For discussion
on 25 October 2022

TFWLHA/02/2022

Pilot Trial of Floating Photovoltaic System at Kai Tak Approach Channel

PURPOSE

This paper is to seek Members' views on the proposed pilot trial of a small scale floating photovoltaic (PV) system to be installed at a small portion of Kai Tak Approach Channel.

BACKGROUND

1. Drainage Services Department (DSD) has been proactively promoting the use of renewable energy (RE) at its facilities, including biogas and solar power generation, in order to reduce carbon emissions and mitigate climate change.

2. Climate change is an imminent global issue that would threaten the human well-being on Earth. Climate change results in an increase in global temperature, which causes extreme rainfall, sea level rise, and extreme sea-levels due to storm surges caused by tropical cyclones to occur more frequently. Therefore, there is an urgent need to tackle climate change at the root source, by reducing greenhouse gas emissions, thereby protecting and preserving the harbour from inundation or flooding under extreme events in the long run.

3. In October 2021, the Hong Kong Government announced "Hong Kong's Climate Action Plan 2050+" (the climate action plan), setting out the vision of "Zero-carbon Emissions • Liveable City • Sustainable Development", and outlining the strategies and targets for combating climate change and achieving carbon neutrality. The climate action plan also mentioned that the Government is exploring the feasibility of installing floating or other appropriate types of solar energy generation systems in suitable water channels.

4. DSD takes forward the RE initiatives of installing floating PV systems in water channels to reduce carbon emissions from power generation, to promote public understanding of solar power

generation installations to combat climate change and to raise awareness on sustainable development. A small scale pilot floating PV system at San Tin polder was commissioned early this year. In parallel, a pilot trial of a small scale floating PV system at a small portion of Kai Tak Approach Channel is being studied.

OVERVIEW OF FLOATING PV SYSTEMS

5. Floating PV systems are typically formed by PV panels mounted on floatable platforms over water channels/bodies. Solar radiation captured by the PV panels are converted into electricity, which can be conveyed to the electrical grid via underwater cables and inverters. Similar to typical marine vessels, the floating platforms can be moored to the bank, and then anchored to the seabed by weight.

6. Floating PV system installations create new options for scaling up renewable energy generation capacity, especially in cities like Hong Kong where population density is high and land is scarce. With only electrical equipment required on land side, floating PV systems take up significantly less space than land-based systems, freeing up precious land that could otherwise be used for development. Performance and efficiency are also enhanced for floating PV systems due to the cooling effect of water and the systems are less susceptible to dust. They are also able to suppress the growth of algae by limiting the amount of sunlight reaching the water body.

7. The installation of PV panels on the surface of lakes, reservoirs and ponds is one of the fast-growing power generation technologies today. The site for floating PV systems has more recently expanded to also include rivers, nearshore, and sometimes even off-shore areas.

PROPOSED DESIGN OF THE PILOT FLOATING PV SYSTEM

8. The proposed design of the pilot floating PV system at a small portion of Kai Tak Approach Channel includes –

(a) **PV Panels and Floating Platform**

The proposed dimension of each PV module is about 2.0 m^2 [2.0m (L) × 1.0m (W)]. About 690 nos. of PV modules will be installed to achieve about 260kW power generation. The material, coating, orientation and inclination of the modules will be arranged to enhance safety/durability and to minimize glare nuisance to the surrounding areas, especially the developments on both sides of Kai Tak Approach Channel. The overall dimension of the floating platform is about 18 metres wide by 200 metres long, occupying a water surface area of about 3,700 m^2 (equivalent to about one seventieth of the total area of Kai Tak Approach Channel). The proposed location of the floating platform is aimed to make good use of the unused space between the existing 7-cell box culvert outlet and the Kai Tak Bridge with reduced headroom near the seawall. At this location, the middle reaches of the Kai Tak Approach Channel can be maintained to allow ample headroom for future water sports activities and minimise the potential conflicts with nearby uses. About 20% of the floating platform will be a greenery trial planting area with brackish planting to enhance the amenity and to break down the scale of the panels. The greenery trial planting area will be designed for minimal landscaping maintenance.

With the floating PV panel system installed, we anticipate the average annual power generation to be tentatively about 260,000 kWh, which is equivalent to the annual power consumption of 77 three-person households. Moreover, this renewable energy initiative is projected to reduce 180 metric tons of carbon emissions annually (equivalent to carbon absorption of about 7,700 nos. of trees). The generated power is planned to be used by the adjacent government facilities, such as DSD' sewage facilities. In addition, the generated electricity would also be used to enhance user experience, such as by powering information display boards or wireless mobile phone charging stations, thereby creating a more

vibrant and smarter neighbourhood.

(b) **Anchorage System for Floating Platform**

An anchorage system will be installed to provide support for holding the floating platform in place. A gravity anchor system, which connects the precast concrete anchor blocks placed on the seabed to the floating platform via mooring cables, will be proposed for this pilot trial. To account for tidal fluctuations and adverse weather conditions, the floating platform would only allow limited movement to minimize impact to nearby facilities. The anchorage system design would also consider such environmental effects as wind, wave and current under a river outlet/marine environment with reference to local and international standards to ensure safety to water and land users. A layout of the proposed pilot floating PV system is shown in **Annex B**.

IMPLEMENTATION TIMEFRAME OF THE PILOT FLOATING PV SYSTEM

9. The target commencement of the pilot trial would be by end 2022, and the target completion of the first phase installation works is tentatively scheduled in the first half of 2023. The proposed floating PV system is intended to be in place at the Kai Tak Approach Chanel for a period not more than 5 years after construction, subject to review.

COMPLIANCE WITH HARBOUR PLANNING PRINCIPLES

10. References have been made to the Harbour Planning Principles when planning the proposed pilot trial of the floating PV system.

Principle 1: Preserving Victoria Harbour and Principle 5: Proactive Harbour Enhancement

(a) No reclamation work is required to be carried out at the

Victoria Harbour for this pilot trial. This pilot floating PV system will provide a green element choice to the Harbour Area. The pilot trial aims to combat climate change thereby protecting and preserving the harbour against inundation/flooding risk. The existing/proposed uses of the waterfront/harbour would not be adversely affected.

(b) The proposed pilot floating PV system would slightly improve the water quality of the nearby area by suppressing algae growth. To make good use of the renewable energy generated and to complement the greenery planting trial, submerged aerators would be considered installing in the floating PV systems as a trial, thereby trying to further improve the water quality and biodiversity of Kai Tak Approach Channel.

Principle 2: Stakeholder Engagement and Principle 4: Integrated Planning

(c) In formulating the climate action plan, the Council for Sustainable Development had conducted public engagement in the community and organised a number of briefing sessions, regional forums and other public interaction activities to gauge the views of the community.

(d) DSD has also conducted consultation with the relevant stakeholders/interfacing parties to seek their comments on this pilot trial. We have consulted Kowloon City District Council's Housing and Development Planning Committee and obtained their support. When planning for the pilot trial, liaison with government bureaux/departments such as Energizing Kowloon East Office, Civil Engineering and Development Department (CEDD), Leisure and Cultural Services Department, Planning Department and other departments were conducted. Coordination with other concurrent projects in the vicinity, including Hospital Authority's New Acute Hospital and CEDD's Central Kowloon Route and the Kai Tak Basecamp, were also carried out to resolve any potential interface issues. Besides, we have also consulted water sports associations/bodies engaging water sports in Kai Tak Typhoon Shelter and incorporated their comments in the design.

Principle 3: Sustainable Development

(e) The proposed floating PV system demonstrates sustainable development by being a source of renewable energy that emits no carbon during electricity generation. It is an energy-positive project that supplies clean and green energy to the nearby DSD facilities and provides possibility for public utilization at the promenade adjacent to the system. This pilot trial is also striving towards the goal of carbon neutrality policy set out in the Climate Action Plan.

(f) The proposed floating PV system utilizes a small portion of water surface for renewable energy generation, which saves land resources for other usage.

(g) In addition to PV panels, a portion of the floating platform will be planted with greenery. This makes the proposed floating PV system capable of not only reducing carbon emission by generating electricity, but the greenery would also actively absorb carbon to enhance the environment.

(h) With green energy generation at the waterfront, potential trial installation of aerators can be integrated into the future design for improving the environment thereby enhancing the enjoyment of the users of water sports and other leisure activities at the waterfront without increasing carbon emission.

(i) The proposed floating PV system is an innovative and aesthetic installation that promotes the new Kai Tak Development Area as an advance and appealing green community to the public, as well as enhances public understanding of solar power generation installations to combat climate change.

Principle 6: Vibrant Harbour, Principle 7: Accessible Harbour and Principle 8: Public Enjoyment

(j) The location of the proposed floating PV system installation has considered the extent of water activities that are being planned at the Kai Tak Approach Channel and the floating PV

system has been designed to facilitate co-use of the water bodies. The choice of site and size of the floating PV system will not obstruct the planned promenade and hence will not affect the accessibility of the harbour. The width of the proposed floating PV system has been minimized to reduce the risk of collision and obstruction to water activities. Land-side electrical and mechanical units at the promenade are minimal. Moreover, the proposed floating PV system installation could also attract people to the waterfront and promote vibrancy of the harbourfront.

(k) After development, both sides of the Kai Tak Approach Channel will become a landscaped promenade for public enjoyment. The implementation of the proposed floating PV system being a solar power generation system at the Kai Tak Approach Channel increases the public awareness of the use of renewable energy and strengthen the support for renewable energy projects.

(l) The proposed floating PV system synergises with the activities being carried out or planned, such as water sports, to create a unique environment where leisure and infrastructure can harmonically co-exist in the same water body. Furthermore, future promenade amenities can harness this renewable energy source to enhance user experience, such as by powering information display boards or wireless mobile phone charging stations, thereby creating a more vibrant and smart neighbourhood.

(m) Greenery elements integrated to the floating platform would add visual interest to the waterfront including its promenade and surrounding development to create a harmonious and pleasant environment for the public.

WAY FORWARD

11. We would like to seek views/comments from Members on the proposed pilot trial.

Annex A Location Plan of the Proposed Pilot Trial of a Small Scale

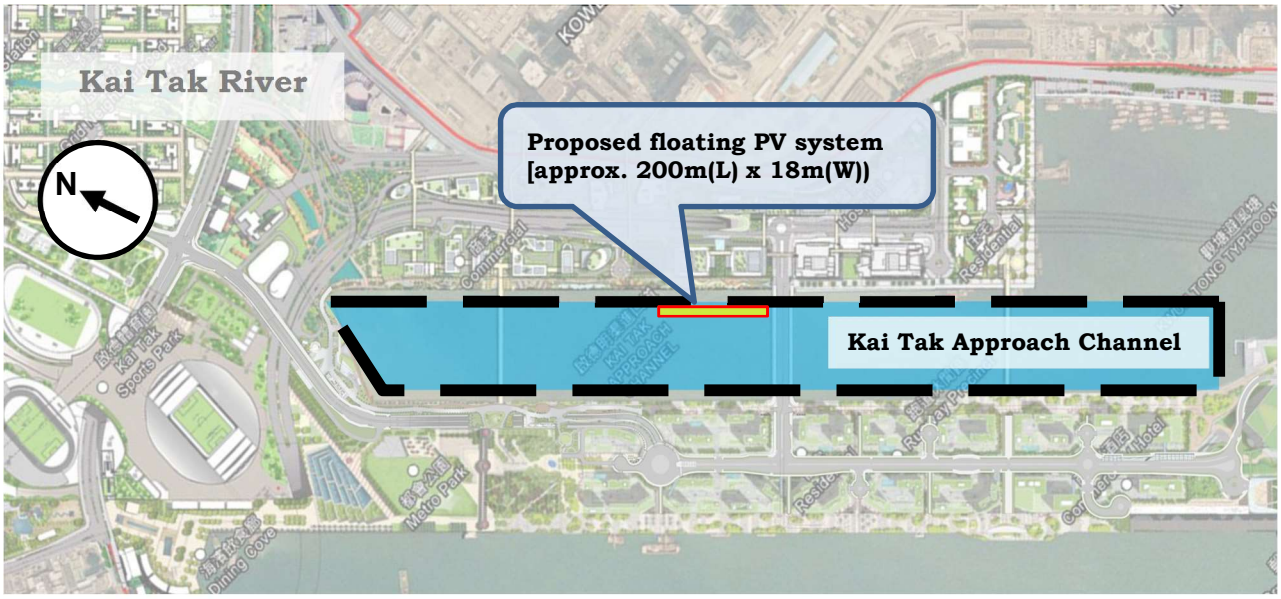
Floating PV System

Annex B Layout of the Proposed Pilot Floating PV System

Drainage Services Department
October 2022

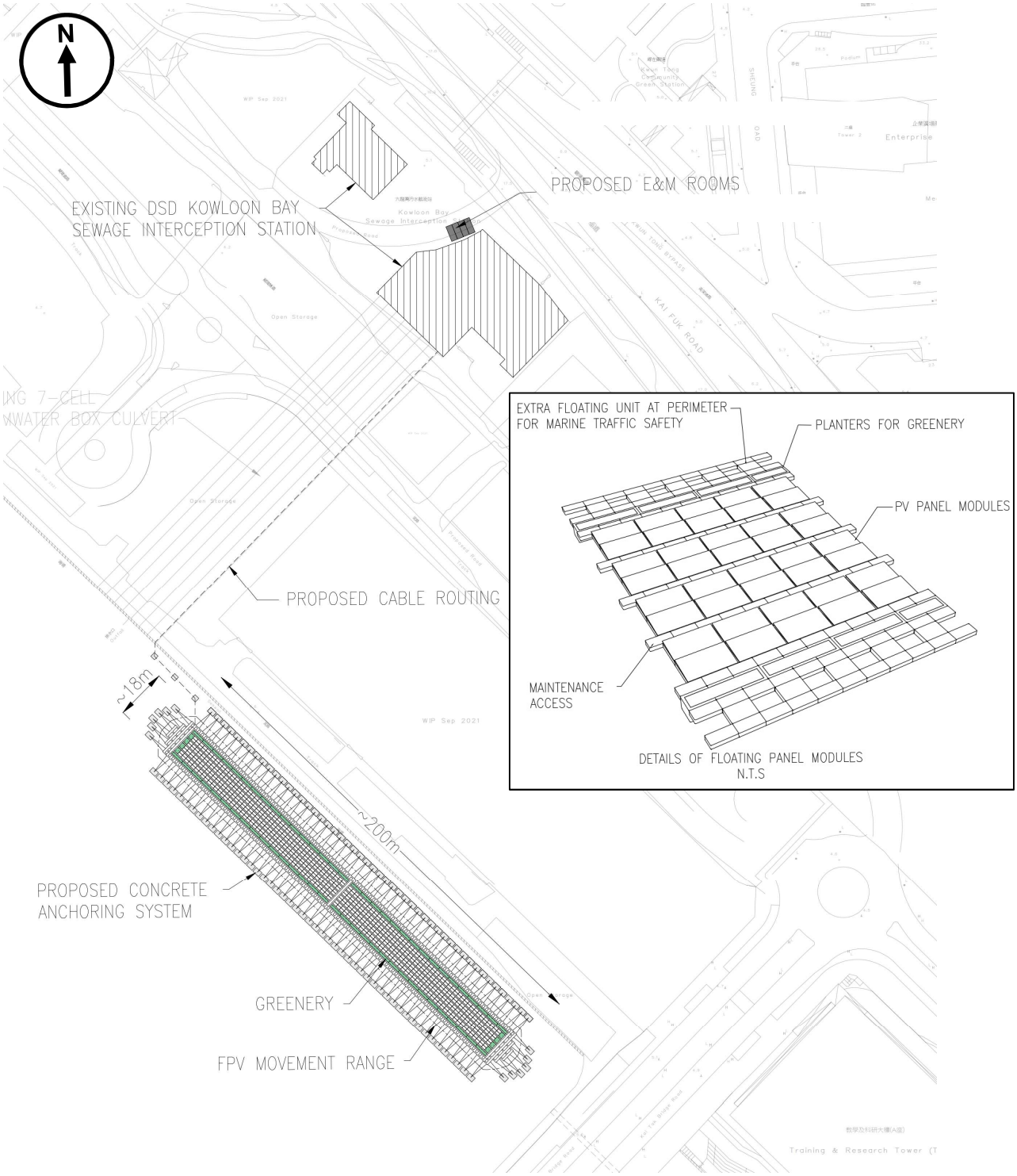
Annex A

Location Plan of the Proposed Pilot Trial of a Small Scale Floating PV System



Annex B

Layout of the Proposed Pilot Floating PV System



(subject to design)