CITIPOWER

# CBD supply

## CP BUS 6.01 - CBD supply - Jan2020 - Public

## Regulatory proposal 2021–2026

CitiPower

November 2019

# Contents

| | |
|---|---|
| Business | CBD supply |
| Title | CBD supply |
| Project ID | CP BUS 6.01 - CBD supply - Jan2020 - Public |
| Category | Augmentation capital investment |
| Identified need | Meet CBD security of supply obligations, and manage the expected demand for electricity and have the capacity to connect customers. |
| Recommended option | Option 1 - redevelop Tavistock Place zone substation and construct new 11kV feeders |
| Proposed start date | 2021/22 |
| Proposed commission date | 2024/25 |
| Supporting documents | 1. CP MOD 6.06 - CBD supply - Jan2020 - Public<br>2. CP ATT102 - ESCV - Electricity distribution code - Aug2018 - Public<br>3. CP ATT103 - ESCV - CBD security of supply - Feb2008 - Public<br>4. CP ATT212 - Merz - CBD Security - Aug2006 - Public<br>5. CP ATT213 - New substation securing power supply - Jul2019 - Public |

# 1 Overview

The southwest of Melbourne's Central Business District (**CBD**) has been experiencing significant growth over the past 10 years. This is being driven by new mixed residential and commercial developments in Docklands and around the redeveloped Southern Cross railway station.

The growth in load has driven two distinct needs within the CBD:

1. The Electricity Distribution Code (**Code**) in effect requires us to provide an 'N-1 Secure' level of supply security for the 66kV sub-transmission assets for CBD load. Due to expected load growth in the southwest of the CBD, we need to develop additional transfer capabilities within the CBD.
2. To manage the expected demand for electricity and to have the capacity to connect customers, we will need to increase the 11kV connection point capacity servicing the southwest of the CBD.

We have recognised that there are cost synergies from addressing these two needs together within one program of work. Rather than developing two standalone business cases that could not capture the synergies well, we have combined the works into this single business case.

We have considered a 'do nothing' scenario and four options in this business case. Our recommendation is Option 1—to redevelop Tavistock Place (**TP**) zone substation and construct new 11kV feeders from TP. This option:

- achieves N-1 Secure within the Melbourne CBD
- provides the capability to meet expected demand and new customer connections for the longest time (to 2040) compared to the other options
- has positive, and the highest net benefits.

The net present values (**NPV**) of the options are outlined in the table below.

**Table 1 Options analysis ($2019, 000)**

| Option | NPV incremental benefits |
|---|---|
| Do nothing (base case)[1] | - |
| Option 1—11kV feeders to TP | 1,072,324 |
| Option 2—11kV feeders to SB | 1,012,859 |
| Option 3—11kV feeders to VM | 1,071,665 |
| Option 4—demand management | Infeasible (unquantified) |

Source: CitiPower

The required investment for the preferred option is outlined in the table below.

[1] This option has negative benefits (unserved energy), however, all options have been assessed relative to this scenario and so it is presented as zero costs and benefits.

Table 2 Investment for recommended option ($ 000, 2019)

| Approach | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/16 | Total |
|---|---|---|---|---|---|---|
| Capital investment | 2,200 | 8,220 | 9,525 | 4,480 | - | 24,425 |

Source: CitiPower

# 2 Background

Historically, the southwest of the CBD was characterised by manufacturing activities. While these businesses have long since disappeared, there are still low rise warehouse sites available that have become prime targets for redevelopment. Over the past 10 years, the southwest of Melbourne's CBD has been experiencing significant growth. This is being driven by new mixed residential and commercial developments which have been supported by the 2006 redevelopment of the Southern Cross railway station. Similar developments have also been seen in Docklands, which is supplied by the CBD electrical network as there is no local zone substation within the Docklands precinct. A number of large business parks and complexes have been constructed and proposed within the last five years. As developers seek to attract new residents and clients, the facilities and hence energy needs of these developments is increasing. This growth is placing increasing demands on the CBD electrical infrastructure.

The southwest of the CBD is served by three zone substations, TP, Little Queen (**LQ**) and Little Bourke (**JA**). TP is one of the last CBD zone substations remaining that supplies electricity at 6.6kV rather than the current standard of 11kV, meaning it is islanded; electricity cannot be switched from adjacent zone substations under fault conditions to help alleviate the lost load. It also has around half the capacity of the new 11kV feeders and one quarter of the zone substation capacity, which is limited by transformer ratings. As discussed more in section 4.2, TP has been flagged to be decommissioned as part of the large project to decommission the 22kV zone substation network supplied from the West Melbourne Terminal Station, meaning without additional investment, the load will be served by LQ and JA. The figure below shows the location of the CBD zone substations.

**Figure 1** Melbourne CBD zone substations


Source: CitiPower

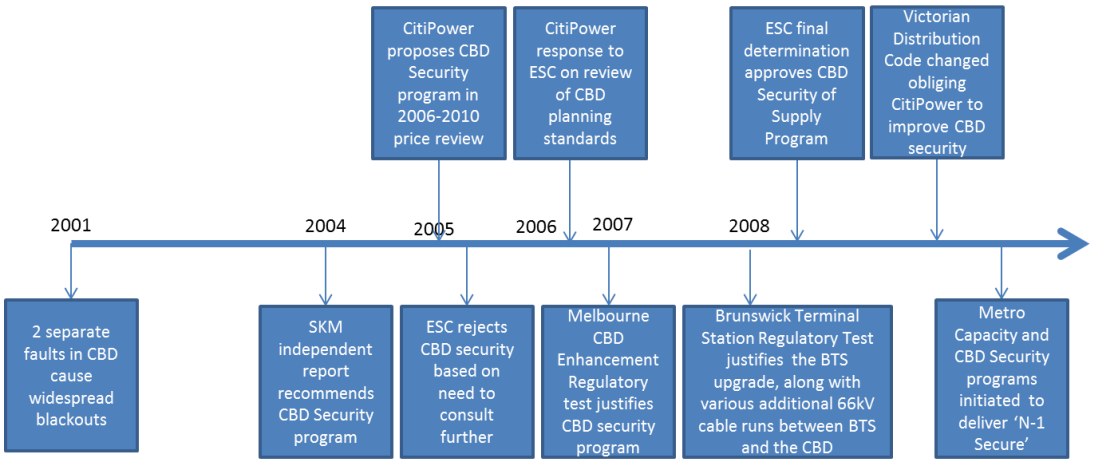
## 2.1 CBD security of supply plan

Following two significant Melbourne CBD faults in 2001, we undertook a review of the CBD's supply security to determine the appropriate standard that should be applied. In 2006, we published a Regulatory Investment Test report that economically justified the scope of the works defined to upgrade the 66kV sub-transmission network in the Melbourne CBD to N-1 Secure for the seven zone substations.[2] The review led to the Essential Services Commission (**ESCV**) amending the Code to require us to develop and implement a CBD Security of Supply Upgrade Plan (**security of supply plan**) to strengthen the CBD supply security.[3]

In effect the obligation requires us to ensure that the Melbourne CBD is 'N-1 Secure'. That is, that we must maintain supply after the loss of two 66kV cable elements, with an allowance of 30 minutes switching time after the loss of the first element. This is a lesser level of system security than N-2, which does not include a 30 minute allowance.

An overview of the decisions leading to the CBD security of supply obligation is set out in the figure below.

**Figure 2 CBD Security Timeline Summary of Approval**




Source: CitiPower

### 2.1.1 Project timeframe

Prior to implementing of the security of supply plan, the majority of our CBD customers were supplied by sub-transmission lines from only two terminal stations—West Melbourne Terminal Station (**WMTS**) and Richmond Terminal Station (**RTS**). These supplied seven CBD zone substations at 66kV. The security of supply plan required the construction of a third terminal station at 66kV to serve the CBD, which required AusNet Services Transmission to upgrade the Brunswick Terminal Station (**BTS**).

As a result of community and local government objections to the planning permit for the BTS upgrade, the works were significantly delayed. This resulted in consequential delays for our related distribution works. A summary of the delays at BTS are shown in the figure below.

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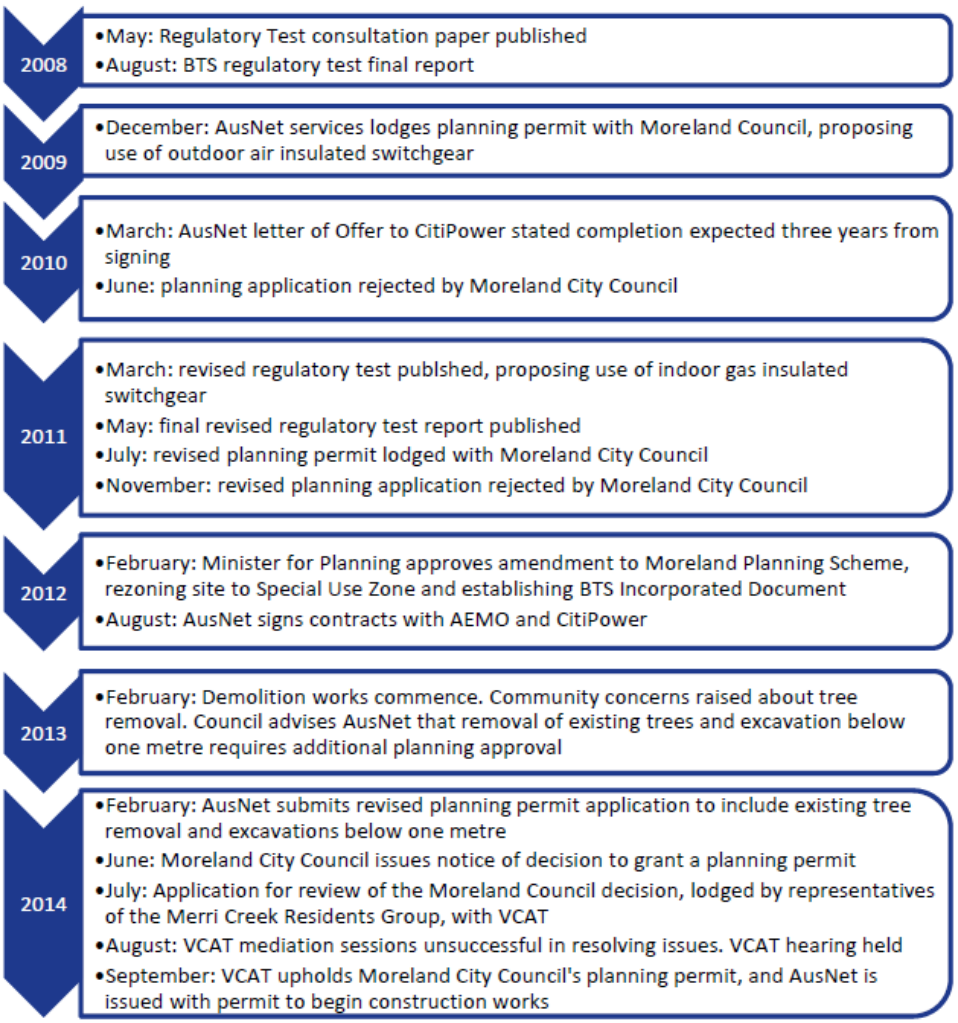
2 CP ATT212: Sinclair Knight Merz, CitiPower; Review of CBD Security of Supply and Planning Standards, Updated Final Report, 22 August 2006.

3 CP ATT102: Essential Services Commission (Victoria), Electricity Distribution Code, clause 3.1A.

Figure 3 Delays in the upgrade of BTS




Source: CitiPower

The works at BTS were completed in 2016. As a result we will deliver the transformation of the Waratah Place switching station into a zone substation with greater switching capability in 2021. After this, and the works subject to this business case, the Melbourne CBD will be N-1 Secure as planned.

## 2.2 Connection points

There are a fixed number of 11kV feeders (which supply developments in the CBD from our zone substations) that can exit from each of our zone substations. This is limited by the number and capacity of circuit breakers available in each zone substation, which in turn is limited by space within a zone substation. For the zone

substations supplying the southwest CBD, JA has 30 high capacity circuit breakers and LQ has 41 standard circuit breakers supplying. All of these circuit breakers across both zone substations are currently in use.[4]

As discussed in section 3.2 the number of feeder connection points on the JA and LQ zone substations is at full capacity and the number of feeders with sufficient capacity to connect new single large building loads is nearing capacity.

## 2.3 Combining the program of works

The works to address reaching an N-1 Secure standard and the works to enhance connection point capacity are complementary—both require additional transformers and circuit breakers to be developed. We have therefore considered the two programs in the same business case.

Section 3 separately presents these two identified needs, and section 4 considers the combined works programs that can address these needs.

[4] Some circuit breakers are reserved for switching purposes, however, these are playing a critical function of supporting CBD security and are considered in use as no load can be added to them.

# 3 Identified need

The identified needs of this business case are to meet:

*System security plan—N-1 Secure rating for 66kV underground cable circuits*

- our obligations under the Code with respect to CBD system security
- our stakeholders' expectations that we deliver N-1 Secure level in the CBD

*Managing load—N rating for 11kV assets*

- the capital expenditure objective to manage expected demand for standard control services
- our obligations under our Electricity Distribution Licence (**Licence**) to offer connection services and supply to a customer.

These are discussed more in the following sections.

## 3.1 System security plan

Under the Code we have obligations to:[5]

> *(a) carry out the capital and other works specified in the CBD security of supply upgrade plan in accordance with that plan;*
>
> *(b) ensure that the Melbourne CBD distribution system meets the security of supply objectives specified in the CBD security of supply upgrade plan on and from the dates specified in the CBD security of supply upgrade plan;*

At the time of developing the security of supply plan, an important consideration for the ESCV was that proposed works would in fact deliver an N-1 Secure level of security to CBD customers.[6] To that end, they engaged an engineering consultant to review the plan. We and the ESCV recognised that expected load growth in the southwest CBD would drive the need for around 35MVA of load transfer capability between the LQ and JA zone substation from LQ.[7]

In its final decision on the security of supply works in 2008 (available at attachment CP ATT103), the ESCV therefore required the reconstruction of TP to cater for growth in southwest CBD load to be included in the security of supply plan to be undertaken when required. This was to ensure the substations servicing the southwest of the CBD achieve a level of N-1 Secure in the face of expected load growth.[8]

### 3.1.1 Whether N-1 Secure is being met

Following the completion of the WP work (the penultimate works required to reach N-1 Secure) the distribution network will be configured as shown in the figure below.

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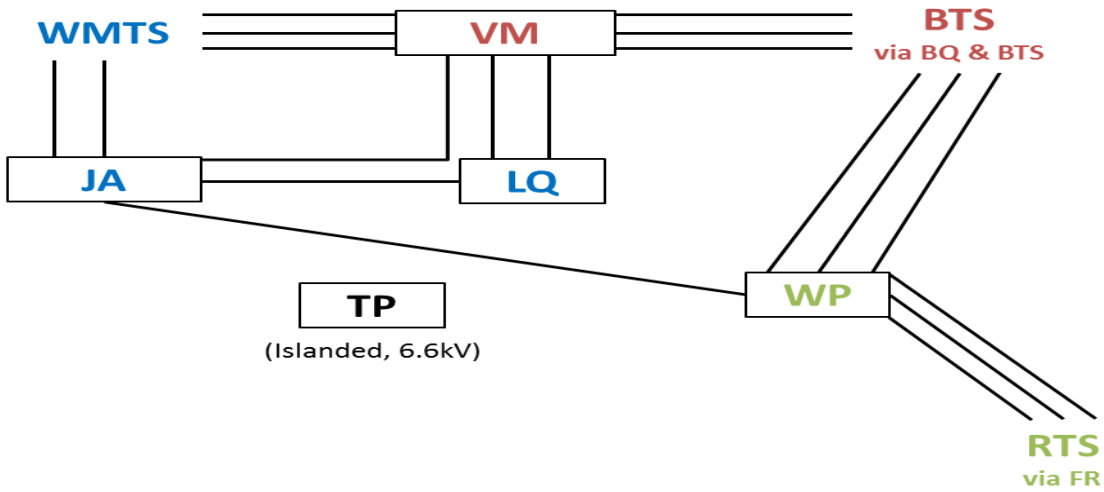
5 CP ATT102: Essential Services Commission (Victoria), Electricity Distribution Code, Clause 3.1A.

6 CP ATT103: Essential Services Commission (Victoria), Final decision; CBD security of supply, February 2008, p. 12.

7 CP ATT103: Essential Services Commission (Victoria), Final decision; CBD security of supply, February 2008, p. 29.

8 CP ATT103: Essential Services Commission (Victoria), Final decision; CBD security of supply, February 2008, p. 14, 29.

Figure 2 66 kV system configuration in relation to the zone substations supplying the southwestern CBD




Source: CitiPower

Due to load growth in the southwest of Melbourne CBD which limits transfer capability, there will be insufficient capacity to meet all demand on JA-LQ 66kV sub-transmission system under the condition when two sub-transmission assets fail (i.e. the requirement of N-1 Secure level of security albeit with a 30 minute allowance for switching).

The table below outlines the line rating, transfer capability and maximum demand on the JA and LQ zone substations.

Table 3 Feeder rating under N-2 conditions and demand forecasts

| Location | Sub-transmission line (normal supply) | Line rating for N-2 scenario (MVA) | Transfers available for N-2 scenario (MVA)[9] | Forecast 2021 demand (MVA) | | Forecast 2026 demand (MVA) | |
|---|---|---|---|---|---|---|---|
| | | | | 50%PoE | 10%PoE | 50%PoE | 10%PoE |
| JA | WMTS-JA1<br>WMTS-JA2<br>VM-JA<br>JA-LQ[10] | 114.6 | 27 | 132.1 | 138.4 | 155.3 | 162.6 |
| LQ | JA-LQ<br>VM-LQ1<br>VM-LQ2 | 76.6 | 19 | 104.3 | 108.4 | 119.5 | 123.5 |

Source: CitiPower

The table below shows the current and projected level of load at risk after all available transfers under these conditions for JA-LQ sub-transmission lines at the 50% probability of exceedance (**PoE**) demand forecasts.

Table 4 Load at risk and expected unserved energy for at 50% PoE load forecast

| | | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|---|---|
| JA | Load above N-2 rating (MVA) | - | - | 3.1 | 5.1 | 11.1 | 13.7 |
| | Energy at risk (MWh) | - | - | 4 | 9 | 47 | 80 |
| | Hours at risk | - | - | 2 | 4 | 12 | 17 |
| LQ | Load above N-2 rating (MVA) | 8.7 | 14.8 | 16.4 | 18.4 | 22.2 | 23.9 |
| | Energy at risk (MWh) | 53 | 251 | 354 | 518 | 986 | 1,264 |
| | Hours at risk | 20 | 73 | 98 | 133 | 202 | 235 |

Source: CitiPower

At 50% PoE, almost 14MVA at JA and 24MVA at LQ (or 38MVA in total) is at risk by 2026 meaning the N-1 Secure standard will not be achieved. We note this is in line with the expectation that 35MVA of load transfer from LQ to TP would eventually be required as outlined in 2008 when the ESCV made its final decision to approve the security of supply plan.

9 We note available transfers will further reduce as load grows which will result in more load at risk over time.

10 JA-LQ sub-transmission line is to provide supply from JA to LQ, but is unavailable to provide JA supply back from LQ as there is no 66kV bus at LQ, that is, all three sub-transmission supplies to LQ are directly connected to LQ transformers and it is not possible to supply a whole JA station load via LQ transformers by reverse power flow.

Table 5 shows the current and projected level of load at risk under N-2 conditions after all available transfers for JA-LQ sub-transmission lines at the 10% PoE demand forecasts.

**Table 5 Load at risk and expected unserved energy for JA-LQ sub-transmission system (N-2) at 10% PoE load forecast**

| | | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|---|---|
| JA | Load above N-2 rating (MVA) | - | 4.3 | 8.9 | 13.1 | 19.2 | 21.0 |
| | Energy at risk (MWh) | - | 6 | 27 | 70 | 185 | 233 |
| | Hours at risk | - | 4 | 9 | 16 | 28 | 36 |
| LQ | Load above N-2 rating (MVA) | 12.8 | 18.9 | 21.3 | 23.9 | 26.7 | 27.9 |
| | Energy at risk (MWh) | 163 | 566 | 858 | 1,257 | 1,833 | 2,129 |
| | Hours at risk | 51 | 143 | 188 | 236 | 307 | 336 |

Source: CitiPower

This shows that by 2026, 21MVA at JA and almost 28MVA at LQ is at risk.

### 3.1.2 Stakeholder expectations

The security of supply project is a vital program given:

- the CBD supports 25% of the state's economic value
- over 460,000 jobs, or 15% of Victoria's employment are based in the CBD
- almost 20% of the $3.7 billion spent by tourists annually is invested with the CBD's hotels, restaurants, venues, iconic cultural and sports complexes and events.

Throughout the security of supply program we have undertaken significant engagement, with our customers being highly supportive of it. With respect to the program, the Victorian Minister for Energy, Environment and Climate Change stated:[11]

> *This upgrade will mean a more secure and reliable electricity supply for Melbourne's CBD and highlights the importance of modernising critical delivery infrastructure*

It is also the ESCV's expectation when it approved the security of supply plan that it would deliver the level of N-1 Secure within the CBD. As part of its decision it stated:[12]

> *The Commission's final decision in relation to the first element of CitiPower's CBD security of supply proposal is:*
>
> - *CitiPower, upon completion of the project, be required to certify to the Commission that N-1 Secure has been delivered to the Melbourne CBD at the 66kV subtransmission level.*

[11] CP ATT213: CitiPower, Media Release, New substation securing power supply in Melbourne CBD, 3 July 2019.

[12] CP ATT103: Essential Services Commission (Victoria), Final decision; CBD security of supply, February 2008, p. vi.

To meet our stakeholders' expectations it is important that we finish the program by providing a level of N-1 Secure to the southwest portion of the CBD.

## 3.2 Managing load

We must meet the capital expenditure objective to manage expected demand for standard control services and meet our obligations under our Licence to offer connection services and supply to a customer.[13]

The energy and demand considered in this analysis differs to that considered in the security of supply analysis; this considers the N condition at the 11kV level whereas the former was based on the N-2 condition at the 66kV level (which has different diversity factors applied).

### 3.2.1 Number of connection points available for large loads

The number of connection points available to accommodate larger loads is also limited. We are seeing an influx of large single developments in the southwest of the CBD. For example, the Collins Arch development currently under construction includes two 39 level towers which includes a mix of residential, commercial and luxury hotel tenants. This development requires 4.4MVA of supply.

**Figure 4 Collins Arch development**

Source: Multiplex

From a network planning perspective, the size of developments is important because all the connection points at JA and LQ are being used meaning additional feeders capable of accommodating single large loads cannot be added to the existing zone substations. The table below outlines the number of feeders that have at least 2.5MWA of capacity remaining available, excluding reserve feeders and after accounting for committed loads.

[13] National Electricity Rules, clause 6.5.7(a)(1). CP ATT026: CitiPower, Electricity Distribution Licence, 2016, clause 6.

Table 4 Feeders with capacity to connect single loads of 2.5 MW or more

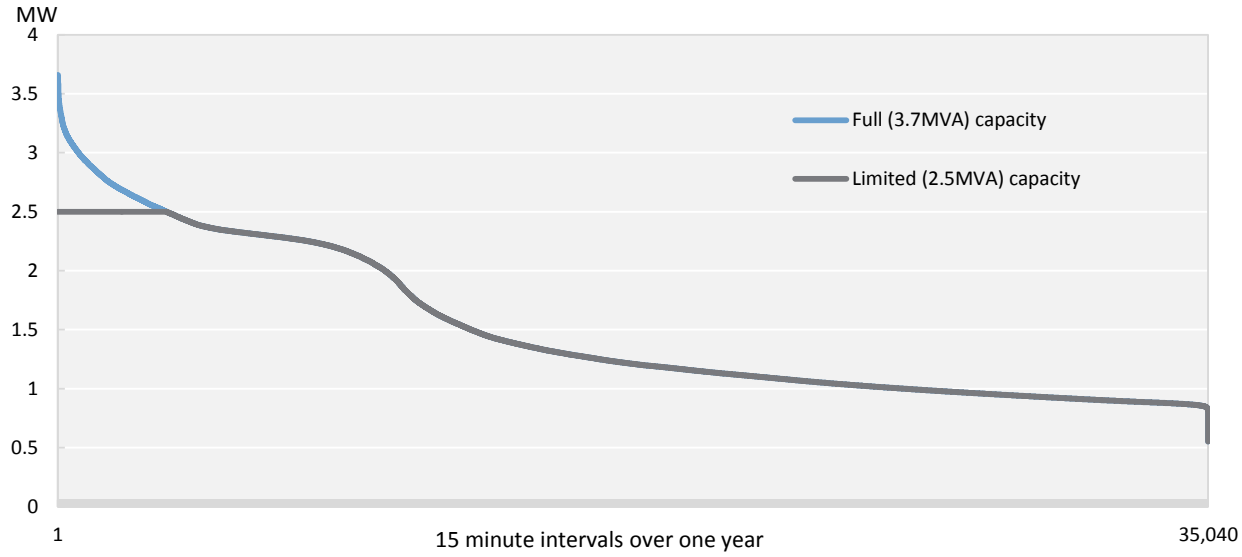
| Zone substation | JA | LQ |
|---|---|---|
| Feeders with of capacity 2.5MVA available | 8 | 2 |

Source: CitiPower

The existing feeders are only able to supply around an additional 10 large connections. Since 2014 we have averaged 4 connections over 2.5MW per annum on JA, LQ and Victoria Market (**VM**) noting that VM is also overloaded and loads in this area are being connected to JA and LQ. On this basis, we will not be able to connect single large load customers by 2022/23 in the southwest of the CBD.

We have considered the energy at risk from being unable to provide single large loads with the demand requested (using the average maximum demand of connections above 2.5MW, which is 3.7MW) but instead providing them with a maximum capacity of 2.5MW. The load duration curves for single large loads should they receive the full requested capacity compared to receiving limed capacity is shown below.

Figure 5 Load duration curves (MW per interval)




Source: CitiPower

The area between these two load duration curves is the energy at risk for a single large load that is unable to connect with its full requested capacity. The amount of unserved energy is shown below. [14]

Table 4 Unserved Energy (MWh)

| Year | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|---|
| Unserved energy | - | - | 483 | 1,448 | 2,413 | 3,379 |

Source: CitiPower

[14] CP MOD 6.06 - CBD supply - Jan2020 - Public

### 3.2.2 Connection point capacity

The number of connection points serving the southwest of the CBD is limited, which effectively limits the 11KV feeder capacity. The table below outlines the remaining capacity, which includes load that has been approved and reserved but has not yet been realised due to construction times.[15] It also shows the number of years (based on the average MVA reserved each year from 2014) this capacity will support.[16]

**Table 3 Feeder capacity - N conditions (MVA)**

| Zone substation | JA | LQ |
|---|---|---|
| Remaining feeder capacity | 92.2 | 96.3 |
| Reserved capacity for committed developments | 106.6 | 26.3 |
| Average MVA reserved per annum | 17.8 | 4.4 |
| Capacity available after subtracting reserved capacity (years) | -1.0 | 15.9 |

Source: CitiPower

This is based on the remaining feeder capacity less reserved capacity and adding the average (over 2014–2019) capacity reserved each year. We have used reserved capacity rather than actual capacity because it is the capacity left after the reserved capacity that we consider when planning the network and making connection offers.

If we were to continue connecting customers without undertaking investment, demand in the southwest of the CBD will exceed feeder capacity under N conditions.

This means that both with respect to connection point capacity and the number of connection points available for large loads, we will not be able to meet our capital expenditure objective to manage expected demand for standard control services and our obligations under our Licence to offer connection services and supply to a customer.

### 3.2.3 Constraints timing

As discussed, based on existing and reserved capacity, and forecast load increases, connection points will start becoming limited around 2022/23. We consider it will be possible to push out the constraint by:

- offloading some smaller loads to LQ, although LQ has limited uncommitted feeder capacity (for both connections that will connect to it and be offloaded to it) and so the ability to do this is limited; in additional this will require feeder construction works.
- using standby feeder capacity in the short term. This will compromise or ability to meet N-1 on our feeders.
- noting that not all of the reserved capacity will connect immediately. It typically takes around 3 years for capacity to be used once it has been reserved.

[15] This is calculated based on the total feeder capacity and is assuming 100% of the feeder capacity can be utilised regardless their physical arrangement and location which may restrict their use for new customers.

[16] Approved load for new connections with diversification for the impact on the feeder level.

- limiting the demand of new connections until upgrade works can be completed—developments do not always require their full supply in the first year of completion as it can take 12 months for tenants to move in.

On this basis, we consider it possible to push the timing of the works to completion by 2024/25. This will allow us to complete the planned 6.6kV decommissions works at TP and then rebuild it with 66kV network (the preferred option discussed in section 4).

# 4 Options analysis

To address the identified needs we have identified three options and a 'do nothing' scenario.

## 4.1 Do nothing

Under this option we would not undertake works to reach N-1 Secure in the CBD. Without undertaking any action:

- 38MVA (equivalent to several CBD blocks) will not be N-1 Secure and will be at risk
- the security of supply works completed to date will not deliver the N-1 Secure level of system security that we have been working to achieve.

This means we would not meet our obligations under clause 3.1A of the Code to complete the works in our security of supply plan or reach an N-1 level of security in the CBD as outlined in section 3. Meeting our Code requirements is a condition of our Licence and is therefore an essential obligation, making this option unviable.

Additionally by 2022/23 there will be insufficient feeder and zone substation capacity in the southwest of the CBD to:

- meet expected load
- connect single large loads.

This means we would not meet our obligations under the National Electricity Rules to manage the expected demand for standard control services or our obligations under our Licence to offer connection services and supply to a customer.[17]

## 4.2 Option 1—11kV feeders to Tavistock Place

Under this option we would redevelop TP and construct new 11kV feeders from LQ and JA to TP.

TP currently supplies electricity at 6.6kV, which is a network we are presently retiring because:

- the 6.6kV network is an aging asset—6.6kV supply was the electrical standard applied in the 1940's and our 6.6kV assets date back to this period. This puts them at a relatively high risk of failure.
- it limits network flexibility—the 6.6kV network cannot integrate with the broader 11kV network making it an island. If a fault occurs on this network, electricity cannot be switched from the 11kV network to restore supply.
- is capacity limited—the 6.6kV network supplies just over half of the power an 11kV network supplies. This is an obsolete configuration that no longer meeting a modern and growing CBD.

Therefore under this option instead of fully decommissioning TP, it will be decommissioned and redeveloped to 11kV supply.

### 4.2.1 Costs

Under this option, TP is redeveloped to a 66/11kV zone substation with high capacity 11kV connection points. The following table provides a breakdown of the scope of works and investment required to implement this option.

[17] CP ATT026: CitiPower, Electricity Distribution Licence, 2016, clause 6. National Electricity Rules, clause 6.5.7(a)(1).

Table 6 Scope and investment of required works ($ 000, 2019)

| Works | Cost |
|---|---|
| Distribution works<br>• 8 new 6.5MVA feeders from TP[18]<br>• 2 new 11kV switch board at TP<br>• 2 new 42/55MVA transformers at TP<br>• 66kV GIS | 10,880 |
| Sub-transmission cable works<br>• 2 new FBTS-TP 66kV supply (4,300m)<br>• TP cut in JA-WP cable (500m) | 10,545 |
| Building works | 3,000 |
| **Total** | **24,425** |

Source: CitiPower

### 4.2.2 Benefits

This option will enable transfers of approximately 14MVA from JA and 24MVA from LQ and would meet the requirement to maintain the N-1 Secure standard for the CBD. This option is consistent with the ESCV's final decision on the security of supply plan conducted in 2008 to maintain N-1 secure supply.

It will also make 20 additional connection points available (high capacity feeders will be designed under this option) with a total station N capacity of 110MVA.[19] This will meet expected load requirements until 2035 initially, when an option to develop a third transformer will be available meaning there will be no unserved energy until 2040 with full development (30 connection points).[20] In addition to addressing the identified needs, retaining TP has the following additional benefits; it is:

- the only zone substation in the southwestern CBD and is strategically positioned to supply this part of the network over the long term as growth for the southwestern CBD continues
- able to support load growth in Southbank and Docklands
- able to offload the heavily loaded JA, LQ and subsequently VM zone substations and therefore will defer major augmentations at those locations
- the only option to supply at 66kV from Fisherman's Bend Terminal Station, increasing the diversity and security of CBD supply from the transmission network.

[18] Minimum works to address the 66kV risk to achieve CBD (N-1) Secure supply

[19] The new TP will be built with two 55MVA transformers but can be developed to full capacity with additional transformer and 11kV feeders at a later stage.

[20] Based on the feeder total capacity.

## 4.3 Option 2—11kV feeders to Southbank

Under this option we would augment Southbank (**SB**) zone substation and construct new 11kV feeders from LQ and JA to SB.

### 4.3.1 Costs

Currently there are a limited number of connection points at SB and the zone substation is also seeing fast load growth from new developments in Southbank. To enable transfers from LQ and JA to SB, major augmentation works are required to increase the zone substation capacity and the number of connection points. A new transformer and two more 11kV busses can be installed at SB.

The following is a breakdown of the scope of works and investment required to implement this option.

Table 7 Scope and investment of required works ($ 000, 2019)

| Works | Cost |
|---|---|
| Distribution works<br>• 8 new 6.5MVA feeders from SB to 471 FLINDERS LA (R) (1,300m)<br>• 1 new 50/55MVA transformer at SB<br>• 2 new 11kV switch boards at SB | 14,613 |
| Sub-transmission works<br>• 1 new FBTS-SB 66kV supply from FBTS<br>• Cross river conduits for 11&66kV | 14,500 |
| Building works | 300 |
| **Total** | **29,413** |

Source: CitiPower

### 4.3.2 Benefits

This option will enable transfers of approximately 14MVA from JA and 24MVA from LQ and would meet the requirement to deliver the N-1 Secure standard for the CBD.

It will also make 130MVA total station capacity available and 10 additional connection points with high capacity feeders available, which will meet expected load requirements until 2028.

A dis-benefit of this option is that it requires running feeder cables across Yarra River from Southbank to the CBD area.

## 4.4 Option 3—11kV feeders to Victoria Market

Under this option we would redevelop VM and construct new 11kV feeders from LQ and JA to VM.

### 4.4.1 Costs

VM is a fully developed zone substation with no spare connection points due to load growth in the north CBD and the JA offload project.[21]

To enable transfers from LQ, JA to VM, augmentation works are required to increase the zone substation capacity and the number of connection points. This includes redeveloping VM with larger transformers and high capacity connection points. Additionally, the existing building housing the zone substation requires a major upgrade for new plant as well as better ventilation system.

A breakdown of the scope of works and investment required to implement this option is outlined in the table below.

Table 8 Scope and investment of required works ($ 000, 2019)

| Item | Cost |
|---|---|
| Distribution works<br>• 8 new 6.5MVA feeders from VM to JA (650m)<br>• 3 new 11kV switch board at VM<br>• 3 new 50/55MVA transformers at VM<br>• Extend 4 new VM 6.5MVA feeders (200m) to LQ | 17,407 |
| Building works | 10,000 |
| **Total** | **27,407** |

Source: CitiPower

### 4.4.2 Benefits

This option will enable transfers of approximately 14MVA from JA and 24MVA from LQ and would meet the requirement to deliver the N-1 Secure standard for the CBD.

It will also upgrade the existing 32 6MVA connection points to 30 new connection points that accommodate high capacity feeders rated at 10MVA. This will meet expected load requirements until 2031.

A dis-benefit from this option is the material risk to maintaining supply to existing VM customers while undertaking works; there is insufficient supply from surrounding feeders/zone substations to supply VM customers during the re-building works. Given this is infeasible the option is not considered further.

## 4.5 Option 4—demand management

Demand management would not be able to meet the identified need of providing N-1 Secure standard within the CBD. If demand management is required, it indicates N conditions cannot be met.

[21] In the 2016–2020 regulatory period, in order to connect new loads and address the more immediate risk at JA, we are undertaking works to offload JA to VM. After the JA offload, VM will have no spare feeder connection points. In addition, VM is already highly loaded (84% loaded to its N-1 and N rating) therefore offload to VM is only a short-term solution for the capacity constraint and can only delay major augmentation works for the area for a short period of time.

To address the identified need with respect to the unserved energy outlined in table 4, a significant amount of demand management would be needed. In the CBD options for demand management are limited as discussed below:

- load control—in this option load control is taken as a preventative approach, which means customer load will have to be controlled / reduced for the forecast period of high demand in order to avoid the electrical assets being loaded above the N rating. However this is infeasible because CBD customers, in particular offices and hotels, are much less flexible in participating in the demand management. In addition, CBD customers place a high value on supply (hence the N-1 Secure standard), meaning demand management payments would need to be higher than the avoided cost of augmentation.
- Microgrid—customers have their own microgrids (e.g. rooftop PV and battery) to become self-supported when the network reaches its N rating. However this is not possible given the limited roof space to allow sufficient amount of PV panels, limited sun exposure due to high density of CBD buildings, and high cost and space requirements for sufficiently large for battery units.
- voltage reduction—this is a common demand management option however not for the load type of CBD customers. One of the main contributions to the increasing demand and energy in CBD buildings is air conditioners, which is a reactive load. By reducing the voltages, the current will increase which will further overload the electrical assets, therefore this option does not meet the requirement.

Given southwest CBD load growth is too high for demand management to become a viable option and none of the above options is able to address the CBD sector of supply need, demand management option is not considered further.

# 5 Recommendation

Option 1 is the preferred option because it is the least cost option that meets the identified needs and has the highest net benefits. The NPV of benefits is shown in the attached business case model and shown in the table below.[22]

**Table 9 Investment for recommended option ($ 000, 2019)**

| Option | NPV incremental benefits |
|---|---|
| Do nothing (base case)[23] | - |
| Option 1—11kV feeders to TP | 1,072,324 |
| Option 2—11kV feeders to SB | 1,012,859 |
| Option 3—11kV feeders to VM | 1,071,665 |
| Option 4—demand management | Infeasible (unquantified) |

Source: CitiPower

This option also:

- keeps TP in service which provides additional benefits for meeting longer term CBD growth not achieved by the other options
- has lower risks than the other options which include running feeders across the Yarra River and supply outage risks.

As such, we will implement the works in line with our and the ESCV's the original expectation from when the security of supply plan was developed.

We propose to ensure the required 38 MVA of 11kV feeder capacity is in place by 2024/25. The timing of the required investment is outlined in the table below.

**Table 10 Investment for recommended option ($ 000, 2019)**

| Year | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | Total |
|---|---|---|---|---|---|---|
| Option 1 | 2,200 | 8,220 | 9,525 | 4,480 | - | 24,425 |

Source: CitiPower

[22] CP MOD 6.06 - CBD supply - Jan2020 - Public

[23] This option has negative benefits (unserved energy), however, all options have been assessed relative to this scenario and so it is presented as zero costs and benefits.