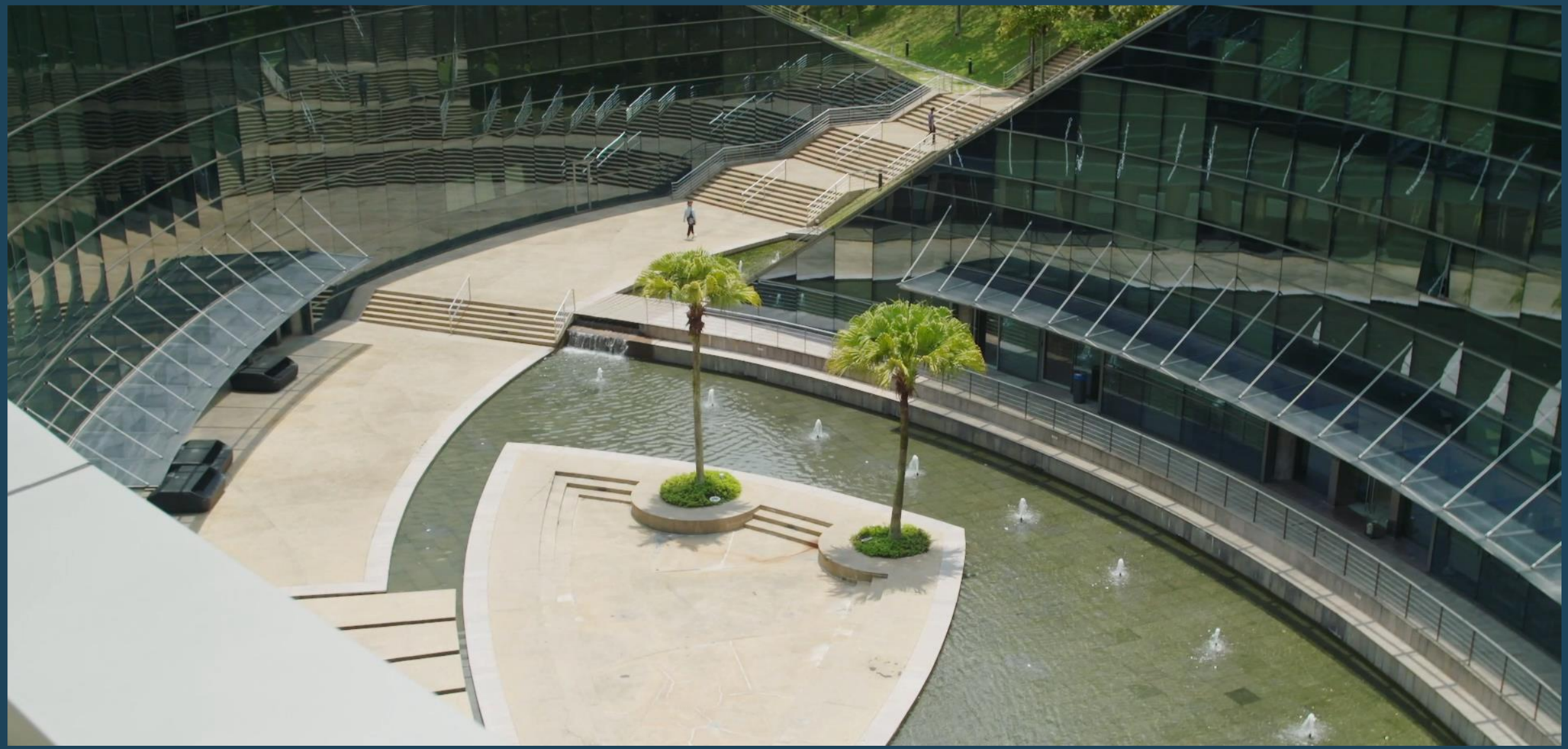


NTU Singapore – Multi-building cooling system (iVN)

NTU Singapore – Carbon emissions savings



NTU Singapore - Video



Take away message

The ICL Digital Twin

- overcome barriers related to cooperation and sharing of information
- helps identifying where to act
- provide the quality of information to facilitate intelligent decisions
- leverages the best of building simulation, metered data and AI/Machine Learning, allowing us to more accurately control a building's operation.
- Accessible and customisable to adapt to different end users

For whom? What skills? What project stage?

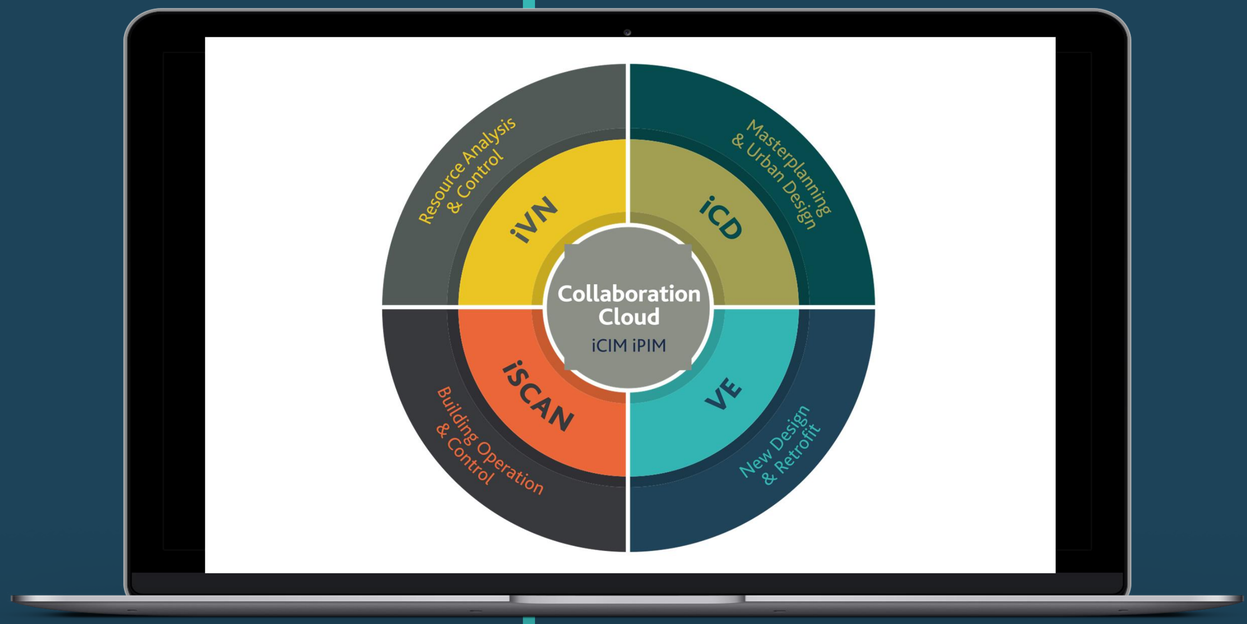
For all stakeholders in the value chain- engineers, architects, owners, occupants, Facility managers, workers

Digital Twin is accessible through tablets, smartphones, PCs- standard digital skills

Central place to store all project data

Bespoke dashboards to suit different profiles- skills – required level of detail- relevant KPIs

To be used in any kind of design and operation process, from small projects to large portfolios



Open questions

How to convince the various actors to move to a digitalized world ?

Hi-fidelity information facilitates strong investment business cases to reduce carbon emissions, capital, maintenance and energy costs

How to promote enthusiasm toward embedding digitalization and transferring knowledge among by different actors?

- All data stored in one easily accessible platform
- Share community information and citizen engagement
- Access to live site data
- Bespoke dashboards
- Giant touch screens, desktop, tablets

How the construction industry digitalisation can support the building stock transformation toward a higher energy efficiency and wider RES integration?

The ability to simulate and generate data plus access live data is key to creating Digital Twins

Closely monitor and manage your sustainability objectives and targets