WAYNE STATE UNIVERSITY

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***Director*, Healthy Urban Waters**
***U.S. Chair*, Great Lakes Science Advisory Board, IJC**

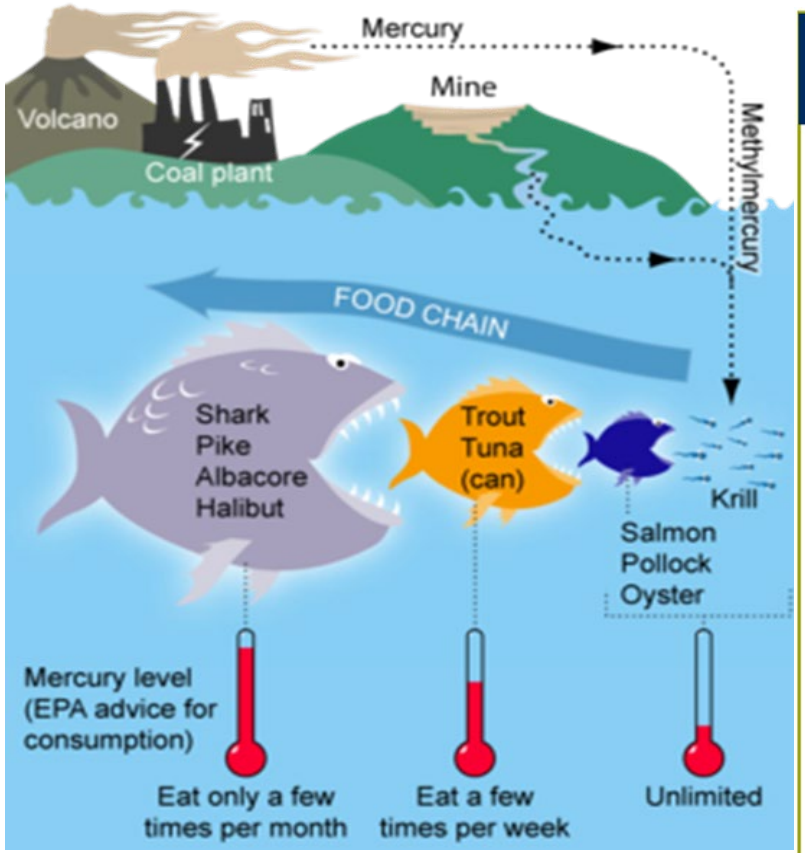
ACCELERATING
THE FUTURE OF
ENVIRONMENTALLY SENSITIVE
ELECTRICITY

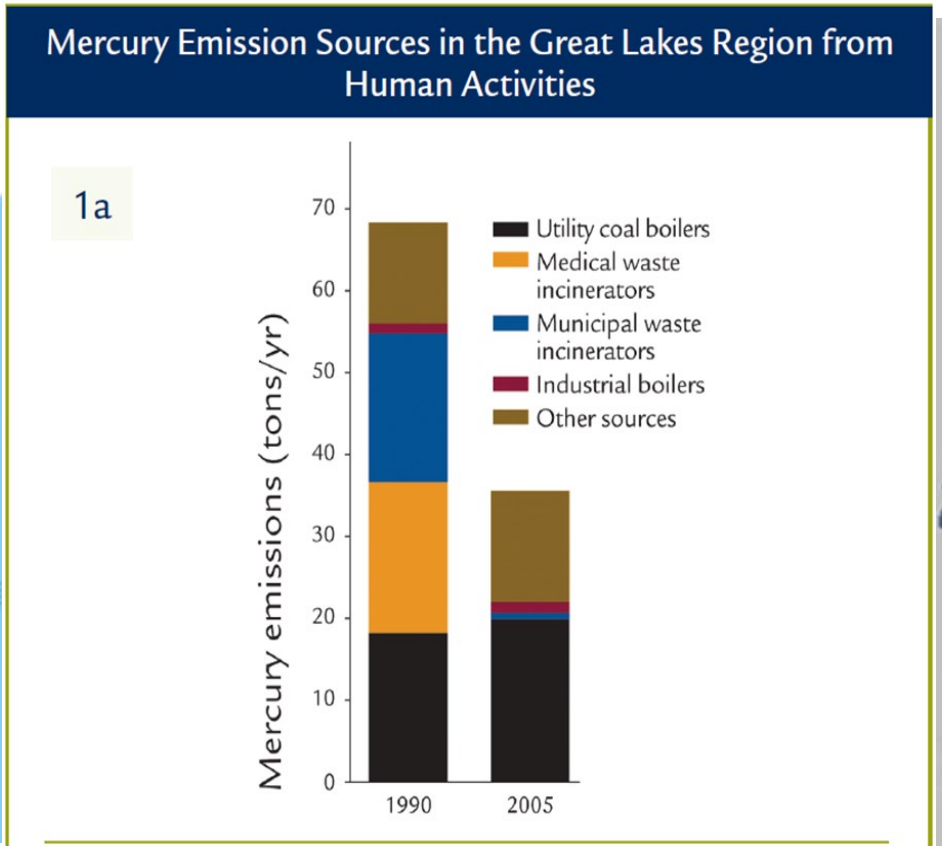
Big Data and Analytics for Healthier Air, Water, and Climate

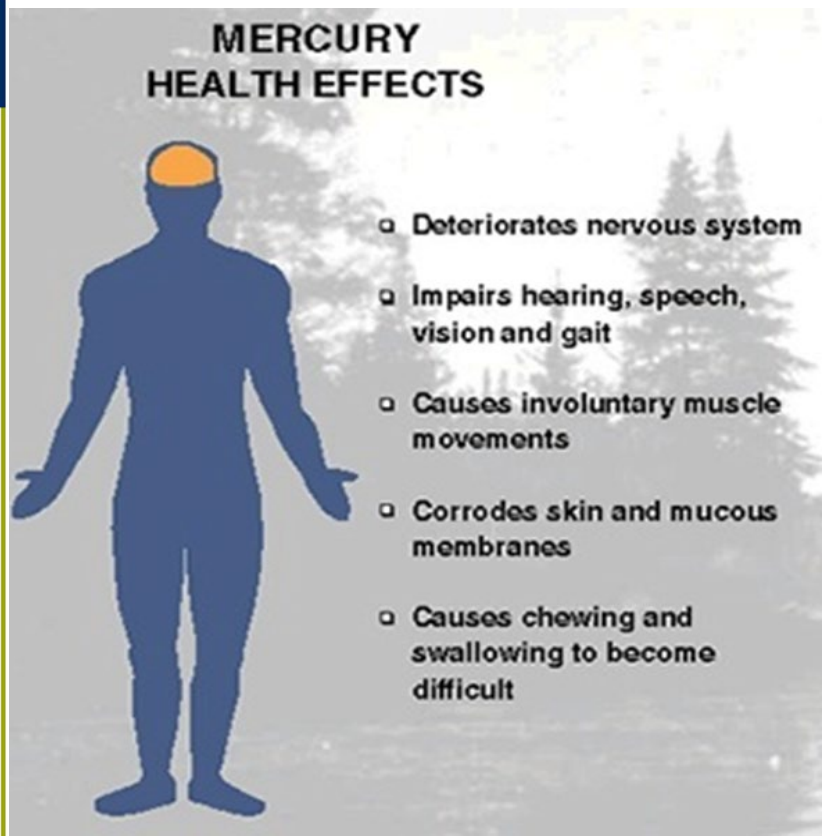
WSU Symposium on AI, Big Data and Analytics

GHG Emissions & Climate Change

Hg Deposition to Great Lakes







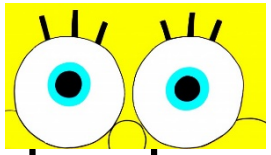
People **WANT** to reduce emissions….but how????

Well-Known Options……

Alternative Energy
Reduce Energy Consumption
Efficiency Gains

…….all take infrastructure changes, behavior changes, and/or policy/legislation
Bottom Line…..We've been TRYING, and will continue to TRY…..but the machine moves soooooo slowly.

How to make “quick”, “painless” reductions of Carbon as well as other pollutants*?????*

Answer: Provide TRANSPARENCY to the energy grid. Allow consumers to *SEE*  when clean energy is *on the margin*……and when dirty energy is *on the margin*.

Allow consumers to make INFORMED choices

Wayne State Gets Grant To Cut Toxic Emissions By Power Plants Into Great Lakes

August 22, 2013 at 4:56 pm **Filed Under:** Emissions Analysis, federal grant, Great Lakes Protection Fund, Mercury, power plants, Toxic Emissions, Wayne State University

istockphoto

DETROIT (WWJ) — A team of Wayne State University researchers are working on a technology that could quickly and significantly reduce the emission of mercury and other toxic substances by power plants into the Great Lakes basin — by letting consumers use power when it's being produced in the least toxic manner.

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MOST VIEWED

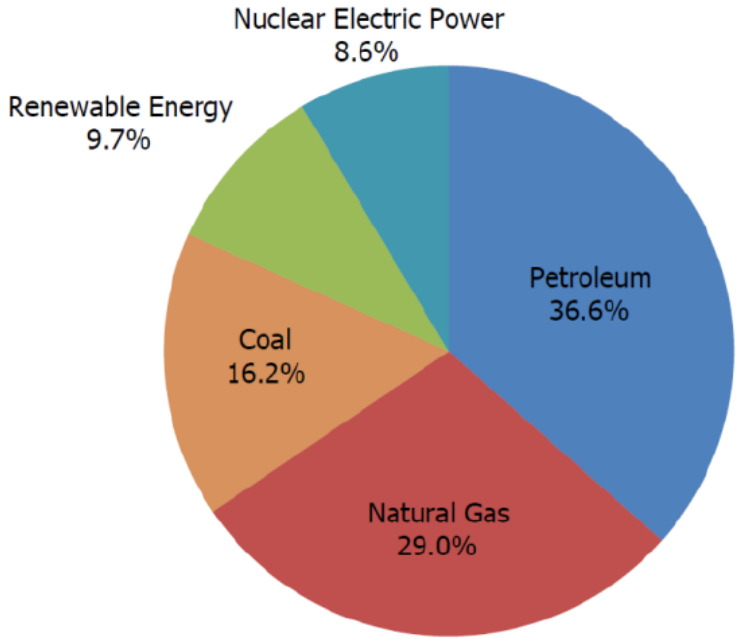
Emission Reductions USING New **Data Analytics** for Emission-Targeted Demand Response

AKA……

Environmentally Sensitive Electricity

Simple (?????) Explanation/Illustration

Figure 3-3: 2015 U.S. Energy Consumption by Energy Source (Percent)



http://ravenswoodmedia.com/notdrupal/ravenswoodftp/graphic.mov

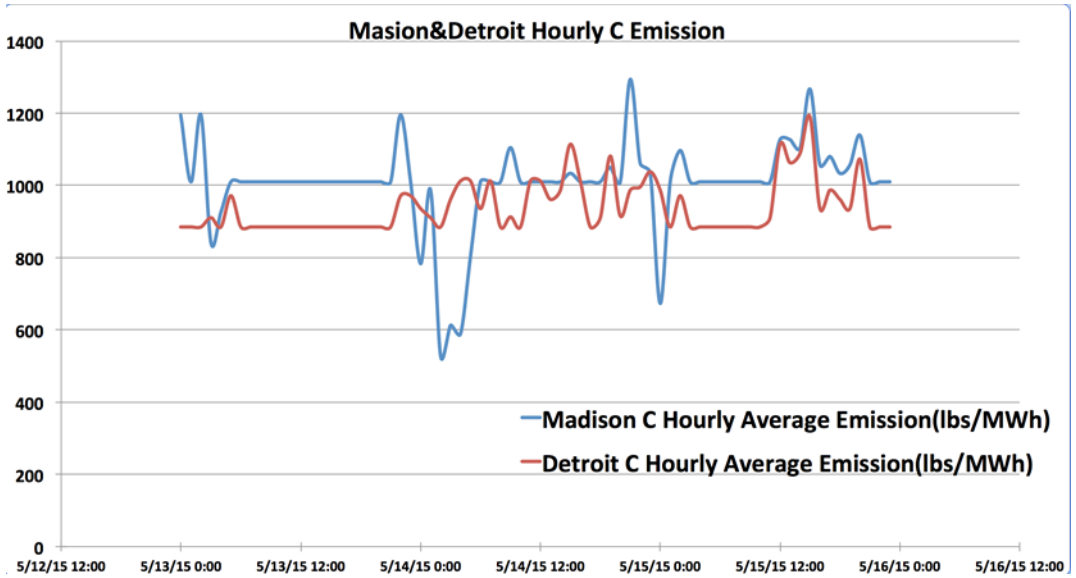
Quick Primer……Energy *on the MARGIN*

What is marginal energy, or fuel on the margin?

Fuel on the margin, when talking about the electric grid, refers to which fuel will be used to generate the next additional kilowatt of power that is required.

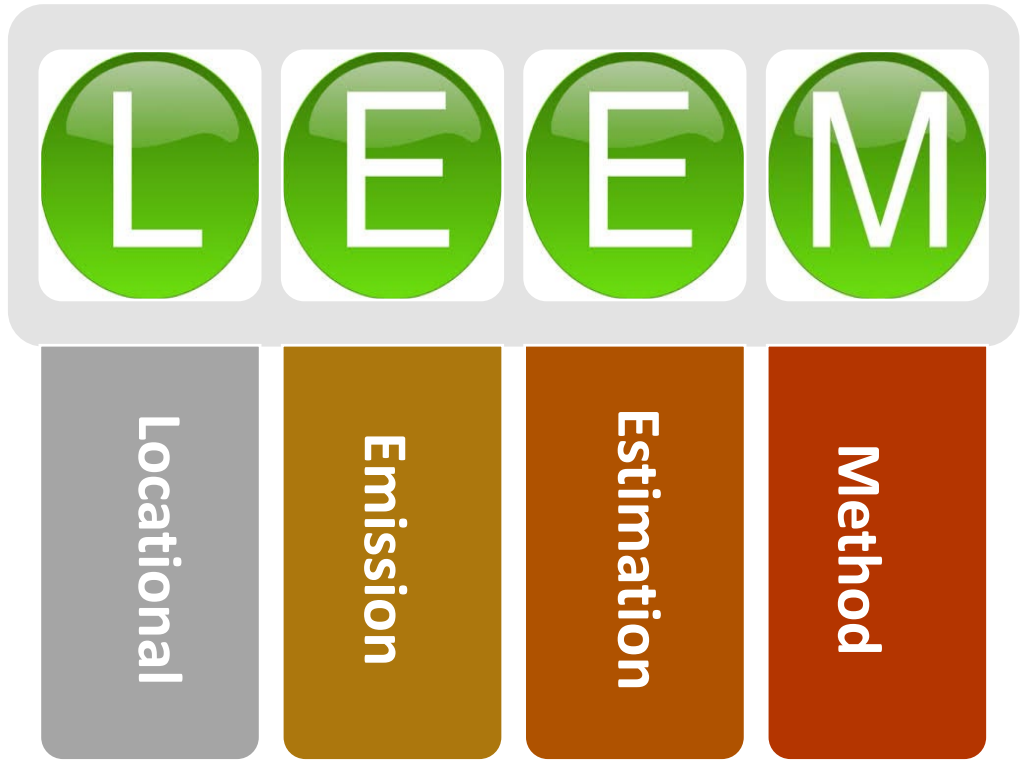
When you turn on a light at 6 AM, which one of the power plants will increase in generation to meet that demand?

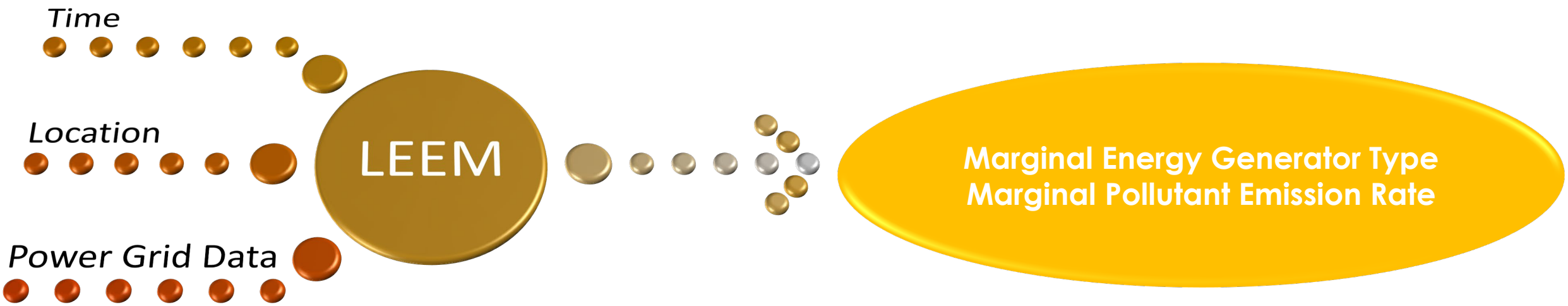
The fuel burned at that plant is the **fuel on the margin**, and is largely (but not exclusively) a function of how much it costs to turn that fuel into electricity. The power plant that responds to your demand is the **marginal generator!**



Currently, this information is MASKED for the consumer. Most consumers have NO IDEA where their energy “comes from”!!!!

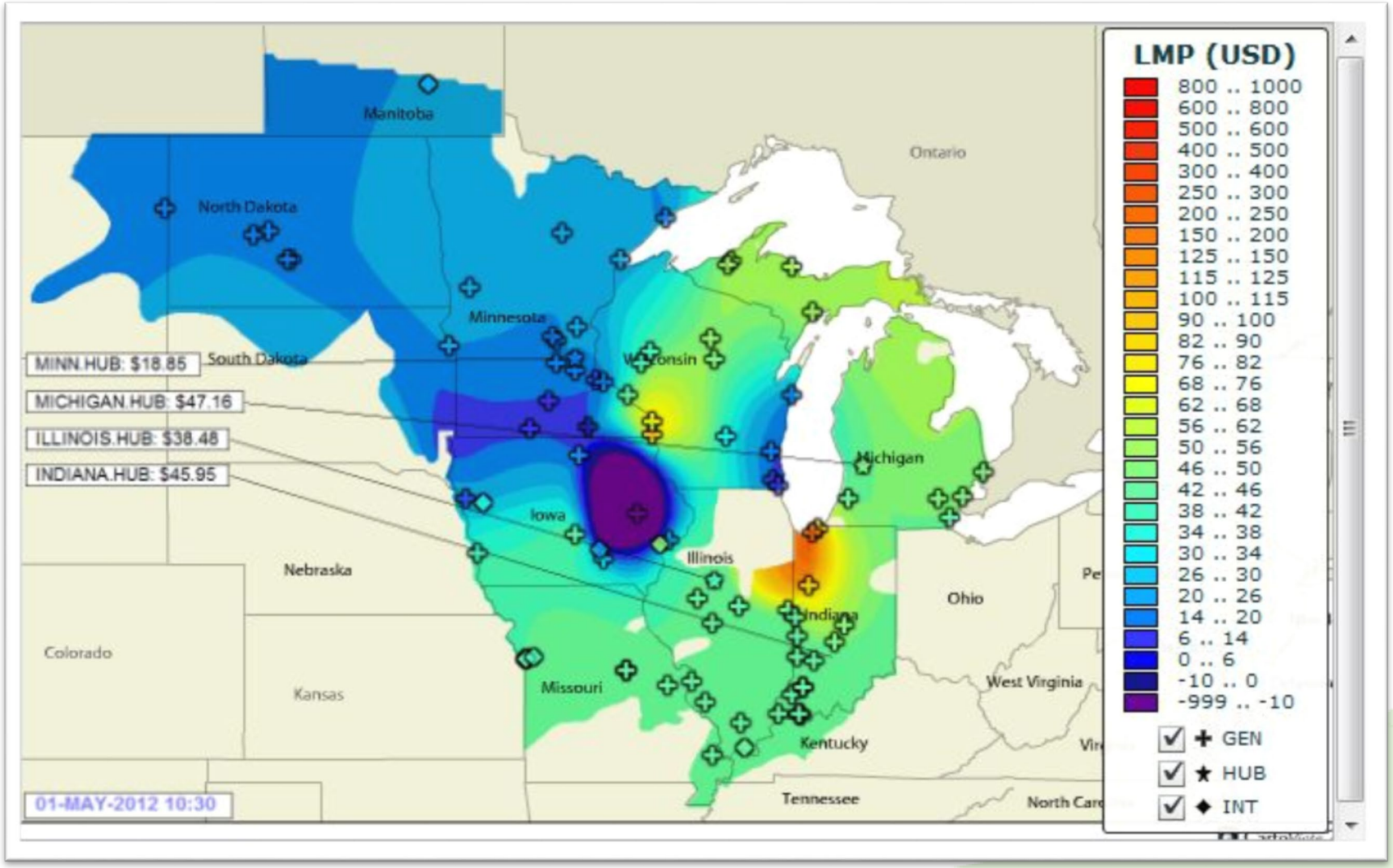
Power operators provide this information only **AFTER THE FACT.**


L
E
E
M
Locational
Emission
Estimation
Method

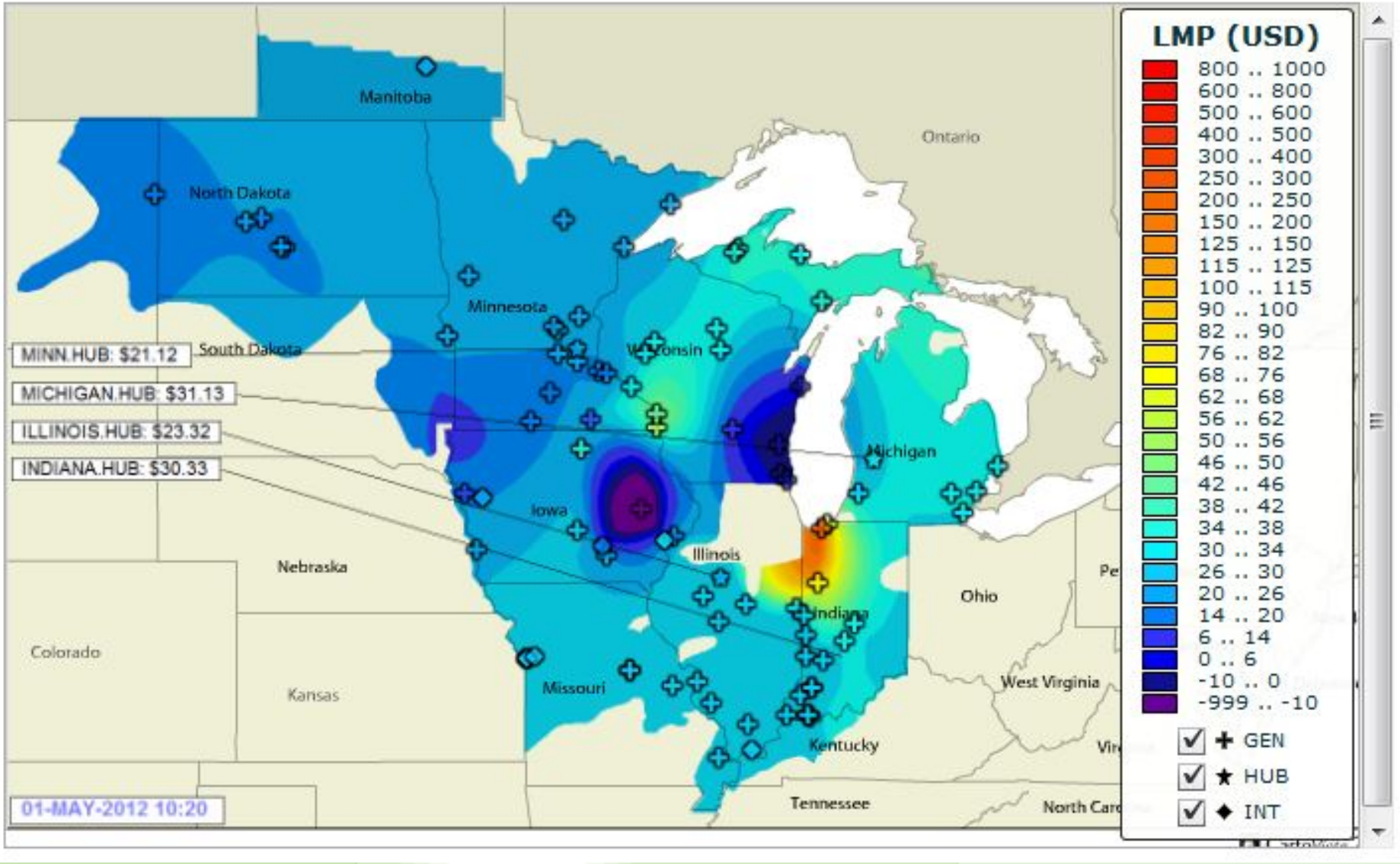

Time
Location
Power Grid Data
LEEM
Marginal Energy Generator Type
Marginal Pollutant Emission Rate

LEEM

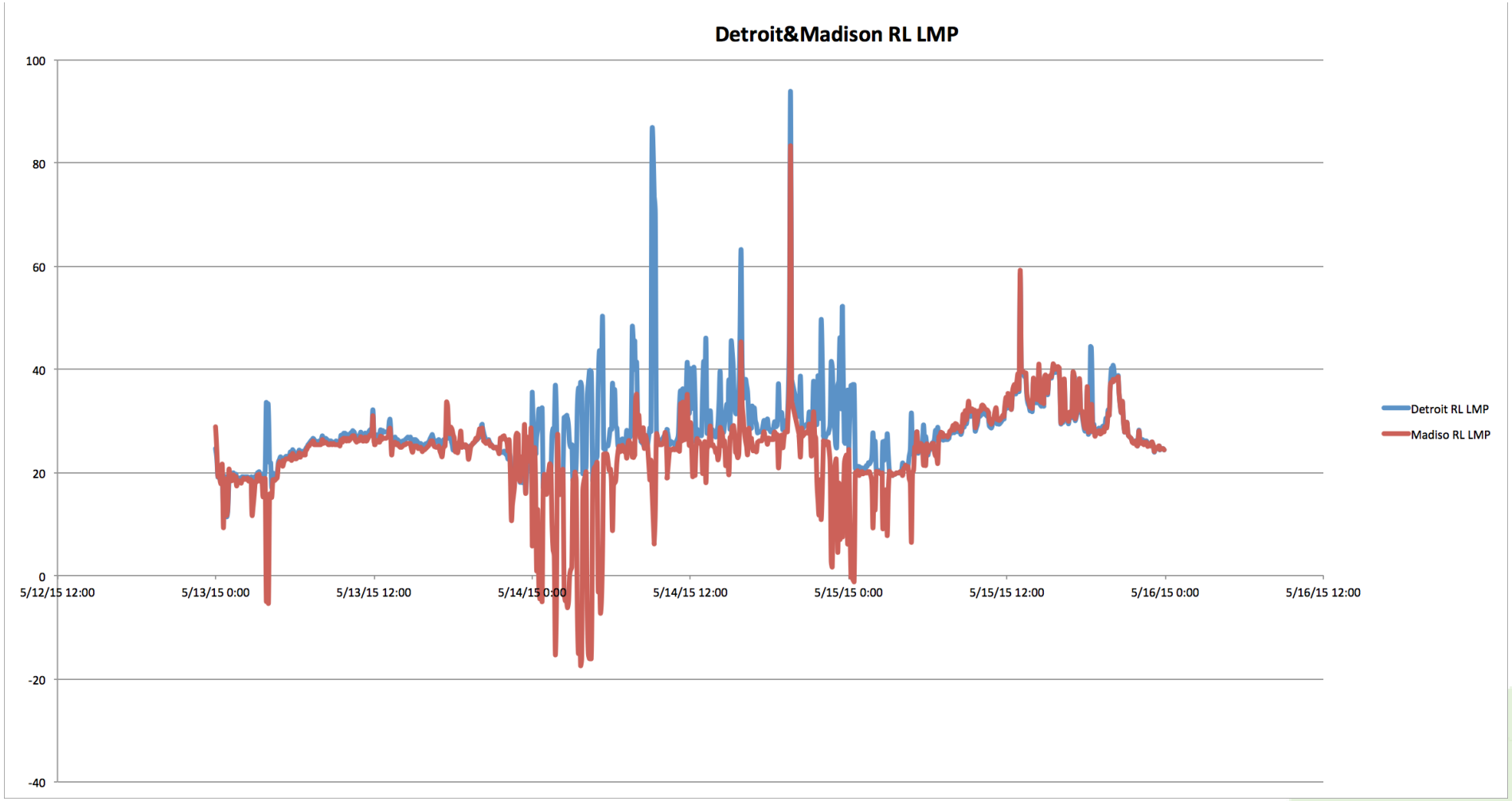
LMP = f (space)



LMP = f (time)


LMP (USD)
800 .. 1000
600 .. 800
500 .. 600
400 .. 500
300 .. 400
250 .. 300
200 .. 250
150 .. 200
125 .. 150
115 .. 125
100 .. 115
90 .. 100
82 .. 90
76 .. 82
68 .. 76
62 .. 68
56 .. 62
50 .. 56
46 .. 50
42 .. 46
38 .. 42
34 .. 38
30 .. 34
26 .. 30
20 .. 26
14 .. 20
6 .. 14
0 .. 6
-10 .. 0
-999 .. -10
GEN
HUB
INT
MINN.HUB: $21.12
MICHIGAN.HUB: $31.13
ILLINOIS.HUB: $23.32
INDIANA.HUB: $30.33
01-MAY-2012 10:20
Manitoba
Ontario
North Dakota
Minnesota
South Dakota
Iowa
Nebraska
Illinois
Ohio
Colorado
Kansas
Missouri
West Virginia
Kentucky
Tennessee

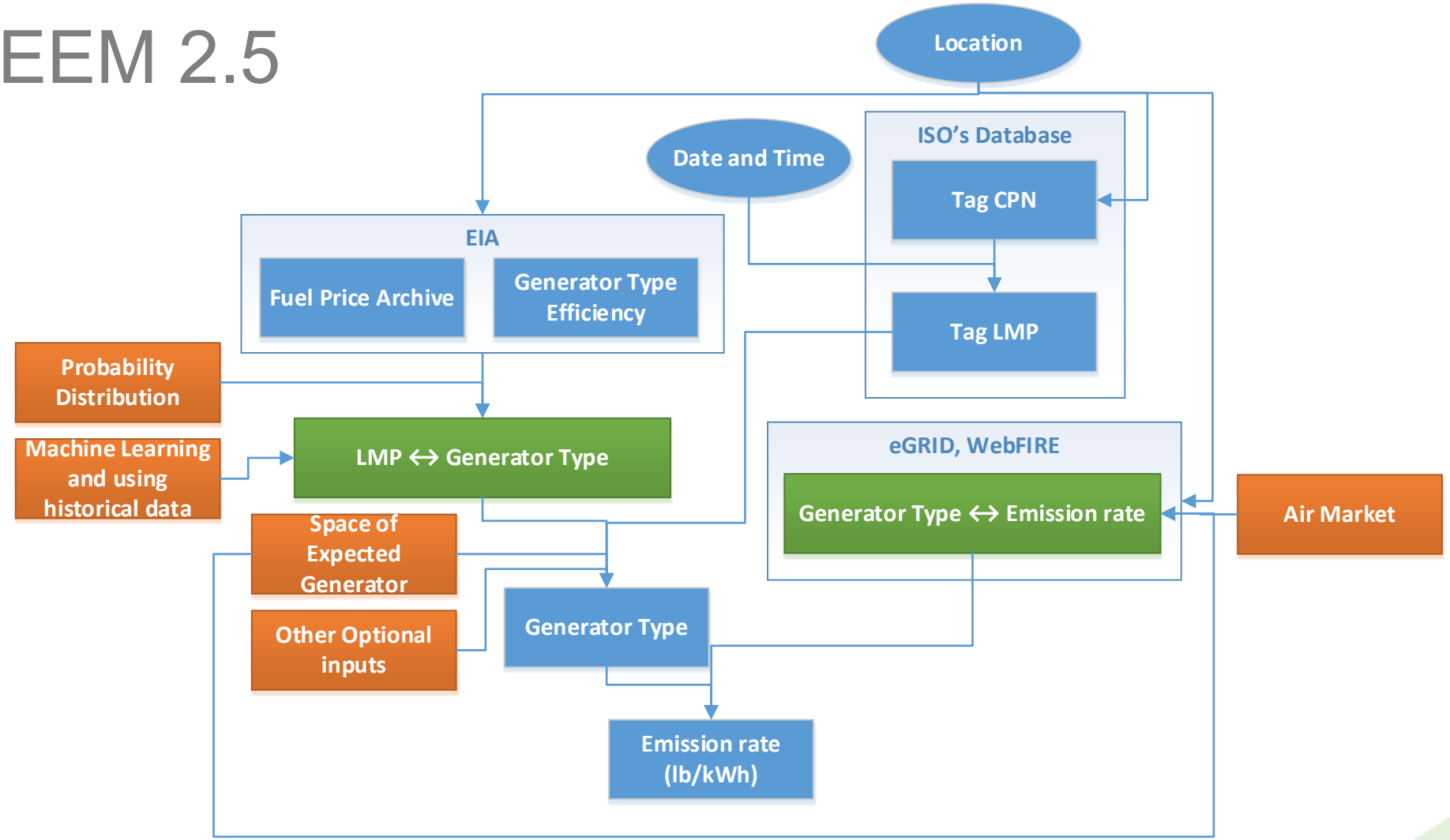
LME = f (space, time)



The Algorithm

LEEM

LEEM 2.5


Location
Date and Time
ISO's Database
Tag CPN
Tag LMP
EIA
Fuel Price Archive
Generator Type Efficiency
Probability Distribution
Machine Learning and using historical data
LMP ↔ Generator Type
eGRID, WebFIRE
Generator Type ↔ Emission rate
Air Market
Space of Expected Generator
Other Optional inputs
Generator Type
Emission rate (lb/kWh)

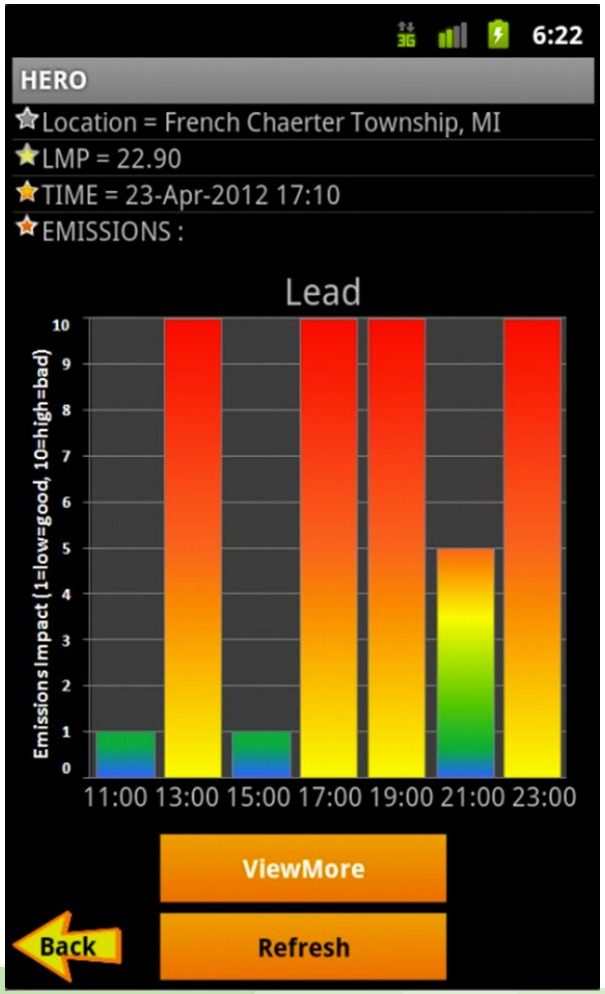
EMERGING APPLICATIONS/ PRODUCTS

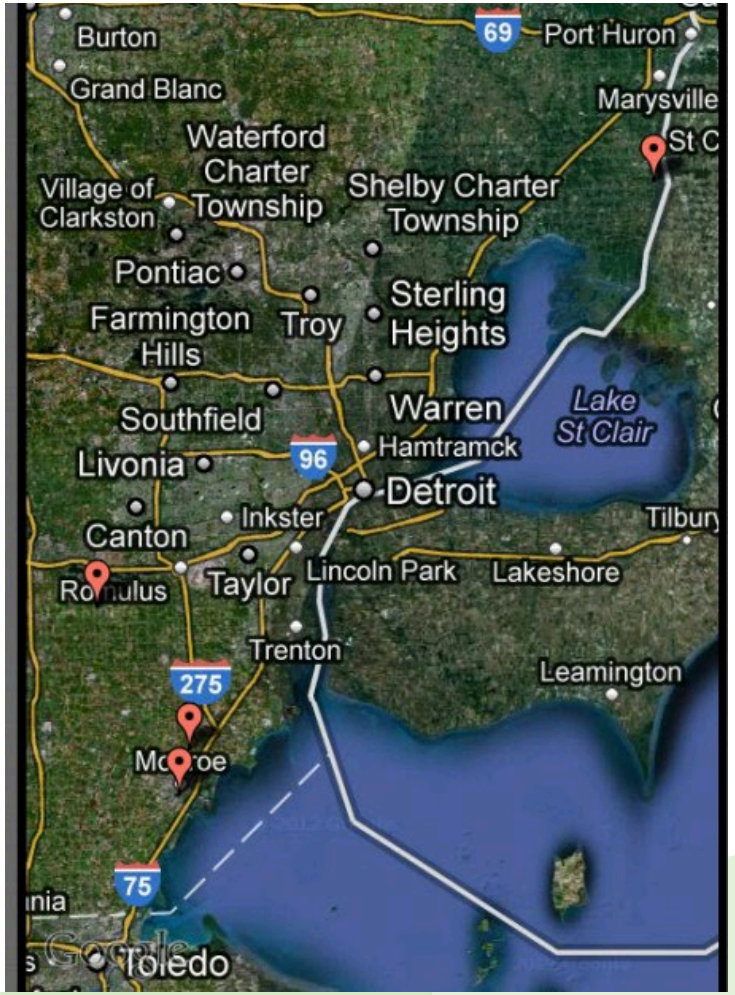
SmartCharge

Example:

HERO

Home Emissions Read-Out

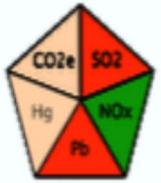
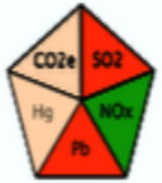
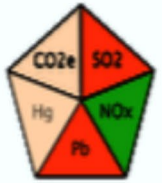
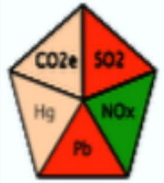
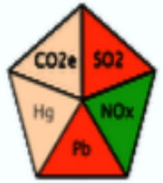
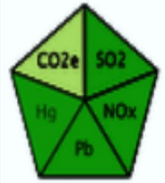




Subscribe to Daily Marginal Emissions Forecast

Here is your marginal electricity emissions forecast for today:

Date: 11/13/14
Zip Code: 48103

	6 am	8 am	10 am	12 pm	2 pm	4 pm	6 pm	8 pm
Emissions								

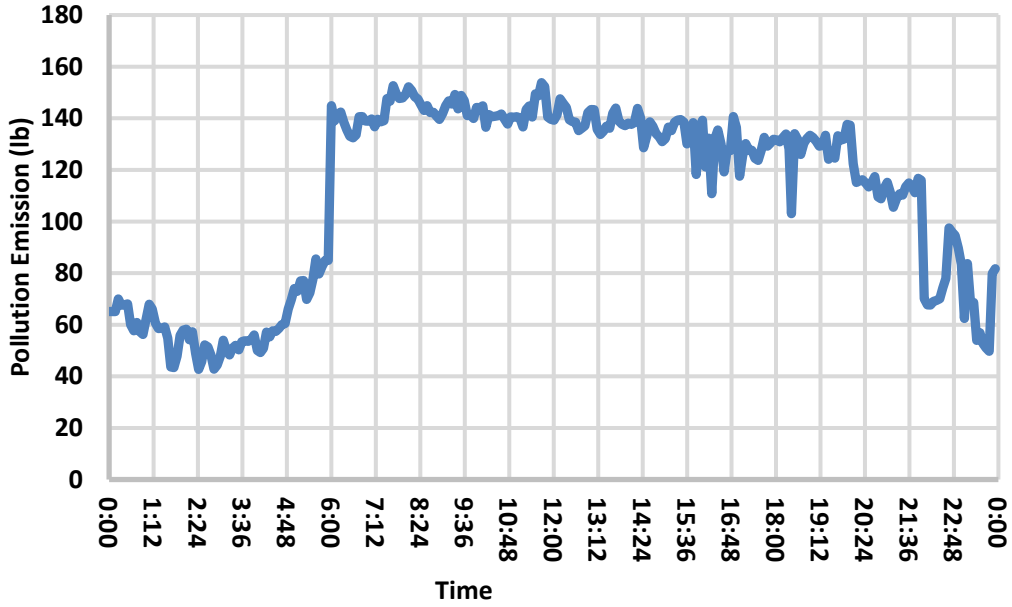
Example: Chrysler House, Detroit

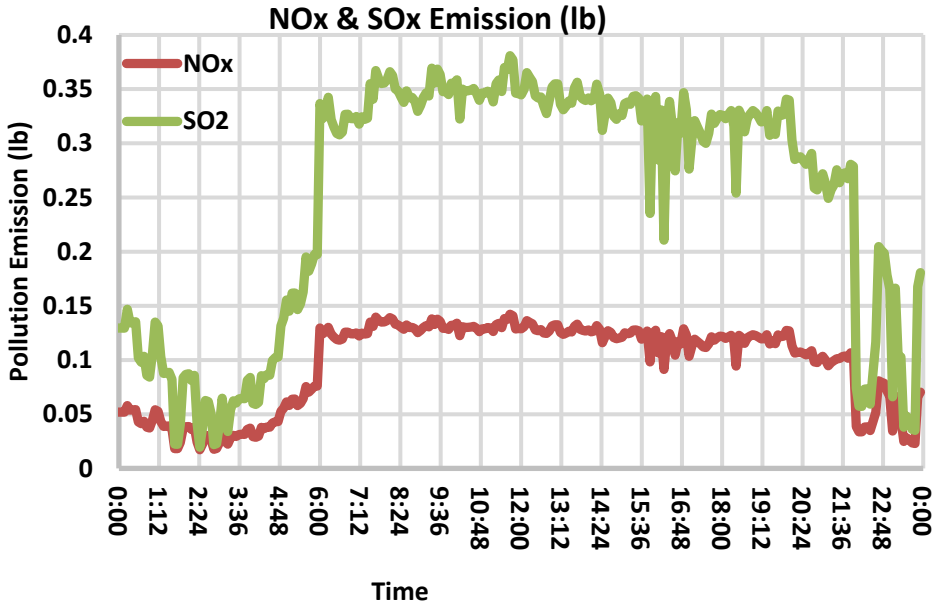
- Building Energy Management

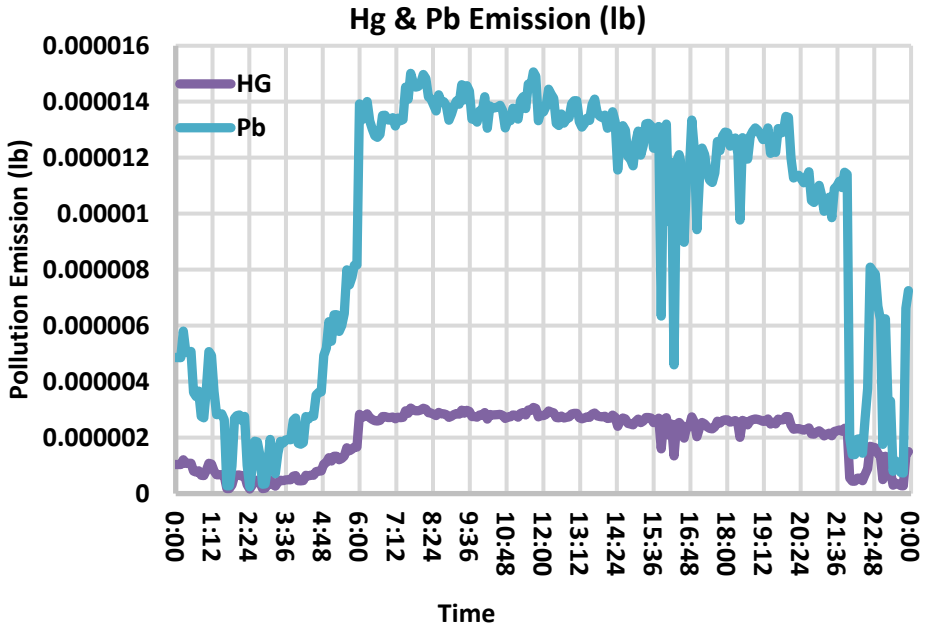
Stories

Chrysler House Marginal Emissions (lb)

5 Pollutants are tracked:
CO2, NOx, Sox, Hg, Pg







EXAMPLE: WATER UTILITY ENERGY CHALLENGE (WUEC)

FUNDED BY

Great Lakes Protection Fund

WATER UTILITY ENERGY CHALLENGE

GREAT LAKES BASIN

PARTNERS

E2i

WAYNE STATE

American Water Works Association

HEALTHY URBAN WATERS

Erb Family Foundation

CDM Smith

GROWTHCAPITAL NETWORK

Great Lakes and St. Lawrence Cities Initiative

Example

Engineering Building Marginal Emissions Dashboard

Test Drive!

http://18.216.144.169/index.html

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Watch: Smart Energy for a Cleaner Great Lakes

https://vimeo.com/123342691

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