The impact of setback regulations on PV deployment strategies in Gyeonggi province, South Korea

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Supplementary Materials

Note 1: Korean administrative

South Korea has three-tier local governance systems: Tier 1 (province-level or state-level) includes 8 provinces and 7 metropolitan cities, including Seoul. Tier 2 (county-level) includes 226 counties and cities affiliated with the Tier 1 governments, and 2 autonomous jurisdictions (Sejong city and Jeju Island). Lastly, Tier 3 (town-level) governments are affiliated with the Tier 2 governments. Even if Gyeonggi-do, a province in tier 1, consists of 31 cities and counties, both cities and counties will be collectively referred to as 'cities'. (Ko, 2023)

Note 2: Setback regulation by local government

As of July 2024, 12 cities in Gyeonggi Province have implemented setback regulations as outlined in the Table SM 1 below.

Table SM 1. Setback regulation by local government

Location and cities*	SW	IC	AS	YP	YeJ	GC	PJ	YaJ	PC	DD	GP	YC
Residential housing	-	300	500	300	200	100	100	100	300	100	500	300
Roads	-	300	200	200	200	-	100	100	200	100	300	200
Rivers	-	-	-	-	-	-	-	-	-	-	-	200
Tourist attractions	-	-	200	200	200	-	-	-	-	-	300	-
Natural parks	-	-	-	200	-	-	-	-	-	-	300	-
Educational institutions	-	-	-	-	-	-	-	-	300	-	-	-
Medical facilties	-	-	-	-	-	-	-	-	300	-	-	-
Cultural heritage sites	100	300	-	200	-	-	-	100	-	100	300	-
Public sports facilities	-	-	200	-	200	-	-	-	-	-	-	-
Natural habitation areas	100	-	-	-	-	-	-	-	-	-	-	-

*SW: Suwon-si, IC: Iceon-si, AS: Ansan-si, YP: Yangpyeong-gun, YeJ: Yeoju-si, GC: Gwacheon-si, PJ: Paju-si, YaJ: Yangju-si, PC: Pocheon-si, DD: Dongducheon-si, GP: Gapyeong-gun, YC: Yeoncheon-gun

Note 3: Assumed parameters for PV generation potential

The area factor and density factor were calculated using data (Public data portal, 2024) on solar installations established under relevant laws, including the "ACT ON THE PROMOTION OF THE DEVELOPMENT, USE AND DIFFUSION OF NEW AND RENEWABLE ENERGY" and municipal ordinances, as illustrated in the Figure SM 1 and Figure SM 2 below.

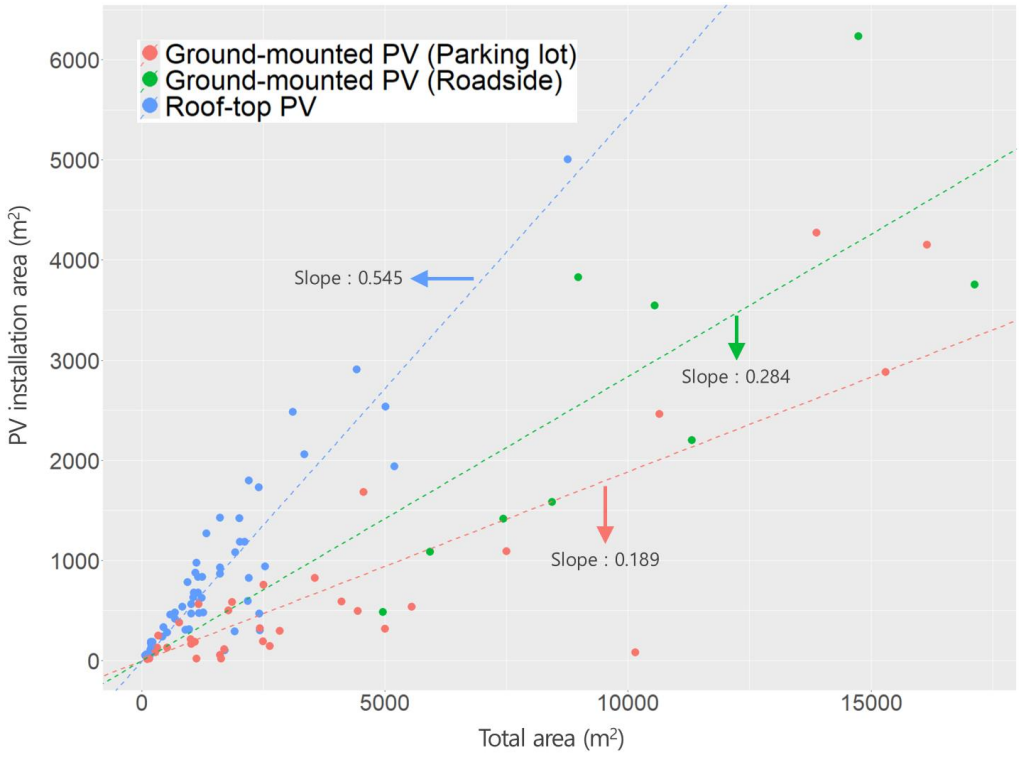

Figure SM 1. Area covered by PV to total area of individual site. (Total area vs. PV installation area)

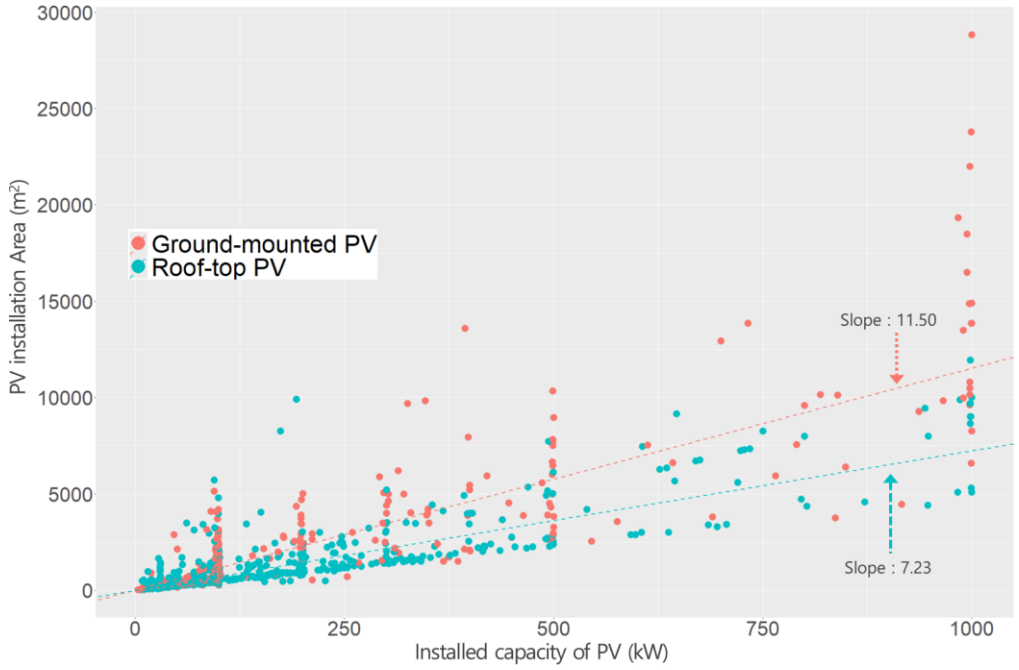

Figure SM 2. Required area for PV installation (capacity(kW) vs. area(m2))

Note 4: Assumption for calaculating LCOE and results.

Previous studies (Lee and Lim, 2021) calculated region- and type-specific LCOE using the assumptions outlined in Table SM 2 below and the LCOE formula presented in the main article. The results of the previous study were utilized in this study as shown in Table SM 3. For your reference, KRW stands for Korean Won, and as of October 4, 2024, the exchange rate against the US dollar is 1,320 KRW per USD.

Table SM 2. Assumed parameters for calculating LCOE in previous study

Type	Ground-mounted PV				Roof-top PV	Water-surface PV
Scale	100kW	1MW	3MW	20MW	1MW	3MW
Capital expenditure (Thousand KRW/kW)	1,491	1,310	1,213	1,154	1,113	1,786
Operating expenditure (KRW/kW·year)	29,360	22,243	23,496	12,860	21,552	25,402
Land lease expense	Applied differently depending on the region				-	-
Interest rate (%)	4.4%					
Corporate tax rate (%)	Applied differently depending on net income Below 200 million KRW: 11%, 200 million KRW to 20 billion KRW: 20%, 20 billion KRW to 300 billion KRW: 22%					
Economic lifetime (year)	20					
Degradation rate	0.54%					

Table SM 3. LCOE by cities and PV types.

City	Town	grdmtd_PV (Won/kWh)	rftp_PV (Won/kWh)
Gapyeong-gun	-	155	137
Goyang-si	Deogyang-gu	379	360
	Ilsandong-gu	524	506
	Ilsanseo-gu	521	504
Gwacheon-si	-	650	632
Gwangmyeong-si	-	744	726
Gwangju-si	-	237	219
Guri-si	-	592	573
Gunpo-si	-	546	528
Gimpo-si	-	261	243
Namyangju-si	-	267	249
Dongducheon-si	-	203	185
Bucheon-si	-	991	973
Seongnam-si	Bundang-gu	1,139	1,120
	Sujeong-gu	722	703
	Jungwon-gu	873	854
Suwon-si	Gwonseon-gu	507	489
	Yeongtong-gu	773	755
	Jangan-gu	444	425
	Paldal-gu	933	915
Siheung-si	-	393	376
Ansan-si	Danwon-gu	334	317
	Sangnok-gu	504	486
Anseong-si	-	168	150
Anyang-si	Dongan-gu	1,140	1,121

	Manan-gu	654	636
Yangju-si	-	225	207
Yangpyeong-gun	-	166	148
Yeoju-si	-	161	144
Yeoncheon-gun	-	146	129
Osan-si	-	407	389
Yongin-si	Giheung-gu	489	471
	Suji-gu	556	538
	Cheoin-gu	212	194
Uiwang-si	-	451	432
Uijeongbu-si	-	443	425
Icheon-si	-	178	160
Paju-si	-	205	187
Pyeongtaek-si	-	239	221
Pocheon-si	-	166	148
Hanam-si	-	492	473
Hwaseong-si	-	220	203

References

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