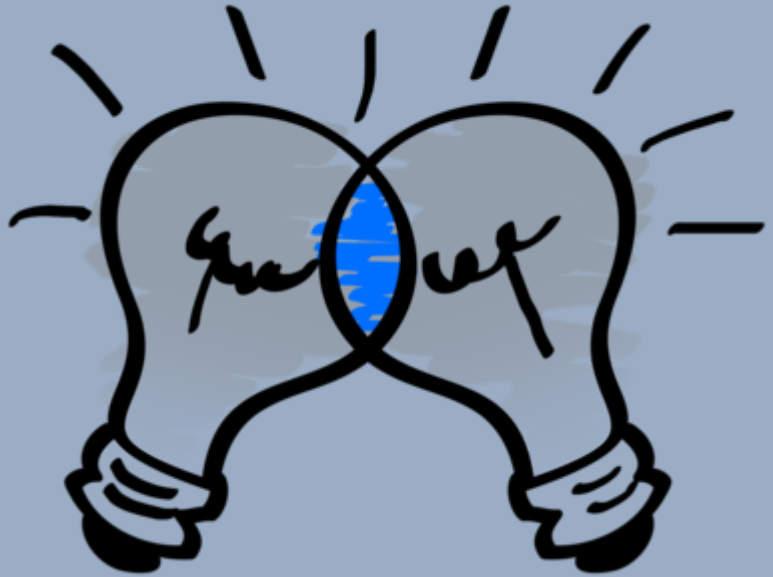


ENERGY MARKETS 101

In North Dakota

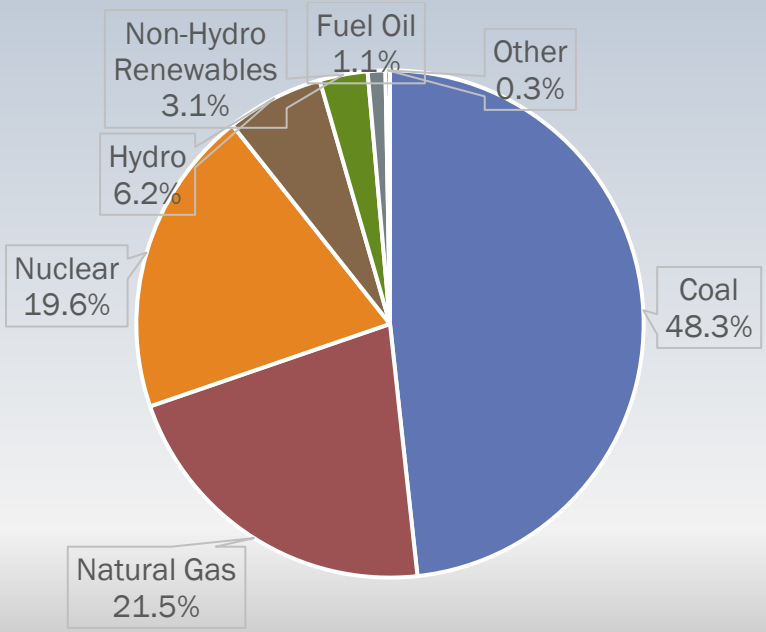
Jean Schafer, Senior Legislative Representative,
Basin Electric Power Cooperative

OVERVIEW

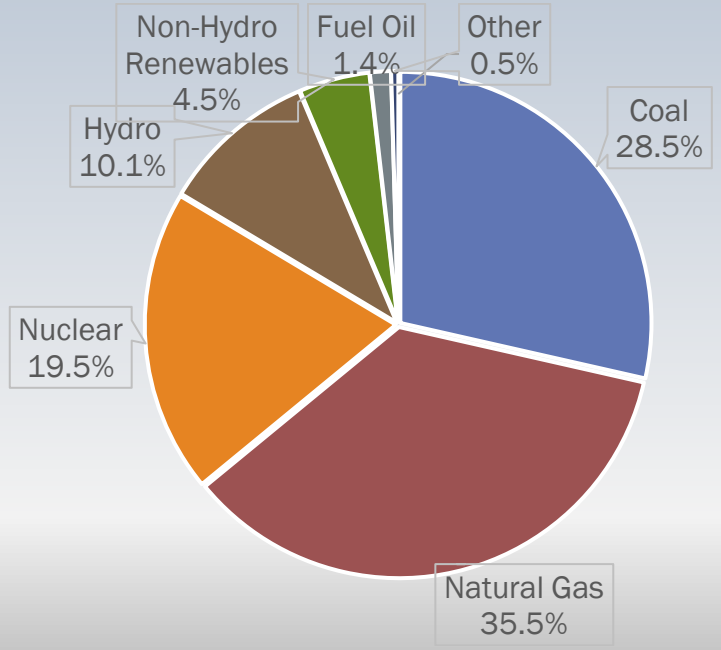
MIX OF RESOURCES

The mix of resources used to generate electricity is changing dramatically.....

2008 National Energy Resource Mix



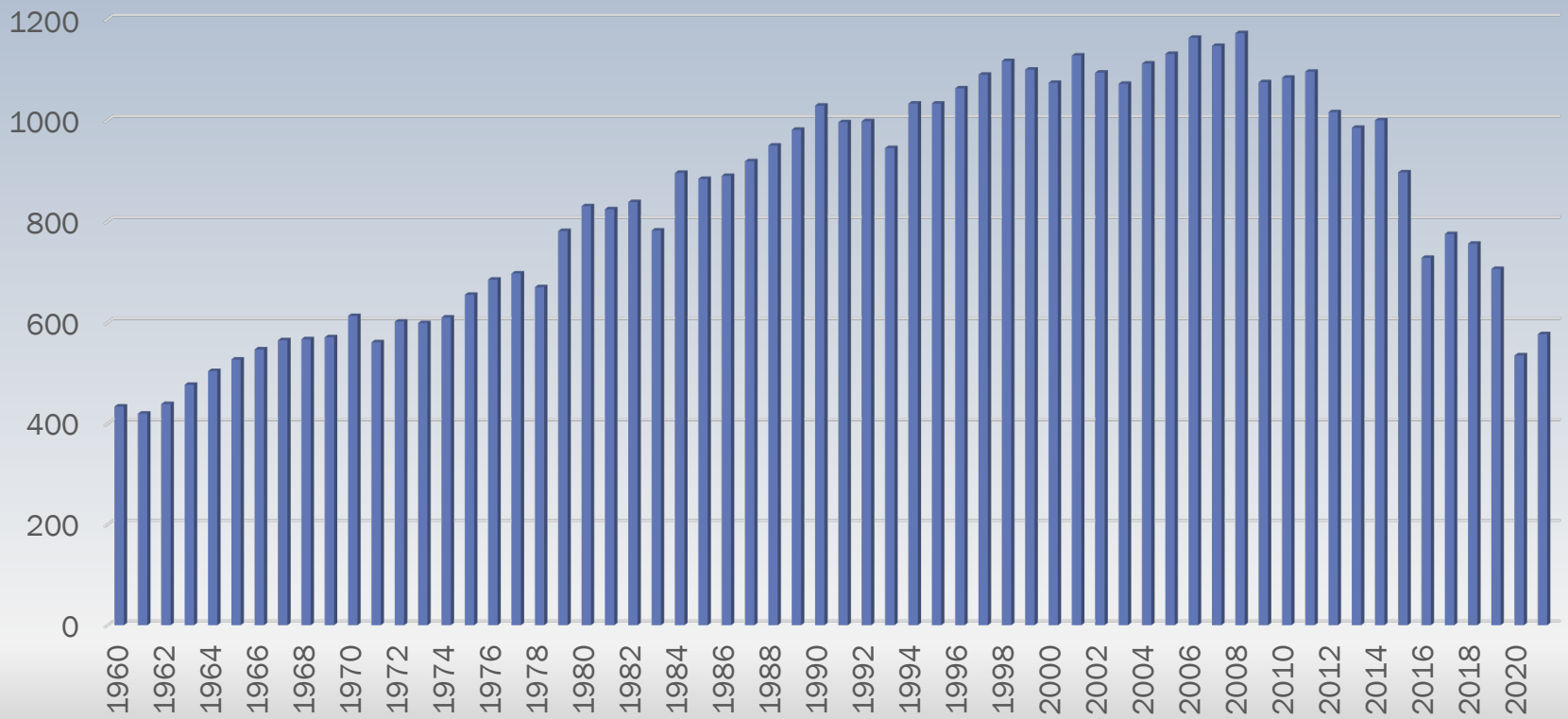
2022 National Energy Resource Mix *(Dec)*



Source: Department of Energy, Energy Information Administration

U.S. COAL PRODUCTION

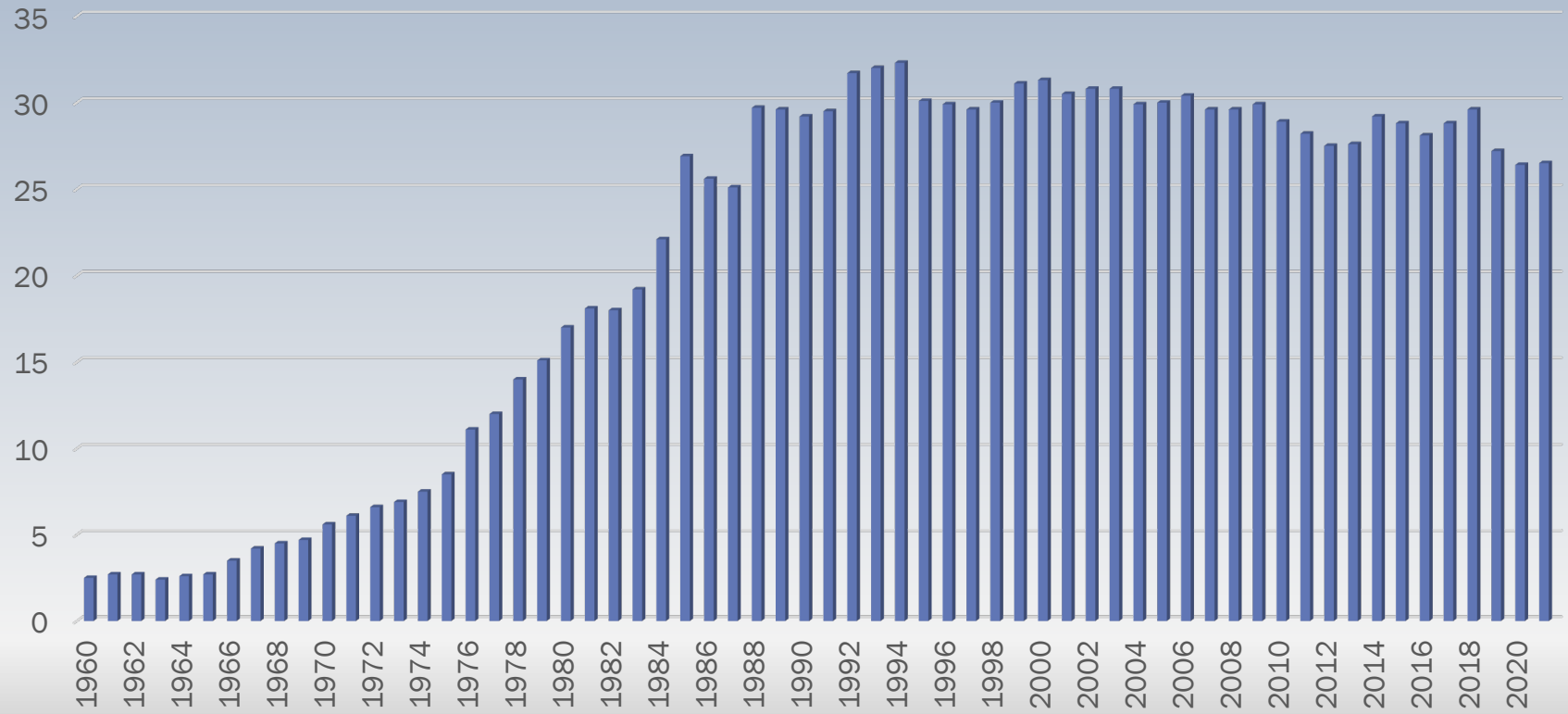
1960-2021



Source: Department of Energy, Energy Information Administration

ND COAL PRODUCTION

1960-2021



Source: Department of Energy, Energy Information Administration

ATTRIBUTES OF GENERATION

AS A GENERAL RULE

- Coal and nuclear generation are 24/7 dispatchable and rampable power production
- 70-95% Capacity Factor

COAL

- Coal plants are less flexible than gas generation.
- It can take several hours, possibly days, to completely shut down and startup a coal plant.
  - If a coal plant is not price competitive it will normally reduce output to minimum levels instead of shutting down
  - At this point, they can potentially be selling power at a loss until the market price increases (loads increase or wind generation reduces)
  - Minimum operating levels for a coal plant vary
  - Many are 40 - 50% capacity
  - Occurring less frequent with Economic Dispatch

ATTRIBUTES OF GENERATION

AS A GENERAL RULE

- Natural gas generation can be used for:
  - Peaking
  - Intermediate
  - Baseload
  - 5-90% Capacity Factor (price and supply)

NATURAL GAS

- Natural gas can be a very low-cost fuel source - fluctuates
- Generally, natural gas has the ability to respond faster to load changes than coal-based generation
- Depending on the price of the fuel, natural gas generation can be dispatched before or after coal generation
- Natural gas has higher transportation interruption risks than coal

ATTRIBUTES OF GENERATION

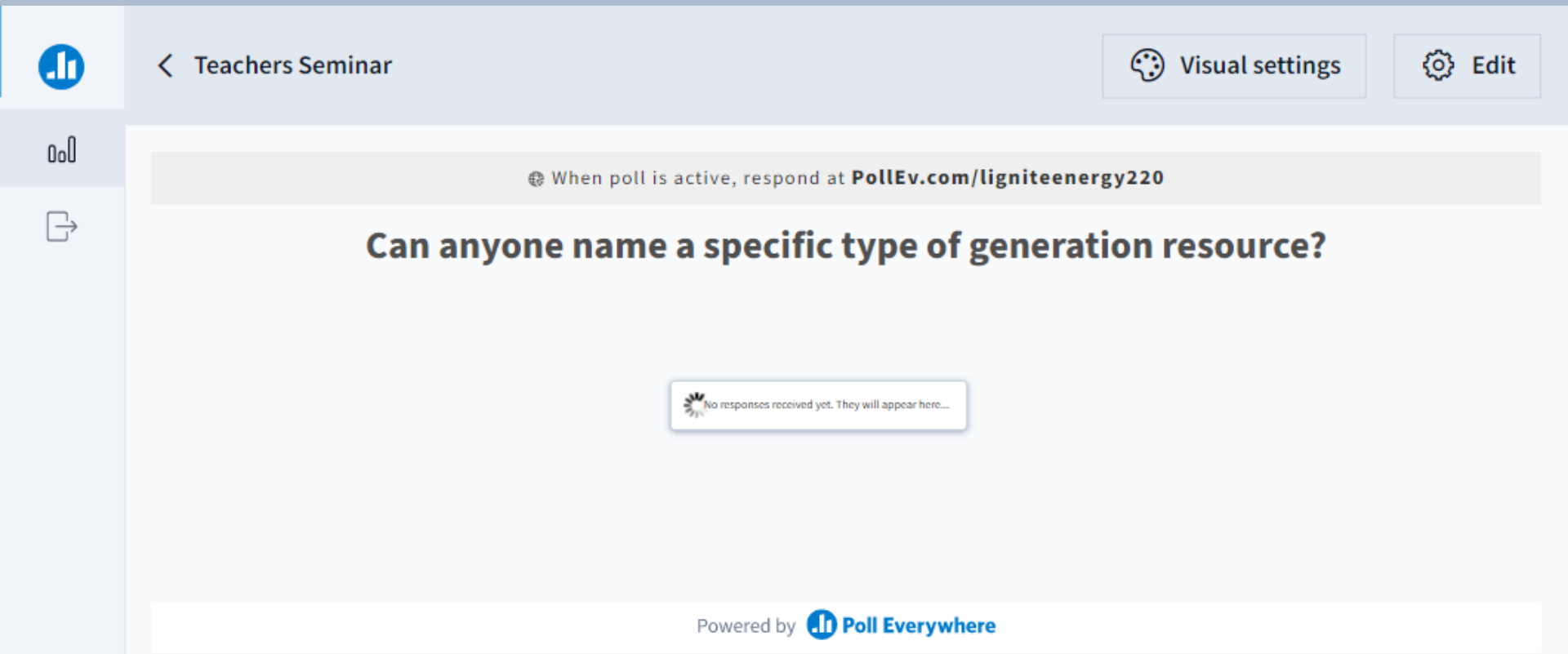
AS A GENERAL RULE

- Wind and solar are intermittent power with annual capacity factors of 20-50%

WIND

- Wind has zero variable (fuel) costs and normally priced into the market at zero, or below all other generation costs
  - Possible for negative pricing due to “take or pay provisions”
  - Use Production tax credits (PTCs)
    - Wind owners benefit for 10 years
    - All Federal taxpayers fund PTCs
  - In general, wind is dispatched when it runs
    - Recent RTO changes have shifted wind to curtailable
    - All SPP projects are converted
  - Excellent wind resources in the Midwest
- Wind facilities lifespan are 20-30 years
  - Repowering of projects is starting to occur

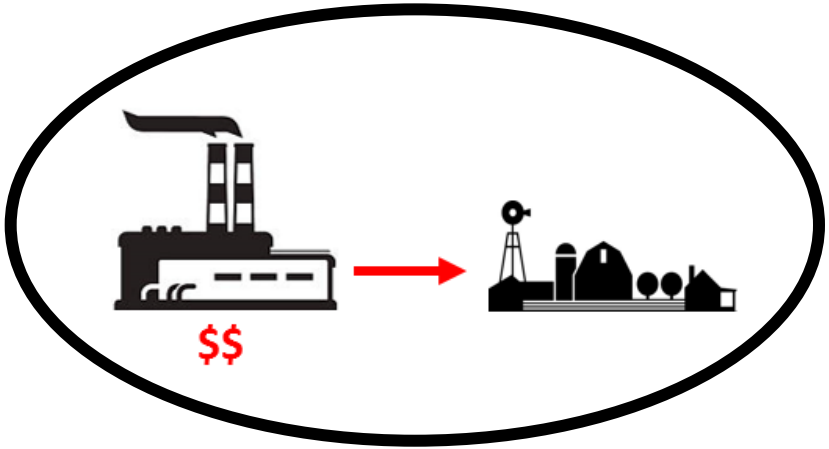
QUESTION 1

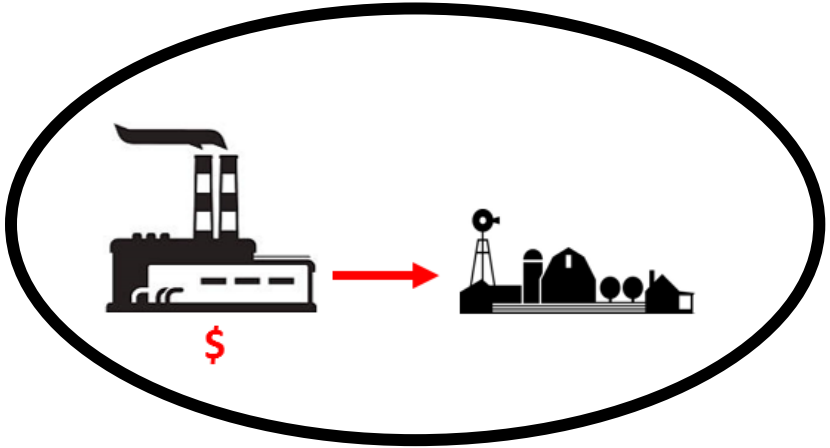

Teachers Seminar
Visual settings
Edit
When poll is active, respond at PollEv.com/ligniteenergy220
Can anyone name a specific type of generation resource?
No responses received yet. They will appear here...
Powered by Poll Everywhere

EVOLUTIONS OF THE ELECTRIC GRID

IN THE BEGINNING: SELF SERVE

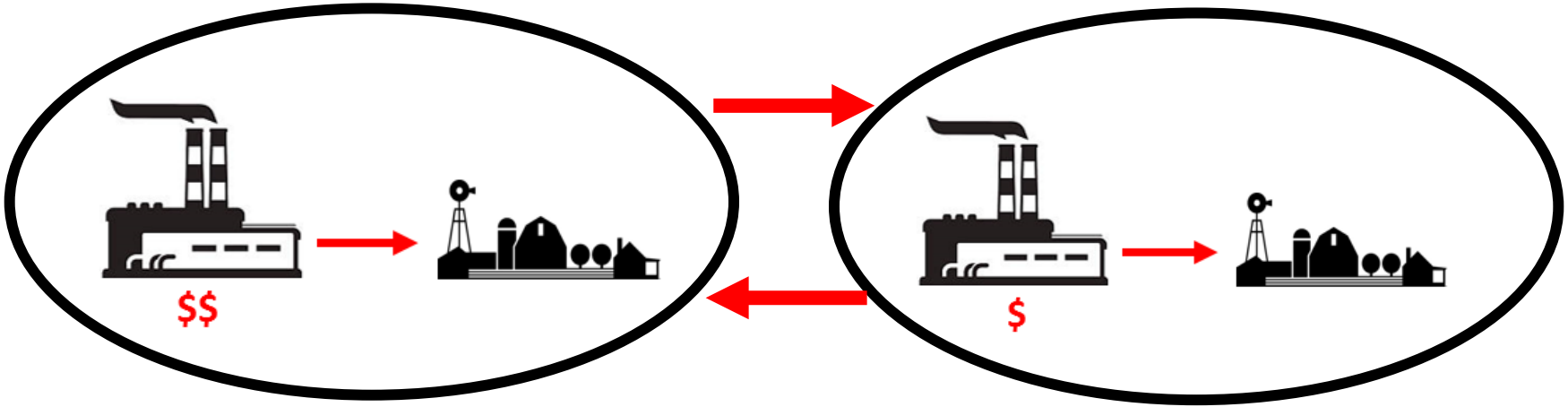
Each utility system served its own geography, and generated to meet its own load as if it were an island





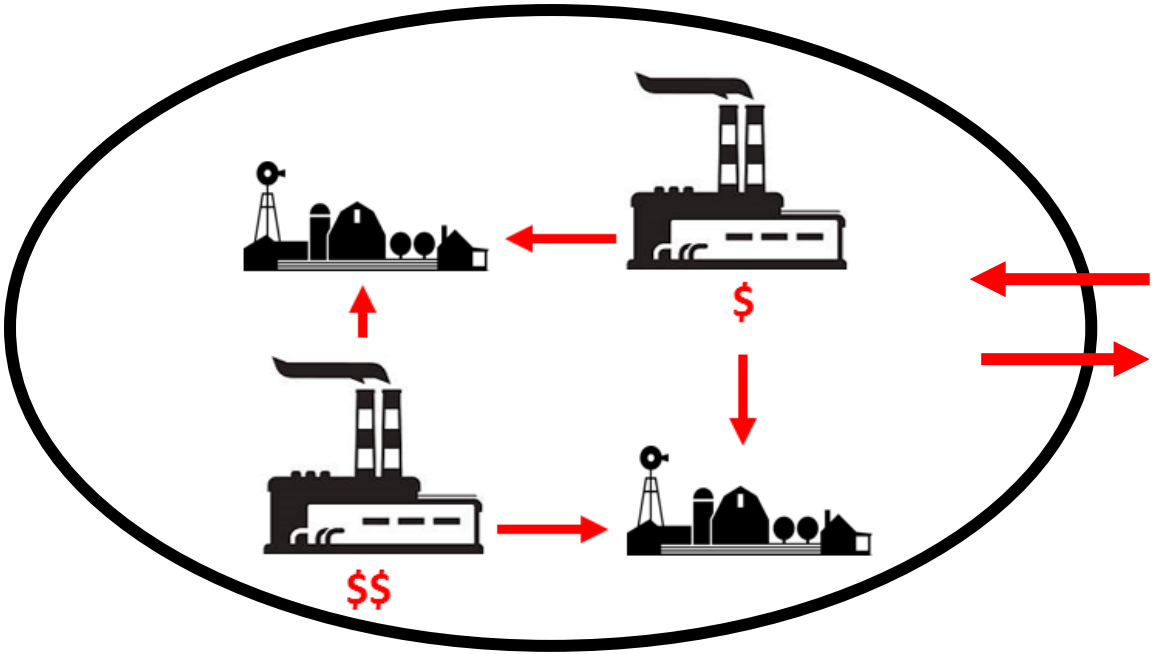
GRID EVOLUTION: BILATERALS

Utilities began bilaterally exchanging power to reduce cost and enhance reliability, but still operated as separate utilities



POWER “POOLS” FORMED

Utilities entered into power-pooling agreements to operate as one system for maximum cost savings and reliability = Regional Transmission Organizations

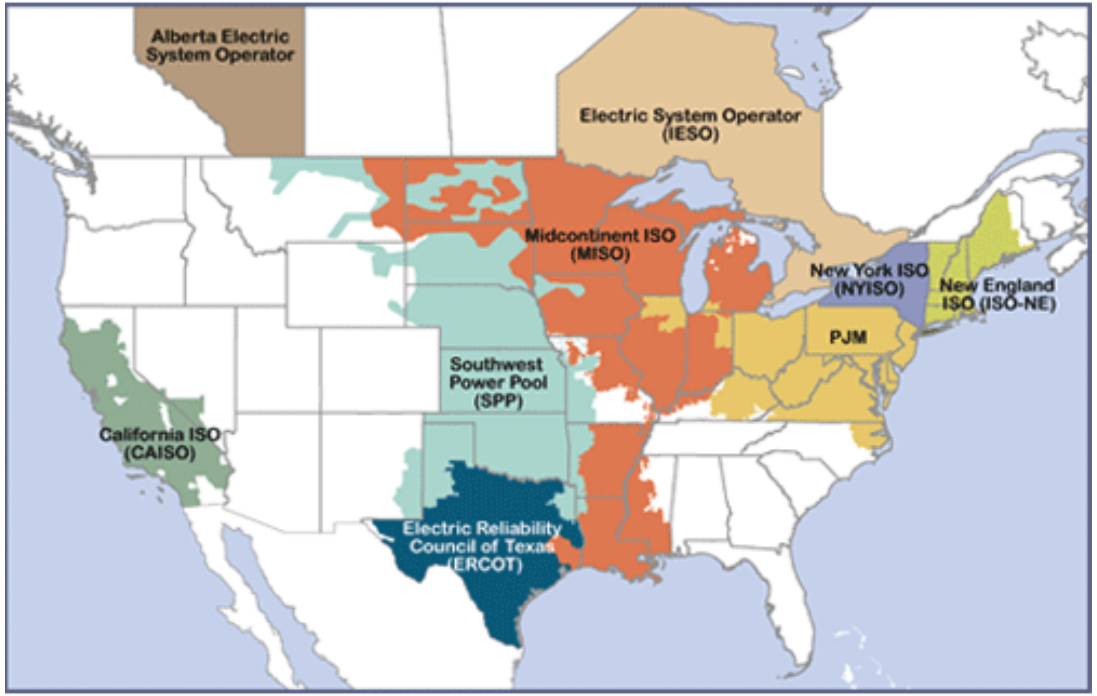


THE GRID TODAY

7 RTO and ISO's across US - Dominant form of energy dispatch

RTO Functions -
Transmission services - shared facilities and cost allocations are socialized

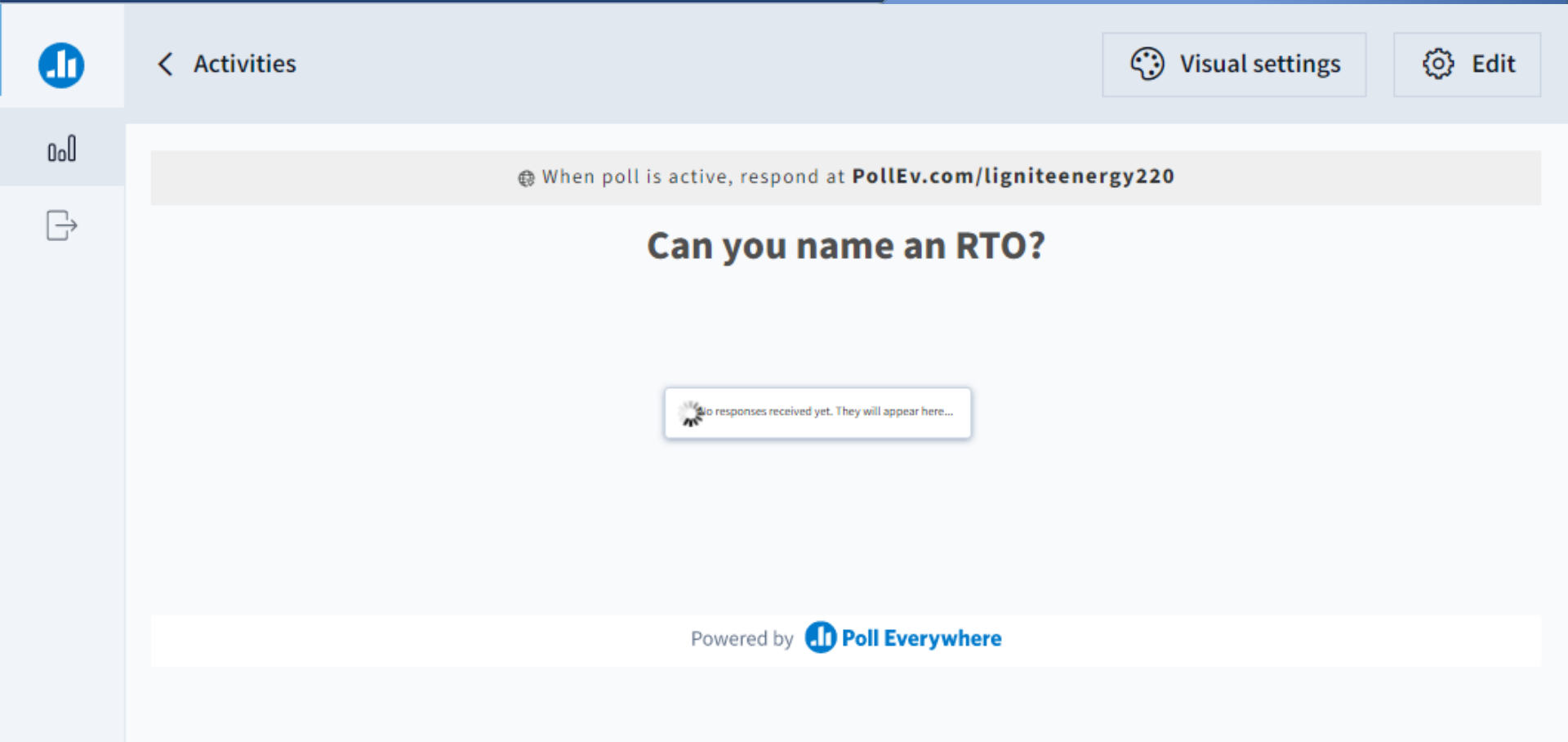
Wholesale Power Markets - generation can be sold or purchased or both



QUESTION 2


Activities
Visual settings
Edit
When poll is active, respond at PollEv.com/ligniteenergy220
What does the acronym "RTO" stand for?
o responses received yet. They will appear here...
Powered by Poll Everywhere

BONUS


Activities
Visual settings
Edit
When poll is active, respond at PollEv.com/ligniteenergy220
Can you name an RTO?
o responses received yet. They will appear here...
Powered by Poll Everywhere

MARKET OPERATIONS

ELECTRICITY MARKETS

- Southwest Power Pool (SPP)
  - 105,454 MW Capacity
  - 31,217 MW Wind
  - Longer north to south, cold vs hot dynamics
  - Large percentage of wind generation
- Midcontinent Independent System Operator (MISO)
  - 190,000 MW Capacity
  - 30,400 MW Wind
  - Wider east to west, therefore more diverse sustained weather/load pattern
  - Has capacity for more wind generation

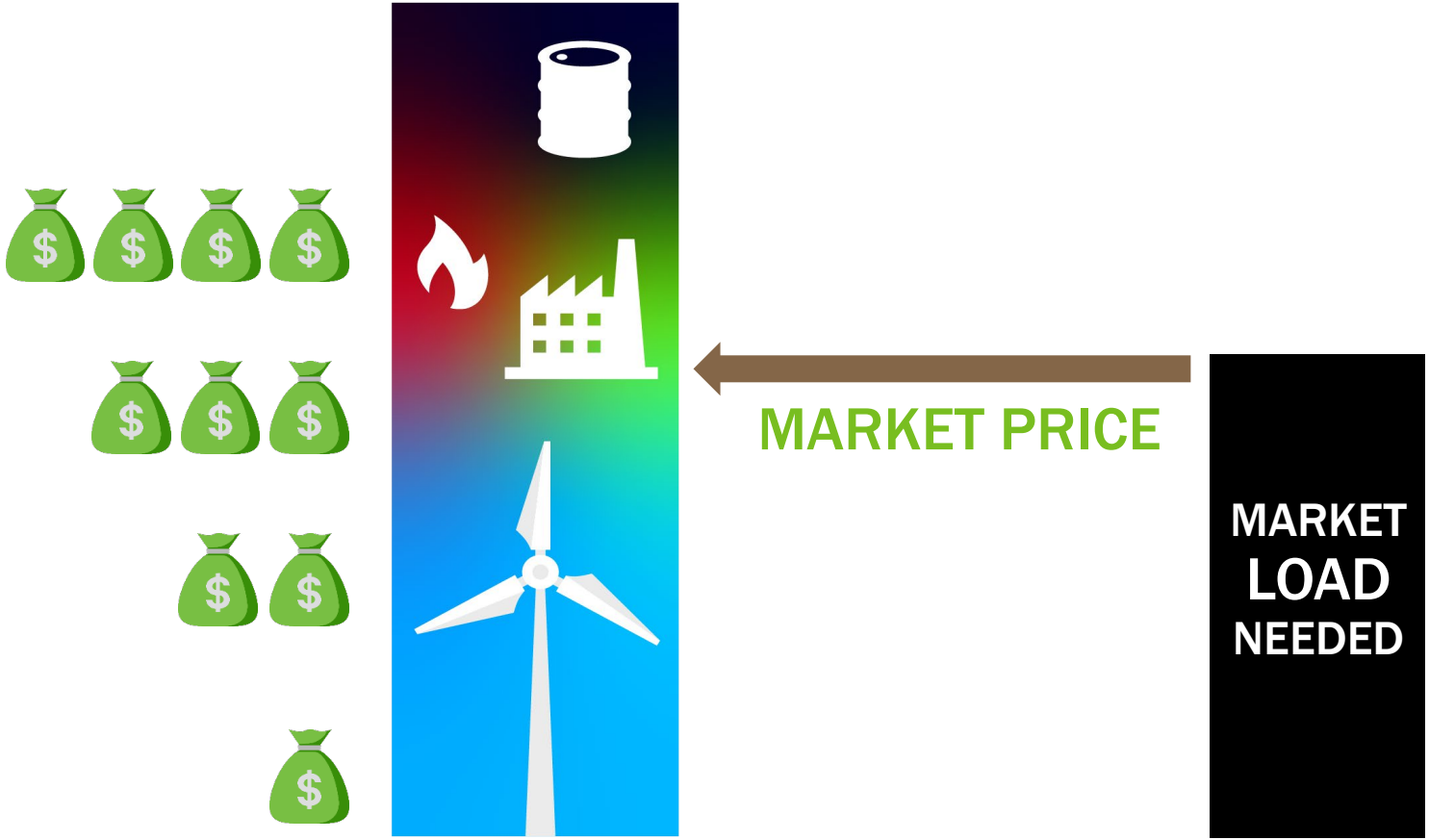
ELECTRICITY MARKETS

- All ND generation units belong to organized markets (RTOs)
  - Southwest Power Pool (SPP) - Basin Electric
  - Midcontinent Independent System Operator (MISO) - All Others/some Basin load
- Utilities give control of generation dispatch and transmission to SPP or MISO
- Utilities still own, operate and maintain generation and transmission facilities - Vertical Integration

ELECTRICITY MARKETS

- Utilities bid **generation** and **load** into the market
  - Only bid in the variable cost of power (mainly fuel price)
  - Lowest priced generation (and “must run”) runs first
  - Fixed costs (labor, mortgage, taxes, etc.) must be recovered from utility ratepayers or in the contracts for Independent Power Producers
    - This is called a “Cost of Service” model

MARKET COMMITMENT OF GENERATION



ELECTRICITY MARKETS

- Two separate transactions occur in organized markets
  - Selling generation into the market and buying power from the market
  - Utilities buy power based on the market clearing price
- The billings for the power and transmission are handled by the market operators - SPP and MISO

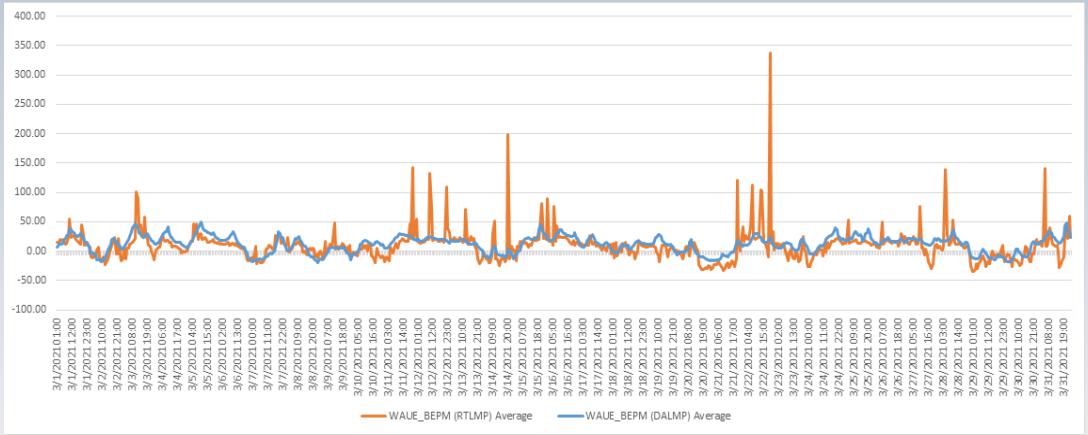
MAJOR PRICE DRIVERS

Day Ahead

- Types of Generation in the Market
- Levels of Load in the Market
- Natural Gas Prices

Real Time

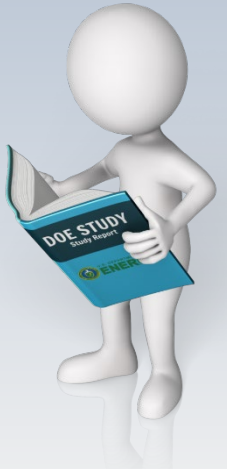
- Changes in wind levels
- Changes in load due to weather
- Resources tripping
- Congestion
- Lines tripping



UTILITY CONCERNS

COAL PLANT IMPACTS

- Coal plants main pressure comes from:
  - Production costs increases
  - When natural gas prices are low
  - Government subsidized renewable energy
  - Renewable Energy cost decreasing
- Other pressure comes from:
  - Cost of environmental regulations
    - 45Q tax credit for carbon capture projects
    - Expensive, can't be built without 45Q – 12 years
  - Decline in demand for electricity in some regions



CONCERNS…

- PTCs drive investment in wind generation - were phasing out
  - Credits continue to be extended
  - Government subsidized wind energy has lowered wholesale power prices, which is good for consumers
- BUT the low “fuel only” prices make coal plants uneconomic at times, where they must run and lose money waiting for loads to increase or renewable energy to reduce
  - Results in coal plants going to economic status vs must run status for economics

CONCERNS…

- Generators, like baseload coal, are not being adequately compensated for the services, such as 24/7 operation and backup for renewables
- RTO rules are shifting to allow more diverse market-based incentives
  - Developing policies that enhance fuel assurance
  - Perform initial and ongoing assessments of minimum reliability attributes needed from SPP's resource mix - Seasonally
- Newest - Cost impacts of transmission capacity for new generation

WHY THE SUDDEN PROBLEM?

- Increased Independent Power Producers online
- Interconnect transmission mitigation costs have been rising
- They are out of options to stretch the grid further without major costs
- They are not picking on wind or any other resource-all go through a similar modeling program to assess system impacts
- Even transmission planning professionals got surprised by the suddenness of the change in cost
- Transmission takes 8-10 years to get in place - $1M+/mile of HV line

QUESTIONS??