Marine Electrification

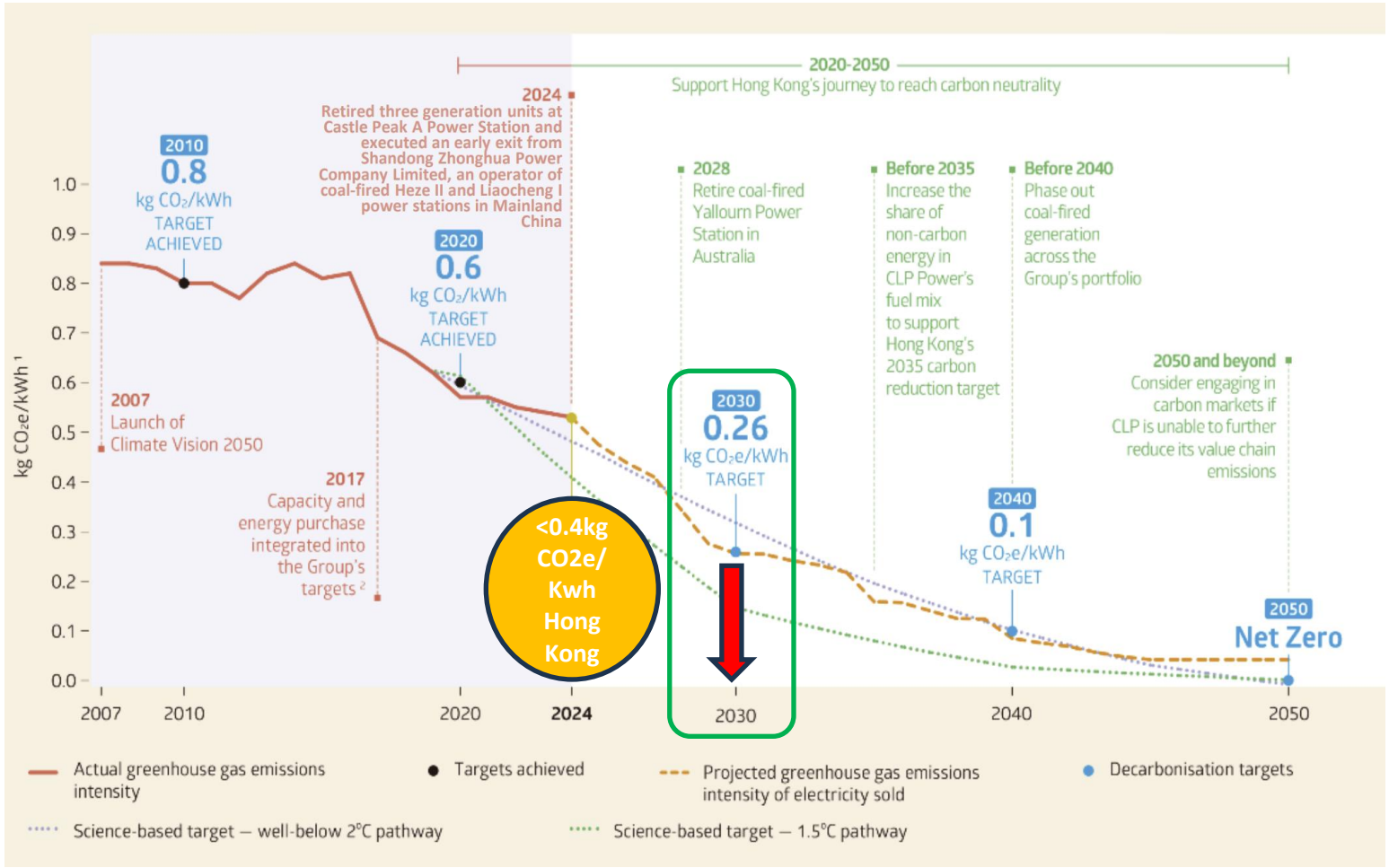
Marine Energy Infrastructure, CLP eMobility

HKCOS, 23 Apr 2025

Power Brighter Tomorrows

CLP Electricity Supply

Trajectory to Net Zero – Green Grid for Electrification



CLP's grid carbon intensity will be well below IMO emissions reduction targets equivalent by 2030 and almost Zero emissions by 2045

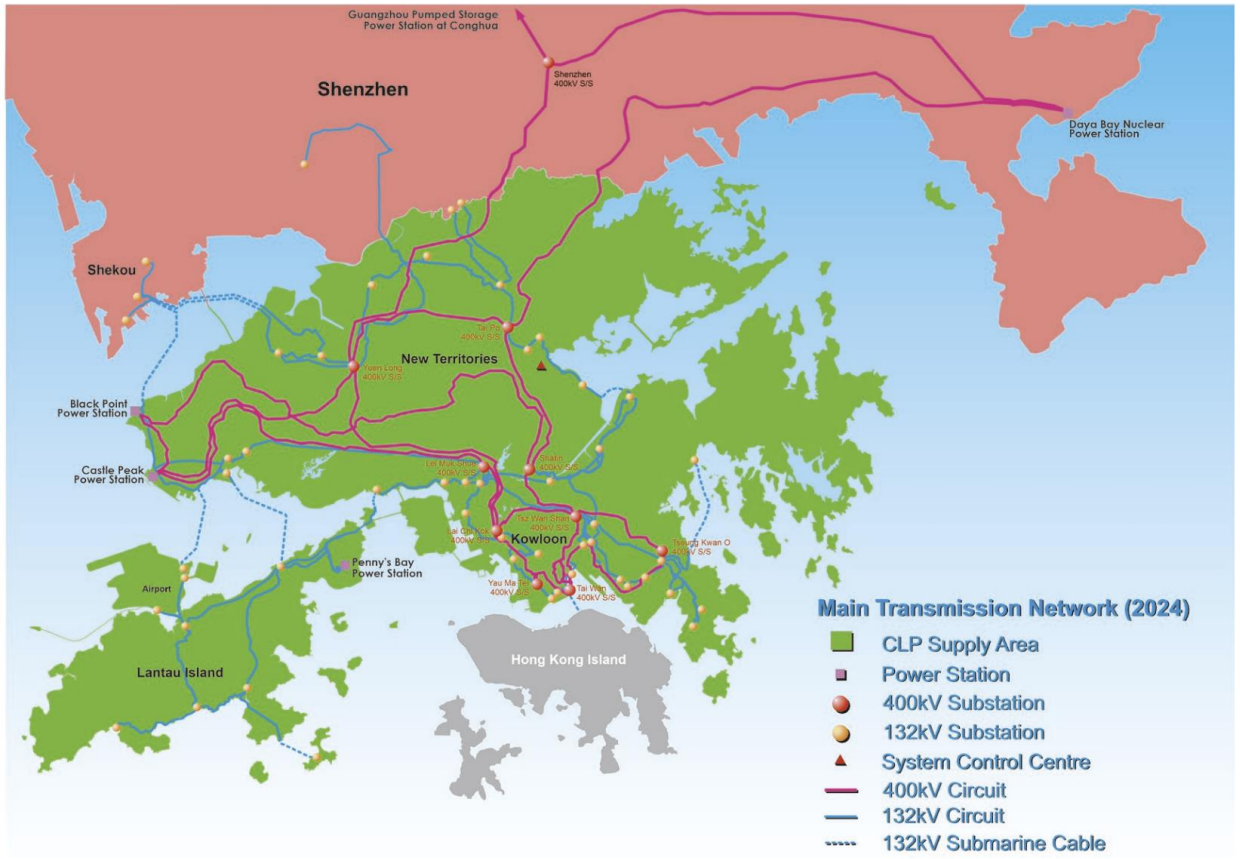
As of 31 Dec 2024, CLP Group's generation and energy storage capacity in Hong Kong was 7,222 MW.

The Carbon emission intensity of CLP's electricity supply is already low (under 0.4 kgCO2/kWh), thanks to the **zero-carbon nuclear power (1/3) and low-carbon gas / LNG (over ½). Coal usage is lower than 20% in our fuel mix.**

By 2035, coal will be phased out from our power generation. The zero-carbon ratio would be increased to 60-70%, mainly from the increase of Nuclear Power and Renewables. Carbon intensity is expected to drop to about 0.1 kgCO2/kWh, favoring wider deployment of electrification.

<u>This provides a valuable means for local vessels to reduce emissions, by taking electricity from a secure, reliable and increasingly low carbon grid supply.</u>

CLP Grid Coverage

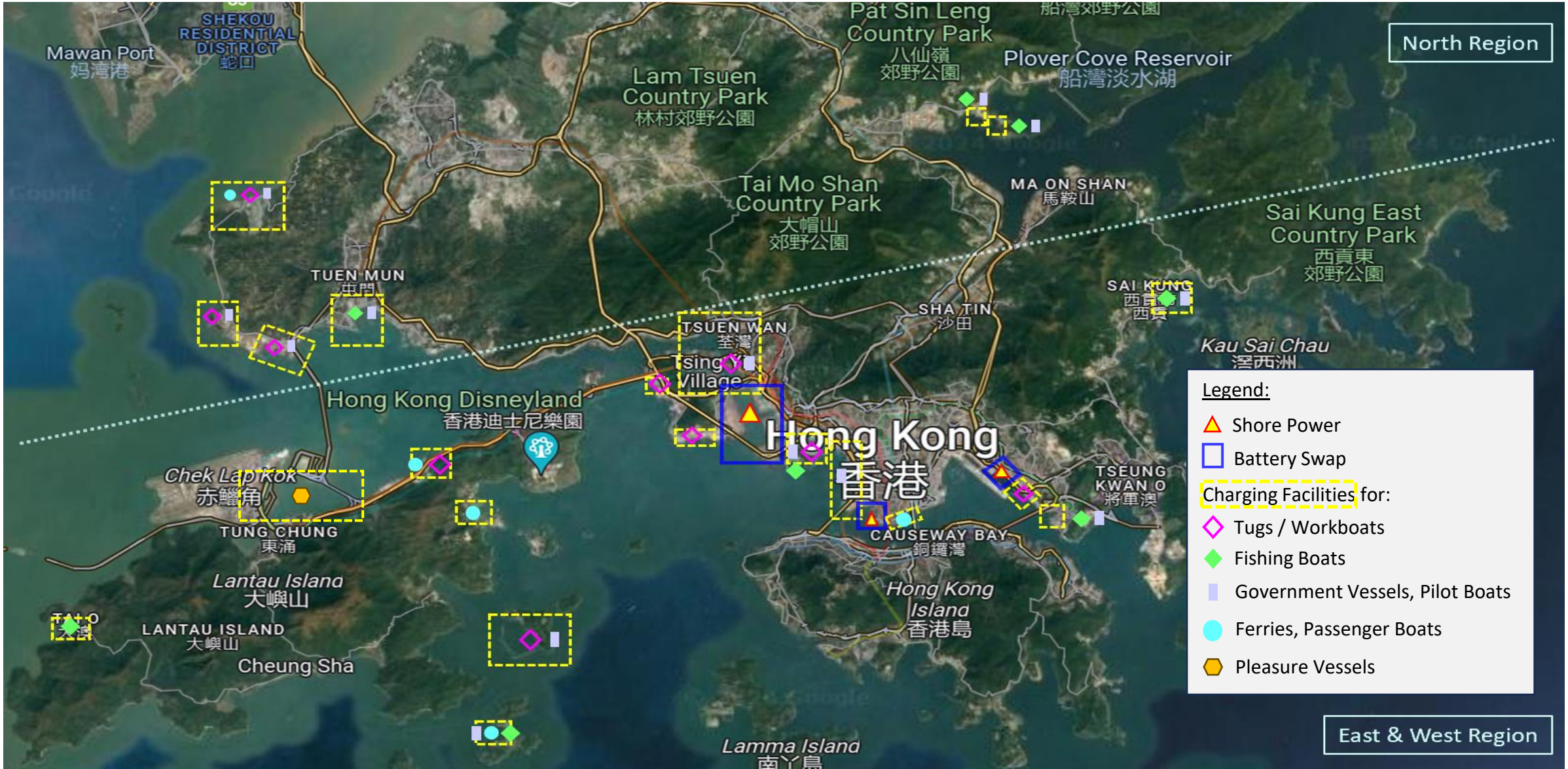


Coverage for Maritime

- CLP Power's supply area covers Kowloon, New Territories and most of the outlying islands in Hong Kong.
- This includes most of the **Industrial Port and Terminal Industry** (Kai Tak, Kowloon, Yau Ma Tei to Tsing Yi) adjacent to the various Terminals where much of the Harbour Fleet operate.
- Harbour and Outlying Island Ferry Routes as well as Marinas for Pleasure Vessels.

CLP's Marine Energy Infrastructure team is dedicated to supporting such **Marine Electrification Decarbonisation developments** leveraging our International maritime expertise in this area along with our experience from our established EV charging services.

Potential Charging Locations by Industry



Power Supply for Shore Power and E-Vessel Charging

Efficiency of Shore Power

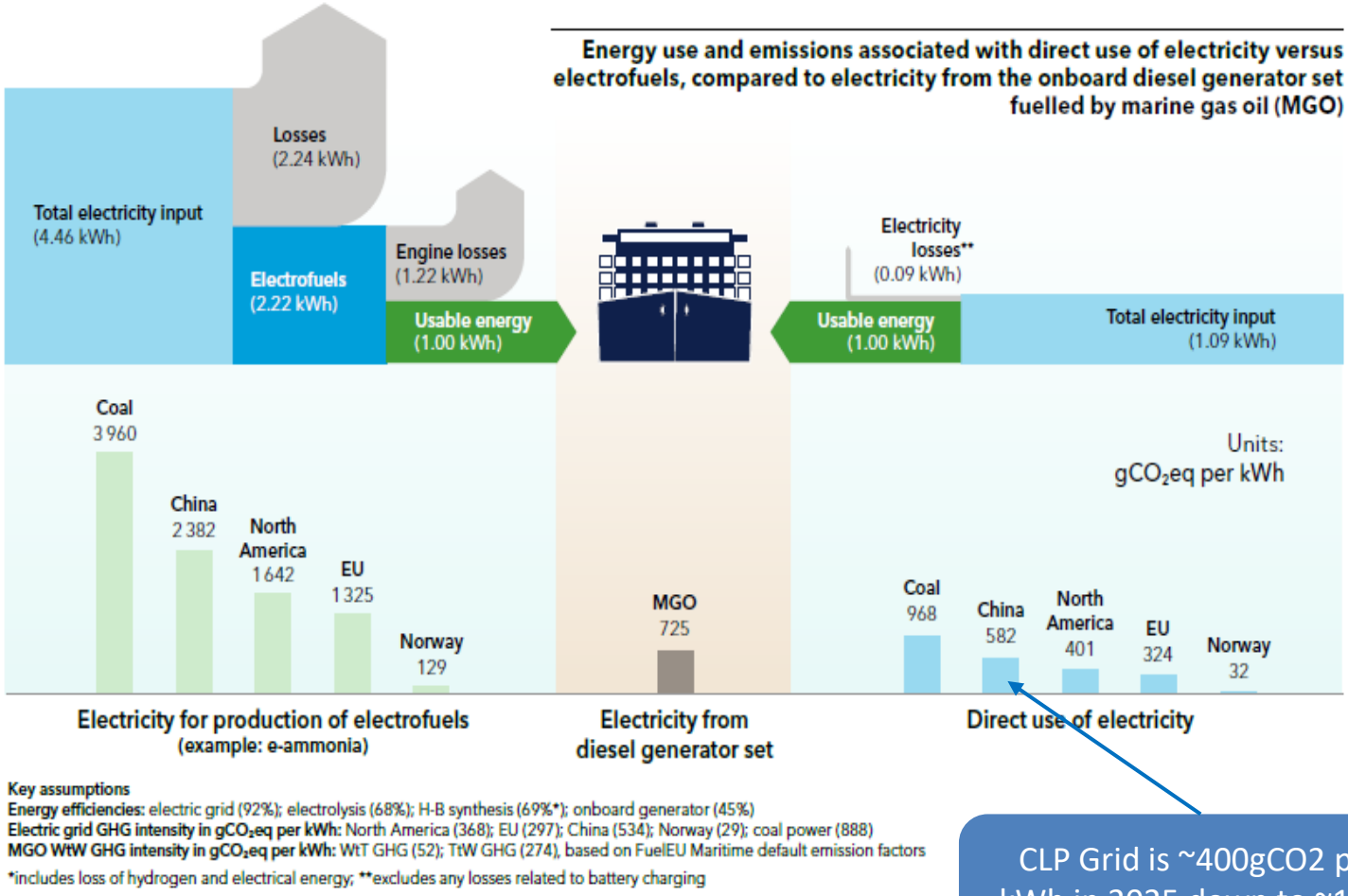
Electricity from shore is the most efficient way to power ships in terms of the ratio of energy used per output for propulsion and onboard consumers.

Shore Power avoids running generators in port and charging batteries can enable zero emissions at sea for propulsion and utilities (Increasingly ocean-going vessels are using large batteries to offset emissions).

Shore Power is the only current viable solution for “zero emissions / Pollution” available to all vessels (with minor modification) when in the port (other than Nuclear and Hydrogen fuel cell).

Green and low carbon fuels are expensive, using Shore power helps to conserve such fuels for the ocean going voyages.

Where the Grid’s carbon intensity is low then Shore power will become key for vessels operating on conventional or low carbon fuels in meeting compliance, reducing their customers Scope 3 emissions and avoiding hefty penalties through to 2050.



CLP Grid is ~400gCO2 per kWh in 2025 down to ~100g CO2 per kWh by 2035

Electric Vessel and Charging Infrastructure

The development of standardized megawatt charging systems is necessary to support the electrification of coastal and inland vessels. These systems must provide reliable, high-power charging for fleets of electric vessels which may have an operating range over large territories.

Similar to the evolution of Electric Vehicles, standardized charging infrastructure is important for interoperability and cost-effectiveness.

Charging supply provision across Class I, II, III & IV can be covered from ~ 0.1-3MW. This could utilize: Low Voltage charging, High Voltage charging, and where HV power supply is difficult to arrange then a combination of LV and battery for taking peak demand is often used in many ports.

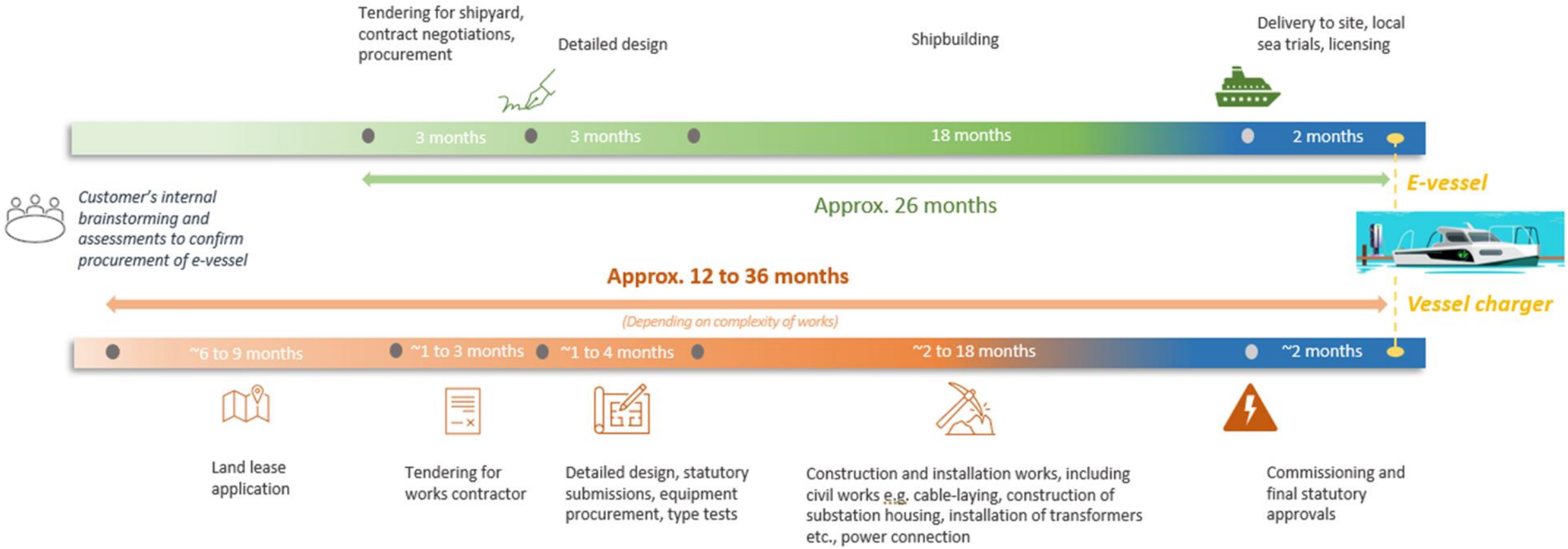
- Plug-in pier side chargers providing between ~75kW to 200kW super chargers for fast charging.
- Typically suited for pleasure vessels, fishing boats and smaller working vessels but suitable for majority of local vessels.

- Power demand of 1MW to 3MW requires higher voltage and cable handling, due to cable weight and to account for swell / tide.
- For vessels with a fast turnaround HV autonomous systems can be employed to help with safety aspects and reduce operational costs.

- Larger working boats such as barges and tugs have a power demand of up to 3MW requiring High Voltage supply.
- Charging can be via Direct Current High Voltage from the port grid, or via a battery near the berth charged from a LV supply where suitable. The latter can be quicker to deploy and has flexibility to charge multiple users.

Development timeline for Electric Vessel and Charging Infrastructure

Onshore charging infrastructure development has multiple factors to consider. It's crucial for power supply assessments to be conducted early so that the grid operator can work with the developer in optimizing the charging solution.



Note: This assumes that nearby ring capacity is available, otherwise longer duration will be required to enhance the necessary power supply infrastructure.

Challenges

Challenges

1) Policy & Regulation

- **Fleets ready for replacement, but uncertainty regarding government direction –** Local Vessel owners are awaiting a clear government signal or roadmap regarding likely decarbonisation pathway. Whilst there is an interest in electrification and in many cases a company ESG target to meet, there is hesitation by operators in making technology choices despite fleets nearing or beyond replacement age in HK.
- **There is no central coordinating body –** Effective coordination is required across various government departments and stakeholder groups to support transition with regards to direction

2) Operational Feasibility

- **Lack of market education around available technologies -** Electric and alternative fuel vessels are already available in the global market, though local operators may not be well-informed about the latest developments and what is available to address their specific operational needs.
- **Third Party Charging Points operators** – similar to the early years of the Electric Vehicle market, there are no established charging operators, whilst the activities are not complicated a credible party is required to take responsibility of this task and / or the vessel owner will need to develop its personnel for handling and servicing charging equipment

3) Infrastructure Development

- **Approval for charging infrastructure is complex and not well understood –** Approvals from multiple government departments are required for the installation of vessel charging infrastructure. Local operators are not clear on procedures or how to commence engaging with the authorities
- **Varied charging needs complicate cohesive deployment –** Different vessels and operational profiles dictate different charging needs, which requires coordination to appropriately plan and deploy.
- **Limited space available –** There is limited real estate available in HK to deploy charging infrastructure and may require additional re-work of existing land or new technologies to maximize available land (e.g., Pontoon Charging)

4) Economic Consideration

- **High upfront cost of electric vessels and charging infrastructure -** This poses significant challenges for fleet operators looking to adopt these new technologies, despite the lower total cost of ownership over the vessel lifespan.

Challenges - Shore Power




Container Vessels Power Requirement ranges from ~6MW to ~8MW while Cruise is higher and more complex at ~10MW up to 20MW,

Main Challenges

- Providing electric power to vessels in port can be a challenging load for the electricity grid, and in many cases grid developments might be required, sometimes with long lead times and high costs (i.e. if a substation is required). In some cases, increased power production in the grid might also be required.
- Location of additional shore power equipment on the vessels and onshore is in some applications challenging, i.e. certain berths in Kwai Chung are “compact” and need to be managed around cargo handling
- Shore Power “owner” needs to consider CAPEX Investment against utilization (rate of usage by vessels) given up initial high up-front investment. Clear regulations or company policy are required to signal the required use of Shore Power in order to convince Shipowners, Terminals, Operators and Investors to commit.

THANK YOU

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