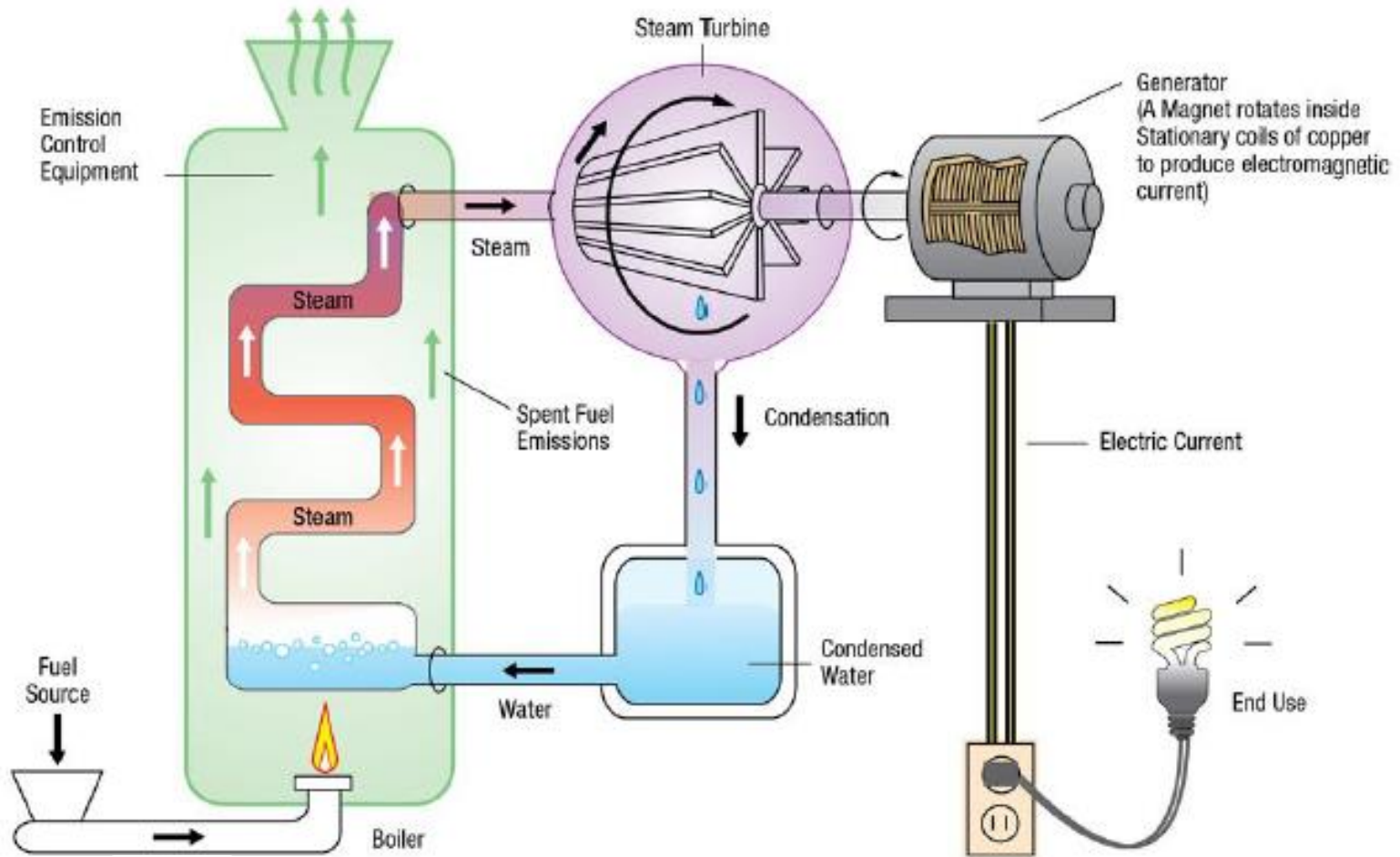

ELECTRICITY 101

PRESENTED TO HOUSE ENERGY AND ENVIRONMENT COMMITTEE
JANUARY, 2013

BY

MARK SCHREIBER ON BEHALF OF KEC, KEPCO, KCPL, MIDWEST ENERGY, SUNFLOWER ELECTRIC,
EMPIRE DISTRICT ELECTRIC, KMW, WESTAR ENERGY

THERMAL GENERATION



ELECTRICAL TERMS

Water System	Electrical Term	Function
Pump	Generator	The prime mover. Supplies energy to the system. Converts motion to electricity.
Pipe	Conductor	Object on which the electrical current flows. The larger the pipe or conductor the more water or current will flow.
Water Pressure	Voltage	The pressure or the push that moves the water or electrical impulse in the system.
Water Flow	Current	The amount of water or electricity that is flowing.
Restriction of water pipe	Resistance	The characteristic that restricts water and current flow.
Amount of water delivered	Power	This is the rate at which electrical energy is changed into useful work. The quantity of water delivered.

TERMINOLOGY

Watt (W) – the basic unit of measure of electric power.

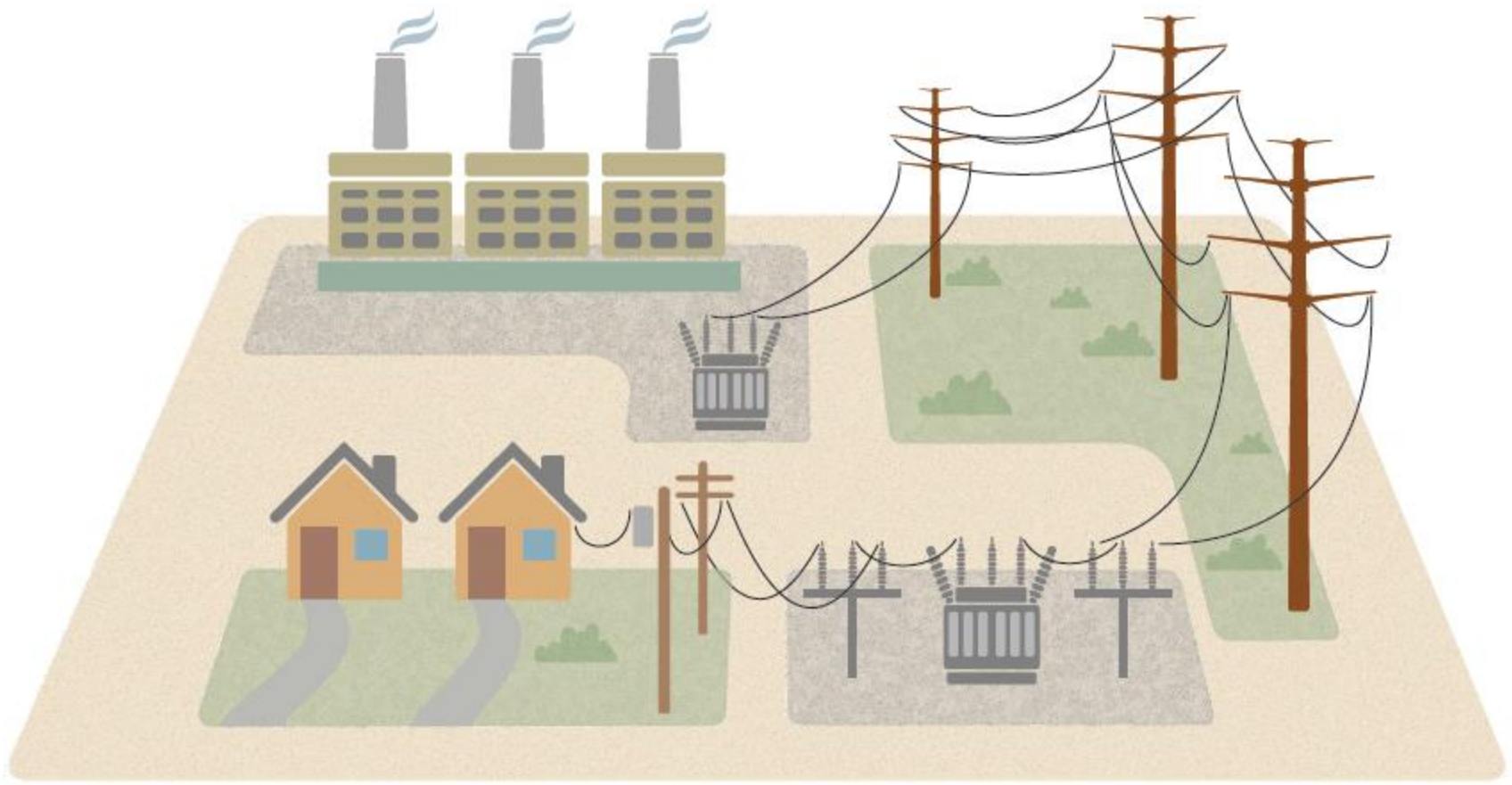
Kilowatt (kW) – 1,000 watts

Kilowatt Hour (kWh) – A unit by which residential and most business customers are billed for monthly electric use. It represents the use of 1 kilowatt for 1 hour

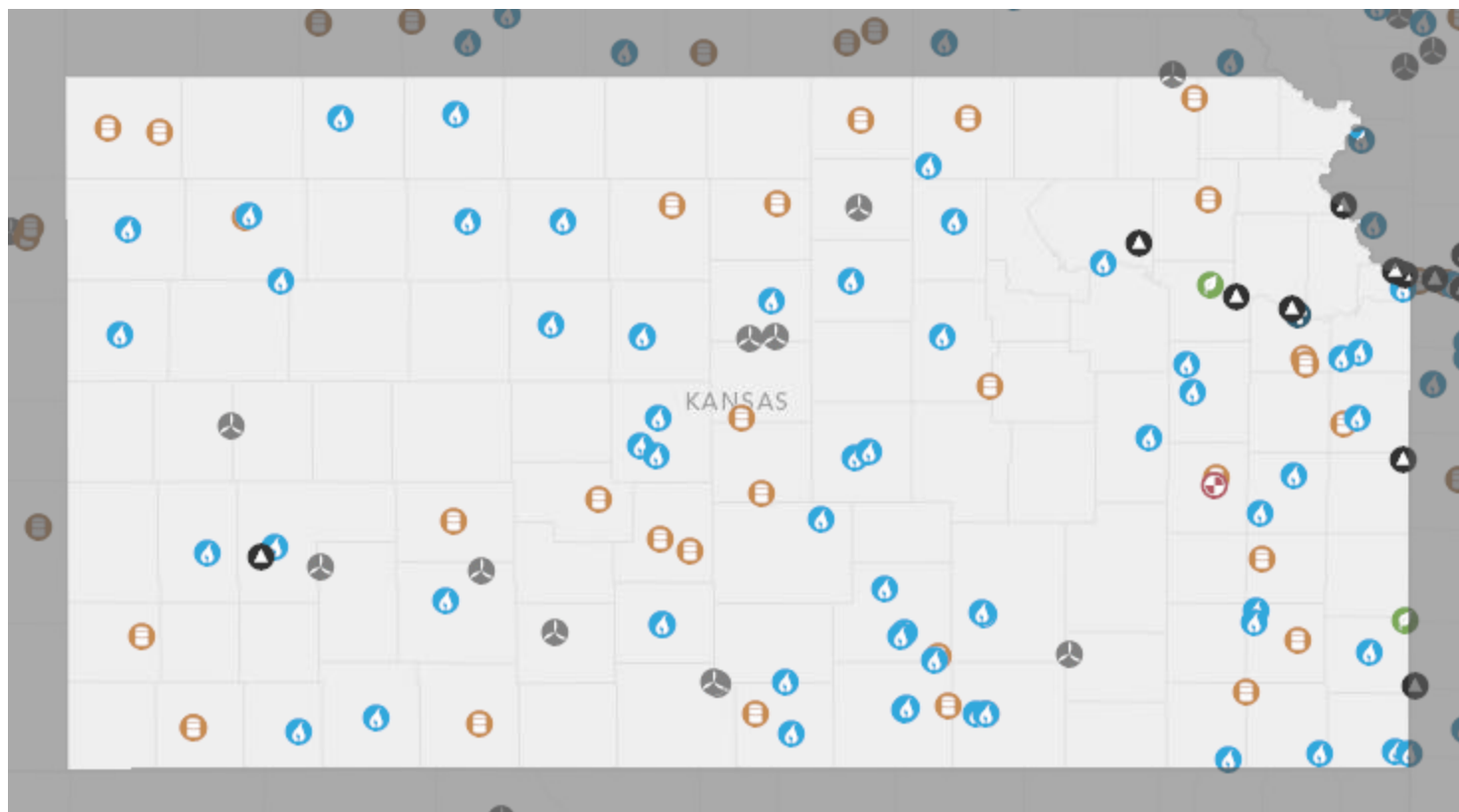
- Average U.S. household uses about 958 kWh per month

Megawatt (MW) – one million watts








ELECTRICAL SYSTEM



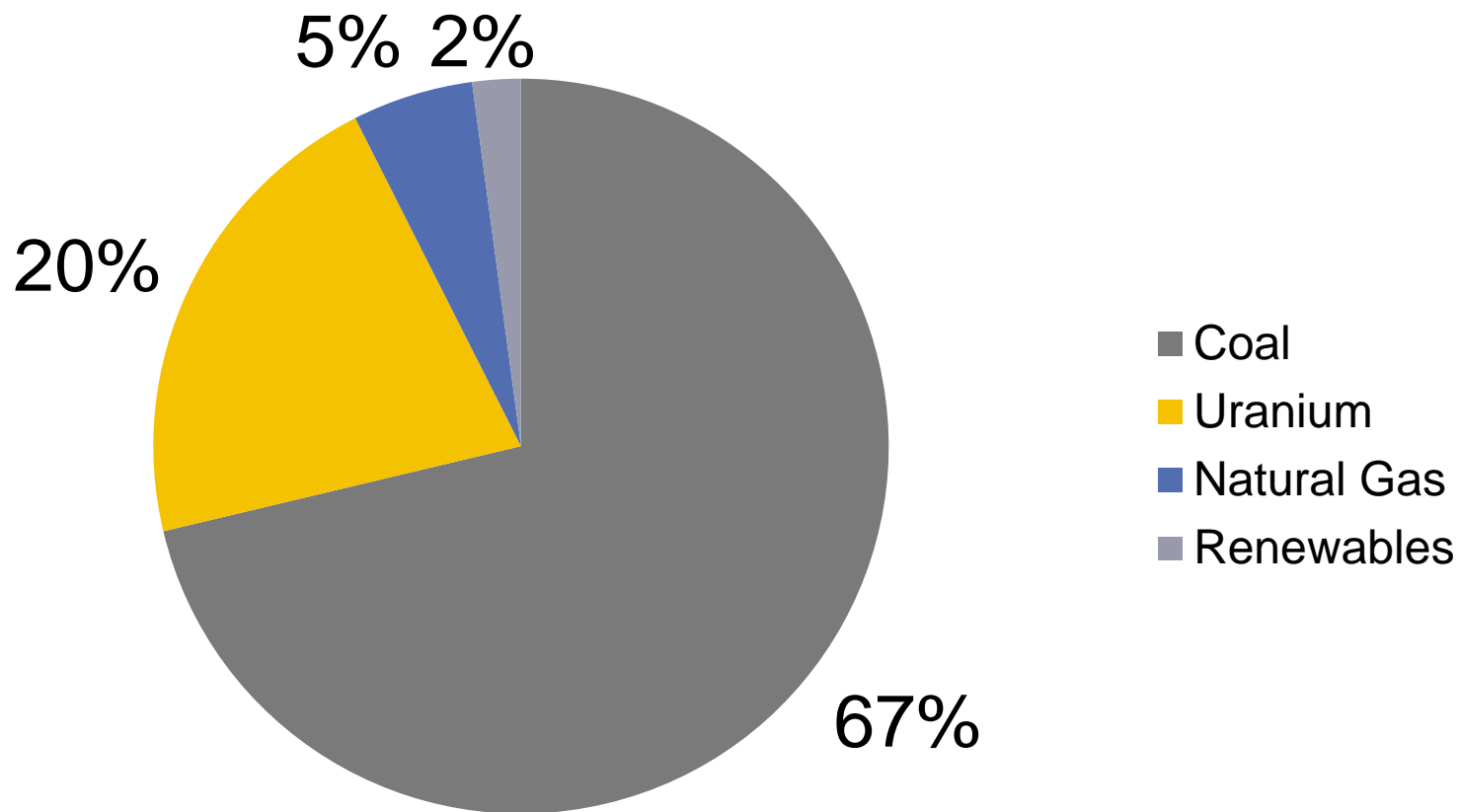
GENERATING STATIONS



Source: EIA

- | | | | |
|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
|  Biomass |  Natural Gas |  Petroleum | |
|  Coal |  Nuclear |  Wind |  Hydro |

GENERATION FUELS



Source: EIA, for 2010

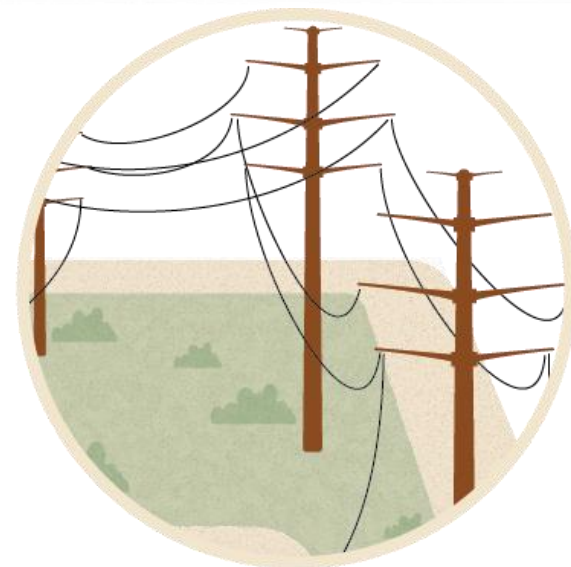
TRANSMISSION

Moves bulk power long distances

Large diameter wires and tall towers

High voltage

Besides environmental retrofits, the construction of new transmission and upgrading existing transmission are the most active utility projects in the state.



DISTRIBUTION

Lower voltages than transmission

Smaller diameter wires and shorter poles

Typically seen in neighborhoods or near businesses

Primarily overhead, but some underground

- Placing lines underground can be 3X the expense of overhead



UTILITY STRUCTURE

IOU – Investor-Owned Utility

- Shareholders provide capital for construction/maintenance operations
- Two-thirds of U.S. customers served by IOUs
- In Kansas, represented by Empire District Electric, KCPL, Westar Energy

Electric Cooperative

- Customers are also the owners
- About 13% of U.S. customers served by an electric cooperative
- In Kansas, 28 distribution cooperatives and 2 generation and transmission (G&T) cooperatives

Municipal Utility

- Owned and operated by a municipal government entity
- In Kansas, 119 municipal electric utilities with the largest being Kansas City Kansas Board of Public Utilities (BPU)

STATE LEGISLATION

Retail Electric Suppliers Act (RESA) – 1976

Establishes certified territories for retail electric providers

Avoids duplication of services

Renewable Energy Standard (RES) – 2009

10% by 2010, 15% by 2016, 20% by 2020

Based on peak load

Kansas utilities are close to meeting or have exceeded the 2016 requirement

Parallel Generation(2001) / Net Metering(2009)

REGULATORS

•Federal

- Federal Energy Regulatory Commission (FERC)
- North American Electric Reliability Corporation (NERC)
- Department of Energy (DOE)
- Environmental Protection Agency (EPA)
- Nuclear Regulatory Commission (NRC)

•Regional

- Southwest Power Pool (SPP)

•State

- Kansas Corporation Commission (KCC)
- Kansas Department of Health and Environment (KDHE)

SOUTHWEST POWER POOL (SPP)

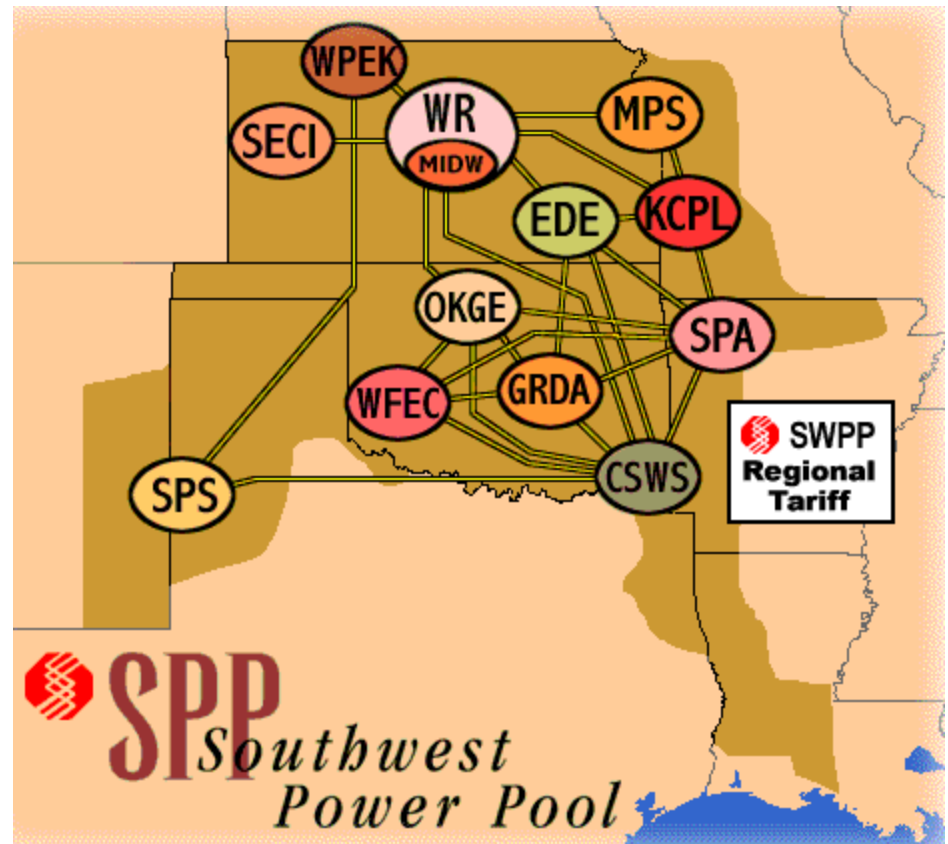
Regional Transmission Organization (RTO) mandated by FERC to ensure:

- Reliable supplies of power
- Adequate transmission infrastructure
- Competitive wholesale electricity market;

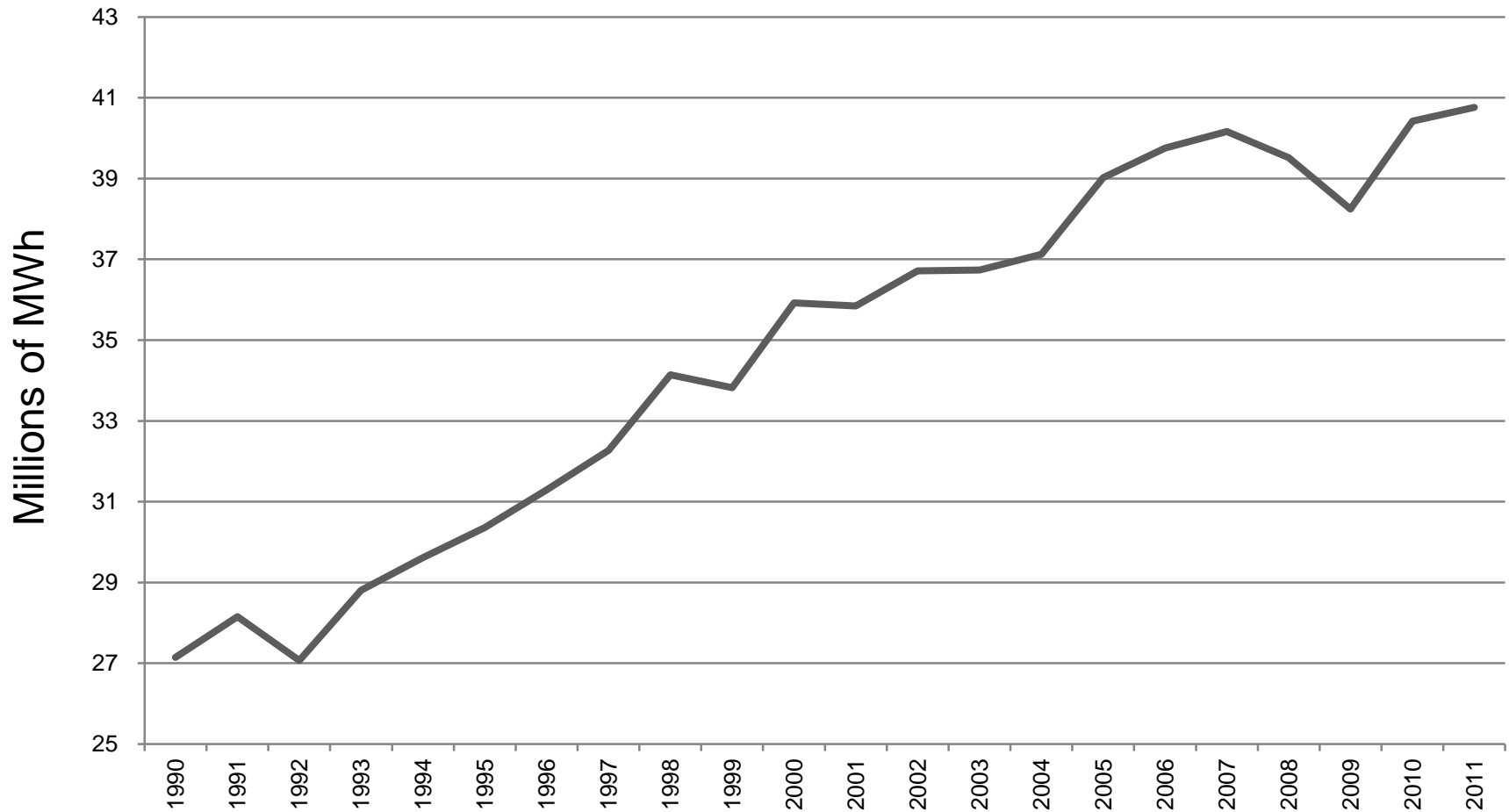
Serves as a regional entity of NERC

Based in Little Rock, Ark., with members in nine states

More than 48,000 miles of transmission lines

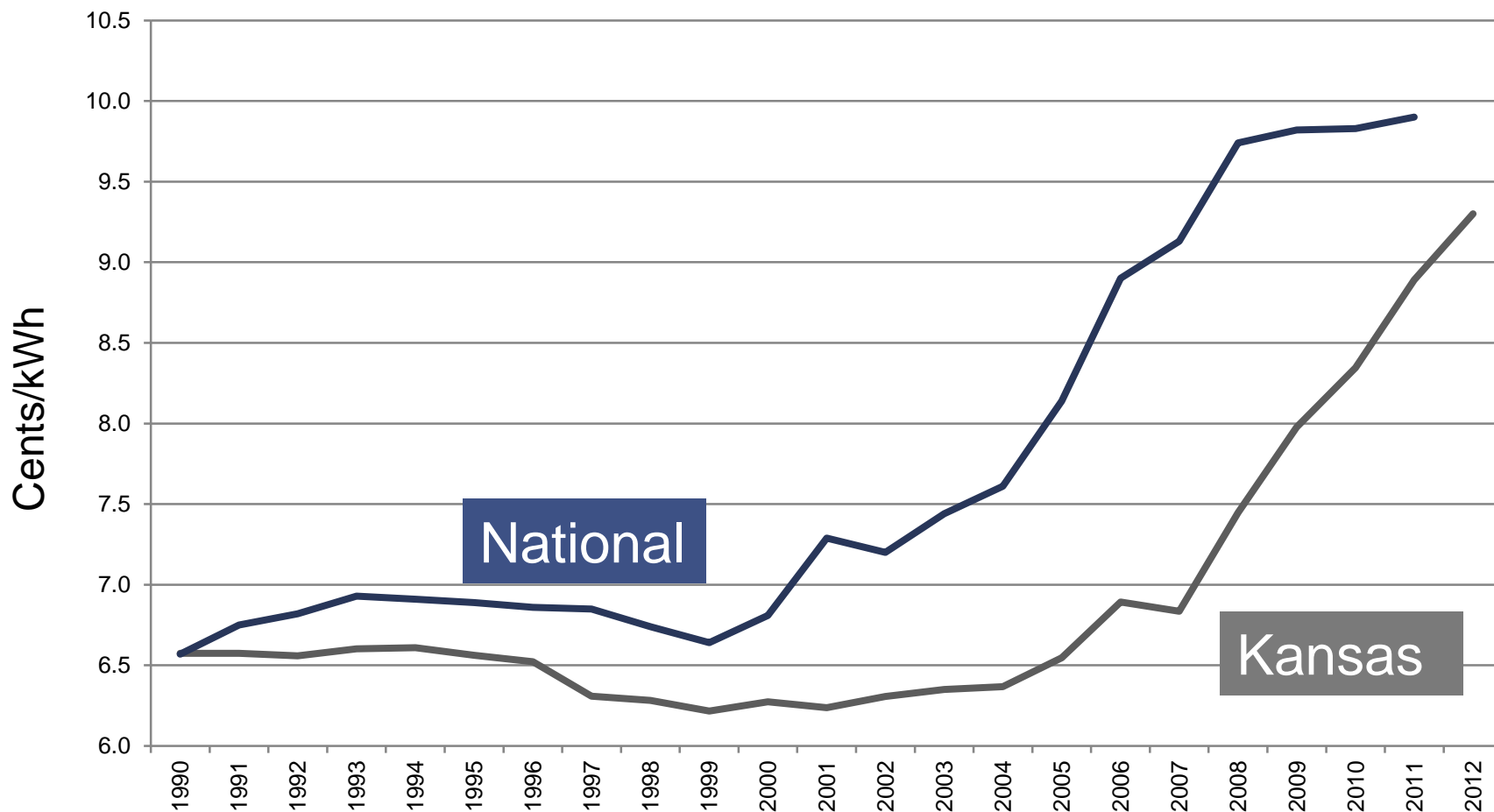


KANSAS ELECTRICITY SALES



Source: EIA

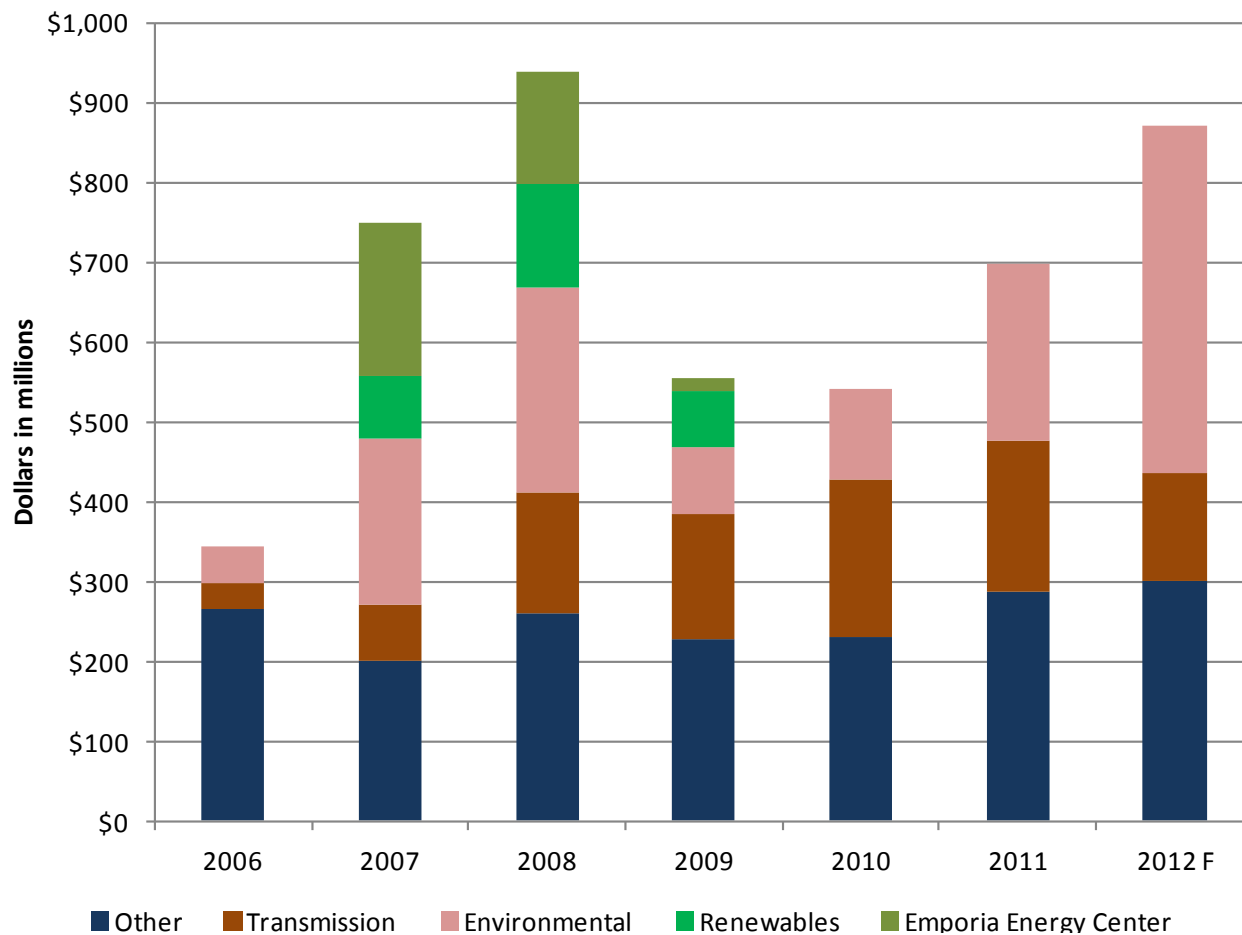
ELECTRICITY PRICES



*2012 through September
Source: EIA

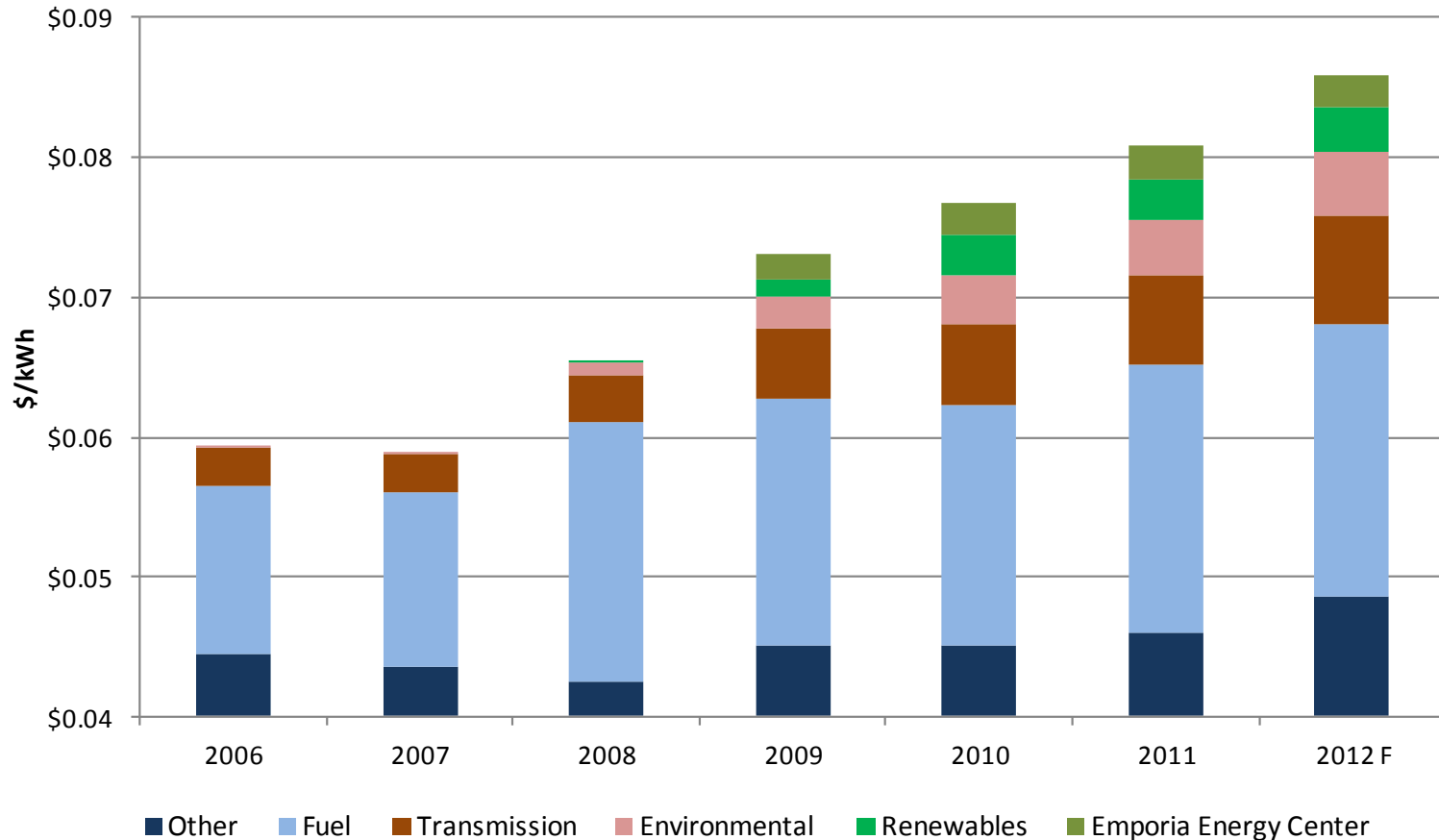
CONSTRUCTION CYCLES

Westar Energy's Capital Investments



IMPACT ON RATES

Illustrative Make-up of Westar Energy Retail Rates



Note: Renewables does not include the reduction of avoided fuel expense

ENVIRONMENTAL

Regulations on air, water and land impacts

Significant driver of rate increases

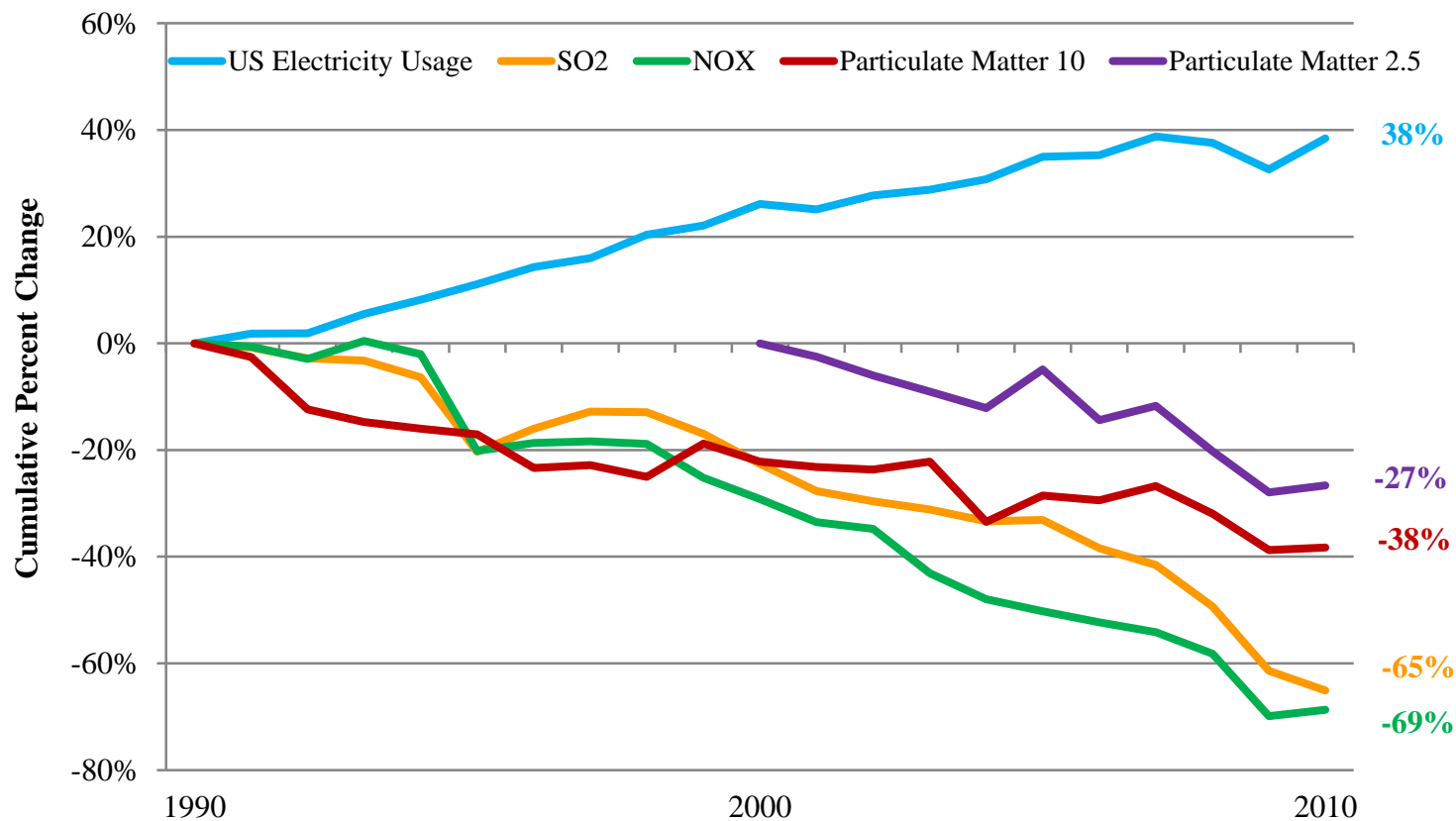
Among state's most active and largest private construction

Regulations

- Mercury and Air Toxics Standards (MATS)
- Cross-State Air Pollution Rule (CSAPR)
- Water intake impact - 316(b)
- Coal combustion residuals (CCR)
- Reciprocating Internal Combustion Engine Rule (RICE)

EFFECTIVE REDUCTIONS

U.S. power plant emissions down sharply, while power production up \approx 40%



Source: US EPA , "National Trends in Particulate Matter Levels"; USEIA