



HANDBOOK FOR ROOFTOP SOLAR DEVELOPMENT IN ASIA

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Preface

This *Handbook for Rooftop Solar Development in Asia* was written to support the Asian Development Bank's (ADB) Asia Solar Energy Initiative (ASEI), which aims to create a virtuous cycle of solar energy investments in the region, so that developing Asian countries may optimally benefit from the clean and inexhaustible energy provided by the sun.

The ASEI uses an integrated, multipronged approach that features three interlinked components: (1) knowledge management, (2) project development, and (3) innovative finance solutions. This publication furthers the first prong of disseminating knowledge management solutions, to facilitate solar technology transfer, deliver quality inputs to policy and decision makers in solar power development, and facilitate innovation in financing mechanisms.

In addition to catalyzing large, utility-scale solar projects, the Asia and Pacific region will also benefit from further exploring the possibilities of rooftop solar photovoltaic (PV) technology. It has particular utility in being suited for decentralized solar power generation for remote and rural communities, although this publication also shows that larger-scale urban systems are practical, economical, and make good use of unused rooftop space.

As such, this handbook demystifies the process of implementing a rooftop solar PV project through a step-by-step guide to development. It covers the initial stages of how to conduct a prefeasibility assessment, how to finance a system, and how to ensure proper operations and maintenance. By being aware of all the steps in the process, and with guidance on handling the various aspects, this handbook hopes to help streamline the implementation process and therefore make rooftop solar PV much more accessible.

As a point of reference, this handbook provides examples from ADB's experience in implementing its own rooftop solar PV system, which ADB completed in 2012. Though this handbook was written to be accessible to all audiences, experienced developers may find ADB's experience helpful, as we have included tips for bidding and procurement, and in choosing an adequate financing mechanism.

With the cost of solar PV systems decreasing, alongside rising fossil fuel and electricity prices, implementing a rooftop solar PV system is becoming an attractive option, even in heavily urbanized areas. ADB has predicted increased energy demand in Asia's future, and rooftop solar PV is one option, among many alternative energy solutions, that can meet that demand in a sustainable manner.



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From ADB, Aiming Zhou, senior energy specialist, supervised the preparation of the handbook. Carina Paton prepared the handbook, with assistance from Chatiya Nantham, Alejandro Ana, Oscar R. Roman, Anil Terway, and Mark Lister who provided research and technical support. Nelly Sangrujiveth drafted the policy and regulations section and provided editorial assistance. Staff support was provided by Maria Dona Aliboso, Patricia Calcetas, and Maria Angelica Rongavilla. Andres Kawagi Fernan and Charito Isidro provided valuable help at various stages of the production and printing process.

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Abbreviations

AC	alternating current
ACEGE	AC electricity generation effectiveness
ADB	Asian Development Bank
BIPV	building-integrated photovoltaics
CDM	Clean Development Mechanism
CdTe	cadmium-telluride
CER	carbon emission reduction credit
CIGS	copper-indium-gallium-selenide
CPV	concentrating photovoltaics
DAS	data acquisition system
DC	direct current
DHI	diffuse horizontal irradiance
DMC	developing member country
DNI	direct normal irradiance
DSSC	dye-sensitized solar cell
FIT	feed-in tariff
GHI	global horizontal irradiance
GSMC	Good Social Management Certificate
HVAC	heating, ventilation, and air conditioning
IEA	International Energy Agency
IEC	International Electrotechnical Commission
LEED	Leadership in Energy and Environmental Design
NREL	National Renewable Energy Laboratory
OPV	organic photovoltaics
PPA	power purchase agreement
PR	performance ratio
PV	photovoltaic
REC	renewable energy certificate
RPS	renewable portfolio standard
SLA	solar leasing arrangement
STC	standard test conditions
UL	Underwriters Laboratories
UNFCCC	United Nations Framework Convention on Climate Change
US DOE	United States Department of Energy

Weights and Measures

A	ampere
°C	degree Celsius
GWh	gigawatt-hour
kg	kilogram
kW	kilowatt
kWh	kilowatt-hour
kWp	kilowatt-peak
m ²	square meter
MJ	megajoules
MW	megawatt
MWh	megawatt-hour
V	volt
W	watt
W/m ²	watts per square meter
Wp	peak watt