



TRANSPOWER

# Enhancing System Planning with Special Protection Schemes (SPSs)

Proposing an Intertrip Scheme for the Henderson-Wellsford Circuit

Thomas Mander – EEA APEX 2025

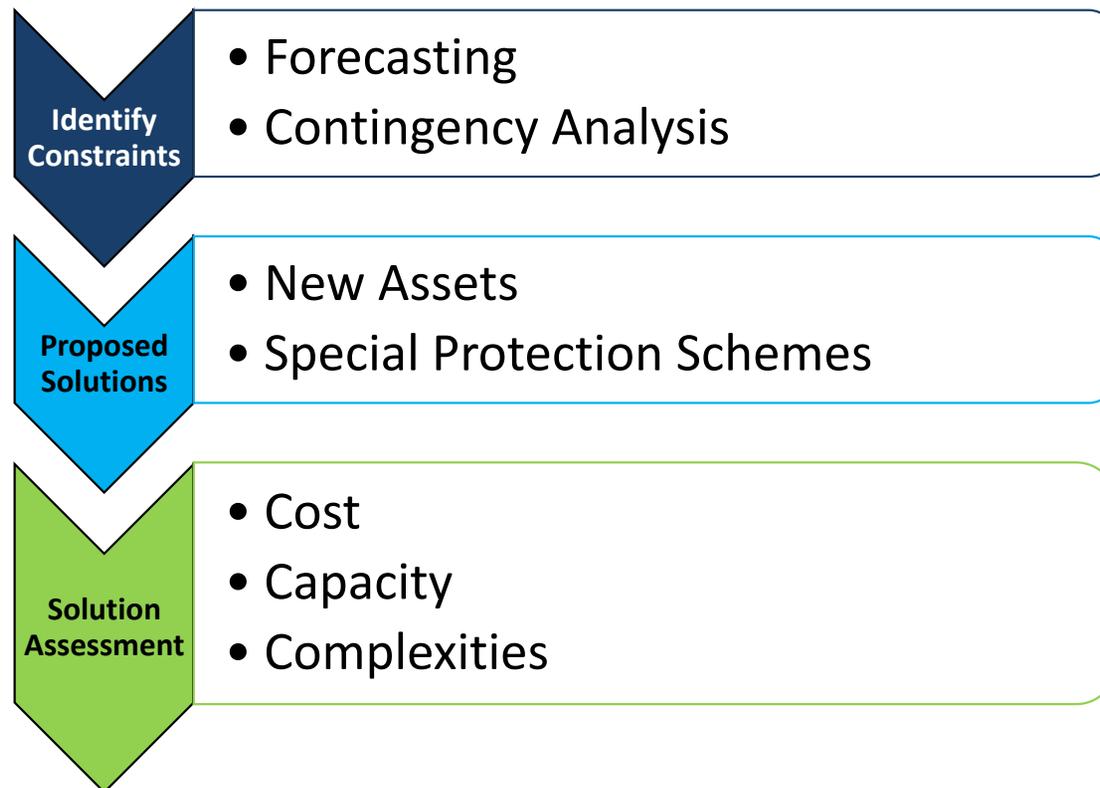


## Transpower's decisions affect everyone

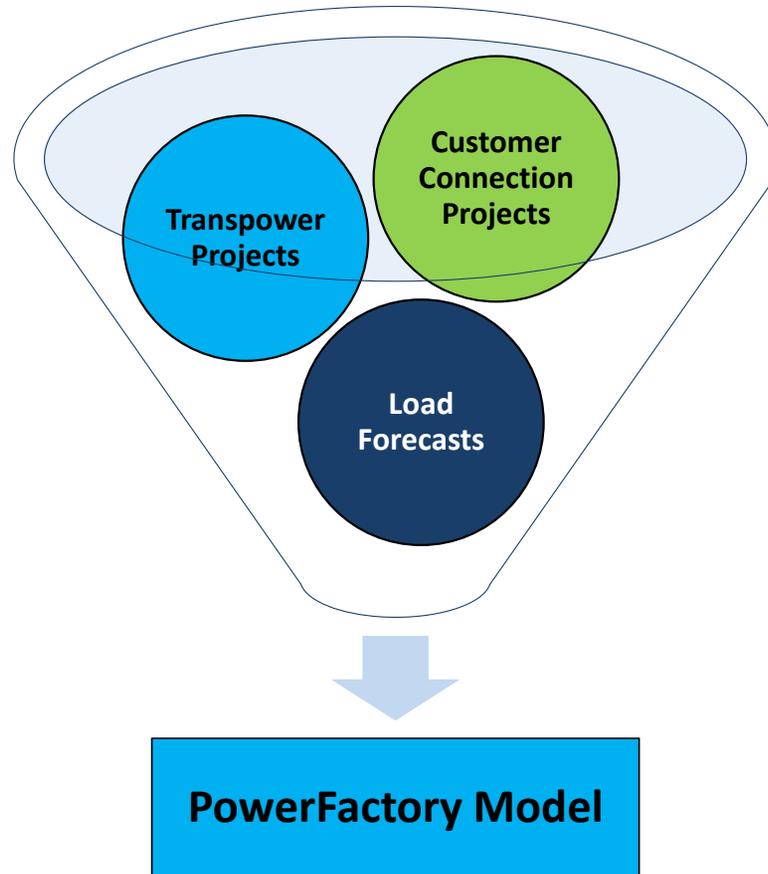
- How do our investments affect you?
- Decision making in system planning.
- Using Special Protection Schemes (SPSs) to enable an affordable energy transition.



## System Planning identifies Constraints, Proposes and Assesses Solutions



# We Build PowerFactory Models Using Committed Projects



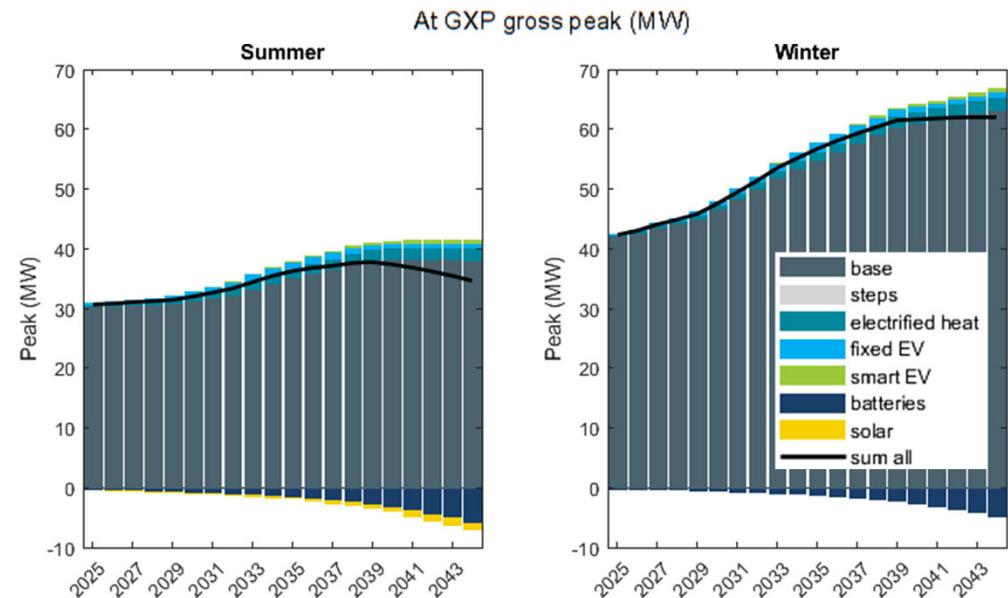
Identify Constraints

Proposed Solutions

Solution Assessment

## Multiple Load Forecasts are Made to Cope with an Uncertain Future

- Prudent & Expected Forecasts.
- Merge EDB and National Forecasts.
- Seasonal Forecasts.
- Forecasts at Regional and GXP peaks.
- What happens post 2045?



Identify Constraints

Proposed Solutions

Solution Assessment

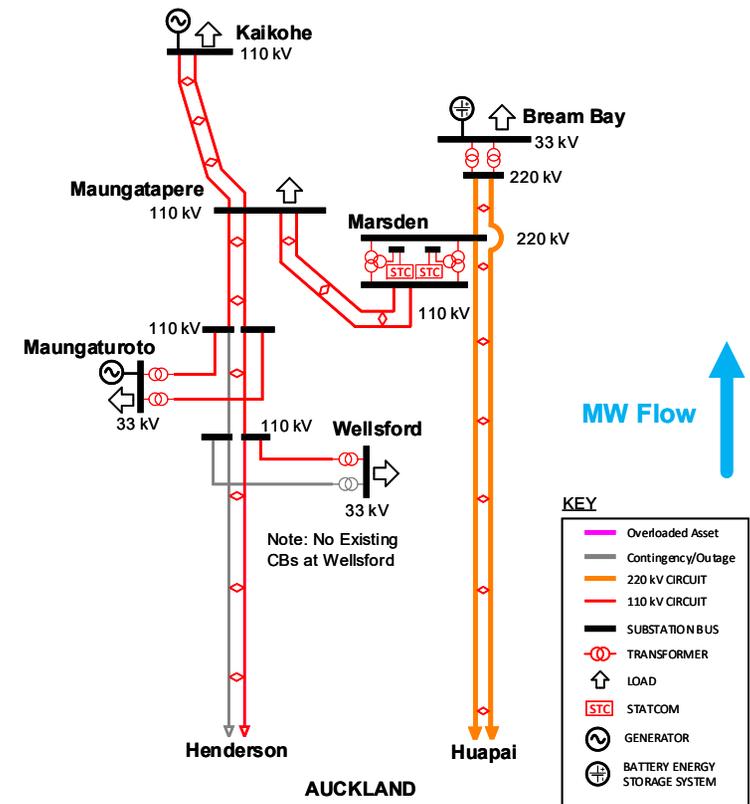
# The Henderson-Maungaturoto Circuit Will Overload From 2032

## The Scenario

- Prudent Load Forecast
- Regional Peak Load Forecast
- Henderson-Maungaturoto Contingency

## The Outcome

- Parallel circuit overloads in Winter 2032.

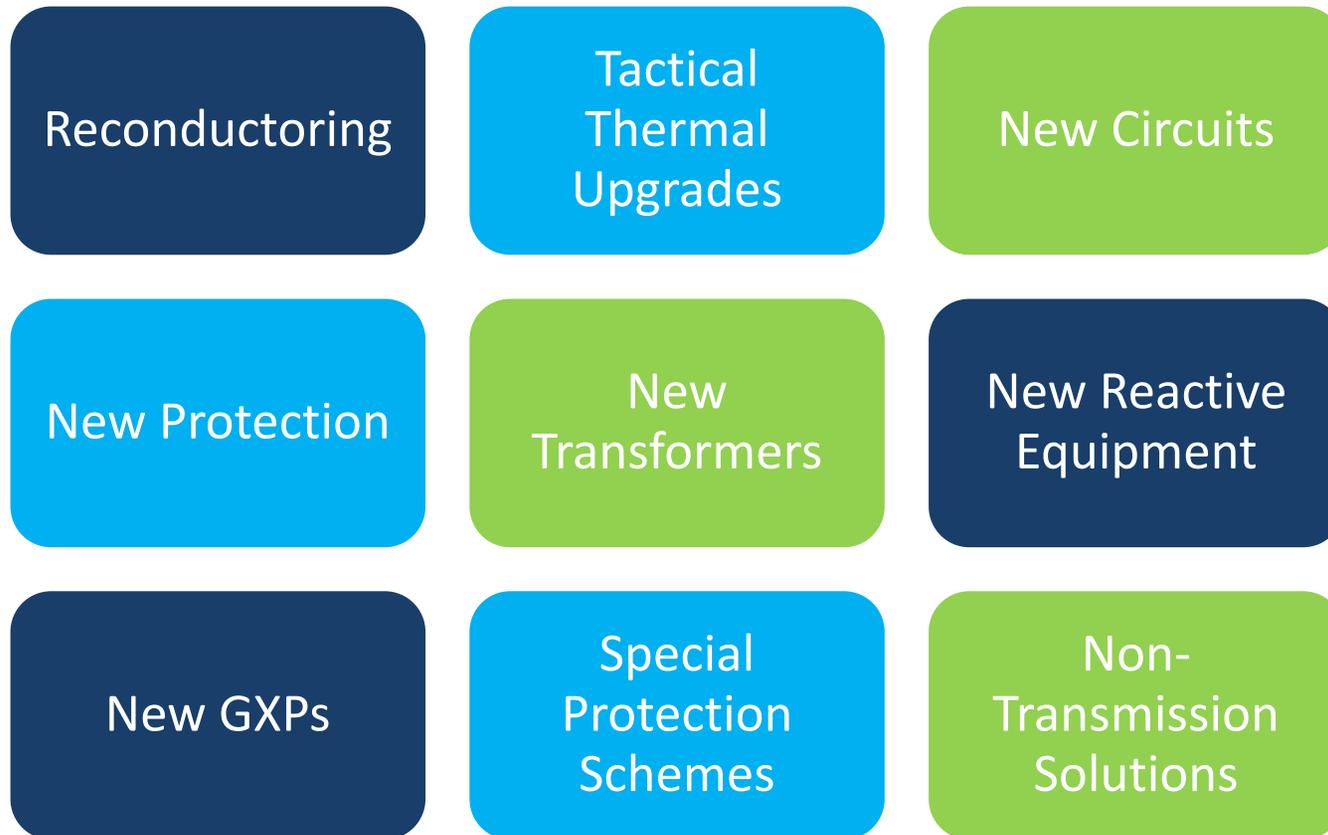


Identify Constraints

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## SPSs are a new way to remove constraints



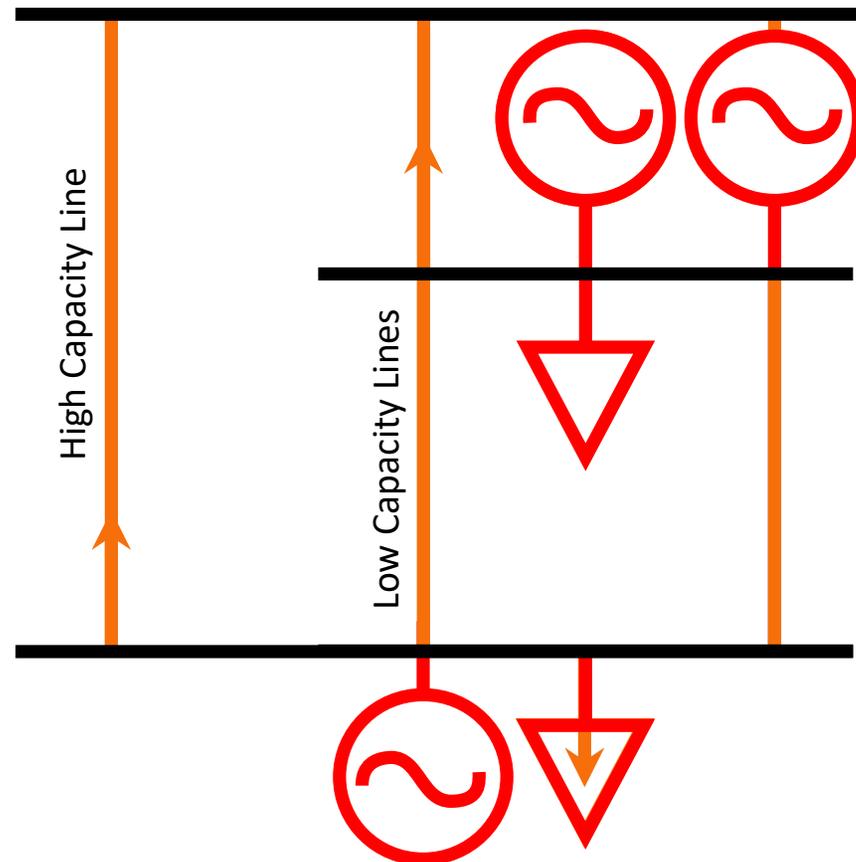
Identify Constraints

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## SPSs are instructions following a contingency

- Generation Runback
- Load Shedding
- Anti-Islanding Schemes
- Intertrip Schemes



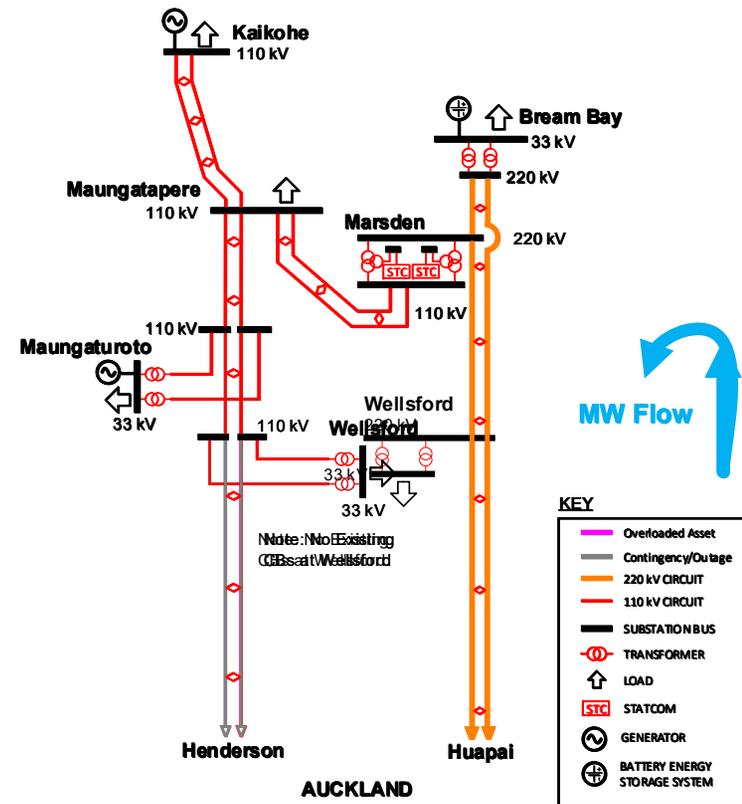
Identify Constraints

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## An intertrip scheme provides a new solution to the Henderson-Wellsford overload

- Overload forecast to occur from 2032.
- Existing options to remedy this were:
  - Henderson-Wellsford Tactical Thermal Upgrade (TTU)/Reconductoring.
  - Load Shedding Special Protection Scheme (SPS) at Wellsford.
  - Transfer Wellsford Substation to 220 kV circuits.
- My proposed solution was to:
  - Install line protection at Wellsford.
  - Implement a circuit intertrip scheme.



Identify Constraints

Proposed Solutions

Solution Assessment

## The intertrip scheme is a low-cost option to increase capacity

	TTU	Load Shedding	220 kV Substation	Intertrip Scheme
<b>Cost</b>	Med-High	Low	High	Low-Med
Integration Complexity	Low	Medium	Low-Medium	Medium
Expected Shortfall	During 110 kV N-2 events	During 110 kV N-1 events	During 220 kV N-2 events	During non-parallel 110 kV N-2 events
N-1 Capacity Increase	~37%	0%	~46%	~27% (0.9 p.u. voltage)
<b>New Overload Year</b>	~2055	~2032	~2058	~2051

Identify Constraints

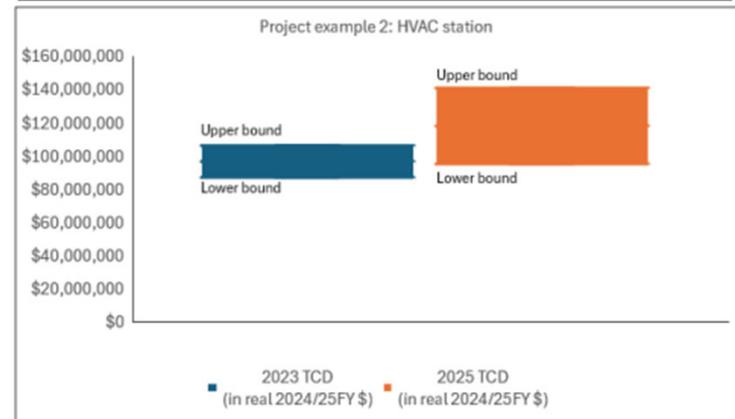
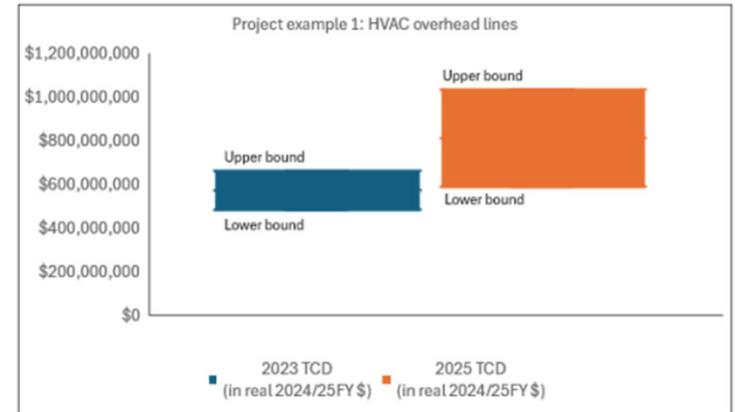
Proposed Solutions

Solution Assessment

# Deferring high-cost investments is cheaper!

- SPS's are great as a temporary solution to reduce upfront cost.
- Investment is cheaper in the future as businesses generate money.
- From 2023-2025 AEMO's costing tool increased the cost of overhead lines projects by ~43%.
- During the energy transition, deferring investments by a couple years **may** be detrimental to the balance sheet.

	TTU	Intertrip Scheme
Cost	Med-High	Low-Med
N-1 Capacity Increase	~37%	~27% (0.9 p.u. voltage)
New Overload Year	~2055	~2051



[https://www.aemo.com.au/-/media/files/stakeholder\\_consultation/consultations/nem-consultations/2025/2025-electricity-network-options-report/ghd-2025-transmission-cost-database-update-final-report](https://www.aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2025/2025-electricity-network-options-report/ghd-2025-transmission-cost-database-update-final-report)

Identify Constraints

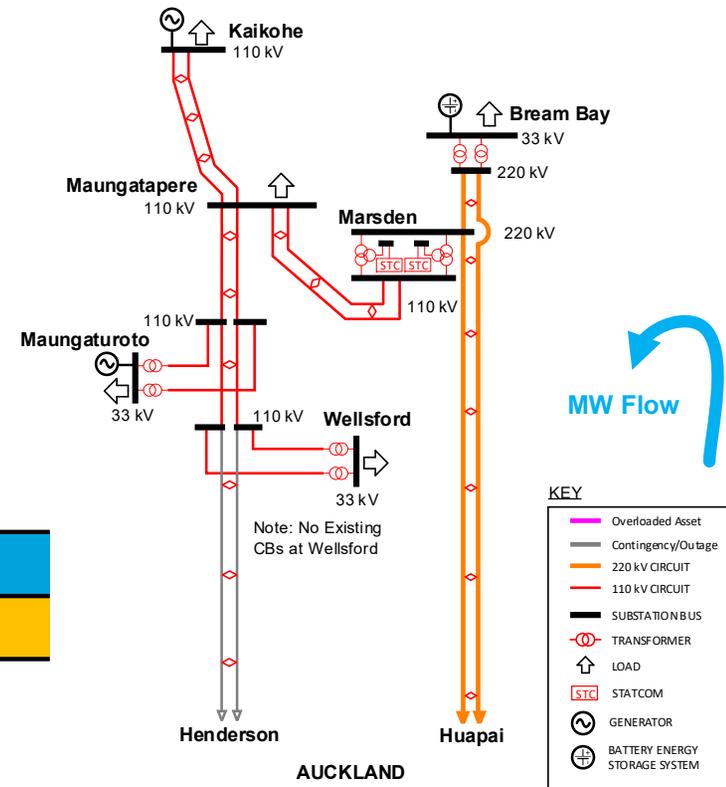
Proposed Solutions

Solution Assessment

# We need to rise to the challenges of integrating SPSs

- They change grid topology.
- Communication Required.
- Planned outages may be difficult to acquire.
- May interact with other SPSs.
- Market tool integration.

	TTU	Intertrip Scheme
Integration Complexity	Low	Medium



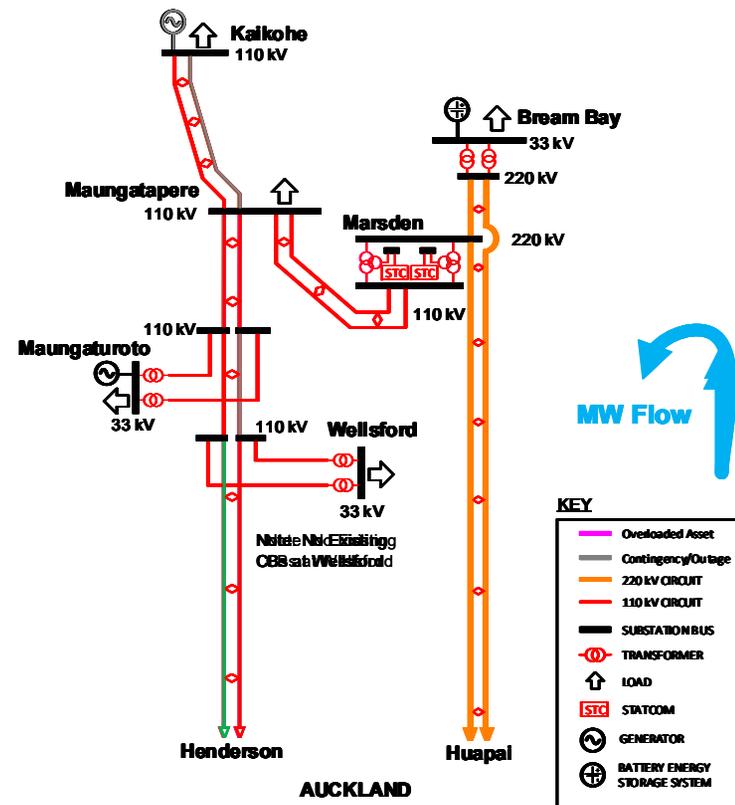
Identify Constraints

Proposed Solutions

Solution Assessment

# Integration of the Northland intertrip scheme is achievable

- Topology:
  - Loads Marsden transformers.
  - Low voltage.
- Communication Failure:
  - Triggers SPS.
- Planned outages issues:
  - Maungatapere-Maungaturoto circuit - 2039.
  - Marsden Transformer - 2046.
  - Turning off the SPS during these outages defers these issues.
- SPS Interactions:
  - Henderson-Wellsford intertrip doesn't trigger Kaikohe runback.
  - Kaikohe runback doesn't trigger Henderson-Wellsford intertrip.



Identify Constraints

Proposed Solutions

Solution Assessment

## System Planning is using SPSs to enable an affordable energy transition

- System Planning uses committed projects, load forecasts and contingency analysis to identify constraints.
- SPSs provide a low-cost option to defer constraints.
- Integration assessment of SPSs is required to ensure reliability.

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graph LR; A[Identify Constraints] --> B[Proposed Solutions]; B --> C[Solution Assessment];
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Identify Constraints

Proposed Solutions

Solution Assessment



**Thank you**

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