



IES delivered an interactive 3D visualisation and masterplanning model for NTU's flagship 'Living Lab' programme, in addition to calibrated modelling, building performance simulation and analysis of energy reduction technologies across the campus.

SERVICES PROVIDED

- Sustainable Masterplanning (iCD)
- Campus Information Model (iCIM)
- Virtual Testing, Energy Modelling & Building Performance Optimisation (iSCAN & VE)



**NTU ECO CAMPUS
SINGAPORE**

SECTOR: IES ICL

DATE: April 2019

COUNTRY: Singapore

www.iesve.com/icl

NTU EcoCampus Singapore



IES was contracted to deliver a 3D masterplanning and visualisation model, along with virtual testing and building performance optimisation, for Nanyang Technological University (NTU)'s 250-hectare flagship Ecocampus. Delivered in two phases, the project used IES' innovative ICL technology to provide high-level visualisation and analysis of testbed energy reduction technologies on site, before delving into detailed simulation and calibrated modelling of 21 campus buildings.

NTU firstly wanted to understand, at the campus level, which testbed solutions were performing the best, and to identify the optimum scale and location for their deployment.

The EcoCampus initiative covers the whole of NTU's 200ha campus and the adjoining 50ha JTC Corporation CleanTech Business Park. There are 200+ buildings on site with a 1.1million m² floor area.

"The challenge was to scrutinize these testbed technologies in detail which is what the project with IES helped us achieve," commented Ms Priyanka Mehta, Project Manager, ERI@N, Nanyang Technological University.

IES and NTU worked together on this project in a highly symbiotic and collaborative relationship. Through on-site and off-site support, IES provided access to its latest ICL technology, alongside associated high-level training and consulting. Meanwhile, NTU has given valuable technology feedback and provided a large-scale real-life implementation opportunity.

Phase 1 of the project concentrated on creating a masterplanning (iCD) model of the EcoCampus, complete with energy signatures for each building on the campus.

The model was accurate to 91% for total energy consumption and 97% for chiller energy consumption. A corresponding online cloud based Campus Information Model (iCIM) for communication and engagement with campus staff and students was also created and connected to the masterplanning model for automatic updates.

The masterplanning model was then used as a baseline to simulate and analyse testbed technologies ranging from improved thermal performance of the building envelope, to lighting sensors, chiller optimisation and smart plugs that turn equipment off out of hours. Overall, these combined measures reduced energy consumption across the campus by 10%, saving \$3.9M and 8.2kt of carbon.

IES' detailed performance knowledge became even more essential as the project then moved into Phase 2 – the 'implementation' phase of the project - where the best solutions from the Phase 1 'testbed' were chosen and applied.

Using real operational data from utilities and NTU's Building Management Systems (BMS), IES were able to assess and identify opportunities to achieve optimal performance in existing operational buildings across the campus, using its innovative Ci2 (Collect, Investigate, Compare, Invest) process.

During the 'Collect' and 'Investigate' stage, building information was gathered and operational data imported into iSCAN to investigate issues/faults across a selection of 21 buildings on the NTU campus. This brought to attention issues including: low and high CO₂ levels, unstable off-coil temperatures, lower than expected return air temperatures, faulty energy consumption meters, and staff offices and meeting rooms temperature setting issues.

Virtual models were then created in the VE for each of the 21 buildings and calibrated using the operational data. These closely calibrated models established an accurate baseline for the existing buildings in operation, enabling IES to 'Compare' and determine potential savings for a range of technologies in the 'Invest' stage.

A selection of new technologies relating to building envelope, lighting and occupancy sensors, plug load management and high-performing optimised chillers were simulated using the calibrated models to determine potential savings. The results demonstrated that, if installed in the buildings, these technologies could achieve 31% average energy savings and a total cost saving of approximately \$4.7million.

"Working with the team has been a truly positive experience; with all feedback received favourably and acted on quickly."

Ms Priyanka Mehta
Project Manager, ERI@N, Nanyang Technological University.

"The possibility to quickly assess energy saving options through innovative technologies across the campus was a great value-addition from this collaboration with IES"

Nilesh Y. Jadhav,
Program Director,
EcoCampus @NTU

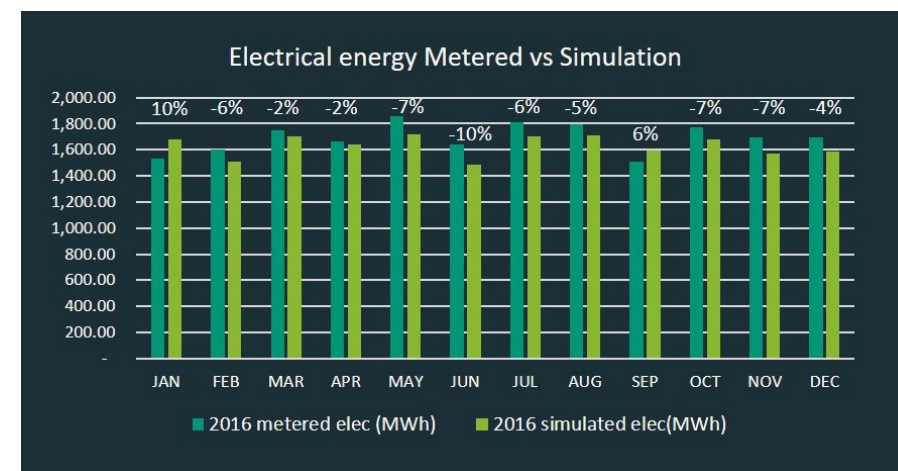
iCIM: Visualisation of electricity usage across NTU campus



iSCAN: Operational data import

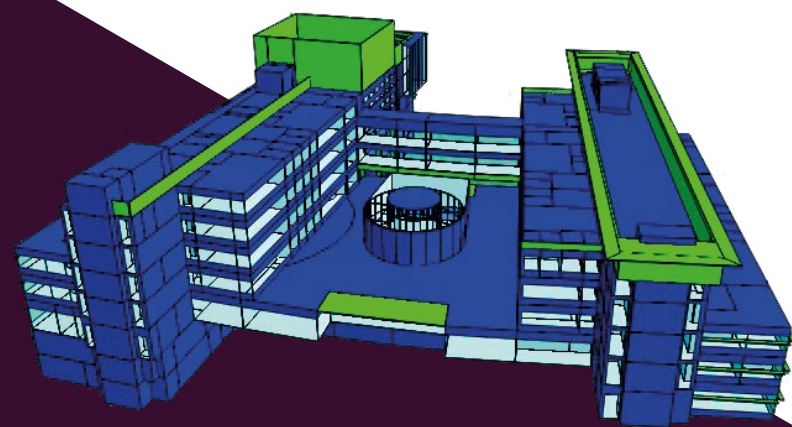


Calibrated Model Results: Simulation vs Metered Data

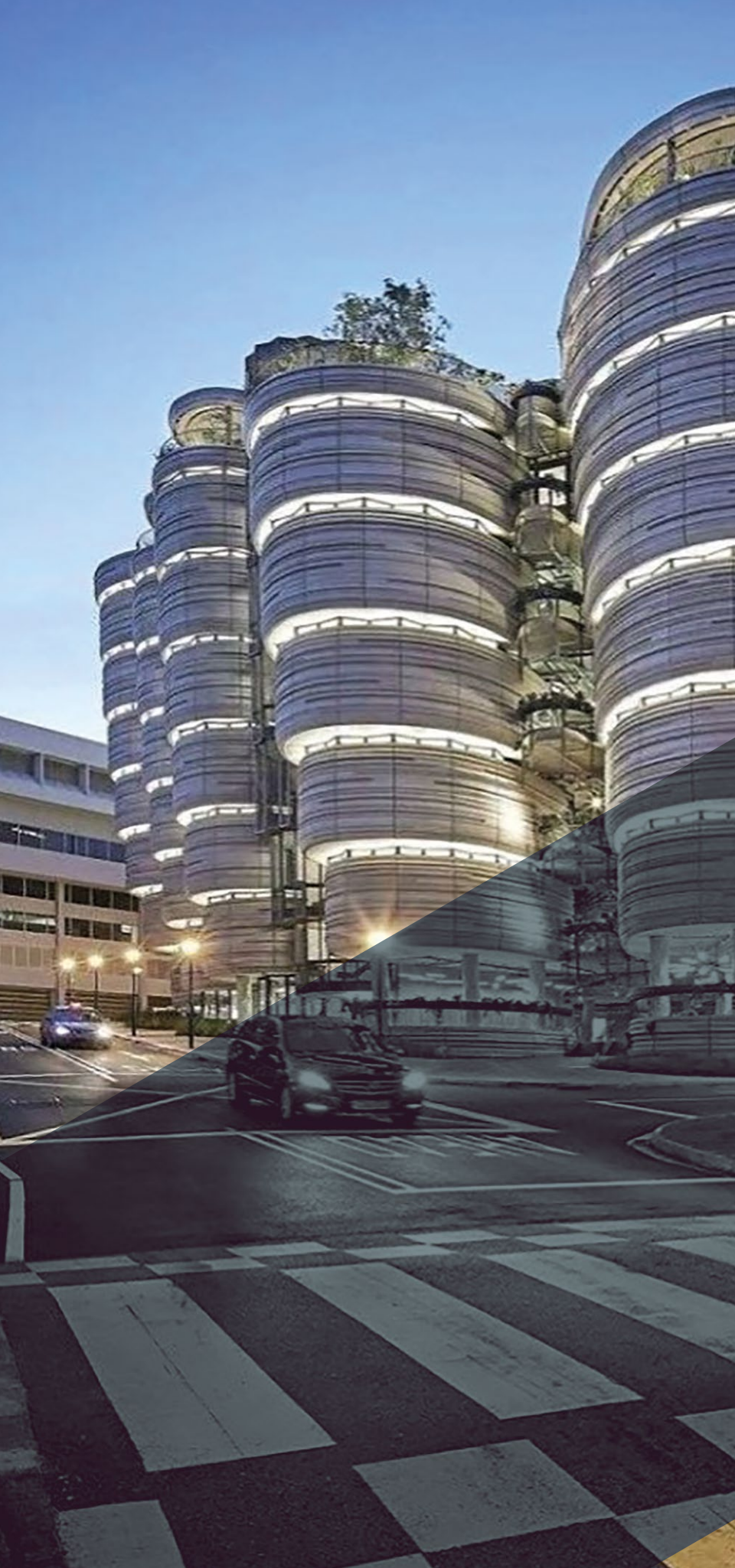


KEY FACTS

- 250+ ha campus; 200+ buildings; 1.1million m² built area
- iCD masterplanning model 91% accurate for total and 97% for chiller energy consumption
- Phase 1 testbed technologies uncovered overall savings of 10% energy, \$3.9M, 8.2kt carbon
- Calibrated VE models used to test improvements to optimise performance of campus buildings.
- Phase 2 implementation uncovered 31% simulated average energy savings and \$4.7m cost savings.



VE: Virtual models of NTU campus buildings



PLEASE CONTACT

E-mail enquiries@iesve.com

Call 0141 945 8500

www.iesve.com/icl

EUROPE | NORTH AMERICA
ASIA | AUSTRALIA