VIDA Health

HTA: Energy and water metering

HTA-2026-002

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Purpose

This Health Technical Advice (HTA) provides guidance on how to implement effective energy and water metering systems within new and existing healthcare facilities.

This HTA is to be read in conjunction with the Guidelines for sustainability in health care capital works ('the Guidelines') and the Engineering guidelines for healthcare facilities.

This HTA supersedes the *Department of Health and Human Services (DHHS) Guidance note on implementing effective energy and water metering systems*.

Context

Understanding how energy and water are used within healthcare facilities is the first step in identifying system faults and opportunities to improve efficiency. Correctly designed, installed, and commissioned metering systems can accurately monitor energy and water consumption and usage trends from hospital campus level down to individual appliances.

Metering is one component of an integrated data monitoring system that provides the ability to process and combine information which can be used to optimise operational performance and provide valuable information for benchmarking and health infrastructure planning.

Beyond the site boundary, metering data is managed at the portfolio level by the Department of Health through the environmental data management system (EDMS). To ensure consistency in data capture across the health system, all Victorian public healthcare capital works must meet the requirements set out in this HTA.

All-electric policy

In compliance with the Victorian Government's 'all-electric' policy, new gas infrastructure will not be installed for public healthcare facilities, therefore information pertaining to gas metering in this guide is only applicable to facilities with existing gas infrastructure.

Benefits of metering healthcare facilities

Metering healthcare facilities has the following benefits that span the asset life cycle as well as providing insights into health infrastructure at portfolio level.

Operational analytics

- Commissioning and tuning: Continuous verification of building system operation provides data to assist with performance optimisation
- Monitoring equipment efficiency: Calculating and monitoring performance indicators, such as the Coefficient of Performance for a cooling system
- Identifying opportunities: Understanding which systems, ward, or individual items of equipment are consuming the most energy and water is important for identifying opportunities to improve efficiency, with metering data supporting return on investment calculations
- Measurement and verification: Confirmation that energy and water targets have been met in new builds and retrofit projects
- Demand response: Understanding what end uses drive peak demand can highlight opportunities for load shedding to reduce peak electrical loads and associated utility charges

- Consumption trends: Identifying changes in consumption trends can identify suboptimal operation or system faults and enable a proactive maintenance regime

Reporting

- Real time dashboards: Wall displays, websites and hand-held applications which use interactive and easily understood graphical interfaces to engage and inform building users
- Exception reporting: Automated notifications of failures or out of range performance can be sent as texts or emails to facility management staff or integrated with a computerised maintenance management system (CMMS) to trigger a maintenance response
- Management reporting: Automation of weekly, monthly, and annual[1] reports which document patterns of consumption and utility costs
- Performance benchmarking: Normalisation of energy and water consumption to allow comparison against benchmarks (e.g. predicted energy performance loads, NABERS Public Hospitals reverse calculator)
- Tenant energy and water cost recovery: Where space has been let to third parties, metering can provide an accurate means of apportioning energy and water costs based on actual tenant consumption

Health infrastructure planning

- Portfolio visibility: Across the health system, metering can identify which assets require investment due to lower performance and higher running costs
- Right-sizing: Understanding actual loads means when equipment is replaced, it's selection can be based on actual demand rather than a like-for-like approach, which can result in oversizing
- Electrification: Electrical and thermal metering can be used to better understand building and campus performance and assist with site electrification planning and implementation

Application of metering for healthcare facilities

Existing facilities

Existing facilities represent a high-value opportunity for metering retrofits. In many facilities, particularly those which predate NCC 2009 requirements for metering, there is often no metering system, or the installed metering system is inadequate to realise the benefits outlined above. Retrofitting meters can be challenging as there is often a lack of information on existing infrastructure or metering.

Based on the availability of existing conditions information, an audit of existing assets may be required to determine appropriate and relevant scope of works for an upgrade project.

Further advice for implementing metering systems in existing facilities is provided in **Appendix 2**.

Capital works projects

In capital works projects, energy and water metering and monitoring is required by the Guidelines as a business-as-usual (BAU) requirement, including development of a metering and monitoring strategy, 'Good practice'

[1] Most public health services must report against *Financial Reporting Directive 24: Reporting of environmental data by government entities*. See https://www.dtf.vic.gov.au/financial-reporting-directions-and-guidance.

metering, and requirements around data monitoring and reporting. These requirements are outlined in more detail in the subsequent sections.

Cost effectiveness

Although metering systems represent an additional cost, they provide the information necessary to improve the performance of new and existing buildings, as well as assisting in the planning of future works. Monitoring-based commissioning, which relies on the use of meters to allow for continuous tracking of energy data for maintaining and improving facility energy performance, has been demonstrated to be highly cost effective.

Metering and monitoring strategy

To ensure a project-specific and integrated metering and monitoring approach that meets stakeholder requirements, the Guidelines require projects to develop a metering and monitoring strategy. The metering strategy should be developed early in the design process and the refined throughout the design phase. The strategy should include the following as a minimum.

Objectives

Describe what the metering and monitoring system is intended to achieve, including compliance with relevant codes and standards, integration with new and existing systems, and to enable operational analytics and reporting.

Stakeholder requirements

Map the relevant stakeholders including the facility owner, end users, reporting bodies, design team, subject matter experts, and the commissioning team. Establish stakeholder data needs and reporting requirements to ensure these are captured in the system design.

Metering scope and hierarchy

Develop a metering strategy and schematic that includes all agreed metering requirements.

Monitoring and data collection approach

Describe details such as the meter type and accuracy requirements, interval data requirements, communications protocols, integration with monitoring platforms, data storage and backup.

Analytics and reporting

Define how the collected data will be utilised, such as building performance dashboards, trend analysis, exception reporting, performance KPI’s, monthly and annual reporting, commissioning and tuning, and fault detection. Also consider if analytic and building optimisation platforms are preferred by the operator.

Commissioning and validation

Outline requirements for metering labelling, commissioning and validation, and as-built documentation.

Futureproofing

Where relevant, ensure that the metering and monitoring system is futureproofed for building expansion, electrification of existing equipment, additional future submeters, electric vehicle charging, and renewable energy systems.

Handover requirements

Define any specific handover requirements such as built and validation information, operator training and associated artifacts, and periodic calibration and maintenance requirements.

Metering and monitoring requirements

All Victorian public health capital works projects must comply with the metering and monitoring requirements outlined in the following section.

National Construction Code (NCC)

At the time of publication, *NCC 2022 (Volume 1) Section J Part J9 Energy monitoring and on-site distributed energy resources* includes requirements for energy monitoring under *Part J9D3 Facilities for energy monitoring* and forms the minimum regulatory requirements for building metering coverage and data monitoring in Victoria.

Table 1: NCC 2022 Section J metering requirements

Floor area	Requirements
>500m^2	Metering required to record time-of-use consumption of gas and electricity
>2,500m^2	Metering required to record individually the energy consumption of the following end uses: • air-conditioning plant including, where appropriate, heating plant, cooling plant, and air handling fans • artificial lighting • appliance power • central hot water supply • internal transport devices including lifts, escalators and moving walkways where there is more than one serving the building • on-site renewable energy equipment • on-site electric vehicle charging equipment • on-site battery systems • other ancillary plant Energy meters must be interlinked by a communication system that collates the time-of-use energy data to a single interface monitoring system where it can be stored, analysed, and reviewed.

‘Good practice’ metering

‘Good practice’ metering is a business-as-usual (BAU) requirement in the Guidelines and is intended to meet the balance of front-end metering and back-end data management.

Good practice metering includes:

- Requirements regardless of building size
- Additional metering granularity compared to NCC Section J
- Metering of major energy consuming equipment
- Metering of water end-uses
- Metering of tenancies

Appendix 1 provides full details on the 'good practice' metering requirements.

Additional metering opportunities that exceed the 'good practice' requirements (for example thermal metering of ward-level chilled and heating use) may be identified during the project design phase or be required by the health service (the operator). For capital works following the Guidelines, the cost of additional metering above 'good practice' may be supported by the project 2.5% sustainability budget.

Australian Standards

Meters are covered by Australian standards which specify aspects of metering such as accuracy, safety, reliability, and testing. The relevant standards include:

- AS 62052.11 (2023): Electricity metering equipment - general requirements, tests, and test conditions
- AS 60044: Instrument transformers
- AS 3565.1 (2010): Meters for cold and heating drinking and non-drinking water supplies.

NABERS

Victorian public hospitals and aged care facilities may be rated under the National Australian Built Environment Rating System (NABERS) energy and water schemes. NABERS has specific requirements around metering accuracy, reporting boundaries (e.g. exclusion of electric vehicles), commissioning, and validation for non-utility meters.

Public hospitals and aged care facilities which are eligible for a NABERS rating must follow the requirements of *NABERS The Rules - Energy and Water for Public Hospitals*[2], and the *NABERS Metering and Consumption Rules*[3].

Solar PV metering

Metering of all solar PV installations (and other behind the meter renewable energy sources) is required by the NCC. The project team should confirm if the electricity network provider requires any specific requirements such as the installation of generation metering modules.

For all embedded generation systems 100 kW or over that claim Large-scale Generation Certificates (LGCs), metering and data storage must comply with Clean Energy Regulator (CER) requirements and these systems require ongoing management by the operator to create and manage LGCs[4].

[2] https://www.nabers.gov.au/ratings/spaces-we-rate/public-hospitals

[3] https://www.nabers.gov.au/publications/metering-and-consumption-rules

[4] https://cer.gov.au/schemes/renewable-energy-target/large-scale-renewable-energy-target/large-scale-generation-certificates

Additional voluntary frameworks

Green Star

If a VIDA Health project is benchmarking against Green Star, or undertaking a certified rating, then the metering and monitoring system must meet the requirements in the Green Star submission guidelines in addition to requirements outlines in this HTA.

International Performance Measurement and Verification Protocol

The International Performance Measurement and Verification Protocol (IPMVP) define a methodology for quantifying the energy savings resulting from energy efficiency projects and has been widely adopted internationally as the industry standard approach to measurement and verification (M&V).

It is commonly used in energy performance contracts (EPCs) where financing is contingent on a robust and objective method for determining the energy and water savings resulting from equipment and facility upgrades. The IPMVP provides several options for calculating energy savings which include field measurements of isolated systems, whole facility metering or use of a calibrated energy simulation model.

Where an EPC is implemented on an existing facility, it is generally necessary to exclude any recently built facilities from the baseline, thereby requiring new facilities to be adequately sub-metered.

Reporting

The Guidelines require that metering is installed and commissioned to report to the building management system (BMS) or a dedicated monitoring platform in the engineering or facilities management office (or both). Also, the system must be able to provide real-time notifications to engineering or facilities management personnel (or both) of use outside abnormal parameters.

EDMS

The Department of Health administers a web-based environmental data management system (EDMS). This is an integrated system where metering data and other operational performance information is managed for the Victorian public health portfolio. The EDMS enables benchmarking of asset performance for resource and cost management and is used to meet annual reporting requirements by health services and the Department of Health.

The Department of Health must be notified of all new assets so that the EDMS is correctly set up and configured for data assignment. The template for EDMS asset registration can be found in Appendix 4 of the Guidelines and is a requirement for project teams to provide at practical completion.

Additionally, the Guidelines require that installed solar systems are configured for automatic export of generation data to the EDMS. Requirements for data export can be found in Appendix 6 of the Guidelines and is a requirement for project teams to evidence at practical completion.

Appendix 1 – Metering applications

(Note: multiple entities and tenancies must be metered separately)

Metering Scope	NCC	Good Practice	Recommendations and opportunities
Energy			
General lighting	✔	✔	Floor by floor metering, or by functional area, may be considered.
Appliance power	✔	✔	Floor by floor metering, or by functional area, may be considered. Equipment uses that exceed 100kVA.
Air handling system	✔	✔	Air handling plant – meter as a group. Fan coil systems – meter as a group.
Lifts, hoists, and escalators	✔	✔	Meter as a group.
Carpark (ventilation, power, and lighting)			Limit metering to carparks with at least 20 car spaces.
Carpark (electrical vehicles)	✔	✔	Separately meter EV or allow space for metering if there is future provision.
Chilled Water Plant	✔	✔	Separately meter chillers and cooling towers / heat rejection plant. Separately meter pumps which exceed 20kVA.
Heating Hot Water Plant	✔	✔	Separately meter hot water generators. Separately meter pumps which exceed 20kVA.
Domestic hot water plant	✔	✔	Separately meter boilers. Separately meter pumps which exceed 20kVA.
Energy generation plant such as diesel generators, solar PV, etc.	✔	✔	Separately meter each generation plant.
Solar PV		✔	Energy generation data to be set-up to automatically report to the EDMS.
Large energy intensive engineering system uses (>100kVA)		✔	Meter all end uses which exceed 100kVA.
Communication Room/ Data centre power		✔	Separately meter communication rooms or data centres which exceed 20kVA.
Steam system		✔	Separately meter by end use to facilitate identification of inefficient operation or system leaks.

Metering Scope	NCC	Good Practice	Recommendations and opportunities
Technical compressed air system		✔	Separately meter to facilitate identification of system leaks.
Small energy uses (i.e., security, fire boards etc)			Avoid meter end uses which are less than 20kVA.
Electrical reheat (existing only)			Avoid meter end uses which are less than 20kVA.
Water			
Rainwater reuse		✔	Meter rainwater tanks as a group.
Recycled water (grey/black water treatment)		✔	Separately meter all treatment systems.
Fittings and fixtures		✔	Floor by floor metering, or by functional area, may be considered.
Heat rejection system / Cooling tower system		✔	Meter make-up water use for the heat rejection / cooling tower system.
Laundry facilities		✔	Meter all laundry facilities.
Renal dialysis		✔	Meter all end uses.
Fire system water			Meter all fire systems that contain a fire pump room.
Hydrotherapy Pools			Meter the make-up water consumption.
Irrigation			Meter only where there is a large area of landscaping requiring irrigation.
Solar domestic hot water			Do not meter unless there is a specific project requirement.
Kitchenettes			Do not meter unless there is a specific project requirement.
Cogeneration/Trigeneration (existing systems only)			
Fuel consumption		✔	Meter gas, electricity, heating hot water and Chilled Water (CHW) in the case of tri-generation to estimate plant efficiency.
Ancillary plant energy consumption (e.g., heat rejection and ventilation)		✔	
Generated electricity		✔	
Generated heating hot water and/or steam		✔	
Generated chilled water (Trigeneration only)		✔	

Appendix 2 - Implementing metering in existing buildings

Implementing an effective metering system in existing facilities can be challenging due to the configuration of existing services, and a lack of information identifying the layout of services. This can increase metering system costs and make separation of some types of energy use consumption more difficult. However, these challenges can generally be overcome, and the investment is typically justified due to the potential for energy and water savings.

Mixed lighting and power boards

Mixed light and power switchboards (rather than separate) are common, particularly in older buildings, and can make it difficult to segregate lighting and power consumption. In these cases, independent metering of lighting and power would require individual sub-meters for each lighting and power circuit, or replacement of the switchboard. The most cost-effective approach is to meter the complete board and estimate the relative contribution from lighting and power based on an assessment of loads and operational hours.

For example, if a particular board is serving an area with 10 x T5 fluorescent lights (28W each) that operate for 12 hours daily, the lighting contribution to the switchboard energy may be estimated by calculating the annual lighting consumption (10 x 28W x 12h x 365 days). The power component can be estimated by subtracting the lighting consumption from the total energy consumption measured at the switchboard. Another alternative approach may be the apportioning of the total energy of board by functional floor area, which is a form of virtual metering.

Shared central mechanical plant

A healthcare campus may include multiple buildings which are served by a common central mechanical plant resulting in the individual energy consumption for each building is not available. The recommended approach in this situation is to retrofit thermal meters into the chilled water or hot water loops servicing each building. The amount of gas or electricity used to condition each individual area can be apportioned based on an assessment of the average thermal load of the mechanical plant for the studied area as a portion of total thermal load (applied to an estimate of operational hours). The cost of installing a thermal meter is often not justified for smaller buildings with limited heating and cooling demand and in this case virtual metering may be an appropriate solution.

Insufficient as-built information

Successive capital improvements can add considerable complexity to building services infrastructure which is not always adequately represented in as-built services drawings. Documentation may not be up to date or may contain gaps so the services infrastructure may be poorly understood.

This is particularly the case with HVAC ductwork and water piping, making it problematic to isolate and meter certain energy and water end uses. In these cases, on-site investigations, surveys, and testing are recommended to confirm the configuration and operation of the network.

The layout of water piping can be investigated by observing the impact of opening and closing taps and valves. Additional metering may be necessary to determine the layout of electrical and gas systems however this can be achieved by using temporary meters to reduce costs.

Electrification planning

Electrification of existing health sites can enhance energy resilience, mitigate future gas reliability risk, and contribute to Victoria's broader emissions reduction commitment of net zero carbon by 2045.

For health sites planning for electrification, installation of metering and monitoring can provide essential data to support the design process, such as real-world heating and cooling demand data which enables the right sizing of equipment.

Typically, a full heating and cooling season of data is required to ensure peak demands are captured, therefore metering should be installed as early as possible, with granular trend data that is stored for the required timeframe.

Required metering should be determined through an initial electrification feasibility study undertaken by a qualified consultant team, and in consultation with VIDA Health and the site operations team.

Appendix 3 - Metering technologies and communication protocols

Meters are not a new technology however they are becoming increasingly sophisticated to improve accuracy, remote access, reliability and to integrate with real time tracking and reporting software platforms.

Technologies

The common types of meters are electricity, gas, water, and thermal energy. Thermal energy meters provide flow and temperature differential measurement and are often used on heating and cooling plant to monitor efficiency.

Examples of typical meters

Electricity Meter

Source: Schneider

Water Meter

Source: SpireMT

Gas Meter

Source: Accutherm

Thermal Mass Flow Meter

Source: ABB

Accuracy

Meters should be specified to provide a level of accuracy appropriate to the application. If data is used for cost recovery (i.e. a health facility tenant is being billed) meters must be a 'Pattern' approved meter under the National Measurement Institute (NMI). The NMI provides information on mandatory trade measurement laws and approval requirements for utility meters.

Communication protocols

Meters need to be connected to a data collection device to enable automated meter reading and reporting and must be configured per the intended end use.

Regular interval data can produce profiles that provide valuable feedback information such as the influence of the time of day on usage. Several standardised metering communications protocols have been widely adopted by industry.

The most common protocols include pulse, Modbus RS485, BACNet, ethernet, GSM (i.e., via a Telco mobile network), and low powered radio mesh. Open protocols are recommended to avoid reliance on a particular system or supplier. Electricity meters can be sourced with any of the above communication protocols. The recommended protocol in most cases is Modbus RS485 as this is still the most widely supported within the buildings and control industry.

Water and gas meters are typically less sophisticated and provide only a pulse output, which requires careful attention during set-up. The pulse 'shape' needs to be clearly read by the collection system, and the pulsing frequency should provide an adjustable and appropriate level of accuracy and resolution (fewer pulses per minute means a lower level of data resolution).

Thermal meters generally use an electronic device to convert their specific communication protocol (Mbus) to Modbus, which enables them to 'talk' in the same language as the rest of the meters. Data storage provides an important means of preserving metering data when communications are interrupted. Electricity meters can be specified with on-board memory storage however pulse meters require a separate data logger with storage capability.

Data Collection Systems

Data collection systems for metering networks can be hosted via on-site computers or within a remote cloud-based computing network. On-site systems include building management systems (BMS) and energy/water monitoring systems (EMS). Cloud based systems are becoming increasingly common due to the greater security capacity and utility they provide with respect to data management and analytics.

Virtual Metering

A virtual meter is created by combining or subtracting readings from new or existing meters. For example, if the electricity use of a ward is metered, and within the ward the communication room is separately metered, the power consumption of the ward equipment can be described as the total ward electricity consumption minus the communication room consumption. Another example of virtual metering is apportioning total energy or water use by functional floor area however this is typically only appropriate for areas of similar use.

The use of virtual maters can reduce the number of physical submeters required and the associate cost and maintenance. VIDA Health permit virtual metering for general consumption calculations, however, in some cases virtual metering does not meet relevant standards, such as for the measurement of deductable end uses from a NABERS rating, and therefore its application needs to be reviewed against all project requirements.

Building Management System (BMS)

Most existing buildings rely on some form of BMS for automation of building systems, and in most cases this system can be expanded to collect the data from meters and facilitate the generation of reports and spreadsheets. A BMS is typically effective for automation of building systems (as per the original intent of the BMS) but less effective for data visualisation and analysis, so capabilities and limitations should be identified for each project by qualified designer and/or contractor so that the solution can be tailored to the stakeholder needs and available budget.

Web/cloud-based system

These systems include some hardware to collect the data delivered by meters and upload it to the "cloud". Cloud-based systems can provide a higher degree of flexibility as they are often designed to be "technology agnostic" meaning that they can incorporate data from different types of proprietary BMS as well as other types of sustainability metrics such as waste generation.

A cloud-based system is well suited to situations where there are multiple buildings or campuses which need to be integrated into a single reporting system.

Data from utility smart meters

Electricity utility smart metering data can be read by Metering Data Agencies, using wireless "Radio Frequency" technology. The metering data can then be exported into a software platform to provide a site-wide platform that contains utility and sub-metering data.

Commissioning of metering systems

Metering systems should always be properly commissioned to validate correct installation and operation. Metering problems can easily go undetected for long periods of time when commissioning is not performed. Meters in new capital works projects are included in the normal commissioning process, however, the use of an independent commissioning agent (ICA) to oversee the commissioning process is recommended. An ICA may be engaged during the design process to review the metering strategy and confirm that the metering locations are appropriate for commissioning and maintenance access, and all components of the metering systems have been correctly specified.

Validation of meters should be performed by a specialist following initial installation and then whenever the metering system is altered or at a maximum interval of every 10 years. To assist with this validation a metering management plan should be established which should:

- uniquely identify each applicable metering system
- show the details of the last validation check for that metering system (if any)
- nominate the date by which the next regular validation check for that metering system should be completed
- record the validation of any altered metering systems
- type of area the meter is connected to.

The process for validating meter readings is the latest version of the *NABERS Metering and Consumption Rules*[5]. As part of the commissioning and validation process, it is recommended that the facility manager should have all single-line diagrams and metering schematics updated and verified to reflect the current meter coverage locations. These should be updated continuously to reflect any future upgrade works.

Resources

VHBA guidelines

Guidelines for Sustainability in Health Care Capital Works <https://www.vhba.vic.gov.au/sites/default/files/2021-10/Sustainability-guidelines-for-capital-works-VHBA-Revised-October-2021.pdf>

VHBA engineering guidelines for healthcare facilities <https://www.vhba.vic.gov.au/engineering-guidelines-healthcare-facilities>

Other guidelines and standards

NCC 2022 Volume One <https://ncc.abcb.gov.au/editions/ncc-2022/adopted/volume-one/preface/copyright-and-licence-notice>

Australian Standards (AS 62052.1, AS 60044.1, AS 3565.1) < http://www.standards.org.au/>

[5] https://www.nabers.gov.au/publications/metering-and-consumption-rules

Department of Health Environmental data management tools < https://www.health.vic.gov.au/planning-infrastructure/environmental-data-management-tools>

NABERS for Public Hospitals < https://www.nabers.gov.au/sites/default/files/2022-12/Fact%20Sheet%20-%20Public%20Hospitals.pdf>

NABERS Metering and Consumption Rules <https://www.nabers.gov.au/publications/metering-and-consumption-rules>

International Performance Measurement and Verification Protocol (IPMVP) < http://www.evo-world.org/>

NITP 14 (National Instrument Test Procedures for Utility Meters)
<https://www.nabers.gov.au/publications/metering-and-consumption-rules>

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