What is needed to make a smart city a smart reality?

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Smart city images – courtesy google

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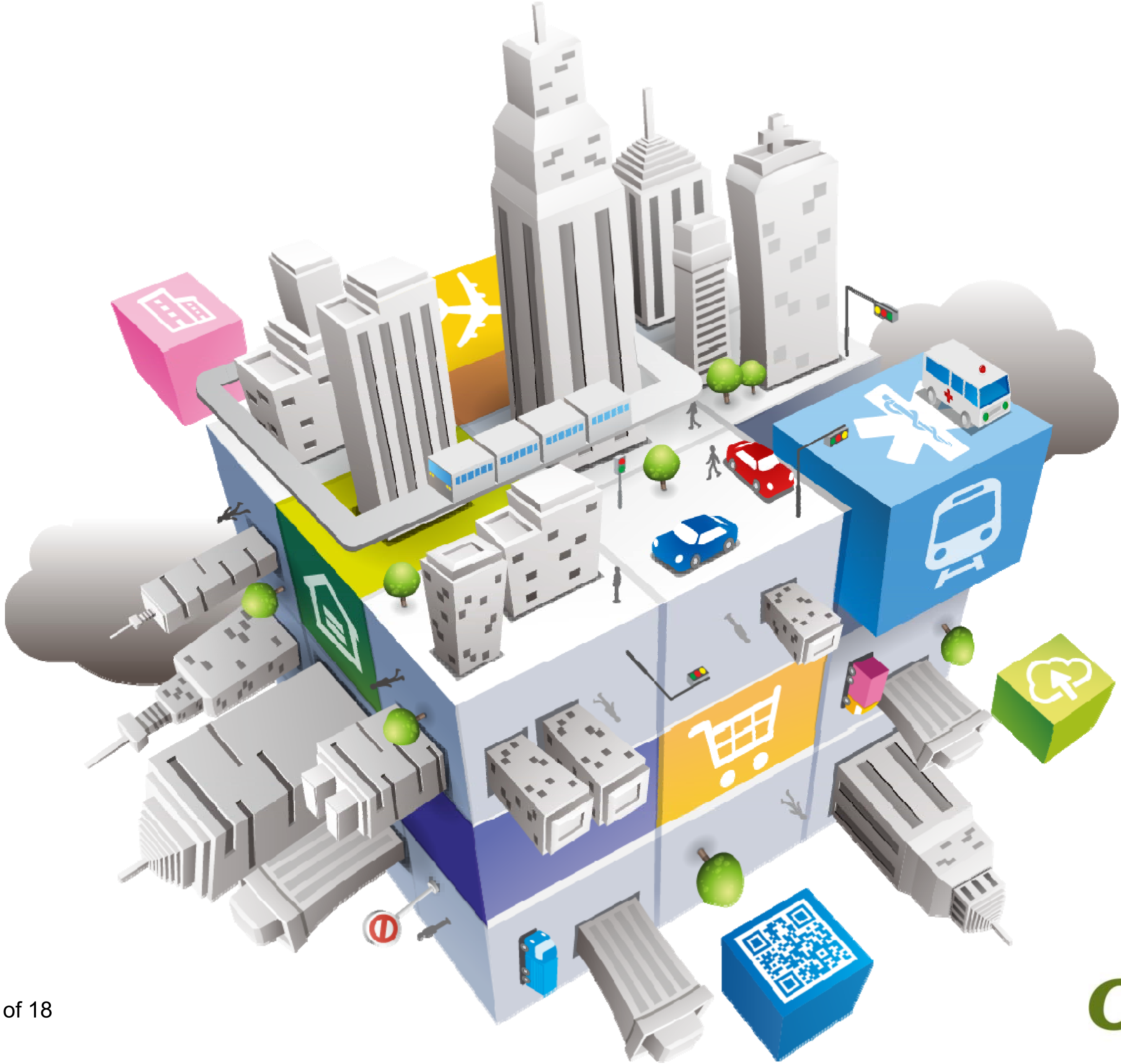

But really, what is a smart city/ smart power system?

- Will a smart NZ city/community be the same as one in Miami or Oslo or Brisbane?
- How will we measure how smart a community is?
- Can it be defined by economics, environmental footprint, level of technology or is ‘smart’ something more humanistic?

Some thoughts - smart cities

- meet the residents social values
- are adaptable to new needs and values
- are safe
- are sustainable
- are fair to all residents
- respect the environment

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2020 – some givens

- Growing customer appetite to explore the use of technology to contribute to their power needs

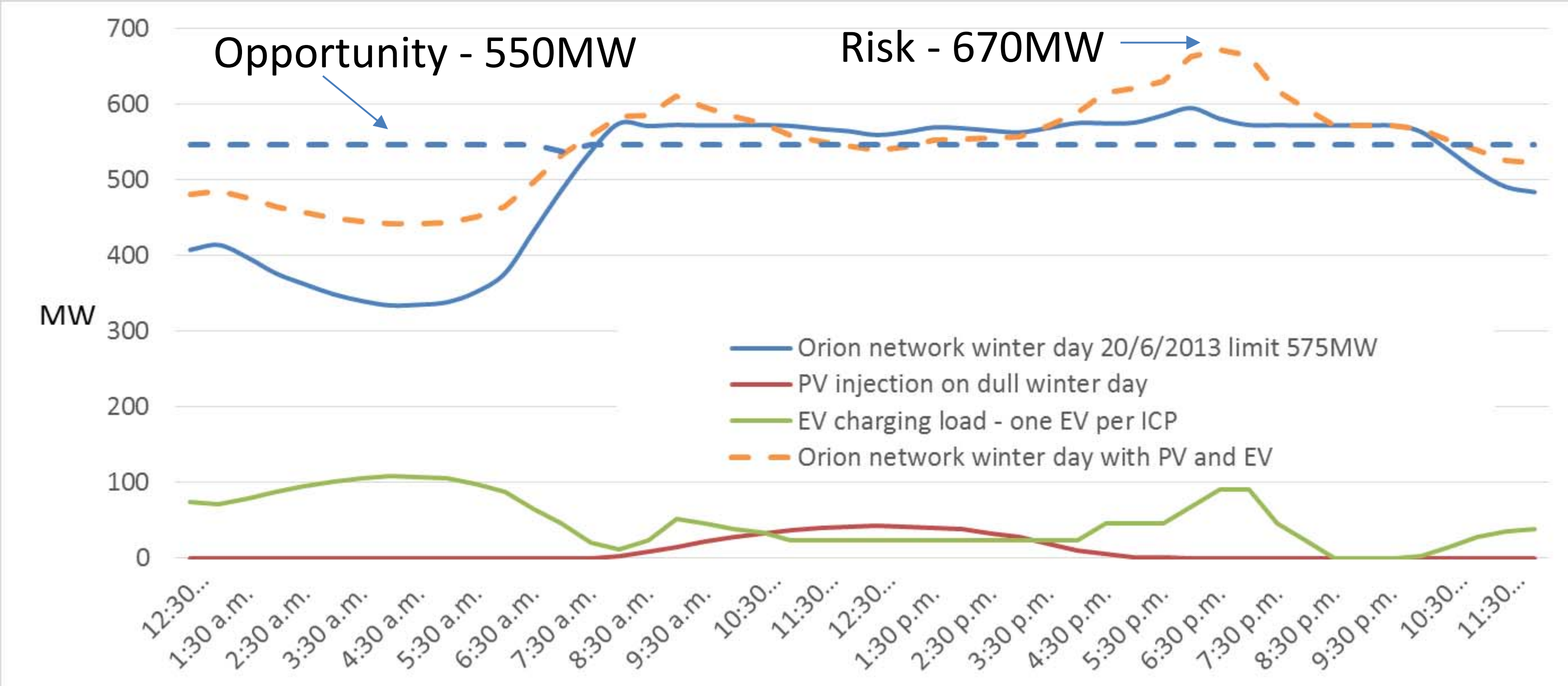
- Growing customer expectation that power industry will assist communities achieve their social and environmental goals

- Technology status:
  - PV and BS price falling
  - EVs offered at acceptable price and range

Some extreme scenarios to test the potential long term impacts of PV, EVs and storage on the distribution network

and the grid for that matter

Combined impact of EV, PV and battery storage on a cold winter day



- 45% of ICPs with a Tesla 5kW/7kWh battery to achieve above reduction
- 15% of ICPs with batteries will achieve 65% of the peak demand reduction
- Can expect 3-5 days of this so inter-day energy transfers difficult
- Energy efficiency could drop peak another 10-20%

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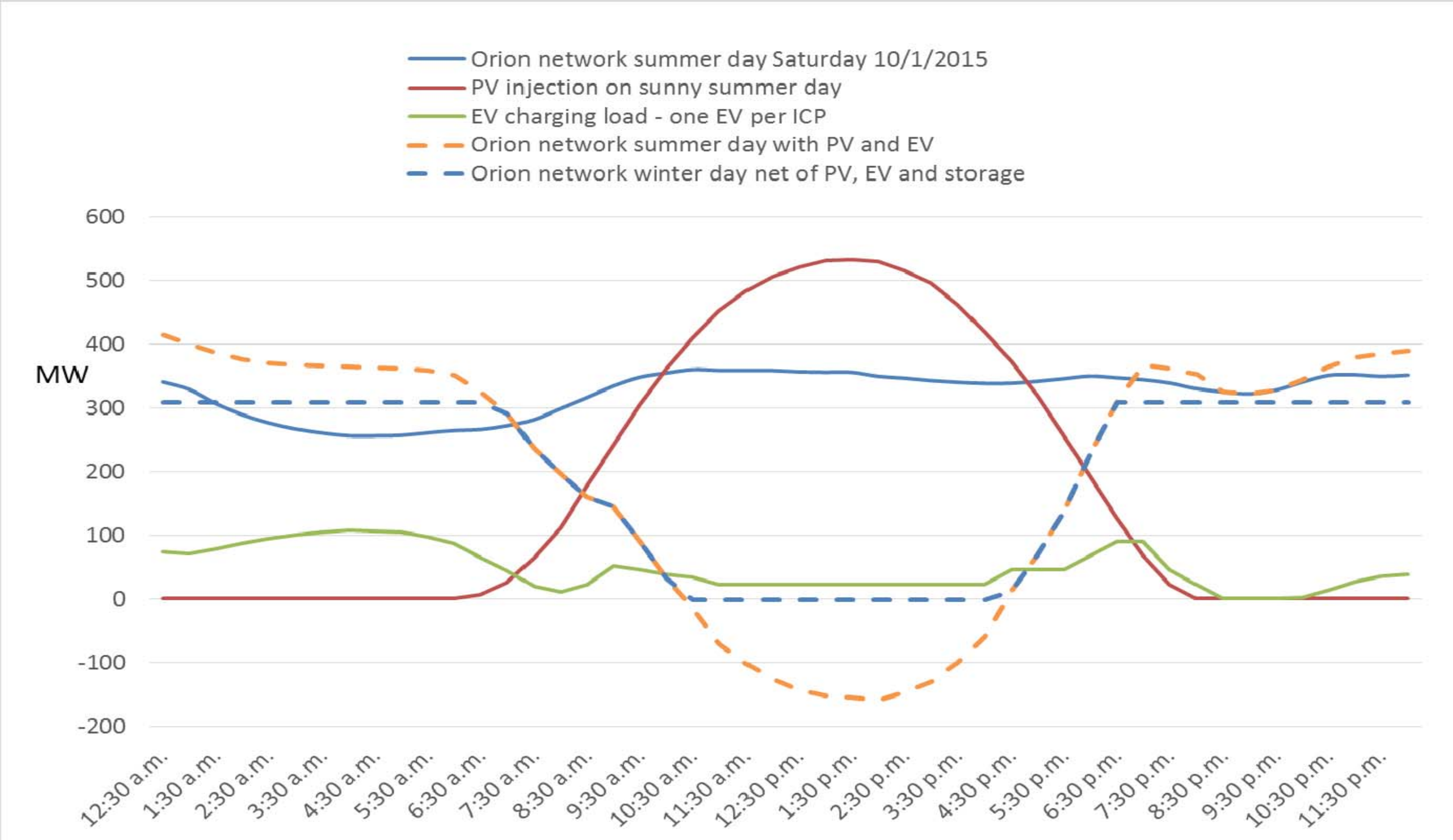
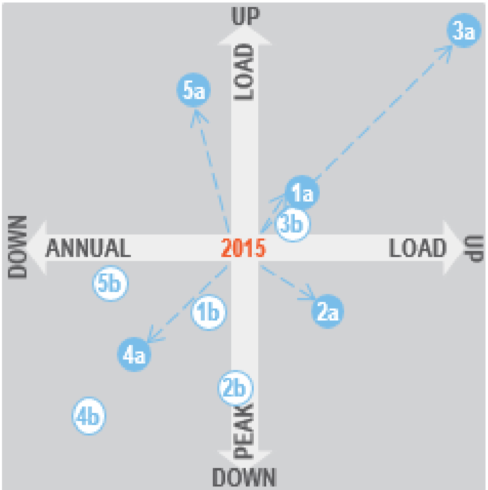
Combined impact of EV, PV and battery storage on a sunny summer day



- PV export to grid avoided by storage equivalent to 50% of ICPs with a Tesla 5kW/7kWh battery

Other uptake scenarios - distribution network impact analysis

SCENARIO MATRIX – 2040[1]



Scenarios	EV	Storage	PV	EVs Charging at Peak	Tech + Pop'n ↑ Demand Peak	Tech + Pop'n ↑ Demand Annual	Tech only Demand Peak	Tech only Demand Annual
1 Central Scenario Current industry thinking for tech proves accurate. No new game changing technology.	35%	10%	30%	25%	*+8%*	*+11%*	*-8%*	*-7%*
2 Reflective Prices Prices reflect real cost. Battery storage more attractive option. EV uptake as expected and p.m. peak charging minimal.	30%	25%	5%	20%	*-8%*	*+17%*	*-19%*	*-2%*
3 Extreme EV EVs cheaper than expected plus high and rising petrol prices accelerate uptake. Vehicle turnover increases to take advantage.	80%	10%	30%	25%	*+37%*	*+40%*	*+5%*	*+10%*
4 Hydrogen Cars Competitors offer solutions to manage customer's systems to offer best value. EV uptake stalls due to hydrogen fuel cell vehicles.	10%	30%	60%	5%	*-14%*	*-22%*	*-23%*	*-32%*
5 Spiralling Strong EV uptake combined with peak charging. Network prices increase & winter generation tech fuels a start to off-gridding.	45%	60%	80%	80%	*+24%*	*-10%*	*-4%*	*-27%*

1. Energy efficiency modelled for all scenarios at 0.5% annual improvement on existing demand and 30% one-off in

THIRDHORIZON

ork

Off grid feasibility – Blue Skin Bay (261 ICPs)

(I.G.Mason – EEA Conference proceedings)

Optimising Energy Returned on Energy Invested

- EROEI for PV is 5-9 and wind about 15-80
- EROEI for PV is 5 and wind about 35 for Blue Skin Bay

Option	Generation capacity as a % of annual requirement	Battery storage requirement (% of annual energy)	Battery storage requirement for annual ICP energy of 4100kWh	Energy return on energy invested (battery life 20 years)
PV with storage	200%	25.2%	1033kWh	less than 0.45
Wind with storage	500%	6.4%	262kWh	1.7

Battery storage makes community scale grid defection unattractive from an Energetics perspective

Integrating these new technologies will require new levels of coordination and cooperation to ensure that:

- power system stability is maintained
- peak demand does not grow disproportionately
- our renewables objectives can be met
- customer expectations can be met

2020 - what can we do to remain relevant to our customers over the next few years?

- Create flexible and adaptive platforms for customer participation – back office and comms
- Be mindful of traditional economics but recognise the value of the social intangibles – explore customer service options around new technology
- Customer education and engagement
  - our local natural resources are the envy of the world
  - presenting our service differently e.g. HWCs the old battery
  - showing flexibility by offering choice and experimenting

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2035: a scenario with game-changer potential

- DG breakthrough has just occurred with sustainable weather independent small scale community or home based generation becoming economically available
- Power treated like other products and services – choice exists
- Customer involvement so engrained that people don't complain about power companies anymore – they are in control
- Technology is a tool in the background that enables families and communities to spend time together
- Storage of power simple, mobile and cost effective
- EVs mainstream with significant autonomous vehicle use

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Now to 2035 – some mistakes we could make?

Mistake	Consequence
Assuming that no investment in the traditional power system is required	Underinvestment leading to national electricity crisis
Assuming that the management of the power system does not need to change	Power system unstable due to uncontrolled DG and DSM
Assuming that customers are only driven by economics	Loss of customer relevance and support to achieve needed change
Ignoring the possibility of new entrants with new value adding services	Loss of influence over outcomes that effect our ability to meet customer expectations

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Thoughts for NZWEA

- Clearly wind is a better fit for NZ than PV, how can customers/communities get involved in wind generation?

- How could demand side response be managed to maximise profitability of wind generation leading to higher uptake/investment?

In summary…it is the ‘values’ of people that will influence our cities and energy solutions

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