Emerging Energy Consumers

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Who we are…

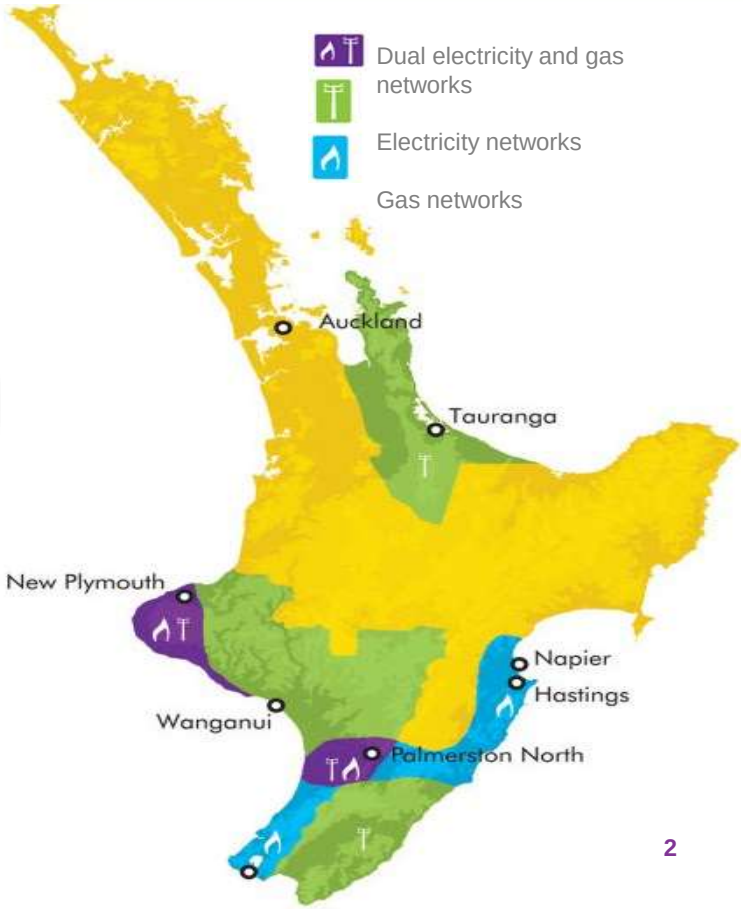
- **Powerco is New Zealand's largest geographically diverse electricity lines business**
- **Around 420,000 consumers connected to its gas and electricity networks**

Inform this

- **Powerco applies approximately $140M operating and capital expenditure per year**

- **>2000 ICP (~7.5MW) Residential PV installations and increasing at a rate of 2-3 per day.**
- **2 Fast (DC) EV charging stations on footprint and 4 being built over the next few months.**
- **Estimated 200+ EVs on footprint**

How this?



Electricity Distribution in New Zealand

Powerco transforms the electricity voltage at its substations. We then distribute electricity through power lines to your property.

POWER STATION

GENERATION

High voltage electricity is created using water, wind, geothermal, gas and coal.

PYLON

TRANSMISSION

Pylons move the high voltage electricity in bulk.

SUBSTATION

DISTRIBUTION

Powerco substations transform the high voltage electricity ready for customer use.

POWER LINES

DISTRIBUTION

Powerco distributes the electricity via power lines and cables to your gate.

CUSTOMER

RESIDENTIAL

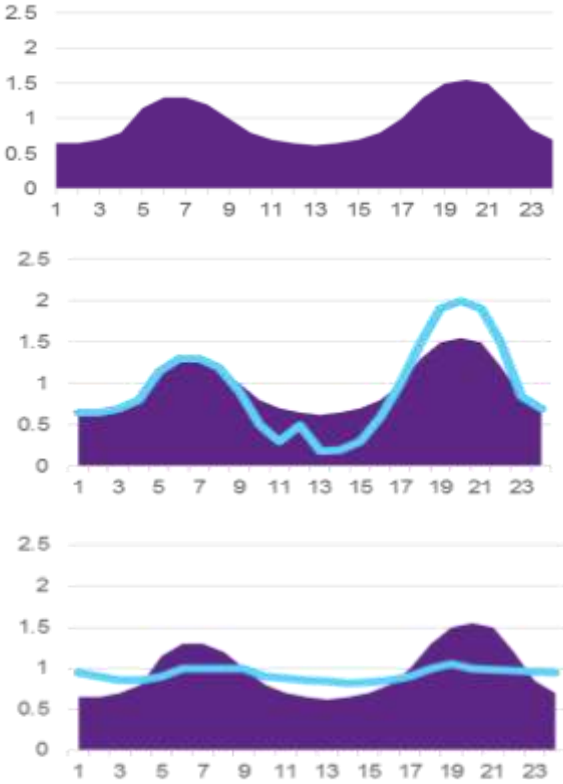
Your service line carries electricity from the power line to your home. You then pay your power bill direct to your retailer.

The challenge of network optimisation

Current model – build networks to meet peak demand

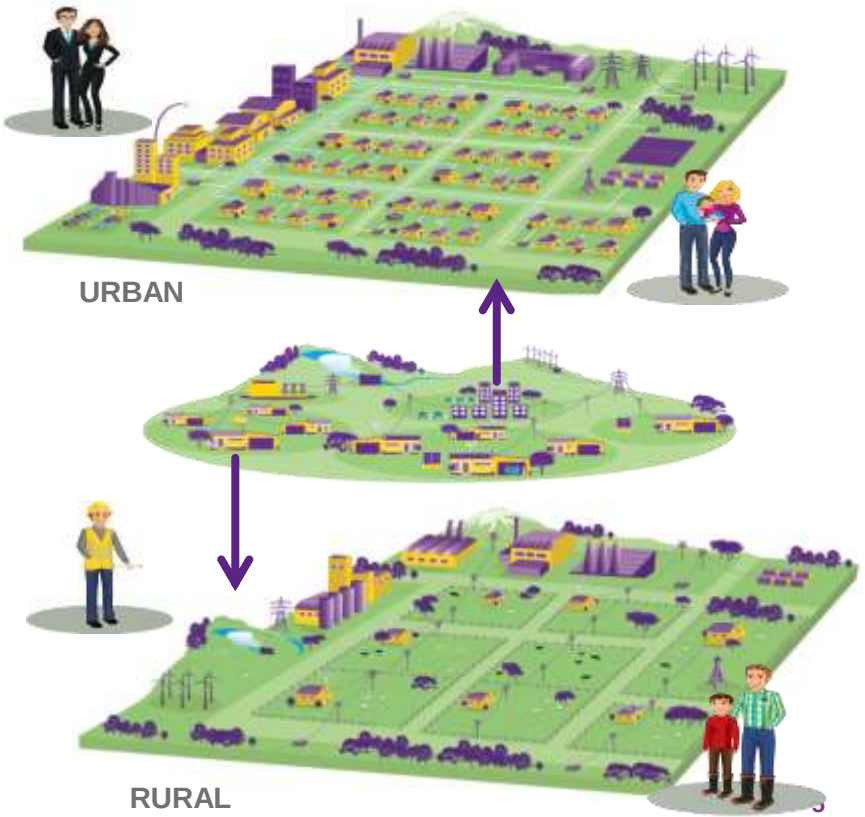
Possible future – if new technologies aren't coordinated they will reduce the utility of current infrastructure

Optimal Outcome – using new technologies and network smarts to reduce peak loads and optimise network performance

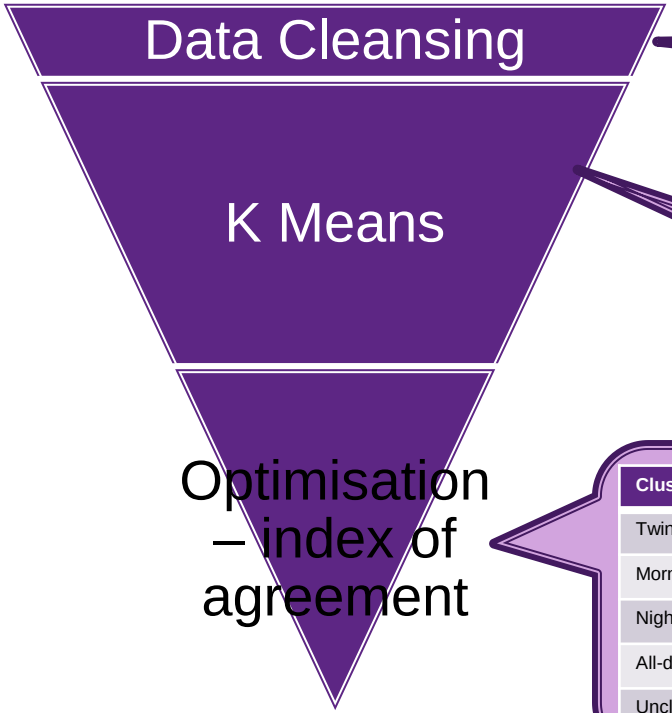


A challenge – learning about our customers without engaging with them

- Are there discernible groups of customers on our network?
- Do some households contribute to network peaks than others?
- What is the scale of different customer types?



Methodology



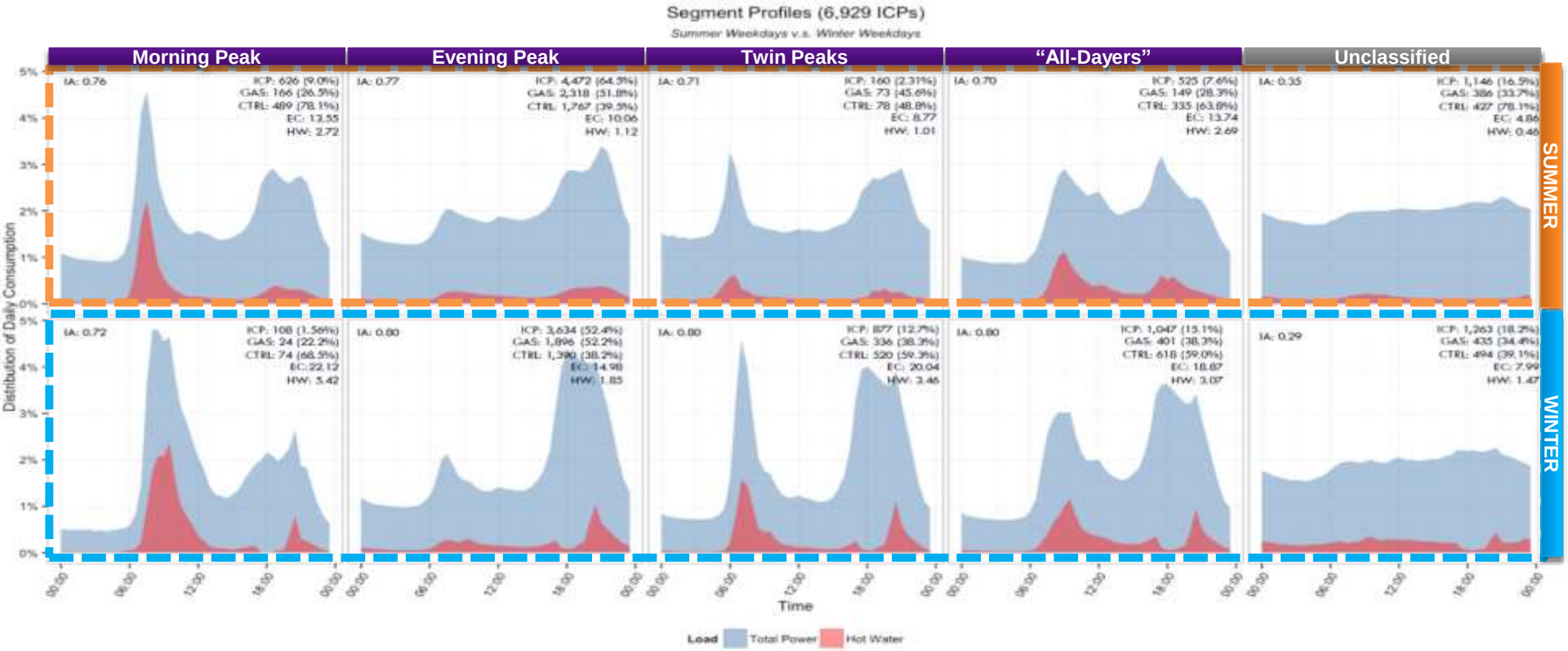
Started with a total of 11,033 ICPs.

There were 3,769 ICPs with insufficient data and approximately 1,200 outliers (number differs depending on season)

Cluster	Summer	Winter
Twin Peaks	20	645
Morning Peak	578	0
Night Peak	1,751	1,510
All-dayer	0	993
Unclassified	4,500	3,781

Cluster	Summer	Winter
Twin Peaks	160	887
Morning Peak	626	108
Night Peak	4,472	3,634
All-dayer	525	1,047
Unclassified	1,146	1,263

Results


Segment Profiles (6,929 ICPs)
Summer Weekdays v.s. Winter Weekdays
Morning Peak
Evening Peak
Twin Peaks
"All-Dayers"
Unclassified
SUMMER
WINTER
IA: 0.76
ICP: 626 (9.0%)
GAS: 166 (26.5%)
CTRL: 489 (78.1%)
EC: 13.55
HW: 2.72
IA: 0.77
ICP: 4,472 (64.5%)
GAS: 2,318 (51.8%)
CTRL: 1,767 (39.5%)
EC: 10.06
HW: 1.12
IA: 0.71
ICP: 160 (2.31%)
GAS: 73 (45.6%)
CTRL: 78 (48.8%)
EC: 8.77
HW: 1.01
IA: 0.70
ICP: 525 (7.6%)
GAS: 149 (28.3%)
CTRL: 335 (63.8%)
EC: 13.74
HW: 2.69
IA: 0.35
ICP: 1,146 (16.5%)
GAS: 386 (33.7%)
CTRL: 427 (78.1%)
EC: 4.86
HW: 0.46
IA: 0.72
ICP: 108 (1.56%)
GAS: 24 (22.2%)
CTRL: 74 (68.5%)
EC: 22.12
HW: 5.42
IA: 0.80
ICP: 3,634 (52.4%)
GAS: 1,896 (52.2%)
CTRL: 1,390 (38.2%)
EC: 14.98
HW: 1.85
IA: 0.80
ICP: 877 (12.7%)
GAS: 336 (38.3%)
CTRL: 520 (59.3%)
EC: 20.04
HW: 3.46
IA: 0.80
ICP: 1,047 (15.1%)
GAS: 401 (38.3%)
CTRL: 618 (59.0%)
EC: 18.87
HW: 3.07
IA: 0.29
ICP: 1,263 (18.2%)
GAS: 435 (34.4%)
CTRL: 494 (39.1%)
EC: 7.99
HW: 1.47
Distribution of Daily Consumption
5%
4%
3%
2%
1%
0%
00:00
06:00
12:00
18:00
Time
Load
Total Power
Hot Water

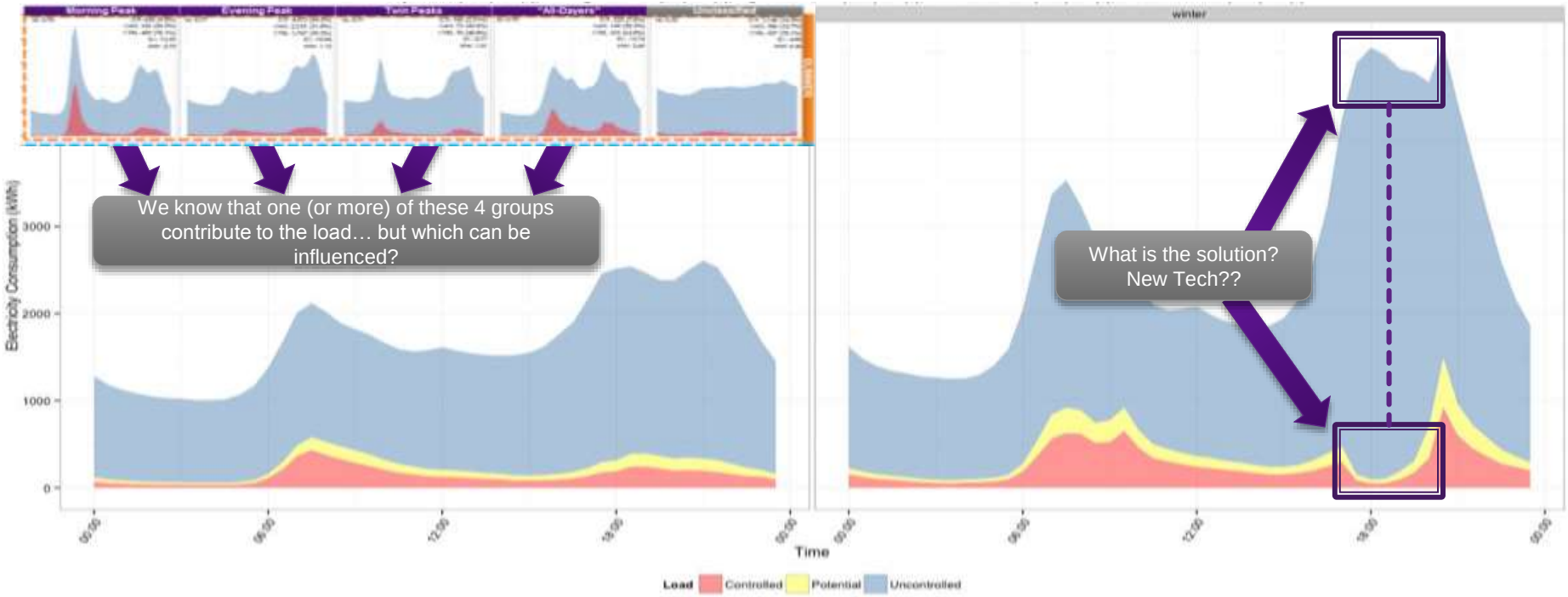
Understanding how customers change loads over time

Segmentation Movement

Segment Movement	Winter					
Summer	Morning Peak	Night Peak	All-Dayer	Twin Peaks	Unclassified	Grand Total
Morning Peak	20	129	151	302	24	626
Night Peak	22	2959	576	486	429	4472
All-Dayer	47	144	226	34	74	525
Twin Peaks	4	77	17	20	42	160
Unclassified	15	325	77	25	694	1146
Grand Total	**108**	**3634**	**1047**	**877**	**1263**	**6929**

It seems that certain segments' stability are affected by the electricity consumption at night during winter (e.g. oven, heater, hot water for washing dishes).

Getting the mix right, which groups will enable a reduction in peak demand?



Summary

- The demands on networks are changing
- Distributors need to understand the diversity of their customers in order to optimise network utility and maintain customer value
- We cannot treat all customers the same
  - Dual gas and electricity customers are less likely to have morning peaks
  - Many segments become evening peakers in the winter
  - The ‘twin peak’ customer is only a small segment of our network
- The future smart grid will require utilities to have greater insight into demand and consumption in order to maintain quality of supply
  - Utilities will require more monitoring technologies
- Understanding the variation in usage profiles gives us an insight into loads which can potentially be shifted
  - Hot water ripple does not provide enough controllable capacity on it’s own