Operationalizing "Emissions First" Principles:
Maximizing the Emissions Impacts of Clean Energy Projects

Background

Clean energy buyers, developers, and investors are increasingly realizing that not all MWh have the same emissions impacts, in sharp contrast to traditional carbon accounting approaches. As a result, the GHG Protocols are being revised, and industry groups such as the Emissions First Partnership have formed to champion *emissions* based measurements, rather than MWh based measurements.

Objective

Understand the variability in emissions impacts between technologies and locations, and identify strategies to maximize the avoided emissions by different clean energy projects.
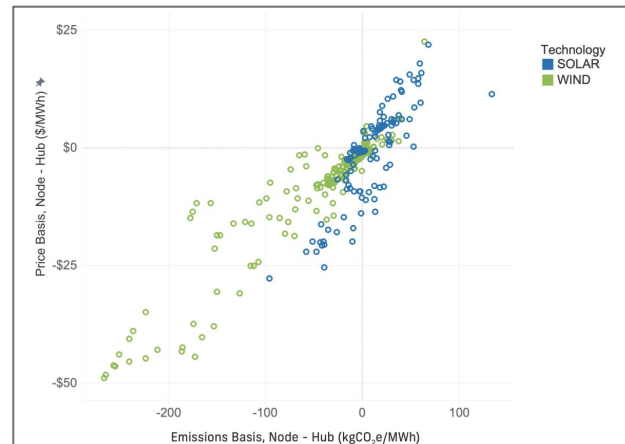
Methods

Combine hourly generation/load at each project in ERCOT and PJM with the nodal marginal emissions rate (LME) in each hour at that particular node.
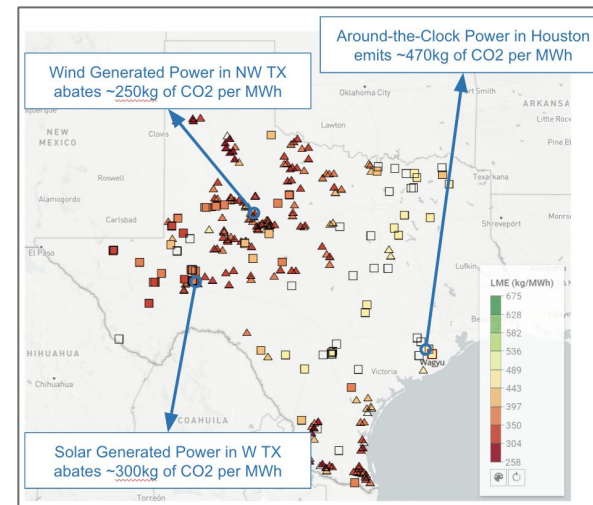
Wind and Solar

Transmission congestion hurts both nodal prices and the environment. Projects in congested areas tend to have a lower emissions impact not because they produce fewer MWh due to curtailment, but because each MWh avoids fewer emissions on the grid. *Note: congestion is very different than price!*

The incremental output from projects in congested areas displaces other congested renewables. For example, wind can displace solar. Neither will be able to displace a dirty peaker close to load if they are behind a transmission constraint.

[1]Source: ERCOT generation, REsurety LME data

Green Hydrogen

Matching electricity consumption and generation MWh annually or hourly within the same RTO does not guarantee carbon-free hydrogen. Location within a grid and timing matters. Locations only 20 miles apart can have emissions impacts that vary by 50%[1]! Carbon-matching is being considered as an approach for the 45V PTC that allows for flexibility in time and location so long as the emissions avoided by generation matches the emissions induced by consumption.

Wind Generated Power in NW TX abates ~250kg of CO_2 per MWh

Around-the-Clock Power in Houston emits ~470kg of CO_2 per MWh

Solar Generated Power in W TX abates ~300kg of CO_2 per MWh

Storage

In areas where LMEs and LMPs are closely correlated, storage energy arbitrage reduces emissions. Otherwise, emissions can go up.
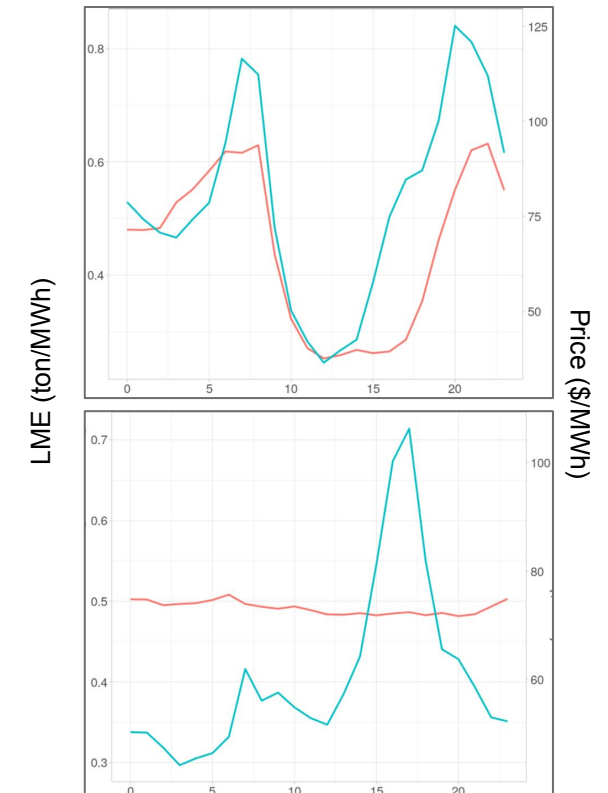
Further reading:
Making It Count: Updating Scope 2 Accounting to Drive the Next Phase of Decarbonization (REsurety)
Pathways to Carbon Neutrality (TCR)

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