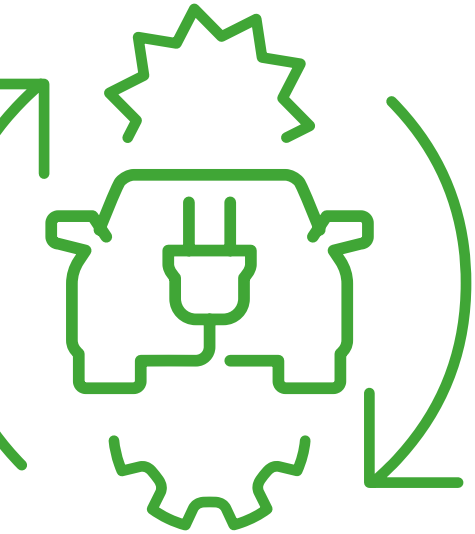
ComAp
The heart of smart control



Driving the Future Optimised EV Charging with Microgrids

Whitepaper

In recent years, there has been a significant increase in the adoption of electric vehicles, with many major vehicle manufacturers launching new models and expanding their electric vehicle (EV) product lines. This trend is driven by the increasing demand for sustainable transportation (as the transportation sector is one of the biggest CO2 emission producers) and the decreasing cost of battery technology. However, as the popularity of electric cars continues to grow, so does the need for reliable and environmentally sustainable energy sources to power them.

The use of renewable energy sources to charge electric cars is crucial to ensure that the environmental benefits of EVs are fully realised. While electric cars themselves produce zero emissions, the production of electricity used to charge them can still result in emissions if generated from non-renewable sources such as coal or natural gas. The use of renewable energy sources such as wind, solar, and hydroelectric power to charge electric cars is therefore essential to reduce carbon emissions and mitigate climate change. Hybrid microgrids can also provide a reliable and resilient source of power to EVs, even in remote or off-grid locations.

Further Pressure on the Grid with Rapid EV Chargers

Peak electricity demand growth continues to outpace base demand growth in many regions, creating challenges for network owners and operators. These challenges are expected to be exacerbated further with growth of electric vehicles in the upcoming years, which will result in the significant growth of rapid charger infrastructure – rapid EV charging uses more power, and relies on more stable electrical infrastructure. With localised battery storage in a microgrid being a solution, we expect this development will lead us to the next frontier for microgrids where EV charging via a microgrid will be common. A microgrid allows for islanded power specifically for charging EVs, meaning there is no power drawn from the grid, leaving it available for all other users. Microgrids can also be deployed rapidly without any costly and time-consuming network infrastructure development.

Smart Microgrids with Grid-to-vehicle and Vehicle-to-grid Connectivity

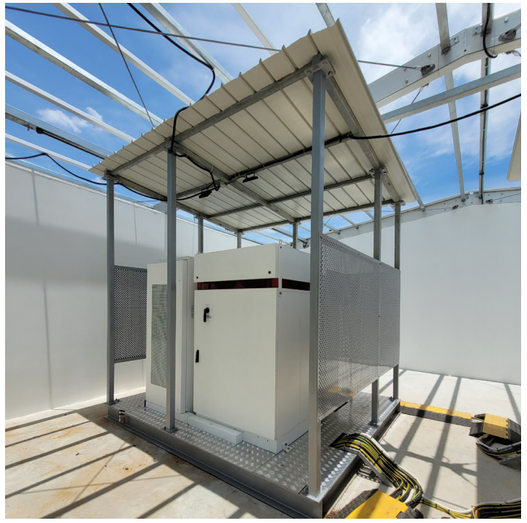
The EV-integrated microgrid architecture integrates EVs with solar and battery energy storage (BESS) to make the transition to an EV system as seamless as possible, without putting existing infrastructure under pressure. As a result of solar and BESS, the current distribution system would be less stressed and additional EVs charging stations could be easily integrated.

An alternative way to look at the charging requirements of EV fleets is to think of them as variable loads that may participate in demand response programmes and follow controlled or intelligent charging procedures. Because vehicle-to-grid (V2G) battery cycling has the potential to hasten battery degradation, the most cost-effective way to deploy V2G quickly is to provide auxiliary services in the form of grid-balancing services, thanks to smart EV fleet charging techniques.

An EV-integrated Microgrid: Singapore's Example

Singapore is one of the countries that has set a target to phase out all internal combustion engine (ICE) vehicles by 2040 and increase the adoption of EVs to at least 40% of the total vehicle population by 2040. The government has also set a target to reduce carbon emissions from the transportation sector by 47% by 2050, compared to 2005 levels. Achieving these targets will require significant investments in EV charging infrastructure and the use of renewable energy sources to power them.

Singapore has already taken steps to promote the adoption of EVs and the use of renewable energy sources to power them. The government has announced plans to install 60,000 EV charging points by 2030, and has launched several initiatives to incentivize the purchase of EVs, such as tax rebates and grants for EV buyers.



In addition, the traditional power grid infrastructure is being digitalised as part of the new government initiative to create a smart grid infrastructure that provides value to consumers and other stakeholders in the energy market. Singapore is exploring the use of renewable energy sources to power its transportation sector, including the development of hybrid microgrids to power EV charging stations. The government has launched several pilot projects to test the feasibility of using renewable energy sources such as solar power to power EV.

One such pilot project was recently commissioned by ComAp at a site that was originally built as a quarantine facility (consisting of 12 large tents, along with medical and staff facilities), and then used as a vaccination clinic and a microgrid test centre. The site was upgraded by adding EV chargers integrated into the microgrid control system. ComAp, together with their partners, designed and installed a microgrid, consisting of solar panels on top of the tents, coupled with a battery storage system (BESS), that could power the entire site in case the grid connection fails, whilst also feeding back any excess energy into the grid. The system operates as a set of nanogrids (smaller microgrids) that together form a complex-wide microgrid. When a mains failure occurs, the nanogrids operate in islanded mode, providing power to their own parts of the complex, using their own BESS. When the mains connection is re-established each nanogrid will perform their own reverse synchronisation procedure independently back to the grid, to provide a seamless transition, without any power disruption.

When microgrid mode is enabled, the power system decouples from the grid. Rather than operating as three independent nanogrids, the ComAp system takes on the leading role to manage the entire site as an islanded microgrid. This ensures the facility continues to be supplied without disruption but also improves the overall resiliency of the site.

ComAp's system always prioritises the use of the PV and uses any excess to charge the BESS. If more power is generated than the BESS needs, it is then exported to the grid.

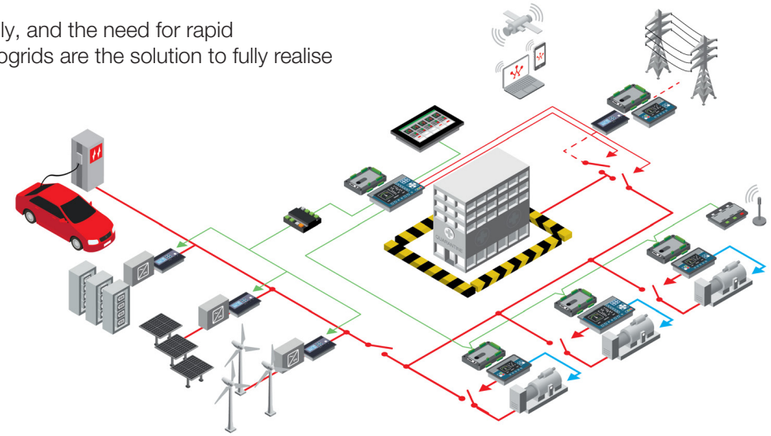
This project has proven that ComAp supports its customers in their transition to more sustainable power production in a very innovative and flexible way, opening up new possibilities for hybrid microgrids with integrated EV chargers and their smart energy management.

The hybrid power generation/EV charging test site is an important step towards the development of sustainable energy solutions that can power EVs not only in Singapore, but globally. It demonstrates the feasibility of using renewable energy sources to power EVs and provides valuable insights into the performance and reliability of the system.

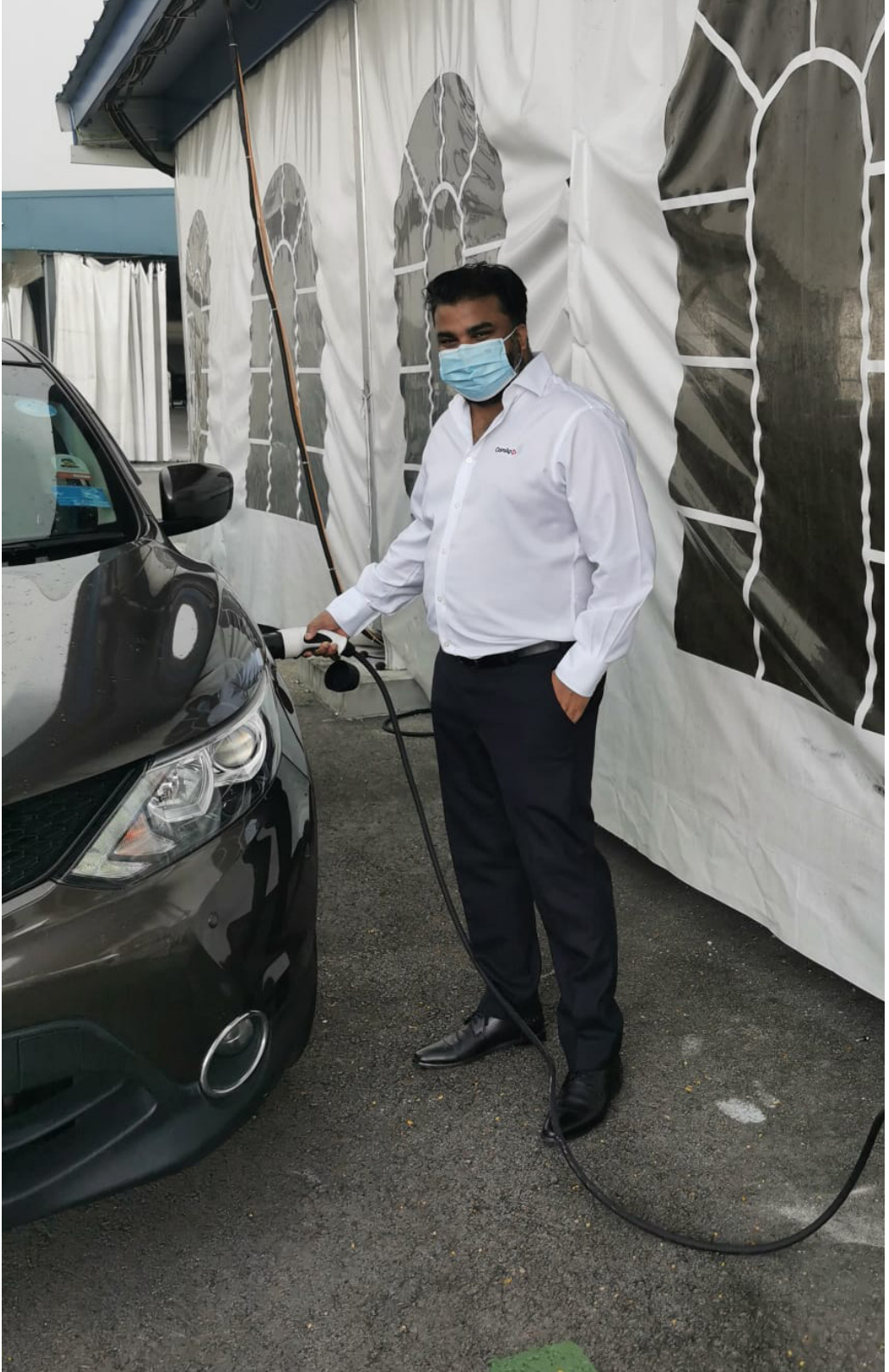
The potential of microgrids with integrated EV chargers for greener global transport

EVs have the potential to make a profound impact on the energy and transportation industries over the next few years. Reduced air pollution and noise, and promoting renewable energy sources over fossil fuels are some of the key benefits of adopting EVs. Charging EVs using a hybrid microgrid incorporating renewables allows the environmental benefits of the EV to be fully realised rather than charging them using traditional coal or natural gas energy sources, since the energy required for charging is produced in a more environmentally sustainable way. A hybrid microgrid charging station allows vehicles to be charged without any additional power drawn from the mains, as they can operate in isolation from the grid. Any excess power they generate that is not needed for powering EVs can either be stored for future use or exported back to the grid to benefit other users.

With the increased adoption of EVs globally, and the need for rapid infrastructure to charge them, hybrid microgrids are the solution to fully realise the benefits of EV use.



A simplified diagram of the facility



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For more information about how ComAp can help you with your microgrid design, installation and commisioning, please scan the QR code or email us at the address below

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