DEEP DECARBONIZATION DECISIONS

How to efficiently rid the grid of carbon - siting and operating clean energy projects to provide the greatest impact in carbon emission reduction with the lowest financial risk

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INTRODUCTION

Climate change is the greatest existential threat of our time. The purpose of this poster is to introduce a framework to measure locational carbon intensity, which will be important in determining where to best prioritize our climate change mitigation efforts.

Current efforts to measure the carbon intensity of electricity to inform decision making use averages across long time horizons and/or large market areas. These existing approaches have enabled voluntary emissions reporting and investment decisions related to decarbonization. While these efforts have moved the industry forward, an approach that neglects to consider the actual power flows on the grid and how they change over time is not sufficient for decarbonizing the global economy. It is now essential that new, transparent, accurate, and well-understood metrics for the locational carbon intensity of the grid are defined as a matter of priority.

The addition of locational carbon intensity to existing carbon analytics is the only means of capturing the full picture when it comes to determining the carbon intensity of the electricity system and to provide for effective decision making around supply and demand. We call this approach **"Total Carbon Accounting" (TCA)**.

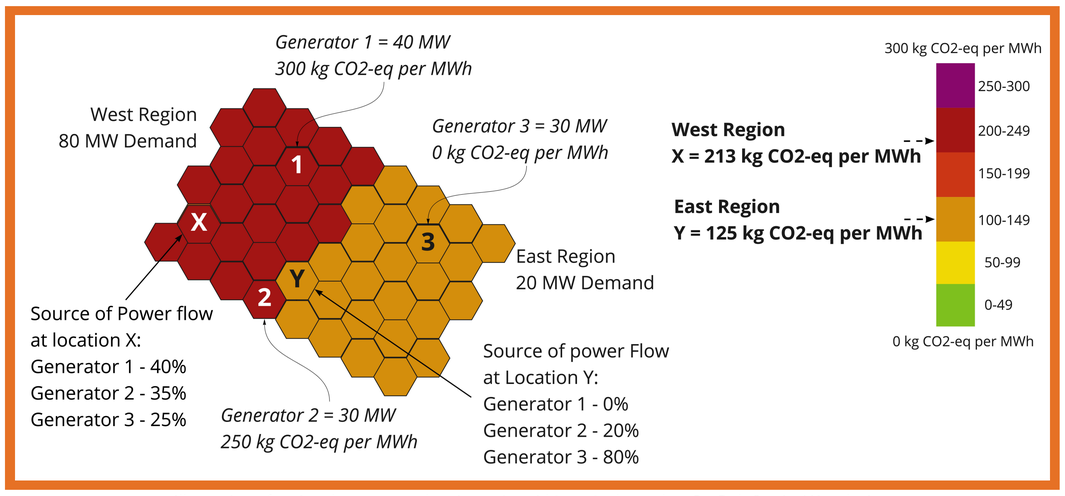

Illustration of regional average carbon intensity within a single market. Dr. Bob Currie / Kevala, Inc.

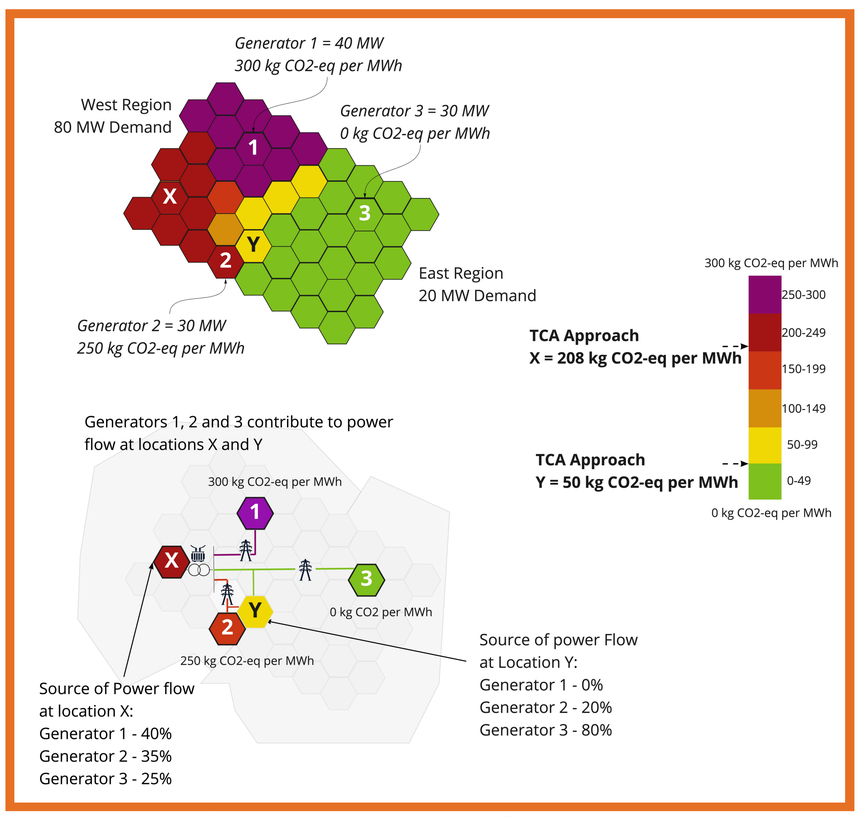

Illustration of Locational Carbon Intensity to Support TCA. Dr. Bob Currie / Kevala, Inc.

METHODOLOGY

Total Carbon Accounting requires the ability to calculate Localized Carbon Intensity, including developing a system model, machine learning, and time-series analysis, plus the complex calculations of flows from sources to sinks across vast electrical networks.

Steps 1-3 in the Methodology establish 24hr forecast data to populate transmission and distribution (T&D) models, while steps 4-7 are to perform complex analysis across T&D.

RESULTS

Total Carbon Accounting identifies where the consumed power is generated for any location on the grid. For any given moment in time, TCA provides a basis for quantifying the carbon intensity of all energy consumption. TCA focuses on the physical flows of electricity and supports improved reporting of carbon emissions, and in doing so, enables better planning and operations of program and rate design. TCA achieves this goal by quantifying the carbon associated with all generation sources, including those embedded in the distribution system, customer premises, as well as the delivery paths taken by the power from these generators to supply load.

CONCLUSIONS, SUMMARY, AND WHAT'S NEXT

By focusing on discrete analysis of all components in the balance of supply and demand on the grid, TCA serves as a long-term foundation for evolving carbon awareness efforts. TCA provides distinct advantages over current methods that average carbon intensity over large geographic areas, or focus on the emissions of marginal units. These outdated practices can lead to unintended changes in the formulation of carbon intensity in energy markets. TCA supports climate action policies, program and rate designs, and procurement strategies for policymakers, utilities, and energy consumers, and can underpin carbon reporting efforts.

- As more companies set net zero goals, it is important for them to have access to a tool that accurately models carbon flow throughout the grid and enables them to make project and purchasing choices that truly reduce their Scope 2 emissions.
- Current practices in carbon intensity analytics are insufficient to deliver locational carbon intensity.
- Kevala, in partnership with National Grid, Exelon, and ComEd, has demonstrated the need for locational carbon intensity as a critical component of decarbonizing the grid and has proposed a framework for calculating and delivering this important data through TCA.

National Grid, Exelon, ComEd, and Kevala will continue to collaborate on the development and deployment of Total Carbon Accounting solutions across multiple locations in the UK and US with the intention of learning and demonstrating the concepts presented in this white paper and comparing results to alternative approaches.

We are currently testing these methods and invite others to join in this collaboration to ensure that the best possible approaches are used to evaluate, prioritize, and measure decarbonization activities.

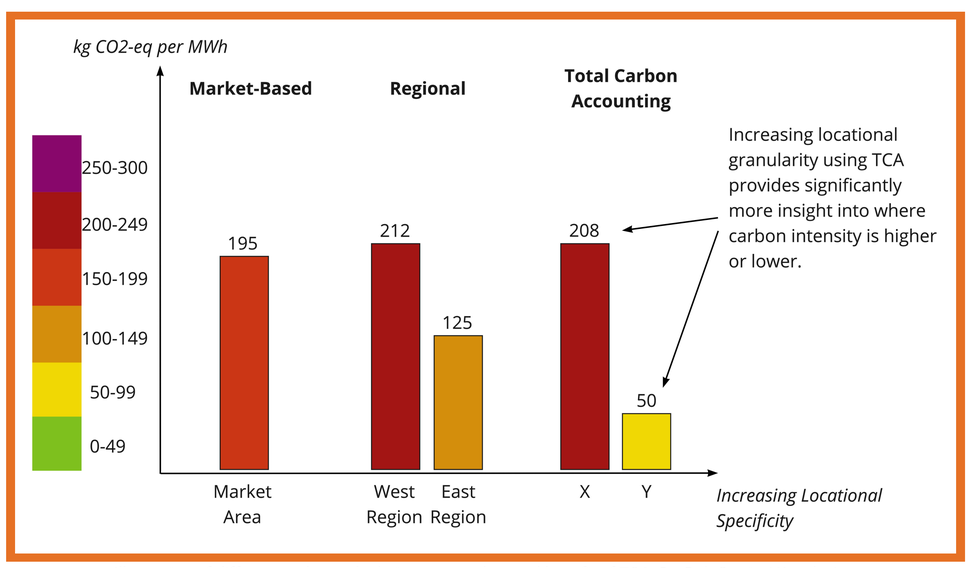

Illustration of different carbon calculation approaches and benefit of TCA. Dr. Bob Currie / Kevala, Inc.

Kevala, National Grid, Exelon, ComEd. (2021). *Total Carbon Accounting: A Framework to Deliver Locational Carbon Intensity Data* [White paper]. https://kevala.com/total-carbon-accounting/