

Annex A4

RESEARCH COLLABORATION OPPORTUNITY

Research Collaboration Opportunity Ref No.: RCO-CUGE-2018-04

Project Title: Solar Green Roof Performance

1. Key Challenges and Objectives

1.1 Both photovoltaic system and green roof system require rooftop surface. Traditionally, it requires choosing one over the other.

Instead of competition, the two systems can be synergistic. The Solar Green Roof (SGR) combines them, with green roof beneath photovoltaic panels, to simultaneously improve PV-performance (via evapotranspiration cooling) and roof-thermal-performance.

1.2 Site:

Alexandra Primary School, with existing polycrystalline photovoltaic arrays, is a keen partner. There are two existing PV arrays, side-by-side, that will be deployed in this study. Each PV array measures approximately 4m wide by 20m long, and about 1.2m away from the concrete roof surface. Only one of these two PV arrays will be fitted with extensive green roof system directly beneath up to the drip-lines of the PV array. The other will be used as a control PV array in this study.

The study will inform real-world applications and also educate students with an excellent case study within their school. When successful, this model is replicable to other suitable schools.

1.3 Method:

In this real-world set up, the project should include (but not be limited to):

- Comparative empirical data (PV-yield & roof-thermal-performance) collected/monitored over a year against a control.
- Monthly green roof vegetative health data (chlorophyll level, etc.) to form a baseline understanding on greenery performance under such deep shaded environment.

Such baseline information will inform real-world application challenges, potential system adjustments and improvements.

2 Minimum Project Deliverables

The deliverables described here represent the minimum outcomes arising from the proposed project. Additional relevant deliverables that are proposed will be favourably considered during project evaluation.

- To set up a demonstration site at Alexandra Primary School – install green roof system (with irrigation system) beneath pre-existing PV arrays, to be fitted with weather-monitoring, thermal-monitoring and PV-monitoring sensors to collect empirical data, with data-logger, daily over a year. Monthly plant health data (chlorophyll level, etc.) to be monitored.

The following data sets are to be recorded (at minimum half-hourly resolution) over a year (to capture seasonal variations):

- Weather data (on exposed roof)
 - Weather data (beneath PV with green roof & beneath PV without green roof)
 - Roof-Thermal data (beneath the green roof & beneath the roof structure)
 - PV-Thermal data (on the underside of the PV array)
 - PV-Yield data
- Systematically carry out monitoring and documentation of: data, insights, findings and real-world challenges will facilitate future system improvements and suggestions.
 - Deliver progress report at mid-year, and final report at end of project. To include in these reports, amongst other things, recommendations for scalability of project in real-world application contexts (such as HDB's SolarNova Project, etc.).

3 Budget Limits

3.2 The proposed budget cannot exceed \$100,000. Proposals that exceed this limit will not be considered. Please note that this amount is simply an indication of budget availability, not an estimate of expected project cost.

3.3 The project duration should also not exceed 2 years. Proposals requiring more than 2 years can be considered, but with strong justification.

3.4 Please note that NParks' decision on the funding support to be awarded for the project is final.

4 Submission Instructions

Proposals for the Research Collaboration Opportunity as stated above must be submitted to Mr Poh Choon Hock at poh_choon_hock@nparks.gov.sg by 9th November 2018, 1200 hrs.

5 **Enquiries**

For transparency, all enquiries and associated clarifications will be published (without details on the identity of the person making the enquiry) on the Research Collaboration Opportunity page on the CUGE website. We regret that phone enquiries will not be entertained.

For enquiries, please contact Mr Poh Choon Hock at poh_choon_hock@nparks.gov.sg.