

# **Darwin-Katherine Electricity System Plan**

**Biennial Review**

**July 2024**

# Acknowledgement

The Northern Territory Government respectfully acknowledges Aboriginal and Torres Strait Islander peoples as the First Nations people of this country.

We acknowledge the continuing connection to lands, waters and communities, and the evolving cultures of all our First Nations people.

We pay our deepest respects to all Aboriginal and Torres Strait Islander cultures, and to their leaders – past, present and emerging.

# Table of contents

Introduction	5
Key highlights	7
Progress towards the renewable energy target	8
Northern Territory Electricity Market Reforms	9
Focus area 1: Solar and Renewable Energy Hub	10
Focus area 2: Storage batteries	13
Focus area 3: Thermal generation	14
Focus area 4: High spec security batteries	14
Focus area 5: Virtual Power Plants	15
Focus area 6: Demand management initiatives	15
Next steps	16

The goal

**50%**

of electricity is  
renewable



Low cost



Secure



Future-proof

# Introduction

Published in October 2021, the Darwin-Katherine Electricity System Plan (DKESP) charts the type, size and timing of energy infrastructure investments and complementary strategic policies and actions needed in the Darwin-Katherine Electricity System (DKES) to achieve the 50 per cent renewable energy target (RET) by 2030.

The DKESP identifies six focus areas to 2030 to support the achievement of the RET securely and at lower cost (refer to Figure 1):

- Solar and Renewable Energy Hub
- Storage batteries
- Thermal generation
- High spec security batteries
- Virtual Power Plants (VPPs)
- Demand management initiatives.

Although acknowledging the significant upfront investments required, the modelling undertaken for the DKESP estimated total system savings from meeting the 50 per cent RET to be

\$30 million per year by 2030, compared to a business-as-usual approach.

This biennial review highlights the progress across each of the six focus areas as well as other actions undertaken in the first two years of the DKESP that collectively support the transition to renewable energy.

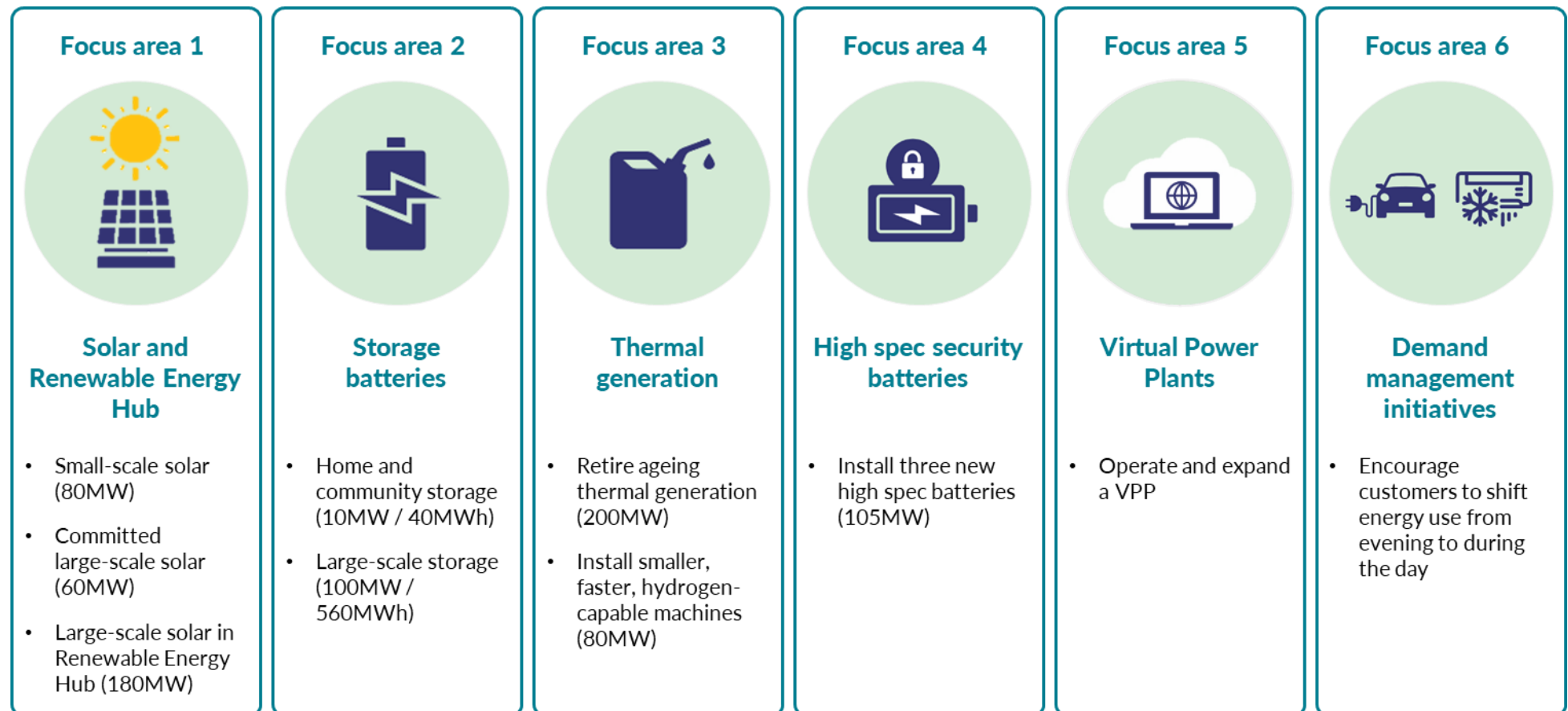
The Department of Industry, Tourism and Trade (DITT), alongside other government agencies, government owned corporations, and the broader energy industry, have worked together to achieve many key milestones, including:

- Established the framework for new Territory Electricity Market arrangements that provide for a centralised approach for determining and procuring generation resources at lowest cost while ensuring system security and reliability requirements are not compromised
- Identified a preferred site for the Darwin Renewable Energy Hub (RE Hub) and commenced a procurement process to select qualified proponents to construct and operate new large-scale solar generators.

- Completed construction of the first large-scale battery, 35 megawatt (MW) Darwin-Katherine Battery Energy Storage System (DK BESS), at Channel Island Power Station. The DK BESS is expected to be fully operational by the end of 2024.
- Acquired a 22 MW gas turbine that is fast starting and capable of running on various fuel sources. This new gas turbine is part of the plan to modernise the current fleet of generators and enhance grid firming in the DKES.
- Provided grants to more than 2,000 households and businesses in the Darwin-Katherine region to install a battery to complement their rooftop solar photovoltaic (PV) system, resulting in an additional 26.7 megawatt hours (MWh) of battery capacity.

With the extensive foundational activities delivered in the first two years of implementation, the NT is well positioned to achieve the 50 per cent RET by 2030.

Figure 1: Darwin-Katherine Electricity System Plan focus areas to 2030



# Key highlights to June 2024



**16.4 per cent**

of Darwin-Katherine electricity consumption estimated to be from renewable sources in 2023-24.

**35 MW**



Darwin-Katherine Battery and Energy Storage System constructed at Channel Island Power Station



Established the Territory Electricity Market that will boost private investment in renewable energy and facilitate an orderly, efficient transition to renewable energy across the NT's regulated electricity systems.

**3,994**

small-scale solar PV systems were installed in the Darwin-Katherine region between 2021 and 2023.



**42 MW**

of additional small-scale solar PV capacity was installed in the Darwin-Katherine region between 2021 and 2023, exceeding the DKESP target.

Selected a site for the Darwin Renewable Energy Hub that met a broad range of community, environmental and economic factors. Initiated environmental investigations, land use planning and power system studies for the site.



**22 MW**

Acquired a new 22 MW gas turbine to modernise the NT's current generator fleet and meet future grid demands.



Commenced a procurement process to identify and select proponents to construct and operate new large-scale solar generators in the Darwin Renewable Energy Hub.

**26.7 MWh**

of battery capacity installed in households and business in Darwin-Katherine region between 2021 to 2023 through the Home and Business Battery Scheme, exceeding the targets set out in the DKESP.



**>2000**

households and businesses in the Darwin-Katherine region have received funding from the Home and Business Battery Scheme to install a battery to complement their rooftop solar PV system.

## Progress towards the renewable energy target

In 2023-24, it is estimated that 257 gigawatt hours (GWh) of electricity in the DKES was generated from renewable energy sources. This accounts for 16.4 per cent of the 1,566 GWh of total electricity generated.

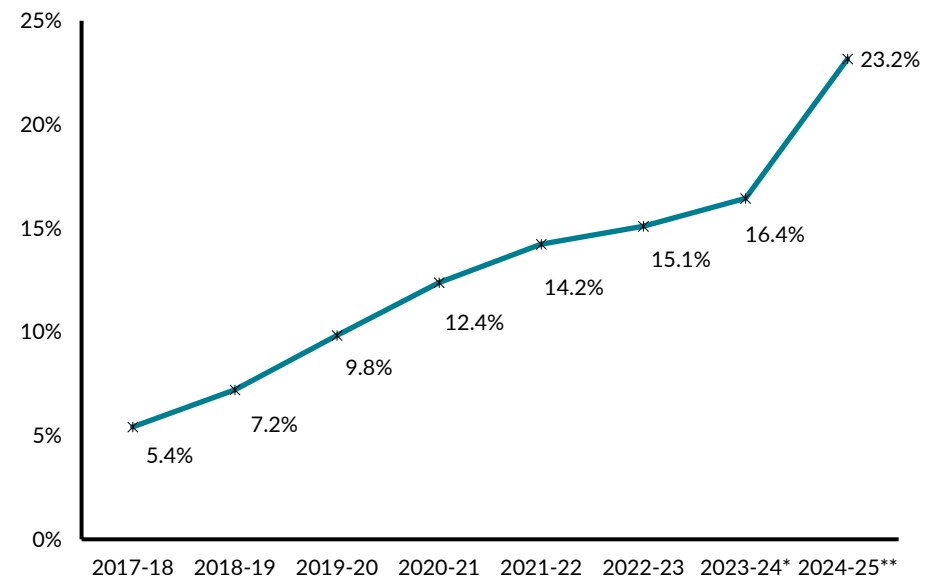
The share of renewable energy in the DKES has more than tripled over the past six years from 5.4 per cent in 2017-18 (refer to Figure 2).

Small-scale rooftop solar PV systems were the largest contributors to renewable energy generation, producing 214 GWh in 2023-24. This represents 83.2 per cent of all renewable energy and 13.7 per cent of the total energy generated in the DKES.

Large-scale solar generators contributed 2.8 per cent of the total energy generation in the DKES in 2023-24. While the total capacity of large-scale generators has been relatively stable in recent years, an increase is expected in the coming years.

Currently, there are six large-scale solar generators connected to the DKES with a combined total capacity of about 68.2 MW. Four of these generators commenced dispatching energy into the DKES in 2023 and 2024. The remaining two are expected to begin dispatching electricity into the DKES in the second half of 2024. In 2024-25, the Government forecasts that the proportion of renewables will increase to 23.2 per cent.

Figure 2: Renewable energy target, Darwin-Katherine electricity system



Notes: \* Estimate; \*\* Forecast.

Source: Department of Industry, Tourism and Trade



## Territory Electricity Market

In January 2024, the NT Government announced a new Territory Electricity Market (TEM) framework, and work has commenced to implement the new arrangements.

The TEM is based on findings from a comprehensive review of the Territory's electricity market. The primary objectives of the review were to ensure affordability, reliability, and security of electricity supply while facilitating an orderly transition to renewable energy.

Under the TEM, a 'public procurement model' will apply in the DKES. This model centralises the planning and procurement of wholesale electricity services to coordinate generation investment and connection.

The key elements of the public procurement model design are:

- The Northern Territory Electricity System and Market Operator (NTESMO) will be tasked to

periodically develop a Regulated Electricity System Investment Plan (RESIP) that will determine the investments required to meet power system needs and renewable energy targets. The RESIP will be approved by the responsible Minister.

- NTESMO will undertake a central procurement process to procure the electricity services in line with the RESIP and Market Rules.
- NTESMO will operate the power system to securely supply electricity at lowest cost.
- System costs will be recovered from electricity retailers on a fair and equitable basis, considering their contribution to system peak and total energy consumption.

The public procurement model provides the most pragmatic way for meeting the NT Government's vision for improved renewable energy integration that ensures a secure, reliable and affordable energy future.

The new market arrangements for the DKES are planned to go live in July 2026. Leading up to this, work is in progress on legislative and structural changes to support the new arrangements.

The implementation of the TEM will be guided by engagement with industry stakeholders, who will play a crucial role in providing feedback on the detailed rules and procedures needed to implement the new market framework. This engagement is being undertaken through an Industry Reference Group.

While the new TEM arrangements are being implemented, a series of priority investments are being progressed under interim arrangements to support and accelerate the adoption of renewables, including additional large-scale solar and a Renewable Energy Hub, high spec batteries and synchronous condensers.

## Focus area 1

# Solar and Renewable Energy Hub

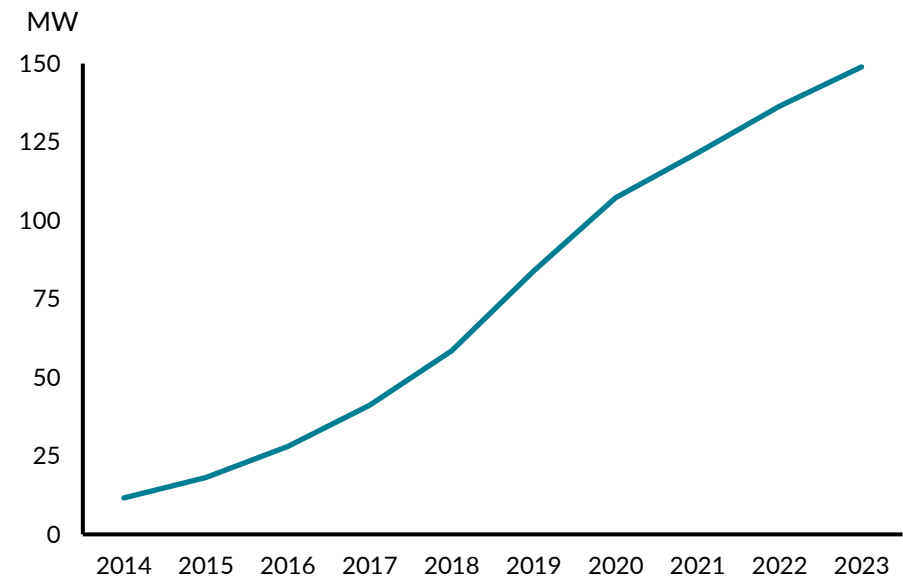
### Behind the meter small scale solar

Household investment in small-scale rooftop solar PV systems in the Darwin-Katherine region continues to increase. This is demonstrated by:

- the installation of nearly 4,000 new solar rooftop PV systems in the Darwin-Katherine region between 2021 and 2023, representing a 27 per cent increase from the end of 2020 and bringing the total number of systems to 18,593
- the average size of rooftop solar systems installed continues to increase, reaching 11.8 kilowatts (kW) in 2023, up from 8.2 kW in 2020
- an additional 42 MW of small-scale solar installed between 2021 and 2023, a 40 per cent increase from the total installed capacity bringing the total to about 150MW (refer to Figure 3).<sup>1</sup>

The total additional capacity installed over this period exceeds the DKESP target of 25 MW of behind-the-meter solar output for the corresponding period.

Figure 3: Total installed small-scale solar PV system capacity, Darwin-Katherine region (MW)



Source: Clean Energy Regulator. (various). Postcode data for small-scale installations – SGU – Solar. <https://cer.gov.au/markets/reports-and-data/small-scale-installation-postcode-data>

<sup>1</sup> Source: Clean Energy Regulator. (various). Postcode data for small-scale installations – SGU – Solar. <https://cer.gov.au/markets/reports-and-data/small-scale-installation-postcode-data>

## Darwin Renewable Energy Hub

The Darwin RE Hub is a pivotal component of the DKESP, designed to facilitate the integration of 180 to 230 MW of new solar energy capacity. By connecting multiple renewable energy and storage projects in one site, the Darwin RE Hub aims to leverage economies of scale, ensuring affordable, reliable, and clean electricity for households and businesses served by the DKES.

Between 2021 and 2022, a comprehensive study was conducted to identify and evaluate the optimal location for the Darwin RE Hub. This process identified a preferred site at Weddell that minimises social and community impact, avoids areas of significant environmental value, minimises costs, and maximises opportunities for the Darwin RE Hub to meet future energy demand in the region and contribute to the RET.

Following the identification of the Darwin RE Hub site, significant foundational work has progressed, including activities that have been completed or are well-advanced.

Completed activities include:

- development of a detailed business case that outlines the merits of the project, evaluates the benefits, costs, and risks, and explores options for project delivery
- initial power system and transmission studies, concept designs and initial site layouts
- geotechnical and flood studies over the site to ensure the land is suitable for large-scale solar generators.

Other activities are underway, including:

- environmental investigations and land use planning over the preferred site
- procurement to identify qualified and accredited proponents to construct and operate new large-scale solar generators in the Darwin RE Hub
- processes to obtain Native Title and Sacred Sites clearances over the site.

### Committed large-scale solar

There are six large-scale solar generators in the DKES, all currently connected to the network and energised. These generators are at various stages of commissioning and compliance testing, which is crucial for ensuring uninterrupted electricity supply to customers.

Significant milestones have been achieved in the past year with the following large-scale solar generators dispatching electricity into the DKES:

- Katherine Solar Power Station since September 2023.
- Defence RAAF Darwin Solar Power Station since December 2023
- Defence Robertson Barracks Solar Power Station since July 2024.
- Batchelor 2 Solar Power Station since July 2024.

The remaining two large-scale solar power stations are expected to commence dispatching energy into the DKES in the second half of 2024.

### Synchronous condensers

The DKESP anticipated that batteries alone would deliver the necessary system security services for the DKES. However, the DKESP identified a mitigation strategy to pivot to traditional technologies, such as synchronous condensers with flywheels, to provide these services if required.

Due to the continuing rapid adoption of behind-the-meter rooftop solar and in line with developments in other networks, synchronous condensers are being developed by Territory Generation and Power and Water, to support the security of the system.

Renewable electricity powered synchronous condensers will supplant gas-fired generators as providers to provide some essential system services, such as voltage control and system strength, and allow the DKES to operate with fewer gas-fired generators online at times of high solar output.

## Focus area 2

# Storage batteries

Batteries are essential for maximising the benefits of solar energy. They can capture surplus solar energy produced during the middle of the day and release it when the sun is not shining, particularly in the evening and overnight. Additionally, batteries help reduce the variability of electricity generation from renewable energy technology.

Small-scale batteries continue to grow in uptake in the NT supported by the Home and Business Battery Scheme (HBBS).

To 30 June 2024, more than 2,000 households and businesses across the Darwin-Katherine region have capitalised on the HBBS to install batteries to complement their roof-top solar PV system. This has resulted in the installation of an additional 26.7 MWh of battery storage and contributed \$45 million to the Darwin-Katherine economy.

The increase small-scale battery capacity over the past three years exceeds the target set out in the DKESP of an additional 8 MWh of battery installation over the same period.

As a result of the success of the HBBS, the NT has led the nation since 2021 with the highest proportion of solar PV systems installed with a battery at 33.3 per cent. This is double the rate of South Australia, the next highest jurisdiction at 15 per cent, and 5 times the national level of 6 per cent.<sup>2</sup>

Figure 4: Key highlights small-scale storage batteries, to 30 June 2024

**26.7**  
MWh

Additional battery capacity installed in the Darwin-Katherine region using HBBS funding.

**>2,000**

Households and business in the Darwin-Katherine region received HBBS funding to install a battery

**33.3%**

Proportion of solar PV systems installed with a battery in the NT. This is five times the national average.

<sup>2</sup> Clean Energy Regulator. 2024. Small-scale installation postcode data. <https://cer.gov.au/markets/reports-and-data/small-scale-installation-postcode-data>

## Focus area 3

# Thermal generation

Government-owned electricity generator, Territory Generation, is implementing a fleet transition plan that will replace existing generation assets with assets that are flexible, renewable capable, fast starting and mobile. The Fleet Transition will be carried out in a cost-effective and staged process that will not impact electricity supply.

Under the fleet transition, Territory Generation has procured a TM2500 mobile aeroderivative gas turbine generator for the Channel Island Power Station. Installation works and commissioning of the new generator has commenced and is expected to be fully operational by 2025.

The gas turbine generator is capable of running on various fuel sources, including a high proportion of renewable hydrogen. This enables operators to utilise the most cost-effective and readily available fuel options. Importantly, the gas turbine generator is compatible with the DKBESS, and will support the integration of renewable energy in the NT.

The TM2500 generator project marks the initial phase of a multi-unit deployment plan over the next five years aimed at replacing gas-fired generators approaching the end of their operational life. The project aligns with the DKESP plan of installing 80 MW of agile new thermal generators by 2030.

## Focus area 4

# High spec security batteries

The NT is on track to achieve the DKESP target of installing 105 MW of high-spec security batteries by 2030.

Construction of the first large large-scale battery, the 35MW DK BESS, commenced in September 2022 and was completed in March 2024.

The 35 MW DK BESS is a significant addition to the DKES and represents nearly 15 per cent of the maximum electricity demand in the region. While it is smaller in size compared with the 150 MW battery at South Australia's Hornsdale Power Reserve, relative to the size of the relevant electricity systems, the DK BESS is twice as large.

The DK BESS is expected to be fully operational by the end of 2024. Upon full operation, it is projected to yield annual fuel savings of \$9.8 million, foster additional capacity for residential and industrial solar installations, and mitigate carbon emissions by an estimated 58,000 tonnes annually

In March 2024, the NT Government unveiled plans for the launch of a second large-scale battery project, the DK BESS 2, targeting commissioning from 2026 onwards. This project will involve the strategic placement of large-scale batteries across various locations within the DKES. In addition, in July 2024, Power and Water received conditional support from the Australian Renewable Energy Agency for 16 community batteries, which will be distributed in various locations in the DKES.

These projects will satisfy the DKESP requirement for up to 105 MW of high spec battery capacity.

## Focus area 5

# Virtual Power Plants

The increasing uptake of rooftop solar PV systems in the NT has played a pivotal role in advancing the utilisation of renewable energy sources and alleviating cost of living pressures. However, the surge in solar energy production during periods certain periods of the year presents challenges to effectively balancing supply and demand on the grid.

In 2022, the Alice Springs Future Grid (ASFG) Project launched the Solar Connect VPP trial. The ASFG Project sought to identify and address barriers in the Alice Springs electricity system and identify pathways to transition to 50 per cent renewable energy by 2030. The ASFG Project was co-funded by the NT Government, the Australian Renewable Energy Agency and the then Australian Government Department of Industry, Science, Energy and Resources.

The Solar Connect VPP trial engaged approximately 50 residential energy customers in Alice Springs and involved participants with solar only PV systems, solar and battery systems, and supersize solar installations, each employing different approaches. The lessons learned from the Solar Connect VPP trial will guide the development of limited VPP services in the DKES. Additionally, under the HBBS, grants are only available for battery systems assessed as VPP capable. This ensures foundational infrastructure is in place to support the future rollout of VPP services across the NT.

## Focus area 6

# Demand management initiatives

The DKESP identified opportunities to shift energy demand to the middle of the day when there is surplus solar energy and reduce peak demand during evening and overnight. This would reduce electricity costs as well as strengthen reliability of the power system.

In 2023, Power and Water commenced a rollout of new solar panel-compatible digital smart meters that would replace old mechanical power meters across Darwin-Katherine, Tennant Creek and Alice Springs. This is expected to be completed by 2029.

About 20,000 smart meters were installed by the end of June 2024, replacing old mechanical power meters nearing the end of their operational life. The smart meter rollout will be accelerated with all old meters expected to be replaced with new smart meters by mid-2029.

In 2024 work will commence to identify demand management activities that seek to influence the patterns of energy consumption. This includes consideration of policies that are appropriately targeted at addressing the issues and barriers for customers changing their consumption patterns, including pricing initiatives and improving consumer information and understanding.

## Next steps

With the extensive foundational activities delivered in the first two years of implementation of the DEKSP, the NT is well positioned to achieve the 50 per cent RET by 2030.

Future activity will focus on consolidating and building on the progress to date, including:

- Continuing with the next stage of the development of the Darwin RE Hub, including:
  - engaging with communities, industry and other stakeholders to inform the impact and benefits of the Hub
  - develop the detailed design of the solar farms and transmission assets

- commence headworks construction to support the Hub's development
- Continuing to refine support for small-scale solar and energy storage uptake including integration of electricity vehicles.
- Implement the new Territory Electricity Market and Regulated Electricity System Plan arrangements
- Complete the procurement of the DK BESS 2 high-spec security batteries.

New areas of focus will include:

- Identifying and evaluating demand management initiatives aimed at shifting energy use to midday when there is surplus solar generation
- Identifying opportunities to implement limited use of Virtual Power Plants (VPPs) in the Darwin-Katherine region.

Over time, the TEM and RESIP will assume the centralised planning role currently fulfilled by the DKESP. This will ensure an integrated, collaborative and whole of system approach to planning and funding of investments across the NT to achieve the 50 per cent RET by 2030.





