

The Great Lakes: Reading a Regional Energy System

How It Works or Fails · The Great Lakes · Grades 11–12 / First-Year College

Name _____ Date _____ Class _____

How to use this sheet. A ride-alongside worksheet: keep the interactive Great Lakes map open beside you (IL, IN, OH, MI, WI, KY).

The map	Open it full-screen. IL, IN, OH, MI, WI, KY.
Lens row	Nine views: crude, gas, coal, nuclear, wind, solar, hydro, ethanol, electricity.
State filter	Isolates one state. Crude lens only.
Emissions	AIR QUALITY / GHG / SINKS, on EPA and EIA data.
Vulnerability	Press VULNERABILITY and open a card. Assets are scored for their weaknesses or strengths.
Scenarios	Runs a real event and opens an instrument.
CURVES	Opens the market window on crude, gas, ethanol and electricity.

Part 1 · What this region runs on — and what each source is good for

1.1 Some sources can run whatever the weather does. On the NUCLEAR, COAL and GAS lenses, open a plant on each and find how long it could keep running if nothing were delivered to it. Rank the three. Gas is the biggest fuel in this region — why isn't it the firmest?

1.2 Now the two that cannot run on demand. On the WIND lens, read which months blow hardest and which are weakest. Do the same on SOLAR. For each one, when is it most use to this region, and when is it least?

1.3 Put 1.1 and 1.2 together. Wind and solar are strongest at different times of year. Which of the firm sources has to cover the months when wind is weakest?

1.4 Switch to the CRUDE lens. Compare the region's own oil production with what its refineries run. What does that gap say about where this region's liquid fuel comes from, and what has to keep working for it to arrive?

1.5 On the ELECTRICITY lens, press CURVES for the transport bars. Which states drive electric vehicles, which finish them, and which build the batteries? Are they the same states?

Part 2 · The tradeoff — what it costs and what it buys

Open the emissions app (AIR QUALITY / GHG / SINKS). This region holds both the cleanest firm power in the country (its nuclear fleet) and some of the dirtiest (its coal fleet) at the same time.

2.1 In the emissions app open GHG and find Electric Power. Scrub from FY2000 to today and say what the region's power emissions have done.

2.2 Now switch to the ELECTRICITY lens and scrub the same years. Which fuel changed most — and does the emissions line match what you saw in the mix?

2.3 In the emissions app, open the Industry sector and find Coal Mining inside it. What beyond the power plants shapes this region's emissions?

Part 3 · The weak point — a vulnerability judgment that can change

Press VULNERABILITY and open a card. A vulnerability score here is not fixed — it is a judgment about how this asset can fail, built from the evidence on the card, and it can change: a changed condition, or new research, can legitimately raise or lower it.

Pick ONE asset to read (different groups take different assets):

- Davis-Besse (OH) — the reactor whose head corrosion nearly breached the vessel (2002)
- Palisades (MI) — a reactor with an unusual recent history
- BP Whiting (IN) — the largest inland refinery, all-or-nothing on one site
- Enbridge — open BOTH vulnerability cards: Line 5 at the Straits, and the Mainline it belongs to
- Gen. Gavin (OH) — the merchant coal plant that bought out a whole town
- Monroe (MI) — 3 GW of coal closing on a fixed clock (2028/2032)

3.1 Open your asset's card (the Enbridge choice has two) and read its evidence — what it depends on, what has already happened to it, what its failure would take down. In your own words, what is this asset's real vulnerability: where and how does it fail?

3.2 A rating is a snapshot of today's conditions. What would have to happen in the next five years for this asset's score to move — up or down?

Part 4 · The shock — run a scenario

Each scenario runs a real event on today's infrastructure and moves the supply×demand (CURVES) window.

Pick ONE scenario to run (different groups take different shocks):

- Enbridge Line 5 Shutdown — the Straits crossing goes dark; Detroit and the Toledo refineries lose feed
- BP Whiting Outage — the largest inland refinery drops out of the Chicago market
- Kalamazoo / Line 6B — the 2010 dilbit rupture, the largest inland U.S. oil spill
- Soo Locks / Poe Lock Closure — the only lock for 1,000-ft freighters halts upper-lakes ore, coal, and fuel
- Polar Vortex / Propane — an Arctic outbreak spikes heating demand while freeze-offs trim supply

4.1 Run your scenario. What does it hit FIRST, and — because so much runs through one corridor, plant, or lock — what has no easy backup? Name the cascade (downstream or secondary effects).

4.2 Find your scenario's supply×demand window. For LINE 5, WHITING and KALAMAZOO it is on the CRUDE lens under CURVES, with price and quantity. For the POLAR VORTEX it is on the GAS lens under CURVES, and it reads in Bcf/d — there is no price axis. For the SOO LOCKS it opens by itself when the scene arms, and it reads in tonnes. Whichever you have: which curve moves, and what happens? In a few short words, what is the overall effect of this shock? Then, on the CRUDE lens with CURVES on, look at the REAL MARKET PATH window: does your shock show up in the twenty-five-year track, or does it disappear into it?

Part 5 • Judgment — defend a claim

Use evidence from at least two earlier parts. There is no single right answer.

5.1 On the ELECTRICITY lens, scrub from FY2000 to today and find which state's mix changed MOST and which changed LEAST. Then read the price window: what has residential power cost in each of them over the same years? Using evidence from at least two parts, argue whether the states that moved fastest are the ones paying for it — and say what else could explain what you found.

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