The Renewable Energy Systems and Recycling R&D Center (RESREC) – research on PVs

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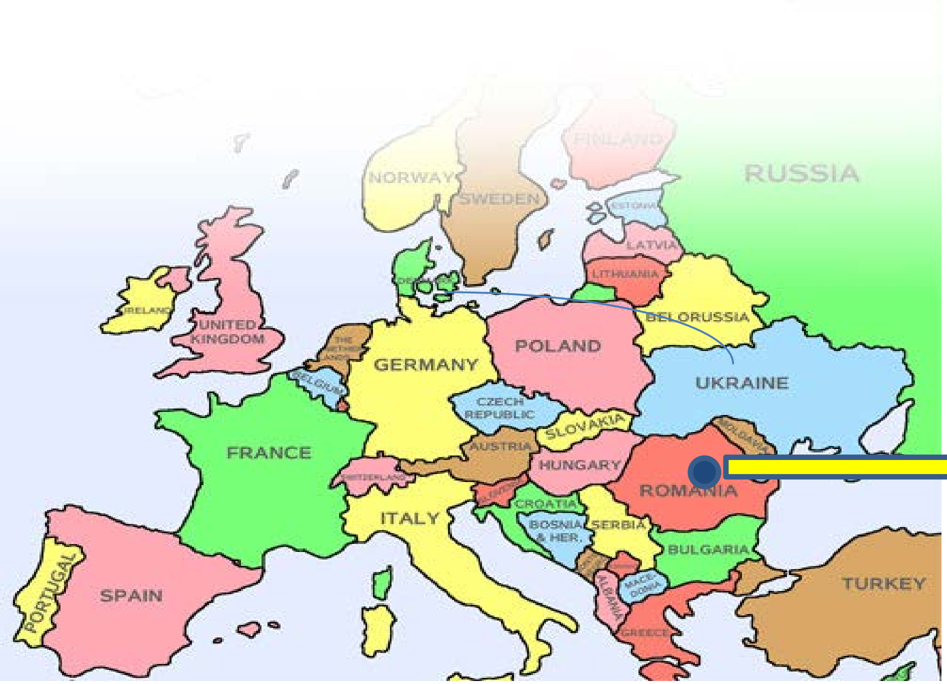

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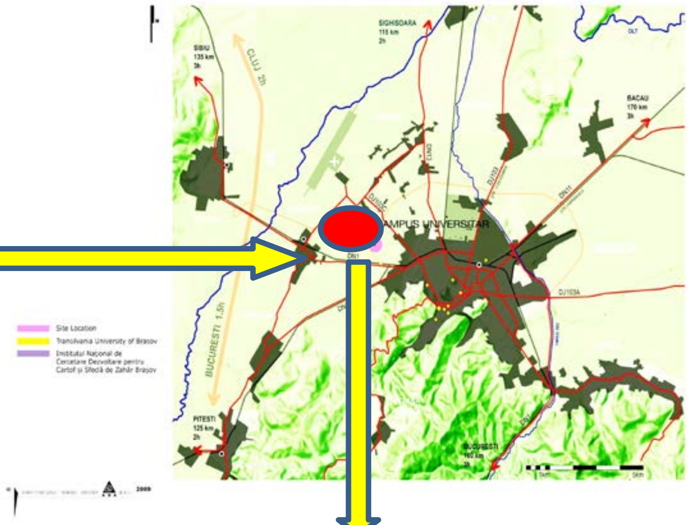

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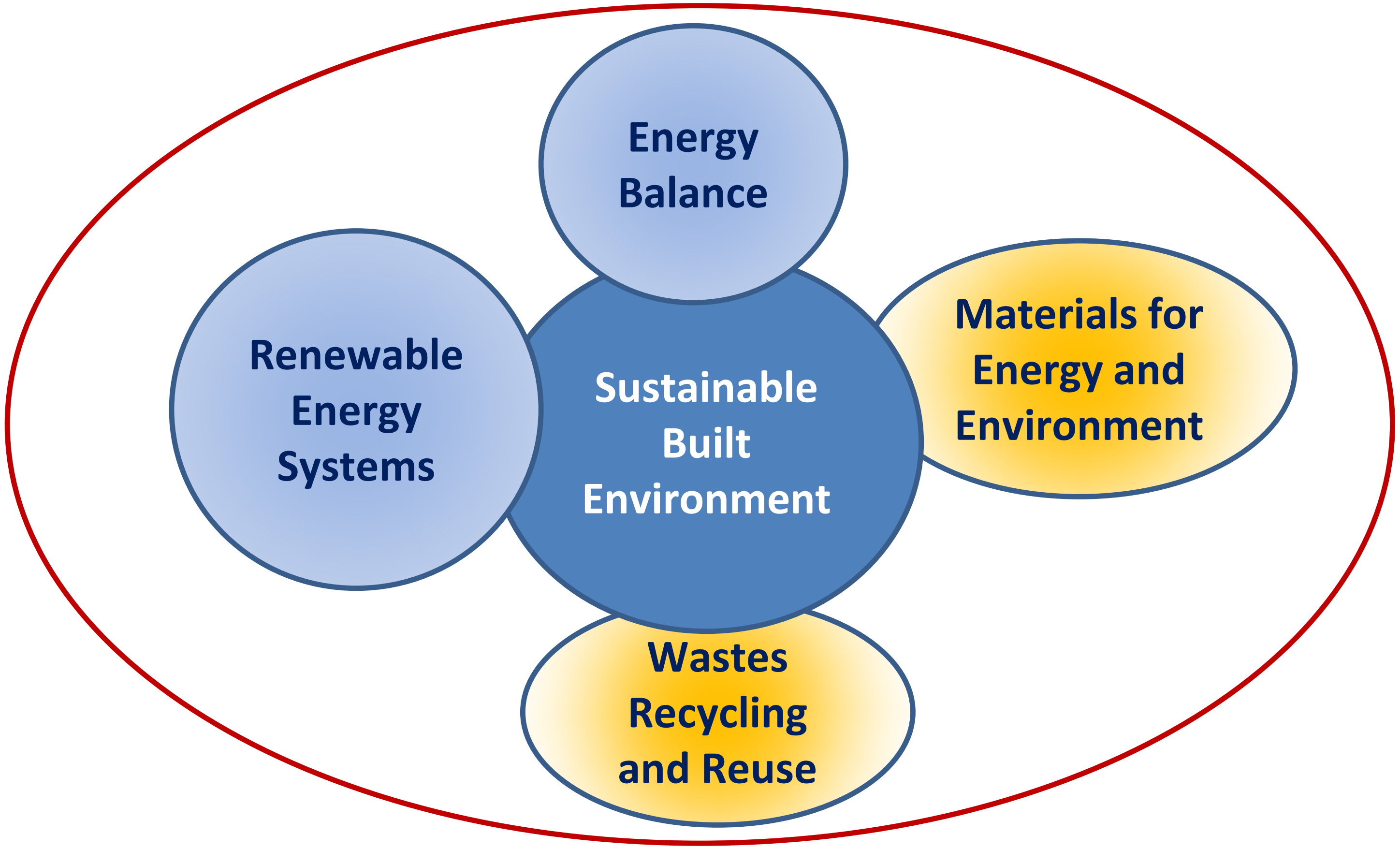
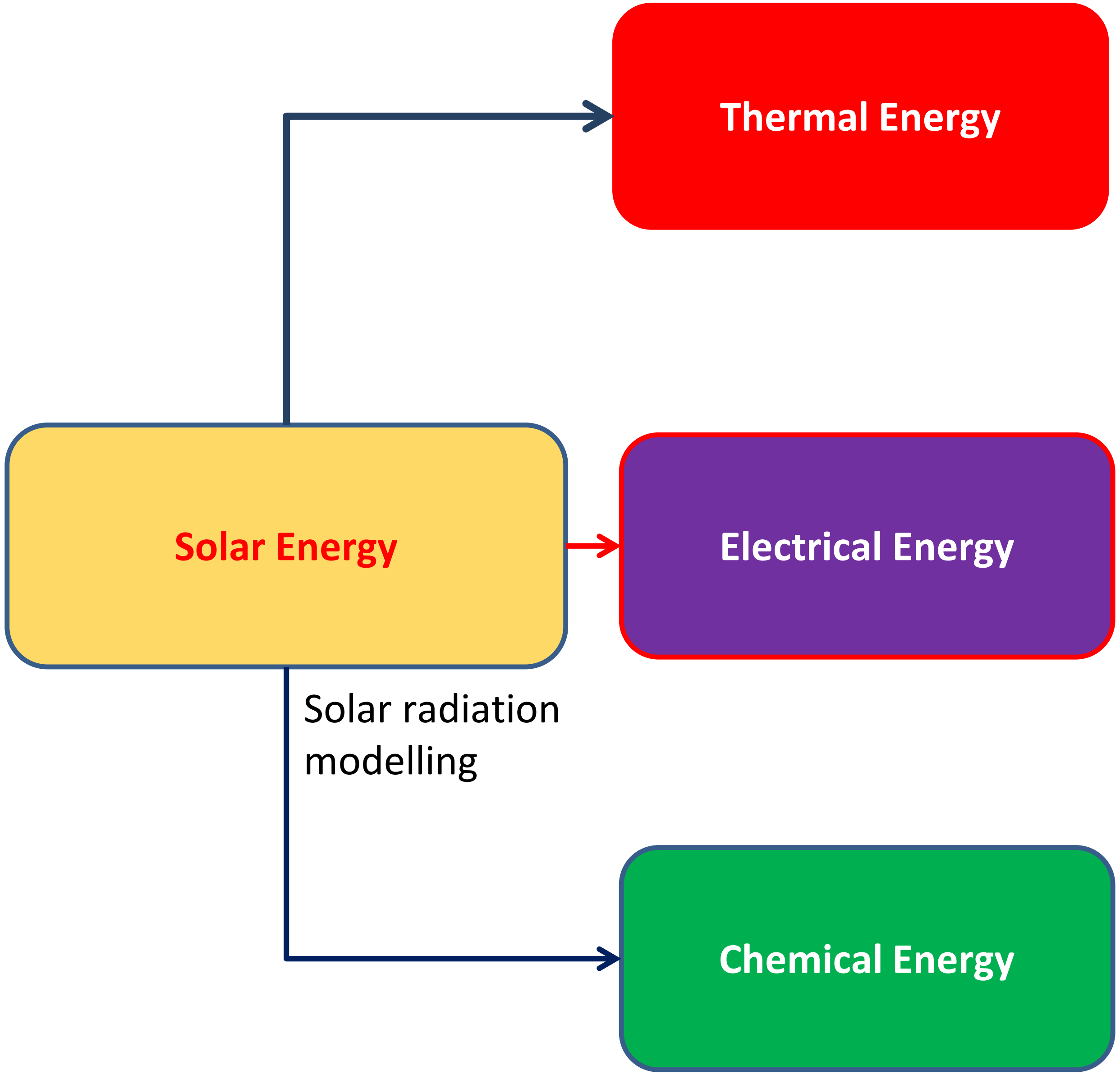
RESREC



Energy Balance
Renewable Energy Systems
Sustainable Built Environment
Materials for Energy and Environment
Wastes Recycling and Reuse

The R&D Centre: Renewable Energy Systems and Recycling, RESREC



- Solar-thermal facades
- Solar-thermal collectors
- Tracking systems
- Tracking algorithms
- Absorber plates
- Durability Testing
- Functional Testing

- PV platforms and strings in the built environment
- Portable PV arrays
- Tracking systems
- Tracking algorithms
- Solid state solar cells

- Photocatalytic materials
- Fly ash/photocatalyst composites
- Photocatalytic processes
- Photoreactors
- Self-cleaning coatings

Realistic assessment of BIPV:

- ***ERoEI*** for BIPV: **targeted value for sustainability: 5**

  current value: 0.82 (< 1) ➔ PVs represents a clean way to produce electrical energy that is not fully sustainable.

- The cost associated to the PV systems are currently subsidized

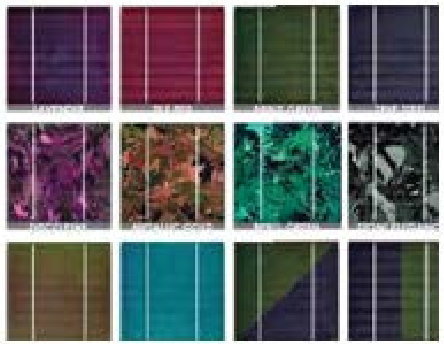
  the solar electricity price is **over 10 cents/kWh** that is double considering as reference the cost of 5 cents/kWh corresponding to solar-thermal systems

- **Further research on**:

➢ Increasing the photovoltaic conversion efficiency

➢ Decreasing the cost(s) of the system (PV modules, inverter, etc.)

➢ Increasing the architectural acceptance, while preserving the functional features



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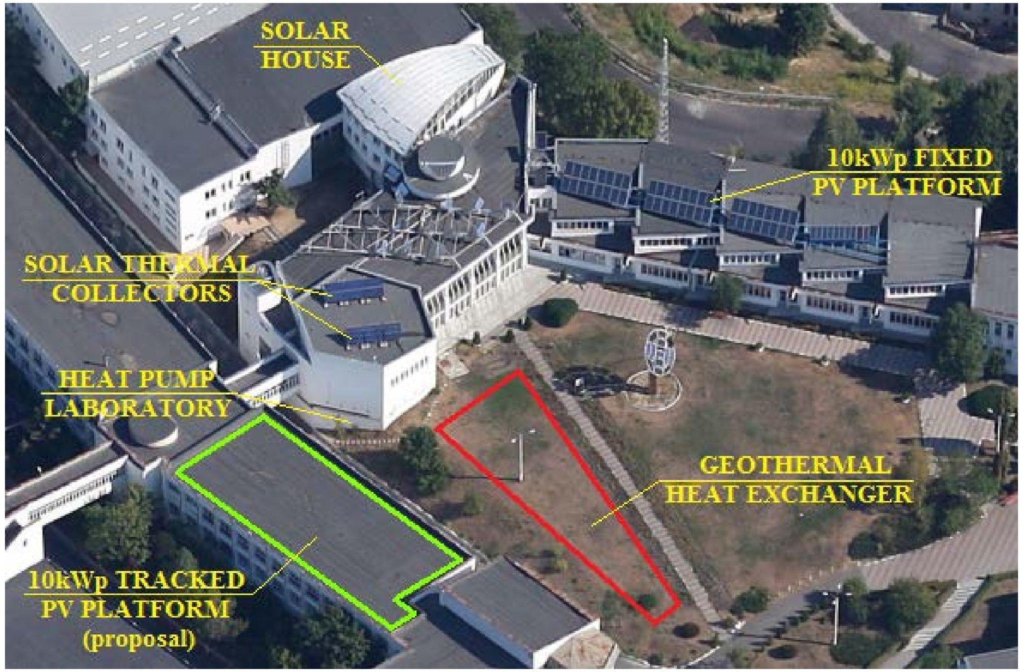
A) The Colina location:

The Solar House (290 m^2, 70m^3)



Energy mix:

- Ground coupled heat exchanger, HP (10 kW)
- Flat plate ST collectors
- PV array: 10kWp

Thermal energy [MWh/year]				Electrical energy [MWh/year]		Total energy [MWh/year]	
Heating		Domestic hot water (DHW)		Demand[a]	Supplied by RES	Demand	Supplied by RES
Demand	Supplied by RES	Demand	Supplied by RES				
45.51	44.51	1.25	0.28	12.75	5.10	59.51	49.89
97.80% RES		22.40% RES		40% RES		83.83% RES	

[a] In estimating the electrical energy demand the lighting loads were considered (1.25 MWh/year) along with the energy needed to power the heat pump and its compressor (11.5 MWh/year).

B) The R&D Institute of the Transilvania University of Brasov (ICDT)

ICDT location: Outdoor Testing rigs:
- Single axis tracking systems (PV, ST)
- Dual-axis tracking system (ST)
- PVT and PV systems
- Flat plate and parabolic trough solar-thermal collectors

B) The R&D Institute of the Transilvania University of Brasov (ICDT)

Overall thermal energy demand: 90030 kWh/year
- **DHW: 4244 kWh/year**
- **Heating: 78027 kWh/year**
- **Cooling: 7759 kWh/year**

Electric energy demand for lighting and other powered appliances (except laboratory equipment): 13224 kWh/year

Specific energy load: 76.7 kWh/m^2/year
(LEB)

Renewable based energy mix:
Thermal energy: 60021 kWh/year
- **Heat pumps**
- **Solar thermal collectors**

Electric energy: 29557 kWh/year
- **Photovoltaic systems**
- **Smal wind turbines**

RES = 86.8%
(nZEB)

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Solutions for the sustainable built environment

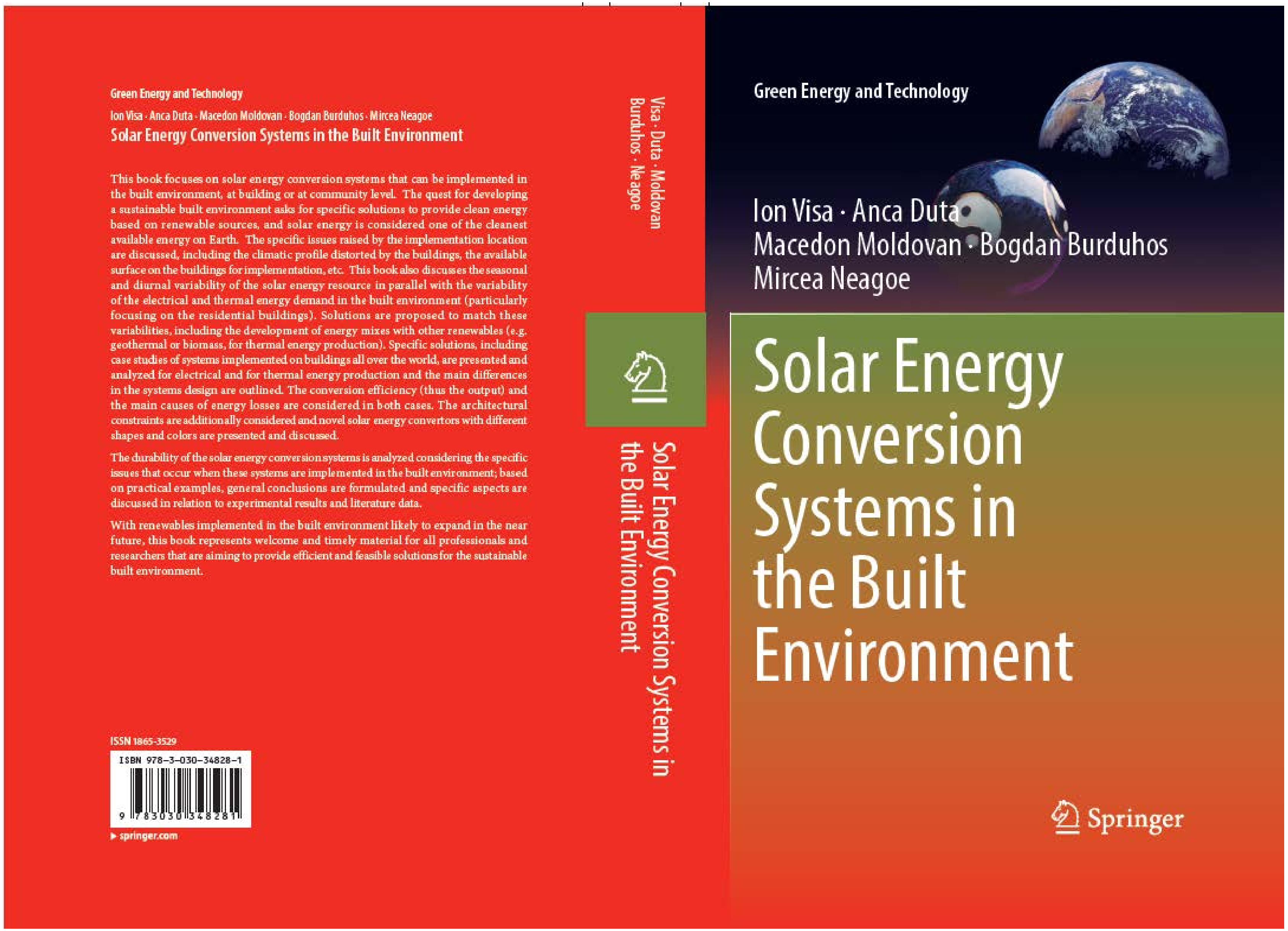
Low energy building(s) - all the ICDT buildings

nearly Zero Energy Buildings nZEB - building L7

Integrating PV tracked platforms in the built environment (on-ground mounting)

Optimization of the **tracking mechanism and tracking algorithm** adapted to various type of PV modules

More detailed information and analysis on the topics….



Green Energy and Technology

Ion Visa · Anca Duta · Macedon Moldovan · Bogdan Burduhos · Mircea Neagoe

Solar Energy Conversion Systems in the Built Environment

This book focuses on solar energy conversion systems that can be implemented in the built environment, at building or at community level. The quest for developing a sustainable built environment asks for specific solutions to provide clean energy based on renewable sources, and solar energy is considered one of the cleanest available energy on Earth. The specific issues raised by the implementation location are discussed, including the climatic profile distorted by the buildings, the available surface on the buildings for implementation, etc. This book also discusses the seasonal and diurnal variability of the solar energy resource in parallel with the variability of the electrical and thermal energy demand in the built environment (particularly focusing on the residential buildings). Solutions are proposed to match these variabilities, including the development of energy mixes with other renewables (e.g. geothermal or biomass, for thermal energy production). Specific solutions, including case studies of systems implemented on buildings all over the world, are presented and analyzed for electrical and for thermal energy production and the main differences in the systems design are outlined. The conversion efficiency (thus the output) and the main causes of energy losses are considered in both cases. The architectural constraints are additionally considered and novel solar energy convertors with different shapes and colors are presented and discussed.

The durability of the solar energy conversion systems is analyzed considering the specific issues that occur when these systems are implemented in the built environment; based on practical examples, general conclusions are formulated and specific aspects are discussed in relation to experimental results and literature data.

With renewables implemented in the built environment likely to expand in the near future, this book represents welcome and timely material for all professionals and researchers that are aiming to provide efficient and feasible solutions for the sustainable built environment.

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