

Advancing Renewable Energy in Buildings

Overcoming Challenges Through Policy and Innovation

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Agenda

1. Introduction
2. Agenda
3. Overview of the Energy Landscape
4. Challenges in the Building Sector
5. Potential Solutions: Policy and Innovation
6. Evaluation and Conclusion

Energy Landscape

- Growing Global Energy Demand
- Climate Change and Energy Consumption
- Building Sector's Impact:
 - Significant energy consumption
 - High greenhouse gas emissions
- Importance of Renewable Energy

Challenges in Renewable Energy Adoption

- High Upfront Costs
- Technological Limitation
- Lack of Public Awareness
- Policy and Regulatory Inconsistencies

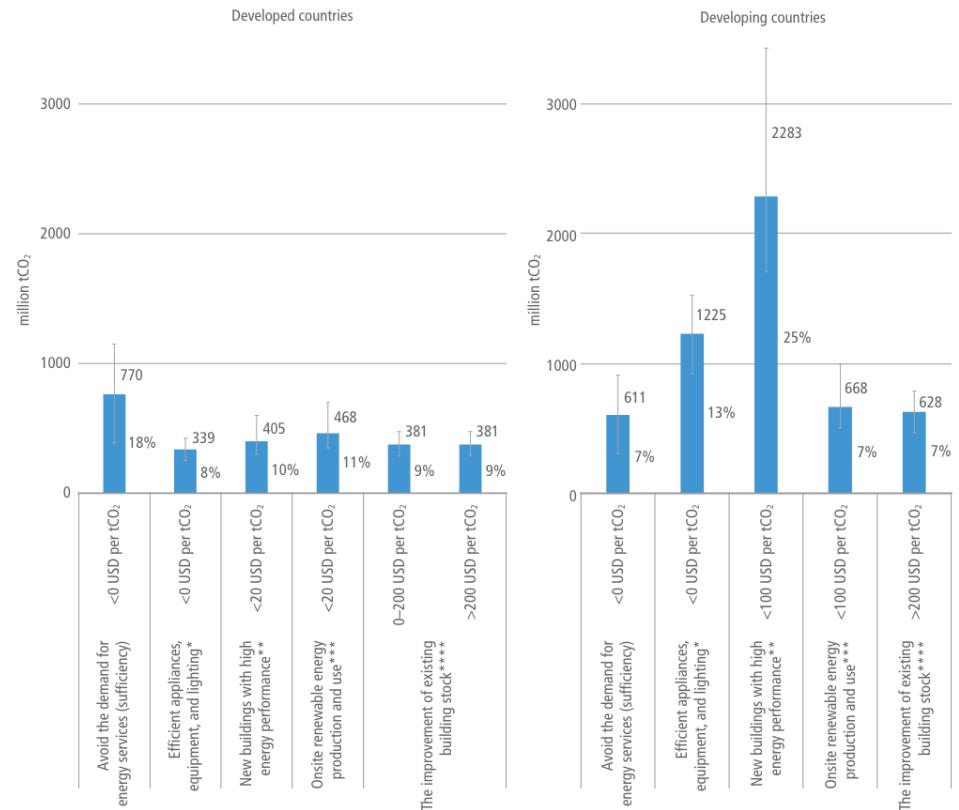


Figure 1: GHG Emission

Note. Energy consumption trends over the past decade in developed and developing countries. ([Environment Program, 2020](#))

Solutions – Policy Approaches

- Role of Government Policy
 - Supportive policies needed
- Key Policy Measures
 - Building energy codes
 - Financial incentives (tax credits, grants, subsidies)
 - Capacity development and training programs



Figure 2: Photovoltaic Roof

Note. The building integrated a photovoltaic roof. ([IKC, 2016](#)).

Solutions – Effective Policy Instruments

- Renewable Portfolio Standards (RPS)
- Renewable Energy Standards (RES)
- Feed-in Tariffs



Figure 3: Green Buildings

Note. Green Building Policy. ([Team, 2023](#)).

Solutions – Technological Innovation

- Need for Technological Advancements
 - Efficiency, affordability, accessibility
- Innovative Technologies:
 - Building-Integrated Photovoltaics (BIPV)
 - Solar Thermal Technologies
 - Geothermal Energy
 - Micro-Wind Turbines



Figure 4: Solar Panel Architecture

Note. Seamlessly integrates photovoltaic technology into building elements, turning them into efficient energy sources while offering durability, sustainability, and financial incentives.. (*Through the Looking Glass, 2024*).

Importance of Energy Storage

- Addressing Intermittency
 - Ensuring reliable energy supply
- Key to consistent energy availability
 - Key to consistent energy availability



Figure 5: Energy Storage

Note. Energy Storage Summit 2023 - Leonardo Royal Hotel, London, United Kingdom. ([Stanley-Tate, 2023](#)).

Evaluation of Solutions

- Policy-Driven Approaches:
 - Effective in incentivizing adoption
 - Challenges: inconsistencies, enforcement, priority shifts
- Technology-Driven Solutions:
 - Potential for increased efficiency and reduced costs
 - Challenges: high costs, expertise required, risk of obsolescence



Figure 6: “Living wall”

Note. “Living wall” to enhance the building in London. ([Steve Fitch, 2014](#)).

Conclusion

- Balanced Approach Required:
 - Combination of policy and innovation
- Collaboration Needed:
 - Governments, industry leaders, individuals
- Focus on:
 - Encouraging investment and innovation
 - Advancing technology for efficiency and affordability
- Goal:
 - Clean, sustainable energy for buildings
 - Mitigating climate change, enhancing energy security
 - Healthier planet for future generations



Figure 7: Sustainable Architecture Skills

Note. Green building policies have become a global phenomenon. ([Team, 2023](#)).

References

- Babí Almenar, J., Elliot, T., Rugani, B., Philippe, B., Navarrete Gutierrez, T., Sonnemann, G., & Geneletti, D. (2021). Nexus between nature-based solutions, ecosystem services and urban challenges. *Land Use Policy*, 100, 104898. <https://doi.org/10.1016/j.landusepol.2020.104898>
- Chen, C., Cao, X., Zhang, S., Lei, Z., & Zhao, K. (2022). Dynamic Characteristic and Decoupling Relationship of Energy Consumption on China's Construction Industry. *Buildings*, 12(10, 10), 1745. <https://doi.org/10.3390/buildings12101745>
- Chen, L., Chen, Z., Zhang, Y., Liu, Y., Osman, A. I., Farghali, M., Hua, J., Al-Fatesh, A., Ihara, I., Rooney, D. W., & Yap, P.-S. (2023). Artificial intelligence-based solutions for climate change: A review. *Environmental Chemistry Letters*, 21(5), 2525–2557. <https://doi.org/10.1007/s10311-023-01617-y>
- Chen, L., Hu, Y., Wang, R., Li, X., Chen, Z., Hua, J., Osman, A. I., Farghali, M., Huang, L., Li, J., Dong, L., Rooney, D. W., & Yap, P.-S. (2024). Green building practices to integrate renewable energy in the construction sector: A review. *Environmental Chemistry Letters*, 22(2), 751–784. <https://doi.org/10.1007/s10311-023-01675-2>
- Environment Program, U. N. (2020). *Buildings - Energy System*. IEA. <https://www.iea.org/energy-system/buildings>
- Environment Program, U. N. (2024, March 6). *Global Status Report for Buildings and Construction | UNEP - UN Environment Programme*. <https://www.unep.org/resources/report/global-status-report-buildings-and-construction>
- IKC, S. (2016). *BIPVco Integrated Roof [Graphic]*. <https://www.flickr.com/photos/specific-ikc/30088006605/>

Intergovernmental Panel on Climate Change (IPCC) (Ed.). (2023). Buildings. In *Climate Change 2022 - Mitigation of Climate Change: Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 953–1048). Cambridge University Press.
<https://doi.org/10.1017/9781009157926.011>

Komurlu, R., Kalkan Ceceloglu, D., & Arditı, D. (2024). Exploring the Barriers to Managing Green Building Construction Projects and Proposed Solutions. *Sustainability*, 16(13, 13), 5374.
<https://doi.org/10.3390/su16135374>

Okwandum, A. C., Esho, A. O.-O., Iluyomade, T. D., Olatunde, T. M., Okwandum, A. C., Esho, A. O.-O., Iluyomade, T. D., & Olatunde, T. M. (2024). The role of policy and regulation in promoting green buildings. *World Journal of Advanced Research and Reviews*, 22(1, 1), 139–150.
<https://doi.org/10.30574/wjarr.2024.22.1.1047>

Stanley-Tate, D. (2023). *Energy Storage Summit 2023* [Graphic].
<https://www.flickr.com/photos/194605019@N03/52708970693/>

Steve Fitch. (2014). "Living wall" to enhance the building. London [Graphic].
<https://www.flickr.com/photos/111683772@N02/14529433557/>

Team, V. E. G. M. (2023, September 21). *Green Building Policy Evolution: 2023 & Beyond*. Vert Energy Group. <https://vertenergygroup.com/the-evolution-of-green-building-policy-in-2023-and-beyond/>
Through the Looking Glass: The Role of Solar Glass in Advancing Solar Panel Architecture. (2024, May 31). <https://www.mitrex.com/blog/through-the-looking-glass-the-role-of-solar-glass-in-advancing-solar-panel-architecture>

Yang, M., Chen, L., Wang, J., Msigwa, G., Osman, A. I., Fawzy, S., Rooney, D. W., & Yap, P.-S. (2023). Circular economy strategies for combating climate change and other environmental issues. *Environmental Chemistry Letters*, 21(1), 55–80. <https://doi.org/10.1007/s10311-022-01499-6>

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