Greetings,

We are pleased to offer the newest installment of EPRI's Energy Systems and Climate Analysis (ESCA) newsletter.

This newsletter highlights two recent publications in Nature Energy on the role of offshore wind in the United States, and enhancing capacity expansion models for the consideration of energy storage resources.

We also include quick insights on the impacts of El Niño, resource planning considerations for hydrogen, carbon capture, and energy storage, and two new insights on greenhouse gas emissions accounting, and greenhouse gas emissions offsets. Read on to learn more.

All of ESCA's publicly available work, and past announcements, can be found on the ESCA website.

Research Highlights

NEW in Nature Energy: ESCA research on the role of offshore wind, and enhanced modelling of energy storage

Expanded modelling scenarios to understand the role of offshore wind in decarbonizing the United States.

Key modelling limitations in existing research were exposed to a ‘stress test’ that combines multiple factors not often considered by traditional scenario frameworks.

Offshore wind deployment
could reach 31–256 GW by 2050,
which is 1-8% of generation, and a broader range than other U.S. studies due to the range of uncertainties analyzed.

Projected costs of offshore wind relative to land-based resources imply there is **significant uncertainty about offshore wind's deployment**, despite its large resource potential and anticipated role.

Stringent climate policies, lower relative costs, transmission expansion, and increased siting limitations for land-based wind and solar could increase offshore wind deployment.

Offshore wind's role can be large regionally, especially for Atlantic coastal states, reaching a 20% generation share in New York and New England by 2050.

Offshore wind may provide a hedge against uncertainty regarding competing land uses and interregional transmission.

READ ARTICLE

Two Page Summary

Energy storage solutions to decarbonize electricity through enhanced capacity expansion modelling.

For many energy storage technologies, **energy and power capacities can be sized independently**. These independent decisions should be captured and constrained appropriately in capacity expansion models.

Chronological modelling of operational decisions is crucial for capturing energy storage dynamics because the energy available during one time period is a function of the charge and discharge decisions of all prior time periods.

Accurately **capturing degradation costs** is also important from a system perspective, as these costs vary based on a storage asset's operation and are potentially a key driver of dispatch decisions and price formation in zero-carbon electricity markets.

It is important to **consider multiple weather years to capture year-to-year variability** to improve the valuation of long-duration, multi-day and seasonal energy storage technologies.

Evolving market operations offer new opportunities for resources that are energy-limited and exhibit opportunity costs, and have rapid response times, like energy storage.

READ ARTICLE

For more information, please contact John Bistline JBistline@epri.com

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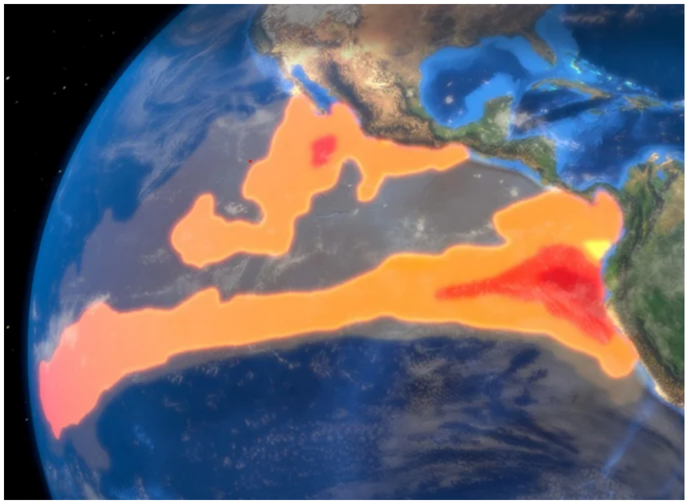
Climate READi: Impacts of the El Niño-Southern Oscillation on Hurricanes and Summer Temperature



The National Weather Service declared in early June of this year that El Niño has emerged over the tropical Pacific Ocean, and there will be a 56% chance that it will develop into a strong El Niño condition in the late fall of 2023 through spring of 2024. The El Niño-Southern Oscillation (ENSO) is the most important large-scale mode of year-to-year climate variability on earth. This Insight from EPRI's Climate READi initiative provides a scientific overview of El Niño and its impact on hurricanes and summer temperatures in the United States.

For more information, please contact Erik Smith ESmith@epri.com and Laura Fischer lfischer@epri.com.

READ QUICK INSIGHT

Back Pocket Insights on incorporating emerging technologies in energy system resource planning

EPRI's Program on Resource Planning for Electric Power Systems has released new two-page insights discussing the incorporation of hydrogen, carbon capture, and energy storage into utility resource plans.

- **[Hydrogen in Energy System Resource Planning]**: Hydrogen holds potential as a carbon-free fuel source for dispatchable power generation, but it presents some technical and economic challenges, even with IRA incentives.
- **[Carbon Capture and Storage in Energy System Resource Planning]**: Early demonstration projects demonstrate the feasibility of CCS, but additional deployment is required to achieve n*th*-of-a-kind costs, and pipelines are the most economically feasible method for transporting CO2.
- **[Energy Storage in Energy System Resource Planning]**: Variability of weather, intermittent generation, and customer demand can be addressed by the flexibility of energy storage. Storage assets can serve more than one purpose, including energy arbitrage, ancillary services, voltage and frequency regulation, and black start capability.

Hydrogen

Carbon Capture

Energy Storage

For more information, please contact Romey James RJames@epri.com and Nidhi Santen NSanten@epri.com

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Quick Insights on GHG Emissions Accounting and Offsets

ESCA's Adam Diamant and Heidi Scarth have published two quick insight documents reviewing technical considerations, requirements, and challenges regarding greenhouse gas emissions accounting and offsets.


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QUICK INSIGHTS

Program on Technology Innovation: Key Challenges in Electric Company Greenhouse Gas Emissions Accounting

This Technology Innovation (TI) program Quick Insight (QI) highlights key elements and challenges associated with voluntary corporate greenhouse gas (GHG) emissions accounting and reporting by electric companies and combined utilities in the United States.[1] It is intended to provide a quick overview and point to additional technical resources for senior executives and managers of electric companies responsible for GHG emissions accounting, sustainability reporting, and corporate decarbonization strategy.

KEY POINTS

- A GHG emissions inventory accounts for the GHG emissions and removals attributed to a company's operations over a calendar year. In addition to mandated GHG reporting requirements in some jurisdictions,[2] several voluntary standards provide guidance on data inputs and calculation methods for voluntary reporting.
- A GHG emissions inventory typically includes emissions of carbon-dioxide (CO_2) and several other GHGs, and includes a company's direct "scope 1" emissions (e.g., emissions from combusting fossil fuels to generate electricity) and indirect "scope 2" emissions (e.g., emissions associated with company purchases of electricity, heat, steam, and cooling for its own use).
- "Scope 3" emissions are indirect and include 15 categories of *upstream* and *downstream* emissions. For example, Scope 3 emissions for a natural gas supplier would include emissions from combustion of the natural gas by their customers. Scope 3 emissions typically are considered optional for voluntary reporting, but stakeholders increasingly are requesting this information.
- In 2023, California enacted new laws that require companies that exceed $1 billion in annual revenue and that do business in California to begin publicly disclosing their scope 1, 2 and 3 GHG emissions to state regulators and disclose their "climate risk." The U.S. Securities and Exchange Commission (SEC) is considering taking similar action.
- An important methodological challenge for completing GHG inventories is accounting for the GHG emissions related to purchased electricity (either retail or wholesale). Average grid-based emission factors (EFs) often are used to estimate CO_2 emissions associated with power purchases in electric company GHG inventories while *marginal* EFs can be used to estimate the potential GHG emissions impact of an "intervention," such as a GHG offsets project designed to reduced emissions. *Load-based EFs* estimate the GHG emissions associated with delivered electricity.

[1] For more information about GHG accounting concepts and methods, see *Greenhouse Gas Emissions Accounting for Electric Companies: A Compendium of Technical Briefing Papers and Frequently Asked Questions*. EPRI, Palo Alto, CA: 2021. 3002022366.

[2] For example, the mandatory CO_2 Cap-and-Trade programs in California and Washington, and the Regional Greenhouse Gas Initiative in the Northeast.

GHG Accounting

Key Technical Considerations and Requirements for Greenhouse Gas Emissions Offsets

This Program 201 (P201) back-pocket-insight (BPI) is the first of three future BPI's that will summarize key issues associated with efforts to develop, procure, and use greenhouse gas (GHG) emissions offsets, and the role that offsets may play in the broader global goal of rapidly reducing global GHG emissions by mid-century.

This first BPI describes key technical considerations and conceptual requirements for GHG offsets and provides a short overview of project monitoring and third-party verification associated with offset project implementation. This BPI is based on research recently completed as part of a supplemental project on *Exploring the Role of Greenhouse Gas Emissions Offsets to Achieve Corporate Decarbonization Goals* sponsored by Program 201 (*Energy and Environmental Policy Analysis*).[1]

GHG Emissions Offset Quality

GHG emissions offsets provide a way for organizations to substitute less costly "external" GHG emission reductions for potentially more costly GHG emissions reductions that an organization may be able to achieve by reducing its own direct emissions. In addition, GHG offsets provide a mechanism for companies to reduce their GHG emissions beyond what they may be legally required to reduce or in addition to GHG emissions reductions they may be able to achieve cost-effectively by reducing their own direct emissions. However, in order for GHG offsets to contribute to mitigating global climate change, GHG emissions to the atmosphere must be the same (or lower) when a GHG emission offset credit is used (i.e., retired) as they would have been if an entity had reduced its own direct GHG emissions by a similar amount. Offset credits that meet this condition preserve "environmental integrity." The quality of a GHG emission offset credit refers to the level of confidence an offset credit will fulfill this basic principle.

GHG Offset Quality Criteria and Descriptions

There are five essential criteria used to determine the "quality" of a GHG emissions offset. These criteria include *additionality, avoiding overestimation, permanence, exclusivity, and avoiding harm*. Each of these criteria are described in Table 1. To ensure these criteria are met, GHG offset programs require offset projects to be validated, verified, and monitored. An overarching requirement is that offset projects or activities be (i) *validated* against eligibility conditions related to these criteria; and (ii) *verified* to ensure their performance in reducing or removing emissions and (iii) *monitored* at prescribed intervals during project implemental and in some cases for many years in the future. Typically, validation and verification functions are performed by accredited, third-party auditors (aka "validators" or "verifiers") on behalf of offset programs as a precondition for the issuance of offset credits.

GHG Emissions Offset Protocols

All existing GHG offset programs in both the voluntary[2] and compliance[3] carbon markets require potential GHG offset projects to be developed, validated, executed, monitored, and verified in a manner consistent with one or more specific offset project *protocols*. To develop an offset project that can be issued credits, an offset project first must be eligible to be accepted under a specific offset program. Additionally, each potentially eligible offset project must be developed in a manner consistent with an approved offsets protocol that includes relevant project eligibility rules, quantification methods, and measurement, monitoring and verification (MRV) requirements that have been developed by the relevant program.

Validation, Monitoring, and Verification

Under all existing offset programs, proposed offset projects must be validated against eligibility requirements (including correct application of additionality tests and accounting methods); they must actively monitor parameters related to project performance and quantification of emissions reductions and ensure all monitoring data are verified. Independent, third-party auditors (aka "validators" and/or "verifiers") perform validation and verification functions. Auditors check that projects have properly applied prescribed methods for measuring, monitoring, and quantifying associated GHG emissions reductions. In most cases, offset credits are only issued after GHG reductions or removals have occurred and been verified by an auditor. Established programs all have processes for accrediting and approving third-party auditors to conduct validation and verification services.

[1] *Exploring the Role of Greenhouse Gas Emissions Offsets to Achieve Corporate Decarbonization Goals: A Compendium of Technical Briefing Papers and Frequently Asked Questions*. EPRI, Palo Alto, CA: 2022. 3002025723. https://www.epri.com/research/products/000000003002025723.

[2] Examples in the voluntary carbon market include the American Carbon Registry (ACR), the Climate Action Reserve (CAR) and the Verified Carbon Standard (VCS), now VERRA.

[3] An example in the compliance carbon market include the California Air Resource Board's Compliance Offsets Program (see https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program).

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GHG Offsets

- **[Key Challenges in Electric Company GHG Emissions Accounting]**
  This insight intended to provide a quick overview and point to additional technical resources for senior executives and managers of electric companies responsible for GHG emissions accounting, sustainability reporting, and corporate decarbonization strategy.

- **[Technical Considerations and Requirements for GHG Emissions Offsets]**
  This is the first of three future insights from EPRI's Program 201 that will summarize key issues associated with efforts to develop, procure, and use greenhouse gas (GHG) emissions offsets, and the role that offsets may play in the broader global goal of rapidly reducing global GHG emissions by mid-century

For more information, please contact Adam Diamant ADiamant@epri.com and Heidi Scarth HScarth@epri.com

Member Center

The ESCA Group conducts its research as part of EPRI Programs 178 (*Resource Planning for Electric Power Systems*) and 201 (*Energy, Environmental, and Climate Policy Analysis*). Examples of recent program-specific research includes:

- Inflation Reduction Act Power Sector Tax Credit Selection and Technology Strategy (3002027792) - Program 178 and Program 201
- Harmonized Carbon Capture Costs for Integrated Modeling (3002026706) - Program 178
- Emissions and Energy Impacts of the Inflation Reduction Act (3002026641) - Program 201

For more information about these programs, please contact Nidhi Santen (P178) or David Young (P201).

Thank you for your continued interest in our work. If you have any questions, please email eea@epri.com.

Best,

EPRI Energy Systems and Climate Analysis Group

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