



RECTIFIER TECHNOLOGIES
MORE THAN JUST RELIABLE POWER SUPPLIES

OVERVIEW

NEW ENERGY MARKET

FOCUS ON

ELECTRIC VEHICLE (EV) CHARGERS



NEW OPPORTUNITY IN THE EV MARKET:

- RT is developing **high efficiency bi-directional** power conversion technology to be integrated into its product offering.
- This presentation addresses new needs in the electricity energy market, driven by the rapid adoption of EVs globally.



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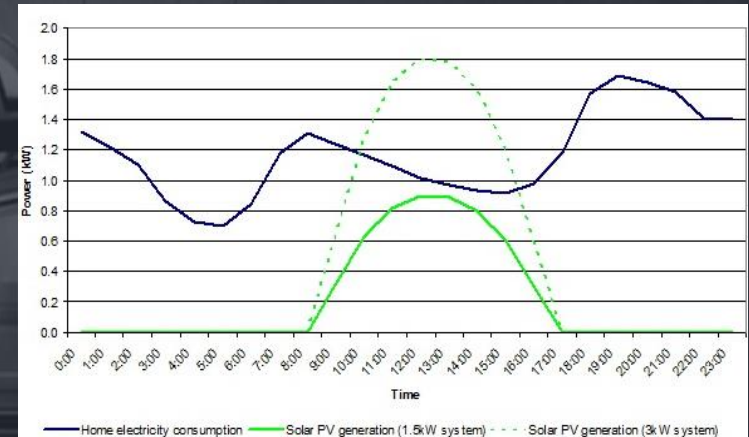
This presentation is mainly based on Australian conditions which vary widely from state to state due to significantly different weather conditions. However the principles discussed generally apply all round the world albeit with different emphasis and figures.

The intention is to communicate the breath of the challenge to grid stability that EVs represent and the consequent opportunity that this represents for RT

ENERGY DEMAND

(Australian home as an example)

- A typical Australian home consumes 18kWh of electrical energy daily¹
- EVs with a 100kWh battery can power a typical home for 24hrs with over 70% charge balance left
- Peak demand: morning 7-9am; evening 6-9pm²
- Night power consumption = $< \frac{1}{2}$ peak demand
- Total average electrical power demand in Australia is close to 30GW³
- The extra power required in the evening peak is 5 - 10GW depending on time of year and location within Australia



Typical power consumption for average household²



Electricity Generating capacity for Australia³

¹ Australia Energy Update 2018 | https://www.energy.gov.au/sites/default/files/australian_energy_update_2018.pdf , pg.5

² Home energy consumption | <https://www.solarchoice.net.au/blog/home-energy-consumption-versus-solar-pv-generation>

³ Australia Energy Regulator | <https://www.aer.gov.au/wholesale-markets/wholesale-statistics/generation-capacity-and-peak-demand>

GRID OVERLOAD CONCERNS

- The total power generation capacity in Australia is ~45GW³
- If 1 million EVs all connect to a 10kW charger at the same time, the power demand would be 10GW
- If 5 million EVs are connected, the demand would be 50GW clearly an untenable situation.
- Rapid uptake of EVs has the potential to cause problems to the reliability of the Electrical power supply
- Coal powered generators are being shut down as we transition to green energy, so the situation will only become worse.



SOLUTIONS TO GRID OVERLOAD

1. Avoid charging during peak demand
EV battery charging should be limited to minimum demand periods
2. Use Vehicle-to-Grid (V2G) technology to reduce peak demand and thus enhance grid reliability

V2G TECHNOLOGY

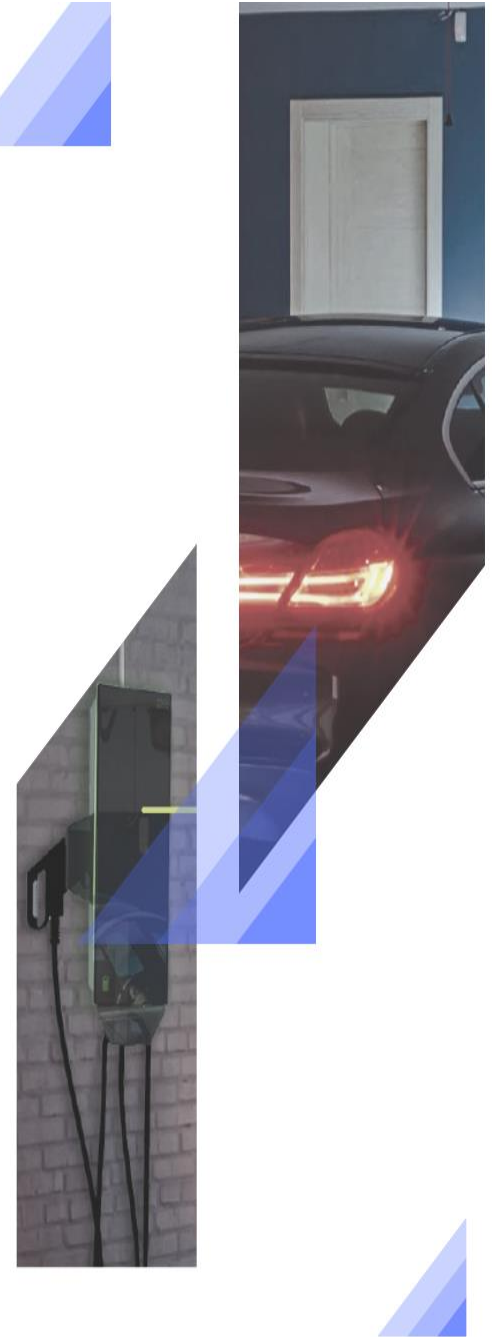
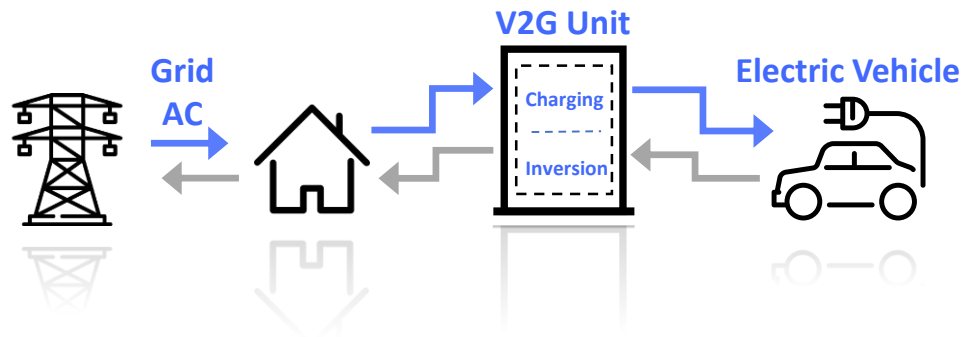
A V2G unit is a bi-directional power converter

1st mode (charging)

AC Power is transformed into DC and used to charge the EV battery.

2nd mode (inversion)

DC power from the battery is converted to AC and connected back into the grid.



ONCE IN A GENERATION OPPORTUNITY

- EVs combined with V2G have the potential to actually improve grid power reliability and thus be part of the solution for the grid.
- Over the next ten years, the potential V2G market in Victoria alone could be up to 5million. This represents a quarter of the Australia car fleet⁴
- Even by capturing only 10% of the market in Victoria, the potential is up to 500,000 units over the next 10 years.
- Clearly this will be a Trillion dollar market worldwide.



V2G EXTRA PERKS

- In the coming years, it is probable that power companies will charge a high price at peak demand period. eg: evening
- V2G EV owners could save money perhaps even make a profit by charging the battery at off-peak rate and then resell at the high-peak demand period.

MORE AFFORDABLE EVs

- Hyundai's Ioniq with starting price of \$45,000 is leading the charge into affordable EVs in Australia. The Korean car giant is preparing to launch a wave of new EVs over the next 12 months along with other car makers⁵





SUMMARY

RT believes that V2G bi-directional Home Charger will be an important technology in the coming EV revolution.

The first R&D prototype is expected by the end of Q2 2019, and can be in full production by the end of Q4 2019.



THANK YOU



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