MISSOURI S&T MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

# Cyber-Physical Systems Energy and the Environment

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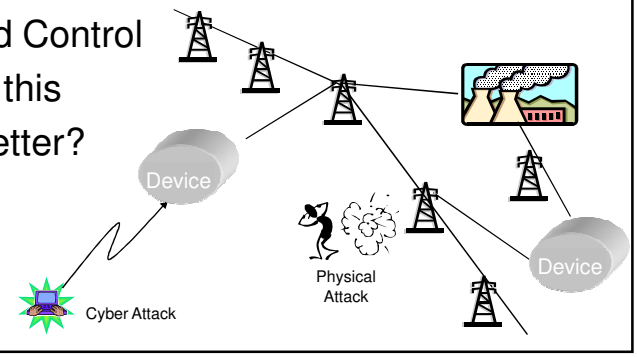
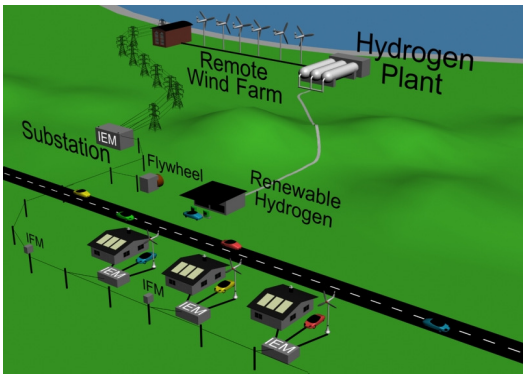
## Using Cyber to Improve Efficiency

- Improve Power Transmission over Overloaded Lines
  - Advanced Power Electronics Devices
  - Distributed Control
  - Risks – is this better?



# Using Cyber to Restructure

- Generate energy locally
  - Wind, Solar
  - Energy Storage
    Plug in Hybrids
  - Share Power
  - Economics




**FREEDM – Future Renewable Electric Energy Delivery and Management Systems**

McMillin, 12/15/2008

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# Major Challenges

- Define What is Correct?
  - Formal Methods from Computer Science Engineering, Social Sciences
- Common Semantic Basis
  - Cyber-Physical Resiliency
- Complex Interactions
  - Security and Privacy
  - Non-interfering,
    Plug-and-Play
  - Hybrid Simulation Environments

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# Major Risks and Vital Dialog

- Lack of understanding of different schools of thought
  - Engineers vs. Scientists vs. Social Scientists
- Finding "Hooks" into or "Bridges" among disciplines to develop unified sciences
  - Stability <-> Frequency <-> Timing
  - Commodity Flow <-> Transportation
  - Information & Commodity Flow <-> Privacy
- Educated workforce

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# Have an Open Mind and Don't Re-Invent the Wheel