



GLOBAL RENEWABLE ENERGY TRANSITION – ISSUES AND OPTIONS

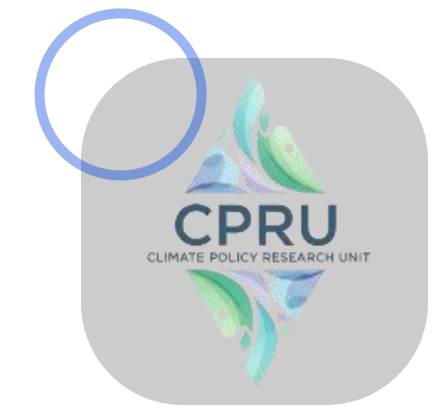
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04 Core issues and options in the Global Renewable energy transition

05 Deeper Dive into key energy policies

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Energy Transition over Time



Industrial

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... and water mills
... tralized,
... iciency, and
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Industrial Revolution 2.0

Use of coal and
steam engines

Mechanization
electricity from
coal

growing energy
demand



Oil, Gas & Grid Expansion 3.0

Rise of petroleum
and natural gas

Rise of national
electric grids

Nuclear power
introduced

Rural and industrial
sectors Electrified



Digital Era & Decarbonization 4.0

Smart grids and
IoT-enabled
Integration of
renewables
Big Data,
blockchain, and
predictive
maintenance
Energy storage
systems and
demand-
management
Carbon capture
and
storage

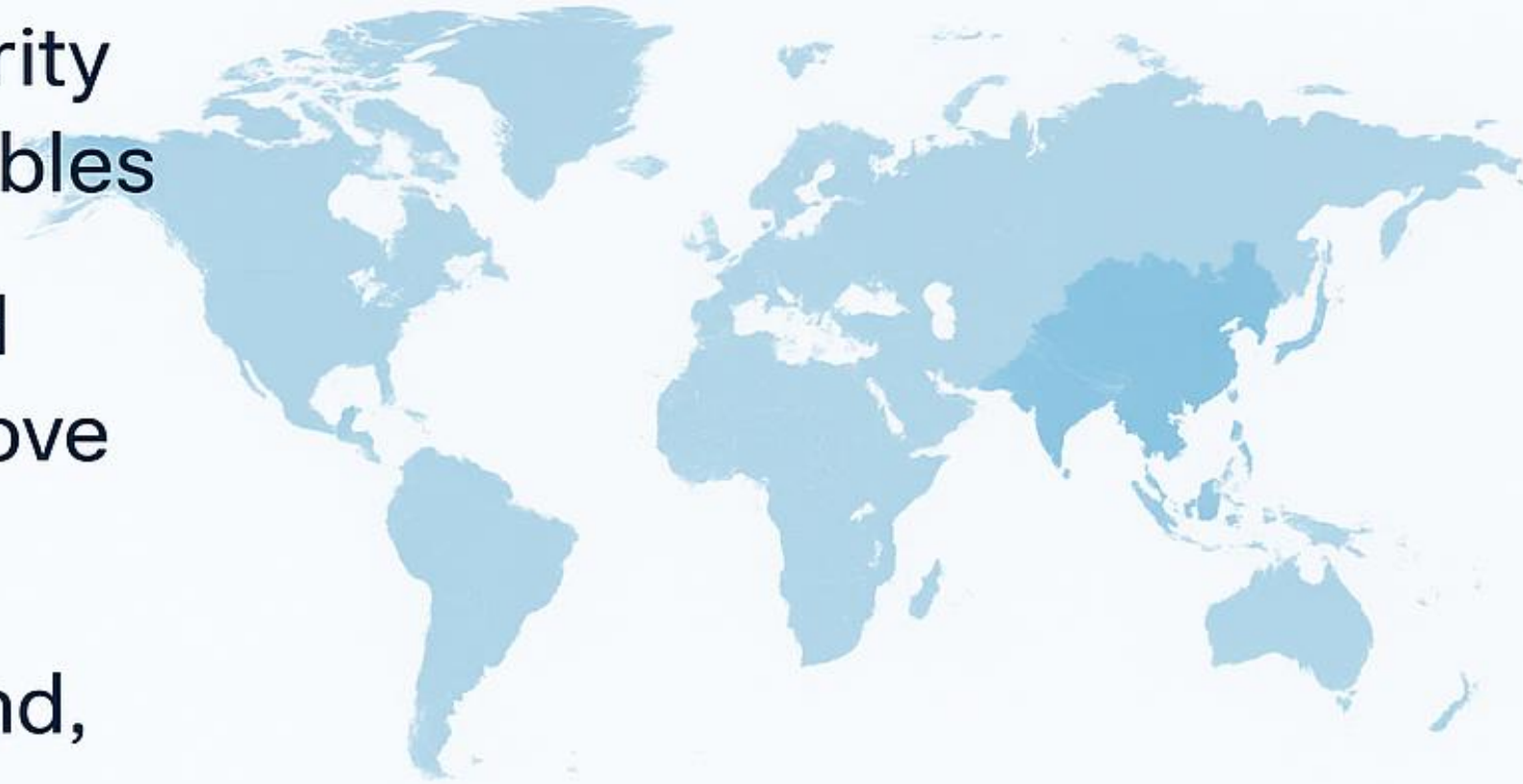


AI-Driven Renewable Transition 5.0

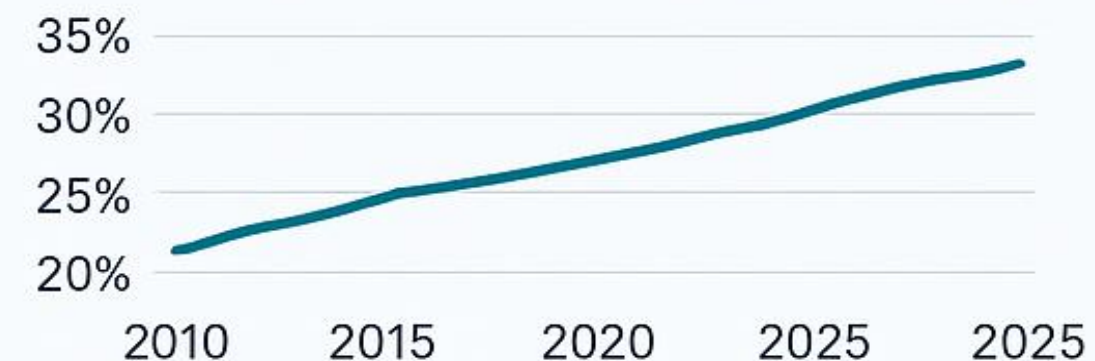
AI-based grid
optimization and
forecasting
Robotics infrastructure
maintenance
Hydrogen economy
Bioenergy with carbon
capture (BECCS)
Peer-to-peer (P2P)
energy trading via
blockchain
Net-zero,
decentralized, and
resilient energy
ecosystems
Development of
energy intensive data
centers

From Fossil Fuels to Renewables: A Global Turning Point

- Climate change & energy security driving massive shift to renewables
- Global CO₂ emissions at record highs; temperatures +1.2 °C above pre-industrial levels
- Transition focuses on solar, wind, hydro, and modern bioenergy



Renewable Share Rising Globally



Glance at Global Profile



Figure 1. Regional Growth in Renewable Electricity (2012–2022).

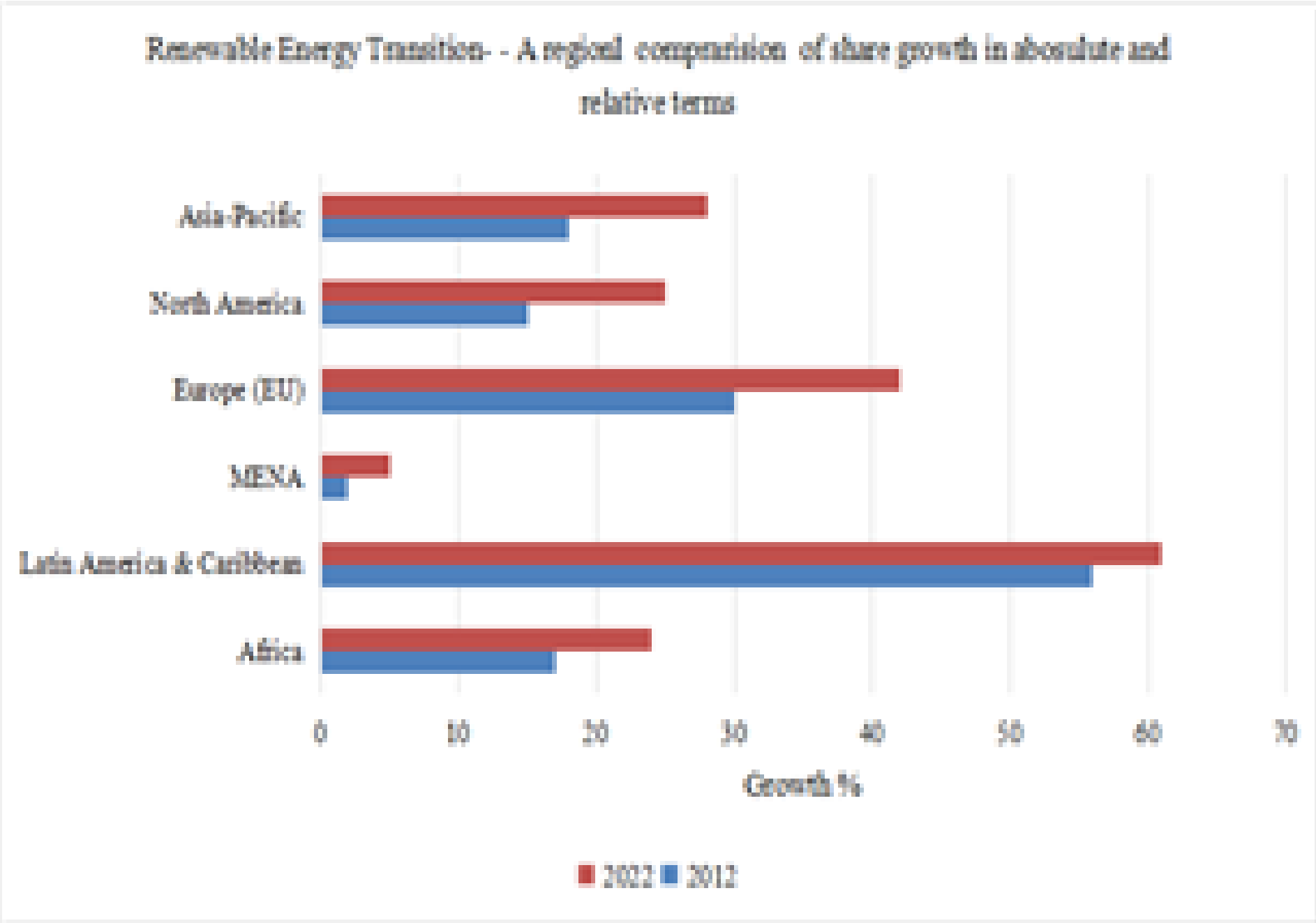


TABLE 1. THE GLOBAL ENERGY LANDSCAPE 2005-2025

Country/Region	Renewable Energy Share (%) 2005	Renewable Energy Share (%) 2015	Renewable Energy Share (%) (ets) 2025	Main Renewable Subsectors Driving Growth	Source
Pakistan	17	30	41.6	Hydropower	[24], [25], [26]
India	10-15	22.5	35-40 %	Solar, Wind, Small Hyro	[27], [25], [28]
China	10-5	20-25	30-35	Wind , Solar , Large Hydro	[27], [25], [28]
United Sates	7-8	10-12	20-25	Solar	[24], [27], [28]
European Union	15-20	25-30	35-40	Wind, Solar, Biomass	[24], [27], [28]
Bangladesh	1-2	3-5	10	Solar, Biomass	[25], [28]
Ghana	5-7	8-10	10-15	Biomass, Solar	[25], [28]
Thailand	5-7	10-15	15-20	Biomass, Solar	[25], [28]
Indonesia	4-5	10-12	20-25	Geothermal, Hydropower, Biomass	[25], [28]
Bhutan	90	100	100	Hydropower	[27], [25], [24]

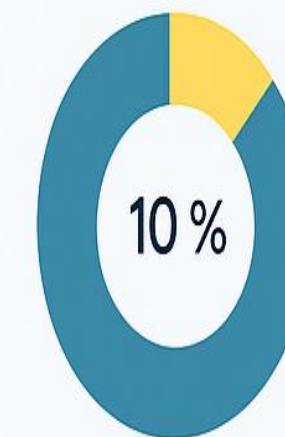
Main Points:

- Added **277 GW solar** in 2024–25 (+45%)
→ **887 GW total solar capacity**.
- **Wind power**: +80 GW → total **521 GW**.
- Solar's share in electricity generation: **4.1% (2020) → 12.4% (2025)**.
- **Wind + solar capacity now exceed coal and gas.**
- Challenges: Grid congestion, storage limits, and coal reliance for baseload.
- Policy focus: **Grid modernization, power market reforms, and storage investment.**

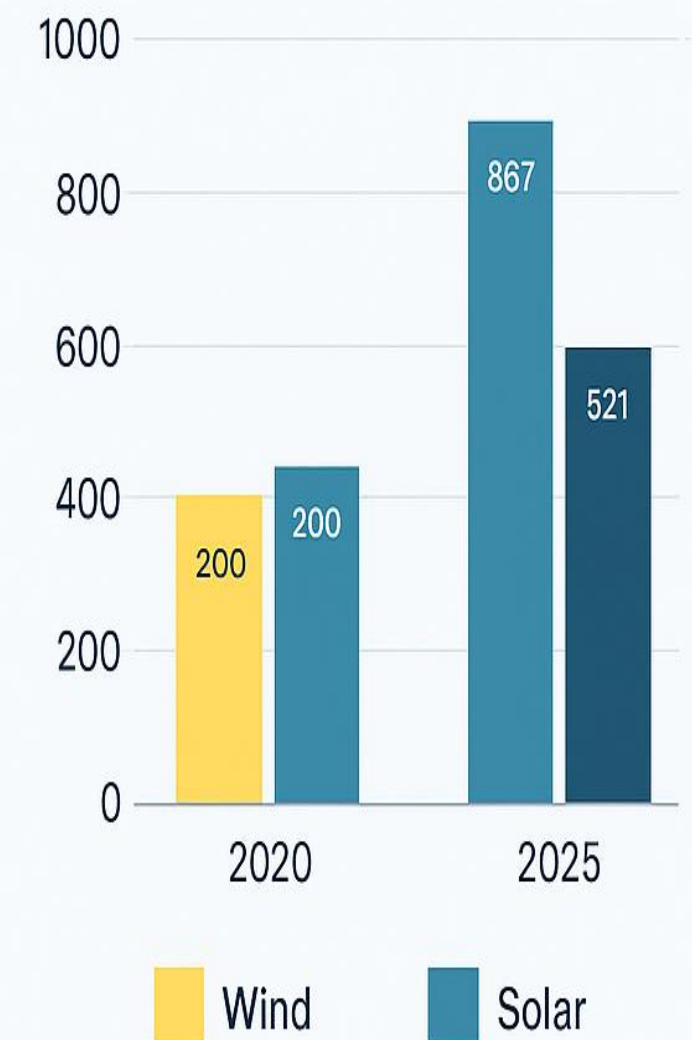
China's Renewable Surge: World's Energy Powerhouse

- Added 277 GW solar in 2024-25 (+45%) → 887 GW total solar capacity
- Wind power: +80 GW → total 521 GW
- Solar's share in electricity generation: 4.1% (2020) → 12.4% (2025)

China's Energy Mix Transition



Installed Capacity Trends



Main Points:

Achieved 100 GW solar target (2025) – up from 3 GW in 2014.

Attracted \$90 billion investment and 300,000 solar jobs.

Target: 500 GW clean power by 2030 – *half of national electricity from renewables.*

Transition driven by economic opportunity, not ideology.

Innovations in business models, financing, and market design enabled success.

Example: Development of solar parks, utility reforms, and timely payments to investors.

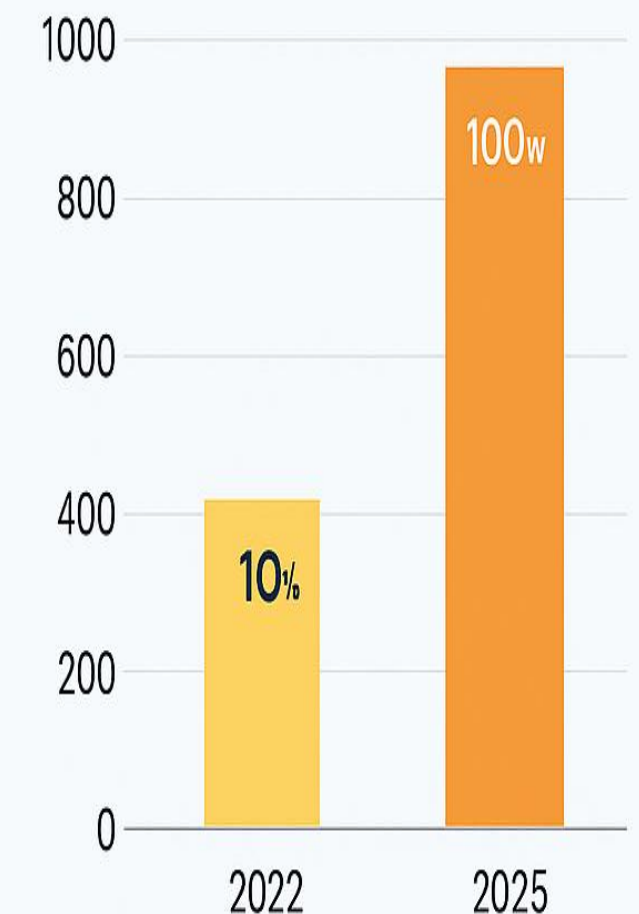
India's Solar Revolution: Doubling Down on Clean Power

- 100 GW solar target by 2022
- Reaching 100 GW in February 2025
- 500 GW clean power goal by 2030
- Economic and climate leadership

Solar's Share
of Power



Solar Capacity Growth



Main Points:

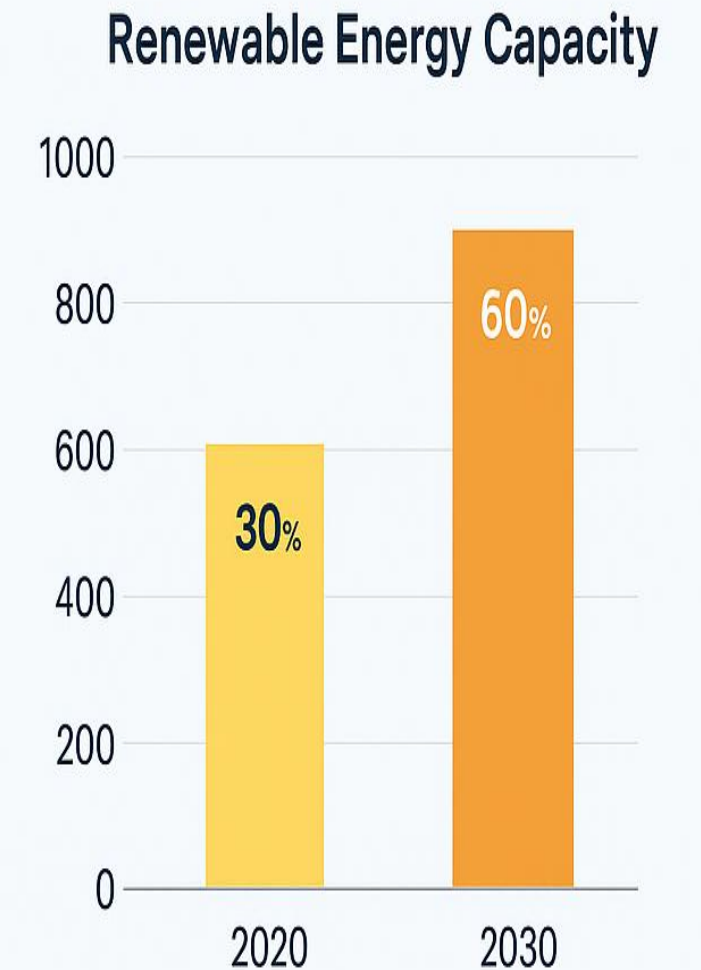
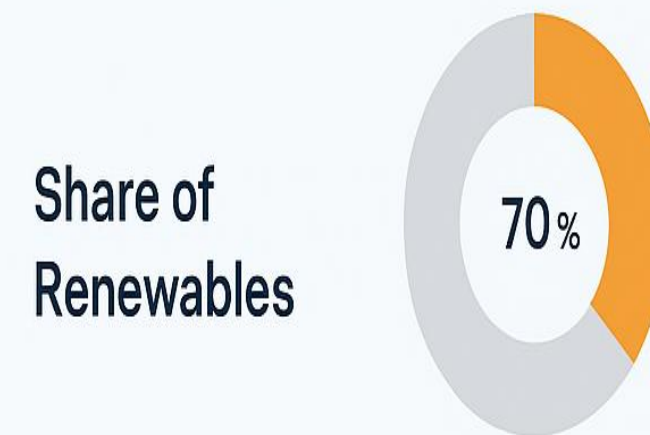
- **Target:** 50% emission reduction by 2030 (conditional on \$101 billion financing).
- **Energy transition goals:** 60% renewables, 30% electric vehicles, coal import ban.
- **Policies:**
 - Net Metering (2015) → **3.2 GW rooftop solar** by 2024.
 - Smart grid pilots (PEPCO, DISCOs).
- **Challenges:**
 - Grid losses, theft, under-investment in T&D.
 - Load-shedding persists despite surplus generation.
- **Nature-based solutions:** Ten Billion Tree Tsunami & Recharge Pakistan.

Visuals:

- Map of Pakistan with renewable projects.
- Icons: solar rooftops, EVs, tree planting.

Pakistan's Energy Transition: Ambitious Renewable Energy Goals

- 50% emissions reduction by 2030
- 60% renewable energy target
- 15% from domestic resources
- USD 101 billion for energy transition



Pakistan possesses immense mineral wealth—valued at nearly US\$8 trillion

Developing Countries – Innovation & Localization



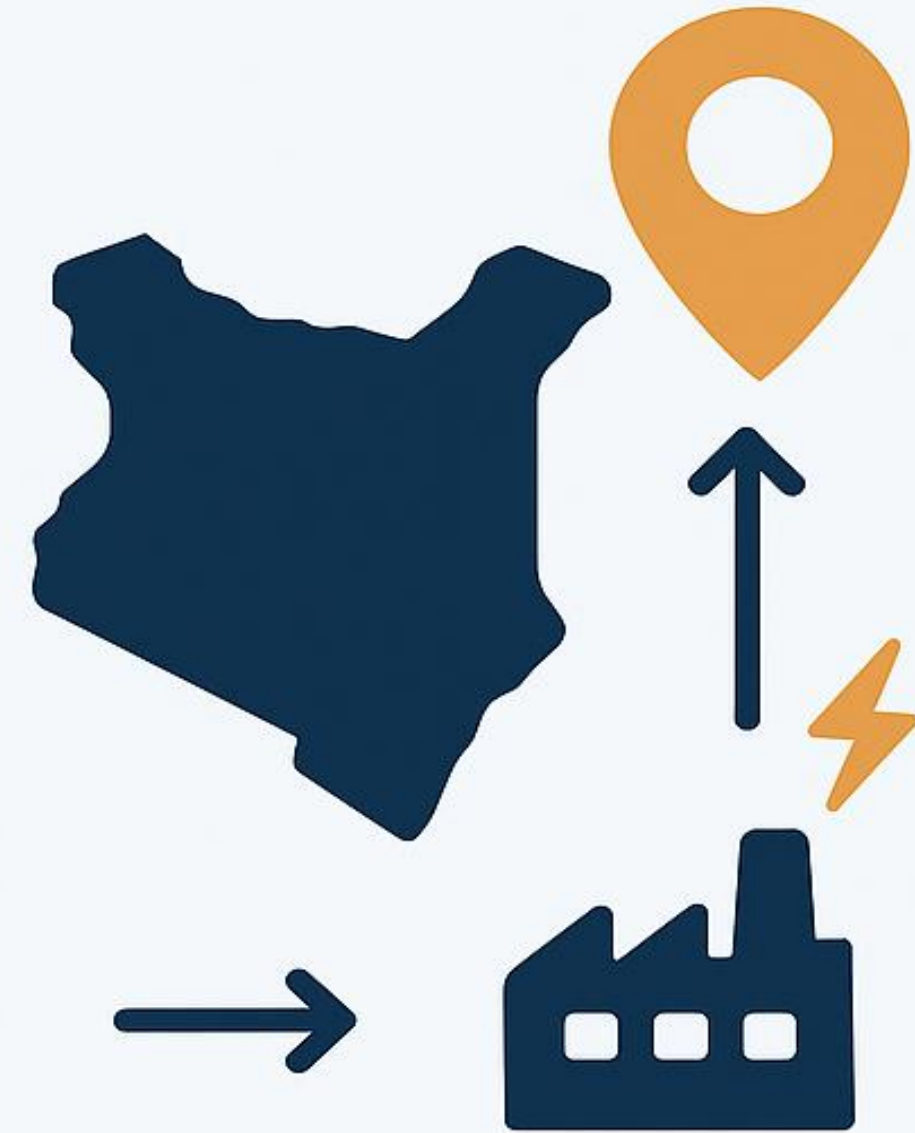
Government planning



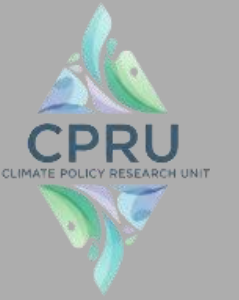
Market design



Capacity building



CORE ISSUES AND OPTIONS IN THE GLOBAL RENEWABLE ENERGY TRANSITION



A. Uneven Global Distribution and Regional Disparities

- Despite progress, the world remains off track to meet climate goals.
- Current renewable installations fall short of the **11.2 TW target** needed by **2030**.
- Achieving the **1.5°C pathway** requires **doubling annual additions** to about **1,043 GW**.
- **Regional disparities** persist in renewable energy adoption.
- **Europe** reached a **44% renewable share** in **2023**.
- **China, India, and Bangladesh** still rely heavily on **fossil fuels**.
- This **uneven transition** highlights **global inequities** in clean energy adoption and **policy implementation**.

B. US Policy Reversals Might Affect Global Trend

- In early **2025**, the **U.S. energy transition** faced major setbacks.
- President **Trump's "Unleashing American Energy" Executive Order** reversed key **clean energy policies**.
- The order **prioritized fossil fuel expansion** over renewable energy development.
- **Support for renewables and electric vehicles** was significantly **reduced**.
- The U.S. **withdrew from the Paris Agreement**, undermining climate commitments.
- These actions created **regulatory uncertainty** and **stalled renewable progress** across the nation.

C.. Grid Integration and Infrastructure Constraints

- **China** achieved rapid renewable expansion in **2024**, adding **277 GW of solar** and **80 GW of wind capacity**.
- Despite record installations, **much of this capacity remains underutilized**.
- The main causes are **transmission bottlenecks** and **limited energy storage**.
- These **infrastructure gaps** highlight that renewable success needs more than just capacity growth.
- **Modernized grids** and **flexible power systems** are essential for efficient integration of renewables.

D. Structural Challenges in Developing Countries

- **South and Southeast Asian countries** continue to face **structural barriers** to renewable energy adoption.
- **India** awarded **59 GW** of renewable capacity in **2024**, but **transmission and contractual delays** have stalled nearly **40 GW** of projects.
- **Bangladesh** is still in the **early stages** of renewable development, with renewables making up only **4.5% of total capacity**.
- The country remains **heavily reliant on fossil fuels**.
- **Indonesia** also continues to **depend on coal** despite having **vast renewable potential**.
- These challenges highlight the urgent need for **stronger infrastructure, effective policy enforcement, and greater financial support** for clean energy transition.

DEEPER DIVE IN TO KEY POLICIES

A. U.S. Renewable Energy Policy Setbacks

- The 2025 policy rollback halted clean energy momentum, delaying over **\$14 billion in renewable projects**.
- It undermined **U.S. leadership and competitiveness** in green innovation and technology.
- Reviving progress demands **targeted manufacturing incentives, state-driven action, and long-term policy stability** to strengthen renewables and grid resilience.

B. China – Supply Chain Dominance and Strategic Expansion

China's control of EV batteries and rare earths has created major global supply dependencies.

The **2025 export restrictions** disrupted industries and intensified geopolitical tensions.

Nations like the **U.S. are pursuing diversification**, green innovation, and **strategic partnerships** — including possible collaboration with Pakistan — to reduce reliance.

C. Grid Transmission Under-Investment

India's 2024 renewable drive awarded 59 GW, but **40 GW is stalled** by grid, PPA, and land issues.

Global trend: auctioned capacity often exceeds infrastructure readiness, leading to curtailment and delays.

Key fixes: coordinate grid and capacity expansion, invest in **smart grids**, and **streamline regulations** to speed deployment.

D. Hydropower Excellence and Circular Economy Innovation

Nepal leads in renewables, producing **over 95% of its power from hydropower** and exporting surplus energy to India and Bangladesh.

Major projects like *Arun-3* and *Upper Trishuli-1* aim to lift capacity to **28,500 MW by 2035**.

Beyond hydro, Nepal promotes **circular energy**, expanding **waste-to-bio-CNG, biogas, and off-grid solar**, now serving **3.6 million+ people**.

Business as usual not an option



01

Strategic Insights:

- Phase out fossil fuel subsidies and align grid expansion with renewable growth.
- Foster equitable access by integrating decentralized systems and inclusive policies.

02

Multi-Channel Mastery:

- Balance large-scale deployment with localized microgrids and digital integration.
- Promote innovation in storage, circular energy recovery, and surplus monetization.

03

Data-Driven Precision:

- Track transition progress with transparent, evidence-based policy metrics.
- Use real-time data to reduce curtailment and optimize renewable utilization.

Technology's Role in the Energy Transition

Technology plays a central role in the **energy transition** by accelerating the shift from fossil fuels to renewable energy systems through *innovations like AI, IoT, and blockchain, which optimize grids, forecast renewables, and decentralize energy markets.*

The three scopes for carbon emissions measurement are vital for evaluating sustainability—Scope 1: direct emissions from company-owned sources (Ex: Company vehicles, boilers); Scope 2: indirect emissions from purchased energy; and Scope (example Electricity for offices/factories) 3: all other indirect emissions along the value chain (Suppliers, product use/disposal) , which are the most challenging and typically largest.

Recent policy reversals in the U.S. signal weakened ambition for renewable energy deployment, particularly affecting Scope 3 compliance, with many oil and tech giants *intensifying focus on Scopes 1 and 2 but struggling or selectively reporting on Scope 3, especially under changing regulatory environments*



1. Need to Speed Up Global Transition

- Renewable deployment is growing, yet **global progress lags behind Paris Agreement targets**.
- Fossil fuel dependence and uneven investment across regions threaten **net-zero goals**.
- Urgent need to align **policy, finance, and technology** for a just transition.

2. Structural and Policy Barriers

- **Uneven regional development** leads to capacity gaps between developed and developing nations.
- **Policy reversals and regulatory uncertainty** undermine investor confidence.
- **Financing limitations** and high capital costs restrict renewable expansion in low-income economies.

3. Pathways to Inclusive Sustainability

- **Technological innovation**: Smart grids, storage, and circular energy systems.
- **Financial innovation**: Green bonds, blended finance, and risk guarantees for emerging markets.
- **Policy innovation**: Stable long-term frameworks, localization of value chains, and community ownership models.
- Promotes **equitable access, resilience, and shared prosperity** in the energy transition.

Accelerating the Global Energy Transition

1. **Need to Speed Up Global Transition**

- Renewable deployment is advancing but not fast enough to meet climate goals.
- Fossil fuel dependence and uneven regional progress threaten net-zero pathways.
- Coordinated policy, technology, and finance are vital for acceleration.

2. **Structural and Policy Barriers**

- Regional disparities and financing gaps delay renewable deployment.
- Policy reversals and regulatory uncertainty hinder investment confidence.
- Limited access to affordable finance constrains developing economies.

3. **Pathways to Inclusive Sustainability**

- Technological innovation: Smart grids, storage, circular energy systems.
- Financial innovation: Green bonds, blended finance, risk guarantees.
- Policy innovation: Stable frameworks, local value chains, equitable energy access.

Accelerating the Global Energy Transition



Need to Speed Up Global Transition

- Renewable deployment is growing, yet global progress lags behind Paris Agreement targets
- Fossil fuel dependence and uneven investment across regions threaten net-zero goals
- Urgent need to align policy, finance, and technology for a just transition

Structural and Policy Barriers

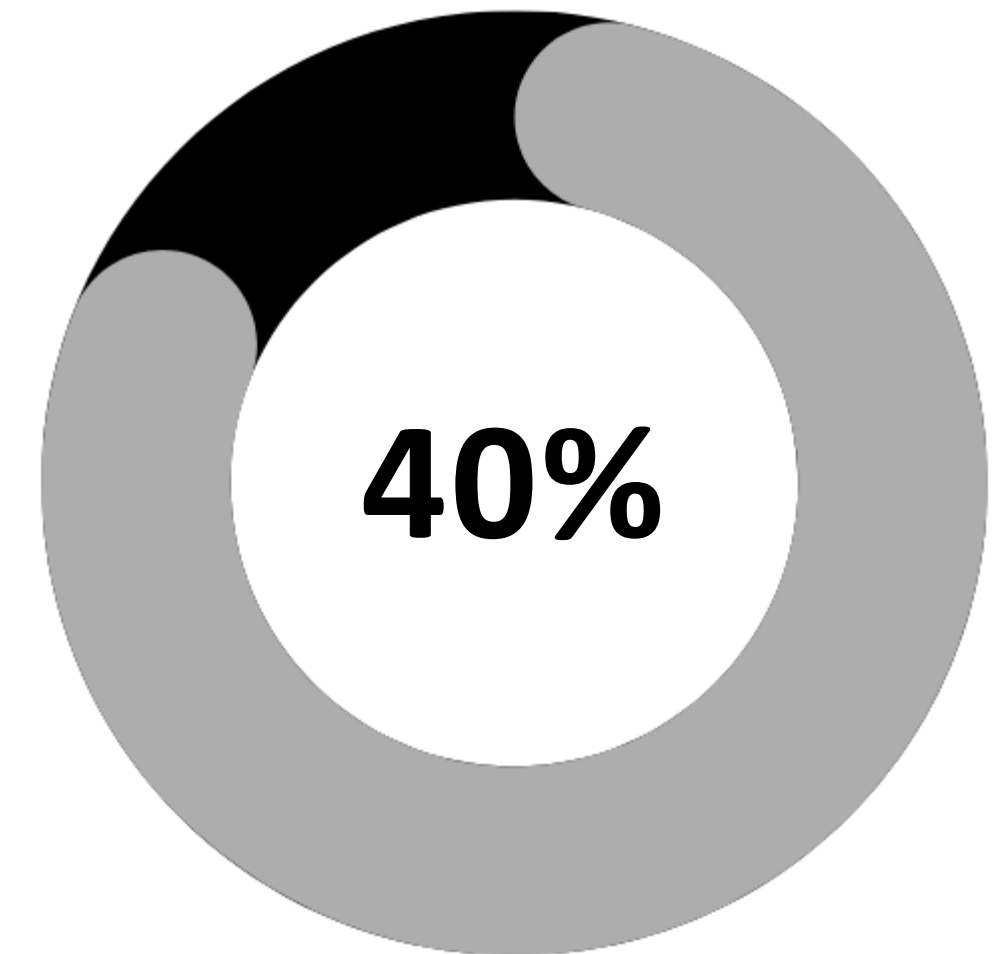
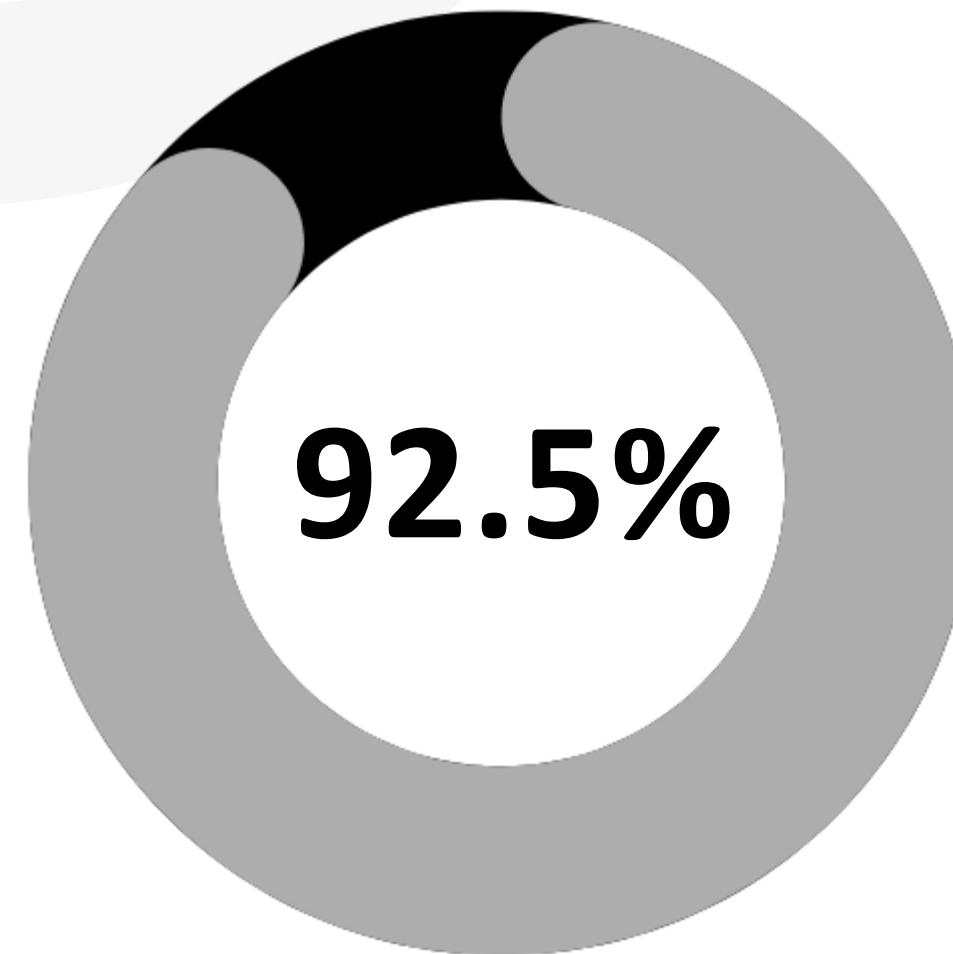
- Uneven regional development leads to capacity gaps between developed and developing nations
- Policy reversals and regulatory uncertainty undermine investor confidence

Pathways to Inclusive Sustainability

- Technological innovation: Smart grids, storage and circular energy systems
- Financial innovation: Green bonds, blended finance, and risk guarantees for emerging markets
- Policy innovation: Stable

CONCLUSION AND FUTURE WORK

The global renewable transition is advancing but remains off pace for climate goals. In 2024, renewables added 585 GW (about 92.5% of all new power), raising global capacity to 4,448 GW, yet only 40% of the 11.2 TW needed by 2030. Asia, led by China, dominates with over 70% of new additions, while Africa contributes less than 2%, highlighting equity gaps. Despite U.S. slowdowns from policy reversals, innovations like China's 7.75 GW pumped hydro expansion and new iron-air batteries show that technology is ready—but coordinated, equitable investment is still essential.



In 2024, renewables added 585 GW (about 92.5% of all new power), raising global capacity to 4,448 GW, yet only 40% of the 11.2 TW needed by 2030



THANK YOU

FOR YOUR ATTENTION

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