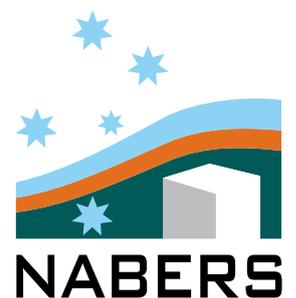


NABERS Energy for data centres

# Rating Your Data Centre Energy



A guide for data centre  
owners, managers and tenants



## About this Guide

This guide is for data centre owners, managers and tenants who are responsible for data centres and wish to understand more about managing and improving the energy efficiency of the data centres they control.

It describes the differences between the three NABERS Energy for data centres rating tools, explains the factors considered in the star rating calculations and details the rating assessment process.

For more information on the NABERS Energy for data centres rating tools, contact the NABERS team on: 02 9995 5000 or [nabers@environment.nsw.gov.au](mailto:nabers@environment.nsw.gov.au)

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Published by:

Office of Environment and Heritage

59 Goulburn Street, Sydney NSW 2000

PO Box A290, Sydney South NSW 1232

Phone: (02) 9995 5000 (switchboard)

Phone: 131 555 (environment information and publications requests)

Phone: 1300 361 967 (national parks, climate change and energy efficiency information, and publications requests)

Fax: (02) 9995 5999

TTY users: phone 133 677 then ask for 131 555

Speak and listen users: phone 1300 555 727 then ask for 131 555

Email: [info@environment.nsw.gov.au](mailto:info@environment.nsw.gov.au)

Website: [www.environment.nsw.gov.au](http://www.environment.nsw.gov.au)

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ISBN 978 1 74293 787 8

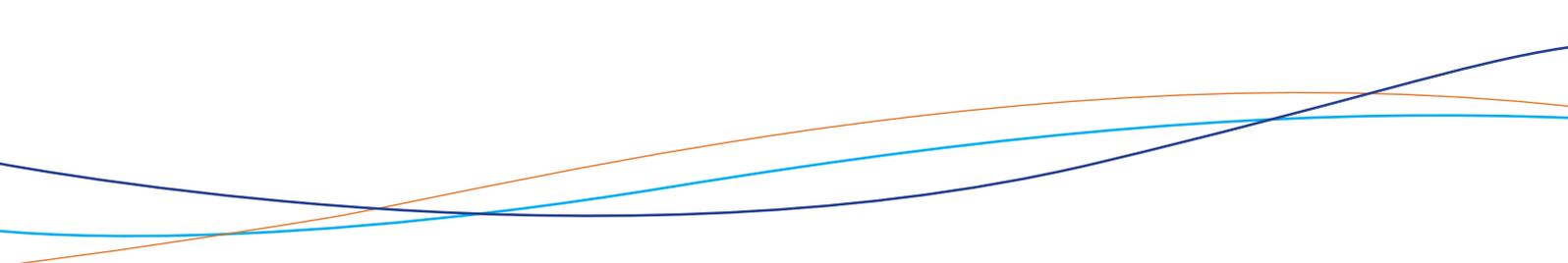
OEH 2012/0710

December 2012

Printed on environmentally sustainable paper

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# 1 Responding to industry needs

The last decade has seen a rise in online connectivity that has revolutionized everyone's business and social lives.

It is estimated that due to new people connecting to the internet, an increased demand for more and higher quality data, and an increase in smart phone activity, internet traffic in Australia will grow 36% per year. Based on this, we can expect that in 2016 internet usage will be nearly five times that of 2011.<sup>1</sup> As the volume of traffic increases, so will our need for data centres to process and store data.

While reliability and speed of access to data will remain the major concerns for those involved with data centres, energy efficiency and ICT sustainability are increasing as a priority.

Most companies have server and data storage equipment, whether hosted internally or offsite. But how many companies are aware of the amount of energy their IT equipment consumes or what it is costing annually? And how many companies know how to obtain the information required to make a business case for energy efficiency upgrades, which could save on annual operational costs and reduce carbon emissions? According to Fujitsu's 'ICT Sustainability: The Global Benchmark 2012' report, only 8.7% of Australian organizations budgeted for ICT power bills or took direct responsibility for their energy consumption.<sup>2</sup>

Further, national and international research on data centre energy efficiency has highlighted a lack of clear and consistently accepted metrics or means of measuring, reporting and comparing the energy efficiency of data centres as a whole. Without such metrics to benchmark performance it is impossible to compare the energy efficiency of one data centre with another.



Data centres are one of the most intensive greenhouse gas (GHG) emitters in the built environment and are estimated to consume 2% of the world's energy. In 2006–07, data centres were responsible for consuming 2 to 3 billion kilowatt hours (kWh) of electricity, or 1.5% of Australia's total annual energy.<sup>3</sup>

To address this gap and respond to the increasing energy consumption as a result of Australia's rapidly growing technology sector, the NSW Office of Environment and Heritage in collaboration with the Australian Government Department of Climate Change and Energy Efficiency (DCCEE) developed a set of tools within the industry respected NABERS rating system, to rate the energy efficiency of data centres.

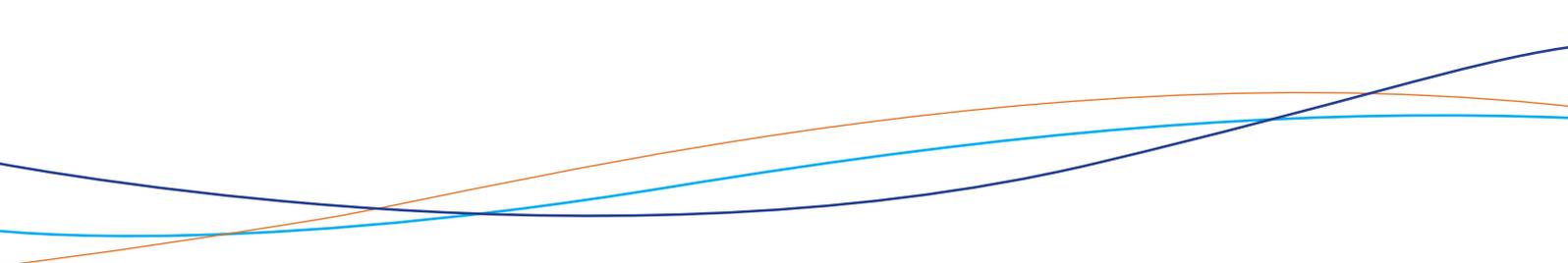
The NABERS suite of tools provides a common language for energy efficiency in commercial buildings that is now widely recognised by industry. It is hoped that the new NABERS Energy for data centres rating tools will provide a common language to facilitate a clearer understanding between those working within the data centre and energy efficiency industries and the wider business community.

The NABERS Energy for data centres rating tools offers three tools to measure and benchmark the IT equipment, infrastructure services and whole data centre.

<sup>1</sup> Cisco Visual Networking Index (VNI) White Paper - May 30 2012  
[http://www.cisco.com/web/solutions/sp/vni/vni\\_forecast\\_highlights/index.html](http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html)

<sup>2</sup> Fujitsu, 2012, ICT Sustainability: The Global Benchmark 2012

<sup>3</sup> Johnson, P. & Marker, T. of Pitt and Sherry (2009) Data Centre Energy Efficiency Product Profile, prepared for Equipment Energy Efficiency Committee.



## 2 About NABERS

The National Australian Built Environment Rating System, NABERS, is the industry standard for measuring and benchmarking the environmental performance and efficiency of existing Australian buildings.

NABERS is managed nationally by the NSW Office of Environment and Heritage (OEH) on behalf of the Australian national, state and territory governments and has been operating for over 12 years.

### 2.1 NABERS goal

The goal of NABERS is to encourage innovation and best practice in environmental performance within the commercial built environment, leading to improved outcomes such as:

- > reduced energy consumption
- > lower greenhouse gas (GHG) emissions
- > reduced water consumption
- > less waste, and
- > better working environments.

NABERS provides an accurate, comparable measure of the operational performance of various types of buildings. It does this by measuring energy and water efficiency, indoor environment quality and waste recovery. The level of performance is expressed as a NABERS star rating, which is valid for one year.

### 2.2 What do the NABERS stars mean?

NABERS rating tools measure environmental performance on a scale of 1 to 6 stars. Three stars represent market median performance and a 6-star rating demonstrates market-leading performance. A 1-star rating represents below median market practice and indicates that there is considerable scope for improvement.

A NABERS Energy rating provides an industry recognised benchmark upon which companies can make informed decisions for improving their energy efficiency.



The NABERS suite of performance-based rating tools are now widely recognised by industry.

NABERS Energy for data centres converts the energy consumed by the data centre to full fuel cycle greenhouse gas emissions (i.e including the emissions from energy that is lost through transmission and distribution losses) and uses them to benchmark its energy performance. Ratings may be improved by either reducing the energy consumption of the facility or by purchasing zero/low emissions energy sources, such as accredited GreenPower. To provide transparency, and an indication of the intrinsic energy efficiency of the building, NABERS ratings display the rating with and without the purchase of zero/low emissions fuel.

## 2.3 NABERS Assessments

NABERS allows for two types of assessment: A self-assessment and an Accredited Assessment. A NABERS Energy self-assessment can give you a rough indication of your energy performance and is for information only.

A self-assessment, is not a substitute for an official NABERS Accredited Assessment and cannot be published, promoted or use the NABERS brand.

## 2.4 Value of Accredited Assessments

The benefits of having an Accredited Assessment are:

- > the assessment's reliability is certified by the NABERS scheme
- > it allows you to use the NABERS branding to promote your data centre or organisation, and
- > the assessment process is informative and provides an evidence base for decision making.

### 2.4.1 Obtaining an Accredited Assessment

To obtain a NABERS Accredited Assessment you need to engage a NABERS Accredited Assessor. The Assessor will rate your data centre in compliance with the NABERS Energy for data centres Rules. The Rules provide a detailed methodology for gathering, interpreting and using information to calculate a NABERS rating. The Assessor can handle all aspects of the rating for you.

Your Assessor will conduct a site visit, collect the relevant information and complete your rating application. They will then send you the completed application for your approval. After you have approved the application, your Assessor will lodge it with the NSW Office of Environment and Heritage. OEH staff will check that the rating application complies with the NABERS Rules before certifying the application and producing a rating certificate.

### 2.5 Finding a NABERS Assessor

NABERS Assessors are specifically trained to undertake data centre ratings. You will find them on the NABERS website ([www.nabers.gov.au](http://www.nabers.gov.au)). The cost of a rating can vary, depending on the type of rating and the size of the data centre. As with any professional service, we encourage you to obtain more than one quote to ensure a competitive price.

### 2.6 When the NABERS Assessor visits your site

To complete your rating application, your Assessor will need to inspect your data centre in order to:

- > become familiar with the data centre layout and features, including the infrastructure services and IT equipment
- > confirm that documentation provided for the assessment is accurate, complete, up-to-date and relevant for the rating
- > visit plant rooms to ensure that all relevant equipment is covered under the meters included in the rating, and
- > resolve any issues that arise.

However, there may be circumstances where access to all or part of the data centre is refused on safety or security grounds. The Assessor must then explain why they could not access these spaces, and document the reasons in the rating application. If there are known impacts on the quality of the information obtained (for example, an estimate instead of verified information) then these must also be fully described.

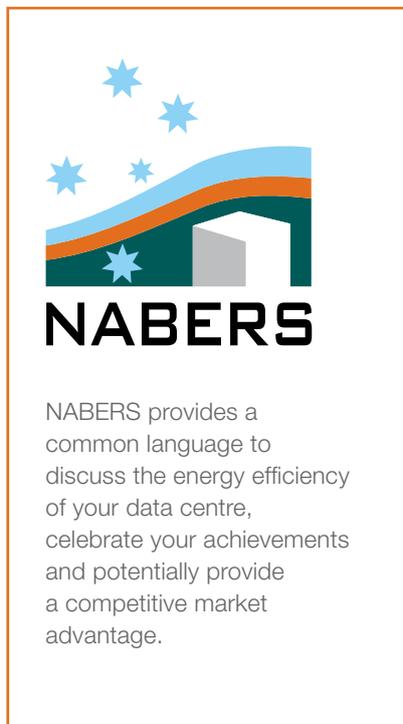
### 3 Why rate your data centre?

For anyone in IT working with or within an organisation that has a sustainability strategy, achieving and reporting on energy efficiency will be critical for retaining customers and meeting sustainability key performance indicators.

The NABERS Energy for data centres rating tools can help you assess, compare and improve your data centre energy performance. It provides a reliable and easy-to-use benchmark which enables you to compare your data centre's energy performance with others in the Australian market. If you are seeking to attract or retain tenants, for example, a NABERS Energy rating can give you an industry-respected, demonstrable advantage in the leasing market.

A good NABERS Energy rating reflects the competitive advantage of energy efficient data centres, as it highlights the reduced operational costs for the tenant and/or the data centre owner. If you obtain an Accredited Assessment you can use the NABERS brand to promote your organisation and data centre. In turn you will gain market recognition for your environmental achievements.

NABERS Energy star ratings also serve as a common language with which to coordinate team efforts, set goals, evaluate performance and market achievements. They are the foundation upon which successful energy efficiency strategies are built. NABERS provides a common language to discuss the energy efficiency of your data centre, celebrate your achievements and potentially provide a competitive market advantage.



A NABERS Energy rating provides a common language for all parties to understand the efficiency of the data centre.

### 3.1 Setting star rating targets for your data centre

NABERS has created the NABERS Energy for data centres Reverse Calculator that allows you to calculate the maximum amount of energy your data centre can use to achieve a star rating that you specify. This is particularly useful if you are setting NABERS star rating performance targets for your data centre.

For more information, please refer to the NABERS website [www.nabers.gov.au](http://www.nabers.gov.au)

Note that results obtained with the Reverse Calculators are for your information only, and cannot be reported or promoted in any way.

### 3.2 Three tools within NABERS Energy for data centres

To ensure that the tools are technically robust and up to date, NABERS created two Technical Working Groups to oversee development

- > a Data Centre Infrastructure Technical Working Group (TWG) to develop a benchmark metric for data centre building services, and
- > an IT Workload TWG to develop a methodology to rate the efficiency of the IT components within a data centre.

The NABERS Energy for data centres rating tools compare the greenhouse gas emissions of a data centre against others in the market. It uses commonly accessible and comparable measurements to benchmark and assess actual performance. The less energy consumed for a given level of output, the more efficient the data centre and the higher the NABERS star rating awarded.

There are three tools:

**IT Equipment rating** – benchmarks the greenhouse gas emissions associated with the energy consumed by the IT equipment within a data centre over a one month period (approximately).

**The IT Equipment rating is for organisations that own or manage their IT equipment (including servers, storage devices, network equipment), but have no control over their data centre’s support services such as air conditioning, lighting and security, and wish to measure the energy efficiency of their IT equipment.** In most cases this means organisations that lease their data centre space – so they are the occupants but not the owners or managers of the space.

Developed in partnership with government and industry

For a list of Technical Working Group members, see section 7.0 Acknowledgements

Three rating tools to reflect the different responsibilities within a data centre



IT Equipment rating is based on approximately one month of energy consumption to reflect the high turn over of equipment within a data centre.

The Infrastructure and Whole Facility ratings are based on 12 months.

**Infrastructure rating** – benchmarks the greenhouse gas emissions associated with the energy consumed in supplying infrastructure services to IT equipment within a data centre over a 12 month period.

**The Infrastructure rating is for data centre managers or organisations that provide data centre support facilities to host IT equipment.**

**Whole facility rating** – benchmarks the greenhouse gas emissions associated with the energy used by the IT equipment and infrastructure services within a data centre over a 12 month period.

**The Whole Facility rating is for organisations that both manage and occupy their data centre and want to rate the IT equipment and the whole of the data centre support facilities.**

The data required for each rating type is:

Data required	IT Equipment Rating	Infrastructure Rating	Whole Facility Rating
Energy consumption	✓ Covering approximately one month	✓ Covering 12 months	✓ Covering 12 months
Storage capacity	✓		✓
Processing capacity	✓		✓

To ensure a fair and comparable rating, a data centre to be accredited under NABERS must have:

- > Processing capacity greater than zero
- > Storage capacity greater than zero, and a
- > Dedicated system for the removal of heat from the data centre IT equipment for NABERS Infrastructure and Whole Facility ratings.

## 4 An IT Equipment Rating

Read this section if you are an IT Manager or Chief Information Officer (CIO) looking to better understand how energy efficient your IT equipment is.

A NABERS IT Equipment rating is designed for organisations that control and manage their own IT equipment.

### 4.1 The world's first performance-based rating tool

The NABERS IT Equipment rating tool is the world's first performance-based benchmarking tool to compare the energy associated with the IT equipment capacity within a data centre.

Experience in developing the NABERS Energy for data centres rating tools has shown that Australian data centres have limited energy monitoring and sustainability reporting. As a result NABERS has focussed on developing simple, measurable benchmarks based on the most readily accessible data, while maintaining a robust measure of energy performance to ensure the rating is relevant and useful for industry.

An IT Equipment rating measures features that are closely related to the primary functions of a data centre (processing, storage and networking) and that all data centres provide, regardless of how they provide them. Given the current limitations in energy reporting and data collection by industry; difficulties in accessing useful work and energy consumption; and the requirement to ensure the metrics fairly represent all types of data centres functions; NABERS has developed two IT Equipment metrics:

- > Processing capacity – measures the sum of the number of server cores multiplied by clock speed in gigahertz (GHz), and
- > Storage capacity – measures the total unformatted storage capacity in terabytes (TB).

The NABERS performance benchmark model predicts the industry median greenhouse gas emissions for a given amount of data centre processing and storage capacity. This means that if a data centre consumes more energy than the benchmark model predicts, the site is less energy efficient than the industry median (set at 3 stars), while if it consumes less energy it is more efficient than the median.



The IT Equipment benchmark predicts the industry median greenhouse gas emissions for a given amount of data centre processing and storage capacity.

It provides easily measurable benchmarks, while maintaining a robust measure of energy performance to ensure the rating is relevant and useful for industry.

## 4.2 Data required for a self-assessment

To undertake a self-assessment for a NABERS IT Equipment rating you need to collect the following data:

- Energy Consumption**  Electricity consumption data of all IT equipment for approximately one month of operation
- Storage Capacity**  Total unformatted storage capacity in TB calculated from a current list of all operating storage devices within the data centre
- Processing Capacity**  Total processing capacity measured by the sum of the number of server cores multiplied by the clock speed for all servers within the data centre.

A self-assessment can provide you with an indication of your star rating.

The accessibility of this information can vary greatly and may depend on how well the centre is managed.

Once the information has been collected, follow the instructions on the NABERS website ([www.nabers.gov.au](http://www.nabers.gov.au)) and use the online rating Calculator to obtain an indication of your star rating.

## 4.3 Information required for a NABERS Accredited Assessment

An Accredited NABERS IT Equipment rating assesses the greenhouse gas emissions associated with the energy consumed by your IT equipment over a one month period (approximately).

To help your Assessor plan and organise your assessment, you will need to provide the following information:

### Electricity consumption of all IT equipment

A minimum of 5 meter readings over approximately a one month period for all relevant utility or validated non-utility meters.

Single-line diagram of the metering set-up within the data centre.

For more information on validating non-utility meters refer to the NABERS fact sheet *Validating non-utility meters for NABERS ratings*.

### Storage Capacity

A current and valid listing of all functioning storage equipment, with unformatted storage (TB) for each storage device.

### Processing Capacity

A current and valid listing of all functioning server equipment, with clock speed (in GHz) and number of cores for each server.

### 4.3.1 Assessing your IT Equipment electricity consumption

To assess your IT equipment under NABERS, your Assessor will need to accurately measure the electricity consumption for all your servers, storage devices, networking equipment, and any other IT equipment within the data centre. To do this your Assessor will need a single-line diagram indicating distribution of the energy within the centre to show the location of meters used for the rating.

To assess your IT equipment electricity consumption, meter readings must be taken of all utility or non-utility meters that provide energy to your IT equipment.

NABERS allows for some IT equipment electricity to be estimated where inadequate metering is available, as long as the total estimated consumption is within 5% of the overall consumption.

A NABERS Accredited Assessment provides you with a credible and reliable assessment of your energy performance, which you can promote and market.



In an ideal set-up, all IT equipment is separately metered in the data centre.

The NABERS IT Equipment rating assesses the electricity consumed by the IT equipment within the data centre and allows for some estimated energy to be included, but only metered exclusions.

To accurately calculate your IT equipment consumption, your Assessor may need to exclude non-IT equipment, such as lighting or in-rack fans that are attached to the same meter as the IT equipment. This is allowed under NABERS where the electricity to be excluded is separately metered.

Allowable metered exclusions from an IT Equipment rating include the energy used by:

- > Infrastructure services
- > In-rack fans (not including fans installed within IT equipment)
- > UPS supported equipment that is not located within the data centre, and
- > Support areas such as offices and exterior lighting.

### 4.3.2 Measuring the IT equipment electricity consumption

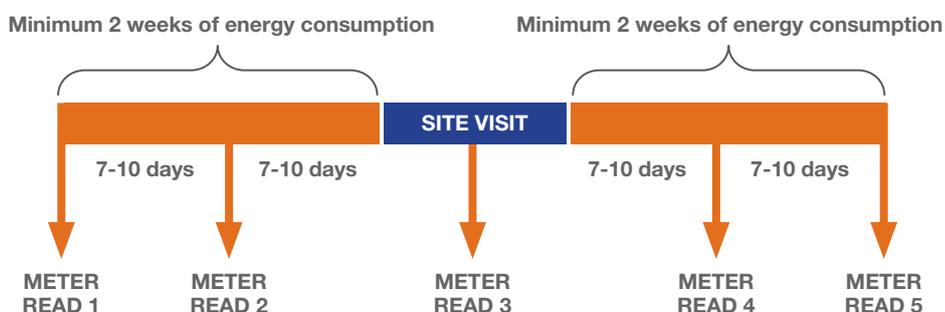
Because of the high rate of IT equipment change within data centres, the rating period for an IT Equipment rating is based on approximately one month of electricity consumption for a representative and stable period of IT equipment use (i.e. no changes to or decommissioning of equipment).

To measure the energy consumption, a minimum of five meter reads must be taken to ensure an accurate measure of consumption. This includes weekly meter readings with one meter read on the day of the Assessor's site visit to verify the processing and storage capacity (see Figure 1). It is important that the meter read for all meters occurs on the same day at approximately the same time.

The variation in the daily average consumption after the site visit must be within 10% of the daily average consumption measured before the site visit. Where the difference is greater than 10%, the energy consumption data must be collected again.

The rating should be conducted over a stable and representative period of IT equipment use.

**Figure 1: IT Equipment energy consumption measurement period**



### 4.3.3 Assessing the processing and storage capacity

To assess the energy efficiency of your IT equipment, your Assessor will require information on your server and storage equipment located in the data centre.

To conduct a rating, your Assessor will need to verify that the information matches the current IT equipment configuration by conducting a site visit. In order to do this, they will need the following documentation to calculate your processing and storage capacity:

NABERS only considers functioning servers and storage devices to calculate your processing and storage capacity. These are servers or storage devices that are located within the data centre, contribute to your processing and storage and have not been decommissioned and switched off.

#### Data Centre layout

a marked up drawing of the data centre to help locate individual items of equipment referenced in the calculation of processing capacity and storage capacity

#### Processing capacity

a list of all functioning server equipment located within the data centre, including the equipment manufacturer and model number, clock speed and number of cores for each server and location within the data centre, for example rack ID

#### Storage Capacity

a list of all functioning storage equipment located within the data centre, including the equipment manufacturer and model number, with terabytes TB of unformatted storage for each unit and location within the data centre, for example rack ID

You need to ensure your list of servers and storage devices is up to date prior to commencing a NABERS rating.

To validate the processing and storage capacity your Assessor must visit the data centre in the middle of the IT equipment energy consumption measurement period with a minimum of 2 weeks' energy consumption collected on either side.

## 5 An Infrastructure Rating



The NABERS Energy for data centres infrastructure rating measures energy efficiency in delivering support services to IT equipment, using the widely-accepted industry PUE.

Read this section if you are data centre manager for an organisation that owns and manages data centre facilities and is looking to better understand how energy efficient your data centre infrastructure services are.

A NABERS Infrastructure rating is designed for organisations that control and manage the provision of infrastructure services to the IT equipment within a data centre.

### 5.1 Development of the NABERS Infrastructure rating

The NABERS benchmark for an Infrastructure Rating measures the energy efficiency in delivering support services to IT equipment, using the widely accepted industry Power Usage Effectiveness (PUE) ratio. PUE is a measure of how efficiently a data centre uses its power; specifically, how much of the power is actually used by the IT equipment, in contrast to the infrastructure services. However, as NABERS is emissions based, PUE is expressed in kilograms of emissions with some modification to provide for shared cooling services and a climate correction.

A NABERS Infrastructure rating measures the energy efficiency in supplying infrastructure services to the IT equipment within your data centre over a 12 month period. It does this by measuring:

- > IT equipment electricity consumption, and the
- > infrastructure services energy consumption.

The NABERS Infrastructure rating assesses the consumption of external energy (such as electricity, gas, diesel and coal) used by each piece of equipment by taking readings from utility meters or validated non-utility meters.

## 5.2 Data required for self-assessment

To undertake a NABERS Infrastructure self-assessment rating you need to collect the following information on the energy consumption of the IT equipment and infrastructure services:

**Energy Consumption (IT)**  12 months of energy consumption data for the assessable IT equipment

**Energy Consumption (Infrastructure)**  12 months of energy consumption data for the infrastructure services

**Location**  The postcode of the data centre's physical location

The accessibility of this information can vary greatly and may depend on how well the centre is managed.

Once the information has been collected, follow the instructions on the NABERS website ([www.nabers.gov.au](http://www.nabers.gov.au)) and use the online rating Calculator to obtain an indication of your star rating.

## 5.3 Information required for a NABERS Accredited Assessment

A NABERS Infrastructure rating assesses the energy efficiency in supplying infrastructure services to the IT equipment within your data centre over a 12-month period.

The infrastructure services are services that support the activity of the data centre, including:

- > Air-conditioning to the data centre
- > Lighting to the data centre
- > Power back-up for the data centre, including generator fuel and Uninterrupted Power Supplies (UPSs)
- > Power distribution including Power Distribution Units (PDUs), and
- > Security services for the data centre.

A NABERS accredited rating provides a consistent methodology; Government rigor; third party accreditation of individuals that can do a rating; and an independent assessment.

'IT equipment' includes the servers, storage equipment and network equipment, and other information technology equipment within the data centre.

To help your Assessor plan and organise your assessment, you will need to provide the following information:

**Energy consumption of all IT equipment**

12 months of electricity consumption for all relevant utility or validated non-utility meters.

For more information on validating non-utility meters refer to the NABERS fact sheet *Validating non-utility meters for NABERS ratings*.

**Energy consumption for the infrastructure services**

12 months of energy consumption for all relevant utility or validated non-utility meters.

For more information on validating non-utility meters refer to the NABERS fact sheet *Validating non-utility meters for NABERS ratings*.

**Single line diagram**

Indicating the energy distribution within the centre to show the location of meters used for the rating.

**Postcode**

Postcode of the data centre's location to account for potential impact of climate on the energy consumption.

**Note:** For a NABERS Accredited Assessment, your Assessor is primarily concerned with consumption, i.e. the amount of electricity in kWh or gas in megajoules (MJ) rather than the energy costs. Please ensure that you provide full copies of bills and not just the first page. If you have trouble finding a continuous record of energy bills for the rating period it may be easier to arrange for your Assessor to contact your energy utilities. You will need to write a letter to your energy supplier granting your Assessor permission to access this information.

### 5.3.1 Assessing your energy consumption

As discussed, the NABERS Infrastructure rating assesses the energy efficiency of your data centre infrastructure services in delivering support services to the IT equipment by measuring:

- > the IT equipment electricity consumption, and the
- > infrastructure services energy consumption.

The IT equipment energy for a NABERS Infrastructure rating is calculated using metered energy inclusions, and metered and estimated non-IT equipment exclusions. While the infrastructure services energy for a NABERS Infrastructure rating is calculated using metered energy and some estimated energy (where it is within 5% of the overall consumption), but uses only metered, allowable exclusions. An example of an estimation for the infrastructure services is the un-metered consumption of in-rack services, such as lighting or fans.

#### Accounting for PDU losses

The measurement of the IT equipment energy within data centres can occur at a number of metering locations such as the UPS input, UPS output, or PDU output. To ensure a consistent approach, NABERS uses the Green Grid's *Guidelines for measuring and publishing values of PUE at dedicated data centre facilities* ('Green Grid's Guidelines'). This includes four measurement categories based on where the IT energy is measured.

To ensure a consistent measurement standard for NABERS Infrastructure ratings, NABERS assumes the IT energy is measured at the PDU output – equivalent to a category 2 measurement location as defined by the Green Grid's Guidelines. This means that if the meter is located at the PDU 'output' no adjustment factor is applied. However, where the IT equipment energy is located between the UPS and PDU ('input' to PDU), calculations are performed to adjust for PDU losses. These adjustments are based on PDU losses being estimated at 3% of the overall PDU throughput.



The IT equipment energy for a NABERS Infrastructure rating is calculated using metered energy inclusions, and metered and estimated non-IT equipment exclusions.

The infrastructure services energy for a NABERS Infrastructure rating is calculated using metered energy inclusions and some small estimated inclusions, and metered, allowable exclusions.

## Accounting for shared services

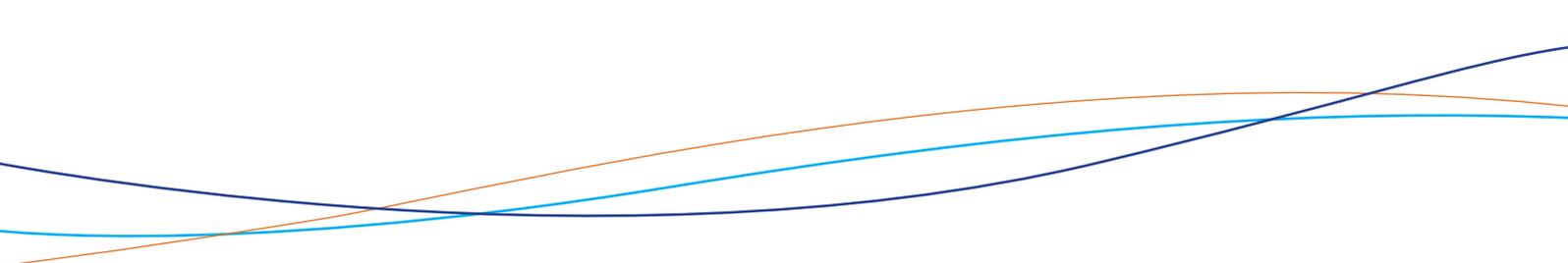
Some data centres are part of a larger building which has a supplementary tenant condenser water loop that serves the data centre. This supplementary condenser water loop is generally operated by the building owner and its energy consumption details are not available to the data centre.

Although the heat rejection is a relatively small component of infrastructure energy, to ensure an accurate NABERS rating the energy consumption from the shared heat rejection is included in the NABERS Infrastructure rating. To account for this an adjustment of 40 watts per kilowatt heat rejected is applied to the NABERS Infrastructure benchmark. Where only part of the cooling plant uses the unmetered heat rejection, the correction is adjusted based on the percentage of plant capacity affected.

### 5.3.2 Measuring the energy consumption

The NABERS Infrastructure rating measures the energy consumed by the IT equipment and infrastructure services over a continuous 12 month period.





## 6 Whole Facility Rating

Read this section if you are an IT Manager or Chief Information Officer (CIO) looking to better understand the energy efficiency of your data centre as a whole.

A NABERS Whole Facility rating is preferable when you control the IT equipment, lighting and air conditioning for your data centre, or where there is inadequate metering to obtain a NABERS IT Equipment or Infrastructure rating.

### 6.1 Development of the NABERS Whole Facility rating

The NABERS Whole Facility rating has been designed to provide the ability to compare the energy efficiency of one data centre with another by assessing the energy efficiency of the data centre as a whole in delivering both IT productive capacity as well as the support services to the IT equipment.

The NABERS Whole Facility benchmark is a combination of both the IT Equipment and Infrastructure rating benchmarks. The NABERS IT Equipment benchmark predicts the industry median performance for a given amount of data centre processing and storage capacity, while the NABERS Infrastructure benchmark predicts the industry median greenhouse gas emissions to supply infrastructure services to the IT equipment. The final NABERS Whole Facility benchmark takes both into account, so a data centre will only achieve a high NABERS star rating when both the IT equipment and infrastructure services are energy efficient.



The NABERS Whole Facility rating compares the energy efficiency of one data centre with another by assessing the energy efficiency of the data centre as a whole in delivering both IT productive capacity as well as the support services to the IT equipment.

## 6.2 Data required for self-assessment

To undertake a NABERS Whole Facility self-assessment rating you need to collect the following data:

- Energy Consumption**  12 months of energy consumption data for the entire data centre
- Location**  the postcode of the data centre's physical location
- Storage capacity**  the total unformatted storage capacity in terabytes TB calculated from a current list of all operating storage devices within the data centre
- Processing capacity**  total processing capacity measured by the sum of the number of server cores multiplied by clock speed for all servers within the data centre

The accessibility of this information can vary greatly and may depend on how well the centre is managed.

Once the information has been collected, follow the instructions on the NABERS website ([www.nabers.gov.au](http://www.nabers.gov.au)) and use the online rating Calculator to obtain an indication of your star rating.

## 6.3 Information required for a NABERS Accredited Assessment

A NABERS Whole Facility rating measures the energy efficiency of the IT equipment and infrastructure services for your data centre over a 12 month period.

To help the Assessor plan and organise your assessment, you will need to provide the following information:

**Energy consumption for the entire data centre** 12 months of energy consumption from utility or validated non-utility meters for the entire data centre.

For more information on validating non-utility meters refer to the NABERS fact sheet *Validating non-utility meters for NABERS ratings*.

**Single line diagram** Indicating the energy distribution within the centre to show the location of meters used for the rating.

**Postcode** Postcode of the data centre's location to account for potential impact of climate on the energy consumption.

**Storage Capacity** A current and valid listing of all functioning storage equipment, with unformatted storage (TB) for each storage device.

**Processing Capacity** A current and valid listing of all functioning server equipment, with clock speed (in GHz) and number of cores for each server.

**Note:** For an Accredited Assessment, your Assessor is primarily concerned with consumption, i.e. the amount of electricity in kWh or gas in megajoules (MJ) rather than the energy costs. Please ensure that you provide full copies of bills and not just the first page. If you have trouble finding a continuous record of energy bills for the rating period it may be easier to arrange for your Assessor to contact your energy utilities. You will need to write a letter to your energy supplier granting your Assessor permission to access this information.

### 6.3.1 Assessing your energy consumption

As discussed the NABERS Whole Facility rating assesses the energy efficiency of the entire data centre (i.e. both the IT equipment and the infrastructure services) using the energy consumption at the point of supply to the data centre or at the input to the UPSs supplying all the equipment within the data centre.

In order to accurately assess this, your Assessor will need a single-line diagram indicating distribution of the energy for the data centre in relation to any external spaces, such as offices.

To accurately calculate your NABERS Whole Facility rating, your Assessor may need to exclude non-data centre equipment which is attached to the same meter that supplies the data centre. This is only allowed under NABERS where the energy to be excluded is separately metered.

#### Accounting for shared services

Some data centres are part of a larger building which has a supplementary tenant condenser water loop that serves the data centre. This supplementary condenser water loop is generally operated by the building owner and its energy consumption details are not available to the data centre.

Although the heat rejection is a relatively small component of infrastructure energy, to ensure an accurate NABERS rating the energy consumption from the shared heat rejection is included in the NABERS Whole Facility rating. To account for this an adjustment of 40 watts per kilowatt heat rejected is applied to the NABERS Infrastructure benchmark. Where only part of the cooling plant uses the unmetered heat rejection, the correction is adjusted based on the percentage of plant capacity affected.

### 6.3.2 Measuring the energy consumption

The NABERS Whole Facility rating measures the energy consumed by the entire data centre over a continuous 12-month period.

NABERS only considers functioning servers and storage devices to calculate your processing and storage capacity. These are servers or storage devices that are located within the data centre, contribute to your processing and storage and have not been decommissioned and switched off.

### 6.3.3 Assessing the processing and storage capacity

To conduct a rating, your Assessor will need to verify that the information matches the current IT equipment configuration by conducting a site visit. In order to do this, your Assessor will need the following documentation to calculate your processing and storage capacity:

#### **Data Centre layout**

a marked up drawing of the data centre to help locate individual items of equipment referenced in the calculation of processing capacity and storage capacity

#### **Processing capacity**

a list of all functioning server equipment located within the data centre, including the equipment manufacturer and model number, clock speed and number of cores for each server and location within the data centre, for example rack ID

#### **Storage capacity**

a list of all functioning storage equipment located within the data centre, including the equipment manufacturer and model number, with terabytes TB of unformatted storage for each unit and location within the data centre, for example rack ID

You need to ensure your list of servers and storage devices is up to date prior to commencing a NABERS rating.

To validate the processing and storage capacity your Assessor must visit the data centre within the 12-month period that the energy consumption is collected.

## 7 Acknowledgements

Thank you to all the people involved in developing the NABERS Energy for data centre rating tools.

A special thank you to the NSW Office of Environment and Heritage (OEH) and the Australian Government Department of Climate Change and Energy Efficiency (DCCEE) who managed the project and to the project consultants, Exergy Pty Ltd.

The development of the NABERS Energy for data centre rating would not have been possible without the assistance from the Technical Working Group members. A special thank you goes to these Technical Working Group members:

Glenn Allan	National Australia Bank (NAB)
Frank Aue	PTS Consulting (formally of CSTechnology)
Farhad Azizian	Schneider Electric
Malcolm Black	Formerly at CISCO Systems
Greg Boorer	Canberra Data Centres
Allan Booth	Australian Government Department of Climate Change and Energy Efficiency
Warren Chamberlain	Equinix Internet Business Exchange
Jon Curry	Telstra Corporation
Greg D'Arcy	IBM Australia & New Zealand
Mark Deguara	Emerson Network Power
Eamonn Eason	Interactive Pty Ltd
Lachlan Feggans	Fuji Xerox Australia Pty Limited
Michael Gunton	Fujitsu Australia Limited
Nathanwi Hart	Australian Government Department of Immigration and Citizenship
Stephen Hodgson	NSW Businesslink Pty Ltd
David Jilla	Australia Post
Kris Kumar	Digital Realty Trust
Andrew McEachern	Amazon Web Services (formerly contractor to the NSW Office of Environment and Heritage)
David McEwen	Colliers International
David Oram	Australian Government Department of Finance and Deregulation
Gordon Paddy	NEXTDC (formerly at Global Switch)
Matthew Pontin	EMF Griffiths
Damien Spillane	Digital Realty Trust
David Thomson	NSW Department of Finance and Services
Sean Treweek	AIRAH representative (WSP Lincolne Scott)
Graham Tucker	Australian Information Industry Association (Intel)
Simon Wise	CSTechnology
Moussa Youssef	NSW Department of Education and Community services (formerly at Westpac Banking Corporation)

Members as at December 2012

Thank you also to the US Environmental Protection Agency and the international Green Grid for their advice and assistance in developing the NABERS Energy for data centres rating tools.

## 8 Glossary

Term	Definition
<b>Assessor</b>	An individual accredited under the NABERS scheme who is authorised by the National Administrator to conduct Accredited Assessments in accordance with the NABERS Rules to conduct a data centre rating.
<b>Data centre</b>	<p>A facility that is dedicated to the housing and operation of IT equipment. It may be a stand-alone facility or a facility within a building that also includes other facilities such as offices.</p> <p>For the purposes of NABERS, a data centre includes all services and equipment directly located in or servicing the IT equipment area (typically defined by a closed-off area with dedicated space temperature control) and does not include facilities serving other areas such as supporting office space.</p>
<b>Information technology (IT) equipment</b>	<p>IT equipment includes:</p> <ul style="list-style-type: none"><li>&gt; computer servers</li><li>&gt; storage</li><li>&gt; network, and</li><li>&gt; other IT equipment within the data centre.</li></ul>
<b>IT equipment rating</b>	<p>Benchmarks the GHG emissions associated with the energy consumed by the data centre IT equipment over a one month (approximate) period.</p> <p>An IT equipment rating does not include services covered under an Infrastructure rating.</p>
<b>Infrastructure rating</b>	Benchmarks the GHG emissions associated with the energy consumed in supplying infrastructure services to IT equipment within a data centre over a 12-month period.

Term	Definition
<b>Infrastructure services</b>	<p>Infrastructure services are services that support the activity of the data centre, including:</p> <ul style="list-style-type: none"> <li>&gt; air conditioning to the data centre</li> <li>&gt; lighting to the data centre</li> <li>&gt; power back-up for the data centre, including generator fuel</li> <li>&gt; power distribution including power distribution units (PDUs), and</li> <li>&gt; security services for the data centre.</li> </ul>
<b>National Administrator</b>	<p>The body responsible for administering the NABERS scheme, in particular for:</p> <ul style="list-style-type: none"> <li>&gt; establishing and maintaining the standards and procedures to be followed in all aspects of the operation of the scheme</li> <li>&gt; determining issues that arise during the operation of the scheme and the making of ratings, and</li> <li>&gt; accrediting Assessors and awarding accredited ratings in accordance with NABERS standards and procedures.</li> </ul> <p>The functions of the National Administrator are undertaken by the NSW Government through the Office of Environment and Heritage (OEH).</p>
<b>Non-utility meter</b>	<p>A meter measuring distribution of energy in a building, not operated by a utility supplier.</p> <p>Non-utility meters under NABERS need to be validated to ensure they are recording the energy consumption correctly. For more information on validated non-utility meters refer to the NABERS fact sheet <i>Validating non-utility meters for NABERS ratings</i>.</p>
<b>Power distribution unit (PDU)</b>	<p>An electrical distribution board located between the uninterrupted power supply (UPS) and the IT equipment, containing circuit breakers for electrical circuits supplying IT equipment.</p>

Term	Definition
<b>Processing Capacity</b>	The total processing capacity (measured in gigahertz (GHz)) is the sum of the server clock speed (in GHz) multiplied by the number of cores for all functioning servers. One gigahertz is equal to $10^9$ Hertz.
<b>Rating period</b>	<p>One continuous month (approximate) of energy consumption data used for the NABERS IT Equipment ratings.</p> <p>The continuous 12-month period of energy consumption data used for NABERS Energy Infrastructure and Whole Facility ratings.</p>
<b>Rules</b>	NABERS Energy for data centres <i>Rules for collecting and using data</i> (including rulings).
<b>Servers</b>	Computers and/or devices used to store, process and output information over a network.
<b>Storage devices</b>	Devices used in the storage of digital information on any type of media (e.g. hard disks).
<b>Storage capacity</b>	The total unformatted storage capacity (measured in terabytes (TB)) is calculated by multiplying the number of disks by the storage (in TB) for each functioning storage device. One TB is equal to $10^{12}$ bytes.
<b>Uninterrupted power supply (UPS)</b>	A device that provides battery back-up when the electrical power fails or drops to an unacceptable voltage level.
<b>Whole Facility rating</b>	Benchmarks the greenhouse gas emissions associated with the energy used by the IT equipment and infrastructure services for a data centre over a 12-month period.

## 9 NABERS Energy for data centre checklist

### 9.1 Checklist to perform a NABERS Energy for data centre – IT Equipment rating

**Processing Capacity**  Up-to-date list of all functioning servers including their clock speed and number of cores, equipment manufacturer, equipment model and location in the data centre.  
This will be verified by your Assessor on-site.

**Storage Capacity**  Up-to-date list of all functioning storage devices including their unformatted terabytes of storage, equipment manufacturer, equipment model and location in the data centre.  
This will be verified by your Assessor on-site.

**Energy Coverage**  Single line diagram indicating distribution of energy within the data centre and a clear indication of the location of meters used to supply electricity to the IT equipment within the data centre.  
This will be verified by your Assessor on-site.

Documentation of any GreenPower purchases.

**Metering Systems**  Evidence of accuracy and validation of high-voltage electricity meters and all other non-utility meters, and records of readings of non-utility meters.  
For more information on validating non-utility meters refer to the NABERS fact sheet *Validating non-utility meters for NABERS ratings*.  
This will be checked by your Assessor on-site.

Evidence of Non-utility Meter Management Plan, where required.

**Consumption Data**  Daily utility/validated non-utility metering data covering a minimum one month of electricity used to cover the Rating Period. The records must clearly indicate the meter identification and reading.

A minimum of five non-utility meter readings 7-10 days apart for the Rating Period.  
Your Assessor will take the third (middle) non-utility meter reading when on site to verify the processing and storage capacity data.

Documentation of the equipment and duty cycle for any small un-metered end-uses within the data centre.  
This will be checked by your Assessor on-site and the consumption calculated according to the NABERS Rules.

## 9.2 Checklist to perform a NABERS Energy for data centre – Infrastructure rating

### Energy Coverage

Single line diagram indicating distribution of energy within the data centre and the coverage of each distribution board to clearly distinguish between the IT equipment and infrastructure services and the metering points in relation to the UPS and PDUs.

This will be verified by your Assessor on-site.

Documentation of any GreenPower purchases.

### Metering Systems

Evidence of accuracy and validation of high-voltage electricity meters and all other non-utility meters, and records of readings of non-utility meters.

For more information on validating non-utility meters refer to the NABERS fact sheet *Validating non-utility meters for NABERS ratings*.

This will be checked by your Assessor on-site.

Evidence of Non-utility Meter Management Plan, where required.

### Consumption Data

Utility billing data covering the full twelve months of the Rating Period.

12 months of non-utility meter readings, where required, covering the Rating Period to record the meters supplying the IT equipment and infrastructure services within the data centre.

Bills for deliveries of any discrete (batch) supplies, showing quantities delivered and how they were measured.

Documentation of the equipment and duty cycle for any small un-metered end-uses within the data centre.

This will be checked by your Assessor on-site and the consumption calculated according to the NABERS Rules.

Documentation for any un-metered in-rack services.

Documentation of the cooling capacity of all cooling system equipment, if part (but not all) of this equipment has un-metered heat rejection.

This will be checked by your Assessor on-site.

### 9.3 Checklist to perform a NABERS Energy for data centre – Whole Facility rating

**Processing Capacity**  Up-to-date list of all functioning servers including their clock speed and number of cores, equipment manufacturer, equipment model and location in the data centre.  
This will be verified by your Assessor on-site.

**Storage Capacity**  Up-to-date list of all functioning storage devices including their unformatted terabytes of storage, equipment manufacturer, equipment model and location in the data centre.  
This will be verified by your Assessor on-site.

**Energy Coverage**  Single line diagram indicating distribution of energy within the data centre.  
This will be verified by your Assessor on-site.

Documentation of any GreenPower purchases.

**Metering Systems**  Evidence of accuracy and validation of high-voltage electricity meters and all other non-utility meters, and records of readings of non-utility meters.  
For more information on validating non-utility meters refer to the NABERS fact sheet *Validating non-utility meters for NABERS ratings*.  
This will be checked by your Assessor on-site.

Evidence of Non-utility Meter Management Plan, where required.

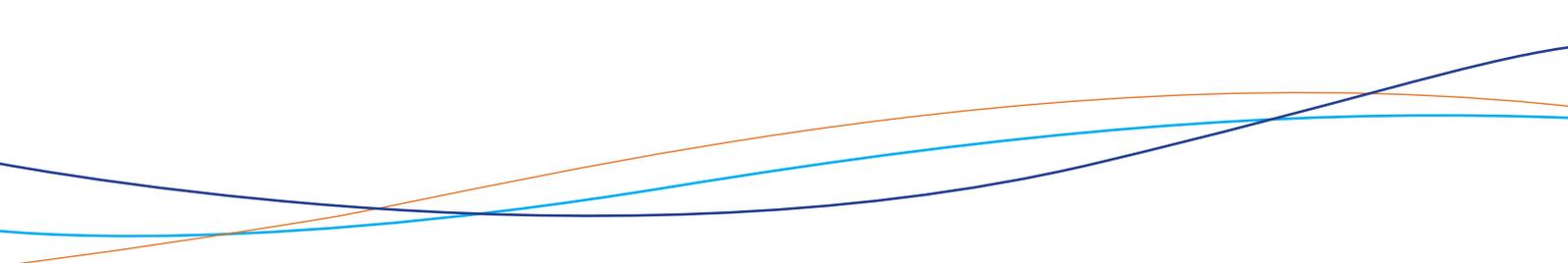
**Consumption Data**  Utility billing data covering the full twelve months of the Rating Period.

12 months of non-utility meter readings covering the Rating Period, where required.

Bills for deliveries of any discrete (batch) supplies, showing quantities delivered and how they were measured.

Documentation of the equipment and duty cycle for any small un-metered end-uses within the data centre.  
This will be checked by your Assessor on-site and the consumption calculated according to the NABERS Rules.

Documentation of the cooling capacity of all cooling system equipment, if part (but not all) of this equipment has unmetered heat rejection.  
This will be checked by your Assessor on-site.



## 10 References

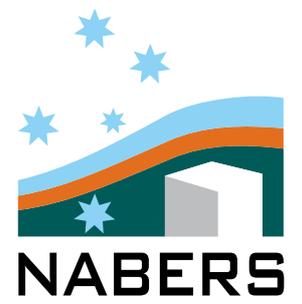
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NABERS is a national initiative managed by the New South Wales Government

**Office of Environment and Heritage**

59-61 Goulburn Street, Sydney

PO Box A290

Sydney South NSW 1232

Phone: +61 2 9995 5000

Fax: +61 2 9995 5999