

The Contribution of Railways to Urban and Regional Development in a Smart and Disruptive World

By

Peter Newman AO

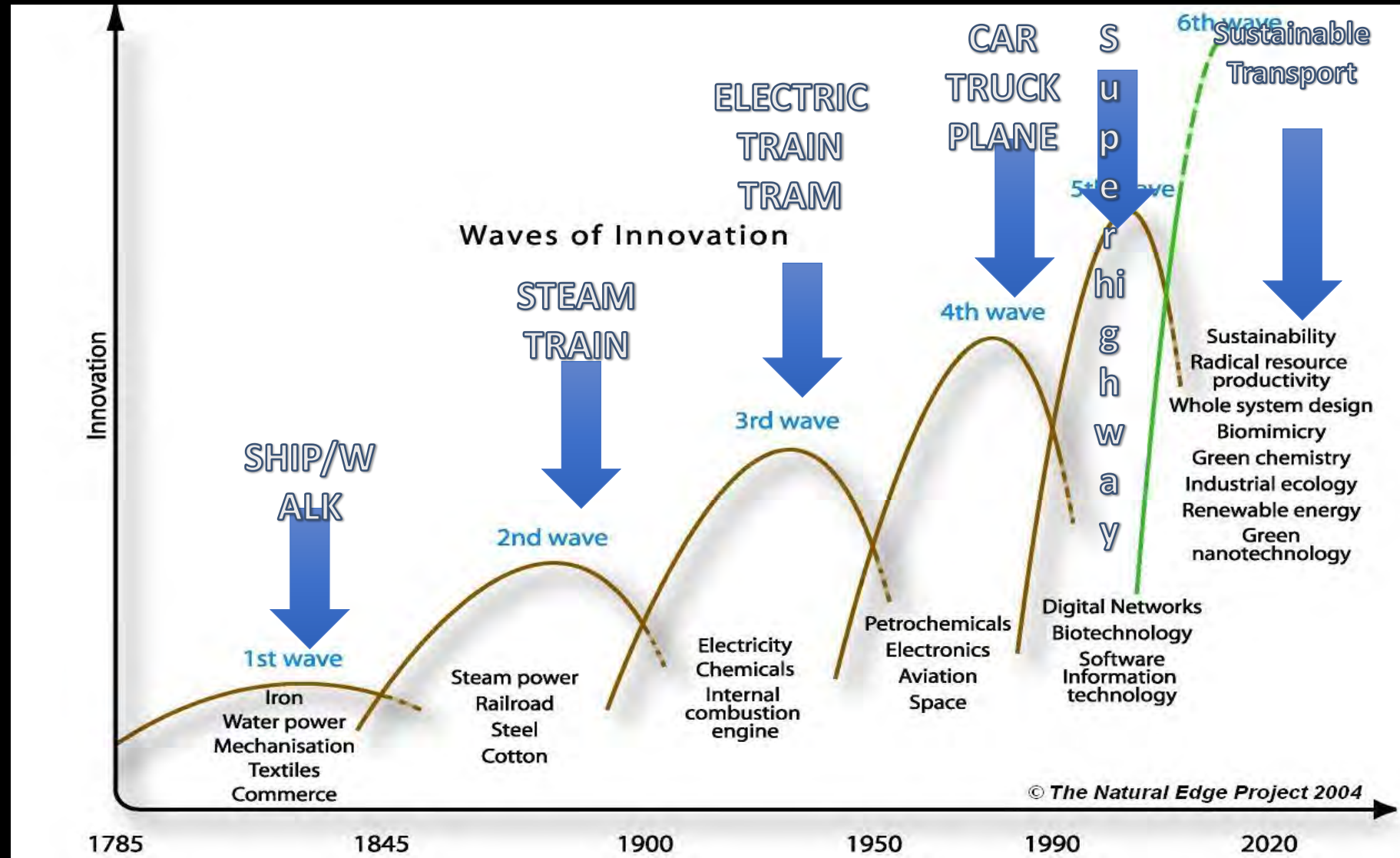
Professor of Sustainability

CUSP, Curtin University

Perth, Australia

History of innovation and transport....

Next: Sustainable transport....



Disruptive Innovation

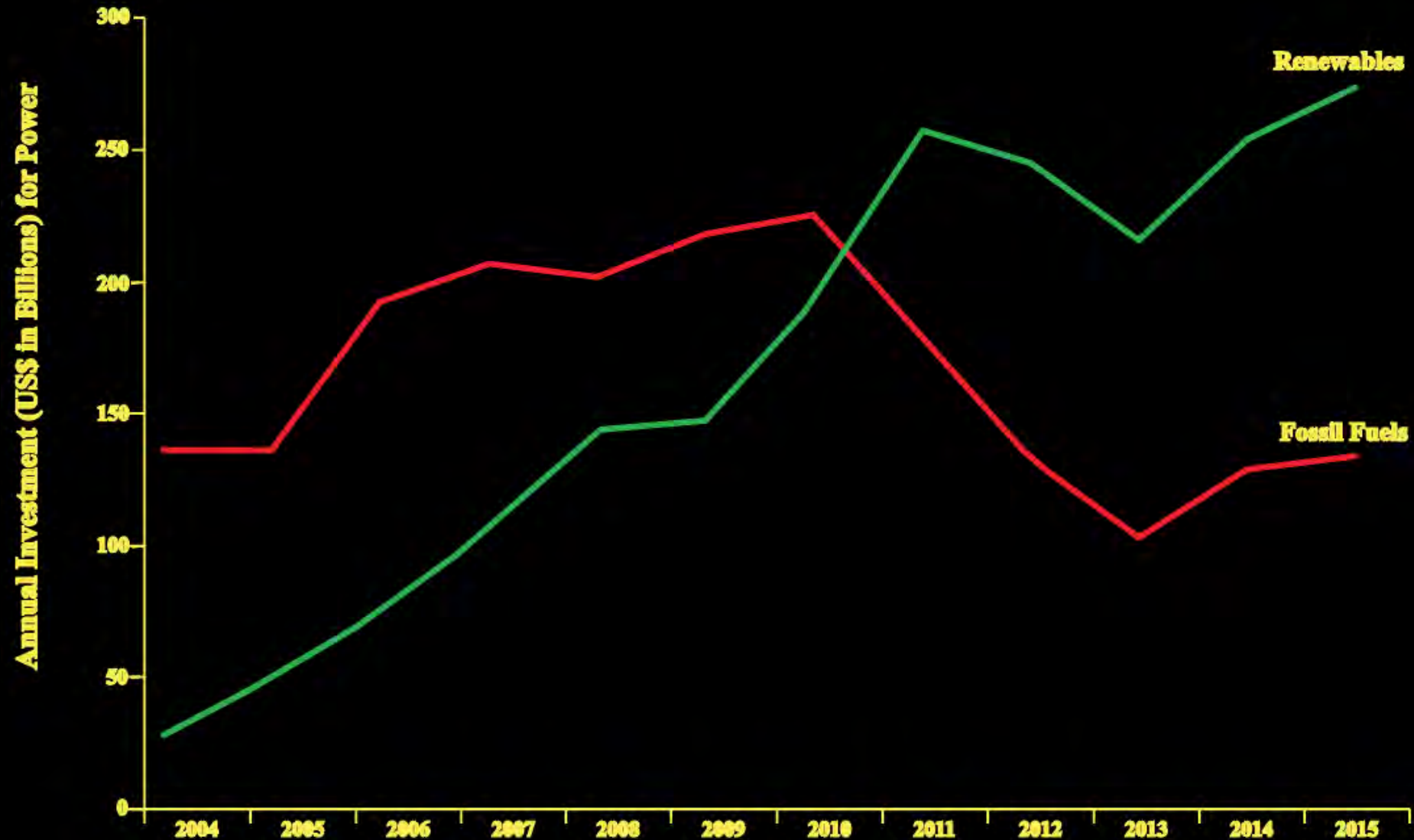
- Developed by Christensen at Harvard explaining how technological change takes many by surprise.
- Demand for a new product even though it may not be the cheapest because it is better overall. As a result the *whole system changes*...
- 3.5 inch floppy discs were preferred to 5.5 inch discs despite being less cost effective. Led to personal computer...
- Leaves stranded assets. The Kodak effect...
- Disruptive innovation in energy and transport is changing our world...

Disruptive innovation in energy and transport is happening much more quickly than expected....

Transformative and rapid change is being driven by demand for household/ business scale solar...and new transit *with* TOD's

Coal is being disrupted....

Power investment 2:1 Renewables to Coal and Gas.

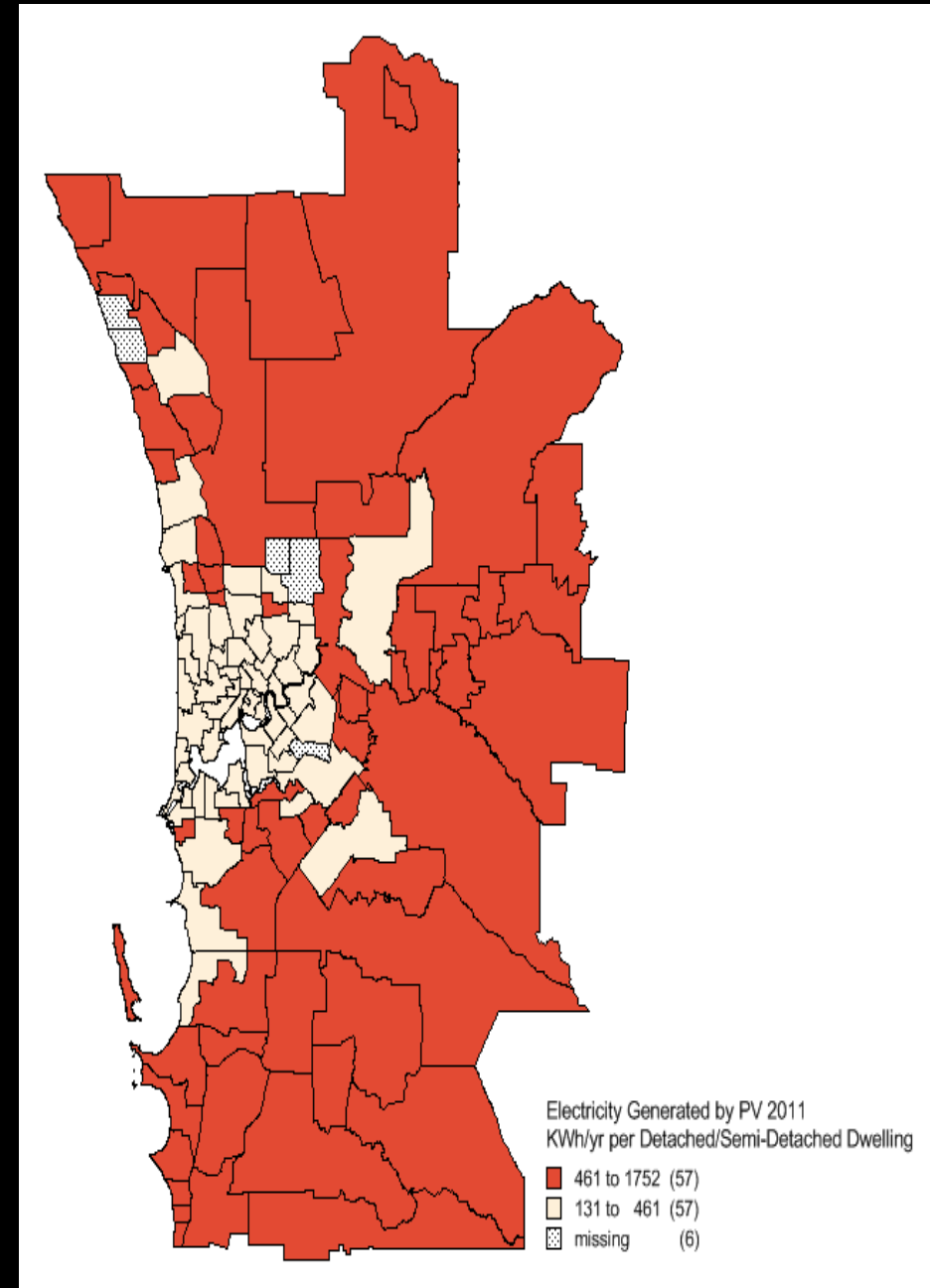


Solar power (PV)

25% of Perth homes
550 MW in 4 years...
Largest power station in WA

70% by 2025
'It is inevitable...'
Minister for Energy.

Coal assets stranded.



WGV solar-storage, electric vehicles and 'Citizen Utilities' and social housing....



US coal major Peabody files for bankruptcy [★]

725
Shares



Published on 13/04/2016, 9:28am

World's largest private coal mining company is mired in debt after failing to anticipate price downturn



Global markets are mainstreaming...

THE CONVERSATION

Academic rigour, journalistic flair

Arts + Culture Business + Economy Education **Environment + Energy** FactCheck Health + Medicine Politics + Society Science + Technology

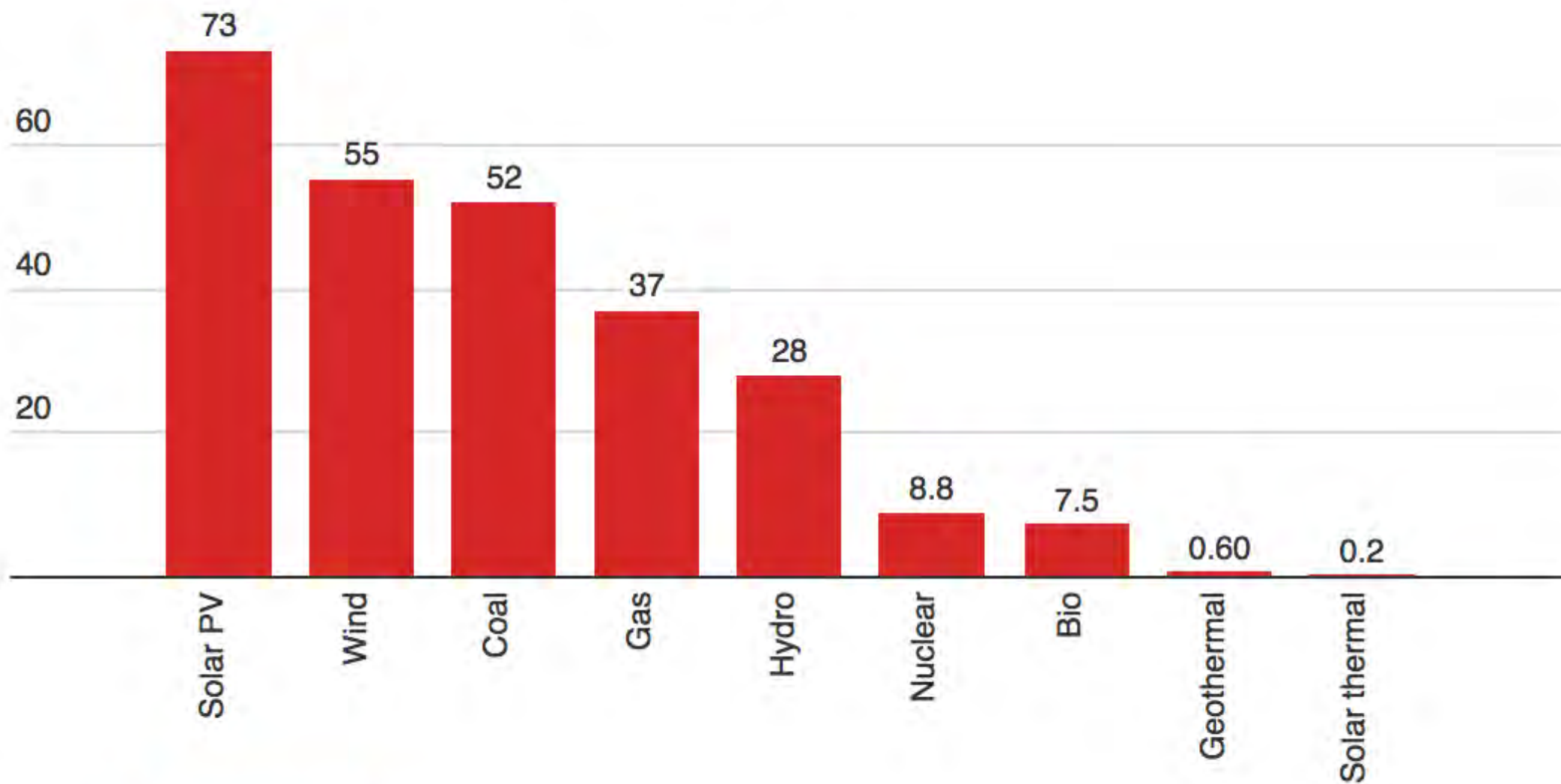


No politician can singlehandedly bring back coal – not even Donald Trump

November 28, 2016 3.58pm AEDT

New energy build in 2016

Net addition (in gigawatts) of electricity generation capacity

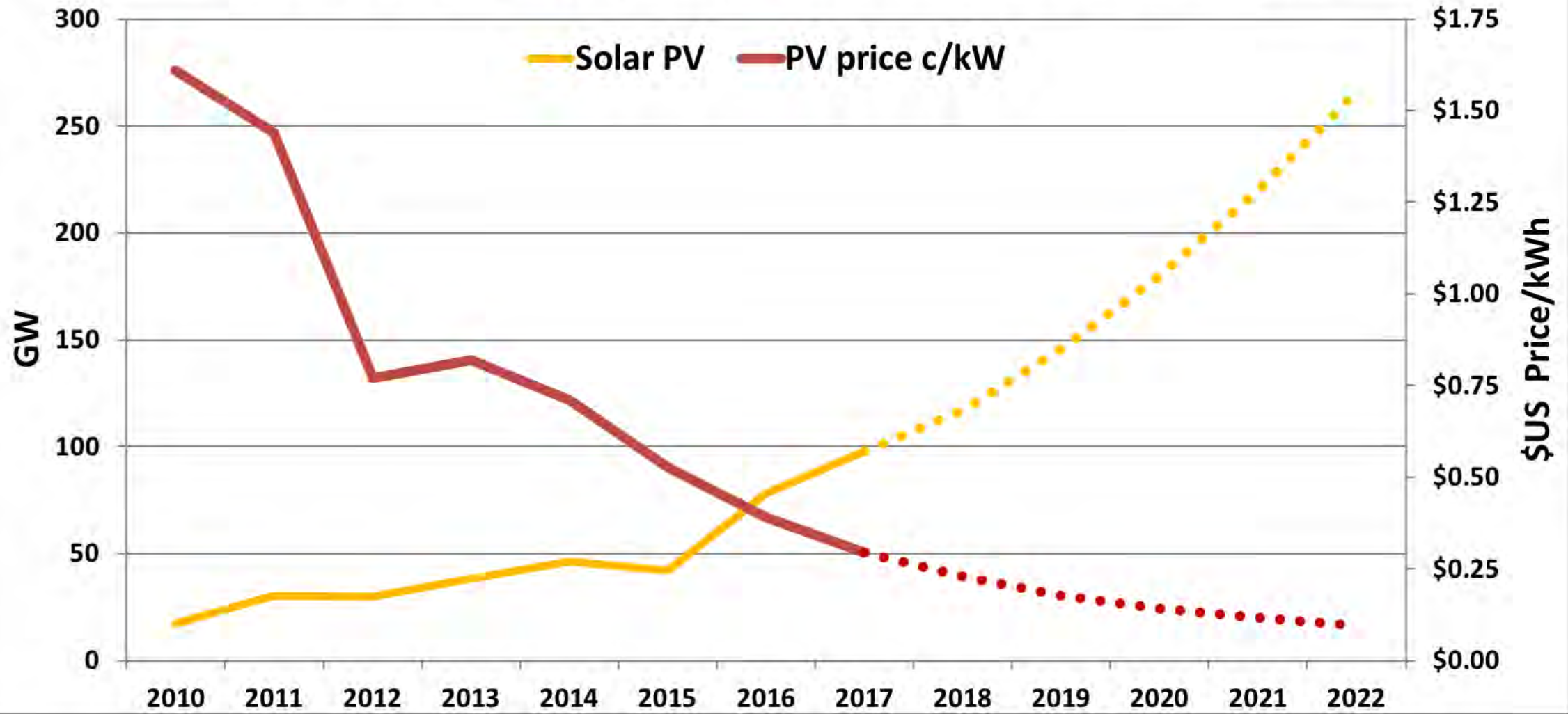


Source: [REN21/IRENA/WNA](#)

More volume brings lower cost — mass production China

Global cumulative solar & price

2010-2017 market data; @FSS_Au @ProfRayWills forecast av. 28% annual price decline 11Feb18



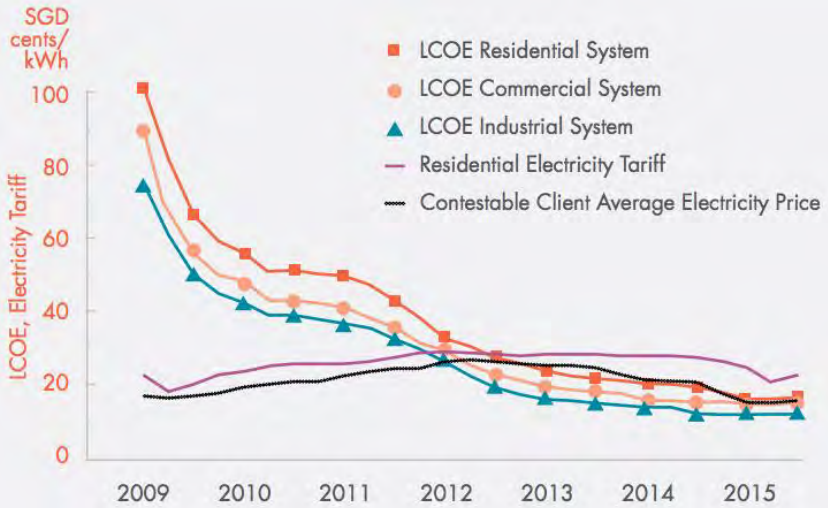


Figure 3-8: Levelised Cost of Electricity³⁰ for Solar Systems in Singapore Compared to Electricity Tariffs³¹

Perth has 700 MW

Perth has 30% of residences, and just starting on non-residential...

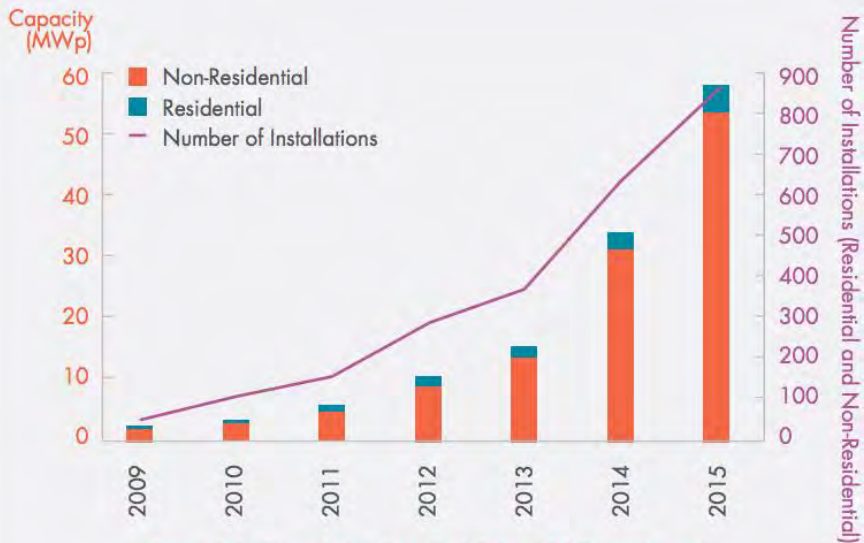


Figure 3-9: Cumulative Installed Solar PV Capacity and Number of Installations in Singapore³²

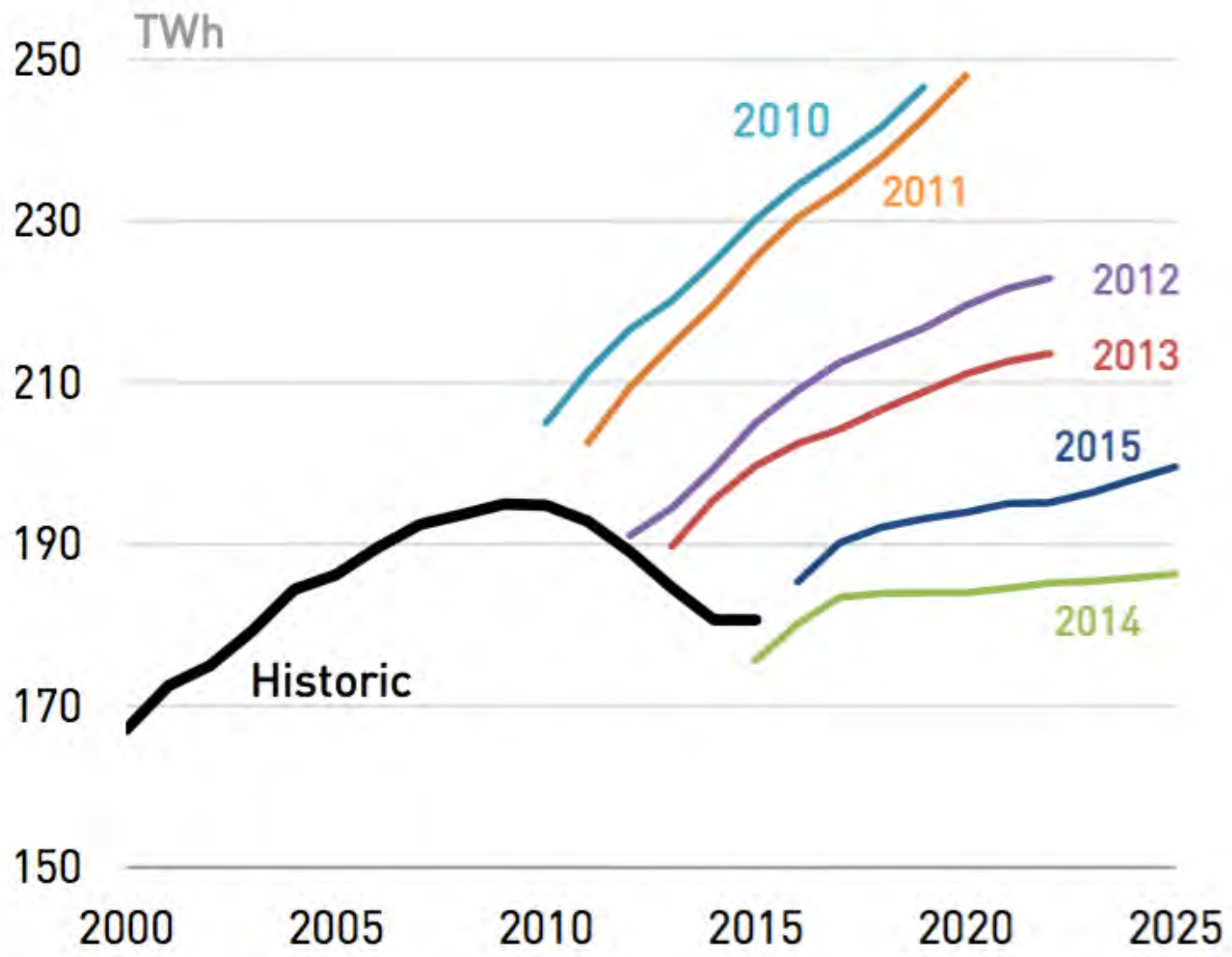


FIGURE 37

Electricity demand and successive projections by the Australian Energy Market Operator⁶⁷.

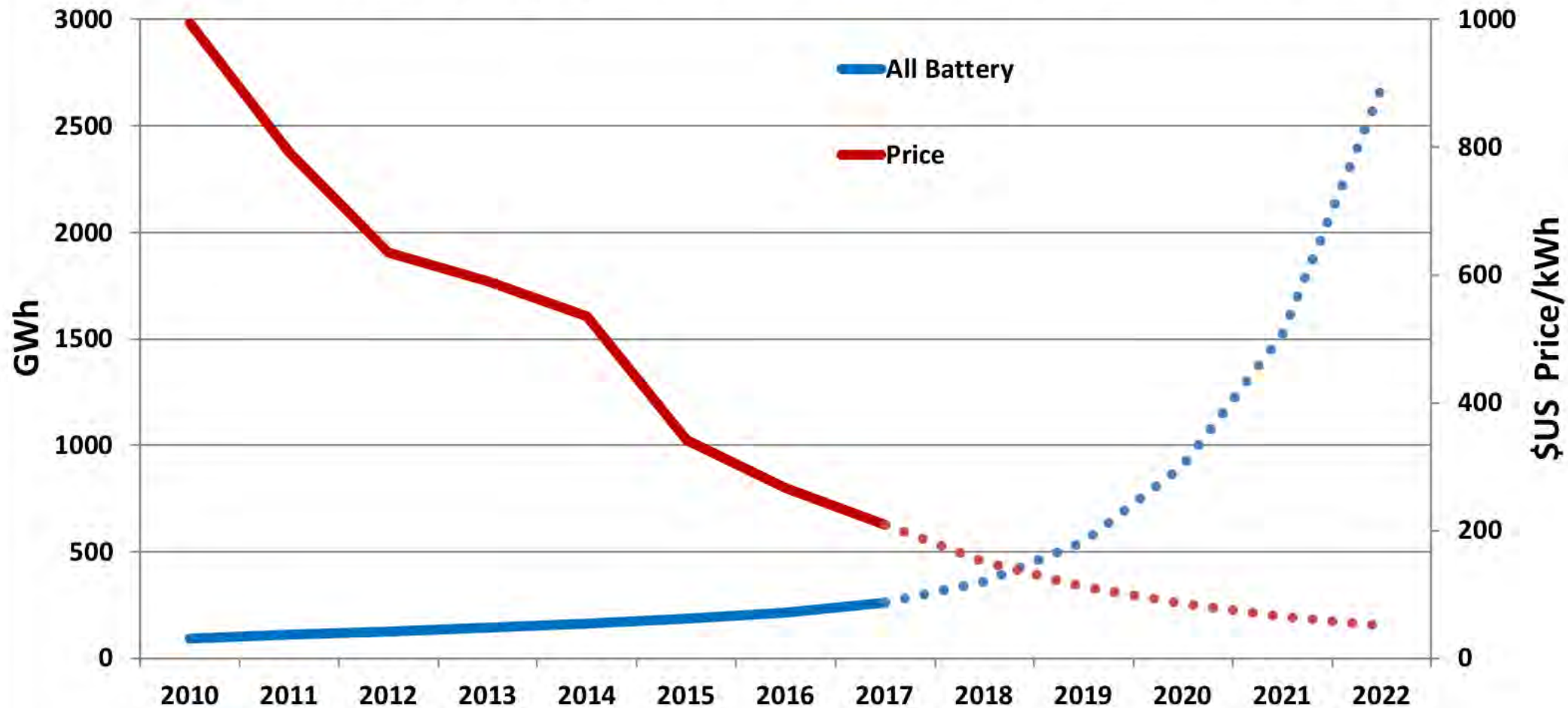
Combination of reduced demand and increased solar disrupted the electricity system in Australia

Its hard to change old ways of thinking.
Especially governments...

More volume brings lower cost - batteries

Global cumulative all batteries (EVs + storage) & price

2010-2016 market data; @FSS_Au @ProfRayWills forecast av. 28% annual price decline Update 14Feb18



Josh's House...affordable and zero carbon.

Joshshouse.com.au 40 million hits



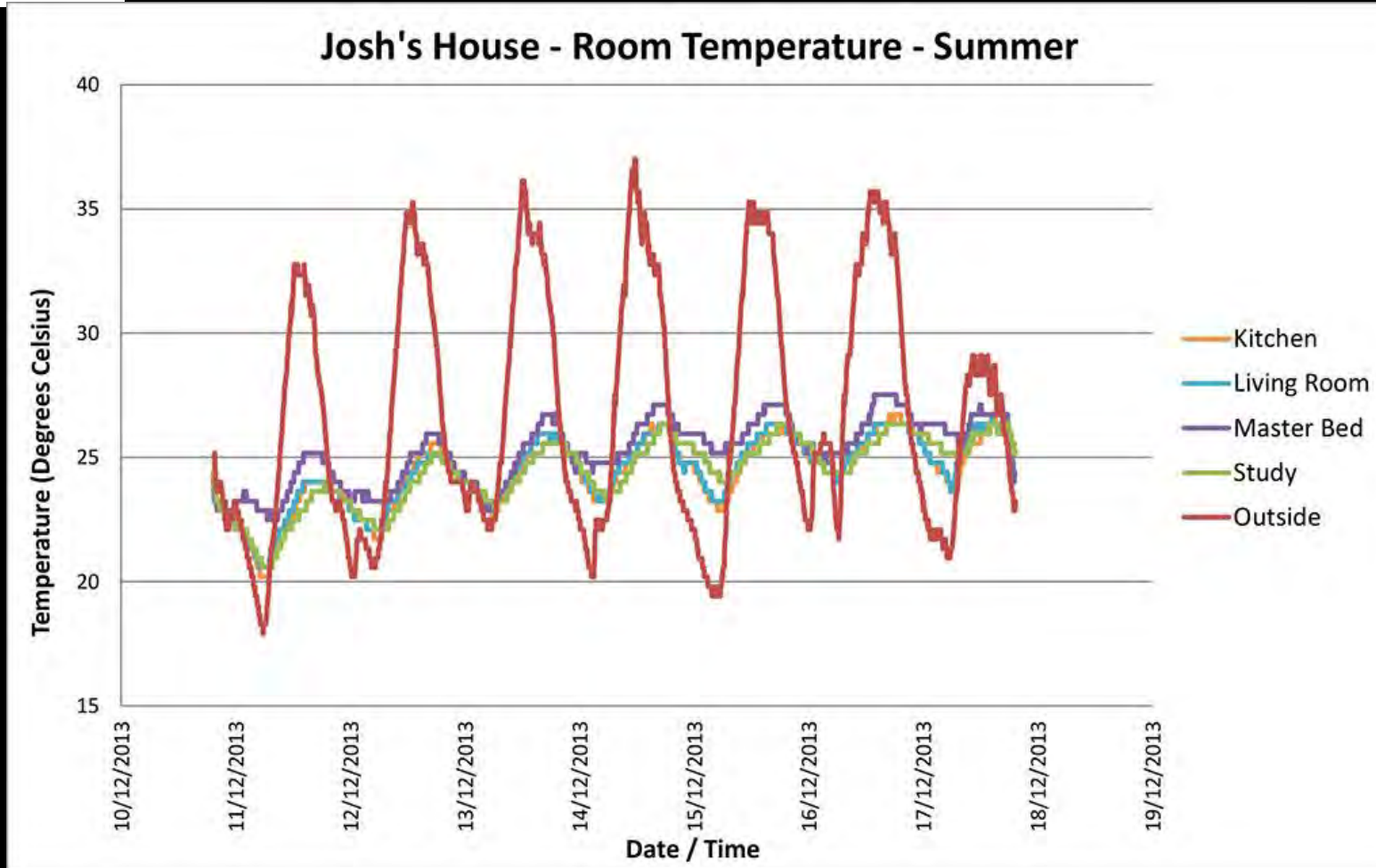
SOLAR GAIN





Summer Temperatures

No air con but always cool in summer...





The holy grail arrives



BYD-ENERGY



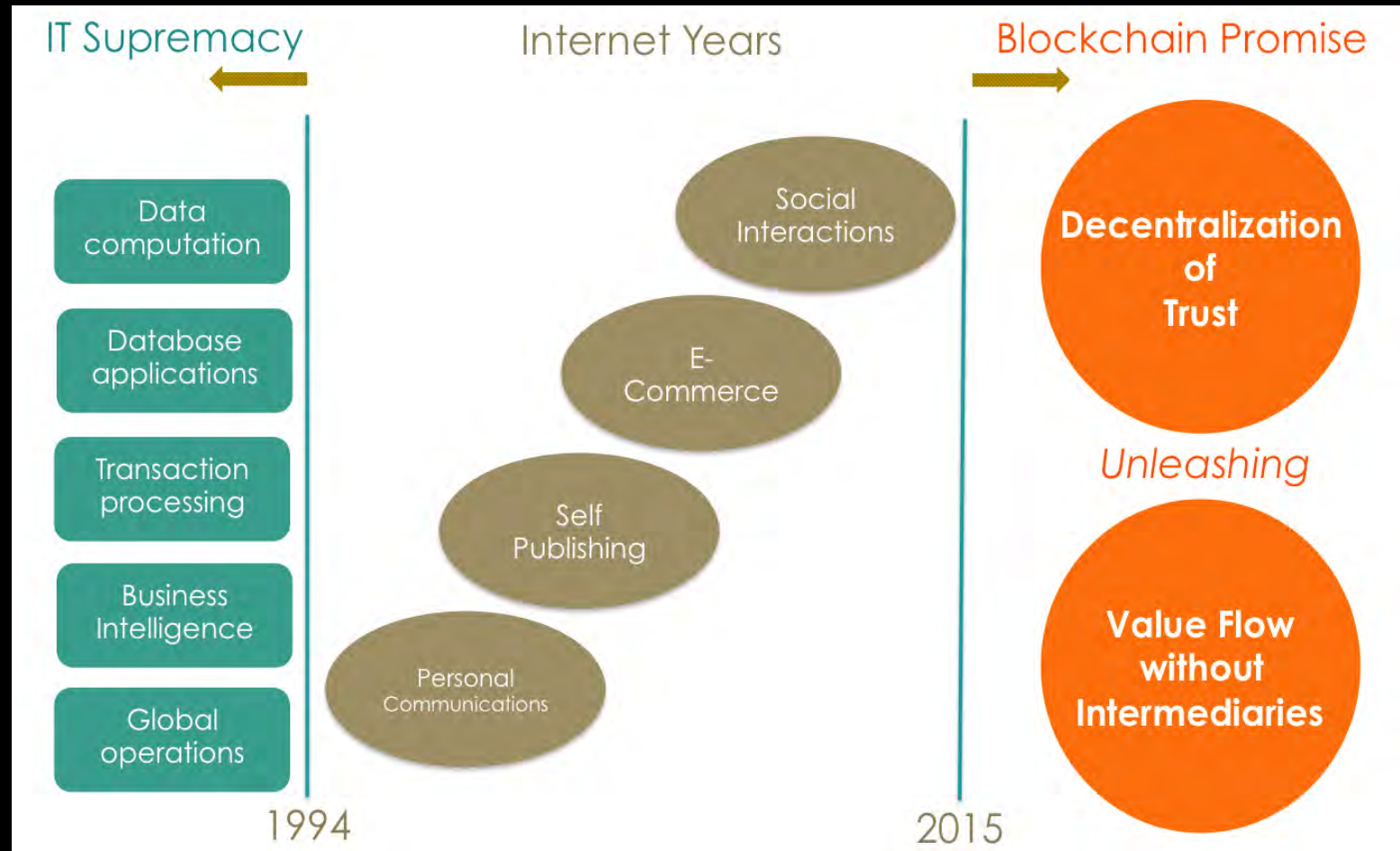
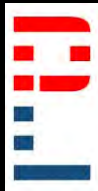
WGV solar-storage, social housing, water sensitive design, electric vehicles and 'Citizen Utilities'...PIMBY!

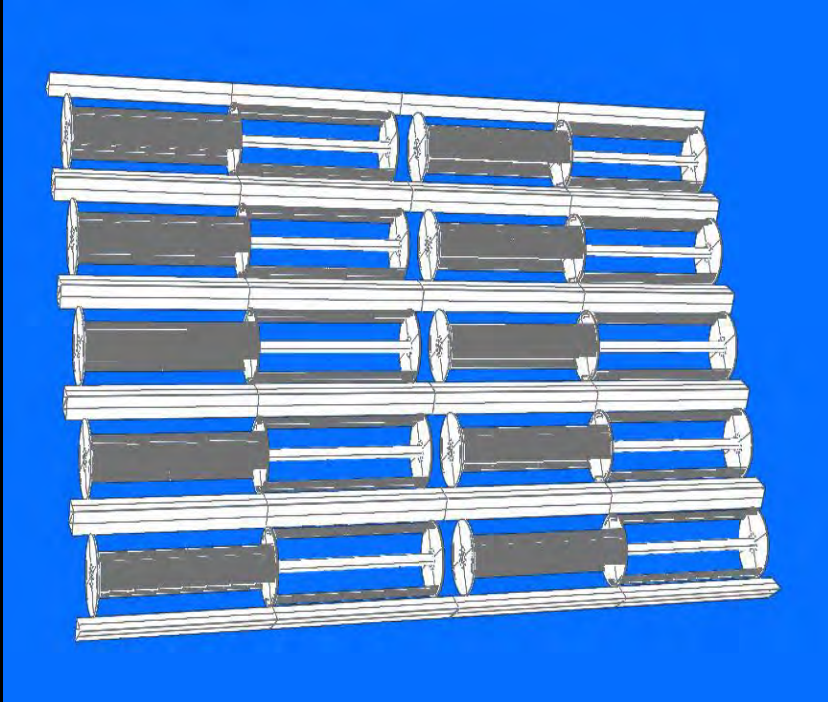
WGV – Zero carbon and SDG's!



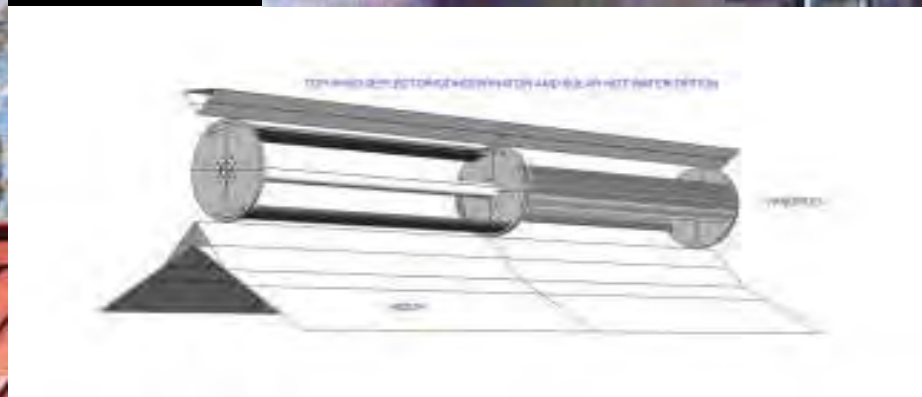
Blockchain and 'citizen utilities'...making microgrids work

Power Ledger Pty Ltd





Windpods

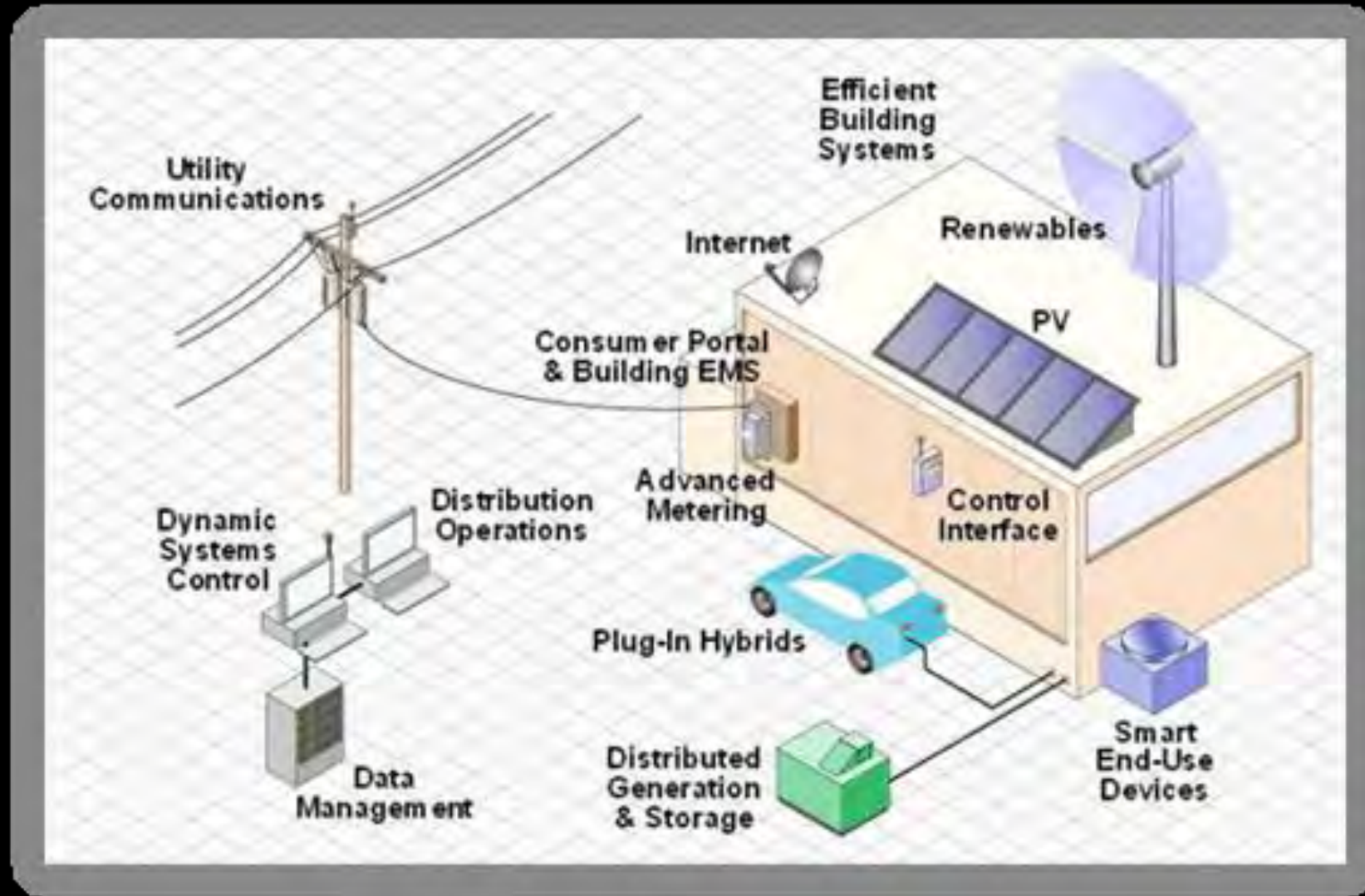


Roof mounted wind systems

City generation systems



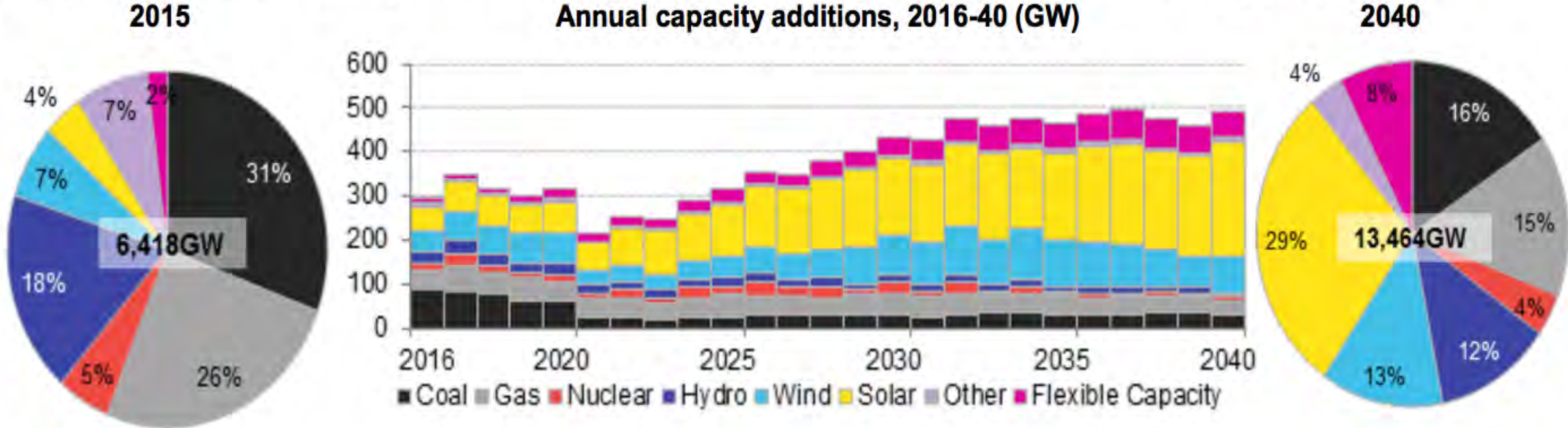
Enabling Technology: Smart Grids



The System Change...

- Power is becoming much more *local and community-based* with grids less driven by the long distance power plant.

Figure 1: Global installed capacity in 2012 and 2040 and projected capacity additions, by technology (GW)



Source: Bloomberg New Energy Finance. Note: Flexible capacity includes power storage, demand response, and other potential resources.

Put your money on solar....From 4% to 29%. Coal from 31% to 16%.

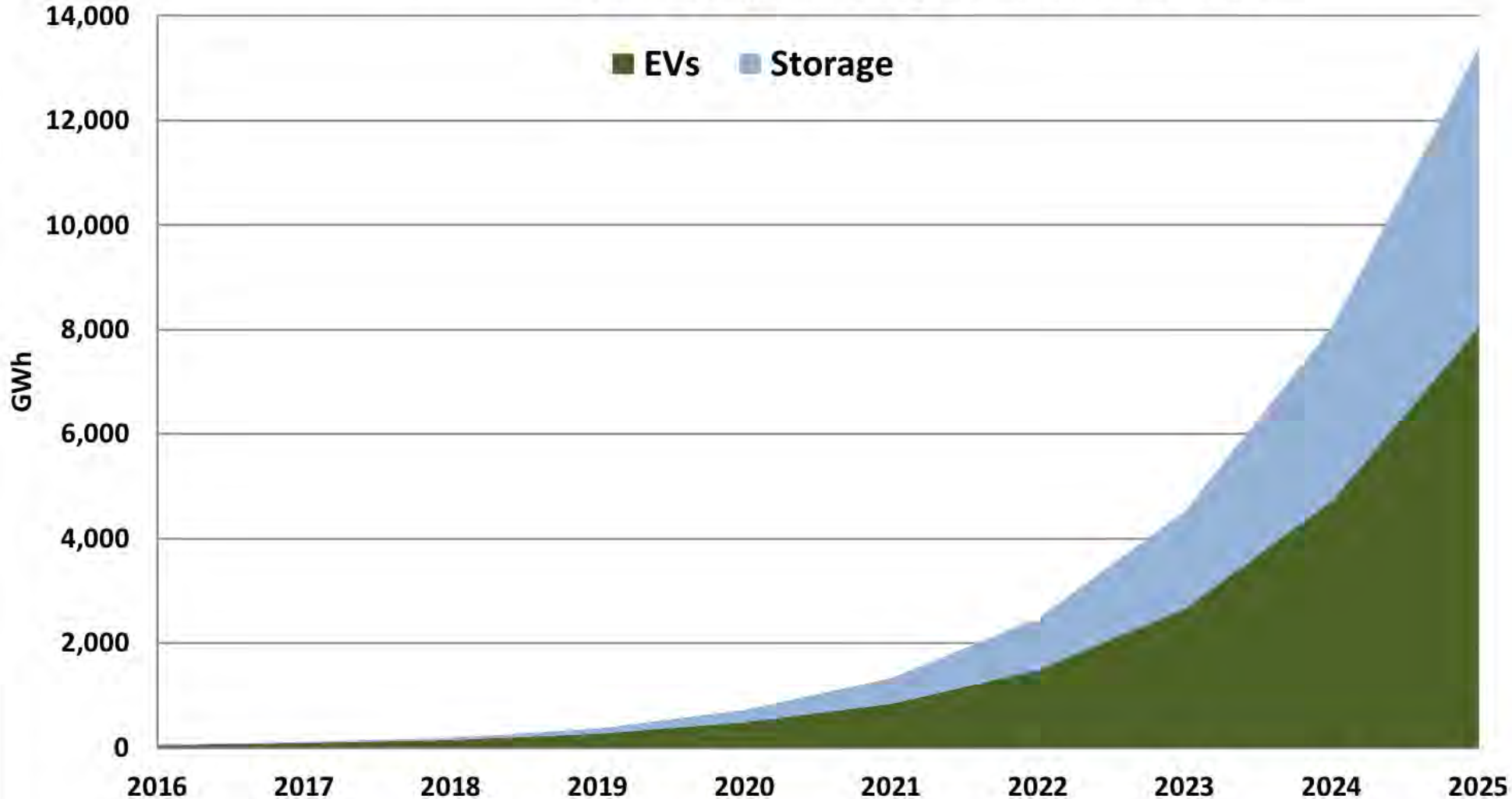
Oil is being disrupted...

By electric vehicles and electric transit built around real estate.

Batteries in transport versus stationary storage

Cumulative global battery use in electric vehicles and stationary storage

Chart and projection @FSS_Au @ProfRayWills 14Feb18



EVs and Li-ion Batteries – solar transport



E-Bikes are the new part of the solar revolution...can do all modes with one CARD



- 200 million e-bikes in China



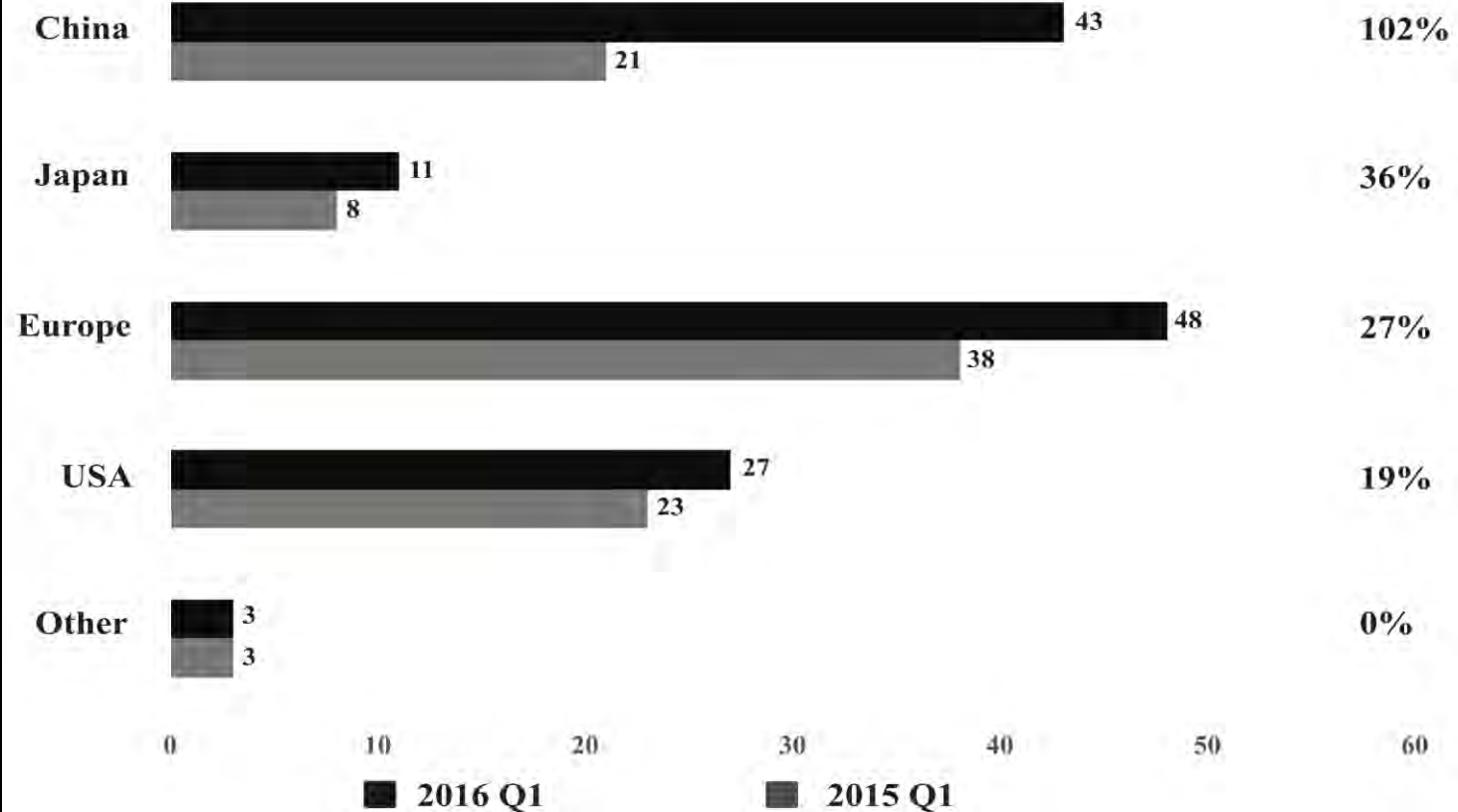
www.shutterstock.com - 335388089

Electric vehicles are growing globally at over 40% per year ...

Honda Zero Carbon Home



Volume of Plug-in Electric Vehicles and % Growth 2015-2016



WP-15 Pick Up EV

Designed with input from fleets, the W-15 is powered by a Panasonic Li-ion battery pack, delivering 80 miles of all-electric range. The gasoline Range Extender offers additional range of high-efficiency driving. The W-15 comes equipped with an external 7.2 kw power outlet providing up to 30 amps directly from the vehicle battery pack.






Tesla Semi



Semi is the safest, most comfortable truck ever. Four independent motors provide maximum power and acceleration and require the lowest energy cost per mile.

 **20_s**

0-60 mph with 80k lbs

< 2 kWh/mi

Energy consumption

0.36_{C_d}

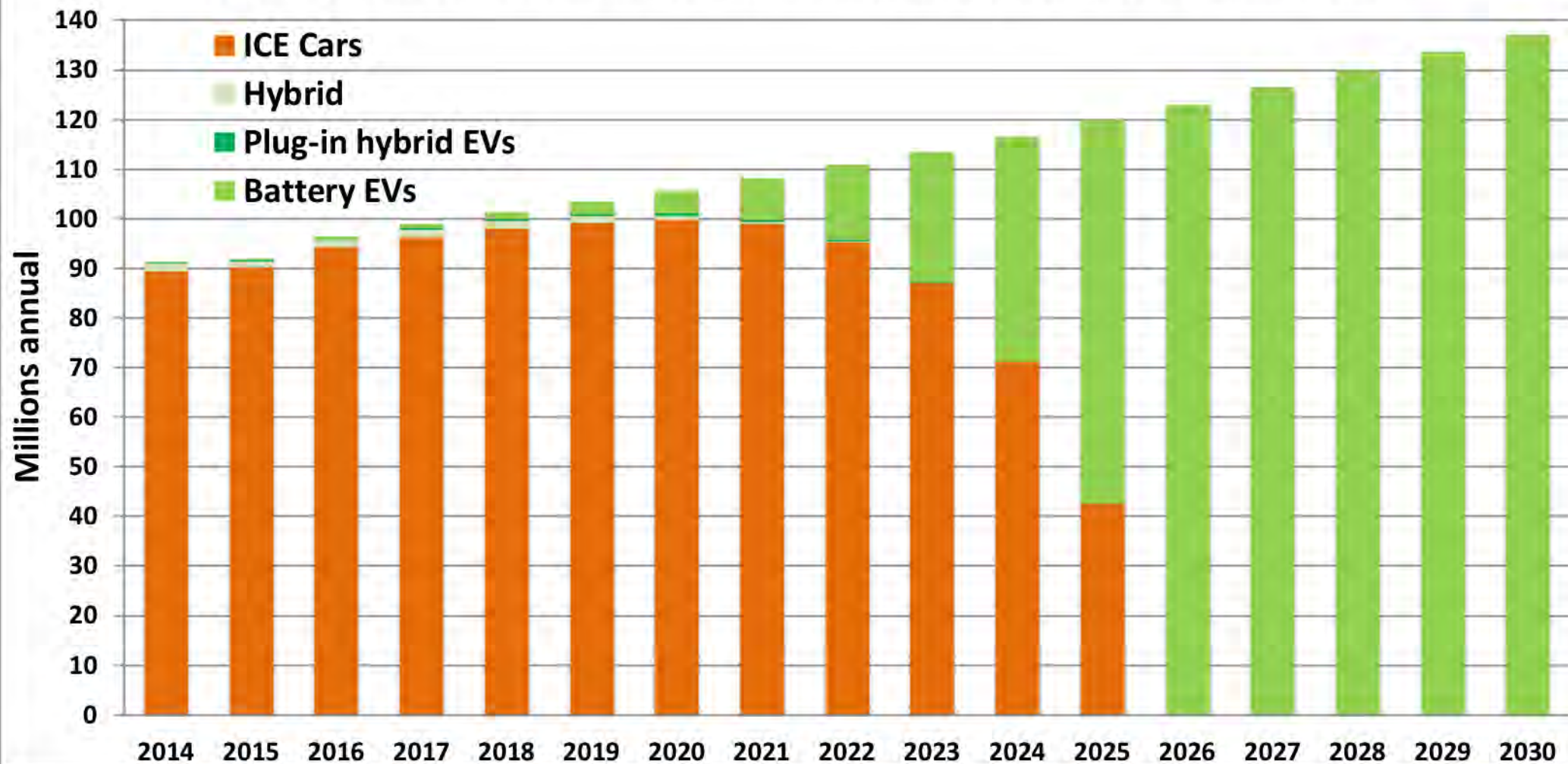
Drag Coefficient

[Reserve now](#)

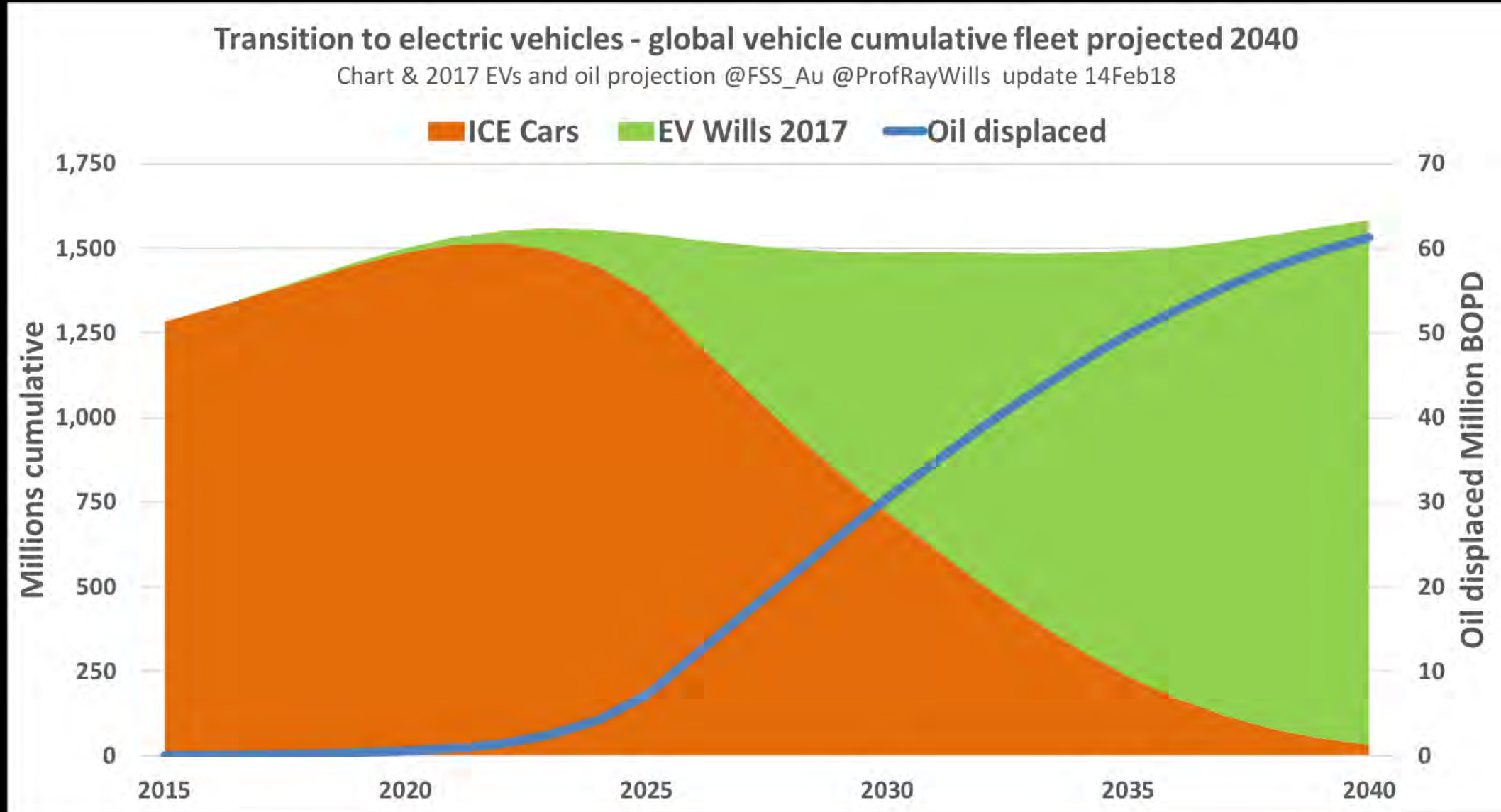
Potential EV growth

Transition to EVs - global vehicle annual sales to 2016 and projected to 2030

Car data OICA; EV data 2014-2016 @InsideEVs & @IEA Chart & projection @FSS_Au @ProfRayWills updated 11Feb18



Full electric fleet by ± 2040



EV Recharging Infrastructure



Toyota



NB: Standardized EV infrastructure is essential.



请注意充电
黑头线为绿壳车
黄头线是普通车



开锁
15221698179

注意
本人有事回家
切勿打扰



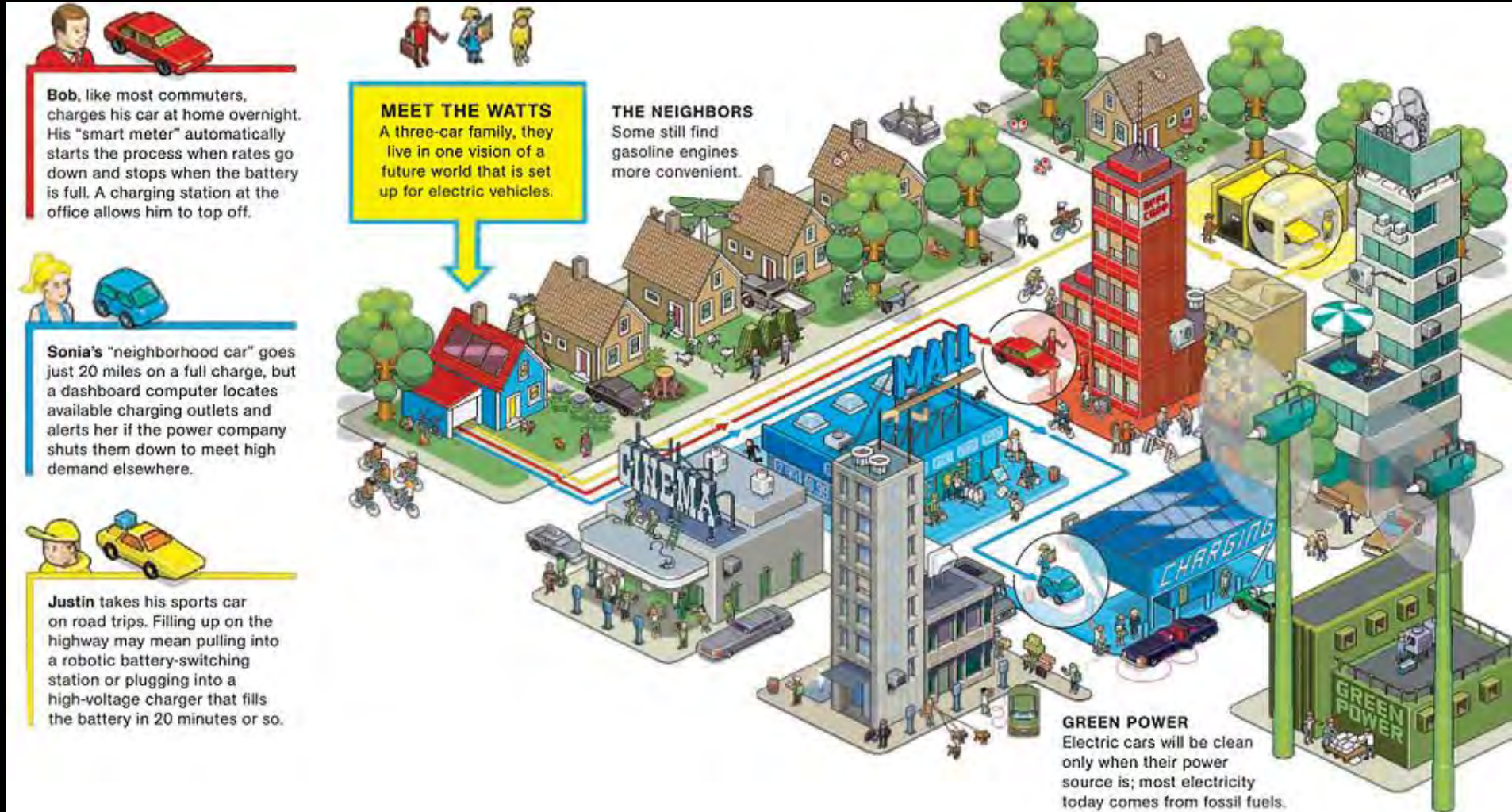
Green TODs for recharging PEVs....

- Stations should be where smart grids and renewables are fully integrated with green buildings....



National Geographic December, 2009

The Smart City....no public transport?



Masdar Car free experiment failed.... LRT not done and PRT could not replace cars





Public transport vehicles can be PEVs too



Tindo solar-electric bus in Adelaide

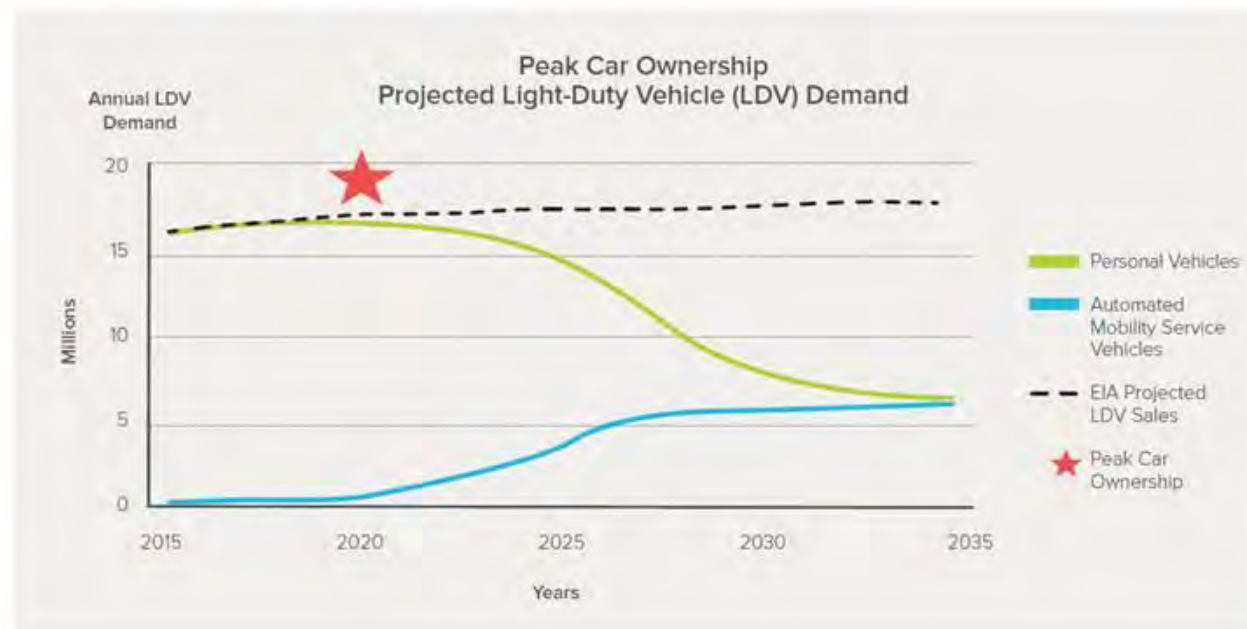
Alstom battery-powered light rail in Bordeaux



Autonomous Vehicles? The phasing out of private vehicles... 'Transport as a Service'

Rocky
Mountains
Institute,
2016

FIGURE 12:
PROJECTED LIGHT-DUTY VEHICLE DEMAND



Smart transport is shared transport....

On-demand shuttle buses to move NSW commuters between home and train stations

By Michelle Brown

Updated 24 minutes ago



PHOTO: Citymapper uses smartcreens to tell passengers their location and what's coming next. (Facebook: Citymapper)

A private rideshare-style service to move people between their doorstep and the train station will be trialed in Sydney and the

RELATED STORY: [Could Sydney's inner-west soon see Uber-style buses?](#)

RELATED STORY: [NSW puts problem Sydney bus zone out to](#)



PHOTO: Chariot in the US has sought to reinvent mass transit through crowdsourcing routes. (Facebook: Chariot)



New trackless
train in
ZhuZhou
ART –
Autonomous
Rail Transit

The 2nd Rail Revolution is based around Real Estate Transit Oriented Development

- People living in TODs have 50% less car use and save 20% of their household income due to one less car.

PLACEMAKING...



From TOD to DOT....

Development Oriented Transit is the future

TRANSIT ACTIVATED CORRIDOR...the next phase in transport planning.



Stirling City Centre



Riverside Project



Bentley Technology Precinct

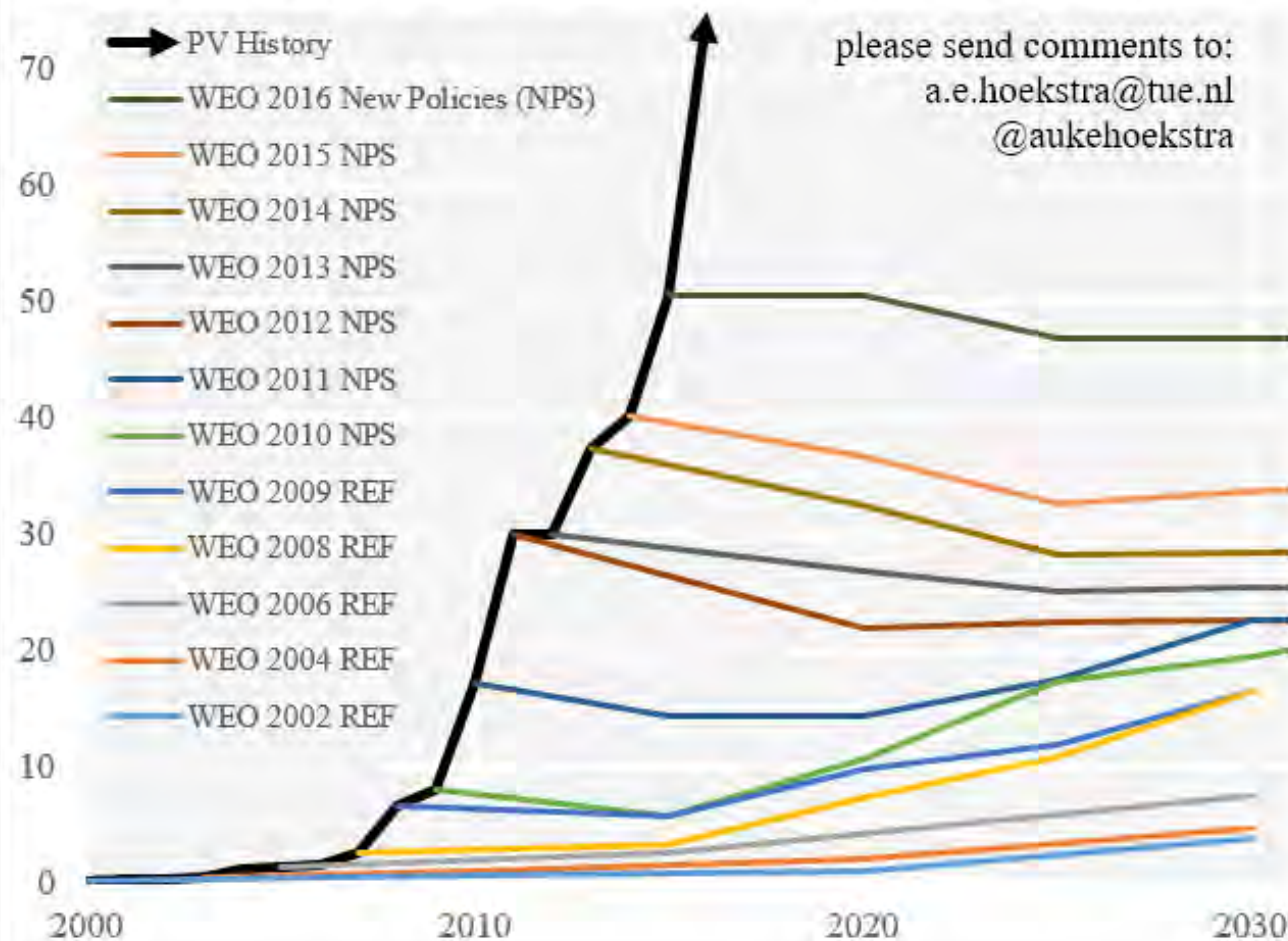
The System Change...

- Transit will become fully electric and based around real estate deals that can drive the whole financing of the system
- Requires much more local partnerships.

Disruption
defies
projection
modelling...

Annual PV additions: historic data vs IEA WEO predictions

In GW of added capacity per year - source International Energy Agency - World Energy Outlook



Predictions – After the Peak

