Renewable Energy and Sustainability

Prospects in the Developing Economies

Edited by Imran Khan



Contents

10.7 Way forward 28910.8 Conclusion 291Self-evaluation questions 292Numerical problems 292References 292

11. Hydrogen energy–Potential in developing countries 299

Minhaj Uddin Monir, Azrina Abd Aziz, Mohammad Tofayal Ahmed and Md. Yeasir Hasan

- 11.1 Introduction 299
- 11.2 Energy sectors in developing countries 301
- 11.3 Sources of hydrogen production 303 11.3.1 Fossil fuel source 304
 - 11.3.2 Biomass and algae source 305
 - 11.3.3 Microbial source 306
- 11.4 Technologies for hydrogen production 307 11.4.1 Thermal process 307
 - 11.4.2 Electrolytic process 311
 - 11.4.3 Photolytic process 312
- 11.4.4 Fermentation process 313 11.5 Current status of hydrogen production 315
- 11.6 Challenges of hydrogen conversion 317
- 11.7 Hydrogen potentiality in developing countries 317
- 11.8 Conclusions 319
- Self-evaluation questions 320

References 321

The role of demand-side management in sustainable energy sector development 325

Samuel Gyamfi, Felix Amankwah Diawuo, Emmanuel Yeboah Asuamah and Emmanuel Effah

- 12.1 Introduction 325
- 12.2 Concept of demand-side management 326
- 12.3 Basic techniques in DSM 327
 12.3.1 Flexible load techniques 332
 12.3.2 Flexible storage techniques 332
 12.3.3 Demand-side generation techniques 333
- 12.4 DSM contribution to sustainability 335
- 12.5 Case studies 336
 - 12.5.1 Case study 1: DSM in Ghana 336

12.5.2 Case study 2: DSM in South Africa 338
12.5.3 Case study 3: DSM in China 339
12.5.4 Case study 4: DSM in India 340
12.6 Future directions of DSM 340
12.7 Conclusion 341
Self-evaluation questions 341

References 342

 The role of energy storage technologies for sustainability in developing countries 347

Md Momtazur Rahman, Imran Khan and Kamal Alameh

- 13.1 Introduction 34713.1.1 Role of energy storage technologies in energy transitions 349
- 13.2 Classification of energy storage technologies 349
 - 13.2.1 Mechanical energy storage 349
 - 13.2.2 Thermal energy storage 355
 - 13.2.3 Electrochemical energy storage 357
 - 13.2.4 Electromagnetic energy storage 361
- 13.3 Progress and challenges of energy storage technologies in developing countries 362
- 13.4 Sustainability evaluation of energy storage technologies in developing countries 366
- 13.5 The case of China 36713.5.1 Summary and benefits of the energy storage project 367
- 13.6 Challenges and policy implications 367
- 13.7 Conclusion 369
- 13.8 Self-evaluation 37013.8.1 Questions 37013.8.2 Numerical problems 370

References 371

 Climate change, sustainability, and renewable energy in developing economies 377

Mahfuz Kabir, Zobaidul Kabir and Nigar Sultana

- 14.1 Introduction 377
- 14.2 Linkage between climate change, energy, and sustainability 379
- 14.3 Growth of electricity demand and climate change: Impact on developing economies 382

xii