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ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY
An Initiative of the Clean Energy Ministerial

21st CENTURY POWER PARTNERSHIP
AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

Power Sector Decarbonization Action Plan Series: Introduction to the Action Plans

September 26, 2023

Housekeeping - Zoom

- This webinar is **being recorded** and will be shared with attendees.
- You will be **automatically muted** upon joining and throughout the webinar.
- Please use the **chat feature** to add comments and share input.
- Please use the **Q&A function** in your toolbar to ask questions.

- If you have **technical issues**, please use the chat feature to message Holly Darrow.
- You can adjust your audio through the **audio settings.** If you are having issues, you can also dial-in and listen by phone. Dial-in information can be found in your registration email.
- We will be launching a **survey** when the event ends. Your feedback is highly valuable to us!

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Webinar & Speaker Introductions

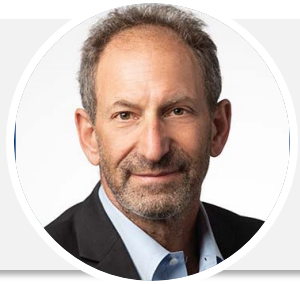
Moderated by Dr. Doug Arent, National Renewable Energy Laboratory

September 26th, 2023

Agenda

- Overview of the Clean Energy Solutions Center
- Overview of the 21st Century Power Partnership
- Findings from the CEM13 Collaborative Report
- Overview of Action Plan Origins and Development
- Findings from the CEM14 Event and Action Plan Next Steps
- Q&A

Webinar Speakers



Doug Arent

Executive Director of Strategic Public-Private Partnerships, **National Renewable Energy Laboratory**

Robert Horner

International Relations Specialist, **U.S. Department of Energy**

Prateek Joshi

Energy Engineer, **National Renewable Energy Laboratory**

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Overview of the Clean Energy Solutions Center

Presented by Robert Horner, U.S. Department of Energy

September 26th, 2023

The Clean Energy Solutions Center

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CLEAN ENERGY MINISTERIAL
Advancing Clean Energy Together

OBJECTIVE

To accelerate the transition of clean energy markets and technologies.

RATIONALE

Many developing governments lack capacity to design and adopt policies and programs that support the deployment of clean energy technologies.

AMBITION/TARGET

Support governments in developing nations of the world in strengthening clean energy policies and finance measures

ACTORS

Leads:

Operating Agent:

NREL
Transforming ENERGY

Partners:

More than 40 partners, including UN-Energy, IRENA, IEA, IPEEC, REEEP, REN21, SE4All, IADB, ADB, AfDB, and other workstreams etc.

ACTIONS

- **Deliver** dynamic services that enable *expert assistance*, *learning, and peer-to-peer sharing of experiences. Services are offered at no-cost to users.*
- **Foster** dialogue on emerging policy issues and innovation across the globe.
- **Serve** as a first-stop clearinghouse of clean energy policy resources, including policy best practices, data, and analysis tools.

UPDATES

Website:
www.cleanenergyministerial.org/initiatives-campaigns/clean-energy-solutions-center

Factsheet:
www.nrel.gov/docs/fy22osti/83658.pdf

Requests: Now accepting Ask an Expert requests!

The Clean Energy Solutions Center

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ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY

CLEAN ENERGY MINISTERIAL
Advancing Clean Energy Together

Ask an Expert Service

- Ask an Expert is designed to help policymakers in developing countries and emerging economies identify and implement ***clean energy policy*** and finance solutions.
- The Ask an Expert service features a network of more than **50** experts from over **15** countries.
- Responded to **300+** requests submitted by **90+** governments and regional organizations from developing nations since inception

Training and Capacity Building

- Delivered over **300** webinars training more than **20,000** public & private sector stakeholders.

Resource Library

- Over **1,500** curated reports, policy briefs, journal articles, etc.

For additional information and questions, reach out to Jal Desai, NREL, jal.desai@nrel.gov

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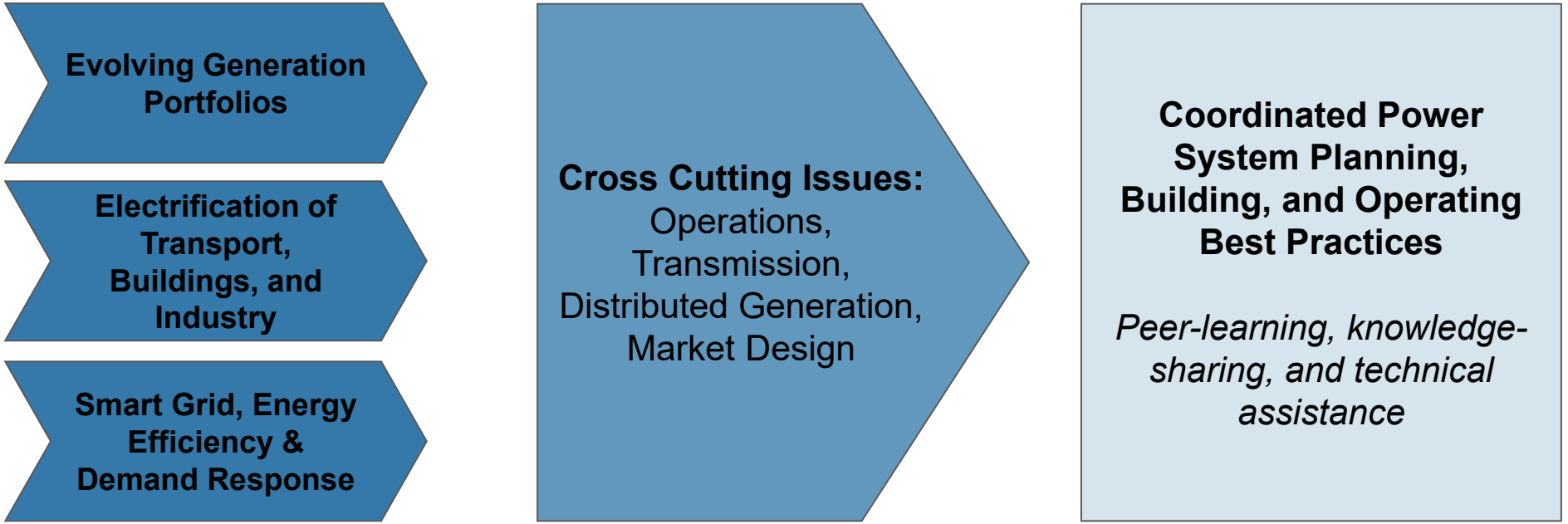
Overview of the 21st Century Power Partnership

Presented by Prateek Joshi, National Renewable Energy Laboratory

September 26th, 2023

21CPP Objectives: Power System Transformation

Accelerate the transition to clean, efficient, reliable, and cost-effective power systems.



Coordinating with related CEM Campaigns

21CPP: Focus Areas

Annual Program of Work often includes:

- "Thought Leadership" studies that focus on generic power system transformation topics across the world

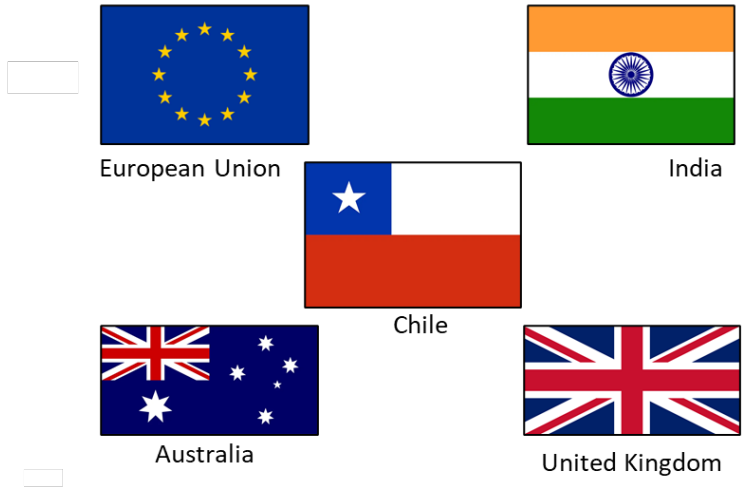
- In-country technical assistance, often as part of a larger development assistance effort, focused on *Planning, Building, and Operating best practices for decarbonizing power systems.*
  - High-resolution grid integration studies often highlight this work.

- Information exchange, capacity building, fellowship programs, and other exercises to share lessons-learned and knowledge transfer.

21CPP: Recent Activities

2021-2022:
Released a collaborative report for energy ministers on lessons learned for rapid decarbonization of power sectors.

2022-2023:
Worked with a first cohort of countries to develop Action Plans for power sector decarbonization based off the report.



March 2023: Workshop on transmission planning and operations
May 2023: Workshop on resource adequacy and grid flexibility

21CPP: Planned Activities

2023-2024:

Webinar series to discuss details of Action Plans in the first cohort.

+

Work with a second cohort of countries to develop Action Plans to be released at CEM15 in Brazil.

Potential for technical workshops, thought leadership report, etc.

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Findings from the CEM13 Collaborative Report

Presented by Prateek Joshi, National Renewable Energy Laboratory (NREL)

September 26th, 2023

Collaborative Effort

Collaborating Workstreams

First-of-its kind collaborative effort among CEM power sector workstreams to deliver unified messaging to energy ministers.

“Lessons Learned for Rapid Decarbonization of Power Sectors”

Lessons Learned for Rapid Decarbonization of Power Sectors

I. Planning

1. Increase collaborative governance practices
2. Plan with new tools and methodologies
3. Ramp up capacity to develop national scenarios
4. Effectively use long-term scenarios
5. Integrate different levels of planning
6. Conduct renewable energy and storage integration studies
7. Coordinate renewable energy and transmission planning
8. Enable integrated clean energy systems
9. Include all technologies appropriate within national context
10. Research social equity impacts

II. Building

1. Set a robust and escalating carbon price
2. Incentivize zero-carbon energy technologies, including clean hydrogen
3. Increase grid investments at an unprecedented rate
4. Rapidly transition to digitalized smart power systems
5. Ensure electricity markets support clean energy
6. Scale renewable energy and storage via auctions
7. Design policy packages to deploy energy efficiency
8. Foster innovation for heat pumps and industrial motors
9. Support advanced nuclear demonstration projects
10. Develop carbon capture incentives and hubs

III. Operating

1. Champion knowledge sharing with peers
2. Promote standards and open-source tools
3. Endorse interoperability to integrate different technologies
4. Assure integration of flexible resources, including grid-edge assets
5. Endorse transmission interconnections
6. Advocate for state-of-the-art metrics, data, models and tools
7. Enable the various grid services of energy storage
8. Assure the use of improved wind and solar forecasting capabilities
9. Accelerate deployment of grid enhancing technologies
10. Support demand response via appropriate regulations and incentives

Overarching Themes

Planning

Increase Coordination

- Inter- and Intra-governmental
- Cross-sectoral
- Public-Private sector

Develop Capacity

- Government & universities
- Energy systems planning
- Long-term scenarios
- Legislative incentives
- Effective communication

Building

Scale Financing

- Grid modernization
- Demonstrations
- Private capital
- Business models

Set Clear Incentives

- Carbon pricing
- Procurement
- Transparent incentives

Operating

Adopt Robust Standards

- Open-source tools
- Harmonized standards
- Market design

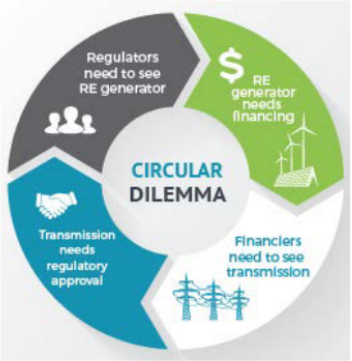
Prioritize Grid Flexibility

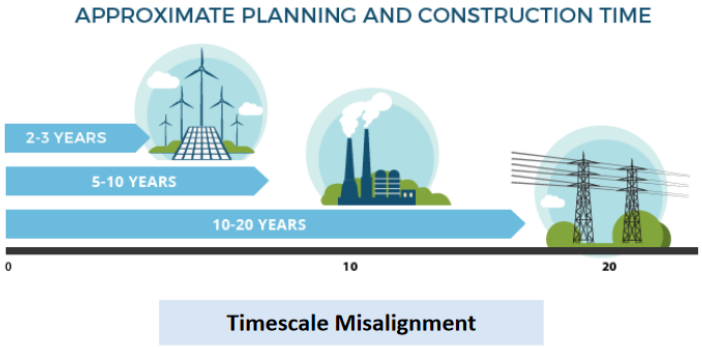
- Compensation mechanisms
- Load aggregation
- Transmission & distribution

Planning Example: Coordinate Renewable Energy and Transmission Planning

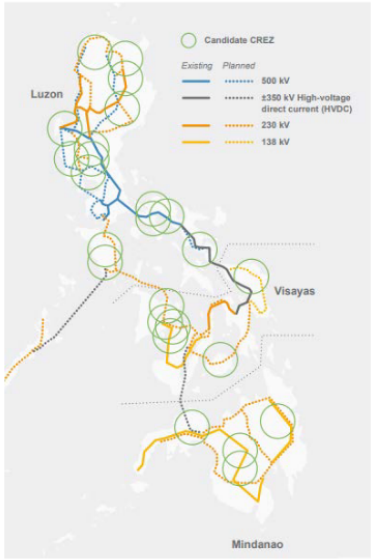
Lessons for Ministerial Action: Coordinating generation and transmission planning (e.g., with a REZ transmission planning process) can unlock access to the highest-quality and lowest-cost RE resources.

Traditional transmission planning might miss best renewable resources





Timescale Misalignment



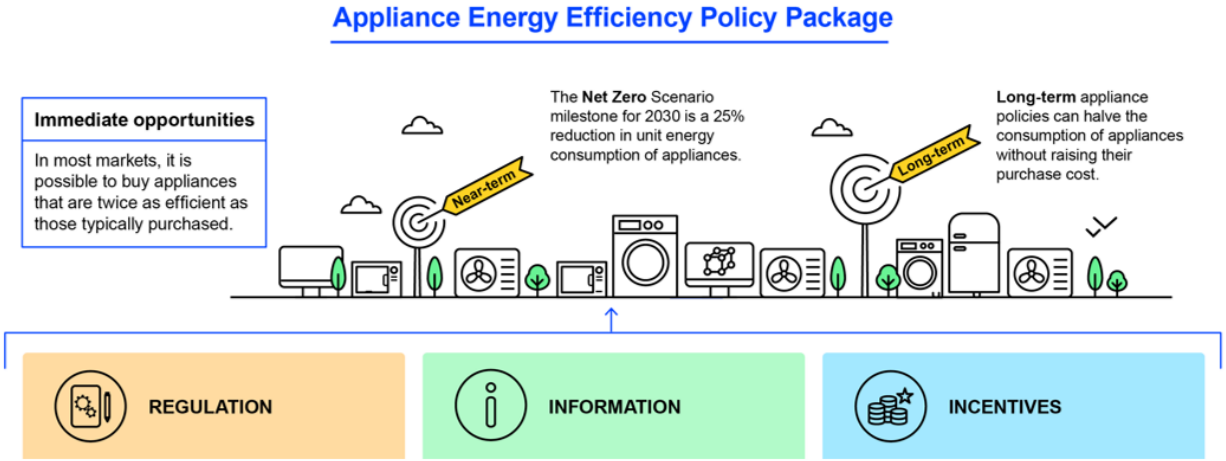
Proactive transmission planning with Renewable Energy Zones (REZ)

- High quality RE resources
- Suitable topography and land-use designations
- Demonstrated interested from developers

Source: Lee et al. (2020)

Building Example: Design Policy Packages to Deploy Energy Efficiency

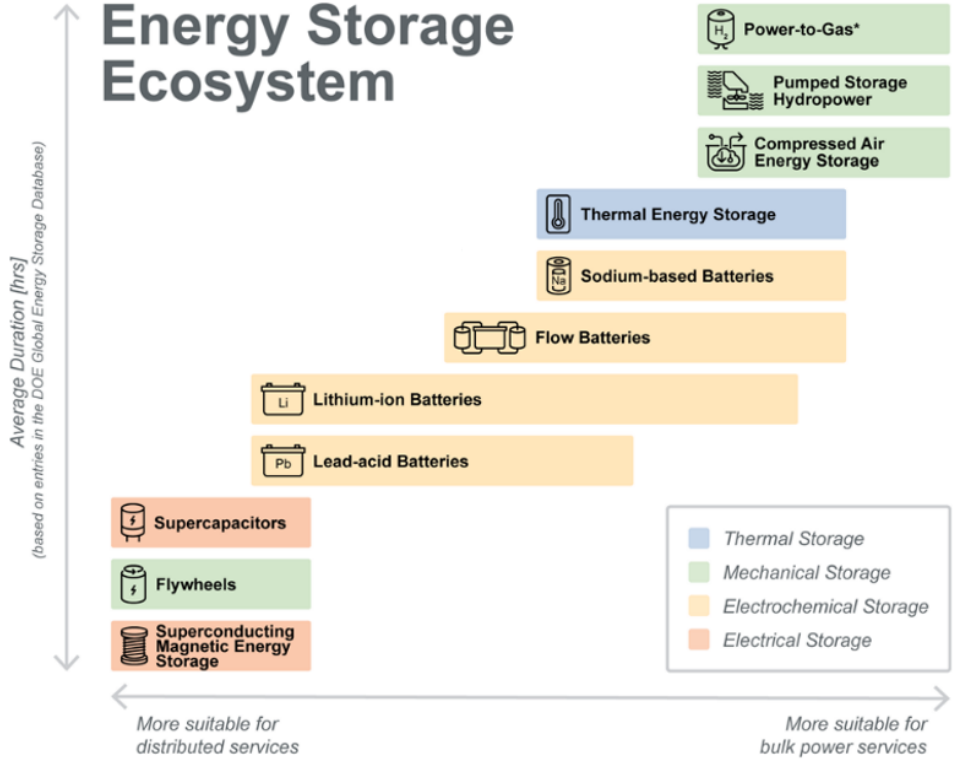
- Policies have helped **halve the energy consumption of key end-uses** in the longest-running programs
- **Building envelope design** is also a key enabler of systematic reductions in energy consumption
- **Minimum Energy Performance Standards** are a highly cost-effective way to improve equipment energy efficiency
- Standards should be accompanied by **mandatory labelling** and targeted **incentives** to deploy the most efficient equipment



Lessons for Ministerial Action: Design and implement comprehensive Policy Packages (regulation, information, and incentives) to ensure large-scale deployment energy efficiency (e.g., for appliances, etc.)

Source: IEA Appliance Efficiency Policy Package (2022)

Operating Example: Enable the Various Grid Services of Energy Storage



Power-to-Gas Technologies
Includes green hydrogen (produced by renewable energy) and other low carbon fuels and chemicals such as ammonia. These are a potential source of long-duration energy storage.

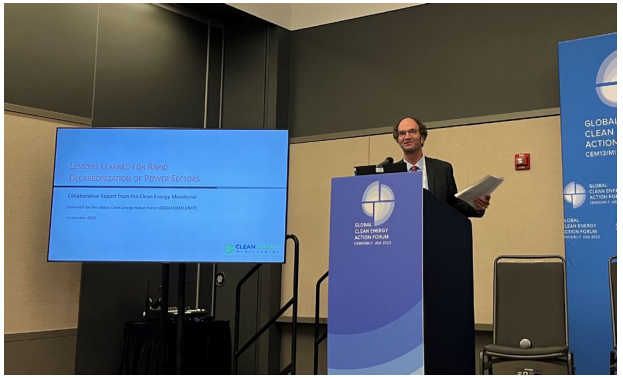
Lessons for Ministerial Action: Different types of energy storage (thermal, mechanical, electrical, and electrochemical) can provide a variety of grid services for different durations that are beneficial for operating decarbonized power systems.

Source: Bowen et al., 2021

Outcomes at the Global Clean Energy Action Forum (GCEAF/CEM13) and beyond

GLOBAL CLEAN ENERGY ACTION FORUM
CEM13/MI•7 USA 2022

- Minister and CEO roundtable on power sector decarbonization, reflecting on lessons learned and discussing needed actions
- Side event focused on the collaborative report findings, including a panel discussion



- Event at SPIREC 2023 highlighting the outcomes of the report

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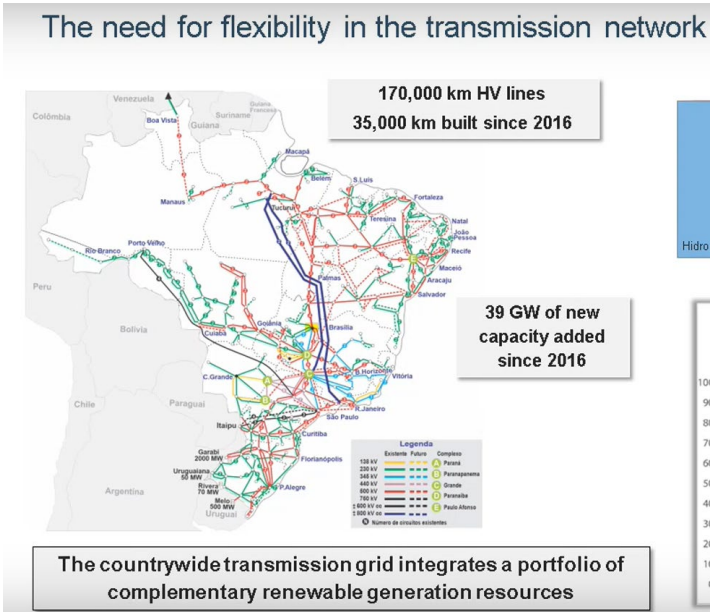
Technical Workshops to Support Cohort 1 of Action Plans

Transmission Planning and Operations: Getting More with Less (March 2023)



Resource Adequacy and Flexibility: Keeping the Lights On (May 2023)

Six Principles for Resource Adequacy Analysis

Principle 1
Quantifying size, frequency, duration, and timing of capacity shortfalls is critical to finding the right resource solutions.

Principle 2
Chronological operations must be modeled across many weather years.

Principle 3
There is no such thing as perfect capacity

Principle 4
Load participation fundamentally changes the resource adequacy construct.

Principle 5
Neighboring grids and transmission should be modeled as capacity resources.

Principle 6
Reliability criteria should be transparent and economic.

Outcomes at CEM14: Action Plan Release

CEM-14/MI-8
INDIA 2023
ADVANCING CLEAN ENERGY TOGETHER

- Side event providing an overview of the first cohort of Action Plans: Australia, Chile, the European Commission, India, and the United Kingdom

- Announcements from Brazil, Canada, and the United States to join cohort 2 of the Action Plans, to be released at CEM15 in 2024

Outcomes at CEM14: Action Plan Synthesis Report

Highlights common themes among the Action Plans, based on the best practices outlined in the CEM13 collaborative report.

21st Century POWER PARTNERSHIP
Accelerating the transformation of power systems

JULY 2023

KEY TAKEAWAYS: FIRST COHORT OF ACTION PLANS FOR RAPID POWER SECTOR DECARBONIZATION

India · Australia · Chile · European Union · United Kingdom

Background

A collaborative report from the Clean Energy Ministerial (CEM) on *Lessons Learned for Rapid Decarbonization of Power Sectors* was delivered to energy ministers and presented at the 13th CEM (CEM13) in the United States in September 2022. In light of these lessons learned and discussed at CEM13, several jurisdictions signaled intent to develop Action Plans for power sector decarbonization, to be released at CEM14 in India in July 2023. These Action Plans, supported by the 21st Century Power Partnership and other CEM workstreams via direct technical assistance and capacity building, are intended to focus on select implementation actions given each country's existing power sector goals and activities, and are an opportunity for countries to display leadership in power sector decarbonization. The first set of Action Plans has been developed by India, Australia, Chile, the European Union, and the United Kingdom.

These Action Plans are voluntary, developed by each country individually, not comprehensive of all activities within the jurisdiction, and are living documents that are subject to change.

Common Themes

These Action Plans differ in their approach to power sector decarbonization based on the domestic resources available, governance structure, and regional context, among other factors. However, they also share common themes that

Australia: The Integrated System Plan accounts for transport and industry electrification, and the Powering Australia Plan is a coordinated economy-wide approach to achieving climate targets.

Chile: A path to carbon neutrality contains mitigation actions in the power sector (e.g., coal phaseout), as well as mitigation actions linking the power sector to industry and transport.

European Union: The REPowerEU plan links renewables (increasing the target to 42.5% of the energy mix by 2030) to energy security (ending dependence on Russian oil and gas).

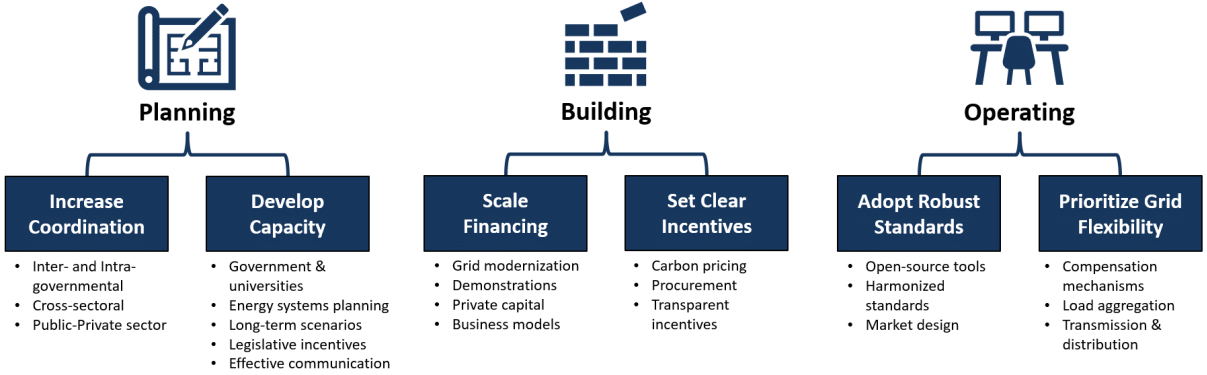
United Kingdom: The decarbonization targets include components for hydrogen and carbon capture, utilization, and storage, both of which require coordination with heavy industry.

Planning: Long-Term Scenario Development

India: The Transmission Plan for Integration of 500 GW of Renewable Energy and the National Electricity Plan, developed every 5 years, were recently published.

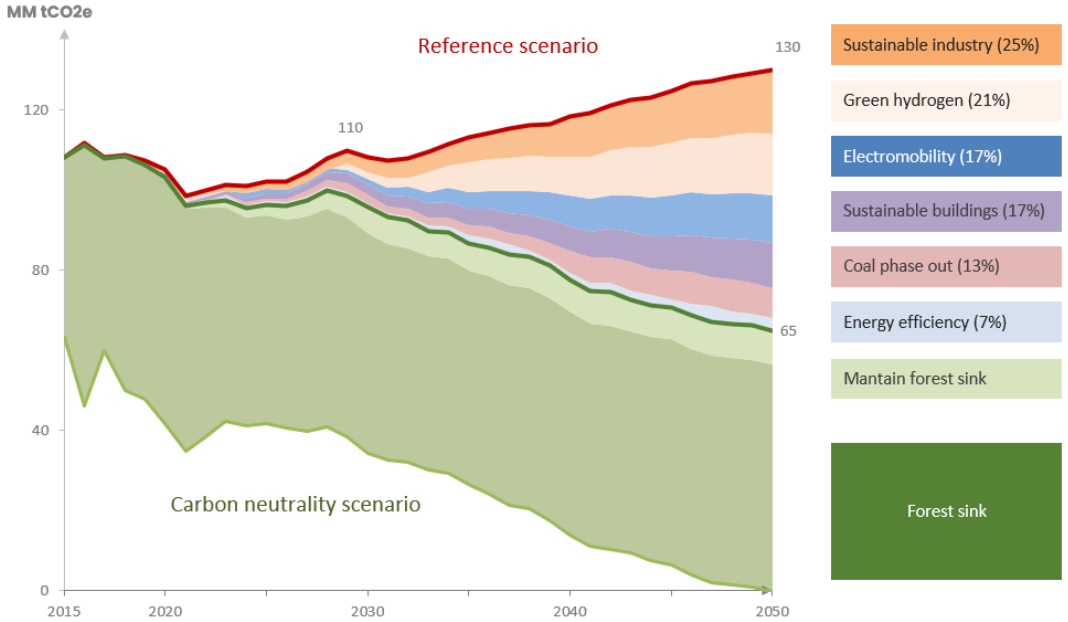
Australia: The Integrated System Plan envisions an expansion of utility-scale wind and solar (ninefold increase), distributed solar (fivefold increase), and storage (30-fold increase) by 2050.

Chile: Chile is targeting a coal phaseout by 2040, and their projected power generation mix by 2050 includes a significant amount of solar photovoltaics, concentrating solar power,



Chile Example: Planning – Cross-Sectoral Coordination

- Chile's pathway to carbon neutrality by 2050 contains mitigation actions in the power sector (e.g., coal phase out)
- Pathway also contains actions linking the power sector to industry (green hydrogen and sustainable industry) and transportation (electromobility via fuel cells and lithium-ion batteries)



Australia Example: Planning – Long-Term Scenario Development

- Integrated System Plan envisions significant build-out of utility-scale wind and solar PV, distributed solar PV, and storage
- Storage includes batteries, virtual power plants, and pumped hydropower
- Long-term plan includes retirement of coal capacity by 2043

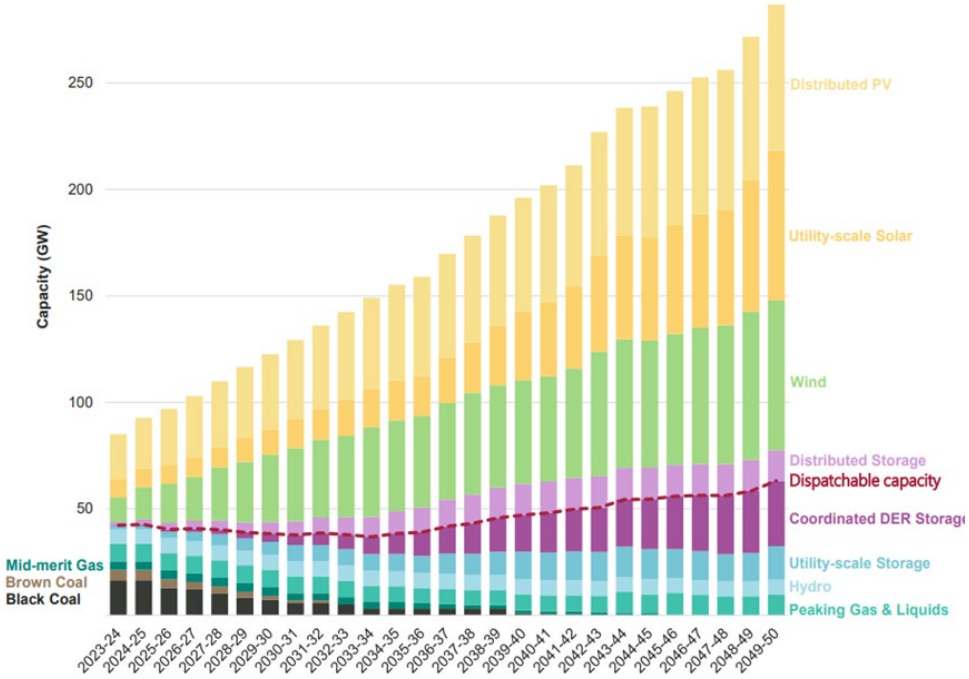


Figure. Long-term Plan for Power Sector Resources in Australia

India Example: Building – Grid Modernization Actions

- Supporting development of transmission to interconnect 500 GW of renewable and non-fossil capacity by 2030
- Transmission and renewables build out includes an emphasis on Renewable Energy Zones
- India is also developing guidelines to ensure resource adequacy with high RE levels

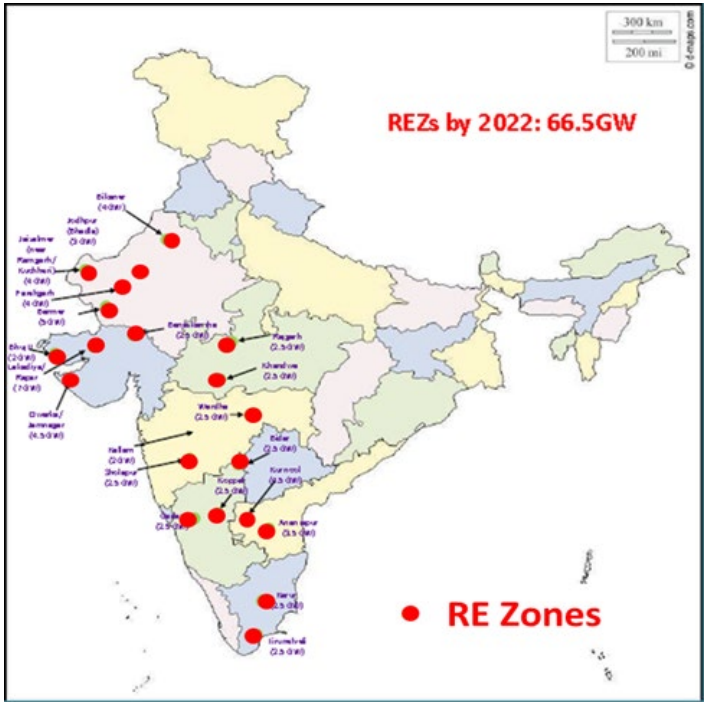


Figure. Select Renewable Energy Zones (REZs) Identified in India

EU Example: Building – Clear Procurement Approaches

- EU's Renewable Energy Directive (RED) provides a strong signal for industry growth and supported by Offshore Renewable Energy and Solar Energy strategies
- EU policies support manufacturing to strengthen the European supply chain and clean energy job market

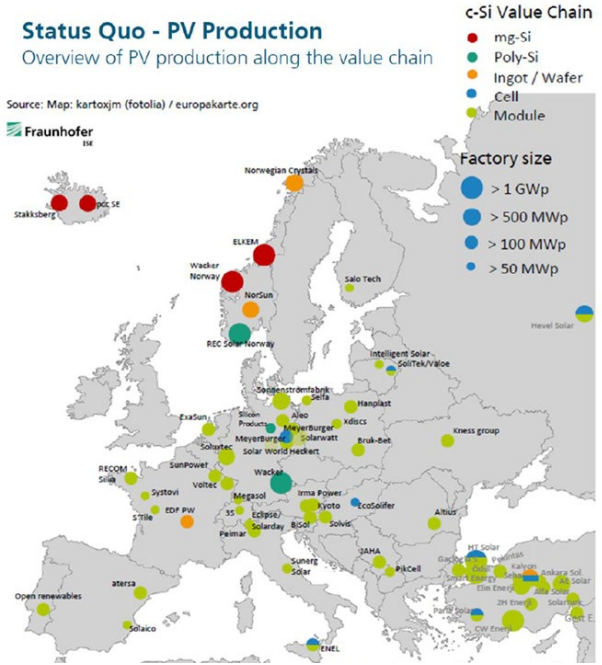


Figure. Solar PV Production Along the Value Chain in the EU

UK Example: Operating – Prioritize All-Asset Flexibility

- The UK has significantly phased down the percentage of coal generation in electricity mix, going from 40% in 2012 to 1.8% in 2020
- This transition has been enabled by both flexibility in demand and generation assets, such as natural gas, imports, and renewables

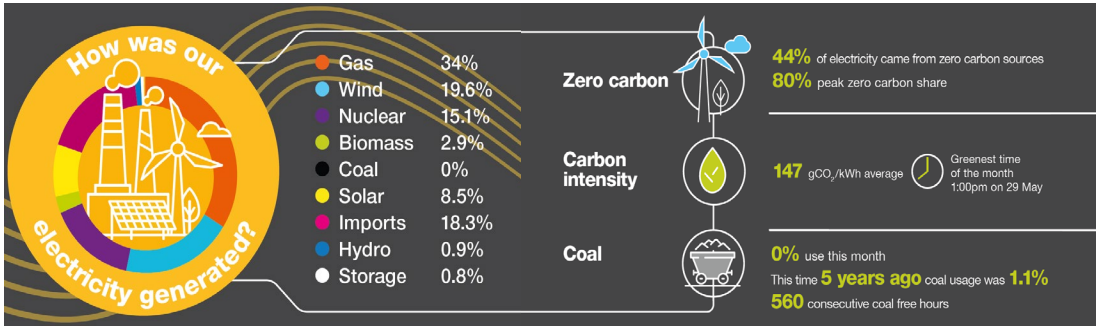


Figure. Electricity Generation in the UK in May 2022

Rest of Webinar Series

- Chile spotlight: mid-October
- Australia spotlight: late-October
- European Commission spotlight: mid-November
- Others: to-be-scheduled

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