



Photovoltaic Project with Battery Storage Planned on Po Toi Island

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- Second Life of Retired EV Batteries
- Project Progress
- Summary

Background of Po Toi Island (1)

- Current electricity supply system on Po Toi Island
 - Electricity for residential and public facilities such as street lighting is supplied by the government-owned diesel generators
 - Transportation and refilling of fuel for the generators are arranged by local residents
 - Daily electricity supply is confined to 12 hours (6 p.m. to 6 a.m.)



Background of Po Toi Island (2)

- Electricity is distributed to local residents through a LV distribution network formed by 29 street lighting poles
- Major electrical loads are being identified
- Estimation on power consumption under different seasons was conducted
- A moderate scale PV system is planned as a near-term solution to enhance the electricity supply situation on Po Toi Island



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Household Appliance / Public Utilities	Maximum Demand
Lighting	70W (per household)
Electric Fan	50W (per household)
Refrigerator	50W (per household)
Miscellaneous	25W (per household)
Street Lighting	150W (per lighting)
Tin Hau Temple	1,000W (collectively)
Main Pier	1,000W (collectively)
Community Hall	1,000W (collectively)
Aqua Privy	150W (collectively)

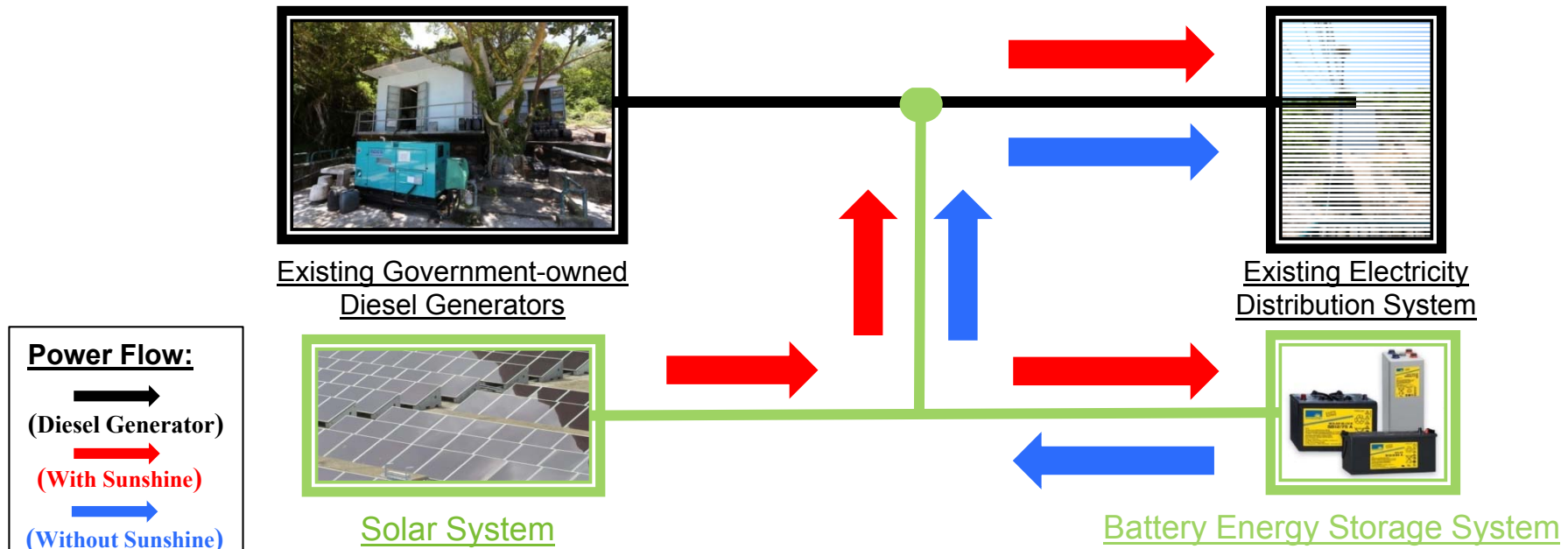
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Season	Day	Daily day-time consumption (kWh)	Daily night-time consumption (kWh)	Daily consumption (kWh)
Spring	Weekdays	14.90	71.93	86.83
	Weekends	27.28	81.71	108.99
Summer	Weekdays	22.10	82.13	104.23
	Weekends	44.23	105.41	149.64
Autumn	Weekdays	14.90	71.93	86.83
	Weekends	27.28	81.71	108.99
Winter	Weekdays	17.45	79.08	96.53
	Weekends	26.08	89.39	115.46

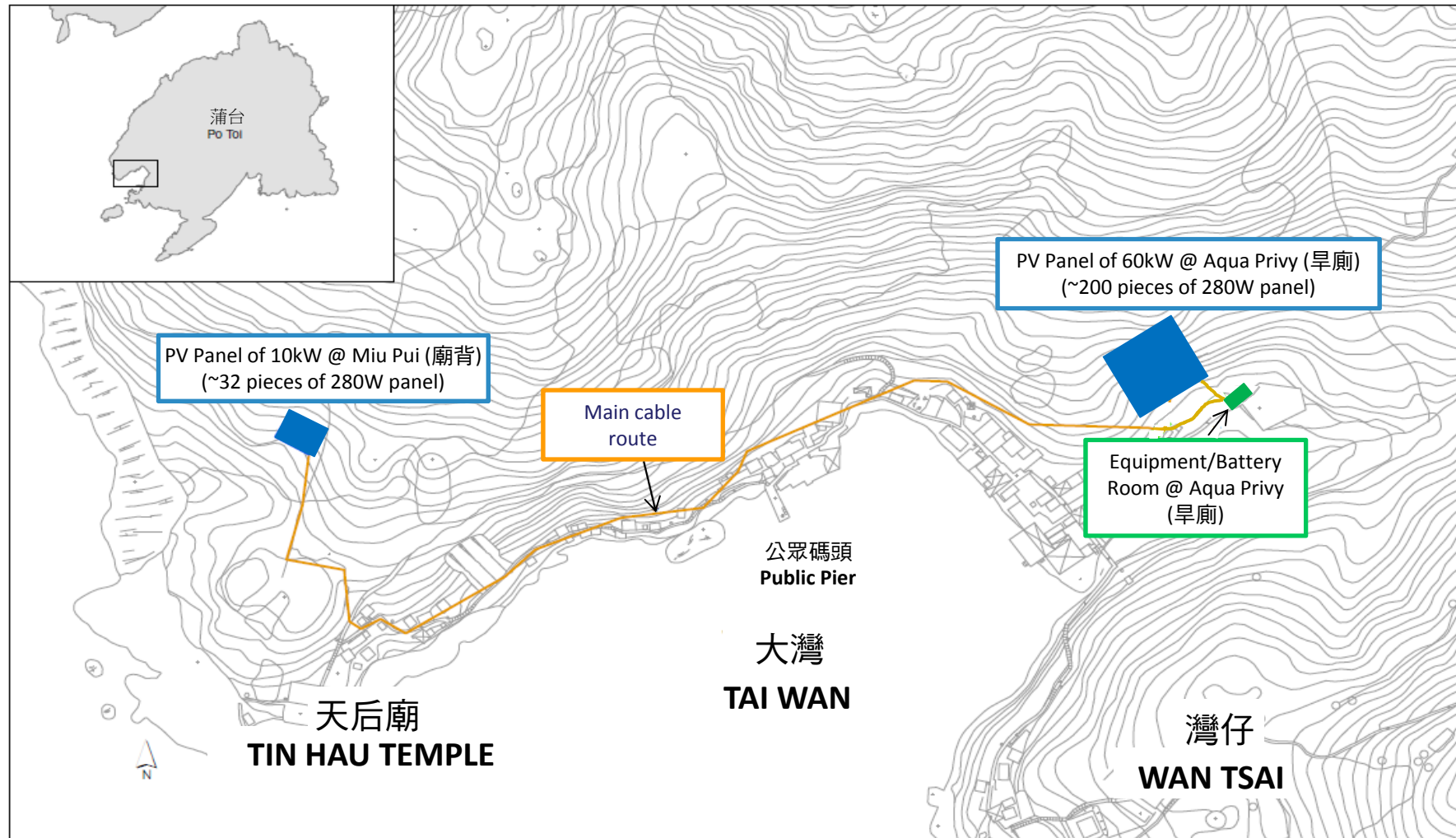
PV System on Po Toi Island (1)

- PV System on Po Toi Island
 - On top of the existing electricity network, PV System which consists of a battery energy storage system will be installed to supplement the diesel generators
 - Release heavy burden on local residents
 - Mitigate pollution problem caused by the diesel generators



PV System on Po Toi Island (2)

- Overview of site location:



PV System on Po Toi Island (3)

- Detailed site locations:



Slope near Miu Pui (PV Panel)



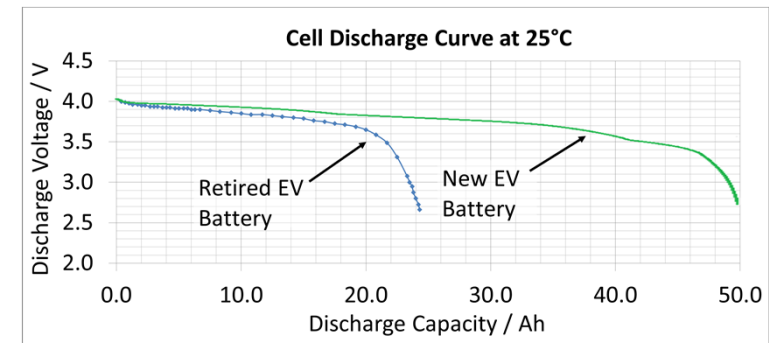
Slope near Aqua Privy
(PV Panel)



Space near existing platform
(Equipment Room)

Second Life of Retired EV Batteries (1)

- Batteries from retired EVs in HK Electric EV Fleet
 - In 2016, the 100th EV has been introduced in the company fleet
 - EVs purchased in early years are about to retire
 - After checking, about 50% remaining useful capacity is found in the retired EV batteries
 - Simple disposal induces wastage of resources



Second Life of Retired EV Batteries (2)

- Work with PolyU to develop a “Hybrid Battery Energy Storage System (HBESS)” consisting of both new VRLA batteries and retired EV batteries
- Instead of enlarging the total usable capacity of storage system, the retired EV batteries are intentionally designed to serve the purpose of extending the service life of new VRLA batteries due to their uncertain performance



Existing Government-owned Diesel Generators



Existing Electricity Distribution System



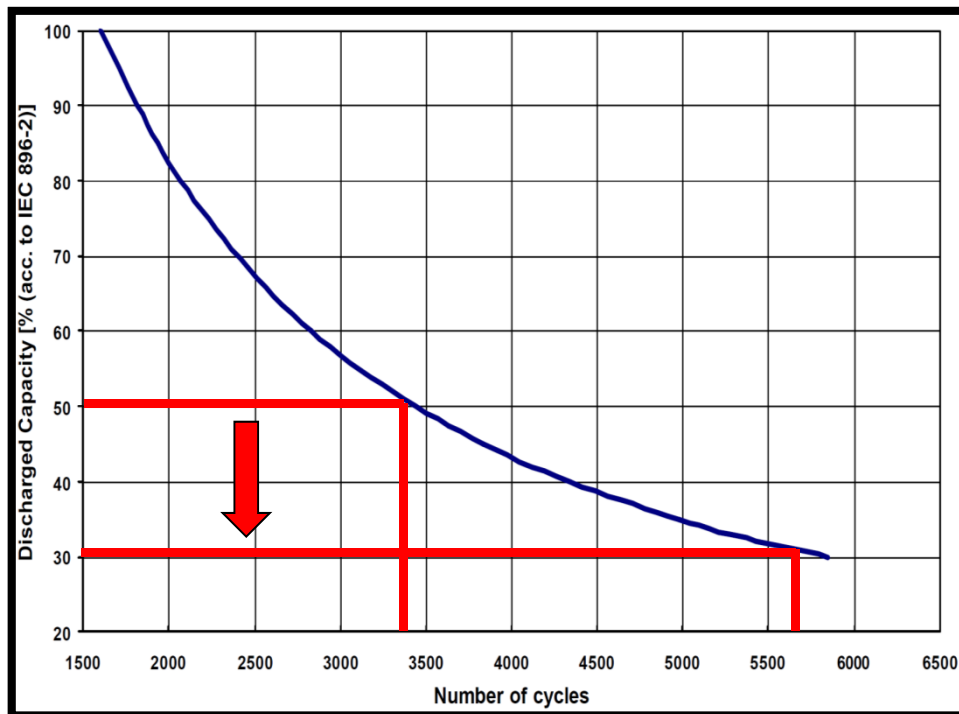
Solar System



Hybrid Battery Energy Storage System

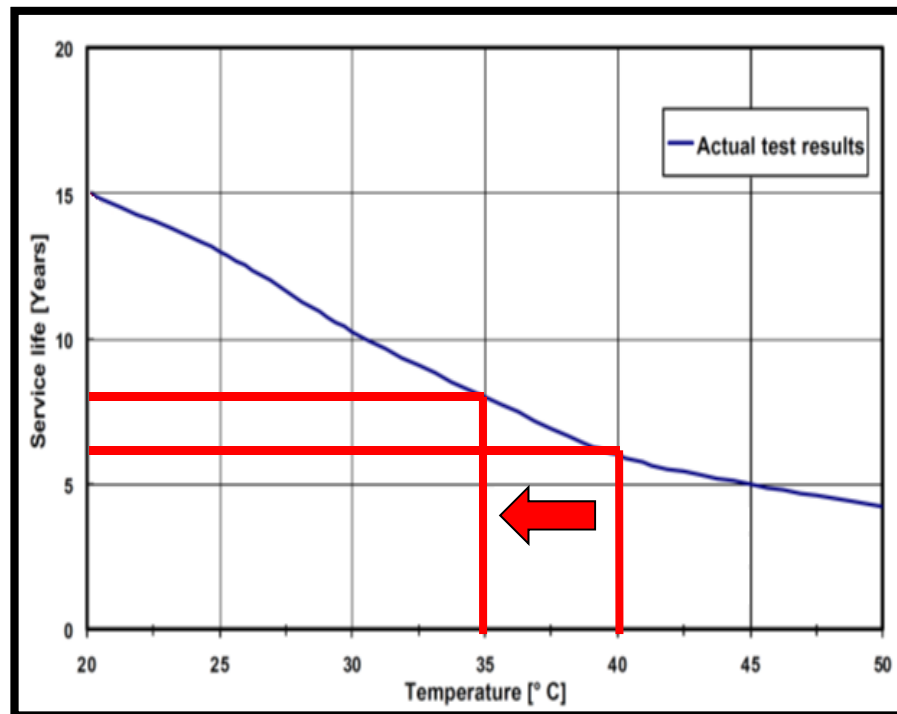
Second Life of Retired EV Batteries (3)

- Extending service life of VRLA batteries by:
 - Reduction of Depth of Discharge (DOD)
 - Control of Charge/Discharge Rate by Temperature
 - Advanced Charging Method



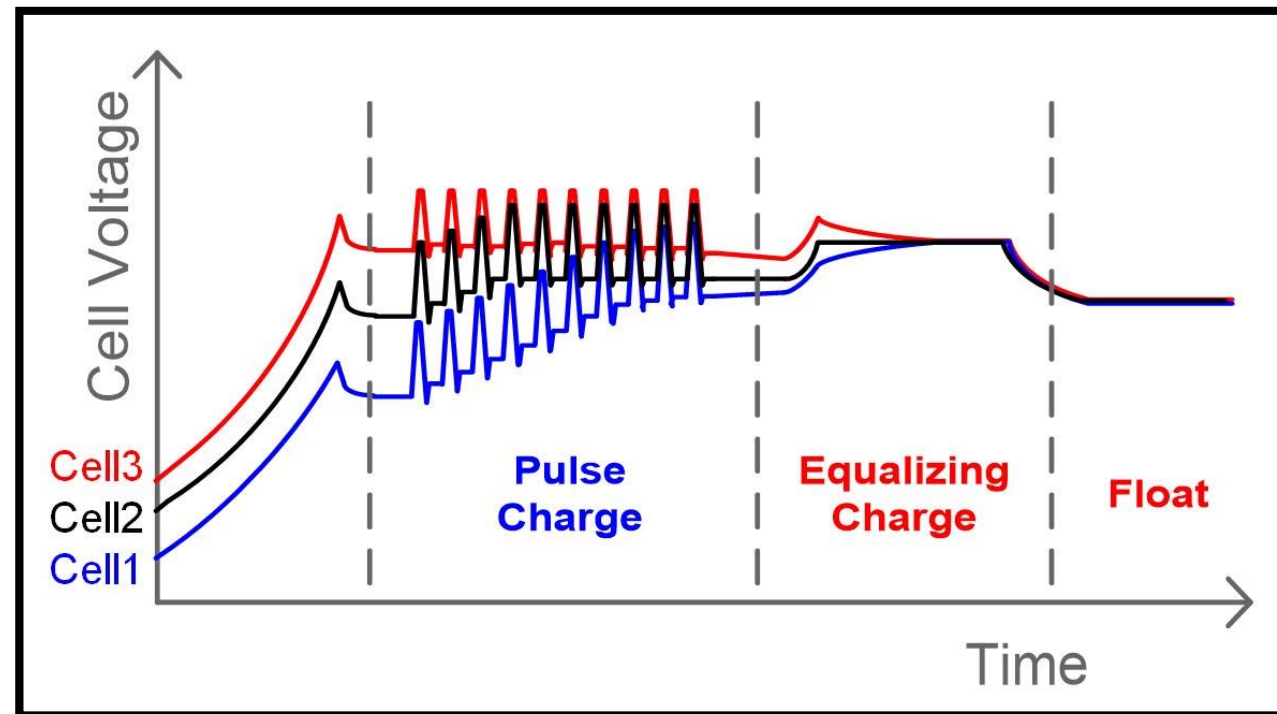
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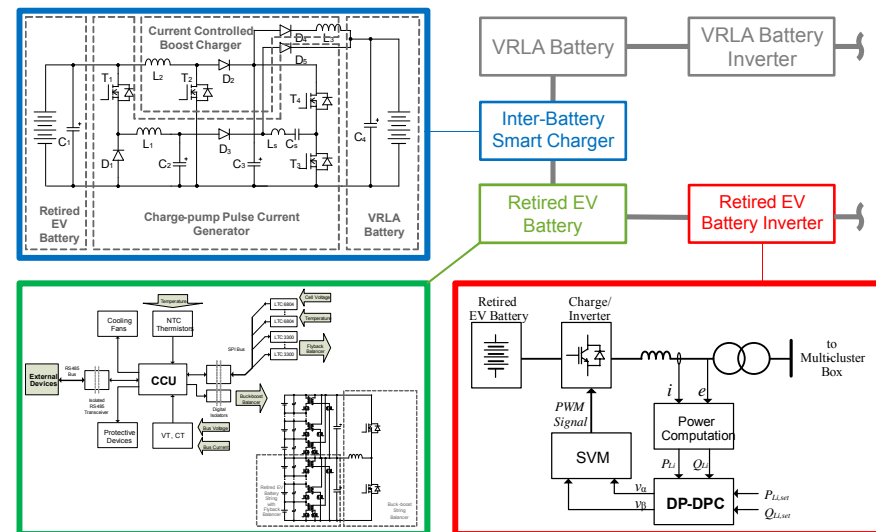
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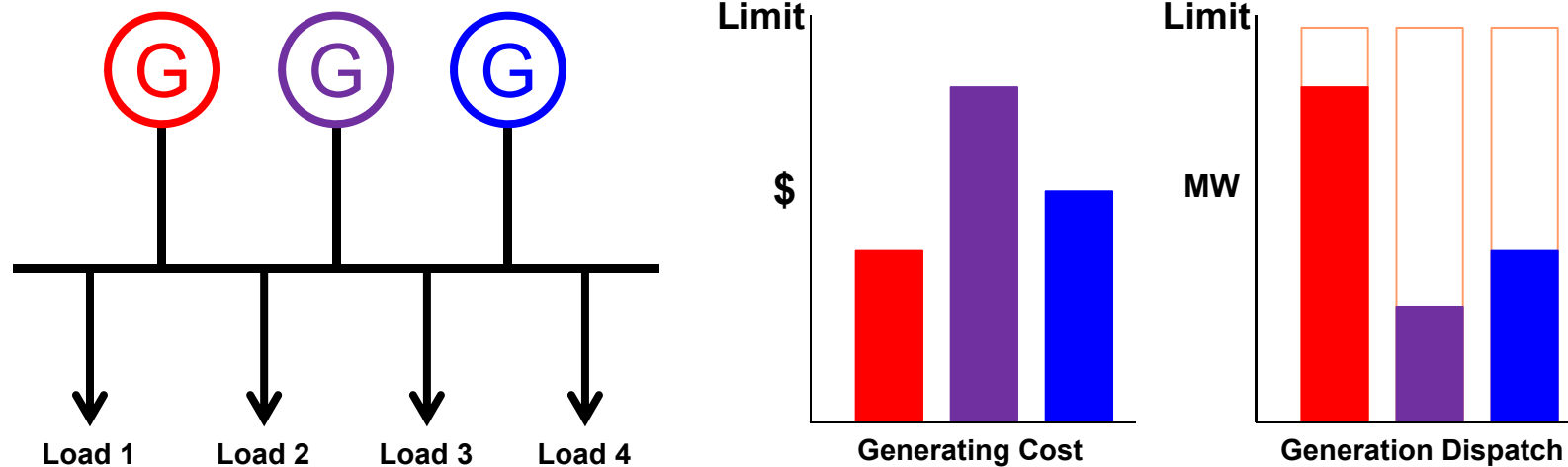
Second Life of Retired EV Batteries (4)

- Design of major equipment for the retired EV batteries
 - **Dedicated charger/inverter with DPC** which is capable of real-time management of real & reactive power
 - **Specially designed Battery Management System (BMS)** with advanced balancing, real-time cells' SoC, SoH, remaining useful life (RUL) estimation
 - An **auxiliary inter-battery charger** linking the retired batteries and VRLA batteries to enhance the useful life of the new batteries



Second Life of Retired EV Batteries (5)

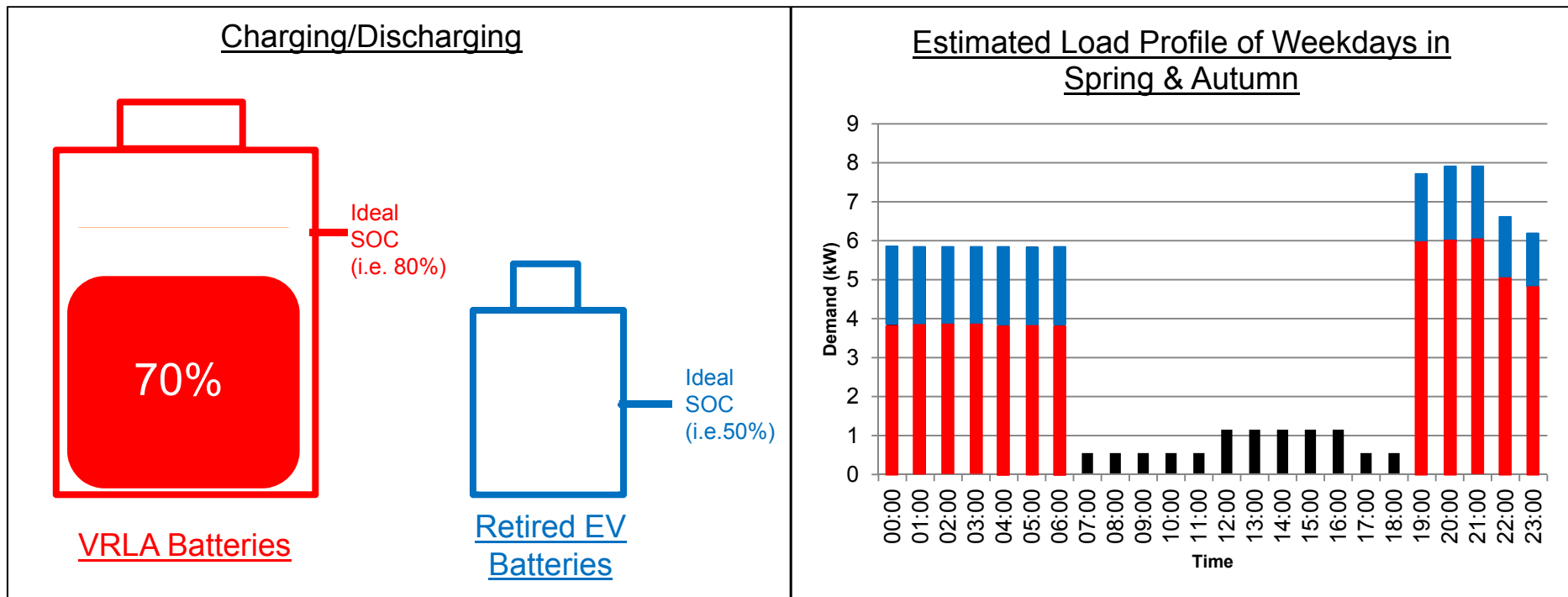
- Coordinating charging and discharging processes between retired EV batteries and VRLA batteries by adopting the concept of “Economic Dispatch”



➤ Instead of fuel and operating cost, SOC & temperature control are used

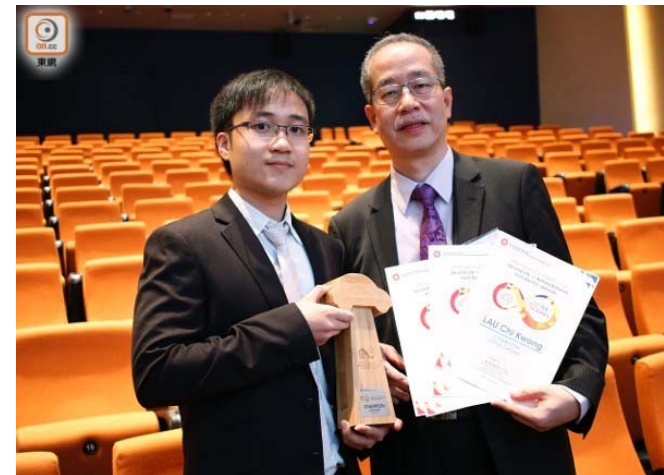
Second Life of Retired EV Batteries (6)

- Applying the concept of “Economic Dispatch” to coordinate the retired EV batteries and VRLA batteries during charging and discharging



Second Life of Retired EV Batteries (7)

- The application of HBESS in PV System on Po Toi Island has won the championship in “International Competition on Second Life for Retired Batteries from Electric Vehicles” organized by EPD in 2017

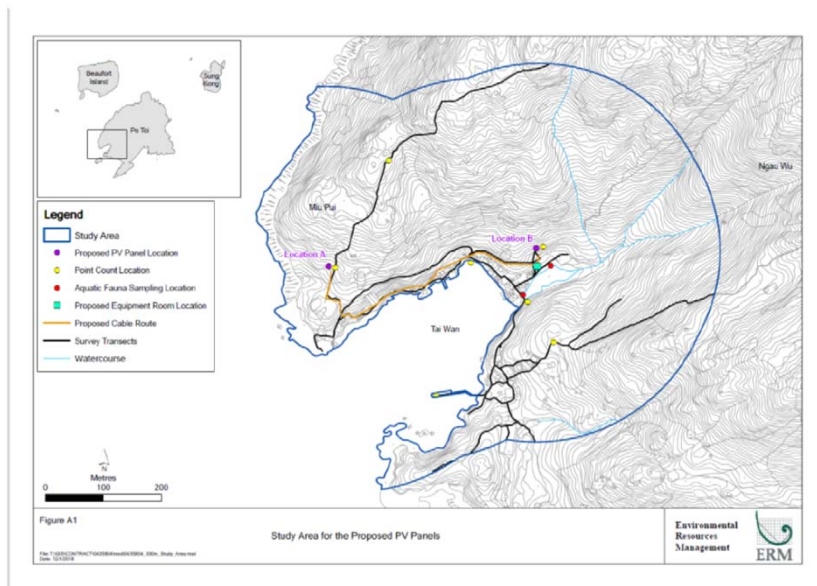


Project Progress (1)

- The PV System is planned to be commissioned in 2020
- Recent work:
 - **Aug 2016**, submitted comprehensive project proforma to Environment Bureau (EnB)
 - **Feb 2017**, informed by EMSD in 2015 Auditing Review Recommendation to start Lands/Planning Application and Environmental Study to finalize the project scope for EnB's consideration
 - **Nov 2017**, commenced the preparation of project profile for direct application of Environmental Permit (EP)
 - **Dec 2017**, started land survey for Land/Planning Application

Project Progress (2)

- **Feb 2018**, kicked off the engagement and started meeting with environmental groups, such as Hong Kong Bird Watching Society (香港觀鳥會)
- **Mar 2018**, conducted a briefing session with PA to introduce the basic design of PV System to local residents



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Summary

- Providing a practicable solution and real implementation to deal with the growth of retired EV batteries and hence contributing to promotion of EV
- High system compatibility with support by detailed research and encourages the usage of renewable energy
- Developing Po Toi into a real-life example for education and promotion of “Green” concept





Thank You