Two LBNL Methods for Estimating the Emissions Avoided due to Renewable Energy Generation

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A New Plant's Effect on the Future Emissions from a Power Pool

- **When a new plant begins operations, it impacts emissions in two ways.**
  - **It may affect the operations of plants that are relatively responsive to changes in load.**
  - **It may offset the need for another generation source that would have been built in its place.**
- **The first impact referred to as operating margin (OM) effect, the second as the build margin (BM) effect.**

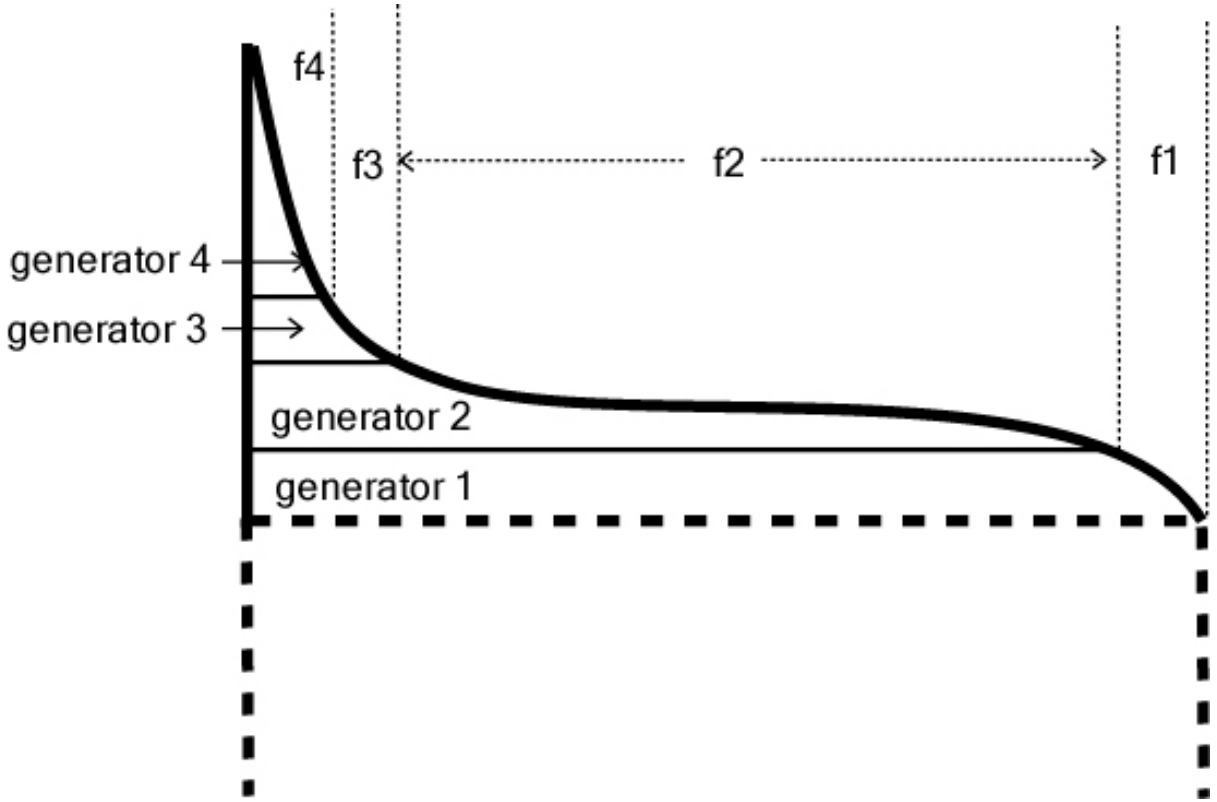
Two Methods Devised by LBNL to Estimate Avoided Emissions

- Marginal Avoided GHG – Power Sector (MAGPWR)
  - This is a load duration curve model designed to calculate the OM for a given grid.
  - It is best suited to smaller projects thought to affect primarily the operating margin.
- MBase Electric
  - This a more comprehensive tool that produces both BM and OM outputs.
  - However, the modeling of the OM is less sophisticated than MAGPWR.

MAGPWR Methodology

- Construct a load duration curve from a chronological load curve.
- Fill the curve from the bottom up with plant-level or resource-level data beginning with highest capacity factor units first.
  - If generating costs are known, cost data may be used instead to stack by plant or fuel type.
- Calculate the weighted OM based on the amount of time each resource operated on the margin.

Marginal Avoided GHG – Power Sector (MAGPWR)



MBase Methodology

- Plants are separated into three cohorts to produce three different margins.
  - Recent baseload plants
  - Recent load following plants
  - All load following plants (may want to exclude some pondage hydro used for load following0
- The generation and corresponding emissions from these plants can be averaged or ranked into percentiles to yield three types of margins
  - Baseload BM
  - Load following BM
  - OM
- These three margins can be combined in various ways according to a project's expected impact on future emissions.

Case Study #1
5 MW Landfill Gas

- MAGPWR – Assume project affects OM use rate given by MAGPWR.
- MBase – Since LFG provides firm baseload power, assume effect is primarily on baseload BM.
  - If no capacity credit is assumed, may want to use OM.
  - A combined margin can also be used.

Case Study #2
100 MW Wind Farm

- MAGPWR – Assume offset generation is entirely from OM and use the MAGPWR factor.
- MBase – Since wind is intermittent (non-firm), assume effect is primarily on OM and use MBase OM rate.
  - Capacity credit may be given to some share of the wind farm and generation up to that point can be credited with baseload BM.

Case Study #3
1000 MW Wind Farm for RPS

- MAGPWR – Not well suited for this project due to lack of ability to model build margin effect.
- MBase – Divide generation into (statistically) firm and non-firm shares and estimate avoided emissions using corresponding baseload BM and OM rates.
- The fact that this is for an RPS is a separate question.
  - Emissions **are** avoided, but whether they count for a given crediting program is purely a policy question. Using agreed-on definitions of additionality, they would not.

Use of MAGPWR and MBase for Criteria Pollutants

- Sure, why not?
- If emissions of these pollutants are correctly matched to plants, both tools could be modified to produce NO_x and SO_x rates.
- However, if dealing with a capped emissions market, emissions may never be truly avoided unless permits are retired as a result.

Evaluation of MBase and MAGPWR Approaches

- Accuracy
  - OM: high for MAGPWR, medium for MBase
- Practicality
  - High practicality when plant-level data available. In the U.S. these data are easily available from public sources, but for greater accuracy detailed dispatch tables may be needed to guide the modeling.
- Transparency
  - Crystal clear. Calculations in spreadsheets are easily verified, MAGPWR is somewhat more complex.
- Conservativeness
  - Choosing higher stringency levels in MBase can increase conservativeness for BM.

For Further Information

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