

53rd American Solar Energy Society National Solar Conference 2024 (SOLAR 2024)

Connecting Technology and Policy

**Washington, DC, USA
20-23 May 2024**

Editors:

**Kat Friedrich
Carly Rixham**

Print ISBN: 979-8-3313-0908-4
eISBN: 979-8-3313-0907-7

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2024) by American Solar Energy Society
All rights reserved.

Printed with permission by Curran Associates, Inc. (2024)

For permission requests, please contact American Solar Energy Society
at the address below.

American Solar Energy Society
2525 Arapahoe Ave, Ste E4-253
Boulder, Colorado 80302
USA

Phone: (303) 443-3130

info@ases.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

TRACK 1: TECHNOLOGY INNOVATIONS AND LIFE CYCLES (APPLICATIONS OF PV AND SOLAR THERMAL, LIFE CYCLES AND IMPACTS)

Solar Synergy: Unifying PV Energy and Smart Home Solutions..... <i>Boris Budagyan</i>	4
Productive Uses of Renewable Energy (PURE) for Uganda..... <i>Robert Foster</i>	20
Solar Thermal Collectors and Multi-Source Heat Pump Systems..... <i>Gaylord Olson</i>	34
An Approach Characterizing the Performance Degradation of a 140 kW Solar Panel in WV	49
<i>R. Subnom</i>	
Analyzing Optimal Renewable Energy Portfolio for Electricity Generation in Arizona and Texas with Lowest Carbon Emissions	61
<i>Rahim Khoie</i>	
A Study of Carbon Emissions and Energy Consumption of Solar Power Generation in Phoenix, Arizona	75
<i>Rahim Khoie</i>	
Optimizing a Foldable Solar Cooker with Enhanced Thermal Properties for Humanitarian and Refugee Camp Deployment	88
<i>Tariku Demissie</i>	
Modeling and Production Performance Analysis of a Campus 5 MW Solar Installation in the California San Joaquin Valley	93
<i>David Mueller</i>	
Beyond the Surface: Environmental Depth of Photovoltaic Recycling Methods..... <i>Asli Birturk</i>	100

TRACK 2: GRIDS AND SOLAR COMMUNITIES (SMART GRIDS FROM NANO TO MICRO)

Predicting Weather-Dependent Energy Savings for Low-Income Residential Buildings for Specific Upgrades with Limited Data..... <i>Phillip Clayton</i>	112
Renewables in Recent and Future Heat Waves..... <i>Nir Krakauer</i>	118
Experimental Study of Ambient Dusts and Installment Orientations Effects on Solar Panel Efficiency	127
<i>Xiuhua Si</i>	

TRACK 3: NET ZERO ENERGY BUILDINGS, PASSIVE HEATING AND COOLING (DECARBONIZING THE BUILDING SECTOR)

Enhancing Building Performance with Solar Heating Reflective Coatings: Impacts on Thermal and Electrical Efficiency	142
<i>Yizhou Yang</i>	
Solar Energy Potential and Integration in Alabama Residential Buildings: A Photovoltaic System Feasibility Study.....	154
<i>Yizhou Yang</i>	
Exploring the Impact of Spatial Factors on Circadian Daylight Distribution.....	167
<i>Neda Ghaeili</i>	
Team SHUNYA: Harnessing Solar Power and Circularity in Urban Housing - A Student-Built Net Zero Home Case Study.....	179
<i>Ali Khan</i>	
Designing High-Performance Buildings with a Focus on Equity: A U.S. Department of Energy Solar Decathlon Case Study	191
<i>Nea Maloo</i>	
Early Experiences with a High-Elevation Off-Grid Solar Residence in Colorado	203
<i>Dave Renné</i>	
Evaluation of Retrofit Passive Solar Heating for Emergencies	216
<i>Martin Smullen</i>	
Thermal Comfort in Hot, Humid Weather in a Dome-Shaped Building	228
<i>Roya Taheri</i>	
Energy and Economic Analysis of Combined Use of Phase Change Material with Insulation in Residential Buildings.....	244
<i>Prabhat Sharma</i>	

TRACK 4: EDUCATION AND TRAINING (EDUCATING & ENGAGING STAKEHOLDERS)

Integrating Energy Technology and Policy: A New Graduate-Level Course	255
<i>Kristin Field</i>	
Mobilizing to Support Large-Scale Solar and Storage Goals	258
<i>Jill Cliburn</i>	

TRACK 5: POLICY, LEGISLATION, ECONOMICS, AND FINANCE (EQUITABLE ENERGY OWNERSHIP AND ACCESS — POLICY, REGULATION, AND INVESTMENT)

To What Extent Are the United States and Nigeria Able to Balance Economic Growth Against Emission Reduction Goals?.....	271
<i>Bolu Ayankojo</i>	
What Is the Future of Photovoltaics in the Electrification of Africa?.....	285
<i>Moses Bass</i>	

Firm-Dispatchable Power and Its Requirement in a Power System Based on Variable Generation.....	294
<i>Stephen Clark</i>	
Policy and Data Needs for Increased Grid Reliability and Energy Equity	308
<i>Clifford Ho</i>	
Maximizing DPV Hosting Capacity with Regional Firm VRE Power.....	319
<i>Marc Perez</i>	
The Practical Implementation of Distributed Solar CHP With Thermal and EV Battery Storage for Schools	329
<i>Steven Smiley</i>	
Comparative Analysis of Building Envelope Performance across Income Levels for Enhancing Thermal Resilience during Heatwaves	342
<i>Suman Paneru</i>	
Review of Sustainable Urban Planning and Design Policy Interventions for Heatwave Management in Urban Environments.....	358
<i>Huijin Zhang</i>	
Navigating South Africa's Energy Crisis: Advancing Toward a Solar-Powered Future.....	371
<i>Akua Debrah</i>	

Author Index