POLICY INNOVATION AND CO-ORDINATION OFFICE
Public Policy Research Funding Scheme
(Project Number: 2017.A2.027.18B)

Engaging the Community to Develop a Model for Sustainable Energy Futures: A Case Study of Two Prospective Solar Communities in Hong Kong

透過社區參與建立可持續能源發展的未來模型：以香港兩個潛在太陽能社區為案例

FINAL REPORT

Principal Investigator:
MAH Ngar-yin Daphne
Asian Energy Studies Centre; Department of Geography,
Hong Kong Baptist University

Co-investigators:

CHUNG Ting Yiu Robert
Hong Kong Public Opinion Research Institute (PORI)

LAW Wai Yi Winnie
The University of Hong Kong

LEUNG Kwok Hi Michael
City University of Hong Kong

LO Tek Sheng Kevin
Hong Kong Baptist University

WOLFRAM Marc
Leibniz Institute of Ecological Urban and Regional Development

YEUNG Hoi Shan Frances
Greenpeace East Asia

ZHOU Qiming
Hong Kong Baptist University

Core research team:
CHEUNG Man-wai Darren, Hong Kong Baptist University
CHEUNG Tin-fu Altair, City University of Hong Kong
WONG Wai-ming Mandy, Hong Kong Baptist University
WANG Yachao Maggie, Hong Kong Baptist University
LEE Hin-fan Glenn, Hong Kong Baptist University

December 2019

ACKNOWLEDGEMENTS

This research project (Project Number: 2017.A2.027.18B) is funded by the 2nd round of the Public Policy Research Funding Scheme in 2018 – 2019 from the Policy Innovation and Co-ordination Office of The Government of the Hong Kong Special Administrative Region.

We would like to acknowledge the following persons and parties for their contribution to this study:

We would firstly like to give our thanks to the residents in both Fairview Park and Hong Lok Yuen who have agreed to be interviewed or participated in our community workshops for their time and input in our research activities. Their ideas and comments are valuable and allow us to deepen our understandings on the two case communities in respect to the potentials and barriers that householders are facing in consideration of installing solar PV systems. We would also like to thank the householders who have agreed to permit the research team to collect solar resource data in their houses for their generosity.

We would also like to take this opportunity to appreciate the efforts of the stakeholders involved in this research project for their insightful comments about the energy market in Hong Kong, and their valuable and opinions on the prospect and weaknesses of the current Feed-in Tariff Scheme.

During this year of research, the project's working group members have made enormous contribution to support this research project. We would like to thank them for their inputs throughout this year. We would also like to thank the working group members who have participated in the plenary sessions in the community workshops. Their opinions and insights not only contribute to the research project, but they also help to clarify householders' questions in solar PV system installations. The project's working group members are as follow (in alphabetical order):

CHAN Chong Kai Stephen (CLP)
KIM Soyoung (Sungdaegol People Representative)
LEUNG Chin Pang William (W3 Corporate Ltd.)
YAU Wing Kwong (Heung Yee Kuk)
YEE Tak Chow (HK Electric)

During the whole research period, we have received massive support from our helpers from mainly seven academic institutions, which are Asian Energy Studies Centre of Hong Kong Baptist University, Department of Geography of Hong Kong Baptist University, College of International Education of Hong Kong Baptist University, City University of Hong Kong, The Chinese University of Hong Kong, The Hong Kong Polytechnic University, and The University of Hong Kong. We would like to give thanks for their efforts in providing research supports to various research activities. Staff and helpers who have involved in this research project are as follows (in alphabetical order):

CHAN Lok Yin Yoyo
CHAN Nga Sze Patricia
CHEUNG Ho Lam Bryan
CHEUNG Lo Ki Clive
CHEUNG Wing Kei Kiki
CHOI Wai Lun Tommy

CHUI Yiu Lam Ivan
HAN Kyuyeon Becky
HO Chun Kit Jasper
HO Ka Hei
HUYNH Ka Chun Kennie
KO Chun Ho Tony
KWOK Wing Lok Ronald
KWONG Wai Yee Levia
LAU Chun Mo Jason
LEE Yiu Ting Ben
LEUNG Tak Chi Margery
LI Kai Chun John
LI Wai Leuk Charles
LIN Ziwei Fiona
LIU Po Kwan Katie
LO Yan Crystal
MAK Tsz Kwan Karen
NG Wing Him Ryan
SHEK Hoi Ying Melody
TSE Kai Him Anthony
WAN Ho Ching Daniel
WONG Kin Long Kenneth
WOO Hiu Yan

We sincerely thank everyone who has participated in this project and all of your efforts are highly appreciated.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS ii
TABLE OF CONTENTS iii
LIST OF TABLES vi
LIST OF FIGURES vi
LIST OF APPENDICES viii
LIST OF ABBREVIATIONS x

EXECUTIVE SUMMARY 2
1. INTRODUCTION 7
2. OBJECTIVES OF THE STUDY 9
3. RESEARCH METHODOLOGY 10
3.1. Research questions 10
3.2. Case selection and case community characteristics 10
3.3. An interdisciplinary and multi-method research approach 12
3.3.1. Solar potential assessment 12
3.3.2. Household interviews 13
3.3.3. Stakeholder interviews 13
3.3.4. Solar community workshops 14
3.4. An integrated model of engaging communities in solar development 15
4. THE HONG KONG CONTEXT 16
4.1. Energy mix and the electricity sector in Hong Kong 16
4.2. Hong Kong's RE polices 16
4.3. The pre-FiT development of solar power in Hong Kong 18
4.4. The Hong Kong's FiT 18
5. FINDINGS 20
5.1. The FiT Scheme is an effective policy in regard to stimulating the substantial growth of new solar projects in Hong Kong and arousing some interests in solar energy in our case communities, but has not yet made solar energy a mainstream form of energy at both city and community levels 20
5.1.1. Since the introduction of the FiT Scheme, there has been a substantial growth of new solar projects in Hong Kong 20
5.1.2. Major developments of solar in FP and HLY in response to the introduction of FiT policy 21
5.1.3. Seven key observations of the FiT implementation 24

5.2. Our multi-method solar assessment results found that the two case communities have rich solar resources; they alone have the potential to contribute to 1/10 of the government estimate of 660 MW 25

5.3. The two communities have seven types of community capitals and a number of high-capacity residential actors. These community capacities can help the government to realise more ambitious solar targets. 26

5.3.1. A dynamic stakeholder landscape of the two prospective solar communities 26

5.3.2. "High-capacity actors" and "influential actors" existed in the communities 30

5.3.3. Seven types of community capitals existed in FP and HLY which could foster the growth of more solar PV 31

5.4. The FiT was perceived as an effective policy in terms of shortening payback period, among other perceived benefits. 36

5.5. The FiT is however effective only to a certain extent in fostering solar development in HK. The FiT was insufficient to address the multi-facet barriers faced by interested households 38

5.6. The introduction of FiT Scheme was a missed opportunity for the government to utilise community platforms in order to accelerate low-carbon transitions 46

5.6.1. Opportunities for the government to engage the communities in delivering a more rapid growth of solar for a low-carbon Hong Kong 46

5.6.2. An opportunity was missed in a phase of confusion, as many interviewed householders adopted a wait-and-see attitude 48

5.7. Hong Kong's recent solar policy initiatives are in line with a global trend, but Hong Kong is in general lagging behind in setting a clear solar target and an advanced energy policy framework 49

6. POLICY IMPLICATIONS AND RECOMMENDATIONS 52

6.1. The government needs to develop a community solar policy in Hong Kong 52

6.1.1. In the *long-term decarbonisation strategies that the government has planned to develop by 2020*, the government needs to strategically prioritise community development as a viable local low-carbon option, rather than prioritising the option of importing more low-carbon electricity from Guangdong. 52

6.1.2. The government needs to set a *clear and meaningful solar target* to provide guidance for solar development in Hong Kong 52

6.1.3. The government needs to *better develop and utilise solar resource assessments to support evidence-based target-setting* for solar power 52

6.1.4. The government needs to *strengthen the FiT*. Four key areas that worth particular attention are: (i) revisiting feed-in tariff rates, (ii) opening up the option of net metering, (iii) strengthening regulatory measures to improve transparency of the permitting process, and (iv) reconsidering the role of the two power utilities as the primary agents for solar deployment. 53

6.1.5. The government needs to deploy an intelligent mix of policy instruments beyond the FiT to effectively address the multiple barriers faced by prospective solar householders. Four prioritised policies include: (i) a green technology policy, (ii) a community solar empowerment policy, (iii) regulatory measures (to target building-related institutional barriers), and (iv) economic measures. 54

6.1.6. The government needs to revisit and consider revamping SCAs to enable community solar as a viable resource for Hong Kong in meeting low-carbon energy challenges 61

6.2. In a broader perspective, the government needs to develop a community-based energy planning and policy-making system 63
7. DETAILS OF THE PUBLIC DISSEMINATION HELD 66
8. CONCLUSION 68
REFERENCES 69

LIST OF TABLES

Table 3-1: An overview of FP and HLY.....12
Table 3-2: An overview of the interviewed households in FP and HLY.....13

Table 5-1: Breakdown of applications of the FiT Scheme and RE Certificates (as at end of September 2019).....21
Table 5-2: An overview of solar resources in FP and HLY.....26
Table 5-3: An overview of solar resources in FP and HLY.....28
Table 5-4: Roles of stakeholders within and outside a community in fostering solar deployment.....29
Table 5-5: List of high-capacity residential actors in FP and HLY (selected examples).....31
Table 5-6: A comparison of community capitals in FP and HLY.....35
Table 5-7: Perceived positive outcomes of FiT by FP and HLY interviewees.....38
Table 5-8: Perceived technical barriers by FP and HLY interviewees.....42
Table 5-9: Perceived financial (economic) and market barriers perceived by FP and HLY interviewees.....43
Table 5-10: Institutional barriers perceived by FP and HLY interviewees.....44
Table 5-11: Administrative, social and other barriers by FP and HLY interviewees.....45
Table 5-12: An overview of socioeconomic features of and solar policies in Hong Kong and other cities in the world.....51

Table 6-1: An intelligent mix of policy instruments needed for effective community solar deployment.....55

Table 7-1: Outputs of Public Dissemination.....66

LIST OF FIGURES

Figure 3-1, 3-2 and 3-3: Panoramic view of Fairview Park (FP; top left) and Hong Lok Yuen (HLY; top right); tilted rooftops with ceramic tiles of Hong Lok Yuen (HLY; bottom).....11
Figure 3-4: A policy model of engaging communities in solar development.....15
Figure 3-2: Panoramic view of Hong Lok Yuen (HLY). ..... **Error! Bookmark not defined.**

Figure 3-3: Tilted rooftops with ceramic tiles of Hong Lok Yuen (HLY). ..... **Error! Bookmark not defined.**

Figure 4-1: Timeline of the government's RE-related public consultations, studies, SCAs and the FiT Scheme. 17

Figure 5-1: Solar development in FP and HLY before and after the launch of the FiT Scheme. 23
Figure 5-2: A stakeholder landscape of the two case communities. 27
Figure 5-3: Horticulture of FP neighbourhood as a sign of environmental awareness. 32
Figure 5-4: The seven types of community capitals of FP and HLY 34
Figure 5-5: Perceived barriers from FP (n=41) and HLY (n=30) interviewee 39
Figure 5-6: Economic, environmental, and social values of solar PV installation perceived by FP and HLY interviewees (n=71). 47

Figure 6-1: Four types of rooftop solar PV systems with illegal structures in Taiwan. 60
Figure 6-2: A summary of performance-based RE incentive factors for the utilities 62

LIST OF APPENDICES

Appendix 3-1	Lists of interviews
	3-1a: A list of household interviews in Fairview Park
	3-1b: A list of household interviews in Hong Lok Yuen
	3-1c: A list of interviews with stakeholders
	3-1d: A list of sessions of the two community workshops
Appendix 3-2	PPR residential interview guidelines
Appendix 4-1	A chronology of major renewable policy initiatives in Hong Kong
Appendix 4-2	Major renewable energy measures announced in the 2018 Policy Address
Appendix 4-3	An overview of FiT policies in Germany, Japan, and China
Appendix 5-1	Solar electricity generation and FiT income received by solar households in Fairview Park and Hong Lok Yuen
Appendix 5-2	Fairview Park management office's solar application form
Appendix 5-3	Hong Lok Yuen management office's solar application form
Appendix 7-1	Presentation slides of the meeting with Environment Bureau and Electrical and Mechanical Services Department (EMSD) on 4th September 2019
Appendix 7-2	Presentation slides of the meeting with Environment Bureau on 27th November 2019
Appendix 7-3	Presentation slides of the sharing session with EMSD on 20th May 2019
Appendix 7-4	Presentation slides of the meeting with EMSD on 21th August 2019
Appendix 7-5	Community workshop in Fairview Park on 23rd March 2019
	7-5a: Briefing document on the community workshop in FP
	7-5b: Scenario cases used in the community workshop
	7-5c: Pre-workshop questionnaire
	7-5d: Workshop presentation powerpoint
	7-5e: Post-workshop questionnaire
Appendix 7-6	Community workshop in Hong Lok Yuen on 1st June 2019
	7-6a: Briefing document on the community workshop in HLY
	7-6b: Scenario cases used in the community workshop
	7-6c: Pre-workshop questionnaire
	7-6d: Workshop presentation powerpoint

7-6e: Post-workshop questionnaire

Appendix 7-7 Solar Community Guidebook

Appendix 7-8 Presentation slides of the 1st Solar Schools task force meeting on 14th November 2018

Appendix 7-9 Presentation slides of the Hong Kong Solar Schools Workshop 2019 on 8th June 2019

Appendix 7-10 Presentation slides of the workshop on Photovoltaic systems and the feed-in-tariff in Hong Kong on 11th December 2018

Appendix 7-11 Presentation slides of the workshop on Renewable Energy and Feed-in-tariff in Hong Kong on 29th April 2019

Appendix 7-12 Presentation slides of the Transdisciplinary Symposium on Environmental Health and Social Sciences on 24th May 2019

Appendix 7-13 Presentation slides of the workshop on Data Analytics in Journalism, Social Science, and Business Studies on 3rd June 2019

Appendix 7-14 A letter to EMSD: AESC's policy recommendations in solar communities in Fairview Park and Hong Lok Yuen

Appendix 7-15 AESC's comments on the public engagement document of Long-term Decarbonisation Strategy

LIST OF ABBREVIATIONS

CLP	China Light and Power Hong Kong Limited	中華電力有限公司
C&SD	Census and Statistics Department, The Government of the Hong Kong Special Administrative Region	香港特別行政區統計處
DMC	Deed of Mutual Covenant	大廈公契
EMSD	Electrical and Mechanical Service Department, The Government of the Hong Kong Special Administrative Region	香港特別行政區政府機電工程署
ENB	Environment Bureau, The Government of the Hong Kong Special Administrative Region	香港特別行政區政府環境局
FiT	Feed-in Tariff	上網電價
FP	Fairview Park	錦綉花園
GW	Gigawatts	吉瓦
GWh	Gigawatt hours	吉瓦時
HKE	The Hongkong Electric Company, Limited	香港電燈有限公司
HLY	Hong Lok Yuen	康樂園
kW	Kilowatts	千瓦
kWh	Kilowatt hours	千瓦時
LegCo	Legislative Council of the Hong Kong Special Administrative Region	香港特別行政區立法會
MO	Management Office	管理處
MW	Megawatts	兆瓦
MWh	Megawatt hours	兆瓦時
PV	Photovoltaic(s)	光伏
RE	Renewable Energy	可再生能源
SCAs	The Scheme of Control Agreements	管制計劃協議

EXECUTIVE SUMMARY

1. Abstract of the research

Urban solar has become a global trend as solar photovoltaic (PV) costs continue to decline and policy-makers seek effective post-Fukushima climate/ energy strategies. Community-based solar initiatives have emerged in many major cities including Seoul, Tokyo, Singapore, London, and New York. In Hong Kong, the introduction of a feed-in tariff (FiT) Scheme in October 2018 presents opportunities to realise the underexploited solar PV potential in this city. This, however, raises various questions: Are solar communities a viable energy option for Hong Kong? Can Hong Kong pursue sustainable energy futures that partly depend on solar communities? What can Hong Kong learn from the experience of leading PV cities elsewhere? How can Hong Kong manage the technical, economic, and socio-political and institutional challenges to solar development, including the new opportunities offered by the FiT policy?

This is a one year, interdisciplinary, scenario-based research project, involving a comparative study of two prospective solar communities: Fairview Park (FP; 錦綉花園) in Yuen Long and Hong Lok Yuen (HLY; 康樂園) Tai Po. The potential of solar communities as an energy transition pathway will be analysed by tracking and explaining the ex ante and ex post responses of prospective solar households and solar-powered schools in response to the introduction of the FiT policy. A policy model has been developed to examine, and explain how and to what extent community inputs in solar development can contribute to energy transitions.

The study is based on data collected from a sample of approximately 76 households and two schools from the two case communities as well as 21 stakeholder meetings. Face-to-face interviews, deliberative and engagement events (involving interactive online solar maps, scenario narratives, deliberative workshops) were utilised to generate an extensive original database. A multi-disciplinary research team has been assembled to integrate expertise in the fields of energy policy and governance, solar resource assessment, geographical information systems, and deliberative participation.

Our study has seven major findings:

(1) The FiT Scheme is an effective policy in stimulating a substantial growth of new solar projects in Hong Kong and arousing some solar interests in our case communities, but it has not yet mainstreamed solar at both city and community levels;

(2) Our multi-method solar assessment results find that the two case communities have rich solar resources. They alone have the potential to contribute to 1/10 of the government estimates of 660 MW of solar that could be realised by 2030;

(3) The two communities have seven types of community capitals and a number of high-capacity residential actors. These community capacities can help the government to realise more ambitious solar targets;

(4) The FiT is perceived as an effective policy of shortening payback period, among other perceived benefits;

(5) The FiT is however effective only to a certain extent in fostering solar development in Hong Kong. The FiT is insufficient to address the multi-facet barriers faced by interested households;

(6) The introduction of FiT Scheme is a missed opportunity for the government to utilise community platforms for accelerating low-carbon transitions through urban solar; and

(7) Hong Kong's recent solar policy are initiatives in line with a global trend, but Hong Kong is in general lagging behind in setting a clear solar target and an advanced energy policy framework. There is a need for Hong Kong to accelerate the deployment of solar.

Project outputs include a guiding model for engaging communities in solar development, a guide book of solarised communities, one working paper, and two papers to be submitted for publication in top-tiered journals. The project contributes to enhancing energy literacy in Hong Kong and promotes rational debates about local energy options and transitions.

2. Policy implications and recommendations

We have to two major policy recommendations with sub-sets of suggestions as follows:

(1) The government needs to develop a community solar policy in Hong Kong

i. In the *long-term decarbonisation strategies up to 2050 planned to be drawn by the Hong Kong Government by 2020*(LegCo, 2018b)(LegCo, 2018b), the Hong Kong Government needs to strategically prioritise community solar development as a viable local low-carbon option, rather than prioritising the option of importing more low-carbon electricity from Guangdong;

ii. The government needs to set a *clear and meaningful solar target* to provide guidance for solar development in Hong Kong;

iii. The government needs to *better develop and utilise solar resource assessment, to support evidence-based target-setting* for solar power;

iv. The government needs to *strengthen the FiT Scheme*. Revisiting FiT rates, opening up the option of net metering, improved transparency of the permitting process; reconsidering the role of the two power utilities as the primary agents for solar deployment, are the four key areas that worth particular attention;

v. The government needs to deploy an intelligent mix of policy instruments beyond the FiT to effectively address the multiple barriers perceived by prospective solar householders. Four prioritised policies include: a green technology policy, a community solar empowerment policy, regulatory measures (to target building-related institutional barriers), and economic measures; and

vi. The government needs to revisit and consider revamping SCAs to enable community solar as a viable resource for Hong Kong in meeting low-carbon energy challenges.

(2) In a broader perspective, the government needs to develop a community-based energy planning and policy-making system which should be underpinned by the following five elements:

i. *A citizen centered approach*: which fully recognises the values and potentials of engaging the public and communities in energy policy-making;

ii. Utilising "community" as a governing platform in which the government can garner and mobilise rich, critical, and unique capacities that exist in communities to enhance its governing power to deliver rapid and deep low-carbon transitions;

iii. An emphasis on *local (community scale) energy system optimisation* of local consumption patterns, solar generation, and local electricity storage systems;

iv. Community as an innovation, demonstration, and trialling site for low-carbon transitions for the advancements of technologies, as well as policies; and

v. *A participatory policy-making system* as an unpinning mechanism: to enable community inputs to be fed into each stage of energy policy-making, from agenda setting, to policy formulation, policy implementation, policy monitoring, and to policy evaluation.

隨着太陽能成本持續下降及福島事故引發對能源安全的關注下，發展太陽能社區逐漸成為全球趨勢。2018年10月開始推行的上網電價將對本港發展太陽能提供機遇，亦帶來疑問：太陽能社區是否可行的能源選項？香港是否可依靠太陽能社區作可持續發展？香港可從其他先進城市汲取甚麼經驗？香港可怎樣處理從發展太陽能帶來的技術、經濟、社會及政制上的挑戰和機遇？

本研究為期一年，旨在探討上網電價實施前後，社區參與對能源轉型決策過程的作用。我們訪問了元朗錦綉花園及大埔康樂園兩個社區約76家潛在太陽能發電戶及2間學校、以及相關持分者進行訪問，並舉行了兩場太陽能社區工作坊。本研究綜合能源政策管治、太陽能評估技術、地理信息系統及商議式民調等專業作跨學科分析。

1. 我們的七個研究結果如下：

(1) 香港的上網電價政策能有效增加興建太陽能發電系統，而且能激發社區居民對太陽能的關注及興趣，但太陽能仍然未能在社區和香港成為主流發電模式；

(2) 我們採用多種太陽能評估方法，發現錦綉花園及康樂園有豐富的太陽能資源，有潛力達致政府之前的預計，太陽能發電在2030年可達到660兆瓦的十分之一；

(3) 兩個社區分別有七種重要的社區資本，這些資本都有助政府將來訂立更進取的太陽能發展目標；

(4) 在上網電價所帶來的眾多好處中，上網電價被視作縮短安裝可再生能源系統回本期的一項有效政策；

(5) 然而，上網電價在推動太陽能發展的成效有限，仍然不足以解決對安裝太陽能系統有興趣的住戶所面對的多重問題；

(6) 雖然政府推出上網電價計劃，但卻錯失了一個透過社區發展太陽能來加快實現低碳轉型的機會；

(7) 香港的太陽能發展雖然能跟上全球的趨勢，但在設立太陽能目標以及能源政策框架仍然相對落後，香港有必要加快發展太陽能發電。

這研究的成果將用作發表：社區參與發展太陽能的指導模型、太陽能社區指南、前期工作文件及兩篇學術文章。本研究將會對加深公眾能源知識及促進本地能源轉型作出貢獻。

2. 對政策的影響及建議

本研究提出兩項重點建議及有關的子建議如下：

(1) 香港政府有需要制定 <u>社區太陽能發展政策</u> ，當中包括以下範疇：

i. 香港政府在 *2020 年將推出的至 2050 年的長遠減碳策略中*，政府需優先將發展社區太陽能設施列為一個可行的低碳方案。同時，相比從廣東省進口低碳電源，政府需將重點放在發展香港本土的太陽能社區上；

ii. 香港政府需*設立一個清晰及有意義的太陽能目標*，為未來太陽能發展訂立指引；

iii. 香港政府需*發展及充分利用太陽能潛力評估*，提供*理據支持訂立太陽能目標*；

iv. 香港政府需在以下四個方面*優化*上網電價計劃，包括：檢視上網電價的電價水平、在毛電價之外增加淨電價的選項、在審批過程上增加透明度、檢視兩家電力公司在發展太陽能設施所扮演的角色；

v. 香港政府在上網電價以外需落實一系列的政策，幫助解決潛在太陽能發電戶的困難。四個需優先考慮的範疇包括：制定綠色科技政策、制定太陽能授權社區的相關的政策、改革有關建築物安裝太陽能系統的規定及經濟方面的政策。

vi. 香港政府需重新審視及修改現行《管制計劃協議》，確立發展太陽能社區作為一項應對香港未來低碳能源轉型的可行方案。

(2) 在更廣泛的層面上，政府需發展一個以 **社區為中心的能源規劃及政策制定的系統**，以下五點為相關的建議：

i. 一個以市民為中心的方法：讓決策者能充分了解公眾及社區參與能源規劃及政策制定的價值及潛力；

ii. 善用社區群體作為管治平台，充分利用社區擁有的豐富、重要及獨特的資源來加速及深化低碳轉型；

iii. 優化社區規模的能源系統：綜合社區的能源使用、太陽能發電系統、電力儲存裝置等；

iv. 社區能作為一個低碳轉型的創新科技及政策的試點及示範場地；

v. 以一個公眾參與的政策制定系統為中心：讓社區人士在政策制定的各個階段，從政策的制定、落實、到檢討，均可參與。

1. INTRODUCTION

The urgency to develop effective climate/ low carbon strategies and the rapid decline in solar photovoltaic (PV) costs has given rise to a global trend of urban solar developments in recent years. New York, London, Seoul, Tokyo, and Singapore are among the leading international megacities which have set ambitious solar targets supported by major solar policies and programmes. In Hong Kong, how to deliver rapid and deep cut in greenhouse gas emissions to address climate impacts and to meet with the global commitment to the Paris Agreement have heightened the policy attention on the potential of solar as a viable low-carbon energy option in this city.

In Hong Kong, solar PV has played a minor role in our energy sector. The current solar PV installation in Hong Kong is only approximately 6.29 megawatts (MW), contributing to the minute 0.05% of the total installed capacity of the city's electricity system (C&SD, 2019; Meinhardt, 2019). Hong Kong does face some major challenges in increasing its solar PV capacity: it is a highly urbanised city with a cityscape of high-rise buildings with limited roof space; costs are still a major concern as the public appears to be highly sensitive to tariff impacts associated with any supportive policies to solar.

It is however important to note that many other leading cities have increasingly recognised the value of urban solar. London has set a solar PV target of 1 gigawatts (GW) by 2030 and Seoul 1 GW by 2022 (Chung, 2017; Energy Policy Division of Environment Bureau, 2015; Mah et al., 2017; Mayor of London, 2018; Meinhardt, 2019). These cities have adopted a great variety of approaches for accelerating the deployment of solar power with an increasing attention on involving communities in it. The solar cooperatives and social enterprises in Sungdaegol in Seoul, Solar Loans for Roof Power in Tokyo, crowded funded solar projects in social housing estates in Brixton in suburban London, and collective tendering practice in social housing in Singapore, a council-operated community-funded solar farm in Lismore in Australia are some good examples of these great diversity of projects with different level of community engagement (H. Kim, 2017; Mah et al., 2018b; Tarhan, 2013).

These cities are motivated to use more solar partly because this technology has become substantially cheaper and more mature. It is also because solar PV is one of the most inclusive energy options, in which governments value the importance of engaging communities as a way to enhance policy legitimacy, make the actual implementation of policy more effective, to build up public trust (or to reduce public distrust) – all are important to enhance a government's governing capacity to deliver a transition to a more sustainable futures in a timely and socially robust manner. This study focuses on solar PV. In Hong Kong, solar energy is widely considered to have much greater development potential than other forms of

renewable energies (RE) such as wind power, due to our access to solar radiation and its convenient application (LegCo, 2018a).

It is in these global and local contexts that the first major RE policy, the feed-in tariff (FiT) Scheme, was introduced by the Hong Kong Government and the two local power companies first in 2018. This study is set out to answer these questions: Are solar communities a viable energy option for Hong Kong? Can Hong Kong pursue sustainable energy futures that partly depend on solar communities? What can Hong Kong learn from the experience of leading PV cities elsewhere? How can Hong Kong manage the technical, economic, and socio-political and institutional challenges to solar communities, including the new opportunities offered by the FiT policy?

We aim to assist energy policy development in Hong Kong by offering a better understanding of the prospects, barriers, and possible strategies in regard to engaging communities to develop solar energy as a viable energy option in meeting our climate and energy challenges.

2. OBJECTIVES OF THE STUDY

This project aims:

(1) to assist energy policy development in Hong Kong by offering a better understanding of the prospects, possible scenarios, barriers, and possible strategies in regard to engaging the community to develop solar energy;

(2) to develop a policy model of understanding and explaining how solar development can be facilitated in Hong Kong through the active engagement of communities in critical processes of energy transitions and policy-making; [Who, what types of resources, key processes + policy mixes]

(3) to apply our model in two prospective solar communities, Fairview Park (FP) in Yuen Long and Hong Lok Yuen (HLY) in Tai Po. Our comparative study of the two communities will help identify the technical, economic as well as socio-political and institutional barriers that need to be addressed, and develop possible solutions to overcome the barriers;

(4) to provide analysis of first-movers' response to Hong Kong's FiT policy that will facilitate policy adaptions to the responses and practices of solar first-movers;

(5) to develop and test a set of engagement and deliberative methods. We will develop alternative scenarios of solar community development, and organise deliberative workshops as engagement tools with which to present a series of alternative scenarios of solar community developments for Hong Kong community stakeholders to consider, to debate, and to facilitate them to make informed decisions regarding the future of solar community in Hong Kong;

(6) to develop a set of good-practice guidelines on solar community, setting down principles and indicators, and sharing case examples; and

(7) to promote energy literacy, rational energy debates, and evidence-based energy policy-making in Hong Kong.

The findings and implications of our case communities are, to a certain extent, generalisable to similar types of residential properties, such as village houses and low-rise residentials, and on a wider scale to communities in other parts of Hong Kong. The prospects and barriers of developing solar communities could also be replicated to other types of residential buildings, such as subsidised apartment buildings. Our policy recommendations and policy model of community engagement in RE policy-making can be replicated into other contexts of energy transitions, in particular energy mix, smart grids, time-of-use pricing, energy saving, and electric vehicles as energy storage systems.

3. RESEARCH METHODOLOGY

3.1. Research questions

Through conducting a review of the implementation and effects of the Hong Kong FiT with a particular reference to our two case communities, FP and HLY, this study addresses the following research questions:

(1) What is the solar energy potential of the two case communities?

(2) What kind of resources and capacities do the case communities possess in the developments of community solar?

(3) What are the impacts of the Hong Kong FiT policy on the developments of community solar in our case communities?

(4) To what extent and how the FiT can address the barriers confronting prospective solar adopters in the two case communities?

(5) What are the policy implications of the observed phenomenon?

3.2. Case selection and case community characteristics

Two prospective solar communities, FP and HLY, are selected to examine the extent to which FiT could facilitate community solar development. FP and HLY worth study for three reasons. First, FP and HLY share a number of common features, which enhance the comparability of the cases. They, for example, are both low density-communities characterised by: (1) semi-detached and garden housing design; (2) tilted rooftops with ceramic tiles and non-competing uses that can maximise sunlight exposure; (3) relatively flat and widening terrains; as well as (4) relatively high-income level (Figures 3-1, 3-2 and 3-3). The two case communities thus have favourable conditions for large scale solar deployment. Second, based on our three previous publications in 2017 and 2018, including *the Hong Kong's Solar PV Future: Stakeholder Perspectives (A Study Report), Barriers and Policy Enablers for Solar Photovoltaics (PV) in Cities: Perspectives of Potential Adopters in Hong Kong*, and *Study Report for the Renewable Dialogue Workshop for Hong Kong* (Mah et al., 2018a; Mah et al., 2017; Mah et al., 2018b), some residents in these two case communities expressed interests in installing solar PV on their rooftops, indicating their communities as potential first-movers responding to the new FiT Scheme. Third, FP and HLY differ in some important aspects. They, for example, differ in their approaches to overcoming barriers. Some FP residents had actively pursued their management office (MO) to permit rooftop solar PV installations and the company responded by issuing guidelines and later relaxation of the permitted rooftop areas for installation before the launch of the FiT Scheme. In HLY, residents and their MO invited prospective solar installers to a meeting to share market information. An overview of

FP and HLY are provided in Table 3-1.

Figure 3-1, 3-2 and 3-3: Panoramic view of Fairview Park (FP; top left) and Hong Lok Yuen (HLY; top right); tilted rooftops with ceramic tiles of Hong Lok Yuen (HLY; bottom).
Photo credits: (left) Chun-hei Wong and Bethel High School (2017);[1] (right and bottom) Mondo Ching (2019).

[1] A drone video of Fairview Park: https://drive.google.com/file/d/1NdK4TzAMpo-zkS2aru00rGqTlVuUoPXb/view?usp=sharing (Source: Chun-hei Wong and Bethel High School)

Table 3-1: An overview of FP and HLY.

Case community	**FP**	**HLY**
Year of completion (1st phase)	Late 1970s	Early 1980s
Number of buildings	5,024 semi-detached houses	1,132 garden houses and 58 apartments
Number of Schools	3	1
Developer (Largest landowner)	Fairland Resources Limited (formerly Canada Overseas Development)	Hong Lok Yuen Estates Ltd
Unique geographical features	Adjoining Mai Po Inner Deep Bay Ramsar Site (Wetland of international importance)	Hilly landscape
Median monthly household income (Hong Kong median: HK$25,000)	HK$65,000	HK$121,160
Educational attainment (Highest level attended; % of residents)	Primary and below : 17.5% Secondary : 40.4% Post-secondary : 42.1%	Primary and below : 15.2% Secondary : 38.2% Post-secondary : 46.7%

Sources: Data compiled from the Deed of Mutual Covenant of Fairview Park, Fairview Park Property Management Ltd. (2017), "Hong Lok Yuen" 2011), (LandsD (n.d.)), and 2016 Population By-census (2016)

3.3. An interdisciplinary and multi-method research approach

This is an interdisciplinary research that combines expertise in solar resource assessment, RE policies, and energy governance. We adopt a multi-method approach by conducting solar potential assessment, in-depth semi-structured interviews, and stakeholder workshops to examine the impact of the FiT to community solar development in our two case communities. We conducted solar potential assessment with 51 households; 99 in-depth, semi-structured interviews (78 household interviews and 21 stakeholder interviews), and ex-post stakeholder workshops with 57 householders to examine household responses on community solar development before and after the launch of FiT Scheme.

3.3.1. Solar potential assessment

We adopted a multi-method approach to estimate the potential solar resource of FP and HLY by conducting on-site household solar assessment, GIS analysis on the community-wide rooftop areas suitable for solar PV installation, site observations, and household interviews. First, we conducted onsite potential assessment on the rooftops of 32 FP and 19 HLY households between September 2018 and January 2019. We use hemispherical photography technique, the Meternorm software, Horicatcher tool and historical climate data to estimate

the annual and monthly solar irradiation (kWh/m^2) of the surveyed household rooftops. Second, we conducted GIS analysis to estimate the community-wide solar resource potential in the FP and HLY. We estimated the total rooftop areas of FP (5,024 semi-detached houses) and HLY (1,190 houses) from the digitalised rooftops from satellite images. The entire community solar potentials of FP and HLY were projected utilising the onsite assessment results as proxy for the roofs in a similar direction. Third, we conducted site observations in FP in April 2019 by driving along all the streets to identify the number of existing solar households. Fourth, we obtained solar electricity generation data from interviewed solar households to cross-check the solar potential assessment results.

3.3.2. Household interviews

In-depth, semi-structured interviews were conducted with 44 FP and 32 HLY households between August 2018 and June 2019. One FP and one HLY household were interviewed for a second time to collect updated information of community solar development. Two interviewed FP households and three interviewed HLY households had solar panel installed on their rooftops. A snowball sampling was used to recruit existing and prospective solar households. The number of interviewed solar and non-solar households are provided in Table 3-2, and the full list of household interviews is provided in Appendix 3-1a and 3-1b. Household interview questions comprised conditions and electricity generation information of solar panels (if applicable), motivations and perceived barriers to install solar panels, opinions on different solar community models including group-purchasing, rooftop leasing, community-owned solar project, third-party owned solar projects, public-private partnership, and crowdfunding. All interviews were conducted face-to-face (except for three which were conducted by telephone), audio-recorded and supplemented with transcripts or interview notes.

Table 3-2: An overview of the interviewed households in FP and HLY.

Case community	FP	HLY
Number of interviewed *non-solar* households	42	29
Number of interviewed *solar* households	2	3

3.3.3. Stakeholder interviews

To supplement our household interviews, this study conducted 21 semi-structured stakeholder interviews between August 2018 and November 2019. Stakeholders were carefully selected informants of Hong Kong FiT policy, comprising representatives from utilities, solar industry,

two schools within FP,[2] the district councillor in FP,[3] MO, residents' associations, one NGO, and Heung Yee Kuk (a statutory advisory body for indigenous inhabitants in the New Territories). Stakeholders were invited to share views on the development of the FiT Scheme and the prospects of and barriers to community solar development. Interviews were conducted either face-to-face, by telephone or by emails, audio-recorded (for face-to-face interviews), and supplemented with transcripts or interview notes. The list of stakeholder interviews is provided in Appendix 3-1c.

3.3.4. Solar community workshops

We conducted two half-day solar community workshops in FP in March 2019 and HLY in June 2019 respectively. 24 householders and eight stakeholders participated in the FP workshop and 33 householders and nine stakeholders participated in the HLY workshop.

The two workshops aimed to vision, explore the feasibility, pros and cons on different scenarios of community solar development and provide suggestions. The discussion in the workshops mainly focused on three aspects which were concerned by most of our interviewed households. These include: (1) high initial cost, long payback period and limited financing source; (2) lack of technological and market information; and (3) weak environmental awareness.

The workshops adopted similar deliberative design modified from the Stanford University's Center of Deliberative Democracy trademarked Deliberative Pollings. Before the workshop, participants were deliberated by a briefing document, comprising a positive scenario "Smooth and Engaging Solar Community (順風順水太陽能社區起動)"; and a negative scenario "Troublesome and Hopeless Solar Development (麻麻煩煩太陽能發展無望)" of community solar development (Appendix 3-3; Appendix 3-4). In the workshops, community solar experiences were first shared by community leaders (Sungdaegol Energy Self-Reliant Village representative from South Korea for the FP workshop; Heung Yee Kuk representative for the HLY workshop) to participants. The sharing sessions were followed by small group discussions and plenary discussions with experts. Households were invited to share their views on community solar development and discuss on community solar options during the workshops, with reference to the briefing document, positive and negative scenarios. Panel experts consisted of representatives from utility, solar industry, NGO, academia and community representatives. Participants were asked to fill in pre- and post-workshop questionnaires to check on their change in attitudes and perceptions towards solar development.

[2] One school in FP and the school in HLY did not accept our interview invitations.
[3] The district councillor in HLY did not respond to our interview invitation.

3.4. An integrated model of engaging communities in solar development

To guide our investigation and analysis, our study has developed a policy model to understand, examine and explain the extent to which community inputs can affect the six critical energy transition processes, and the key stages the policy cycle of the Hong Kong's FiT Scheme. This model has several characteristics. First, it suggests that the interactions of the community stakeholders may create conducive conditions for the six critical processes of community energy transitions, namely envisioning, community leadership, experimentation, networking, social learning and scaling up niche innovations. Second, communities, if given an opportunity to provide inputs into the policy-making process of the Hong Kong FiT policy, may achieve some normative processes and impacts in each stage of policy-making. Integrating end-user perspectives in the framing of issues and the use of end-user data to assess policy effectiveness are some of the examples. Policy evaluation can obtain feedback to agenda setting to reprioritise issues that require policy attention.

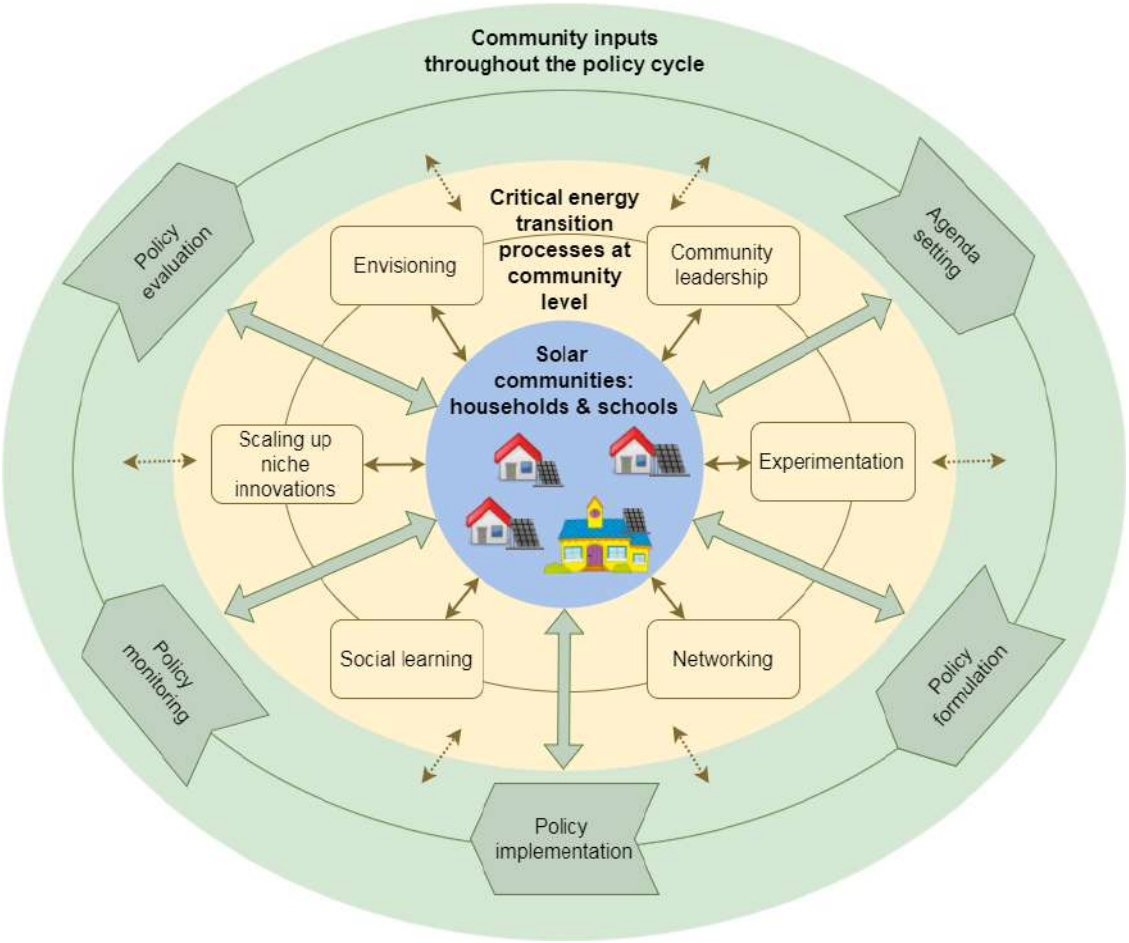


Figure 3-4: A policy model of engaging communities in solar development.

4. THE HONG KONG CONTEXT

4.1. Energy mix and the electricity sector in Hong Kong

Hong Kong has been relying heavily on energy imports and fossil fuels (mainly coal and natural gas) in electricity generation. While Hong Kong obtained 99.8% of the primary energy sources by imports in 2015 (C&SD, 2016), coal (48%), natural gas (27%) and nuclear energy (around 25%) were the three major fuels in electricity generation (ENB, 2017). To reduce reliance on fossil fuels, Hong Kong aimed at reducing coal in the fuel mix from 48% in 2015 to 25% by 2050, and increasing natural gas from 27% in 2015 to 50% by 2050 (ENB, 2017). In the latest long-term decarbonisation strategy consultation, Hong Kong suggested importing more nuclear and RE from mainland China to offset the reduction in fossil fuels (Council for Sustainable Development, 2019).

The current electricity infrastructure in Hong Kong relies on a centralised generation, transmission, and distribution system. Two privately owned, vertically integrated utilities, China Light and Power (CLP) and Hongkong Electric (HK Electric) operate as geographical monopolies which are governed by a regulatory framework known as the Scheme of Control Agreements (SCAs).

4.2. Hong Kong's RE polices

Since the early 2000s, the Hong Kong Government has started to introduce RE initiatives. In 2002, the Electrical and Mechanical Services Department (EMSD) commissioned a study titled "Study on the Potential Applications of Renewable Energy in Hong Kong" and set one of the first RE targets for Hong Kong (EMSD, 2002). Since then, the Government has launched difference policies, including RE incentive factors under the Scheme of Control Agreements (SCAs; in 2008 and 2018) with the electricity companies, consultative documents (in 2010, 2014, 2015, and 2019) and energy plans (in 2017) to engage public discussion on the policy development of RE (Figure 4-1; Appendix 4-1).

In October 2018, the Government introduced its first major RE policy, the FiT Scheme in Hong Kong to promote solar adoption in both residential and private sectors. In the Policy Address announced in the same year, the government emphasised that it would take the lead to develop RE by introducing measures for private, public, and school sectors (LegCo, 2018b). An overview of the major RE measures announced in the 2018 Policy Address is provided in Appendix 4-2, and a chronology of major RE policy initiatives in Hong Kong is provided in Appendix 4-1.

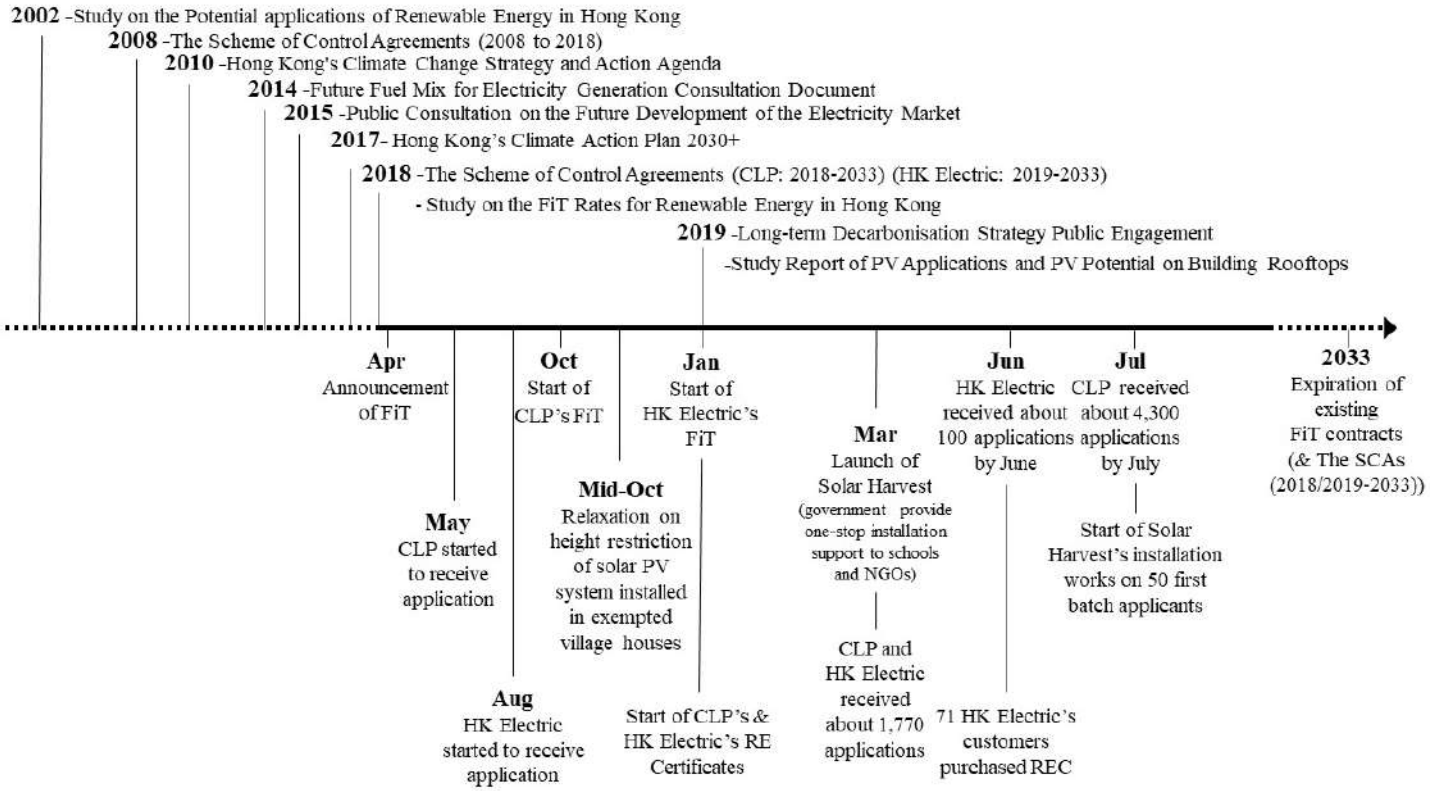


Figure 4-1: Timeline of the government's RE-related public consultations, studies, SCAs and the FiT Scheme.
Sources: Data compiled from Chan (2019) and ENB and EMSD (2019)

The Hong Kong Government currently does not has an explicit RE target (LegCo, 2019b). In the Hong Kong's Climate Action Plan 2030+ published in January 2017, the government estimates that Hong Kong has modest realisable RE potential arising from wind, solar and waste-to-energy at about 3-4% from 2017 to 2030; and only 1-1.5% of Hong Kong's electricity consumption could be powered by solar (ENB, 2017). This government estimate is equivalent to about 440 – 660 million kWh which requires an installed capacity of about 440 – 660 MW of solar PV systems to generate.[4]

In a recent Legislative Council's document, the government states that in consideration of many technical and financial challenges regarding the scaling up RE deployment and the way in which there is limited local experience on FiT, "it is not yet appropriate to specify a target of RE (including that for solar energy) in the fuel mix for electricity generation at this stage" (LegCo, 2019b).

[4] We assume 1 MW of solar PV systems could generate 1 million kWh of solar electricity annually.

4.3. The pre-FiT development of solar power in Hong Kong

Before the implementation of the FiT Scheme, installed solar PV capacity contributed to about 0.05% of the total installed capacity in Hong Kong with a total installed capacity of no more than 6.29 MW in 2017. For electric generation, solar power has generated about 6,289 MWh of electricity, which is 0.014% of the total electricity use in 2016 (C&SD, 2019; Meinhardt, 2019). Hong Kong had made some initial attempts to deploy solar PV. There were approximately 165 solar PV projects in Hong Kong in 2014 [44, 45]. Some of the major local solar projects before the FiT Scheme included a 1 MW solar PV system on Lamma Island, a rooftop solar PV system at the headquarters of the government's Electrical and Mechanical Services Department in Kowloon Bay, and the building-integrated PV systems in Wanchai Tower.

4.4. The Hong Kong's FiT

The Hong Kong Government introduced its first major RE policy, the FiT, under the current SCAs with two electricity companies: First with CLP starting from October 2018 and HK Electric starting from January 2019 (HKSAR, 2017). A FiT is a subsidising policy which generally offers long-term contracts (e.g. 10 to 20 years) to RE producers with a fixed and favourable subsidy.

The FiT Scheme in Hong Kong has several design features as follows:

(1) A fixed-priced FiT with high FiT rates: Hong Kong FiT Scheme guarantees that RE can be sold to the grid at fixed price within the contract period. This means that a "premium tariff" or bonus will not apply in the FiT Scheme in Hong Kong. The current FiT rate is between HK$3-5/kWh (USD0.38-0.64/kWh) in Hong Kong, depending on installed capacity; this is one of the highest rates among all former and existing FiT policies in the world (Appendix 4-3). The FiT rates are subject to an annual review by the government and the two utilities.

(2) Gross metering: Hong Kong FiT Scheme adopts gross metering (paid for every unit of generated electricity) instead of net metering (paid for the excess electricity exported to the grid only) (EMSD, 2018). All RE electricity generated under the FiT Scheme is directly transmitted to the grid rather than for self-consumption by the RE system owners.

(3) Duration of contract until 2033: Under the current SCAs, the FiT contracts between RE producers and utilities will expire in 2033. The maximum contract duration can be up to 15 years depending on the start date of the respective contract.

(4) Utility administered RE certificates: A RE certificate system is introduced where public can buy certificates to support RE generation. The revenue from the sales of RE certificates is used to cover the additional costs borne by the two power companies in procurement of solar electricity. If the revenues from RECs cannot cover the costs, a surcharge is applied in the tariff implying that the additional costs are shared by all electricity consumers of a utility.

(5) No official capacity limits: The Hong Kong Government and the two electricity companies have not capped the total installed capacity or total amount of tariffs each year. CLP and HK Electric review and scrutinise applications on a case-by-case basis.

Since the launch of the FiT Scheme in October 2018, the Hong Kong Government has subsequently implemented a number of complementary policies to support RE development, most notably the relaxation of the height limit for RE system installation on village houses, introduced in late 2018,[5] along with the Solar Harvest Scheme – an initiative introduced in February 2019 that provides a one-stop service solar support scheme for subsidised schools and welfare NGOs.[6]

[5] In order to encourage village houses to install RE system, the height limit for installing RE system has been relaxed from 1.5 metres from the roof level to 2.5 metres since late 2018 (EMSD, 2019a; LandsD, 2018). The exempted village houses in Hong Kong are regulated of maximum 3-storeys with total height not exceeding 27 feet (8.23 metres).

[6] In February 2019, Hong Kong Government announced the "Solar Harvest" Scheme to subsidise and assist schools and welfare NGOs to install small-scale solar photovoltaic (PV) system. The Scheme will conduct feasibility study of solar PV installation and system design, fully subsidise the installation costs of system under 10 kW and provide technical assistance to applicants. The applicants are urged to use the FiT income to finance RE system maintenance and repairing costs (EMSD, 2019b).

5. FINDINGS

5.1. The FiT Scheme is an effective policy in regard to stimulating the substantial growth of new solar projects in Hong Kong and arousing some interests in solar energy in our case communities, but has not yet made solar energy a mainstream form of energy at both city and community levels

5.1.1. Since the introduction of the FiT Scheme, there has been a substantial growth of new solar projects in Hong Kong

CLP received over 5,200 FiT applications between May 2018 and end of September 2019, and approved some 4,500 applications. The CLP approved RE systems generated about 3,500,000 kWh of RE during this period (LegCo, 2019b). HK Electric received 110 FiT applications between August 2018 and the end of September 2019, and approved 73 applications (S20). The HK Electric RE systems generated 250,000 kWh of RE during this period (LegCo, 2019b).

The average FiT application processing time for CLP and HK Electric was about three weeks and two weeks respectively. About 20% of CLP's applicants and 40% of HK Electric's applicants installed on-grid RE systems and started receiving FiT income (LegCo, 2019b). As of the end of September 2019, in approximately 400 of the over 5,200 FiT application (i.e. approximately 8%) received by CLP, the installed capacity approved was lower than that applied for. HK Electric has not adjusted the installed capacity of any of the applications (LegCo, 2019b).

Most of the approved FiT applicants involve small-scale RE systems. In total about 86.6% of the approved FiT applicants install systems with an installed capacity of 10 kW or below. Most of the FiT applicants came from residential customers, while 83% of CLP FiT applicants and 52% of HK Electric FiT applicants were residential customers (LegCo, 2019b).

In terms of RE certificates, CLP and HK Electric sold 143 and 113 RE certificates, equivalent to over 2,500,000 and about 900,000 kWh of RE respectively (LegCo, 2019b).

Table 5-1: Breakdown of applications of the FiT Scheme and RE Certificates (as at end of September 2019).

	CLP	HK Electric
Overview of Feed-in-Tariff Scheme (FiT)		
Applications received	Over 5,200	110
Applications approved	4,513	73
Average time to process applications	Three weeks	Two weeks
Percentage of customers who have successfully installed RE systems and started receiving FiT	20%	40%
RE purchased (kWh)	About 3,500,000	About 250,000
FiT figures' breakdown by installed capacity		
≤10 kW	3,913	57
>10 kW to ≤200 kW	595	16
>200 kW	5	0
FiT figures' breakdown by building types		
Residential customers	83%	52%
Commercial and industrial customers	8%	24%
Schools	4%	17%
Other customers	5%	7%
Overview of RE Certificates		
Applications Received	143	113
Electricity sold (kWh)	Over 2,500,000	About 900,000[7]

Source: (LegCo, 2019b) and S20.

5.1.2. Major developments of solar in FP and HLY in response to the introduction of FiT policy

In our two case communities, there were several important developments regarding solar PV in response to the FiT Scheme as discussed below:

In FP:

(1) The FP MO first issued an application form for solar installation in September 2017 (about one year before the implementation of the FiT in October 2018), and a revised version in May 2018. The MO issued the forms to formalise panel installation procedures and to define the liabilities for system owners (S9). The original version was however widely perceived by residents who were interested in installing solar as unreasonable. The most controversial issue related to a clause in the application form that stated the maximum size of the permitted rooftop solar panel area would be limit to 4m^2. After a meeting was hold between the MO, some residents, the project team of this study, and CLP representatives in May 2018, the MO issued a revised solar

[7] This number includes the RE generated by Lamma Winds.

application form basically sets no explicit limits regarding the size of the solar panels, requiring only an area of no less than 300 mm from the roof edges not be covered by panels.

(2) As of November 2019, 41 applications were made to the MO and 22 applicants have had their solar PV systems installed. These residential solar systems in FP typically involve 24 solar panels installed on rooftops, with an installed capacity of 6.6 kW (S19).

(3) A school that is affiliated with Hong Chi Association (匡智會), located within the vicinity of FP, has received funding support from a charity to install solar PV systems. The installation work is planned to be completed in 2020.

(4) CLPe Solutions, a subsidiary of CLP, proposed to the MO of FP to build a floating solar PV system on Shan Pui River (山貝河) which runs across FP, with a planned installed capacity of 1 MW and an estimated upfront costs of approximately HK$ 3 million. The proposed project has encountered some technical and environmental concerns, and has been put on hold.

In HLY:

(1) In late September 2019, a few days before the FiT Scheme became effective, an owners' association (業主會) of HLY organised a solar sharing session for residents, and invited two solar installers to attend. The sharing session stimulated a number of solar-related initiatives in HLY: The owners' association invited eight solar installers to provide quotation, set up a WhatsApp group, and started to develop group purchasing arrangements.

(2) The MO issued a solar application form in mid-2019.

(3) The MO has received no more than 20 applications for solar installation. Before the implementation of the FiT, there were only two to three solar houses in HLY (S12),

(4) The MO of HLY plans to build a solar PV system on the rooftop of a two-storey apartment building in HLY, and would make the FiT application in early 2020.

(5) Three school buildings, which are affiliated with Hong Chi Association (匡智會), located in Pinehill Village (approximately 4.6 km travel distance away from HLY) have received funding support from a charity to install solar PV systems. The installation work is planned to start in early 2020.

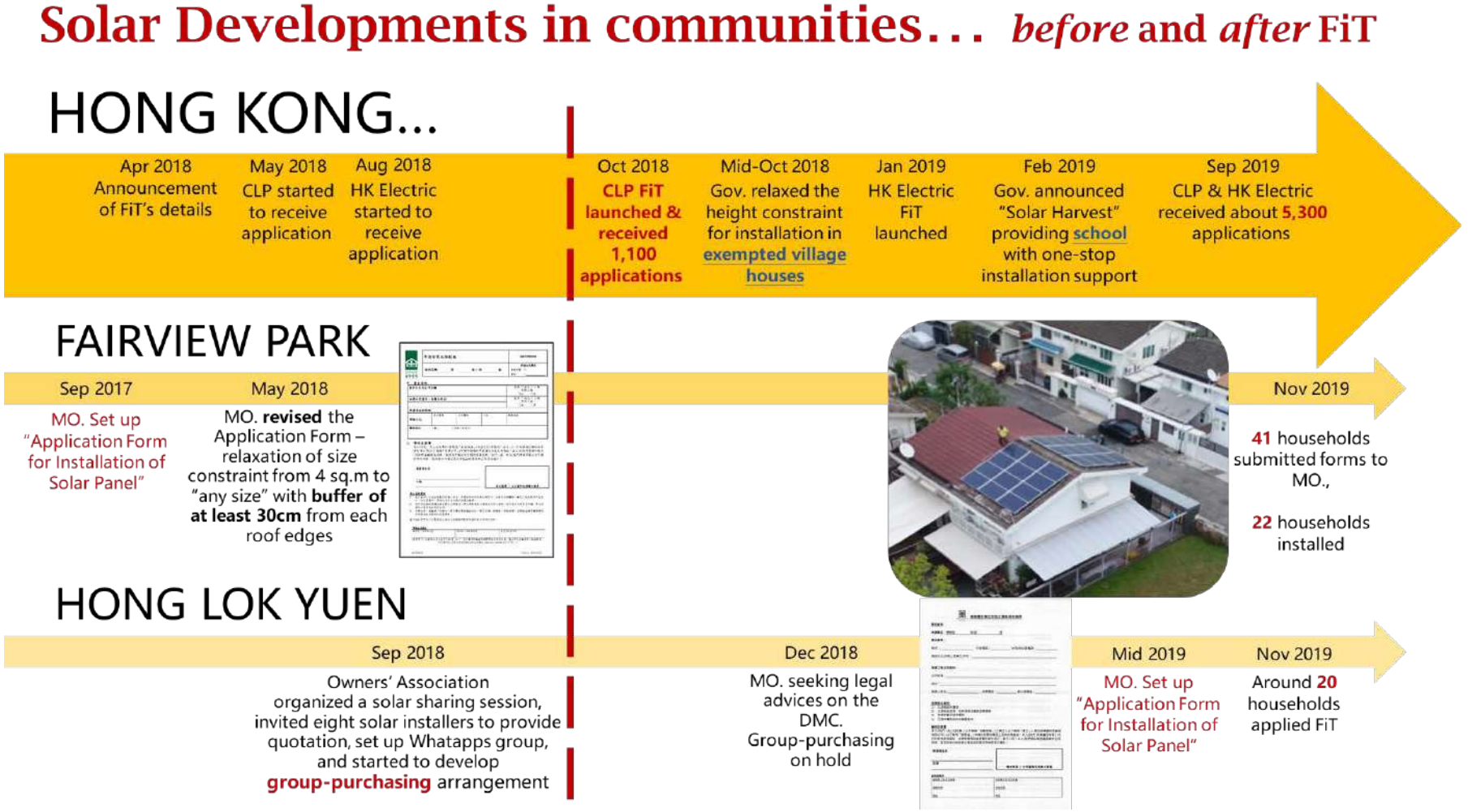


Figure 5-1: Solar development in FP and HLY before and after the launch of the FiT Scheme.

5.1.3. Seven key observations of the FiT implementation

(1) The FiT is highly effective in *shortening the estimated payback period* of solar PV projects in Hong Kong. Before the implementation of the FiT, the estimated payback period of a rooftop solar PV system of a typical exempted village house would be approximately 35 years in the absence of any governmental subsidies (Mah et al., 2018b). After the introduction of FiT, taking into account FiT income, the payback period has been reduced to less than ten years in general (CLP, 2019). Among the interviewed householders who have joined the FiT, none of the estimated payback period of their solar investment is longer than eight years (H31).

(2) The FiT has stimulated *a substantial increase in new solar PV projects in the residential sector*. Before the launch of the FiT Scheme, there were only about 50 on-grid RE systems between 2008 and 2017, including 46 solar PV systems and four wind systems (LegCo, 2018a). Most of the pre-FiT solar projects in Hong Kong were non-residential projects in government buildings and schools with some in commercial buildings (Mah et al., 2018b). Since the introduction of the FiT, CLP and HK Electric have received a total of 5,317 FiT applications (before the end of September 2019), which is approximately 440 new applications per month in the first 12 months of the implementation of the FiT Scheme in Hong Kong.

(3) Most of the new residential solar projects are in village houses, which can benefit from a relaxation of the height limit of solar system installations. *New solar projects in other residential areas, such as our two case communities, are however few* in number.

(4) The FiT and the Solar Harvest Scheme have led to a *surge of solar schools* in Hong Kong. The Solar Harvest Scheme has received approximately 210 applications in the first two rounds of applications, which closed in early April and at the end of May 2019 respectively. Approximately 50 of these applications have been approved with FiT.

(5) The FiT Scheme has received *modest responses from the business sector* (S15).

(6) *The RE Certificate Scheme* has received *lukewarm responses* from the market. Some companies were motivated to buy the RE certificates to fulfil their corporate social responsibility. But generally RE certificates as a market instrument to finance the FiT was ineffective due to its lack of attractiveness and competition of similar products from other regions to the private sector (S15).

(7) The *FiT Scheme has not yet caused solar energy to become a mainstream form of energy* in Hong Kong. The total RE purchased by the two power companies under the FiT Scheme amounted to approximately 3,750,000 kWh as of the end of September,

2019 (3,500,000 from CLP; 250,000 from HK Electric) (Table 5-1), which is equivalent to approximately 0.0085% of the total electricity consumption in Hong Kong.[8] In our two case communities, solar householders are also low in number. As of November 2019, the numbers of solar applications in FY was only 41 households – a minute of 0.8% of the 5,024 households. About 20 applications in HLY represent approximately 2% of the 1,132 households there.

5.2. Our multi-method solar assessment results found that the two case communities have rich solar resources; they alone have the potential to contribute to 1/10 of the government estimate of 660 MW

This study found that solar resources in these two communities are plentiful. According to our GIS-based solar assessment (Table 5-2)**,** the projected annual solar energy potential of the *entire* FP community (including all 5,024 households) amounted to 42,138 – 44,424 MWh with an installed capacity of 42.5 MW.[9] This amount of electricity is equivalent to the annual electricity consumption of about 12,800 – 13,500 three-person households.

The projected annual solar energy potential of the *entire* HLY community (including 1,190 households) amounted to 16,926 – 18,093 MWh.[10] This amount of electricity is equivalent to the annual electricity consumption of about 5,100 – 5,500 three-person households.

To put these estimates into context, 42.5 MW + 17.2 MW = 59.7 MW, which is already equivalent to nearly 10% of the Hong Kong Government's estimate of 660 MW of solar that could be realised by 2030.

To supplement the community-wide solar assessment, we also conducted onsite solar assessment in households in these two residential estates (Appendix 5-1). The estimated annual solar energy potential of the 32 onsite assessment FP households amounted to 222 MWh, with an estimated rooftop area of 1,078 m^2. This amount of solar energy could yield about HK$ 1.2 million, equivalent to the monthly management fee of about 800 FY households (at an average monthly rate of HK$ 1,500). The estimated annual solar energy potential of the 19 onsite assessment HLY households amounted to 210 MWh, with an estimated rooftop area of 984 m^2. This amount of solar energy could yield about HK$ 930,000 FiT income annually, equivalent to the monthly management fee of about 373 HLY households (at an average monthly rate of HK$ 2,500).

[8] 1% electricity consumption in Hong Kong is equivalent to approximately 440 million kWh (ENB, 2017).
[9] We assume an estimated total rooftop area of about 240,811 m^2 are fully equipped with solar PV systems.
[10] We assume an estimated total rooftop area of about 97,544 m^2 are fully equipped with solar PV systems.

Table 5-2: An overview of solar resources in FP and HLY.

	FP	HLY
Solar installed capacity from projection	42.5 MW (assuming an estimated total rooftop area of about 240,811 m^2 are fully equipped with solar PV systems)	17.2 MW (assuming an estimated total rooftop area of about 97,544 m^2 are fully equipped with solar PV systems)
Solar resources from projection	42,138 – 44,424 MWh/year (240,811 m^2 estimated rooftop area; equivalent to annual consumption of about 12,800 – 13,500 3-person households)	16,926 – 18,093 MWh/year (97,544 m^2 estimated rooftop area; equivalent to annual consumption of about 5,100 – 5,500 3-person households)
Solar resources from onsite assessment	222 MWh/year (32 households; 1,078 m^2 estimated rooftop area; equivalent to annual consumption of about 67 3-person households)	210 MWh/year (19 households; 984 m^2 estimated rooftop area; equivalent to annual consumption of about 63 3-person households)
Estimated FiT income (HK$)	About 1,200,000	About 930,000
Actual solar electricity generation (data collected from solar households' electricity bills)	Households A: 2,027 kWh (60 days from August to October 2019 with a capacity of 8.0 kW)	Households B: 1,029 kWh (61 days from August to October 2019 with a capacity of 5.2 kW)

* Data of actual solar electricity generation and FiT incomes of four interviewed/ surveyed households are provided in Appendix 5-2.

5.3. The two communities have seven types of community capitals and a number of high-capacity residential actors. These community capacities can help the government to realise more ambitious solar targets.

5.3.1. A dynamic stakeholder landscape of the two prospective solar communities

This study mapped out a stakeholder landscape of the case communities with the aim of identifying key actors in FP, HLY and beyond these communities with a stake or interest in community solar deployment. It is important to identify solar stakeholders in the case communities because they may contribute to a solution, can be the source of a problem, or might be affected by activities related to solar deployment.

Our study found that there are 12 types of stakeholders, which can be divided into two groups, namely stakeholders *within* a community (shown in the inner circle in Figure 5-2) and

stakeholders *outside* a community (the outer circle of Figure 5-2). For Group 1 stakeholders within a community, this group comprised: (1) Residents (of various interests and perceptions of household and community solar PV installations); (2) developers (landowners) in the community; (3) MO; (4) residents' associations; (5) district councillors; and (6) schools located within the communities.

For Group 2 stakeholders outside a community, this group consisted mainly (1) utilities; (2) utilities' subsidiary; (3) solar installers and solar technology suppliers; (4) decoration workers; (5) Government agencies; and (6) NGOs. This group of stakeholders influenced the developments of solar in these communities in various ways, ranging from administering the FiT Scheme, handling FiT applications for community residents, solving technical problems for solar PV system installations, and implementing the regulations related to the FiT Scheme. The roles of stakeholders are summarised in Table 5-3.

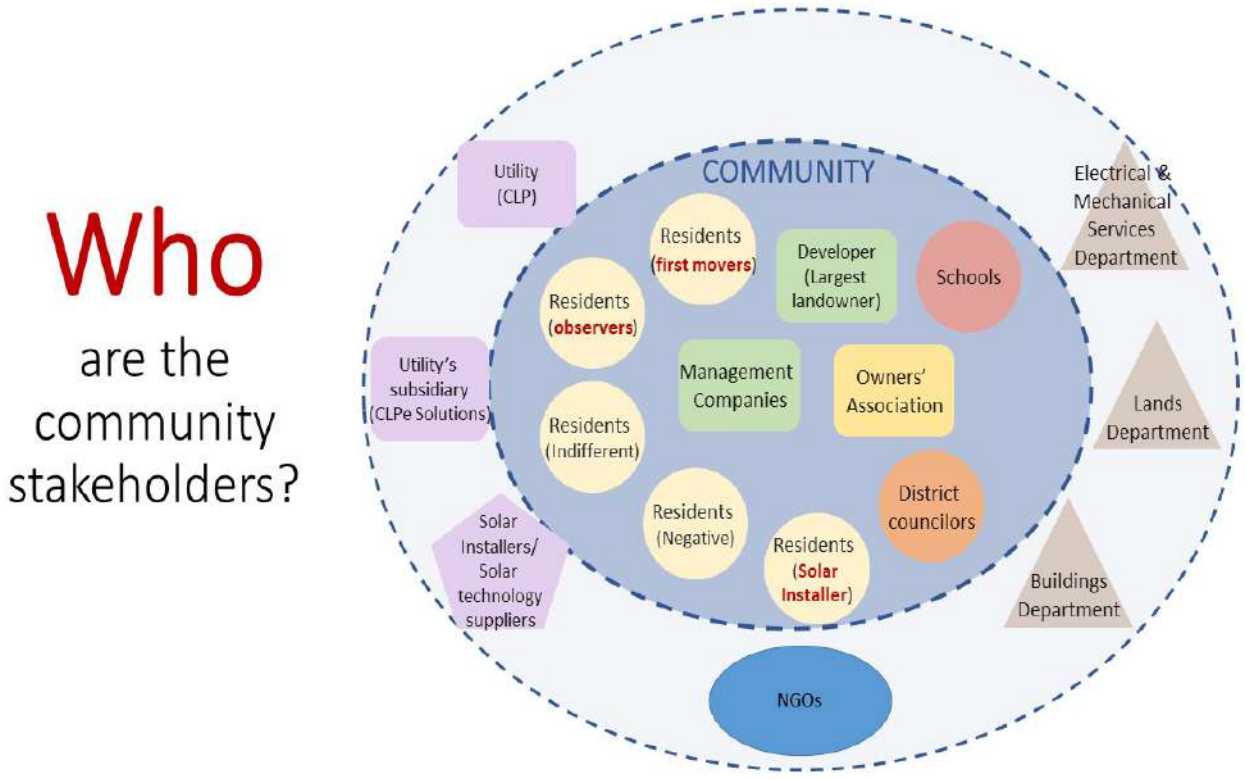


Figure 5-2: A stakeholder landscape of the two case communities.

Table 5-3: An overview of solar resources in FP and HLY.

	FP	HLY
Group 1: Stakeholders within a community		
1. Residents		
1.1. Residents – first-movers of solar PV adopters	F3; F11; F45	H8, H32
1.2. Residents – interested in solar PV adoption, but acted as observers	F4, F5, F8, F9, F12, F19, F22, F23, F31	H1, H2, H3, H4, H6, H8, H9, H10, H18, H19, H22, H26
1.3. Residents – indifferent to solar PV adoption	F13, F21, F22, F24, F26, F29, F30, F37, F41, F42	H5, H7, H11, H12, H13, H14, H15, H21
1.4. Residents –concerned about the potential negative impacts of solar PV (reflection, negative impacts on the aesthetic values, etc.)	F20, F40, F42	Participant of WH3 (whose wife is an artist)
1.5. Residents – who are also solar installers	S16	H32
2. Developer (or the landowner of public space of the respective residential estate; commonly known as "the large landowner (大業主)"	Fairland Resources Limited (formerly Canada Overseas Development)	Hong Lok Yuen Estates Ltd
3. MO	Fairview Park Property Management Limited	Kai Shing – Hong Lok Yuen Property Management Co. Limited
4. Residents' associations	Owners' association of Fairview Park	Two owners' associations
5. District councillors	Mr. To Ka Lun	Mr. Tang Ming Tai
6. Schools	▪ Bethel High School ▪ Hong Chi Morninglight School, Yuen Long ▪ Hong Kong and Macau Lutheran Church Wong Chan Sook Ying Memorial School	▪ International College Hong Kong Hong Lok Yuen
Group 2: Stakeholders outside a community		
7. Utility	CLP	CLP
8. Utility's subsidiary	CLPe Solutions	Not applicable
9. Solar installers and solar technology suppliers	Existing market players	Existing market players
10. Decoration workers	Existing market players	Existing market players
11. Government agencies	including Electrical & Machanical Service Department, Environment Bureau, Lands Department, etc.	including EMSD, Environment Bureau, Lands Department, etc.
12. NGOs	▪ World Wide Fund for Nature Greenpeace ▪ Hong Chi Association	▪ Greenpeace ▪ Hong Chi Association

Table 5-4: Roles of stakeholders within and outside a community in fostering solar deployment.

Group 1: Stakeholders within a community	
Residents	Comprising different types of residents: - First movers in solar PV installation - Prospective solar households who are interested in solar PV installation, but act as observers - Households who are indifferent in solar PV installation - Residents who are not interested; but concerned about the potential negative impacts of solar panels (reflection, negative impacts on the aesthetic values, etc.) - Residents who are solar installers
Developers (landowners)	- Hold ownership of the public space of the communities - The interests of the developer in solar PV projects in public space would affect solar deployment of the communities
MO	- Seek legal advices for the rights and obligations of property owners and residents in solar PV installation according to the Deeds of Mutual Covenant and relevant legal documents - Issue guidelines for property owners and residents in solar PV installation - Coordinate community development and manage co-owned solar PV projects of the community
Residents' associations	- Collect and reflect householders' views on solar PV installations - Promote and support solar households - Coordinate community development and manage co-owned solar PV projects of the community
District councillors	- Promote stakeholders to setup solar community projects - Provide supporting platform for solar households
Schools	- Possess space (schools' rooftops), incentives (environment education values), and resources (support from the government or school sponsoring bodies) to install solar PV systems - Schools' solar PV projects could serve as demonstration for prospective solar communities
Group 2: Stakeholders outside a community	
Utility	- Administer and operate the FiT Scheme - Review the FiT applications; negotiate with applicants on the size of installed capacities - Examine the technical safety of grid connection of the solar PV systems - Install smart meters for on-grid solar PV systems
Utility's subsidiary which is a solar installer	- Identify and seek investment opportunities on solar PV projects in common areas of the communities
Solar installers and solar technology suppliers	- Handle FiT applications, installation design and solar PV systems installations for prospective solar households
Decoration workers	- Work closely with solar installers and solar householders to jointly develop technological solutions (e.g. screw design, colour options for solar tiles) that fit community-specific constraints
Government agencies	- Negotiate and sign the Scheme of Control Agreements (SCAs) with the utilities - Require the utilities to launch FiT Scheme - EMSD responsible for solar PV system safety compliance - Buildings Department responsible for the structural safety of solar houses - Lands Department responsible for the compliance of land leases
NGOs	- Promote solar PV installation in communities - Focus on sustainable development, environment issues, RE policies, community participation

5.3.2. “High-capacity actors” and “influential actors” existed in the communities

When this study conducted the stakeholder mapping exercise, we found that there existed some high-capacity actors and influential actors in the two case communities.

It is important to note that the residents in the two case communities possess higher levels of incomes and education, and there also exist some first-movers who have a high capacity in terms of technical knowledge as well as political networks. In FP, a retired senior government official, a retired senior engineer of Motorola, and a solar installer who is also a resident of FP, were among the first-movers of prospective solar households. In HLY, a resident who is a retired engineer and currently a senior executive of Engineers Without Borders (HK), a solar installer who is also a resident of HLY, a senior executive of an IT unit of a local university are some examples of high-capacity residents (Table 5-5).

We also found that the MOs, houseowners’ associations, and CLP were often regarded by interviewed householders in the two communities as influential actors. It is evident that communications and dialogue between residents’ associations, MOs and CLP are important to enhance action for solar in communities.

As a resident in HLY noted:

“業主會同居民喺推動太陽能發展一件事上呢，喺唔喺有互動呀咁。好 positive 㗎我哋，喺絕對互動。反而嘅就喺我哋責任，就喺牽引啲居民喺呢方面嘅表述咯，同埋睇法… 都同管理處好密切溝通㗎…就喺希望呢個管理處嗰邊，盡早落實佢對太陽能板嘅指引，暫時喺咁。唔可以咁高，唔可以咁矮，太多……” (S11) [11]

[11] English translations: “Our residents’ association definitely interacted with the MO. We have responsibility to facilitate residents to voice out their views on this matter, and we have close communications with the MO.” (S11).

Table 5-5: List of high-capacity residential actors in FP and HLY (selected examples).

In FP:
▪ A retired senior government official who has extensive political network with senior government officials in a number of government bureax and departments, and with the "large landowner (大業主)" of FP. ▪ A resident who is also a solar installer; a former senior office of a local NGO. ▪ A retired senior engineer of Motorola
In HLY:
▪ a resident who is a retired engineer and currently a senior executive of Engineers Without Border (HK) ▪ a resident who is a solar installer, and a distributor of a multi-national supplier company of solar equipments ▪ a senior executive of an IT unit of a local university

5.3.3. Seven types of community capitals existed in FP and HLY which could foster the growth of more solar PV

FP and HLY possess various community capitals for solar deployment at both the household and community levels. This study adapts Emery and Flora (2006)'s Community Capitals Framework to analyse the community capitals of FP and HLY. Seven forms of capitals in a community (natural capital, cultural capital, human capital, social capital, political capital, financial capital, and built capital) were identified in these two case communities and summarised in Figure 5-4 and Table 5-6.

Both FP and HLY possess the *natural capital* of rich sunlight exposure and a favourable landscape for solar PV installation, which is atypical in Hong Kong. Situated on a flat basin terrain, FP adjoins the wetland conservation area of the Mai Po Inner Deep Bay Ramsar Site, low-density, low-rise villages, agricultural areas and a river. HLY, on the other hand, is surrounded by hilly natural landscape and a highway at the front. These landscapes minimise sunlight blockage and shading effects in terms of solar generation.

Both communities have rich *cultural capital*. FP has good resources in terms of relatively strong environmental awareness and pre-existing eco-friendly initiatives prior to this study (Figure 5-4). The young and professional residents of FP were perceived as having strong environmental awareness (S10). To formalise solar panel installation procedures, the FP MO issued application form for solar PV system installation and defined the liability involved for system owners (S9). FP possesses its own decentralised wastewater treatment plant to reduce water pollution and has experience of a shoes recycling campaign under the District Councillor, collecting about 700 pairs of old shoes within one hour (S2). FP also has resident-initiated messenger groups to connect second-hand goods donors and receivers (F3).

Figure 5-3: Horticulture of FP neighbourhood as a sign of environmental awareness. Photo credits: Asian Energy Studies Centre, Hong Kong Baptist University (2019).

HLY has good resources of cultural capital from its experience of organising a community-wide environmental programme. HLY turned their environmental awareness into actions through the MO administered food waste collection project which had been running for five years (S12). In response to solar PV installation, HLY MO sought legal advices to clarify the rights for solar PV installation in the Deed of Mutual Covenant. The MO also implemented a communication channel for the residents to exchange ideas and define problems (S12). Strong environmental awareness and willingness to take actions were favourable for the two communities in promoting solar energy.

The most prominent *human capital* in FP and HLY is their post-secondary education attainment and professional skills. 42.1% of FP residents aged over 19 and 75% of FP interviewees attained post-secondary education (2016 Population By-census, 2016). About 43% of FP interviewees worked as executives or professionals including senior engineers and solar installers, etc. In HLY, 46.7% of the residents aged over 19 and over 90% of the interviewees attained post-secondary education (2016 Population By-census, 2016). About 62% of HLY interviewees worked as executives or professionals including former government officials and solar installers.

FP and HLY showed their *social capital* in building community bonds and organising community activities. Online platforms and social media served as the “glues between actors” in FP and HLY (Emery & Flora, 2006). Facebook pages were actively used by resident groups and a district councillor in FP (S10). However, FP interviewees reported distrust between residents who were pro-democrats and pro-establishments (F2), and between residents and the district councillor. One registered participant in our FP workshop called the organiser, and after confirming that the district councillor would be participating in that

workshop, withdrew her registration, saying she would not come. HLY was also active in building reciprocal relationship through opening several interest groups in mobile messaging apps, with one group focusing on solar community (H30). They were also interested in working together, such as considering group purchases of solar PV panels.

FP and HLY possess *political capital* in their ability to influence community standards and increase influence over other residents. FP residents influenced their MO in relaxing a regulation stated in a solar application form that originally limited the size of a rooftop covered by solar PV panels from 4 m^2 to a revised one that specifies no maximum size but require a 30-cm space to be reserved from the edge of roof (Appendix 5-3). HLY residents, on the other hand, urged their MO to promptly clarify the rights of solar PV installation on the Deed of Mutual Covenants. The resident association in HLY had also self-initiated talks about solar PV installation and contacted contractors to provide quotations in September 2018, one month before the FiT Scheme was implemented (S11).

Financial capital is prominent in FP and HLY as reflected by their household incomes and even potential in FiT revenue. The median monthly household income was HK$65,000 in FP and $121,160 in HLY which were much higher than the Hong Kong regional median (HK$ 25,000; 2016 Population By-census, 2016). All interviewees had monthly household income above $20,000 and about one-third of them had monthly household income above HK$100,000. The financial power from household income enriched the investment capitals in the two communities to install solar PV.

The built capital of FP and HLY is enabled by their building design. Apart from the low-density, low-rise housing design which enriches solar potential, the tilting and ceramic rooftops mean that there is no competitive use of rooftops. FP and HLY contain public spaces within their communities, such as public carpark, clubhouse, water areas which could be used for solar PV deployment. In addition, shuttle bus services are present in both communities.

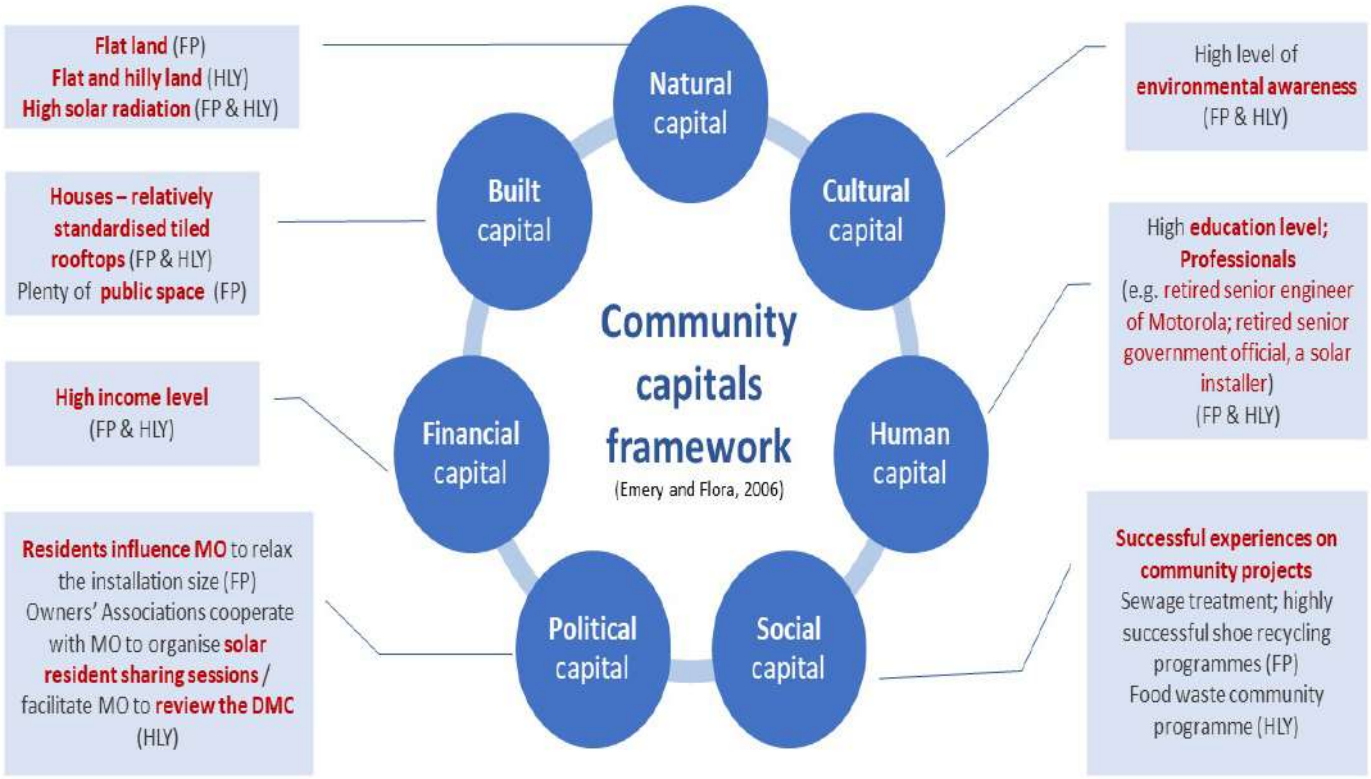


Figure 5-4: The seven types of community capitals of FP and HLY.

Table 5-6: A comparison of community capitals in FP and HLY.

Types of community capitals	**Indicators**	**FP**	**HLY**
1. Natural capital	1.1. Air quality 1.2. Sun and wind 1.3. Water 1.4. Soil 1.5. Biodiversity – Wildlife and plants 1.6. Landscape	▪ Rich sunlight exposure [1.2] ▪ Large area of water surface [1.3] ▪ Ramsar site [1.5] ▪ Flatland [1.6]	▪ Rich sunlight exposure [1.2] ▪ a mix of flat and hilly topography [1.6]
2. Cultural capital	2.1. How we value 2.2. What things we think are possible to change 2.3. Sense of place 2.4. Ways of acting 2.5. Definition of what is problematic	▪ Strong environmental awareness – but only among young professional households (S10) [2.1] ▪ Management culture: MO considered solar PV systems problematic only when they receive complaints (S9) [2.5]	▪ Strong environmental awareness – food waste recycling project organised by MO has been fully utilised over the past 5 years (S12) [2.4] ▪ Residents were active in voicing out opinion through MO's complaint system (S12) [2.4]
3. Human capital	3.1. Leadership 3.2. Education 3.3. Skills 3.4. Health 3.5. Self-esteem 3.6. Self-efficacy	▪ 42.1% of the population aged over 19 attained post-secondary education (HK: 25.9%) [3.2] ▪ 75% of the interviewees attained post-secondary education or above [3.2] ▪ 43% of the interviewees worked in executive level or professional (including engineers and former senior government official) [3.3] ▪ Age issue: "aging community" (S9, S10) [3.4]	▪ 46.7% of the population aged over 19 attained post-secondary education (HK: 25.9%) [3.2] ▪ 90% of the interviewees attained post-secondary or above [3.2] ▪ 62% of the interviewees worked in executive level or professional [3.3] ▪ Chairman of one of the owners' associations was enthusiastic in community works (H30) [3.1]
4. Social capital	4.1. Mutual trust 4.2. Reciprocity 4.3. Collective identity 4.4. Sense of shared future 4.5. Working together (collective action)	▪ Facebook groups initiated among residents and owners' associations or district councillor (S10) [4.2] ▪ Distrust among residents with different political views; distrust between some residents and the current district councillor [4.1]	▪ Different Whatsapp groups for variety of interests within community – solar group had about 40-50 people (H30) [4.2] ▪ Planning of group-purchasing for solar PV systems [4.5] ▪ Experiences of government-funded community food waste recycling project [4.5]
5. Political capital	5.1. The ability of a group to influence standards, regulations and enforcement of those regulations that determines the distribution of resources and the ways they are used 5.2. Increased voice and influence of people (e.g. organisation, connections, voice, power)	▪ Residents influenced MO to revise solar application form – which enlarged the scale of solar resources that could be used in the community [5.1]	▪ Residents' enquiries on solar PV installation facilitated MO to set up guidelines and regulations [5.1] ▪ Residents' association initiated solar talks in collaboration with MO [5.2]
6. Financial capital	6.1. A health economy if financial capitals are distributed fairly (e.g. saving, debt capital, investment capital, subsidies, tax revenues, tax abatements, grants)	▪ Median monthly household income: $65,000 (HK: $25,000) [6.1]	▪ Median monthly household income: $121,600 (HK: $25,000) [6.1] ▪ Community Saving: MO had HK$10 million savings [6.1]
7. Built capital	7.1. Human-constructed infrastructure used as tools for production of other capitals (e.g. sewers and water systems, electronic communication, transportation, housing)	▪ Housing had standardised tilted rooftop with ceramic tiles - minimal shading effect [7.1] ▪ Lots of public space, such as community parks and Shan Pui River [7.1] ▪ Shuttle bus service available within community [7.1]	▪ Housing had standardised tilted rooftop with ceramic tiles - minimal shading effect [7.1] ▪ A few public spaces, such as the rooftops on three common buildings [7.1] ▪ Shuttle bus service available within community [7.1]

5.4. The FiT was perceived as an effective policy in terms of shortening payback period, among other perceived benefits.

Most interviewed households perceived the FiT as an effective policy that could motivate them to install solar PV systems. About 55% and 63% of the interviewees in FP and HLY regarded FiT as effective in terms of motivating them to consider installing solar PV systems. This finding is consistent with data derived from stakeholder interviews.

FP and HLY household and stakeholder interviewees were also asked to comment on the perceived positive outcomes of the FiT. A summary of the major perceived positive outcomes of FiT is provided in Table 5-7.

The most direct perceived outcome of FiT was the shortening of the payback period for solar PV system installation. Before the implementation of the FiT Scheme, the payback period of installed solar PV systems could be about 35 years (Mah et al., 2018b), while EMSD's study published in July 2019 found that the payback period for solar PV systems ranged from 42 to 108 years (Meinhardt, 2019). After the implementation of the FiT Scheme, the payback period of installing solar PV systems was reduced to around ten years (CLP, 2019).

According to our interviewed solar households, the payback period is expected to be less than 10 years. Feedback from solar households suggested that FiT would cover the installation costs in the long run and shorten the payback period to between three to eight years (F3, F44, F11, H30). Although the income levels of the two case communities were higher than the Hong Kong average, the financial incentive from FiT was perceived as "the last push" needed for households to take action; FiT was regarded as "not critical but of course better than none." (H30) In addition, interviewed households expected the FiT incomes to be sufficient to cover the maintenance and insurance costs of their solar PV systems.

Enhancing environmental awareness through facilitating RE use was another commonly stated positive output of the FiT. Some interviewed households agreed that the FiT was a good start to arousing interest and generating discussions about RE in society (F34). The peer effect of solar households could also draw neighbours' attention and awareness to RE use (F44).

The FiT encourages solar deployment in the business sector. Enterprises could make use of this opportunity to develop solar at their premises and improve their companies' image. The FiT also incentivises the business sector to respond to their corporate social responsibility by installing solar PV systems and take action in regard to environmental protection (H8).

Some interviewees perceived the FiT implementation as a means of building trust on behalf of the government (H30; H32). To them, The FiT symbolised the determination of and promise

made by the Government to develop solar energy. They perceived the return of investing in solar to be assured and secured by the Government and utilities under the FiT Scheme.

Promoting solar industry development was perceived by interviewees to be another positive output of the FiT. Expecting more solar PV system installations may create a feedback loop and prompt market reformation, resulting in the emergence of solar system contractors. The increasing supply of contractors was perceived as making it easier to find a trustworthy contractor and enhancing system standards (H26; S13), while market competition will sort out the substandard contractors.

In addition, the FiT resolved the technical issue regarding RE storage. With the FiT, solar electricity generated by solar households can be fed into the grid instead of being stored in batteries. Not only did the RE grid connection eliminate the environmental pollution resulting from battery waste, but the FiT Scheme also helped to reduce battery replacement costs considerably; they could cost up to $100,000 every two years before the FiT Scheme was launched (H32).

Table 5-7: Perceived positive outcomes of FiT by FP and HLY interviewees

Positive policy outcomes		**Prospective solar householders in Fairview Park**	**Prospective solar householders Hong Lok Yuen**
(i)	Shorten payback period	Provide financial returns that (1) cover the upfront cost [F8; F16; F19; F32; F23] (2) subsidize electricity fee [F40; S3; S4] (3) support system's insurance and maintenance [F14]	Provide financial returns that cover the upfront cost [H1; H3; H6; H10; H13; H14; H19]
(ii)	Enhance environmental awareness	Promote RE [F4; F31; F44; S3]	Promote RE [H9; H10]
(iii)	Increase the proportion of RE in electricity generation	Increase deployment of solar energy [F3; F14; F24; F34]	Increase deployment of solar energy [H23; H26]
(iv)	Encourage deployment in business sector	Facilitate deployment to (1) improve business image [F16; F18] (2) fulfil social responsibility [F39]	Facilitate deployment to (1) improve business image [H24] (2) fulfil social responsibility [H7]
(v)	Build up public trust	/	FiT indicate the political commitment of the government to develop solar energy [H30; H32]
(vi)	Eliminate electricity storage concern	/	Provide alternative to store electricity on-grid instead of using batteries [H32]
(vii)	Enhance industry development	/	Improve quality of solar energy system when more people install [H26]

5.5. The FiT is however effective only to a certain extent in fostering solar development in HK. The FiT was insufficient to address the multi-facet barriers faced by interested households.

Despite the fact that the FiT was widely welcomed by the interviewed householders and workshop participants, there remained ten major types of barriers to solar deployment in the two case communities. These include: technical, financial (economic), market, institutional (internal), institutional (external), administrative, social, geographical and physical, a lack of personal interest, and split incentives. The barrier of split incentives was relatively minimal as most of them are houseowners, rather than tenants (Figure 5-5 and Table 5-8 – Table 5-11). Their views on the major barriers are illustrated as follows:

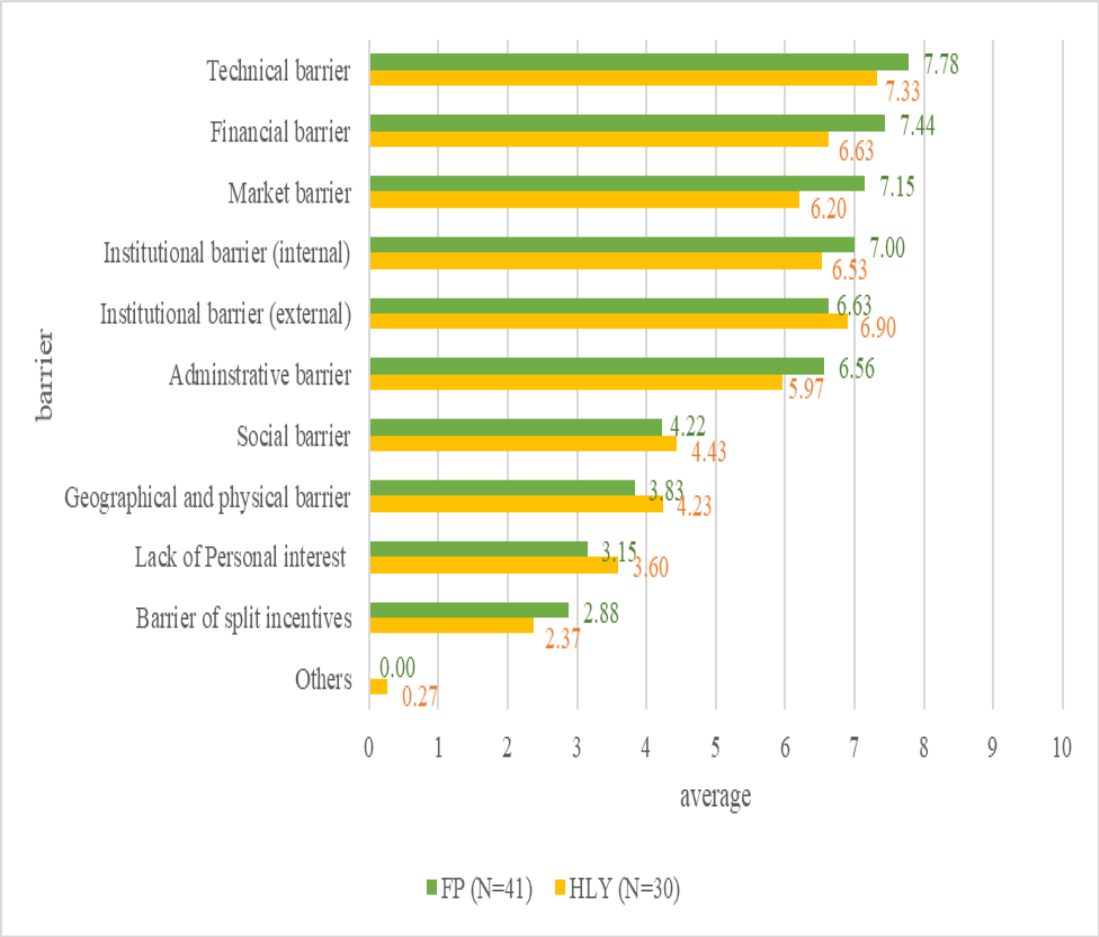


Figure 5-5: Perceived barriers from FP (n=41) and HLY (n=30) interviewee

(1) ***Technical barriers.*** Technical barriers, such as water seepage and concerns regarding house structure, were highlighted by both case communities. Houses in FP were ageing and had water seepage issues even without solar PV installation (F40). Households were concerned about the time-consuming process involved in installation and the complicated maintenance process, not only "how" but also "who" could deal with the maintenance beyond the warranty (F35; H15). HLY households expressed concerns regarding scaffolding and the removal of roofing tiles during maintenance (H7; H8). Some were concerned about the ability of the PV panels to withstand typhoons. The efficiency and lifespan of current solar PV system were also questioned by the households. Other concerns included health issues arising from radiation and the potential fire hazard.

(2) ***Financial (economic) barriers***. In the absence of direct subsidies provided by the government, the FiT cannot address households' concerns over high upfront costs of solar PV systems. According to households and solar installers we interviewed (F3; S16), the upfront costs of residential solar PV systems ranged from HK$100,000 to 200,000 in FY, and from HK$300,000 to HK$500,000 in HLY (S17). Even with the introduction of the FiT, some interviewed households note that the

payback period was generally too long for households. Interviewees also concerned about the additional costs for maintenance and repair (F26; F29; H24).

(3) ***Market barriers.*** A lack of market information, standardisation, accreditation of products, and insurance systems added to the market obstacles in both case communities. Some households reported that they could hardly find reliable contractors (H29; WF2). Some noted that they had encountered solar contractors who varied greatly in terms of the level of professionalism, including some who overstated the efficiency of PV systems, and some who were unfamiliar with the installation requirements imposed by MO and CLP (F5). Some worried that solar companies may not be able to deliver after-services when needed or may even close down (F21; F32; H13; WF3).

(4) ***Institutional barriers.*** Institutional barriers were found to be a critical factor affecting householders' decisions in regard to installing solar PV systems. Institutional barriers came from both internal and external sources associated with solar application and permitting procedures. Internally, MO were perceived by many interviewees and workshop participants as playing a passive, if not restrictive and inhibitive, role in regulating the installation of residential solar PV in the case communities. In FP, it took some eight months for residents to convince the MO to relax a condition stated in the MO's solar application form, which originally set a limit of the permitted rooftop solar panel area to only $4m^2$; this was regarded by some interested householders as a decision made by the MO out of ignorance of the solar technology (F3). Many interviewed householders perceived the MO as having authority over individual households to approve or reject a solar PV installation application with little justification (F8; F21; F32). Many interviewed households in FP and HLY also expressed their concerns that their solar PV installations would be deemed as illegal structure by the MOs.

Externally, utilities' permitting procedures were perceived to exert external institutional barriers. Uncertainty over the time needed to make a successful application of grid connection was a significant factor in deterring interested householders from installing solar PV. Householders raised concerns over the lack of transparency and consistency in the permitting procedures, resulting in widespread uncertainty among prospective solar householders in our two case communities.

Interviewed householders raised the following specific concerns: (i) unexpected additional requests in system upgrades; (ii) case-by-case inspections (in some cases, utility would carry out more than 10 inspections); and (iii) case-by-case capacity reduction requests from the utilities contributed to the lengthy permission process.

First, interviewed householders perceived that there to be a lack of transparency in utilities' inspection of technical issues such as system designs and household grid connection conditions. Our interviewees reported that the inspection could vary from two weeks to over four and a half months. Often, the utilities required solar household applicants to spend several additional months changing from single-phase to three-phase installation.[12] Second, some householders perceived that there to be a lack of consistency in utilities' inspection processes. One solar household interviewee mentioned that the utility staff members examined and inspected her solar PV installation as many as ten times before permitting the FiT contract (WH1). In addition, while utilities state that proposed projects need to fulfil technical and safety requirements (LegCo, 2019), some householders complained that the utility appeared to be arbitrarily "force" applicants to scale down their proposed installed capacity in order to obtain permission (WF3; WH5). This lack of transparency and inconsistency complicated and lengthened the application time and constituted a significant barrier to prospective solar households.

Other concerns perceived by households included the social barrier of neighbours' complaints about solar PV panel reflection (F4; F40; H10). In HLY, potential aesthetic impacts of solar panels appeared to be a major concern. Many residents in HLY emphasised that some 1,000 rooftops covered by red ceramic tiles had contributed to a unique landscape that was highly valued by many residents; they were concerned that solar panels would spoil this valuable landscape (S12; WH3). A lack of personal interests in environmental action was also perceived as a barrier among the two case communities. Split incentives and geographical and physical constraints were barely mentioned by the households, due to the fact that most interviewees owned their own properties and the two case communities had prospective solar resources.

[12] Utilities' guidelines of customers' single-phase and three-phase installations: https://www.clp.com.hk/en/customer-service-site/open-and-close-account-site/meter-installation-guideline-site/Documents/GuideToSupplyMetering_(v8)_Eng_Final.pdf. In some cases, households are advised to change from single-phase to three-phase installation to ensure grid stability.

Table 5-8: Perceived technical barriers by FP and HLY interviewees.

Technical Barriers	FP	HLY	Other stakeholders
Technical barriers:			
(a) Concern on water seepage and water proofing	- Risk of water seepage caused by installation [F1; F3; F9; F10; F13; F14; F16; F18; F19; F32; F40]	- Risk of water seepage caused by installation [H2; H3; H6; H13; H18; H19; S14] - Technical difficulties in simulating water seepage resistibility on tilted roof under heavy rain condition [WH2]	- Concern on water seepage by residents [S11]
(b) Concern on structural loading on roof	- Concern on the weakening of structural support with additional loading [F18; F40; F3; F12; F14; F22; F24; F26; F36; F40; F43]	- Concern on the weakening of structure with additional loading [H6; H7; H12; H13; H21; H22]	- Concern on the weakening of structure with additional loading [S11]
(c) Unknown in equipment efficiency and lifespan	- Uncertainty on the efficiency and lifespan of products [WF1] - Concern on substantial energy loss during transmission e.g. transformer required by utility companies as a safety measure had led to energy loss [F44]	- Uncertainty on the efficiency of products [H5; H3; H23; H24] - Perception that the current technology was of low efficiency [H20]	- Uncertainty on the lifespan of products [S15]
(d) Complexity in installation	- Perceived difficulty and lengthy process for installing solar PV system [F22; F12; F42] - Lack of understanding about the installation requirement [F25; F26]	- Perceived difficulty and lengthy process for installing solar PV system [H2; H14; H21; H27] - Lack of understanding about the installation requirement [H21]	/
(e) Complexity in maintenance	- Lack of understanding on the maintenance requirement [F6; F14; F35; WF3]	- Warranty was too short [H2] - Concern on the need for scaffolding, or damage of rooftop during maintenance [H6; H7; H8] - Lack of access or contact for technicians to maintain the system [H10; H15; H19; H28]	/
(f) Unknown in ability to withstand typhoon	- Risk of typhoon lead to concerns on: (1) destruction that may require additional repair [F3; F9; F23; F26; F28] (2) the legal responsibility on destruction [F27; WF2]	- Risk of typhoon lead to concern on: (1) destruction that may require additional repair [H13; WH1] (2) the legal responsibility on destruction [H18; H19]	- Increased risk of typhoon due to the relaxation of height limit for solar PV installation in exempted village houses [S8, S11]
(g) Degradation of current power supply quality	- Interruption or instability of electricity supply [F2; F28]	- Potential damage on the current electricity facilities [H19; H21]	/
(h) Concern on reflection	- Cause of nuisance from reflection [F4]	- Cause of nuisance from reflection [H10]	- Cause of nuisance from reflection [S11]
(i) Concern on radiation	- Health concern on the harmful radiation emitted from panel [F12; WF2]	/	/
(j) Concern on fire hazard	- Risk of fire hazard [F14; F28]	/	/
(k) Lack of waste treatment for solar panels	- Problem of waste pollution and lack of recycling system for abandoned solar panels [F20]	- Problem of waste pollution and lack of recycling system for abandoned solar panels [H28; WH2; WH4]	- Increase of solar panel waste due to the rapid technological improvement of panels' quality and lifespan [S1]

Table 5-9: Perceived financial (economic) and market barriers perceived by FP and HLY interviewees.

Financial and Market Barriers	FP	HLY	Other stakeholders
Financial (economic) barriers:			
(a) High upfront cost	- Quotation reached about $150,000 generally; acceptable cost was under $100,000	- Quotation might be up to $200,000; considered the installation as economically ineffective [H29]	/
(b) Long payback period	- 10 years was too long; expected payback in 5-6 years. - Possibility of moving out before getting the payback.	- 10 years was too long; expected payback in 3-5 years [H28] - Possibility of moving out before getting the payback.	/
(c) Uncertainty in maintenance and repair	- Concern on: (1) the frequency for maintenance or repair [F29] (2) the costs for maintenance and repair [F18; F39] (3) the additional costs to unknown risk (e.g. typhoon) [F26]	- Concern on the substantial costs [H2; H8; H22] - Unknown in maintenance and repair costs [H24]	/
(d) Lack of subsidies	- Lack of subsidies to support installation or maintenance [F6; F1]	- Lack of subsidies to support installation or maintenance [H12; H20]	/
Market barriers:			
(a) Lack of market information	- Lack of network or access to find contractors [F14; F16; F33] - Lack of contractors in the market [F19; F26; WF2]	- Lack of experienced professional technicians in market [H29; WH1] - Lack of time to search for contractors [H2] - Irresponsive contractors for enquiry [H2]	/
(b) Lack of standards	- Lack of standards for comparison [F18; F23; F25; F28] - Lack of proven track records of contactors [F3]	- Lack of proven track records of contactors [H16; H20]	- Variation of contractors' credibility in the bloom of contractors in market after the launch of FiT [S13] - Lack of expert knowledge to identify trustworthy contractors by the residents [S1]
(c) Immaturity of local market	- Unfamiliar with utilities' requirement of the contactors [F5] - Lack of credibility of contractors (e.g. some may exaggerate the system efficiency [F14]) [F41; F24; F14; WF3] - Concern on the close down of contractor firm [F21; F28; F30; F32; F3; WF2; WF3] - Pendency due to the expectation on product development and improvement in the near future [F27; F34; WF2]	- Lack of references or information about the quality of contractors [H4] - Lack of credibility of contractors [H31] - Lack of experience and knowledge to install solar panels of the contractors [H31] - Concern on the close down of contractor firm [H13; WH2]	- Huge variation of quotation given by contractors [S10] - Failure in keeping promise and meeting the installation standard of contractors [S13] - Lack of supervision of product quality at the importing stage [S1]
(d) Lack of insurance system	- Uncertainty on the availability of home insurance to cover the solar PV systems and the amount of additional insurance costs [F25; F21; F22]	- Uncertainty on the availability of home insurance to cover the solar PV systems [H22]	/
(e) Delay of financial sector – irresponsive to new market needs	/	/	- Excessively high entrance barriers for new market players to get loans [S8]
(f) Delay of innovation on product technology and market in Hong Kong	/	- Risk of typhoon and lack of new technology and construction method to withstand bad weather conditions [H31] - Absence of local market supply for some parts for solar PV system installation [H31]	/
(g) Delay of energy market reformation	/	/	- Levelised cost of solar energy too high while the cost of energy tariff from utility company low; not attractive to people to transit to solar energy. [S8]

Table 5-10: Institutional barriers perceived by FP and HLY interviewees.

Institutional barriers (internal):			
(a) Restrictions on open space	- Bureaucratic obstacles e.g. car park could be a good site for a community solar project, but required "discretion" to be exercised by the Lands Department	- Lack of suitable open space [S12]	- Might require change in use from the Government for alternative use of open space [S9]
(b) Ambiguous regulations and guidelines from MO	- MO was passive in promote solar [F1; F6; F7; F8; F13; F20; F27] - Lack of standard from MO to justify decisions for approving/rejecting installation [F8; F21; F22; F28] - Complexity in application procedure [F32] - Strict regulations on illegal structures [F12; F35; F41; F43] - Irresponsive attitude of MO to the households' demand [WF1]	- Complication in DMC issue – required further clarification if the installation would change the appearance of roof (e.g. orange in colour) [H2; H17; H19; H29; WH1; WH4] - Lack of promotion and support from MO [H7; H10; WH1] - Expectation of disapproval by MO [H13; H16; H23; H24]	- Requirement of legal clarification on the DMC issue [S12]
Institutional barriers (external):			
(a) Lack of certainty and transparency in the permitting procedures from utility companies	- High uncertainty in the permitting procedures: (1) uncertainty in the purchase amount of RE electricity from utility companies (case-by-case without justification) [WF3] (2) uncertainty in CLP grid constraint and capacity [WF1] (3) uncertainty in the processing time required for application - Sluggish responses from CLP [F3; F6; WF3] [13]	- High uncertainty in permitting procedures: (1) uncertainty in the purchase amount of RE electricity from utility companies (case-by-case without justification) [H8; WH1] (2) uncertainty in CLP grid constraint and capacity to cater the need of community [H30; WH5] (3) uncertainty in the processing time required for application with limited staffs responsible for meter installation in the region [WH1] - Lack of justification for approval or rejection [WH5] - Problem in single phrase or three phrase electric power in the community [WH5]	- Uncertainty in the purchase amount of RE electricity from utility companies [S13] - Lack of justification for approval or rejection of the applied installation capacity [S8] - Slow responses for application [S8; S13]
(b) Uncertainty in illegal structure regulations	- Uncertainty if the installation will violate the illegal structure regulations [F2; F9; F21; F22; F23; F25; F27; F31; F36; F37; F38; F39] [14]	- Uncertainty if the installation will violate the illegal structure regulations [H2; H10; H11; H12; H13; H15; H22; H23; H26; H27] - Avoidance for troubles of discovering their illegal structures during installation [H31]	/
(c) Uncertainty in panel specification and installation standards	- Lack of standard on the specification and installation requirement of solar PV system [F2; F19; F22; F32; F38; F39]	- Lack of standard on the specification and installation requirement of solar PV system [H10]	/
(d) Lack of uniform regulations from different Government departments	- Example of potential community project in Shan Pui River: Lengthy application procedures to get concession of various government departments	- Complication on passing regulations from different departments (e.g. building regulations, fire regulations) [H3; H9; H25; WH1; H31]	- Complexity of bureaucracy [S9]
(e) Insufficiency of long-term sustainability plan in Hong Kong	- Lack of enabling sustainability target [F26; F35] - Uncertainty in the sustainability of FiT after 15 years (when SCAs expired) [F10; F14; F18; F30]	- Lack of enabling sustainability target [H10]	- Lack of Government promotion or sustainability target [S13]
(f) Monopolistic nature of the electricity market	/	/	- Concern on the fair judgement of approved installation capacity as utility also setup a subsidiary as a solar installer [S8]

[13] Some governments set up a renewable facilitation office to streamline application procedures.

[14] If alterations and additions to the existing building structure are involved to support the additional system components, prior approval and consent from the Building Authority under the Building Ordinance and Lands Department are required. (Electrical and Mechanical Services Department, n.d.) (Source: REFIT Workshop Briefing Document, p.32)

Table 5-11: Administrative, social and other barriers by FP and HLY interviewees.

Administrative barriers:			
(a) Lack of step-by-step guidance for FiT	- Confusion on: (1) application procedures [F8; F27; F39] (2) application time [F21; F41]	- Complexity in application [H9; H11; H20] - Confusion on: (1) application procedures [H23; H24] (2) application time [H2; H11; H14; H21; WH5] (3) application fee [H9]	/
(b) Uncertainty in the FiT contract	- Uncertainty in the sustainability of high FiT rate in the coming 15 years [F18; F22; F41; WF2] - Perception of 15-year FiT contract as too short [F30]	- Uncertainty in the sustainability of high FiT rate in the coming 15 years [H14; H24; H28] - Perception of 15-year FiT contract as too short [H11]	- Uncertainty in the continuity of FiT and its ability to influence the general public [S10]
Social barriers:			
(a) Complaints from neighbourhood	- Complaints on reflection [F4; F40] - Complaints on poor aesthetic [F20]	- Complaints on reflection [H10; H20] - Complaints on poor aesthetic [H14; H20] - Opposition out of cultural beliefs of dark coloured PV panel as unpropitious [WH3]	- Needs in balancing the view of solar and non-solar households [S12] - Growing complaining culture [S12] - Complaints on the aesthetic value and violation of DMC by some residents [S11]
(b) Lack of examples in the community	- Lack of proven cases of installation for peer learning [F9; F12; F19; F22]	- Lack of proven cases of installation for peer learning [H9; S12]	/
(c) Concern on privacy issue	/	- Risk of more outside workers coming into the community (especially with celebrities living in the community) [H10; S12]	/
Geographical and space constraint :			
/	/	/	/
Lack of Personal interest			
(a) Lack of motives to care about the environment	- Low priority for environmental action [F1; F14; F19; F39; F41]	- Low priority for environmental action [H16; H20; H26]	- Perceived minimal positive externality of installing solar PV to the environment and no responsibility to take green action [S10]
Split incentives:			
(a) Uncertainty in the continuity of investment and return of system as a tenant	/	- Possibility of moving out if owners did not renew the lease [H21]	/
Others:			
(a) Concern on aesthetic value	/	-Visual impacts of rooftop solar PV panels [WH3; WH5]	/

5.6. The introduction of FiT Scheme was a missed opportunity for the government to utilise community platforms in order to accelerate low-carbon transitions

5.6.1. Opportunities for the government to engage the communities in delivering a more rapid growth of solar for a low-carbon Hong Kong

Our study found that the two communities possess four critical favourable conditions that the Hong Kong Government can use as an opportunity to mobilise the resources embedded in the communities in order to accelerate solar deployment in Hong Kong. These four favourable conditions are:

(1) The communities have *rich solar resources* and sizeable household numbers; the potential to *achieve economies of scale* in deploying solar.

(2) Residents were able to *envision a solar future* in their communities and in Hong Kong. They envisioned their communities becoming solar cities, and took pride in it. One participant in the HLY workshop envisioned that:

> "呢個唔係一個短暫，一年、兩年嘅 project，因為呢個我地裝左十年嘅嘢，咁樣係咪佢可能長遠嘅少少，整一個 project 將我哋康樂園叫做太陽城，即係有一個大啲概念，有一個樣野畀啲細路知道，呢個係一個我哋一個遠景呀、我哋一個遠景，即係如果我哋一個……成個住戶成個屋苑都冇一個遠景嘅，咁即係就變咗自己做自己嘢囉, 係咪先。" [15]

(3) Many of our interviewed householders and workshop participants *recognised that the totality of the public values* of installing solar PV in their communities goes beyond economic benefits to environmental and social ones, and beyond their own community to society at large. Figure 5-6 shows that our interviewed householders gave high scores across economic, environmental, and social values related to solar deployment, with environmental value scored the highest, followed by social values.

It is important to note that many interviewees emphasised that economic benefits were important, but not the most important motivations for them to explore the use of solar. One solar householder in FP emphasised the way in which he recognised that the values of making the first move was greater than his own personal economic gains. He

[15] English translation: "This is not a short-term, one or two year's project. As this system will be installed for ten years, and is it possible to think in the long-run, to start a project and call Hong Lok Yuen as a "Solar City", a huge concept like this. Then we can let the next generation knows that this is our vision. I mean if the whole community do not have a vision, then we will turn out like we working on an individual base, not a community, isn't it?"

was keen to be a pioneer and to demonstrate the conceptual viability of a "nice" solar house for his community. He noted:

(4) "如果裝咗，啲人黎探我地，咁就睇到下太陽能，呢個意識又加強咗，屋企人亦都因為有呢樣野，而係加自覺去環保。我就好想除咗我地自己，咁希望周圍都有，咁其實成個社區有咁嘅意識，就更加重要嘅。" (F3)[16]

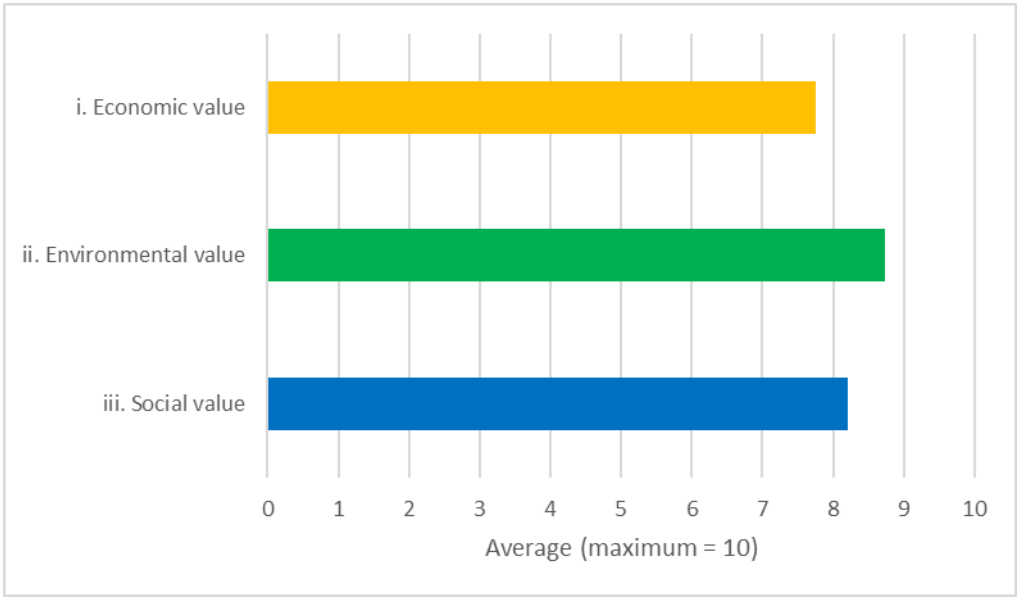


Figure 5-6: Economic, environmental, and social values of solar PV installation perceived by FP and HLY interviewees (n=71).

(4) There exist high-capacity actors and strong social networks in the communities, and the communities themselves have a high capacity to act collectively to achieve goals that are desirable for the whole community.

As discussed in the Findings section, a number of high-capacity and potentially influential actors of solar deployment were identified in the two case communities. Some of them are retired senior government officials and senior executives of Motorola, and many are well-educated professionals. The FiT has aroused interest in installing solar PV among this group of high-capacity residents who were enthusiastic in regard to the prospect of solar.

These two communities also have no shortage of successful experiences of community-wide environmental initiatives. These positive experiences in the communities appeared to enhance their confidence to envision a more ambitious solar future in their communities and their

[16] English translation: "If I installed the system, and when there are people come and visit us, they will also notice the PV system and it can raise their awareness as well. Even for our families, the PV system will also remind us to enhance our environmental awareness. And to be honest, I would like not only ourselves, but also our neighbours, we would like to see the systems everywhere, and I think it is more important that when there is the sense of awareness in the whole community."

desire to develop more solid ideas about how possible problems could be addressed collectively.

In FP, numerous recycling initiatives, such as the collection of old and unused items, provided evidence to show that this community has a high capacity to act collectively and to practice environmental-friendly behaviour in their everyday lives (F3). In relation to solar deployment, some FP residents suggested setting up a community energy cooperative with reference to experiences in Sungdaegol, a district in Seoul in which a community energy cooperative set up by local residents provides technical support, market information, and environmental education to foster solar adoption. Some participants of the FP workshop explained that they believed such an energy cooperative based in FP would play an important role: If their solar installers close down, they could still seek technical support from the FP energy cooperative which should be technically competent and could help to remove some of the householders' technical concerns.

5.6.2. An opportunity was missed in a phase of confusion, as many interviewed householders adopted a wait-and-see attitude

Although the FiT did arouse interests in solar PV adoption in the communities, many interested householders adopted a wait-and-see attitude. There is no evidence to suggest that the experiences of some of the first-movers of solar householders were consolidated and stimulated a noticeable growth of new solar projects. Individual actions, rather than collective efforts, prevailed in the two case communities.

Some residents commented that the first year of the FiT policy was "a phase of confusion (混亂期". As a result of this confusion, householders' enthusiasm about solar was diminished. When a participant in the FP workshop reviewed the first year of the implementation of the FiT, he noted:

"我自己期望即係錦綉如果五千户之中有 5% …如果香港期望係有即係 1-2% 係再生能源，我覺得錦綉係絕對可以 5%或者以上，咁但係而家係一種嘅即係混亂期，*混亂期其實係靠透過各自嘅住戶，自己嘅意欲有幾大，然後你咪先行者*，但係*供應商*我自己接觸得到的話呢，亦都係未成熟，佢唔係冇太陽能技術呀，佢可能會未嚟過錦綉安裝，佢唔理解呢度嘅斜頂、瓦頂、防水等呢啲問題，咁甚至係佢有啲供應商自己同管理處接觸，佢同我講佢話管理處否決呀等等呀，咁即係話呢個混亂期呢，都會導致到喺呢個初段呢，安裝係有但係都仲係少，咁係真係先行者走去做，你咪搵到自己唔同供應商囉，但係如果背後*有團體*好似浸大咁樣，咁*熱心地去累積呢 50 戶經驗之後*呢，亦都令到*趨向標準化*，到時可能有 A、B、C、D 餐黎到係去供應，咁後來者就比較容易地係去做，分享住戶心得又好，或者係供應商佢能夠已經係趨向一個標準化嘅價格，呢

個都要累積經驗，我估開頭嘅時候我而家需要*麻煩期*嚟㗎，因為有 50 戶之後呢就會順風順水，希望有 250 戶嘅安裝咁樣。”(WF1)[17]

Based on our interview and workshop data, there were three sources of confusion encountered by the interested households in FP and HLY:

(1) ***From solar installers***: many perceived that there was no reliable solar suppliers to deal with technical issues;

(2) ***From the MOs***: many perceived that MOs failed to provide them clear guidelines on technical and aesthetic requirements on their solar systems;

(3) ***From CLP***: many perceived that there was a lack of transparency, consistency, and certainty in CLP's permitting process.

5.7. Hong Kong's recent solar policy initiatives are in line with a global trend, but Hong Kong is in general lagging behind in setting a clear solar target and an advanced energy policy framework

Urban solar in leading cities has increasingly become a global trend. Many cities, including New York, London, and Seoul, have been escalating their solar deployment by upwardly revising their solar targets, introducing more comprehensive policies and regulatory frameworks, and exploring various approaches such as community-based solar developments to complement government-led or utility-led RE projects.

While the introduction of the FiT Scheme is a major step forward in Hong Kong solar deployment, Hong Kong has been lagging behind other major world cities in the development of urban solar. As shown in Table 5-12, Hong Kong has moderate solar resources (in terms of solar radiation) which is not the highest among these selected cities, but is also not the lowest. However, in terms of solar targets, Hong Kong is not comparable to other major cities; Hong Kong lacks an explicit solar target and only recognises a realisable RE potential by 2030 based on the current technology level at 3-4% (Council for Sustainable Development, 2019;

[17] English translation: "I expect if there is 5% among the 5,000 households in Fairview Park… If there are 1-2% of electricity in Hong Kong comes from RE, I think Fairview Park can definitely achieve 5% or more. However, these days are sort of a chaotic period, it depends on households' self-interests to become the first-mover. However, the suppliers that I contacted before are still not mature. I don't mean that they do not have the PV system technology, but the experience to install solar PV panels in Fairview Park. They may not understand the problems of the inclined roofs, tile roofs and the waterproofing work in Fairview Park. Some suppliers may have to contact the MO individually and end up telling the customer that the MO has rejected the project. This chaotic period leads to a limited case of installations which are mainly those first-movers, and they have to find suppliers by themselves. However, if there is a strong backup like HKBU which collects the experience of 50 flats, it can lead to standardisation. At that time, maybe the supplier lists will be shortened to only a few popular options and it is easier for the latecomers to follow. No matter it is experience sharing among households or a standard price among the suppliers, it is all about experiences. I guess it will be troublesome in the beginning, and things will go smoothly after the first 50 installation cases. I hope there will be 250 households who will install the PV systems eventually." (WF1)

ENB, 2017). London, which is less resourceful in solar resources than Hong Kong, has set a solar target of 1 GW by 2030 and 2 GW by 2050 (Mayor of London, 2018).

The FiT supplemented by the RE certificate system is a major RE policy in Hong Kong. Some other RE policies, such as renewable portfolio standards, which has been commonly adopted in other cities such as Seoul, have not been introduced in Hong Kong. The actual number of solar households in Hong Kong is also substantially lower than in other leading cities. There were about 920 solar prosumers from the residential sector in Hong Kong as at September 2019 (compiled from data provided by CLP and HK Electric) while Seoul has roughly 34,000 solar households in 2017 (Byrne et al., 2017; D.-s. Kim, 2017).

Table 5-12: An overview of socioeconomic features of and solar policies in Hong Kong and other cities in the world

	London (UK)	**Munich (Germany)**	**New York City (US)**	**Sydney (Australia)**	**Foshan (China)**	**Kyoto (Japan)**	**Seoul (South Korea)**	**Hong Kong**
Population by city (2016)	8,799,000	1,543,000	8,538,000	4,824,000	7,463,000	1,475,000	9,806,000	7,336,600
Global rank of GDP by country (2017)	5th	4th	1st	13th	2nd	3rd	12th	2nd (HK: 33rd)
GDP by country (2017; in billion US$)	2,622	3,677	19,390	1,323	12,238	4,872	1,531	341
National level socio-economic and political features	Central government can dictate local governance activities	Local states have the right of "self-government"	Democratic country and states retain certain level of sovereignty	Democratic country similar to the UK system	Centralised, authoritarian country	Democratic country; Post-Fukushima energy landscape	Democratic country that has a long history of military dictatorship	Democratic legislative system under the sovereignty of China
Global rank of GHG emissions by country (2014)	17th (494 $MtCO_2e$)	10th (817 $MtCO_2e$)	2nd (6,319 $MtCO_2e$)	16th (523 $MtCO_2e$)	1st (11,601 $MtCO_2e$)	8th (1,322 $MtCO_2e$)	13th (632 $MtCO_2e$)	1st (11,601 $MtCO_2e$)
Electricity markets	Liberalised	Liberalised	Liberalised	Liberalised	Deregulating	Deregulating	Deregulating	Regulated
Solar targets by city	1 GW by 2030	100% RE by 2025	350 MW by 2025	30% RE by 2030	1.5 GW by 2020	475 GWh from residential solar PV by 2020	1 GW by 2022	N.A.
Daily solar radiation (kWh/m^2)	2.8	N.A.	4.0	N.A.	N.A.	N.A.	4.9	3.6
No. of residential solar PV prosumers by country	755,000 (2015)	1,396,000 (2015)	1,300,000 (2016)	1,937,000 (2018)	465,000 (2017)	2,053,000 (2016)	34,000 (Seoul only, 2017)	N.A.
Major RE Policies	• FiT • Solar Leasing • RECs • RE Bonds	• FiT • Net Metering	• Net Metering • Solar Leasing • RECs • RE Bonds		• FiT • Solar Leasing	• FiT • Net Metering • Solar Leasing • RECs • RE Bonds	• FiT • Net Metering • Solar Leasing • RECs • RE Bonds	• FiT • Solar Leasing • RECs • RE Bonds
Solar community engagement approaches (selected examples)	• Neighbourhood solar cooperative • Solar empowerment zone • RE provider exchange platform	• Solar urban planning as the government tool	• Solar partnership between government and university • Solar empowerment zone • Microgrid energy trading platform • Solarize Brooklyn programme for providing group pricing, discounts and free roof assessments by experienced solar installers	• National policy support under Mandatory RE Target • Pilot p2p energy trading platform	• Entrepreneurial cooperation in prosumer development facilitated by local government • Urban village as base for solar community	• Government initiated and developer-driven prosumer development integrated with smart homes • Keihanna new city as site for solar prosumers	• Grassroots prosumers' communities promoted by city government • Community coupon scheme for energy trading between prosumers and consumers	• FiT policy • RE certificates

Key references: Authors; sources for ***New York City***: (CUNY, 2016; Shah, 2014) ; ***London***: (Fuller & Bulkeley, 2014; Mayor of London, 2018); ***Munich***: (Stadtwerke München, 2018); ***Sydney***: (City of Sydney, 2017; Localvolts Pty Ltd, 2018; Vorrath, 2018); ***Foshan***: (Mah et al., 2017; Office of Foshan People's Government, 2014); ***Kyoto***: (Energy Policy Division of Environment Bureau, 2015); ***Seoul***: (Byrne & Taminiau, 2015); ***Hong Kong***: (Lo et al., 2018); **Others**: (European Commission, 2017; WRI, 2017)

6. POLICY IMPLICATIONS AND RECOMMENDATIONS

6.1. The government needs to develop a community solar policy in Hong Kong

6.1.1. In the *long-term decarbonisation strategies that the government has planned to develop by 2020*, the government needs to strategically prioritise community development as a viable local low-carbon option, rather than prioritising the option of importing more low-carbon electricity from Guangdong.

Our study found that the two case communities have rich solar resources. They alone have the potential to contribute to 1/10 of the government estimates of 660 MW of solar that could be realised by 2030. The communities possess a great variety of capitals that could foster their ability to achieve ambitious solar goals. As mentioned in the Sustainable Development Goals (SDGs) 2030 report (Reddy, 2016), local authorities, indigenous peoples, and civil society will be involved in the SDGs 2030 (United Nations, 2015). The importance of the plurality of energy sources and solutions was mentioned in Goal 7. The SDGs 2030 report therefore recognises the important role of local energy solutions in delivering more sustainable futures.

6.1.2. The government needs to set a *clear and meaningful solar target* to provide guidance for solar development in Hong Kong

As discussed, the Hong Kong Government does not currently have a RE (including solar) target. The government's Hong Kong Climate Action Plan 2030+ released in 2017 only stated that Hong Kong had about 3-4% of realisable RE potential from wind, solar and waste-to-energy exploitable between 2017 and 2030 (ENB, 2017).

In our study, interviewees from households and other stakeholder groups converged on the concerns about FiT policy sustainability in the absence of explicit targets. Targets were considered essential to leading strategic plans and actions in terms of an energy transition, which in return would help sustain the FiT (F26; H10). An interviewee from a utility suggested that the absence of explicit RE target could not provide justification to households or even the government itself to commit to RE development and energy transition in Hong Kong (S15).

6.1.3. The government needs to *better develop and utilise solar resource assessments to support evidence-based target-setting* for solar power

Understanding the solar potential allows policy-makers to determine what is potentially achievable by harnessing solar energy. This can aid in setting the solar PV target and enhancing solar PV deployment within a specific timeline.

Numerous local studies have estimated Hong Kong's solar PV potential to range from 5.9% all the way to 35% (Mah et al., 2018b). In this study, we adopted a multi-method approach to assess solar resource potential in the two case communities. We used a GIS approach to estimate the community-wide rooftop areas suitable for solar PV installations, as well as on-site household solar assessment, household interviews, and site observations. Our combined datasets suggest that the two case communities have rich solar resources. They alone have the potential to contribute to 1/10 of the government estimates of 660 MW of solar that could be realised by 2030. This study has showed the importance of solar resource assessment in enabling an evidence-based target-setting and policy-making of an energy technological option.

6.1.4. The government needs to *strengthen the FiT*. Four key areas that worth particular attention are: (i) revisiting feed-in tariff rates, (ii) opening up the option of net metering, (iii) strengthening regulatory measures to improve transparency of the permitting process, and (iv) reconsidering the role of the two power utilities as the primary agents for solar deployment.

It is important to note that if solar is deployed on a larger scale, the potential tariff impacts of the FiT could become a source of public controversies. The government needs to pay sufficient attention to the following three areas: (i) how to set the price level and finance the FiT subsidies so as to modulate electricity price increases; (ii) how to build-in adjustment mechanisms to ensure the FiT is responsive to the changing market situation (e.g. further cost reductions), and to avoid windfall profits of solar householders and investors; (iii) how to address the issue of cross-subsidisation which is associated with inequity - when a majority of the public as electricity consumers would have to share the costs but the FiT subsidies would be benefited by a privileged group who owns rooftops.

The potential tariff impacts of the FiT are of particular concern because the current RE certificate system does not function well. Our study found that the sales of the certificates are of limited scale, and there was a small number of buyers in the market. The government needs to develop strategies to enhance attractiveness of the RE certificate system, for example, through lowering the prices of the certificates whilst exploring other financial models.

Our study also found that the choice between gross and net metering also needs attention as the FiT Scheme continues to evolve in Hong Kong. A gross metering system, which pay solar householders for every unit of generated electricity, is currently adopted in Hong Kong. In comparison, a net metering system, which pays a solar householder for the surplus solar electricity exported to the power grid only, has the strength of creating strong incentives for householders to reduce electricity consumption and therefore optimising the household

electricity consumption and production. Net metering systems, however, need to be supported by retail electricity pricing systems that can effectively reflect the costs and benefits of consumer decisions on energy saving and solar generating behaviour. An overview of the adoption of gross/net metering in FiT policies in Germany, Japan, and China is provided in Appendix 4-2.

6.1.5. The government needs to deploy an intelligent mix of policy instruments beyond the FiT to effectively address the multiple barriers faced by prospective solar householders. Four prioritised policies include: (i) a green technology policy, (ii) a community solar empowerment policy, (iii) regulatory measures (to target building-related institutional barriers), and (iv) economic measures.

Feed-in tariffs have been found as one of the most effectively RE policies but their actual implementation and policy effects often varies in different context. In Hong Kong, we found that the FiT was effective, but only to a limited extent. Many prospective solar householders in our two case communities have adopted a wait-and-see attitude as their multiple barriers have remained largely unresolved. Together these barriers are stalling progress on solar deployment in these prospective solar communities.

The government therefore needs to give closer attention to policy mixes and a comprehensive, rather than the choice of a single “most effective” policy instrument as this probably does not exist because of the complexity of steering energy transitions through policy. It is important for the government to use the combinations of policy instruments, mobilise different stakeholders, and to consolidate synergies to improve policy effectiveness.

Based on our study and policy experiences worldwide, the government needs to develop a more comprehensive policy mixes that should include at least four main types of policy initiatives that can target at three key stakeholder groups as summarised in Table 6-1 and illustrated below:

Table 6-1: An intelligent mix of policy instruments needed for effective community solar deployment.

Policy initiatives	Targetted stakeholder groups	Key components/ mechanisms of the policy initiative
(1) A green technology policy	▪ Solar installers; green technology manufacturers and component suppliers	▪ Promote accreditation schemes for local solar installers ▪ Provide sufficient incentives to utilities and new market players to develop new business models for community solar projects ▪ Give priorities to support demonstration and trialling of community solar projects
(2) A **community solar empowerment policy**	▪ MOs, NGOs, academic units, etc.	▪ Provide tax exemptions for MOs or NGOs, etc. which initiates community-based solar projects.
(3) Regulatory measures to address issues related to solar projects in common areas of a residential estate or illegal structures of a building	▪ Developers, landowners, MOs	▪ Identify possible areas for the government to exercise discretions in view of public interests (for solar power can bring environmental and social benefits) so as to i) allow change of Planning xxx; ii) allow solar projects to be built in building premises that do not involve major illegal structure
(4) Economic measures	▪ Prospective solar householders	▪ e.g. direct subsidies and tax exemptions for solar householders

(1) ***A green technology policy***: The proposed green technology policy should give attention to:

- The promotion of *accreditation schemes for local solar installers:* Since the establishment of FiT, the number of Solar PV contractors increase significantly. However, based on our understanding, residents have expressed reservations on the professional standards among the contractors. Such accreditation systems or professional codes for solar PV industrial practitioners could enhance public trust in the green technology market.

- The role of government in facilitating *demonstration and trialling* of solar PV applications in communities: The government can set up a solar PV testbed in prospective solar communities that have high solar resource potentials, and offer incentives to MOs, residents' associations, or NGOs to set up showroom of

options of solar technologies, or information centre to support solar education in communities. Experiences on installing solar in a community would then be gradually built up and consolidated so that residential can develop solutions to address remaining problems. Many also perceived that the MO could proactively assume a facilitating role: MOs can standardise options for panel technologies, budget plans, etc. for interested households.

Box 1. Case example 1: Kyoto - Accreditation systems for solar personnel

The Kyoto government has established an accreditation systems for solar personnel. Trained and accredited solar personnel can then be eligible to provide customer services, initiate promotional and marketing events. As of the end of October 2018, there were 268 solar personnels registered in the system. The Kyoto government has already planned to expand this accreditation system to other energy technologies, including Home Energy Management Systems (HEMS) and Energy management system (EMS)(Kyoto Prefecture, 2018).[18]

Box 2. Case examples 2: Foshan - Integrity Management System (誠信管理) for solar PV projects

In order to better monitoring the misconducts from the solar installers and solar PV projects, such as the legal disputes, accident liabilities, and complaints on product quality, Chancheng District, Foshan implemented a three-year trial to put solar industry under the Integrity Management System from March 2019 (Foshan Chancheng Justice Bureau, 2019).

While the details for the Chancheng District solar industry integrity management system is still pending, Foshan City Government has experiences in utilising such system to monitor other industries. For instance, the “Foshan City Construction and Housing Industry Integrity Manage System” applies a grading system for the industry. Each company will be assigned an equal number of points when they first join the system. The points will be added or deducted based on a set of criteria for merits and misconducts. The points will also be adjusted each year to reflect the most updated integrity performance (Foshan Housing and Urban-Rural Development Bureau, 2019).

[18] https://www.pref.kyoto.jp/kankyo_haku/documents/10-3-1_30.pdf

(2) ***A community solar empowerment policy***: the government needs to introduce this policy to provide incentives to MOs, NGOs or other parties which facilitate the developments of solar in communities. A community solar empowerment policy is critically important to stimulate a change of role of MOs – one of the most critical actors of community solar – from a "regulator" to a "facilitator" of community solar developments.

As one interviewed householder in FP noted:

"政策上包括政府個政策，就向個社區有政策 which is 管理處嘅規條啦，如果管理處嗰度唔係以一個 regulator，純粹係 regulator 就管制嘅心態，而係一個推動嘅心態，一定會好唔同啦，當然要管理處自己有個光環向上高，就係話如果做得到，佢都威嘅。但係有冇野令到佢覺得威而去做呢，而家又好似佢冇咩需要呀，冇乜經濟誘因。個管理處亦不嬲好低調嘅，做佢做嘅一盤管理嘅生意姐，咁所以就未必係會，反而呢就係覺得，有啲野有啲經濟誘因，而係向政府政策都推動到。譬如而家你睇到嗰個停車場[19]，係光禿禿嘅，咁雖然有啲樹，但啲樹呢遮唔到啲車嘅，咁如果係可以加一啲太陽能板嘅一啲 shelter，一就係可以係吸太陽能啦，發到電啦，發電係可以儲起黎，自己夜晚夠街燈呀，夠可能加啲風扇呀。另外呢，就啲車冇咁熱，就車需要嘅撻車之後嘅冷氣就可以減啦，廢氣又少咗啲啦。"[20]

The householder continued to note that he did see the government has a role to play in incentivize the MO to support solar projects in common space in FP, by suggesting the government to exercise discretions of the Building Ordinance for public interests . He noted that:

"以而家個建築物條例黎講，就如果係加個咁嘅蓬，就已經係違反地契架喇，因為你係可以起嘅樓面面積，同埋個覆蓋率呢，係已經限咗。但係其實呢如果睇反政府嘅，如果地政署嘅一啲執行嘅守則，其實向好多情況下，係好多，就如果你以一個*公眾利益*嘅理由向佢申請一啲豁免計算呢，其實做得到嘅，包括咩野呢，包括係有啲停車場嘅出入口，加個更亭，你令到可以管理好啲啦，或者係加啲公眾設施，係唔會令到是但一個居民係個別受益架呢，如果係係 for 整

[19] The car park mentioned here is owned by the developer, managed by the MO.

[20] English translations: "And in terms of the policies, which include public policies as well as regulations set by the management office in a community level, if the management office does not treat themselves as a regulator, but a pusher to encourage others to take action, the whole situation can be very different. It requires incentives for them to do so obviously, if they can installed solar panels in the public area, they will have a good reputations as well. However, the question is whether there are anything that can bring them a good reputations, and it seems that there are less economic incentives. Government has already been a good enough pusher. For instance, the car park has nothing there at the moment. Despite of the few trees, they cannot become shelters for the cars. If they can set up some solar panels and create a shelter, it can generate solar power for the street lights at night and possibly fans. The shelters will lower the cars' temperature, it can then reduce the air conditioner used after starting the car as well as the emission."

個社區嘅健康、安全，嗰啲係有福祉架呢，咁*其實都有例子係豁免*嘅，如果話一個*太陽能嘅一個遮陰棚，又可以發到電，發到電又係回反去管理公司，管理公司又將呢個當係一個基金去改善嗰個社區架呢*，咁其實呢個都可以我覺得*值得去推動嘅，呢個都唔係淨只錦綉*。" [21]

This community solar empowerment policy can provide incentives to encourage MOs to explore various ways to facilitate solar deployment. In FP and HLY, residents generally have high income levels and they have the rooftops to install solar panels, but they cannot afford the time to study the relevant market information of solar and to vet solar installers (Participants in WH1). Comparing with other places such as the UK, there are case examples that a MO can invite quotations from solar installers, and develop internal specifications specifically for one housing estate for householders who would like to install the Solar PV systems.[22] There are also similar policies in the US, an initiative, Solarise Brooklyn, helped the communities to select two experienced installers as well as offering group pricing and free roof assessments. Householders can then choose for the supplier based on that specification to reduce time on making decisions. In long term, it can attract more households to install Solar PV systems (Shah, 2014).

In addition, the government may set up a "Community solar empowerment fund" under this community solar empowerment policy. Although the FiT can shorten the pay-back period, the high upfront costs and unknown costs of maintenance have remained as one of the critical concerns among householders. The Environmental and Conservation Fund (ECF) which was set up by the government has actively encouraged housing estates to introduce many different kinds of environmental protection practices over these years. HLY, for example, received an ECF several years ago to set up a food waste recycling project in their community (S12). Some stakeholders suggested that the ECF could provide funding support to community

[21] English translations: "Building a solar panel shelter would be against the land leases under the existing Building Ordinance as the floor area and the site coverage are fixed by the land leases. However, if you study the government or the regulations for the land departments, there are many circumstances, yes many, that you can apply for some exceptions to increase the public benefits in the local area. These applications will usually be approved. So what does it include? It includes setting a security guard post at the exit of a car park to improve the management quality, or setting up some public facilities which will not benefit specific individuals. For applications which aim to increase the public health, safety, or bring positive effects to the community, there are successful cases for them to apply for an exception. If a solar panel shelter can generate power, and the management office can use the profit generated by the system to make improvement to our community. I think that it is worth to try, and I don't mean only in Fairview Park."

[22] Source: A sharing of one's own experience by a participant of the HLY community workshop who also owns a house in the UK.

projects related to solar power. Community residents and/or social groups, MOs, for example, who received the funding support would be required to, for example:

- promote community engagement/ environmental education on solar power;
- share experiences on solar installations on e.g. installation processes, smart ways to choose solar installers;
- set up two to three demonstration solar houses in a community so that residents can visualise the benefits for the community to deploy solar.

(3) ***Regulatory measures***: regulatory measures are needed to address institutional barriers in relation to (a) common areas, e.g. car parks, parks, in communities which often are suitable siting locations for solar PV projects, and (b) rooftops of residential buildings which may be associated with illegal structure. Some interviewed householders suggested that the government may consider exercising discretion in such cases for the public interests that solar power can bring environmental and social benefits. Exercising such discretions will certainly be a source of public controversies in Hong Kong. A case example in Taiwan can serve as a reference for the government to regulate and standardise solar projects on rooftops which have illegal structures.

Box 3. Case example 3: Taiwan – The use of regulatory measures to regulate solar associated with illegal building structures

The Taiwanese Government has introduced regulatory measures to regulate solar PV installation on rooftops which have illegal structures. Rooftop solar PV installations are: (1) either exempted from obtaining licenses and approvals; or (2) permitted for installation under certification by strcutural engineers, depending on the conditions of solar PV systems in relation to the illegal structures.

Four types of rooftop solar PV systems with illegal structures are identified, namely: (i) Structure of solar PV system independent from illegal structure (Types A&B); (ii) Structure of solar PV system integrated into illegal structure (Type C); and (iii) structure of solar PV system mounting on top of illegal structure (Type D). (1) applies to Types A, B, and C while (2) applies to Type D.

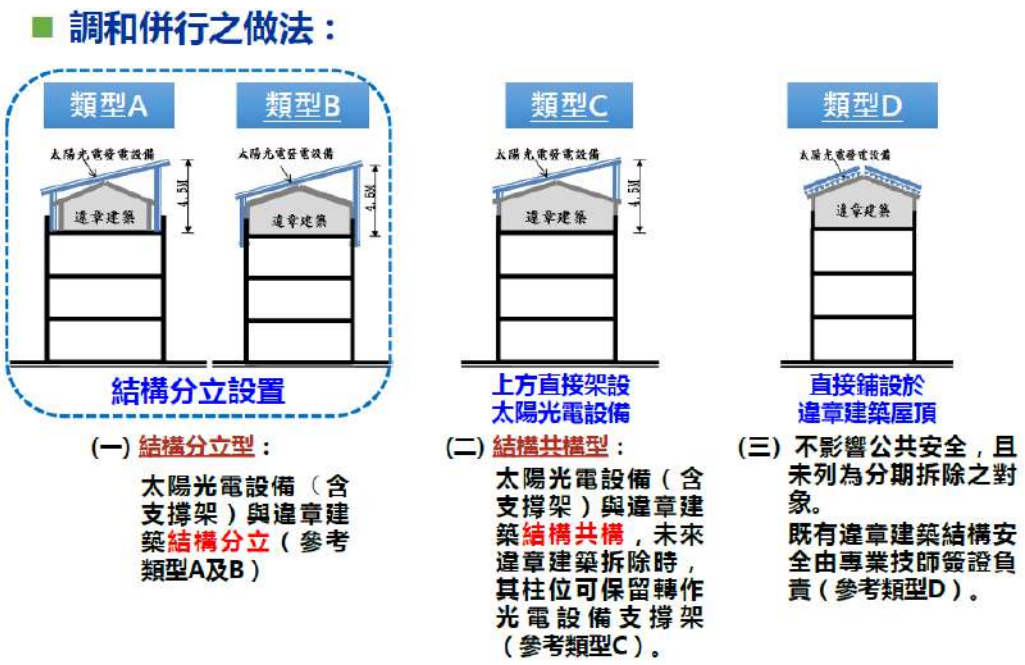


Figure 6-1: Four types of rooftop solar PV systems with illegal structures in Taiwan.
Sources: (Chen, 2017)

(4) ***Economic measures***: The FiT was perceived as effective in shortening payback period, but was not sufficient to address many other barriers faced by our interviewed householders in FP and HLY. Tax exemptions and direct subsidies for residential solar PV investments were suggested by interviewees. Tax exemptions appeared to receive a higher level of public acceptance when compared with direct subsidies.

6.1.6. The government needs to revisit and consider revamping SCAs to enable community solar as a viable resource for Hong Kong in meeting low-carbon energy challenges

Grid access – allow third party access to existing power grids is a critical factor of accelerating the development of solar PV. Our study found that the government needs to strengthen its regulatory framework that govern the economic and environmental performance of the two regulated utilities. The EMSD and the two power companies have also drawn up technical guidelines to facilitate grid connection of RE power systems(LegCo, 2010). However, many of our interviewed householders, workshop participants, and interviewed stakeholders raised concerns over whether the utilities have genuine motives, and strong enough incentives to promote solar. Interviewees were sceptical and questioned whether the utility has imposed excessive requirements on the permitting procedures, and whether the utility has invested sufficient manpower to ensure applications are handled in timely manner.

Two changes can be introduced into the existing SCAs to at least partially build up public trust in the utilities. Firstly, the SCAs can set up a built-in *incentive mechanisms* to incentive the utilities to support *community solar projects*. The government may consider refining the SCAs by introducing a community solar incentive factor. A similar incentive mechanism has already been introduced in the existing SCAs to provide economic incentives for the utilities to invest in RE projects – although the incentives are widely regarded by many as immaterial.

Secondly, it is also important to note that the introduction of *renewable portfolio standards* – that set a minimum requirement of RE electricity in utilities' electricity generation mixes are perceived by some interviewed households and stakeholders as highly important, if not essential, to provide very clear guidance from the government to steer utilities' investments towards sustainability, and also provide sufficient incentives to utilities to make commitments to support solar deployment.

Opening up the electricity market has been a matter of public debate in Hong Kong for more than two decades. Whether, and how, the current vertically integrated and monopolised electricity market in Hong Kong needs to be opened up in order to accelerate low-carbon transitions would require timely and effective public consultation.

Box 4. Case example 1: Hong Kong - SCAs (2018/2019-2033) introduce RE incentive factors for RE performance

Under the existing SCAs between the Hong Kong Government and the utilities (CLP and HK Electric), the permitted rate of return for conventional energy is fixed at 8%. In addition, RE incentive factors were introduced to encourage the utilities in promoting RE deployment and RE generation. The extra permitted rate of return for the utilities in RE generation is capped at 0.05% per annum, and the extra permitted rate of return for new connection of RE systems and regular RE generation is capped at 0.005% per annum (HKSAR et al., 2018; LegCo, 2018a). Three types of RE incentive factors are introduced (Figure 6-2):

(1) Ratio of RE electricity generation to total volume of generation;

(2) Number of new RE systems connected to the grid; and

(3) Number of RE systems that have regular electricity generations.

RE Performance	RE Incentive Factor
Ratio of RE to total volume of electricity generated	
>5%	+0.05%
≥2% and <5%	+0.025%
≥0.75% and <2%	+0.02%
≥0.5% and <0.75%	+0.015%
≥0.25% and <0.5%	+0.01%
<0.25%	0
Number of new Renewable Energy Systems connected	
For a calendar year ≥60 and <120 new connections	+0.00125%
For a calendar year ≥120 new connections	+0.0025%
Number of RE systems that generate electricity regularly	
For a calendar year ≥120 new connections which generate electricity on a regular basis	+0.0025%

Figure 6-2: A summary of performance-based RE incentive factors for the utilities. Sources: (HKSAR et al., 2018; LegCo, 2018a)

6.2. In a broader perspective, the government needs to develop a community-based energy planning and policy-making system

From a broader perspective beyond the specific energy technology of solar PV, the findings of this study suggest that in a longer term a community-based energy planning and policy-making system is needed in Hong Kong. This study showed that community inputs could be substantial in shaping and enhance energy planning and policy-making in many important aspects. It is important for the government to engage citizens in our energy governance system.

A community-based energy system is one that would deliver its low-carbon and sustainability goals through engaging communities. This community-based energy model will have five features that set it apart from the conventional policy-making system in Hong Kong. The five features are:

(1) *A citizen centered approach*: which fully recognise the values and potentials of engaging the public and communities in energy policy-making.

(2) Utilising "c*ommunity" as a governing platform* in which the government can garner and mobilise rich, critical, and unique capacities that exist in communities to enhance its governing power to deliver rapid and deep low-carbon transitions. Our study found that

(3) An emphasis on *local (community scale) energy system optimisation* of local consumption patterns, solar generation, and local electricity storage systems. An expert panellist of the FP workshop suggested that:

> "因為錦綉係 residential area，咁所以我地係日抖嘅耗電量會比較細，如果發電量係好龐大嘅話呢，會有技術上嘅問題，咁或者我地需要係，試下嘗試係錦綉附近，其實都仲有啲地啊，如果能夠配合去起一啲工業嘅譬如工廠大廈啊，我見到譬如係元朗工業城啦、元朗工業區果邊呢，其實中電係好積極去批太陽能發電嘅，因為係日抖嘅時候，佢嘅耗電量好大，佢地係工業區，咁就算唔係工業區都有好多商業嘅活動。所以係日抖嘅時候都會開冷氣啊，要用好多電。咁嘅話呢，配合得到個發電量，相對嘅發電量，就會做到、solve 到頭先個技術嘅問題。我咁樣可唔可以咁講啊，咁所以如果我地需要配合嘅，咁暫時錦綉係純 residential area，如果係附近能夠，大家機會投資一啲工廠大廈，或者睇下我地要點樣有一啲大 loading 嘅設備呢，就會更佳好，更佳容易，我相信。呢個係我暫時所知嘅，技術嘅樽頸，嘅解決方案。" (FP workshop)[23]

[23]English translations: As FP is a residential area, there will be less energy consumption during daytime. If the power generation is too large, there will be generate technical problems. What we can do is that, we can try

(4) *Communities as innovation, demonstration, and trialling sites* for low-carbon transitions. Our study found that communities are important arenas for experimentation and demonstration activities of solar technologies. Such R&D activities that took place not in the laboratories but in the communities supplemented expert and technological knowledge. In HLY, for example, a resident who is also a solar installer was commissioned by his neighbour to install PV roofing tiles on this neighbour's rooftop. This solar roofing-tile project was the first of its kind in HLY, and one of the very few in Hong Kong. In this project, three parties - the solar installer, the decoration working and the solar householder - actively offered feedback to each other to optimise the installation of the roofing tiles that fit the community-specific contexts. The solar installer further offered feedback to the solar technology supplier to further improve the products. This interactive process that lasted for more than three months highlighted the existence of close social ties, patience, and strong commitment of the concerned parties in this community (S12; S14).

Our cases also showed communities are important platform for sharing and replication of successful experiences on solar applications in their neighbourhood. Many interviewed residents and workshop participants emphasised that they would like to share more peer experiences and knowledge as no one wants to be a guinea pig.

(5) *A participatory policy-making system* as an unpinning mechanism: Our study found that community inputs can make important contributions to each stage of energy policy-making, from agenda setting, to policy formulation, policy implementation, and policy evaluation as follows:

i. In the stage of *agenda setting*, a good assessment of potential solar resources of a prospective solar community would enable the government to make evidence-based policy-making and target-setting decisions. Our finding of the existence of rich solar resources in communities suggest that Hong Kong needs a policy shift from cleaner fuels (the use of more gas and imported nuclear to replace coal) to a new policy oriental towards urban solar;

ii. In the stage of *policy formulation*, a good understanding of the perceived barriers of prospective solar householders provide strong evidence to support a strengthening of RE policies to address not only economic concerns, but also a wide range of technical, institutional, and social barriers;

---

cooperate with other land user nearby, such as industrial buildings, like those in Yuen Long Industrial Estate. Actually CLP are actively approving solar power systems, as industrial estates has a high level of energy consumption, and even not industrial estates, there will also be commercial activities, they will use air-conditioner during daytime, which will also lead to a high level of energy consumption. In this case, it can match with the level of power generation, it can then solve the technical problem that I mentioned before. Again, for FP as a residential area, if anyone has the chance to invest on some industrial buildings, or install systems with a heavier loading, and it will be the best situation I believe. This is the solution of the technical problem that I have known so far. (WH5)

iii. In the stage of *policy implementation*, our study shows that community members could have been able to enhance implementation capacity by networking, pooling of resources (which include financial, human, and political resources, and expertise), experimentation (e.g. of different options of solar technologies), and gaining experience of possible solutions;

iv. In the stage of *policy monitoring*, end-user data from householders are critical to measure and check progresses (e.g. changes in attitudes and behaviours) against planned targets. Our study found that the FiT has not yet stimulated and mainstreamed solar although attitudes have changes (more supportive to solar) after the introduction of FiT; and

v. In the stage of *policy evaluation*, our interviewed households offered useful feedback on the effectiveness of the FiT, what effects it had (e.g. effective in shortening payback period, but less effective in address institutional barriers). Community inputs can thus inform policy-makers how to improve effectiveness of existing, as well as the development of new policies.

While energy policy-making policies (including solar) can be a challenging process, community inputs can strengthen current policy-making practice in Hong Kong. In essence, energy policy-making is a continuous learning, re-evaluation, and adjustment which needs continuous engagement with stakeholders (including community stakeholders). Inviting public inputs is a bottom-up approach which can complement expert and technological knowledge in important ways.

7. DETAILS OF THE PUBLIC DISSEMINATION HELD

This one-year project includes five types of public dissemination activities, which are: 1) internal meetings with governments / utility's senior executives, 2) the organisation of community workshops, 3) the publication of a Community Solar Guidebook, 4) the launch of Hong Kong Solar Partnership – under which a Solar Community Task Force and a Solar School Task Force were established, and 5.) Public seminars / consultancy papers / working papers. The list of the outputs of Public Dissemination is provided in Table 7-1.

The project team had meetings with government bodies including Environment Bureau (ENB) and Electrical and Mechanical Services Department (EMSD), and a utility company, CLP Power Hong Kong (CLP) to disseminate the research findings from this project. We also deliver the research findings via preparing consultancy papers and participating in focus group meeting organised by Council for Sustainable Development and EMSD.

The project results were also disseminated via workshops. Two solar community workshops were organised to the residents from FP and HLY. Furthermore, to promote environmental education in our next generation, we have established set up the Hong Kong Solar Partnership which organised workshops on RE education. Moreover, the project PI, Dr. Mah and research team member, Dr. Cheung have participated and presented the project outputs in public seminars to foster academic exchange in solar energy development.

Table 7-1: Outputs of Public Dissemination.

Date	Details of the activities	Appendix
1. Internal meetings with governments/ utility's senior executives		
20th August, 2018	Meeting with a senior executive from CLP.	/
4th September, 2018	Meeting with representatives from ENB and EMSD to discuss the solar development in Hong Kong.	Appendix 7-1
27th November 2018	Meeting with representatives from Environment Bureau, which includes: - Mr. Wong Kam-sing, Secretary for the Environment.	Appendix 7-2
20th May 2019	Sharing session with three representatives from EMSD.	Appendix 7-3
21st August 2019	Meeting with three representatives from EMSD.	Appendix 7-4
2. Community workshops		
23rd March 2019	30 Fairview Park residents shared their views on the feasibility of solar development.	Appendix 7-5
1st June 2019	22 Hong Lok Yuen residents shared their views on the feasibility of solar development.	Appendix 7-6
3. Community Guidebook		
6th December 2019	A guidebook entitled "Solar Community Guidebook" was published.	Appendix 7-7
4. Hong Kong Solar Partnership / Solar Schools		
September 2018	The Hong Kong Solar Partnership was launched. (Website: http://aesc.hkbu.edu.hk/hongkongsolarpartnership)	/
14th November 2018	The 1st Solar Schools task force meeting was held.	Appendix 7-8

8th June 2019	Hong Kong Solar Schools Workshop 2019 (香港太陽能工作坊 2019) was organised for schools about RE education.	Appendix 7-9
5. Public seminars / Consultancy paper / Working Paper		
1st August, 2018	The project PI attended the focus group meeting on "Public Engagement on Long-Term Decarbonisation Strategy" organised by the Council for Sustainable Development.	/
11th December 2018	The project PI presented on "Preliminary Results on Hong Kong Solar Energy Policy Research" ("香港太陽能政策研究初步結果") in the Workshop on Photovoltaic systems and the feed-in-tariff in Hong Kong organised by Department of Electrical and Electronic Engineering, The University of Hong Kong.	Appendix 7-10
29th April 2019	The research team member, Dr. Cheung presented on "Renewable Energy Policies for a cleaner Hong Kong " in the Workshop on Renewable Energy and Feed-in-tariff in Hong Kong" organised by Department of Electrical and Electronic Engineering, The University of Hong Kong".	Appendix 7-11
24th May 2019	The project PI presented on "Governing urban community energy through renewable feed-in tariff (REFIT) policy: Contexts, capabilities, and scaling-up mechanisms of two prospective solar communities in Hong Kong" in the Transdisciplinary Symposium on Environmental Health and Social Sciences jointly organised with David C. Lam Institute for East-West Studies (LEWI), Baptist University of Hong Kong.	Appendix 7-12
3rd June 2019	The project PI presented on "Using cross-disciplinary mixed methods to provide insights into the processes and outcomes of energy transitions in the socio-political, economic and environmental contexts in Asia"; and the research team member, Dr. Cheung presented on "Complementarity between conventional research methods and big data analysis: The case of Korea and Seoul nuclear and energy transition policy" in the Workshop on Data Analytics in Journalism, Social Science, and Business Studies organised by Centre for Business Analytics and the Digital Economy, David C. Lam Institute for East-West Studies (LEWI) and Department of Journalism, Baptist University of Hong Kong.	Appendix 7-13
11th June 2019	The project team prepared a letter to EMSD regarding the policy recommendation on solar communities in Fairview Park and Hong Lok Yuen.	Appendix 7-13
20th September 2019	The project team has prepared a letter to Council for Sustainable Development commenting on the public engagement document, "Public Engagement on Long-Term Decarbonisation Strategy" .	Appendix 7-14
6th December 2019	A working paper entitled "Policy mixes and the scaling up mechanisms of energy transitions: Insights from the renewable feed-in tariff policy and community solar in Hong Kong" was published.	/

8. CONCLUSION

This study explored the role of communities to make urban solar a viable resource for Hong Kong to meet low-carbon energy challenges. We found the FiT – the first major RE policy introduced in Hong Kong – played an important role in arousing interests in FP and HLY – two of the mostly promising solar communities in Hong Kong. The FiT was particularly effectively in shortening the payback period of residential rooftop solar. The FiT was however found to have limited effect. After the implementation of the FiT for 12 months, as of the end of September 2019, the FiT has led to a noticeable increase of new solar projects, but has not yet mainstream solar in Hong Kong's fossil fuel-based electricity system.

The FiT is a milestone of the RE development in Hong Kong. We, however, found that the introduction of this policy was a missed opportunity for the government to mobilise the unique and huge capitals embedded in our communities to realise a more ambitious RE goals.

One of the key findings of our study is that the government needs to introduce an intelligent mix of policy instruments beyond the FiT to effectively address the multiple barriers perceived by prospective solar householders in order to unlock the under-used solar potentials in the case communities.

The government also needs to introduce a more effective regulatory framework to create sufficient incentives to utilities to allow grid access by solar prosumers in the most efficient and economically viable manners.

In a longer term, in consideration of the potential of communities in enhancing the government's governing power to govern sustainable low-carbon/energy transitions, the government needs to develop a community-based energy planning and policy-making system.

REFERENCES

2016 Population By-census. (2016). District Profiles. from https://www.bycensus2016.gov.hk/en/bc-dp-major-hosing-estates.html

Byrne, J., & Taminiau, J. (2015). A review of sustainable energy utility and energy service utility concepts and applications: realizing ecological and social sustainability with a community utility. *Wiley Interdisciplinary Reviews: Energy and Environment, 5*(2), 136-154. doi: 10.1002/wene.171

Byrne, J., Taminiau, J., Kim, K. N., Lee, J., & Seo, J. (2017). Multivariate analysis of solar city economics: impact of energy prices, policy, finance, and cost on urban photovoltaic power plant implementation. *Wiley Interdisciplinary Reviews: Energy and Environment, 6*(4), e241. doi: 10.1002/wene.241

C&SD. (2016). *Hong Kong Energy Statistics: 2015 Annual Report*. Hong Kong.

C&SD. (2019). *Hong Kong Energy Statistics: 2018 Annual Report*. Hong Kong.

Chan, J. Y. (2019, 28 August). [FiT] CLP received over 4,300 applications expect to reduce about 30,000 tonnes annual carbon emission (【上網電價】中電接獲逾 4300 宗申請　料每年減約 3 萬噸碳排放量) *HK01*. Retrieved from https://www.hk01.com/%E7%A4%BE%E6%9C%83%E6%96%B0%E8%81%9E/368791/%E4%B8%8A%E7%B6%B2%E9%9B%BB%E5%83%B9-%E4%B8%AD%E9%9B%BB%E6%8E%A5%E7%8D%B2%E9%80%BE4300%E5%AE%97%E7%94%B3%E8%AB%8B-%E6%96%99%E6%AF%8F%E5%B9%B4%E6%B8%9B%E7%B4%843%E8%90%AC%E5%99%B8%E7%A2%B3%E6%8E%92%E6%94%BE%E9%87%8F

Chen, W.-T. (2017, November 16). It requires integrating 5,000 Green Energy Roof to become incentive (Text in Chinese). from https://e-info.org.tw/node/208497#1

Chung, E. (2017, November 22). Gov't announces plan to take Seoul solar, *Korea JoongAng Daily*. Retrieved from http://koreajoongangdaily.joins.com/news/article/article.aspx?aid=3041048

City of Sydney. (2017). Environmental Action 2016 - 2021: Strategy and Action Plan. from https://www.cityofsydney.nsw.gov.au/__data/assets/pdf_file/0007/284749/Environmental-Action-strategy-and-action-plan.pdf

CLP. (2019). CLP Information Kit. from https://www.clp.com.hk/en/about-clp-site/media-site/resources-site/publications-site/Documents/CLP-Information-Kit-English.pdf

Council for Sustainable Development. (2019). *Long-term Decarbonisation Strategy Public Engagement*. Retrieved from https://www.susdev.org.hk/download/pe_document_e.pdf.

CUNY. (2016). *NY Solar PV Incentive Guide: Residential*. New York City: City University of New York. http://www.cuny.edu/about/resources/sustainability/solar-america/installingsolar/incentives/NYCSolarPVIncentiveGuide_Residential_1.19.2016.pdf.

DSD. (2016). Solar farm at Siu Ho Wan Sewage Treatment Works comes into operation (with photos) [Press release]. Retrieved from https://www.info.gov.hk/gia/general/201612/09/P2016120900235.htm

Emery, M., & Flora, C. (2006). Spiraling-Up: Mapping Community Transformation with Community Capitals Framework. *Community Development, 37*(1), 19-35. doi: 10.1080/15575330609490152

EMSD. (2002). *Study on the Potential Applications of Renewable Energy in Hong Kong*. Hong Kong: Retrieved from https://www.info.gov.hk/archive/consult/2003/emsd-e.pdf.

EMSD. (2018). *Study on the Feed-in Tariff Rates for Renewable Energy in Hong Kong Final report*. Retrieved from https://www.enb.gov.hk/sites/default/files/en/node67/Study_on_the_Feed-in_Tariff_Rates_for_RE_in_HK.pdf.

EMSD. (2019a). *Guidance Notes For Solar Photovoltaic System Installation*. Retrieved from https://re.emsd.gov.hk/english/files/PVGuidanceNotes.pdf.

EMSD. (2019b). Solar Harvest - Solar Energy Support Scheme for Schools and Welfare Non-Governmental Organisations. Retrieved 15 May, 2019, from https://re.emsd.gov.hk/english/gen/4S/4S.html
ENB. (2017). *Hong Kong's Climate Action Plan 2030+*. Retrieved from https://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanEng.pdf.
ENB, & EMSD. (2019). *"Solar Harvest - Solar Energy Support Scheme for Schools and Welfare Non-Governmental Organisations" Guide to Application*. Retrieved from https://re.emsd.gov.hk/english/gen/4S/files/Solar_Harvest_Guide_to_Application_Eng.pdf.
Energy Policy Division of Environment Bureau. (2015). Action plan in promoting renewable energy installation (Text in Japanese). Retrieved July 6, 2018, from http://www.pref.kyoto.jp/energy/documents/2015action-plan.pdf
European Commission. (2017). Study on "Residential Prosumers in the European Energy Union".
Fairview Park Property Management Ltd. (2017). Introduction of the Estate. Retrieved 23 August, 2019, from http://en.fairviewpark.hk/fair_info.php.
Foshan Chancheng Justice Bureau. (2019, February 22). Management Guidelines For Distributed Solar PV Generation Projects In Chancheng District (Trial) (Text in Chinese). Retrieved September 16, 2019, from http://www.chancheng.gov.cn/chancheng/qfbgw/201902/ad560950fbb5477ca3772d2443b76533.shtml
Foshan Housing and Urban-Rural Development Bureau. (2019, July 18). Notice on Integrity Management Measures of Real Estate Industry (Text in Chinese). Retrieved September 19, 2019, from http://zwgk.chancheng.gov.cn/hycg/0202/201811/5c040de0ec1949b99a40f8f613fd02c7.shtml
Fuller, S., & Bulkeley, H. (2014). Creating a low carbon zone in Brixton, London, UK. In H. Bulkeley, V. Castan-Broto & G. Edwards (Eds.), *An Urban Politics of Climate Change: Experimentation and the Governing of Socio-Technical Transitions* (pp. 199-218). Abingdon: Routledge.
HKSAR. (2017). *Summary of changes to current Scheme of Control Agreements as agreed with the power companies*. Hong Kong: The Government of the Hong Kong Special Administrative Region. http://gia.info.gov.hk/general/201704/25/P2017042500763_257722_1_1493123116092.pdf.
HKSAR, CLP, & CAPCO. (2018). *Scheme of Control Agreement*. Retrieved from https://www.enb.gov.hk/sites/default/files/en/node66/new_CLP_SCA_eng.pdf.
Hong Lok Yuen. (2011, July 3). *South China Morning Post*. Retrieved from http://www.scmp.com/article/972362/hong-lok-yuen
Kim, D.-s. (2017, August 14). Seoul City to expand support for installation of solar panels at homes, *The Korea Herald*. Retrieved from http://www.koreaherald.com/view.php?ud=20170814000876
Kim, H. (2017). A community energy transition model for urban areas: The Energy Self-Reliant Village Program in Seoul, South Korea. *Sustainability, 9*. doi: 10.3390/su9071260
Kyoto Prefecture. (2018). *Kyoto Prefecture Environment White Paper (Heisei 30 Version) (Text in Japanese)*. Kyoto: Retrieved from http://www.pref.kyoto.jp/kankyo_haku/hakusyo30.html.
LandsD. (2018). *Building New Territories Exempted Houses*. Retrieved from https://www.landsd.gov.hk/en/images/doc/Building%20NT%20Exempted%20Houses_e.pdf.
LandsD. (n.d.). *List of Consents to Sell, Consents to Assign and Approvals of Deeds of Mutual Covenant issued from 01/04/1982 to 31/12/1993*. Retrieved from http://www.landsd.gov.hk/en/consent/district/tp(pre1994)wac_e.pdf.
LegCo. (2010). *Official Record of Proceeding: Wednesday, 20 April 2010*. Hong Kong: Retrieved from https://e-info.org.tw/node/208497#1.
LegCo. (2018a). Information Note: Feed-in Tariff for Solar Power in Selected Places. from https://www.legco.gov.hk/research-publications/english/1718in04-feed-in-tariff-for-solar-power-in-selected-places-20180117-e.pdf
LegCo. (2018b, November 26). To Take Forward Tasks in relation to the Promotion of Renewable Energy and Long Term Development of the Electricity Market – Manpower Arrangement for

the Environment Bureau from https://www.legco.gov.hk/yr18-19/english/panels/ea/papers/ea20181126cb1-189-3-e.pdf
LegCo. (2019a). LCQ12: Feed-in Tariff [Press release]. Retrieved from https://www.info.gov.hk/gia/general/201901/23/P2019012300458.htm
LegCo. (2019b). LCQ21: Renewable energy [Press release]. Retrieved from https://www.info.gov.hk/gia/general/201910/23/P2019102300390p.htm
Lo, K., Mah, D. N.-y., Wang, G., Leung, M. K. H., Lo, A. Y., & Hills, P. (2018). Barriers to adopting solar photovoltaic systems in Hong Kong. *Energy & Environment, 29*(5), 649-663. doi: 10.1177/0958305X18757402
Localvolts Pty Ltd. (2018). Localvlots: About Us. from https://localvolts.com/about-us/
Mah, D. N.-y., Cheung, D. M.-w., Wang, M. Y., & Lo, K. (2018a). Renewable Dialogue Workshop for Hong Kong - Study Report (pp. 34). Hong Kong: Asian Energy Studies Centre, Hong Kong Baptist University, Greenpeace East Asia, 350HK.
Mah, D. N.-y., Lo, K., & Hills, P. (2017). *Hong Kong's Solar PV Future: Stakeholder Perspectives (A Study Report)*. Hong Kong: Greenpeace; Worldwide Fund for Nature.
Mah, D. N.-y., Wang, G., Lo, K., Leung, M. K. H., Hills, P., & Lo, A. Y. (2018b). Barriers and policy enablers for solar photovoltaics (PV) in cities: Perspectives of potential adopters in Hong Kong. *Renewable and Sustainable Energy Reviews, 92*, 921-936. doi: 10.1016/j.rser.2018.04.041
Mayor of London. (2018). *Solar Action Plan for London*. London: Greater London Authority.
Meinhardt. (2019). *Study Report of Photovoltaic (PV) Applications and PV Potential on Building Rooftops in Hong Kong*.
Office of Foshan People's Government. (2014). *Implementation plan on promoting PV power generation and adoption (Text in Simplified Chinese).* Retrieved from http://www.sdsn.org.cn/newsshow.asp?id=371.
Reddy, P. S. (2016). Localising the sustainable development goals (SDGs): the role of local government in context (I. a. G. School of Management, Trans.) (pp. 1-15). South Africa: University of KwaZulu-Natal.
Shah, R. (2014). The Story of Solarize Brooklyn: How a team of neibors expand solar homeownership in New York City's most populus borough? New York: Solar One.
Stadtwerke München. (2018). SWM Renewable Energies expansion campaign. from https://www.swm.de/english/company/energy-generation/renewable-energies.html
Tarhan, M. D. (2013). The Community Power Report. Retrieved December 8, 2017, from http://www.communitypowerreport.com/2013/10/brixton-energys-third-crowdfunded-solar.html
United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. United States.
Vorrath, S. (2018). *New solar focused energy retailer calls for "prosumer" investors*. Australia: One Step Off The Grid. https://onestepoffthegrid.com.au/new-solar-focused-energy-retailer-calls-prosumer-investors/.
WRI. (2017). CAIT Climate Data Explorer. from http://cait.wri.org

Appendix 3-1: Lists of interviews

Appendix 3-1a: A list of household interviews in Fairview Park,

All the interviewees agreed to be interviewed anonymously and all interviews were indicated by numbers. The semi-structure interviews were conducted in both face-to-face and telephone format. Some of the interviews were useful to provide insights to the authors but might not be referenced in the main content. The order of the interviews is arranged in chronological order of interview date.

Fairview Park's household interviews

Code of interview	Number of interviewee(s)	Format of interview (F: Face-to-face; T: Telephone)	Date of interview	Duration of interview (approximately)
F1	2	F	23 Aug 2018	1 hour 30 minutes
F2	1	F	23 Aug 2018	1 hour 30 minutes
F3#	2	F	23 Aug 2018	1 hour 30 minutes
F4	1	F	25 Aug 2018	1 hour
F5	1	F	27 Aug 2018	45 minutes
F6	1	F	28 Aug 2018	1 hour 45 minutes
F7	1	F	2 Sep 2018	45 minutes
F8	1	F	8 Sep 2018	45 minutes
F9	1	F	8 Sep 2018	1 hour 30 minutes
F10	1	F	8 Sep 2018	45 minutes
F11	1	T	10 Sep 2018	45 minutes
F12	1	F	10 Sep 2018	30 minutes
F13	1	F	10 Sep 2018	30 minutes
F14	1	F	12 Sep 2018	1 hour 15 minutes
F15	1	F	15 Sep 2018	30 minutes
F16	1	F	15 Sep 2018	45 minutes
F17	1	F	15 Sep 2018	45 minutes
F18	1	F	15 Sep 2018	45 minutes
F19	1	F	20 Sep 2018	1 hour 45 minutes
F20	1	F	21 Sep 2018	1 hour
F21	1	F	22 Sep 2018	1 hour 30 minutes
F22	1	F	22 Sep 2018	1 hour
F23	1	F	22 Sep 2018	1 hour
F24	1	F	22 Sep 2018	1 hour 30 minutes
F25	1	F	22 Sep 2018	1 hour
F26	1	F	22 Sep 2018	45 minutes
F27	1	F	23 Sep 2018	45 minutes
F28	1	F	23 Sep 2018	1 hour
F29	1	F	23 Sep 2018	1 hour
F30	1	F	27 Sep 2018	1 hour 15 minutes
F31	1	F	27 Sep 2018	45 minutes
F32	1	F	27 Sep 2018	45 minutes
F33	1	F	29 Sep 2018	1 hour 30 minutes
F34	1	F	29 Sep 2018	45 minutes
F35	1	F	29 Sep 2018	45 minutes
F36	1	F	29 Sep 2018	1 hour
F37	1	F	29 Sep 2018	1 hour 15 minutes
F38	1	F	29 Sep 2018	45 minutes

F39	1	F	29 Sep 2018	45 minutes
F40	1	F	30 Sep 2018	45 minutes
F41	2	F	30 Sep 2018	1 hour
F42	1	F	30 Sep 2018	45 minutes
F43	1	F	30 Sep 2018	1 hour 15 minutes
F44#	2 *same interviewees as in interview F3	F	23 Jan 2019	45 minutes
F45#	1	F	7 Apr 2019	1 hour

Appendix 3-1b: A list of household interviews in Hong Lok Yuen

Code of interview	Number of interviewee(s)	Format of interview (F: Face-to-face; T: Telephone)	Date of interview	Duration of interview (approximately)
H1	1	F	25 Aug 2018	30 minutes
H2	1	F	30 Aug 2018	1 hour
H3	1	F	30 Aug 2018	45 minutes
H4	1	F	31 Aug 2018	30 minutes
H5	1	F	31 Aug 2018	45 minutes
H6	1	F	1 Sep 2018	1 hour 15 minutes
H7	1	F	1 Sep 2018	1 hour 15 minutes
H8	1	F	1 Sep 2018	1 hour
H9	1	F	1 Sep 2018	1 hour
H10	1	F	5 Sep 2018	1 hour 30 minutes
H11	1	F	5 Sep 2018	1 hour
H12	1	F	8 Sep 2018	45 minutes
H13	1	F	8 Sep 2018	30 minutes
H14	1	F	8 Sep 2018	1 hour
H15	1	F	9 Sep 2018	45 minutes
H16	1	F	9 Sep 2018	1 hour
H17	1	F	9 Sep 2018	1 hour
H18	1	F	9 Sep 2018	1 hour
H19	1	F	10 Sep 2018	45 minutes
H20	1	F	10 Sep 2018	1 hour 15 minutes
H21	1	F	10 Sep 2018	45 minutes
H22	1	F	15 Sep 2018	1 hour
H23	1	F	15 Sep 2018	45 minutes
H24	1	F	22 Sep 2018	1 hour
H25	1	F	22 Sep 2018	1 hour 30 minutes
H26	1	F	23 Sep 2018	1 hour
H27	1	F	29 Sep 2018	30 minutes
H28	1	F	30 Sep 2018	1 hour 15 minutes
H29	1	F	30 Sep 2018	1 hour
H30	1 *same interviewee as in interview H10	T	28 Jan 2019	45 minutes
H31#	1 – household & 2 – solar contractors	F	6 May 2019	45 minutes
H32#	1	T	23 May 2019	30 minutes
H33#	2	F	22 June 2019	1 hour

#Households installed **solar PV system** before or during the study period.

Appendix 3-1c: A list of interviews with stakeholders

All the interviewees agreed to be interviewed anonymously and all interviews were indicated by numbers. The semi-structure interviews were conducted in both face-to-face and telephone format. Some of the interviews were useful to provide insights to the authors but might not be referenced in the main content. The order of the interviews is arranged in chronological order of interview date.

Codes of interview	Descriptions	Format of interview (F: Face-to-face; T: Telephone; E: Email Converation)	Date of interview	Duration of interview (approximately)
S1	A general manager of a utility company	F	21 Aug 2018	50 minutes
S2	An assistant of a district councilor in Yuen Long	F	23 Aug 2018	1 hour
S3	A principal of a non-solar school in Fairview Park	F	27 Aug 2018	1 hour
S4	A teacher of a non-solar school in Fairview Park	F	28 Aug 2018	1 hour 30 minutes
S5	An assistant general secretary of an NGO	F	30 Aug 2018	1 hour
S6	A director of a solar PV contractor company	T	27 Nov 2018	30 minutes
S7	A manager of a property management company	F	3 Dec 2018	30 minutes
S8	A managing director of a solar contractor company	F	11 Jan 2019	1 hour 30 minutes
S9	A manager of property management company in Fairview Park	T	16 Jan 2019	30 minutes
S10	A district councilor of Yuen Long	F	23 Jan 2019	1 hour 30 minutes
S11	A chairman of an Owners' Association in Hong Lok Yuen	T	21 Feb 2019	50 minutes
S12	A manager of property management company in Hong Lok Yuen A staff of property management company in Hong Lok Yuen	F	15 Apr 2019	1 hour 15 minutes
S13	A member of Heung Yee Kuk	F	3 May 2019	1 hour
S14	A chairman of a solar PV contactor and distributor A project director of a solar PV contactor and distributor	F	6 May 2019	1 hour 30 minutes

S15	A general manager of a utility company *same interviewee as in interview S1	T	2 Aug 2019	2 hours 30 minutes
S16	A project manager of a solar PV contractor company	T	20 Nov 2019	30 minutes
S17	A chairman of a solar PV contactor and distributor *same interviewee as in interview S14	T	21 Nov 2019	30 minutes
S18	A Planning Manager of a Utility Company	E	25 Nov 2019	N.A.
S19	A manager of property management company in Fairview Park	E	26 Nov 2019	N.A.
S20	A general manager of a utility company *same interviewee as in interview S1	E	28 Nov 2019	N.A.
S21	A manager of property management company in Hong Lok Yuen *same interviewee as in interview S12	T	28 Nov 2019	15 minutes

Appendix 3-1d: A list of sessions of the two community workshops.

All the workshop participants agreed to join discussion anonymously. Their discussion were numbered and arranged according to the workshop sessions. Some of the discussion were useful to provide insights to the authors but might not be referenced in the main content.

Codes of sessions	Descriptions	Date of sessions	Duration of sessions (approximately)
WF1	Fairview Park Solar Community Workshop - Small Group A Discussion	23 Mar 2019	1 hour
WF2	Fairview Park Solar Community Workshop - Small Group B Discussion		1 hour
WF3	Fairview Park Solar Community Workshop - Small Group C Discussion		1 hour
WF4	Fairview Park Solar Community Workshop - Plenary Discussion		1 hour 15 minutes
WH1	Hong Lok Yuen Solar Community Workshop - Small Group A Discussion	1 Jun 2019	1 hour
WH2	Hong Lok Yuen Solar Community Workshop - Small Group B Discussion		1 hour
WH3	Hong Lok Yuen Solar Community Workshop - Small Group C Discussion		1 hour
WH4	Hong Lok Yuen Solar Community Workshop - Small Group D Discussion		1 hour
WH5	Hong Lok Yuen Solar Community Workshop - Plenary Discussion		1 hour

Appendix 3-2: PPR residential interview guidelines

透過社區參與建立可持續能源發展的未來方向：以香港兩個潛在太陽能社區為案例

訪談指引 (適用於居民受訪者)

I. 自我介紹

- 您好，很高興認識您。我們是來自香港浸會大學(地理系、社會科學院、亞洲能源研究中心)、香港城市大學、香港大學、城均館大學(南韓)和綠色和平的研究團隊。
- 我的名字是_____，我代表我們的研究團隊訪問您。非常感謝您對我們研究項目感興趣。

關於項目：

- 我們的研究項目名為「透過社區參與建立可持續能源發展的未來方向：以香港兩個潛在太陽能社區為案例」。
- 這項研究將對比兩個潛在太陽能社區的能源發展過程。這兩個社區分別為元朗錦綉花園及大埔康樂園。
- 透過收集來自兩個社區大約 80 個潛在太陽能家庭及數間學校數據，
- **我們希望調查和了解社區太陽能項目中的動機、願境、憂慮、建議、技術潛力。**
- 您今天分享的意見將有助促進香港太陽能的發展、實施的相關策略及政策建議。

訪問形式和保密

- 訪問需時約 60 分鐘。若您不介意，我們希望可以錄音作內部紀錄和分析。
- 在我們的發佈物上不會識別到個別的訪問者。個人資料將會保密。
- 我可以開始錄音紀錄訪問? (獲得許可，繼續錄音；不獲許可，不要開始錄音) 感謝您允許我們於訪問中錄音。
- 您是自願參與本研究；您可以拒絕參與。如果您決定參與，亦可以隨時退出本研究。

II.訪談的主要內容

A 部分: 您家有沒有安裝太陽能系統

1. 太陽能系統採用和運作

1.1 太陽能系統採用和運作狀態

a) 此物業的太陽能採用情況

☐ 已安裝太陽能光伏系統

☐ 正在安裝太陽能光伏系統

☐ 暫時沒有計劃安裝太陽能光伏系統 –> *直接跳到推動力和阻力部分*

b) 如果已安裝太陽能光伏系統，請問系統已經運作了多久？

_____ (多少年，多少個月)

c) 如果已安裝太陽能光伏系統，請問它目前運作嗎？

☐ 運作

☐ 已經不運作

☐ 其他 _____

d) 如果已安裝太陽能光伏系統，它是您或您家人策劃安裝的嗎？還是其他人（例如之前的業主）？

1.2 有關系統和性能（如適用）

e) 系統種類（*可選多項*）

☐ 太陽能熱水器

☐ 太陽能光伏系統（連結中電電網）

☐ 太陽能光伏系統（供電給住宅，但不接駁中電的電網）

☐ *太陽能光伏系統(不供電給住宅;只供電給個別的電器、路燈或水泵等)*

（*最後這一類型不算在我們的研究範圍內,可以不需要繼續問1.2 和1.3。*）

*f) 幫助受訪者填寫：太陽能發電裝置的數量*_____

g) 所用的太陽能板為哪些類型？（例如: 單晶硅 (monocrystalline)、多晶硅 (polycrystalline)、其他）

h) 太陽能板安裝於什麼地方? (在天台，抑或是在車房上蓋? 是鑽入還是用粘在上面?)

i) 太陽能發電系統是否附設太陽能追蹤系統、智能電錶或充電池等裝備？

j) 太陽能發電系統的總發電容量為多少千瓦?

k) 到目前為止，太陽能發電系統總共每年產生了多少電量? 如果可得到相關數據，請問是用什麼方法取得數據?

1.3 融資(如適用)

a) 安裝成本是多少?

b) 安裝後，有沒有產生維修或保養的費用? 如果有，請問是多少錢?

c) 除了使用您的家庭收入或儲蓄外，此項目有沒有使用其他經濟資源? *(e.g. 向銀行，其他私人公司或親友借錢、集資、與鄰居共同籌集項目)*

2. 推動力 (先讓受訪者想一想，讓他舉出自己的例子才給予他例子)

a) 討論推動力及願境: 您認為推動您家庭決定是否安裝太陽能發電系統，最重要的推動因素是什麼?

b) 這表列出了一些推動因素，請您按 1 至 10 的等級進行評分(10 為非常重要，1 為非常不重要) *見附錄 1*

c) 請按順序列出三項最主要推動您家去採用太陽能系統的因素，並解釋您的排序。

3. 價值 (先讓受訪者思考，讓他舉出自己的例子才給予他例子。)

a) 您認為，在香港發展太陽能最重要的價值是?

b) 請按 1 至 10 的等級對以下價值列表進行評分(其中 10 為非常重要，1 為非常不重要) *見附錄 2*

4. 阻力 (先讓受訪者思考，讓他舉出自己的例子才給予他例子。)

a) 您家在安裝太陽能發電系統時，您認為會遇到什麼阻力 (在規劃，實施和項目完成後)? / 有哪些因素讓您家不想裝太陽能？

b) 請按 1 至 10 的等級對以下阻力列表進行評分(其中 10 為非常重要，1 為非常不重要): *見附錄 3*

c) 請按順序列出三項最影響您家安裝太陽能系統的阻力因素，並解釋您的排序。

5. 滿意程度

a) 如果您家已安裝了太陽能發電系統，您對該系統有多滿意？ 請為以下各方面評分（10 分為最高分，1 分為最低分）: *見附錄 4*

b) 請解釋上述(a)部分的分數

B 部分: 可再生能源上網電價政策(上網電價)

1. 請問您有沒有聽過香港即將實施的可再生能源上網電價政策? 如果有，請簡單解說一下這政策的內容。
2. *說明: 講解中電發佈的細節，介紹以下內容: [用信息表]*
3. **討論**
   a) 您認為上網電價會不會推動**您家**安裝(更多)太陽能發電系統或考慮安裝(更多) 太陽能發電系統? 為什麼?
   b) 您認為上網電價會不會推動您**屋苑**安裝(更多)太陽能發電系統或考慮安裝(更多) 太陽能發電系統? 為什麼?
   c) 您認為上網電價會不會推動**香港人及企業**安裝(更多)太陽能發電系統或考慮安裝(更多) 太陽能發電系統? 為什麼?
   d) 您認為上網電價有什麼利弊?
   e) 有什麼阻力肯可影響上網電價的實施或降低有效性?
   f) 您可否就以上提出的阻力，提出一些解決方法（例如政策建議）？
4. 您是否知道，錦繡的管理公司去年公布「申請安裝太陽能板」的申請表格，列出安裝太陽能板的條款，讓有興趣的住戶可作出申請？

C 部分: 透過社區合作的模式來發展太陽能

1. 設想以社區合作的模式來發展太陽能
   a) 您覺得錦綉花園(康樂園)是不是一個適合用社區合作的模式來發展太陽能的地方？為什麼？
   b) 若錦綉花園(康樂園)以社區合作的模式發展太陽能發電，您可否設想幾個可行的做法嗎?請舉出幾個例子。

2. *向受訪者介紹幾個可行的社區合作模式，* *見附錄 5，並紀錄受訪者提及而不在表格上的形式。*

3. **討論**

a) 您認為哪幾個社區合作模式（上述第 1 題及第 2 題所提及的選項）在您居住的屋苑會比較有效推動太陽能採用? 您覺得哪幾個些會相對無效? 為什麼?

b) 至於您認為比較有效的選項，有可能出現哪些障礙阻礙該社區合作模式的實施或降低該選項的有效性?

c) 您可否為以上（b）題中提及的障礙建議一些潛在的解決方案（可包括政策上的建議及其他想法）？

D 部分: 社區、態度、意識

1. **社區參與**

a) 您有沒有參與過任何在錦綉花園（康樂園）內的社區團體和活動（可以是正式、非正式，大或小型）？ 如果有，您參與的是什麼類型的社區團體和活動?

b) 您有沒有參與有關可再生能源、能源效益或節能的社區團體或興趣小組? 如果有，請說明。

c) 據您的觀察，屋苑內有沒有一些地區領袖（正式或非正式）可能願意並且能夠激勵鄰居採用太陽能？

2. **態度和意識 (把這個表格交給受訪者完成。不需要讀給他們。) 請參照附錄 6**

Part E: 香港太陽能地圖

[記錄該地址的評估數據資料到香港太陽能地圖上]

III. 家庭，物業及個人資料

在訪問完結前，我們想收集您的一些家庭，物業及個人資料。請放心，在我們所有會發布的文件報告上，您的身分是不會被識別的。

請使用附錄 7

非常感謝您抽空參與訪問，如果您對訪問有任何疑問，歡迎在辦公時間內致電 3411 7187，與這研究項目的首席研究員、香港浸會大學地理系助理教授馬雅燕博士聯繫。

我們目希望於康樂園及錦綉花園各訪問 40 戶居民。**若您可以推薦其他住戶接受訪問，我們將非常感激。**

另外，我們準備了超市禮卷感謝您抽空接受訪問及合作。麻煩簽收，多謝，再見!

（停止錄音。請在資料上記下受訪者的姓名，聯繫方式和地址。）

附錄

請工作人員填寫以下資料

受訪者：_____ 訪問代碼：_____

訪問員：_____ 訪問日期：_____

筆記員：_____ 筆記完成日期：_____

是否有錄音？ ☐ 有 ☐ 沒有

是否當日有提供電費資料？ ☐ 有 ☐ 沒有

此物業的太陽能採用情況
☐ 已安裝太陽能光伏系統
☐ 正在安裝太陽能光伏系統
☐ 未開始安裝, 但已找承辦商報過價錢
☐ 暫時沒有計劃安裝太陽能光伏系統

受訪者通過哪些渠道得知我們的研究項目?
☐ 收到郵寄的邀請信
☐ 收到浸大的 Whatsapp／電話／電郵 邀請
☐ 見到 Facebook post (是谁發的? E.g. 區議員／街坊／浸大研究員)
☐ 收到鄰居／朋友／親戚的邀請
☐ 其他（請註明：_____）

備註（例如一些訪問中注意到的特別值得關注的內容）：

_____
_____
_____

附錄一：推動力列表

	推動力因素	評分 (1 至 10)										
		NA	1	2	3	4	5	6	7	8	9	10
i	**我家有良好的地理及空間因素：**e.g. 有充足的太陽能資源、空間											
ii	**經濟利益：**e.g. 直接的經濟利益，例如獲得上網電價補貼和減省電費；間接的經濟利益，例如提升物業價值											
iii	**能獲得技術支援/技術推動：**e.g. 有專業人士提供我所需要的技術援助；太陽能發電的可行性評估結果理想											
iv	**市場推動：**e.g. 在市場上，我很容易找到價格合理的太陽能板及合適的承辦商											
v	**體系推動（政府或電力公司）：**e.g. 政府有清晰的可再生能源目標，政府和中電對於上網電價補貼有明確的承諾。例如上網補貼能延續到一定的年期，如 10 至 15 年。											
vi	**體系推動（管理公司或業主立案法團）：**e.g. 管理公司或業主立案法團制定的規則有利於（可幫助或至少不阻攔）住戶安裝太陽能系統。											
vii	**行政推動：**e.g. 申請程序簡單易明，而且若需要協助我們也知道去哪裡尋求；有時間和資源處理這些行政程序											
viii	**社區利益：**e.g. 改善屋苑的環境及提升屋苑的形象											
ix	**個人興趣：**e.g. 我個人對於節省能源，科技 DIY，可再生能源，環保，減排溫室氣體有興趣；想努力讓家居生活更加環保											
x	**與他人互相學習/影響：**e.g. 來自鄰居或親友的影響，鼓勵或協助											
xi	**其他：**請註明											

附錄二：價值列表

	價值	評分 (1 至 10)										
		NA	1	2	3	4	5	6	7	8	9	10
i	**經濟價值：** e.g. 減少由空氣污染引致的醫療費用；降低對於進口能源的依賴、避免因缺電引致的經濟損失（加強能源安全）；推進本地綠色產業、創造更多綠色就業機會											
ii	**環境價值：** e.g. 環保、減排溫室氣體、減少空氣污染											
iii	**社會價值：** e.g. 提高城市的綠色形象、降低核能風險、降低能源危機風險、改善市民居住環境、為後代保護城市的資源和環境											
vi	**其他：** 請註明											

附錄三：阻力

	阻力因素	評分 (1 至 10)									
		NA	1	2	3	4	5	6	7	8	9	10
i	**地理及空間限制：** e.g. 物業範圍內太陽能資源不太充沛、沒有太多合適的空間											
ii	**經濟障礙:** e.g.初置成本高，投資回本期長，收益率不確定性，買電的費用更平											
iii	**技術困難：** e.g. 安裝問題、性能問題、維護和更換困難、電網連接問題、增加屋頂需要承托的重量、影響屋頂防水層											
iv	**市場障礙：** e.g. 例如找不到合適的產品，安裝服務或太陽能承辦商；太陽能承辦商的服務水準參差											
v	**體系障礙（政府或電力公司）:** e.g. 難以達到政府和中電對於太陽能裝置大小和高度的限制要求；擔心「僭建」問題，或難以達到其他中電的要求和規定											
vi	**體系障礙（管理公司或業主立案法團）:** e.g. 受限於屋苑管理公司或業主立案法團的規定											
vii	**行政障礙：** e.g. 難以完成所需的行政程序（可能因為收集資料遇到麻煩、未清晰理解程序、不夠時間或資源完成程序）											
viii	**社區障礙：** e.g. 受到鄰居的勸阻或反對，不想負面影響街道/屋苑的外觀											
ix	**缺少個人興趣：** e.g.寧願將時間和資源用於其他事情，或者更願意通過其他方式支持環境可持續發展 / 清潔能源											
x	**分割的誘因（Split incentives）：** e.g. 業主因為自己不住在物業中（而且電費由租戶繳付）所以沒有經濟誘因裝太陽能；租戶則因為房子不是自己擁有的，所以也沒有動力裝											
xi	**其他：** 請註明											

附錄四：滿意程度

	被評分方面	評分 (1 至 10)										
		NA	1	2	3	4	5	6	7	8	9	10
i	**系統性能**（e.g. 發電量）											
ii	**對環境和社會效益的貢獻：**											
iii	**對於您家的經濟效益**（e.g.直接的利益，例如降低電費和收到上網電價補貼；間接利益，例如提升物業價值）											
iv	**其他效益**（請註明）											
v	**項目的總體評價**											

備註:

環境價值： e.g. 環保、減排溫室氣體、減少空氣污染
社會價值： e.g. 提高城市的綠色形象、降低核能風險、降低能源危機風險、改善市民居住環境、為後代保護城市的資源和環境

附錄五：社區合作模式的例子（*備註：這些只是例子，並不是一個詳盡的清單。每一類合作形式也有多種實行方法，以下無法一一列出。*）

	WHAT does it mean? **什麼意思？**	**WHO gets what?** **誰得到什麼？**	**WHERE?** **哪裡？**	**WHY?** **為什麼？**
1. Group-purchasing **集體採購**	同一個社區的多個住戶（例如 20-50 戶)同時向同一個供應商/承辦商購買各自（不是共同擁有）的太陽能發電系統。他們可以因此拿到一個團購價。	系統將安裝在各個住戶的物業上，每戶人家各自擁有並營運自己的發電系統。	系統將安裝在各個住戶的物業上。最佳的選擇是：團購住戶的物業的地理環境和間隔是一式一樣或類似的。	購買發電系統時，住戶們可以協商拿到一個團購價，而承辦商可以因同時在一個地區接到大量相似的訂單而能夠降低成本和提高工作效率。
2. Rooftop leasing **屋頂租賃**	一間公司租用住戶們的屋頂空間安裝太陽能發電系統。 **例如：一間公司可能想打造一條「太陽能街」，就向某街十幾戶租借十幾個天台去安裝太陽能發電系統。**	住戶們得到公司支付的租金，也得到系統發的電，而公司則收取電價補貼和有發電系統的擁有權。	公司可在同一個社區租用一群鄰近房屋(例如一條街）的天台空間。	該公司受益於收取電價補貼，為社區做出貢獻，提提升企業形象，而且不需要專門買地來做太陽能項目。參與的住戶們則有益於得到的租金收入和電力。
3. Community-owned solar project **社區共同擁有的太陽能項目**	社區多個用戶共同擁有並營運一個太陽能項目，而且當中會與大業主或管理處合作。 **例如：有 30 戶住戶事先同大業主或管理處溝通過，可能得到佢地社區某地方的使用權(如停車場)，再一同集資並共同擁有其系統。**	多個用戶可以共同擁有這個太陽能發電系統，並分享所發的電和電價補貼的收入(如發股利)，或將收益用於社區的項目，例如美化公園，又或者減少管理費。	發電系統可以安裝在屋苑內的一個共用空間（例如會所或停車場)。	社區中的用戶們即使不在自己屋頂安裝發電板也可享用這個共同的發電系統。

	WHAT does it mean? 什麼意思？	WHO gets what? 誰得到什麼？	WHERE? 哪裡？	WHY? 為什麼？
4. Third-party owned solar projects (for electricity users in a community) **第三方擁有的太陽能項目（給社區內的電力用戶使用）**	太陽能發電系統由第三方設立，擁有和營運；社區的用戶們可以用該系統發的電。 **同第三項差不多，但搞手是第三方機構設立，擁有及營運而已（如賽馬會等機構），以一個與社區一同合作的商業模式。**	項目由一個第三方機構設立，擁有和營運。該機構可以自己承擔所有費用，或者賣可再生能源證書(REC)來得到資助，又或者讓電力用戶們定期付款買電。	發電系統可以設立在社區的公共空間，也可以設用戶們的屋頂。	電力用戶們不需要承擔安裝發電系統的初置費用，也可以不需要用自己家的空間裝發電系統。項目擁有者則受益於出售可再生能源證書(REC)給買家或出售可再生能源給電力用戶們。
5. Public-Private Partnership **政府和社会资本合作**	一間私營機構（例如中國銀行/馬會/谷歌）提供資金安裝發電系統；政府參與協調和組織項目。 **即政府可能有個部門(如教育局)做引導及協助，私營企業出資，社區提供地方，住戶可用返相關的電力。**	私營機構負責提供資金，營運項目並成為發電系統的擁有者，得到上網電價補貼。政府參與協調和組織項目。社區的住戶們可以享用產生的再生能源。	發電系統可以安裝在一個政府擁有的公共設施上（例如運動中心或公立學校）、社區的的公共空間或住宅屋頂。	這個合作模式可創造出大型的可複製的項目，有助於政府實現可再生能源使用目标。
6. Crowdfunding **眾籌**	個人或公司可以通過網上的平台借錢／捐錢給項目擁有者投資做新的太陽能項目。	項目擁有者向貨款人／捐款人們借錢／捐錢以支付太陽能項目的初置費用，一旦開始收到電價補貼，便可以開始還錢。項目擁有者負責營運發電系統、得到所發的電力、得到電價補貼。（貨款人們有可能得到利息收入（如果是商業項目）也有可能不會得到（如果是慈善項目）。）	貨款人／捐款人們可能住在發電系統附近，但也不一定住在系統附近。	社區（特別是非營利組織，例如學校，老人院或孤兒院）可以通過众籌來為太陽能項目籌款。

附錄 6: 態度與意識

a) 您是否贊成以下的有關您居住的社區的陳述? 請用☑表示答案。

	無意見	非常不同意	不同意	中立	同意	非常同意
a) 我的社區可反映我是什麼類型的人。	☐	☐	☐	☐	☐	☐
b) 我的社區是我喜歡的地方。	☐	☐	☐	☐	☐	☐
c) 就我所知，香港有一些社區居住環境比我居住這區還好。	☐	☐	☐	☐	☐	☐

b) 您是否贊成以下陳述? 請用☑表示答案。

	無意見	非常不同意	不同意	中立	同意	非常同意
a) 當我與其他人合作時，我感覺良好。	☐	☐	☐	☐	☐	☐
b) 我會做讓家人喜悅的事情，即使我討厭這項活動。	☐	☐	☐	☐	☐	☐
c) 我的快樂取決於在我四周的人是否快樂。	☐	☐	☐	☐	☐	☐
d) 我經常做「自己的事」。	☐	☐	☐	☐	☐	☐
e) 競爭是很自然的事。	☐	☐	☐	☐	☐	☐
f) 我享受在很多方面與眾不同及獨一無二。	☐	☐	☐	☐	☐	☐
g) 如果家人不贊成，我會放棄一樣我非常喜歡的活動。	☐	☐	☐	☐	☐	☐
h) 當其他人表現比我好時，會令我煩躁。	☐	☐	☐	☐	☐	☐

c) 您是否贊成以下陳述? 請用☑表示答案。

	無意見	非常不同意	不同意	中立	同意	非常同意
a) 香港人用電的行為不會對氣候有大的影響。	☐	☐	☐	☐	☐	☐
b) 我願意付多一些錢去買更節能的電器。	☐	☐	☐	☐	☐	☐
c) 為了我們的子孫後代，我們需要減少使用化石燃料(如煤或天然氣發電)。	☐	☐	☐	☐	☐	☐

附錄 7: 家庭，物業及個人資料

1. 您的家庭

a) 居住地

□康樂園　　□錦綉花園

b) 請問有多少人居住在這地址 (在過去一年;請填上具體數值)? (包括家庭成員及僱傭) _____

c) 家庭狀況:

- 請寫下每個年齡層的家庭成員人數:

0 – 2: _____　　3 – 6: _____

7 – 12: _____　　13 – 17: _____

18 – 29: _____　　30 – 39: _____

40 – 49: _____　　50 – 59: _____

60 – 69: _____　　70 或以上: _____

- 請寫下僱傭數目(如果有): _____
- 在星期一至五，有多少名家庭成員及僱傭於白天(上午 9 時至下午 5 時)在家? _____
- 有多少家庭成員已經退休？ _____
- 有多少家庭成員有大學學位? _____
- 寵物的數目及種類，如有: _____

d) 您家庭每月收入是?

□ 港幣19,999 或以下　　□ 港幣20,000 - 39,999

□ 港幣40,000 - 59,999　　□ 港幣60,000 - 79,999

□ 港幣80,000 - 89,999　　□ 港幣100,000 - 119,999

□ 港幣120,000 - 139,999　　□ 港幣140,000 - 159,999

□ 港幣160,000或以上　　□ 其他（例如已退休）

2. 物業情況

a) 房屋類型

□ 公寓　□ 獨立屋　□ 排屋 (兩個或以上的房子連在一起)

b) 物業擁有人

□ 您家庭擁有此物業

□ 您家庭租借此物業

□ 其他 _____

c) 您的家庭成員在此物業居住的頻繁程度。

☐ 每月超過 20 天　　☐ 每月 10-19 天

☐ 每月 1-9 天　　☐ 每月少於 1 天

☐ 其他：請注明_____

d) 在以上(e)題，如果答案是每月少於 20 天，請查看以下選項是否適用於您的家庭(請檢查全部適用選項)：

☐ 我的家庭會把這房子用作度假屋

☐ 我們出租此地方給租戶

☐ 有沒有其他補充? _____

e) 能源使用數據: 請提供過去十二個月這物業的能源使用數據(例如電費單)。

f) 空調類型

☐ 窗式空調

☐ 分體式空調

☐ 其他: _____

g) 請列出三個您認為在這個物業消耗最多電力的電器。

_____

3. 關於您的資料

a) 性別

☐ 男　☐ 女

b) 年齡

☐ 18-29　☐ 30-39　☐ 40-49　☐ 50-59　☐ 60-69　☐ 70 或以上

c) 教育程度

☐ 幼兒教育至中學或同等學歷

☐ 高中畢業或同等學歷

☐ 副學士/高級文憑/文憑/證書及同等學歷

☐ 學士學位及同等學歷

☐ 碩士或以上學歷

d) 職業

☐ 行政及專業人員　☐ 文職及服務人員

☐ 勞動工人　☐ 學生

☐ 家庭主婦/家務料理者　☐ 其他: _____

Appendix 4-1: A chronology of major renewable policy initiatives in Hong Kong

Year	Document title	Parties (??)	Key initiatives	References
2002	Study on the Potential Applications of Renewable Energy in Hong Kong Stage 1 Study Report	Electrical & Mechanical Services Department	**RE target –** 1% (by 2012) 2% (by 2017) 3% (by 2022)	(Electrical and Mechanical Services Department, 2002, p. 222)
2008	The Scheme of Control Agreements (2008-2018)	HKSAR & CLP HKSAR & HEC	**RE incentive Factor** – up to 0.05% yearly	(HKSAR, CLP Power Hong Kong Limited, et al., 2008; HKSAR, The Hongkong Electric Company, et al., 2008)
2010	Hong Kong's Climate Change Strategy and Action Agenda	Environment Bureau	**Carbon intensity reduction** – reduce 50-60 % (by 2020 compared with 2005)	(Environment Bureau, 2010)
2014	Future Fuel Mix for Electricity Generation Consultation Document	Environment Bureau	**RE (waste-to-energy only) potential** – 1% (by early 2020s)	(Environment Bureau, 2014, p. 20)
2015	Public Consultation on the Future Development of the Electricity Market	Environment Bureau	Aim to develop more RE based on the public views on the tariff implications	(Environment Bureau, 2015)
2017	Hong Kong's Climate Action Plan 2030+	Environment Bureau & the Steering Committee on Climate Change	Aim to deploy RE in wider and larger scale in coming years. **RE potential** – 3-4% (by 2030) **Solar potential** – 1-1.5% (by2030) **Carbon intensity reduction target** – reduce 65-70 % (by 2030 compared with 2005)	(Environment Bureau, 2017, p. 24)

2018	The Scheme of Control Agreements (CLP: 2018-2033) (HEC: 2019-2033)	HKSAR & CLP HKSAR & HEC	FiT policy introduced in Oct 2018 by CLP; then Jan 2019 by HEC. A corresponding renewable certificate system introduced by CLP and HEC. **RE incentive Factor** – up to 0.05% yearly **Renewable Energy Connections Incentive** – up to 0.0025% yearly	(HKSAR, CLP Power Hong Kong Limited, et al., 2018; HKSAR, The Hongkong Electric Company, et al., 2018)
2018	Study on Feed-in-Tariff Rates for Renewable Energy in Hong Kong	Electrical & Mechanical Services Department	Adopting the LCOE assessment for FiT rates, assuming a ten years payback period. HK$ 4.9 for PV≤10 kW HK$ 3.9 for 10 kW>PV≤200 kW HK$ 3.1 for 200 kW>PV≤1 MW	(Electrical and Mechanical Services Department, 2018)
2019	Solar Harvest Solar Energy Support Scheme for Schools and Welfare Non-Governmental Organisations	Electrical & Mechanical Services Department	Solar Harvest policy introduced in March by the government	(Electrical and Mechanical Services Department, 2019)
2019	Long-term Decarbonisation Strategy Public Engagement	Council for Sustainable Development	Estimated to have about 80% of electricity generated from zero carbon energy sources by 2050 in order to achieve the below 2°C global temperature increase target	(Council for Sustainable Development, 2019)
2019	Study Report of Photovoltaic (PV) Applications and PV Potential on Building Rooftops in Hong Kong	Electrical & Mechanical Services Department	**Estimated rooftop PV potential (installation capacity)** – 568 MW - 1,002 MW **Estimated rooftop PV potential (annual generation):** 505,326 MWh - 880,733 MWh	(Meinhardt (M&E) Ltd, 2019)

Appendix 4.2: Major renewable energy measures announced in the 2018 Policy Address.

The renewable energy measures announced in the 2018 Policy Address include:

For private residential and business sectors
(1) introducing FiT Scheme to provide economic incentives to adopt solar PV under the post-2018 SCAs; (2) introducing the RE certificates to encourage individuals and business sector to support local RE development; (3) relaxing the restrictions of the height limit to 2.5 metres for installing solar PV systems and support structures on the rooftop of New Territories Exempted Houses without seeking the permission from the Lands Department or the Buildings Department (BD) (Legistlative Council, 2019)
For public sector
(1) installing small-scale floating PV systems in Shek Pik and Plover Cove Reservoirs (+https://www.wsd.gov.hk/en/home/climate-change/mitigating/floating-solar-power-system/index.html); (2) installing solar PV systems in government premises, including the Hong Kong largest solar farm (1.1 MW) at the Siu Ho Wan Sewage Treatment Works of the Drainage Services Department (DSD) (DSD, 2016)
For school and NGO sectors
(1) introducing the Solar Harvest Scheme to subsidise and assist schools and welfare NGOs to install small-scale solar PV systems at their premises (+https://re.emsd.gov.hk/english/gen/4S/4S.html). As at May2019, Solar Harvest has received over 210 applications (Legislative Council, 2019) and some 40 schools have connected their solar PV systems to the grid (estimated from data provided by S18).

References:

DSD. (2016). Solar farm at Siu Ho Wan Sewage Treatment Works comes into operation (with photos) [Press release]. Retrieved from https://www.info.gov.hk/gia/general/201612/09/P2016120900235.htm

Legislative Council. (2019). LCQ21: Renewable energy [Press release]. Retrieved from https://www.info.gov.hk/gia/general/201910/23/P2019102300390p.htm

Legistlative Council. (2019). LCQ12: Feed-in Tariff [Press release]. Retrieved from https://www.info.gov.hk/gia/general/201901/23/P2019012300458.htm

Appendix 4-3: An overview of FiT policies in Germany, Japan, and China

An overview of Feed-in Tariff policies in Japan, Germany and China.

	Starting time	**Features**	**Feed-in tariff Amount (solar PV only)**	**Metering**	**Contract duration**	**Sources**
Germany	2000	With degression rate in at least 0.5% each month ; Amended in 2004,2009,2012,2014; Depend on installed capacity and installation site	**EEG - Building mounted type:** 0.57 USD/kWh (2004) 0.51 EUR 0.24 USD/kWh (2012) 0.21 EUR 0.099 – 0.14 USD/kWh (2017) 0.0891 – 0.127 EUR	Net metering	20 years	(Clearingstelle, 2012, p. 33; 2017, p. 62; Electrical and Mechanical Services Department, 2018; Legal Sources on Renewable energy, 2019; Song et al., 2016)
Japan	2012	Change annually ; Depend on the installed capacity;	**=<10kW (tax excluded):** 0.38 USD/kWh (2012) 42 yen 0.31 USD/kWh (2015) 33 yen 0.26 USD/kWh (2017) 29 yen 0.24 USD/kWh (2019) 26 yen	Net metering (only excess electricity purchased in resident PV)	10 years	(Agency for Natural Resources and Energy, n.d.; Byrne et al., 2016; Electrical and Mechanical Services Department, 2018; IEA, 2018; Ministry of Economy, 2012)
			>10kW (tax excluded) : 0.37 USD/kWh (2012) 40 yen 0.27 USD/kWh (2015) 29 yen 0.19 USD/kWh (2017) 21 yen	Gross metering	20 years	
China	2013	Fixed regionally; Amended in 2016, 2017; Depend on geographical region	**Zone 1:** 0.13 USD/kWh (2013 – 2015) 0.9 RMB 0.12 USD/kWh (2016) 0.8RMB 0.09 USD/kWh (2017) 0.65 RMB	Gross metering	20 years	(IEA, 2017; Song et al., 2016)

			Zone 2: 0.14 USD/kWh (2013 – 2015) 0.95 RMB 0.13 USD/kWh (2016) 0.88 RMB 0.11 USD/kWh (2017) 0.75 RMB			
			Zone 3 or 4: 0.15 USD/kWh (2013 – 2015) 1 RMB 0.14 USD/kWh (2016) 0.98 RMB 0.12 USD/kWh (2017) 0.85 RMB			
			Distributed, national-wide: 0.053 USD/kWh (2018) 0.37 RMB	Net metering	20 years	(National Development and Reform Comission, 2017)
Hong Kong	2018	Fixed tariff; Depend on installed capacity	**=<10kW:** 0.64 USD/kWh (2019) 5 HKD	Gross metering	15 years (end at 2033)	(Electrical and Mechanical Services Department, n.d.-a)
			>10kW to =<200kW: 0.51 USD/kWh (2019) 4 HKD			
			>200kW to =<1MW: 0.38 USD/kWh (2019) 3 HKD			
Notes:		1. All tariff is converted to US Dollar for comparison.				

Appendix 5.1: Solar electricity generation and FiT income received by solar households in Fairview Park and Hong Lok Yuen

Code	PV Installed Capacity (kW)	Report Period	Electricity Generation (kWh)	FiT income (HKD)
F3	6.6	Jan-Mar 2019 (45 days)	775	3,900
F11	8	Mar-Apr 2019 (24 days)	429	2,145
		Apr-Jun 2019 (62 days)	1,581	7,905
		Jun-aug 2019 (61 days)	1,767	8,835
F27	9.9	May-Jun 2019 (40 days)	1,095	5,745
		Jun-Aug 2019 (62 days)	1,964	9,820
		Aug-Oct 2019 (61 days)	1,957	9,785
H32	5.13	Feb-Apr 2019 (60 days)	596	2980
		Apr-Jun 2019 (59 days)	786	3,930
		Jun-Aug 2019 (63 days)	1,059	5,295
		Aug-Oct 2019 (61 days)	1,029	5,145

Appendix 5-2: Fairview Park management office's solar application form

申請安裝太陽能板	AD/FRM/36
錦綉花園 _____ 段 _____ 街 / 路 _____ 號	管理公司專用 交表日期 : 屋型 :_____

甲. 業主資料

業主姓名或公司名稱	先生 / 太太 / 小姐 居於上址 ☐是 ☐否
如公司業主 – 負責人:	先生 / 太太 / 小姐 居於上址 ☐是 ☐否

商業登記証號碼:

聯絡方式	住宅電話	公司電話	手提	電郵地址

通訊地址 ☐同上 ☐其他（請說明）

乙. 聲明及簽署

本人/我們，為上述物業(以下簡稱「相關物業」)之業主(以下簡稱「業主」)，現向錦綉花園物業管理有限公司(以下簡稱「管理公司」)申請於相關物業屋頂上安裝太陽能板。本人/我們同意遵守附表I內的所有條款及細則，並按照管理公司有關的安裝指引，進行工程。本人/我們明白管理公司有權於任何時候，更改附表內對安裝太陽能板的要求而無需另行通知。

簽署者全名

_____

日期

_____

業主簽署 / 公司蓋印及授權人簽署

個人資料聲明

1. 業主並不一定要在此提供資料。然而，管理公司必須收集有關資料，以提供相關服務。若業主未能提供所需資料，在有需要時，管理公司將無法提供相關之服務。
2. 業主所提供的資料必須真實及正確無誤，業主有權要求取得及修正個人資料。個人資料如有需要改動，業主須儘快以書面通知管理公司。
3. 管理公司、其職員、代理人、獲管理公司授權的人士、顧問公司、承辦商、保險公司、公司或政府機構或會使用所提供的資料以執行其職務。

業主謹此聲明業主同意根據上述個人資料聲明收集及處理業主的個人資料。

管理公司專用

處理員工姓名及簽署	覆核員工姓名及簽署	處理日期及時間

（免責聲明：此表格以中文及英文編寫，如中、英文兩個版本有任何抵觸或不相符之處，應以英文版本為準。如有需要，可向管理公司索取英文表格或於本司網頁 www.fairviewpark.hk 下載。）

Appendix I

AD/FRM/36 (Version: 2017.09.22)

First version, published in September 2017

安裝太陽能板及輔助設備的條款及細則

1. 業主必須向管理公司提交太陽能板的規格、安裝方法及輔助設備清單等資料，以便管理公司作出審批。
2. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。
3. 業主須就有關太陽能板、其輔助設備與安裝向機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並須遵守有關條例的要求及規定。
4. 業主須自行承擔所有就安裝太陽能板及有關輔助設備所引致的任何損毀或損失。
5. 無論任何情況下，管理公司及錦綉花園道路擁有人，均不須對有關安裝之直接 或間接引致的損毀或損失，負上任何責任。
6. 業主須定期保養太陽能板以確保該等設備外觀良好及結構安全，否則管理公司有權要求業主移除有關之太陽能板，並將屋頂還原至原有模樣，或採取任何管理公司認為合適的行動，所有涉及的費用均由業主負責。
7. 對於沿着錦綉大道及錦綉河的單位，太陽能板應安裝於背向大道或河道的屋頂後方位置。
8. 安裝在屋頂的太陽能板，總面積不可超越 4 平方米，以及距離中牆 (如有) 最少 1 米。
9. 當業主接獲管理公司或政府部門的要求，業主必須拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。
10. 管理公司有權不時檢視及修改安裝太陽能板的條款及細則。
11. 管理公司對有關申請擁有絕對否決權，尤其是相關物業存有違規建築物。
12. 當收到鄰近住戶的合理投訴時，管理公司保留可要求業主拆除太陽能板及有關輔助設備的權利。

Revised version, published in May 2018

安裝太陽能板及輔助設備的條款及細則

1. 業主必須向管理公司提交太陽能板的規格、安裝方法及輔助設備清單等資料，以便管理公司作出審批。
2. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。
3. 業主須就有關太陽能板、其輔助設備與安裝向機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並須遵守有關條例的要求及規定。
4. 業主須自行承擔所有就安裝太陽能板及有關輔助設備所引致其他房屋的任何損毀或損失。
5. 無論任何情況下，管理公司及錦綉花園道路擁有人，均不須對有關安裝之直接或間接引致的損毀或損失，負上任何責任。
6. 業主須確保單位有足夠的結構承托力安裝太陽能板，以及定期保養太陽能板以確保該等設備外觀良好及結構安全，否則管理公司有權要求業主移除有關之太陽能板，並將屋頂還原至原有模樣，或採取任何管理公司認為合適的行動，所有涉及的費用均由有關業主負責。
7. 太陽能板只可安裝在屋頂的位置，除屋頂部可貼近邊緣外，距離單位左右兩邊及底部邊緣不少於 300 毫米，太陽能板須與屋頂平行安裝且高度離屋頂不可超過 150 毫米。
8. 當業主接獲管理公司或政府部門的要求，業主必須自費拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。
9. 管理公司有權不時檢視及修改安裝太陽能板的條款及細則。
10. 管理公司對有關申請擁有絕對否決權，尤其是相關物業存有違規建築物。
11. 當收到鄰近住戶的合理投訴時，管理公司保留可要求業主拆除太陽能板及有關輔助設備的權利。

Appendix 5-3: Hong Lok Yuen management office's solar application form

康樂園於單位安裝太陽能板申請表

單位資料

申請單位：康樂園 _____ 行/路 _____ 號

業主資料：

姓名：_____ 手提電話：_____ 住宅/辦公室電話：_____

通訊地址(如與上述單位不同)：_____

負責工程公司資料:

公司名稱：_____

地址：_____

負責人姓名：_____ 手提電話：_____ 辦公室電話：_____

所需提交資料:

- ☐ 已簽署的申請表
- ☐ 太陽能板規格、先料清單及顏色設備清單
- ☐ 安裝計劃及設計圖則
- ☐ 已通中電批核的申請圖則本

聲明及簽署

本人/我們，為上述物業（以下簡稱「相關物業」）之業主（以下簡稱「業主」），現向康樂園物業管理有限公司（以下簡稱「服務處」）申請使用屬於業務上安裝太陽能板，本人/我們同意遵守附表1內的所有條款及細則，並按照情服務處有關書面委員指引，進行工程，本人/我們明白服務處有權於任何時候，更改附表內列安裝太陽能板的要求而無需另行通知。

簽署者全名

_____

日期

_____

業主簽署 / 公司蓋章及授權人簽署

服務處專用

負責工程名及簽署	代理工程名及簽署
處理日期	簽板日期
備註	備註

附表 I

安裝太陽能板及輔助設備的條款及細則

(要求或會因時有所更改)

1. 業主必須向服務處提交太陽能板的規格、物料清單、輔助設備清單、安裝計劃及設計圖等資料，以便服務處作出審批。

2. 太陽能板只可安裝在屋頂的位置，除屋頂部可貼近邊緣外，距離單位左右兩邊及底部邊緣不少於 300 毫米，太陽能板須與屋頂平行安裝且高度離屋頂不可超過 150 毫米，而太陽能板所佔的面積不可多於整體天面面積的 70%。

3. 業主須就有關太陽能板、其輔助設備與安裝向機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並須遵守有關條例的要求及規定。

4. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。

5. 業主必須自行承擔所有就安裝太陽能板及有關輔助設備所引致其他房屋的任何損毀或損失。

6. 無論任何情況下，服務處及康樂園街道擁有人，均不須對有關安裝之直接或間接引致的損毀或損失，負上任何責任。

7. 業主須確保單位有足夠的承托力安裝太陽能板，以及定期保養太陽能板以確保該等設備外觀良好及結構安全，否則服務處有權要求業主移除有關之太陽能板，並將屋頂還原本至原有模樣，或採取任何服務處認為合適的行動，所有涉及的費用均由有關業主負責。

8. 當業主接獲服務處或政府部門的要求，業主必須自費拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。

9. 服務處有權不時檢視及修改安裝太陽能板的條款及細則。

10. 服務處對有關申請擁有絕對否決權，尤其是相關物業存有違規建築物。

11. 當受到鄰近住戶的合理投訴時，服務處保留可要求業主拆除太陽能板及有關輔助設備的權利。

個人資料收集聲明

以下是康樂園物業管理有限公司遵照香港特別行政區法例第 486 章《個人資料(私隱)條例》之要求而發表，在向閣下收集資料時通知閣下若干事項。

- 在我們為閣下提供服務之時，閣下會被要求向我們提供個人識別資料。我們有必要收集閣下之資料，以便向閣下提供服務。倘若閣下未能提供所需資料，我們將不能向閣下提供有關服務。
- 我們所收集之資料將用作處理有關申請、日常管理及/或任何跟進事宜。
- 我們只會在有需要的時間內，為了達到收集個人資料所需目的而保存閣下的個人資料及只供我們的獲授權人仕使用。

如閣下同意向我們支付合理之手續費，閣下有權要求存取或更正我們所持有關於閣下之資料。倘若閣下需要直接我們是否持有閣下之個人資料，又或者想存取或更正閣下有關之任何不確資料，請電郵 dpo@kaishing.com.hk 往敬啟管理服務有限公司，或投寄到香港港灣道三十號新鴻基中心二十三樓二三零一室資料保障主任。

Hong Lok Yuen
Application Form for Installation of Solar Panel

Premises Information:

Apply Premises : House No._____ , Street/Road _____ , Hong Lok Yuen

Owner' Information:

Name : _____ Mobile phone no. : _____ Home/Office Tel no. : _____

Correspondence Address(if different from above) : _____

_____

Company information:

Company Name : _____

Address : _____

Name of Responsible Person : _____ Mobile Phone No : _____

Office Tel No : _____

Required submission:

- ☐ Signed Application Form
- ☐ Specification of the solar panel, list of ancillary equipment and list of auxiliary equipment
- ☐ Installation plan and design plan

Declaration and Signature

I/We, the owner(s)("the Owner(s)")of the captioned premises("the Corresponding Premises"),apply to Hong Lok Yuen Property Management Co., Ltd("Management Office")for installation of solar panel on the roof of the Corresponding Premises and agree to observe the terms and conditions stipulated in Appendix I and follow any further instruction from the Management Office relating thereto in support of this application. We understand that the Management Office has absolute right to change the requirements stipulated in the Appendix I from time without the necessity of providing prior written notice for stipulated in the Appendix I from time to time without the necessity of providing prior written notice for me/us.

Full Name of Signatory

_____

Date

_____

Owner's Signature /
Company Chop with Authorized Signature

For Management Office Use Only

Name and signing of handling staff	Name and signing of approved staff
Processing date & time	Approved date & time
Remarks	Remarks

Appendix 1

Terms and Conditions for Installation of Solar Power Panel and Other Ancillary Equipment

(Subject to Change)

1. House owner shall provide Specification of the solar panel, list of ancillary equipment and list of auxiliary equipment to the Management Office for approval.
2. The solar panel shall be allowed to be installed only on the roof. Calculated from the edge of the roof, not less than 300 mm from the left sides, right sides and the bottom sides of the roof, the solar panels shall be installed parallel to the roof and the height shall not exceed 150 mm from the roof, and the solar panels shall not occupy more than 70% of the overall surface area.
3. House owner shall apply to Electrical and Mechanical Services Department, Building Department and any other Government Departments concerned for approval of solar panel(s) and ancillary equipment as well as the installation and shall also comply with the requirements and provisions in relation thereto.
4. No other ancillary equipment, such as water tank; electrical accessories etc. shall be allowed to be installed on the roof except the solar panel(s) using non-reflective materials.
5. House owner shall be solely responsible for any damages or loss to other houses arising from the installation of such solar panel(s) and ancillary equipment.
6. The Management Office and the road owners of Hong Lok Yuen shall, under no circumstances, be responsible for or liable to any damages or loss arising directly or indirectly from such installation.
7. House owner shall ensure the structural capability of the house unit for the installation is adequate and keep regular maintenance on the set up to ensure the solar panel(s) are structurally safe and in good conditions, otherwise the Management Office can demand the House owner to remove such solar panel(s) and reinstate the roof to the original state at his/her own costs or takes any action as the Management Office thinks fit.
8. House owner shall remove such panel(s), and ancillary equipment and reinstate the roof to the original estate at his/her own cost when required by the Management Office or Government department(s).
9. Any terms and conditions provided herein shall be subject to review and revision from time to time by the Management Office.
10. The Management Office shall have absolute right to reject the application at its sole discretion, especially if there is any unauthorized building work in the Corresponding Premises.
11. The Management Office reserves the right to request removal of the solar panel(s) and ancillary equipment upon receiving reasonable complaint from nearby residents.

Personal Information Collection Statement

It is the policy of Hong Lok Yuen Property Management Limited, as one "Data User", in complying with the requirements of the Personal Data (Privacy) Ordinance, Chapter 486 of the Laws of the Hong Kong SAR and notifies you of certain matters when collecting information from you.

- At the time of providing our services, you may be asked to provide us with personally identifiable information. It is necessary for us to collect your information for providing you the services. You are not obliged to supply the data here but if you fail to provide the information requested, we may not be able to provide you the services or assistance.
- The information we collected will be used for processing all matters relating to the relevant application, daily operation and/or any follow up actions.
- We will keep your personal data only for as long as necessary to fulfill the purpose for which it is collected. The data you provide will only be handled by our authorized employees and persons.
- You have the right to request access to, or correction of, information about you which is held by us, by paying us the reasonable charges incurred by us in relation to administering and complying with your request. If you need to check whether we hold your personal information or if you wish to have access to, or correct any information relating to you which is inaccurate, please write via e-mail to our Data Protection Officer at dpo@kaiching.com.hk or via mail to Room 2301, 23/F, Sun Hung Kai Centre, 30 Harbour Road, Wan Chai, Hong Kong.

Appendix 7-1: Presentation slides of the meeting with Environment Bureau and Electrical and Mechanical Services Department (EMSD) on 4th September 2019

香港太陽能學校研究
初步結果

馬雅蒽博士

香港浸會大學

亞洲能源研究中心總監

地理系助理教授

2018年9月4日

A Work-in-progress

Please do not cite or quote without the permission of the Project Team (daphnemah@hkbu.edu.hk)

(Photo credit: Anthony Dixon, Helios Renewable Energy Limited; AESC, HKBU)

我們的主要研究項目

研究期間	研究項目	贊助機構	研究伙伴
2015-2016	香港**屋頂太陽能**的發展潛力及政策建議	中電	城大
2016	香港**太陽能政策**研究	綠色和平、世界野生自然基金會	城大、港大、史丹福大學
2017	香港可再生能源研究 (**可再生能源上網電價補貼**)	綠色和平、350香港	
2016	香港**太陽能地圖**	浸大	
2016-2020	亞洲城市太陽能發展: 能源創新及轉型 • **佛山、首爾**	UCL、浸大 GRF	UCL、京都大學、延世大學
2018	香港太陽能**學校**: 機遇及挑戰	綠色和平	城大、 浸大物理系、 教育系
8.2018-9.2019	Engaging the Community to Develop a Model for Sustainable Energy Futures: A Case Study of Two Prospective Solar Communities in Hong Kong	PPR	城大、港大、南韓、城均館大學、綠色和平、中電、港燈

學校: 是推動香港可再生能源的重要一環

	村屋/ 低密度住宅	私人大廈/ 商界	學校
地	• 村屋：> 40,000 • 天台用途：晒衫、BBQ及其他休憩用途	• 住宅、商業、工業大廈 • 企業：購買可再生能源證書	• 政府學校-約900間 • 天台、停車場等
回本期	<10年	<3年 (工、商界)	• 不大重要 • 但初置成本是最大阻力
太陽能的價值	• 慳電費/賺少少錢 • 減排/環保 • 綠色就業機會	• 社會企業責任 • 保持競爭力 • 綠色就業機會	• 教育價值 (e.g. STEM) • 減排/環保

相片來源: https://www.hkcnews.com/news_%E6%96%B0%E8%81%9E/hk-discuss/2017/12/%E4%B8%81%E5%B1%8B-%E4%B8%81%E6%AC%8A-%E5%8E%9F%E5%B1%85%E6%B0%91-20171218043112_e57c_large.jpg; http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/; https://s.yimg.com/uu/api/res/1.2/J0gt0B3O0yNq6P_5G8EIHw--~B/aD0xOTk7dz0zNjA7c209MTthcHBpZD15dGFjaHlvbg--/http://media.zenfs.com/en_us/News/singtao/236232.jpg; www.isd.gov.hk http://w22.property.hk/article_content.php?ln=sc&author=PHK_NEWSPROP&id=53143

2018年3月-4月　**22**間中、小學

訪問

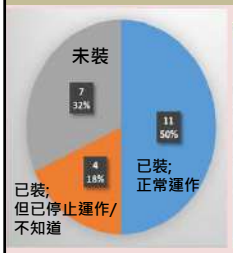
太陽能
資源評估

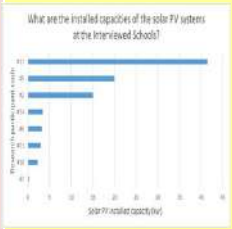
2018年6月30日

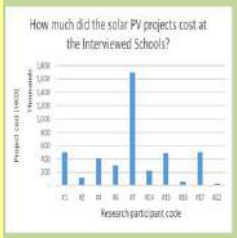
工作坊

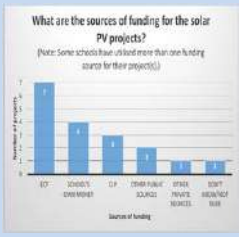
馬雅燕博士	盧笛聲博士	陳茂興博士	顧伊麗博士	梁國熙教授	楊凱珊
香港浸會大學 亞洲能源研究中心 總監 地理系助理教授	香港浸會大學 地理系助理教授	香港浸會大學 物理系講師	香港浸會大學 兒童發展研究中心 署理中心主任	香港城市大學 能源及環境學院 副院長及教授	綠色和平東亞分部 資深項目主任

受訪學校太陽能系統開始運行年份: 最早- 1998









"健康狀況" :

- 15 間學校裝有太陽能板
- 11 : 仍正常運作
- 3: 已停止運作
- 1 : 資料不詳

規模 :

- 0.3千瓦至41.5千瓦

項目成本 :

- 3萬至170萬
- 平均 : 43萬

資金來源 :

- ECF
- 校內資金
- 中電...

太陽能學校: 每年太陽能發電量 :

(根據 6 間太陽能學校提供的資料)

最高: 50,000 度電

(足夠該受訪學校一年用電量的20%)

最低: 1,600度電

平均: 24,000度電 →

4 部 x 2匹冷氣機
一年每日開8小時

http://www.hitachi-hk.com.hk/filemanager/common/Window_2016/2016_Win_Catalog.pd

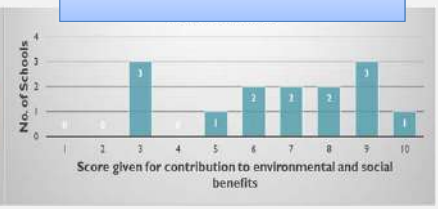
學校對自己的太陽能項目有何評價？

經濟價值

教育價值

設施的運作表現

對環境和社會有貢獻



學校的太陽能資源評估報告
(城市大學 能源與環境學院 梁國熙教授)

	Solar (Yes / No / Not working)	Current installed capacity (kW)	Current annual electricity generation (kWh)	Estimated annual electricty generation (based on current installed capacity; kWh)	Avaliable Area (at 50% of rooftop space; m^2)	Estimated maximum capacity (at 50% of rooftop space; kW)	Estimated maximum electricty generation (at 50% rooftop space filled; kWh)	Locations of schools by district
	Y	65.4	44,500.0	18,480.7	220.0	38.9	41,776.7	Kwun Tong
	Y	41.5	50,000.0	147,679.6	500.0	90.4	110,733.3	Tsuen Wan
	Y	20.0	(It hasn't been a year yet.)	20,535.3	600.0	108.4	124,395.1	Southern
	Y	15.0	not sure	13,565.9	650.0	117.5	104,639.1	Wong Tai Sin
	Y	3.4	2,666.0	5,272.9	180.0	32.3	38,037.5	Sai Kung
	Y	3.2	3,225.0	6,578.3	1,400.0	255.9	332,675.0	Southern
	Y	3.0	7,417.0	9,384.9	160.0	28.8	22,334.2	Yuen Long
	Y	2.4	770.0	Not installed	220.0	39.5	48,585.7	Kwai Tsing
	Y	2.3	1,600.0	2,864.7	650.0	117.5	127,022.2	Kwai Tsing
	Y	info not available	36,000.0	607.0	300.0	54.2	58,497.0	Kwun Tong
	Y	info not available	info not available	5,788.2	770.0	139.0	159,000.9	Tuen Mun
	NW	0.3	not working	Not installed	900.0	162.7	197,158.0	Tai Po
	NW	info not available	not working	5,137.0	390.0	69.7	77,702.2	Eastern
	NW	info not available	not working	760.4	160.0	28.4	33,418.7	Yuen Long
	NW	no information	not working	502.2	1,300.0	516.5	424,199.2	Kowloon City
	N	N/A	N/A	Not installed	1,000.0	180.7	192,353.6	Tai Po
	N	N/A	N/A	Not installed	500.0	90.4	114,174.7	Kwai Tsing
	N	N/A	N/A	Not installed	350.0	62.5	57,643.6	Yuen Long
	N	N/A	N/A	Not installed	300.0	53.1	67,981.5	Islands
	N	N/A	N/A	Not installed	250.0	44.4	57,093.5	Islands
	N	N/A	N/A	Not installed	430.0	76.8	84,749.3	Sha Tin
	N	N/A	N/A	Not installed	1,800.0	323.7	394,131.0	Sai Kung
Total		**156.5**	**146,178.0**	**237,157.0**	**13,030.0**	**2,631.1**	**2,868,301.7**	

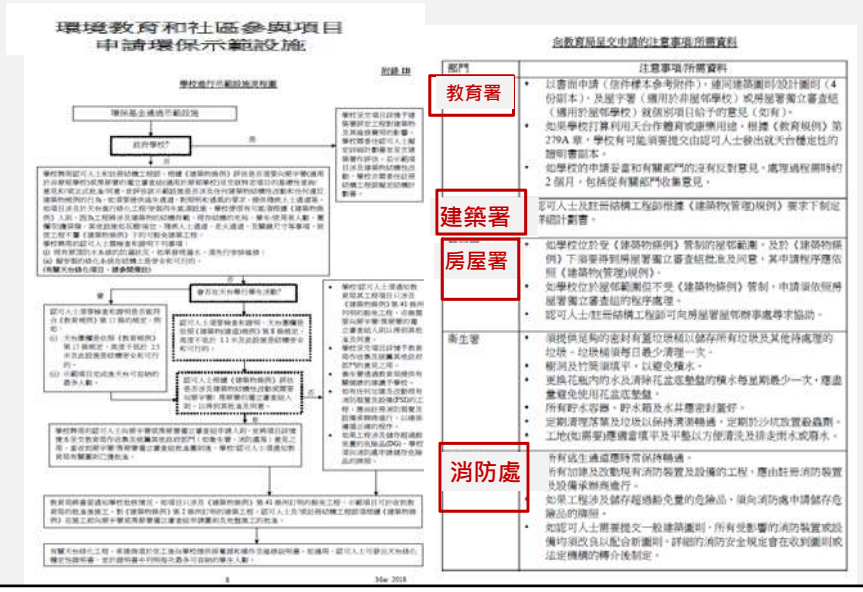
太陽能學校: 為何而做?

第一位:教育價值	• 三大類 - 科普教育、環保教育、關愛社區
第二位:內部影響力/領導力	• 來自 - 校長、老師、學生、家長、校內環保團體
第三位:環境效益	• 減少溫室氣體排放
第四位:資金推動	• 資金來源:如ECF; 回本期: 不重要

面對的阻力

第一位	經濟障礙
第二位	規管上的限制
第三位	行政障礙
第四位	技術困難

規管方面的障礙



教育署...建築署...消防處...房屋署 ...

申請程序

所花時間長達**6**年

申請年期:
- < 1 年: 1個項目
- ~ 1 年: 6個項目
- 其他: 2.5年、3 年、5年、6年

入則

費用：最高達**16**萬

個案1:

項目總費用: 約58萬

- 硬件及安裝費: 35萬
- 入則: 16萬 （ 3 成 ）
- 數據統計顯示系統: 3.5萬

結合太陽能系統與環保教育/STEM

知易行難

在課堂融入太陽能發電設施的概念和運作??

受訪學校#6：

"離地，

... 上堂有介紹、有展示過網站，但數據未有詳細用於教育。"

原因:

- 學生不准上天台
- 堆肥等其他項目更能容易達到環保教育效果
- 其他...

總結

障礙/困難	解決方法?
	1. 政府、兩電提供直接資助？ 2. 政府、兩電提供配對基金、低息貸款? 3. 太陽能租賃服務? 4. 民間集資 (crowdfunding?)
	1. 政府提供「一站式」服務平台? 2. 政府中央採購? (先例: 流感疫苗) 3. 教育局設立「太陽能學校技術支援小組」: • 由有經驗的校長、老師當值聽熱線 • 分享「申請書參考範例」
	環保教育: 知易行難... 機遇: 將學校太陽能項目，融入STEM 和VISUAL ARTS的學科

http://teaching.monster.com/benefits/articles/9070-handling-mountains-of-paperwork-and-ieps
http://www.goodluckpublishers.com/index.php?route=product/product&product_id=212

外地經驗分享

Case 1: Solar Schools Program - UK

Strategy: **Community Crowdfunding**

Context

- A charity - **10:10** helps schools **crowdfund** for the cost of solar panels
- 10:10 provides schools with **training**, **resources** and **personal support** to run their own SS project

How does it work

- 10:10 - a **charity** provides a crowdfunding platform for **online donation**; and
- Provides **assistance** for schools to hold **offline fundraising** such as tried-and-tested cake sales

Outcomes

- **80** schools (primary and secondary) participated; **£723,000** raised; **2,370** panels installed

Barrier addressed

- Financial barrier; Regulatory and Administrative barrier

Case 2: The Darlington Solar Education Project - Darlington, State of Wisconsin, USA

Strategy: **Partnership-Third Party Financing (co-ownership)**

Content

- In 2016, **Darlington Community School District (DCSD)** installed the largest solar energy system **(156kW)**
- It is expected to generate **200,000 kWh** of electricity per year, or about 19% of the entire district's use
- It used innovative financing with **co-ownership** to **limit the district's upfront costs**

How does it work

- DCSD contracted with Hoffman Planning, Design & Construction, Inc. to assist in carrying out this project
- Typically, the local government **hired a consultant** to identify investors, developers and help financing

Outcomes

- It will save the school district about **US$12,500** in **usage charges** and roughly **US$3,250** in **demand charges**, or **about 20%** of our current overall energy costs

Barriers addressed

- Financial barrier; Technical barrier

Case 3: The Solar Market Pathway Funding Program - Harrisonburg, State of Virginia, USA

Strategy: **Group Purchasing**

Content

- **The Council of Independent Colleges in Virginia (CICV)** is working with **15** of its member schools to **group purchase** PV panels and help them develop comprehensive solar plans

How does it work

- In 2011, the **US Department of Energy (DoE)** launched **the Sun-Shot Initiative** to reduce the total costs of Solar Energy by 75%, making it more cost competitive with other forms of energy without subsidies
- CICV has been awarded more than **US$807,000** in **federal funding** from the DoE Sun-Shot Initiative
- CICV provides its member colleges access to **discounted purchasing** opportunities through its association with several group purchasing organizations such as **Coalition for College Cost Savings (CCCS)**

Outcomes

- **Bargaining power** to achieve **cost reduction**

Barriers addressed

- Financial barrier; Administration barrier

Case 4: Dubai Solar Schools Initiative - Dubai, United Arab Emirates

Strategy: **Solar Leasing**

Content

- This initiative aims to drive Dubai's **top 100 schools into solar schools** by 2020
  - An Italian green design consultancy - **Arch Italy Green Energy DMCC** offers schools in Dubai got a **fully funded** solar plants under a **zero-capex/zero-opex formula** with a **solar leasing** model

How does it work

- South Africa's **Sun Exchange** **finance 1MW** of rooftop facilities for educational institutions in Dubai
- Sun Exchange **finances and leases** the solar facility through its newly established Dubai entity
- Anyone can purchase solar assets start from **US$10** per solar cell

Outcomes

- After **7-9** years, these schools and universities could **reduce their energy bills dramatically** - in some cases to zero

Barriers addressed

- Financial barrier; Technical barrier; Regulatory barrier

Case 5: Solar Schools at municipal scale - Kawagoe, Japan

Strategy: **Cooperation and Coordination among the government's departments**

Content

- Number of schools in the city: 33 elementary, 22 junior high, 1 special-needs
- **Multiple municipal government departments** **share roles** to make all-out efforts for promoting the solar PV installation project

How does it work

- **The Board of Education** **made various arrangements** with each school and **took budgetary measures**
- **The Construction Department** was responsible for **installation works**
- **The Environment Department** applied for **subsidies/grants**

Outcomes

- **Total Installed generation capacity**: 209 kW
- It is useful for providing environmental education to children and for raising local residents' awareness of PV power generation

Barriers addressed

- Regulatory and Administrative barriers

Case 6: Idogaya Elementary School Project - Yokohama, Japan

Strategy: **Engagement with experts**

Context

- The school **cooperates with experts** to provide **outreach program** for students

How does it work

- It invites experts from **NPOs** and **manufacturers** to provides outreach program
- Students **report their learning outcome** to local residents

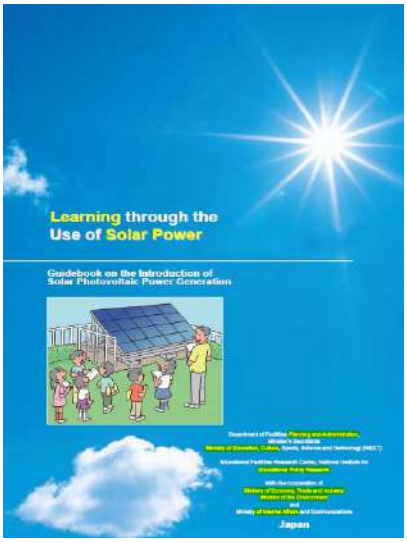
Outcomes

- It can **ease teachers' work load** and solve the problem of insufficient relevant knowledge
- Students are encouraged to learn voluntarily, thus, **environmental education** is further promoted

Barrier addressed

- Administrative barrier

Solar School Guidebook - Japan



https://www.nier.go.jp/shisetsu/pdf/e-taiyoukou.pdf

Acknowledgement

This research project (Project Number: 2017.A2.027.18B) is funded by the special round of the Public Policy Research Funding Scheme from the Policy Innovation and Co-ordination Office of The Government of the Hong Kong Special Administrative Region.

鳴謝

本研究項目（項目編號：2017.A2.027.18B）獲香港特別 行政區政府政策創新與統籌辦事處公共政策研究資助計劃／策略性公共政策研究資助計劃撥款資助。

Appendix 7-2: Presentation slides of the meeting with Environment Bureau on 27th November 2019

香港太陽能研究
初步結果

馬雅燕博士 Dr. Daphne Mah
香港浸會大學 Hong Kong Baptist University
亞洲能源研究中心總監 Director of Asian Energy Studies Centre
地理系助理教授 Assistant Professor of Dept. of Geography

2018年11月27日

A Work-in-progress
Please do not cite or quote without the permission of the Project Team (daphnemah@hkbu.edu.hk)

(Photo credit: Anthony Dixon, Helios Renewable Energy Limited; AESC, HKBU)

1. 我們的研究團隊

Collaborating Researchers for Solar Projects

Daphne Mah
HKBU
Energy Policy

Kevin Lo
HKBU
Energy Policy

K. P. Chun
HKBU
Global change

Byron Choi
HKBU
Computer Science

Zhou Qiming
HKBU
GIS

Alice Siu
Stanford University
Public engagement

Michael K.H. Leung
City University of Hong Kong
Energy Engineering

Akihisa Mori
Kyoto University
Energy Policy

Marc Wolfram
Sungkyunkwan University
Urban Governance

Sara Fuller
Macquarie University
Energy Justice

Gilles Lepesant
Unit Géographie-Cités
Energy Transition

Richard Balme
Paris School of International Affairs
Environmental Governance

2. 我們的研究項目

研究期間	研究項目	贊助機構	贊助金額	研究伙伴
2015-2016	香港**屋頂太陽能的發展潛力**及**政策**建議	中電	$195,720	城大
2016	香港**太陽能政策**研究	綠色和平、 世界野生自然 基金會	$300,000	城大、港大、 史丹福大學
2016	香港**太陽能地圖**	浸大	$100,000	浸大圖書館
2016-2017	中國能源創新及轉型: **佛山住宅式太陽能發展**的經驗	UCL、浸大		UCL
2017	香港可再生能源研究 (**可再生能源上網電價補貼**)	綠色和平、 350香港	$80,000	
2017-2019	**可持續能源轉型**（SETs）的協商參與、信任和社會學習：日本、韓國和中國的比較研究	研究資助局 (研資局)	$1,326,170	港大、京都大學、 延世大學、 清華大學
2018	香港**太陽能學校**: 機遇及挑戰	綠色和平	$135,000	城大
2018-2019	社區參與發展可持續能源未來模式: 兩個香港**太陽能社區**的研究	政策創新與統籌辦 事處	$632,500	城市大學、港大、 成均館大學、綠色 和平
2018-2020	通過**社區參與**實現城市能源轉型的多樣性和關鍵：倫敦，弗萊堡（德國），紐約市，東京，首爾和佛山（中國）的國際比較研究	浸大	$150,000	麥覺理大學、Unit Géographie-Cités、京都大學、成均館大學、Sciences Po

3. 我們的研究：重點及特式

3.1 Themes:

- Governance for sustainable energy transitions on the Asian region,
- focusing on solar PV,
- smart grid-enabled energy transitions (including demand response programmes), and
- public acceptance of nuclear energy

3.2 Multi-method research:

- (a) solar assessment,
- (b) household and school interviews,
- (c) deliberative energy workshops;
- (d) scenario developments

3.3 A global solar city network

3.4 Knowledge exchange:

- Hong Kong Solar Partnership

3.5 Inputs to public policies:

- solar resource assessment,
- inform target-setting,
- policy formulations,
- policy evaluation

Hong Kong Solar Partnership

A platform for dialogue, and sharing of good practice

Renewable deliberative workshops

https://youtu.be/hpzgrVkyfas?t=181

To collect citizens' informed views on controversial energy issues

Online Solar Map

http://digital.lib.hkbu.edu.hk/solarmap/

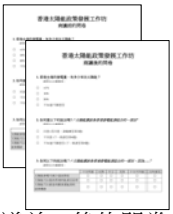
To engage the public through playful, and innovative ways

Hong Kong solar Partnership:

- Aims:
  - Facilitate dialogue
  - Try new ways of public engagement
  - Share good practice
- Website – just launched
- Funding sources: HKBU, CLP, HEC
- Is underpinned by research

http://aesc.hkbu.edu.hk/hongkongsolarpartnership

「商議式」的工作坊
(Deliberative Workshops)



訪談　簡介文件　小組討論　專家答問環節　商議前、後的問卷

2016年　香港太陽能政策研究

第一階段 (2016年6月至2017年3月): 訪問99人

第二階段 (2016年11月4-5日):
商議式工作訪－參加者57人

第1類
潛在太陽能發電戶及村民

第2類
隨機抽樣的香港市民

第3類
公、私營各界別人士

https://youtu.be/hpzgrVkyfas?t=181

香港太陽能地圖
http://digital.lib.hkbu.edu.hk/solarmap/

- 你 可 估算 你的物業天台的太陽能發電潛力
- 評估 不同上網電價方案下，回本期可縮短多少年

4. 初步的研究結果

《香港中、小學發展太陽能的潛力與挑戰》研究

《香港太陽能社區》的研究

學校: 是推動香港可再生能源的重要一環

	村屋/ 低密度住宅	私人大廈	學校
地	• 村屋：> 40,000 • 天台用途：晒衫、BBQ及其他休憩用途	• 住宅、商業、工業大廈 • 企業：購買可再生能源證書	• 政府學校-約900間 • 天台、停車場等
回本期	<10年	<3年 (工、商界)	• 不大重要
太陽能的價值	• 慳電費/賺少少錢 • 減排/環保	• 社會企業責任 • 保持競爭力	• 教育價值 (STEM) • 減排/環保

相片來源: https://www.hkcnews.com/news_%E6%96%B0%E8%81%9E/hk-discuss/2017/12/%E4%B8%81%E5%B1%8B-%E4%B8%81%E6%AC%8A-%E5%8E%9F%E5%B1%85%E6%B0%91-20171218043112_e57c_large.jpg; http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/; https://s.yimg.com/uu/api/res/1.2/J0gt0B3O0yNq6P_5G8EIHw--~B/aD0xOTk7dz0zNjA7c209MTthcHBpZD15dGFjaHlvbg--/http://media.zenfs.com/en_us/News/singtao/236232.jpg; www.isd.gov.hk http://w22.property.hk/article_content.php?ln=sc&author=PHK_NEWSPROP&id=53143

訪問及評估太陽能發電潛力

學校數目：22間

調查日期：2018年1月至8月

學校種類：17間資助學校、2間直資學校及3間私立或國際學校。

研究結果1:

受訪學校太陽能發電潛力被大量浪費

若19間受訪學校使用校園天台
僅一半面積安裝太陽能板
一年可生產：

=約240萬度電

=751個香港三人家庭
一年的用電量

=全港最大
太陽能發電場發電量的2倍

渠務署小濠灣污水處理廠太陽能發電場

約240萬度電

約11萬度電

太陽能潛力 vs 現況

實現潛力=4.6%

被浪費潛力=~95%！

《香港中、小學發展太陽能的潛力與挑戰》研究受訪學校太陽能系統及潛力表[1]

受訪學校	有沒有太陽能系統？狀況如何？	目前太陽能系統發電容量（千瓦）	目前太陽能系統全年發電量（度）	學校天台5成面積（平方米）	如使用學校天台5成面積安裝太陽能系統，估計發電量（度）	學校地區
1	有	65.4	44,500.0	220.0	41,776.7	觀塘
2	有	41.5	50,000.0	500.0	110,733.3	荃灣
3	有	3.4	2,666.0	180.0	38,037.5	西貢
4	有	3.2	3,225.0	1,400.0	332,675.0	南區
5	有	3.0	7,417.0	160.0	22,334.2	元朗
6	有	2.4	770.0	220.0	48,585.7	葵青
7	有	2.3	1,600.0	650.0	127,022.2	葵青
8	有	沒有資料	3,000.0	300.0	58,497.0	觀塘
9	有、但已停止運作	0.3	0	900.0	197,158.0	大埔
10	有、但已停止運作	沒有資料	0	390.0	77,702.2	東區
11	有、但已停止運作	沒有資料	0	160.0	33,418.7	元朗
12	有、但已停止運作	沒有資料	0	1,300.0	424,199.2	九龍城
13	沒有	N/A	N/A	1,000.0	192,353.6	大埔
14	沒有	N/A	N/A	500.0	114,174.7	葵青
15	沒有	N/A	N/A	350.0	57,643.6	元朗
16	沒有	N/A	N/A	300.0	67,981.5	離島
17	沒有	N/A	N/A	250.0	57,093.5	離島
18	沒有	N/A	N/A	430.0	84,749.3	沙田
19	沒有	N/A	N/A	1,800.0	394,131.0	西貢
總數		121.5千瓦	113,178度	11,010平方米	2,480,266.6度	

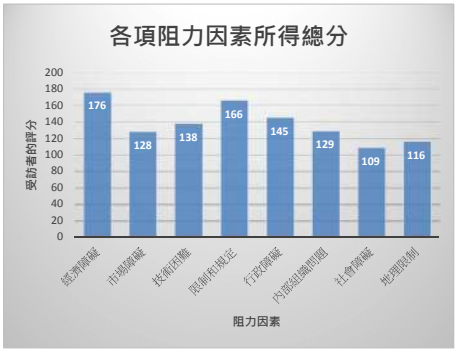
[1] 在22間受訪學校當中，有19間學校有提供足夠數據作分析，其餘3間受訪學校的數據沒有包括在此數據表內。

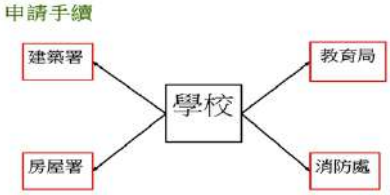
研究結果2

學校在發展太陽能項目時遇上多重阻力

主要阻力

- 缺乏初始資金
- 太陽能項目申請手續繁複
- 行政工作量大



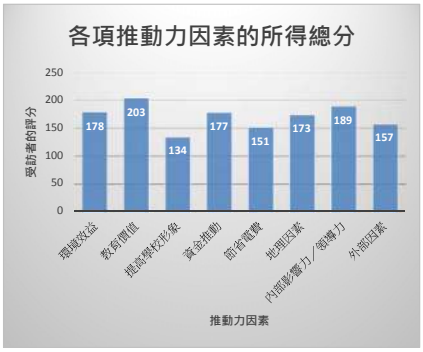


第一位	經濟障礙
第二位	規管上的限制
第三位	行政障礙
第四位	技術困難

研究結果3

教育意義最重要，投資回本不重要

太陽能學校: 為何而做?



第一位: 教育價值	• 三大類 - 科普教育、環保教育、關愛社區
第二位: 內部影響力/領導力	• 來自 - 校長、老師、學生、家長、校內環保團體
第三位: 環境效益	• 減少溫室氣體排放
第四位: 資金推動	• 資金來源:如ＥＣＦ; 回本期: 不重要

17

Subject: Re:《星島日報》查詢：協助學校安裝小型可再生能源系統（環境局回覆）

就你的查詢，環境局回覆如下：

行政長官在2018年《施政報告》中宣佈推出一項新計劃，協助學校及非政府機構安裝小型可再生能源系統。新計劃下政府會為**有關學校**／機構支付可再生能源系統項目的**全部資本成本（包括系統組件及安裝費用等）**，以及為有關項目**提供技術支援**，例如**場地視察及技術評估、系統安裝及測試等**。環境局及機電工程署現正擬定計劃的具體細節，並將於**明年**公布詳細安排。在擬定計劃的具體安排時，我們會**與不同的持份者保持溝通**，並歡迎它們就計劃**提供意見**。

HONG KONG SOLAR PARTNERSHIP

Hong Kong Solar Partnership

Solar School Working Group – 第一次會議

2018年11月6日

學界顧慮:

- 有多少學校能受惠?
- 學校能否保留一定自主權，例如讓老師及同學參與項目的設計?
- 政府、中電及港燈，能否做得夠快、夠好?

學界建議:

- 盡快公布細節
- 「一站式」、「中央採購」...
- 建立平台 – 經驗分享 (項目、融合STEM教學)
- 問卷調查 – 了解校界興趣、需要哪類政策

《透過社區參與建立可持續能源發展的未來方向：以香港兩個潛在太陽能社區為案例》研究

http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/

研究目的

- 以「**錦繡**」及「**康樂園**」兩個有潛能成為太陽能社區的屋苑作為研究案例
- 本研究旨在**探討社區參與對能源轉型的決策過程的作用**

研究方法

- 分析社區及附近學校對上網電價實施前後的反應
- 在社區及學校進行現場太陽能測量，**評估太陽能潛力**
- **訪問**相關持分者，探討香港太陽能社區的前景、發展方案、面臨的障礙及可行的策略，及對太陽能政策的想法 (已訪問錦繡43戶+康樂園29戶)
- 舉行**工作坊** (2019年2月)促進各方交流、商討對策

探討的議題

- 發展太陽能社區是否可行的能源選項？
- 香港是否可依靠太陽能社區作為可持續能源將來的一部分？
- 香港可從其他太陽能先進城市汲取甚麼經驗？
- 香港可怎樣處理從發展太陽能帶來的技術、經濟、社會

錦綉花園太陽能評估
11戶試驗研究(2018年2月)

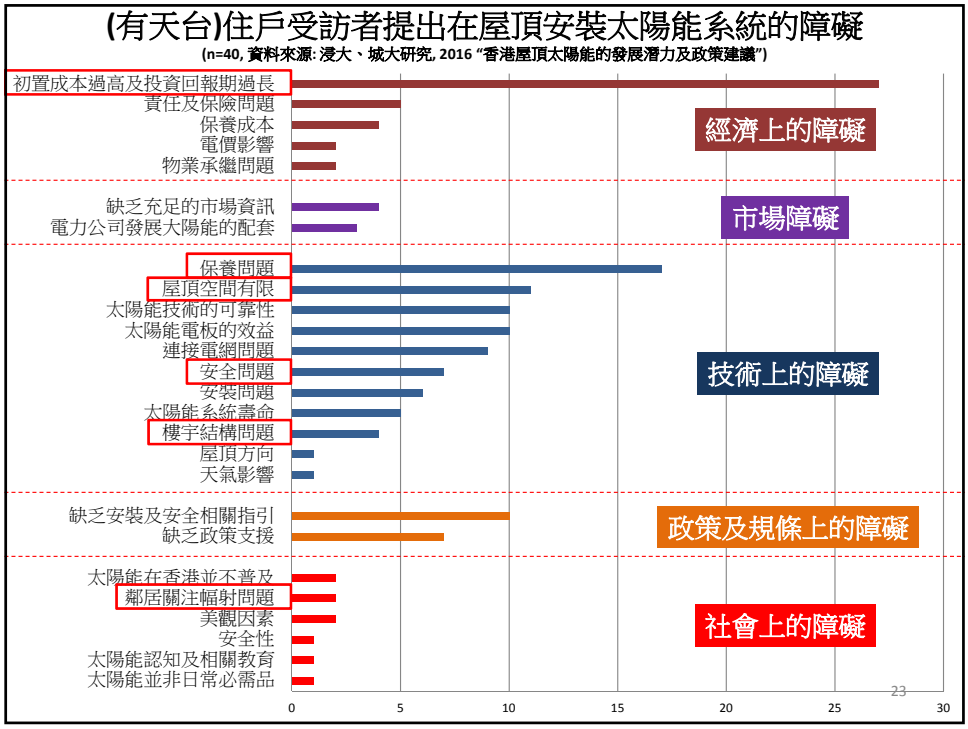
- 香港城市大學能源研究學院及能量研發能源研究中心
- 運用測量儀器(horicatcher)在住戶的**天台**測量了**邊的遮陽物**（例如天台圍牆或周邊的其他建築物）及天台記錄天台的角度和方向
- 隨後通過**分析軟件**(Meteonorm),
- 並結合香港**氣候數據**
- 估算各住宅天台的**太陽能潛力**。

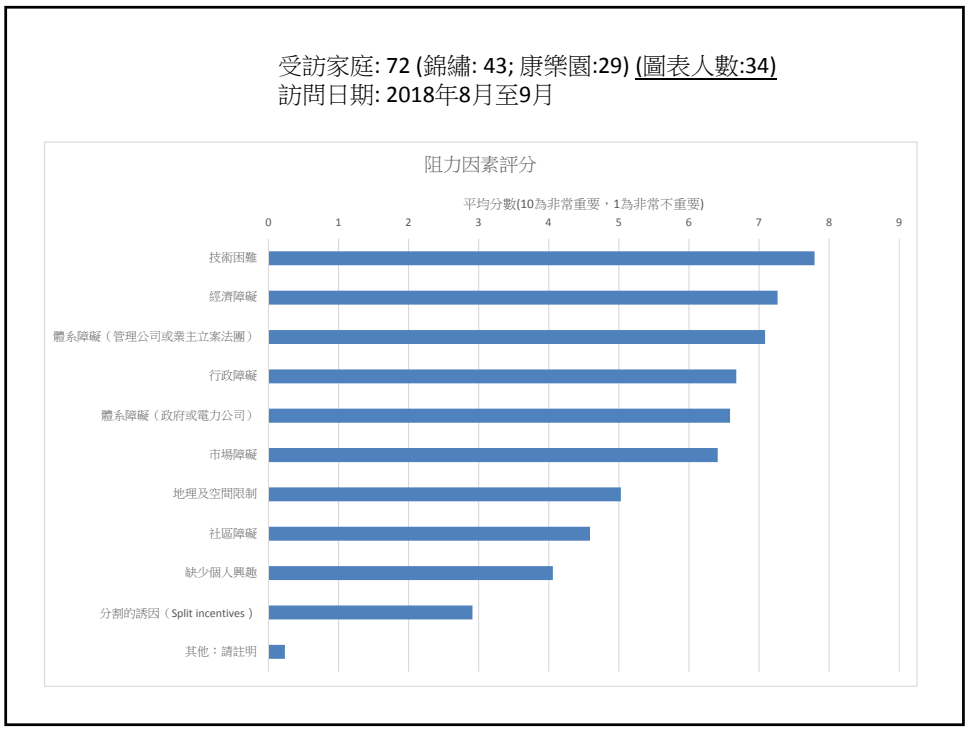
- 估算結果顯示若安裝太陽能發電系統，**每年每平方米的發電量大約會有多少**。
- 住戶可通過估算結果**推斷可得到的可再生能源上網電價補貼**大約有多少。

錦綉花園天台每年每平方米的發電量

11戶試驗研究
(2018年2月)

Assessment No.	House No.	Azimuth (direction)	Inclination	H_Gkhor: Irradiation of global rad., tilted plane, with high horizon (Annual amount)	polycrystalline Silicon panel (Annual electricity generation) 12%	Amorphous Silicon panel(flexible) (Annual electricity generation) 8%	DSSC (Annual electricity generation) 10%
		degrees	degrees	kWh/m^2/year	kWh/year	kWh/year	kWh/year
1	1.1	-58	19	1343	161.16	107.44	134.30
2	1.1	122	19	1247	149.64	99.76	124.70
3	1.1	32	13	618	74.16	49.44	61.80
4	1.2	45	17	1361	163.32	108.88	136.10
5	1.2	-135	17	1249	149.88	99.92	124.90
6	1.3	-58	16	1307	156.84	104.56	130.70
7	1.3	122	16	1253	150.36	100.24	125.30
8	1.4	-73	5	890	106.80	71.20	89.00
9	1.4	107	5	869	104.28	69.52	86.90
10	1.4	-73	16	1273	152.76	101.84	127.30
11	1.4	107	16	1273	152.76	101.84	127.30
12	1.5	55	9	1072	128.64	85.76	107.20
13	1.5	-125	9	1000	120.00	80.00	100.00
14	1.5	-35	17	1347	161.64	107.76	134.70
15	1.5	145	17	1220	146.40	97.60	122.00
16	1.6	55	4	1248	149.76	99.84	124.80
17	1.6	-35	19	1357	162.84	108.56	135.70
18	1.6	145	19	1211	145.32	96.88	121.10
19	1.7	-150	2	1086	130.32	86.88	108.60
20	1.7	-60	17	1347	161.64	107.76	134.70
21	1.7	120	17	1257	150.84	100.56	125.70
22	1.8	119	11	1274	152.88	101.92	127.40
23	1.8	-61	3	1011	121.32	80.88	101.10
24	1.8	-61	19	1339	160.68	107.12	133.90
25	1.8	119	19	1251	150.12	100.08	125.10
26	2.1	32	1	943	113.16	75.44	94.30
27	2.1	-58	19	1310	157.20	104.80	131.00
28	2.1	122	19	1156	138.72	92.48	115.60
29	2.2	30	7	755	90.60	60.40	75.50
30	2.2	-60	19	1336	160.32	106.88	133.60
31	2.2	120	19	1249	149.88	99.92	124.90
32	2.3	85	3	1088	130.56	87.04	108.80
33	2.3	-95	19	1283	153.96	102.64	128.30
34	2.3	85	19	1300	156.00	104.00	130.00


(有天台)住戶受訪者提出在屋頂安裝太陽能系統的障礙
(n=40, 資料來源: 浸大、城大研究, 2016 "香港屋頂太陽能的發展潛力及政策建議")
初置成本過高及投資回報期過長
責任及保險問題
保養成本
電價影響
物業承繼問題
經濟上的障礙
缺乏充足的市場資訊
電力公司發展大陽能的配套
市場障礙
保養問題
屋頂空間有限
太陽能技術的可靠性
太陽能電板的效益
連接電網問題
安全問題
安裝問題
太陽能系統壽命
樓宇結構問題
屋頂方向
天氣影響
技術上的障礙
缺乏安裝及安全相關指引
缺乏政策支援
政策及規條上的障礙
太陽能在香港並不普及
鄰居關注輻射問題
美觀因素
安全性
太陽能認知及相關教育
太陽能並非日常必需品
社會上的障礙
0
5
10
15
20
25
30
23


受訪家庭: 72 (錦繡: 43; 康樂園:29) (圖表人數:34)
訪問日期: 2018年8月至9月
阻力因素評分
平均分數(10為非常重要，1為非常不重要)
0
1
2
3
4
5
6
7
8
9
技術困難
經濟障礙
體系障礙（管理公司或業主立案法團）
行政障礙
體系障礙（政府或電力公司）
市場障礙
地理及空間限制
社區障礙
缺少個人興趣
分割的誘因（Split incentives）
其他：請註明

初步研究結果1:

受訪者認同REFIT是有效的政策，但絕大部分仍持觀望態度。

"First movers" 未能起積極的示範作用

個案 A

個案 B

香港住戶安裝太陽能系統面對多重障礙

ＲＥＦＩＴ落實後，
住戶仍面對經濟因素以外的障礙:

１. 申請程序、需時的不確定性:
"不知道要搞幾耐"

2. 技術問題:
- "isolation transformer"
  – CLP 的安全準則過高?
- 潛建... 漏水

3. 工程承辦商質素參差:
"好多公司話可以做，但全部拿不出 references"

初步研究結果2:
太陽能行業存在隱憂

技術參差不齊？信譽成疑?

香港的安裝成本高

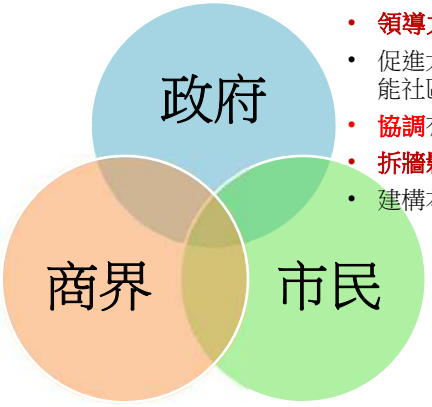
- 香港：安裝成本約佔太陽能系統價格的**1/3**
- 相對德國及中國大陸：

香港是德國的**2.5**倍　　香港是中國大陸的**4**倍

資料來源: Song, A., Lu, L., Liu, Z., & Wong, M. (2016). A Study of Incentive Policies for Building Integrated Photovoltaic Technology in Hong Kong. *Sustainability*, *8*(8), 709. doi:10.3390/su8080709

28

5. 政策建議



- **領導力**
- 促進太陽能學校、太陽能社區的**示範項目**
- **協調**有關政策部門
- **拆牆鬆綁**
- 建構本地**太陽能產業**

- 創新**商業模式**、滿足用家需要
- 中電、港燈，太陽能承辦商有真正的**積極性**去做得快、做得好

- **社區資源**
- **集體智慧**
- 社會支持

https://www.staystock.com/products/lightbulb-cartoon-character-points

28

政策建議 1: 尋找發展太陽能的「香港模式」- 大力推動太陽能*學校*、太陽能*社區*

"學校"

1. **大量太陽能**資源未被利用
2. 有機會能「**規模化**」地發展太陽能
   (按學校類型; 辦學團體的議價優勢)
3. **領導力:** 來自熱心的校長及老師
4. 學校**網絡:**
   (e.g. 校長聯會、辦學團體，如匡智會的網絡)
   → 動員能力、
5. 太陽能的**「總」價值**:
   環境、經濟+ "*教育*價值"
   → STEM

"社區"

1. **大量太陽能**資源未被利用
2. 有機會能「**規模化**」地發展太陽能
   (如錦繡)
3. **領導力:** 來自居民領袖
4. 社區 **網絡**
5. 太陽能的**「總」價值**:
   + 太陽能社區的"*社會*價值"
   - 如, 社會和諧，節能意識的提高

- 更好地擢化、運用太陽能學校、太陽能社區的**示範項目**
- 分享正面及**成功**的例子
- **共同**研發、**解決**問題

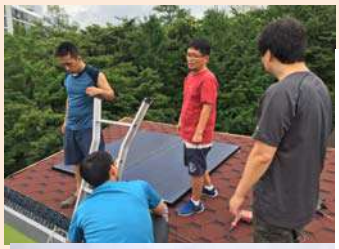
弘立書院(ISF Academy)

聖言中學

新蒲崗居屋采頤花園
- 902 塊太陽能板
- 12座居屋、3,000 伙
- 估計年產近20萬度電、賺逾百萬元，最快8年可回本

啟德明渠

首爾 盛大谷 (Sungdaegol): 能源自主社區



(Photo credits: So-young Kim)

Flat Cable
(專利)

橫濱
Home battery

(Photo credits: AESC, 2015)

政策建議 2: 香港的Solar Empowerment Zones

http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/

政策建議 2:

Solar Empowerment Zones in Yuen Long and more???

Fairview Park 錦綉花園

If…

180W/solar PV Panel (1.65 m^2) x 6 solar PV panels
(~9.9m^2 = available rooftop area)

= ~1 kW potential installed capacity per rooftop

Potential solar PV capacity at Fairview Park
= ~1 kW X 5 024 houses
= ~5.4 MW ????

New York Solar Empowerment Zone

- - expediting the permit process

  - more flexibility in certain technical requirements

  - encouraging neighbors to plan solar projects together to take advantage of bulk pricing

  - projects are eligible for additional incentives

http://sustainableflatbush.org/2008/08/07/i-wanna-be-a-solar-empowerment-zone/

政策建議 3:

香港的太陽*資源評估*及*目標的制定*，可透過*公眾參與*來優化

香港: 太陽能潛力有沒有被低估?

"根據現時估計，在2030年前太陽能只可應付約**1至1.5%**的香港總電力需求。" (香港氣候行動藍圖2030+，2017)

村屋 (超過40,000間)

錦綉花園 (約5,000戶)

公屋及私人住宅大廈

政府學校 (約900間)

政府建築物、天橋、
隔音屏障、運動場看台

水塘

?

相片來源: https://www.hkcnews.com/news_%E6%96%B0%E8%81%9E/hk-discuss/2017/12/%E4%B8%81%E5%B1%8B-%E4%B8%81%E6%AC%BA-%E5%8E%9F%E5%B1%85%E6%B0%91-20171218043112_e57c_large.jpg;
http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/;

不同的評估方法，能相輔相承

Solar output potential in HK: 5.9% - 35%

Table 3

Recent studies estimating Hong Kong's solar PV output potential to the total electricity consumption by its respective year.

Authors	Estimated solar PV potential output (%) of total electricity Consumption (Year)	Methodology/remarks
You and Yang [183]	35% (1995)	- Includes BIPV (residential, commercial, institutional) such as rooftops and outer walls oriented south, east, and west, but excludes shadow facades of high-rise buildings
EMSD [304]	17% (1999)	- Includes BIPV (residential, commercial, institutional) and non-BIPV such as open space, roads and railways, airport and non-built areas such as grasslands and country parks; however, this estimate did not factor in cloud cover or shading
Peng and Lu [185]	14.2% (2011)	- Includes rooftop PV - Takes into account of partial shading
Lu [186]	10.7% (2014)	- Includes rooftop PV - Do not take into account of shading
Wang [187]	5.9% (2012)	- This potential is specific to rooftop solar PV; this study also addresses solar PV deployment on all open space areas and Government, Institution and Community facilities, which could contribute to 6.4% and 1.1% respectively of Hong Kong's total electricity consumption in 2012. - Done with remote sensing, included cloud cover

城市大學能源及環境學院:
實地測量 + 利用Google Earth 輔助

向受訪學校/ 住戶，
蒐集太陽能發電量數據，
以了解*現況*及與*潛力*評估結果作比較。

Mah, D. N.-y., Wang, G., Lo, K., Leung, M. K. H., Hills, P., Lo, A. Y., 2018. Barriers and policy enablers for solar photovoltaics (PV) in cities: Perspectives of potential adopters in Hong Kong. Renewable and Sustainable Energy Reviews, 92, 921-936.

政策建議 4:
*全民參與*與明確的*可再生能源政策*是關鍵

- 可再生能源政策不應是「小圈子」受惠的政策
- **上網電價可能引致的社會問題:「劫貧濟富」?**
- ***2017年11月浸大工作坊:"***

市民對政府發展太陽能抱有懷疑: 市民不清楚政府發展太陽能的展望及目標...市民質疑政府的可再生能源政策缺乏持續性、系統性"

- Renewable Portfolio Standards? 綠色建築政策?

"Solar for all"

- 開放政府土地、公共空間(如水塘、政府建築物天台等)安裝太陽能系統，讓市民「投資」公用土地發電項目

- 首爾: Solar Power Generation Citizen Funds

-

小蠔灣污水處理廠的大型太陽能發電場

石壁水塘的試驗性浮動太陽能發電裝置（合成照片）

還有其他地方嗎?

資料來源:香港氣候行動藍圖2030+; https://sse.erg.cuhk.edu.hk/sse/sites/default/files/public/news/2017-02-06_DSD_SiuHoWan_SolarFarm.jpg

首爾

香港

https://www.hk01.com/%E5%91%A8%E5%A0%B1/242154/%E4%B8%8A%E7%B6%B2%E9%9B%BB%E5%83%B9-%E9%96%8B%E6%94%BE%E9%9B%BB%E7%B6%B2%E8%A8%8E%E8%AB%96%E7%84%A1%E6%AD%A2%E5%A2%83-%E6%B8%AF%E4%BA%BA%E7%94%A8%E9%9B%BB%E4%BD%95%E6%99%82%E6%9C%89%E5%BE%97%E6%8F%80

Supplementary slides

制定指引

錦繡花園：
安裝太陽能板申請表

申請安裝太陽能板

AD/FRM/36

附表 I

安裝太陽能板

要求會因時有所更改

安裝太陽能板及輔助設備的條款及細則

1. 業主必須向管理公司提交太陽能板的規格、安裝方法及輔助設備清單等資料，以便管理公司作出審批。
2. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。
3. 業主須就有關太陽能板、其輔助設備與安裝與機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並遵守有關條例的要求及規定。
4. 業主須自行承擔所有就安裝太陽能板及有關輔助設備所引致的任何損或或損失。
5. 無論任何情況下，管理公司及錦繡花園道路擁有人，均不須對有關安裝之直接 或間接引致的損害或損失，負上任何責任。
6. 業主須定期保養太陽能板以確保該等設備外觀良好及結構安全，否則管理公司有權要求業主移除有關之太陽能板，並將屋頂還原至原有模樣，或採取任何管理公司認為合適的行動，所有涉及的費用均由業主負責。
7. 對於沿著錦綉大道及錦綉河的單位，太陽能板應安裝於當向大道或河道的屋頂後方位置。
8. 安裝在屋頂的太陽能板，總面積不可超越 4 平方米，以及距離中軸 (如有) 最少 1 米。
9. 當業主接獲管理公司或政府部門的要求，業主必須拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。
10. 管理公司有權不時檢視及修改安裝太陽能板的條款及細則。
11. 管理公司對有關申請擁有絕對酌決權，尤其是相關物業存有違規建築物。
12. 當收到鄰近住戶的合理投訴時，管理公司保留可要求業主拆除太陽能板及有關輔助設備的權利。

AD/FRM/36 (Version: 2017/09)

Acknowledgement

This research project (Project Number: 2017.A2.027.18B) is funded by the special round of the Public Policy Research Funding Scheme from the Policy Innovation and Co-ordination Office of The Government of the Hong Kong Special Administrative Region.

鳴謝

本研究項目（項目編號：2017.A2.027.18B）獲香港特別 行政區政府政策創新與統籌辦事處公共政策研究資助計劃／策略性公共政策研究資助計劃撥款資助。

A sharing session with EMSD

AESC, HKBU

20th May, 2019

1. 我們的研究團隊

馬雅燕
香港浸會大學
能源管治與政策

盧笛聲
香港浸會大學
能源政策

張文偉
香港浸會大學
能源政策

秦國斌
香港浸會大學
地球系統變化

周啟鳴
香港浸會大學
地理信息系統

蔡冠球
香港浸會大學
計算機科學

Kingsley Ng
香港浸會大學
Visual Arts

梁國熙
香港城市大學
太陽能資源評估/ 能源效益

Richard Balme
巴黎政治學院
環境治理

Sara Fuller
麥覺理大學
能源公平

Gilles Lepesant
法國國家科學研究中心
能源轉型

Akihisa Mori
京都大學
能源政策

Alice Siu
史丹福大學
公眾參與
Online Deliberative Polling

Marc Wolfram
成均館大學
城市治理

我們的太陽能研究項目

研究期間	研究項目	贊助機構	贊助金額	研究單位
2015-2016	香港**屋頂太陽能的發展潛力**及**政策**建議	中電	$195,720	浸大、城大
2016	香港**太陽能政策**研究	綠色和平、 世界野生自然 基金會	$300,000	浸大、城大、港大、 史丹福大學
2016	香港**太陽能地圖**	浸大圖書館	$100,000	浸大
2016-2017	中國能源創新及轉型: **佛山住宅式太陽能發展**的經驗	UCL、浸大		浸大 UCL
2017	香港可再生能源研究 (**可再生能源上網電價補貼**)	綠色和平、 350香港	$80,000	浸大
2017-2019	**可持續能源轉型**（SETs）的協商參與、信任和社會學習：日本和南韓的比較研究	研究資助局 (研資局)	$1,326,170	浸大、港大、京都 大學、延世大學、 清華大學
2018	香港**太陽能學校**: 機遇及挑戰	綠色和平	$135,000	浸大、城大
2018-2019	社區參與發展可持續能源未來模式: 兩個香港**太陽能社區**的研究	香港特區政府` 政策創新與統籌辦 事處	$632,500	浸大、城市大學、 港大、成均館大學、 綠色和平
2018-2020	通過**社區參與**實現城市能源轉型的多樣性和關鍵：倫敦、弗萊堡（德國）、紐約市、東京、首爾和佛山的國際比較研究	浸大	$150,000	浸大、麥覺理大學、 Unit Géographie- Cités、京都大學、 成均館大學、 Sciences Po

2. 初步的研究結果

《香港中、小學發展太陽能的潛力與挑戰》研究

《香港太陽能社區》的研究
(錦繡、康樂園)

太陽能發展進程

香港...

2018年4月 公佈上網電價計劃詳情

2018年5月 中電開始接受申請

2018年8月 港燈開始接受申請

2018年10月 中電開始計劃並接收 1,100份申請

2018年10月中 政府放寬 ***村屋***安裝高度上限

2019年1月 港燈開始計劃

2019年2月 政府宣佈為***學校***提供一站式的太陽能板安裝服務

2019年3月 中電及港燈共收到 約1770份申請

錦綉花園

2017年9月 管理公司設立 ***安裝太陽能板之申請表***

2018年5月 管理公司修改申請表，允許太陽能板面積由 **4平方米增至只需與屋頂邊緣留空30平方厘米**

2019年1月 有**21**間住戶向管理處申請，**16**戶獲批

康樂園

2018年9月 業主會舉行太陽能講座及設立Whatsapp群組，居民蘊釀**團購**

2018年9月尾 業主會邀請8間承辦商報價並發放資訊給居民

2018年12月 管理公司研究是否有違公契，團購暫時擱置

《香港中、小學發展太陽能的潛力與挑戰》研究

訪問及評估太陽能發電潛力

學校數目：22間

調查日期：2018年1月至8月

學校種類：17間資助學校、2間直資學校及3間私立或國際學校。

Huge untapped solar resources in HK schools

Findings from solar schools study (2018):

- If **19** **of the case study schools** use **50% of their rooftop area** for PV solar panels…
- They can generate: **2.4 million kWh/ year**
- Enough to meet the average power consumption of **751** **three-person households** in HK
- = 2 times of the electricity generation in the Solar Farm at Siu Ho Wan Sewage Treatment Works (over 4200 panels = 1.1MW)
- BUT, these 19 schools utilised only **5%** of solar resources

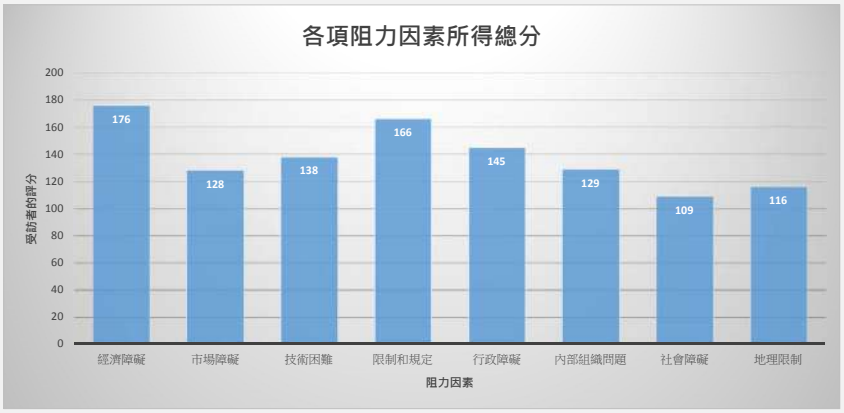
Results

School #	Available Roof Area (m^2)	Annual Solar PV Electricity (kWh)	Annual FiT Payment (HKD)
1	160	22334.2	89336.8
2	160	33418.7	133674.7
3	180	38037.5	152150.0
4	220	48585.7	194342.7
5	220	41776.7	167106.6
6	250	57093.5	228373.9
7	290	67981.5	271925.9
8	300	58497.0	233988.0
9	350	57643.6	230574.4
10	390	77702.2	310808.6
11	430	84749.3	338997.0
12	500	114174.7	456698.9
13	500	110733.3	442933.1
14	600	124395.12	497580.5
15	650	104639.1	418556.3
16	650	127022.2	508088.8
17	770	159000.9	636003.6
18	900	197158.0	788632.0
19	1000	192353.6	769414.6
20	1300	424199.2	1272597.5
21	1400	332675.0	998025.1
22	1800	394131.0	1182392.9

Summary

Roof Area (m^2)	Annual Solar PV Electricity (kWh)	Annual FiT Payment (HKD)
250 – 650	**57,000 – 127,000**	**228k – 508k**

面對的阻力



第一位	經濟障礙
第二位	規管上的限制
第三位	行政障礙
第四位	技術困難

《香港太陽能社區》的研究

http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/

Solar Community Project: Methdology

研究目的	研究方法	探討的議題
• 以「**錦綉**」及「**康樂園**」兩個有潛能成為太陽能社區的屋苑作為研究案例 • 本研究旨在**探討社區參與對能源轉型的決策過程的作用**	• 分析社區及附近學校對上網電價實施前後的反應 • **2018.9-2019.1** 在社區及學校進行現場太陽能測量，**評估太陽能潛力** • **2018.8-9月: 訪問**相關持分者，探討香港太陽能社區的前景、發展方案、面臨的障礙及可行的策略，及對太陽能政策的想法 (已訪問錦綉43戶+康樂園29戶) • 2019.3-4月 舉行**工作坊**促進各方交流、商討對策	• 發展太陽能社區是否可行的能源選項？ • 香港是否可依靠太陽能社區作為可持續能源將來的一部分？ • 香港可從其他太陽能先進城市汲取甚麼經驗？ • 香港可怎樣處理從發展太陽能帶來的技術、經濟、社會政治及制度上的挑戰和機遇？

錦繡花園

總結:

No.	no. of rooftops	total rooftop area (m^2)	estimated electricity output (kWh/year)	annual income (HK$)	FIT rate ($/kWh)
1	2	15	3320	$16,601	$5
2	2	16	3552	$17,759	$5
3	2	17	3754	$18,771	$5
4	2	19	4236	$21,181	$5
5	2	24	5337	$26,683	$5
6	2	25	5492	$27,462	$5
7	1	26	5728	$28,642	$5
8	2	26	5759	$28,796	$5
9	2	26	5654	$28,270	$5
10	2	27	5996	$29,979	$5
11	2	27	5896	$29,481	$5
12	3	29	6450	$32,248	$5
13	2	30	6377	$31,883	$5
14	2	31	5989	$29,945	$5
15	2	32	6879	$34,393	$5
16	2	32	6980	$34,900	$5
17	2	32	6316	$31,580	$5
18	2	32	7113	$35,567	$5
19	1	33	7704	$38,522	$5
20	2	34	7213	$36,063	$5
21	2	34	8400	$42,002	$5
22	3	37	6088	$30,438	$5
23	2	38	8303	$41,514	$5
24	3	41	8944	$44,718	$5
25	2	46	11008	$55,042	$5
26	2	50	11009	$55,046	$5
27	3	57	11199	$55,994	$5
28	3	58	11488	$57,438	$5
29	3	61	13144	$52,576	$4
30	4	73	14474	$57,895	$4
31	2	73	1575	$63,009	$4
32	3	110	21724	$86,894	$4

參考:

上網電價計劃:
<10kW: $5/kWh
10kW-200kW: $4/kWh
>200kW: $3 kWh

註: 10kW的系統大小大約是60m^2
(會根據各太陽能板不同的規格而改變)

受訪住戶太陽能發電潛力*未被好好利用*

我們早前為**32**戶錦綉居民進行太陽能潛力測量，僅**2**戶已安裝太陽能板。

若受訪居民的屋頂都裝上太陽能板，一年可生產：

= 約24萬度電

=*全港最大太陽能發電場*發電量： 1/5

***小濠灣: 1.1 MW; 4,237**塊太陽能板

渠務署小濠灣污水處理廠
太陽能發電場

=錦綉居民 *每年少收的上網電價*: **$120萬**

= 800個錦綉住戶 *一個月的管理費* (以$1,500計算)

- 整個錦繡的太陽能發電量:
- 初步推算結果 - 六月底

初步研究結果2：

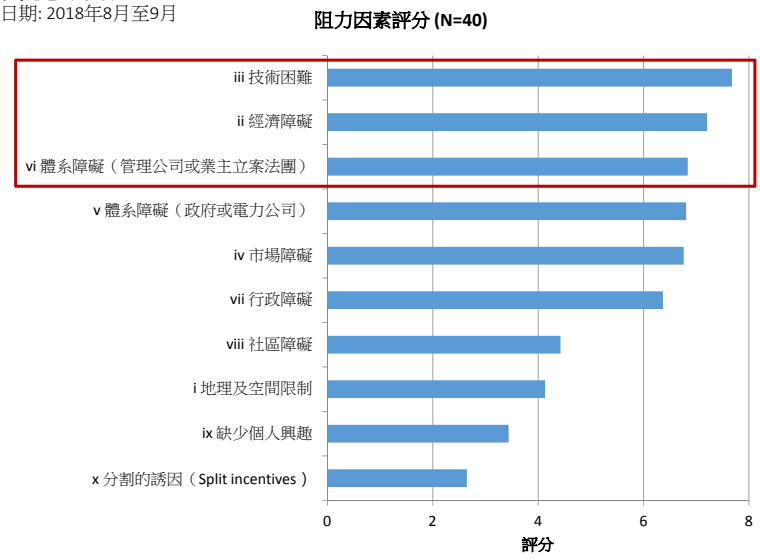
受訪者*認同*上網電價是*有效*的政策，但大部分仍持*觀望*態度。

即使有上網電價，仍有*不少障礙*。

已裝了太陽能系統的住戶，*未有*在社區中起到積極的*示範作用*。

*有上網電價，*但仍有不少障礙.....

受訪家庭: 錦綉: 40
訪問日期: 2018年8月至9月



*有上網電價，*但仍有不少障礙.....

(1) 成本、回本期...*仍然*是問題

...咁姐係我諗住**十幾萬不如換架車先**啦,做咗其他野先啦...
(F1)

成本高,預想是**10萬以下**, 會否**可以分期**
(F12)

無人support我地, 所以最好政府OR **中電**出個**Funding低息貸款**。
(F6)

十年回報期太耐,
十年後可能已搬走...
(F41)

不過**初頭貴**囉, 未係**普及化**
(F21)

*有上網電價，*但仍有不少障礙.....

(2) 技術困難

完全**無一D客觀D既資訊**去比較，性能呀、價錢呀...
(F23)

好似岩岩個**颱風**過左，吹爛左，個太陽能板**飛左去隔離屋**或者車喇，咁個責任歸邊個，呢一個***個人責任***問題都係我既concern。
(F23)

壞左或者**老化**咁呢d野點樣再好好地處理呢...個維修點處理呢...(F35)

如果我裝完之後遇著一個**大颱風**，佢壞左或者損毀左，會唔會話有保險公司承擔返個責任等等...
(F28)

維修保養要錢...唔知**家居保險**包唔包...增加保險成本...
(F22)

(3) 環保意識薄弱 (大部分居民)

香港人住屋都成困難，**無條件**講再生能源發展
(F41)

我而家咁嘅價錢，用電力公司囉，我**唔係一定必須要環保架**，係米呀，做咩要同你做環保，我要俾多1、2百蚊俾你呀？
(F1)

...想看其他人安裝後的情況再作決定...
(F12)

如果**可以睇到人地有成功例子，會比較有信心**
(F19)

...REFIT唔會推動安裝，除非**有成功例子**比人參考...
(F22)

錦綉花園....有可能的社區合作模式.....???

1. 集體採購(=團購) — 支持：69% (N=39)
2. 屋頂租賃 — 支持：55% (N=40)
3. 社區共同擁有的太陽能項目 — 支持：31% (N=39)
4. 第三方擁有的太陽能項目 — 支持：46% (N=37)
5. 政府和私營投資者合作 — 支持：64% (N=36)
6. 眾籌 — 支持：16% (N=37)

...因為錦綉花園有個群組有住客發表過話有興趣，問下有無**團購**，我相信呢到***5000幾戶***應該會有唔少用戶會有興趣....(F23)

私人機構負責更好，我不用煩，更可令世界更美好，**風險又不屬我**...(F41)

如果佢**善用設施**既,我覺得可取既...(F23)

例如可能係個湖啊，巴士站個頂，又或者其他啲花園。聽落去大家都讚成嘅，因為**as long as唔好掂到自己**...(F18)

康樂園

https://bluebalu.files.wordpress.com/2011/12/003-stage-8-hong-lok-yuen.jpg

總結:

No.	no. of rooftops	total rooftop area (m^2)	estimated electricity output (kWh/year)	annual income (HK$)	FIT rate ($/kWh)
1	2	66.55	14460.09	$57,840.30	$4.00
2	3	70	14552.34	$58,209.36	$4.00
3	2	23.12	5152.76	$25,763.80	$5.00
4	2	85	17756.5	$71,026.00	$4.00
5	1	83	18992.1	$75,968.20	$4.00
6	4	111	21439.04	$85,656.16	$4.00
7	2	32.09	7135.81	$35,679.05	$5.00
8	1	59.69	13526.35	$67,631.75	$5.00
9	2	32.44	7097.55	$35,487.75	$5.00
10	2	11.58	1479.4	$7,397.02	$5.00
11	2	20.9	4681.08	$23,405.40	$5.00
12	3	87.73	18148.23	$72,592.92	$4.00
13	2	46	10154.27	$50,771.35	$5.00
14	1	63.13	13833.68	$55,334.72	$4.00
15	2	29.03	6400.83	$32,004.15	$5.00
16	4	39	8495.58	$42,477.90	$5.00
17	2	64.2	14073.14	$70,365.72	$5.00
18	2	23.78	5398.87	$26,994.35	$5.00
19	4	52	10092.3	$50,461.52	$5.00

參考:

上網電價計劃:
<10kW: $5/kWh
10kW-200kW: $4/kWh
>200kW: $3 kWh

註: 10kW的系統大小大約是60m^2
(會根據各太陽能板不同的規格而改變)

受訪住戶太陽能發電潛力*未被好好利用*

我們早前為**19**戶康樂園居民進行太陽能潛力測量，**0**戶已安裝太陽能發電系統 (只有2戶裝有太陽能熱水器)。

若受訪居民的屋頂都裝上太陽能板，一年可生產：

= 約**21萬度電**

=*全港最大太陽能發電場*發電量：**1/5**

*小濠灣: 1.1 MW; 4,237塊太陽能板

渠務署小濠灣污水處理廠
太陽能發電場

=康樂園居民*每年少收的上網電價*: **$94萬**

=**376個康樂園住戶** *一個月的管理費*

(約$1,000 - $4,000; 此以$2500 計算)

初步研究結果2：

受訪者*認同*上網電價是*有效*的政策，但大部分仍持*觀望*態度。

即使有上網電價，仍有*不少障礙*。

已裝了太陽能系統的住戶，*未有*在社區中起到積極的*示範作用*。

政策建議 1: 可再生能源政策必須具有清晰的“願景 (*vision*)” 和“目標(*target*)”

	Hong Kong	Seoul	Singapore	London	New York City
Solar vision	??? -Policy Address 2018/ Climate Change Action Plan 2030+ -Apply wider among Hong Kong public sector under the REFIT and RE certificate system	-“2022 Solarcity Plan” -“One Less Nuclear Power Plant” initiative	-“SolarNova” – install panel across HDB blocks -research and development for higher performance of solar PV systems	-“Solar Action Plan” – for zero carbon city -planning system for solar installation -solar technology investment and improvement	-“OneNYC plan” -To identify and remove barriers to solar deployment -Provision on solar jobs -“Solar 100”
Solar target (MW/GW)	Potential in total electricity generation: 1 – 1.5% (~**660MW**) by 2030	**1GW** by 2022	350 MW by 2020	850 MW by 2030 ; **2 GW** by 2050	350 MW by 2025 ; **1GW** by 2030
Solar resources (kWh/m²)	3.6	4.9	4.5	2.8	4
Solar installation (at present)	<5MW (2017)	73.143 MW (2016)	112.3 MW (2017)	113.2 MW (2017)	85 MW (2016)
Solar in electricity generation (at present)	10,278 MWh (2016)	86,829 MWh (2016)	Renewable Energy: 814 GWh (2014)	102.4 GWh (2017)	39,530 MWh (annual) (2016)
Sources	(Environment Bureau, 2017) (Electrical and Mechanical Services Department, 2018)	(Chung, 2017) (Korean Energy Economics Institute, 2017)	(Housing & Development Board, n.d.; National Climate Change Secretariat, n.d.) (Energy Market Authority, 2018 (National Climate Change Secretariat, n.d.) (Trading Economics, n.d.)	(Department for Business. Energy & Industrial Strategy, 2018a) (Department for Business. Energy & Industrial Strategy, 2018b) (Mayor of London, 2018)	(energy NYC, 2016) (NYC, 2016) (Solar Energy Industries Association, 2018)

[1] With reference that 1% is equal to about 4.4 GWh in current Hong Kong (Environment Bureau, 2017, p. 24).

政策建議 2: 尋找發展太陽能的「香港模式」 -大力推動太陽能*學校*、太陽能*社區*

其他國際城市都大力推動各具特式的太陽能發展: 首爾、倫敦、新加坡，香港....

"學校"

1. **大量太陽能**資源未被利用
2. 強力的RE政策:
    1. 香港的**REFIT** 全球最高+Solar Harvest
3. 有機會能「**規模化**」地發展太陽能

(按學校類型; 辦學團體的議價優勢)

3. **領導力:** 來自熱心的校長及老師
4. 學校**網絡:**

(e.g. 校長聯會、辦學團體，如匡智會的網絡)

→ 動員能力、學校及社會資源

5. 太陽能的**「總」價值**:

環境、經濟+ "*教育*價值" → STEM

"社區"

1. **大量太陽能**資源未被利用
2. 香港的**REFIT:** 全球最高
3. 有機會能「**規模化**」地發展太陽能 (如錦繡)
4. 得天獨厚的生態環境: 米埔后海灣拉姆薩爾 **國際重要濕地**
5. **領導力:** 來自居民領袖
6. 社區 **網絡**
5. 太陽能的**「總」價值**:

+ 太陽能社區的"*社會*價值"

- 如, 社會和諧，節能意識的提高

太陽能學校: 外地經驗分享

Case 3: Solar Schools Program - UK

Strategy: **Community Crowdfunding**

Context

- A charity - **10:10** helps schools **crowdfund** for the cost of solar panels
- 10:10 provides schools with **training**, **resources** and **personal support** to run their own SS project

How does it work

- 10:10 - a **charity** provides a crowdfunding platform for **online donation**; and
- Provides **assistance** for schools to hold **offline fundraising** such as tried-and-tested cake sales

Outcomes

- **80** schools (primary and secondary) participated; **£723,000** raised; **2,370** panels installed

Barrier addressed

- Financial barrier; Regulatory and Administrative barrier

Case 4: Idogaya Elementary School Project - Yokohama, Japan

Strategy: **Engagement with experts**

Context

- The school **cooperates with experts** to provide **outreach program** for students

How does it work

- It invites experts from **NPOs** and **manufacturers** to provides outreach program
- Students **report their learning outcome** to local residents

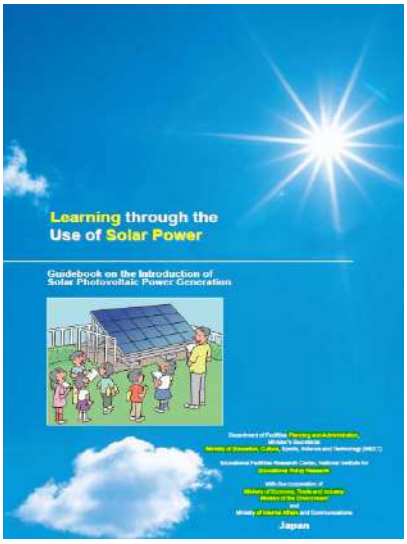
Outcomes

- It can **ease teachers' work load** and solve the problem of insufficient relevant knowledge
- Students are encouraged to learn voluntarily, thus, **environmental education** is further promoted

Barrier addressed

- Administrative barrier

Solar School Guidebook - Japan



https://www.nier.go.jp/shisetsu/pdf/e-taiyoukou.pdf

政策建議 3:

香港的太陽*資源評估*及*目標的制定*，
可透過*公眾參與*來優化

香港: 太陽能潛力如何能更準確地被評估?

"根據現時估計，在2030年前太陽能只可應付約1至1.5%的香港總電力需求。" (香港氣候行動藍圖2030+，2017)

村屋 (超過40,000間)

錦綉花園 (約5,000戶)

公屋及私人住宅大廈

政府學校 (約900間)

政府建築物、天橋、
隔音屏障、運動場看台

水塘

相片來源: https://www.hkcnews.com/news_%E6%96%B0%E8%81%9E/hk-discuss/2017/12/%E4%B8%81%E5%B1%8B-%E4%B8%81%E6%AC%BA-%E5%8E%9F%E5%B1%85%E6%B0%91-20171218043112_e57c_large.jpg;
http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/;

不同的太陽能資源評估方法，能相輔相承

Solar output potential in HK: 5.9% - 35%

Table 3
Recent studies estimating Hong Kong's solar PV output potential to the total electricity consumption by its respective year.

Authors	Estimated solar PV potential output (%) of total electricity Consumption (Year)	Methodology/remarks
You and Yang [183]	35% (1995)	- Includes BIPV (residential, commercial, institutional) such as rooftops and outer walls oriented south, east, and west, but excludes shadow facades of high-rise buildings
EMSD [104]	17% (1999)	- Includes BIPV (residential, commercial, institutional) and non-BIPV such as open space, roads and railways, airport and non-built areas such as grasslands and country parks; however, this estimate did not factor in cloud cover or shading
Peng and Lu [185]	14.2% (2011)	- Includes rooftop PV - Takes into account of partial shading
Lu [186]	10.7% (2014)	- Includes rooftop PV - Do not take into account of shading
Wong [187]	5.9% (2012)	- This potential is specific to rooftop solar PV; this study also addresses solar PV deployment on all open space areas and Government, Institution and Community facilities, which could contribute to 6.4% and 2.1% respectively of Hong Kong's total electricity consumption in 2012. - Done with remote sensing, included cloud cover

城市大學能源及環境學院:
實地測量 + 利用Google Earth 輔助

向受訪學校/ 住戶，
蒐集太陽能發電量數據，
以了解*現況*及與*潛力*評估結果作比較。

Mah, D. N.-y., Wang, G., Lo, K., Leung, M. K. H., Hills, P., Lo, A. Y., 2018. Barriers and policy enablers for solar photovoltaics (PV) in cities: Perspectives of potential adopters in Hong Kong. Renewable and Sustainable Energy Reviews, 92, 921-936.

太陽能數據: 可以更好地利用

智慧城市:

(1) 優化政策的制訂

Stanford project "The DeepSolar Project"

-
- http://web.stanford.edu/group/deepsolar/home.html
- "We offer DeepSolar as a **publicly-available database** for researchers, utilities, solar developers and policymakers to further uncover solar deployment **patterns**, build **comprehensive economic and behavioral models**, and ultimately support the adoption and management of solar electricity."

(2) 環保教育 (STEM)

Online solar power data logging systems
e.g. www.sunnyportal.com

Hong Kong solar Partnership:
Who, aims, organisation structure

- Aims:
  - Facilitate dialogue
  - Try new ways of public engagement
  - Share good practice
- Website – just launched
- Funding sources: HKBU, CLP, HEC
- Is underpinned by research

http://aesc.hkbu.edu.hk/hongkongsolarpartnership

Hong Kong Solar Partnership

SOLAR SCHOOLS TASK FORCE

First gathering 14 November 2018

Asian ENERGY STUDIES CENTRE

香港浸會大學 HONG KONG BAPTIST UNIVERSITY

Why schools

1. **Leadership** from principals and teachers

2. School **networks**
   (e.g. 校長聯會、辦學團體的網絡)
   →Effective mobilization

3. Education **Bureau**
   →Green schools awards

4. Education **values** of solar
   → STEM

Huge untapped solar resources in HK schools
Findings from solar schools study (2018):

- If **19** **of the case study schools** use **50% of their rooftop area** for PV solar panels…
- They can generate: **2.4 million kWh/ year**
- Enough to meet the average power consumption of **751** **three-person households** in HK
- = 2 times of the electricity generation in the Solar Farm at Siu Ho Wan Sewage Treatment Works (over 4200 panels = 1.1MW)
- BUT, these 19 schools utilised only **5%** of solar resources

Solar School Working Group: Possible outputs

(1)Solar School Peer Support Group?
- Teachers from experienced solar schools take the role as mentors
- Take turns to answer enquiries; share templates

(2) Solar school GUIDEBOOK? Web-based & interactive?

(3) Engaging students as SOLAR INVESTIGATORS through project-based learning?
- Engage students as **solar researchers**
- **Primary or Secondary School Students** - Solar investigators
- **University Students** – Solar trainers
- **Professors** – Project leaders

(4) Solar school workshop
- Tentative theme: "Integrating STEM into Solar Schools"

(5) Policy recommendations?
- The importance role of "School Sector" in solar developments in HK: solar school targets? Which policies will (not) work?

政策建議 1: 可再生能源政策必須具有清晰的 "願景 (*vision*)" 和"目標(*target*)"

	Hong Kong	Seoul	Singapore	London	New York City
Solar vision	??? -Policy Address 2018/ Climate Change Action Plan 2030+ -Apply wider among Hong Kong public sector under the REFIT and RE certificate system	-"2022 Solarcity Plan" -"One Less Nuclear Power Plant" initiative	-"SolarNova" – install panel across HDB blocks -research and development for higher performance of solar PV systems	-"Solar Action Plan" – for zero carbon city -planning system for solar installation -solar technology investment and improvement	-"OneNYC plan" -To identify and remove barriers to solar deployment -Provision on solar jobs -"Solar 100"
Solar target (MW/GW)	Potential in total electricity generation: 1 – 1.5% (~660MW) by 2030	1GW by 2022	350 MW by 2020	850 MW by 2030 ; 2 GW by 2050	350 MW by 2025 ; 1,000 MW by 2030
Solar resources (kWh/m²)	3.6	4.9	4.5	2.8	4
Solar installation (at present)	<5MW (2017)	73.143 MW (2016)	112.3 MW (2017)	113.2 MW (2017)	85 MW (2016)
Solar in electricity generation (at present)	10,278 MWh (2016)	86,829 MWh (2016)	Renewable Energy: 814 GWh (2014)	102.4 GWh (2017)	39,530 MWh (annual) (2016)
Solar in total electricity generation/consumption/demand in % (at present)	Renewable energy in electricity consumption is about 0.1% (2016)	Solar energy in electricity generation is 9.93% (2016)	Solar energy in electricity generation is 0.8% (2017)	Solar energy (via FiT) in electricity demand is 8GWh = 0.2% (2016)	Solar energy in state's electricity generation is 1.40% (2018, New York State)
Sources	(Environment Bureau, 2017) (Electrical and Mechanical Services Department, 2018)	(Chung, 2017) (Korean Energy Economics Institute, 2017)	(Housing & Development Board, n.d.; National Climate Change Secretariat, n.d.) (Energy Market Authority, 2018 (National Climate Change Secretariat, n.d.) (Trading Economics, n.d.)	(Department for Business. Energy & Industrial Strategy, 2018a) (Department for Business. Energy & Industrial Strategy, 2018b) (Mayor of London, 2018)	(energy NYC, 2016) (NYC, 2016) (Solar Energy Industries Association, 2018)

[1] With reference that 1% is equal to about 4.4 GWh in current Hong Kong (Environment Bureau, 2017, p. 24).

Acknowledgement

This research project (Project Number: 2017.A2.027.18B) is funded by the special round of the Public Policy Research Funding Scheme from the Policy Innovation and Co-ordination Office of The Government of the Hong Kong Special Administrative Region.

鳴謝

本研究項目（項目編號：2017.A2.027.18B）獲香港特別 行政區政府政策創新與統籌辦事處公共政策研究資助計劃／策略性公共政策研究資助計劃撥款資助。

Meeting with EMSD for discussion on Study Report of Photovoltaic (PV) Applications and PV Potential on Building Rooftops in Hong Kong

Room 1218, Department of Geography,
Academic and Administration Building,
Hong Kong Baptist University

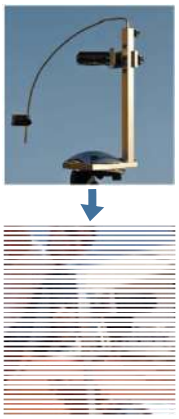
21st August, 2019

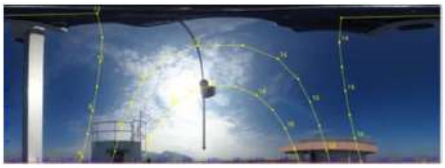
Solar Potential Assessment Methodology for Public Policy Research (PPR) Study: Engaging the Community to Develop a Model for Sustainable Energy Futures: A Case Study of Two Prospective Solar Communities in Hong Kong

現場太陽能評估
(On-site Solar Assessment)

太陽能光伏系統發電分析

- 香港城市大學能源及環境學院/能量研發能源研究中心。
- 現場使用測量儀器 horicatcher 和分析軟件 Meteonorm 來估算屋頂每年可接收多少太陽能。
- 進一步估算安裝太陽能光伏系統的全年發電量。
- 最後計算每年可再生能源上網電價補貼。





社區太陽能潛力推算
(Community Solar Potential Projection)

Based on the solar assessment on about 50 houses in Fairview Park and Hong Lok Yuen,

A. Calculation of shading ratio:

A shading ratio (S) is calculated for each sample household which have conducted solar potential assessments:

$$S = \frac{H_{Gkhor}}{H_{Gh}}$$

where

H_{Gkhor} refers to the assessed irradiance taking azimuth, rooftop inclination and surrounding building heights into account; and

H_{Gh} refers to the irradiance received assuming rooftop inclination is 0° and surround building heights are 0° in all directions

Categories of shading ratio of Fairview Park		
Categories	Direction	S (Min - Max)
N	North side (0° ≤ γ ≤ 90°, 270° ≤ γ ≤ 0°)	0.92026825633383 - 0.961251862891207
S	South side (90° < γ < 270°)	0.96274217585693 - 1.02384500745156
Categories of shading ratio of Hong Lok Yuen		
Categories	Direction	S (Min - Max)
All	Direction of rooftop cannot be determined	0.919402985074627 - 1.01268656716418
NE	0° - 90°	0.937313432835821 - 0.972388059701493
SE	90° - 180°	0.92089552238806 - 1.01268656716418
SW	180° - 270°	0.947014925373134 - 1.01193139448173
NW	270° - 360°	0.919402985074627 - 0.959701492537313
Note: 0° denotes North.		

B. Area Estimation:

- Digitalize the roofs from satellite image
- Calculate all observed roof areas of Fairview Park and Hong Lok Yuen with **GIS** analysis tool (GeoInfo Map)

C. Calculation of Solar Potential:

The maximum solar panel installed capacity is calculated as follows:

$$\sum \text{Installed capacity (kW) of rooftop} = \frac{0.3\text{kW}}{1.7} \text{ x Area (working or useable)}$$

The solar energy potential is calculated as follows:

$$E = S \times \mathrm{H_{Gh}} \times A \times eff \times PR$$

where
S is the shading ratio;

$\mathrm{H_{Gh}}$ is the irradiance received assuming rooftop inclination is 0° and surround building heights are 0° in all direction (the $\mathrm{H_{Gh}}$ values in Fairview Park and Hong Lok Yuen are 1,342 kWh/m^2 and 1,340 kWh/m^2 respectively based on Meternorm);

A is the working area/useable area;

eff is the efficiency of solar panel (17% is used assuming monocrystalline silicon solar panels are used) ; and

PR is the performance ratio of the PV system (82% is used assuming the PV system would lost part of the generation because of various reasons, except shading).

Limitation

1. Potential errors in household number
Number of Households –
Fairview Park: 5,024 (Official) vs 4,996 (Observation)
Hong Lok Yuen: 1,202 (Official) vs 1,163 (Observation)

2. Limitation of conducting solar assessments in the highest and biggest roof
Only accessible roof are measured and assessed due to safety concern.

3. Distorted image in GeoInfo Map

4. The maximum installed capacity of household rooftops
The shape of roofs are not considered, but area only.

Results

太陽能評估 (Solar Assessment) 錦綉花園

以**32戶**太陽能評估結果的**平均數**計算

- 系統面積：34 m^2
- 太陽能發電量：6.95 兆瓦時/年

以**32戶**太陽能評估結果的**總數**計算

- 系統面積：1078 m^2
- 太陽能發電量：222.43兆瓦時/年
- 年度上網電價收入：$1,129,947

No.	adjusted no. of rooftop	adjusted rooftop area	adjusted entire system output potential (kWh/year)	adjusted yearly income	FIT rate
1	2	15	3320.1	16600.5	5
2	2	16	3551.81	17759.05	5
3	2	17	3754.11	18770.55	5
4	2	19.16	4236.14	21180.7	5
5	2	22.75	4619.66	23098.32	5
6	2	23.96	5327.74	26638.71	5
7	2	24	5336.64	26683.2	5
8	2	25.08	5492.35	27461.75	5
9	1	26	5728.32	28641.6	5
10	2	26	5759.26	28796.3	5
11	2	26.24	5654.06	28270.3	5
12	2	27.16	5995.86	29979.3	5
13	2	27.42	5896.14	29480.7	5
14	2	29.79	6376.58	31882.9	5
15	2	31	5988.93	29944.65	5
16	2	31.59	6878.69	34393.45	5
17	2	31.94	6980	34900	5
18	2	31.99	6315.97	31579.85	5
19	2	32	7113.48	35567.4	5
20	1	33.25	7704.36	38521.8	5
21	2	33.51	7212.573	36062.87	5
22	2	33.9	8400.39	42001.95	5
23	2	37.74	8280.51	41402.55	5
24	2	37.8	8302.78	41513.92	5
25	2	38.9	8540.69	42703.44	5
26	2	40	8724.4	43622	5
27	2	42	9339.12	37356.48	4
28	2	44	9795.06	39180.24	4
29	2	46	11008.35	55041.75	5
30	2	50	11009.2	55046	5
31	2	73	1575.2	63008.8	4
32	2	84	18214.14	72856.56	4

太陽能評估 (Solar Assessment) 康樂園

以**19戶**太陽能評估結果的**平均數**計算

- 系統面積：52m^2
- 太陽能發電量：11.07兆瓦時/年

以**19戶**太陽能評估結果的**總數**計算

- 系統面積：984m^2
- 太陽能發電量：210.37兆瓦時/年
- 年度上網電價收入： $933,843

No.	no. of rooftops	total rooftop area (m^2)	estimated electricity output (kWh/year)	annual income (HK$)	FIT rate ($/kWh)
1	2	11.58	1479.4	7397.02	5
2	2	20.9	4681.08	23405.4	5
3	2	23.12	5152.76	25763.8	5
4	2	23.78	5398.87	26994.35	5
5	1	26.28	5897.23	29486.17	5
6	2	29.03	6400.83	32004.15	5
7	2	32.44	7097.55	35487.75	5
8	4	39	8495.58	42477.9	5
9	2	46	10154.27	50771.35	5
10	4	52	10092.3	50461.52	5
11	1	59.69	13526.35	67631.75	5
12	1	63.13	13833.68	55334.72	4
13	2	64.2	14073.14	70365.72	4
14	2	66.55	14460.09	57840.3	4
15	3	70	14552.34	58209.36	4
16	1	75	16498.5	65994	4
17	1	83	18992.1	75968.2	4
18	3	87.73	18148.23	72592.92	4
19	4	111	21439.04	85656.16	4

社區太陽能潛力推算
(Community Solar Potential Projection)

Result	Fairview Park	Hong Lok Yuen
Number of working samples	4,996 households	1,163 households
Total rooftop area (m^2)	240,811	97,544
Total usable rooftop area (m^2)	232,337	94,765
Maximum installed capacity based on rooftop area (MW)	42.51	17.21
Maximum installed capacity based on useable rooftop area (MW)	41.01	16.72
Total estimated annual solar energy potential based on total rooftop area (MWh)	42137.95 - 44423.73	16926.09 - 18093.03
Total estimated annual solar energy potential based on total useable rooftop area (MWh)	40655.19 - 42860.57	16443.94 - 17579.17

若錦綉花園及康樂園的屋頂都裝上太陽能板：

= 一年可生產不少於**5700萬度電**

= 裝機容量可達全香港太陽能潛力的**8.75%**
(根據《氣候行動藍圖 2030+》，2030年最大裝機容量為660兆瓦)

=不少於**17,000 個**三人家庭每年用電量 (每年約3,300度)

太陽能訪問
(Solar Household Survey)

錦綉花園個案

- 裝機容量: 6.6 kW
- 發電量(2019年2月至3月,45日計算): 775 kWh
- 上網電價電費(2019年2月至3月,45日計算): $3,900

康樂園個案

- 裝機容量: 5.13 kW
- 發電量(2019年1月至5月,平均每月): 430 kWh
- 上網電價電費(2019年1月至5月,平均每月): $2,150

學校的太陽能潛力評估

19間學校受訪學校的太陽能系統及潛力表 2018

受訪學校	有沒有太陽能系統？狀況如何？	目前太陽能系統發電容量（千瓦）	目前太陽能系統全年發電量（度）	學校天台5成面積（平方米）	**如使用學校天台5成面積安裝太陽能系統，估計發電量（度）**	學校地區
1	有	65.4	44,500.0	220.0	41,776.7	觀塘
2	有	41.5	50,000.0	500.0	110,733.3	荃灣
3	有	3.4	2,666.0	180.0	38,037.5	西貢
4	有	3.2	3,225.0	1,400.0	332,675.0	南區
5	有	3.0	7,417.0	160.0	22,334.2	元朗
6	有	2.4	770.0	220.0	48,585.7	葵青
7	有	2.3	1,600.0	650.0	127,022.2	葵青
8	有	沒有資料	3,000.0	300.0	58,497.0	觀塘
9	有、但已停止運作	0.3	0	900.0	197,158.0	大埔
10	有、但已停止運作	沒有資料	0	390.0	77,702.2	東區
11	有、但已停止運作	沒有資料	0	160.0	33,418.7	元朗
12	有、但已停止運作	沒有資料	0	1,300.0	424,199.2	九龍城
13	沒有	N/A	N/A	1,000.0	192,353.6	大埔
14	沒有	N/A	N/A	500.0	114,174.7	葵青
15	沒有	N/A	N/A	350.0	57,643.6	元朗
16	沒有	N/A	N/A	300.0	67,981.5	離島
17	沒有	N/A	N/A	250.0	57,093.5	離島
18	沒有	N/A	N/A	430.0	84,749.3	沙田
19	沒有	N/A	N/A	1,800.0	394,131.0	西貢
總數		121.5千瓦	113,178度	11,010平方米	**2,480,266.6度**	

若19間受訪學校使用校園天台僅
一半面積安裝太陽能板

一年可生產：

=約240萬度電

=751個香港三人家庭
一年的用電量

=全港最大
太陽能發電場發電量的2倍

渠務署小濠灣污水處理廠太陽能發電場

約240萬度電
太陽能潛力 vs 現況

約11萬度電

實現潛力=4.6%

被浪費潛力=~95%！

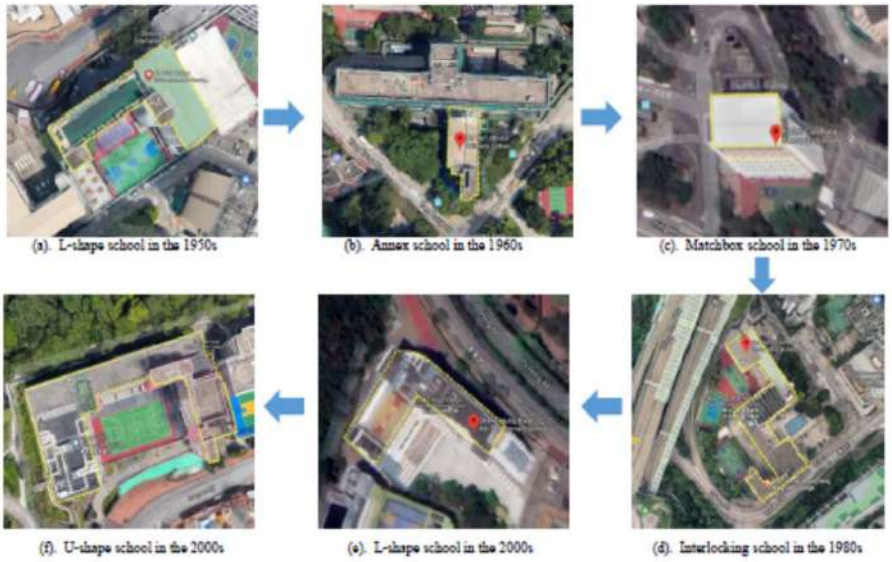


Figure Y. Examples of Hong Kong schools in different designs. (source: Google Map)

School Sponsoring Bodies	Number of Primary Schools
Hong Kong Sheng Kung Hui	57
Catholic Diocese of Hong Kong	52
Hong Kong Government	34
Po Leung Kuk	24
The Hong Kong Council of the Church of Christ in China	22
Tung Wah Group of Hospitals	14
Hong Chi Association*	13
The Methodist Church, Hong Kong	11
Canossian Daughters of Charity	10
Baptist Churches	8
Hong Kong Buddhist Association	7
Sisters of the Precious Blood	7
The Evangelical Lutheran Church of Hong Kong	7
Kowloon Tong Alliance Church	6
Lutheran Church-Hong Kong Synod	6
Salesians of Don Bosco	6
The Lok Sin Tong Benevolent Society Kowloon	6
Hong Kong Taoist Association	5
Shun Tak Fraternal Association	5
Yan Chai Hospital	5
Heung Hoi Ching Kok Lin Association	4
Pok Oi Hospital	4
Sik Sik Yuen	4
Ching Chung Taoist Association of Hong Kong	3
Five Districts Business Welfare Association	3
Institute of the Brothers of the Christian Schools	3
Tsung Tsin Mission of Hong Kong	2
Tung Lin Kok Yuen	2
Chi Hong Ching Yuen	1
Chi Lin Nunnery	1

Notes:
(1) The Table includes the major school sponsoring bodies which organise public primary schools (direct subsidy, aided and government schools) in Hong Kong.
(2)* indicates school sponsoring body that only hosts special schools.

Sources: (Education Bureau of Hong Kong, n.d.; Hong Chi Association, n.d.)

Discussions of Study Report

Issues to be discussed:

1. About the sampling method of "Questionnaire Survey" and "Phone Interview"

a) We would like to learn more about ***the criteria for selecting the interviewees in the Target Groups.*** Referring to P.3 of the full report, it seems that some stakeholders such as NGOs and Think Tanks are not selected into the survey target groups.

b) Referring to P.3 of the full report, the identity of the interviewees in each target group, such as "rural committees" and "educational institutions", are not provided. ***If possible, could EMSD provide more details about the identity of interviewees in each target group? For instance, what do "rural committees" refer to?***

c) Referring to P.8 of the full report, 6 out of 43 RE suppliers have returned the questionnaire survey, ***do the 6 responses from the 43 RE suppliers come from RE suppliers who have experience with PV systems?***

d) Referring to P.4 of the full report, it seems that phone interviews were only conducted in the private sector. ***What are the selection criteria for recruiting interviewees for the phone interviews? What are the reasons for excluding non-private sector in the phone interviews (other than the "rural committee" target group)?***

e) Referring to P.9 of the full report, the study report mentioned "30 organizations from private sector were selected in the following-up phone calls". ***How many interviewees were selected for the second stage interview in each sector?***

f) Could EMSD provide more details about the phone interviews, such as the length of each interview?

2. About the calculation method of PV potential in Hong Kong

a) Referring to P.7 and P.39 of the full report, this study report cited reference [17] for calculating the roof area suitable for PV installation, ***did the study report use this parameter in the calculation of the roof area suitable for PV installation for each land use (except NTEH)?***

b) The broad categories of each building type (e.g. GIC) might not be effective in capturing the wide range of available roof ratio in each category. For example, the available roof ratio of schools vary considerably across schools in Hong Kong. Referring to P. 37 Table 4.2 of the full report, ***could EMSD clarify the definition of each building type for calculating the available roof ratio?***

c) There are considerable discrepancies between the available roof ratio from this study report and Hong Kong Baptist University (HKBU) and City University (CityU) previous/ on-going studies.

Building types	In this EMSD report (%)	HKBU and CityU's previous studies (%)
Private residential ≤ 25 storey	12 – 18	Almost 100 in Fairview Park (Source: an on-going PPR study)
NTEH	56 – 76 (Based on calculation of 22-30 PV panels for each 65m² NTEH)	37 – 100 (Source: a completed contract study on rooftop solar potential in HK)

Hence, ***how does this study report calculate the available roof ratio of the above building types?***

3. About the robustness of the surveyed results

a) Referring to Tables 3.2 and 3.3 of the full report, it seems that there exist considerable discrepancies between the findings from this study report and HKBU study.

Table 3.2 Domestic Scale ≤ 10kW		
	In this study report	**In HKBU study (from PPR project's interviews)**
Average Capital Cost (HK$/kW)	122,000	23,176 (3 households)
Panel efficiency (kW/m²)	0.062	0.165 - 0.197

Table 3.3 Domestic Scale ≤ 10kW		
	In this study report	**Information provided by industries (2014 data; used in HKBU and CityU's Study)**
Payback Period (Years)	108	27 - 49

What are the factors which could explain for the discrepancies between this study report and the AESC study?

b) Referring to P.18 (Capital Cost per Installed Capacity in difference years Domestic scale: installed Capacity ≤ 10kW), ***has this study report taken out the outlier (around 800 HK$/kW) for the calculation in this study?***

Appendix

Appendix:

敬啟者:

推動錦綉花園及康樂園成為太陽能社區的建議

我們是香港浸會大學亞洲能源研究中心的研究團隊，正進行一項為期一年(2018年8月至2019年8月)、由香港政府政策創新與統籌辦事處資助、主題為「透過社區參與建立可持續能源發展的未來方向：以香港兩個潛在太陽能社區為案例」的研究項目。就政府及兩電於2018年10月及2019年1月開始為期十五年的「上網電價計劃」，我們希望可以了解政策對鼓勵錦綉花園及康樂園等中密度住宅安裝太陽能系統的影響，同時了解居民發展太陽能的經驗。

透過與居民及社區持份者的接觸，我們發現錦綉花園和康樂園各有特點和條件發展太陽能。錦綉花園的特色在於其發展規模。錦綉花園共有約五千戶，並且毗鄰米埔內后海灣拉姆薩爾國際重要濕地，很有潛能成為國際知名的太陽能社區。 而康樂園的特色則在於居民相對優厚的經濟條件及社區凝聚力。康樂園早有發展社區項目的經驗 – 廚餘回收，而社區內亦有由居民自發組成的太陽能群組，動員能力相對較強。

我們於2018年9月至今年5月，在錦綉花園及康樂園共訪問了大約80多名居民及相關持份者、為合共約50名居民的居所進行太陽能發電潛力評估，及分別舉行了兩場各有30多名居民出席的商議工作坊。我們初步得出以下研究結果: (1) 錦綉花園和康樂園於天然資源、居民經濟負擔、興趣等方面亦相當有潛力發展太陽能；(2)「上網電價計劃」雖然為居民帶來一定誘因，不少居民仍持審謹、觀望態度，有部份問題仍有待解決，當中主要包括 – 高昂初置成本、難以在市場物色可靠承辦商、擔心漏水及颱風問題、及欠缺示範項目。我們的研究發現居民對政府有所訴求，因此，初步整合了居民及持份者的意見，並提出以下三點建議，謹供政府參考。

第一，我們建議政府**設立「太陽能項目專屬資助基金」**。「上網電價計劃」雖然可以大大縮短回本期，但高昂的初置成本仍是居民的重要考慮之一。政府「環境及自然保育基金」一直以來積極推動屋苑、商廈實行環保活動，其中康樂園數年前亦透過這基金設立屋苑廚餘循環再造項目，環保工作得以推動至今。我們建議政府就太陽能發展提供類似支援，為居民的個人或社區的太陽能合作項目提供基金，以減輕初置成本負擔，獲資助的居民或社區團體則需要舉辦太陽能相關的社區參與/宣傳計劃，例如詳細紀錄及匿名分享安裝經驗，在社區、甚至為全港發揮示範作用。個案分享可有助居民清楚安裝流程、了解選擇合適承辦商的注意事項，相信長遠能增強居民對安裝太陽能設備的信心。

第二，我們建議政府**重點打造「錦綉花園或康樂園太陽能街」**。透過訪問，我們發現錦綉花園有些熱心環保的居民聚居同一街或小區，康樂園亦有已安裝住戶帶頭鼓勵鄰居安裝太陽能設備。參考政府最近為學校安裝太陽能光伏系統提供資金及技術援助的「採電學社」計劃，我們認為政府可先於這些較有潛力的地點重點支持太陽能光伏項目。作為試點，政府可提供技術及資金協助，例如邀請該街道或小區居民參與計劃安裝太陽能光伏系統。此等計劃亦有助居民，甚至電力公司了解現時的電網可承載量。

第三，我們建議政府**推動行業設立「太陽能光伏系統工程專業守則」**。就「上網電價計劃」出台後，不少新興的太陽能承辦商湧現，但根據我們的了解，居民對承辦商的專業水平有所保留，除了系統的規格外，他們對漏水、颱風等問題仍存有很大憂慮。尤其是防水工程難以得到保證，令不少受訪者卻步安裝。了解到政府為學校安裝太陽能光伏系統時亦有進行試水，政府可要求或規管承辦商必須為客戶進行試水，若安裝後出現漏水問題，亦有助釐清雙方責任。然而，錦綉花園及康樂園的屋頂均為斜頂，試水規定亦需小心考慮可行性。

「上網電價計劃」是香港發展可再生能源的重要一步，政策亦成功凝聚了一批有興趣、有能力發展太陽能的錦綉花園及康樂園居民，若政府在這難得的機遇能更積極提供配合措施，相信必定能加快社區發展太陽能的進程。

我們的研究將於今年八月完結，屆時將向 貴署提供較全面及完整的研究結果以供參考。

馬雅燕博士
香港浸會大學 亞洲能源研究中心 總監
二零一九年六月十一日

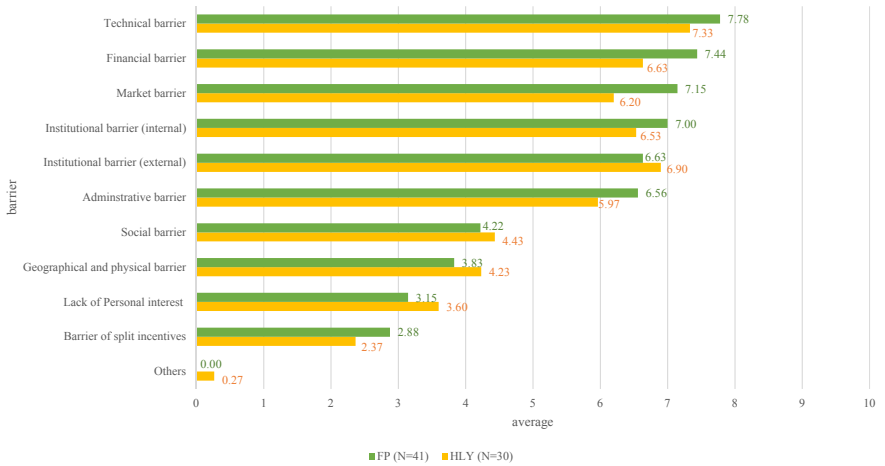


Figure 5.3.1 Perceived barriers of residents from Fairview Park (N=41) and Hong Lok Yuen (N=30) in household interviews.

Barriers	Prospective householders in Fairview Park [household interview and workshop]	Prospective householders Hong Lok Yuen [household interview and workshop]	Other stakeholders [stakeholder interview]
Technical barriers:			
(a) Concern on water seepage and water proofing	-Risk of water seepage caused by installation [F1;F3;F9;F10;F13;F14; F16;F18;F19;F32;F40]	-Risk of water seepage caused by installation [H2;H3;H6;H13;H18;H19; MrChing/@3] -Difficulty in stimulating water seepage on sloped roof [workshop/gpB/@11]	-Concern on water seepage by residents [Benny/@4]
(b) Concern on structural loading on roof	-Concern on the weakening of structural support with additional loading [F18;F40;F3;F12;F14;F22 ; F24;F26;F36;F40;F43]	-Concern on the weakening of structural support with additional loading [H6;H7;H12;H13;H21:H22]	-Concern on the weakening of structural support with additional loading by residents [Benny/@4]
(c) Unknown in equipment efficiency and lifespan	-Uncertainty on the efficiency and lifespan of products [workshop/T/gpA/@4] -Concern on substantial energy loss during transmission e.g. transformer required by utility companies as safety precaution to their grid system will result in energy loss. [data: Anita – visit with So-young]	-Uncertainty on the efficiency of products [H5;H3;H23; H24] -Perception that the current technology is low efficient [H20]	-Uncertainty on the lifespan of products [MrYee/@8]
(d) Complexity in installation	-Perceived difficulty and lengthy process for installing solar PV system [F22; F12;F42] -Lack of understanding about the installation requirement [F25;F26]	-Perceived difficulty and lengthy process for installing solar PV [H2;H14; H21;H27] -Lack of understanding about the installation requirement [H21/@1]	/
(e) Complexity in maintenance	-Lack of understanding on the maintenance requirement [F6;14;F35; workshop/T/gpC/@6] -Concern on frequent checking [F24]	-Warranty is too short [H2/@1] -Concern on the need for scaffolding, or damage of rooftop while maintenance [H6;H7;H8] -Lack of access or contact for technicians to maintain the system [H10;H15;H19;H28]	/
(f) Unknown in ability to withstand typhoon	-Risk of typhoon lead to concern on: (1) destruction that may require additional repair[F3;F9;F23;F26; F28/@2] (2) the legal responsibility on destruction [F27; workshop/T/gpB/@1]	-Risk of typhoon lead to concern on: (1) destruction that may require additional repair [H13; workshop/gpA/@3] (2) the legal responsibility on destruction [H18;H19]	-Increased risk to wind element during typhoon due to the relaxation of height in exempted village house [Glenn/@2] -Threat of typhoon [Benny/@4]
(g) Degradation of current power supply quality	-Interruption of stability for electricity supply [F2;F28]	-Potential damage on the current electricity facilities [H19;H21]	/
(h) Concern on reflection	-Cause of nuisance from reflection [F4]	-Cause of nuisance from reflection [H10/@7]	-Cause of nuisance from reflection [Benny/@5]
(i) Concern on radiation	-Health concern on the radiation emitted from panel as harmful [F12; workshop/T/gpB/@10]	/	/
(j) Concern on fire hazard	-Risk of fire hazard [F14; F28/@2]	/	/
(k) Lack of waste treatment for solar panels	-Problem of solar waste pollution and lack of recycling system for solar panels [F20/@3]	-Problem of solar waste pollution and lack of recycling system for solar panels [H28/@1; workshop/gpB/@21; gpD/@2]	-Increase of solar waste due to the rapid development of panels' quality and lifespan that might lead to frequent [MrYee/@8]

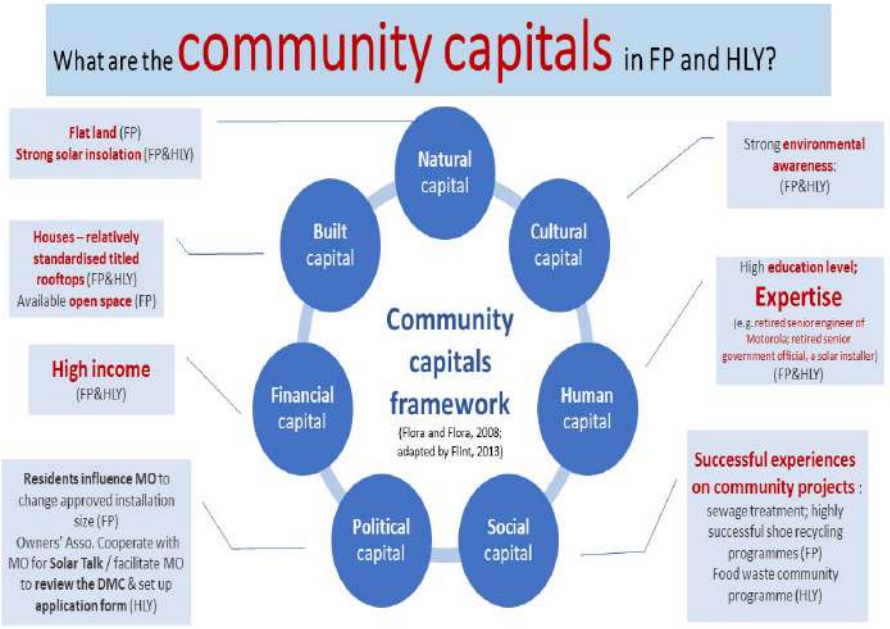
Economic barriers:			
(a) High upfront cost	-Quotation reaches about $150,000 generally. Acceptable cost is under $100,000	-Quotation may up to $200,000. Consider the installation as economically ineffective. [H29/@1]	/
(b) Long payback period	-10 years is too long. Expect payback in 5-6 years. -Possibility to move out before revenues start	-10 years is too long. Expect payback in 3-5 years. [H28/@1] -Possibility to move out before revenues start	/
(c) Uncertainty in maintenance and repair	-Concern on: (1) the frequency for maintenance or repair [F29] (2) the cost for maintenance and repair [F18;F39] (3) the additional cost to unknown risk (e.g. typhoon) [F26]	-Concern on the substantial cost [H2;H8,H22] -Unknown in maintenance and repair cost[H24]	/
(d) Lack of subsidy	-Lack of subsidy to support installation or maintenance [F6; F1]	-Lack of subsidy to support installation or maintenance [H12 ; H20]	/

Market barriers:			
(a) Lack of market information	-Lack of network or access to find contractors [F14;F16;F33] -Lack of contractors in the market [F19;F26; workshop/T/gpB/@4]	-Lack of professional technician in market [H29; workshop/gpA/@11] -Lack of time to search for contractors [H2] -Irresponsive contractors for enquiry [H2/@2]	/
(b) Lack of standards	-Lack of standard for comparison [F18;F23;F25;F28] -Lack of proven track records of contactors [F3]	-Lack of proven track records of contactors [H20;H16]	-Variation of contractor's credibility in the bloom of contractors in market after the launch of FiT [DrYau/@1] -Lack of expert knowledge to identify trustworthy contractors by the residents [MrYee/@6-7]
(c) Immaturity of local market	-Unfamiliarity on utility companies' requirement of the contactors [F5] -Lack of credibility of contractors (e.g. some may exaggerated the system efficiency [F14]) [F41;F24;F14; workshop/T/gpC/@2] -Concern on the close down of contractor firm [F21;F28;F30;F32;F3; workshop/T/gpB/@1&4; workshop/T/gpC/@4] -Pendency due to the expectation on product development and improvement soon [F27; F34; workshop/T/gpB/@7]	-Lack of references or information about the quality of contractors [H4] -Lack of credibility of contractors [MrChing/@9] -Lack of experience and knowledge to install solar panel of the contractors [MrChing/@5] -Concern on the close down of contractor firm [H13; workshop/gpB/@12]	-Large variation of quotation given by contractors [MrTo/@1] -Fault in keeping promise and meet the installation standard of contractors [DrYau/@1-2] -Lack of supervision of product quality at the importing stage [MrYee/@8]
(d) Lack of insurance system	-Uncertainty on the availability of home insurance to cover the solar PV system and the amount of additional insurance cost for solar PV system [F25;F21;F22]	-Uncertainty on the availability of home insurance to cover the solar PV system [H22]	/
(e) Delay of financial sector – irresponsive to new market needs.	/	/	-Excessively high entrance barriers for new market players to get loans [Glenn/@2]
(f) Delay of innovation on product technology and market in Hong Kong	/	-Risk of typhoon and lack of new technology and construction method to withstand that. [MrChing/@3] -Absence of local market supply for some construction material in solar panel installation [MrChing/@4]	/
(g) Delay of energy market reformation	/	/	-Levelized cost of solar energy is too high while the cost of energy tariff from utility company is low. This cannot attract people transit to use solar energy.

Institutional barriers (internal):			
(a) Restriction on open space	-Bureaucratic obstacles e.g. car park could be a good site for a community solar project, but require "discretion" to be exercised by the Land Department	-Lack of suitable open space [stakeholder/MrChung/@2]	-Requirement of the change in land use from Government for alternative use of open space [stakeholder/MrYeung/@2]
(b) Ambiguous regulations and guidelines from Management Office	-Passive attitude of MO to promote solar [F1;F6/@1-2;F7/@2;8/@1;F13/@2; F20/@3;F27/@2] -Lack of standard from MO to justify their decision for approving installation [F8/@2;F21/@2;F22/@1;F28/@2] -Complexity in application procedure [F32/@3] -Strict regulations on illegal structure [F12/@2;F35/@2;F41/@3; F43/@2] -Irresponsive attitude of MO to the households' demand [workshop/T/gpA/@1]	-Complication in DMC issue – require further clarification to see if the installation will change the appearance of roof (e.g. orange in colour) as stated [H2/@2;H17/@2;H19/@2; H29/@1; workshop/gpA/@9; gpD/@6] -Lack of promotion & support from MO [H7/@2;H10/@5; workshop/gpA/@5] -Expectation of disapproval for installation by MO [H13/@2;H16/@2;H23/@1; H24/@2]	-Requirement of legal clarification on the DMC issue [stakeholder/MrChung/@2]
Institutional barriers (external):			
(a) Lack of certainty and transparency in the permitting procedures from utility companies	-High uncertainty in the permitting procedures. (1) unknown on the purchase amount of RE electricity from utility companies (case-by-case without justification) [workshop/T/gpC/@5] (2) unknown on CLP grid constraint and capacity [workshop/T/gpA/@6] (3) unknown on the time required for approval -Sluggish responses from CLP (interview: Stephen; workshop/T/gpC/@2 F6/@2; workshop/T/gpC/@9) [1]	-High uncertainty in permitting procedures. (1) unknown on the purchase amount of RE electricity from utility companies (case-by-case without justification) [H8/@1-2; workshop/T/gpA/@1] (2) unknown on CLP grid constraint and capacity to eater the need of community [H30/@3; workshop/plenary/@9] (3) unknown on the time required for approval with limited staffs responsible for meter installation in the region[workshop/gpA/@5] -Lack of justification for approval or rejection [workshop/plenary/@11] -Problem in single phrase or three phrase electric power in the community [workshop/plenary/@13]	-Unknown on the purchase amount of RE electricity from utility companies [DrYau/@2] -Lack of justification for approval or rejection of installation capacity [Glenn/@3] -Slow response for application [Glenn/@3; DrYau/@2-3]
(b) Uncertainty in illegal structure regulation	-Uncertainty if the installation will violate the illegal structure regulation [F2/@8;F9/@2;F21/@1;F22/@1; F23/@2 ;F25/@2; F27/@2; F31/@2 ;F36/@1;F37/@1;F38/@2;F39/@2]	-Uncertainty if the installation will violate the illegal structure [H2/@3;H10/@1;H11/@2; H12/@2;H13/@2;H15/@2; H22/@2;H23/@1;H26/@2; H27/@1]	/

[1] Some governments set up a renewable facilitation office to streamline application procedures.

Administrative barriers:			
(a) Lack of step-by-step guidance for FiT	-Confusion on: (1) the steps in application procedure [F27;F8/@1;F39/@2] (2) application time [F21/@2;F41/@2]	-Complexity in application [H9/@2;H11/@2;H20@2] -Confusion on: (1) the steps in application procedure [H23/@1;H24/@2] (2) application time [H2;H14;H21;H11/@2; [workshop/plenary/@7,13]] (3) application fee [H9@2]	/
(b) Uncertainty in the FiT contract	-Uncertainty on the sustainability of high FiT rate in the coming 15 years [F18;F22/@1;F41/@2; workshop/T/gpB/@8] -Perception of 15 years (SoC) as too short [F30]	-Uncertainty on the sustainability of high FiT rate in the coming 15 years [H14; H24;H28] -Perception of 15 years (SoC) as too short [H11/@3]	-Uncertainty of the continuity of the scheme and its ability to influence the general public [stakeholder/MrTo/@1]
Social barriers:			
(a) Complaints from neighborhood	-Complaints on reflection [F4/@2;F40/@2] -Complaints on poor aesthetic [F20/@2]	- Complaints on reflection [H10/@8; H20/@2] - Complaints on poor aesthetic [H14/@2;H20/@2] -Opposition out of cultural belief that dark color PV panel as unpropitious [workshop/gpC/@5]	-Needs in balancing the view of solar and non-solar households [stakeholder/MrChung/@1] -Growing complain culture [stakeholder/MrChung/@2] -Complaints on the aesthetic value and violation of DMC by some residents [Benny/@7]
(b) Lack of examples in the community	-Lack of proven cases of installation as peer learning [F9; F12; F19; F22]	-Lack of proven cases of installation as peer learning [H9; MrChung/@2]	/
(c) Concern on privacy issue	/	-Risk of more outside workers come into the community (especially with celebrities living in the community) [H10/@16; MrChing/@3]	/
Geographical and space constraint :			
/	/	/	/
Lack of Personal interest			
(b) Lack of motives to care the environment	-Low hierarchy to invest money on environmental action [F1;F14;F19;F39;F41]-	-Low hierarchy for environmental action [H26/@2;H20;H16]	-Externality of environmental action as perceive no responsibility to take green action (MrTo/@2-3)
Split incentives:			
(a) Uncertainty in the continuity of investment and return of system as renter of the house	/	-Possibility to move out if owner do not continuous the lease [H21/@1]	/
Others:			
(a) Concern on asthenic value	/	-Poor asthenic of solar PV panel on roof [workshop/gpC/@3 ; plenary-Gary/@8]	/



Acknowledgement

This research project (Project Number: 2017.A2.027.18B) is funded by the special round of the Public Policy Research Funding Scheme from the Policy Innovation and Co-ordination Office of The Government of the Hong Kong Special Administrative Region.

鳴謝

本研究項目（項目編號：2017.A2.027.18B）獲香港特別 行政區政府政策創新與統籌辦事處公共政策研究資助計劃／策略性公共政策研究資助計劃撥款資助。

Appendix 7-5: Community workshop in Fairview Park on 23rd March 2019

Appendix 7-5a: Briefing document on the community workshop in Fairview Park

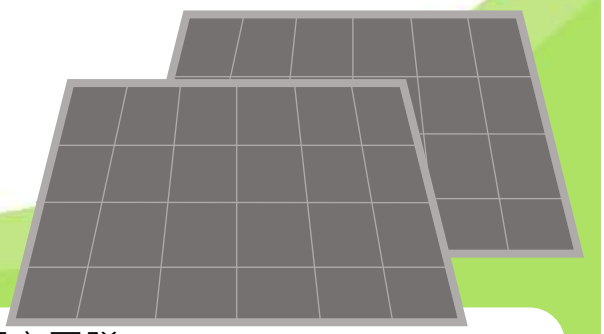
錦綉花園太陽能社區工作坊

簡介文件

2019 年 3 月 23 日(星期六)

上午 9:15 至 下午 12:30

匡智元朗晨曦學校



主辦單位

Asian Energy Studies Centre

香港浸會大學 HONG KONG BAPTIST UNIVERSITY

協辦單位

HONG KONG SOLAR PARTNERSHIP

研究團隊

Asian Energy Studies Centre

GREENPEACE 綠色和平

SUNG KYUN KWAN UNIVERSITY 1398

香港大學 THE UNIVERSITY OF HONG KONG

CityU 香港城市大學 City University of Hong Kong

目錄

1 引言 3

1.1 歡迎辭及前言 3

1.2 中心簡介 5

1.3 工作坊目的 6

1.4 工作坊的參與人士 6

1.5 討論模式 6

1.6 專家簡介 7

1.7 工作坊程序 8

2 香港太陽能社區的構想 9

2.1 香港政府的願景 9

2.2 現時政策 – 上網電價計劃 9

2.3 香港太陽能發展歷程 10

3 您的看法：未來的錦綉花園 11

補充資料：居民與社區參與太陽能的模式 12

聲明

這次工作坊是香港政府政策創新與統籌辦事處公共政策研究資助計劃的研究項目「透過社區參與建立可持續能源發展的未來模型：以香港兩個潛在太陽能社區為案例」(項目編號：2017.A2.027.18B)的一個研究部分。工作坊將使用問卷及討論時的資料作學術研究用途。我們會將你的個人資料保密，在將來發表的所有研究報告上亦會以匿名處理你的個人資料。由於此簡介文件當中有未發表的資料，未經研究團隊同意，請不要轉載或引用本簡介文件。若對上述研究計劃有任何問題，或對本簡介文件有任何查詢，請與馬雅燕博士聯絡 (電郵：aesc@hkbu.edu.hk 或致電 3411-7187)。

拍攝、視像錄影和錄音聲明*：工作坊當日，我們的工作人員將會進行**拍攝、視像錄影和錄音**，讓主辦及協辦單位作學術研究、記錄和日後資訊傳播等用途。若您不願意被拍攝或視像錄影，當日登記時請知會我們的工作人員，我們會給您帶上特別的名牌，以作識別；請您放心，我們屆時會作出妥善的安排。*

1 引言

1.1 歡迎辭及前言

今天這場工作坊正正因為有您們的參與，才變得重要。我們衷心感謝您們每一位，願意抽空來到這次工作坊，與我們一起商討太陽能社區發展在香港未來的角色。

發展太陽能已成為二十一世紀可持續能源轉型的一個主要議題。其中，以社區為單位發展的分佈式太陽能系統扮演著重要角色。隨着太陽能技術日趨成熟、太陽能發電成本持續下降及相關政策如上網電價等帶動下，世界各地均湧現不同形式的太陽能社區。錦綉花園是香港少數擁有優厚太陽能發電潛力的地區，大家作為錦綉花園的一份子，對錦綉發展成一個太陽能社區有甚麼看法呢？

此工作坊的目的是邀請錦綉花園住戶及這個社區的持份者，分享您們對安裝太陽能系統及讓錦綉花園發展成為太陽能社區的意見。這次工作坊希望能集思廣益，為錦綉花園以至香港發展太陽能出一分力。

這工作坊的設計，是參考了美國史丹福大學開發的「商議式民意調查」方法。顧名思義，商議就是商量、議論。我們將透過小組討論、與專家互動等環節，讓您與其他參與者討論各自不同的意見。究竟社區發展太陽能在錦綉花園以至香港有何機遇和挑戰？這工作坊希望提供一個讓大家共聚一堂的平台，讓您們及其他持份者就這個重要問題，進行討論和商議，經過深思熟慮後再歸納出自己的看法和願景。

透過這次工作坊，香港政府、本港兩家電力公司及有關持份者將會聆聽到您的寶貴意見，您的建議將可能影響日後相關政策的制定。

這份「簡介文件」是這次工作坊的關鍵組成部份，這文件為您們提供一個簡要的概覽，幫助您們了解社區發展太陽能的過程中遇到的障礙及可能的應對措施等。請大家在出席前抽空細閱這簡介文件，在工作坊期間亦可隨時拿出來參考。

最後，我們衷心感謝這個行業的專家們，為這份簡介文件的初稿給予意見。另外，我們感謝政策創新與統籌辦事處公共政策研究資助計劃的研究項目(項目編號：2017.A2.027.18B)和香港浸會大學學術研究委員會的撥款支持。

再次感謝您抽空參與我們的工作坊！

項目研究團隊敬啟

馬雅燕博士
香港浸會大學
亞洲能源研究中心總監
地理系助理教授

盧笛聲博士
香港浸會大學
地理系助理教授
林思齊東西學術交流研究所
副總監

周啟鳴教授
香港浸會大學
香港地學計算與
分析研究中心主任
社會科學院副院長 (研究)

梁國熙教授
香港城市大學
能源及環境學院教授

鍾庭耀博士
香港大學
民意研究計劃總監

羅惠儀博士
香港大學
社會科學學院
策動永續發展坊
副總監及首席講師

Marc Wolfram 博士
成均館大學 (韓國)
城市變革實驗室
(Urban Transformations Lab)
負責人
建築系副教授

楊凱珊
綠色和平東亞分部
資深項目主任

1.2 中心簡介

香港浸會大學亞洲能源研究中心 (Asian Energy Studies Centre) 成立於 2014 年 (前身為早於 1998 年成立的“香港能源研究中心”)，是社會科學院轄下的研究中心。亞洲能源研究中心以成為亞太區公認的可持續能源研究中心為宗旨，致力從管治角度分析及著眼研究亞洲區的可持續能源發展。透過進行跨學科的研究項目、組織學術研討會及公共研討會，和參與其他學術活動，我們致力創造新知識、提供切實可行的政策建議、促進知識交流，及促進相關持份者的參與來推動和改善能源政策。

更多有關中心的研究項目或活動，請瀏覽 http://aesc.hkbu.edu.hk/。

香港浸會大學亞洲能源研究中心及地理系於 2018 年牽頭成立「香港太陽能伙伴合作平台」(Hong Kong Solar Partnership)，旨在為香港太陽能持份者提供太陽能發展合作及社區參與的平台。

更多有關「香港太陽能伙伴合作平台」的資料，請瀏覽 http://aesc.hkbu.edu.hk/hongkongsolarpartnership。

1.3 工作坊目的

這次工作坊希望提供一個開放的平台讓持份者討論香港太陽能社區發展。以錦綉花園為研究個案，我們希望探討居民在現行可再生能源政策下，發展太陽能社區的可能性、困難及願景。

我們將於本周六 (2019 年 3 月 23 日)在錦綉花園舉行工作坊，並計劃下月再在康樂園舉行同類工作坊，希望與大家集思廣益，一同探索太陽能發展不同方案的利弊、可行性。

根據我們從 2018 年 8 月至 2019 年 2 月期間在錦綉花園進行的訪問，我們在周六的工作坊，將圍繞三個居民較關注的範疇，邀請您分享意見。這三個範疇是：(1) 初置成本高、回報期長、融資模式有限；(2) 市場及技術資訊不足；及(3) 環保意識薄弱。

1.4 工作坊的參與人士

我們邀請約 30 名有興趣或已安裝太陽能板的錦綉住戶，與來自學術界、太陽能行業和非政府機構的專家及代表進行交流。來自首爾的太陽能社區領袖將應邀分享她在韓國發展太陽能社區的經驗。

1.5 討論模式

工作坊將採用商議式民意調查進行。透過小組討論、大會互動等環節，各參與人士可表達意見，及向其他居民、專家、代表提問。

另外，我們亦為參與人士 4 歲或以上的同行小孩提供太陽能 DIY 工作坊。

1.6 專家簡介

金少英女士 Soyoung Kim

金女士為首爾銅雀區盛大谷（Sungdaegol）能源自主社區代表。從 2011 年福島核事故開始，金女士積極提倡社區能源轉型活動。她以社區自主設立的兒童圖書館為中心，向社區家庭宣揚社區節能，逐漸發展成「能源超市」、太陽能咖啡車、推動社區安裝太陽能板等組織及活動。呼應首爾的「減少一間核電廠」政策，盛大谷的能源運動令盛大谷成為全市首個「能源自主社區」。

有關首爾及盛大谷能源自主社區的資料，請瀏覽以下網頁：

Power to the People (24 Hours of Reality 2016)短片：
https://www.youtube.com/watch?v=dYcCW8yagF4

綠色和平–「平權師奶」與節能社區掀「反核」韓流：

http://www.greenpeace.org/hk/sites/no-nuclear/#/seoulolnpp3/energy-sufficient-village/

端傳媒––一位韓國 OPPA，一個自主社區，一場節能韓流：

https://theinitium.com/article/20160311-hongkong-nuclearpower/

香港浸會大學亞洲能源研究中心於 2018 年 5 月的香港大學“上網電價「全民綠電」新契機”研討會上的發言：首爾的經驗：對香港可再生能源政策發展的啟示

https://drive.google.com/file/d/18ix4_INcUU-iyEI2-gLLJgVQhyoYqy4d/view?usp=sharing

1.7 工作坊程序

地點: 匡智元朗晨曦學校 – 新界元朗錦綉花園荔枝北路 133 號

日期: 2019 年 3 月 23 日 (星期六)

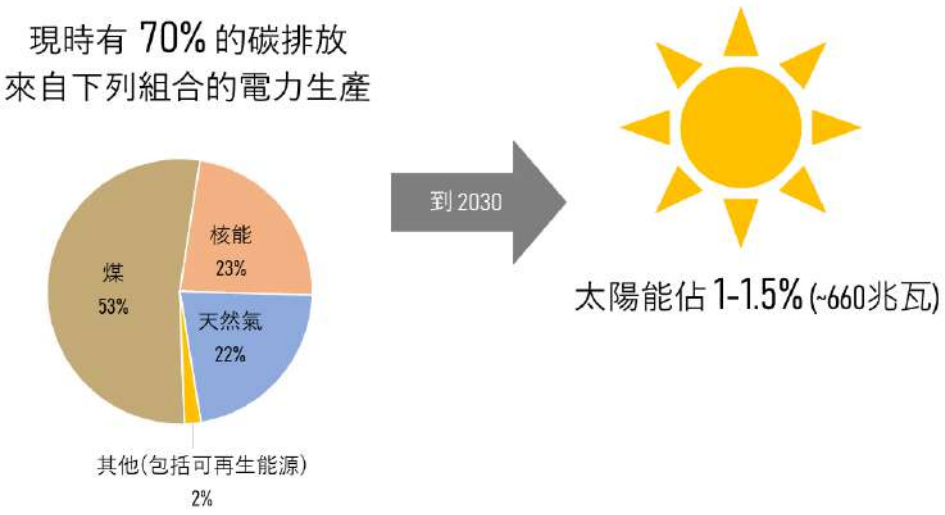
語言: 廣東話及韓語 (大會將提供傳譯)

時間	場地 1(參加討論人士)	場地 2 (同行小孩)
09:15 – 09:30	登記	
09:30 – 09:40	**歡迎致辭** 馬雅燕博士 香港浸會大學地理系助理教授及 亞洲能源研究中心總監	
09:40 – 10:00	**初步研究結果分享** 馬雅燕博士 香港浸會大學地理系助理教授及亞洲能源研究中心總監 梁國熙教授 香港城市大學 能源及環境學院教授	
10:00 – 10:30	**首爾太陽能社區經驗分享*** 金少英女士 (Ms. Soyoung Kim) 首爾能源自主社區代表 *大會將提供韓粵傳譯	**太陽能 DIY 工作坊** 節目包括: 1.「懂說話的智慧太陽能板」 示範 2.「太陽能手作坊」 動手組裝太陽能玩具 (完成後可帶走)
10:30 – 10:45	**休息**	
10:45 – 11:45	**小組討論**	
11:45 – 12:30	**互動環節**	
	工作坊結束	

2 香港太陽能社區的構想

2.1 香港政府的願景

根據環境局在 2017 年發表的香港氣候行動藍圖 2030+，政府希望 在 2030 年減少 65 – 70% 的碳強度 (按 2005 年的水平)。參考現時香港的情況，我們需要減少使用化石燃料和增加使用可再生能源來達成減碳目標。



2.2 現時政策 – 上網電價計劃

中電可再生能源上網電價:

https://www.clp.com.hk/zh/community-and-environment/renewable-schemes/feed-in-tariff

港燈上網電價計劃:

https://www.hkelectric.com/zh/customer-services/smart-power-services/feed-in-tariff-scheme

機電工程署及香港兩間電力公司就上網電價計劃提供了申請上網及一些安裝太陽能板的須知。

太陽能板的安裝要求及申請程序	https://re.emsd.gov.hk/tc_chi/fit/ri/fit_ri_g.html
合資格供應商列表	https://re.emsd.gov.hk/tc_chi/gen/gother/gother_equ.html
合資格承辦商列表	https://re.emsd.gov.hk/tc_chi/gen/gother/gother_EL.html
太陽能系統安裝指南	https://re.emsd.gov.hk/tc_chi/files/PVGuidanceNotes.pdf

2.3 香港太陽能發展歷程

太陽能進程

3 您的看法：未來的錦綉花園

討論內容

社區發展太陽能充滿機遇，但亦暗藏不同問題。就錦綉發展太陽能社區，我們構思出正面及負面發展的可能性。

正面的情景我們稱之為「**順風順水太陽能社區起動**」，
而負面的情景為「**麻麻煩煩太陽能發展無望**」。

請觀看這兩個不同情景的故事：

「**順風順水太陽能社區起動**」：
https://drive.google.com/file/d/1CBsYuFYrWLMrUv20H_LQMEHLvYp47J43/view?usp=sharing

「**麻麻煩煩太陽能發展無望**」：
https://drive.google.com/file/d/1A-XqpBHymjW_6rvpASNIoKpNHN7dX943/view?usp=sharing

就著上述的情景，請各位居民在不同的發展方案下，就以下三大範疇作出討論，並提出您的意見：

一. 初置成本高、回報期長、融資模式有限
二. 市場及技術資訊不足
三. 環境教育及意識薄弱

我們也邀請您想想：

1. 就推動錦綉社區太陽能發展，您認為**哪個情景較能反映現實/可能會發生的狀況**？
2. 就著上述兩個情景，您認為有甚麼地方**最需要/最值得關注**？
3. 就推動社區太陽能發展可能會遇到的問題，您有何解決辦法/任何**建議**？
4. 您認為有哪些重要**議題/考慮因素在工作坊未能好好有結論**，值得大家在會後再作**討論、跟進**？
5. 您認為錦綉的太陽能社區**可以發展到甚麼程度**？您對您的社區透過社區模式發展有甚麼**願景**？

補充資料：居民與社區參與太陽能的模式

		各戶自行安裝	**團購** **與私營機構合作發展社區公共空間作太陽能發電用途**	**社區自發自用** **設立社區能源交易市場** **利用電動車作蓄電池使用**
方案背景	主要持份者	居民	居民、管理處、 電力公司、太陽能投資者	居民、管理處、 電力公司、社企
	合作關係	沒有 (各太陽能住戶自行負責)	太陽能住戶、管理處及第三方合作	太陽能住戶、非太陽能住戶、管理處、社企及第三方合作
	融資模式	自行投資	團購 與第三方合資	社區能源交易
考量因素	成本及安排	- 初置成本高 - 回本期長 - 逆變器更換費用	- 需要聚集到一定數量的住戶，才能發揮「團購」作用，減低初置成本 - 與第三方合資可能衍生行政費用	- 初置成本下調 - 上網電價逐年下降 - 電費有加價壓力；並可能有新增的電費項目，包括過網費、可再生能源附加費 - 成立地區電力系統的條件，如： i 太陽能和電動車得到廣泛使用 ii 大部分住戶同意安裝智能電錶 iii 大部分住戶提供實時用電數據
	技術及市場	- 太陽能系統的安裝位置 - 逆變器的壽命 - 漏水、防風等安裝問題 - 承辦商質素 - 保險制度	- 團購需要以劃一設計安裝太陽能系統，住戶或許各有所需 - 承辦商質素及承接工程能力 - 以團購方式購買保險 - 可能需要行政手續	- 智能社區微型電網 - 智能電力管理系統 - 電動車作蓄電池技術 - 社企模式管理社區電力系統 - 設立能源中介平台及管理
	政策	- 政府與電力公司的協議	- 政府與電力公司的協議	- 社區電價具市場競爭力 - 規管社區電力交易的相關法例

Appendix 7-5b: Scenario cases used in the community workshop

錦綉花園太陽能社區工作坊

順風順水太陽能社區起動

*以下情景根據研究資料虛構而成，並非真實個案。

陳先生是錦綉花園居民，他看到政府及兩電最近推出的上網電價計劃，於是**計劃安裝**太陽能板。
陳先生瀏覽了不同網站，花了**兩星期**查閱機電工程署的承辦商列表。

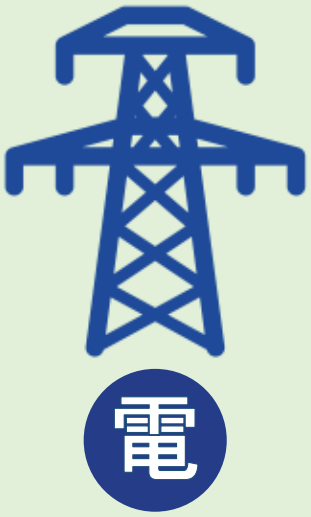
陳先生分別找到四間太陽能承辦商報價。

他**比較**了承辦商的價錢、防漏工程的安排、設備安全性等。

希望把設備安裝在不顯眼位置，並確保**防水**工程完成妥當。

*安裝成本參考訪問資料釐訂，並非實際數字。

很快，他按照自己的**預算**和**喜好**，選擇了**心儀的**太陽能承辦商。



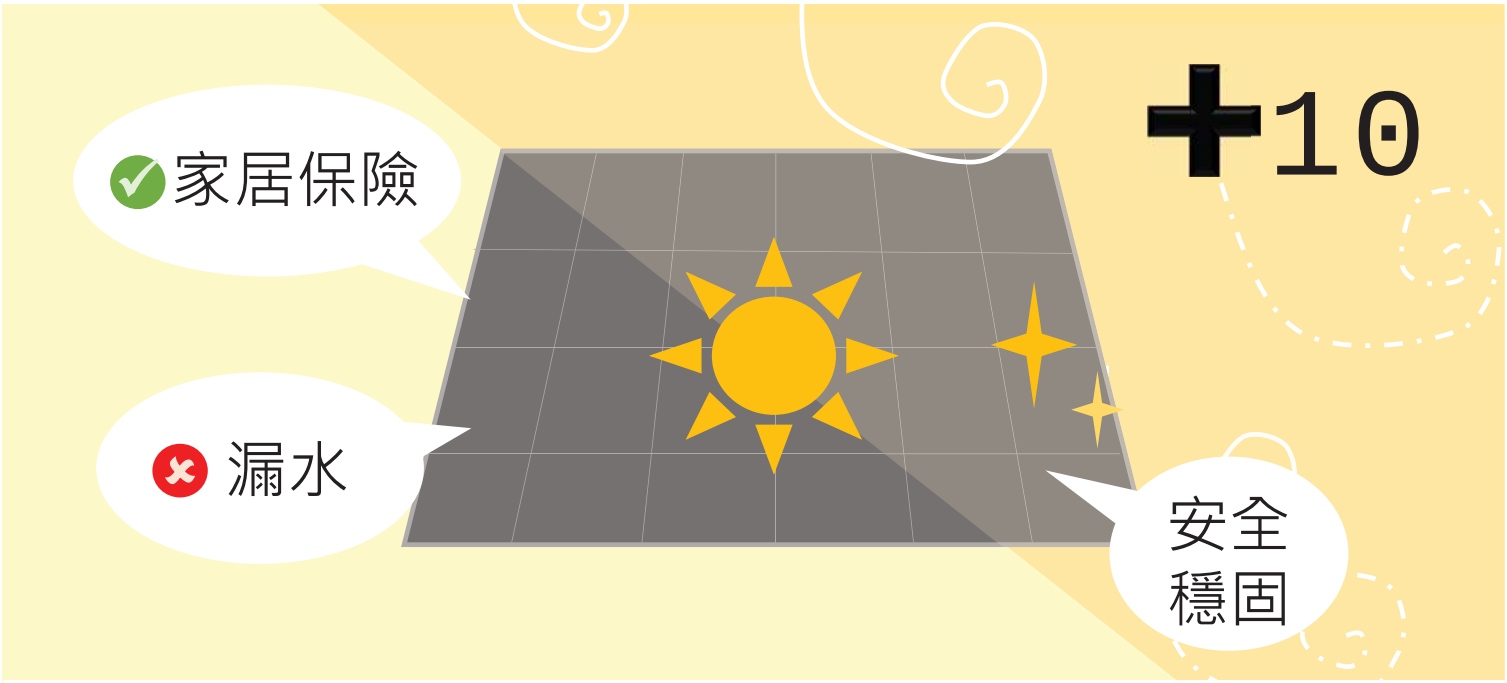
陳先生向**管理處**及**電力公司申請**安裝太陽能板，承辦商亦**成功**為陳先生**申請上網電價**。

在確定安裝太陽能板前，陳先生參加居民開設的太陽能**Whatsapp群組**。

居民正為**團購**作出**熱烈討論**。

群組成員**積極**揀選承辦商。在大家**踴躍討論**下，**很快**便選擇了一間太陽能承辦商。

由於安裝太陽能板的費用有一半來自安裝工程，三十多戶團購能**節省人工支出**。
承辦商願意**提供九五折**，而居民需要選購同一款太陽能板及統一安裝安排。



終於，陳先生安裝了太陽能板，亦成功為設備買到**家居保險**，對設備**安全**及保障都十分**安心**。
工程很穩妥**沒有漏水**，亦**抵擋**了近來**颱風**的吹襲。

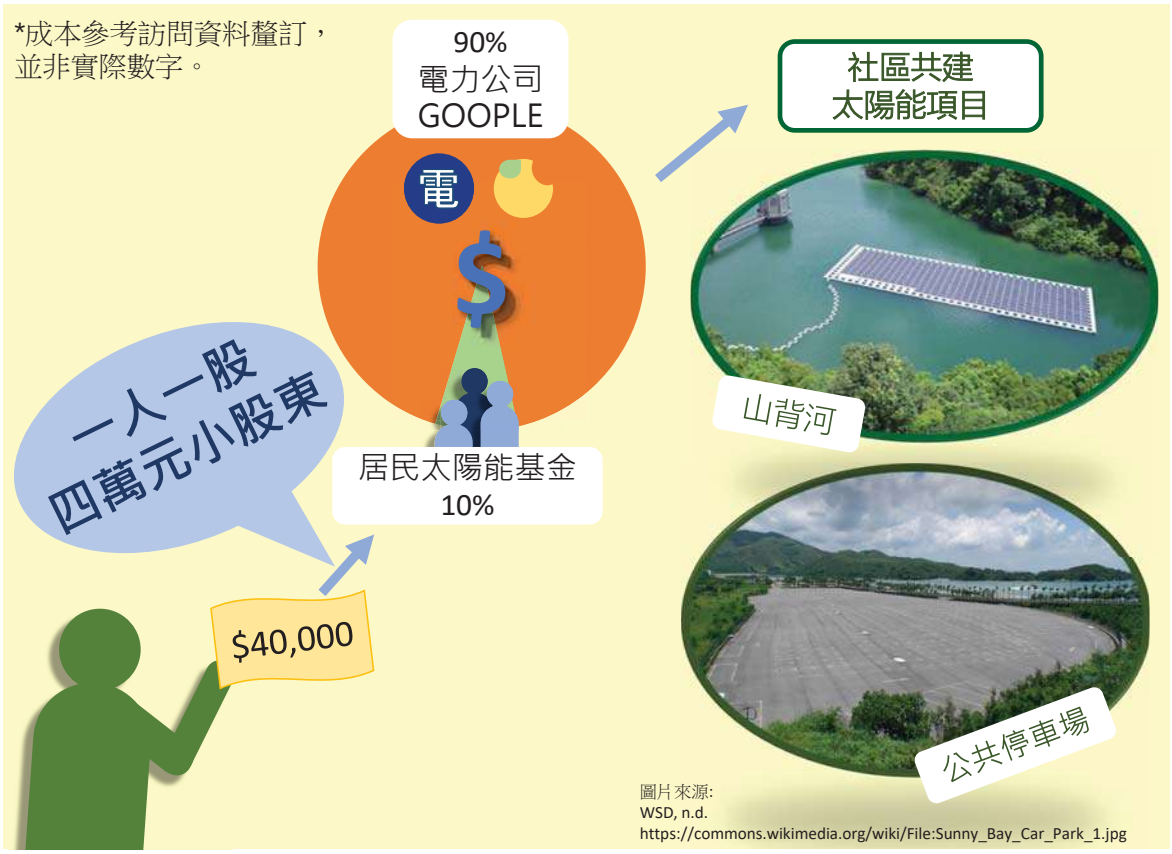
*收入參考訪問資料釐訂，並非實際數字。

陳先生發現安裝太陽能板的**三大好處**: (1)**有錢收**; (2)可以**認識新朋友**; (3)促進**社區和諧**。
鄰居很**羨慕**陳先生可以賺取上網電價，陳先生於是把他們加進Whatsapp群組，
讓更多人可以一起**交流**。居民間亦多了一個**共同話題**。

三個月後，
陳先生收到
管理處的通告，
提到**能源供應商**
及**大企業**
GOOPLE 計劃
在山背河或
停車場建立
「**社區共建太陽能項目**」，

邀請居民**集資**，

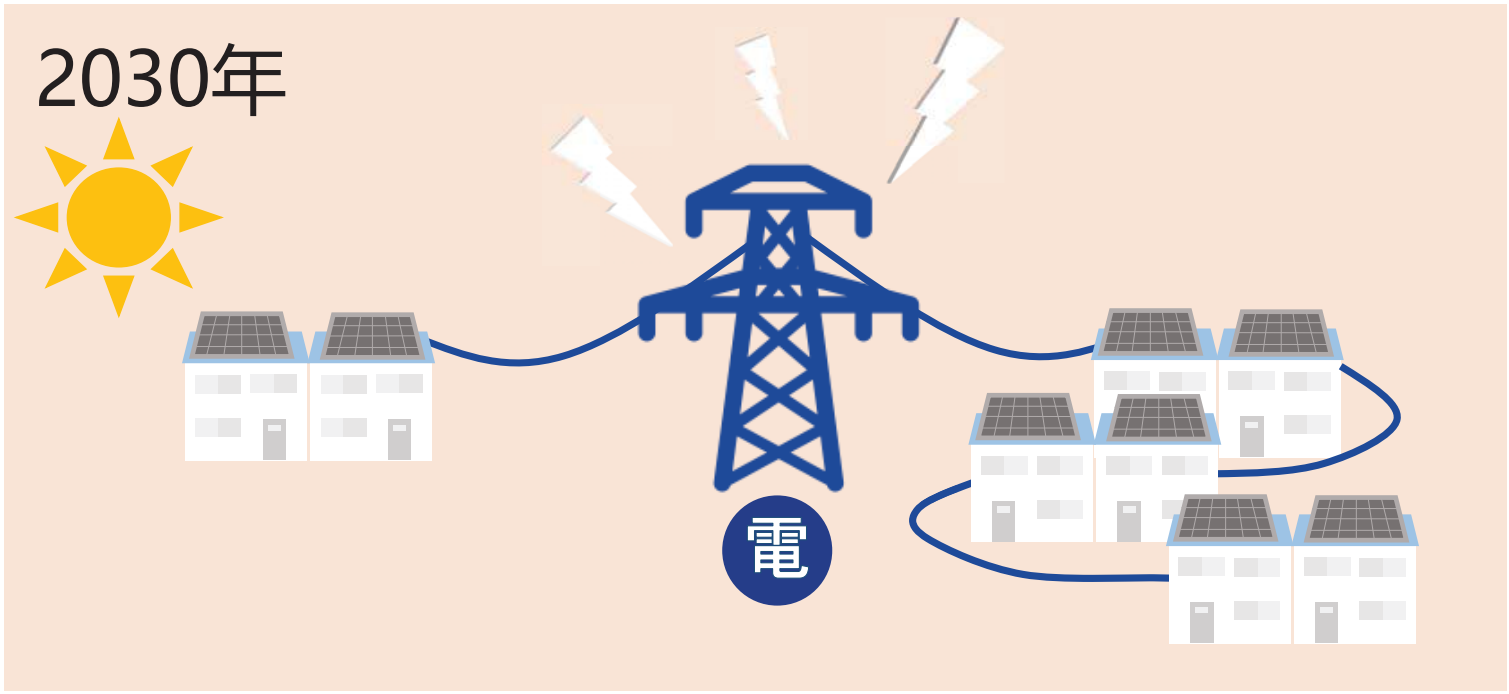
形式如同投資
i- Bond。



在扣除成本後，
每戶每年可得
$2000上網電價
作收入。

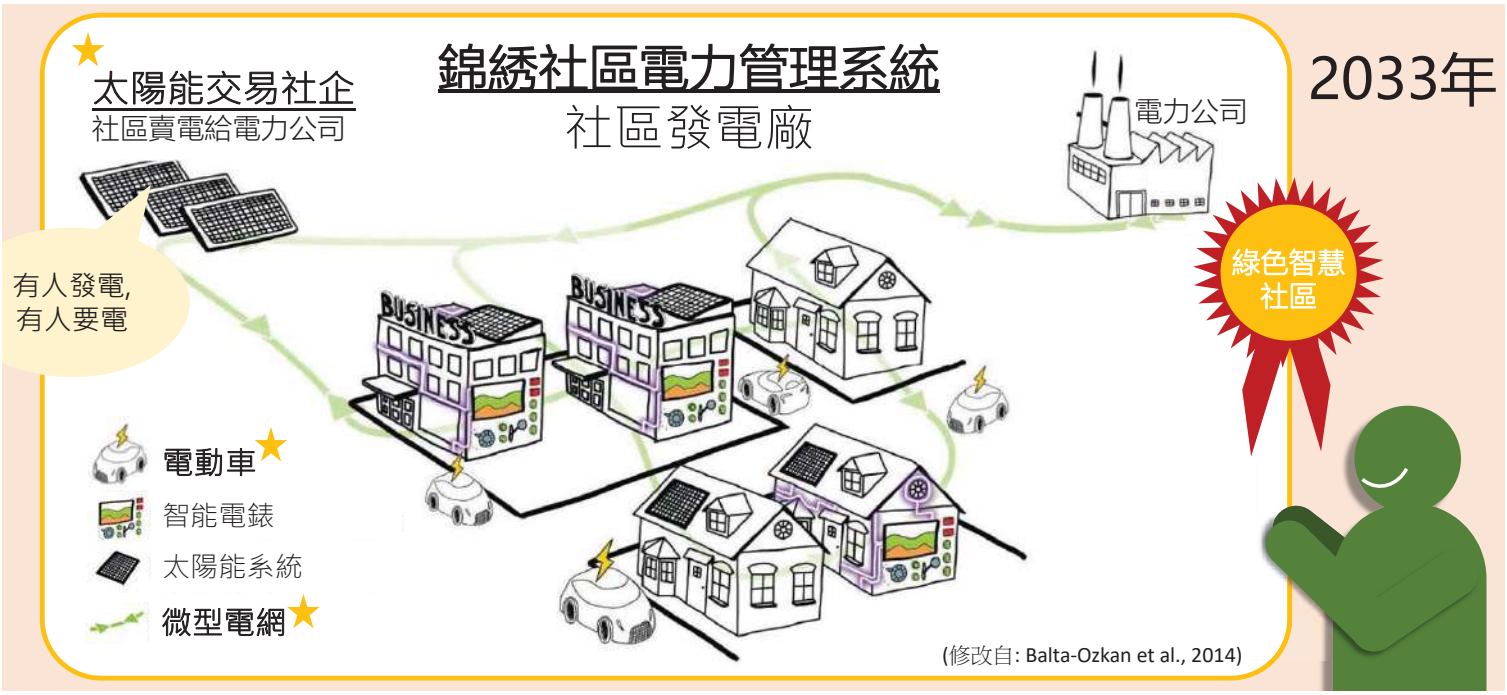
陳先生亦獲邀
擔任**項目顧問**。

由於錦綉花園
毗鄰米埔
拉姆薩爾濕地，
錦綉亦成為
國際知名的
太陽能社區。



十多年過去，到2030年，**越來越多**錦綉住戶安裝太陽能板，
電力公司需要將電網**配套設施**升級，以維持電網**穩定**。

上網電價計劃在2033年完結前，錦綉有不少住戶已經安裝了太陽能板。
不過，有些居民雖然**支持**太陽能發電，但由於**經濟因素**或**其他原因**而沒有安裝。



在2033年，順應**「智慧城市」**的大潮流，錦綉建立**「社區電力管理系統」**，好好管理區內的**太陽能發電系統**，和**電動車的儲電**系統。錦綉儼如一個**小型發電廠**，鄰居可賣太陽能電給鄰居，甚至以**社企**形式由社區賣電給電力公司。電力公司與居民互相知道**供電和用電狀況**，更好地調節供電量和用電量，令整個電力系統運作得更**有效率**及**穩定**。

錦綉花園太陽能社區工作坊

參考資料:

Balta-Ozkan, N., et al. (2014). "Scenarios for the Development of Smart Grids in the UK: synthesis report."

*以上情景根據研究資料虛構而成，並非真實個案。
如對資料有任何查詢，可聯絡亞洲能源研究中心(電話: 34117032 ; 電郵:aesc@hkbu.edu.hk)。

錦綉花園**太陽能社區工作坊**

麻麻煩煩太陽能發展無望

*以下情景根據研究資料虛構而成，並非真實個案。

陳先生是錦綉花園居民，看到政府及兩電最近推出的上網電價計劃，於是計劃安裝太陽能板。
陳先生感到**無從入手**，又**無法找到有經驗的朋友協助**。

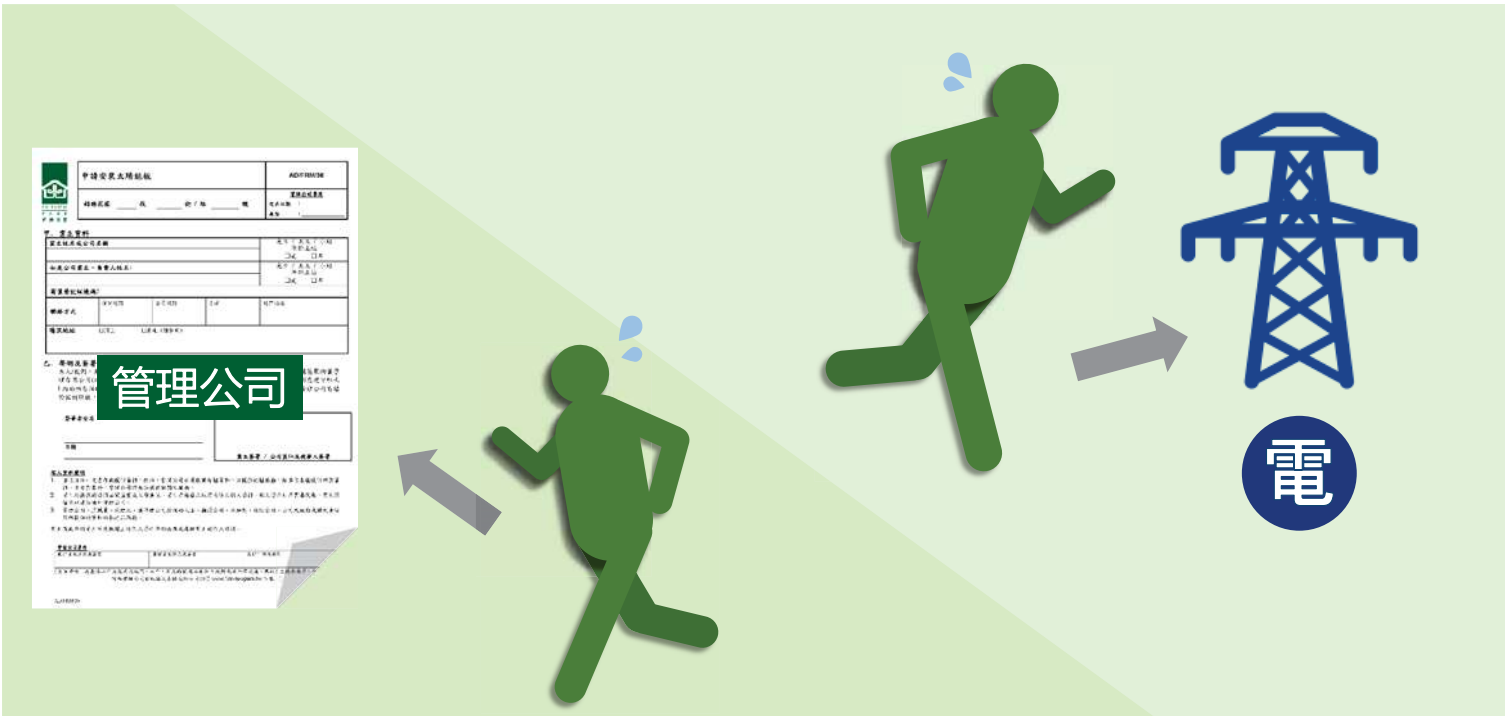
陳先生經過**費時的資料搜集**，先後找到四間太陽能承辦商報價。

不過，他對價錢、防漏工程的安排、設備安全性等抱有**疑惑**，

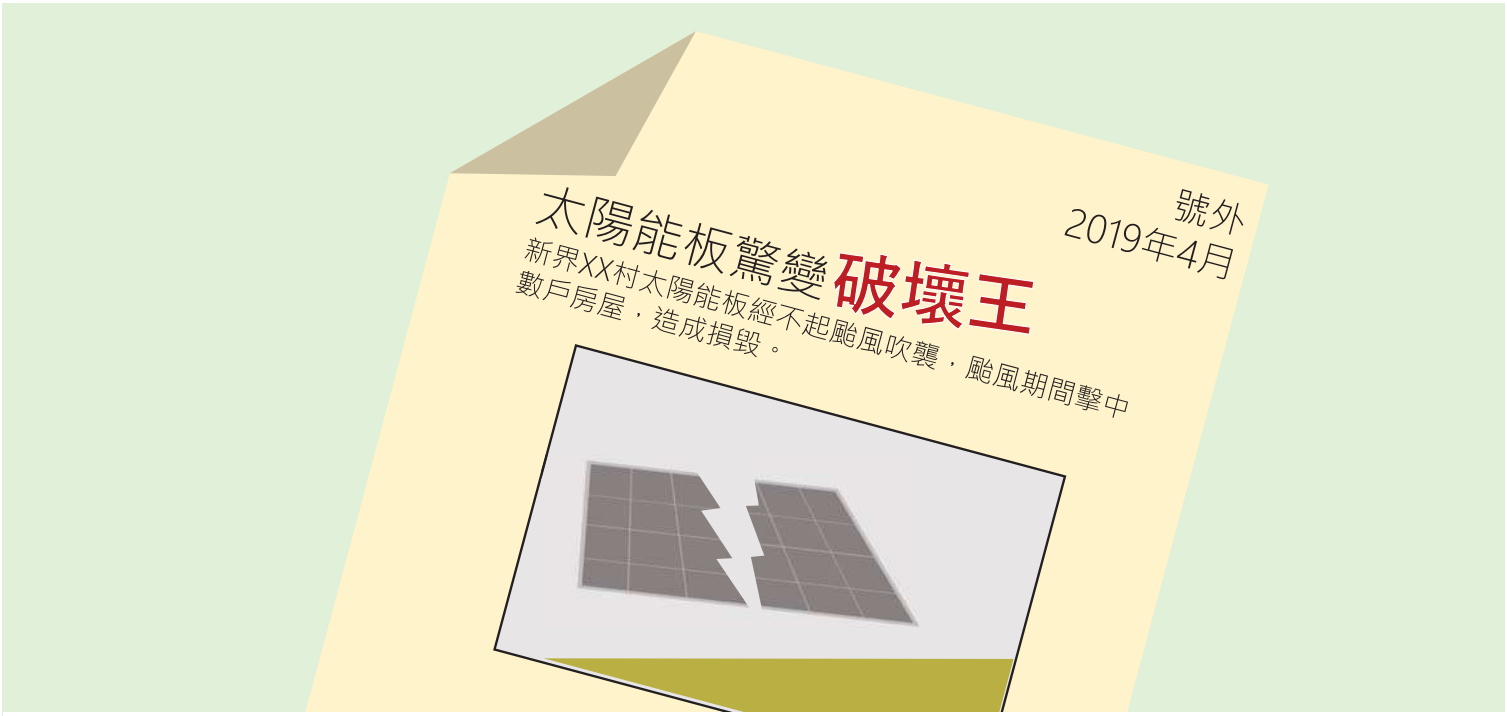
不知哪一個承辦商才信得過。

*安裝成本參考訪問資料釐訂，並非實際數字。

陳先生最終選了一間承辦商。但是，為解決漏水問題，承辦商需要把防水工程外判，陳先生需要支付**額外費用**。安裝費用亦因此增加不少。



陳先生開始相關**申請**程序，先後向管理公司和電力公司提出申請，經過一輪**繁複**的行政手續後，終於在**六個月後**獲批上網電價。



不過，在開始工程的時候，陳先生卻看到有關太陽能板引起的**意外**，令陳先生有所卻步。

不久，陳先生參加了居民開設的太陽能**Whatsapp群組**。

居民正討論**團購**。

陳先生留意到有些**群組成員**長期**沒有加入討論**或主動搜集資料，

而有些成員亦對選擇十分**挑剔**。

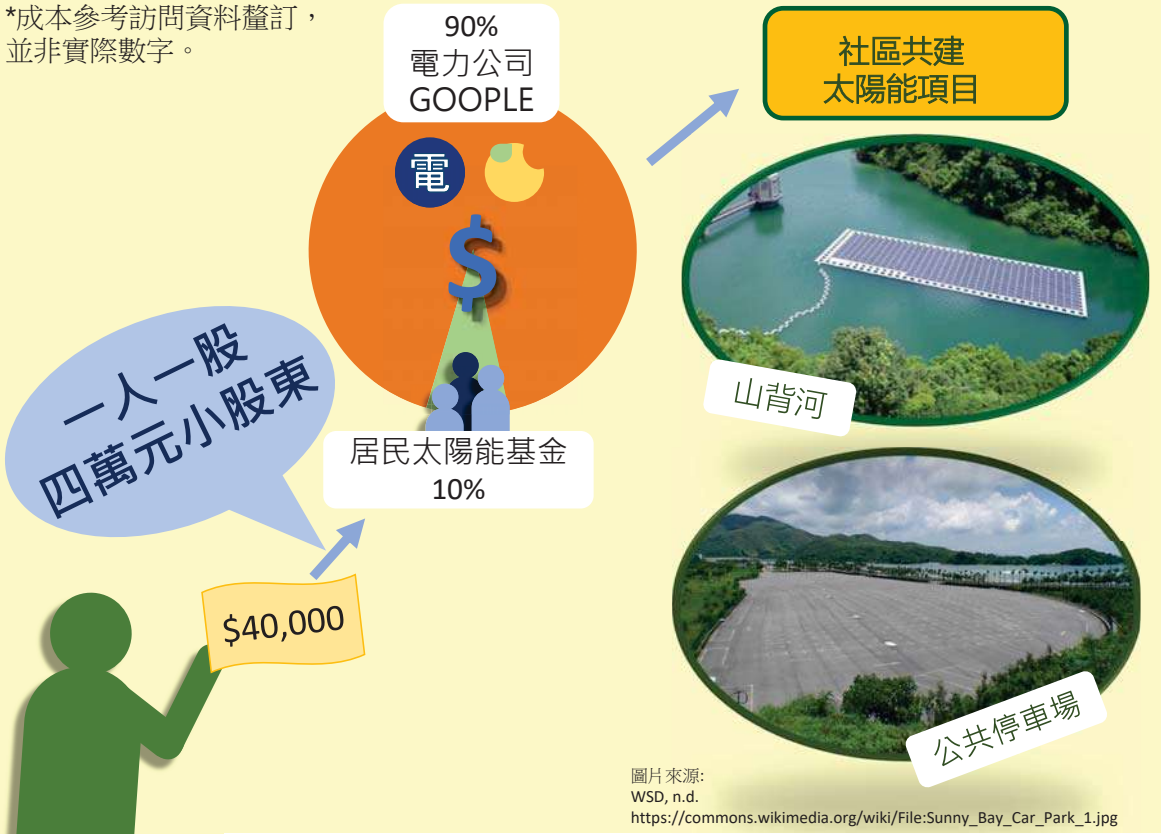
大家對**價格**、安裝**美觀**性、**防水**的要求亦各有不同。經過長達**三個月**的討論及意見磨合，只有**零星**數間住戶願意團購。承辦商不願意提供任何折扣，**團購最終不了了之**。

三個月後，
陳先生收到
管理處的通告，
提到**能源供應商**
及**大企業**
GOOPLE 計劃
在山背河或
停車場建立
「**社區共建太陽**
能項目」，

並邀請居民集資，

形式如同投資
i- Bond。

*成本參考訪問資料釐訂，
並非實際數字。



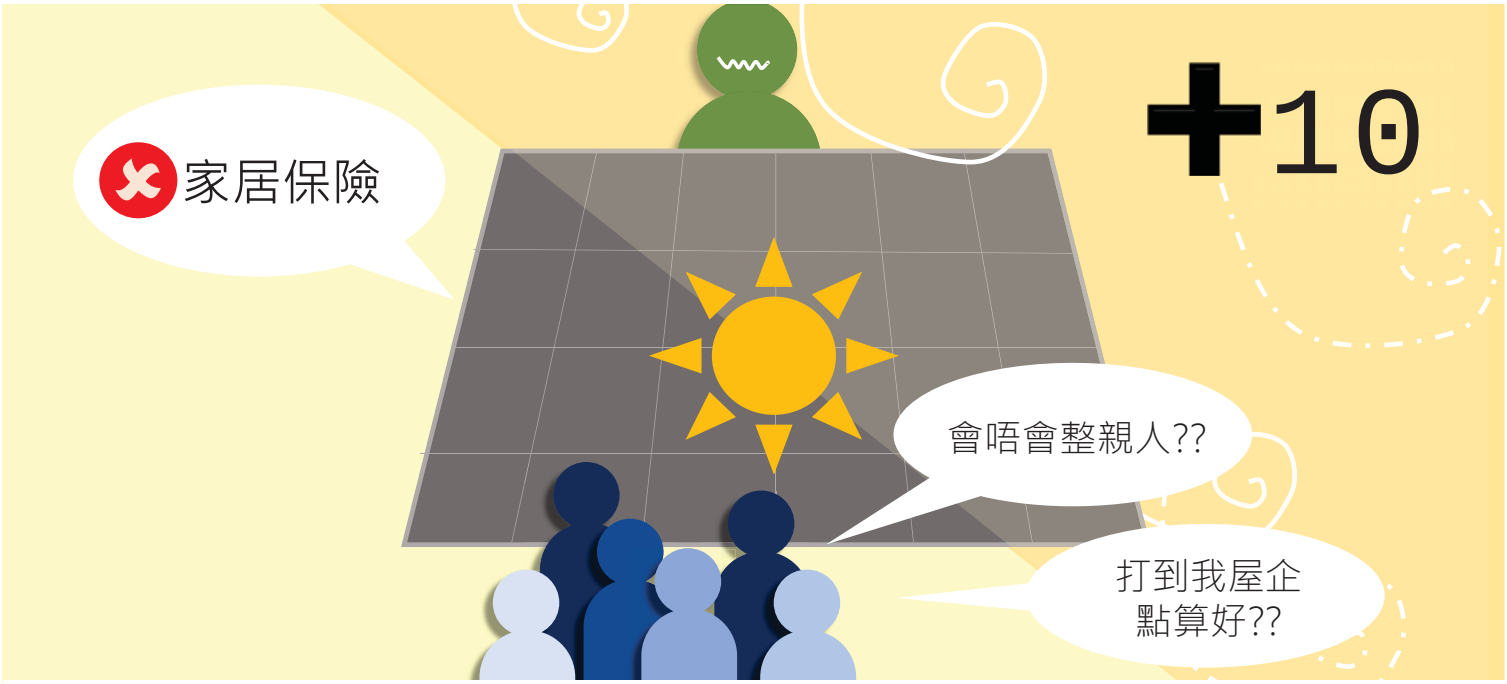
圖片來源:
WSD, n.d.
https://commons.wikimedia.org/wiki/File:Sunny_Bay_Car_Park_1.jpg

*收入參考訪問資料釐訂，
並非實際數字。

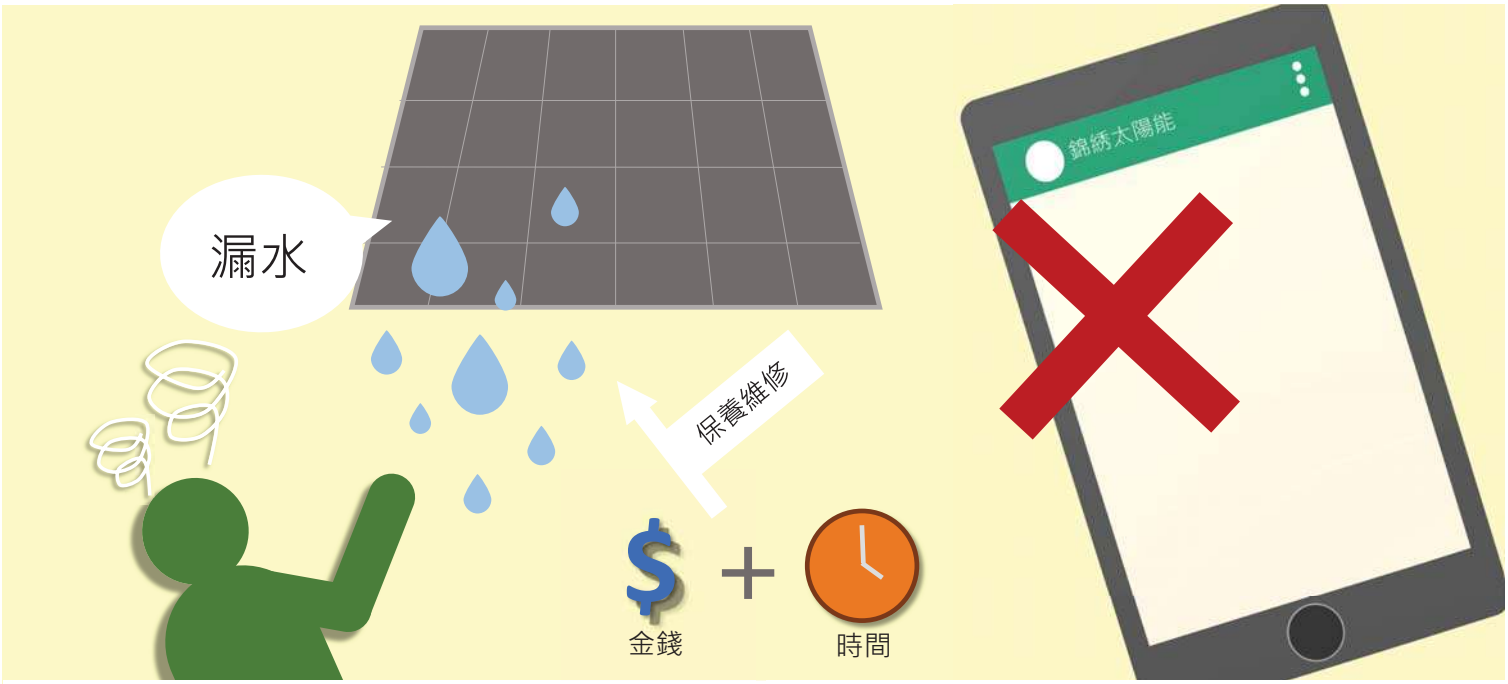
在扣除成本後，
每戶每年可得
$2000上網電價
作收入。

但是，有不少
居民**投訴**
太陽能板**反光**、
影響**風水**、有礙
景觀。

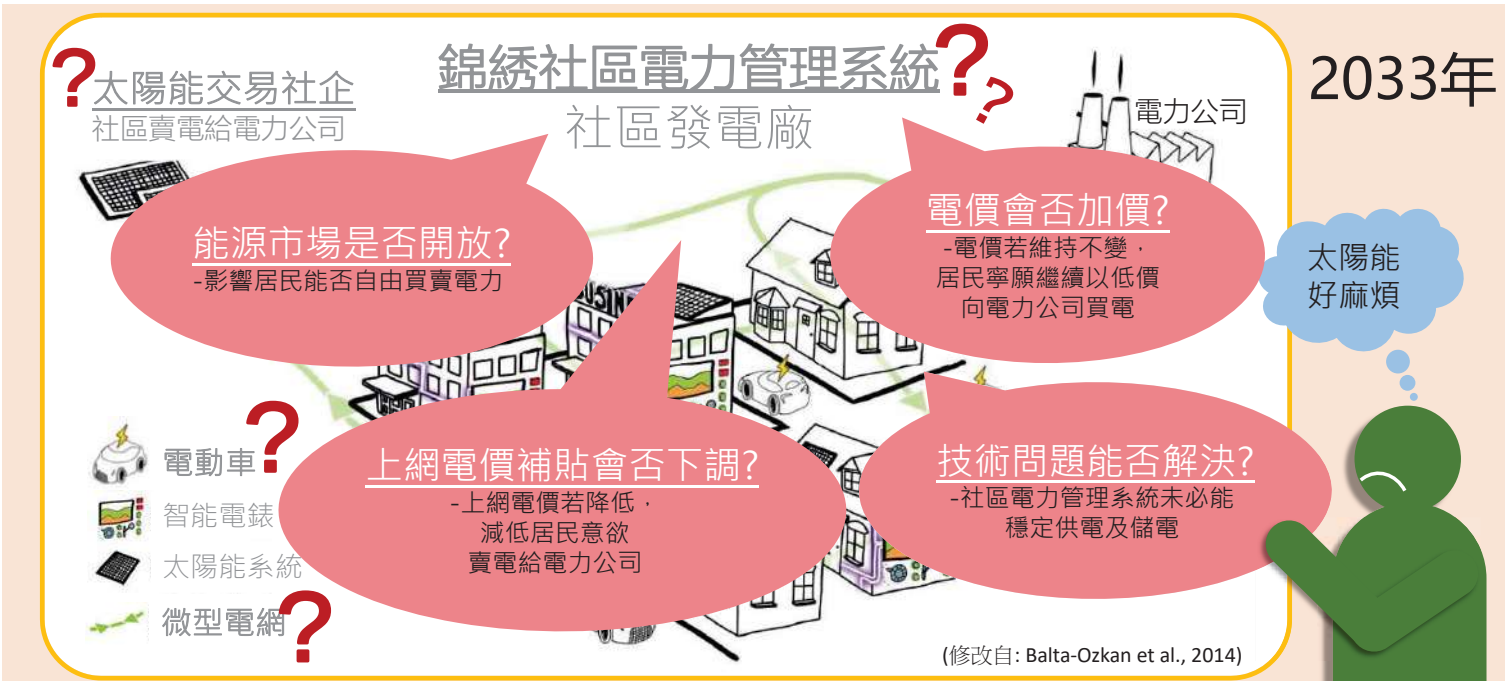
山背河及停車場
計劃亦涉及
渠務署、 屋宇署、
環境局、
地政總署等**多個**
政府部門審批，
手續漫長。



最後，陳先生雖然安裝了太陽能板，但**無法找到任何保險公司承保**。最近一次十級**颱風**，鄰居不斷發Whatsapp給陳先生，問他的太陽能板會否飛脫墮下等等。打風期間，陳先生無時無刻都**提心吊膽**。



幸好，颱風過後沒有嚴重意外，但陳先生的屋企卻嚴重**漏水**。
陳先生雖然希望向其他太陽能住戶詢問關於保養維修的問題，但先前的**群組已消聲匿跡**，陳先生只好獨自面對。



十多年過去了，在2033年，政府大力推動「**智慧城市**」，有錦綉居民亦順應大潮流，發起將**錦綉變成綠色的智慧社區**，建立「**社區電力管理系統**」，管理區內的**太陽能發電系統**，和**電動車的儲電**系統。
但建立智慧社區不單涉及很多**複雜因素**影響，例如**技術**問題、**能源市場是否開放**。陳先生與幾位發起居民談來談去，也不知何去何從。

再者，錦綉到2033年亦只有零星數家住戶安裝了太陽能板，社區的太陽能發電量少，**「社區電力管理系統」最終不了了之**。

錦綉花園太陽能社區工作坊

參考資料:

Balta-Ozkan, N., et al. (2014). "Scenarios for the Development of Smart Grids in the UK: synthesis report."

*以上情景根據研究資料虛構而成，並非真實個案。
如對資料有任何查詢，可聯絡亞洲能源研究中心(電話: 34117032 ; 電郵:aesc@hkbu.edu.hk)。

Appendix 7-5c: Pre-workshop questionnaire

錦綉花園太陽能社區工作坊

商議**前**的問卷

Code

請☒出合適選項。

1. 你家有沒有安裝太陽能板?

☐ 有(請跳至題 3)　　☐沒有

2. 如沒有，你有多大興趣安裝?

完全 沒有興趣	沒有興趣	中立	有興趣	十分 有興趣	無意見
☐	☐	☐	☐	☐	☐

3. 香港上網電價計劃在 2018 年**何月**開始實施? _____月

4. 您是否支持用下列方式，來發展錦綉的社區太陽能?

	非常 不支持	不支持	中立	支持	非常 支持	無意見
(i) 各住戶自行找承辦商安裝	☐	☐	☐	☐	☐	☐
(ii) 團購	☐	☐	☐	☐	☐	☐
(iii) 社區一人一股集資籌建太陽能項目(如在停車場、山貝河)	☐	☐	☐	☐	☐	☐
(iv) 我希望有更多錦綉住戶安裝太陽能板，錦綉成為一個太陽能社區	☐	☐	☐	☐	☐	☐
(v) 長遠來說，設立錦綉社區的太陽能交易市場，社區電力可自發自用	☐	☐	☐	☐	☐	☐

5. 您同意以下的說法嗎?

	非常 不同意	不同意	中立	同意	非常 同意	無意見
(i) 香港人的用電行為不會對氣候有大影響	☐	☐	☐	☐	☐	☐
(ii) 我願意多付一些錢去買更節能的電器	☐	☐	☐	☐	☐	☐
(iii) 為了我們的子孫後代，我們需要減少使用化石燃料(如煤或天然氣發電)	☐	☐	☐	☐	☐	☐

6. 你認為安裝太陽能板有沒有以下價值?

	價值	**評分 (1=完全沒有價值 至 10=非常有價值)**										
		NA	1	2	3	4	5	6	7	8	9	10
i	***經濟*價值：**e.g. 減少由空氣污染引致的醫療費用；降低對於進能源的依賴、避免因缺電引致的經濟損失（加強能源安全）；推進本地綠色產業、創造更多綠色就業機會	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
ii	***環境*價值：**e.g. 環保、減排溫室氣體、減少空氣污染	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
iii	***社會*價值：**e.g. 提高香港這城市的綠色形象、降低核能風險、降低能源危機風險、改善市民居住環境、為後代保護城市的資源和環境	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
vi	***社區*價值：**e.g. 錦綉可以建立自己的太陽能社區，社區的電力自發自用、促進社區和諧	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

7. 您的資料 (*請放心，您提供的資料將匿名處理*)

a) 性別

☐ 男 ☐女

b) 年齡

☐ 18-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60-69 ☐ 70 或以上

c) 教育程度

☐ 幼兒教育至中學或同等學歷
☐ 高中畢業或同等學歷
☐ 副學士/高級文憑/文憑/證書及同等學歷
☐ 學士學位及同等學歷
☐ 碩士或以上學歷

d) 職業 (**可選取多於一個選項**)

☐ 行政及專業人員 ☐ 文職及服務人員
☐ 勞動工人 ☐ 學生
☐ 家庭主婦/家務料理者 ☐ 已退休
☐ 其他: _____

e) 您家庭每月收入是?

☐ 港幣 19,999 或以下 ☐ 港幣 20,000 - 39,999
☐ 港幣 40,000 - 59,999 ☐ 港幣 60,000 - 79,999
☐ 港幣 80,000 - 99,999 ☐ 港幣 100,000 - 119,999
☐ 港幣 120,000 - 139,999 ☐ 港幣 140,000 - 159,999
☐ 港幣 160,000 或以上 ☐ 其他（例如已退休）

8. 參加工作坊前，你有閱讀過主辦單位所提供的「簡介文件」嗎？

- ☐ 沒有看過
- ☐ 只看了文件的一小部分，不到一半
- ☐ 看了文件約一半的內容
- ☐ 看了文件一半以上的內容，但沒有看完
- ☐ 已看了整份文件
- ☐ 不知道/不願透露

--- 問卷完成 ---

謝謝您!

Appendix 7-5d: Workshop presentation powerpoint

《香港太陽能社區》的研究
初步結果

香港政府 政策創新與統籌辦事處 公共政策研究資助計劃 的研究項目 (2018-2019)

馬雅燕博士
香港浸會大學
亞洲能源研究中心總監
地理系助理教授

梁國熙教授
香港城市大學
能源及環境學院教授

2019年3月23日

http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/

太陽能發展進程

香港...

2018年4月 公佈上網電價計劃詳情

2018年5月 中電開始接受申請

2018年8月 港燈開始接受申請

2018年10月 中電開始計劃 並接獲 1,100份申請

2018年10月中 政府放寬 ***村屋*** 安裝高度上限

2019年1月 港燈開始計劃

2019年2月 政府宣佈為 ***學校*** 提供一站式的太陽能板安裝服務

2019年3月 中電及港燈共接獲 約1770份 申請

錦綉花園

2017年9月 管理公司設立 ***安裝太陽能板之申請表***

2018年5月 管理公司修改申請表，允許太陽能板面積由 **4平方米增至只需與屋頂邊緣留空30平方厘米**

2019年1月 有**21**間住戶向管理處申請，**16**戶獲批

康樂園

2018年9月 業主會舉行太陽能講座及設立Whatsapp群組，居民蘊釀 **團購**

2018年9月尾 業主會邀請8間承辦商報價並發放資訊給居民

2018年12月 管理公司研究是否有違公契，團購暫時擱置

研究方法

研究目的	研究方法	探討的議題
• 以「**錦綉**」及「**康樂園**」兩個有潛能成為太陽能社區的屋苑作為研究案例 • 本研究旨在**探討社區參與對能源轉型的決策過程的作用**	• 分析社區及附近學校對上網電價實施前後的反應 • **2018.9-2019.1** 在社區及學校進行現場太陽能測量，**評估太陽能潛力** • **2018.8-9月: 訪問**相關持分者，探討香港太陽能社區的前景、發展方案、面臨的障礙及可行的策略，及對太陽能政策的想法 (已訪問錦綉43戶+康樂園29戶) • 2019.3-4月 舉行**工作坊**促進各方交流、商討對策	• 發展太陽能社區是否可行的能源選項？ • 香港是否可依靠太陽能社區作為可持續能源將來的一部分？ • 香港可從其他太陽能先進城市汲取甚麼經驗？ • 香港可怎樣處理從發展太陽能帶來的技術、經濟、社會政治及制度上的挑戰和機遇？

為何研究錦綉？

“太陽能是錦綉的「社區資源」”

5,024 戶

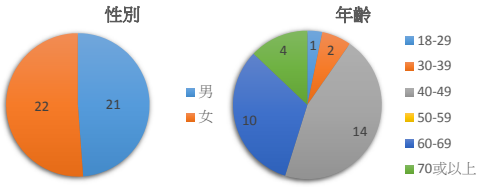
優良的地理環境　日照優勢

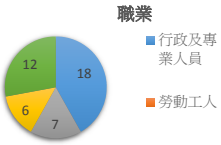
https://drive.google.com/file/d/143lfTZOKD8ZZmUOsIEU3fDMGD_tJk1-v/view?usp=sharing

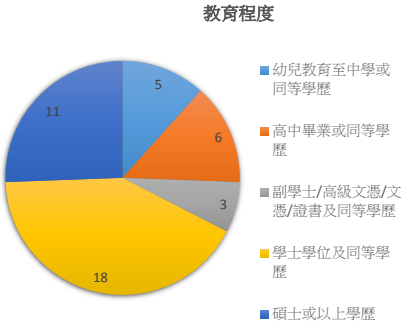
(鳴謝: 伯特利中學 黃俊禧同學)

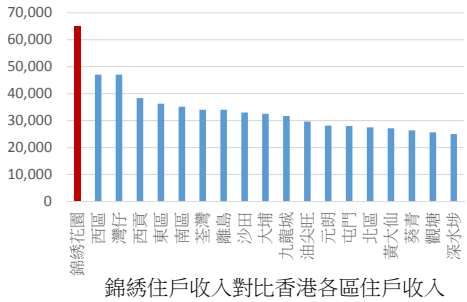
0:56-1:38

訪問: 錦綉花園 43戶









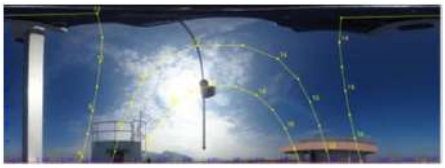
錦綉住戶收入對比香港各區住戶收入
(從事經濟活動的家庭住戶每月收入中位數)

初步研究結果 1：

受訪住戶有太陽能資源、但未有充分利用

太陽能光伏系統發電分析

- 香港城市大學能源及環境學院/能量研發能源研究中心。
- 使用測量儀器 horicatcher 和分析軟件 Meteonorm 來估算錦繡花園屋頂每年可接收多少太陽能。
- 進一步估算安裝太陽能光伏系統的全年發電量。
- 最後計算每年可再生能源上網電價補貼。



總結:

No.	no. of rooftops	total rooftop area (m^2)	estimated electricity output (kWh/year)	annual income (HK$)	FIT rate ($/kWh)
1	2	15	3320	$16,601	$5
2	2	16	3552	$17,759	$5
3	2	17	3754	$18,771	$5
4	2	19	4236	$21,181	$5
5	2	24	5337	$26,683	$5
6	2	25	5492	$27,462	$5
7	1	26	5728	$28,642	$5
8	2	26	5759	$28,796	$5
9	2	26	5654	$28,270	$5
10	2	27	5996	$29,979	$5
11	2	27	5896	$29,481	$5
12	3	29	6450	$32,248	$5
13	2	30	6377	$31,883	$5
14	2	31	5989	$29,945	$5
15	2	32	6879	$34,393	$5
16	2	32	6980	$34,900	$5
17	2	32	6316	$31,580	$5
18	2	32	7113	$35,567	$5
19	1	33	7704	$38,522	$5
20	2	34	7213	$36,063	$5
21	2	34	8400	$42,002	$5
22	3	37	6088	$30,438	$5
23	2	38	8303	$41,514	$5
24	3	41	8944	$44,718	$5
25	2	46	11008	$55,042	$5
26	2	50	11009	$55,046	$5
27	3	57	11199	$55,994	$5
28	3	58	11488	$57,438	$5
29	3	61	13144	$52,576	$4
30	4	73	14474	$57,895	$4
31	2	73	1575	$63,009	$4
32	3	110	21724	$86,894	$4

參考:

上網電價計劃:
<10kW: $5/kWh
10kW-200kW: $4/kWh
>200kW: $3 kWh

註: 10kW的系統大小大約是60m^2
(會根據各太陽能板不同的規格而改變)

初步研究結果：錦綉花園太陽能系統的成本及回報

- 系統面積：38m²
  (接受太陽能評估住戶的平均屋頂面積)
- 安裝成本：$160,000
  (按受訪住戶回覆的數字推算)
- 太陽能發電量：7,597千瓦時/年
  (接受太陽能評估住戶的平均太陽能發電量)
- 年度上網電價收入：$37,985
  (上網電價: $5/千瓦時)
- 估計回本期：4.2年

個案1

- 裝機容量: 6.6kW
- 發電量: 775 kWh (45日計算)
- 45日的上網電價電費: $3,900

受訪住戶太陽能發電潛力*未被好好利用*

我們早前為**32**戶錦綉居民進行太陽能潛力測量，僅**2**戶已安裝太陽能板。

若受訪居民的屋頂都裝上太陽能板，一年可生產：

= 約24萬度電

=*全港最大太陽能發電場*發電量：**1/10**

*小濠灣: 1.1 MW; 4,237塊太陽能板

渠務署小濠灣污水處理廠
太陽能發電場

=錦綉居民*每年少收的上網電價*：**$120萬**

= **800**個錦綉住戶*一個月的管理費*(以$1,500計算)

初步研究結果2：

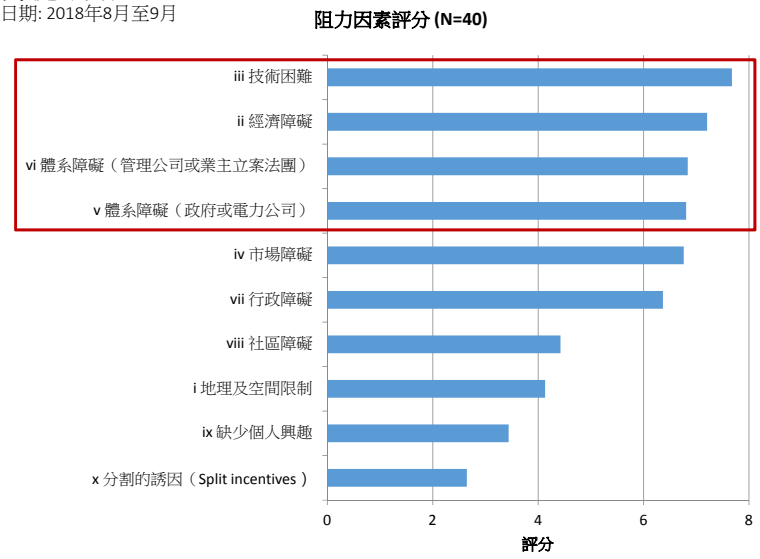
受訪者*認同*上網電價是*有效*的政策，但大部分仍持*觀望*態度。

即使有上網電價，仍有*不少障礙*。

已裝了太陽能系統的住戶，*未有*在社區中起到積極的*示範作用*。

*有上網電價，*但仍有不少障礙……

受訪家庭: 錦綉: 40
訪問日期: 2018年8月至9月



*有上網電價，*但仍有不少障礙……

(1) 成本、回本期…*仍然*是問題

…咁姐係我諗住**十幾萬不如換架車先**啦,做咗其他野先啦…
(F1)

成本高,預想是**10萬以下**, 會否**可以分期**
(F12)

無人support我地, 所以最好政府OR **中電**出個**Funding低息貸款**。
(F6)

十年回報期太耐,
十年後可能已搬走…
(F41)

不過**初頭貴**囉, 未係**普及化**
(F21)

有上網電價，但仍有不少障礙……

(2) 技術困難

完全**無一D客觀D既資訊**去比較，性能呀、價錢呀…
(F23)

好似岩岩個**颱風**過左，吹爛左，個太陽能板**飛左去隔離屋**或者車喇，咁個責任歸邊個，呢一個***個人責任***問題都係我既concern。
(F23)

壞左或者**老化**咁呢d野點樣再好好地處理呢…個維修點處理呢…(F35)

如果我裝完之後遇著一個**大颱風**，佢壞左或者損毀左，會唔會話有保險公司承擔返個責任等等…
(F28)

維修保養要錢…唔知**家居保險**包唔包…增加保險成本…
(F22)

(3) 環保意識薄弱 (大部分居民)

香港人住屋都成困難，**無條件**講再生能源發展
(F41)

我而家咁嘅價錢，用電力公司囉，我**唔係一定必須要環保架**，係米呀，做咩要同你做環保，我要俾多1、2百蚊俾你呀？
(F1)

…想看其他人安裝後的情況再作決定…
(F12)

如果**可以睇到人地有成功例子，會比較有信心**
(F19)

…REFIT唔會推動安裝，除非**有成功例子**比人參考…
(F22)

初步研究結果3：

錦綉花園....有可能的社區合作模式.....???
大家的想法

錦綉花園....有可能的社區合作模式.....???

1. 集體採購(=團購) — 支持：69% (N=39)
2. 屋頂租賃 — 支持：55% (N=40)
3. 社區共同擁有的太陽能項目 — 支持：31% (N=39)
4. 第三方擁有的太陽能項目 — 支持：46% (N=37)
5. 政府和私營投資者合作 — 支持：64% (N=36)
6. 眾籌 — 支持：16% (N=37)

...因為錦綉花園有個群組有住客發表過話有興趣，問下有無**團購**，我相信呢到***5000幾戶***應該會有唔少用戶會有興趣....(F23)

私人機構負責更好，我不用煩，更可令世界更美好，**風險又不屬我**...(F41)

如果佢**善用設施**既,我覺得可取既...(F23)

例如可能係個湖啊，巴士站個頂，又或者其他啲花園，聽落去大家都讚成嘅，因為**as long as唔好掂到自己**...(F18)

下一步....

- 第二輪的居民及其他持份者的訪問
- 整合錦綉及康樂園的資料
- 今年九月前，向政府提出政策建議

這個工作坊正因為有您們的參與，才變得重要
踴躍發言，與大家分享您的看法!

Acknowledgement

This research project (Project Number: 2017.A2.027.18B) is funded by the special round of the Public Policy Research Funding Scheme from the Policy Innovation and Co-ordination Office of The Government of the Hong Kong Special Administrative Region.

鳴謝

本研究項目（項目編號：2017.A2.027.18B）獲香港特別 行政區政府政策創新與統籌辦事處公共政策研究資助計劃／策略性公共政策研究資助計劃撥款資助。

Appendix 7-5e: Post-workshop questionnaire

錦綉花園太陽能社區工作坊

Code

商議**後**的問卷

請☒出合適選項。

1. 如你家已安裝了太陽能板，請跳至題 2。

   如你家沒有安裝太陽能板，你有多大興趣安裝?

完全沒有興趣										十分有興趣	無意見
0	1	2	3	4	5	6	7	8	9	10	-
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

2. 香港上網電價計劃在 2018 年**何月**開始實施? _____月

3. 您是否支持用下列方式，來發展錦綉的社區太陽能?

	非常不支持	不支持	中立	支持	非常支持	無意見
(i) 各住戶自行找承辦商安裝	☐	☐	☐	☐	☐	☐
(ii) 團購	☐	☐	☐	☐	☐	☐
(iii) 社區一人一股集資籌建太陽能項目(如在停車場、山貝河)	☐	☐	☐	☐	☐	☐
(iv) 我希望有更多錦綉住戶安裝太陽能板，錦綉成為一個太陽能社區	☐	☐	☐	☐	☐	☐
(v) 長遠來說，設立錦綉社區的太陽能交易市場，社區電力可自發自用	☐	☐	☐	☐	☐	☐

4. 您同意以下的說法嗎?

	非常不同意	不同意	中立	同意	非常同意	無意見
(i) 香港人的用電行為不會對氣候有大影響	☐	☐	☐	☐	☐	☐
(ii) 我願意多付一些錢去買更節能的電器	☐	☐	☐	☐	☐	☐
(iii) 為了我們的子孫後代，我們需要減少使用化石燃料(如煤或天然氣發電)	☐	☐	☐	☐	☐	☐

5. 你認為安裝太陽能板有沒有以下價值?

	價值	**評分** **(1=完全沒有價值 至 10=非常有價值)**										
		NA	1	2	3	4	5	6	7	8	9	10
i	***經濟*價值**：如 減少由空氣污染引致的醫療費用；降低對於進能源的依賴、避免因缺電引致的經濟損失（加強能源安全）；推進本地綠色產業、創造更多綠色就業機會	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
ii	***環境*價值**：如 環保、減排溫室氣體、減少空氣污染	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
iii	***社會*價值**：如 提高香港這城市的綠色形象、降低核能風險、降低能源危機風險、改善市民居住環境、為後代保護城市的資源和環境	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
vi	***社區*價值**：如 錦綉可以建立自己的太陽能社區，社區的電力自發自用、促進社區和諧	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

6. 有關工作坊

a) 你對這個工作坊有何看法？

	根本沒用					中立					非常有用	無意見
	0	1	2	3	4	5	6	7	8	9	10	-
(i) 整個工作坊	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
(ii) 小組討論	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
(iii) 互動環節	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

b) 你同意以下的說法嗎？

	非常不同意	不同意	中立	同意	非常同意	無意見
(i) 小組主持人提供機會讓每個人都參加討論	☐	☐	☐	☐	☐	☐
(ii) 小組所有成員都有差不多的參與程度	☐	☐	☐	☐	☐	☐
(iii) 小組主持人有時試圖以自己的觀點影響小組成員	☐	☐	☐	☐	☐	☐
(iv) 小組主持人確保一些反對的意見都會被考慮	☐	☐	☐	☐	☐	☐
(v) 小組討論被少數成員所主導	☐	☐	☐	☐	☐	☐
(vi) 小組成員都能尊重對方的意見	☐	☐	☐	☐	☐	☐
(vii) 工作坊的簡介文件客觀地反映了不同的意見	☐	☐	☐	☐	☐	☐
(viii) 專家答問環節解決了我們小組的討論問題	☐	☐	☐	☐	☐	☐
(ix) 總的來說，這個過程有助於我理解整個問題	☐	☐	☐	☐	☐	☐

c) 你同意以下的說法嗎？

	非常不同意	不同意	中立	同意	非常同意	無意見
(i) 從這個工作坊中，我獲得了一些新知識	☐	☐	☐	☐	☐	☐
(ii) 在這個工作坊中，我能從一些新角度去思考香港的可再生能源發展	☐	☐	☐	☐	☐	☐
(iii) 參加完這工作坊後，我改變了我對香港可再生能源上網電價補貼政策的一些觀感/想法	☐	☐	☐	☐	☐	☐
(iv) 參加完這工作坊後，我更有興趣參與錦綉的社區太陽能活動	☐	☐	☐	☐	☐	☐
(v) 參加完這工作坊後，我更有興趣探討在家安裝太陽能板的可能性	☐	☐	☐	☐	☐	☐

7. 請提供你的姓名。
（註：你的個人資料只作研究用途。我們會將你的個人資料保密，在將來發表的所有研究報告上亦會以匿名處理你的個人資料。）

_____

--- 問卷完成 ---

謝謝您!

錦綉花園太陽能社區工作坊

麻麻煩煩太陽能發展無望

*以下情景根據研究資料虛構而成，並非真實個案。

陳先生是錦綉花園居民，看到政府及兩電最近推出的上網電價計劃，於是計劃安裝太陽能板。陳先生感到**無從入手**，又**無法找到有經驗的朋友協助**。

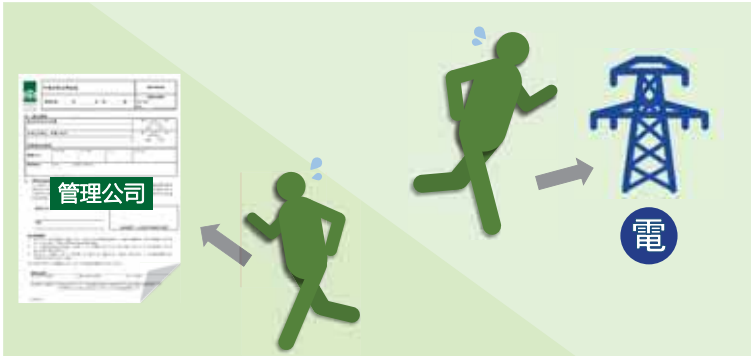
陳先生經過**費時的資料搜集**，先後找到四間太陽能承辦商報價。

不過，他對價錢、防漏工程的安排、設備安全性等抱有**疑惑**，

不知哪一個承辦商才信得過。

*安裝成本參考訪問資料釐訂，並非實際數字。

陳先生最終選了一間承辦商。但是，為解決漏水問題，承辦商需要把防水工程外判，陳先生需要支付**額外費用**。安裝費用亦因此增加不少。



陳先生開始相關**申請**程序，先後向管理公司和電力公司提出申請，經過一輪**繁複**的行政手續後，終於在**六個月後**獲批上網電價。

不過，在開始工程的時候，陳先生卻看到有關太陽能板引起的**意外**，令陳先生有所卻步。

不久，陳先生參加了居民開設的太陽能**Whatsapp群組**。

居民正討論**團購**。

陳先生留意到有些**群組成員**長期**沒有加入討論**或主動搜集資料，

而有些成員亦對選擇十分**挑剔**。

大家對**價格**、安裝**美觀**性、**防水**的要求亦各有不同。經過長達**三個月**的討論及意見磨合，只有**零星**數間住戶願意團購。承辦商不願意提供任何折扣，**團購最終不了了之**。

三個月後，陳先生收到管理處的通告，提到**能源供應商**及**大企業GOOPLE**計劃在山背河或停車場建立「**社區共建太陽能項目**」，

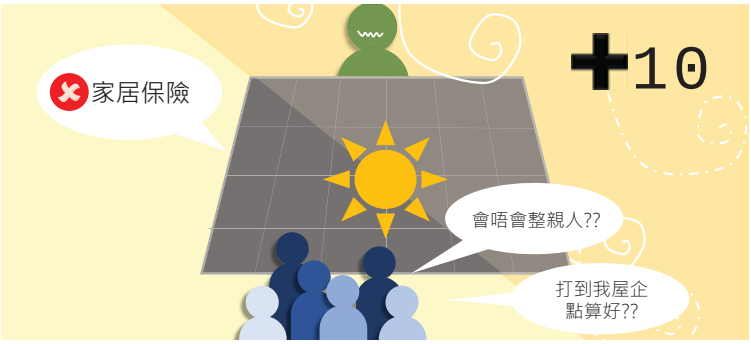
並邀請居民集資，

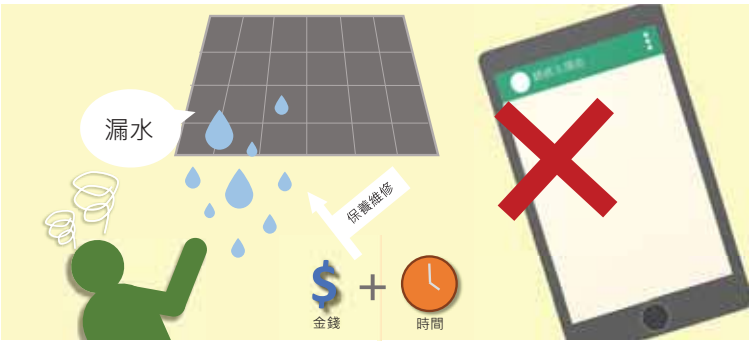
形式如同投資**i- Bond**。

在扣除成本後，每戶每年可得**$2000**上網電價作收入。

但是，有不少居民**投訴**太陽能板**反光**、影響**風水**、有礙**景觀**。

山背河及停車場計劃亦涉及渠務署、屋宇署、環境局、地政總署等**多個政府部門審批**，手續漫長。

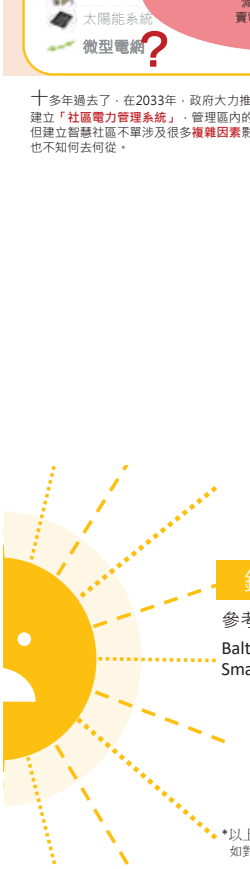




最後，陳先生雖然安裝了太陽能板，但**無法找到任何保險公司承保**。最近一次十級**颱風**，鄰居不斷發Whatsapp給陳先生，問他的太陽能板會否飛脫瓆下等等。打風期間，陳先生無時無刻都**提心吊膽**。

幸好，颱風過後沒有嚴重意外，但陳先生的屋企卻嚴重**漏水**。陳先生雖然希望向其他太陽能住戶詢問關於保養維修的問題，但先前的**群組已消聲匿跡**，陳先生只好獨自面對。

十多年過去了，在2033年，政府大力推動「**智慧城市**」，有錦綉居民亦順應大潮流，發起將**錦綉變成綠色的智慧社區**，建立「**社區電力管理系統**」，管理區內的**太陽能發電系統**，和**電動車的儲電**系統。
但建立智慧社區不單涉及很多**複雜因素**影響，例如**技術**問題、**能源市場是否開放**。陳先生與幾位發起居民談來談去，也不知何去何從。



再者，錦綉到2033年亦只有零星數家住戶安裝了太陽能板，社區的太陽能發電量少，**「社區電力管理系統」最終不了了之**。

錦綉花園太陽能社區工作坊

參考資料:

Balta-Ozkan, N., et al. (2014). "Scenarios for the Development of Smart Grids in the UK: synthesis report."

*以上情景根據研究資料虛構而成，並非真實個案。
如對資料有任何查詢，可聯絡亞洲能源研究中心(電話: 34117032 ; 電郵:aesc@hkbu.edu.hk)。

Appendix 7-5b: Scenario cases used in the community workshop

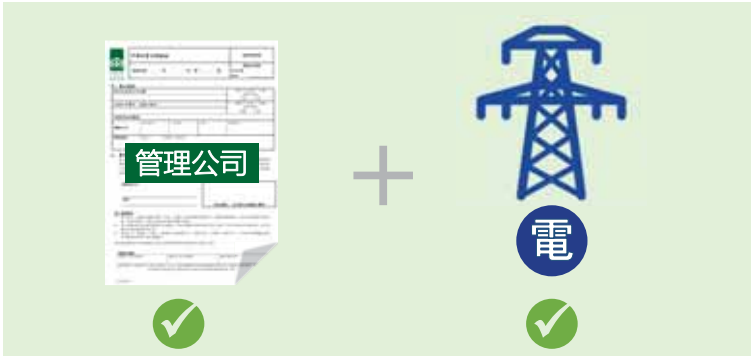
陳先生是錦綉花園居民，他看到政府及兩電最近推出的上網電價計劃，於是**計劃安裝**太陽能板。
陳先生瀏覽了不同網站，花了**兩星期**查閱機電工程署的承辦商列表。

陳先生分別找到四間太陽能承辦商報價。

他**比較**了承辦商的價錢、防漏工程的安排、設備安全性等。

希望把設備安裝在不顯眼位置，並確保**防水**工程完成妥當。

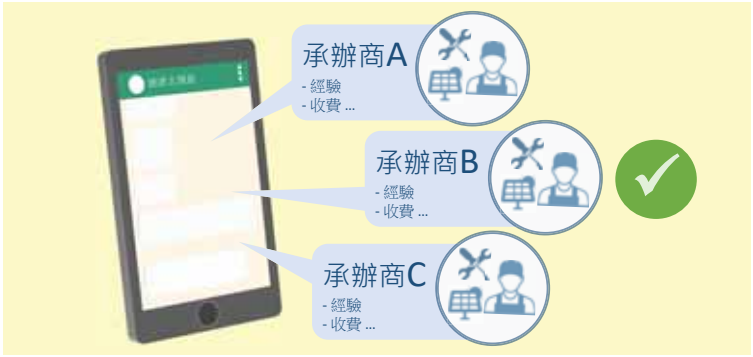
很快，他按照自己的**預算**和**喜好**，選擇了**心儀的**太陽能承辦商。



陳先生向**管理處**及**電力公司申請**安裝太陽能板，承辦商亦**成功**為陳先生**申請上網電價**。

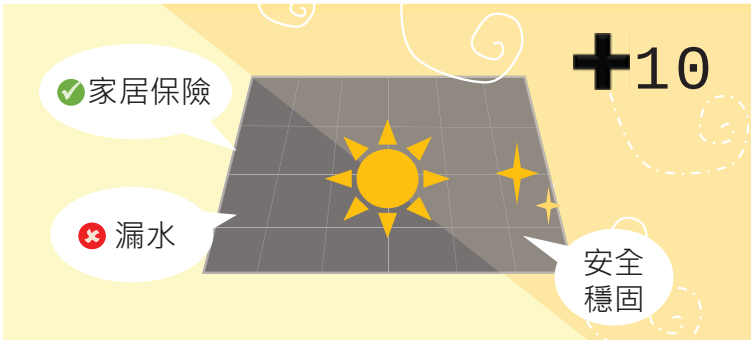
在確定安裝太陽能板前，陳先生參加居民開設的太陽能**Whatsapp群組**。

居民正為**團購**作出**熱烈討論**。

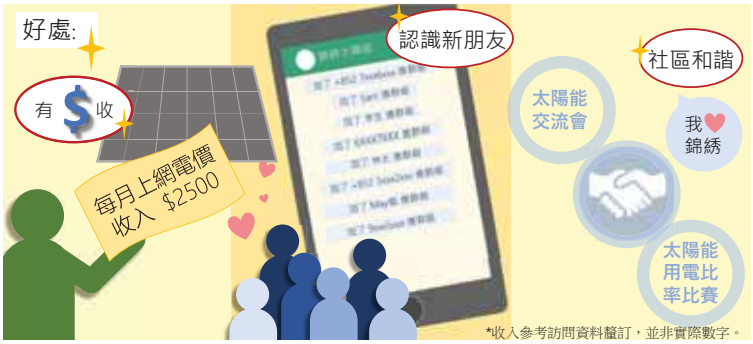


群組成員**積極**揀選承辦商。在大家**踴躍討論**下，**很快**便選擇了一間太陽能承辦商。

由於安裝太陽能板的費用有一半來自安裝工程，三十多戶團購能**節省人工支出**。
承辦商願意**提供九五折**，而居民需要選購同一款太陽能板及統一安裝安排。



終於，陳先生安裝了太陽能板，亦成功為設備買到**家居保險**，對設備**安全**及保障都十分**安心**。
工程很穩妥**沒有漏水**，亦**抵擋**了近來**颱風**的吹襲。



陳先生發現安裝太陽能板的**三大好處**: (1)**有錢收**; (2)可以**認識新朋友**; (3)促進**社區和諧**。
鄰居很**羨慕**陳先生可以賺取上網電價，陳先生於是把他們加進Whatsapp群組，
讓更多人可以一起**交流**。居民間亦多了一個**共同話題**。

三個月後，
陳先生收到
管理處的通告，
提到**能源供應商**
及**大企業**
GOOPLE 計劃
在山背河或
停車場建立
「**社區共建太陽**
能項目」，

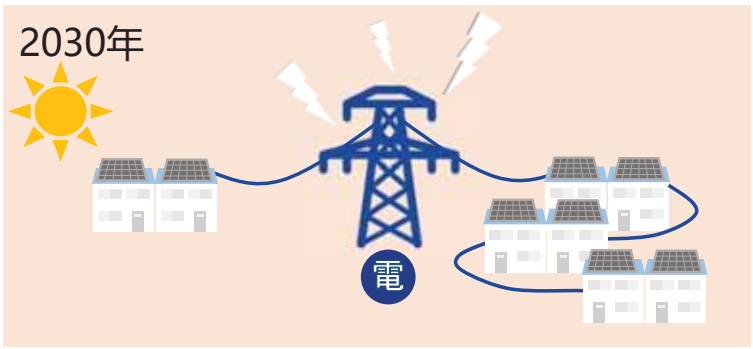
邀請居民**集資**，

形式如同投資
i- Bond。

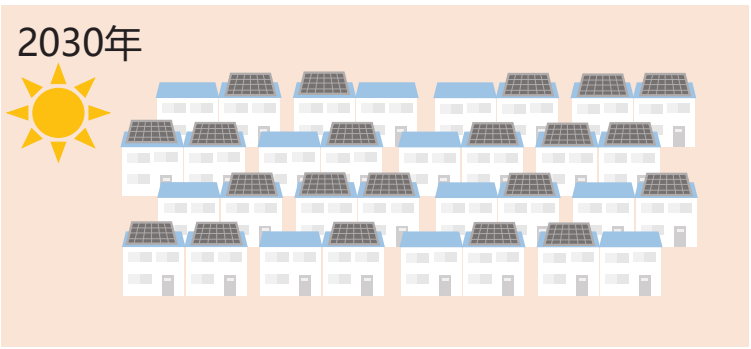
在扣除成本後，
每戶每年可得
$2000上網電價
作收入。

陳先生亦獲邀
擔任**項目顧問**。

由於錦綉花園
毗鄰米埔
拉姆薩爾濕地，
錦綉亦成為
國際知名的
太陽能社區。



十多年過去，到2030年，**越來越多**錦綉住戶安裝太陽能板，
電力公司需要將電網**配套設施**升級，以維持電網**穩定**。



上網電價計劃在2033年完結前，錦綉有不少住戶已經安裝了太陽能板。
不過，有些居民雖然**支持**太陽能發電，但由於**經濟因素**或**其他原因**而沒有安裝。

在2033年，順應**「智慧城市」**的大潮流，錦綉建立**「社區電力管理系統」**，好好管理區內的**太陽能發電系統**，
和**電動車的儲電**系統。錦綉儼如一個**小型發電廠**，鄰居可賣太陽能電給鄰居，甚至以**社企**形式由社區賣電給電力公司。
電力公司與居民互相知道**供電和用電狀況**，更好地調節供電量和用電量，令整個電力系統運作得更**有效率**及**穩定**。

錦綉花園太陽能社區工作坊

參考資料:

Balta-Ozkan, N., et al. (2014). "Scenarios for the Development of Smart Grids in the UK: synthesis report."

*以上情景根據研究資料虛構而成，並非真實個案。
如對資料有任何查詢，可聯絡亞洲能源研究中心(電話: 34117032 ; 電郵:aesc@hkbu.edu.hk)。

Appendix 7-6: Community workshop in Hong Lok Yuen on 1st June 2019

Appendix 7-6a: Briefing document on the community workshop in Hong Lok Yuen

康樂園太陽能社區工作坊

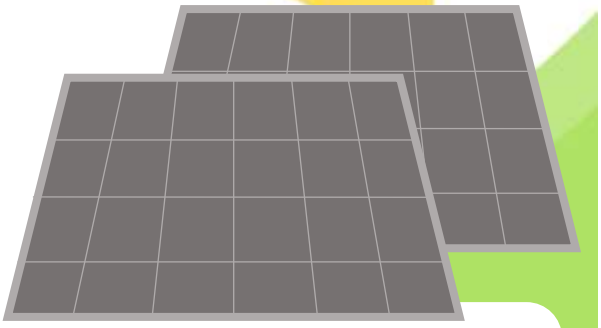
簡介文件

2019 年 6 月 1 日(星期六)

上午 9:30 至 下午 12:45

康樂園管理處

康樂園市中心徑 C 3 座 2 樓



主辦單位

Asian Energy Studies Centre

香港浸會大學 HONG KONG BAPTIST UNIVERSITY

協辦單位

Hong Kong Solar Partnership

研究團隊

Asian Energy Studies Centre

Greenpeace 綠色和平

Sungkyunkwan University

香港大學 The University of Hong Kong

CityU 香港城市大學 City University of Hong Kong

目錄

1 引言 3
1.1 歡迎辭及前言 3
1.2 中心簡介 4
1.3 工作坊目的 5
1.4 工作坊的參與人士 5
1.5 討論模式 5
1.6 工作坊程序 6
2 香港太陽能社區的構想 7
2.1 香港政府的願景 7
2.2 現時政策 – 上網電價計劃 7
2.3 香港太陽能發展歷程 8
3 您的看法：未來的康樂園 9
補充資料：居民與社區參與太陽能的模式 10

聲明

這次工作坊是香港政府政策創新與統籌辦事處公共政策研究資助計劃的研究項目「透過社區參與建立可持續能源發展的未來模型：以香港兩個潛在太陽能社區為案例」(項目編號：2017.A2.027.18B)的一個研究部分。工作坊將使用問卷及討論時的資料作學術研究用途。我們會將你的個人資料保密，在將來發表的所有研究報告上亦會以匿名處理你的個人資料。由於此簡介文件當中有未發表的資料，未經研究團隊同意，請不要轉載或引用本簡介文件。若對上述研究計劃有任何問題，或對本簡介文件有任何查詢，請與馬雅燕博士聯絡（電郵 ： aesc@hkbu.edu.hk 或致電 3411-7187）。

拍攝、視像錄影和錄音聲明：*工作坊當日，我們的工作人員將會進行**拍攝、視像錄影和錄音**，讓主辦及協辦單位作學術研究、記錄和日後資訊傳播等用途。若您不願意被拍攝或視像錄影，當日登記時請知會我們的工作人員，我們會給您帶上特別的名牌，以作識別；請您放心，我們屆時會作出妥善的安排。*

1 引言

1.1 歡迎辭及前言

今天這場工作坊正正因為有您們的參與，才變得重要。我們衷心感謝您們每一位，願意抽空來到這次工作坊，與我們一起商討太陽能社區發展在香港未來的角色。

發展太陽能已成為二十一世紀可持續能源轉型的一個主要議題。其中，以社區為單位發展的分佈式太陽能系統扮演著重要角色。隨着太陽能技術日趨成熟、太陽能發電成本持續下降及相關政策如上網電價等帶動下，世界各地均湧現不同形式的太陽能社區。康樂園是香港少數擁有優厚太陽能發電潛力的地區，大家作為康樂園的一份子，對康樂園發展成一個太陽能社區有甚麼看法呢？

此工作坊的目的是邀請康樂園住戶及這個社區的持份者，分享您們對安裝太陽能系統及讓康樂園發展成為太陽能社區的意見。這次工作坊希望能集思廣益，為康樂園以至香港發展太陽能出一分力。

這工作坊的設計，是參考了美國史丹福大學開發的「商議式民意調查」方法。顧名思義，商議就是商量、議論。我們將透過小組討論、與專家互動等環節，讓您與其他參與者討論各自不同的意見。究竟社區發展太陽能在康樂園以至香港有何機遇和挑戰？這工作坊希望提供一個讓大家共聚一堂的平台，讓您們及其他持份者就這個重要問題，進行討論和商議，經過深思熟慮後再歸納出自己的看法和願景。

透過這次工作坊，香港政府、本港兩家電力公司及有關持份者將會聆聽到您的寶貴意見，您的建議將可能影響日後相關政策的制定。

這份「簡介文件」是這次工作坊的關鍵組成部份，這文件為您們提供一個簡要的概覽，幫助您們了解社區發展太陽能的過程中遇到的障礙及可能的應對措施等。請大家在出席前抽空細閱這簡介文件，在工作坊期間亦可隨時拿出來參考。

最後，我們衷心感謝這個行業的專家們，為這份簡介文件的初稿給予意見。另外，我們感謝政策創新與統籌辦事處公共政策研究資助計劃的研究項目(項目編號：2017.A2.027.18B)和香港浸會大學學術研究委員會的撥款支持。

再次感謝您抽空參與我們的工作坊！

項目研究團隊敬啟

馬雅燕博士
香港浸會大學
亞洲能源研究中心總監
地理系助理教授

盧笛聲博士
香港浸會大學
地理系助理教授
林思齊東西學術交流研究所
副總監

周啟鳴教授
香港浸會大學
香港地學計算與
分析研究中心主任
社會科學院副院長（研究）

梁國熙教授
香港城市大學
能源及環境學院教授

鍾庭耀博士
香港大學
民意研究計劃總監

羅惠儀博士
香港大學
社會科學學院
策動永續發展坊
副總監及首席講師

Marc Wolfram 博士
成均館大學（韓國）
城市變革實驗室
(Urban Transformations Lab)
負責人
建築系副教授

楊凱珊
綠色和平東亞分部
資深項目主任

1.2 中心簡介

香港浸會大學亞洲能源研究中心（Asian Energy Studies Centre）成立於 2014 年（前身為早於 1998 年成立的“香港能源研究中心”），是社會科學院轄下的研究中心。亞洲能源研究中心以成為亞太區公認的可持續能源研究中心為宗旨，致力從管治角度分析及著眼研究亞洲區的可持續能源發展。透過進行跨學科的研究項目、組織學術研討會及公共研討會，和參與其他學術活動，我們致力創造新知識、提供切實可行的政策建議、促進知識交流，及促進相關持份者的參與來推動和改善能源政策。

更多有關中心的研究項目或活動，請瀏覽 http://aesc.hkbu.edu.hk/。

香港浸會大學亞洲能源研究中心及地理系於 2018 年牽頭成立「香港太陽能伙伴合作平台」(Hong Kong Solar Partnership)，旨在為香港太陽能持份者提供太陽能發展合作及社區參與的平台。

更多有關「香港太陽能伙伴合作平台」的資料，請瀏覽 http://aesc.hkbu.edu.hk/hongkongsolarpartnership。

1.3 工作坊目的

這次工作坊希望提供一個開放的平台讓持份者討論香港太陽能社區發展。以康樂園為研究個案，我們希望探討居民在現行可再生能源政策下，發展太陽能社區的可能性、困難及願景。

我們早前已在錦綉花園舉行工作坊，並將於本周六 (2019 年 6 月 1 日)在康樂園舉行同類工作坊，希望與大家集思廣益，一同探索太陽能發展不同方案的利弊、可行性。

根據我們從 2018 年 8 月至 2019 年 2 月期間在康樂園進行的訪問，我們在周六的工作坊，將圍繞三個居民較關注的範疇，邀請您分享意見。這三個範疇是：(1) 初置成本高、回報期長、融資模式有限；(2) 市場及技術資訊不足；及(3) 環保意識薄弱。

1.4 工作坊的參與人士

我們邀請約 25 名有興趣或已安裝太陽能板的康樂園住戶，與來自學術界、太陽能行業和非政府機構的專家及代表進行交流。

1.5 討論模式

工作坊將採用商議式民意調查進行。透過小組討論、大會互動等環節，各參與人士可表達意見，及向其他居民、專家、代表提問。

另外，我們亦為參與人士 5 歲或以上的同行小孩提供太陽能活動。

1.6 工作坊程序

地點: 康樂園管理處 - 康樂園市中心徑 C3 座 2 樓

日期: 1/6/2019 (星期六)

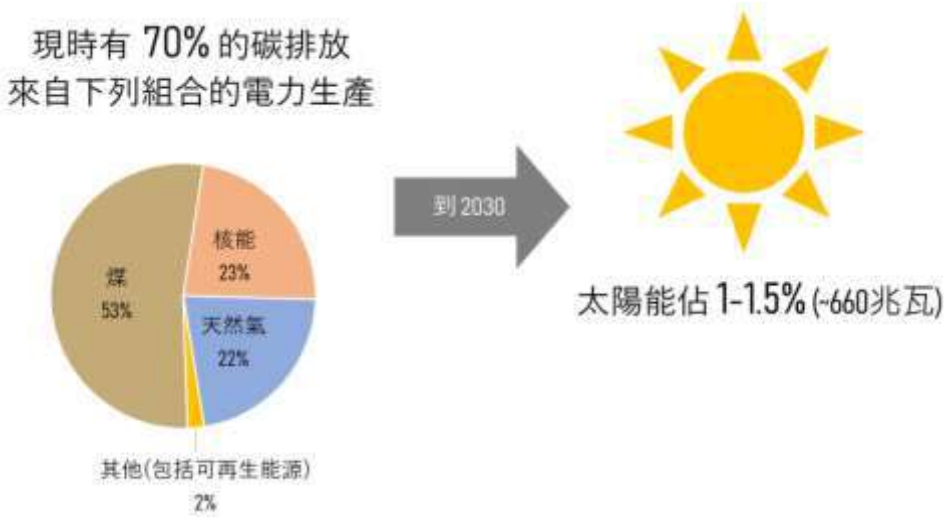
語言: 廣東話為主

時間	環節
9:30 - 9:45	登記
9:45 - 9:55	**歡迎致辭** 馬雅燕博士 香港浸會大學地理系助理教授 及 亞洲能源研究中心總監
9:55 - 10:15	**初步研究結果分享** 馬雅燕博士 香港浸會大學地理系助理教授 及 亞洲能源研究中心總監 梁國熙教授 香港城市大學能源及環境學院教授
10:15 - 10:30	**康樂園社區合作項目經驗分享** 邱榮光博士 環保協進會總監 及 新界鄉議局委員
10:30 - 10:45	**休息**
10:45 - 11:45	**小組討論**
11:45 - 12:45	**互動環節** 朱明德先生 中華電力有限公司策略規劃高級經理 梁展鵬先生 W3 Corporate Ltd. 總監 馬雅燕博士 香港浸會大學地理系助理教授 及 亞洲能源研究中心總監 梁國熙教授 香港城市大學能源及環境學院教授
	工作坊結束

2 香港太陽能社區的構想

2.1 香港政府的願景

根據環境局在 2017 年發表的香港氣候行動藍圖 2030+，政府希望 在 2030 年減少 65 – 70%的碳強度（按 2005 年的水平）。參考現時香港的情況，我們需要減少使用化石燃料和增加使用可再生能源來達成減碳目標。



2.2 現時政策 – 上網電價計劃

中電可再生能源上網電價:
https://www.clp.com.hk/zh/community-and-environment/renewable-schemes/feed-in-tariff

港燈上網電價計劃:
https://www.hkelectric.com/zh/customer-services/smart-power-services/feed-in-tariff-scheme

機電工程署及香港兩間電力公司就上網電價計劃提供了申請上網及一些安裝太陽能板的須知。

太陽能板的安裝要求及申請程序	https://re.emsd.gov.hk/tc_chi/fit/ri/fit_ri_g.html
合資格供應商列表	https://re.emsd.gov.hk/tc_chi/gen/gother/gother_equ.html
合資格承辦商列表	https://re.emsd.gov.hk/tc_chi/gen/gother/gother_EL.html
太陽能系統安裝指南	https://re.emsd.gov.hk/tc_chi/files/PVGuidanceNotes.pdf

2.3 香港太陽能發展歷程

3 您的看法：未來的康樂園

討論內容

社區發展太陽能充滿機遇，但亦暗藏不同問題。就康樂園發展太陽能社區，我們構思出正面及負面發展的可能性。

正面的情景我們稱之為「**順風順水太陽能社區起動**」，
而負面的情景為「**麻麻煩煩太陽能發展無望**」。

請觀看這兩個不同情景的故事：

「**順風順水太陽能社區起動**」：

https://drive.google.com/file/d/1A_kcjW--f-MMAZgFJLvF1kopcq2UjEO5/view?usp=sharing

「**麻麻煩煩太陽能發展無望**」：

https://drive.google.com/file/d/1x-yKiOJYZ2brXIPI55WsqU6TpDJt9HDM/view?usp=sharing

就著上述的情景，請各位居民在不同的發展方案下，就以下三大範疇作出討論，並提出您的意見：

一. 初置成本高、回報期長、融資模式有限
二. 市場及技術資訊不足
三. 環境教育及意識薄弱

我們也邀請您想想：

1. 就推動康樂園社區太陽能發展，您認為**哪個情景較能反映現實/可能會發生的狀況**？
2. 就著上述兩個情景，您認為有甚麼地方**最需要/最值得關注**？
3. 就推動**康樂園社區太陽能**發展可能會遇到的問題，您可以想出三個**具體建議**給政府嗎？
4. 您認為康樂園的太陽能社區**可以發展到甚麼程度**？您對您的社區透過社區模式發展有甚麼**願景**？

補充資料：居民與社區參與太陽能的模式

		各戶自行安裝	**團購** **與私營機構合作發展社區** **公共空間作太陽能發電用途**	**社區自發自用** **設立社區能源交易市場** **利用電動車作蓄電池使用**
方案背景	主要持份者	居民	居民、管理處、 電力公司、太陽能投資者	居民、管理處、 電力公司、社企
	合作關係	沒有 (各太陽能住戶自行負責)	太陽能住戶、管理處及第三方合作	太陽能住戶、非太陽能住戶、管理處、社企及第三方合作
	融資模式	自行投資	團購 與第三方合資	社區能源交易
考量因素	成本及安排	- 初置成本高 - 回本期長 - 逆變器更換費用	- 需要聚集到一定數量的住戶，才能發揮「團購」作用，減低初置成本 - 與第三方合資可能衍生行政費用	- 初置成本下調 - 上網電價逐年下降 - 電費有加價壓力；並可能有新增的電費項目，包括過網費、可再生能源附加費 - 成立地區電力系統的條件，如： i 太陽能和電動車得到廣泛使用 ii 大部分住戶同意安裝智能電錶 iii 大部分住戶提供實時用電數據
	技術及市場	- 太陽能系統的安裝位置 - 逆變器的壽命 - 漏水、防風等安裝問題 - 承辦商質素 - 保險制度	- 團購需要以劃一設計安裝太陽能系統，住戶或許各有所需 - 承辦商質素及承接工程能力 - 以團購方式購買保險 - 可能需要行政手續	- 智能社區微型電網 - 智能電力管理系統 - 電動車作蓄電池技術 - 社企模式管理社區電力系統 - 設立能源中介平台及管理
	政策	- 政府與電力公司的協議	- 政府與電力公司的協議	- 社區電價具市場競爭力 - 規管社區電力交易的相關法例

康樂園太陽能社區工作坊

順風順水太陽能社區起動

*以下情景根據研究資料**虛構**而成，並**非真實個案**。

陳先生是康樂園居民，他看到政府及兩電最近推出的上網電價計劃，於是**計劃安裝**太陽能板。
陳先生瀏覽了不同網站，花了**兩星期**查閱機電工程署的承辦商列表。

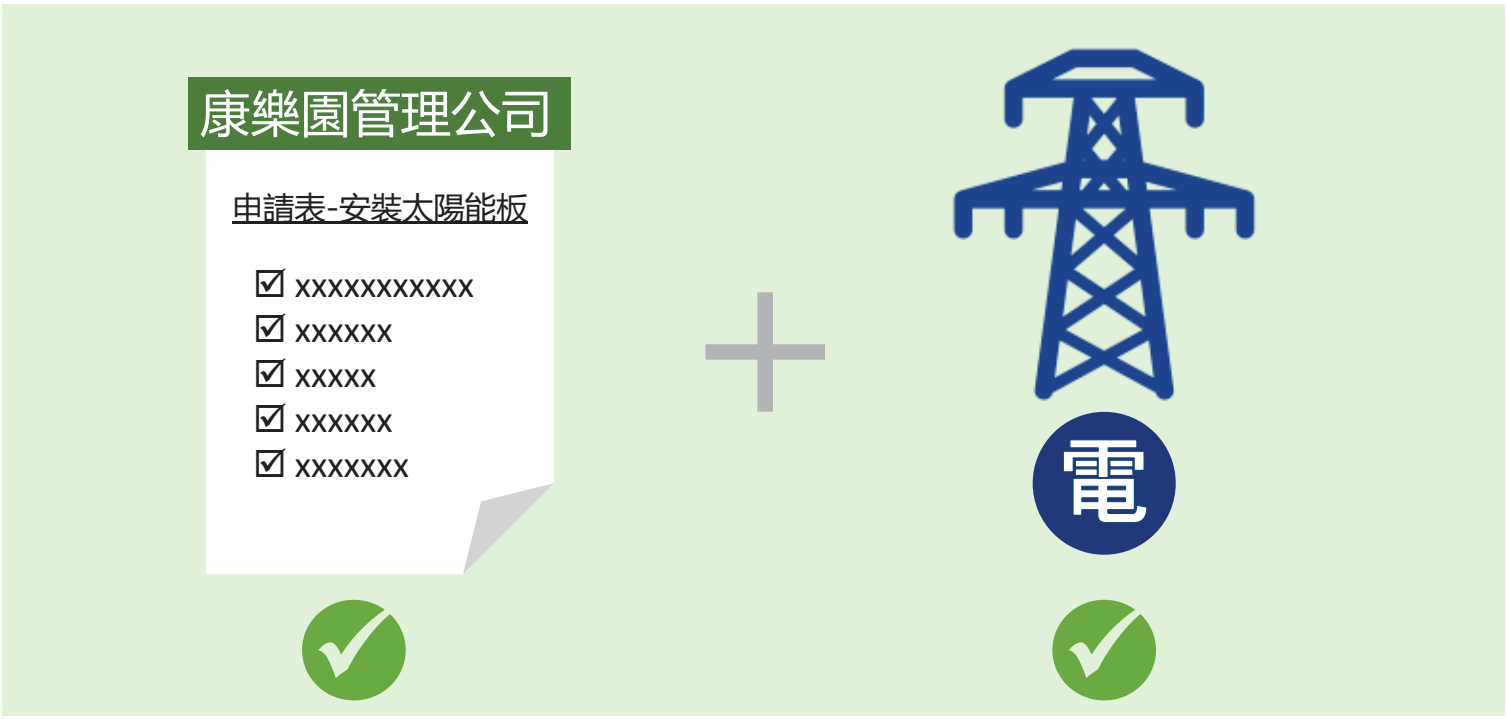
陳先生分別找到四間太陽能承辦商報價。

他**比較**了承辦商的價錢、防漏工程的安排、設備安全性等。

希望把設備安裝在不顯眼位置，並確保**防水**工程完成妥當。

*安裝成本參考訪問資料釐訂，並非實際數字。

很快，他按照自己的**預算**和**喜好**，選擇了**心儀的**太陽能承辦商。



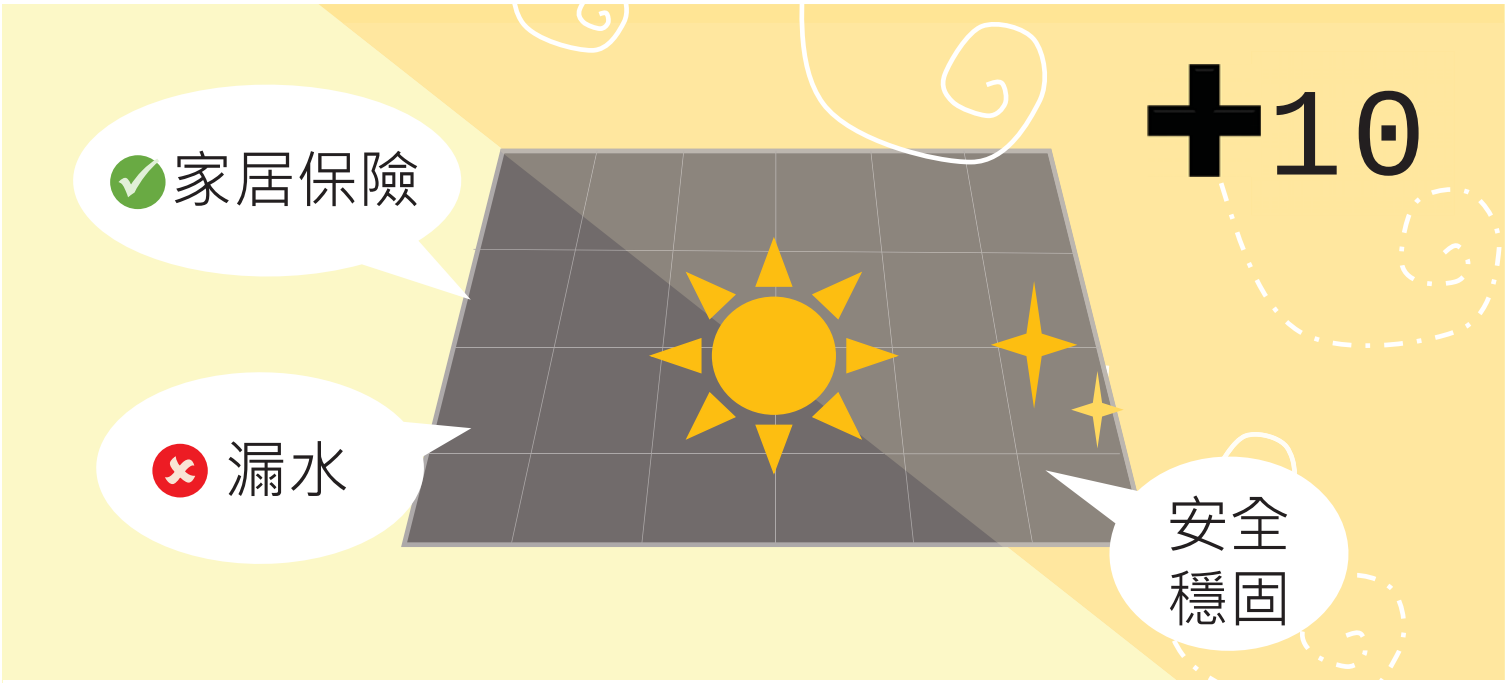
陳先生向**管理處**及**電力公司申請**安裝太陽能板，承辦商亦**成功**為陳先生**申請上網電價**。

在確定安裝太陽能板前，陳先生參加居民開設的太陽能**Whatsapp群組**。

居民正為**團購**作出**熱烈討論**。

群組成員**積極**揀選承辦商。在大家**踴躍討論**下，**很快**便選擇了一間太陽能承辦商。

由於安裝太陽能板的費用有一半來自安裝工程，三十多戶團購能**節省人工支出**。
承辦商願意**提供九五折**，而居民需要選購同一款太陽能板及統一安裝安排。



終於，陳先生安裝了太陽能板，亦成功為設備買到**家居保險**，對設備**安全**及保障都十分**安心**。
工程很穩妥**沒有漏水**，亦**抵擋**了近來**颱風**的吹襲。

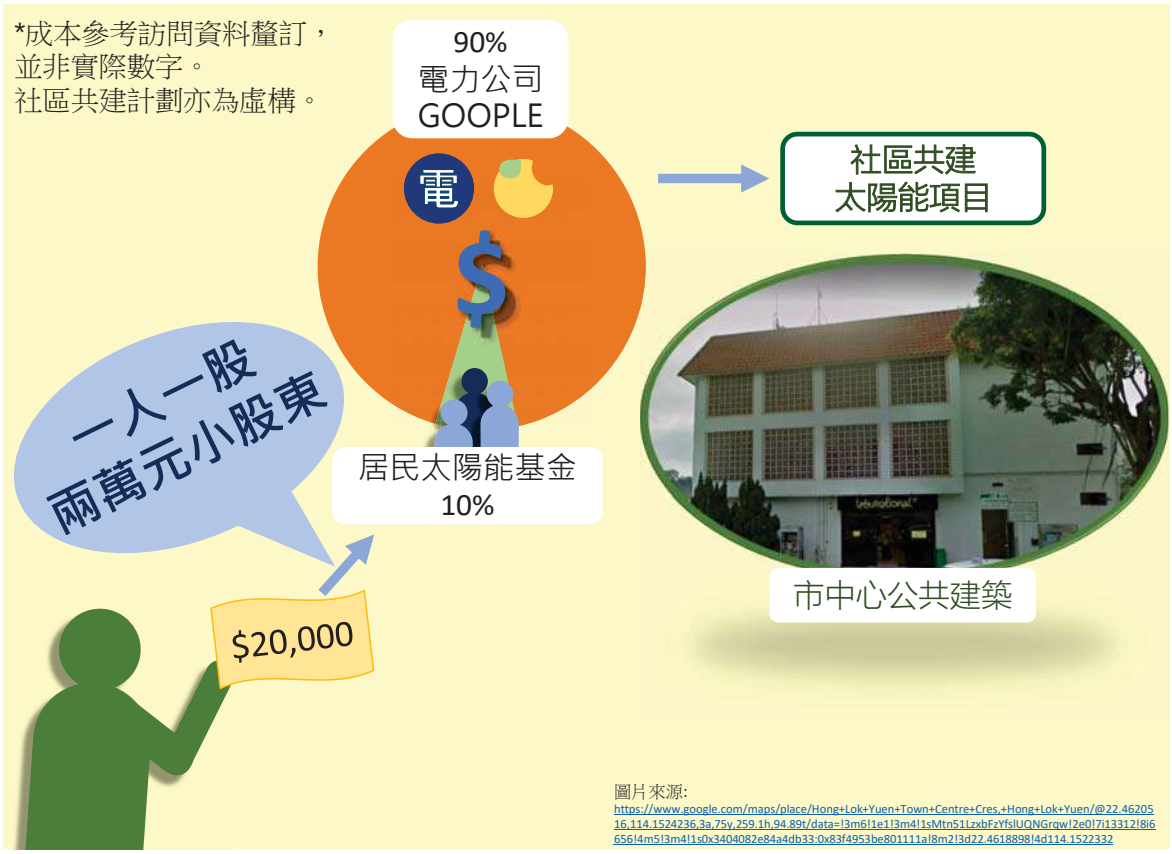
*收入參考訪問資料釐訂，並非實際數字。

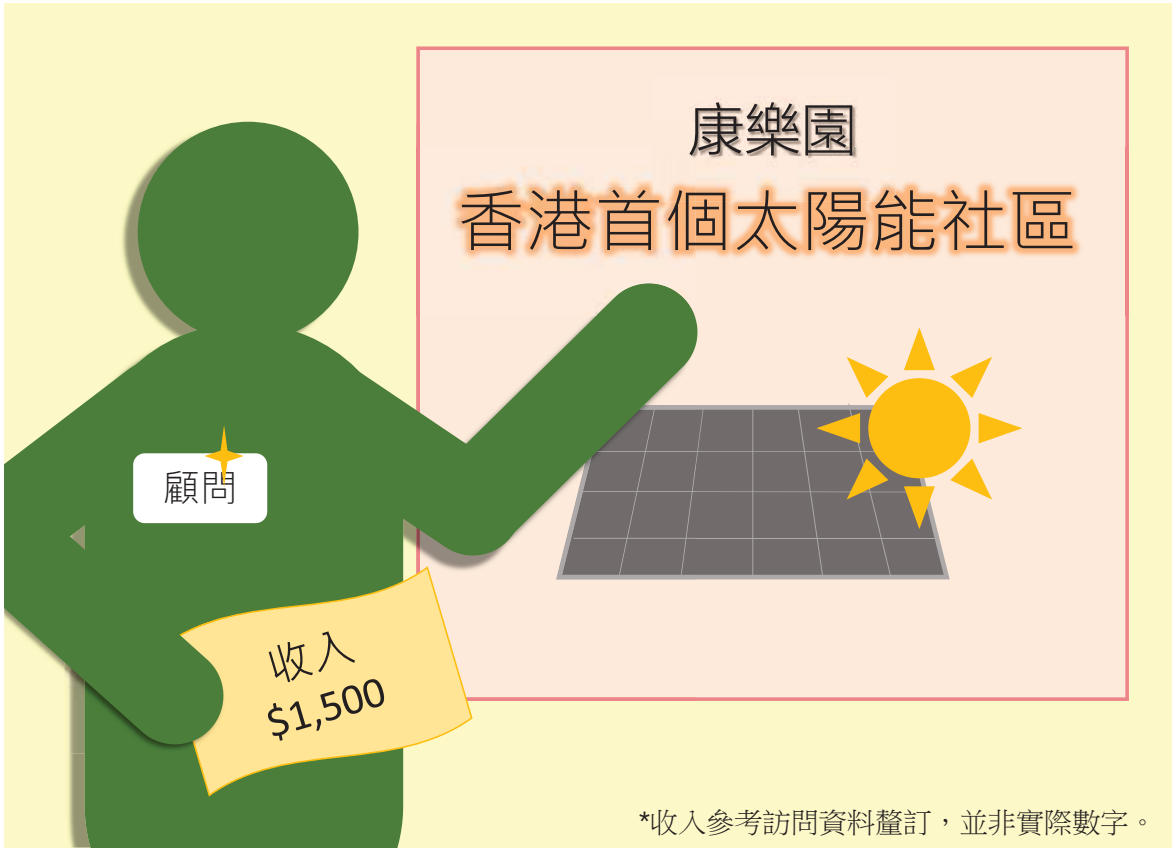
陳先生發現安裝太陽能板的三大好處: (1)**有錢收**; (2)可以**認識新朋友**; (3)促進**社區和諧**。
鄰居很**羨慕**陳先生可以賺取上網電價，陳先生於是把他們加進Whatsapp群組，
讓更多人可以一起**交流**。居民間亦多了一個**共同話題**。

三個月後，
陳先生收到
管理處的通告，
提到**能源供應商**
及**大企業**
GOOPLE 計劃
在公共地方建立
「**社區共建太陽**
能項目」，

邀請居民**集資**，

形式如同投資
i- Bond。



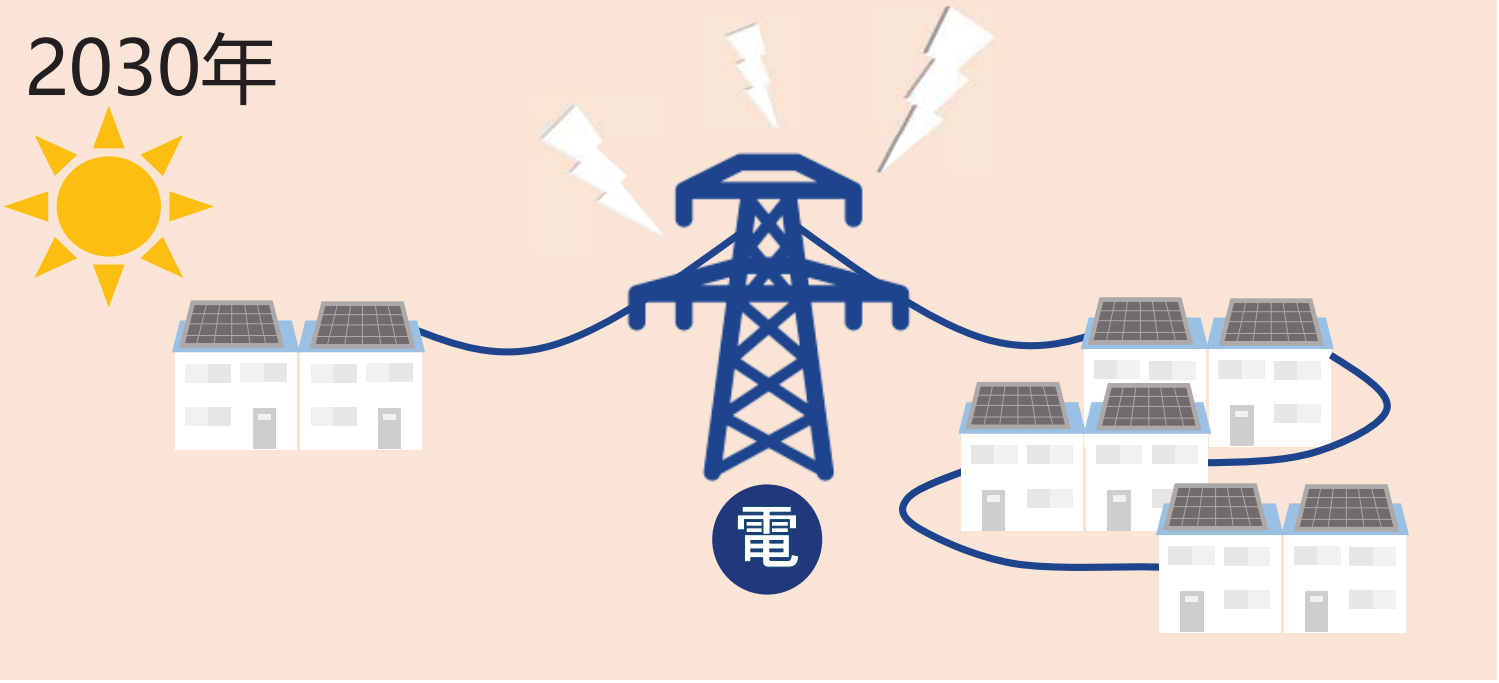


在扣除成本後，
每戶每年可得
$1500上網電價
作收入。

陳先生亦獲邀
擔任**項目顧問**。

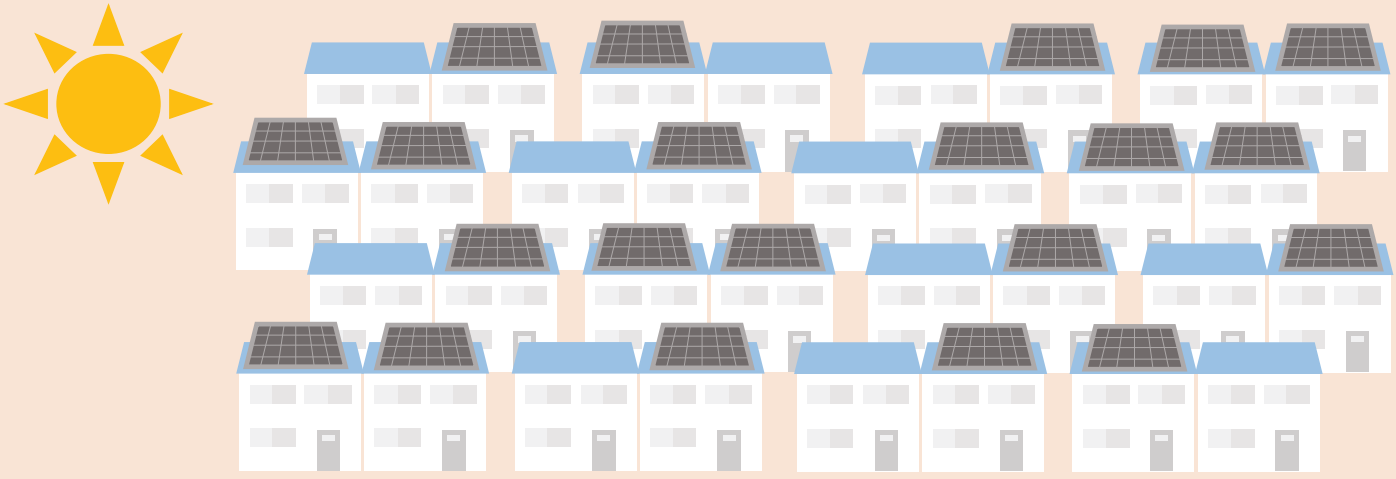
康樂園亦成為
香港知名的
太陽能社區。

2030年

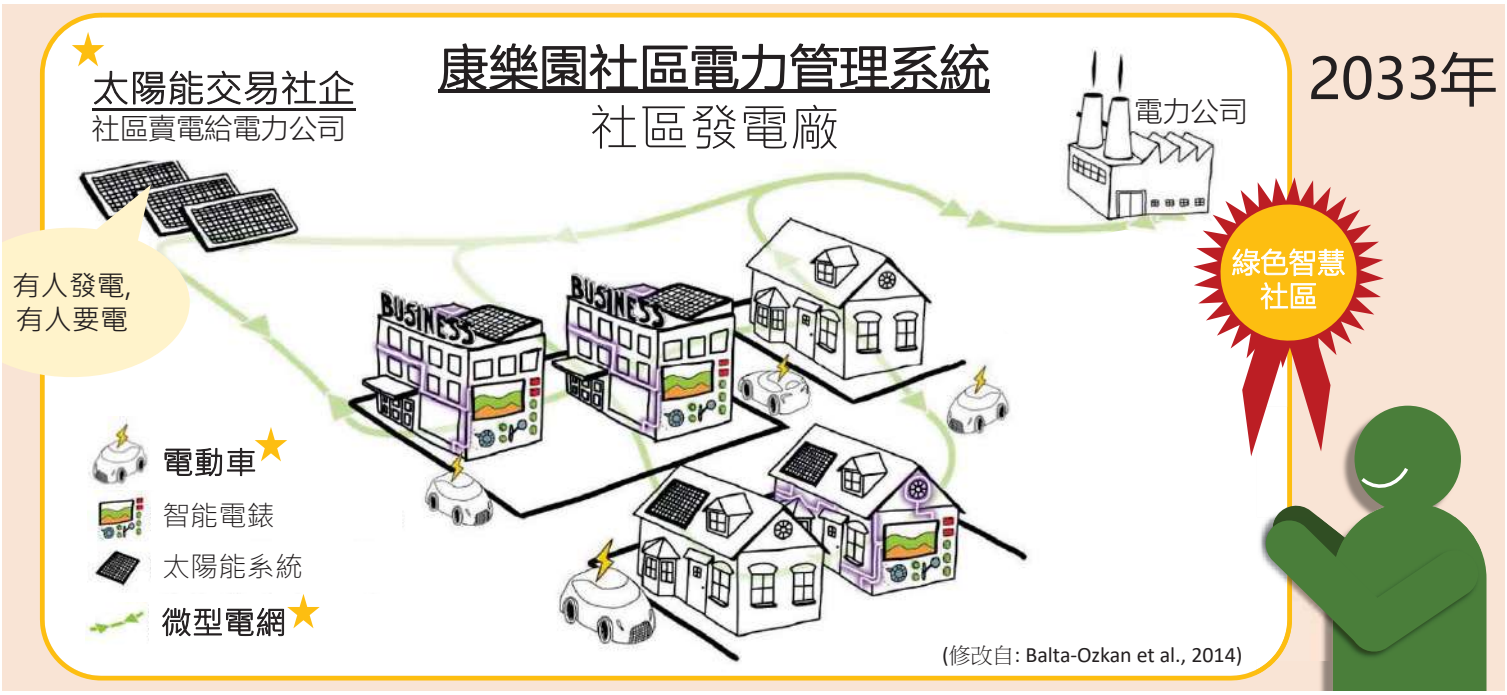


十多年過去，到2030年，**越來越多**康樂園住戶安裝太陽能板，
電力公司需要將電網**配套設施**升級，以維持電網**穩定**。

2030年



上網電價計劃在2033年完結前，康樂園有不少住戶已經安裝了太陽能板。
不過，有些居民雖然**支持**太陽能發電，但由於**經濟因素**或**其他原因**而沒有安裝。



在2033年，順應**「智慧城市」**的大潮流，康樂園建立**「社區電力管理系統」**，好好管理區內的**太陽能發電系統**，和**電動車的儲電**系統。康樂園儼如一個**小型發電廠**，鄰居可賣太陽能電給鄰居，甚至以**社企**形式由社區賣電給電力公司。電力公司與居民互相知道**供電和用電狀況**，更好地調節供電量和用電量，令整個電力系統運作得更**有效率**及**穩定**。

康樂園太陽能社區工作坊

參考資料:

Balta-Ozkan, N., et al. (2014). "Scenarios for the Development of Smart Grids in the UK: synthesis report."

*以上情景根據研究資料虛構而成，並非真實個案。
如對資料有任何查詢，可聯絡浸會大學亞洲能源研究中心(電話: 34117032 ; 電郵:aesc@hkbu.edu.hk)。

康樂園太陽能社區工作坊

麻麻煩煩太陽能發展無望

*以下情景根據研究資料**虛構**而成，並**非真實個案**。

陳先生是康樂花園居民，看到政府及兩電最近推出的上網電價計劃，於是計劃安裝太陽能板。
陳先生感到**無從入手**，又**無法找到有經驗的朋友協助**。

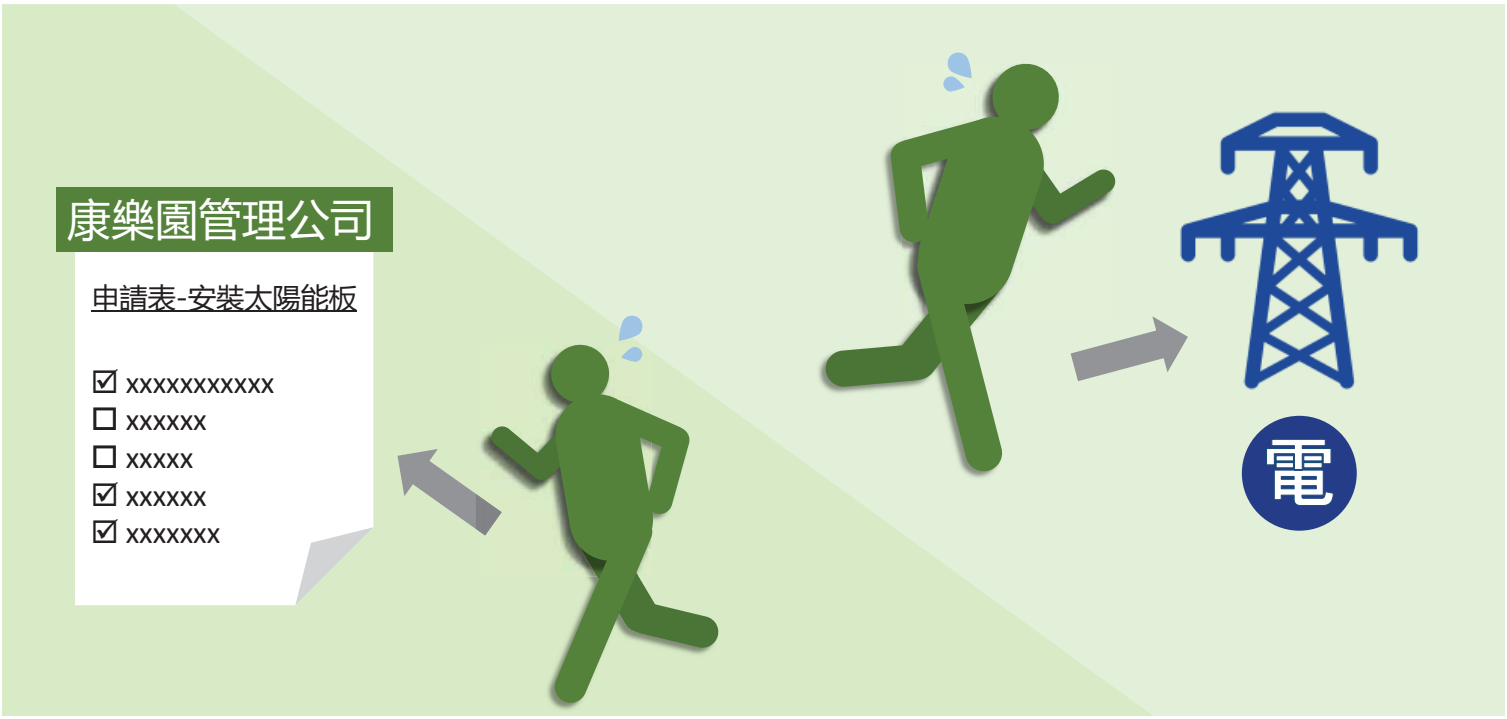
陳先生經過**費時的資料搜集**，先後找到四間太陽能承辦商報價。

不過，他對價錢、防漏工程的安排、設備安全性等抱有**疑惑**，

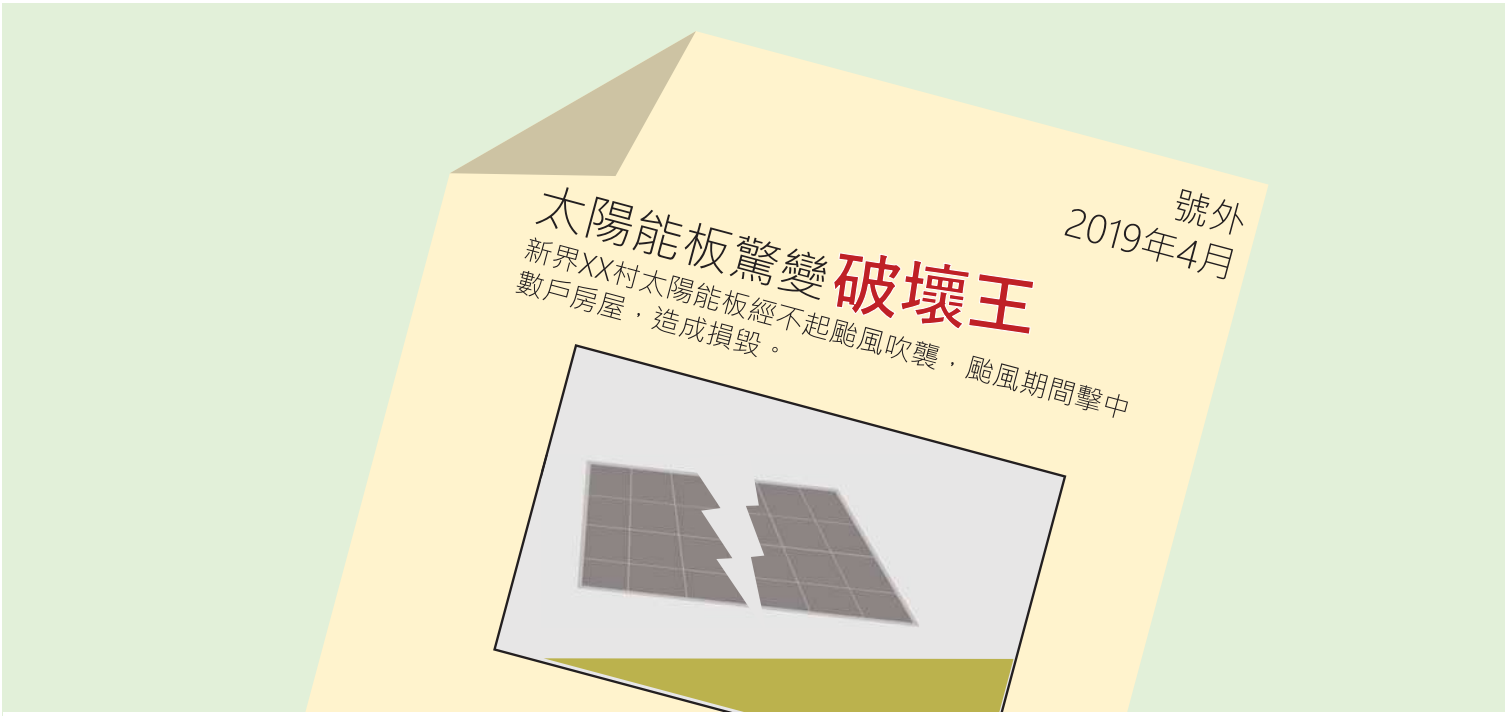
不知哪一個承辦商才信得過。

*安裝成本參考訪問資料釐訂，並非實際數字。

陳先生最終選了一間承辦商。但是，為解決漏水問題，承辦商需要把防水工程外判，陳先生需要支付**額外費用**。安裝費用亦因此增加不少。



陳先生開始相關**申請**程序，先後向管理公司和電力公司提出申請，經過一輪**繁複**的行政手續後，終於在**六個月後**獲批上網電價。



不過，在開始工程的時候，陳先生卻看到有關太陽能板引起的**意外**，令陳先生有所卻步。

不久，陳先生參加了居民開設的太陽能**Whatsapp群組**。

居民正討論**團購**。

陳先生留意到有些**群組成員**長期**沒有加入討論**或主動搜集資料，

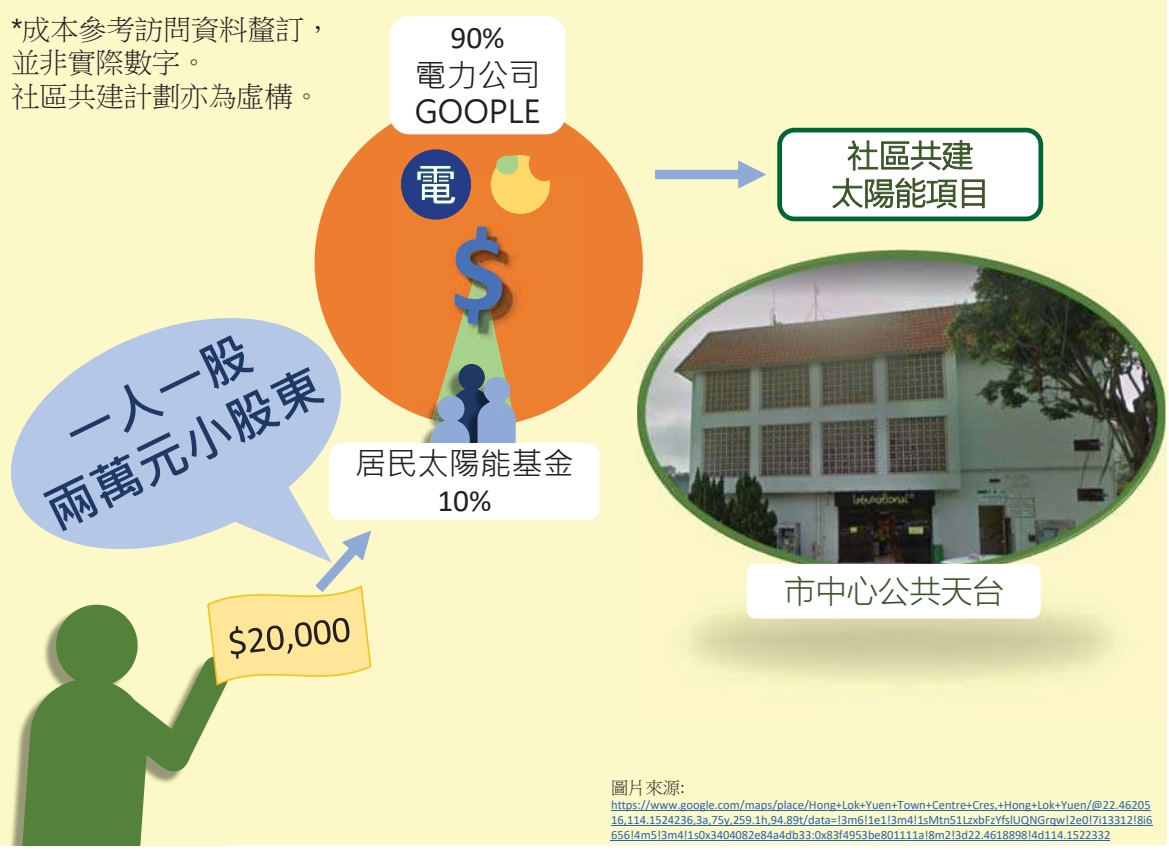
而有些成員亦對選擇十分**挑剔**。

大家對**價格**、安裝**美觀**性、**防水**的要求亦各有不同。經過長達**三個月**的討論及意見磨合，只有**零星**數間住戶願意團購。承辦商不願意提供任何折扣，**團購最終不了了之**。

三個月後，
陳先生收到
管理處的通告，
提到**能源供應商**
及**大企業**
GOOPLE 計劃
在公共地方建立
「**社區共建太陽**
能項目」，

邀請居民**集資**，

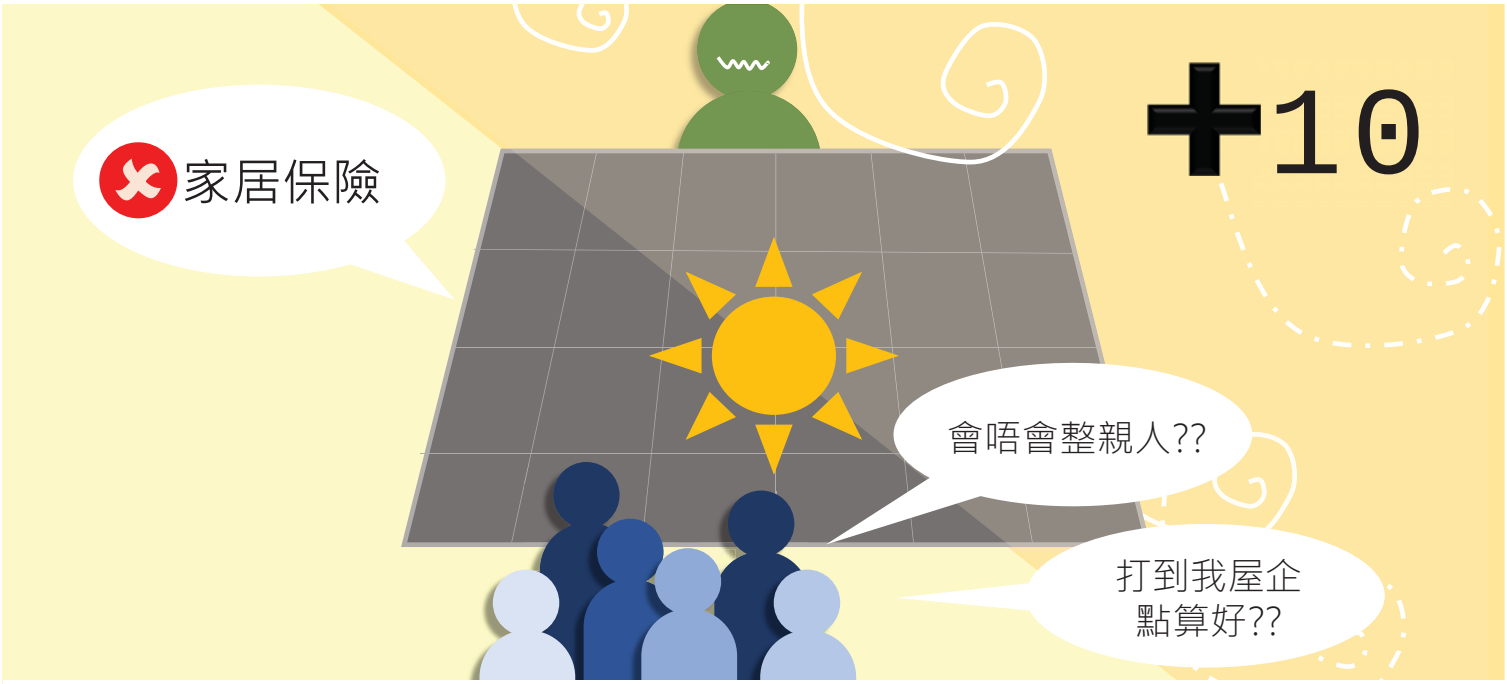
形式如同投資
i- Bond。



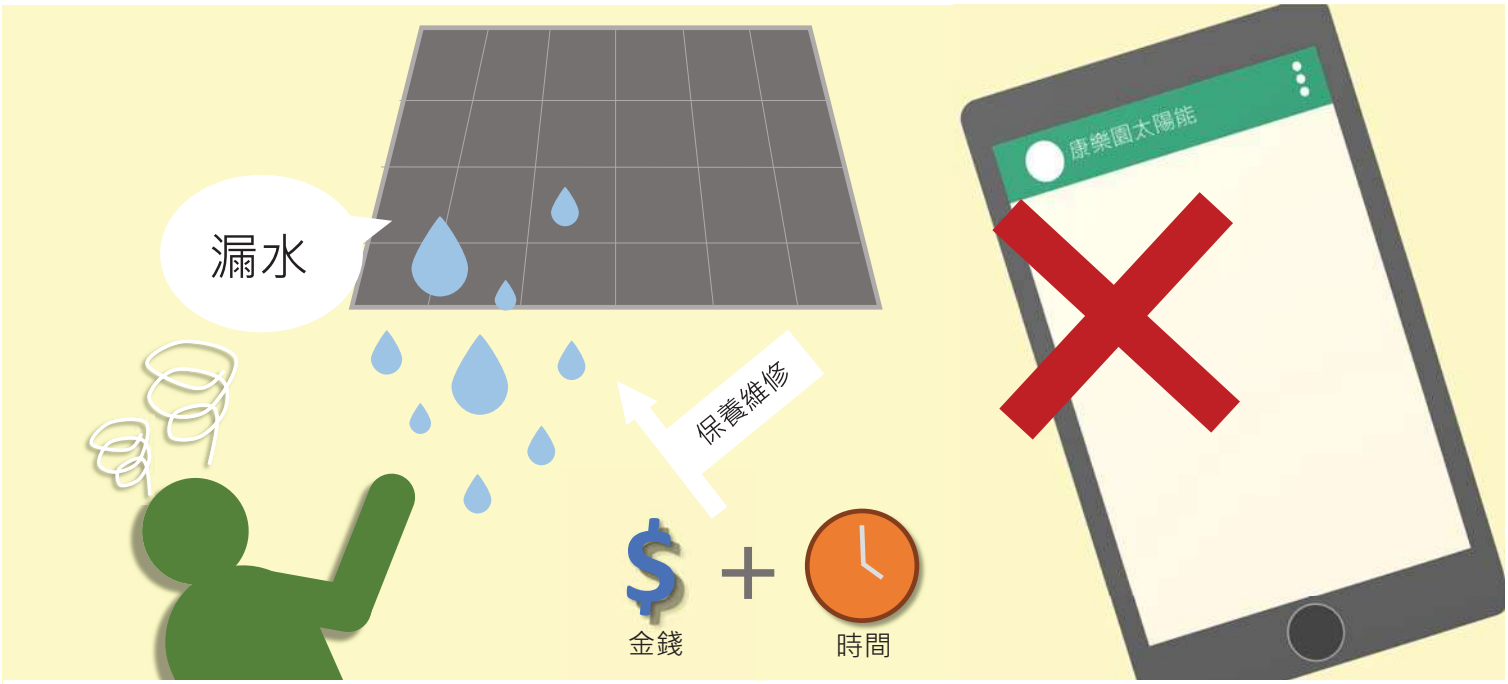
在扣除成本後，
每戶每年可得
$1500上網電價
作收入。

但是，有不少
居民**投訴**
太陽能板**反光**、
影響**風水**、有礙
景觀。

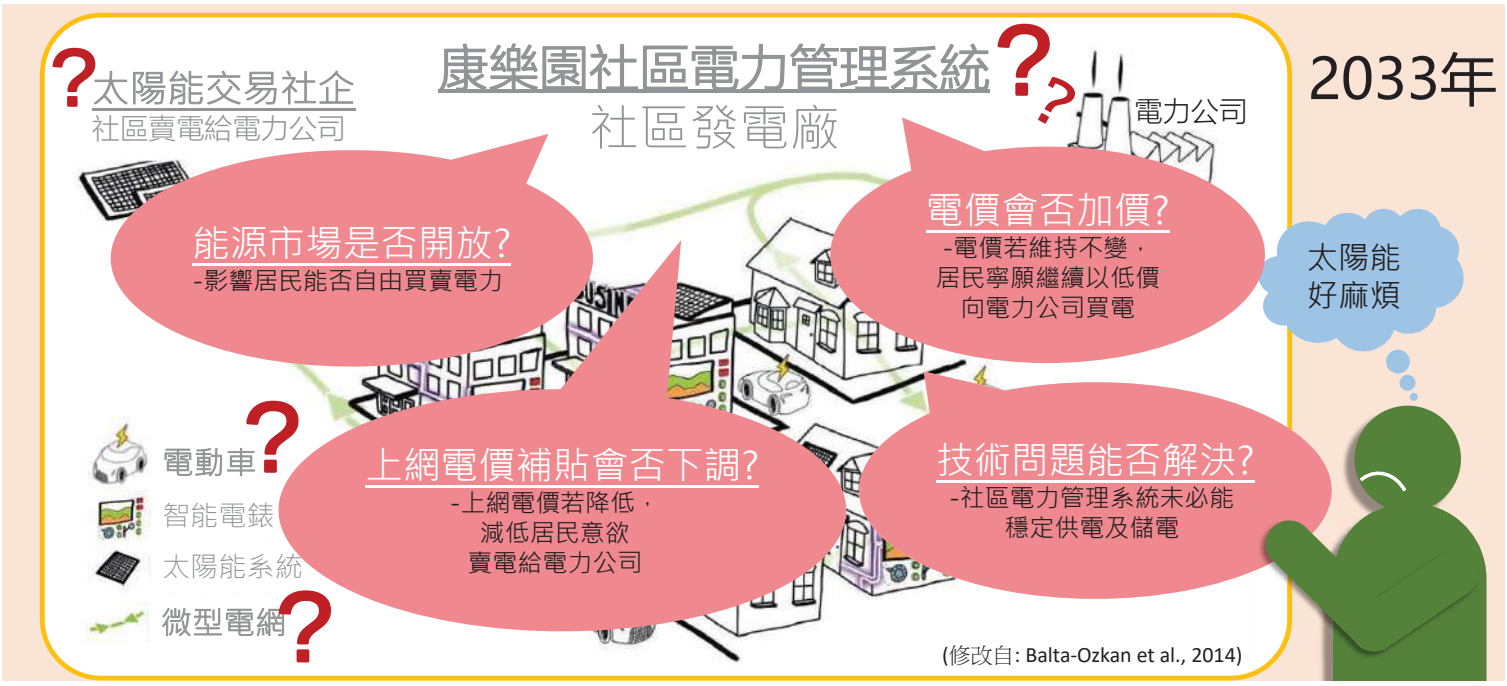
公共空間計劃
亦涉及
屋宇署、
環境局、
地政總署等**多個**
政府部門審批，
手續漫長。



最後，陳先生雖然安裝了太陽能板，但**無法找到任何保險公司承保**。最近一次十級**颱風**，鄰居不斷發Whatsapp給陳先生，問他的太陽能板會否飛脫墮下等等。打風期間，陳先生無時無刻都**提心吊膽**。



幸好，颱風過後沒有嚴重意外，但陳先生的屋企卻嚴重**漏水**。
陳先生雖然希望向其他太陽能住戶詢問關於保養維修的問題，但先前的**群組已消聲匿跡**，陳先生只好獨自面對。



十多年過去了，在2033年，政府大力推動「**智慧城市**」，有康樂園居民亦順應大潮流，發起將康樂園**變成綠色的智慧社區**，建立「**社區電力管理系統**」，管理區內的**太陽能發電系統**，和**電動車的儲電**系統。
但建立智慧社區不單涉及很多**複雜因素**影響，例如**技術**問題、**能源市場是否開放**。陳先生與幾位發起居民談來談去，也不知何去何從。

再者，康樂園到2033年亦只有零星數家住戶安裝了太陽能板，社區的太陽能發電量少，**「社區電力管理系統」最終不了了之**。

康樂園太陽能社區工作坊

參考資料:

Balta-Ozkan, N., et al. (2014). "Scenarios for the Development of Smart Grids in the UK: synthesis report."

*以上情景根據研究資料虛構而成，並非真實個案。
如對資料有任何查詢，可聯絡浸會大學亞洲能源研究中心(電話: 34117032 ; 電郵:aesc@hkbu.edu.hk)。

Appendix 7-6c: Pre-workshop questionnaire

康樂園太陽能社區工作坊

商議**前**的問卷

Code

請☒出合適選項。

1. 你家有沒有安裝太陽能板?

☐ 有(請跳至題 3)　　☐沒有

2. 如沒有，你有多大興趣安裝?

完全沒有興趣										十分有興趣	無意見
0	1	2	3	4	5	6	7	8	9	10	-
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

3. 香港上網電價計劃在 2018 年**何月**開始實施? _____月

4. 您是否支持用下列方式，來發展康樂園的社區太陽能?

	非常不支持	不支持	中立	支持	非常支持	無意見
(i) 各住戶自行找承辦商安裝	☐	☐	☐	☐	☐	☐
(ii) 團購	☐	☐	☐	☐	☐	☐
(iii) 社區一人一股集資籌建太陽能項目(如在市中心建築的公共天台)	☐	☐	☐	☐	☐	☐
(iv) 我希望有更多康樂園住戶安裝太陽能板，康樂園成為一個太陽能社區	☐	☐	☐	☐	☐	☐
(v) 長遠來說，設立康樂園社區的太陽能交易市場，社區電力可自發自用	☐	☐	☐	☐	☐	☐

5. 您同意以下的說法嗎?

	非常不同意	不同意	中立	同意	非常同意	無意見
(i) 香港人的用電行為不會對氣候有大影響	☐	☐	☐	☐	☐	☐
(ii) 我願意多付一些錢去買更節能的電器	☐	☐	☐	☐	☐	☐
(iii) 為了我們的子孫後代，我們需要減少使用化石燃料(如煤或天然氣發電)	☐	☐	☐	☐	☐	☐

6. 你認為安裝太陽能板有沒有以下價值?

	價值	**評分 (1=完全沒有價值 至 10=非常有價值)**										
		NA	1	2	3	4	5	6	7	8	9	10
i	***經濟*價值**：e.g. 減少由空氣污染引致的醫療費用；降低對於進能源的依賴、避免因缺電引致的經濟損失（加強能源安全）；推進本地綠色產業、創造更多綠色就業機會	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
ii	***環境*價值**：e.g. 環保、減排溫室氣體、減少空氣污染	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
iii	***社會*價值**：e.g. 提高香港這城市的綠色形象、降低核能風險、降低能源危機風險、改善市民居住環境、為後代保護城市的資源和環境	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
vi	***社區*價值**：e.g. 康樂園可以建立自己的太陽能社區，社區的電力自發自用、促進社區和諧	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

7. 您的資料 (*請放心，您提供的資料將匿名處理*)

a) 性別: ☐ 男 ☐女

b) 年齡: ☐ 18-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60-69 ☐ 70 或以上

c) 教育程度

☐ 幼兒教育至中學或同等學歷
☐ 高中畢業或同等學歷
☐ 副學士/高級文憑/文憑/證書及同等學歷
☐ 學士學位及同等學歷
☐ 碩士或以上學歷

d) 職業 (**可選取多於一個選項**)

☐ 行政及專業人員 ☐ 文職及服務人員
☐ 勞動工人 ☐ 學生
☐ 家庭主婦/家務料理者 ☐ 已退休
☐ 其他: _____

e) 您家庭每月收入是?

☐ 港幣 19,999 或以下 ☐ 港幣 20,000 - 39,999
☐ 港幣 40,000 - 59,999 ☐ 港幣 60,000 - 79,999
☐ 港幣 80,000 - 99,999 ☐ 港幣 100,000 - 119,999
☐ 港幣 120,000 - 139,999 ☐ 港幣 140,000 - 159,999
☐ 港幣 160,000 或以上 ☐ 其他（例如已退休）

8. 參加工作坊前，你有閱讀過主辦單位所提供的「簡介文件」嗎？

☐ 沒有看過
☐ 只看了文件的一小部分，不到一半
☐ 看了文件約一半的內容
☐ 看了文件一半以上的內容，但沒有看完
☐ 已看了整份文件
☐ 不知道/不願透露

--- 問卷完成 ---

謝謝您!

Appendix 7-6d: Workshop presentation powerpoint

《香港太陽能社區》的研究
初步結果

香港政府 政策創新與統籌辦事處 公共政策研究資助計劃 的研究項目 (2018-2019)

馬雅燕博士
香港浸會大學
亞洲能源研究中心總監
地理系助理教授

梁國熙教授
香港城市大學
能源及環境學院教授

2019年6月1日

https://bluebalu.files.wordpress.com/2011/12/003-stage-8-hong-lok-yuen.jpg

太陽能發展進程…..「*上網電價 $5*」

香港...

- 2018年4月 公佈上網電價計劃詳情
- 2018年5月 中電開始接受申請
- 2018年8月 港燈開始接受申請
- **2018年10月 中電開始計劃並接收 1,100份申請**
- 2018年10月中 政府放寬 ***村屋***安裝高度上限
- 2019年1月 港燈開始計劃
- 2019年2月 政府宣佈為***學校***提供一站式的太陽能板安裝服務
- 2019年3月 中電及港燈共收到 約1770份申請

錦綉花園

- 2017年9月 管理公司設立安裝太陽能板之**申請表**
- 2018年5月 管理公司修改申請表，允許太陽能板面積由 4平方米增至只需與屋頂邊緣留空 30平方厘米
- 2019年1月 有**21**間住戶向管理處申請，16戶獲批

康樂園

- 2018年9月 業主會舉行太陽能**講座** (80人/50戶參加) 及設立**Whatsapp群組**，居民蘊釀***團購***
- 2018年9月尾 業主會邀請**8間承辦商報**價並發放資訊給居民
- 2018年12月 管理公司研究是否有違公契，團購暫時**擱置**
- 2019年4月 太陽能住戶: **少於10戶 - 約4** 戶已參加「上網補貼」

研究方法

研究目的	研究方法	探討的議題
• 以「**錦綉**」及「**康樂園**」兩個有潛能成為太陽能社區的屋苑作為研究案例 • 本研究旨在**探討社區參與對能源轉型的決策過程的作用**	• 分析社區及附近學校對上網電價實施前後的反應 • **2018.9-2019.1** 在社區及學校進行現場太陽能測量，**評估太陽能潛力** • **2018.8-9月: 訪問**相關持分者，探討香港太陽能社區的前景、發展方案、面臨的障礙及可行的策略，及對太陽能政策的想法 (訪問錦綉43戶+康樂園29戶) • 2019.3-6月 舉行**工作坊**促進各方交流、商討對策	• 發展太陽能社區是否可行的能源選項？ • 香港是否可依靠太陽能社區作為可持續能源將來的一部分？ • 香港可從其他太陽能先進城市汲取甚麼經驗？ • 香港可怎樣處理從發展太陽能帶來的技術、經濟、社會政治及制度上的挑戰和機遇？

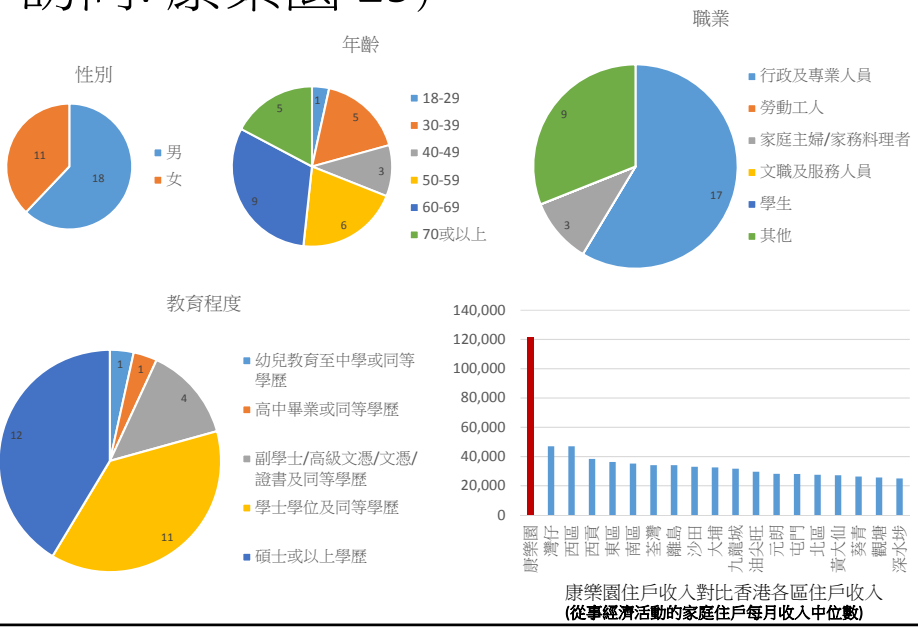
為何研究康樂園？

“太陽能是康樂園的「社區資源」”

1,192 戶

優良的地理環境　日照優勢

訪問: 康樂園 29戶

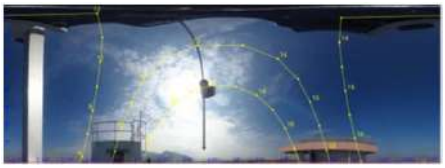


初步研究結果 1：

受訪住戶有太陽能資源、但未有充分利用

太陽能光伏系統發電分析

- 香港城市大學能源及環境學院/能量研發能源研究中心。
- 使用測量儀器 horicatcher 和分析軟件 Meteonorm 來估算錦繡花園屋頂每年可接收多少太陽能。
- 進一步估算安裝太陽能光伏系統的全年發電量。
- 最後計算每年可再生能源上網電價補貼。



總結:

No.	no. of rooftops	total rooftop area (m^2)	estimated electricity output (kWh/year)	annual income (HK$)	FIT rate ($/kWh)
1	2	11.58	1479.4	7397.02	5
2	2	20.9	4681.08	23405.4	5
3	2	23.12	5152.76	25763.8	5
4	2	23.78	5398.87	26994.35	5
5	1	26.28	5897.23	29486.17	5
6	2	29.03	6400.83	32004.15	5
7	2	32.44	7097.55	35487.75	5
8	4	39	8495.58	42477.9	5
9	2	46	10154.27	50771.35	5
10	4	52	10092.3	50461.52	5
11	1	59.69	13526.35	67631.75	5
12	1	63.13	13833.68	55334.72	4
13	2	64.2	14073.14	70365.72	4
14	2	66.55	14460.09	57840.3	4
15	3	70	14552.34	58209.36	4
16	1	75	16498.5	65994	4
17	1	83	18992.1	75968.2	4
18	3	87.73	18148.23	72592.92	4
19	4	111	21439.04	85656.16	4

參考:

上網電價計劃:

<10kW:	$5/kWh
10kW-200kW:	$4/kWh
>200kW:	$3 kWh

註: 10kW的系統大小大約是60m^2

(會根據各太陽能板不同的規格而改變)

初步研究結果：康樂園太陽能系統的成本及回報

- 系統面積：51.8m²
- 安裝成本：$250,000
  (按受訪住戶回覆的數字推算)
- 太陽能發電量：11,072千瓦時/年
- 年度上網電價收入：$49,149
- 估計回本期：5年

(以上資料以**19戶**太陽能評估結果的**平均數**計算)

個案

- 裝機容量: 5.13 kW
- 發電量(平均每月): 430kWh
- 上網電價電費(平均每月): $2,150

受訪住戶太陽能發電潛力*未被好好利用*

我們早前為**19**戶康樂園居民進行太陽能潛力測量，

2戶已安裝太陽能熱水器，**0**戶安裝了太陽能板。

若受訪居民的屋頂都裝上太陽能板，一年可生產：

= 約21萬度電

=*全港最大太陽能發電場*發電量：**1/5**

*小濠灣: 1.1 MW; 4,237塊太陽能板

渠務署小濠灣污水處理廠
太陽能發電場

=康樂園居民*每年少收的上網電價*：**$93萬**

=**373**個康樂園住戶*一個月的管理費* *(約$1,000 - $4,000; 此以$2500 計算)*

初步研究結果2：

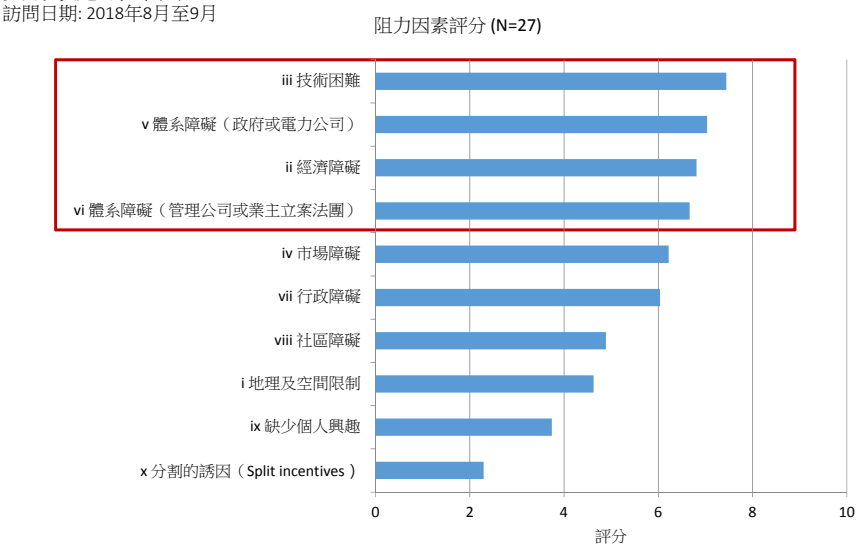
受訪者*認同*上網電價是*有效*的政策，但大部分仍持*觀望*態度。

即使有上網電價，仍有*不少障礙*。

已裝了太陽能系統的住戶，*未有*在社區中起到積極的*示範作用*。

*有上網電價，*但仍有不少障礙.....

受訪家庭: 康樂園: 27
訪問日期: 2018年8月至9月



*有上網電價，*但仍有不少障礙.....

(1) 成本、回本期...*仍然*是問題

最大問題是**回本期**，將來可能會**出售物業**，若回本期太長，未必能回本，或**等於白白把設備送給買家**。(H4)

始終覺我**10幾萬唔少錢**，個阻力太大。(H15)

回本期都長，你話能夠回本期短好多，即係個**FIT rate高d**，令到你好快回本，**資助多**先有可能。(H2)

太貴都唔抵裝住，**新科技**不斷**不停降價**。(H14)

如果搵人返黎**維修**或者**定期檢查**，果個費用都好高。(H8)

有上網電價，但仍有不少障礙.....

(2) 技術困難

有人幫手**俾下意見**，話俾我聽**reliable**既話，我唔會hesitate去做。 (H3)

我相信除非有一個組織(承辦商)可以係**維修保養方面做得好**，反應快、**維修快**同**價錢低**，先可以推動更多人安裝依個系統。（H6）

我唔清楚個太陽能系統會唔會需要求其他能源係會影響我間屋，一黎係個**電既影響**，二黎係個**承托力既影響**，我唔會為左裝而改我間屋結構，都會煩依點，因為依度都30幾年。其實有**好多安全上既考慮因素**。(H21)

我都擔心安裝會唔會**影響屋宇結構**，我地依d屋**好怕漏水**。我就唔清楚需唔需要鑽野果d。(H6)

驚搵唔到可靠既contractor，年期長，**間野冇左**咁點算。(H13)

(3) 環保意識薄弱 (大部分居民)

康樂園都唔多人裝住。 (H3)

我**覺得會做既人唔會咁多**，著重環保既人我唔sure多唔多，**5蚊度對佢地黎講好少錢**，佢地唔concern，**對於唔關佢地事既佢地唔大興趣**。(H7)

大家都有少少懶啦，就算知道呢樣野，但係佢**無咁多easy accessibility**既時候，就會覺得**遲d先算**。(H15)

如果係，即係有時有啲**peer group嘅影響**呢。譬如我前後左右都裝呢，咁我就可能好有興趣裝，咁或者我自己裝咗呢，我諗附近都有走黎問，問我你點樣搞呀，呢啲野。咁但係**大家都唔郁嘅時候**，又好似又**唔想做guinea pig**嗰個囉。(H10)

知道佢環保但係成本太高。 (H12)

初步研究結果3：

康樂園....有可能的社區合作模式.....???
大家的想法

康樂園....有可能的社區合作模式.....???

1. 集體採購(=團購) — 支持：78% (N=27)
2. 屋頂租賃 — 支持：44% (N=25)
3. 社區共同擁有的太陽能項目 — 支持：64% (N=25)
4. 第三方擁有的太陽能項目 — 支持：46% (N=24)
5. 政府和私營投資者合作 — 支持：71% (N=24)
6. 眾籌 — 支持：24% (N=21)

屋頂無乜用途既話會有人租出黎既..但整體構思都幾好..但個人黎講都要睇下佢**租金出到幾多**，**租約幾長**...**責任邊個負責**。但都係可行既。(H17)

可行，如果**政府肯去推動**，個**發展會快好多**。(H28)

最好啦，**政府做就唔怕間公司中途走左去唔做**。(H2)

有用，**Peer Group都好重要**，五十間一齊做呢，對管理處管理、承辦商**Bargaining**都會好咗，有個樣板；批出機會大，**成本效益高**，**Economies of Scale**，**Win-win** 。(H10)

下一步....

- 第二輪的居民及其他持份者的訪問
- 整合錦綉及康樂園的資料
- 今年九月前，向政府提出政策建議

這個工作坊正因為有您們的參與，才變得重要
踴躍發言，與大家分享您的看法!

Acknowledgement

This research project (Project Number: 2017.A2.027.18B) is funded by the special round of the Public Policy Research Funding Scheme from the Policy Innovation and Co-ordination Office of The Government of the Hong Kong Special Administrative Region.

鳴謝

本研究項目（項目編號：2017.A2.027.18B）獲香港特別 行政區政府政策創新與統籌辦事處公共政策研究資助計劃／策略性公共政策研究資助計劃撥款資助。

Appendix 7-6e: Post-workshop questionnaire

康樂園太陽能社區工作坊

Code

商議**後**的問卷

請☒出合適選項。

1. 如你家已安裝了太陽能板，請跳至題 2。

   如你家沒有安裝太陽能板，你有多大興趣安裝?

完全沒有興趣										十分有興趣	無意見
0	1	2	3	4	5	6	7	8	9	10	-
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

2. 香港上網電價計劃在 2018 年**何月**開始實施? _____月

3. 您是否支持用下列方式，來發展康樂園的社區太陽能?

	非常不支持	不支持	中立	支持	非常支持	無意見
(i) 各住戶自行找承辦商安裝	☐	☐	☐	☐	☐	☐
(ii) 團購	☐	☐	☐	☐	☐	☐
(iii) 社區一人一股集資籌建太陽能項目(如在市中心建築的公共天台)	☐	☐	☐	☐	☐	☐
(iv) 我希望有更多康樂園住戶安裝太陽能板，康樂園成為一個太陽能社區	☐	☐	☐	☐	☐	☐
(v) 長遠來說，設立康樂園社區的太陽能交易市場，社區電力可自發自用	☐	☐	☐	☐	☐	☐

4. 您同意以下的說法嗎?

	非常不同意	不同意	中立	同意	非常同意	無意見
(i) 香港人的用電行為不會對氣候有大影響	☐	☐	☐	☐	☐	☐
(ii) 我願意多付一些錢去買更節能的電器	☐	☐	☐	☐	☐	☐
(iii) 為了我們的子孫後代，我們需要減少使用化石燃料(如煤或天然氣發電)	☐	☐	☐	☐	☐	☐

5. 你認為安裝太陽能板有沒有以下價值?

	價值	**評分** **(1=完全沒有價值 至 10=非常有價值)**										
		NA	1	2	3	4	5	6	7	8	9	10
i	***經濟*價值**：如 減少由空氣污染引致的醫療費用；降低對於進能源的依賴、避免因缺電引致的經濟損失（加強能源安全）；推進本地綠色產業、創造更多綠色就業機會	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
ii	***環境*價值**：如 環保、減排溫室氣體、減少空氣污染	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
iii	***社會*價值**：如 提高香港這城市的綠色形象、降低核能風險、降低能源危機風險、改善市民居住環境、為後代保護城市的資源和環境	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
vi	***社區*價值**：如 康樂園可以建立自己的太陽能社區，社區的電力自發自用、促進社區和諧	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

6. 有關工作坊

a) 你對這個工作坊有何看法？

	根本沒用					中立					非常有用	無意見
	0	1	2	3	4	5	6	7	8	9	10	-
(i) 整個工作坊	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
(ii) 小組討論	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
(iii) 互動環節	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

b) 你同意以下的說法嗎？

	非常不同意	不同意	中立	同意	非常同意	無意見
(i) 小組主持人提供機會讓每個人都參加討論	☐	☐	☐	☐	☐	☐
(ii) 小組所有成員都有差不多的參與程度	☐	☐	☐	☐	☐	☐
(iii) 小組主持人有時試圖以自己的觀點影響小組成員	☐	☐	☐	☐	☐	☐
(iv) 小組主持人確保一些反對的意見都會被考慮	☐	☐	☐	☐	☐	☐
(v) 小組討論被少數成員所主導	☐	☐	☐	☐	☐	☐
(vi) 小組成員都能尊重對方的意見	☐	☐	☐	☐	☐	☐
(vii) 工作坊的簡介文件客觀地反映了不同的意見	☐	☐	☐	☐	☐	☐
(viii) 專家答問環節解決了我們小組的討論問題	☐	☐	☐	☐	☐	☐
(ix) 總的來說，這個過程有助於我理解整個問題	☐	☐	☐	☐	☐	☐

c) 你同意以下的說法嗎？

	非常不同意	不同意	中立	同意	非常同意	無意見
(i) 從這個工作坊中，我獲得了一些新知識	☐	☐	☐	☐	☐	☐
(ii) 在這個工作坊中，我能從一些新角度去思考香港的可再生能源發展	☐	☐	☐	☐	☐	☐
(iii) 參加完這工作坊後，我改變了我對香港可再生能源上網電價補貼政策的一些觀感/想法	☐	☐	☐	☐	☐	☐
(iv) 參加完這工作坊後，我更有興趣參與康樂園的社區太陽能活動	☐	☐	☐	☐	☐	☐
(v) 參加完這工作坊後，我更有興趣探討在家安裝太陽能板的可能性	☐	☐	☐	☐	☐	☐

7. 請提供你的姓名及電話。
（註：你的個人資料只作研究用途。我們會將你的個人資料保密，在將來發表的所有研究報告上亦會以匿名處理你的個人資料。）

姓名: _____

電話號碼: _____

--- 問卷完成 ---

謝謝您!

香港浸會大學
HONG KONG BAPTIST UNIVERSITY

Asian ENERGY STUDIES CENTRE

HONG KONG SOLAR PARTNERSHIP

太陽能社區指南

2019年11月

目錄

前言

1. 為何選擇太陽能發電？

1.1. 全球大勢所趨

1.2. 香港的可再生能源願景

1.3. 可再生能源上網電價計劃

2. 階段一：籌備安裝太陽能光伏系統

2.1. 太陽能光伏系統包括哪些組件？

2.2. 設計太陽能光伏系統時需要考慮甚麼？

2.3. 如何動員其他社區人士一同安裝？

2.4. 社區中不同持分者有何角色？

3. 階段二：安裝太陽能光伏系統

3.1. 安裝太陽能光伏系統及申請上網電價有何程序？

3.2. 如何選擇專業可靠的太陽能光伏系統承辦商？

4. 階段三：保養太陽能光伏系統

5. 常見問題

6. 個案分享

6.1. 錦綉花園管理公司：主動草擬指引

6.2. 錦綉花園公眾地方項目：工程公司與發展商(大業主)曾計劃以「社區」模式合作發展

6.3. 錦綉花園住戶：如何花點心思，讓系統實用又美觀

6.4. 采頤花園：管理公司鼓勵業主參與

6.5. 首爾盛大谷：邁向能源自主社區

7. 實用資料

8. 參考資料

前言

香港浸會大學亞洲能源研究中心整合研究結果及相關團體的資料，製作《太陽能社區指南》，為社區各界人士(包括業主、管理公司等)，提供籌備、安裝、管理、保養太陽能光伏系統的實用資訊，以推動香港可再生能源的發展。

我們希望社區各界人士善用本指南，抓緊香港發展太陽能的機遇，為支持安裝太陽能光伏系統踏出重要一步，共同為香港的可再生能源發展出一分力。

香港浸會大學
亞洲能源研究中心
2019年11月

有關亞洲能源研究中心的資訊，可瀏覽中心網頁 http://aesc.hkbu.edu.hk/ 。
如有任何有關本指南的查詢，歡迎與中心聯絡：
電郵：aesc@hkbu.edu.hk
電話：3411 7187/ 3411 7032

本指南由香港政府政策創新與統籌辦事處的
公共政策研究資助計劃(Ref: 2017.A2.027.18)，
及香港浸會大學的社會科學學院研究基金(Ref: FRG2/17-18/096)資助。

聲明

歡迎有需要人士使用本指南作非牟利用途。
未經亞洲能源研究中心同意及授權，
請不要複製或複印本指南的
任何內容作商業用途。

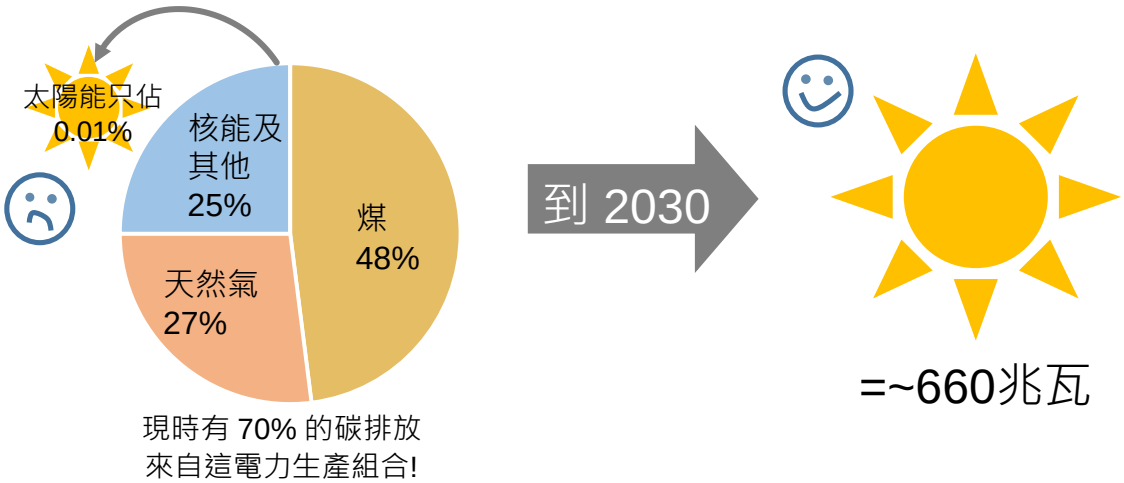
1. 為何選擇太陽能發電？

1.1. 全球大勢所趨

踏入二十一世紀，發展可再生能源如太陽能已成為全球趨勢。其中，住宅及分佈式的太陽能光伏系統發揮著重要角色。隨着太陽能技術日趨成熟、安裝成本持續下降、相關政策等因素帶動下，世界各地均湧現不同形式的太陽能發展，並為環境、社區及個人帶來多方面的好處，包括：

1.2. 香港的可再生能源願景

本港現時約75%的電力依賴化石燃料，2016年的太陽能發電量僅佔總發電量的0.01%(*註2)。截至2017年，太陽能的裝機容量只有約6.29兆瓦(*註3)。香港位於亞熱帶地區，大多數時間能採納充沛的陽光，加上太陽能科技日趨成熟，政府近年又積極推出可再生能源上網電價等相關政策，令本地發展太陽能的潛力大增。環境局預計，香港在2030年的太陽能發電量可提高至1 – 1.5%，即約660兆瓦。



*註1： 資料來自美國 NREL 在2017年發表的 U.S. Solar Photovoltaic System Cost Benchmark: Q1 2017
*註2：資料根據環境局在2017年發表的《香港氣候行動藍圖2030+》計算
*註3：資料來自機電工程署在2019年發表的《香港光伏系統應用情況及建築物天台光伏系統的潛力研究報告》（“Study Report of Photovoltaic (PV) Applications and PV Potential on Building Rooftops in Hong Kong”）

1.3. 可再生能源上網電價計劃

為推動可再生能源普及發展，政府與兩間電力公司在現行的《管制計劃協議》中引入上網電價計劃。根據該計劃，凡裝設可再生能源發電系統(如太陽能和風能)者，可把系統接駁至電網，電力公司會以每度電港幣3 – 5 元的上網電價回購電力。

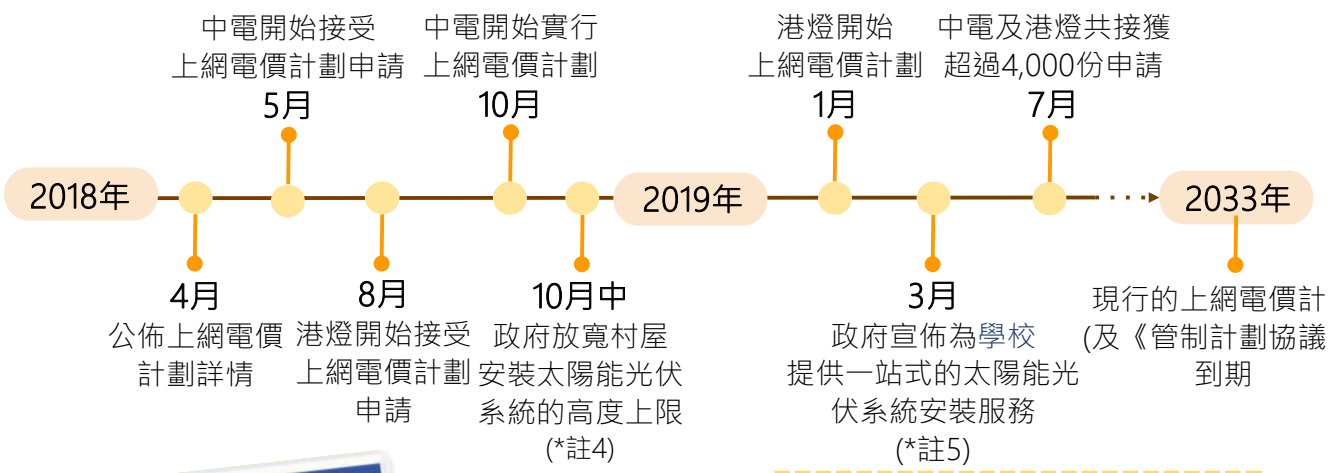
收取上網電價

香港上網電價計劃特色

- 上網電價計劃有效期至2033年底
- 電力公司將與政府每年審視上網電價，並有機會作出調整

可再生能源系統裝機容量	上網電價(每生產1度電可獲)
≤ 10千瓦	港幣 5 元
> 10千瓦至 ≤ 200千瓦	港幣 4 元
> 200千瓦至 ≤ 1兆瓦	港幣 3 元

表一：上網電價級別
(資料來源：中華電力有限公司、香港電燈有限公司)



(資料來源：
中華電力有限公司、
香港電燈有限公司)

如何賺取電力公司以上網電價回購電力的金額？

凡安裝可再生能源接駁至電網的系統發電，電力公司則以上網電價回購相關電力，並按量減免其每期電費。

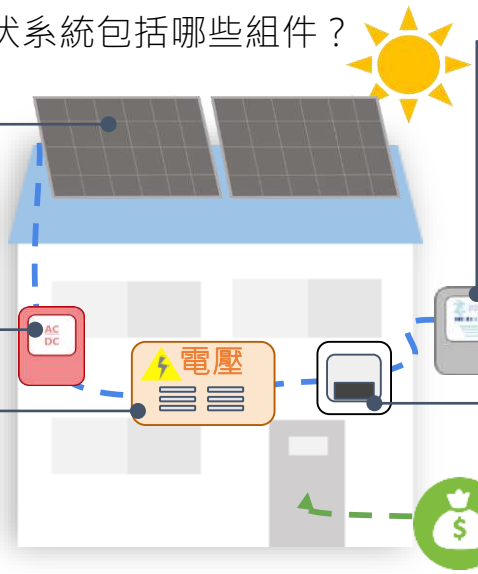
如果客戶的可再生能源系統發電量多於電力使用量，則可以選擇:

(1) 把餘額保留在電力公司的賬戶內，用以減免未來之電費
(2) 電力公司以支票發還餘額
(3) 把餘額轉賬至其所指定的同名銀行戶口(只適用於港燈客戶)
(餘額需超過港幣150元)

*註4：政府放寬村屋太陽能光伏系統的高度上限，由1.5米改至2.5米。
*註5：政府推出「採電學社：學校及非政府福利機構太陽能支援計劃」，為學校及非政府福利機構免費安裝太陽能光伏系統。

2. 階段一：籌備安裝太陽能光伏系統

2.1. 太陽能光伏系統包括哪些組件？



太陽能板
主要有三大類別：
單晶硅、多晶硅
及薄膜

智能電錶
由電力公司負責安裝，
以計算太陽能光伏系統
的發電量

逆變器
將太陽能板產生
的直流電轉為
一般電力系統的
交流電

隔離變壓器(火牛)
避免滯留電從太陽能光
復系統注入配電系統，
影響其他連接裝備

保護裝置
(如斷路器)
以保護系統免受
異常電流破壞

2.2. 設計太陽能光伏系統時需要考慮甚麼？

南面
香港位於赤道以北，太陽能板面向南方安裝，將更有效採集陽光。

開揚
選擇安裝在開揚、不被建築物和樹木遮擋的地方(如天台)。

預留空間
預留空間以便維修，及放置變壓器、逆變器等系統組件。

太陽能板被高樓大廈遮擋了一少部份，不要緊吧？

如果安裝太陽能板的位置受到附近的高樓大廈遮擋，普遍不建議安裝。若遮擋位置在東邊，會嚴重減低上午的發電量；若遮擋位置在西邊，則影響下午的發電量。縱使只有一至兩塊太陽能板受陰影遮蓋，亦有可能令整體的發電量暴跌九成。

毋須提交小型工程申請
根據「新界豁免管制屋宇小型環保及適意設施」，安裝在天台或樓梯頂篷的太陽能光伏系統，若符合屋宇署的規格，毋須向地政總署或屋宇署申請加建。

可瀏覽屋宇署網頁:

須提交小型工程申請
委任合資格專業人士進行工程。
(可查看小型工程項目1.19及3.15)

須符合《建築物條例》
確保系統不會令樓宇負荷過重、影響火警逃生路線、防水及排水。
申請者要先向屋宇署呈交圖則，獲得批准後方可開展工程。

條例
- 村屋 (*註6)
- 其他私人樓宇

應查看會否與屋苑或大廈公契有抵觸
需得到管理公司、業主立案法團等同意。

- 防水工程
- 抵擋颱風的能力
- 消防安全
- 設備保險
- 其他

註6：若屬《建築物條例(新界適用)條例》之新界豁免管制屋宇

2.3. 如何動員其他社區人士一同安裝太陽能光伏系統？

除了以「個人」模式安裝太陽能光伏系統外，亦可以「社區」模式與其他人士合作；兩種模式各有優勢，安裝前應細心考慮。

「個人」模式		住戶得到甚麼好處?
集體採購	同一個社區的多個住戶(如20 – 50戶)同時向一個供應商/承辦商購買各自的太陽能光伏系統。	• 自主管理權 – 每戶各自擁有並打理自己的太陽能光伏系統 • 團購價 – 同時享用團購價以減低初置成本
住戶出租屋頂予其他公司安裝太陽能項目	住戶個別出租屋頂空間給相關公司安裝及管理太陽能光伏系統。	• 租金 – 收取由租用公司支付的租金

✓適合村屋或低密度獨立屋的業主
✓有較大自由度選擇系統規格及安裝安排

✓適合村屋或低密度獨立屋的業主
✓適合大廈業主
✓可攤分安裝及保養維修之成本
✓可攤分管理系統的責任

「社區」模式		住戶得到甚麼好處?
社區共同擁有的太陽能項目	社區多個業主出資共同擁有並管理一個安裝於公共空間(如會所天台、停車場)的太陽能光伏系統。	• 上網電價收入 – 接駁至電網並賺取電力公司回購電力的金額，再將收入按投資大小發放利潤、用於其他社區項目、扣減管理費等 • 提升屋苑形象 – 提升屋苑的環保形象
第三方擁有的太陽能項目	第三方出資設立、擁有和營運太陽能光伏系統。	• 毋須出資安裝或維修系統 • 提升屋苑形象 – 提升屋苑的環保形象
政府和社會企業合作	私營機構(如中國銀行/香港賽馬會/谷歌)提供安裝資金；政府參與協調和組織項目，於公共空間設置太陽能光伏系統。	• 毋須出資安裝或維修系統 • 信心保障 – 政府參與及協調

2.4. 社區中不同持分者有何角色？

不論是以「個人」模式或「社區」模式安裝太陽能光伏系統，除了考慮自身的需要，亦需了解政府部門及社區中不同持分者的角色。

政府

-與電力公司簽訂《管制計劃協議》，要求電力公司提供上網電價計劃
-不同部門負責執行有關安裝的規定 (*註7)

電力公司

-執行上網電價計劃
-審批申請，和申請人商討可接駁至電網的裝機容量
-為接駁至電網的發電系統安裝獨立智能電錶

太陽能系統承辦商/工程公司

-設計及安裝太陽能光伏系統
-可代客戶向電力公司申請上網電價計劃

鄰居/附近居民

-可能是已安裝太陽能光伏系統的先導者
-可能是持觀望態度之人士
-可能是中立人士
-可能是對太陽能光伏系統安全、外觀有所保留的反對者

你

物業管理公司

-為居民提供指引，釐清公契或相關業權責任
-在社區協調發展和管理共同擁有的太陽能發電項目

業主立案法團/居民互助組織

-推動及支援參與太陽能發電項目的住戶
-協調社區發展及管理共同擁有的太陽能項目

區議員

-推動相關人士設立太陽能社區項目
-為太陽能住戶提供支援平台

非政府組織

-關注可持續發展、環保、可再生能源政策、社區參與的等議題，
-可參與、支持、及推廣社區安裝太陽能光伏系統

學校

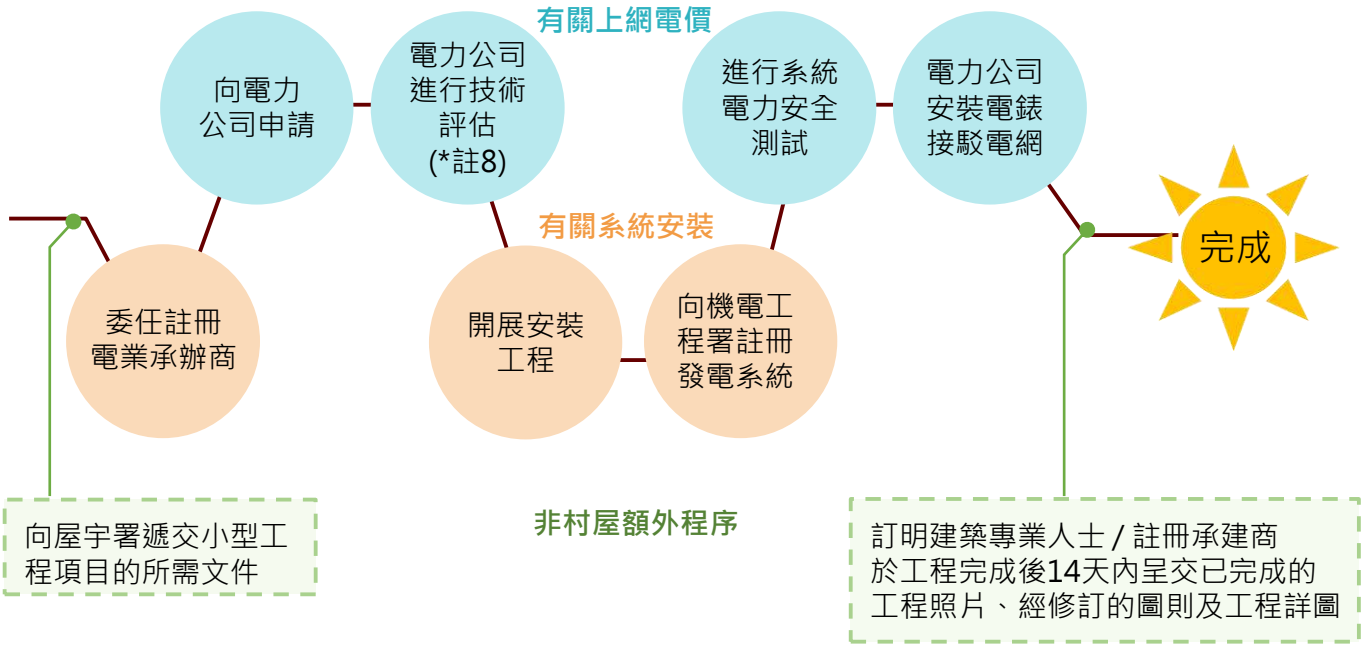
- 擁有如校舍天台等較大的空間安裝太陽能光伏系統
- 擁有推動環保教育的誘因及政府或辦學團體的支援，可在社區起示範作用

註7：如機電工程署負責確保系統的電路安全；屋宇署負責確保系統安裝不會影響樓宇結構；地政署負責確保安裝符合地契規定

3. 階段二: 開始安裝太陽能光伏系統

3.1. 安裝太陽能光伏系統及申請上網電價有何程序？

以下是申請安裝太陽能光伏系統，及接駁至電網的一般流程。所有客戶均需向政府及電力公司提交相關申請，而私人樓宇(非村屋)的申請者需於工程前後向屋宇署提交相關小型工程的文件。



註8：電力公司會根據評估決定可批裝機容量及上網電價(電力公司批准與否會按獨立個案而考慮)

3.2. 如何選擇專業可靠的太陽能承辦商？

你可要求承辦商：

- ☐ 提供公司資歷
- ☐ 列明技術規範，如太陽能光伏系統的可發電量、防滲漏工程安排
- ☐ 提供過往客戶的參考個案
- ☐ 提供太陽能光伏系統主要組件及電路安排的設計
- ☐ 提供安全標準規格證明書，證實太陽能光伏系統符合國際標準(如「國際電工委員會」標準)
- ☐ 提供工程時間表，並承諾如期完成工程
- ☐ 承諾維修保養期及收費上限

機電工程署的
註冊太陽能承辦商名單
(被列入名冊的公司並不代表是政府認可的公司)

安裝承辦商

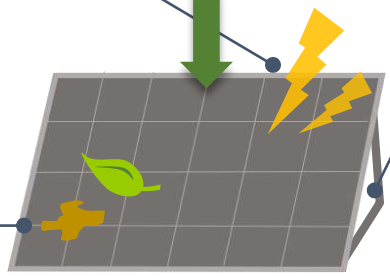
太陽能組件供應商

4. 階段三：保養太陽能光伏系統

善用上網電價賺取的利潤，保養及維持系統正常運作

運作安全

(1) 需定期聘請註冊電業工人員檢查太陽能光伏系統
(2) 需按承辦商指引，定期聘請專人檢查及維修，確保設備的安全和效能



結構安全

(1) 需定期聘請註冊電業工程人員
檢查結構是否穩固
(2) 打風前後應注意檢查系統的結構安全

確保系統發電量和安全!

清潔

大部分太陽能板在製造過程中已作加工，只要安裝時保持適當的斜度，污漬及灰塵就可隨雨水沖走。如有需要，可定期以清水沖走表面上的污垢。

如何能有效監測太陽能發電系統的狀況?

現時不少太陽能光伏系統附有雲端監控系統，用戶不但可以手機軟件，隨時遙距監控系統的發電量，甚至能獨立追蹤每塊太陽能板的發電狀況，了解發電量是否與預期相乎，查看太陽能板上是否有雀鳥糞便、枯葉等阻擋物。

5. 常見問題

上網電價會每年不同嗎？
用戶與電力公司簽訂的上網電價，合約期至2033年底，或系統壽命結束前時完結(以較早日期為準)。兩間電力公司每年都會與政府商討及調整新申請上網電價的價格，預計價格會逐年下調。所以，越早參與計劃及簽約，享有上網電價的年期較長，且能收取較高額的上網電價，可以說是「早申請，早著數」。

電網容量是否有限制？電力公司會否只批出低於用戶所申請的裝機容量？
電網容量是有限制的。電力公司會根據用戶該區的整體電網容量及其他技術因素個別審批。審批上網電價申請時，電力公司必須確保電力供應安全和可靠。如用戶申請的裝機容量超出電網可承受的供電容量，電力公司會在實際情況許可下，增加電網容量或進行強化工程。用戶可選擇接受低於申請的裝機容量，或等待強化工程完成，電力公司可批出申請的裝機容量，再以原來申請的裝機容量把發電系統接駁至電網。

太陽能板的壽命有多少？
高效率及高品質的太陽能板有約二十至四十年壽命。

一般太陽能板的反光問題嚴重嗎？
不嚴重。由於太陽能板只需要採光，不需要吸熱，所以太陽能板的透光率十分高，反光率只有約9.5%，比一般住戶的玻璃窗低。

太陽能光伏系統可以不連接至電網嗎？
可以。但用戶需要預備儲電池，以收集系統產生的太陽能電力。

6. 個案分享

6.1. 錦綉花園管理公司：主動草擬指引

錦綉花園管理公司早於2017年9月，即上網電價計劃開展前13個月，完成草擬**《申請安裝太陽能板》**表格及指引，讓住戶了解管理公司歡迎住戶安裝太陽能光伏系統的立場，亦詳細列明公司積申請住戶的責任，以減少不必要的爭拗和誤會。

表格的主要內容：

- 要求業主確保單位的結構能承托安裝**太陽能**光伏系統，避免意外發生
- 若業主的太陽能光伏系統引致其他房屋損毀，業主須自行承擔相關的責任
- 沒有限制安裝太陽能光伏系統的方向，業主可選擇讓系統達至最佳效能的位置

管理公司在聆聽及參考居民和專家的意見後，於2018年**修訂表格指引**，放寬太陽能板大小的限制，讓住戶的太陽能光伏系統在發電上更乎合經濟效益。

*"安裝在屋頂的太陽能板，**總面積不可超越4平方米**，以及距離中牆(如有)最少1米。"(2017年9月版本)*

→

*"太陽能板只可安裝在屋頂的位置，除屋頂部可貼近邊緣外，距離單位**左右兩邊及底部邊緣不少於300毫米**，太陽能板須與屋頂平行安裝且**高度離屋頂不可超過150毫米**。"(2018年5月修訂版本)*

6.2. 錦綉花園公眾地方項目：工程公司與發展商(大業主)曾計劃以「社區」模式合作發展

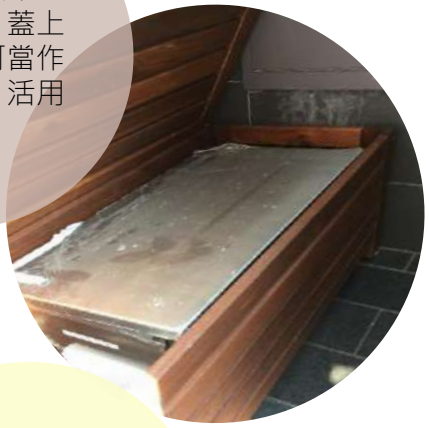
有工程公司曾與錦綉花園發展商(大業主)商討合作，於錦綉花園的公眾地方設置**太陽能光伏系統**。由工程公司負責出資及安裝，再按比例與管理公司攤分上網電價的收入。

6.3. 錦綉花園住戶：花點心思，讓系統實用又美觀

不少住戶在考慮安裝太陽能光伏系統時，或會擔心部分組件影響屋宇外觀及佔用空間。以下的錦綉花園住戶，便運用了不同的設計保留房屋的美感，並活用空間。

以白色膠管包裹發電系統的接駁電線，使之與房屋外觀的顏色一致，及避免電線外露，造成凌亂感 。

將系統的火牛置於木箱中，蓋上木蓋後更可當作木凳使用，活用空間。



將整套電錶安裝在花園的貼牆儲物櫃， 不佔用額外空間之餘，亦可避免設備日曬雨淋。

6.4. 采頤花園：管理公司透過有效的居民諮詢，推動業主參與

更多采頤花園個案的資料，可瀏覽網頁

新蒲崗采頤花園在大廈天台共安裝902塊太陽能板。屋苑在上網電價計劃實施前，已著手研究於屋苑安裝太陽能光伏系統的可行性，並推動居民參與，令其後安裝工程更順暢。最後，屋苑順利在2018年10月成為第一批參與中電上網電價計劃的用戶。

- 問卷調查：管理處在與承辦商接觸後，草擬了四個太陽能光伏系統的安裝方案。期後，管業處向所有住戶發放問卷，諮詢住戶對方案的意見，**調查回應率高達八成**。問卷詳列投標承辦商的資料、安裝系統工程的支出及發電分帳等資料，提高工程資訊的**透明度**。
- 解答住戶疑問：管理處舉辦**分享會**，邀請太陽能專家及電力公司代表解答住戶對太陽能工程的疑問。管理處亦在大廈內**張貼告示**，定期公佈工程招標的最新情況。

采頤花園管理處

2018年四月 接觸多個可再生能源設備承辦商 → 與業主委員會商討可行性 → 為業主、居民舉辦分享會 → 五月 收集承辦商報價及標書 → 向住戶發放標書內容及問卷，並選擇方案 → 六月 在業主委員會會議公佈決定 → 十月 成功收取上網電價

6.5. 首爾盛大谷：邁向能源自主社區

在首爾盛大谷社區，居民自發設立**能源合作社**，除了向居民推廣節能的好處，亦正計劃與區內安裝了太陽能光伏系統的居民合作，在社區內**自由買賣太陽能電力**。合作社也會不定期舉辦可再生能源的推廣活動，如**流動太陽能咖啡車**，教育下一代並讓他們參與和認識太陽能在社區中的角色。

資料來源：金少英女士

7. 實用資料

香港政府機電工程署
上網電價

香港政府屋宇署
搜尋註冊
專業人士或承建商

香港天文台
太陽輻射量的
二十四小時時間序列

中華電力有限公司
可再生能源上網電價

香港電燈有限公司
上網電價計劃

浸會大學
亞洲能源研究中心
太陽能地圖

初步估算物業的可用空間面積 (只適用於天台空間)，並計算可安裝多少太陽能板、每年的發電量、成本、及上網電價回報等。

8. 參考資料

香港政府機電工程署 - 上網電價
https://re.emsd.gov.hk/tc_chi/fit/int/fit_int.html

香港政府機電工程署 - 太陽能光伏系統安裝指南
https://re.emsd.gov.hk/tc_chi/files/PVGuidanceNotes.pdf

中華電力有限公司 - 可再生能源上網電價
https://www.clp.com.hk/zh/community-and-environment/renewable-schemes/feed-in-tariff/feed-in-tariff-residential-customers

中華電力有限公司 - 可再生能源發電系統 與 電網接駁技術要求
https://www.emsd.gov.hk/filemanager/tc/content_1332/sem20180828-Topic2.pdf

香港電燈有限公司 - 上網電價計劃
https://www.hkelectric.com/zh/customer-services/smart-power-services/feed-in-tariff-scheme

香港政府環境局 - 香港氣候行動藍圖 2030+
https://www.enb.gov.hk/sites/default/files/pdf/ClimateActionPlanChi.pdf

端傳媒 - 南韓盛大谷能源社區
https://theinitium.com/article/20160311-hongkong-nuclearpower/

District Administration - What to consider for a solar power RFP
https://districtadministration.com/what-to-consider-for-a-solar-power-rfp/?highlight=solar

New Climate Economy - Unlocking the Inclusive Growth Story of the 21st Century
https://newclimateeconomy.report/2018/wp-content/uploads/sites/6/2018/09/NCE_2018_ENERGY.pdf

Appendix 7-8: Presentation slides of the 1st Solar Schools task force meeting on 14th November 2018

HONG KONG SOLAR PARTNERSHIP

SOLAR SCHOOLS TASK FORCE

First gathering 14 November 2018

Asian Energy Studies Centre

香港浸會大學 HONG KONG BAPTIST UNIVERSITY

HONG KONG SOLAR PARTNERSHIP: WHO, AIMS, ORGANISATION STRUCTURE

- Aims:
  - Facilitate dialogue
  - Try new ways of public engagement
  - Share good practice
- Website – just launched
- Funding sources: HKBU, CLP, HEC
- Is underpinned by research

http://aesc.hkbu.edu.hk/hongkongsolarpartnership

WHY SCHOOLS

1. **Leadership** from principals and teachers
2. School **networks**
   (e.g. 校長聯會、辦學團體的網絡)
   →Effective mobilization
3. Education **Bureau**
   →Green schools awards
4. Education **values** of solar
   → STEM

Huge untapped solar resources in HK schools
Findings from solar schools study (2018):

- If **19** **of the case study schools** use **50% of their rooftop area** for PV solar panels…
- They can generate: **2.4 million kWh/ year**
- Enough to meet the average power consumption of **751** **three-person households** in HK
- = 2 times of the electricity generation in the Solar Farm at Siu Ho Wan Sewage Treatment Works (over 4200 panels = 1.1MW)
- BUT, these 19 schools utilised only **5%** of solar resources

SOLAR SCHOOL WORKING GROUP: POSSIBLE OUTPUTS

(1)Solar School Peer Support Group?

- Teachers from experienced solar schools take the role as mentors
- Take turns to answer enquiries; share templates

(2) Solar school GUIDEBOOK? **Web**-based & interactive?

(3) Engaging students as SOLAR INVESTIGATORS through project-based learning?

- Engage students as **solar researchers**
- **Primary or Secondary School Students** - Solar investigators
- **University Students** – Solar trainers
- **Professors** – Project leaders

(4) Solar school workshop

- Tentative theme: "Integrating STEM into Solar Schools"

(5) Policy recommendations?

- The importance role of "School Sector" in solar developments in HK: solar school targets? Which policies will (not) work?

OUR OUTPUT: SOLAR SCHOOL GUIDEBOOKS?

Some examples:

- Hong Kong Green Building Council, HONG KONG:
https://www.hkgbc.org.hk/eng/greenschguide.aspx

- The Solar Foundation, US:
http://www.solsmart.org/media/SolarOPs_Solar-Schools-Toolkit-FINAL.pdf
- View the interactive map: http://www.solsmart.org/media/SolarOPs_Solar-Schools-Toolkit-FINAL.pdf
- Share solar school experiences: https://www.generation180.org/solar-schools-case-studies

- Ministry of Education, Culture, Sports, Science & Technology (MEXT), JAPAN:
https://www.nier.go.jp/shisetsu/pdf/e-taiyoukou.pdf

- Schools Going Solar (quite comprehensive and technical but not really interesting):
http://www.need.org/files/curriculum/guides/schoolsgoingsolar.pdf

- The Ultimate Guide to Solar Panels (a simple guide):
https://www.greenmatch.co.uk/the-ultimate-guide-to-solar-panels

OUR OUTPUT:
ENGAGING STUDENTS AS SOLAR AMBASSADORS/ RESEARCHERS?

- **Living Laboratory (Georgia Town University) –**
involving students to study Solar Farms: https://sustainabilitycollaborative.gwu.edu/living-labs

During the 2016-17 academic year, Prof. Saniya LeBlanc intertwined research and education by delivering a case study of Duke Energy Renewable (DER) solar farms' technical, financial, and environmental facets and integrating real-world energy applications into graduate and undergraduate courses.

The Living Lab started with **a 3-day site visit** by three faculty and eight students to the DER Pasquotank solar farm in Elizabeth City, NC, and the DER headquarters and remote monitoring center in Charlotte, NC.

After the site visit, the team created **case studies** examining the financial and environmental implications of the solar project. The economic report compared the solar farm power generation and financial metrics to those of a combined cycle power plant and assessed the financial effectiveness of each power generation technology. The environmental report measured the hydrologic impacts of solar farms on the immediate surroundings. Faculty and students worked together closely to develop these analyses.

OUR OUTPUT:

POLICY RECOMMENDATIONS?

Subject: Re:《星島日報》查詢：協助學校安裝小型可再生能源系統（環境局回覆）

就你的查詢，環境局回覆如下：

行政長官在2018年《施政報告》中宣佈推出一項新計劃，協助學校及非政府機構安裝小型可再生能源系統。新計劃下政府會為**有關學校**／機構支付可再生能源系統項目的**全部資本成本（包括系統組件及安裝費用等）**，以及為有關項目**提供技術支援**，例如**場地視察及技術評估、系統安裝及測試等**。環境局及機電工程署現正擬定計劃的具體細節，並將於**明年**公布詳細安排。

在擬定計劃的具體安排時，我們會**與不同的持份者保持溝通**，並歡迎它們就計劃**提供意見**。

環境局及環境保護署
傳媒關係組
廖珮賢（Heidi Liu）
Tel: 3509 8641

Acknowledgement

This research project (Project Number: 2017.A2.027.18B) is funded by the special round of the Public Policy Research Funding Scheme from the Policy Innovation and Co-ordination Office of The Government of the Hong Kong Special Administrative Region.

鳴謝

本研究項目（項目編號：2017.A2.027.18B）獲香港特別 行政區政府政策創新與統籌辦事處公共政策研究資助計劃／策略性公共政策研究資助計劃撥款資助。

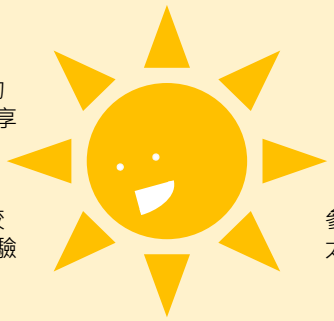
Appendix 7-9: Presentation slides of the Hong Kong Solar Schools Workshop 2019 on 8th June 2019

主辦: 香港浸會大學 HONG KONG BAPTIST UNIVERSITY | ENERGY STUDIES CENTRE | HONG KONG SOLAR PARTNERSHIP

協辦: 香港教育工作者聯會
香港資助小學校長會
新界校長會
香港公平貿易聯盟

太陽能學校工作坊

2019年6月8日 (星期六)



研究團隊的初步研究分享

太陽能教材分享

太陽能學校分享教學經驗

參觀學校的太陽能項目

小組討論及大會交流

*此工作坊主要經費由香港浸會大學贊助，部份經費由香港電燈有限公司贊助。

太陽能學校工作坊程序

離開前請跟進工作人員指示領取證書，感謝!

若跟車前往聖言中學，請於**12:45** 上車。
旅遊巴: TA3163

	時間	活動
	9:00 – 9:15	登記
上午	9:15 – 9:25	**歡迎致辭**
	9:25 – 9:40	**初步研究結果分享** 香港浸會大學 亞洲能源研究中心
	9:40 – 10:00	**太陽能學校的教育經驗分享 1** 佛教榮茵學校 – 杜家慶校長
	10:00 – 10:15	**可再生能源教育價值分享** 學生大使 (香港公平貿易聯盟)
	10:15 –10:30	**太陽能教材分享** 碩士同學 (香港大學 環境管理 - 理學) 香港浸會大學 亞洲能源研究中心實習生
	10:30 – 11:00	**小組討論**
	11:00 – 11:45	**大會問答環節**
	11:45 – 12:15	**參觀學校的太陽能項目1** 佛教榮茵學校
	12:15 – 13:40	簡單午餐 及 專車前往另一所太陽能學校(聖言中學)
下午	13:40 – 14:00	**太陽能學校的教育經驗分享 2** 聖言中學 –黃志強校長
	14:00 – 14:30	**參觀學校的太陽能項目2** 聖言中學

今天的參加朋友:

老師、學校行政人員

專家顧問

專家顧問

杜家慶校長
佛教榮茵學校

梁展鵬 先生
W3 Corporate Ltd.

這個工作坊正因為有您們的參與，才變得重要
踴躍發言，與大家分享您的看法!

《香港中、小學發展太陽能的潛力與挑戰》

研究結果

馬雅燕博士
香港浸會大學
亞洲能源研究中心總監
地理系助理教授

2019年6月8日

A Work-in-progress
Please do not cite or quote without the permission of the Project Team (daphnemah@hkbu.edu.hk)

(Photo credit: Anthony Dixon, Helios Renewable Energy Limited; AESC, HKBU)

1. 我們的研究團隊

Collaborating Researchers for Solar Projects

Daphne Mah
HKBU
Energy Policy

Kevin Lo
HKBU
Energy Policy

K. P. Chun
HKBU
Global change

Byron Choi
HKBU
Computer Science

Zhou Qiming
HKBU
GIS

Alice Siu
Stanford University
Public engagement

Michael K.H. Leung
City University of Hong Kong
Energy Engineering

Akihisa Mori
Kyoto University
Energy Policy

Marc Wolfram
Sungkyunkwan University
Urban Governance

Sara Fuller
Macquarie University
Energy Justice

Gilles Lepesant
Unit Géographie-Cités
Energy Transition

Richard Balme
Paris School of
International Affairs
Environmental Governance

2. 我們的研究項目

研究期間	研究項目	贊助機構	贊助金額	研究伙伴
2015-2016	香港**屋頂太陽能的發展潛力**及**政策**建議	中電	$195,720	城大
2016	香港**太陽能政策**研究	綠色和平、 世界野生自然 基金會	$300,000	城大、港大、 史丹福大學
2016	香港**太陽能地圖**	浸大	$100,000	浸大圖書館
2016-2017	中國能源創新及轉型: **佛山住宅式太陽能發展**的經驗	UCL、浸大		UCL
2017	香港可再生能源研究 (**可再生能源上網電價補貼**)	綠色和平、 350香港	$80,000	
2017-2019	**可持續能源轉型**（SETs）的協商參與、信任和社會學習：日本、韓國和中國的比較研究	研究資助局 (研資局)	$1,326,170	港大、京都大學、 延世大學、 清華大學
2018	香港**太陽能學校**: 機遇及挑戰	綠色和平	$135,000	城大
2018-2019	社區參與發展可持續能源未來模式: 兩個香港**太陽能社區**的研究	政策創新與統籌辦 事處	$632,500	城市大學、港大、 成均館大學、綠色 和平
2018-2020	通過**社區參與**實現城市能源轉型的多樣性和關鍵：倫敦，弗萊堡（德國），紐約市，東京，首爾和佛山（中國）的國際比較研究	浸大	$150,000	麥覺理大學、Unit Géographie-Cités、 京都大學、成均館 大學、Sciences Po

3. 《香港中、小學發展太陽能的潛力與挑戰》研究
(2018)

訪問及評估太陽能發電潛力

學校數目：22間

調查日期：2018年1月至8月

學校種類：17間資助學校、2間直資學校及3間私立或國際學校。

2018年1月至8月

22間學校

(17間資助學校、2間直資學校
及3間私立或國際學校)

與校長、老師進行訪談

太陽能資源評估

2018年6月

太陽能學校工作坊
(29老師及學校代表參加)

小組討論

與大會專家問答

HONG KONG SOLAR PARTNERSHIP

Solar School Working Group
第一次會議
2018年11月6日

香港太陽能地圖

http://digital.lib.hkbu.edu.hk/solarmap/

- 你 可 估算 你的學校天台的太陽能 發電潛力
- 評估 不同上網電價方案下，回本期可縮短多少年

研究結果1: 學校 是推動香港可再生能源的重要一環

	村屋/ 低密度住宅	私人大廈	學校
地	• 村屋： > 40,000 • 天台用途：晒衫、BBQ及其他休憩用途	• 住宅、商業、工業大廈 • 企業：購買可再生能源證書	• 政府學校-約900間 • 天台、停車場等
回本期	<10年	<3年 (工、商界)	• 不大重要
太陽能的價值	• 慳電費/賺少少錢 • 減排/環保	• 社會企業責任 • 保持競爭力	• 教育價值 (STEM) • 減排/環保

相片來源: https://www.hkcnews.com/news_%E6%96%B0%E8%81%9E/hk-discuss/2017/12/%E4%B8%81%E5%B1%8B-%E4%B8%81%E6%AC%8A-%E5%8E%9F%E5%B1%85%E6%B0%91-20171218043112_e57c_large.jpg;
http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/;
https://s.yimg.com/uu/api/res/1.2/J0gt0B3OOyNq6P_5G8EIHw--~B/aD0xOTk7dz0zNjA7c209MTthcHBpZD15dGFjaHlvbg--/http://media.zenfs.com/en_us/News/singtao/236232.jpg; www.isd.gov.hk
http://w22.property.hk/article_content.php?ln=sc&author=PHK_NEWSPROP&id=53143

研究結果2:

受訪學校太陽能發電潛力被大量浪費

若**19**間受訪學校使用校園天台
僅**一半**面積安裝太陽能板
一年可生產：

=約240萬度電

=751個香港三人家庭
一年的用電量

=全港最大
太陽能發電場發電量的2倍

渠務署小濠灣污水處理廠太陽能發電場

約240萬度電

約11萬度電

太陽能潛力 vs 現況

實現潛力=4.6%

被浪費潛力=~95%！

《香港中、小學發展太陽能的潛力與挑戰》研究受訪學校太陽能系統及潛力表[1]

受訪學校	有沒有太陽能系統？狀況如何？	目前太陽能系統發電容量（千瓦）	目前太陽能系統全年發電量（度）	學校天台5成面積（平方米）	如使用學校天台5成面積安裝太陽能系統，估計發電量（度）	學校地區
1	有	65.4	44,500.0	220.0	41,776.7	觀塘
2	有	41.5	50,000.0	500.0	110,733.3	荃灣
3	有	3.4	2,666.0	180.0	38,037.5	西貢
4	有	3.2	3,225.0	1,400.0	332,675.0	南區
5	有	3.0	7,417.0	160.0	22,334.2	元朗
6	有	2.4	770.0	220.0	48,585.7	葵青
7	有	2.3	1,600.0	650.0	127,022.2	葵青
8	有	沒有資料	3,000.0	300.0	58,497.0	觀塘
9	有、但已停止運作	0.3	0	900.0	197,158.0	大埔
10	有、但已停止運作	沒有資料	0	390.0	77,702.2	東區
11	有、但已停止運作	沒有資料	0	160.0	33,418.7	元朗
12	有、但已停止運作	沒有資料	0	1,300.0	424,199.2	九龍城
13	沒有	N/A	N/A	1,000.0	192,353.6	大埔
14	沒有	N/A	N/A	500.0	114,174.7	葵青
15	沒有	N/A	N/A	350.0	57,643.6	元朗
16	沒有	N/A	N/A	300.0	67,981.5	離島
17	沒有	N/A	N/A	250.0	57,093.5	離島
18	沒有	N/A	N/A	430.0	84,749.3	沙田
19	沒有	N/A	N/A	1,800.0	394,131.0	西貢
總數		121.5千瓦	113,178度	11,010平方米	2,480,266.6度	

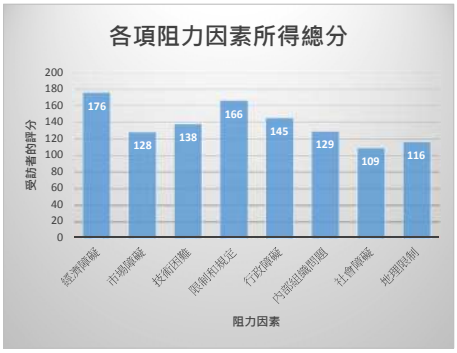
[1] 在22間受訪學校當中，有19間學校有提供足夠數據作分析，其餘3間受訪學校的數據沒有包括在此數據表內。

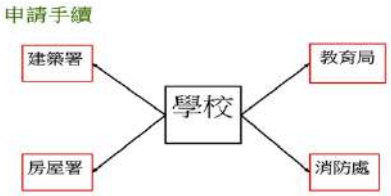
研究結果3

學校在發展太陽能項目時遇上多重阻力

主要阻力

- 缺乏初始資金
- 太陽能項目申請手續繁複
- 行政工作量大



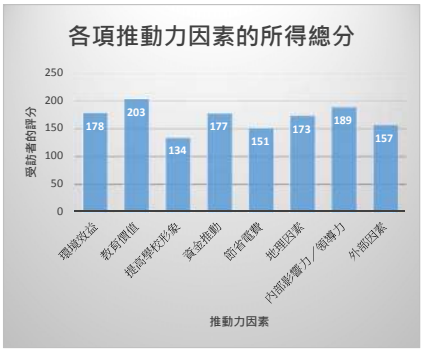


第一位	經濟障礙
第二位	規管上的限制
第三位	行政障礙
第四位	技術困難

研究結果4

教育意義最重要，投資回本不重要

太陽能學校: 為何而做?



第一位: 教育價值	• 三大類 - 科普教育、環保教育、關愛社區
第二位: 內部影響力/領導力	• 來自 - 校長、老師、學生、家長、校內環保團體
第三位: 環境效益	• 減少溫室氣體排放
第四位: 資金推動	• 資金來源:如 E C F; 回本期: 不重要

太陽能發展進程…..「*上網電價 $5 (最高)*」

香港...

2018年4月 公佈上網電價計劃詳情

2018年5月 中電開始接受申請

2018年8月 港燈開始接受申請

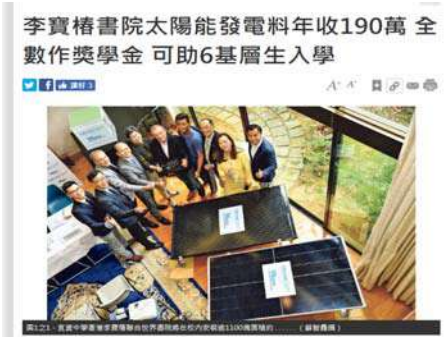
2018年10月 中電開始計劃並接收1,100份申請

2018年10月中 政府放寬 ***村屋***安裝高度上限

2019年1月 港燈開始計劃

2019年2月 政府宣佈為***學校***提供一站式的太陽能板安裝服務

2019年3月 中電及港燈共收到約1770份申請



- https://re.emsd.gov.hk/english/gen/4S/4S.html

明報 2019年6月6日

http://aesc.hkbu.edu.hk/hongkongsolarpartnership

小組討論

- 經過剛才的分享及匯報，你認為**哪些/哪個**的太陽能教學活動是**理想的/較可取**呢？
- 貴校**現時的情況**能否進行該教學活動？為甚麼？
- 需要哪些**額外的資源/幫助**？

鳴謝

本研究項目（項目編號：2017.A2.027.18B）獲香港特別 行政區政府政策創新與統籌辦事處公共政策研究資助計劃／策略性公共政策研究資助計劃撥款資助。

Appendix 7-10: Presentation slides of the workshop on Photovoltaic systems and the feed-in-tariff in Hong Kong on 11th December 2018

香港太陽能政策研究
初步結果

馬雅燕博士 Dr. Daphne Mah
香港浸會大學
亞洲能源研究中心總監
地理系助理教授

2018年12月11日

Workshop on Photovoltaic systems and the feed-in-tariff in Hong Kong. Department of Electrical and Electronic Engineering. The University of Hong Kong

A Work-in-progress
Please do not cite or quote without the permission of the Project Team (daphnemah@hkbu.edu.hk)

(Photo credit: Anthony Dixon, Helios

I. 我們的研究: 簡介

研究背景: 世界主要城市都大力發展太陽能

全球暖化、太陽能發電**成本大幅下降**，及發生**福島核事故**後：

- 過去幾年，不少大城市都已訂立了發展太陽能的目標、具體政策。
- 在香港，我們沒有任何主要的太陽能政策...直至今年10月出台的**「可再生能源上網電價」**

資料來源: AESC, 2018

我們的研究團隊

Collaborating Researchers for Solar Projects

Daphne Mah
HKBU
Energy Policy

Kevin Lo
HKBU
Energy Policy

K. P. Chun
HKBU
Global change

Byron Choi
HKBU
Computer Science

Zhou Qiming
HKBU
GIS

Alice Siu
Stanford University
Public engagement

Michael K.H. Leung
City University of Hong Kong
Energy Engineering

Akihisa Mori
Kyoto University
Energy Policy

Marc Wolfram
Sungkyunkwan University
Urban Governance

Sara Fuller
Macquarie University
Energy Justice

Gilles Lepesant
Unit Géographie-Cités
Energy Transition

Richard Balme
Paris School of
International Affairs
Environmental Governance

我們的研究項目

研究期間	研究項目	贊助機構	贊助金額	研究單位
2015-2016	香港**屋頂太陽能的發展潛力**及**政策**建議	中電	$195,720	浸大、城大
2016	香港**太陽能政策**研究	綠色和平、 世界野生自然 基金會	$300,000	浸大、城大、港大、 史丹福大學
2016	香港**太陽能地圖**	浸大圖書館	$100,000	浸大
2016-2017	中國能源創新及轉型: **佛山住宅式太陽能發展**的經驗	UCL、浸大		浸大 UCL
2017	香港可再生能源研究 (**可再生能源上網電價補貼**)	綠色和平、 350香港	$80,000	浸大
2017-2019	**可持續能源轉型**（SETs）的協商參與、信任和社會學習：日本、韓國和中國的比較研究	研究資助局 (研資局)	$1,326,170	浸大、港大、京都 大學、延世大學、 清華大學
2018	香港**太陽能學校**: 機遇及挑戰	綠色和平	$135,000	浸大、城大
2018-2019	社區參與發展可持續能源未來模式: 兩個香港**太陽能社區**的研究	香港特區政府` 政策創新與統籌辦 事處	$632,500	浸大、城市大學、 港大、成均館大學、 綠色和平
2018-2020	通過**社區參與**實現城市能源轉型的多樣性和關鍵：倫敦、弗萊堡（德國）、紐約市、東京、首爾和佛山的國際比較研究	浸大	$150,000	浸大、麥覺理大學、 Unit Géographie- Cités、京都大學、 成均館大學、 Sciences Po

我們的研究：重點及特式

3.1 Themes:

- Governance for sustainable energy transitions on the Asian region,
- focusing on solar PV,
- smart grid-enabled energy transitions (including demand response programmes), and
- public acceptance of nuclear energy

3.2 Multi-method research:

- (a) solar assessment,
- (b) household and school interviews,
- (c) deliberative energy workshops;
- (d) scenario developments

3.3 A global solar city network

3.4 Knowledge exchange:

- Hong Kong Solar Partnership

3.5 Inputs to public policies:

- solar resource assessment,
- inform target-setting,
- policy formulations,
- policy evaluation

Hong Kong Solar Partnership

http://aesc.hkbu.edu.hk/hongkongsolarpartnership

A platform for dialogue, and sharing of good practice

Renewable deliberative workshops

https://youtu.be/hpzgrVkyfas?t=181

To collect citizens' informed views on controversial energy issues

Online Solar Map

http://digital.lib.hkbu.edu.hk/solarmap/

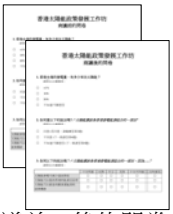
To engage the public through playful, and innovative ways

Hong Kong Solar Partnership:

- Aims:
  - Facilitate dialogue
  - Try new ways of public engagement
  - Share good practice
- Website – just launched
- Funding sources: HKBU, CLP, HEC
- Is underpinned by research

http://aesc.hkbu.edu.hk/hongkongsolarpartnership

「商議式」的工作坊
(Deliberative Workshops)



訪談　簡介文件　小組討論　專家答問環節　商議前、後的問卷

2016年　香港太陽能政策研究

第一階段 (2016年6月至2017年3月): 訪問99人

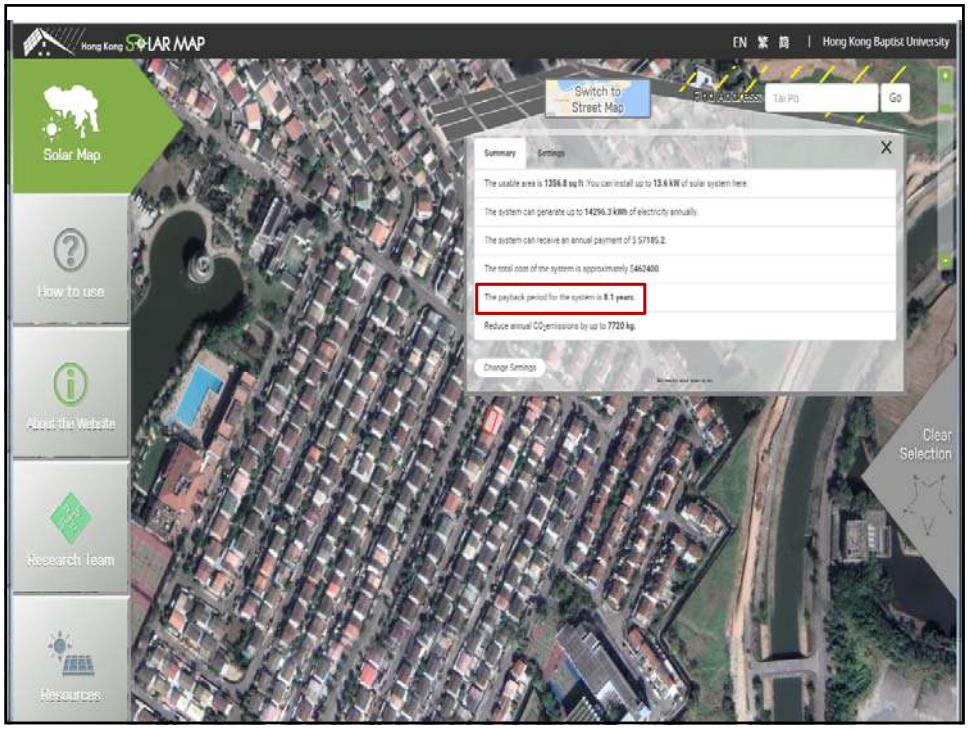
第二階段 (2016年11月4-5日): 商議式工作訪－參加者57人

第1類	第2類	第3類
潛在太陽能發電戶及村民	隨機抽樣的香港市民	公、私營各界別人士

https://youtu.be/hpzgrVkyfas?t=181

香港太陽能地圖
http://digital.lib.hkbu.edu.hk/solarmap/

- 你 可 估算 你的物業天台的太陽能發電潛力
- 評估 不同上網電價方案下，回本期可縮短多少年



II. 初步的研究結果

《香港太陽能社區》
的研究

《香港中、小學發展太陽能的潛力
與挑戰》研究

上網電價對回本期的影響

政策落實*前*:

<u>沒補貼</u>

回本期: **35**年

天台面積：約700平方尺

太陽能板：6塊

(每塊約1.65平方米, 共約10平方米, 佔1/7天台面積)

安裝費用：HK$**55,000**

年產電量：1,560度 (每天產電4.27度)

政策落實*後*:

系統發電容量	上網電價 (每度電)
≤10千瓦	5港元
>10千瓦至≤200千瓦	4港元
>200千瓦至≤1兆瓦	3港元

每年補貼收益：
HK$7,800

- 回本期：**7**年

相片來源: https://farm8.staticflickr.com/7110/6988871534_efe52a2614.jpg

《香港太陽能社區》的研究

http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/

研究目的

- 以「**錦繡**」及「**康樂園**」兩個有潛能成為太陽能社區的屋苑作為研究案例
- 本研究旨在**探討社區參與對能源轉型的決策過程的作用**

研究方法

- 分析社區及附近學校對上網電價實施前後的反應
- 在社區及學校進行現場太陽能測量，**評估太陽能潛力**
- **訪問**相關持分者，探討香港太陽能社區的前景、發展方案、面臨的障礙及可行的策略，及對太陽能政策的想法 (已訪問錦繡43戶+康樂園29戶)
- 舉行**工作坊** (2019年2月)促進各方交流、商討對策

探討的議題

- 發展太陽能社區是否可行的能源選項？
- 香港是否可依靠太陽能社區作為可持續能源將來的一部分？
- 香港可從其他太陽能先進城市汲取甚麼經驗？
- 香港可怎樣處理從發展太陽能帶來的技術、經濟、社會政治及制度上的挑

初步研究結果1:

受訪者認同REFIT是有效的政策，但絕大部分仍持觀望態度。

"First movers" 未能起積極的示範作用

個案 A

個案 B

香港第一個太陽能社區?

Fairview Park 錦綉花園

If...
180W/solar PV Panel (1.65 m^2) x 6 solar PV panels
(~9.9m^2 = available rooftop area)

= ~1 kW potential installed capacity per rooftop

Potential solar PV capacity at Fairview Park
= ~1 kW X 5 024 houses
= ~**5.4 MW** ????

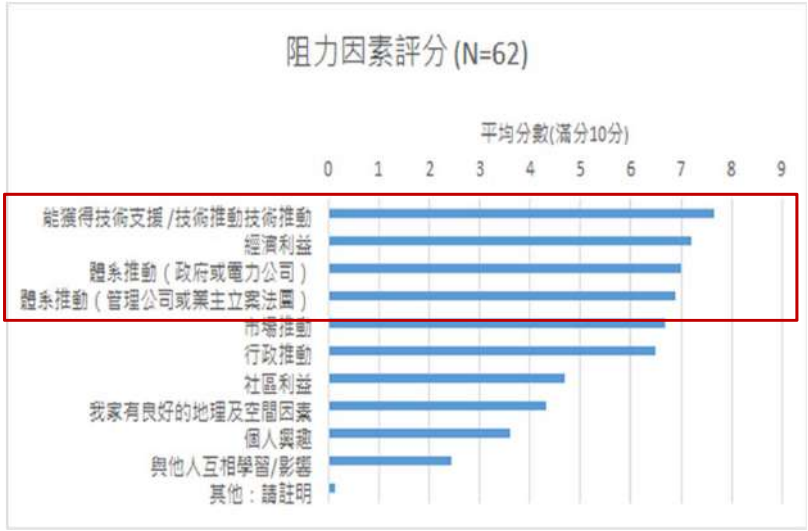
錦綉花園太陽能評估
11戶試驗研究(2018年2月)

- 香港城市大學能源研究學院及能量研發能源研究中心
- 運用測量儀器(horicatcher)在住戶的**屋頂**測量了**邊的遮陽物**（例如其他建築物）及天台記錄天台的角度和方向
- 隨後通過**分析軟件**(Meteonorm),
- 並結合香港**氣候數據**
- 估算各住宅屋頂的**太陽能潛力**。

- 估算結果顯示若安裝太陽能發電系統，**每年每平方米的發電量大約會有多少**。
- 住戶可通過估算結果**推斷可得到的可再生能源上網電價補貼**大約有多少。

受訪家庭: 錦繡: 35; 康樂園:27

訪問日期: 2018年8月至9月



ＲＥＦＩＴ落實後，
住戶仍面對經濟因素以外的多重障礙

圖十二 在香港發展太陽能需要面對的多種障礙

1. 申請程序、需時的不確定性:
"不知道要搞幾耐"

2. 技術問題:
- "isolation transformer"
  – CLP 的安全準則過高?
- 潛建... 漏水

3. 工程承辦商質素參差:
"好多公司話可以做，但全部拿不出 references"

初步研究結果2:
太陽能行業存在隱憂

技術參差不齊？信譽成疑?
業界人手及其專業的增長，會否滯後於市場的需要?

太陽能公屋：任由損壞廢武功　房屋署塞責
(東網 2015年2月16日)

https://hk.on.cc/hk/bkn/cnt/news/20150216/bkn-20150216214200810-0216_00822_001.html?eventid=4028812546ae78770146beaa2b891243&eventsection=hk_news&t=bb4

香港的安裝成本高

- 香港：安裝成本約佔太陽能系統價格的**1/3**
- 相對德國及中國大陸：

初步研究結果3:
需要重視 太陽能發展的*社會*問題:「*公平*性」

- 上網電價可能引致的社會問題：

「*劫貧濟富*」?

- 再進一步放寬低密度住宅裝設太陽能系統的限制

–「*政策傾斜*」?

https://www.storm.mg/article/693913

《香港中、小學發展太陽能的潛力
與挑戰》研究

學校: 是推動香港可再生能源的重要一環

	村屋/ 低密度住宅	私人大廈	學校
地	• 村屋：＞40,000 • 天台用途：晒衫、BBQ及其他休憩用途	• 住宅、商業、工業大廈 • 企業：購買可再生能源證書	• 政府學校-約900間 • 天台、停車場等
回本期	<10年	<3年 (工、商界)	• 不大重要
太陽能的價值	• 慳電費/賺少少錢 • 減排/環保	• 社會企業責任 • 保持競爭力	• 教育價值 (STEM) • 減排/環保

相片來源: https://www.hkcnews.com/news_%E6%96%B0%E8%81%9E/hk-discuss/2017/12/%E4%B8%81%E5%B1%8B-%E4%B8%81%E6%AC%8A-%E5%8E%9F%E5%B1%85%E6%B0%91-20171218043112_e57c_large.jpg;
http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/;
https://s.yimg.com/uu/api/res/1.2/J0gt0B3O0yNq6P_5G8EHtw--~B/aD0xOTk7dz0xNjA7c209MTthcHBpZD15dGFjaHlvbg--/http://media.zenfs.com/en_us/News/singtao/236232.jpg; www.isd.gov.hk
http://w22.property.hk/article_content.php?ln=sc&author=PHK_NEWSPROP&id=53143

訪問及評估太陽能發電潛力

學校數目：22間

調查日期：2018年1月至8月

學校種類：17間資助學校、2間直資學校及3間私立或國際學校。

研究結果1:

受訪學校太陽能發電潛力被大量浪費

若**19**間受訪學校使用校園天台
僅**一半**面積安裝太陽能板
一年可生產：

=約240萬度電

=751個香港三人家庭
一年的用電量

=全港最大
太陽能發電場發電量的2倍

渠務署小濠灣污水處理廠太陽能發電場

《香港中、小學發展太陽能的潛力與挑戰》研究受訪學校太陽能系統及潛力表[1]

受訪學校	有沒有太陽能系統？狀況如何？	目前太陽能系統發電容量（千瓦）	目前太陽能系統全年發電量（度）	學校天台5成面積（平方米）	如使用學校天台5成面積安裝太陽能系統，估計發電量（度）	學校地區
1	有	65.4	44,500.0	220.0	41,776.7	觀塘
2	有	41.5	50,000.0	500.0	110,733.3	荃灣
3	有	3.4	2,666.0	180.0	38,037.5	西貢
4	有	3.2	3,225.0	1,400.0	332,675.0	南區
5	有	3.0	7,417.0	160.0	22,334.2	元朗
6	有	2.4	770.0	220.0	48,585.7	葵青
7	有	2.3	1,600.0	650.0	127,022.2	葵青
8	有	沒有資料	3,000.0	300.0	58,497.0	觀塘
9	有、但已停止運作	0.3	0	900.0	197,158.0	大埔
10	有、但已停止運作	沒有資料	0	390.0	77,702.2	東區
11	有、但已停止運作	沒有資料	0	160.0	33,418.7	元朗
12	有、但已停止運作	沒有資料	0	1,300.0	424,199.2	九龍城
13	沒有	N/A	N/A	1,000.0	192,353.6	大埔
14	沒有	N/A	N/A	500.0	114,174.7	葵青
15	沒有	N/A	N/A	350.0	57,643.6	元朗
16	沒有	N/A	N/A	300.0	67,981.5	離島
17	沒有	N/A	N/A	250.0	57,093.5	離島
18	沒有	N/A	N/A	430.0	84,749.3	沙田
19	沒有	N/A	N/A	1,800.0	394,131.0	西貢
總數		121.5千瓦	113,178度	11,010平方米	2,480,266.6度	

[1] 在22間受訪學校當中，有19間學校有提供足夠數據作分析，其餘3間受訪學校的數據沒有包括在此數據表內。

約**240**萬度電

約**11**萬度電

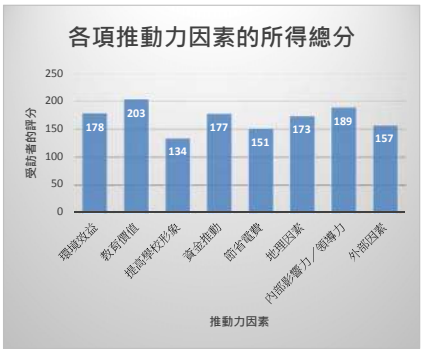
太陽能潛力 vs 現況

實現潛力=**4.6%**

被浪費潛力=~95%！

研究結果2 教育意義最重要，***回本期不重要***
「***上網電價***」政策***未能***推動學校安裝太陽能系統

太陽能學校: 為何而做?



第一位: 教育價值	• 三大類 - 科普教育、 環保教育、關愛社區
第二位: 內部影響力/領導力	• 來自 - 校長、老師、學生、 家長、校內環保團體
第三位: 環境效益	• 減少溫室氣體排放
第四位: ***資金推動***	• 資金來源:如ＥＣＦ; 回本期: 不重要

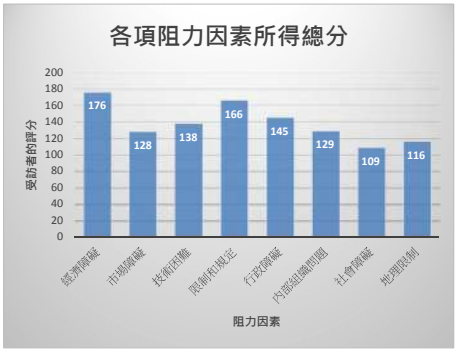
29

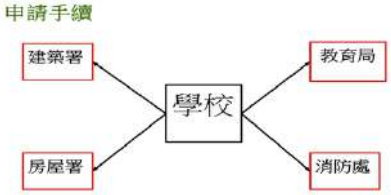
研究結果3

學校在發展太陽能項目時遇上多重阻力

主要阻力

- 缺乏初始資金
- 太陽能項目申請手續繁複
- 行政工作量大





第一位	經濟障礙
第二位	規管上的限制
第三位	行政障礙
第四位	技術困難

30

氣候變化相關段

275. 《巴黎協定》已於2016年11月生效，並適用於香港特區。根據《巴黎協定》，所有締約方應在2020年或之前努力擬訂並通報長期溫室氣體低排放發展戰略，作為國家的一部分，也是國際社會負責任的一員，香港應在2020年或之前制訂至2050年的長期減碳策略。為此，政府已邀請可持續發展委員會於2018-19年度展開公眾參與過程。

276. 推動可再生能源的發展是減緩氣候變化的重要一環，我們會由政府帶頭，更有系統地引入可再生能源。

277. 在私營界別方面，我們引入了上網電價，為個人和非政府機構投資可再生能源提供誘因。我們會進一步為他們提供支援與便利，包括在新界豁免管制地方，即「村屋」天台上，適度放寬裝設太陽能光伏系統的限制；我們亦會在其他私人樓宇，特別是低密度樓宇，作出合適的放寬安排。此外，我們會推出一項新計劃，協助學校和非政府機構安裝小型可再生能源系統。

Subject: Re: 《星島日報》查詢：協助學校安裝小型可再生能源系統（環境局回覆）

就你的查詢，環境局回覆如下：

行政長官在2018年《施政報告》中宣佈推出一項新計劃，協助學校及非政府機構安裝小型可再生能源系統。新計劃下政府會為**有關學校**／機構支付可再生能源系統項目的**全部資本成本**（**包括系統組件及安裝費用等**），以及為有關項目**提供技術支援**，例如**場地視察及技術評估、系統安裝及測試等**。環境局及機電工程署現正擬定計劃的具體細節，並將於**明年**公布詳細安排。在擬定計劃的具體安排時，我們會**與不同的持份者保持溝通**，並歡迎它們就計劃**提供意見**。

學界顧慮:
- 有多少學校能受惠?
- 學校能否保留一定自主權，例如讓老師及同學參與項目的設計?
- 政府、中電及港燈，能否做得夠快、夠好?

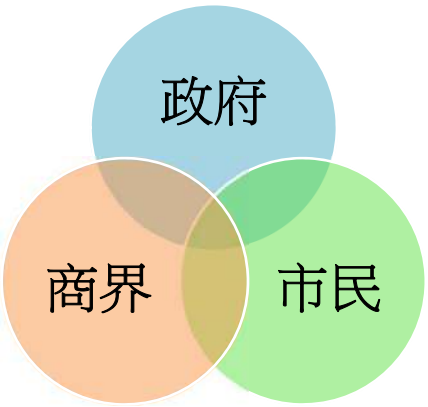
Hong Kong Solar Partnership

Solar School Working Group – 第一次會議

2018年11月6日

學界建議:
- 盡快公布細節
- 「一站式」、「中央採購」...
- 建立平台 – 經驗分享 (項目、融合STEM教學)
- 問卷調查 – 了解校界興趣、需要哪類政策

III. 政策建議



政策建議 1: 可再生能源政策必須具有清晰的“願景 (vision)” 和“目標(target)”

***2017年11月浸大工作坊*:**

市民對政府的信任度下降?

市民對政府發展太陽能抱有懷疑:

- 市民不清楚政府發展太陽能的展望及目標
- 市民質疑政府的可再生能源政策缺乏持續性、系統性 （如：初置成本的補貼、本地太陽能產業的發展）
- 市民認為政府**沒有解決**住戶安裝太陽能系統帶來的法規問題

首爾經驗: 可再生能源*政策*

必須具有清晰的"*願景*" 和明確 "*目標*"

國家層面	可再生能源目標: 20% - 2020 可再生能源配額制 (Renewable Portfolio Standards) • **18間大型發電公司** (>500MW): 2012年 - **2%....** 2024年- **10%** 的發電量來自可再生能源 • + "可再生能源證書制度" (Renewable Certificate)	香港？ "根據現時估計，在2030年前太陽能只可應付約1至1.5%的香港總電力需求。" (香港氣候行動藍圖2030+，2017)
首爾層面	**首爾市長朴元淳: 首爾成為 "無核、能源自主的社會"** **首爾** 「減一座核電廠」政策 • 2012年4月出台: 使首爾從2011年用電量約為400百萬噸油當量（TOE），占全國的10%，下降到2014年約200萬噸油當量，省下相當一座核電廠一年的發電量（約９６億度電）；能源自給率從2.8%提高到5%。 • *公眾*參與政策制定: The Hope Policy Advisory panel (The Environment & Culture Subcommittee), Policy Hearing Workshop, Citizen congress, etc. • 核心項目: **"Seoul City of Sunlight Project": 320 MW** 首爾的可再生能源上網電價補貼 (REFIT) (2013年起)	??
社區層面	• 88 個「能源自主社區」(目標增至100) • 目標: 在住宅大廈及屋苑安裝 40,000 250W 微型太陽能系統	??

政策建議 2: 香港的太陽*資源評估*及*目標的制定*，可透過*公眾參與*來優化

香港: 太陽能潛力有沒有被低估?

"根據現時估計，在2030年前太陽能只可應付約**1至1.5%**的香港總電力需求。" (香港氣候行動藍圖2030+，2017)

村屋 (超過40,000間)

錦綉花園 (約5,000戶)

公屋及私人住宅大廈

政府學校 (約900間)

政府建築物、天橋、隔音屏障、運動場看台

水塘

相片來源: https://www.hkcnews.com/news_%E6%96%B0%E8%81%9E/hk-discuss/2017/12/%E4%B8%81%E5%B1%8B-%E4%B8%81%E6%AC%BA-%E5%8E%9F%E5%B1%85%E6%B0%91-20171218043112_e57c_large.jpg;
http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/;

不同的太陽能資源評估方法，能相輔相承

Solar output potential in HK: 5.9% - 35%

Table 3
Recent studies estimating Hong Kong's solar PV output potential to the total electricity consumption by its respective year.

Authors	Estimated solar PV potential output (%) of total electricity Consumption (Year)	Methodology/remarks
You and Yang [183]	35% (1995)	- Includes BIPV (residential, commercial, institutional) such as rooftops and outer walls oriented south, east, and west, but excludes shadow facades of high-rise buildings
EMSD [184]	17% (1999)	- Includes BIPV (residential, commercial, institutional) and non-BIPV such as open space, roads and railways, airport and non-built areas such as grasslands and country parks; however, this estimate did not factor in cloud cover or shading
Peng and Lu [185]	14.2% (2011)	- Includes rooftop PV - Takes into account of partial shading
Lu [186]	10.7% (2014)	- Includes rooftop PV - Do not take into account of shading
Wong [187]	5.9% (2012)	- This potential is specific to rooftop solar PV; this study also addresses solar PV deployment on all open space areas and Government, Institution and Community facilities, which could contribute to 6.4% and 2.1% respectively of Hong Kong's total electricity consumption in 2012. - Done with remote sensing, included cloud cover

城市大學能源及環境學院:
實地測量 + 利用Google Earth 輔助

向受訪學校/ 住戶，
蒐集太陽能發電量數據，
以了解*現況*及與*潛力*評估結果作比較。

Mah, D. N.-y., Wang, G., Lo, K., Leung, M. K. H., Hills, P., Lo, A. Y., 2018. Barriers and policy enablers for solar photovoltaics (PV) in cities: Perspectives of potential adopters in Hong Kong. Renewable and Sustainable Energy Reviews, 92, 921-936.

政策建議 3: 尋找發展太陽能的「香港模式」- 大力推動太陽能*社區*、太陽能*學校*

"社區"

1. **大量太陽能**資源未被利用
2. 有機會能「**規模化**」地發展太陽能 (如錦繡)
3. **領導力:** 來自居民領袖
4. 社區 **網絡**
5. 太陽能的「**總**」**價值**:
   + 太陽能社區的"*社會*價值"
   - 如, 社會和諧，節能意識的提高

"學校"

1. **大量太陽能**資源未被利用
2. 有機會能「**規模化**」地發展太陽能 (按學校類型; 辦學團體的議價優勢)
3. **領導力:** 來自熱心的校長及老師
4. 學校**網絡:** (e.g. 校長聯會、辦學團體，如匡智會的網絡)
   → 動員能力、
5. 太陽能的「**總**」**價值**:
   環境、經濟+ "*教育*價值"
   → STEM

香港首個太陽能社區?

新蒲崗居屋采頤花園
- 902 塊太陽能板
- 12座居屋、3,000 伙
- 估計年產近20萬度電、賺逾百萬元，最快8年回本

啟德明渠

大公資訊

大公報 | 中國 | 國際 | 香港 | 專欄

渠務署研開河道 "禁區" 港版清溪川不是夢

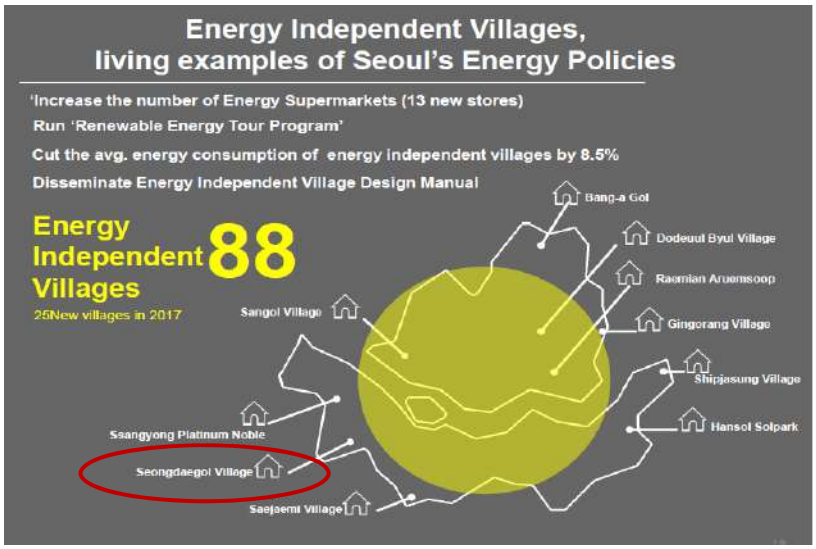
2015-12-27 03:14:13 | 來源：大公網 | 我要分享 | 打印

圖：啟德河模擬圖 渠務署圖片

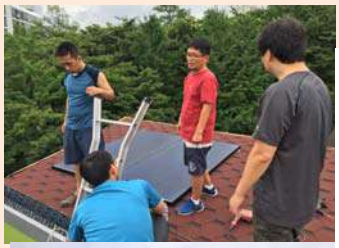
大公網12月27日訊(記者 何進昇、曾敏捷)政府近年積極推廣 "親水文化" ，惟香港的河道與已活化的明渠向來是市民的 "禁區" ，渠務署現正進行為期兩年的活化水體可行性研究，檢視全港逾200條河道，探討活化河道以及讓市民親近河道水體的可能性，一些於活化

http://news.takungpao.com.hk/hkol/topnews/2015-12/3259351.html

首爾經驗: 相信、及善用*社區參與*的*力量*



首爾 盛大谷 (Sungdaegol):
能源自主社區



Flat Cable
(專利)

(Photo credits: So-young Kim)

橫濱
Home battery

(Photo credits: AESC, 2015)

Songpa-gu Guyeo Apartment

(Lee, 2017)

首爾經驗: 首爾政府積極推動
由“個人參與”、“社區參與”，到“全民參與”

1 在主要地標安裝太陽能系統
– 增加公眾認識、支持

The world's first solar-power soundproof tunnel on the Dongbu Expressway

https://www.dailymotion.com/video/x6upnun

https://www.hk01.com/%E5%91%A8%E5%A0%B1/242154/%E4%B8%8A%E7%B6%B2%E9%9B%BB%E5%83%B9-%E9%96%8B%E6%94%BE%E9%9B%BB%E7%B6%B2%E8%A8%8E%E8%AB%96%E7%84%A1%E6%AD%A2%E5%A2%83-%E6%B8%AF%E4%BA%BA%E7%94%A8%E9%9B%BB%E4%BD%95%E6%99%82%E6%9C%89%E5%BE%97%E6%8F%80

https://medium.com/@sns.knowingkorea/the-worlds-first-solar-power-soundproof-tunnel-on-the-dongbu-expressway-b8e50c06573c

首爾政府積極推動
由“個人參與”、“社區參與”，到“全民參與”

2 太陽能發電市民基金
– 公眾集資

目標：
- 公路及道路安裝10MW太陽能發電設施 (2018前)

做法：
- 政府支持成立的市民基金
- 首爾市民參與公共設施上的太陽能投資項目
- 基金上限為50億韓圜(3.45億港元)
- 而每名市民最多可認購1億韓圜(69萬港元)

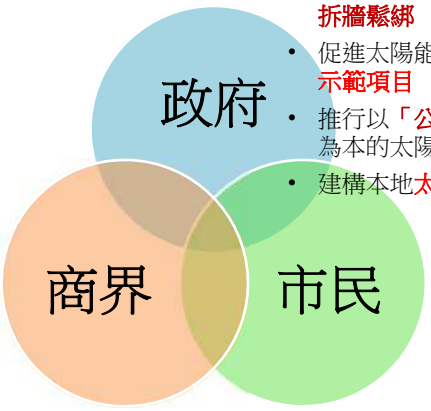
政策建議 4: 更充份地*重視*、*推化*、運用太陽能學校、太陽能社區的示範項目

- 分享正面、**成功**的例子
- **模範太陽能屋、模範太陽學校 – 節省項目設計、申請的時間及成本**
- **共同**研發、**解決**問題

弘立書院(ISF Academy)

聖言中學

總結: 香港太陽能政策的下一步發展



- **領導力: 願景、目標、時間表**
- **政策連貫性: 協調**有關政策部門、**拆牆鬆綁**
- 促進太陽能社區、太陽能學校的**示範項目**
- 推行以**「公平」、「全民參與」**為本的太陽能政策
- 建構本地**太陽能產業**

- 創新**商業模式**、滿足用家需要
- 中電、港燈，太陽能承辦商有真正的**積極性**去做得**快**、做得**好**

- **從「個人參與」、到「社區參與」、到「全民參與」**
- **社區資源、集體智慧**
- 公眾對政策的支持

https://www.staystock.com/products/lightbulb-cartoon-character-points

錦綉花園屋頂每年每平方米的發電量

11戶試驗研究
(2018年2月)

Assessment No.	House No.	Azimuth (direction)	Inclination	H_Gkhor: Irradiation of global rad., tilted plane, with high horizon (Annual amount)	polycrystalline Silicon panel (Annual electricity generation) 12%	Amorphous Silicon panel(flexible) (Annual electricity generation) 8%	DSSC (Annual electricity generation) 10%
		degrees	degrees	kWh/m^2/year	kWh/year	kWh/year	kWh/year
1	1.1	-58	19	1343	161.16	107.44	134.30
2	1.1	122	19	1247	149.64	99.76	124.70
3	1.1	32	13	618	74.16	49.44	61.80
4	1.2	45	17	1361	163.32	108.88	136.10
5	1.2	-135	17	1249	149.88	99.92	124.90
6	1.3	-58	16	1307	156.84	104.56	130.70
7	1.3	122	16	1253	150.36	100.24	125.30
8	1.4	-73	5	890	106.80	71.20	89.00
9	1.4	107	5	869	104.28	69.52	86.90
10	1.4	-73	16	1273	152.76	101.84	127.30
11	1.4	107	16	1273	152.76	101.84	127.30
12	1.5	55	9	1072	128.64	85.76	107.20
13	1.5	-125	9	1000	120.00	80.00	100.00
14	1.5	-35	17	1347	161.64	107.76	134.70
15	1.5	145	17	1220	146.40	97.60	122.00
16	1.6	55	4	1248	149.76	99.84	124.80
17	1.6	-35	19	1357	162.84	108.56	135.70
18	1.6	145	19	1211	145.32	96.88	121.10
19	1.7	-150	2	1086	130.32	86.88	108.60
20	1.7	-60	17	1347	161.64	107.76	134.70
21	1.7	120	17	1257	150.84	100.56	125.70
22	1.8	119	11	1274	152.88	101.92	127.40
23	1.8	-61	3	1011	121.32	80.88	101.10
24	1.8	-61	19	1339	160.68	107.12	133.90
25	1.8	119	19	1251	150.12	100.08	125.10
26	2.1	32	1	943	113.16	75.44	94.30
27	2.1	-58	19	1310	157.20	104.80	131.00
28	2.1	122	19	1156	138.72	92.48	115.60
29	2.2	30	7	755	90.60	60.40	75.50
30	2.2	-60	19	1336	160.32	106.88	133.60
31	2.2	120	19	1249	149.88	99.92	124.90
32	2.3	85	3	1088	130.56	87.04	108.80
33	2.3	-95	19	1283	153.96	102.64	128.30
34	2.3	85	19	1300	156.00	104.00	130.00

錦繡花園物業管理公司：安裝太陽能板申請表

申請安裝太陽能板

AD/FRM/36

Appendix I

舊版本 (2017年9月)

安裝太陽能板及輔助設備的條款及細則

1. 業主必須向管理公司提交太陽能板的規格、安裝方法及輔助設備清單等資料，以便管理公司作出審批。
2. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。
3. 業主須就有關太陽能板、其輔助設備與安裝向機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並須遵守有關條例的要求及規定。
4. 業主須自行承擔所有就安裝太陽能板及有關輔助設備所引致的任何損毀或損失。
5. 無論任何情況下，管理公司及錦綉花園道路擁有人，均不須對有關安裝之直接 或間接引致的損毀或損失，負上任何責任。
6. 業主須定期保養太陽能板以確保該等設備外觀良好及結構安全，否則管理公司有權要求業主移除有關之太陽能板，並將屋頂還原至原有模樣，或採取任何管理公司認為合適的行動，所有涉及的費用均由業主負責。
7. 對於沿着錦綉大道及錦綉河的單位，太陽能板應安裝於背向大道或河道的屋頂後方位置。
8. 安裝在屋頂的太陽能板，總面積不可超越 4 平方米，以及距離中牆 (如有) 最少 1 米。
9. 當業主接獲管理公司或政府部門的要求，業主必須拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。
10. 管理公司有權不時檢視及修改安裝太陽能板的條款及細則。
11. 管理公司對有關申請擁有絕對否決權，尤其是相關物業存有違規建築物。
12. 當收到鄰近住戶的合理投訴時，管理公司保留可要求業主拆除太陽能板及有關輔助設備的權利。

新版本 (2018年5月)

安裝太陽能板及輔助設備的條款及細則

1. 業主必須向管理公司提交太陽能板的規格、安裝方法及輔助設備清單等資料，以便管理公司作出審批。
2. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。
3. 業主須就有關太陽能板、其輔助設備與安裝向機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並須遵守有關條例的要求及規定。
4. 業主須自行承擔所有就安裝太陽能板及有關輔助設備所引致其他房屋的任何損毀或損失。
5. 無論任何情況下，管理公司及錦綉花園道路擁有人，均不須對有關安裝之直接或間接引致的損毀或損失，負上任何責任。
6. 業主須確保單位有足夠的結構承托力安裝太陽能板，以及定期保養太陽能板以確保該等設備外觀良好及結構安全，否則管理公司有權要求業主移除有關之太陽能板，並將屋頂還原至原有模樣，或採取任何管理公司認為合適的行動，所有涉及的費用均由有關業主負責。
7. 太陽能板只可安裝在屋頂的位置。除屋頂部可貼近邊緣外，距離單位左右兩邊及底部邊緣不少於 300 毫米。太陽能板須與屋頂平行安裝且高度離屋頂不可超過 150 毫米。
8. 當業主接獲管理公司或政府部門的要求，業主必須自費拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。
9. 管理公司有權不時檢視及修改安裝太陽能板的條款及細則。
10. 管理公司對有關申請擁有絕對否決權，尤其是相關物業存有違規建築物。
11. 當收到鄰近住戶的合理投訴時，管理公司保留可要求業主拆除太陽能板及有關輔助設備的權利。

錦繡花園物業管理公司：安裝太陽能板申請表

申請安裝太陽能板

AD/FRM/36

Appendix I

舊版本 (2017年9月)

安裝太陽能板及輔助設備的條款及細則

1. 業主必須向管理公司提交太陽能板的規格、安裝方法及輔助設備清單等資料，以便管理公司作出審批。
2. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。
3. 業主須就有關太陽能板、其輔助設備與安裝向機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並須遵守有關條例的要求及規定。
4. 業主須自行承擔所有就安裝太陽能板及有關輔助設備所引致的任何損毀或損失。
5. 無論任何情況下，管理公司及錦綉花園道路擁有人，均不須對有關安裝之直接 或間接引致的損毀或損失，負上任何責任。
6. 業主須定期保養太陽能板以確保該等設備外觀良好及結構安全，否則管理公司有權要求業主移除有關之太陽能板，並將屋頂還原至原有模樣，或採取任何管理公司認為合適的行動，所有涉及的費用均由業主負責。
7. 對於沿着錦綉大道及錦綉河的單位，太陽能板應安裝於背向大道或河道的屋頂後方位置。
8. 安裝在屋頂的太陽能板，總面積不可超越 4 平方米，以及距離中牆 (如有) 最少 1 米。
9. 當業主接獲管理公司或政府部門的要求，業主必須拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。
10. 管理公司有權不時檢視及修改安裝太陽能板的條款及細則。
11. 管理公司對有關申請擁有絕對否決權，尤其是相關物業存有違規建築物。
12. 當收到鄰近住戶的合理投訴時，管理公司保留可要求業主拆除太陽能板及有關輔助設備的權利。

新版本 (2018年5月)

安裝太陽能板及輔助設備的條款及細則

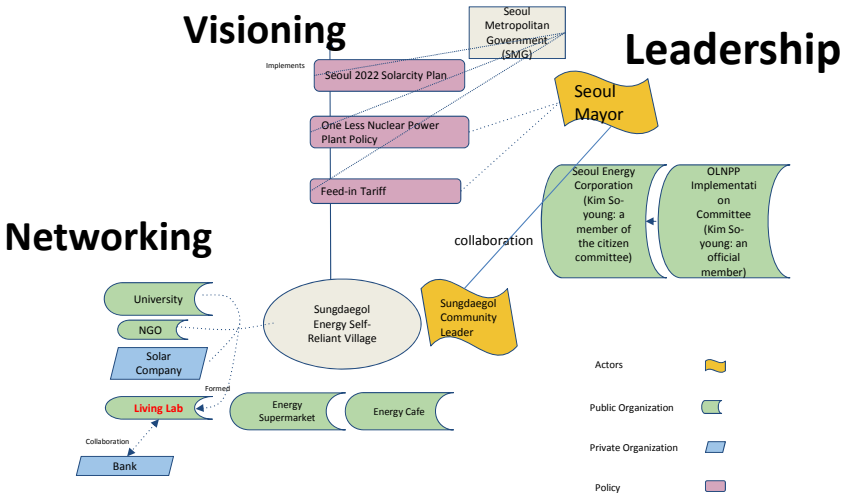
1. 業主必須向管理公司提交太陽能板的規格、安裝方法及輔助設備清單等資料，以便管理公司作出審批。
2. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。
3. 業主須就有關太陽能板、其輔助設備與安裝向機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並須遵守有關條例的要求及規定。
4. 業主須自行承擔所有就安裝太陽能板及有關輔助設備所引致其他房屋的任何損毀或損失。
5. 無論任何情況下，管理公司及錦綉花園道路擁有人，均不須對有關安裝之直接或間接引致的損毀或損失，負上任何責任。
6. 業主須確保單位有足夠的結構承托力安裝太陽能板，以及定期保養太陽能板以確保該等設備外觀良好及結構安全，否則管理公司有權要求業主移除有關之太陽能板，並將屋頂還原至原有模樣，或採取任何管理公司認為合適的行動，所有涉及的費用均由有關業主負責。
7. 太陽能板只可安裝在屋頂的位置。除屋頂部可貼近邊緣外，距離單位左右兩邊及底部邊緣不少於 300 毫米。太陽能板須與屋頂平行安裝且高度離屋頂不可超過 150 毫米。
8. 當業主接獲管理公司或政府部門的要求，業主必須自費拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。
9. 管理公司有權不時檢視及修改安裝太陽能板的條款及細則。
10. 管理公司對有關申請擁有絕對否決權，尤其是相關物業存有違規建築物。
11. 當收到鄰近住戶的合理投訴時，管理公司保留可要求業主拆除太陽能板及有關輔助設備的權利。

Social values of solar *beyond efficiency*

"其實我地好希望好希望係*全線*咁樣，由你細細個開始呢，灌輸一個環保嘅概念，可生能源可能係其中一…可能係小部分架姐，我地係好想好想*再生能源*係教人點樣去*慳電*，真係你用少啲呢先至係最緊要架，….做緊呢個再生能源，亦都有個weather station，即係話到俾佢聽呢佢係發緊幾多電，發緊幾多電，好坦白講，好少架姐… 但係正正就係咁呢我就要話俾人聽，其實發電係一啲都唔容易，亦都需要好多資源，所以呢你慳啲用呢係反而個幫助係仲大，咁呢樣野係我地好想向成個教育裏面呢，帶出黎嘅 。"

(與會者 – 浸大香港太陽能學校工作坊, 2018年6月30日)

盛大谷 太陽能社區: *社區網絡* 與 *資源創造*



Mah, N.-y. D., Forthcoming. Community solar energy initiatives in urban energy transitions: A comparative study of Foshan, China and Seoul, South Korea. Energy Research & Social Science.

鳴謝

本研究項目（項目編號：2017.A2.027.18B）獲香港特別 行政區政府政策創新與統籌辦事處公共政策研究資助計劃／策略性公共政策研究資助計劃撥款資助。

Appendix 7-11: Presentation slides of the workshop on Renewable Energy and Feed-in-tariff in Hong Kong on 29th April 2019

香港太陽能政策研究
初步結果

張文偉博士 Dr. Darren Cheung
香港浸會大學
亞洲能源研究中心
博士後研究員

2019年4月29日

Workshop on Photovoltaic systems and the feed-in-tariff in Hong Kong. Department of Electrical and Electronic Engineering. The University of Hong Kong

A Work-in-progress
Please do not cite or quote without the permission of the Project Team (daphnemah@hkbu.edu.hk)

(Photo credit: Anthony Dixon, Helios

I. 我們的研究: 簡介

研究背景: 世界主要城市都大力發展太陽能

全球暖化、太陽能發電**成本大幅下降**，及發生**福島核事故**後：

- 過去幾年，不少大城市都已訂立了發展太陽能的目標、具體政策。
- 在香港，我們沒有任何主要的太陽能政策...直至今年10月出台的**「可再生能源上網電價」**

資料來源: AESC, 2018

我們的研究團隊

太陽能研究項目合作研究員

馬雅燕
香港浸會大學
能源政策

盧笛聲
香港浸會大學
能源政策

張文偉
香港浸會大學
能源政策

秦國斌
香港浸會大學
地球系統變化

蔡冠球
香港浸會大學
計算機科學

周啟鳴
香港浸會大學
地理信息系統

梁國熙
香港城市大學
太陽能資源評估

Richard Balme
巴黎政治學院
環境治理

Sara Fuller
麥覺理大學
能源公平

Gilles Lepesant
法國國家科學研究中心
能源轉型

Akihisa Mori
京都大學
能源政策

Alice Siu
史丹福大學
公眾參與

Marc Wolfram
成均館大學
城市治理

我們的研究項目

研究期間	研究項目	贊助機構	贊助金額	研究單位
2015-2016	香港**屋頂太陽能的發展潛力**及**政策**建議	中電	$195,720	浸大、城大
2016	香港**太陽能政策**研究	綠色和平、 世界野生自然 基金會	$300,000	浸大、城大、港大、 史丹福大學
2016	香港**太陽能地圖**	浸大圖書館	$100,000	浸大
2016-2017	中國能源創新及轉型: **佛山住宅式太陽能發展**的經驗	UCL、浸大		浸大 UCL
2017	香港可再生能源研究 (**可再生能源上網電價補貼**)	綠色和平、 350香港	$80,000	浸大
2017-2019	**可持續能源轉型**（SETs）的協商參與、信任和社會學習：日本、韓國和中國的比較研究	研究資助局 (研資局)	$1,326,170	浸大、港大、京都 大學、延世大學、 清華大學
2018	香港**太陽能學校**: 機遇及挑戰	綠色和平	$135,000	浸大、城大
2018-2019	社區參與發展可持續能源未來模式: 兩個香港**太陽能社區**的研究	香港特區政府` 政策創新與統籌辦 事處	$632,500	浸大、城市大學、 港大、成均館大學、 綠色和平
2018-2020	通過**社區參與**實現城市能源轉型的多樣性和關鍵：倫敦、弗萊堡（德國）、紐約市、東京、首爾和佛山的國際比較研究	浸大	$150,000	浸大、麥覺理大學、 Unit Géographie- Cités、京都大學、 成均館大學、 Sciences Po

我們的研究：重點及特式

3.1 Themes:

- Governance for sustainable energy transitions on the Asian region,
- focusing on solar PV,
- smart grid-enabled energy transitions (including demand response programmes), and
- public acceptance of nuclear energy

3.2 Multi-method research:

- (a) solar assessment,
- (b) household and school interviews,
- (c) deliberative energy workshops;
- (d) scenario developments

3.3 A global solar city network

3.4 Knowledge exchange:

- Hong Kong Solar Partnership

3.5 Inputs to public policies:

- solar resource assessment,
- inform target-setting,
- policy formulations,
- policy evaluation

香港太陽能伙伴合作平台

http://aesc.hkbu.edu.hk/hongkongsolarpartnership

A platform for dialogue, and sharing of good practice

商議式工作坊

https://youtu.be/hpzgrVkyfas?t=181

To collect citizens' informed views on controversial energy issues

香港太陽能地圖

http://digital.lib.hkbu.edu.hk/solarmap/

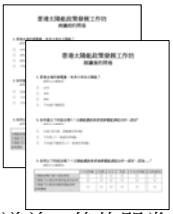
To engage the public through playful, and innovative ways

Hong Kong Solar Partnership
香港太陽能伙伴合作平台

- Aims:
  - Facilitate dialogue
  - Try new ways of public engagement
  - Share good practice
- Website – just launched
- Funding sources: HKBU, CLP, HEC
- Is underpinned by research

http://aesc.hkbu.edu.hk/hongkongsolarpartnership

「商議式」的工作坊
(Deliberative Workshops)



訪談　簡介文件　小組討論　專家答問環節　商議前、後的問卷

2016年　香港太陽能政策研究

第一階段 (2016年6月至2017年3月): 訪問99人

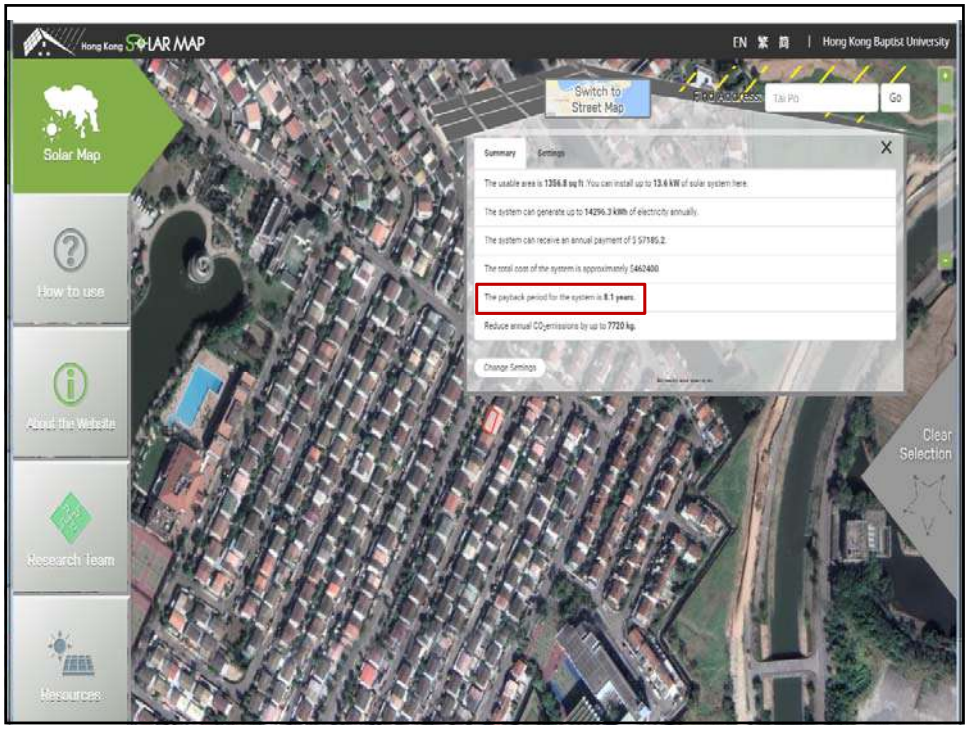
第二階段 (2016年11月4-5日): 商議式工作訪－參加者57人

第1類	第2類	第3類
潛在太陽能發電戶及村民	隨機抽樣的香港市民	公、私營各界別人士

https://youtu.be/hpzgrVkyfas?t=181

香港太陽能地圖
http://digital.lib.hkbu.edu.hk/solarmap/

- 你 可 估算 你的物業天台的太陽能發電潛力
- 評估 不同上網電價方案下，回本期可縮短多少年



II. 初步的研究結果

《香港太陽能社區》
的研究

《香港中、小學發展太陽能的潛力
與挑戰》研究

上網電價對回本期的影響

政策落實*前*:

<u>沒補貼</u>

回本期: **35**年

天台面積：約700平方尺

太陽能板：6塊

(每塊約1.65平方米, 共約10平方米, 佔1/7天台面積)

安裝費用：HK$**55,000**

年產電量：1,560度 (每天產電4.27度)

政策落實*後*:

系統發電容量	上網電價 (每度電)
≤10千瓦	5港元
>10千瓦至≤200千瓦	4港元
>200千瓦至≤1兆瓦	3港元

每年補貼收益：
HK$7,800

- 回本期：**7**年

相片來源: https://farm8.staticflickr.com/7110/6988871534_efe52a2614.jpg

《香港太陽能社區》的研究

http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/

研究目的	研究方法	探討的議題
• 以「**錦綉**」及「**康樂園**」兩個有潛能成為太陽能社區的屋苑作為研究案例 • 本研究旨在**探討社區參與對能源轉型的決策過程的作用**	• 分析社區及附近學校對上網電價實施前後的反應 • 在社區及學校進行現場太陽能測量，**評估太陽能潛力** • **訪問**相關持分者，探討香港太陽能社區的前景、發展方案、面臨的障礙及可行的策略，及對太陽能政策的想法 (已訪問錦綉43戶+康樂園29戶) • 舉行**工作坊** (2019年3月及6月)促進各方交流、商討對策	• 發展太陽能社區是否可行的能源選項？ • 香港是否可依靠太陽能社區作為可持續能源將來的一部分？ • 香港可從其他太陽能先進城市汲取甚麼經驗？ • 香港可怎樣處理從發展太陽能帶來的技術、經濟、社會政治及制度上的挑戰和機遇？

初步研究結果1:

受訪者認同上網電價是有效的政策，

但絕大部分仍持觀望態度。

"First movers" 未能起積極的示範作用

個案 A

個案 B

香港第一個太陽能社區?

Fairview Park 錦綉花園

If...
180W/solar PV Panel (1.65 m^2) x 6 solar PV panels
(~9.9m^2 = available rooftop area)

= ~1 kW potential installed capacity per rooftop

Potential solar PV capacity at Fairview Park
= ~1 kW X 5 024 houses
= ~5.4 MW ????

太陽能光伏系統發電分析

- 香港城市大學能源及環境學院/能量研發能源研究中心。
- 使用測量儀器 horicatcher 和分析軟件 Meteonorm 來估算錦繡花園屋頂每年可接收多少太陽能。
- 進一步估算安裝太陽能光伏系統的全年發電量。
- 最後計算每年可再生能源上網電價補貼。

初步研究結果：錦綉花園太陽能系統的成本及回報

- 系統面積：38m²
  (接受太陽能評估住戶的平均屋頂面積)
- 安裝成本：$160,000
  (按受訪住戶回覆的數字推算)
- 太陽能發電量：7,597千瓦時/年
  (接受太陽能評估住戶的平均太陽能發電量)
- 年度上網電價收入：$37,985
  (上網電價: $5/千瓦時)
- 估計回本期：4.2年

個案1

- 裝機容量: 6.6kW
- 發電量: 775 kWh (45日計算)
- 45日的上網電價電費: $3,900

受訪住戶太陽能發電潛力*未被好好利用*

我們早前為**32**戶錦綉居民進行太陽能潛力測量，僅**2**戶已安裝太陽能板。

若受訪居民的屋頂都裝上太陽能板，一年可生產：

= 約24萬度電

=*全港最大太陽能發電場*發電量：1/10

渠務署小濠灣污水處理廠
太陽能發電場

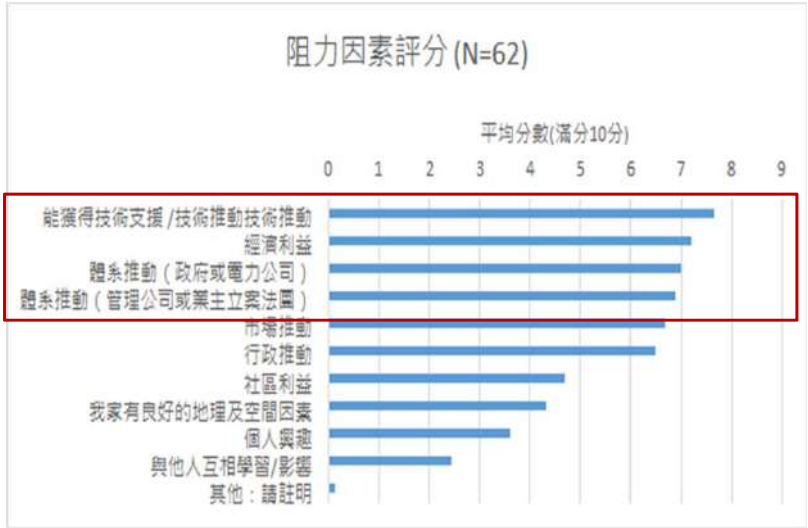
*小濠灣: 1.1 MW; 4,237塊太陽能板

=錦綉居民*每年少收的上網電價*：$120萬

= 800個錦綉住戶*一個月的管理費*(以$1,500計算)

受訪家庭: 錦綉: 35; 康樂園:27

訪問日期: 2018年8月至9月



ＲＥＦＩＴ落實後，
住戶仍面對經濟因素以外的多重障礙

圖十二 在香港發展太陽能需要面對的多種障礙

1. 申請程序、需時的不確定性:
"不知道要搞幾耐"

2. 技術問題:
- "isolation transformer"
  – CLP 的安全準則過高?
- 潛建... 漏水

3. 工程承辦商質素參差:
"好多公司話可以做，但全部拿不出 references"

初步研究結果2:
太陽能行業存在隱憂

技術參差不齊？信譽成疑?
業界人手及其專業的增長，會否滯後於市場的需要?

太陽能公屋：任由損壞廢武功　房屋署塞責
(東網 2015年2月16日)

https://hk.on.cc/hk/bkn/cnt/news/20150216/bkn-20150216214200810-0216_00822_001.html?eventid=4028812546ae78770146beaa2b891243&eventsection=hk_news&t=bb4

香港的安裝成本高

- 香港：安裝成本約佔太陽能系統價格的**1/3**
- 相對德國及中國大陸：

初步研究結果3:
需要重視 太陽能發展的*社會*問題:「*公平*性」

- 上網電價可能引致的社會問題 :

「*劫貧濟富*」?

- 再進一步放寬低密度住宅裝設太陽能系統的限制

–「*政策傾斜*」?

https://www.storm.mg/article/693913

《香港中、小學發展太陽能的潛力與挑戰》研究

學校: 是推動香港可再生能源的重要一環

	村屋/ 低密度住宅	私人大廈	學校
地	• 村屋：> 40,000 • 天台用途：晒衫、BBQ及其他休憩用途	• 住宅、商業、工業大廈 • 企業：購買可再生能源證書	• 政府學校-約900間 • 天台、停車場等
回本期	<10年	<3年 (工、商界)	• 不大重要
太陽能的價值	• 慳電費/賺少少錢 • 減排/環保	• 社會企業責任 • 保持競爭力	• 教育價值 (STEM) • 減排/環保

相片來源: https://www.hkcnews.com/news_%E6%96%B0%E8%81%9E/hk-discuss/2017/12/%E4%B8%81%E5%B1%8B-%E4%B8%81%E6%AC%8A-%E5%8E%9F%E5%B1%85%E6%B0%91-20171218043112_e57c_large.jpg; http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/; https://s.yimg.com/uu/api/res/1.2/J0gt0B3O0yNq6P_5G8EIHw--~B/aD0xOTk7dz0zNjA7c209MTthcHBpZD15dGFjaHlvbg--/http://media.zenfs.com/en_us/News/singtao/236232.jpg; www.isd.gov.hk http://w22.property.hk/article_content.php?ln=sc&author=PHK_NEWSPROP&id=53143

訪問及評估太陽能發電潛力

學校數目：22間

調查日期：2018年1月至8月

學校種類：17間資助學校、2間直資學校及3間私立或國際學校。

研究結果1:

受訪學校太陽能發電潛力被大量浪費

若**19**間受訪學校使用校園天台
僅**一半**面積安裝太陽能板
一年可生產：

=約240萬度電

=751個香港三人家庭
一年的用電量

=全港最大
太陽能發電場發電量的2倍

渠務署小濠灣污水處理廠太陽能發電場

《香港中、小學發展太陽能的潛力與挑戰》研究受訪學校太陽能系統及潛力表[1]

受訪學校	有沒有太陽能系統？狀況如何？	目前太陽能系統發電容量（千瓦）	目前太陽能系統全年發電量（度）	學校天台5成面積（平方米）	如使用學校天台5成面積安裝太陽能系統，估計發電量（度）	學校地區
1	有	65.4	44,500.0	220.0	41,776.7	觀塘
2	有	41.5	50,000.0	500.0	110,733.3	荃灣
3	有	3.4	2,666.0	180.0	38,037.5	西貢
4	有	3.2	3,225.0	1,400.0	332,675.0	南區
5	有	3.0	7,417.0	160.0	22,334.2	元朗
6	有	2.4	770.0	220.0	48,585.7	葵青
7	有	2.3	1,600.0	650.0	127,022.2	葵青
8	有	沒有資料	3,000.0	300.0	58,497.0	觀塘
9	有、但已停止運作	0.3	0	900.0	197,158.0	大埔
10	有、但已停止運作	沒有資料	0	390.0	77,702.2	東區
11	有、但已停止運作	沒有資料	0	160.0	33,418.7	元朗
12	有、但已停止運作	沒有資料	0	1,300.0	424,199.2	九龍城
13	沒有	N/A	N/A	1,000.0	192,353.6	大埔
14	沒有	N/A	N/A	500.0	114,174.7	葵青
15	沒有	N/A	N/A	350.0	57,643.6	元朗
16	沒有	N/A	N/A	300.0	67,981.5	離島
17	沒有	N/A	N/A	250.0	57,093.5	離島
18	沒有	N/A	N/A	430.0	84,749.3	沙田
19	沒有	N/A	N/A	1,800.0	394,131.0	西貢
總數		121.5千瓦	113,178度	11,010平方米	2,480,266.6度	

[1] 在22間受訪學校當中，有19間學校有提供足夠數據作分析，其餘3間受訪學校的數據沒有包括在此數據表內。

約240萬度電

約11萬度電

太陽能潛力 vs 現況

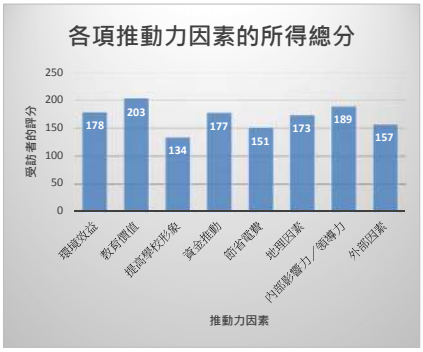
實現潛力=4.6%

被浪費潛力=~95%！

研究結果2 教育意義最重要，*回本期不重要*

「*上網電價*」政策*未能*推動學校安裝太陽能系統

太陽能學校: 為何而做?



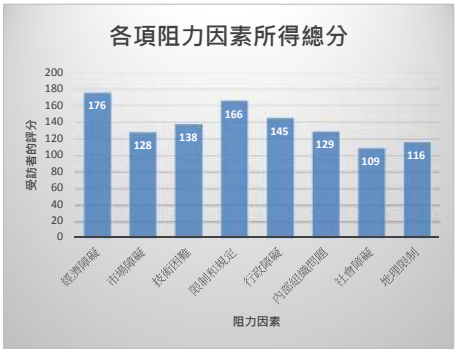
第一位: 教育價值	• 三大類 - 科普教育、環保教育、關愛社區
第二位: 內部影響力/領導力	• 來自 - 校長、老師、學生、家長、校內環保團體
第三位: 環境效益	• 減少溫室氣體排放
第四位: *資金推動*	• 資金來源:如ＥＣＦ; 回本期: 不重要

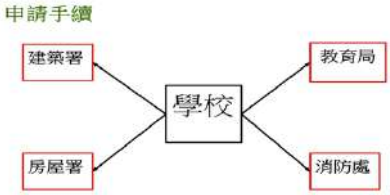
研究結果3

學校在發展太陽能項目時遇上多重阻力

主要阻力

- 缺乏初始資金
- 太陽能項目申請手續繁複
- 行政工作量大





第一位	經濟障礙
第二位	規管上的限制
第三位	行政障礙
第四位	技術困難

33

Hong Kong Solar Partnership

Solar School Working Group – 第一次會議

2018年11月6日

學界顧慮:

- 有多少學校能受惠?
- 學校能否保留一定自主權，例如讓老師及同學參與項目的設計?
- 政府、中電及港燈，能否做得夠快、夠好?

學界建議:

- 盡快公布細節
- 「一站式」、「中央採購」...
- 建立平台 – 經驗分享 (項目、融合STEM教學)
- 問卷調查 – 了解校界興趣、需要哪類政策

一般資訊 › 採電學社：學校及非政府福利機構太陽能支援計劃

採電學社：學校及非政府福利機構太陽能支援計劃

1. 「採電學社」由香港特別行政區政府(“政府”)推行，旨在資助和協助：

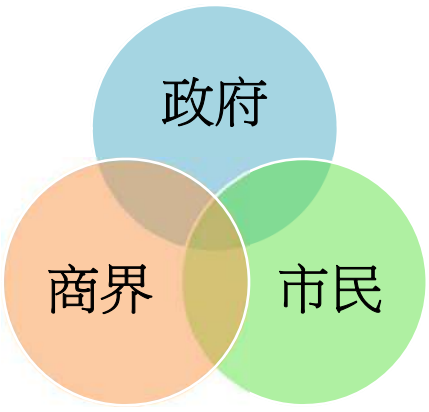
   a. 學校(官立及牟利學校除外)；及

   b. 接受社會福利署經常津助的非政府福利機構

   在其處所安裝小型太陽能光伏系統。

2. 「採電學社」是政府推動本地可再生能源發展的一項計劃。此計劃透過向合資格學校和非政府福利機構提供資助和一站式服務，協助它們在其處所安裝小型太陽能光伏系統，從而能參加本地兩間電力公司推行的上網電價計劃。在「採電學社」下，機電工程署會跟進整個安裝太陽能光伏系統的過程(包括進行實地視察和技術評估、擬定太陽能光伏系統的設計、採購設備、安裝太陽能光伏系統和進行系統測試等)，以及協助合資格學校和非政府福利機構參加上網電價計劃(包括向電力公司提交上網電價申請，以及就電網接駁安排事宜與電力公司聯絡等)。在「採電學社」下，所有與安裝太陽能光伏系統和申請參加上網電價有關的開支(包括太陽能光伏系統的資本開支、安裝費用和專業服務費用等)全部會由「採電學社」支付。

III. 政策建議



政策建議 1: 可再生能源政策必須具有清晰的 “願景 (vision)” 和“目標(target)”

2017年11月浸大工作坊:

市民對政府的信任度下降?

市民對政府發展太陽能抱有懷疑:

- 市民不清楚政府發展太陽能的展望及目標
- 市民質疑政府的可再生能源政策缺乏持續性、系統性 （如：初置成本的補貼、本地太陽能產業的發展）
- 市民認為政府**沒有解決**住戶安裝太陽能系統帶來的法規問題

首爾經驗: 可再生能源*政策* 必須具有清晰的”*願景*” 和明確 ”*目標*”

國家層面	可再生能源目標: 20% - 2030 **可再生能源配額制** (Renewable Portfolio Standards) • **18間大型發電公司** (>500MW): 2012年 - **2%**.... 2024年- **10%** 的發電量來自可再生能源 • + “可再生能源證書制度” (Renewable Certificate)	香港？ “根據現時估計，在2030年前太陽能只可應付約1至1.5%的香港總電力需求。” (香港氣候行動藍圖 2030+，2017)
首爾層面	**首爾市長朴元淳: 首爾成為 "無核、能源自主的社會”** **首爾** 「減一座核電廠」政策 • 2012年4月出台: 使首爾從2011年用電量約為400百萬噸油當量（TOE），占全國的10%，下降到2014年約200萬噸油當量，省下相當一座核電廠一年的發電量（約９６億度電）；能源自給率從2.8%提高到5%。 • *公眾*參與政策制定: The Hope Policy Advisory panel (The Environment & Culture Subcommittee), Policy Hearing Workshop, Citizen congress, etc. • 核心項目: **“Seoul City of Sunlight Project”: 320 MW** 首爾的可再生能源上網電價補貼 (REFIT) (2013年起)	??
社區層面	• 88 個「能源自主社區」(目標增至100) • 目標: 在住宅大廈及屋苑安裝 40,000 250W 微型太陽能系統	??

政策建議 2: 香港的太陽*資源評估*及*目標的制定*，可透過*公眾參與*來優化

香港: 太陽能潛力有沒有被低估?

"根據現時估計，在2030年前太陽能只可應付約**1至1.5%**的香港總電力需求。" (香港氣候行動藍圖2030+，2017)

村屋 (超過40,000間)

錦綉花園 (約5,000戶)

公屋及私人住宅大廈

政府學校 (約900間)

政府建築物、天橋、隔音屏障、運動場看台

水塘

?

相片來源: https://www.hkcnews.com/news_%E6%96%B0%E8%81%9E/hk-discuss/2017/12/%E4%B8%81%E5%B1%8B-%E4%B8%81%E6%AC%8A-%E5%8E%9F%E5%B1%85%E6%B0%91-20171218043112_e57c_large.jpg;
http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/;

政策建議 3: 尋找發展太陽能的「香港模式」- 大力推動太陽能*社區*、太陽能*學校*

"社區"

1. **大量太陽能**資源未被利用
2. 有機會能「**規模化**」地發展太陽能 (如錦繡)
3. **領導力:** 來自居民領袖
4. 社區 **網絡**
5. 太陽能的**「總」價值**:
   + 太陽能社區的"*社會*價值"
   - 如, 社會和諧，節能意識的提高

"學校"

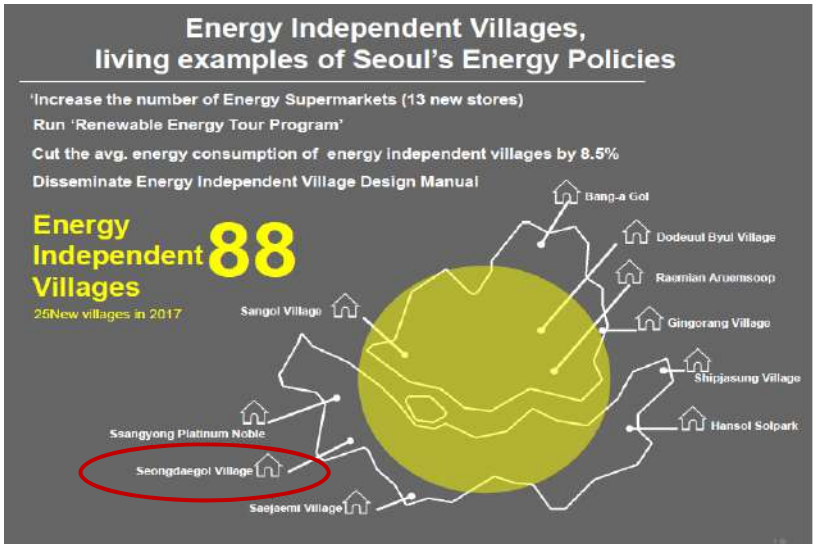
1. **大量太陽能**資源未被利用
2. 有機會能「**規模化**」地發展太陽能 (按學校類型; 辦學團體的議價優勢)
3. **領導力:** 來自熱心的校長及老師
4. 學校**網絡:** (e.g. 校長聯會、辦學團體，如匡智會的網絡)
   → 動員能力、
5. 太陽能的**「總」價值**:
   環境、經濟+ "*教育*價值"
   → STEM

香港首個太陽能社區?

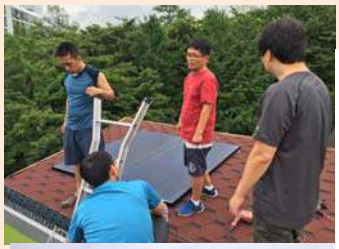
新蒲崗居屋采頤花園
- 902 塊太陽能板
- 12座居屋、3,000 伙
- 估計年產近20萬度電、賺逾百萬元，最快8年回本

啟德明渠

首爾經驗: 相信、及善用*社區參與*的*力量*



首爾 盛大谷 (Sungdaegol):
能源自主社區



Flat Cable
(專利)

(Photo credits: So-young Kim)

橫濱
Home battery

(Photo credits: AESC, 2015)

Songpa-gu Guyeo Apartment

(Lee, 2017)

首爾經驗: 首爾政府積極推動 由“個人參與”、“社區參與”，到“全民參與”

1 在主要地標安裝太陽能系統
– 增加公眾認識、支持

The world's first solar-power soundproof tunnel on the Dongbu Expressway

https://www.dailymotion.com/video/x6upnun

https://www.hk01.com/%E5%91%A8%E5%A0%B1/242154/%E4%B8%8A%E7%B6%B2%E9%9B%B8%E5%83%B9-%E9%96%88%E6%94%BE%E9%9B%B8%E7%B6%B2%E8%A8%8E%E8%AB%96%E7%84%A1%E6%AD%A2%E5%A2%83-%E6%B8%AF%E4%BA%BA%E7%94%A8%E9%9B%BB%E4%BD%95%E6%99%82%E6%9C%89%E5%BE%97%E6%8F%80

https://medium.com/@sns.knowingkorea/the-worlds-first-solar-power-soundproof-tunnel-on-the-dongbu-expressway-b8e50c06573c

首爾政府積極推動
由“個人參與”、“社區參與”，到“全民參與”

2 太陽能發電市民基金
– 公眾集資

目標：
- 公路及道路安裝10MW太陽能發電設施 (2018前)

做法：
- 政府支持成立的市民基金
- 首爾市民參與公共設施上的太陽能投資項目
- 基金上限為50億韓圜(3.45億港元)
- 而每名市民最多可認購1億韓圜(69萬港元)

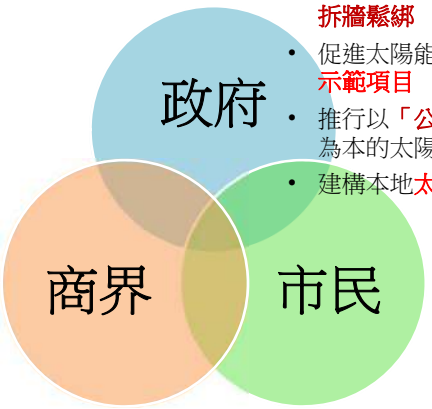
政策建議 4: 更充份地*重視*、*推化*、運用太陽能學校、太陽能社區的示範項目

- 分享正面、**成功**的例子
- **模範太陽能屋、模範太陽學校 – 節省項目設計、申請的時間及成本**
- **共同**研發、**解決**問題

弘立書院(ISF Academy)

聖言中學

總結: 香港太陽能政策的下一步發展



- **領導力: 願景、目標、時間表**
- **政策連貫性: 協調**有關政策部門、**拆牆鬆綁**
- 促進太陽能社區、太陽能學校的**示範項目**
- 推行以**「公平」、「全民參與」**為本的太陽能政策
- 建構本地**太陽能產業**

- 創新**商業模式**、滿足用家需要
- 中電、港燈，太陽能承辦商有真正的**積極性**去做得**快**、做得**好**

- **從「個人參與」、到「社區參與」、到「全民參與」**
- **社區資源、集體智慧**
- 公眾對政策的支持

https://www.staystock.com/products/lightbulb-cartoon-character-points

錦綉花園屋頂每年每平方米的發電量

11戶試驗研究
(2018年2月)

Assessment No.	House No.	Azimuth (direction)	Inclination	H_Gkhor: Irradiation of global rad., tilted plane, with high horizon (Annual amount)	polycrystalline Silicon panel (Annual electricity generation) 12%	Amorphous Silicon panel(flexible) (Annual electricity generation) 8%	DSSC (Annual electricity generation) 10%
		degrees	degrees	kWh/m^2/year	kWh/year	kWh/year	kWh/year
1	1.1	-58	19	1343	161.16	107.44	134.30
2	1.1	122	19	1247	149.64	99.76	124.70
3	1.1	32	13	618	74.16	49.44	61.80
4	1.2	45	17	1361	163.32	108.88	136.10
5	1.2	-135	17	1249	149.88	99.92	124.90
6	1.3	-58	16	1307	156.84	104.56	130.70
7	1.3	122	16	1253	150.36	100.24	125.30
8	1.4	-73	5	890	106.80	71.20	89.00
9	1.4	107	5	869	104.28	69.52	86.90
10	1.4	-73	16	1273	152.76	101.84	127.30
11	1.4	107	16	1273	152.76	101.84	127.30
12	1.5	55	9	1072	128.64	85.76	107.20
13	1.5	-125	9	1000	120.00	80.00	100.00
14	1.5	-35	17	1347	161.64	107.76	134.70
15	1.5	145	17	1220	146.40	97.60	122.00
16	1.6	55	4	1248	149.76	99.84	124.80
17	1.6	-35	19	1357	162.84	108.56	135.70
18	1.6	145	19	1211	145.32	96.88	121.10
19	1.7	-150	2	1086	130.32	86.88	108.60
20	1.7	-60	17	1347	161.64	107.76	134.70
21	1.7	120	17	1257	150.84	100.56	125.70
22	1.8	119	11	1274	152.88	101.92	127.40
23	1.8	-61	3	1011	121.32	80.88	101.10
24	1.8	-61	19	1339	160.68	107.12	133.90
25	1.8	119	19	1251	150.12	100.08	125.10
26	2.1	32	1	943	113.16	75.44	94.30
27	2.1	-58	19	1310	157.20	104.80	131.00
28	2.1	122	19	1156	138.72	92.48	115.60
29	2.2	30	7	755	90.60	60.40	75.50
30	2.2	-60	19	1336	160.32	106.88	133.60
31	2.2	120	19	1249	149.88	99.92	124.90
32	2.3	85	3	1088	130.56	87.04	108.80
33	2.3	-95	19	1283	153.96	102.64	128.30
34	2.3	85	19	1300	156.00	104.00	130.00

錦繡花園物業管理公司：
安裝太陽能板申請表

申請安裝太陽能板 AD/FRM/36

Appendix I

舊版本 (2017年9月)

安裝太陽能板及輔助設備的條款及細則

1. 業主必須向管理公司提交太陽能板的規格、安裝方法及輔助設備清單等資料，以便管理公司作出審批。
2. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。
3. 業主須就有關太陽能板、其輔助設備與安裝向機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並須遵守有關條例的要求及規定。
4. 業主須自行承擔所有就安裝太陽能板及有關輔助設備所引致的任何損毀或損失。
5. 無論任何情況下，管理公司及錦繡花園道路擁有人，均不須對有關安裝之直接 或間接引致的損毀或損失，負上任何責任。
6. 業主須定期保養太陽能板以確保該等設備外觀良好及結構安全，否則管理公司有權要求業主移除有關之太陽能板，並將屋頂還原至原有模樣，或採取任何管理公司認為合適的行動，所有涉及的費用均由業主負責。
7. 對於沿着錦繡大道及錦繡河的單位，太陽能板應安裝於背向大道或河道的屋頂後方位置。
8. 安裝在屋頂的太陽能板，總面積不可超越 4 平方米，以及距離中牆 (如有) 最少 1 米。
9. 當業主接獲管理公司或政府部門的要求，業主必須拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。
10. 管理公司有權不時檢視及修改安裝太陽能板的條款及細則。
11. 管理公司對有關申請擁有絕對否決權，尤其是相關物業存有違規建築物。
12. 當收到鄰近住戶的合理投訴時，管理公司保留可要求業主拆除太陽能板及有關輔助設備的權利。

新版本 (2018年5月)

安裝太陽能板及輔助設備的條款及細則

1. 業主必須向管理公司提交太陽能板的規格、安裝方法及輔助設備清單等資料，以便管理公司作出審批。
2. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。
3. 業主須就有關太陽能板、其輔助設備與安裝向機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並須遵守有關條例的要求及規定。
4. 業主須自行承擔所有就安裝太陽能板及有關輔助設備所引致其他房屋的任何損毀或損失。
5. 無論任何情況下，管理公司及錦繡花園道路擁有人，均不須對有關安裝之直接或間接引致的損毀或損失，負上任何責任。
6. 業主須確保單位有足夠的結構承托力安裝太陽能板，以及定期保養太陽能板以確保該等設備外觀良好及結構安全，否則管理公司有權要求業主移除有關之太陽能板，並將屋頂還原至原有模樣，或採取任何管理公司認為合適的行動，所有涉及的費用均由有關業主負責。
7. 太陽能板只可安裝在屋頂的位置，除屋頂部可貼近邊緣外，距離單位左右兩邊及底部邊緣不少於 300 毫米，太陽能板須與屋頂平行安裝且高度離屋頂不可超過 150 毫米。
8. 當業主接獲管理公司或政府部門的要求，業主必須自費拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。
9. 管理公司有權不時檢視及修改安裝太陽能板的條款及細則。
10. 管理公司對有關申請擁有絕對否決權，尤其是相關物業存有違規建築物。
11. 當收到鄰近住戶的合理投訴時，管理公司保留可要求業主拆除太陽能板及有關輔助設備的權利。

錦繡花園物業管理公司：安裝太陽能板申請表

申請安裝太陽能板

AD/FRM/36

Appendix I

舊版本 (2017年9月)

安裝太陽能板及輔助設備的條款及細則

1. 業主必須向管理公司提交太陽能板的規格、安裝方法及輔助設備清單等資料，以便管理公司作出審批。
2. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。
3. 業主須就有關太陽能板、其輔助設備與安裝向機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並須遵守有關條例的要求及規定。
4. 業主須自行承擔所有就安裝太陽能板及有關輔助設備所引致的任何損毀或損失。
5. 無論任何情況下，管理公司及錦繡花園道路擁有人，均不須對有關安裝之直接 或間接引致的損毀或損失，負上任何責任。
6. 業主須定期保養太陽能板以確保該等設備外觀良好及結構安全，否則管理公司有權要求業主移除有關之太陽能板，並將屋頂還原至原有模樣，或採取任何管理公司認為合適的行動，所有涉及的費用均由業主負責。
7. 對於沿着錦繡大道及錦繡河的單位，太陽能板應安裝於背向大道或河道的屋頂後方位置。
8. 安裝在屋頂的太陽能板，總面積不可超越 4 平方米，以及距離中牆 (如有) 最少 1 米。
9. 當業主接獲管理公司或政府部門的要求，業主必須拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。
10. 管理公司有權不時檢視及修改安裝太陽能板的條款及細則。
11. 管理公司對有關申請擁有絕對否決權，尤其是相關物業存有違規建築物。
12. 當收到鄰近住戶的合理投訴時，管理公司保留可要求業主拆除太陽能板及有關輔助設備的權利。

新版本 (2018年5月)

安裝太陽能板及輔助設備的條款及細則

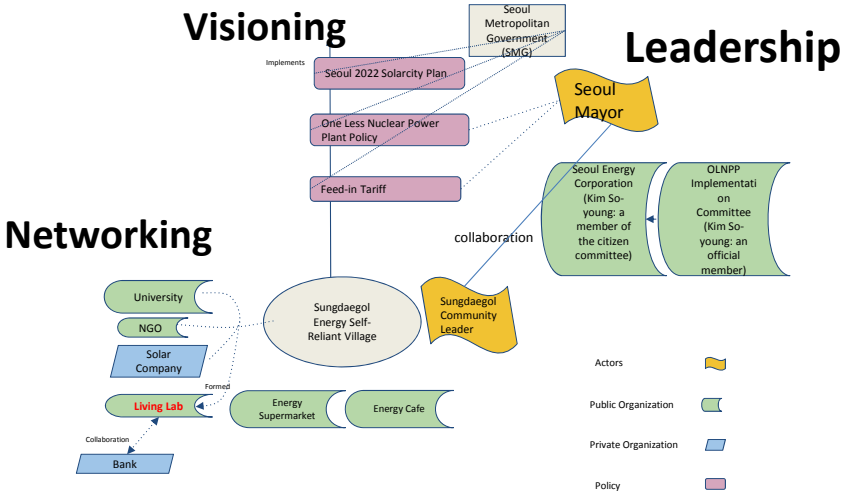
1. 業主必須向管理公司提交太陽能板的規格、安裝方法及輔助設備清單等資料，以便管理公司作出審批。
2. 除了以不反光物料製造的太陽能板外，任何輔助設備包括水箱、電子配件等，均不可安裝在屋頂位置。
3. 業主須就有關太陽能板、其輔助設備與安裝向機電工程署、屋宇署及其他相關政府部門申請及取得同意及批准，並須遵守有關條例的要求及規定。
4. 業主須自行承擔所有就安裝太陽能板及有關輔助設備所引致其他房屋的任何損毀或損失。
5. 無論任何情況下，管理公司及錦繡花園道路擁有人，均不須對有關安裝之直接或間接引致的損毀或損失，負上任何責任。
6. 業主須確保單位有足夠的結構承托力安裝太陽能板，以及定期保養太陽能板以確保該等設備外觀良好及結構安全，否則管理公司有權要求業主移除有關之太陽能板，並將屋頂還原至原有模樣，或採取任何管理公司認為合適的行動，所有涉及的費用均由有關業主負責。
7. 太陽能板只可安裝在屋頂的位置，除屋頂部可貼近邊緣外，距離單位左右兩邊及底部邊緣不少於 300 毫米，太陽能板須與屋頂平行安裝且高度離屋頂不可超過 150 毫米。
8. 當業主接獲管理公司或政府部門的要求，業主必須自費拆除已安裝的太陽能板及有關輔助設備，並同時將屋頂還原至原有模樣。
9. 管理公司有權不時檢視及修改安裝太陽能板的條款及細則。
10. 管理公司對有關申請擁有絕對否決權，尤其是相關物業存有違規建築物。
11. 當收到鄰近住戶的合理投訴時，管理公司保留可要求業主拆除太陽能板及有關輔助設備的權利。

Social values of solar *beyond efficiency*

"其實我地好希望好希望係*全線*咁樣，由你細細個開始呢，灌輸一個環保嘅概念，可生能源可能係其中一…可能係小部分架姐，我地係好想好想*再生能源*係教人點樣去*慳電*，真係你用少啲呢先至係最緊要架，….做緊呢個再生能源，亦都有個weather station，即係話到俾佢聽呢佢係發緊幾多電，發緊幾多電，好坦白講，好少架姐… 但係正正就係咁呢我就要話俾人聽，其實發電係一啲都唔容易，亦都需要好多資源，所以呢你慳啲用呢係反而個幫助係仲大，咁呢樣野係我地好想向成個教育裏面呢，帶出黎嘅 。"

(與會者 – 浸大香港太陽能學校工作坊, 2018年6月30日)

盛大谷 太陽能社區: *社區網絡* 與 *資源創造*



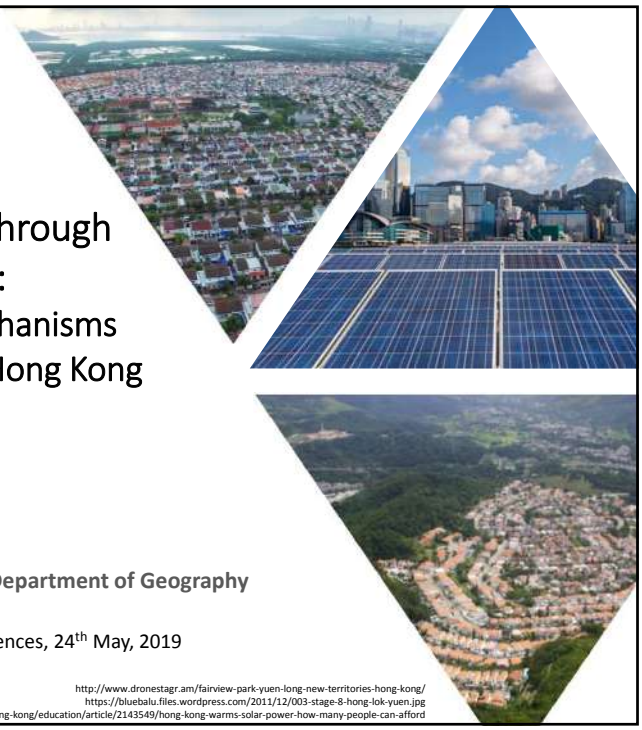
Mah, N.-y. D., Forthcoming. Community solar energy initiatives in urban energy transitions: A comparative study of Foshan, China and Seoul, South Korea. Energy Research & Social Science.

鳴謝

本研究項目（項目編號：2017.A2.027.18B）獲香港特別 行政區政府政策創新與統籌辦事處公共政策研究資助計劃／策略性公共政策研究資助計劃撥款資助。

Appendix 7-12: Presentation slides of the transdisciplinary Symposium on Environmental Health and Social Sciences on 24th May 2019

Governing urban community energy through renewable feed-in tariff (REFIT) policy: Contexts, capabilities, and scaling-up mechanisms of two prospective solar communities in Hong Kong



Dr. Daphne Mah

Director, Asian Energy Studies Centre, Assistant Professor, Department of Geography

Transdisciplinary Symposium on Environmental Health and Social Sciences, 24th May, 2019
Hong Kong Baptist University

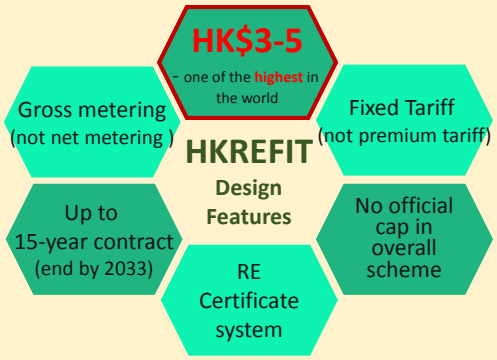
http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/
https://bluebalu.files.wordpress.com/2011/12/003-stage-8-hong-lok-yuen.jpg
https://www.scmp.com/news/hong-kong/education/article/2143549/hong-kong-warms-solar-power-how-many-people-can-afford

1. Context

- **Global climate impacts** and **local air pollution** – some of the most pressing environmental health problems confronting contemporary societies
- **Renewable energy**: a mitigation measure to climate impacts, regional air pollution, etc.
- **Urban solar** – has become a global trend as solar photovoltaic (PV) costs continue to decline and policy-makers seek effective post-Fukushima climate/ energy strategies (including Seoul, Tokyo, Singapore, London, and New York City)
- **Community-based solar** initiatives have emerged in many major leading cities, in different forms and with different outcomes
- In **Hong Kong**, solar – has increased in political priority.
- Now: RE = Only about 1 per cent of Hong Kong's electricity generation
- The government: RE has the potential to provide **3 to 4 %** of the energy mix.

HK's renewable feed-in tariff

- introduced in **Oct 2018**.



- HK REFIT rate: Maximum - HK$5/kWh (**0.64** USD)
- one of the highest in the world: Japan (**0.24** USD), Germany **(0.099–0.14 USD)**, China (**0.053**USD/kWh)

Solar vision and targets in leading cities

- HK's current solar PV installation is only approximately **5 MW**
- But ambitious targets elsewhere: New York has set a solar PV target of **1,000** MW by 2030, London **2,000** MW by 2050, and Seoul **1,000** MW by 2022

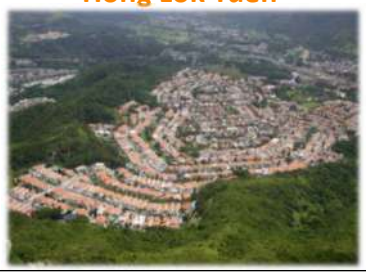
	Hong Kong	Seoul	Singapore	London	New York City
Solar vision	??? -Policy Address 2018/ Climate Change Action Plan 2030+ -Apply wider among Hong Kong public sector under the REFIT and RE certificate system	-"2022 Solarcity Plan" -"One Less Nuclear Power Plant" initiative	-"SolarNova" – install panel across HDB blocks -research and development for higher performance of solar PV systems	-"Solar Action Plan" – for zero carbon city -planning system for solar installation -solar technology investment and improvement	-"OneNYC plan" -To identify and remove barriers to solar deployment -Provision on solar jobs -"Solar 100"
Solar target (MW/GW)	Potential in total electricity generation: 1 – 1.5% (~660MW) by 2030	**1,000 GW** by 2022	350 MW by 2020	850 MW by 2030 ; **2,000 MW** by 2050	350 MW by 2025 ; **1,000 MW** **by 2030**
Solar resources (kWh/m^2)	**3.6**	4.9	4.5	2.8	4
Solar installation (at present)	<5MW (2017)	73.143 MW (2016)	112.3 MW (2017)	113.2 MW (2017)	85 MW (2016)
Solar in electricity generation (at present)	10,278 MWh (2016)	86,829 MWh (2016)	Renewable Energy: 814 GWh (2014)	102.4 GWh (2017)	39,530 MWh (annual) (2016)

"Engaging the community to develop a model for sustainable energy futures: A case study of two prospective solar communities in Hong Kong"

Public Policy Research Grant (funded by the Hong Kong government):
(Sep 2018- Aug2019)
Collaborating institutions/ organisations: BU, CityU, HKU, Sungkyunkwan University, Greenpeace

Fairview Park

Hong Lok Yuen



No. of houses	**5,024** (semi-detached)	**1,192** (semi-detached/ detached)
Median monthly household income (HK average: HK$30,450)	$65,000	$121,160
Solar resources	243,099.81 kWh/year (32 households)	212,869.92 kWh/year (19 households)
Unique features	Adjourning ***Ramsar Site*** – Wetland of International Importance	/

http://www.dronestagr.am/fairview-park-yuen-long-new-territories-hong-kong/
https://bluebalu.files.wordpress.com/2011/12/003-stage-8-hong-lok-yuen.jpg

Solar Developments in communities… *before* and *after* REFIT

HONG KONG…

- **Apr 2018** – Announcement of REFIT's details
- **May 2018年** – CLP started to receive application
- **Aug 2018** – HEC started to receive application
- **Oct 2018** – **CLP REFIT launched & received 1,100 applications**
- **Mid-Oct 2018** – Gov. relaxed the height constraint for installation in **exempted village houses**
- **Jan 2019** – HEC REFIT launched
- **Feb 2019** – Gov. announced "Solar Harvest" providing **school** with one-stop installation support
- **Mar 2019** – CLP & HEC received about **1,770** applications

FAIRVIEW PARK

- **Sep 2017** – *MO. Set up "Application Form for Installation of Solar Panel"*
- **May 2018** – MO. **revised** the Application Form – relaxation of size constraint from 4 sq.m to "any size" with **buffer of at least 30cm** from each roof edges

- **Jan 2019** – **21** households submitted forms to MO., **16** households approved

HONG LOK YUEN

- **Sep 2018** – Owners' Asso. organized Solar Talk & set up Whatsapp group. Developing **group-purchasing**
- **End-Sep 2018** – Owners' Asso. Invited 8 solar contactors to offer quotations and published to residents
- **Dec 2018** – MO. seeking legal advices on the DMC. Group-purchasing on hold
- **Apr 2019** – Total of about **6** houses installed with PV system

3. Theoretical perspectives

(1) Community energy:

- Forms of energy governance: **State**-led, **market**-led, **community**-led (Owen 1999)
- But relatively limited discussion on community-based energy initiatives
- is often associated with terms such as **energy community**, **citizen energy**, **community energy initiatives**

- "**A community**"
  - An important **arena for energy transitions** to take place (Mah, 2019)
  - A **space** in which **collective action** happens due to **geographic proximately** (Haggett & Aitken, 2015)

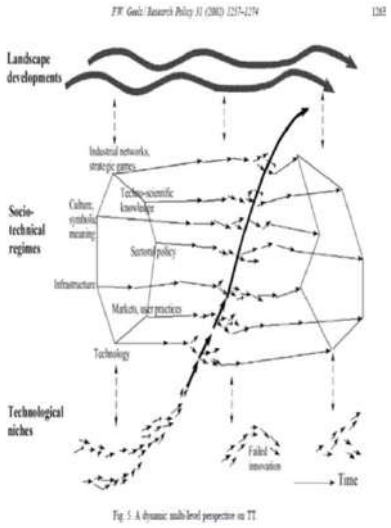
Community as an arena of energy transitions

Utility-based energy systems (Current)	Community-based energy systems (Emerging)
Centralised; **Fossil-fuel**/ nuclear-based	**Distributed** energy generation with more **renewable**
More top-down; **Government, Incumbent utilities** as key actors	More bottom-up; **end-users** play proactive roles as "**prosumers**"
Ideologies: **Efficiency and effectiveness**	Inclusion of **social values** – inclusiveness, fairness, energy autonomy, etc.

http://www.hkcma.asia/ch/member_directory_detail.php?fid=38
https://www.scmp.com/news/hong-kong/education/article/2143549/hong-kong-warms-solar-power-how-many-people-can-afford

(2) Socio-technical system thinking of community energy:

- **Socio-technical energy transitions literature** (Geels, 2002; Kemp and Parto, 2005)
- **the "lock-in" effect** of **established energy technology and incumbent utilities**: re-inforced in energy systems by their own ideas, culture, rules, user practices, networks, and technical competence that have developed over time (Smith et al., 2005; Sovacool, 2009; Szatow *et al.*, 2012).
- **Niches:** such as new energy technologies, new energy governance approaches (e.g. community energy), can scale up, and weaken regimes through niche diffusion processes
- **Co-evolution** of technological, socio, cultural, and institutional changes are required
- **Critical processes** matter: **Community leadership**, envisioning, experimentation, social learning, networking, scaling up niche innovations
- **Contextual factors** explain the differences: Socio-economic and political contexts, **trust**, local traditions, **community cohesion**

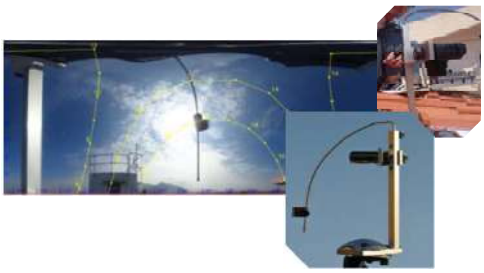


(Geels, 2002)

4. Methodology: A multi-method comparative study

Research questions:

- What are the **impacts** of the Hong Kong **feed-in tariff** on our case communities?
- How and to what extent do community stakeholders **interact** and create **conducive/ inhibitive conditions** for the **scaling up process**?



Data collection:

2018.9-2019.1 Quantitative solar resource assessment conducted in Fairview Park (32 households) and Hong Lok Yuen (19 households)

2018.8-ongoing: Qualitative in-depth household interviews in FP (44 households) and HLY (31 households) and other community stakeholders

2019.3 Community workshop in FP
2019.6 Community workshop in HLY

2018.11 - ongoing HK Solar Partnership (BU-led)
(Solar Community Working Group + Solar School Working Group)

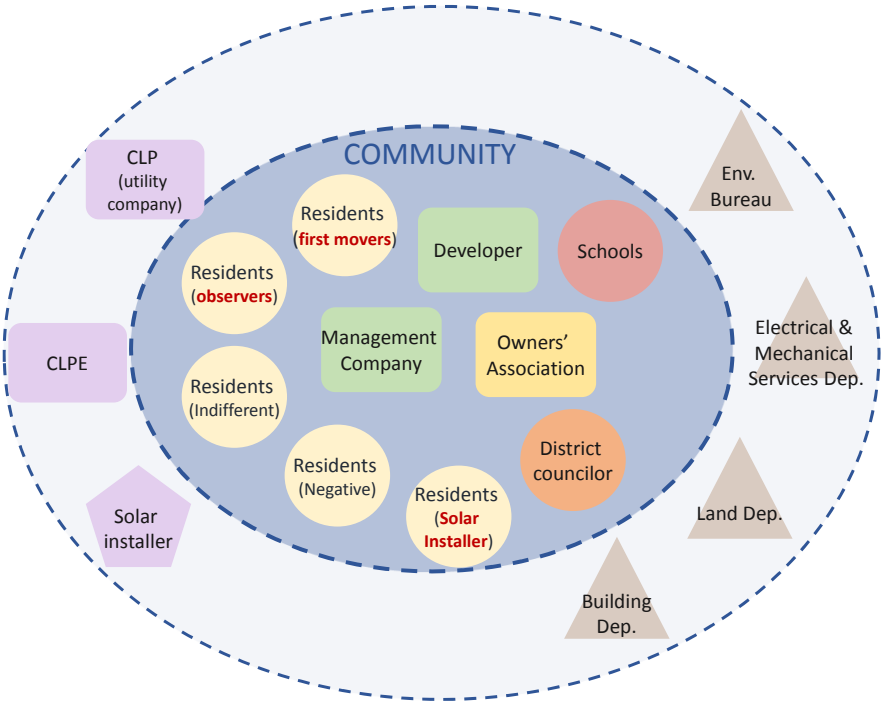
5. Findings

Finding1:
The case communities possess *substantial solar resources*, as well as high levels of *community capacities*

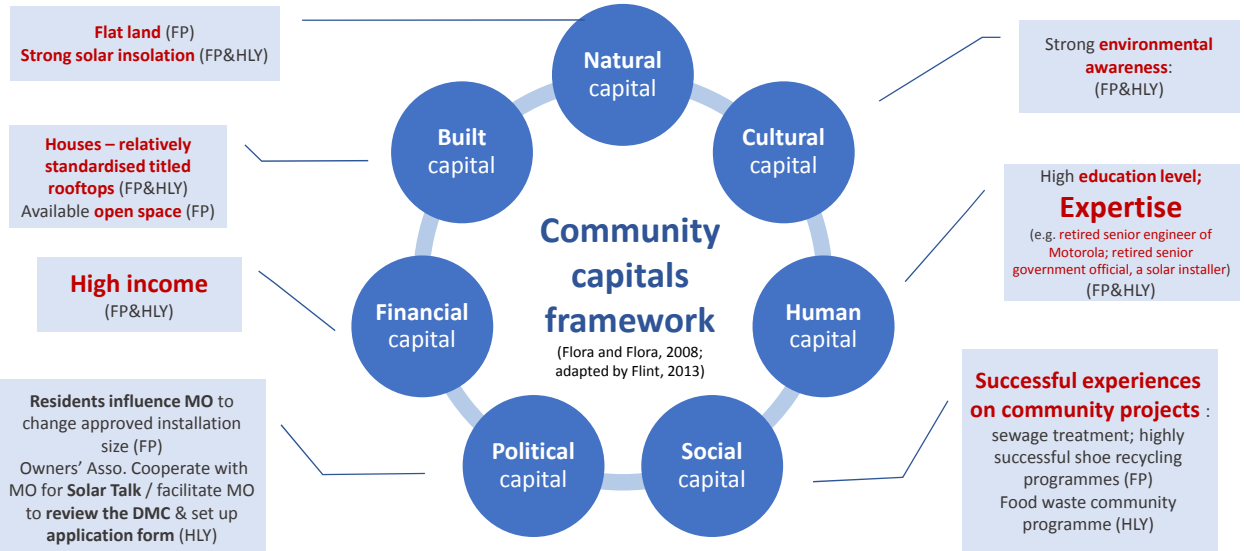
	Fairview Park	Hong Lok Yuen
Estimated solar electricity generation (Annual electricity consumption of a three-persons Hong Kong household: 3,300 kwh)	**24,000** kWh (**32** households) - enough to provide electricity of **7** three-person Hong Kong households for a year	**21,000** kWh (**19** households) - enough to provide electricity of ***6*** three-person Hong Kong households for a year
Potential REFIT earning (year)	HK$1,200,000 (154,000 USD) = 800 households' management fee in a month (assume fee at $1,500/month/household)	$940,000 (120,500 USD) = 376 households' management fee in a month (assume fee at $2,500/month/household)

Who

are the community energy stakeholders?



What are the community capitals in FP and HLY?



Flat land (FP)
Strong solar insolation (FP&HLY)

Houses – relatively standardised titled rooftops (FP&HLY)
Available **open space** (FP)

High income
(FP&HLY)

Residents influence MO to change approved installation size (FP)
Owners' Asso. Cooperate with MO for **Solar Talk** / facilitate MO to **review the DMC** & set up **application form** (HLY)

Strong **environmental awareness**:
(FP&HLY)

High **education level;**
Expertise
(e.g. retired senior engineer of Motorola; retired senior government official, a solar installer)
(FP&HLY)

Successful experiences on community projects :
sewage treatment; highly successful shoe recycling programmes (FP)
Food waste community programme (HLY)

Finding 2: But households did not respond well to the REFIT policy. Solar resources have remained vastly under-used

FAIRVIEW PARK

Jan 2019

21 households submitted solar application forms to MO.

16 households approved

? Solar houses

HONG LOK YUEN

Apr 2019

About **6** solar houses

Group-purchasing on hold

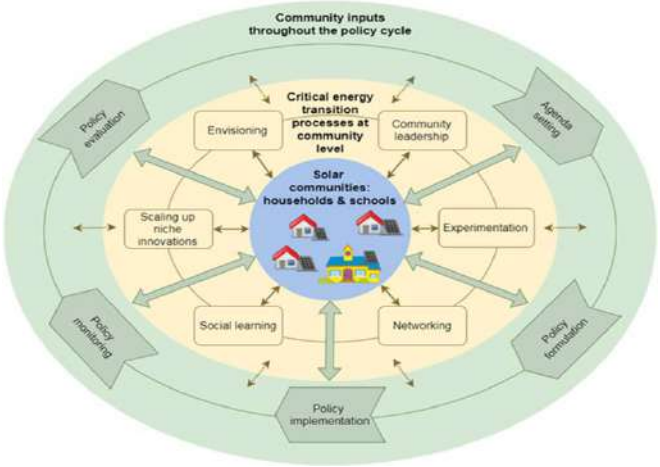
Sources of photos: interviewees

Multiple barriers –

Many *non-economic* barriers remained unaddressed …

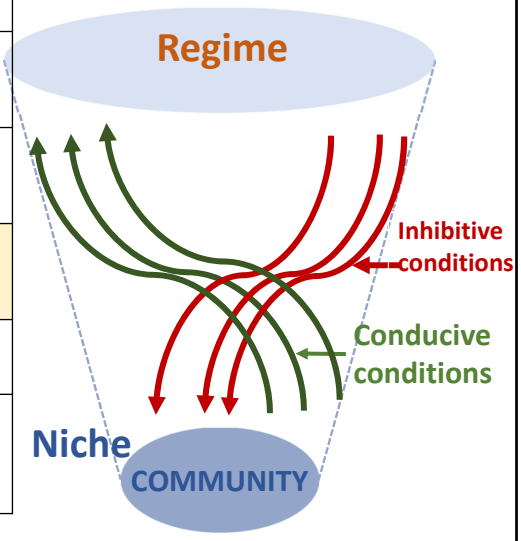
Finding 3: The scaling up mechanisms of community energy transitions the enabling and inhibitive conditions

A preliminary policy model of engaging communities in solar development



- Key indicators:
- (i) Envisioning – the establishment of the guiding vision for the concerned communities which aligns short-term actions with long-term vision (Hodson & Marvin, 2010);
- (ii) Community leadership – some trustworthy individuals in communities have special commitment to the locality and they can mobilise local residents and provide leadership (Martiskainen, 2017);
- (iii) Experimentation – pilot projects involving households and other community stakeholders can demonstrate feasibility, and subsequently enhance community, market, and socio-political acceptance of new energy technologies or energy changes (Mah et al., 2013; Sovacool et al., 2012);
- (iv) Networking - community members can align actors and mobilise resources (which include knowledge, expertise, and skills) (Smith et al., 2010);
- (v) Social learning – learning may occur in which community members not only share knowledge of contextual constraints and opportunities, but also co-develop knowledge, expertise, and technical and policy solutions (Lemke & Harris-Wai, 2015); and
- (vi) Scaling up niche innovations - community pilots and early mover experience can be scaled and become mainstream when technological advancement, business models, environmental awareness, regulatory measures and policy legitimacy are aligned (Kern et al., 2015; Mah et al., 2012).

Governing processes	FP	HLY
1. Community leadership	Conducive conditions: xxx Inhibitive conditions: xxx	Conducive conditions: xxx Inhibitive conditions: xxx
2. Envisioning	Conducive conditions: xxx Inhibitive conditions: xxx	Conducive conditions: xxx Inhibitive conditions: xxx
3. Experimentation	Conducive conditions: xxx Inhibitive conditions: xxx	Conducive conditions: xxx Inhibitive conditions: xxx
4. Social learning	Conducive conditions: xxx Inhibitive conditions: xxx	Conducive conditions: xxx Inhibitive conditions: xxx
5. Networking	Conducive conditions: xxx Inhibitive conditions: xxx	Conducive conditions: xxx Inhibitive conditions: xxx
6. Scaling up niche innovations	Conducive conditions: xxx Inhibitive conditions: xxx	Conducive conditions: xxx Inhibitive conditions: xxx



An illustrative example: *Social learning*

Indicators	Fairview Park	Hong Lok Yuen
Learning may occur in which community members: • **Share existing knowledge** of contextual constraints and opportunities • **co-develop** knowledge, expertise, and technical and policy solutions (Lemke & Harris-Wai, 2015)	• A resident meeting • Management Office (MO) • **Solar Application form** for installation of **solar** panels	• A solar householder, solar installer, decoration workers • New technology → **solar roof tiles**

Social learning - *Fairview Park*

- May 2018: following a resident meeting, the MO. **revised** the ***Solar Application Form***
- **Feedback** from CLP, a solar installer and an academic research team offered to MO
- **relaxation** on the **size constraints** of solar panels
- from **4 m2** to **any size** (with **buffer of at least 30cm** from each roof edges)

Sep 2017

…The size of the solar panels to be installed on the roof shall **not exceed 4 sq.m** and shall be installed projected from the common wall not less than 1 m, if there is any. (2017)

May 2018

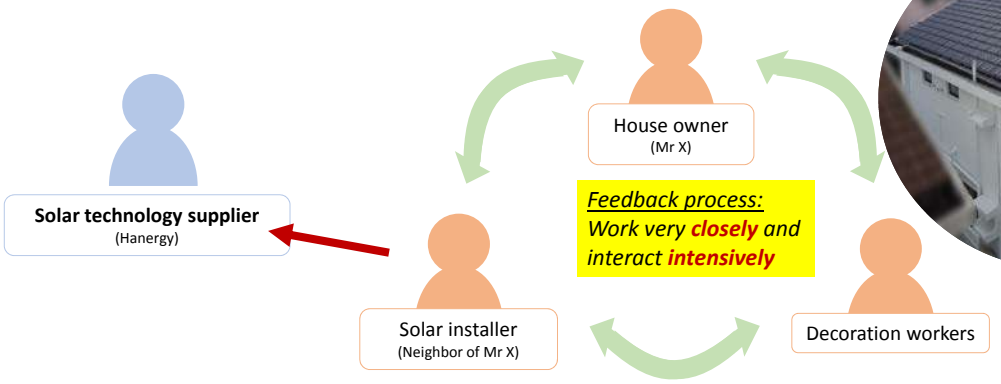
A **resident meeting** with MO and other stakeholders (CLP, solar installer, BU-CityU research team)

May 2018

…No other positions **except the roof** will be allowed for the installation and the solar panel(s) shall be installed **parallel to the roof surface** with the **height no more than 150mm**. All sides of solar panel(s), except the top, shall be distanced from the roof edges **not less than 300mm**. (2018)

Social learning - *Hong Lok Yuen*

- A solar householder, a solar installer & decoration workers co-developed technological solutions that fit local constraints
- (involving screw design, colour options for solar tiles)



Sources of photos: interviewees

(2) **Conducive** conditions created:

- **FP case***: Feedback* processes involving stakeholder of diverse background promote flexibility in the regulatory systems
- **HLY case**: Intensive ***feedback*** processes that allow the co-creation of technological solutions that fit local constraints (HLY)

(3) Inhibitive conditions:

- **FP case:** The existence of ***distrust*** (among residents with different political orientation, and between residents and the district councilor) **limited *peer learning***
- **HLY case**: The lack of ***information sharing platform*** **inhibited *peer learning***

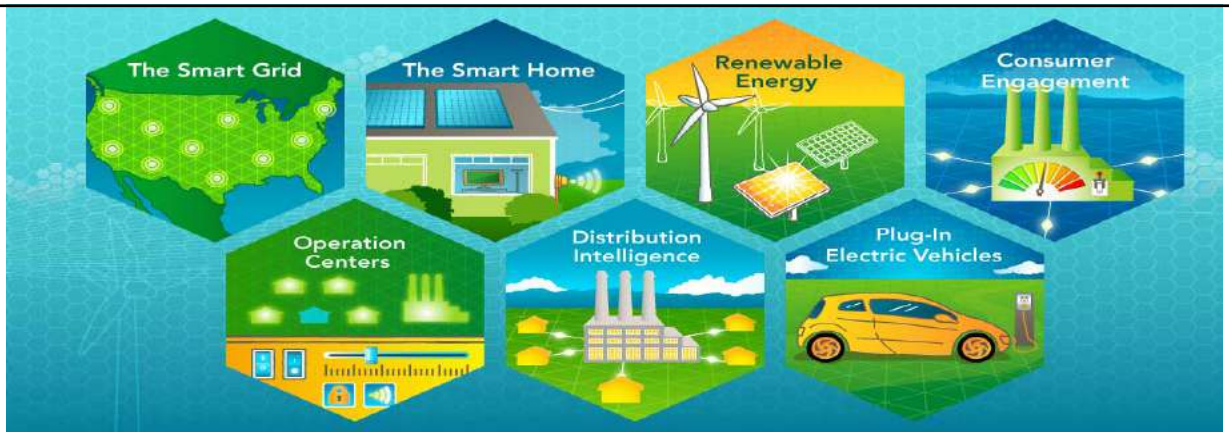
Some concluding remarks …

1. **HK REFIT** – among the **highest** in the world, and yet has **not** been able to **mobilise** the **substantial community capacities** in the two case communities to install solar. **Vast solar resources** have remained **under-used**.

2. **Limits of community** – by comparing the scaling-up mechanisms across the two case communities, we found that some **conducive conditions** have been in place but many are yet to be created. **Inhibitive conditions** are also many.

3. **Government** (and other stakeholders – as communities alone cannot do it by themselves) can play **a more active role** in creating such **conducive conditions** in order to unlock potentials of yet untapped solar resources in prospective solar communities. These government functions may include:
   - Policy mixes; support innovation networks in community; establish a platform to enable social learning

Appendix 7-13: Presentation slides of the workshop on Data Analytics in Journalism, Social Science, and Business Studies on 3rd June 2019



Using cross-disciplinary mixed methods to provide insights into the processes and outcomes of energy transitions in the socio-political, economic and environmental contexts in Asia

Daphne Ngar-yin Mah
Director, Asian Energy Studies Centre; Assistant Professor, Department of Geography

3rd June, 2019

My research agenda:

Governance for sustainable energy transitions from an Asian Perspective

Sustainable energy transitions

Renewable
Solar, wind

Smart grids
demand-side-management
dynamic pricing

Nuclear power
And public acceptability

Governance Innovations

Public acceptability; deliberative participation; community engagement; central-local relationships

smarter market regulators; state-market relations

- Broadening geographical scope beyond HK to South Korea, Japan, China
- Potential area of leading-edge research

Inter-disciplinarity

Asian Perspective

Knowledge Exchange

- Engage colleagues from different disciplines, within and outside BU (**HKBU**: Physics, Computer Sciences, Visual Arts; HK: CityU (School of Energy); HKU (public engagement; public opinion); US – Stanford (deliberative pollings); **France – Science Po**; UK – UCL/ Sheffield; China – Tsinghua)
- Multi-method: using varied data including solar resource assessment, household and other stakeholders' interviews, deliberative workshops to provide insights into the processes, prospects, limitations, and outcomes of energy transitions in the context of socio-political, economic and environmental contexts in the Asian region.

- Consultancy research
- Public education
- Community outreach
- Stakeholders engagement

Collaborating Researchers for Energy Projects

Daphne Mah
HKBU
Energy Policy

Kevin Lo
HKBU
Energy Policy

K. P. Chun
HKBU
Global change

Zhou Qiming
HKBU
GIS

Michael K.H. Leung
City University of Hong Kong
Energy Engineering

Akihisa Mori
Kyoto University
Energy Policy

Marc Wolfram
Sungkyunkwan University
Urban Governance

Alice Siu
Stanford University
Public engagement

John Byrne
University of Delaware
Renewable policy

Sara Fuller
Macquarie University
Energy Justice

Gilles Lepesant
Unit Géographie-Cités
Energy Transition

Richard Balme
Paris School of International Affairs
Environmental Governance

Project Theme 1: Urban energy transitions with solar

Project Title	Research Methods and Datasets	Research questions that we could address
PPR's *"Engaging the **community to develop a model for sustainable energy futures**: A case study of **two prospective solar communities** in Hong Kong"* (2018-2019; ongoing)	Mixed methods: **(i) solar resource assessment**; (ii) household **face-to-face in-depth interviews**; **(iii) deliberative workshops** **(iv) Scenario developments**	***1. Is solar a viable energy option for HK?*** The estimates of solar resources in strategic sectors for SETs (school, and communities) ***2. Policy effectiveness?*** To what extent the new REFIT policy effective in overcome barriers to solar deployment in HK? ***3. Public and stakeholders' perceptions and responses?*** e.g. What are the perceptions and behavior of **prospective solar adopters** and other stakeholders) to solar developments? ***4. Why and how?*** **Socio-technical and economic contextual** factors as an explanatory factor; **Conceptualisation** of energy transitions mechanisms – e.g. community engagement mechanisms
FRGII's "The diversity and critical processes of ***urban energy transitions through community engagement**: An **international comparison*** of London, Freiburg (Germany), New York City, Tokyo, Seoul, Hong Kong and Foshan (China) (2018-2019; ongoing)	Face-to-face interviews; a **comparative study** of 7 cities	
Four other solar/ renewable policy projects (2016-2018) - CLP's ***solar rooftop*** project - WWF/Greenpeace's ***Solar Policy*** project - Greenpeace's ***REFIT*** project - Greenpeace's ***Solar School*** project - UCL's solar and Chinese cities study	Mixed methods: (i) solar resource assessment; (ii) stakeholder in-depth interviews; (iii) deliberative workshops (iv) Comparative study of Asian cities – Foshan and Seoul	

《香港中、小學發展太陽能的潛力與挑戰》研究

約1000 政府學校
(n=

《香港太陽能社區》的研究

錦繡花園
(約5000 戶; n = 47)

康樂園
(約1192戶; n = 29)

Solar resource assessment (conducted by collaborators at CityU)

參考:

上網電價計劃:
<10kW: $5/kWh
10kW-200kW: $4/kWh
>200kW: $3 kWh

註: 10kW的系統大小大約是60m²
(會根據各太陽能板不同的規格而改變)

No.	no. of rooftops	total rooftop area (m²)	estimated electricity output (kWh/year)	annual income (HK$)	FIT rate ($/kWh)
1	2	15	3320	$16,601	$5
2	2	16	3552	$17,759	$5
3	2	17	3754	$18,771	$5
4	2	19	4236	$21,181	$5
5	2	24	5337	$26,683	$5
6	2	25	5492	$27,462	$5
7	1	26	5728	$28,642	$5
8	2	26	5759	$28,796	$5
9	2	26	5654	$28,270	$5
10	2	27	5996	$29,979	$5
11	2	27	5896	$29,481	$5
12	3	29	6450	$32,248	$5
13	2	30	6377	$31,883	$5
14	2	31	5989	$29,945	$5
15	2	32	6879	$34,393	$5
16	2	32	6980	$34,900	$5
17	2	32	6316	$31,580	$5
18	2	32	7113	$35,567	$5
19	1	33	7704	$38,522	$5
20	2	34	7213	$36,063	$5
21	2	34	8400	$42,002	$5
22	3	37	6088	$30,438	$5
23	2	38	8303	$41,514	$5
24	3	41	8944	$44,718	$5
25	2	46	11008	$55,042	$5
26	2	50	11009	$55,046	$5
27	3	57	11199	$55,994	$5
28	3	58	11488	$57,438	$5
29	3	61	13144	$52,576	$4
30	4	73	14474	$57,895	$4
31	2	73	1575	$63,009	$4
32	3	110	21724	$86,894	$4

Solar resources are plentiful across the school sector and communities, but these are vastly under-used

若**19**間受訪**學校**使用校園天台僅一半面積安裝太陽能板一年可生產：

=約**240**萬度電

=751個香港三人家庭一年的用電量

* 真實發電量: 約**11**萬度電

*若受訪的**32**戶**錦綉**居民的屋頂都裝上太陽能板*，一年可生產：

= 約**24萬度電**

=*全港最大太陽能發電場*發電量： **1/10**

*小濠灣: 1.1 MW; 4,237塊太陽能板=錦綉居民*每年少收的上網電價*: $120萬

= 800個錦綉住戶 *一個月的管理費* (以$1,500計算)

若**19**戶的**康樂園**居民(已經浸大/城大太陽能潛力測量)，若都裝上太陽能板, 一年可生產:

= 約**21萬度電**

=*全港最大太陽能發電場*發電量： 1/5

*小濠灣: 1.1 MW; 4,237塊太陽能板

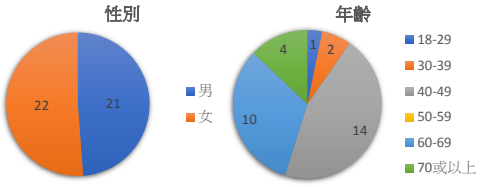
* 真實發電量: **0**

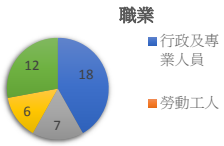
渠務署小濠灣污水處理廠太陽能發電場

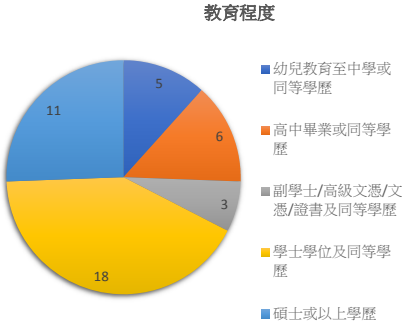
- =康樂園居民*每年少收的上網電價*: $93萬
- = 373個康樂園住戶 *一個月的管理費（約$1,000 - $4,000; 此以$2500 計算)*

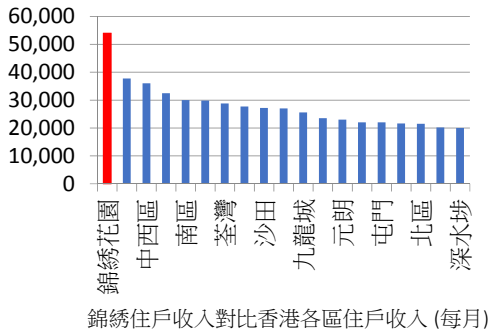
香港太陽能地圖
http://digital.lib.hkbu.edu.hk/solarmap/

訪問: 錦綉花園 43戶







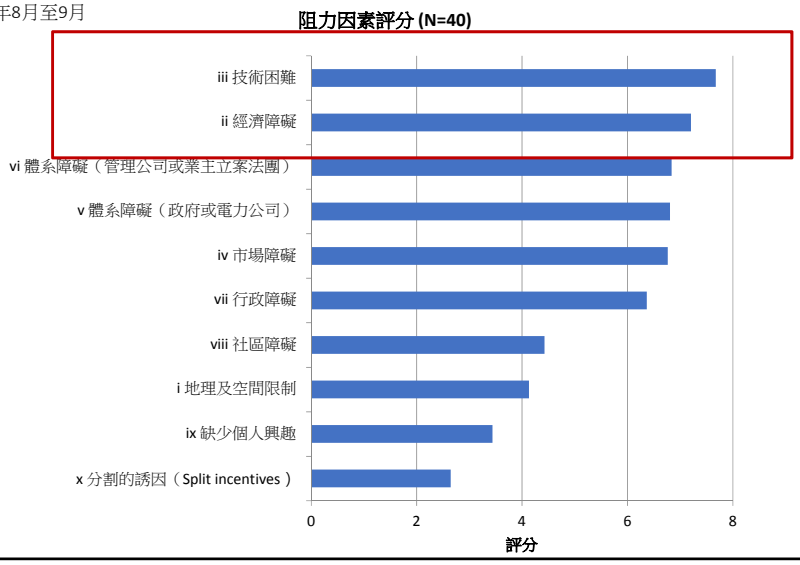


錦綉住戶收入對比香港各區住戶收入 (每月)

***Interviewed house owners' perception**: the new REFIT policy is an effective policy*

But, they were hesitate to install solar. They faced multiple barriers, and many are non-economic ones

受訪家庭: 錦綉: 40
訪問日期: 2018年8月至9月



*有上網電價，*但仍有不少障礙.....

(1) 成本、回本期...*仍然*是問題

...咁姐係我諗住**十幾萬不如換架車先**啦,做咗其他野先啦...
(F1)

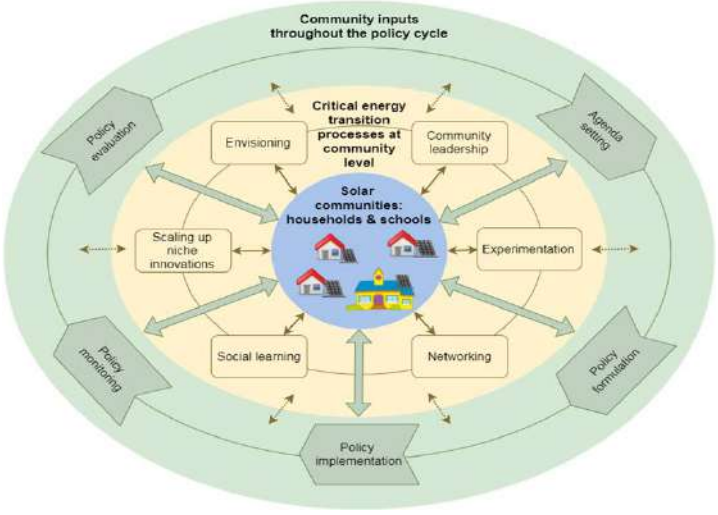
成本高,預想是**10萬以下**, 會否**可以分期**
(F12)

無人support我地, 所以最好政府OR **中電**出個**Funding低息貸款**。
(F6)

十年回報期太耐,
十年後可能已搬走...
(F41)

不過**初頭貴**囉, 未係**普及化**
(F21)

A policy model of engaging communities in solar development



Project Theme 2: Sustainable energy transitions and deliberative participation: a case of smart grids （dynamic pricing, demand-side-management, public acceptability)

Project Title	Research Methods and Datasets	Research questions that we could address
GRF's "*Deliberative participation, trust, and social learning for sustainable energy transitions (SETs): A comparative study of Japan, South Korea, and China"* (2018-2020)	• ***Online*** pilot deliberative pollings; • face-to-face interviews; • a comparative study	1. How do electricity ***consumers*** respond to ***new pricing systems?*** 2. To what extent and how ***deliberative polling*** as an innovative engagement tool can ***integrate public perceptions*** into energy transition ***decision-making***
ECS's "***Engaging Consumers for a Low-carbon Future: A Comparative Study on the Diffusion of Smart Grids in Japan and China"*** (2015-2018)	• **Pilot DPs** in Kyoto and Guangzhou	

An overview of this study

- **Funding:** Early Career Scheme
- **Collaborators:** Stanford, Sun Yat-sen University, Kyoto University
- **This is NOT about:**
  - an examination of the **impact** of SGs on energy demand sectors
- **This is ABOUT:**
  - **Social** aspects of energy transition
  - To understand undergraduate students' **perception** of dynamic pricing options
  - how they considered **benefits, costs, risks,** and **made trade-off decisions**
- **Why undergraduate students?**
  - Studies on youth-led social changes (e.g. DeWaters and Powers, 2011)
- **Why DPs?**

Five key dimensions of comparing different pricing systems

	Benefits	Costs	Risks
Economic			
Environmental			
Technological			
Social			
Regulatory			

Deliberation:

•Dialogues, public debate, reflection on **complex** and **controversial** energy issues/ choices

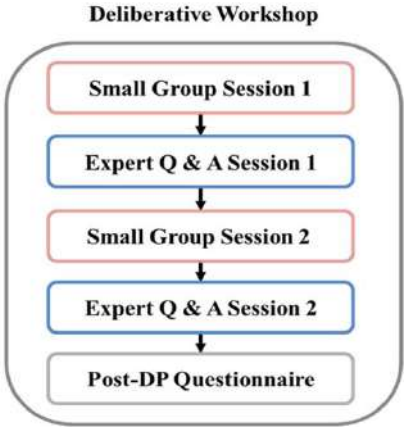
•conducive to nurturing an **informed, energy-literate** public which is better equipped to make thoughtful, considered, and **responsible** energy-related decisions and choices, and to **embrace changes**

Two pilot deliberative pollings (DPs): Guangzhou and Kyoto

- **Guangzhou DP**: 47 undergraduate students from Sun Yat-sen University, Mar 2016
- **Kyoto DP**: 47 undergraduate students from Kyoto University, Kyoto, Jan 2017

Pre-DP Questionnaire

Briefing Document



Pilot deliberative pollings (DPs) in Guangzhou and Kyoto on "Electricity Tariff and Demand-side Management"

(each with 47 undergraduate participants)

Guangzhou pilot DP

Small Group Discussion

Expert Q&A Session

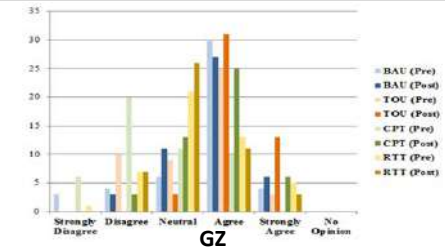
Preliminary finding 1:

Mixed outcomes in participants' choices of pricing options revealed the complexity associated with trade-offs decisions

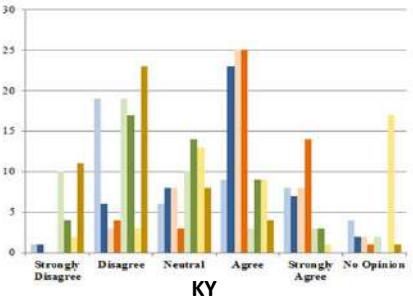
1. *Participants' **acceptance** of complex and **sophisticated pricing** **options** noticeably **increased** after deliberation.*
   - GZ DP: n increased from 28 to 44 (TOU)
   - KY DP: n increased from 33 to 39)

2. *A considerable number of participants were **supportive** of the **status quo (BAU)**.*
   - GZ DP: n changed from 34 to 33)
   - KY DP: n increased from **17** to **30**

Some participants did not favour change even though they were given the opportunity to do so. Why?



GZ



KY

Preliminary finding 2:

National level cultural differences

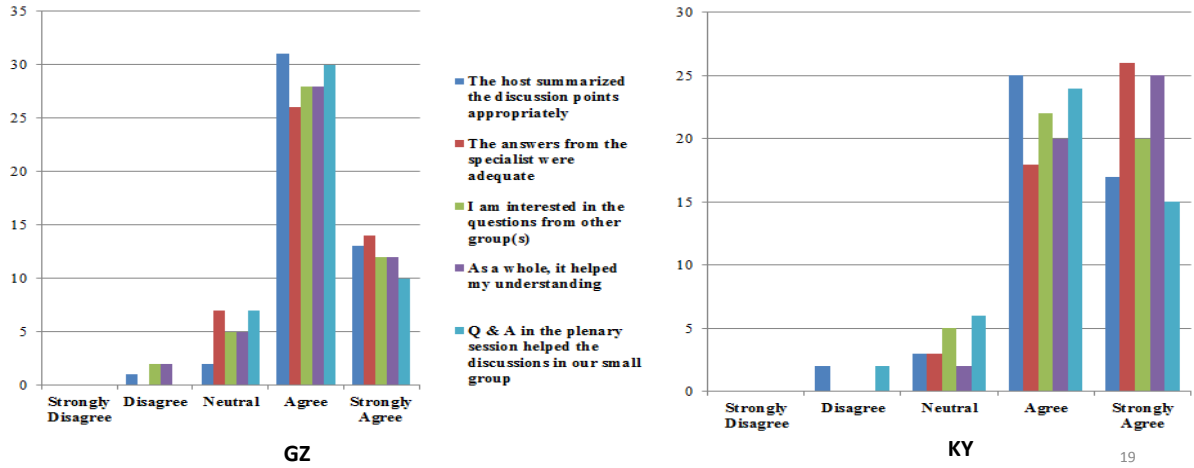
may explain heterogeneity of concerns and responses among young people in GZ and KY

(1) Public trust

(2) Familiarity with market logics

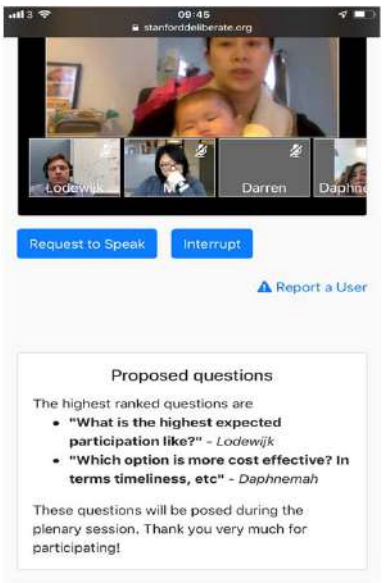
Preliminary finding 3:
The normative mechanisms and outcomes of deliberative participation seem to apply in the Asian context

- **dialogues** and **learning processes** seemed to enable participants to become more informed and competent in **weighing trade-offs** associated with complex energy decisions.



GZ KY

What's next: *online* deliberative pollings in Kyoto and Seoul



Future research directions:

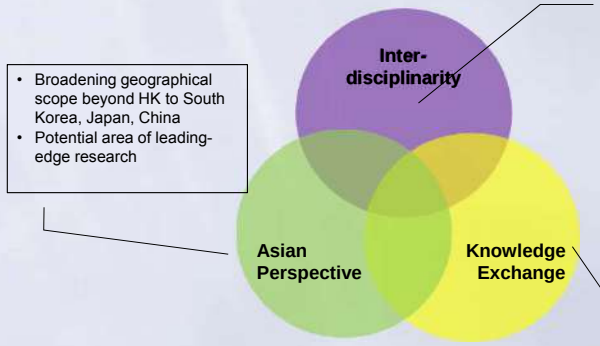
- Governance for energy transitions in Asia
- Establish **energy datasets of HK and other Asian cities** which have potential for big data analytics, e.g. residential electricity consumptions
  - aggregate impacts of households to smooth peak load of the power sector
  - solar electricity generation from communities/ the school sector
- Energy transition **Diffusion** patterns – who, where, how

The Third Asian Energy Conference: Diversity in Urban Energy Transitions in Asia: Trajectories, Governance and Policy Innovations
3 – 4 July 2019
WLB104, The Wing Lung Bank Building for Business Studies, Lam Woo International Conference Centre
Organised by Asian Energy Studies Centre (AESC), Hong Kong Baptist University

Session 1: Socially Enabled Urban Energy Transitions
Session 2: Interdisciplinary Approaches for Energy Policy Innovations
Session 3: Governance Innovation for Low-carbon China
Session 4: Just and Social Perspectives of Energy Transitions

My research agenda:

Governance for sustainable energy transitions from an Asian Perspective



- Broadening geographical scope beyond HK to South Korea, Japan, China
- Potential area of leading-edge research

- Engage colleagues from different disciplines, within and outside BU (**HKBU**: Physics, Computer Sciences, Visual Arts; HK: CityU (School of Energy); HKU (public engagement; public opinion); US – Stanford (deliberative pollings); **France – Science Po**; UK – UCL/ Sheffield; China – Tsinghua)
- Multi-method: using varied data including solar resource assessment, household and other stakeholders' interviews, deliberative workshops to provide insights into the processes, prospects, limitations, and outcomes of energy transitions in the context of socio-political, economic and environmental contexts in the Asian region.

- Consultancy research
- Public education
- Community outreach
- Stakeholders engagement

Sustainable energy transitions

Renewable
Solar, wind

Smart grids
demand-side-management
dynamic pricing

Nuclear power
And public acceptability

Governance Innovations

public acceptability; deliberative participation; community engagement; central-local relationships

smarter market regulators; state-market relations

Acknowledgement

This research project (Project Number: 2017.A2.027.18B) is funded by the special round of the Public Policy Research Funding Scheme from the Policy Innovation and Co-ordination Office of The Government of the Hong Kong Special Administrative Region.

Complementarity between conventional research methods and big data analysis: The case of Korea and Seoul nuclear and energy transition policy

Darren Cheung (dmcheung@hkbu.edu.hk)

3rd June, 2019

香港浸會大學 HONG KONG BAPTIST UNIVERSITY

Sources: https://blog.kepco.co.kr/1280

Outlines

1. **A study about public acceptance of nuclear policy in South Korea**
2. **Seoul energy policy development**
3. **Research on Seoul's community energy transition**

Nuclear in Korea

Reactor	Type	Net capacity	Commercial operation	Planned close
Kori 2	PWR – Westinghouse	640 MWe	7/83	2023
Wolsong 1	PHWR – Candu 6	657 MWe	4/83	pre-2022
Kori 3	PWR – Westinghouse	1011 MWe	9/85	2024
Kori 4	PWR – Westinghouse	1012 MWe	4/86	2025
Hanbit 1, Yonggwang	PWR – Westinghouse	996 MWe	8/86	2026
Hanbit 2, Yonggwang	PWR – Westinghouse	988 MWe	6/87	
Hanul 1, Ulchin	PWR – Framatome	968 MWe	9/88	
Hanul 2, Ulchin	PWR – Framatome	969 MWe	9/89	
Hanbit 3, Yonggwang	PWR (System 80)	994 MWe	12/95	
Hanbit 4, Yonggwang	PWR (System 80)	970 MWe	3/96	
Wolsong 2	PHWR – Candu	647 MWe	7/97	2026
Wolsong 3	PHWR – Candu	651 MWe	7/98	
Wolsong 4	PHWR – Candu	653 MWe	10/99	
Hanul 3, Ulchin	OPR-1000	997 MWe	8/98	
Hanul 4, Ulchin	OPR-1000	999 MWe	12/99	
Hanbit 5, Yonggwang	OPR-1000	998 MWe	5/02	
Hanbit 6, Yonggwang	OPR-1000	993 MWe	12/02	
Hanul 5, Ulchin	OPR-1000	998 MWe	7/04	
Hanul 6, Ulchin	OPR-1000	997 MWe	4/05	
Shin Kori 1	OPR-1000	997 MWe	2/11	
Shin Kori 2	OPR-1000	997 MWe	7/12	
Shin Wolsong 1	OPR-1000	997 MWe	7/12	
Shin Wolsong 2	OPR-1000	993 MWe	7/15	
Shin Kori 3	APR1400	1383 MWe	12/16	
Total: 24		22,505 MWe		

http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/south-korea.aspx

Study on public acceptance of nuclear in Korea

Top 5	Korean	English
1	성장동력	Growth engine
2	수혜	Beneficiary
3	성공	Success
4	UAE	UAE
5	수출	Export

Fig. 1 – Word cloud of tweets in 2009. UAE, United Arab Emirates.

Top 5	Korean	English
1	후쿠시마	Fukushima
2	사망	Death
3	은폐	Conceal
4	위험	Danger
5	방사능	Radioactivity

– Word cloud of tweets in 2012.

Top 5	Korean	English
1	안전	Safety
2	유출	Leakage
3	후쿠시마	Fukushima
4	재처리	Reprocessing
5	처분	Disposal

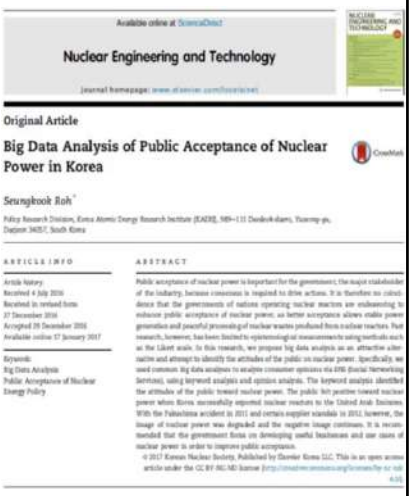
Fig. 3 – Word cloud of tweets in 2014.

- **Keyword analysis** of public awareness of nuclear
- data collected by crawling the Web, Twitter, and Naver.com, for approximately 1.2 million sets of data from January 1, 2009 to July 31, 2014
- compared the awareness of nuclear power for two groups: people living far from a nuclear reactor (Seoul) and people living in the proximity of a nuclear reactor (Kori).

Source: Roh. (2017). Big Data Analysis of Public Acceptance of Nuclear Power in Korea. Nuclear Engineering and Technology, 49, 850-854.

Study on public acceptance of nuclear in Korea

- "The analysis indicates that **Kori** generated **153 times** more tweets with keywords "smart nuclear reactor," "nuclear power," and "nuclear power plant" than did **Seoul**."
- "The **top 19 users** were all living in **Kori**, which indicates that it is difficult to find people living in Seoul who are interested in issues related to nuclear power."
- "Results demonstrate that people distant from a nuclear reactor (**Seoul**) are **not aware of nuclear issues** and that it is people/organizations living in the proximity of a nuclear reactor that lead opinion on nuclear power and nuclear power plants."


Nuclear Engineering and Technology

Original Article

Big Data Analysis of Public Acceptance of Nuclear Power in Korea

Seungkook Roh*

Source: Roh. (2017). Big Data Analysis of Public Acceptance of Nuclear Power in Korea. Nuclear Engineering and Technology, 49, 850-854.

Seoul energy policy development: One Less Nuclear Power Plant

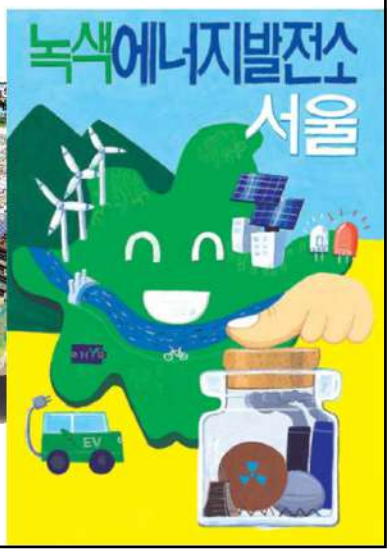
- **One Less Nuclear Power Plant** (**OLNPP**): The flagship energy policy launched in April 2012 by **Seoul**
- **Main target** of OLNPP: **Cut energy consumption** by **2 million TOE**, equivalent to the capacity of one nuclear power plant
- **Target exceeded** in 2014

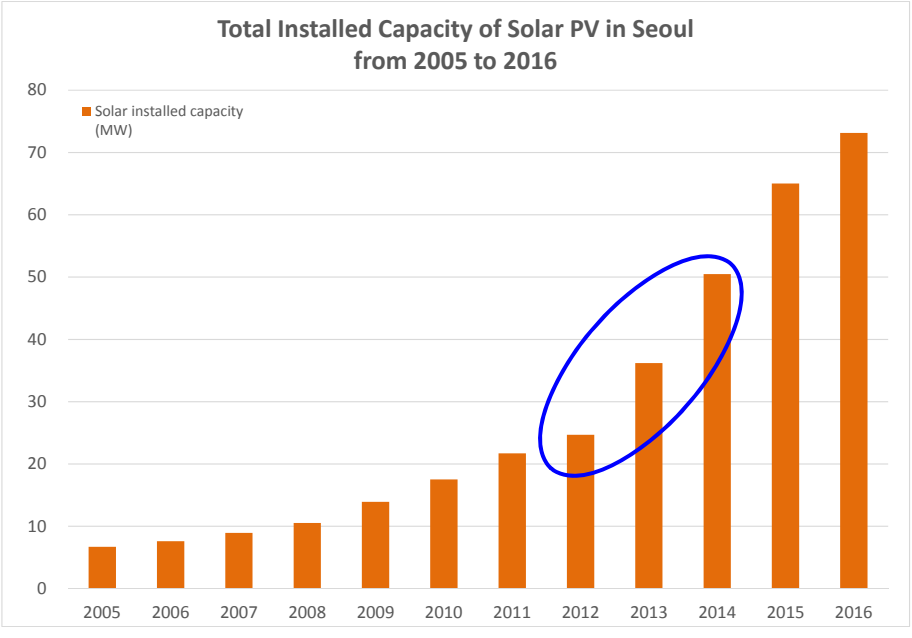
SEOUL METROPOLITAN GOVERNMENT

https://www.ieac.info/IMG/pdf/201305smg-one_less_nuclear_power_plant.pdf

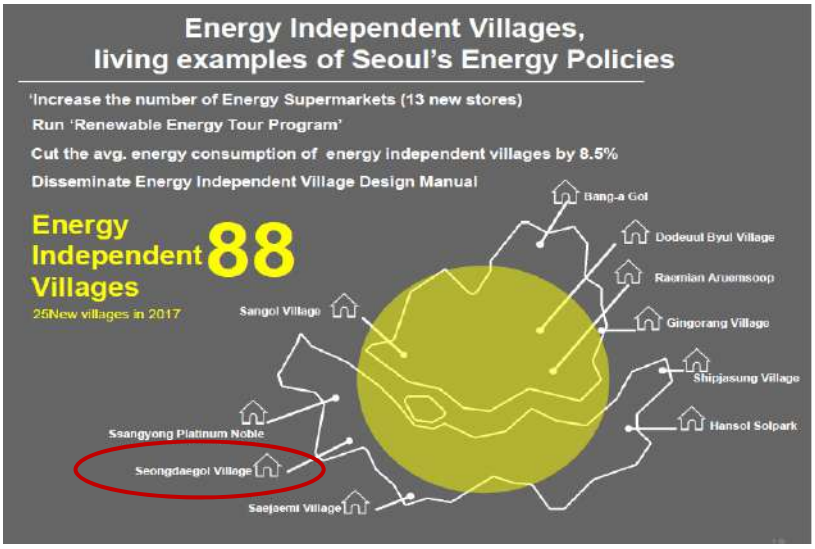
Seoul energy policy development: One Less Nuclear Power Plant

Green Energy Production Plant, Seoul





Bottom-up "*Energy Self-reliant Village*"



sustainability

MDPI

Article

A Community Energy Transition Model for Urban Areas: The Energy Self-Reliant Village Program in Seoul, South Korea

Hana Kim

Energy Policy

An experiment for urban energy autonomy in Seoul: The One 'Less' Nuclear Power Plant policy

Taehwa Lee, Taedong Lee, Yujin Lee

Energy Research & Social Science

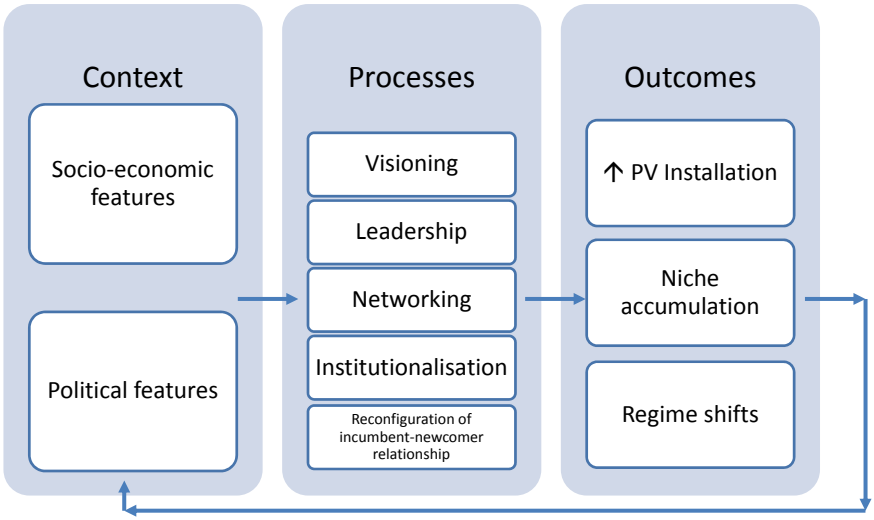
Community solar energy initiatives in urban energy transitions: A comparative study of Foshan, China and Seoul, South Korea

Daphne Ngar-yin Mah

Community solar energy initiatives in urban energy transitions: A comparative study of Foshan, China and Seoul, South Korea

1. Which processes of socio-technical transitions have occurred in the case communities?
2. How do stakeholders in community-level solar initiatives interact in the transition processes?
3. What are the similarities and differences in the key processes of socio-technical transitions in our two case communities?
4. What *contextual* factors can explain these similarities and differences?

Understanding community energy from a systemic perspective: An integrated framework

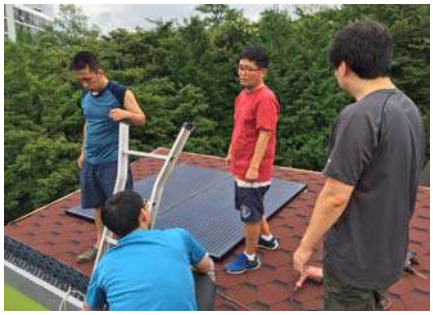


Community solar energy initiatives in urban energy transitions: A comparative study of Foshan, China and Seoul, South Korea

- Semi-structured interviews, desktop research, and field observations
- Interviewees: Key stakeholders, informants, and scholars
- What are the similarities and differences in the key processes of socio-technical transitions in our two case communities?
- What *contextual* factors can explain these similarities and differences?

Seoul's solar policy: Not only rooftops, but balconies

Sungdaegol (盛大谷) Energy Self-reliant Village



(Photo credits: Soyoung Kim)

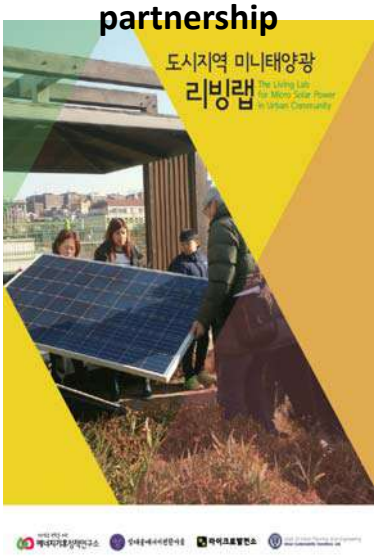
Sungdaegol experiences:
Bottom-up *energy campaigns*

Energy Café to focus on **energy education** to students

Energy Supermarket as the **headquarters** of Sungdaegol energy movements

Dongjak Credit Union to provide **financial assistance**

Community-Solar company-university partnership



Sungdaegol: A Living Laboratory

Invention of **user-friendly cable**: Flat Cable

MOU with the bank

Sungdaegol Technical Team for solar technical issues

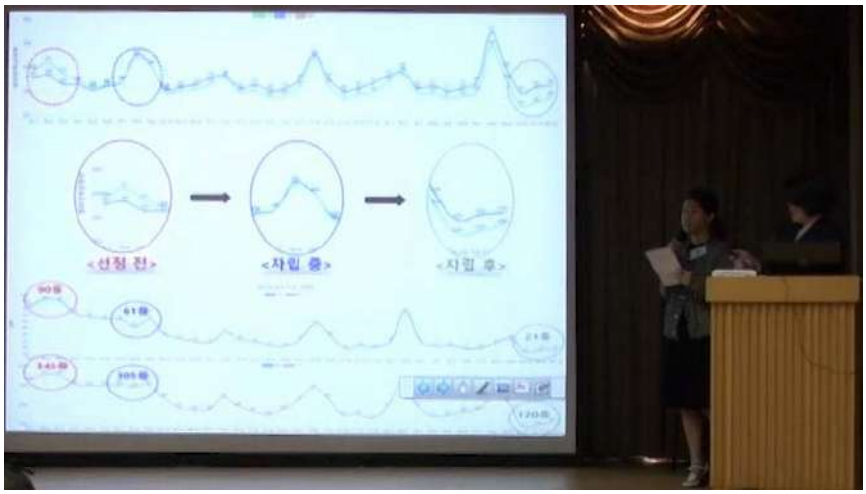
- Volunteer Technical Team
  - Solar installation: 100,000KRW/panel (about HK$720)
  - Post-installation technical services: 20,000KRW (about HK$150)

Sources: Soyoung Kim

Sungdaegol Energy Exchange Platform

- Collaborated with merchant organisation to setup **solar panels** and **energy storage system**
  - Enabled **energy exchange** within Sungdaegol community

Sungdaegol Community Energy Study



The complementarity between conventional research methods and big data analysis

- Using **big data approach** to analyse the patterns and changes; and conventional methods to analyse the process
- **Keywords analysis**: to understand the pattern of community energy transition?
- **Data collection**: energy surveys of energy-self reliant community

Acknowledgement

This research project (Project Number: 2017.A2.027.18B) is funded by the special round of the Public Policy Research Funding Scheme from the Policy Innovation and Co-ordination Office of The Government of the Hong Kong Special Administrative Region.

Appendix 7-14: A letter to EMSD: AESC's policy recommendations in solar communities in Fairview Park and Hong Lok Yuen.

香港浸會大學
HONG KONG BAPTIST UNIVERSITY

Asian ENERGY STUDIES CENTRE

敬啟者:

推動錦綉花園及康樂園成為太陽能社區的建議

我們是香港浸會大學亞洲能源研究中心的研究團隊，正進行一項為期一年(2018年8月至2019年8月)、由香港政府政策創新與統籌辦事處資助、主題為「透過社區參與建立可持續能源發展的未來方向：以香港兩個潛在太陽能社區為案例」的研究項目。就政府及兩電於2018年10月及2019年1月開始為期十五年的「上網電價計劃」， 我們希望可以了解政策對鼓勵錦綉花園及康樂園等中密度住宅安裝太陽能系統的影響，同時了解居民發展太陽能的經驗。

透過與居民及社區持份者的接觸，我們發現錦綉花園和康樂園各有特點和條件發展太陽能。錦綉花園的特色在於其發展規模。錦綉花園共有約五千戶，並且毗鄰米埔內后海灣拉姆薩爾國際重要濕地，很有潛能成為國際知名的太陽能社區。 而康樂園的特色則在於居民相對優厚的經濟條件及社區凝聚力。康樂園早有發展社區項目的經驗 — 廚餘回收，而社區內亦有由居民自發組成的太陽能群組，動員能力相對較強。

我們於2018年9月至今年5月，在錦綉花園及康樂園共訪問了大約80多名居民及相關持份者、為合共約50名居民的居所進行太陽能發電潛力評估，及分別舉行了兩場各有30多名居民出席的商議工作坊。我們初步得出以下研究結果: (1) 錦綉花園和康樂園於天然資源、居民經濟負擔、興趣等方面亦相當有潛力發展太陽能；(2) 「上網電價計劃」雖然為居民帶來一定誘因，不少居民仍持審謹、觀望態度，有部份問題仍有待解決，當中主要包括 — 高昂初置成本、難以在市場物色可靠承辦商、擔心漏水及颱風問題、及欠缺示範項目。

我們的研究發現居民對政府有所訴求，因此，初步整合了居民及持份者的意見，並提出以下三點建議，謹供政府參考。

第一，我們建議政府**設立「太陽能項目專屬資助基金」**。「上網電價計劃」雖然可以大大縮短回本期，但高昂的初置成本仍是居民的重要考慮之一。政府「環境及自然保育基金」一直以來積極推動屋苑、商廈實行環保活動，其中康樂園數年前亦透過這基金設立屋苑廚餘循環再造項目，環保工作得以推動至今。我們建議政府就太陽能發展提供類似支援，為居民的個人或社區的太陽能合作項目提供基金，以減輕初置成本負擔，獲資助的居民或社區團體則需要舉辦太陽能相關的社區參與/宣傳計劃，例如詳細紀錄及匿名分享安裝經驗，在社區、甚至為全港發揮示範作用。個案分享可有助居民清楚安裝流程、了解選擇合適承辦商的注意事項，相信長遠能增強居民對安裝太陽能設備的信心。

Asian Energy Studies Centre
Room 1202, 12/F, Academic and Administration Building,
15 Baptist University Road, Kowloon Tong, Hong Kong
亞洲能源研究中心
香港九龍塘浸會大學道 15 號教學及行政大樓 12 樓 1202 室
Telephone: (852) 3411-7187 Fax: (852) 3411-2383
Email: aesc@hkbu.edu.hk Website: ttp://aesc.hkbu.edu.hk/

Our Mission: To pursue excellence in sustainable energy research, with focus on perspectives of governance in the Asian context; to promote informed energy decision-making and improve energy policies in Asia as well as Hong Kong, by creating new knowledge, providing practical policy recommendations, and promoting knowledge exchange in sustainable energy.

第二，我們建議政府**重點打造「錦綉花園或康樂園太陽能街」**。透過訪問，我們發現錦綉花園有些熱心環保的居民聚居同一街或小區，康樂園亦有已安裝住戶帶頭鼓勵鄰居安裝太陽能設備。參考政府最近為學校安裝太陽能光伏系統提供資金及技術援助的「採電學社」計劃，我們認為政府可先於這些較有潛力的地點重點支持太陽能光伏項目。作為試點，政府可提供技術及資金協助，例如邀請該街道或小區居民參與計劃安裝太陽能光伏系統。此等計劃亦有助居民，甚至電力公司了解現時的電網可承載量。

第三，我們建議政府**推動行業設立「太陽能光伏系統工程專業守則」**。就「上網電價計劃」出台後，不少新興的太陽能承辦商湧現，但根據我們的了解，居民對承辦商的專業水平有所保留，除了系統的規格外，他們對漏水、颱風等問題仍存有很大憂慮。尤其是防水工程難以得到保證，令不少受訪者卻步安裝。了解到政府為學校安裝太陽能光伏系統時亦有進行試水，政府可要求或規管承辦商必須為客戶進行試水，若安裝後出現漏水問題，亦有助釐清雙方責任。然而，錦綉花園及康樂園的屋頂均為斜頂，試水規定亦需小心考慮可行性。

「上網電價計劃」是香港發展可再生能源的重要一步，政策亦成功凝聚了一批有興趣、有能力發展太陽能的錦綉花園及康樂園居民，若政府在這難得的機遇能更積極提供配合措施，相信必定能加快社區發展太陽能的進程。

我們的研究將於今年八月完結，屆時將向 貴署提供較全面及完整的研究結果以供參考。

馬雅燕博士
香港浸會大學 亞洲能源研究中心 總監
二零一九年六月十一日

Asian Energy Studies Centre
Room 1202, 12/F, Academic and Administration Building,
15 Baptist University Road, Kowloon Tong, Hong Kong
亞洲能源研究中心
香港九龍塘浸會大學道 15 號教學及行政大樓 12 樓 1202 室
Telephone: (852) 3411-7187 Fax: (852) 3411-2383
Email: aesc@hkbu.edu.hk Website: ttp://aesc.hkbu.edu.hk/

Our Mission: To pursue excellence in sustainable energy research, with focus on perspectives of governance in the Asian context; to promote informed energy decision-making and improve energy policies in Asia as well as Hong Kong, by creating new knowledge, providing practical policy recommendations, and promoting knowledge exchange in sustainable energy.

香港浸會大學
HONG KONG BAPTIST UNIVERSITY

Asian ENERGY STUDIES CENTRE

錦綉花園共有約五千戶，並且毗鄰米埔內后海灣拉姆薩爾國際重要濕地，
相當有潛力發展具規模、有特色的太陽能社區。

眺望錦綉花園 – 影片: https://drive.google.com/file/d/16-tNl85WcxLs29ktUF6AhhVpTQKbdpmo/view?usp=sharing
(此影片已獲擁有者授權本研究團隊使用)

錦綉花園居民於 2019 年 3 月 23 日的
太陽能工作坊中進行小組討論。

康樂園居民踴躍參與浸會大學亞洲能源研究中心
於 2019 年 6 月 1 日舉辦的太陽能工作坊。

錦綉花園居民與專家們進行對答。

康樂園居民在太陽能工作坊中互相交流。

Asian Energy Studies Centre
Room 1202, 12/F, Academic and Administration Building,
15 Baptist University Road, Kowloon Tong, Hong Kong
亞洲能源研究中心
香港九龍塘浸會大學道 15 號教學及行政大樓 12 樓 1202 室
Telephone: (852) 3411-7187 Fax: (852) 3411-2383
Email: aesc@hkbu.edu.hk Website: ttp://aesc.hkbu.edu.hk/

Our Mission: To pursue excellence in sustainable energy research, with focus on perspectives of governance in the Asian context; to promote informed energy decision-making and improve energy policies in Asia as well as Hong Kong, by creating new knowledge, providing practical policy recommendations, and promoting knowledge exchange in sustainable energy.

香港浸會大學
HONG KONG BAPTIST UNIVERSITY

Asian ENERGY STUDIES CENTRE

20th September, 2019

Dear Prof. Li,

The Asian Energy Studies Centre (AESC), Hong Kong Baptist University, greatly supports the engagement process of the "Long-term Decarbonisation Strategy" led by the Council for Sustainable Development (SDC). With the aim of lending our support to SDC's good work and in the spirit of offering constructive feedback, AESC would like to draw SDC's attention to the prospects of exploring local renewable energy sources as a viable energy option for decarbonising Hong Kong.

This consultation document states that "*as Hong Kong has very limited renewable energy potential, regional cooperation plays a crucial role in helping us achieve a higher carbon reduction target beyond 2030*" (p.27). This statement is in line with the Hong Kong's Climate Action Plan 2030+ published in January 2017, in which the Government estimated that Hong Kong has only modest realisable renewable energy potential arising from wind, solar and waste-to-energy at about 3-4% from 2017 to 2030; and only 1-1.5% of Hong Kong's electricity consumption could be powered by solar. This government estimate is equivalent to about 440 million - 660 million kWh which requires an installed capacity of about 440 - 660 MW of solar PV systems to generate such amount of electricity (assuming 1 MW of solar PV systems could generate 1 million kWh of solar electricity annually).

We are concerned that the decarbonisation document tends to emphasis the importance of a regional energy solution in ways that Hong Kong could import more low-carbon electricity from Guangdong, while **understating local solar as a viable energy resource** in meeting Hong Kong's energy-related climate challenges.

We would therefore like to share an observation on the global trends of urban solar, and some preliminary findings of our recent research that suggests local energy solutions may play a more important role in HK's long-term decarbonisation strategy than it is currently framed in the consultation document.

Asian Energy Studies Centre
Room 1202, 12/F, Academic and Administration Building,
15 Baptist University Road, Kowloon Tong, Hong Kong
亞洲能源研究中心
香港九龍塘浸會大學道 15 號教學及行政大樓 12 樓 1202 室
Telephone: (852) 3411-7187 Fax: (852) 3411-2383
Email: aesc@hkbu.edu.hk Website: ttp://aesc.hkbu.edu.hk/

Our Mission: To pursue excellence in sustainable energy research, with focus on perspectives of governance in the Asian context; to promote informed energy decision-making and improve energy policies in Asia as well as Hong Kong, by creating new knowledge, providing practical policy recommendations, and promoting knowledge exchange in sustainable energy.

1. Local Action, Local Solutions - Core to SD Goals

Responsibility and role of localities in aspects such as climate change were given more attention in the Sustainable Development Goals (SDGs) 2030 than before (Reddy, 2016). As mentioned in the SDGs 2030 report, local authorities, indigenous peoples, and civil society will be involved for the SDGs 2030 (United Nations, 2015). And for energy, the importance of the plurality of energy sources and solutions was mentioned in Goal 7. Although not mentioned explicitly, the report recognised the importance of local energy solutions.

Major leading cities in the world including London, New York City, and Seoul are proactive in developing urban solar as a core element of climate policies. Table 1 provides an overview of some of these cities and Hong Kong in terms of solar developments. While Hong Kong possesses modest solar resources that is comparable to those in some of these other cities, Hong Kong is lagging behind in setting an explicit solar target. Two major renewable energy policies in Hong Kong, the Feed-in Tariff Scheme and renewable energy certificates were launched first in October 2018, followed by Solar Harvest in early 2019. The overview in Table 1 suggests that Hong Kong could be more proactive in introducing effective policy instruments to promote urban solar development, rather than prioritising the import option in our decarbonisation strategy.

Table 1. An overview of leading cities and Hong Kong in urban solar development.

	London	**New York City**	**Kyoto**	**Seoul**	**Hong Kong**
Population by city (2016)	8,799,000	8,615,000	1,475,000	9,931,000	7,336,600
Global rank of GDP by country (2017)	5th	1st	3rd	12th	2nd (HK: 33rd)
GDP by country (2017; in billion US$)	2,622	19,390	4,872	1,531	341
Global rank of GHG emissions by country (2014)	17th (494 $MtCO_2e$)	2nd (6,319 $MtCO_2e$)	8th (1,322 $MtCO_2e$)	13th (632 $MtCO_2e$)	1st (11,601 $MtCO_2e$)
Solar targets by city	2 GW by 2050	1 GW by 2030	475 GWh from residential solar PV by 2020	1 GW by 2022	N.A.
Urban solar initiatives (selected examples)	• Neighbourhood solar cooperative • Solar empowerment zone • Renewable energy provider exchange platform	• Solar partnership between government and university • Solar empowerment zone • Microgrid energy trading platform	• Government initiated and developer-driven prosumer development integrated with smart homes • Keihanna new city as site for solar prosumers	• Grassroots prosumers' communities promoted by city government • Community coupon scheme for energy trading between prosumers and consumers	• Feed-in tariff policy • Renewable energy certificates • Solar Harvest (for schools)

A particularly interesting example to share is the case of Hamburg in Germany. Hamburg is featured by its effort in pursuing the localisation of energy solutions, instead of depending on regional power utility. A referendum was launched in the city to purchase back the electricity grid from Vattenfall, which is a power company serving the broader region, and to transform it into a local city-based public utility. Vattenfall has paid less effort in endorsing clean energy, as it owns two fossil fuel power stations in Europe (Energiewende Team, 2014). Despite the high price of the grid (EUR 400,000,000), the purchase provides opportunities for renewable energy development of the city (The Local Europe AB, 2014). As the city regains its energy independence, it would be more flexible for it to pursue its goals of adopting renewable energy (World Future Council, 2017).

2. Preliminary findings of our recent research that suggests local renewable solutions could be a viable energy option for HK's long-term decarbonisation strategy

AESC is currently conducting an on-going, 15-month Public Policy Research Funding Scheme (PPR) project funded by the Hong Kong Government's Policy Innovation and Co-ordination Office (PICO) titled "Engaging the community to develop a model for sustainable energy futures: A case study of two prospective solar communities in Hong Kong" from September 2018 to November 2019 to research on urban solar development in Hong Kong. The aims of the PPR project is to investigate whether solar communities is a viable energy option for the energy future in Hong Kong, and to identify and develop solutions to the technical, economic socio-political and institutional barriers vis-à-vis the Feed-in Tariff Scheme.

Two prospective solar communities, Fairview Park in Yuen Long and Hong Lok Yuen in Tai Po, are chosen for comparative study. These two communities are characterised by their low-density, low-rise residential housing as well as rich and evenly distributed solar potentials among individual households. This project adopts an interdisciplinary approach by conducting solar potential assessment with 51 households; in-depth, semi-structured interviews with 90 households and stakeholders, and ex-post stakeholder workshops with 57 householders to examine household responses on community solar development before and after the launch of Feed-in Tariff Scheme.

One of the major preliminary[1] findings of this research is that solar resources in these two communities are plentiful. Accordingly to our GIS-based solar assessment (Table 2), the projected annual solar energy potential of the *entire* Fairview Park community (including all 5,024 households) amounted to 42,138 -

[1] Full report of this study is expected to be available by end this year.

44,424 MWh with an installed capacity of 42.5 MW.[2] This amount of electricity is equivalent to the annual electricity consumption of about 12,800 – 13,500 three-person households.

The projected annual solar energy potential of the *entire* Hong Lok Yuen community (including 1,190 households) amounted to 16,926 – 18,093 MWh.[3] This amount of electricity is equivalent to the annual electricity consumption of about 5,100 – 5,500 three-person households.

To put these estimates into context, 42.5 MW + 17.2 MW = 59.7 MW, which is already equivalent to nearly 10% of the Hong Kong Government's "solar target" of 660 MW.

To complement the community-wide solar assessment, we also conducted onsite solar assessment in households in these two residential estates. The estimated annual solar energy potential of the 32 onsite assessment Fairview Park households amounted to 222 MWh, with an estimated rooftop area of 1,078 m^2. The estimated annual solar energy potential of the 19 onsite assessment HLY households amounted to 210 MWh, with an estimated rooftop area of 984 m^2.

Table 2: An overview of solar resources in Fairview Park and Hong Lok Yuen

	Fairview Park	**Hong Lok Yuen**
Solar installed capacity from projection	42.5 MW (assuming an estimated total rooftop area of about 240,811 m^2 are fully equipped with solar PV systems)	17.2 MW (assuming an estimated total rooftop area of about 97,544 m^2 are fully equipped with solar PV systems)
Solar resources from projection	42,138 – 44,424 MWh/year (240,811 m^2 estimated rooftop area; equivalent to annual consumption of about 12,800 – 13,500 3-person households)	16,926 – 18,093 MWh/year (97,544 m^2 estimated rooftop area; equivalent to annual consumption of about 5,100 – 5,500 3-person households)
Solar resources from onsite assessment	222 MWh/year (32 households; 1,078 m^2 estimated rooftop area; equivalent to annual consumption of about 67 3-person households)	210 MWh/year (19 households; 984 m^2 estimated rooftop area; equivalent to annual consumption of about 63 3-person households)

[2] We assume an estimated total rooftop area of about 240,811 m^2 are fully equipped with solar PV systems.

[3] We assume an estimated total rooftop area of about 97,544 m^2 are fully equipped with solar PV systems.

By sharing the preliminary findings of our research, we would like to urge the SDC to pay sufficient attention to local renewable energy sources as a viable energy option for decarbonizing Hong Kong.

Thank you very much for your kind attention.

Yours sincerely,

Daphne Ngar-yin Mah
Director
Asian Energy Studies Centre
Hong Kong Baptist University

Asian Energy Studies Centre
Room 1202, 12/F, Academic and Administration Building,
15 Baptist University Road, Kowloon Tong, Hong Kong
亞洲能源研究中心
香港九龍塘浸會大學道 15 號教學及行政大樓 12 樓 1202 室
Telephone: (852) 3411-7187 Fax: (852) 3411-2383
Email: aesc@hkbu.edu.hk Website: ttp://aesc.hkbu.edu.hk/

Our Mission: To pursue excellence in sustainable energy research, with focus on perspectives of governance in the Asian context; to promote informed energy decision-making and improve energy policies in Asia as well as Hong Kong, by creating new knowledge, providing practical policy recommendations, and promoting knowledge exchange in sustainable energy.