MICROGRID DEVELOPMENT TOOLBOX

STEP 3 // **FEASIBILITY**

OUTCOME

A feasibility study report which sets out the recommended structure for the microgrid system, associated cost/benefit analysis and implementation plan. A decision will be made off the back of this whether to proceed to seek investment for the design and implementation of the microgrid system.

A detailed feasibility study will be undertaken to determine the most suitable microgrid system and commercial model based on the needs of the precinct, business or community and technical and economic feasibility.

Typically this step is supported by appointment of a consultant/s to support the technical and commercial aspects, who can be funded via direct investment from the microgrid user, or via grant funding through State or Federal Governments and agencies. Other options include this work being funded via the microgrid developer/operator. This feasibility work will confirm if an investable business case exists, rule out options that are unlikely to be viable, and highlight the uncertainties that will need to be addressed in the business case.

Continued stakeholder engagement

1. Initially this will involve confirming scope and identification of key users to participate in the feasibility study. This will build off the engagement undertaken in the Identify Opportunity step, beginning with key load centres and sites of interest.
2. Throughout the feasibility stage, further user engagement and testing will be undertaken with the identified precincts, businesses and communities and users to assist with recruitment, understanding community/user needs, identifying required services, and testing the various commercial models and offerings.
3. Stakeholder engagement should be undertaken with support, or preferably be driven by, those known to the proposed microgrid users. This can include the precinct developer, business or local government, community or energy groups.

Technical feasibility

1. The aim of the technical elements of the feasibility study is to identify the technical options available to achieve the goals and objectives of the microgrid
2. This will utilise the data gathered during Step 2, and any broader data required such as network quality data.
3. This analysis should cover:
    a. The scope and energy use profile of the microgrid (i.e. number of users, existing assets, existing distribution system and connection to grid etc.).
    b. An assessment of load flexibility available in the microgrid across the various users.
    c. An assessment on the mix of onsite and offsite generation and storage required to deliver the desired outcomes.
    d. An assessment of power quality requirements and any required infrastructure to deliver desired system resilience (i.e. islanding capability etc.).
    e. Preliminary specifications for a suitable microgrid control system (both hardware, software and integration with existing assets).
4. Financial analysis will include existing technology solution alternatives which provide the most cost effective solution, and optimising the financial analysis to the local distribution networks tariffs and rules.

Commercial feasibility

1. As well as the technical feasibility, a commercial feasibility assessment will be undertaken to establish the commercial viability of different technical options and commercial structures, and the key risks and uncertainties.
2. This includes assessing the varying commercial structures available for ownership, investment and operation of microgrid systems, and user offers. For example, this could include assessing the benefits of operating the microgrids across precincts as individual systems versus aggregating them in a series of virtual microgrids which are capable of providing greater benefit to the system and users.
3. The type of microgrid model selected will determine the services offered. The desired services should be identified and prioritised at this stage. Please see the appendix for an overview of a selection of models.
4. A regulatory review will also be undertaken to ensure regulatory requirements can be met, or identify potential exemptions which may make the selected system more viable, as well as identifying high level contractual requirements between the various parties.

APPENDIX

MICROGRID MODELS

Through Monash's MEMO project we have identified a range of possible microgrid models which range from a single site with multiple assets which has one owner, through to multiple sites operating across the public network. The services provided can range from basic control and optimisation for existing energy costs, through to an on-market microgrid providing full retail services and incorporating power purchase agreements.

The model of microgrid chosen will influence the services available, commercial structure of the microgrid, regulatory barriers/opportunities and the governance structure.

We have set out a high-level overview of the various models below and the pathway which a microgrid could follow from a basic model to a fully autonomous microgrid. We note that precincts/communities will be at different stages along the pathway and will each have different targets.

Precinct microgrids

A Precinct Microgrid is a microgrid that operates within a site that is owned, controlled or occupied by one person or organisation.

A Precinct Microgrid may include: one or more sources of renewable (or low emissions) electricity generation; battery storage; controlled sources of flexible load; and a distribution system (Microgrid Network) that transports both the renewable electricity and network supply to microgrid users (Figure 1).

A Precinct Microgrid is not the same as an embedded network which re-supplies electricity from the grid. In a Precinct Microgrid electricity supply and demand is actively controlled by a Microgrid Operator and integrated with grid supply using a range of technologies.

Examples of where a Precinct Microgrid could be established include: shopping centres; industrial parks; or university campuses.

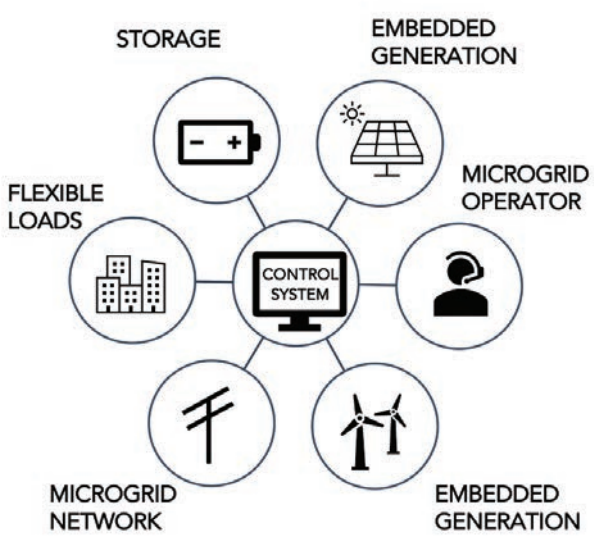


Figure 1 // Components of a Precinct Microgrid

Stages of precinct microgrid development

Precinct Microgrids can be developed in stages. These stages can be classified by the technical capabilities and services the Precinct Microgrid can deliver.

Stage 1: Establishing a Basic Microgrid

The first stage involves developing a ***Basic Precinct Microgrid*** by establishing, connecting and controlling an initial combination of Microgrid Assets (sources of renewable electricity supply or storage, or controllable load) on the site. During this stage, the Microgrid Operator obtains data about their capability to control loads, and reduce the quantity and cost of electricity supplied from the grid.

Stage 2: Delivering External Services

In the second stage, the capacity of the Precinct Microgrid to provide ***External Services*** to the electricity market can be tested. This may initially involve providing incentives for Microgrid Users to allow greater control of their Microgrid Assets. Technologies may also be available to create an internal market for renewable electricity supply, storage and control.

Once these capabilities are established, potential buyers for these External Services could then be identified by a Microgrid Electricity Market Operator (MEMO). If the MEMO is able to secure contracts with these buyers, the revenues may support a business case to add new Microgrid Assets to the Precinct Microgrid.

Stage 3: Taking the Precinct Microgrid On-Market

In the third stage, using the experience gained in providing External Services to the electricity market, and the enhanced control of the Microgrid Assets, there may be an opportunity to take the Precinct Microgrid ***On-Market***.

Taking a Microgrid Precinct On-Market would involve the MEMO becoming an electricity Market Participant. The type of Market Participant would depend on the capabilities of the Precinct Microgrid, in particular the level of renewable generation and storage available. It may also depend on whether the MEMO has access to an off-site supply of renewable electricity, such as through Power Purchase Agreement (PPA) with a windfarm. This development pathway is illustrated in Figure 2.

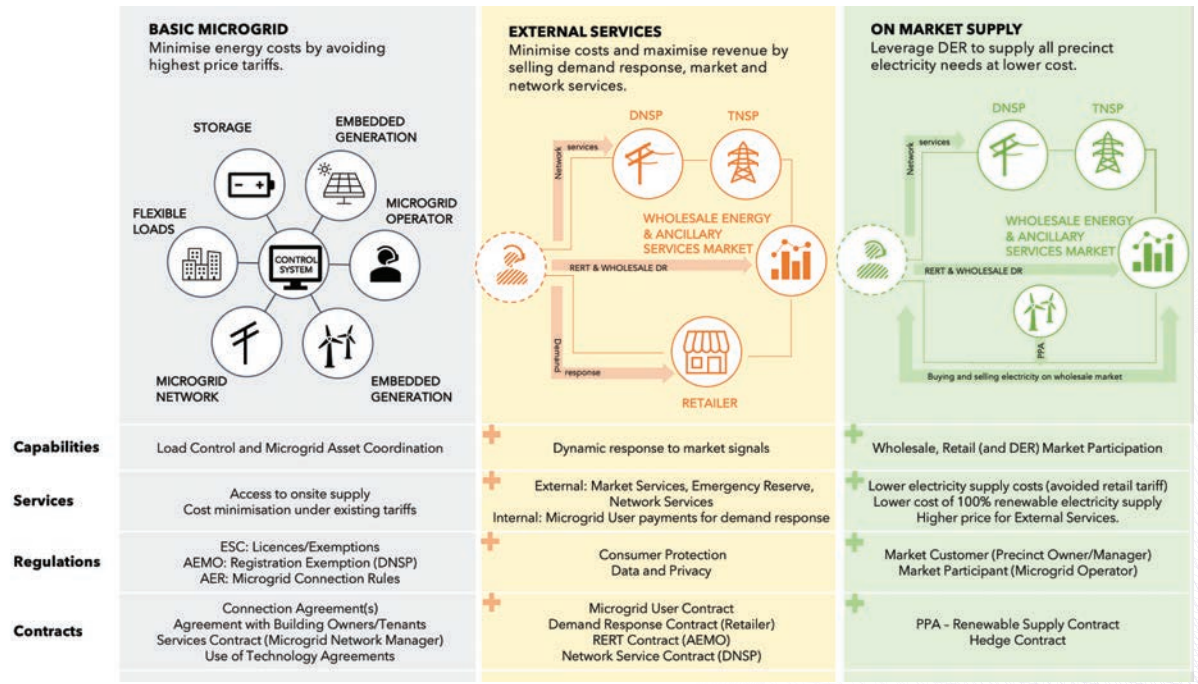


Figure 2 // Precinct Microgrid Development Pathway

Multi-precinct and virtual microgrids

The technologies and capabilities of Precinct Microgrids can be deployed across multiple Precincts. There may also be opportunities to use these technologies in a virtual microgrid that operates across the grid.

Coordinating multiple precinct microgrids

Where the MEMO is serving a number of microgrids precincts (for example a community microgrid and a business park), there is an opportunity to lower electricity costs for all precincts by using the combined on-site generation and flexible load capacity to better respond to market signals (Figure 3). This is the case whether the grid supply to the Precinct Microgrids is being provided by a Retailer or from MEMO itself. However, more value will be created if the Precincts are on-market.

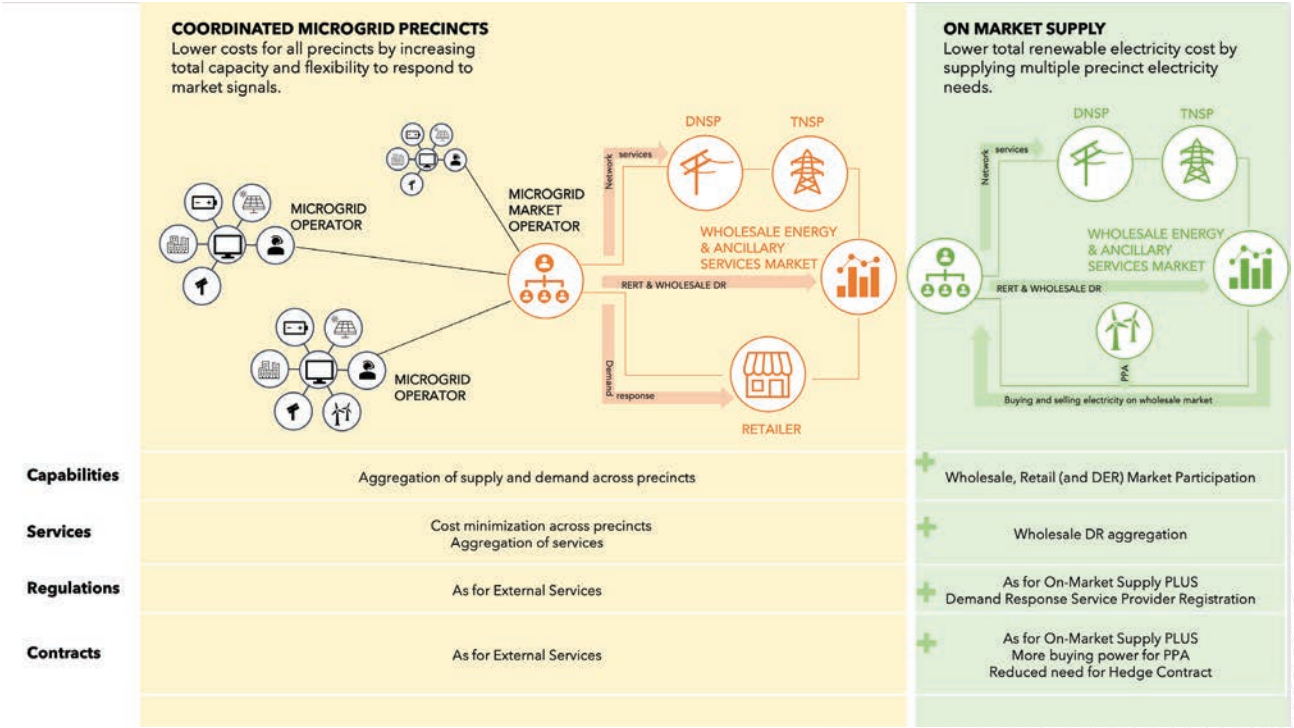
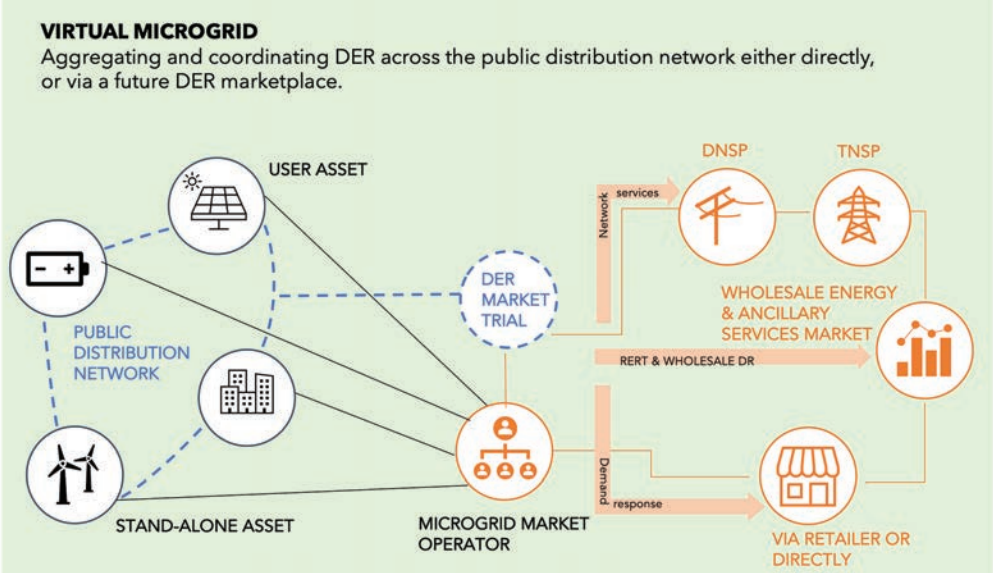


Figure 3 // Coordinated Market Precincts

Virtual microgrid

The key difference between Precinct Microgrids and a ***Virtual Microgrid*** is that Microgrid Users are inter-connected using the grid, rather than a private network. A Virtual Microgrid would be accessible to all grid connected customers in a particular geographic area.

Users would access the outputs and services of User Assets and Stand Alone Assets within the boundary of the Virtual Microgrid. The boundary of the Virtual Microgrid could be defined by a particular section of the grid, for example a shared connection to a zone sub-station. Please refer to Figure 4.



Capabilities	Control and aggregate supply and demand of Microgrid Users across the local distribution network.
Services	Retail supply to Microgrid Users Small generation aggregation Wholesale Demand Response
Regulations	As for On-Market Supply PLUS Registration as a Small Generation Aggregator Registration of User Assets as market generation units Registration as a Demand Response Service Provider
Contracts	As for On-Market Supply PLUS Use of System Agreement with DNSP

Figure 4 // Virtual microgrid

GLOSSARY

DNSP	Distribution Network Service Provider
External Services	The supply of market and/or network services to Market Participants or the Australian Energy Market Operator
Market Participant	People, businesses and organisations which participate in the two electricity markets operated by AEMO
Microgrid Network	A private electricity network to which Microgrid Assets are connected.
Microgrid Asset	A source of renewable electricity supply or storage, or controllable load connected to a Microgrid Network
Microgrid Network Manager	The person or organisation that manager the Microgrid Network
Microgrid Control Services	The use of technology to connect and control Microgrid Assets, and/or manage the supply and demand for electricity across the Precinct Microgrid
Microgrid User	A person obtaining their electricity from the Microgrid
Precinct Asset	A Microgrid Asset connected to the Microgrid Network that is not owned or operated by a Microgrid User
Precinct Microgrid	A microgrid that operates within a site owned or occupied by one person or organisation
Stand Alone Asset	A renewable generation or storage asset that is not located on the site of the Microgrid Precinct
User Asset	A Microgrid Asset that is owned or operated by a particular Microgrid User
Vic NEM	Refers to Victorian NEM pricing