Keolis Downer

Zero Emission Buses

Lessons from Europe, progress in Australia

25 October 2022

Keolis Downer – a strong and long-term partnership

- Present in 15 countries, Keolis is a leading operator and integrator of all modes of transport and shared mobility services
- Multimodal world leader in light rail and automated metro
- Keolis carries over 3 billion passengers every year and partners 300 local authorities around the world

51%

+

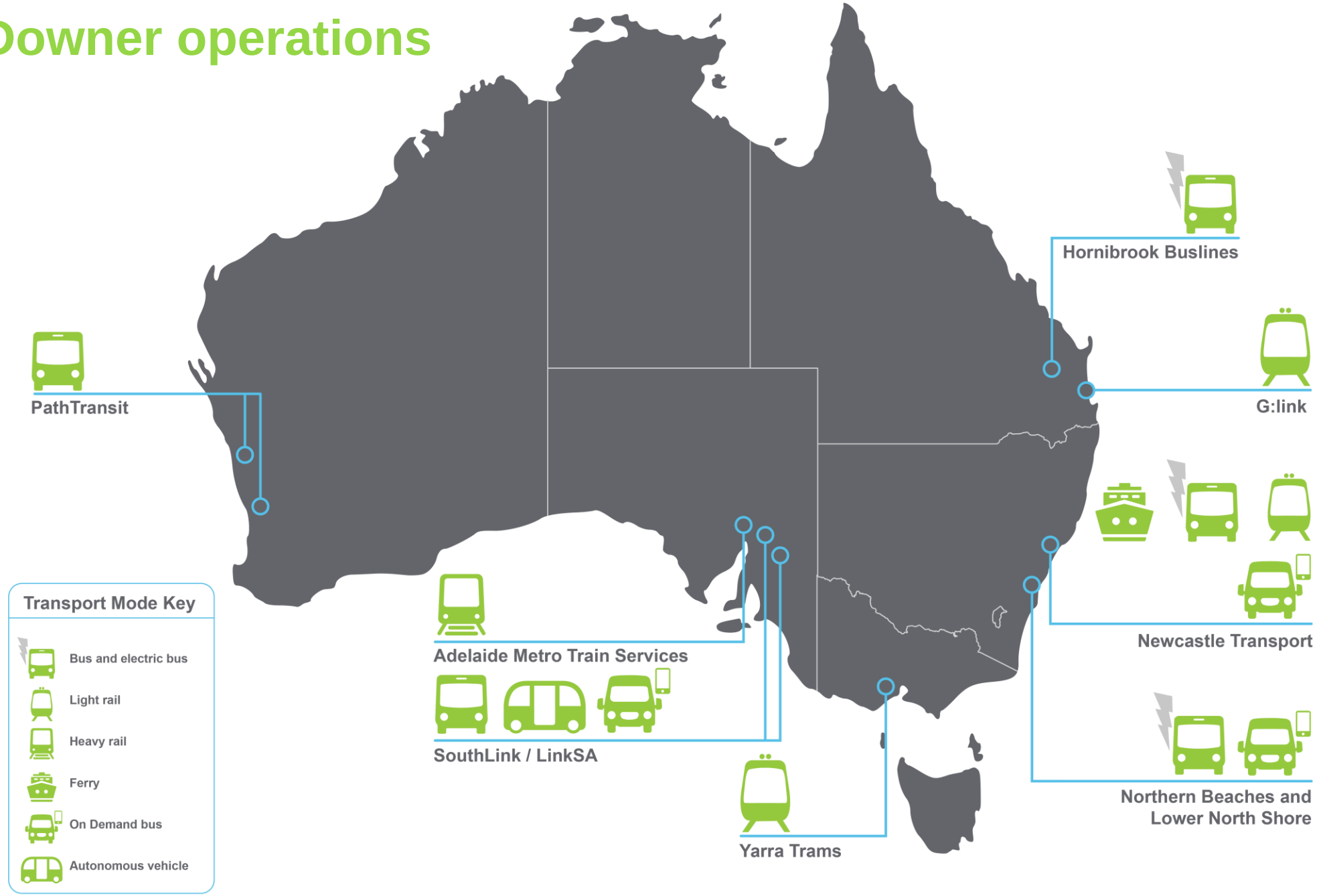
- Downer is the leading provider of integrated services in Australia and New Zealand
- More than 52,000 employees over 300 sites in ANZ, Asia-Pacific, South America and Africa
- 58,000 kilometres of roads managed and maintained in ANZ
- Listed on the Australian Securities Exchange

49%

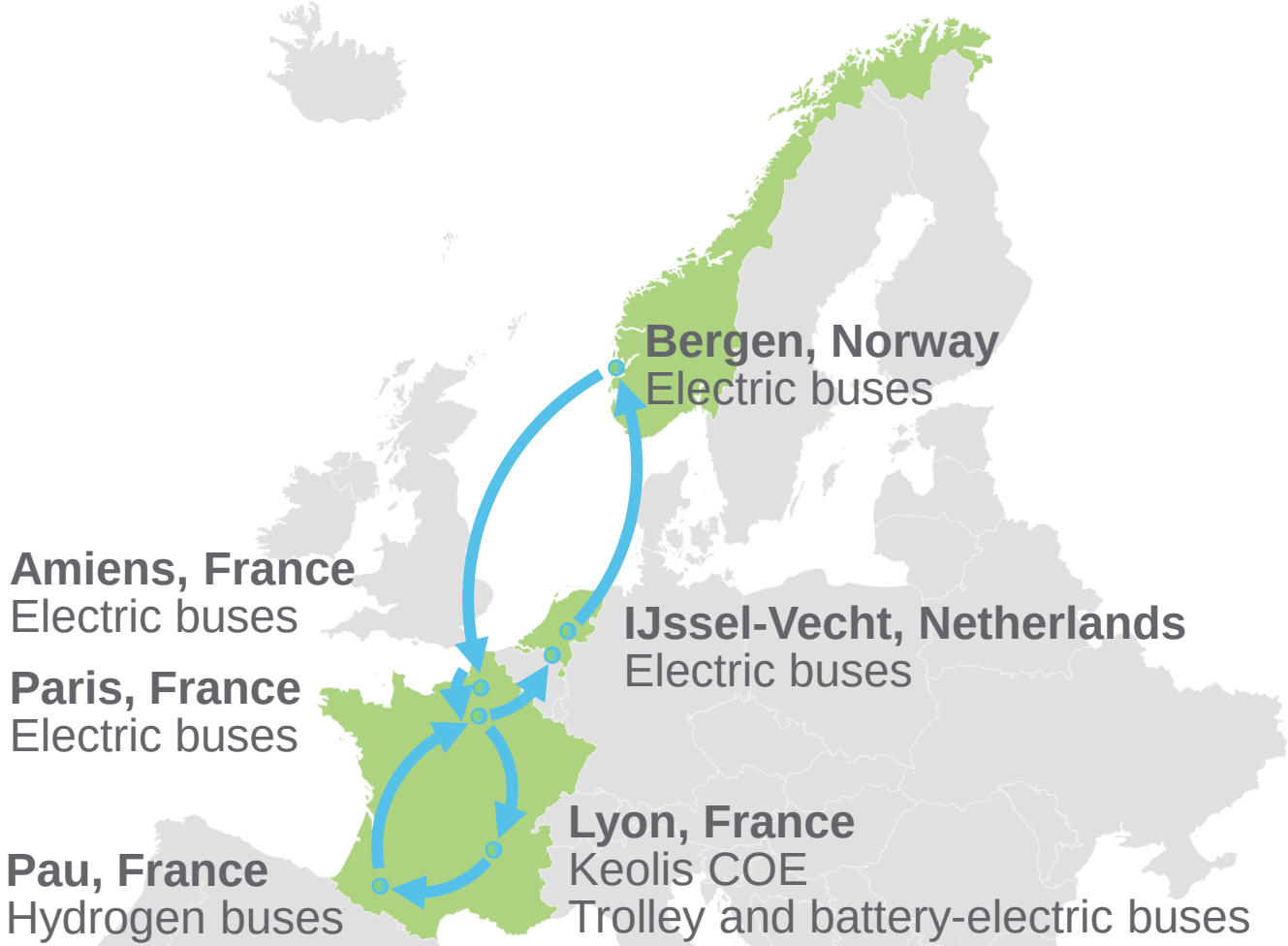
=

Keolis Downer

Keolis Downer operations



Trip overview



Bergen, Norway
Electric buses

Amiens, France
Electric buses

Paris, France
Electric buses

IJssel-Vecht, Netherlands
Electric buses

Lyon, France
Keolis COE
Trolley and battery-electric buses

Pau, France
Hydrogen buses

Electric buses - Velizy

39 battery electric buses

50/100 kW charging

Reduced maintenance costs

Advanced (relatively) smart charging

Software systems need better integration

Electric buses - Lyon

Battery electric AND trolley buses

Trolley buses preferred

Electrics sometimes left idle to preserve battery life

Electric buses - Holland

>250 battery electric buses

60 kW depot charging

300 kW pantograph charging

All-in-one-go rollout led to many challenges

Interfaces need to be eliminated or managed closely

Electric buses – Bergen

>100 battery electric buses

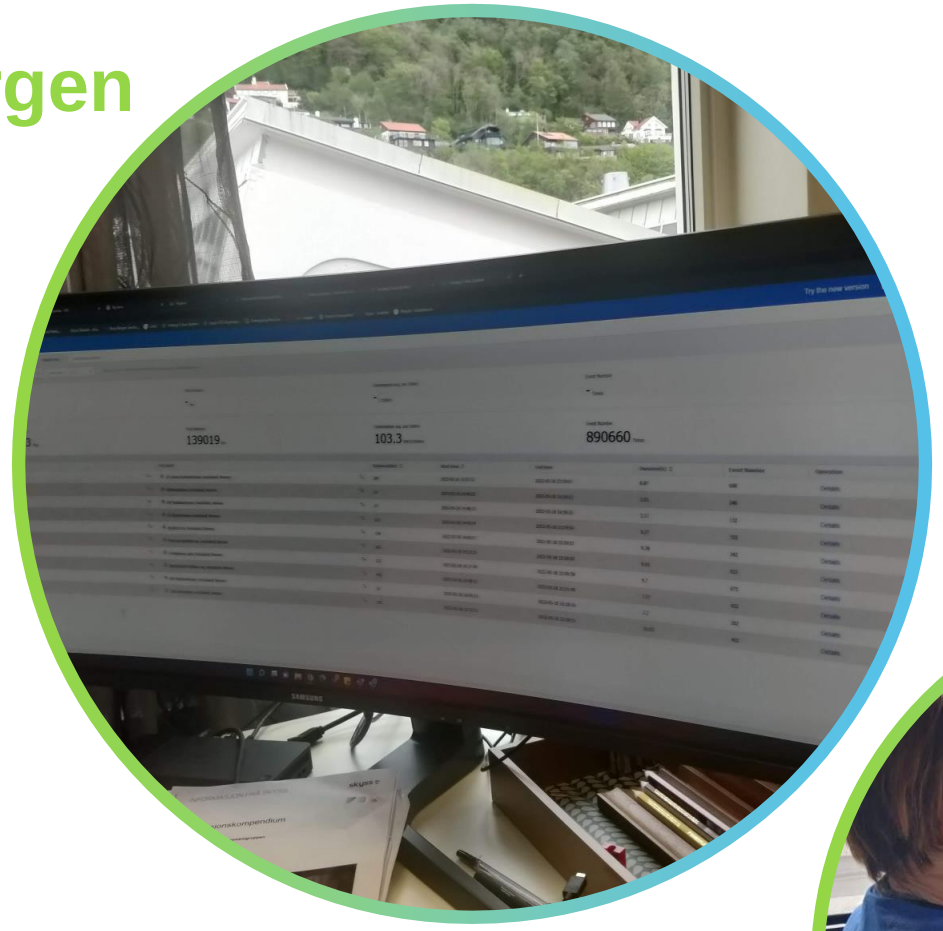
50 kW charging

GB/T (Chinese standard) plugs

Buses very reliable

Fleet management system from OEM not ideal

Driving electric buses is fun!



Electric buses – Amiens

43 18m articulated battery electric buses

Panto-up charging (fast charge on route, slow charge at depot)

Fast charging gives BRT with small batteries

Fleet management system from OEM not ideal

System very vulnerable to a terminus charger failure

Hydrogen buses – Pau

8 18m fuel cell electric articulated buses

1 H2 dispenser per bus (!!!)

Substantial preventative maintenance program for buses

Cost of hydrogen has risen

Key learnings

Every operation is a bit different

Gradual rollout of ZEBs is preferable for large operations

Integration of IT systems should be considered early and often

Plan for the smart capabilities you want, but don’t try to do everything on day one

There are still some areas where Australia can lead!

The Newcastle project team

Keolis Downer

NSW GOVERNMENT | Transport for NSW

ENOBĒ

Downer

SIEMENS

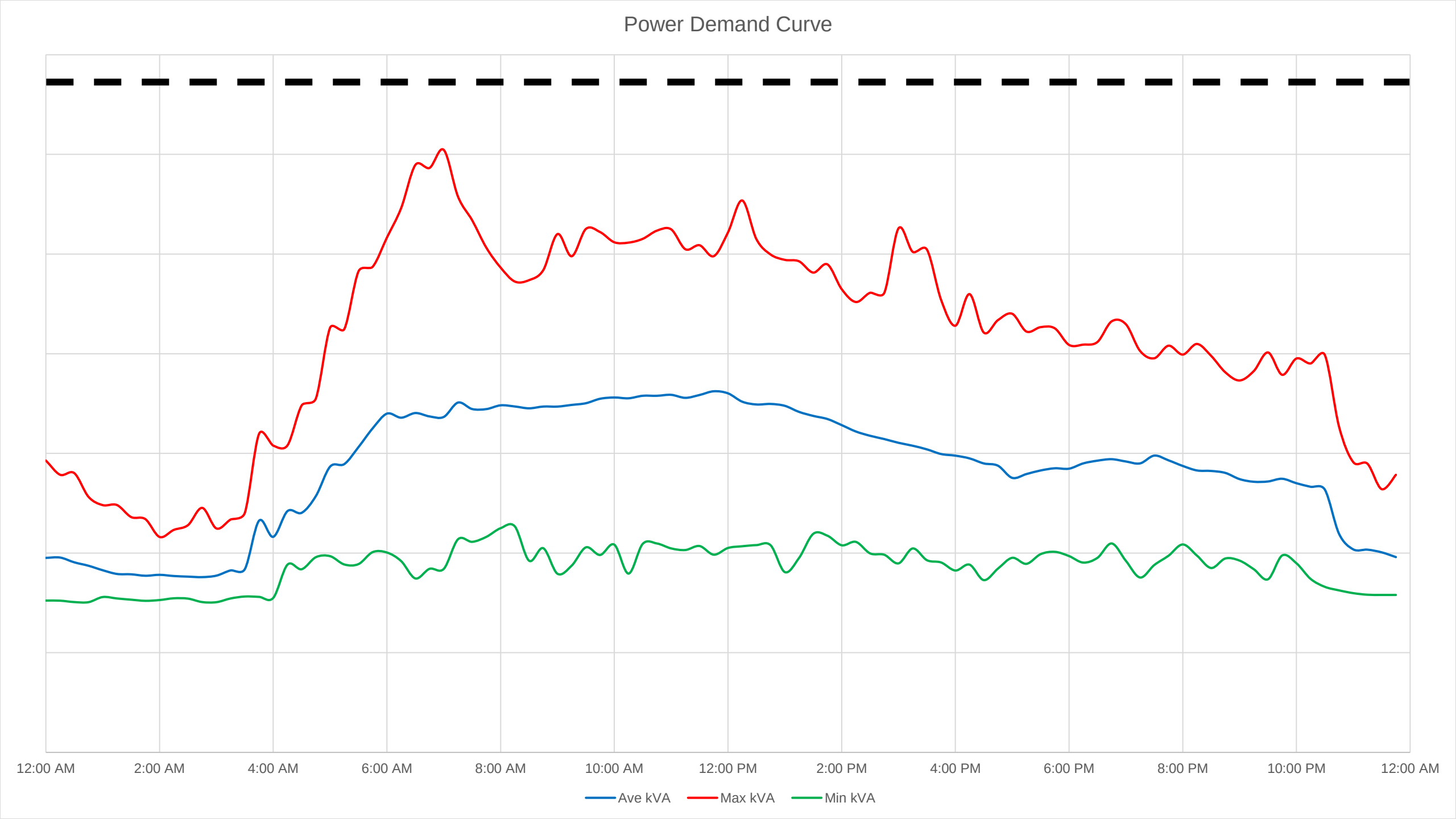
BusTech Group

Why three buses?

Grid connection!

A brief to do as much as possible while changing and spending as little as possible.

A first step…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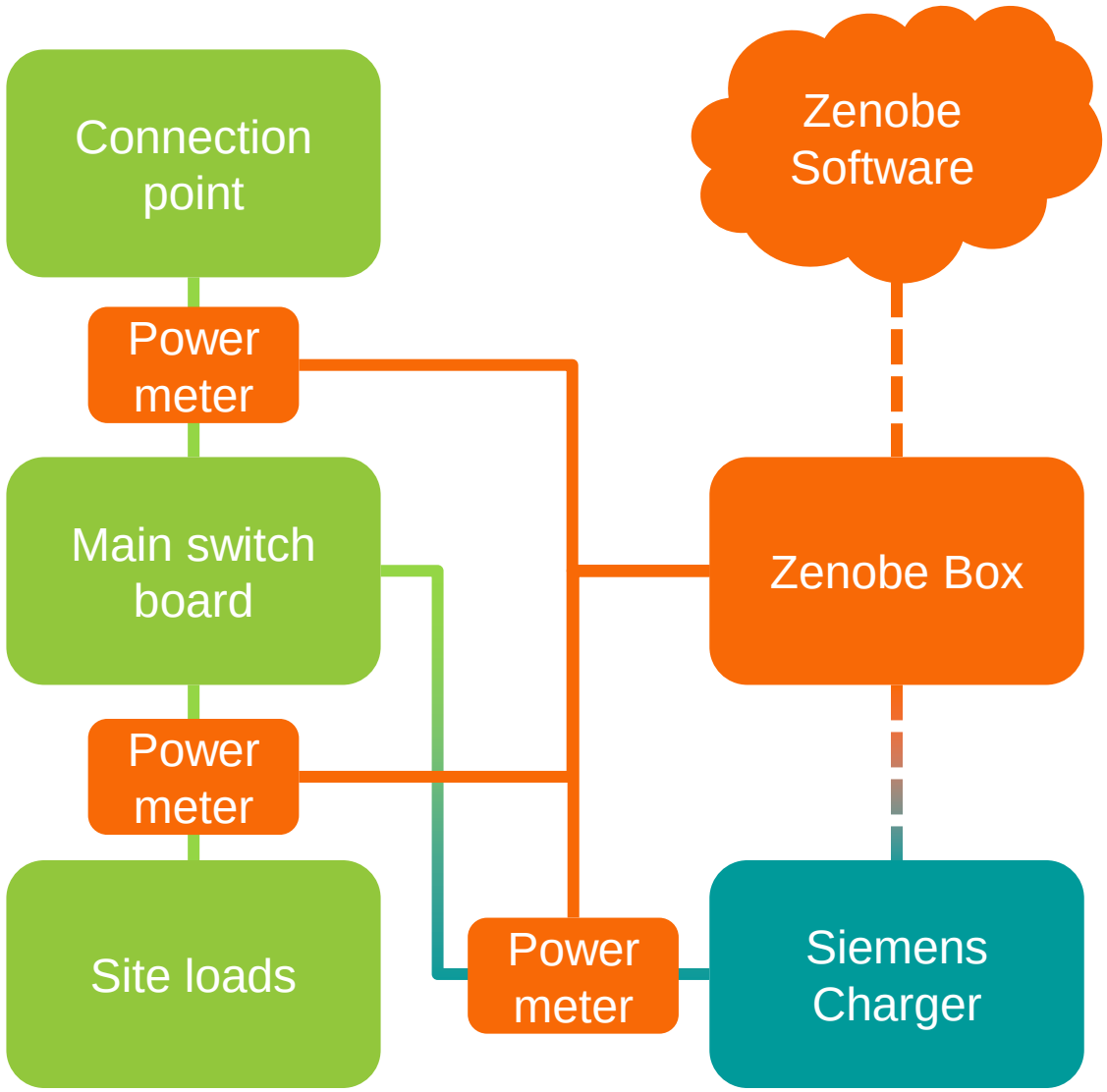
Ave kVA
Max kVA
Min kVA

ITS solution

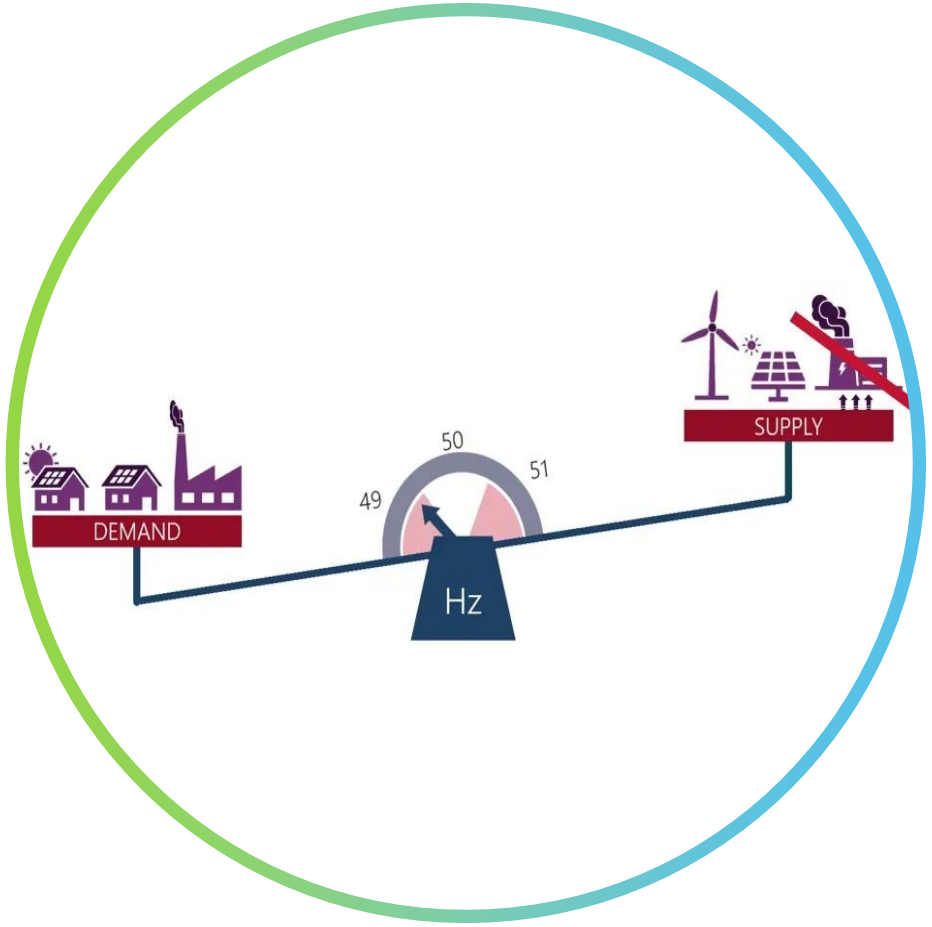


This is more exciting than it may seem…

Bus depots are becoming energy market players!

This same type of technology can be used for:

- Better understanding energy use
- Minimising demand and capacity charges
- Maximising self-consumption of renewables
- Demand response
- Frequency control services



Coming up next:

Pantograph charging (Sydney)

Hydrogen (Newcastle)

Lessons from Australian projects so far

Every operation is different

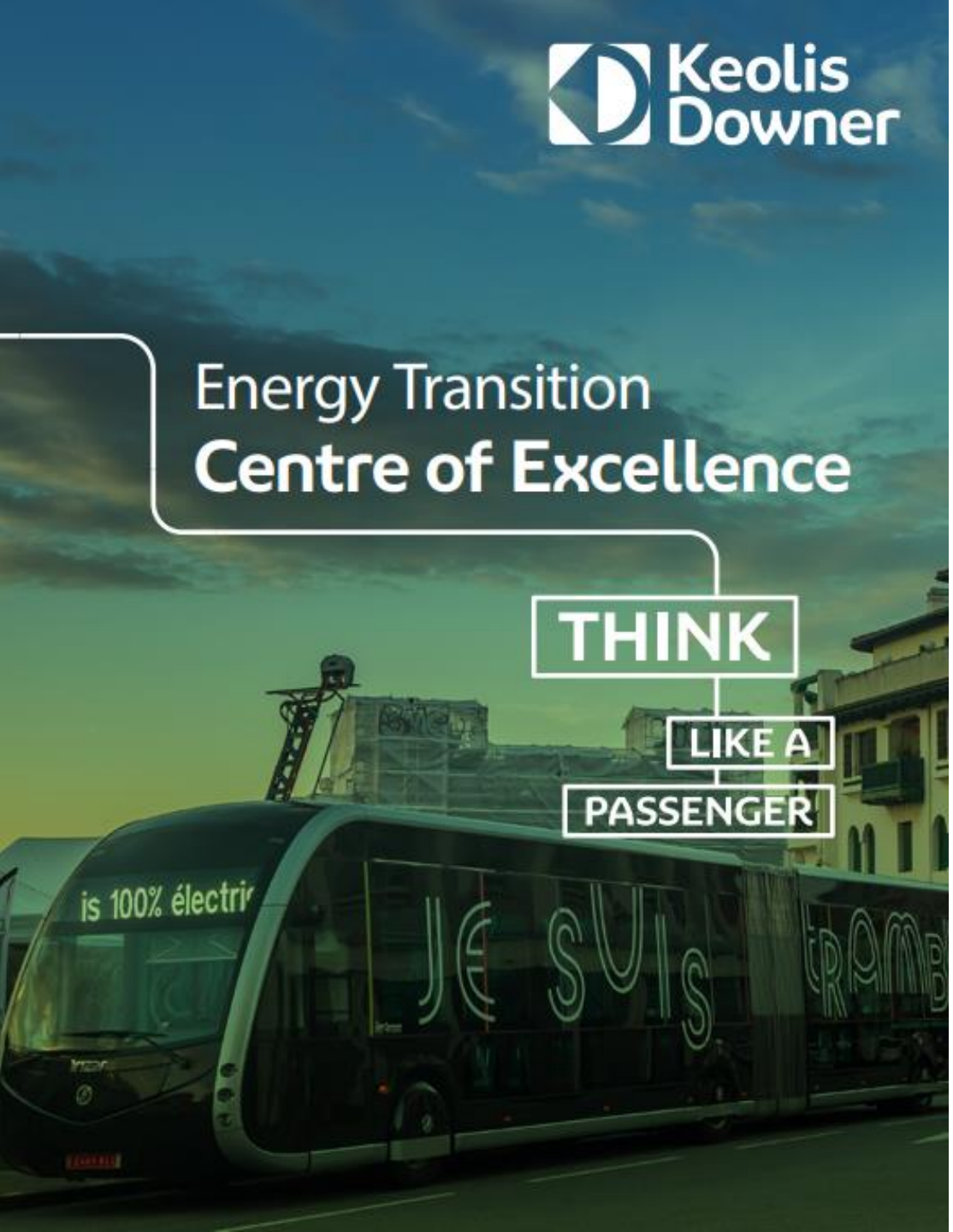
Traditional approaches to procurement of buses may need tweaks

Large variability in price, lead times and maturity across ZEB market

Lots of ducklings to get in a row for successful deployment

Need informed approach to system reliability/redundancy

Working closely with operational staff is essential for smooth rollout



*New Energies & Sustainable Transport (**NEST**):*

Supporting and advising PTAs

Thought leadership

Developing and sharing best practice

Research

Support to operations and bids

Training

Connection to Keolis globally

Relationships and strategic partnerships

THANK YOU

Jonathan Anderson

Sustainable Mobility Manager

Jonathan.Anderson@keolisdowner.com.au

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