THE UNIVERSITY OF SYDNEY

Advanced Utilities Monitoring System Standard

Design, Engineering, Planning & Sustainability

University Infrastructure

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Contents

1 Purpose

The UI Advanced Utilities Monitoring System (AUMS) Standard sets out the University of Sydney's requirements for the installation and integration of utilities metering into the University's AUMS, which is used to monitor electricity, solar, thermal, gas and water meters installed in campus buildings.

Applicable requirements documented in Workplace Health and Safety legislation, Disability Discrimination legislation, State Environmental Planning legislation, Commonwealth and State legislation, National Construction Codes (NCC), the Building Code of Australia (BCA) and Australian and New Zealand Standards (AS/NZS) are the minimum and mandatory compliance requirements.

Where any ambiguity exists between this standard and the aforementioned mandatory requirements then:

a. The highest performance requirements must apply
b. Applicable requirements must follow this order of precedence:
    1. Workplace Health and Safety legislation.
    2. Safety in Design Legislation.
    3. Disability Discrimination legislation.
    4. State Environmental Planning and Assessment legislation.
    5. All other Commonwealth and State legislation.
    6. NCC, BCA and PCA.
    7. AS/NZS.
    8. This standard and other University of Sydney standards.

2 Scope

This standard describes minimum requirements for design, purchase, construction, and operation and maintenance of The AUMS, equipment and infrastructure for buildings and spaces owned, operated, maintained and/or managed by the University of Sydney. It applies to:

a. New Building Construction.
b. Refurbishment spaces within existing buildings
c. Facilities maintenance services.

The standards apply to all planners, project managers, consultants, contractors, sub-contractors, tenants, managing agents and University staff involved in the design, construction and maintenance of existing, new and proposed University buildings and facilities.

The Standard provides:

a. A reference document to enable consistency with the design and engineering objectives.
b. Details of the minimum performance requirements for planning, architectural design and maintenance.
c. Support of the University vision for the built environment and best practice.

The Standard addresses key objectives:

a. Quality design which responds, enhances and complements the environment.
d. Appreciation of the heritage context and cultural history of the campuses.
e. Value for money in all aspects of the project.
f. The design of low maintenance buildings and environments.
g. Longevity of construction approach to design.
h. Standardization of key flashing and ancillary details.

i. Flexible design, to future proof building usage for expansion or adaption to new uses
j. Safety in design.

All AUMS products and services provided or specified by designers, consultants, staff and contractors must conform to this standard.

Where specific applications are not explicitly covered, or ambiguity exists, the intent of the design standard must be satisfied. In such cases a return design brief must be provided for review and approval by the issuer of this standard or their appointed delegate who must have relevant technical competence in the subject matter. Additional more stringent requirements may apply on a project-specific basis dependent upon risk management and insurance requirements.

3 Glossary of Terms

AEST	Australian Eastern Standard Time
AS	Australian Standards
AUMS	Advanced Utility Metering System
BACnet	Interoperability protocol ISO 16484-5
BACnet Advanced Workstation (B-AWS)	Advanced operator workstation
BACnet Operator Workstation (B-OWS)	Network level workstation
BCA	Building Code of Australia
BMCS	Building Management Control System
COS	Central Operations Services
CN	Campus Network
DDC	Direct Digital Control
DLP	Defects liability Period
ELV	Extra Low Voltage
GFA	Gross Floor Area
HLI	High Level Interface
HVAC	Heating, Ventilation and Air conditioning
NCC	National Construction Code
NTP	Network Time Protocol
PC	Practical Completion
PPR	Project Principal Requirements
PUG	Project User Group or Project Working Group
SLD	Single Line Diagram
SMS	Short Message Service
SMTP	Simple Mail Transfer Protocol
THD	Total Harmonic Distortion
UFA	Usable Floor Area
UI	University Infrastructure
UTC	Coordinated Universal Time
VPN	**Virtual Private Network**

4 Roles and Responsibilities

This standard is issued by UI. It is approved and signed off by the Chief of University Infrastructure Officer. UI is responsible for maintaining the standard and keeping it up-to-date.

4.1 AUMS Project Works Responsibilities

It is the responsibility of the head contractor to assign the role of AUMS integrator and to coordinate network connections and interconnection wiring from meters to the AUMS panels.

4.1.1 Electrical Services Contractor

a. Traffolyte labelling of meters
b. Liaise with AUMS Integrator on meter selections and AUMS connections.
c. Installation of electrical smart meters and associated hardware, including but not limited to CT's, CT terminal & shorting blocks, potential fuses, meter wiring etc.
d. Provision of power outlets for AUMS equipment.
e. Provision of data outlets, configured as per UI requirements, for connection of AUMS and BMS systems to Campus network.

4.1.2 Mechanical Services Contractor

a. Selecting, supplying and installing electrical metering in Mechanical Services switchboards and MCC's that meets the requirements of the guideline and the project.
b. Liaise with AUMS Integrator on meter selections and AUMS connections.
c. Installation of electrical smart meters and associated hardware in Mechanical Services switchboards and MCC's, including but not limited to CT's, CT terminal & shorting blocks, potential fuses, meter wiring etc.
d. Traffolyte labelling of meters

4.1.3 Hydraulic Services Contractor

a. Selecting, supplying and installing water and natural gas metering that meets the requirements of the guideline and the project.
b. Liaise with AUMS Integrator on meter selections and AUMS connections.
c. Traffolyte labelling of meters

4.1.4 Solar Service contractor

a. Liaise with AUMS Integrator on inverter selections and AUMS connections.
b. Traffolyte labelling of meters

4.1.5 AUMS Contractor

The AUMS Contractor shall be responsible for the following:

a. Engineering, Installing, Programming, Commissioning and Servicing all AUMS specific system works including JACES, AUMS Server Integration, Graphics, Dashboards and Reports.
b. Coordinating with Electrical, Mechanical, Hydraulic Contractors to ensure metering is selected in accordance with these requirements.

c. Coordinating final connection and integration of metering either directly or by coordination with other Trades.
d. Liaising with BMS System Integrator to ensure integration with BMS.

4.1.6 BMS Contractor

a. Undertaking integration of AUMS with BMS systems and BMS Server.
b. Undertaking BMS Integration works as per the requirements of this document.
c. Liaise with AUMS Integrator where BMS energy and utility data (such as VSD's) is required by the AUMS.
d. Traffolyte labelling of meters

5 Construction Requirements

Due to the complex nature of the University's Infrastructure, the requirements for construction of new buildings, and the refurbishment of existing buildings differ and must be assessed on a case by case basis. Careful consideration must be taken in relation to connection and disconnection of existing services, and the reuse of existing equipment. This section outlines the construction requirements for both new and existing buildings.

5.1 New Buildings

The AUMS provided in University buildings must be designed and installed in accordance with the minimum legislative requirements incorporating all Statutory Regulations, Australian Standards, Local Council, Work Health & Safety (WHS) and WorkCover requirements.

Each building must be equipped with a complete AUMS, all designed and installed in accordance with the requirements of the project PPR, NCC and Australian Standards. Additional measures may also be required to meet specific building hazards and/or the requirements of University Insurers.

The consultant/contractor will consult with UI, and Project User Groups, to discuss any additional mechanical services that must be included in the design, in order to suit the proposed occupancy, associated hazards, proposed equipment and environmental conditions.

5.2 Refurbishments

All existing AUMS systems in a building must be extended/replaced as necessary into the given project. The design for projects within existing buildings must be assessed on a case by case basis and developed in conjunction with this standard.

All project associated redundant equipment, fixings and wiring, including inaccessible ceiling spaces, must be removed as part of the project works. Make good exposed surfaces before commencing the installation of new services. This includes the removal of redundant underground services unless otherwise approved by the project superintendent.

5.3 Reuse of existing equipment

Where existing equipment is utilised as part of a project it is the responsibility of the contractor to confirm its performance\condition and provide a written report to the University. The contractor must ensure that there is sufficient capacity in the existing equipment.

6 Technical Requirements

6.1 Introduction

The AUMS in a University building will include surrounding structures and annexe buildings. In some cases, components of the AUMS will be installed or are to be installed in other buildings. In these cases, the word building in this document must be interpreted as inclusive of these structures, annexes and components.

6.2 Design and Documentation

6.2.1 General

This section outlines the extent of the services to be provided by the contractor during the process of Design and Construction.

The contractor shall be fully responsible for the complete design of the AUMS installations, including the selection, sizes, quantity of equipment, shall provide calculations, drawings and other documentation as necessary to demonstrate conformance with the design parameters, industry practice, UI requirements, codes, regulations and standards. This includes all calculations required to confirm that existing infrastructure is sufficient to supply the proposed systems and equipment installed under the project.

The contractor shall allow to fully co-ordinate the documentation with the Architect, Structural Engineer and all other services consultants / contractors.

6.2.2 Calculations

As part of the contractor's design, it is expected as a minimum that the following design calculations are produced for review by UI for approval prior to finalising design:

a. Cable sizing
b. Gateway capacities (processor capacity and memory)
c. Daisy chain architecture (quantity of meters on each chain)
d. Ensure point Licencing is sufficient of software

6.2.3 Equipment Selection and Sizing

In selecting equipment, the University expects consultants and contractors to select products of proven and reliable quality, with reputable support and after sales service.

Products which are of closed systems and proprietary in nature, thus locking the University into exclusive dependence of one manufacturer must be avoided and only used if there are no other options.

The provision of 20% spare capacity for future use must be provided when designing and sizing all new AUMS installations. Where existing infrastructure is being used, provision must be made to ensure sufficient capacity remains for future works in the building.

6.2.4 Drawings and Documentation

The contractor must provide design, construction and as-built drawings, which may be either design drawings produced by the contractor or shop drawings produced by equipment manufacturers.

The AUMS contractor is responsible for producing all design and as-built documentation, including, but not limited to:

a. Concept design documentation (as required);
b. Detailed design documentation, including:
    i. m matrix
    ii. Layout drawings
    iii. Details
    iv. System architecture
    v. Building specific reports and alarms
    vi. Building specific virtual meters and dashboards
    vii. Schematics
    viii. Dashboards
    ix. Design certification
    x. Equipment details
    xi. Testing / commissioning procedures
c. Workshop drawings, including:
    i. Drawings for the purpose of system installation
d. As Built drawings, including:
    i. Detailed drawings demonstrating the as installed system
e. a. Operations and maintenance manuals.
f. Training manuals

All design documentation must be approved by UI prior to any works progressing onsite. Workshop, as-Built drawings and operation and maintenance manuals must be submitted to for review prior to final sign off.

6.2.5 Technical Submittals

Technical submittals must be provided with the full technical, spatial and network requirements of each proposed item. The technical submissions must include, where applicable, but not be limited to:

a. Certified workshop drawings of each system and control panel complete
b. Electrical requirements including, operational voltage, recommended protection devices, wiring diagrams, connection and terminals details. Also detail of how cables are terminated to the equipment and earthing requirements must be provided.
c. Manufacturer's recommendations for installation including power quality and thermal requirements.
d. Confirmation of product lifespan assuming maintained to manufacturers recommendations.
e. Where equipment model numbers / references are stated these are indicative only and the Contractor MUST ensure the selected equipment fully complies with the entire services standard

f. Workshop Submittals

6.3 Metering Coverage

6.3.1 Electrical Metering

It is critical that the design team carefully review and consider both the use of the building and the ongoing operation in determining metering requirements. It is expected, but not limited to, all mechanical loads, all loads in excess of 50 amps, and where compliance with the BCA Part J is required, will be metered.

In addition to the requirements of NCC 2016 BCA Volume One Section J8 the metering coverage should provide detailed coverage to allow ongoing operational optimisation of the building utility consuming system.

Specifically, sufficient metering shall be provided to differentiate the following loads:

Mechanical Services Loads:
a. Central Cooling Plant
b. Cooling Tower Fans
c. Central Plan Pumping Loads
d. Airside Plant by floor or logically zoned as suits the installation.
e. Central Heating Plant
f. Exhaust Systems
g. Tenant / Occupant systems.
h. Compressed air plant
i. Vacuum\Suction plant

Building Lighting Loads:
a. External Lighting.
b. By floor or logically zoned as suits the installation.
c. Base building lighting.
d. Tenancy / Occupants lighting.

General base building power
a. Solar Generation
b. Tenant / Occupant Floor plug loads
c. Lifts / Vertical Transportation
d. Special Purpose loads (building usage dependent).

The table below defines the minimum metering coverage for different electrical switchboard types:

Switchboard Types	Minimum Coverage	Notes
Regional Board	All circuits, Incoming Feed.	
Building Main Switchboard	All circuits greater than 50A rating. Incoming feed.	
Distribution Board	All circuits greater than 50A rating. Power & Lighting chassis.	
Mechanical Switchboards	Incoming Feed, All circuits greater than 50A	
External Lighting Distribution Boards	Incoming Feed, All circuits greater than 50A	
Occupant / Tenant Distribution Boards	Incoming Feed – Ensure end user consumption can be	

measured for management / outgoing recovery purposes.

6.3.2 Water Metering

Water metering shall be provided for water efficiency, reporting and cost recovery / billing purposes. Where the metering is to be used for cost recovery or billing purposes the specifier must ensure that that both energy meters and the billing / cost reporting specified meet regulatory requirements for energy selling.

Revenue meters shall be specified as per the requirements of project and regulatory requirements. The meters shall be provided with a pulse output (voltage free or open collector output S0) suitable for connection to the AUMS. Minimum resolution of pulses shall be 5L per pulse and maximum resolution shall be 100L per pulse.

Water submeters shall be provided to meet the requirements of the Project. Minimum coverage shall include:

a. Main Building Potable Water Supply
b. Total Recycled / Rainwater Water Supply.
c. Potable Makeup to Recycled / Rainwater Water Supply.
d. Cooling Towers Makeup Supply/Mechanical Services
e. Central Steam system
f. RO/DI Water
g. Toilets / Restroom Water Usage
h. Commercial Kitchens/Communal Kitchens in Student Accommodation facilities
i. Spaces proposed for tenancy leasing agreements
j. Irrigation

6.3.3 Natural Gas Metering

Natural gas metering shall be provided for energy efficiency, reporting and cost recovery / billing purposes. Where the metering is to be used for cost recovery or billing purposes the specifier must ensure that that both energy meters and the billing / cost reporting specified meet regulatory requirements for energy selling.

All equipment and materials installed in natural gas systems must where applicable, be approved for use by Jemena. Intrinsic Isolation barriers must be provided in accordance with Jemena requirements for retail meters. Private meters must be provided with intrinsic isolation unless a hazard assessment is undertaken by a qualified person that determines that isolation is not required.

Natural gas submeters shall be provided to meet the requirements of the Project. Minimum coverage shall include:

a. Main Building Natural Gas Supply
b. Mechanical Services Natural Gas Supply (boilers or other heating).
c. Domestic Hot Water Heating
d. Steam Boilers
e. Laboratory Supplies
f. Commercial Kitchens/Communal Kitchens in Student Accommodation facilities
g. Spaces proposed for tenancy leasing agreements
h. Any large gas consumers (i.e. furnace, incinerator, etc.)

Natural gas meters shall be specified as per the requirements of this guideline and regulatory requirements. The meters shall be provided with a pulse output (voltage free or open collector output S0) suitable for connection to the AUMS. Minimum resolution of pulses shall be 0.1m^3 per pulse and maximum resolution shall be 1m^3 per pulse.

Natural gas energy usage shall be calculated based up recorded consumption multiplied by Meter Pressure Factor and Heating Value.

Meter Pressure Factors and Gas Heating Values shall be programmed into the AUMS on a per meter basis as part of the project specification.

Where gas meters are connected to the AUMS an intrinsically safe barrier must be provided or an appropriate certification from a hazardous area consultant confirming the classification for the area/installation.

6.3.4 Solar Inverters

Solar inverters HLI are to be connected to the AUMS via Modbus or direct BACnet connection.

6.4 Metering Equipment

6.4.1 Metering Panel Locations

Metering Panels must be located in the switch room or other locations approved by UI, external locations will not be accepted.

6.4.2 Metering Panel Construction

Each gateway must be equipped with ELV power supply at 24VAC or 24VDC, DIN rail mounted and fitted in a lockable industrial 600x400x200mm steel panel enclosure. A small backup power supply must be included for the pulse counter devices power supply circuit to allow for 3 days operation without mains power.

Power point must be fitted in board with appropriate RCD protection, a surge diverter installed inside the cabinet on the incoming power supply and ethernet Cat6E connection to the AUMS gateway.

Where external enclosure is required for wireless receiver then it must be weatherproof and of an IP rating of at least 65.

The steel panel enclosure must be labelled “University Advanced Utilities Monitoring System” with the following contact details “University Infrastructure, Engineering and Sustainability Unit” using Traffolyte labels.

6.4.3 NMI Meters

Where revenue meters are connected these meters must be supplied fitted with Modbus ports and the Modbus data made available through the specified Serial-to-Ethernet gateway by connecting the meter to the nearest Serial-to-Ethernet gateway. It is the responsibility of the project/contractor to organise with the supply authority meter provider the Modbus connection for the AUMS to connect to.

6.5 Minimum Metering Parameters

The minimum parameters to be metered for electricity, gas and water are summarised in **Table 1.**

Table 1: Metering Requirements for Electricity, Gas and Water

Type	Value
Electricity (per meter)	3 phase kW
	3 phase kVA (average maximum)
	3 phase kWh (totaliser)
	L-N Voltage (each phase)
	L-L Voltage (each phase
	3 phase kVAr
	3 phase Current (each phase)
	3 phase Power Factor
	Frequency
	Total Harmonic Distortion (total and phase %)
	Neutral Current (calculated)
Gas	Uncorrected Volume (m^3)
Water	Uncorrected volume (l)
	Flow (l/s)
Thermal	kW (cooling)
Solar	HLI points

6.5.1 Mechanical Services Metering

Mechanical Services metering integrated to the AUMS is integrated directly or directly to the AUMS based on its source as follows:

Mechanical Services Switchboard Electrical Smart Meters: Connected directly to the AUMS.

Mechanical Services Gas and Water Pulse Meters: Connected directly to the AUMS

Mechanical Services Thermal and VSD Energy Data: Connected directly to the BMS and relevant parameters integrated to AUMS via BACnet/IP over Campus Network.

6.5.2 Hydraulic Services

6.5.2.1 Water and Gas Meters

For water and gas meters, contractors must provide a pulse measurement device to water and gas meters that will convert the water or gas meter volt free pulses (at a minimum of 100Hz, 25% duty cycle) to a Modbus value that is connected to the building gateway.

Pulse measurements from water and gas meters must be connected to DIN rail-based Modbus/TCP Pulse counters converting the pulses to a Modbus register to be polled by the Smart Gateway.

Where existing building water and gas meters are available via BMCS BACnet controllers, the project will configure the AUMS Server to access these BACnet variables directly through the nearest BMS controller/router.

6.6 AUMS System Architecture

The AUMS system consists of a protected server, hosted in the University's externally operated data centre, and gateway devices. The gateway devices collect data from smart meters via the Campus Network (CN).

The AUMS is based on Tridium Niagara technology, energy and other utility data is integrated to the AUMS Servers as described in this standard. The AUMS Server resides on a dedicated Virtual Private Network (VPN). The EMS system consists of the AUMS Server, Tridium Niagara JACE gateway devices that collect data from smart meters, wireless systems and I/O devices.

The AUMS collects electrical, gas and water data from gas meters, Solar inverters, water meters, thermal meters, and Variable Speed Drives (VSD's). It also collects consumption data for gas and water meters from a Halytech wireless data collection system.

New electrical, gas and water meters installed in new or existing refurbished buildings shall integrate to the existing AUMS based on Tridium Niagara as the integration technology platform.

The AUMS is linked to the campus time and SMTP mail servers to receive time sync and to allow notifications to be emailed to users.

6.6.1 AUMS Gateway Devices

The AUMS uses Tridium Niagara technology to integrate the metering to the AUMS Server. Deemed-to-comply gateways are the Tridium Niagara JACE 8000 or above with AX V3.8.X operating system. JACES must be provided with the following integration drivers supplied as a minimum:

a. Tridium BACnet IP / MSTP Driver
b. Tridium Modbus TCP /RTU
c. Haystack Tridium nHaystack AX v1.3

All AUMS JACES must be configured as a standard BACnet Device, addressed as per the BMS BACnet addressing schema.

6.6.2 Hardwired Architecture (Figure 1)

Refer to Figure 1 for the hardwired AUMS architecture. All connections to the campus networks must be via a Tridium JACE Gateway unless specifically approved otherwise. Thermal meter and Variable Speed Drive data associated with the building BMS must be accessed via the closest BMCS controller/router and integrated to the AUMS server using BACnet/IP protocol.
A maximum of number of allowed meters connected to each gateway is 25.

6.6.3 Wireless Architecture (Figure 2)

In addition to the hard-wired architecture wireless (radio) architecture is implemented where hardwiring is not feasible, the wireless system is based around the Halytech wireless product range. The radio base station collects and provides the Jace with data from the transmitters. Data is transmitted every 6 hours from the transmitters that are collecting 15-minute interval data.

The base station must have the capability to collect 3 days' worth of data without mains power and to store six days' worth of data without network connectivity, upon reconnection to network data is to be automatically uploaded. The base station/transmitters must be setup to allow force polling of transmitter for its data to the AUMS server for viewing. **Figure 2** depicts the wireless system architecture.

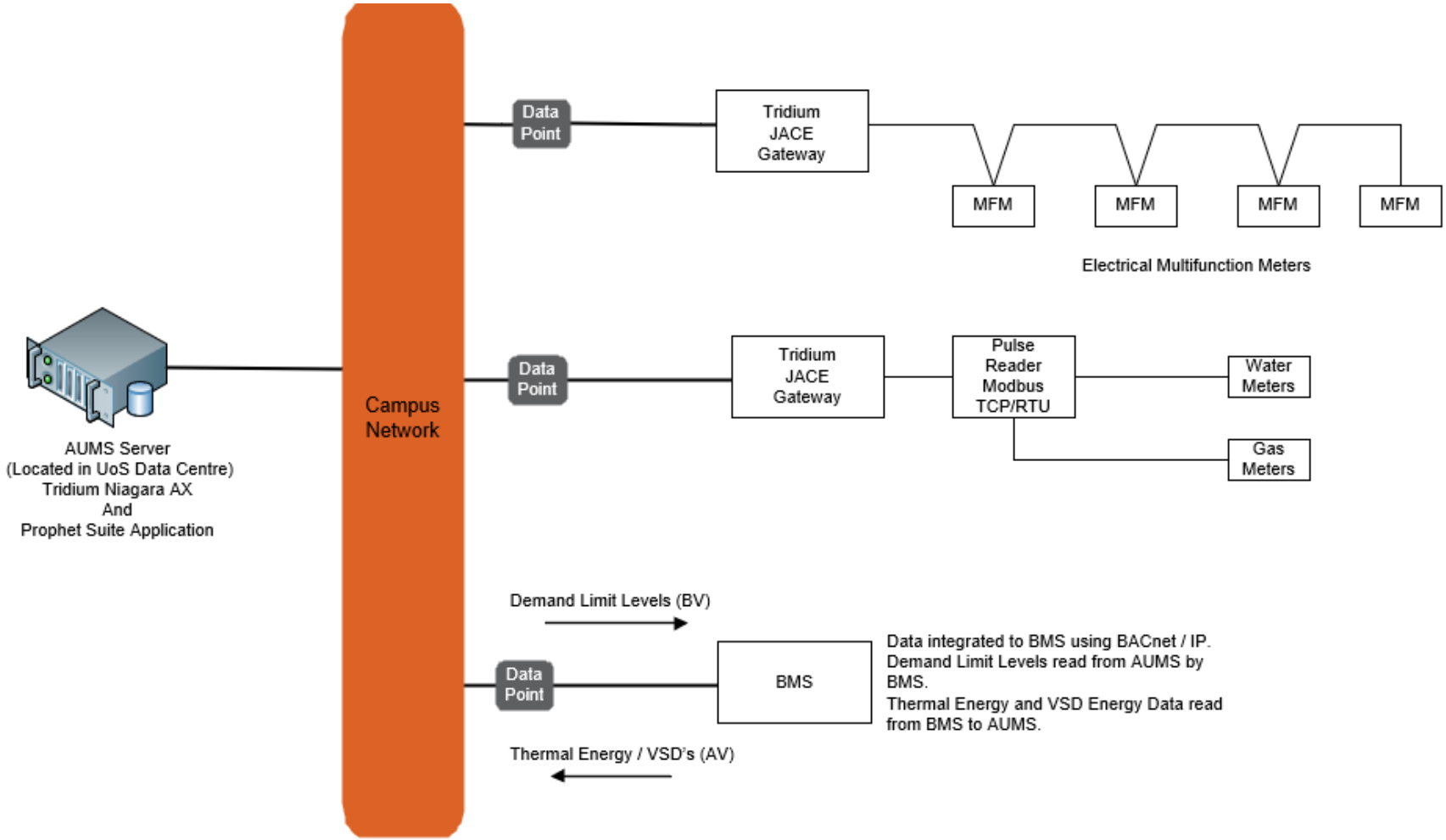


Figure 1: Advanced Utility Monitoring System (AUMS) Architecture - Hard Wired

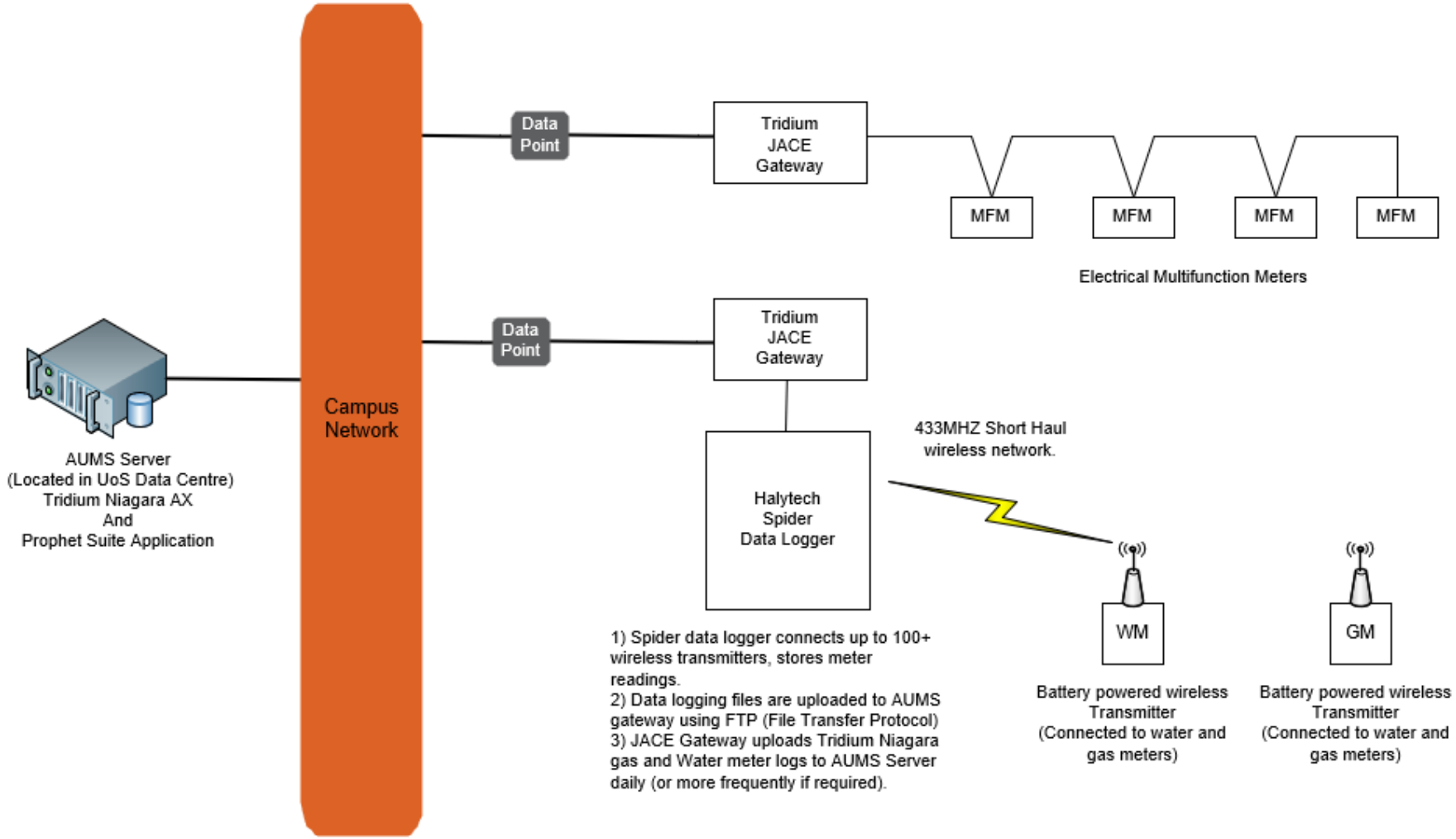


Figure 2: Advanced Utility Monitoring System (AUMS) Architecture – Wireless

6.7 Meter Identification Protocol

Meters addressing must be configured in accordance with the requirements of UI Engineering and Sustainability Unit to ensure that all meters are uniquely identified across the campus. The naming convention used to identify meters must be standardised in accordance with UI direction. All labelling on meters must reflect this standard.

Meters must be supplied fitted with Modbus ports and the Modbus data made available through the specified Serial-to-Ethernet gateway by connecting the meter to the nearest Serial-to-Ethernet gateway.

The meters must be connected by a daisy chain buss (wired in EIA-485 compliant 2 wire communications cable) to the nearest Serial-to-Ethernet Gateway.

6.8 AUMS Specific Equipment

Deemed-to-comply gateways are provided in Table 2. Alternatives may be used only with prior review and approval of UI Engineering.

Table 5.8:1 - Deemed-to-comply AUMS Equipment

Meter Gateway/Equipment	Manufacturer	Description
JACE-8000 or above	Tridium	DIN rail mounted gateway device (shipped with the most recent Niagara version).
MODBUS Driver (DR-MDB-TCP-AX)	Tridium	Modbus/TCP Driver to be used when installing with MODBUS meters.
MODBUS Driver (DR-MDB-RTU-AX)	Tridium	Modbus/RTU Driver to be used when installing with MODBUS meters.
BACNET Driver (DR-BACNET-AX) for BMS integration	Tridium	BACnet IP Driver to be installed
BACNET Driver (DR-MSTP-AX) for BMS integration	Tridium	BACnet MSTP Driver to be installed
nHaystack Driver n1.3	https://project-haystack.org	Open Source Haystack Driver / API
Spider AMR	Halytech	Base-station Wireless Logger device
Spider WRX-OB Wireless transmitters	Halytech	Wireless transmitters connected to pulse meter
WTX-OB Wireless transmitters	Halytech	Battery powered wireless transmitter (Outdoor use)
WTX-C Wireless transmitters	Halytech	Battery powered wireless transmitter (Outdoor use in high moisture containing environments)
WTX-IB Wireless transmitters	Halytech	Battery powered wireless transmitter (Indoor use)
WTX-IM Wireless transmitters	Halytech	Mains powered wireless transmitter (Indoor use)

6.8.1 Smart Meter Gateways

The smart meter gateway is a device that allows data to be gathered and stored as a history (time stamped data) in the memory of the device.

All smart gateways must satisfy the following requirements:

a. They must be diskless, low maintenance and of sufficient capacity to allow for all data gathered to be stored locally for at least 10 days, in the event that the WAN is unavailable, after which the data may be overwritten
b. Each gateway must have the capacity to gather log data from a minimum of 32 meters at 15-minute intervals for 10 days while offline from the WAN
c. They must support Modbus/RTU, Modbus/TCP, BACnet/MSTP and BACnet/IP for integration of metering directly from meters or from BCMS.
d. They must be capable of multi-master operation. This means, the server may poll the gateway for adhoc live data in response to a user graphic request while logging is carried on in the background without any interruption of the 15-minute data logging
e. They must be capable of logging any selected variable at user configurable intervals from 30 seconds to 10 minutes. When in this mode, historical logging at 15-minute intervals must continue normally and must not be affected by live viewing
f. All data logged must be logged with an inherent floating-point accuracy to class 0.5s (AS 62053.22:2005) for active power and class 1 (AS 62053-21:2005) for reactive power
g. They must support pulse counting (to 100Hz) and analogue inputs for whole current electricity meters, water, gas, and heat meters must be supported by the gateways
h. They must be capable of operating independently on local batteries for at least 5 minutes during mains power outages. All programming and configuration will be stored in non-volatile memory in the event of prolonged mains power failure for at least 7 days without mains power.
i. The ability to timestamp all data for storage and update the gateway clock via a central master device

6.9 Software

6.9.1 Meter Software

All meter addressing must be unique, and the meter addresses submitted to UI for approval. The project must ensure that meter schematics are submitted for inspection of meter configuration and addressing.

Meter schedules need to be supplied

6.9.2 AUMS Server Software Data Analysis and Reporting

The AUMS software loaded on the University's server provides the following reporting tools and data output capabilities.

6.9.3 Graphical Data Outputs

a. Time-series daily load profiles displayed with time, in intervals of an hour or less, along the horizontal axis and load along the vertical axis
b. Overlay plots displaying multiple daily profiles on a single 24-hour time-series graph
c. Viewing of multiple time series data points on the same graph
d. Calendar profile: view up to an entire month of consumption profiles on a single screen as one long time series
e. X-Y scatter plots: X-Y scatter plots for visualizing correlations between two variables
f. Intuitive graphical axes that are scaled and labelled

g. A comprehensive and simple graphical programming tool allowing the University users to create their own views, graphs, charts, gauges, and other widgets for viewing live or historical data. Dashboards must be capable of export to printers or .pdf, .csv, .xls or .jpg formats for use in reports, spreadsheets or as live media to campus display systems.
h. Dashboards must be accessible using simple web browsers. They must at least be readable by Internet Explorer, Firefox, Safari and mobile smart phone web browsers. Secure dashboard access via web browsers must be provided via username and password to access. A customised navigation tree with hyperlinked graphics must be provided such that each user (or user group) is provided with personalised access to data relevant to their specific requirements. Users must be able to access utility metered data by clicking on a digital map showing campus buildings.
i. Dashboards as a minimum must contain (for each building group, building, area, switchboard, or grouping in the metering tree) graphics showing live and historical utilities usage, loads, CO2 emissions, utility targets and maximum demand. System administrators must be able to manage meter lists, add new meters, create virtual meters and remove decommissioned meters.
j. See Attachment 1 for existing dashboard configuration and standard tabs setup
k. Building specific dashboards must be developed on a project by project basis refer to Table 3
l. Direct access to schematics and Single Line Diagrams showing current utilities reticulation relevant to the meter being interrogated.

Table 3 : Building specific dashboards

Meter Gateway	Meter Type	Description
Total mechanical services Virtual meter	Electrical/Gas/Water	Provide Dashboard under the building tab for mechanical (collate on an individual dashboard w Mechanical gas, water, electrical and thermal usage)
Total general load virtual meter	Electrical	Provide Dashboard under the building tab for General electrical loads (This would be all meters that are not lighting, and HVAC related)
Total building lighting load virtual meter	Electrical	Provide Dashboard under the building tab for Lighting loads (not including any tenancy lighting loads)
Total building Tennant	Electrical/Gas/Water	Provide Dashboard under the building tab for Tennant (collate on an individual dashboard with gas, water, electrical and thermal usage) Note a Dashboard for each tenancy must be provided.
Total Building PV Meter	Electrical	Provide Dashboard under the building tab for PV usage
Total Building Hydraulics meter	Gas	Provide Dashboard under the building tab for Building Gas usage (excludes mechanical gas usage)
Total Building Hydraulics meter	Water	Provide Dashboard under the building tab for Building hydraulics (excludes water treatment and mechanical usage)

Treatment	Water	Provide dashboard for water treatment plants
Chilled, Heating Condensers water	Thermal	Provide dashboard with thermal meters where available
Building Inverters	Solar	Provide HLI interface dashboard

Analytical Data Outputs

a. Basic statistical analysis such as mean, median, standard deviation, correlation, and regression
b. Benchmarking against set building energy standards
c. Intra/inter-facility comparisons against the building's historical data or across multiple buildings
d. Aggregate data among multiple data points. Integrate different energy units using energy conversions
e. Data mining (data slice/drill-down) time series data by monthly, weekly, daily, hourly, or trended interval
f. Normalisation of energy usage or demand by factors such as building area, number of occupants, outside air temperature, and cooling or heating degree-days (CDD, HDD) to make a fair comparison between buildings
g. Hierarchical summary of usage and cost information by different levels.

Missing data approach:

a. Interpolate missing data
b. Data correction when batteries fail, or meter requires reset – backup and self-correction required

System Specific Outputs

a. Validation, editing, estimation to ensure quantities (kWh, kW, kVar, etc.) retrieved from meters are correct. The process includes validation of data within acceptable error tolerances, editing or correcting erroneous data, and estimating missing data.
b. Equipment fault detection and diagnostics to identify equipment failure or degradation based on customised algorithms and parameters.
c. Power quality analysis of voltage or current phases for conditions that could affect electrical equipment.
d. Forecasting future trends based on historical data and related parameters.

Utility Outputs

a. Energy cost breakdown using energy tariff and usage data to calculate daily or hourly energy cost breakdown and validate utility bills.
b. Real-time cost tracking to calculate electricity costs daily or hourly using real-time meter reading and rate tariffs.
c. End-use cost allocation to tenants using user-defined parameters and algorithms to estimate end-use energy consumption from whole-building energy.
d. Provide cost recovery report where applicable

6.10 AUMS Server Software Configuration

A qualified System Integrator must be engaged to configure the AUMS meter hierarchy. The software must automatically aggregate meters, create virtual meters (by load subtraction or addition) and logical meters (by user defined grouping of meters, such as for light and power or mechanical load groups).

Driver configuration to link meters into the gateways must be integrated with the server software by the System Integrator.

Meters must be set up as templates allowing easy replication where meters are added or deleted.

The software configuration must:
a. Define the structure of the metering system.
b. Apply and create analytical processes.
c. Create and edit visualisation dashboards and reports.
d. Apply dashboards and reports to any part of the energy metering system.
e. Set alarm levels to trigger on detection of anomalies

A data model tree must be created, defining nodes that reflect the metering structure. The software will define aggregation rules for various data types, allowing nodes that do not have physical meters installed to be aggregated in dashboards and reports without specific virtual meters or calculations being required.

Additionally, configure the below, where applicable:
a. Network time-of-use (TOU) schedules,
b. Tariffs
c. Normalisation metrics such as energy per floor area or per cooling degree day.
d. Modelling water and gas usage per time interval, area or function
e. Alarm triggering levels (with suppression of false alarms)

The software must calculate variables to be trended and stored in the SQL database, visualised in dashboards.

All analytical tools, calculations must be made available to authorised UI users and be able to be edited using drag and drop techniques in real time via a graphical "wire sheet".

The System Integrator must develop a comprehensive intelligent user interface to accurately model and interact with building users. All tools to edit and apply dashboards to all parts of the system must be provided within the web browser functionality. The system must provide a full suite of dashboard tools including:
a. Line, bar and pie Charting Tools
b. Tabular data
c. Symbols, Indicators and the like.
d. Embedded multimedia, webpages etc
e. Ability to develop and add custom widgets
f. Energy, water and gas alarms

All charts must allow drill down capability based on defined aggregation rules. Additionally, data can be dragged and dropped into charts as required. The system must be able to save any dashboard created as a template and to then apply this across any or all nodes in the system.
The system must include data reporting and export tools that allow users to export data and dashboards in PDF, XLS and CSV formats. Reports must be able to be created a scheduled or exported as required. The contractor must work with the UI Engineering and Sustainability Unit to develop required reports.

The system must be designed to allow flexibility to develop the system based on evolving needs. The system must allow third party reporting and other data tools from Excel to Microsoft Reporting Services to be used without fundamentally altering the underlying hardware and database infrastructure. Licensing for Microsoft Reporting Services will be provided by the University.

6.11 User Configuration

User permissions must be approved by UI Engineering and Sustainability Unit.
The contractor must ensure that appropriate user login`s are created at the end of each project.

6.12 Calculation and Analysis Tools

The System Integrator must develop calculation and analytical reports using scripted mathematical operators, logical and scientific functions built into the server software suite. All these functions must be transparently recorded in the AUMS.

The software must offer an accessible programming environment (such as Visual Basic) or other scripting language such that complex calculations and formulas can be created using the stored data. For example, the software must be able to calculate greenhouse gas equations or create a water leak detection model that can be used to generate alerts, or generate load profiles, peak demand prediction and other energy demand management functions.
Note that systems that require an external controller to be deployed to provide this capability are not acceptable.

Data must be stored for review and later manipulation using built-in energy analysis tools for load collection and reconciliation to the NMI meters, load profiling, load duration, rollup (into varying periods), load base-lining (period comparison), comparison and rating of building performance, identification of cyclic loads, abnormal loads, service outage events, load contribution from each meter, cost comparison, tariff modelling, normalisation to parameters such as Gross Floor Area (GFA) and ambient conditions (e.g. Degree Days).

6.13 Enterprise Integration and Manual Data Entry

The System Integrator must configure the system to export data to SQL database or spreadsheets. The system must offer open SQL data connectivity (such as ODBC) in addition to export of .csv files.

The software must be capable of user-friendly import of meter data either by meter or in bulk by defining a data structure and method for users to input adhoc data or historical utility data.

The method of manual data entry is via a web-based form where data for meters can be manually entered into the AUMS using a wireless connected tablet computer or smart phone.

6.14 Alarms

The System Integrator must set alarms for thresholds on each individually metered value and send alert notifications for corrective action via SMS, SNMP and Email.

Alarm thresholds levels must be displayed in dashboards using colour. An alarm management system must be included allowing users to view, prioritise, acknowledge and archive alarms.

Alarms must be setup for each project including max demand, water/gas leakage, meter disconnection, controller fault, comms failure and out of parameter data. Alarms shall be setup and sent to nominated users, further alarms identified during the design phase must be emailed. For the wireless systems alarms must be setup for low battery alarm and loss of communication alarm.

6.15 Workflow

The System Integrator must provide functionality that allows users to create workflows based on triggered events (such as alarms). For example, in the event of a water leak alarm, the system may create a water leak report and email it automatically to relevant personnel for action. Another example is the creation of energy reports (e.g. .csv files) which are automatically exported to a carbon reporting system on a daily, or weekly or monthly frequency.

7 Commissioning

Comprehensive pre-commissioning, commissioning and quality monitoring must be specified by the consultant/designer or contractor.

Detailed testing and commissioning records must be provided for each system and each component as appropriate. All such records must be witnessed and verified by the project consultant/head contractor prior to witness commissioning by UI engineers.

Project handover plan must be developed by the consultant/designer to allow the system to be handed over to The University. A 12-month building tuning process will commence at Project handover with systems monitored monthly, reported and assessed quarterly, and include assessment of feedback from the occupants.

A project specific commissioning plan must be developed and provided to the University for review and approval. UI have developed an **AUMS Commissioning Checklist (UI-ENG-F026)** which should be used as a minimum guide when preparing the project specific commissioning plan.

7.1 Building Tuning

On a Quarterly basis starting from practical completion the BMCS contractor is required to provide a building tunning report, the AUMS contractor is to provide regular energy performance updates to the BMCS contractor for the report as well for the BMCS contractors monthly building tunning.

7.2 Validation and Verification

Commissioning of the connection of the meters to the AUMS must:

a. Verify communication to each meter from the AUMS
b. Complete successful AUMS remote reading of meter data and verification of stored values against those stored within the meter register (meter values = stored values)
c. Validate of the meters' communication to the remote metering system in accordance with the NABERS validation protocols
d. Include schedule and checking of all ratios applied to meter data
e. Confirm correct operation of scheduled data polling over a period of 7 days at the AUMS
f. Complete successful retrieval of data from storage database for each meter to the AUMS
g. Provide access details and logins/passwords to any software components required by the AUMS to connect or maintain the interface to metering
h. Demonstrate the end-to-end system, including dashboards, meter hierarchy, historical data, scheduled polling and adhoc polling.
i. Conduct user training for up to 5 USYD staff. All for two full days of training on site.

8 Safety in Design

The contractor must consider risk during the design. A design safety report must be submitted to the relevant UI Project Manager for every design project. Contractors must confirm, so far as it is reasonably practicable, that the structure is without risks to health and safety.

Design risks must be considered for the asset lifecycle covering construction, operational and maintenance, refurbishments and decommissioning.

The design safety report must include the following:

a. Description of design element.
b. Description of potential risks and hazards associated with the design element.
c. A low/medium/high risk assessment considering likelihood and consequence.
d. Proposed measures to eliminate risks where practicable.
e. Control measures to mitigate and manage design risks.
f. Nominating responsibilities for managing the design risks.

This may be provided as a design risk register where appropriate and must include results of any calculations, testing and analysis etc.

g. Documentation and Records

9 Documentation and Records

9.1 Design Documentation

Prior to commencing construction of new or refurbishment projects, the consultant/contractor must fully investigate and document the requirements for the AUMS system required to be installed, altered or modified as part of the project works.

This must include:

a. Review of the current metering installed for the building to determine the proposed AUMS Upgrade Strategy.
b. Provision of a BCA/ NCC Compliance Report.
c. Return Brief defining the systems proposed and any deviations from this standard.
d. Future allowances are to be included in all calculations\sizing.
e. Calculations & selections on the proposed equipment.
f. Budget calculations.
g. New meter ID schedule
h. New metering connections and configuration
i. Commissioning records
j. Product manufacturer specific information
k. System schematics
l. Metering SLD
m. Network Addressing schedule
n. Metering Single SLD
o. Requests for all variations to this Standard submitted using the Request for Dispensation Form (USYD-ENG-F001).
p. Complete the Design & Construct checklist using the Design & AUMS Checklist Form (UI-ENG-F009).

This documentation must be provided by the consultant/contractor in both electronic and hard copy formats and approved by the University.

9.2 Completion Documents

At the completion of all projects, the following documentation must be provided by the contractor for the AUMS installed or altered as part of the project works:

a. O&M manual(s).
b. As-built drawings including all listed items in the design documentation (Cad and DPF format).
c. Asset schedules and labelling (as per the Asset Identification and Labelling Standard).
d. Commissioning test results.
e. Product manufacturer specific information.
f. Details of all usernames and passwords required to access all equipment and software.
g. Warranty schedules for all major items of equipment
h. Maintenance requirements for all items of equipment.
i. Building User Guide.
j. Supply authority completion forms and inspection record.
k. Installers Statutory certificates.
l. Fully surveyed and documented underground services drawings depicting all as built services both PDF and CAD format.
m. Certification of compliance to Australian Standards, The University Standards and the National Construction Code.

This documentation must be provided by the contractor in both electronic and hard copy formats and approved by the University prior to Practical Completion being granted.

10 Assets and Warranties

Assets are to be tagged in accordance with the Universities Asset & Labelling standard for the purpose of maintenance and operation of University Assets. For refurbishment projects the project manage is to provide the existing asset list to the contractor to ensure modified and redundant equipment are captured in the contractors submitted asset list.

Each asset required to be collected can be found in the Form COS-ASSET-F001, each asset required to be coded will be identified by a unique equipment code.

The equipment code will be one the three following types:

a. Virtual asset (This is a concatenation *Building Code - Floor - Room number*)
b. Item count asset (This is a concatenation *Building Code - Floor - Room number*)
c. Unique bar code asset (Unique bar code in the million series number affixed to the asset)

Asset lists are to be submitted prior to practical completion of the project for review and approval by COS.

Equipment Warranties are to be provided for a minimum of 12 months from the date of practical completion. Warranties are to be provided as certificates as part of the O&M from the supplier of the equipment. It is the responsibility of the installation contractor to ensure all maintenance\servicing required to the equipment is provided to ensure warranties are valid at the end of the project DLP period.

11 Defects and Liability Period

Consultants/designers must include in the project specification detailed requirements for the defects and liability period following completion of the AUMS installation.

The contractor must include and allow for recommissioning of all major plant and equipment in the last month of the 12-month defects and liability period and confirm they achieve the original design requirements. In addition, all commissioning must be witnessed by UI Engineering staff with commissioning reports/results formally submitted to UI Engineering. Where specific items are required to be re-witnessed after PC, the 12-month DLP period will commence from this re-witnessing date.

11.1 Maintenance and Testing

For AUMS services installed as part of a refurbishment project of an existing building, regular statutory maintenance and testing must be carried out by the projects AUMS Services contractor during the Defects Liability Period (DLP). The installation contractor must provide a comprehensive handover and the required completion documentation at Practical Completion.

All defects arising from regular statutory/manufacturer maintenance and testing performed during the DLP are the responsibility of the installation contractor.

For new buildings, the installation contractor must provide statutory maintenance and testing of all mechanical services and associated statutory testing for the building, throughout the DLP. Prior to the completion of the DLP, the installation contractor will perform all annual maintenance procedures in the presence of the University Engineering team and provide documentation confirming the provision of all maintenance has been performed during the DLP. In these instances.

Any details which will affect the future maintenance and performance of the new or upgraded equipment must be supplied by the installation contractor at Practical Completion.

Prior to completion of the DLP, a final inspection and full meter validation must be undertaken by the: installation contractor, appropriate UI and COS staff in order to reconcile the performance of the equipment during DLP to produce a final list of project defects. All project defects identified must be rectified by the installation contractor prior to finalisation of the DLP.

12 Operations & Maintenance Manuals

Consultants/designers must include in the project specification detailed requirements for operation and maintenance manuals, including system description, operation procedures, testing and commissioning records, maintenance instructions, product support information and recovery protocols for any computer related systems. Contractors must provide these to the satisfaction of the consultant/designer. Providing a collection of manufacturers' brochures and catalogues is not acceptable to the University.

Discuss with UI to understand what format to submit the O&M Manuals. Typical submissions come via soft copy (editable) and used via a system like Aconex.

Contractors must submit the university designed Asset Management Master Asset Data Capture Spreadsheet (**COS-ASSET-F001**) designed for recording operational and maintenance

activities including materials used, test results, comments for future maintenance actions and notes covering asset condition. Completed logbook pages recording the operational and maintenance activities undertaken for Practical Completion and during the Defects Liability Period must also be provided.

13 Authorisation of Variations

Project managers, consultants, contractors, commissioning agents and facilities maintenance personnel must ensure compliance with these requirements is achieved.

Variations to this standard must only be considered where:

a. The University Standard's requirement cannot physically or technically be achieved.
b. The Performance solution delivers demonstrated and proven superior performance for the same capital and life cycle cost or better.

Consultants and contractors must identify and justify requirements of the standard that do not apply to the project or which need to be varied and these which must be approved by the issuer of this standard. Formal requests for all variations to this Standard must be submitted using the Request for Dispensation Form (**UI-ENG-F001**). The issuer of this standard or their delegated authority must review and consider requirements of stakeholders from clients, projects and facilities management before deciding whether to approve variations. Their formal sign-off is required for acceptance of any non-compliances and departures from this standard's requirements.

14 Quality control

14.1 Design Standard Compliance

Compliance with requirements of this standard must be checked throughout the design, construction and commissioning phases of projects by UI' services consultant. Any issues or deviations from this standard must be reviewed and approved in writing by the issuer of this standard.

Competent UI consultants and representatives must check compliance with this standard during design reviews and formal site inspections. Any non-conformances with requirements of this standard must be documented and provided to the UI Project Manager for issue to contractors and their consultants.

Project Managers must maintain a formal register of non-conformances and manage close out of outstanding non-conformances. Contractors and their consultants issued with non-conformances must take appropriate corrective actions. The UI Project Manager must ensure:

a. Proposed corrective actions are implemented.
b. Close out of non-conformances in relation to this standard is formally approved and signed off by the author of the standard or their delegate.

14.2 Design Standard Certification

Contractors and Consultants must certify compliance to the design standard by submitting a company Design Certification Form to the UI Project Manager at each of the following project phases:

a. Design and Documentation.
b. Tender.
c. Construction.

Notwithstanding UI' internal quality control processes, contractors and their consultants must implement their own robust quality assurance and control procedures to ensure compliance with requirements of this standard.

14.3 Construction Compliance

Consultants and contractors are expected to include check sheets for each system component detailing each item that needs to be checked, tested and verified during the installation process. Such check sheets must be completed and verified by the project consultant/contractors, including the identification of any defects and the closing out of such defects.

14.4 Acceptance

The University will only accept projects as complete when all of the above have been carried out, submitted and verified.

The above standards are not an exhaustive list of the relevant requirements. The consultant/contractor must incorporate all relevant standards and Authorities requirements into project specific design, documentation and installation.

15 Document Amendment History

Version	Amendment	Commencing
001	First Issue	4 September 2013
002	a. 5.1.1 General clause added b. 5.1.2 Calculations/Selections clause added. c. 5.1.3 Drawings and Documentation clause added. d. 5.5.1 Hard Wired Architecture clause added. e. 5.5.2 Wireless Architecture clause added. f. 5.7.3 Serial to Ethernet Gateways clause added.	18 September 2015

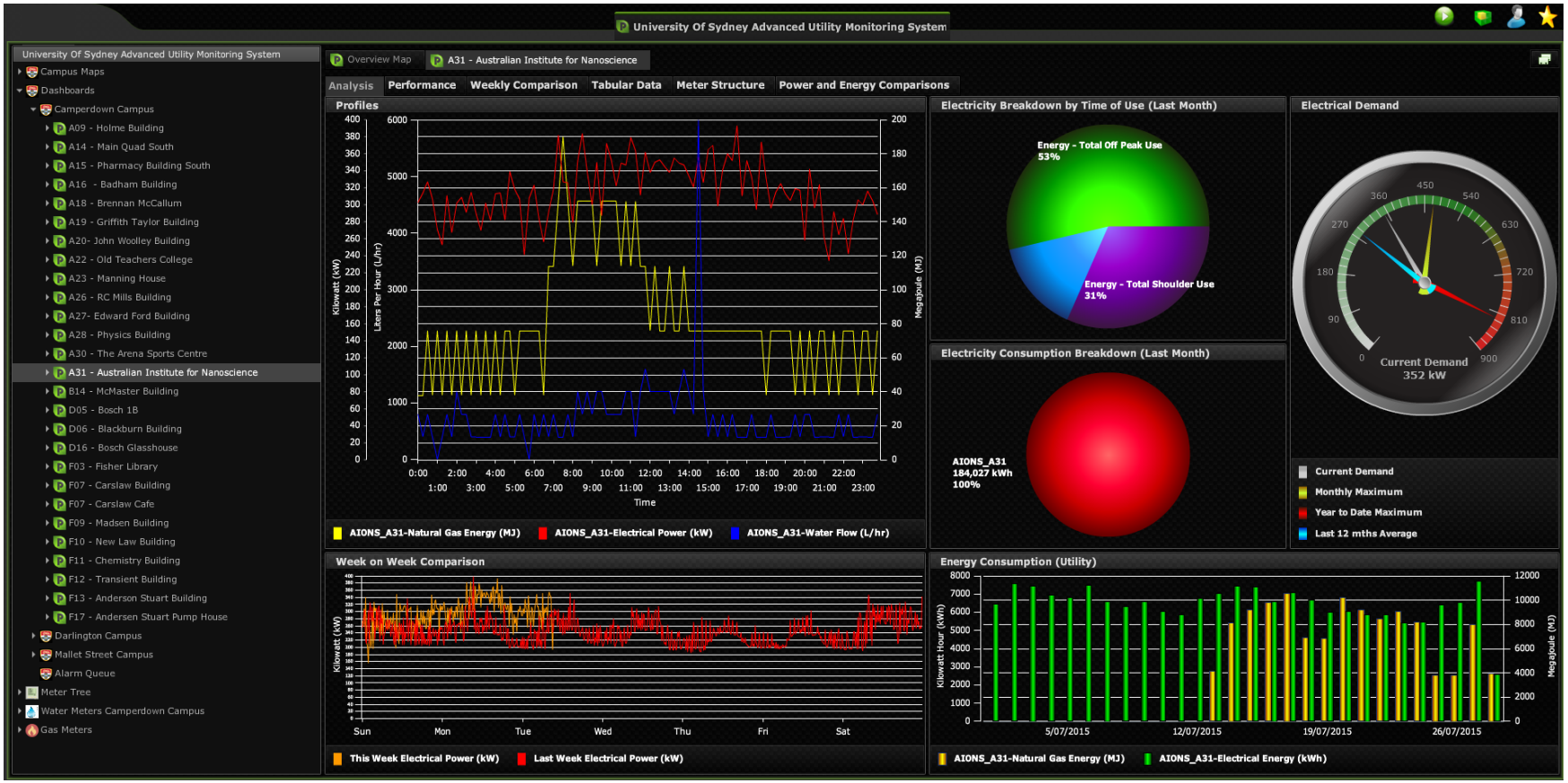
Version	Amendment	Commencing
	g. 5.7.4 Gateway/Wireless Receiver Enclosure and Location clause added. h. Table 3 Building Specific Dashboards added. i. 7 Safety in design clause added. j. k. New Forms added to the website; l. UI Design & Construct Services Checklist Form (UI-ENG-F009)	
3.0	3 Year Revision a. Through projects lessons learnt, industry and consultant feedback we have updated the requirements in the standards where they had a cost impact to align with industry practice as well ensuring any items that are being kept in the standards that are above industry standard level have an ROI. b. Project Definition stage added at 5.1. referring to Project "Gate Paper" and requirement for site inspection / briefing. Requirement for "Return Brief" formalised. c. Documents required for Submission & Approval updated, tightened up, aggregated and clarified. d. Safety in Design legislation reinforced. e. Commissioning Checklists added. f. Supersession of Codes & Standards between project initiation and execution is addressed. A major issue immediately and ongoing given long project gestations. g. Scope / Technical cover increased to include; i. Solar invert connectivity ii. Metering coverage increased iii. Dashboard requirements updated h. Defects period maintenance; include requirements for maintenance and testing during DLP i. Asset and Warranties section updated j. New dashboard screen shots included in attachments section k. Asset Standard Owner is now COS.	26 August 2020

16 Attachments

Attachment 1-Dashboard layouts

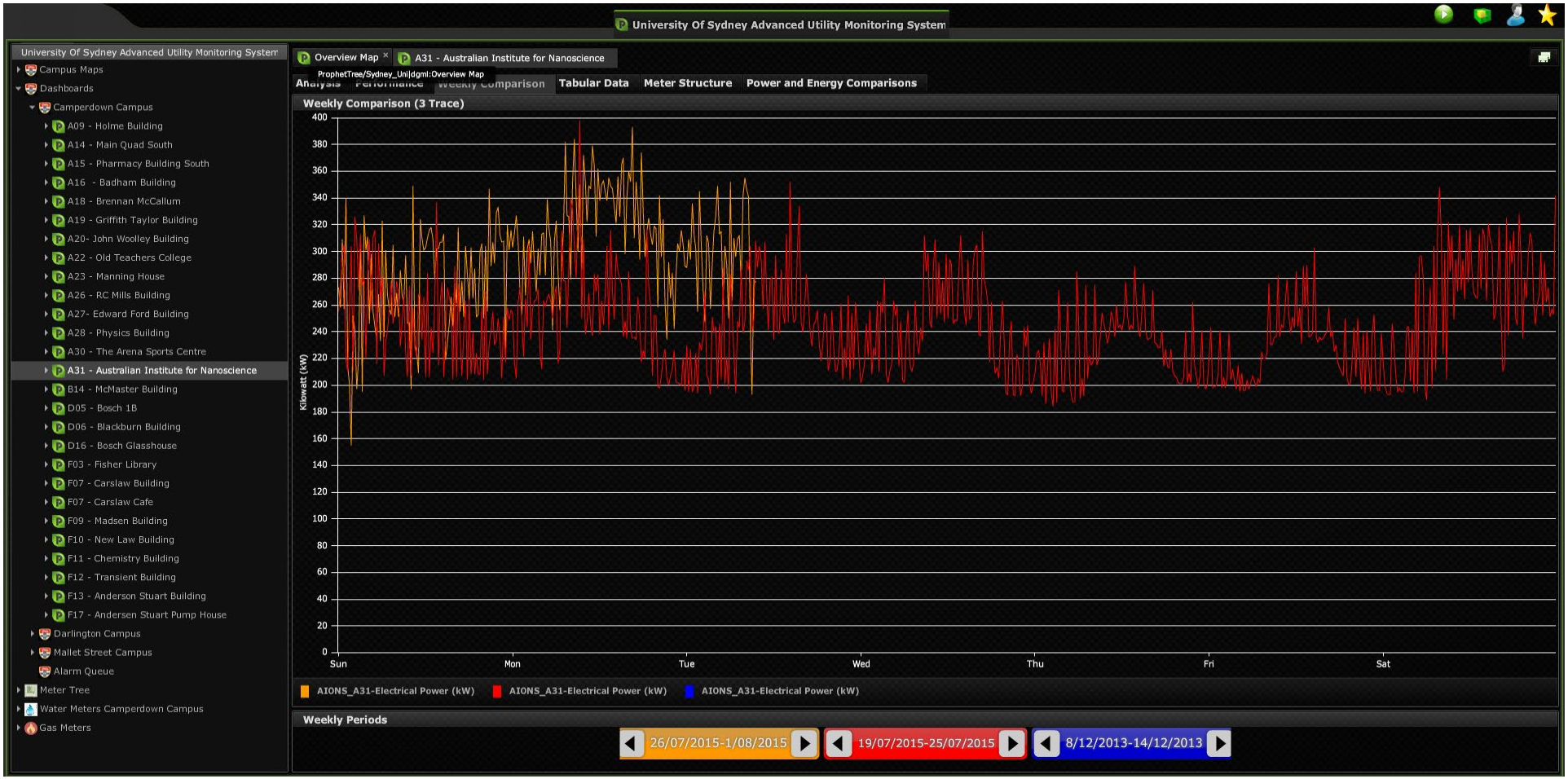
ATTACHMENT 1 DASHBOARD LAYOUTS

ANALYSIS TAB

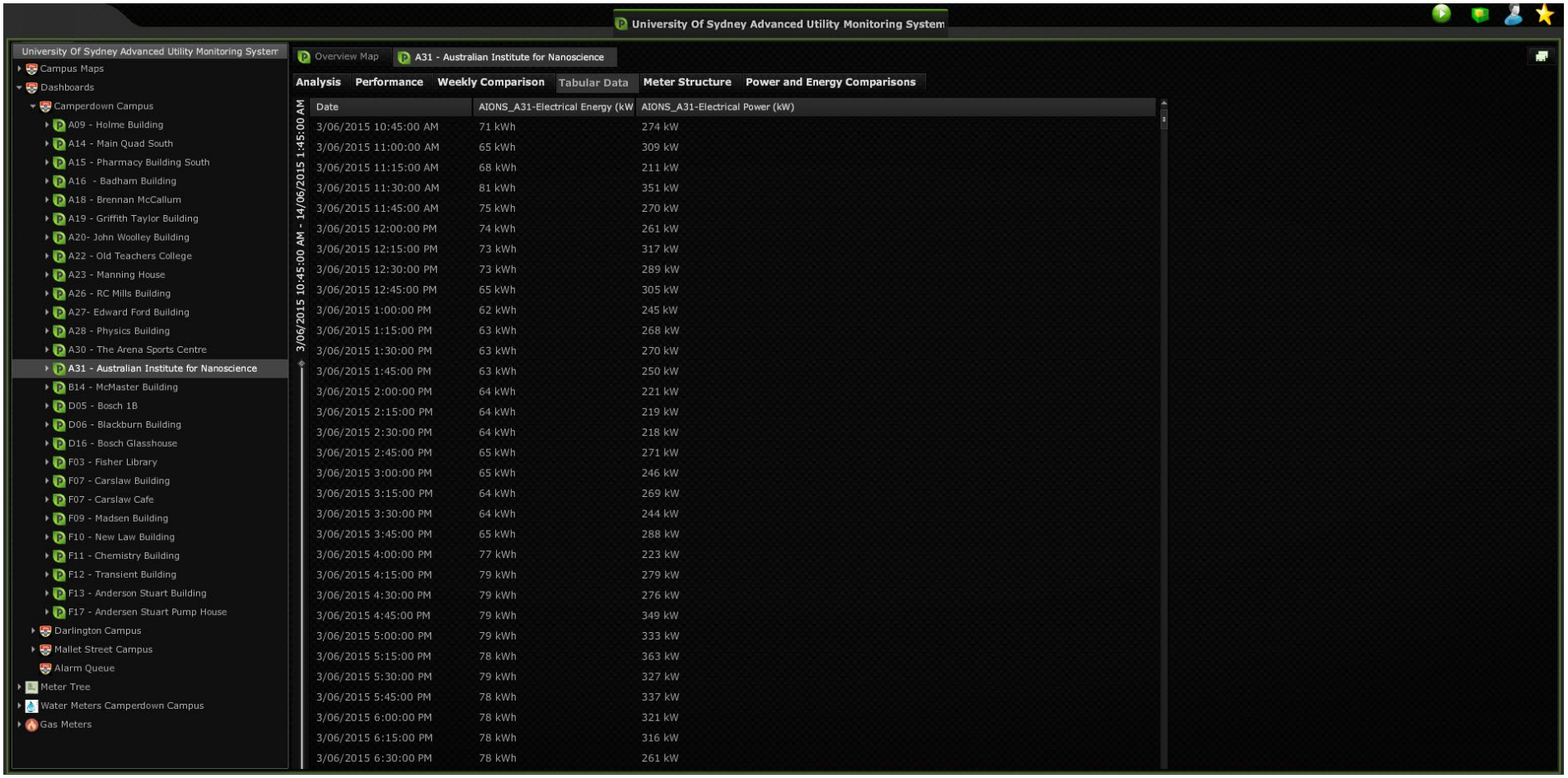


PERFORMANCE TAB

WEEKLY COMPARISON TAB

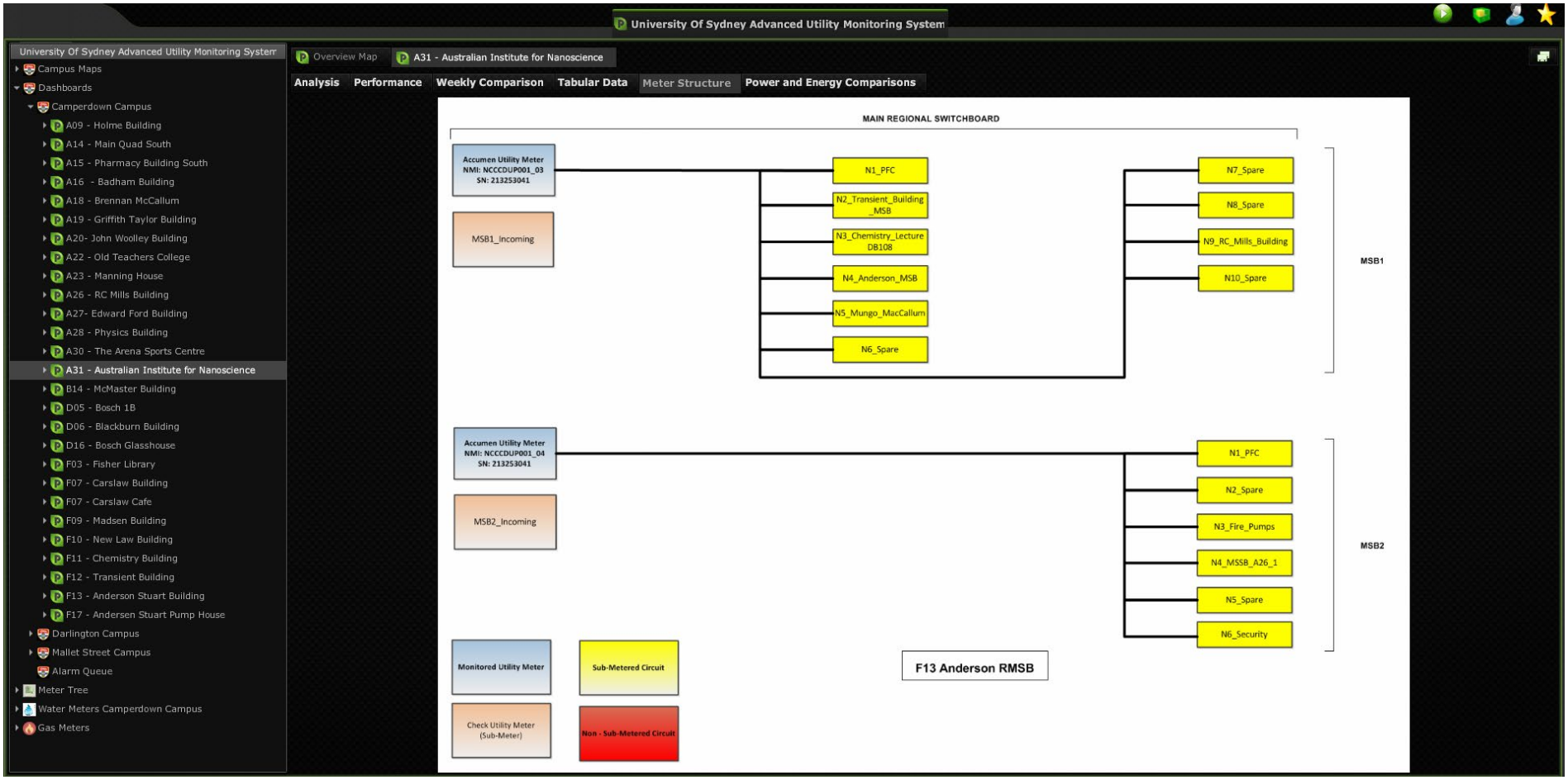


TABULAR DATA TAB



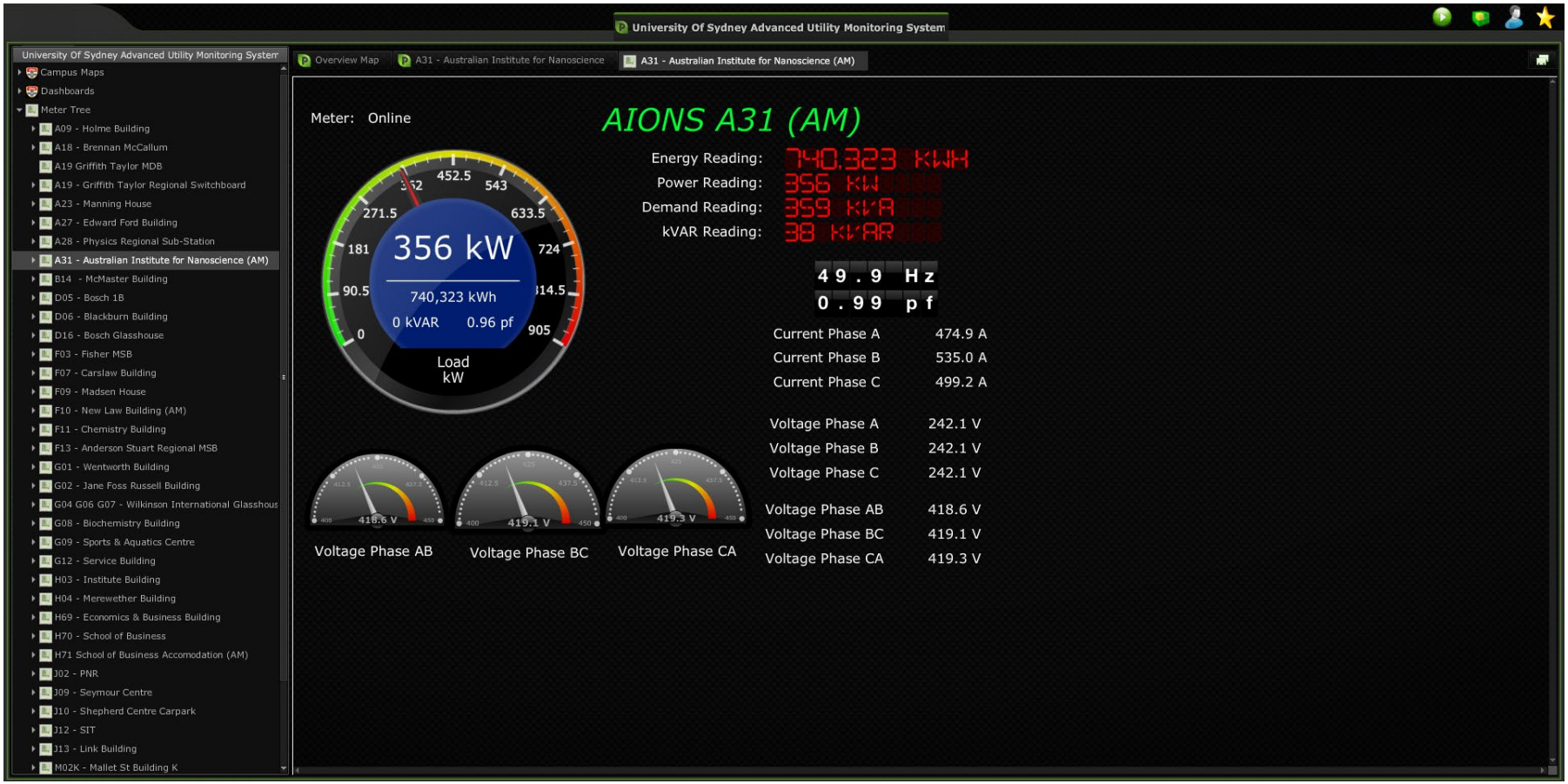
Date	AIONS_A31-Electrical Energy (kW	AIONS_A31-Electrical Power (kW)
3/06/2015 10:45:00 AM	71 kWh	274 kW
3/06/2015 11:00:00 AM	65 kWh	309 kW
3/06/2015 11:15:00 AM	68 kWh	211 kW
3/06/2015 11:30:00 AM	81 kWh	351 kW
3/06/2015 11:45:00 AM	75 kWh	270 kW
3/06/2015 12:00:00 PM	74 kWh	261 kW
3/06/2015 12:15:00 PM	73 kWh	317 kW
3/06/2015 12:30:00 PM	73 kWh	289 kW
3/06/2015 12:45:00 PM	65 kWh	305 kW
3/06/2015 1:00:00 PM	62 kWh	245 kW
3/06/2015 1:15:00 PM	63 kWh	268 kW
3/06/2015 1:30:00 PM	63 kWh	270 kW
3/06/2015 1:45:00 PM	63 kWh	250 kW
3/06/2015 2:00:00 PM	64 kWh	221 kW
3/06/2015 2:15:00 PM	64 kWh	219 kW
3/06/2015 2:30:00 PM	64 kWh	218 kW
3/06/2015 2:45:00 PM	65 kWh	271 kW
3/06/2015 3:00:00 PM	65 kWh	246 kW
3/06/2015 3:15:00 PM	64 kWh	269 kW
3/06/2015 3:30:00 PM	64 kWh	244 kW
3/06/2015 3:45:00 PM	65 kWh	288 kW
3/06/2015 4:00:00 PM	77 kWh	223 kW
3/06/2015 4:15:00 PM	79 kWh	279 kW
3/06/2015 4:30:00 PM	79 kWh	276 kW
3/06/2015 4:45:00 PM	79 kWh	349 kW
3/06/2015 5:00:00 PM	79 kWh	333 kW
3/06/2015 5:15:00 PM	78 kWh	363 kW
3/06/2015 5:30:00 PM	79 kWh	327 kW
3/06/2015 5:45:00 PM	78 kWh	337 kW
3/06/2015 6:00:00 PM	78 kWh	321 kW
3/06/2015 6:15:00 PM	78 kWh	316 kW
3/06/2015 6:30:00 PM	78 kWh	261 kW

METER STRUCTURE TAB

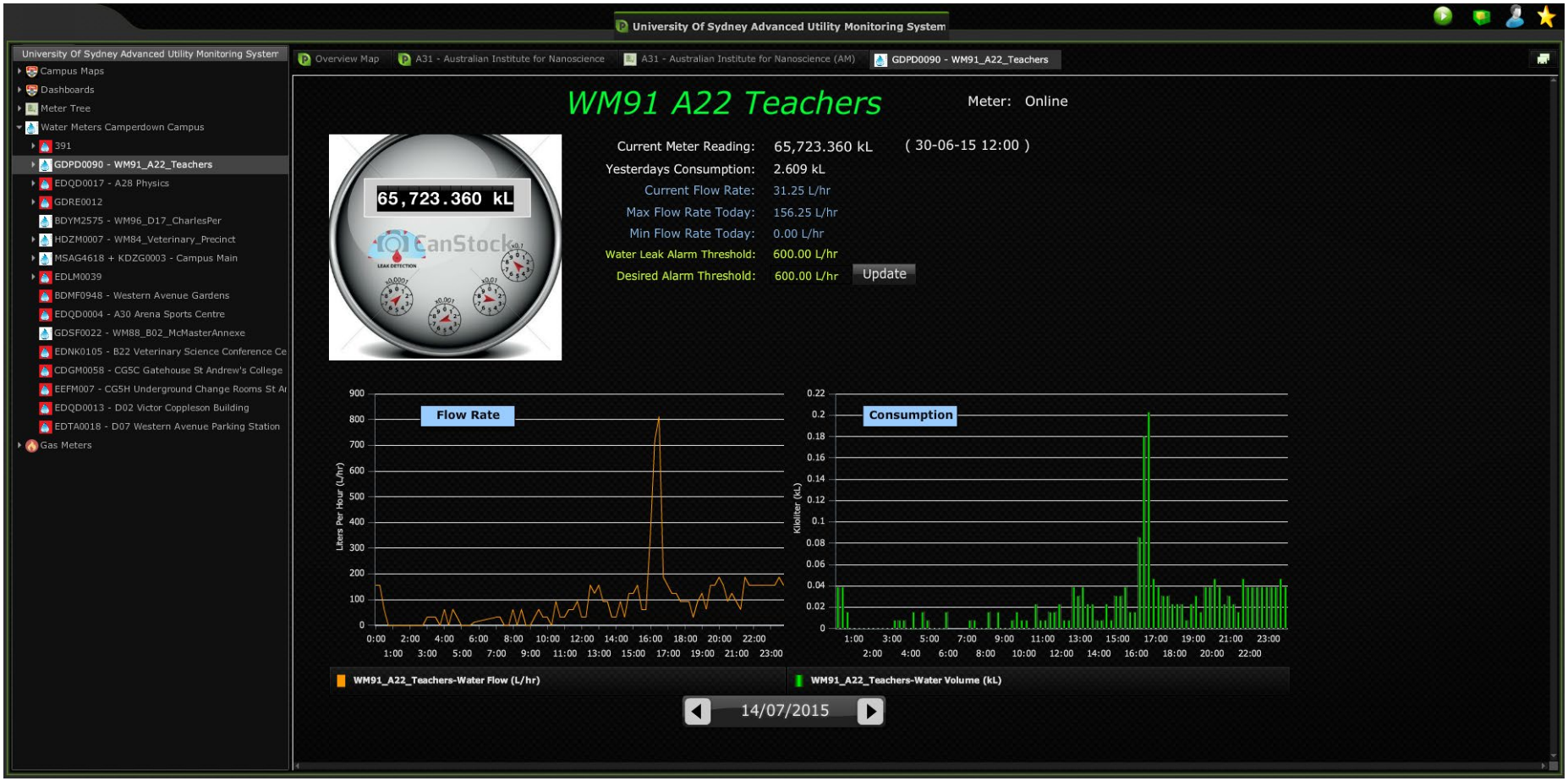


POWER AND ENERGY COMPARISONS TAB

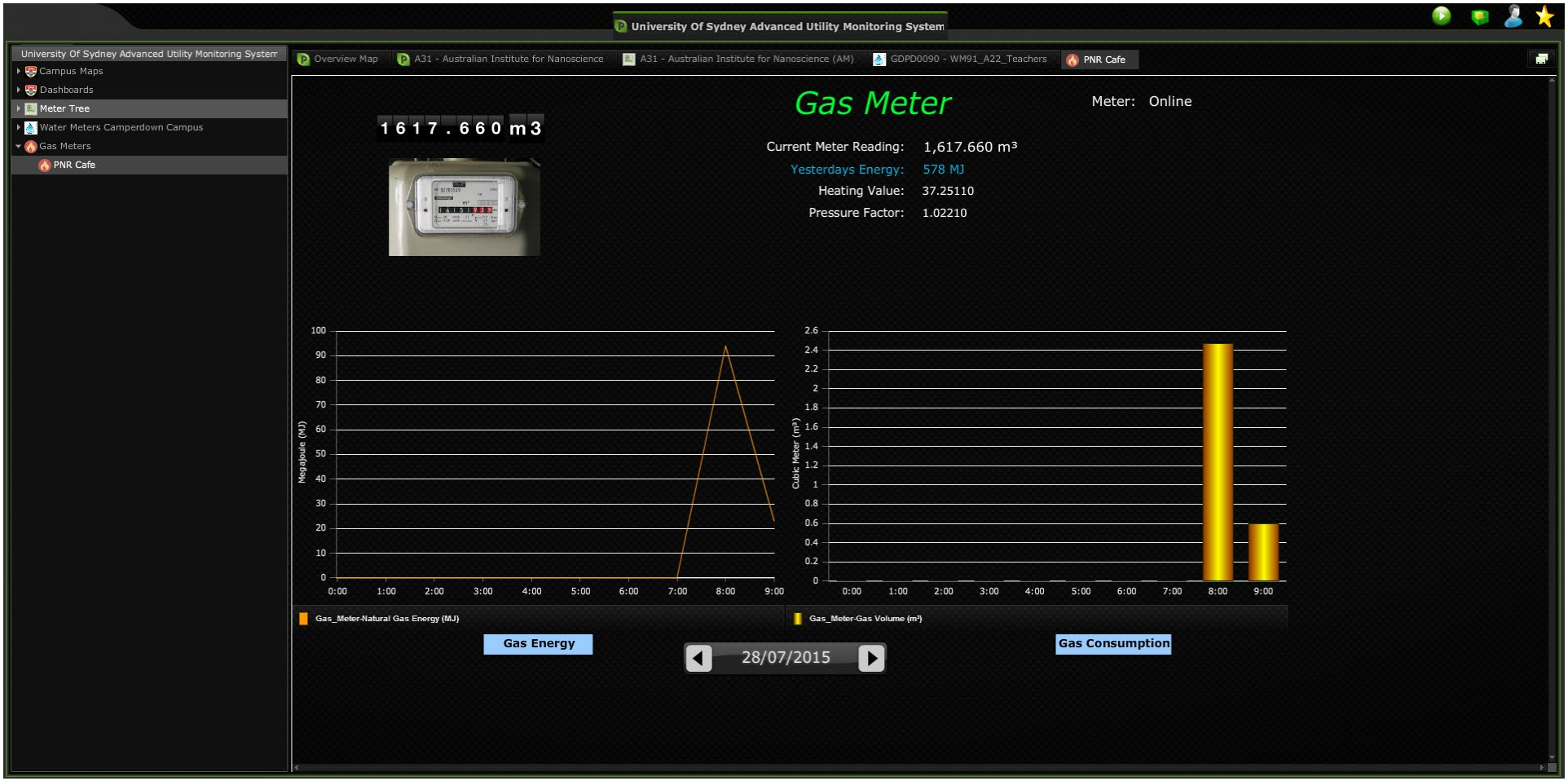
BUILDING ELECTRICAL METER TAB



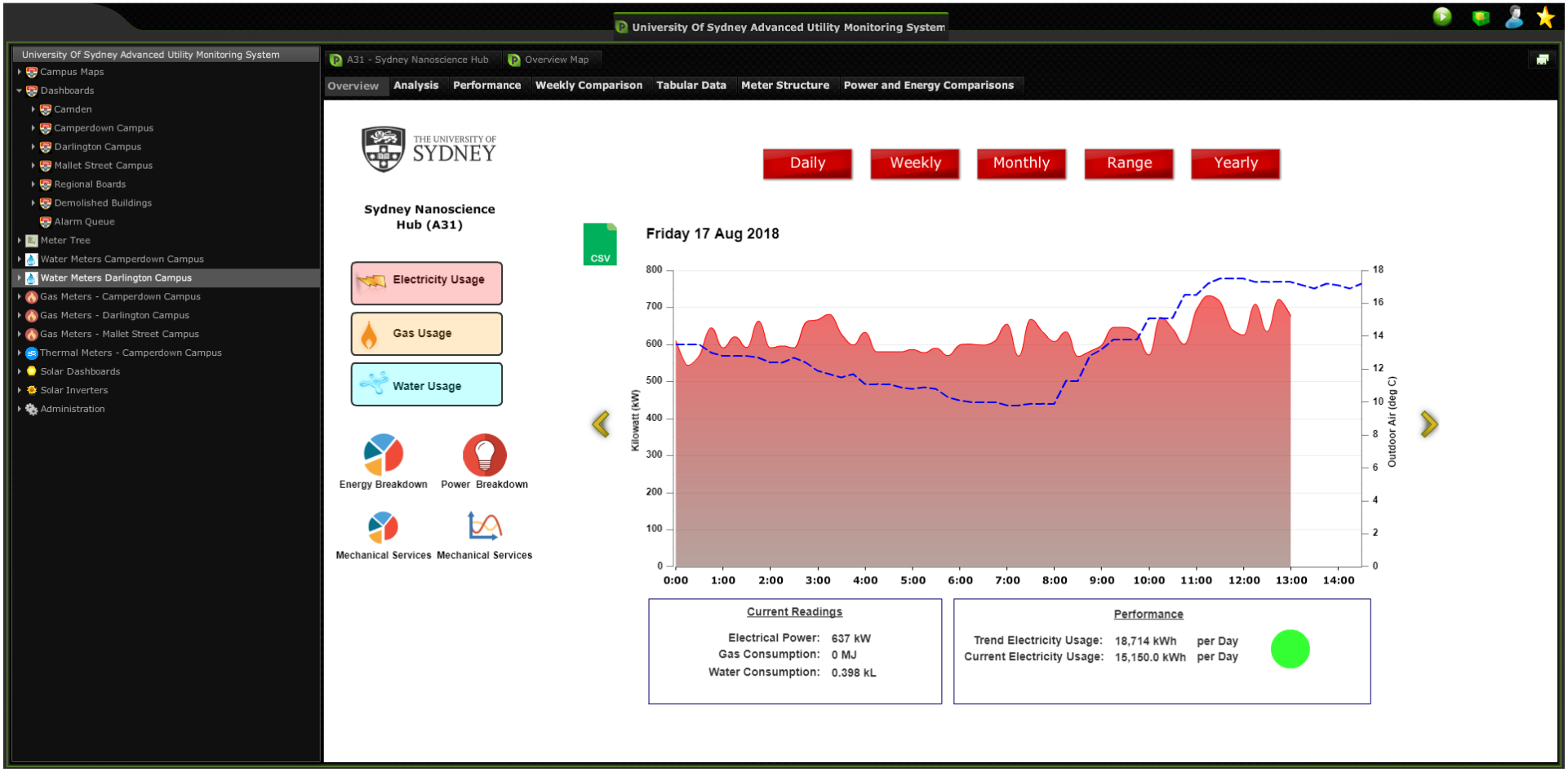
BUILDING WATER METER TAB



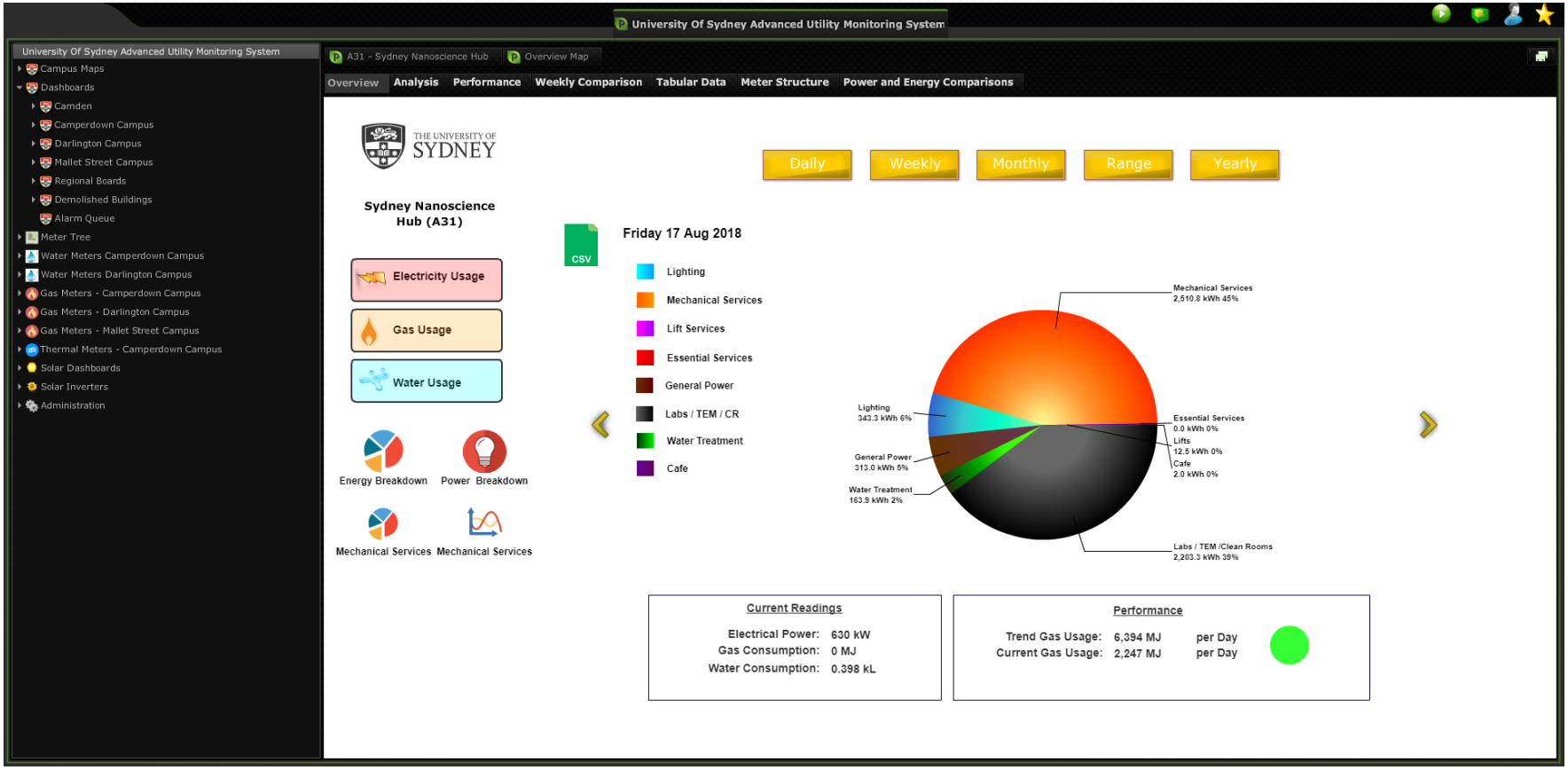
BUILDING GAS METER TAB



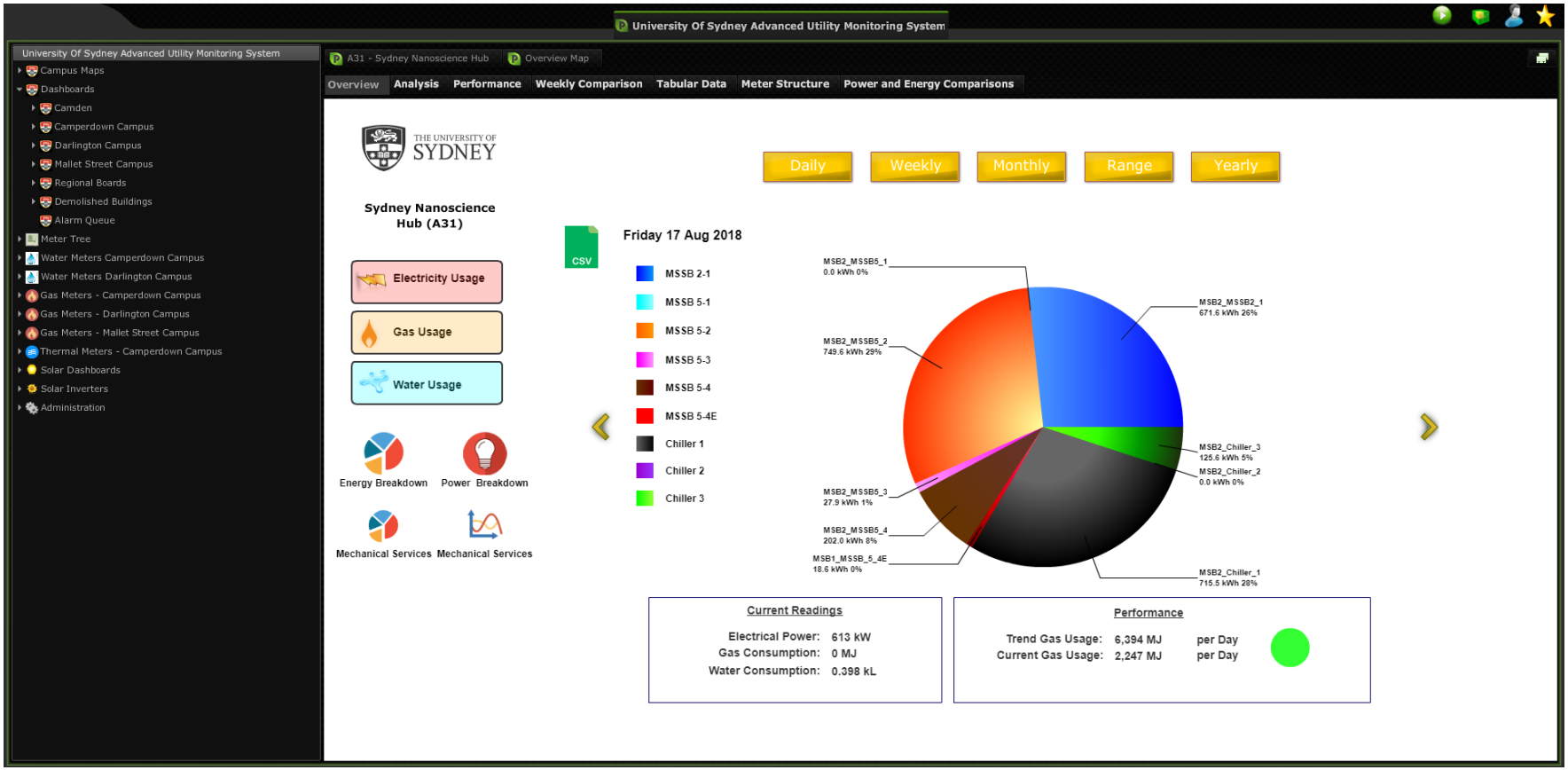
BUILDING SUMMARY DASHBOARD – FRONT PAGE/LANDING PAGE



BUILDING SUMMARY DASHBOARD - ENERGY BREAKDOWN SUMMARY

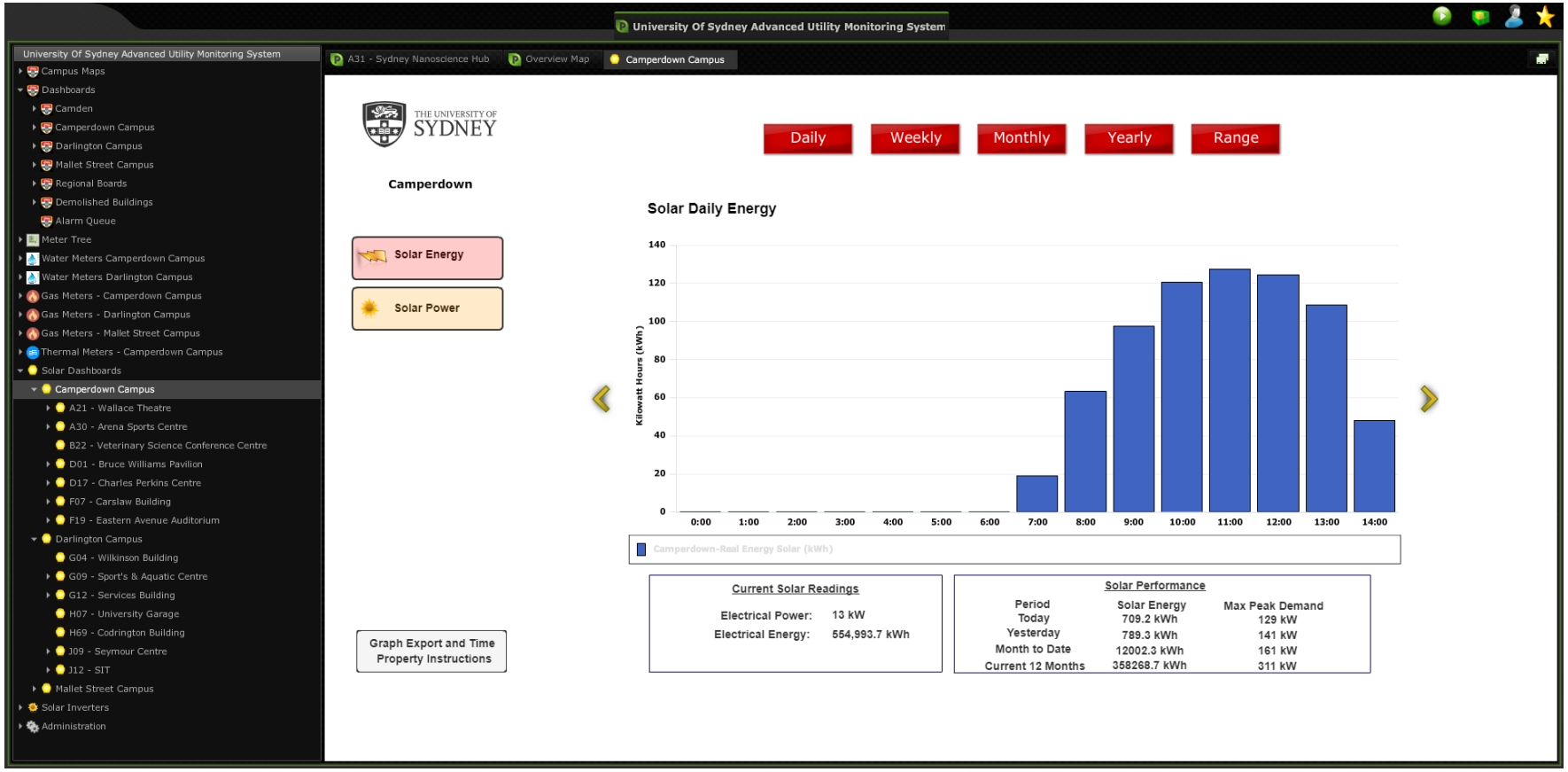


BUILDING SUMMARY DASHBOARD – MECHANICAL SERVICES BREAKDOWN SUMMARY

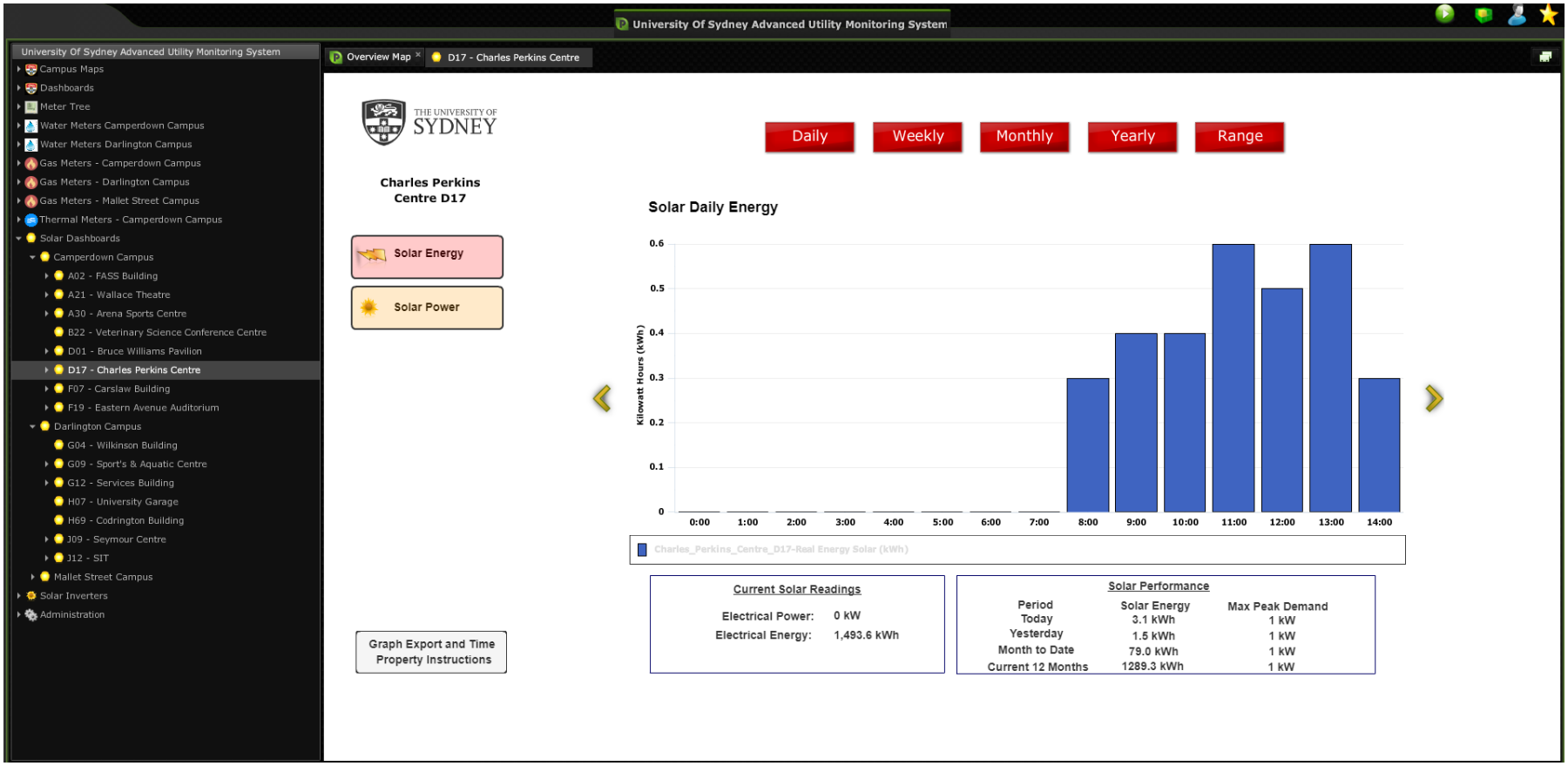


BUILDING SUMMARY DASHBOARD – MECHANICAL SERVICES BREAKDOWN SUMMARY OVER TIME

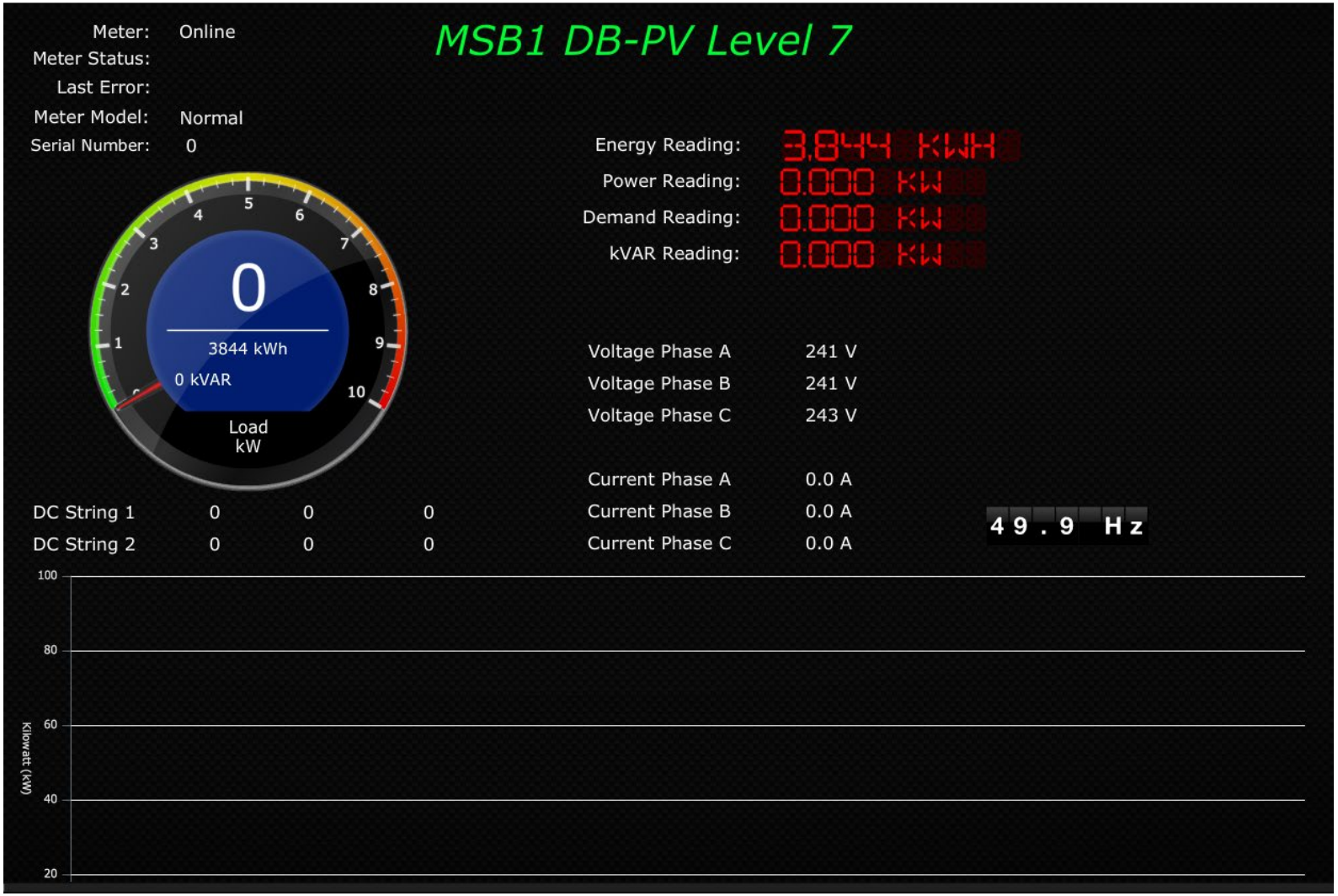
SOLAR DASHBOARD – CAMPUS SUMMARY



SOLAR DASHBOARD – BUILDING SUMMARY



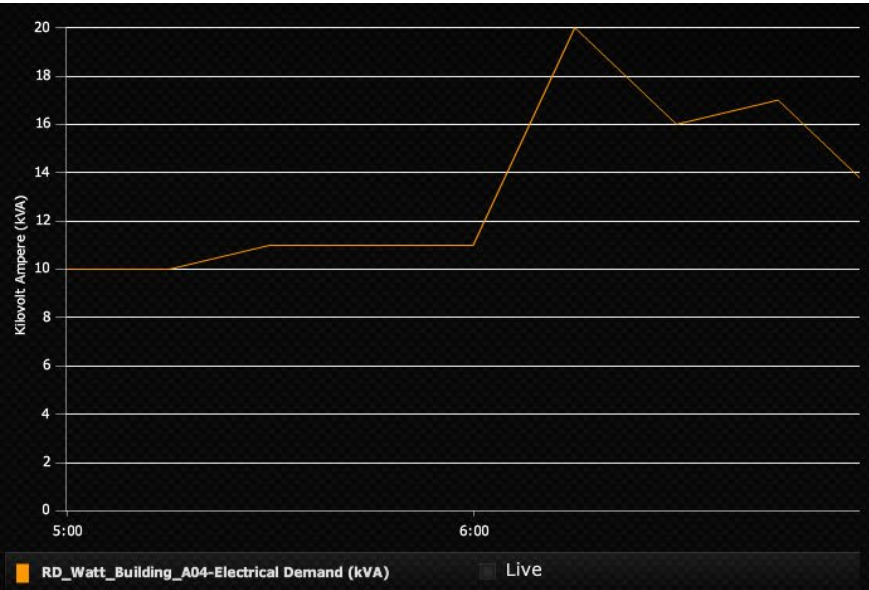
SOLAR INVERTER DASHBOARD



DEMAND MANAGEMENT DASHBOARD

Building	Current	Demand Level 1		Demand Level 2		Demand Level 3		
Fisher Library F03	305 kVA	800 kVA	Normal	850 kVA	Normal	1,050 kVA	Normal	Chart
Carslaw Building F07	172 kVA	300 kVA	false	400 kVA	false	500 kVA	false	Chart
AIONS A31	634 kVA	400 kVA	Load Shed	450 kVA	Load Shed	500 kVA	Load Shed	Chart
Anderson Stuart Building F13	156 kVA	350 kVA	Normal	400 kVA	Normal	450 kVA	Normal	Chart
Badham Building A16	79 kVA	200 kVA	Normal	250 kVA	Normal	870 kVA	Normal	Chart
Blackburn Building D06	0 kVA	240 kVA	Normal	250 kVA	Normal	300 kVA	Normal	Chart
Bosch 1B D05	113 kVA	300 kVA	Normal	751 kVA	Normal	801 kVA	Normal	Chart
Holme Building A09	62 kVA	250 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
Griffith Taylor Building A19	35 kVA	500 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
John Woolley Building A21	58 kVA	700 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
Madsen Building F09	0 kVA	702 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
Main Quad South A14	7 kVA	703 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
New Law Building F10	0 kVA	700 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
Old Teachers College A22	108 kVA	700 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
Pharmacy South MDB A15	0 kVA	700 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
Transient Building F12	0 kVA	700 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
RC Mills Building A26	22 kVA	100 kVA	Normal	150 kVA	Normal	200 kVA	Normal	Chart
Charles Perkins Centre D17	1,081 kVA	700 kVA	Load Shed	650 kVA	Load Shed	350 kVA	Load Shed	Chart
Administration F23	75 kVA	700 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
FASS A02	71 kVA	700 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
RD Watt A04	14 kVA	700 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart
LEES1 Building F22	217 kVA	700 kVA	Normal	750 kVA	Normal	800 kVA	Normal	Chart

NOTES:
1) A 10 minute delay is programmed between Demand Levels before a Demand Level is initiated.
2) Once initiated, Demand Levels have a 15 minute minimum time of operation



THERMAL METER DASHBOARD