Vector's consumption data journey:

Towards 100% coverage

AIMF, 25 November 2022

Chris Franks

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What we'll cover today

1. Vector's approach to Smart Meter data access
2. How we are getting access
3. Making the business case
4. Where we are now.
5. Our next steps

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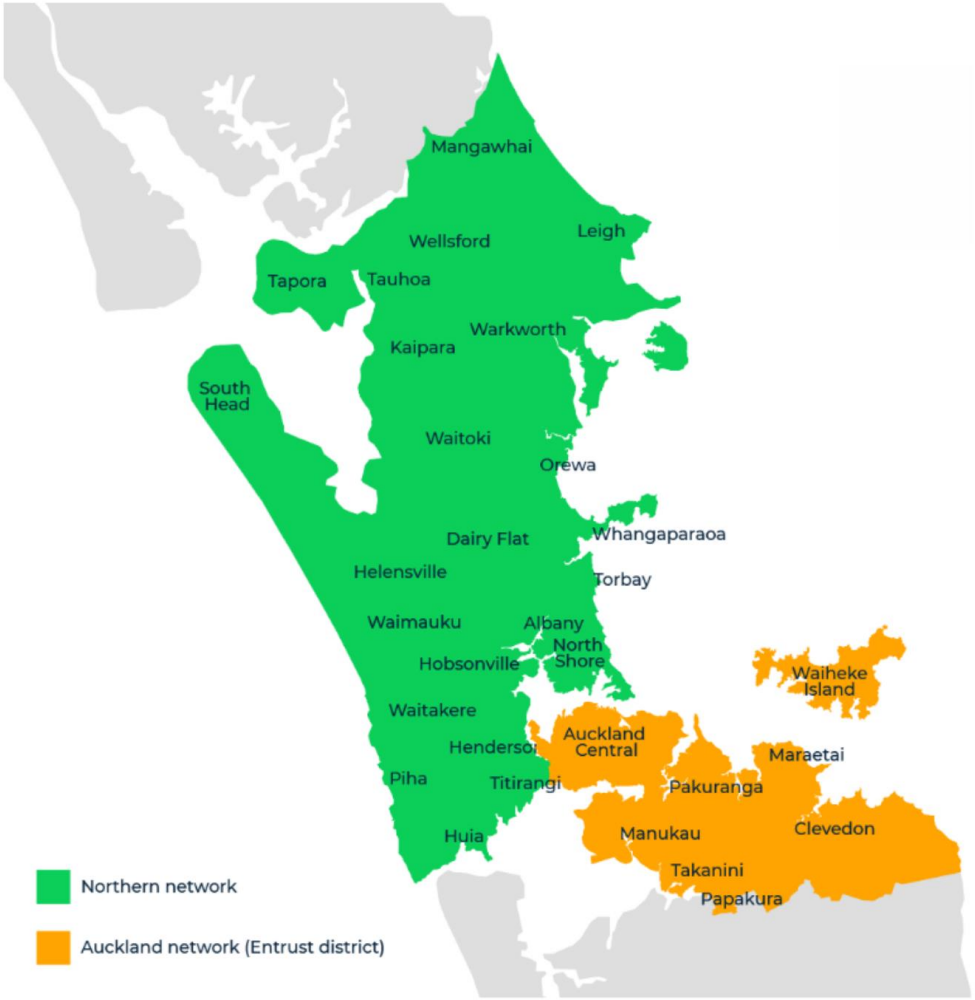
Our Network



600k ICPs

23k Distribution Substations (ground and overhead)

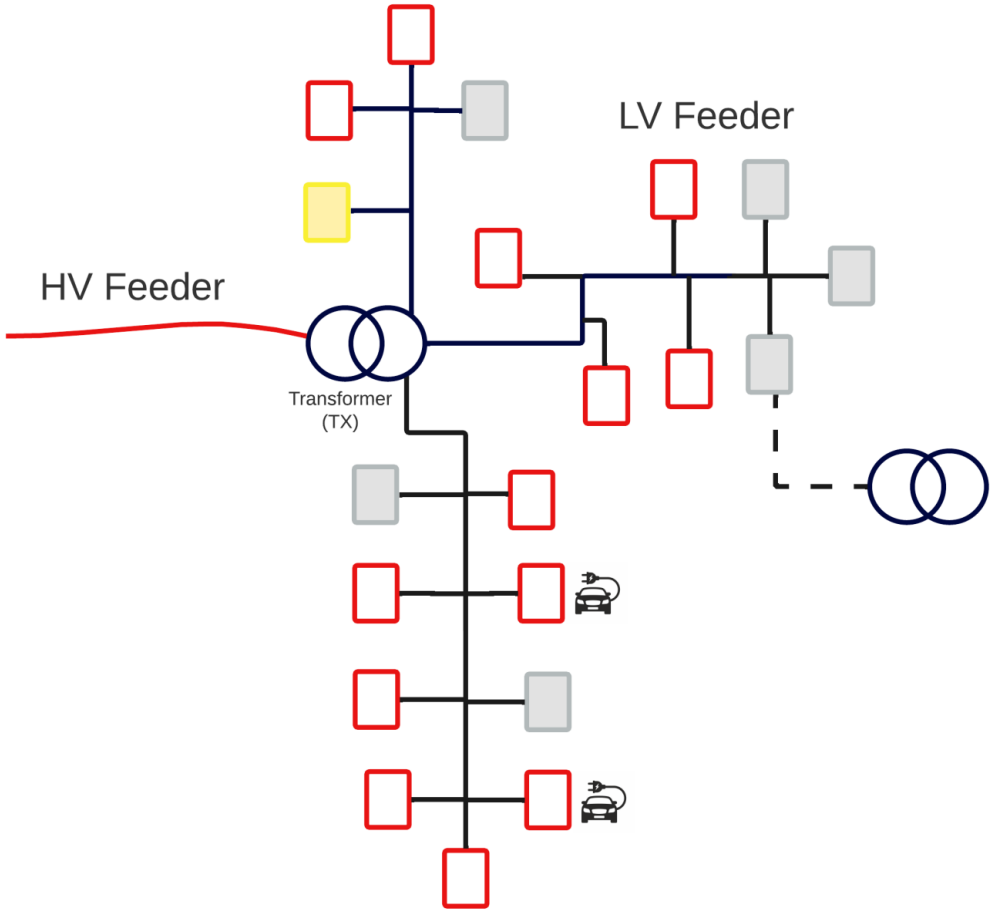
111 Zone Substations

125k Poles

20k km lines/cables

Number of meters we own… **Zero**

What is Smart Meter Data ?



- ICP Level
- Residential & Commercial interval & event data (usually 30 mins or less)
- Collected by MEPs
- Available in batch (monthly), moving to real time (future)

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Smart Meter Data Available – From the Same Meter

Consumption Data

kWh half hour

Available with Retailer approval

Requires DDA contract, Appendix C and Data Agreement

Power Quality Data

Voltage, Current, Phase Angle, etc also includes Event Data.

Available with MEP approval

Requires data agreement with all MEPS on the network

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Key Themes for Smart Meter data Application

	kWh	PQ
LV Network Demand	✓	
Unregistered DER identification	✓	
Customer behaviour	✓	
LV DER Hosting Capacity		✓
Customer service monitoring		✓
Public Safety		✓
LV Network connectivity derivation (NC) - Circuit - Phase		✓

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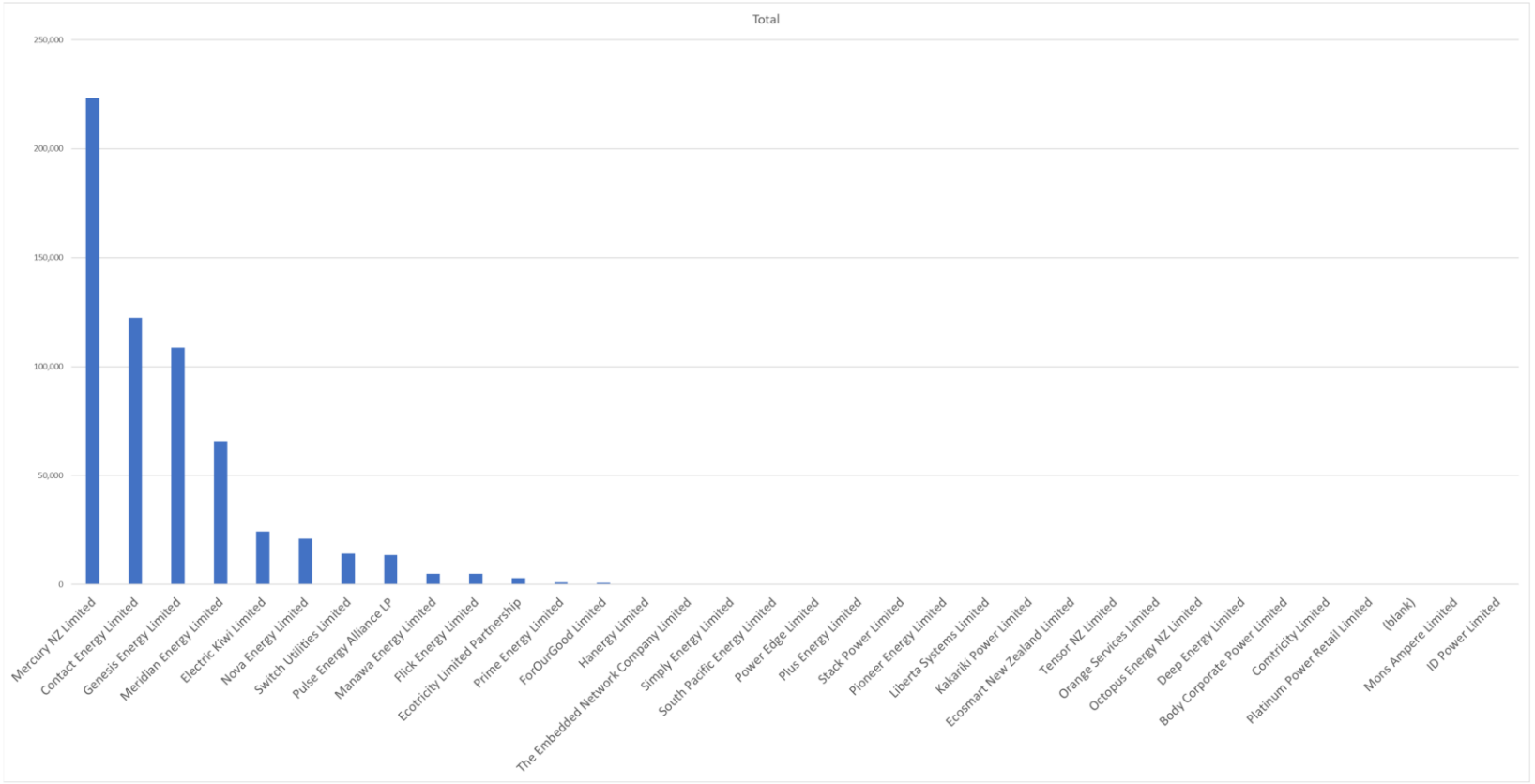
	Theme	Use Case	Data Point	Aggregation	Interval	Topology	Latency
1	LV Network loading (demand)	Transformer Demand Loading	kWh	Sum	30 min	Vector Supplied ICP > Transformer	Monthly
2	Unregistered DER identification	EV Detection	kWh	Sum	30 min	ICP > Address	Monthly
3	ICP connectivity / topology Mapping	ICP Transformer Mapping - Improvement	kWh	Sum	30 min	Vector Supplied ICP > Transformer	Monthly
4	Customer and market analysis	Customer consumption analysis	kWh	Sum	30 min	ICP > Address	Monthly
5	Load control - Effectiveness monitoring	Load drop monitoring	kWh	Sum	30 min	Vector Supplied ICP > Transformer	Monthly
6	DER hosting capacity (Voltage)	Transformer Voltage headroom	V	Average / Instantaneous	30 min / 10 min	Vector Supplied ICP > Transformer	Monthly
7	Customer service monitoring	Power quality service standard monitoring	V	Average / Instantaneous	30 min / 10 min	N/A	Monthly
8	Customer service monitoring	LV SAIDI / LV Outage monitoring	Outage Events	Count	HH:MM:SS	Vector Supplied ICP > Transformer	Monthly
9	ICP connectivity / topology Mapping	ICP Transformer Mapping - Improvement	Outage Events	Count	HH:MM:SS	Vector Supplied ICP > Transformer	Monthly
10	ICP connectivity / topology Mapping	ICP- LV Feeder derivation	V + Active Power + Reactive Power OR V + Current + Phase Angle	Instantaneous	10 min		Monthly
11	ICP connectivity / topology Mapping	ICP-LV Phase derivation	V + Active Power + Reactive Power OR V + Current + Phase Angle	Instantaneous	10 min		Monthly
12	LV Network loading (demand)	LV Feeder Loading	kWh	Average / Instantaneous	30 min / 10 min	Derived ICP > LV Feeder	Monthly
13	LV Network loading (demand)	LV Phase Loading	kWh	Average / Instantaneous	30 min / 10 min	Derived ICP > LV Phase	Monthly
14	DER hosting capacity (Voltage)	LV Feeder Headroom	V	Average / Instantaneous	30 min / 10 min	Derived ICP > LV Feeder	Monthly
15	DER hosting capacity (Voltage)	LV Phase Headroom	V	Average / Instantaneous	30 min / 10 min	Derived ICP > LV Phase	Monthly
16	Customer Safety	High impedance fault detection	V + Active Power + Reactive Power OR V + Current + Phase Angle	Instantaneous	10 min		Daily
17	LV Network Impedence	LV Feeder Impedence	V + Active Power + Reactive Power OR V + Current + Phase Angle	Instantaneous	10 min	Derived ICP > LV Feeder	Monthly

Retailer owned data – kWh Consumption



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The journey to today

1. New Part 10 of the Code went live in 2013, including new retailer-appointed MEP model. Some retailer-MEP agreements had restrictive data access terms
2. Extensive concerns by retailers around privacy and permitted uses of data
3. 2016 Code changes by EA to open up data flows did not work as intended
4. Some bilateral negotiations prior to the DDA, but these did not unlock much data
5. 2020 DDA – and Appendix C – unlocked the door but still had limitations

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The DDA and Appendix C – implementation challenges

1. Three major limitations:
    1. Prohibited data being combined with other datasets, reducing usefulness
    2. Default 6-monthly frequency
    3. Did not consider practicalities of MEPs liaising with EDBs for data provision
2. EA mediated a solution between some ENA and ERANZ members, but this was not accepted by EA Board as replacement Appendix as not all retailers were involved in mediated solution
3. Vector (and others) have charged ahead with the mediated solution and agreed it with retailers
4. Signing agreements did not mean data would start flowing (which the EA had not anticipated)).
    1. Different retailers have taken different approaches (e.g. direct provision vs via MEP)
    2. Actual implementation has taken longer

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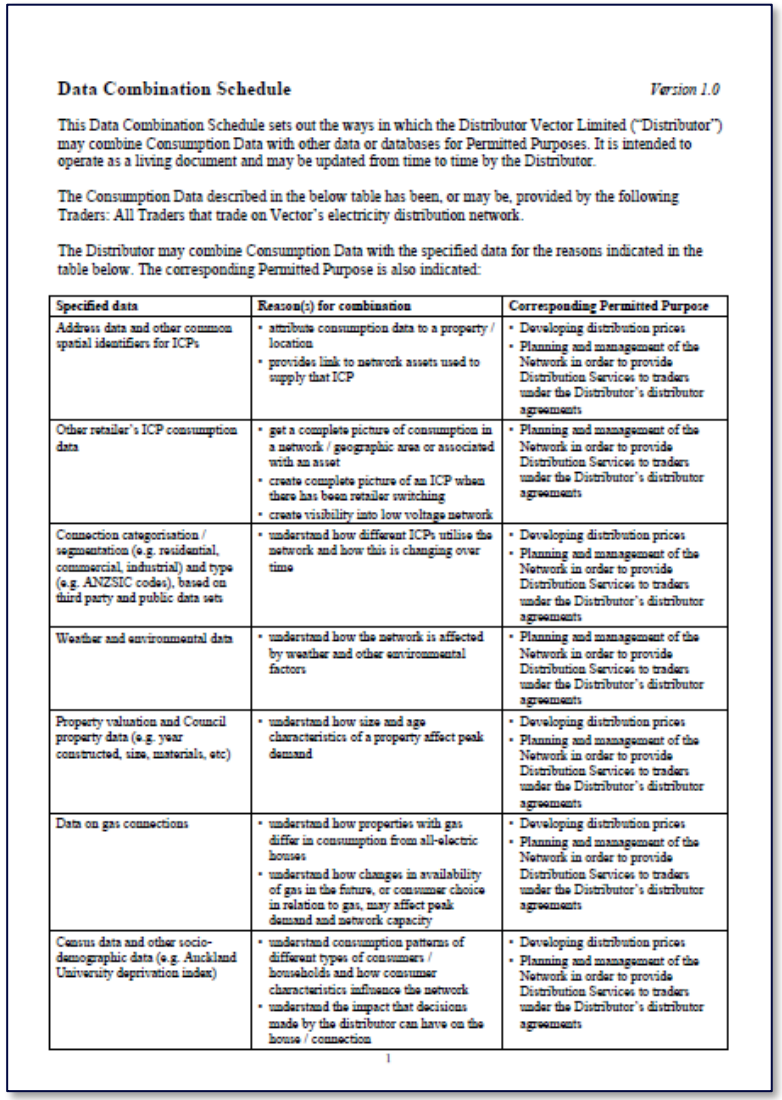
Legal hooks

1. EDB indemnities
2. Strict adherence to the defined permitted use
3. Strict data access and disclosure protocols, and retailer right to audit
4. Data combination schedule



Data Combination Schedule *Version 1.0*

This Data Combination Schedule sets out the ways in which the Distributor Vector Limited ("Distributor") may combine Consumption Data with other data or databases for Permitted Purposes. It is intended to operate as a living document and may be updated from time to time by the Distributor.

The Consumption Data described in the below table has been, or may be, provided by the following Traders: All Traders that trade on Vector's electricity distribution network.

The Distributor may combine Consumption Data with the specified data for the reasons indicated in the table below. The corresponding Permitted Purpose is also indicated:

Specified data	Reason(s) for combination	Corresponding Permitted Purpose
Address data and other common spatial identifiers for ICPs	• attribute consumption data to a property / location • provides link to network assets used to supply that ICP	• Developing distribution prices • Planning and management of the Network in order to provide Distribution Services to traders under the Distributor's distributor agreements
Other retailer's ICP consumption data	• get a complete picture of consumption in a network / geographic area or associated with an asset • create complete picture of an ICP when there has been retailer switching • create visibility into low voltage network	• Planning and management of the Network in order to provide Distribution Services to traders under the Distributor's distributor agreements
Connection categorisation / segmentation (e.g. residential, commercial, industrial) and type (e.g. ANZSIC codes), based on third party and public data sets	• understand how different ICPs utilise the network and how this is changing over time	• Developing distribution prices • Planning and management of the Network in order to provide Distribution Services to traders under the Distributor's distributor agreements
Weather and environmental data	• understand how the network is affected by weather and other environmental factors	• Planning and management of the Network in order to provide Distribution Services to traders under the Distributor's distributor agreements
Property valuation and Council property data (e.g. year constructed, size, materials, etc)	• understand how size and age characteristics of a property affect peak demand	• Developing distribution prices • Planning and management of the Network in order to provide Distribution Services to traders under the Distributor's distributor agreements
Data on gas connections	• understand how properties with gas differ in consumption from all-electric houses • understand how changes in availability of gas in the future, or consumer choice in relation to gas, may affect peak demand and network capacity	• Developing distribution prices • Planning and management of the Network in order to provide Distribution Services to traders under the Distributor's distributor agreements
Census data and other socio-demographic data (e.g. Auckland University deprivation index)	• understand consumption patterns of different types of consumers / households and how consumer characteristics influence the network • understand the impact that decisions made by the distributor can have on the house / connection	• Developing distribution prices • Planning and management of the Network in order to provide Distribution Services to traders under the Distributor's distributor agreements

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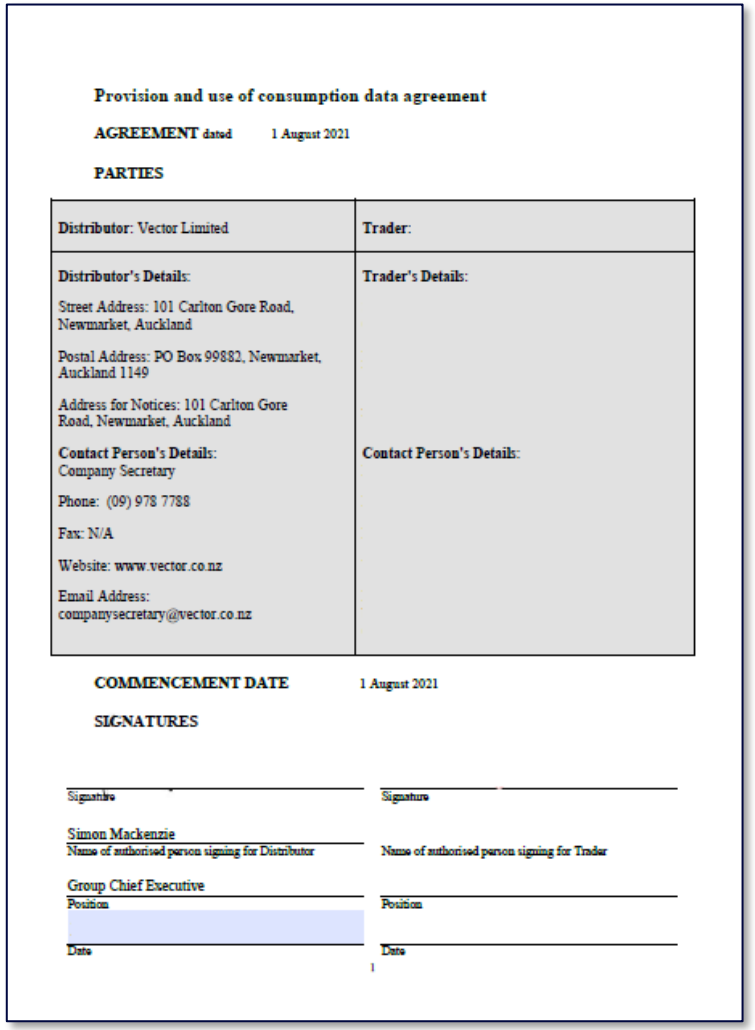
What we're now receiving – consumption data

1. 99% of our ICPs are under contract – currently receiving for 82% of ICPs
2. Historic data back to 2017 – a five-year complete dataset
3. Half-hourly consumption data on a monthly basis
4. Some sourced via retailer, some via MEP (requiring payment for reasonable costs)
5. Preference for EIEP3, but not always used – requiring data cleaning
6. Still need to account for retailer switching, daylight savings differences, etc
7. We have also begun to receive power quality data, on a trial basis



Provision and use of consumption data agreement

AGREEMENT dated 1 August 2021

PARTIES

Distributor: Vector Limited	**Trader**:
Distributor's Details: Street Address: 101 Carlton Gore Road, Newmarket, Auckland Postal Address: PO Box 99882, Newmarket, Auckland 1149 Address for Notices: 101 Carlton Gore Road, Newmarket, Auckland **Contact Person's Details:** Company Secretary Phone: (09) 978 7788 Fax: N/A Website: www.vector.co.nz Email Address: companysecretary@vector.co.nz	**Trader's Details:** **Contact Person's Details:**

COMMENCEMENT DATE 1 August 2021

SIGNATURES

Signature	Signature
Simon Mackenzie Name of authorised person signing for Distributor	Name of authorised person signing for Trader
Group Chief Executive Position	Position
Date	Date

1

Lessons learned

1. EDBs need to budget for the data
2. Data governance
3. We needed strong support from commercial, legal, and regulatory team to engage with retailers and MEPs – a signed Appendix C does not automatically equal data in the door
4. Data platforms – both from a storage and an analytics perspective
5. Data management – volume, de-duplication, creating a ‘whole of network’ view
6. EDBs need to proactively define use cases and what data we need to support these
7. Data science and engaged engineers with analytical background can unlock the value for Permitted Purposes
8. Exec support is essential

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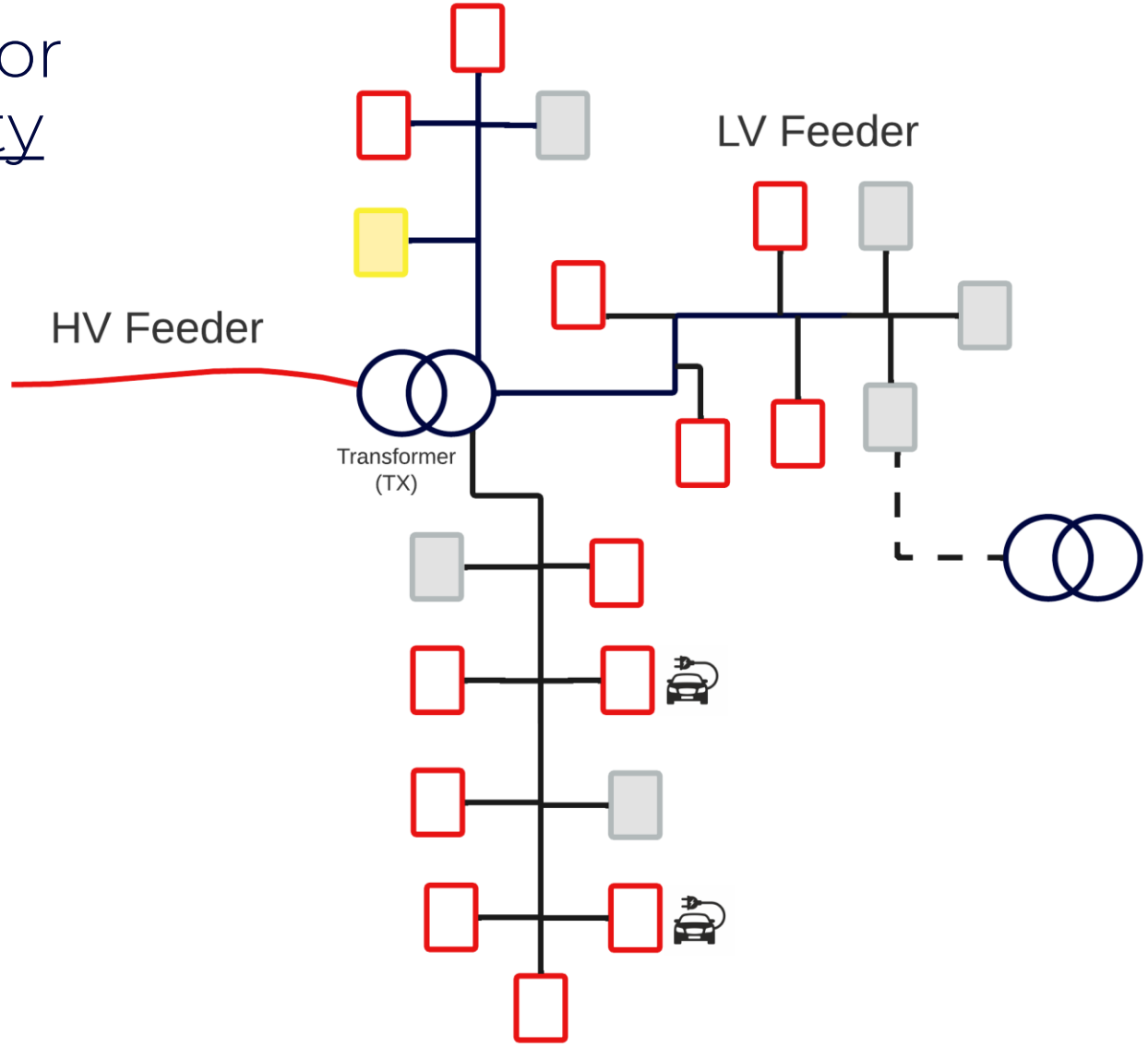
What's next for us – use cases for consumption and power quality

1. Consumption data – ICP-Level demand analysis
    - Distribution transformer capacity
    - EV & DER Detection
    - Current and future network usage requirements
2. Power Quality Data – Voltage (5 mins)
    - LV Feeder & Phase identification
    - Voltage compliance
    - DER hosting capacity
3. On-Demand – Near Real-time
    - Outage management & Operational use cases
    - Non-traditional real-time data



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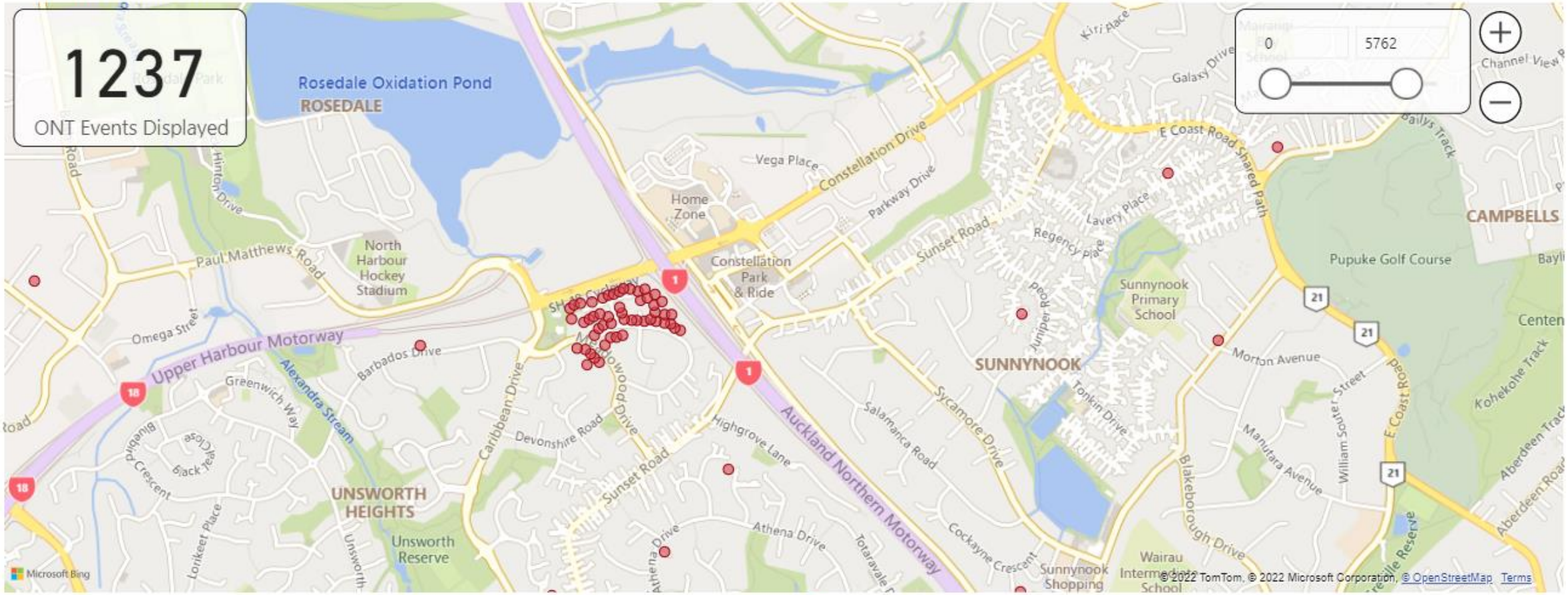
ONT Events Recorded



powerStatus ● off

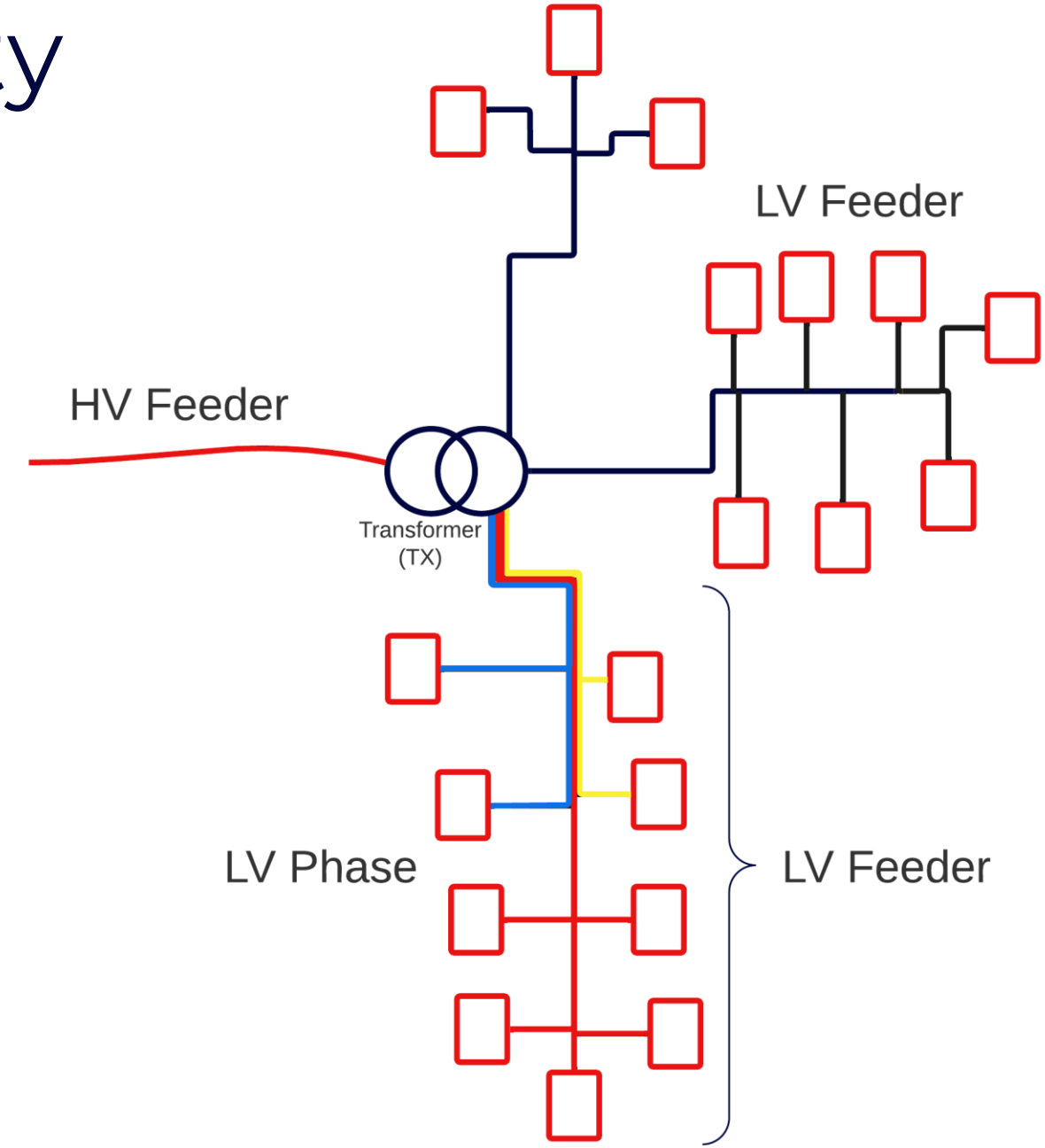
larm Time	Age (Mins)	Status	Property	Road	Suburb	Tui	Transformer	Check Outage
3/09/22 09:37	261	off	10	JAMES ROAD	Manurewa, Auckland	1001632724	S-593	https://help.vector.co.nz/ad
3/09/22 09:37	261	off	8	WYMAN PLACE	Pakuranga Heights, Auckland	1001552517	S-12356	https://help.vector.co.nz/ad
3/09/22 09:37	261	off	11	MEREDITH STREET	Blockhouse Bay, Auckland	1001561535	C-930	https://help.vector.co.nz/ad
3/09/22 09:37	261	off	32	ALEXANDER CRESCENT	Otara, Auckland	1001599153	S-166	https://help.vector.co.nz/ad
3/09/22 09:36	262	off	7	NEWELL STREET	Point Chevalier, Auckland	1001451989	C-44	https://help.vector.co.nz/ad
3/09/22 09:36	262	off	29	CAEN ROAD	Panmure, Auckland	1001534382	C-615	https://help.vector.co.nz/ad
3/09/22 09:36	262	off	58	MOTATAU ROAD	Papatoetoe, Auckland	1001605301	S-1810	https://help.vector.co.nz/ad

Suburb

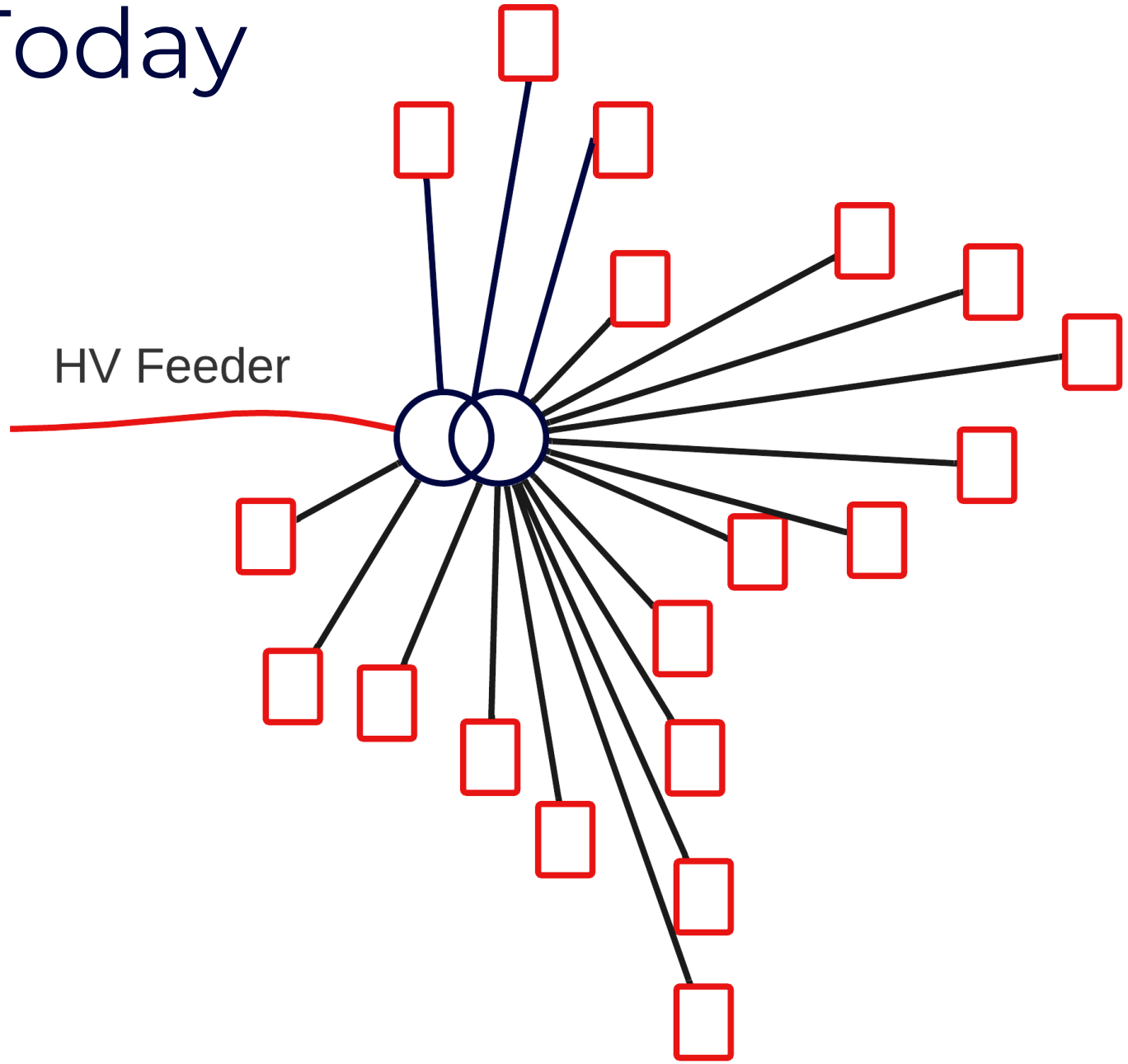
- (Blank)
- Albany Heights, Auckland
- Algies Bay, Auckland
- Arkles Bay, Auckland
- Army Bay, Auckland
- Auckland Central, Auckland
- Avondale, Auckland
- Bayview, Auckland
- Beach Haven, Auckland
- Beachlands, Auckland

ONT Activity

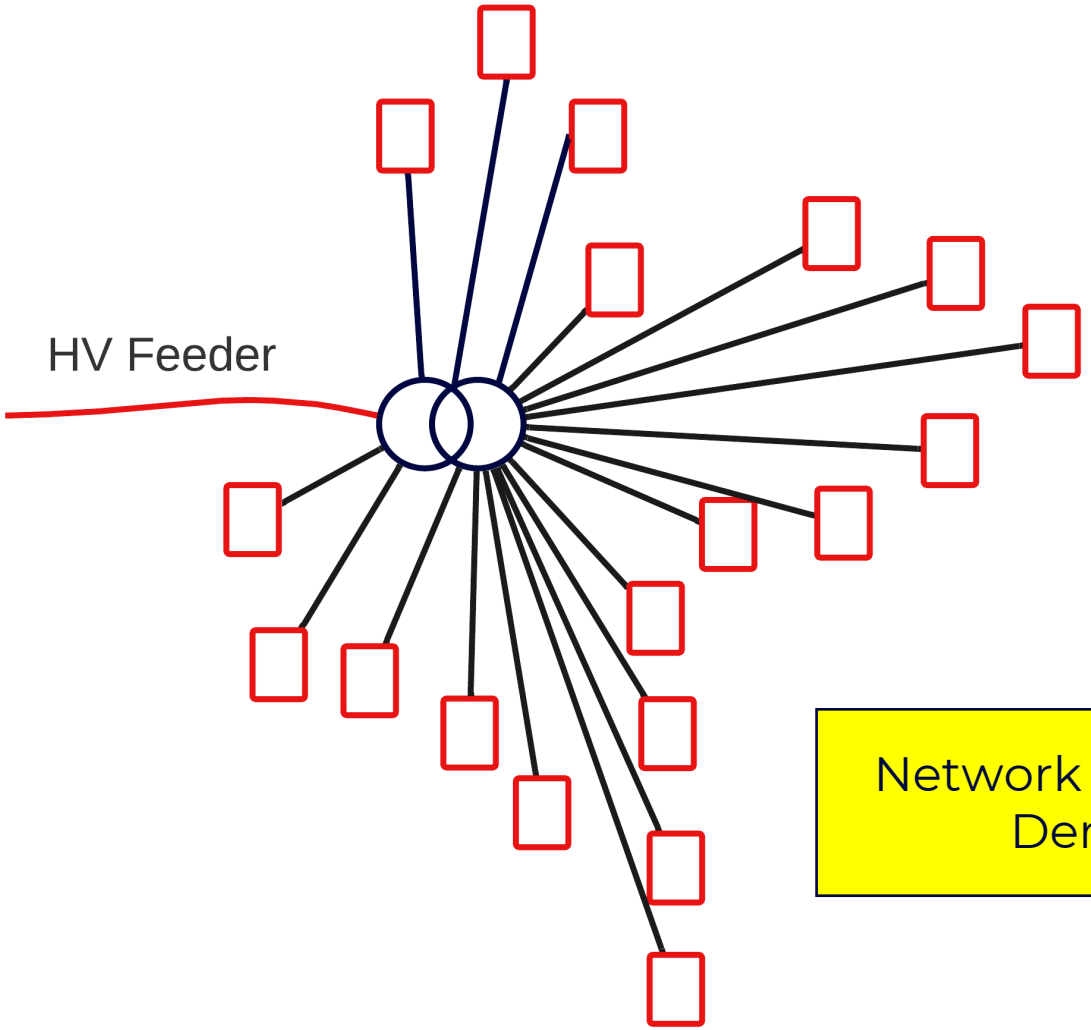
LV Visibility



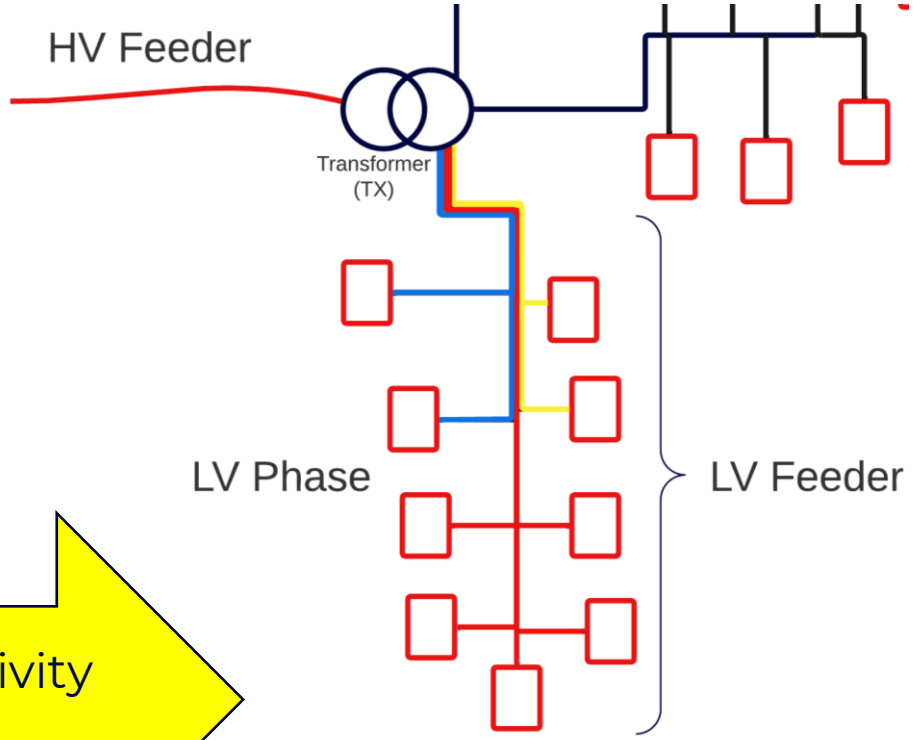
LV Visibility Today



LV Visibility

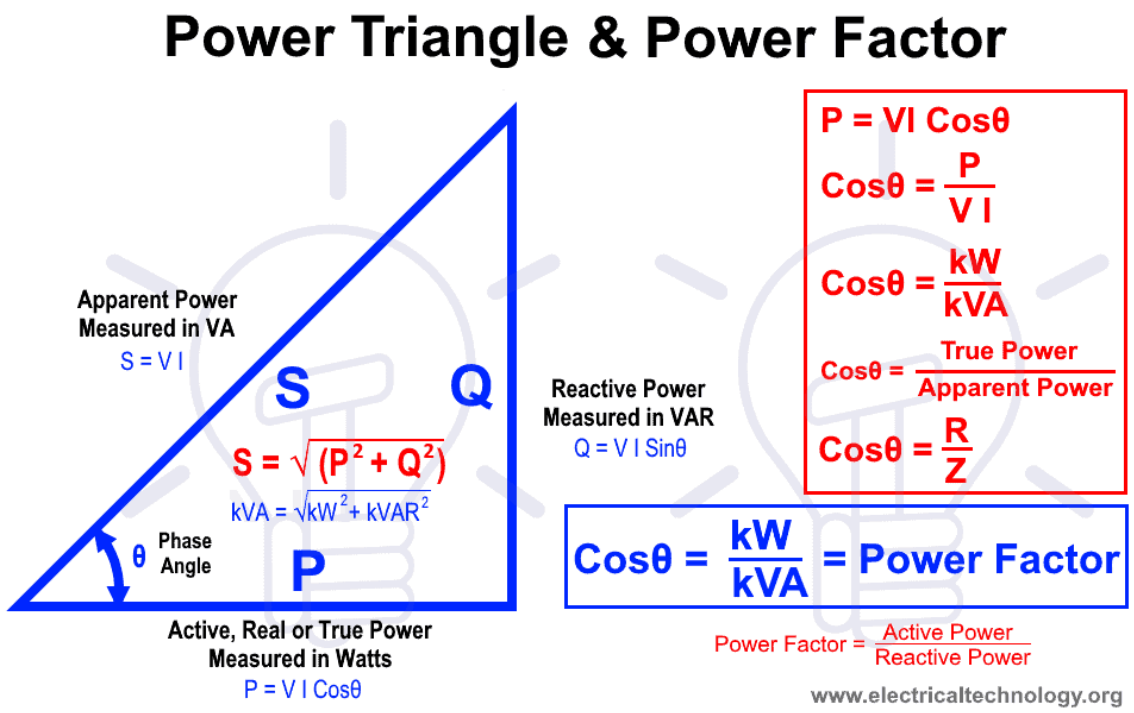


Network Connectivity Derivation



Key Themes for Smart Meter data Application

	ICP	Transformer	LV Feeder + Phase
LV Network Demand	kWh	kWh + GIS	kWh + NC
Unregistered DER identification	kWh	kWh + GIS	kWh + NC
Customer behaviour	kWh	kWh + GIS	
LV DER Hosting Capacity		PQ + GIS	PQ + NC
Customer service monitoring	PQ		
Public Safety	PQ		
LV Network connectivity derivation (NC) - Circuit - Phase		kWh + PQ	kWh + PQ



Data Forms

Power Form

- Voltage (Volt)
- Active Power (Watt)
- Reactive Power (Var)

OR

Current Form

- Voltage (Volt)
- Current (Amp)
- Phase Angle or Power Factor

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1	Voltage	Instantaneous
	Active Power	Instantaneous
	Reactive Power	Instantaneous
1	Voltage	Instantaneous
	Current	Instantaneous
	Phase Angle	Instantaneous
2	Voltage	Instantaneous
	Active Power	Average
	Reactive Power	Average
3	Voltage	Average
	Current	Average
	Phase Angle	Instantaneous
4	Voltage	Average
	Active Power	Average
	Reactive Power	Average
5	Voltage	Average
	Current	Average
	Phase Angle	Average

VM – 5min

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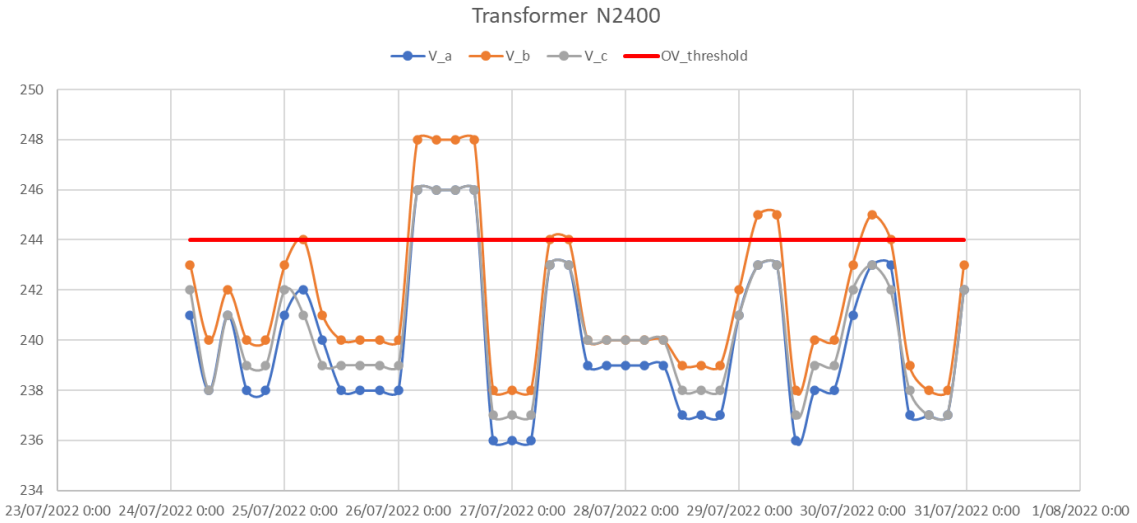
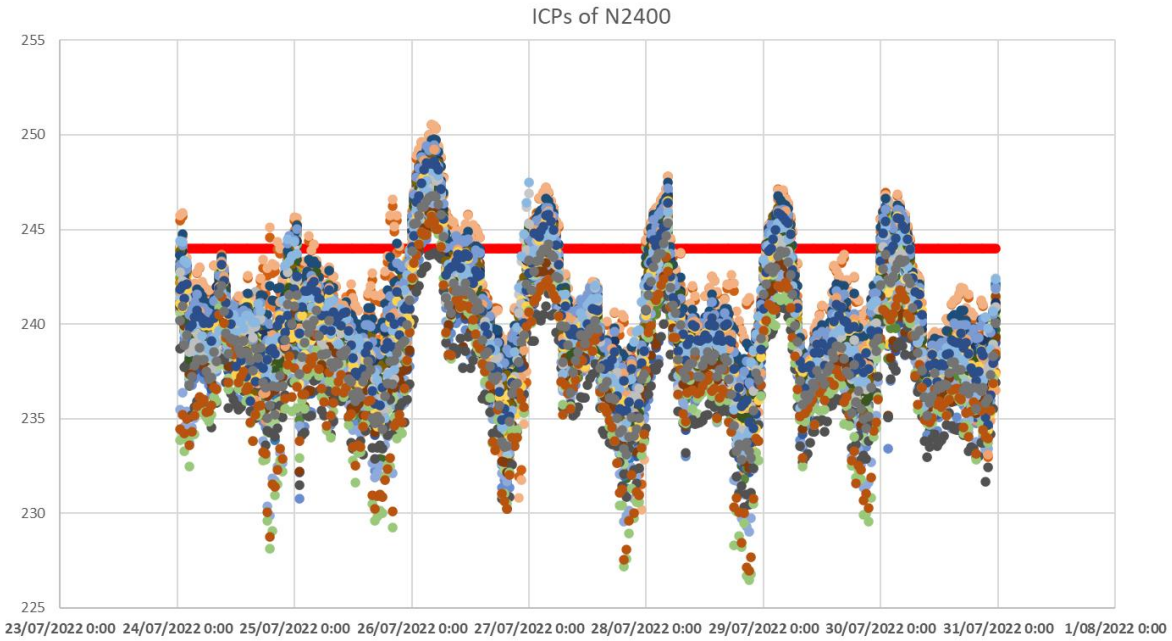
3) Comparison between transformer and ICP voltage profile

	Transformer level	ICP level
OV peak	246V@ phase A, 248V @ phase B, 246V @ phase C	250.5 V
ICPs involved at OV peak		1001274727UNF6C,1001271907UN312
Date/Time	26/07/2022 4:00am	26/07/2022 4:00am – 4:00 pm





Observations

- OV instants are repetitive in nature
- Mostly occurring during night (12:00 am to 6:00 am)

  Likely cause: low demand during night
- OV spike is higher in magnitude at ICP level compared to transformer
  - Fairly ok for Vector MV network

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