WAYNE STATE UNIVERSITY
COLLEGE OF ENGINEERING

LEEM

Automating Energy Management for
environmentally
sensitive electricity

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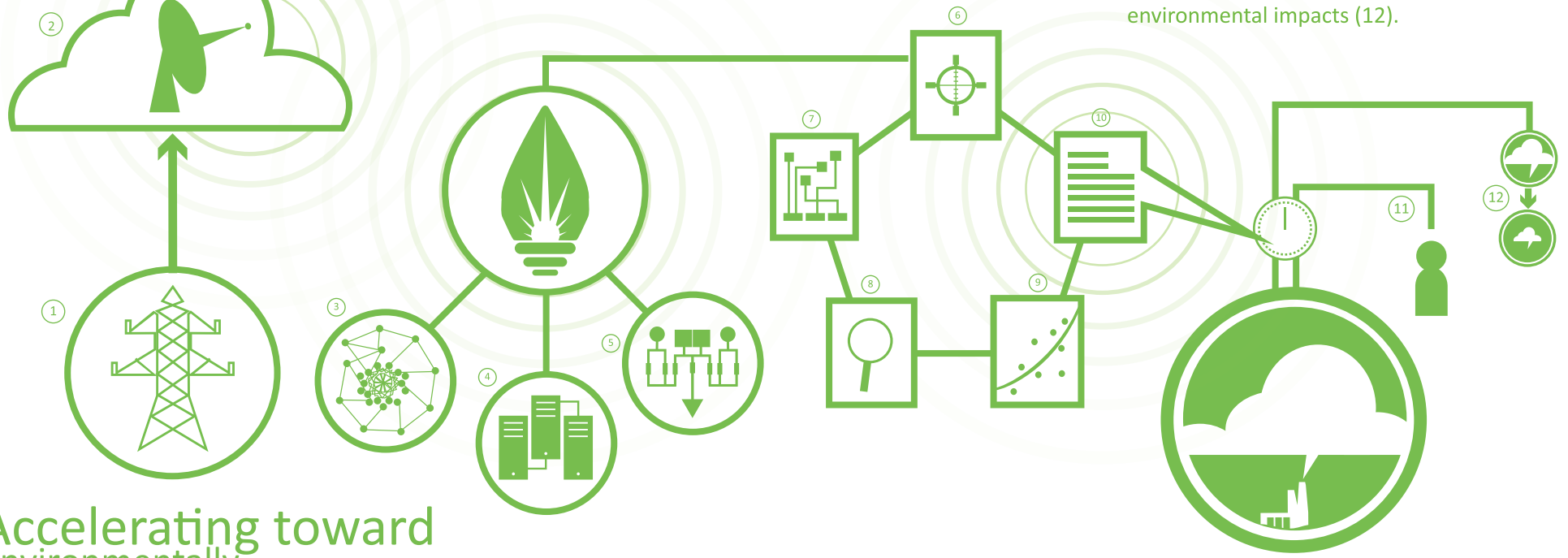
Welcome to LEEM

Shifting Electricity Usage to Reduce Emissions Impact

LEEM provides customized emissions information based on the user's location. Key features of the power grid (1) and environmental data are gathered to the cloud-based LEEM server (2). This data is selected by proprietary LEEM algorithms (3) that select the applicable ISO and the relevant commercial pricing information from databases (4) and workflow models (5) so emissions can be estimated (6), organized (7), analyzed (8), normalized (9), and reported (10) to LEEM users (11). Output information is delivered in a variety of flexible formats and is used to guide energy use decisions across time and space to reduce environmental impacts (12).



Accelerating toward environmentally *sensitive* electrical futures

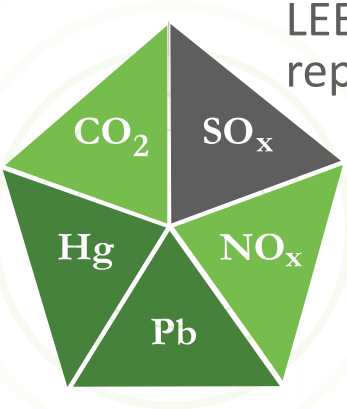
LEEM currently provides data for users in 18 states from New York to North Dakota whose electric grids are managed by MISO, PJM, and NYISO. In the future, LEEM will expand nationally and will include a broader range of emission levels, emissions savings tracking, and will be able to signal when renewable energy is providing a significant marginal load and when the grid is in a high peak-power condition.

LEEM guides **electricity users** to reduce emissions by shifting electrical load away from times of day when the marginal generator produces the most negative emission impacts.

Providers of **energy management systems** use LEEM to enhance products to optimize performance and energy use to reduce emissions and cost.

LEEM helps **utility companies** track load-driven marginal emissions at the local level, improve customer engagement, optimize energy efficiency efforts, and signal when high peak power events are likely.

LEEM emissions data helps **regulators** to model and account for load-driven electricity-related emissions in real-time.

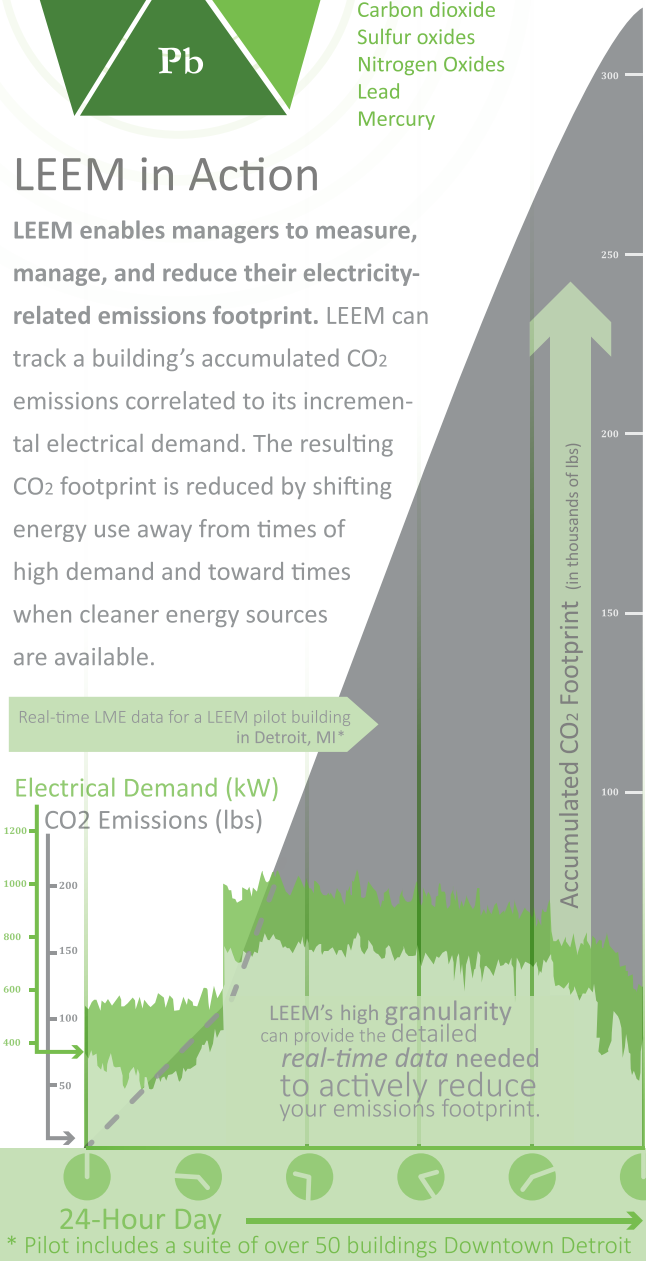


LEEM currently reports LMEs for 5 harmful pollutants

Carbon dioxide
Sulfur oxides
Nitrogen Oxides
Lead
Mercury

LEEM in Action

LEEM enables managers to measure, manage, and reduce their electricity-related emissions footprint. LEEM can track a building's accumulated CO_2 emissions correlated to its incremental electrical demand. The resulting CO_2 footprint is reduced by shifting energy use away from times of high demand and toward times when cleaner energy sources are available.



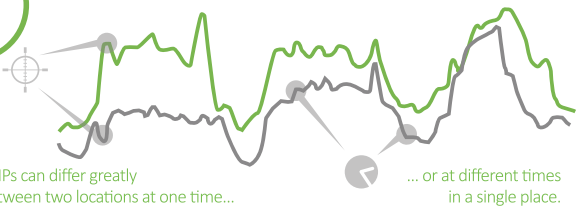
* Pilot includes a suite of over 50 buildings Downtown Detroit

Electricity Production
changes over **space & time**
... and so do emissions.

Example: Changes in locational marginal prices (LMP) for electricity production and the corresponding locational marginal emissions (LME) between Buffalo, NY and Chicago, IL demonstrate emission levels changing over time and space.

Buffalo, NY — Chicago, IL

Locational marginal prices (LMP) can change every 5 minutes minutes depending on generator type, transmission pathways, fuel costs, and market demand.

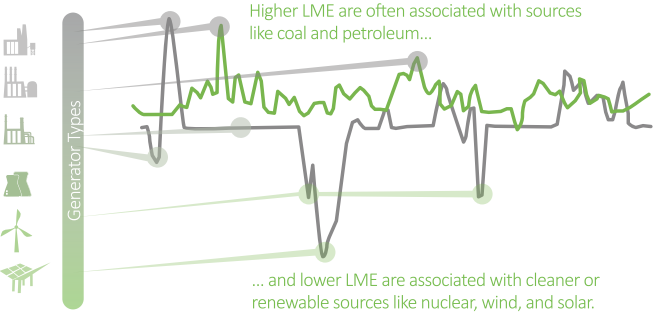


LMPs can differ greatly between two locations at one time...

... or at different times in a single place.

Day 1 | Day 2 | Day 3 | Day 4

As LMP goes up and down, electricity production shifts between generators causing fluctations in **locational marginal emissions (LME)** throughout the day.



LEEM calculates **REAL-TIME** LME information & can identify crucial opportunities **to shift** flexible energy load toward **specific times & places** that **REDUCE EMISSIONS.**

The LEEM team is led by Dr. Carol Miller of Wayne State University's College of Engineering in Detroit, supported in part by funding from the Chicago-based Great Lakes Protection Fund. Current industry partners include MISO, PJM, Siemens Energy, DTE Energy, Consumers Energy, Commonwealth Associates, ILLUME and EcoWorks.

Check out our short video: vimeo.com/118138647