A Techno-Economic Assessment of Photovoltaic and Electric Vehicle Integration for CO_2 Emission Reduction in Cities

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Profile

■ Education

Master, Environmental Science, Tohoku University

Bachelor, Environmental Engineering, Kasetsart University

■ Experience

Teacher assistant for Advanced Environmental Studies class in Tohoku University

■ Research interests

Urban decarbonization, energy management, energy transition, soil remediation, rare metal recovery

■ Collaboration

Research Institution: College of Life Sciences, National Chung Hsing University, Taiwan

What is Techno-economic Assessment?

Techno-economic assessment evaluates the feasibility and economic viability of integrating specific technologies.

Importance

- Guides strategic decision-making
- Identifies cost-effective solutions
- Optimizes resource allocation
- Ensures sustainable and economically viable urban decarbonization

Balance

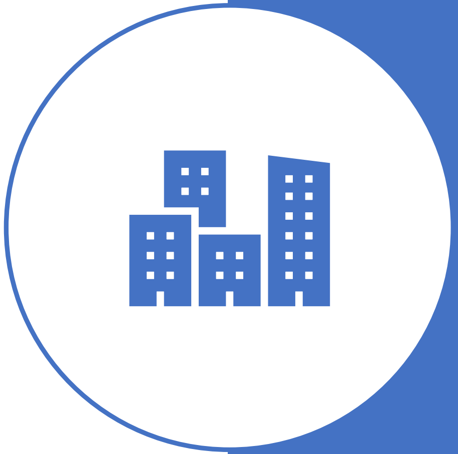
Economic
- Investment costs
- Compensation
- Financing
- Incentives

Renewable energy technologies
- Weather condition (PV & Wind)
- System spec
- System losses

Result

Energy production, CO_2 Emission reduction, Net present value, Payback period, LCOE.

Urban CO2 Emission Challenges



- Cities face a challenge of rising CO_2 emissions, contributing to environmental degradation.
- Urgent solutions are needed to curb this trend and foster sustainability.

Our Goals

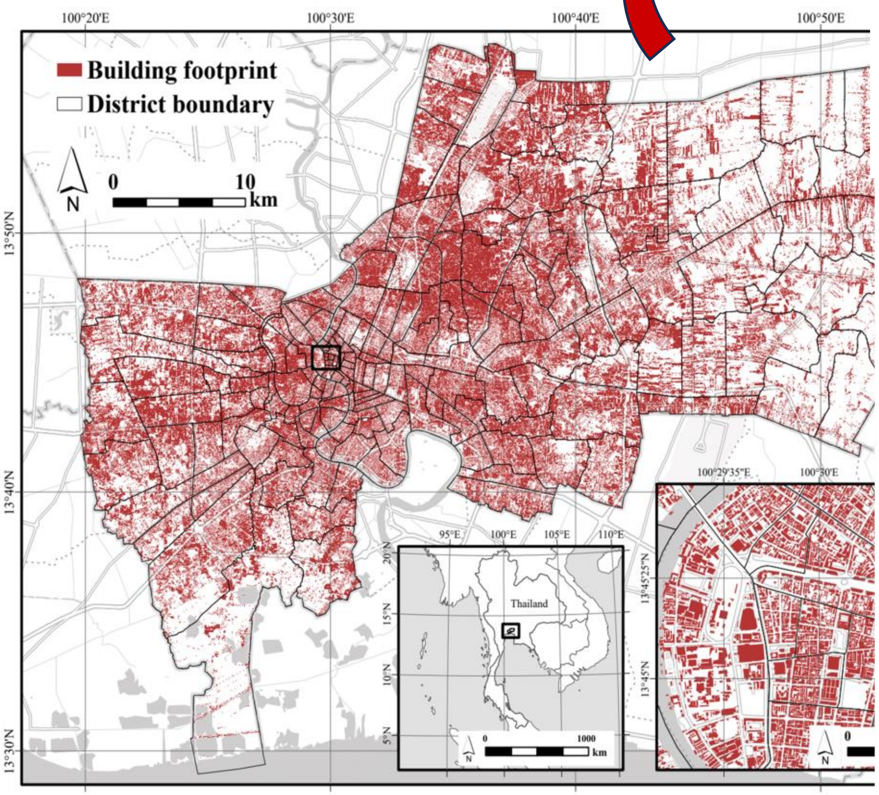
Necessity of PV and EV Integration:

Utilizing Vehicle-to-Home (V2H) systems for EVs to charge using PV-generated electricity at households.

Providing a dual solution for sustainable urban living.

Focus on both technologies for a holistic solution to combat CO2 emissions in cities.

Previous work



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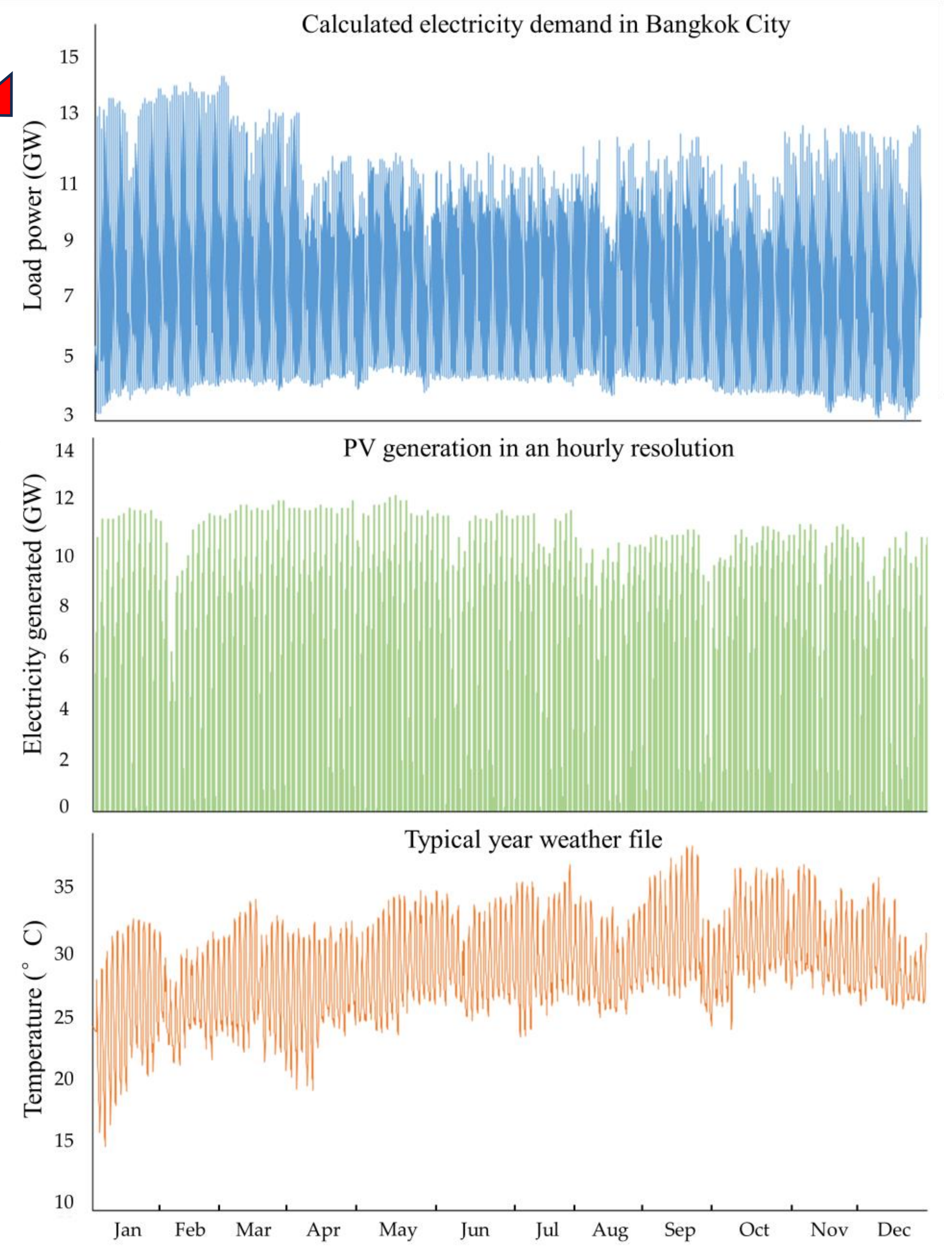

Schemes

2020

FIT is applied ✓

- PV only

FIT is not applied ✗

- PV only
- PV+EV

2030

FIT is applied ✓

- PV only

FIT is not applied ✗

- PV only
- PV+EV

Economic & Environmental Imapct Highlights

	With FIT		Without FIT	
2020	**PV Only**	**PV + EV**	**PV Only**	**PV + EV**
Optimal PV capacity (GW)	22.1	N/A	14.4	N/A
NPV over project period (USD B)	26.6	N/A	23.3	N/A
Discounted Payback Period (yr)	10.3	N/A	8.7	N/A
Cost Saving (%)	8	N/A	7	N/A
CO_2 Emission Reduction (%)	28	N/A	24	N/A
Self-consumption (%)	64	N/A	86	N/A
Self-sufficiency (%)	42	N/A	36	N/A
Energy sufficiency (%)	65	N/A	42	N/A
2030				
Optimal PV capacity (GW)	36.8	36.8	24.7	36.8
NPV over project period (USD B)	59.9	94.0	41.1	94.0
Discounted payback period (yr)	4.0	3.2	4.0	3.2
Cost savings (%)	19	59	13	59
CO_2 emission reduction (%)	32	73	29	73
Self-consumption (%)	43	95	59	95
Self-sufficiency (%)	46	71	43	71

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Thank you!

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