Networked Monitoring and Control of Small Interconnected Wind Energy Systems

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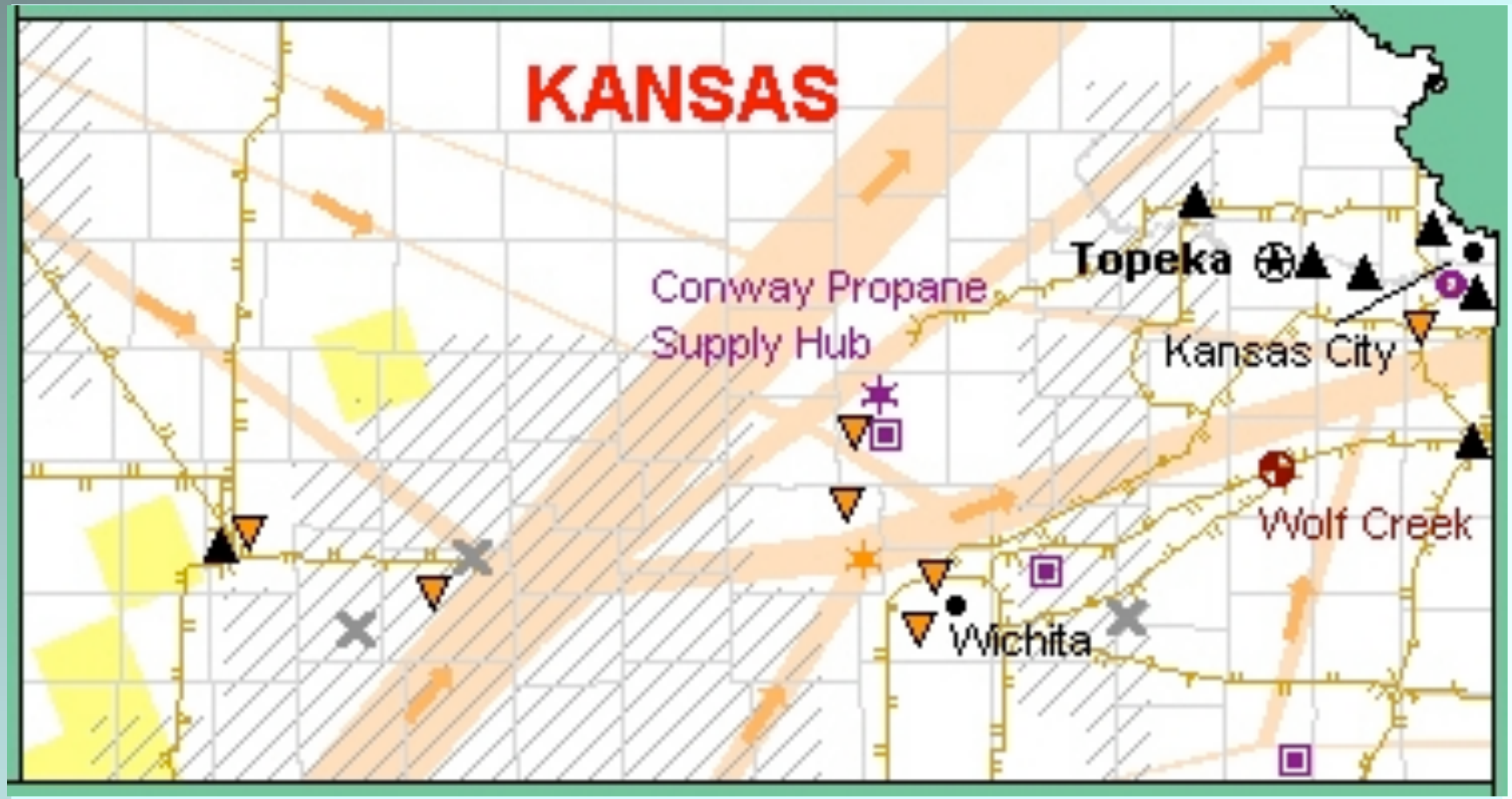

Major Electric Power Plants (>=100 MW)

- Nuclear
- Petroleum
- Coal
- Natural Gas
- Geothermal
- Solar
- Hydroelectric
- Wind
- Wood

Renewable Energy Potential

- Solar - (>= 6.0 kWh/m2/day)
- Wind - (>= 4 Power Class)
- Geo. - (>= 80 milliwatts/m2)

Electric generation in Kansas

Energy Information Administration
tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=KS

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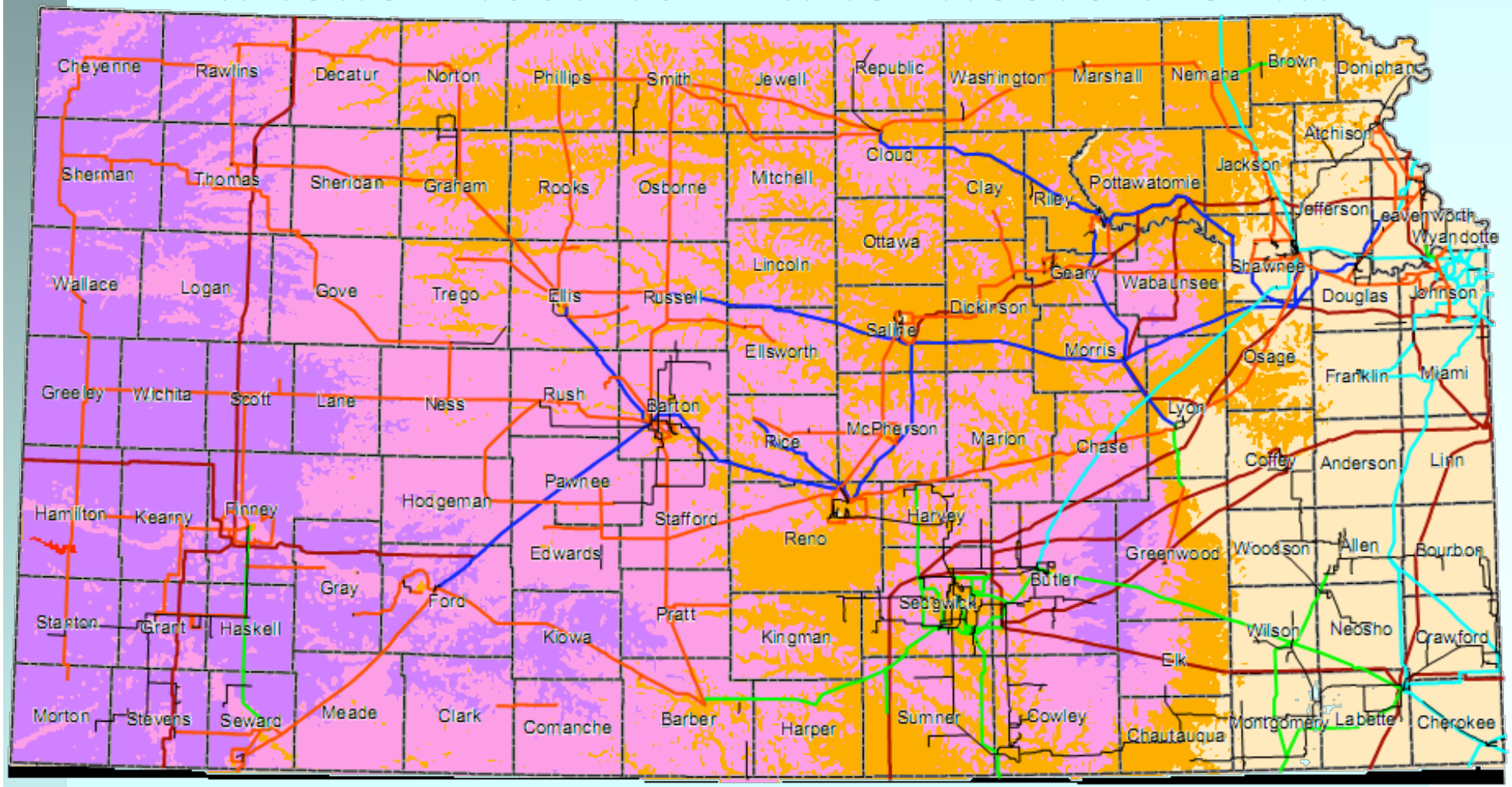
Kansas Electric Transmission Grid



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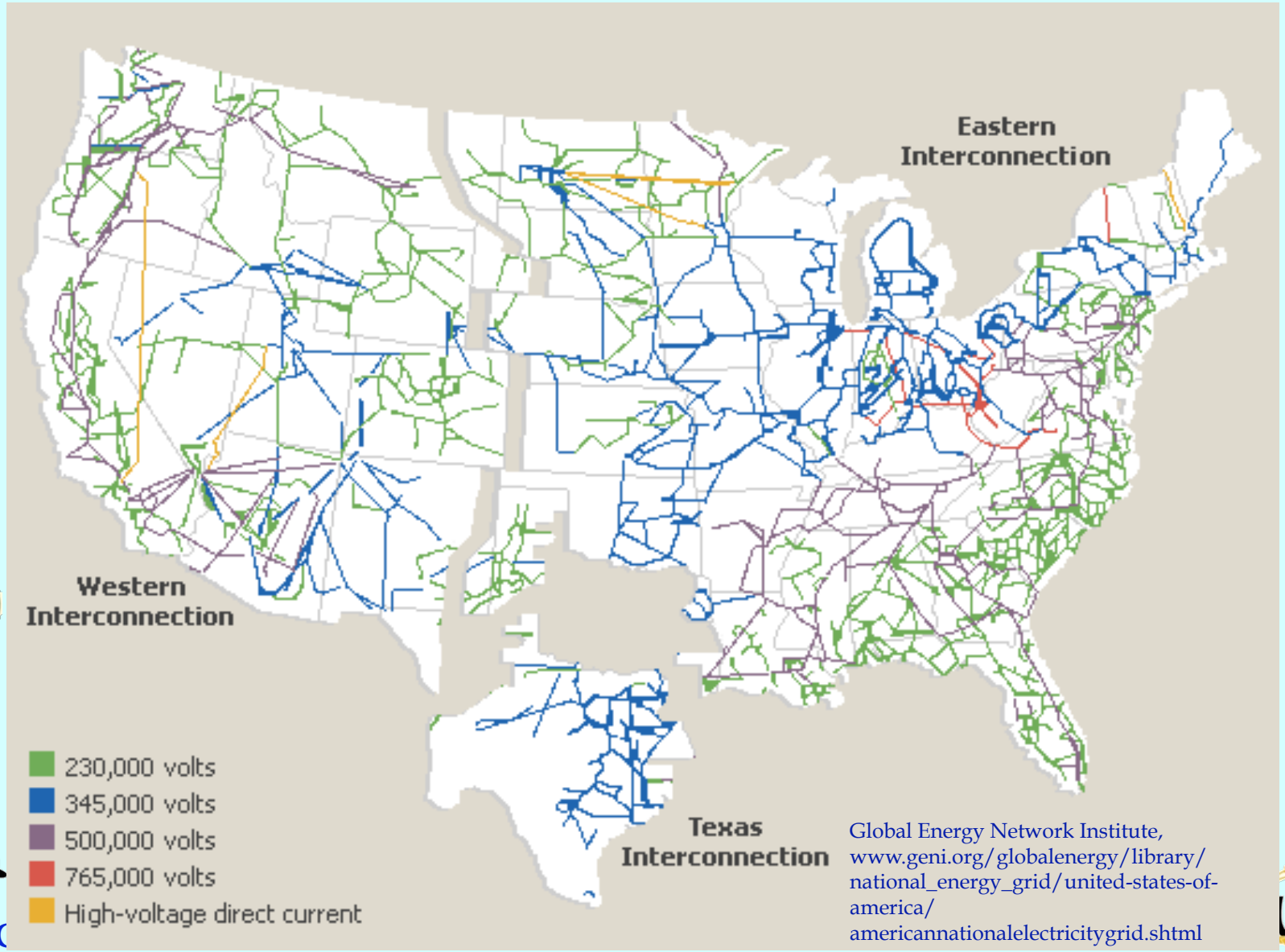
138 - KV
345 - KV
115 - KV
230 - KV
69 - KV
161 - KV

Kansas Corporation Commission,
www.kcc.state.ks.us/energy/wind.htm

US Electric Transmission Grid



Global Energy Network Institute, www.geni.org/globalenergy/library/national_energy_grid/united-states-of-america/americannationalelectricitygrid.shtml

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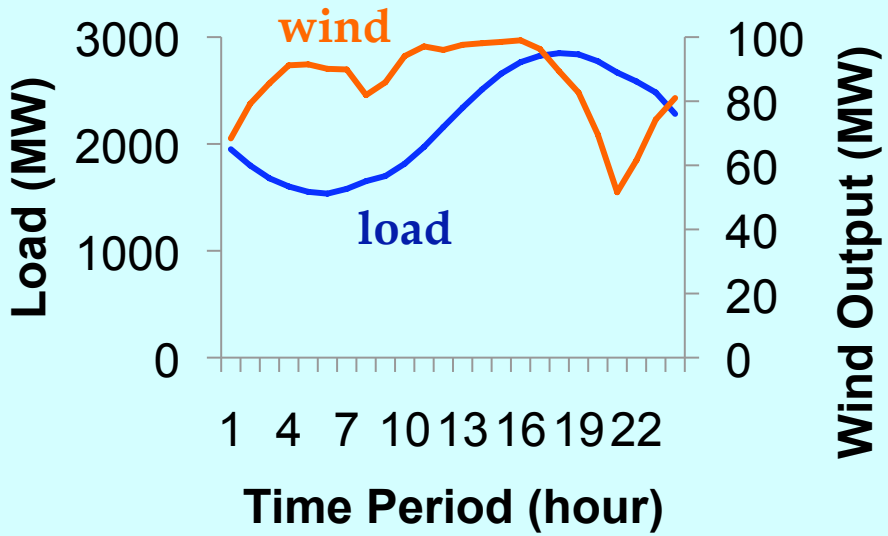
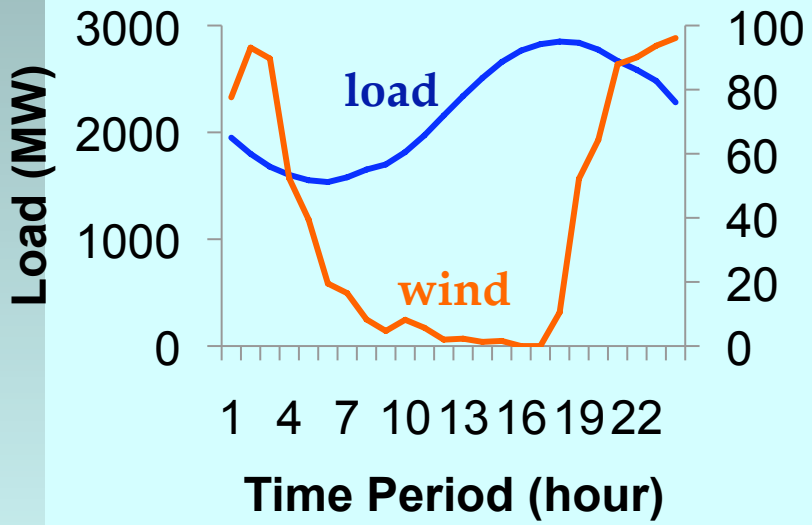
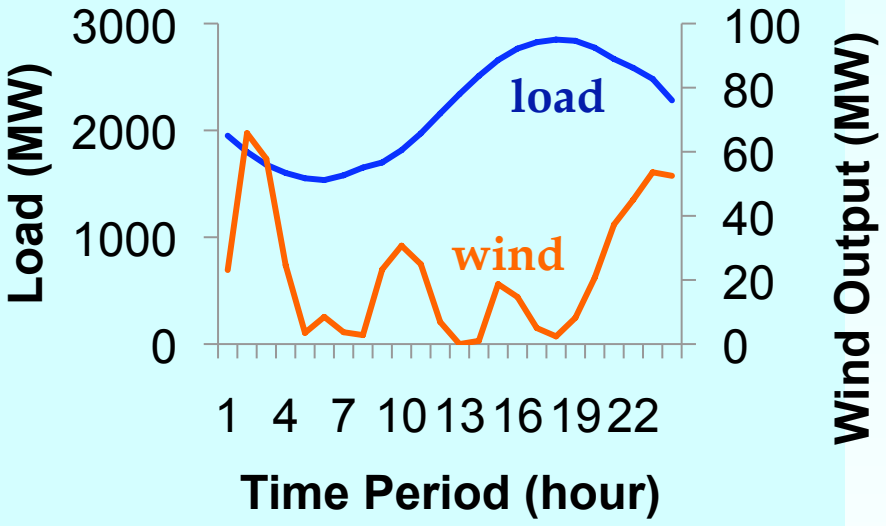
Wind and electricity use







Piyasak Poonpun, *Effects of New Low Carbon Emission Generators and Energy Storage on Greenhouse Gas Emissions in Electric Power Systems,* PhD Dissertation, Wichita State University, 2009.

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Operating Reserves

- Operating reserve requirements:

  5-12% of expected use

  – Must have generation available for 105-112% of expected need

- Capacity credits (California ISO)
  – Coal, nuclear, natural gas, oil, hydro: 100%
  – Solar 89.5%
  – Geothermal 83%
  – Wind 23-25.2%

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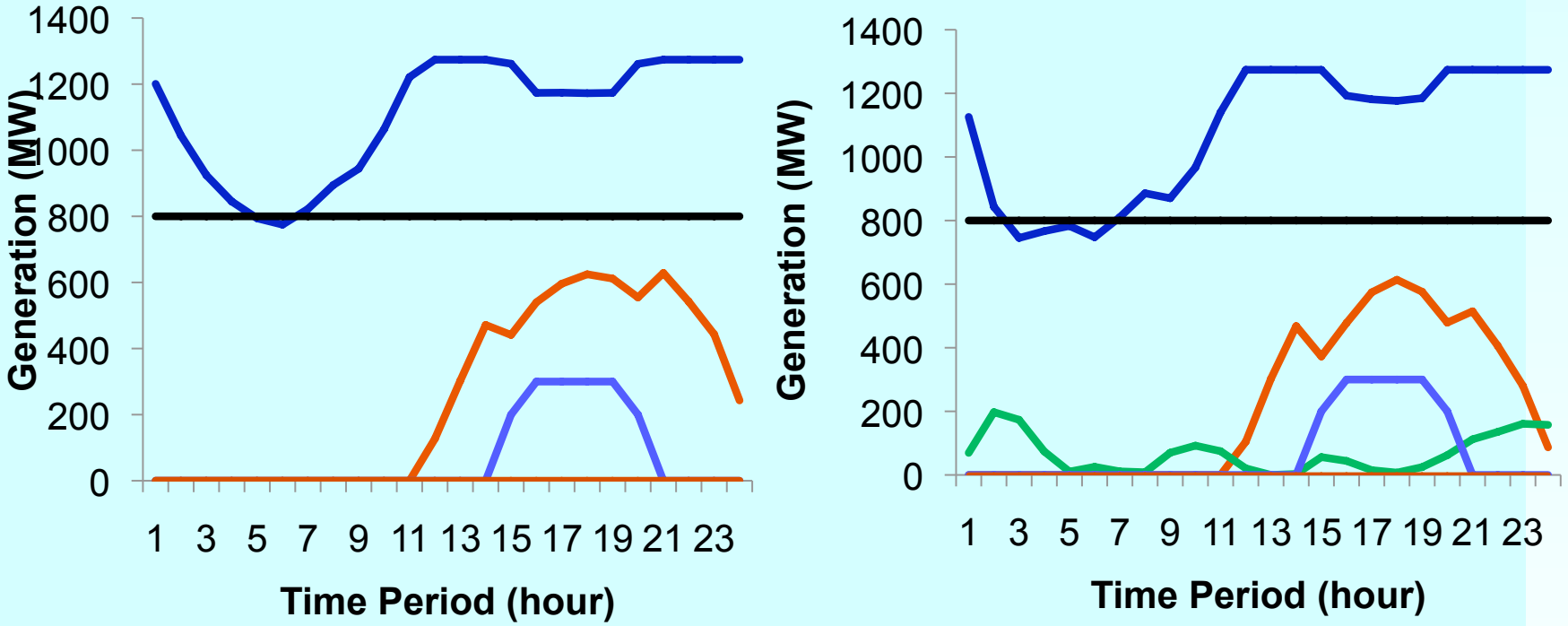
WSU

Effects of Wind Generation on Greenhouse Gas Emissions in Electric Power Systems

Piyasak Poonpun



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Optimum Number of Customer-Side Wind Turbines in the State of Kansas

Michelle Lim

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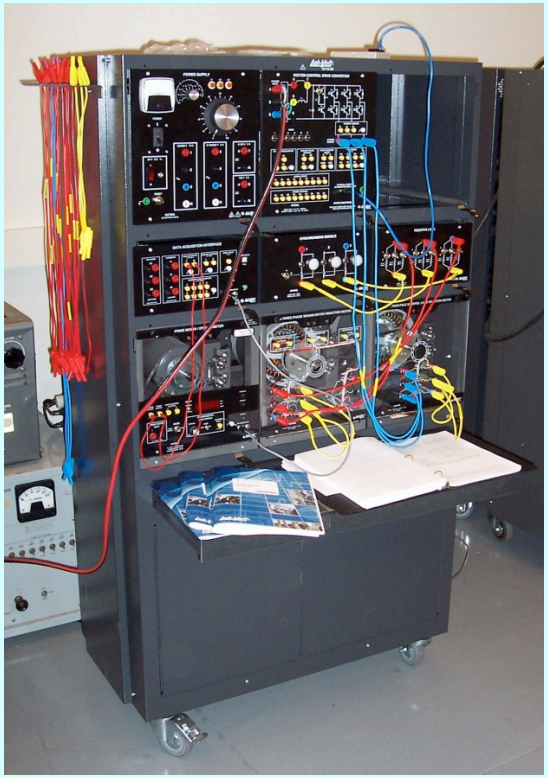
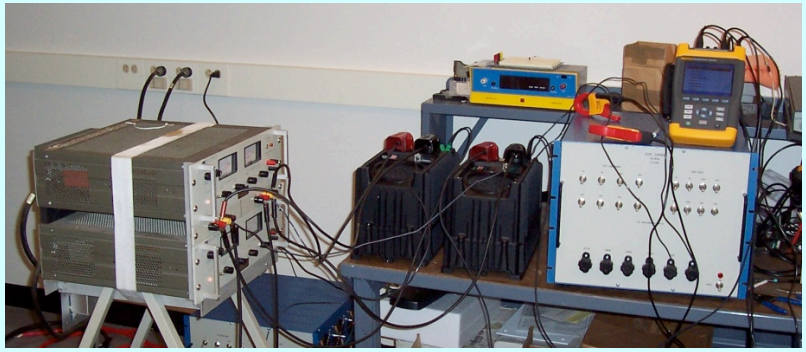
Zhouxing Hu **Perlekar Tamtam**





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