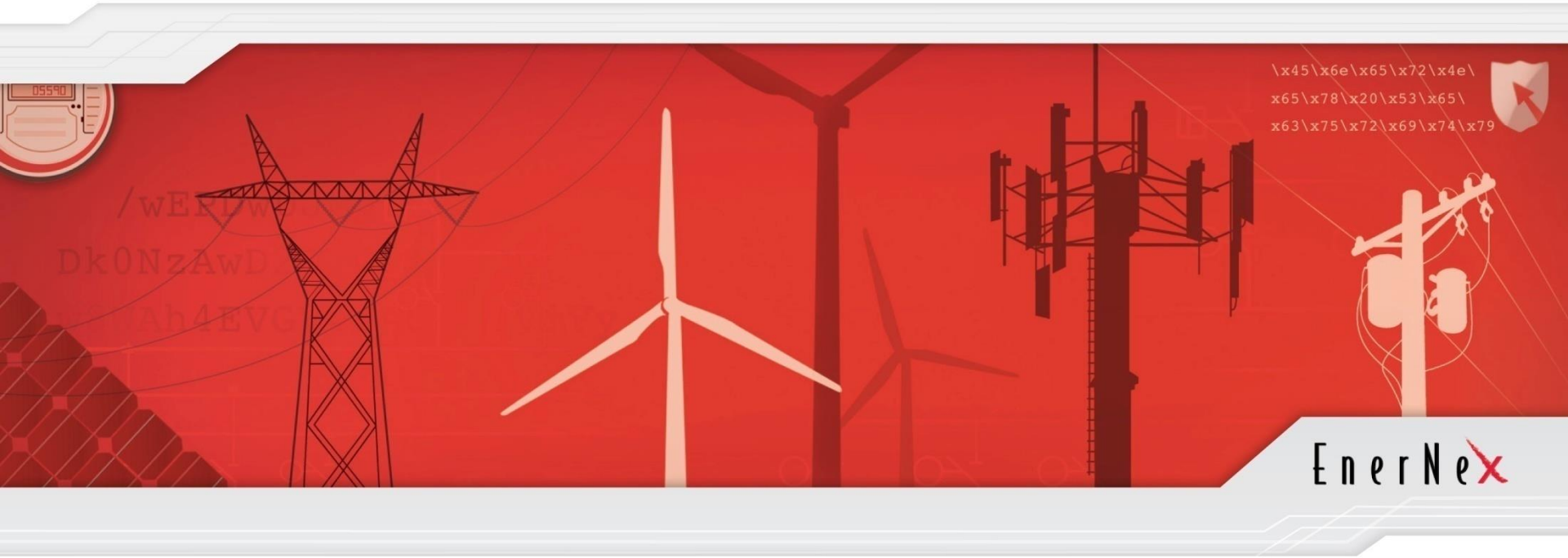
# 2nd Annual Meeting
# IIT Wind Consortium

EnerNex Update
July 20, 2011



# EnerNex Background

- Power system engineering consulting firm
  - Traditional power system studies
  - Smart Grid development and deployment
- About 2/3 of power system studies are wind energy-related
  - Wind turbine model development and simulation studies for turbine vendors
  - Balance-of-plant electrical studies for project developers and EPCs
  - Bulk system interconnection studies
  - Power system operational studies (integration); e.g. EWITS, ISO-NE, PJM, MISO

# Scope

- Development of a comprehensive tutorial on
  - Wind energy technology
  - Interconnection to the bulk electric system
  - Integration with system operations
- Overview
  - 3-day course
  - Targeted at power system professionals, students
  - Can be presented in seminar form, or lectures
- Joint ownership of course materials by IIT/EnerNex

# Outline - 1

- **Background**
  - Utility wind integration state of the art
  - Costs and benefits of large scale integration of wind power
  - Discussion of different wind turbine design concepts
- **Wind Turbine Modeling and Simulation**
  - Introduction to wind turbine modeling and simulation
  - Wind turbine control issues
  - Dynamic simulation studies related to wind power
  - Specific simulation experiences, e.g., voltage control, reactive power control, low voltage ride-thru, system stability

# Outline - 2

- **Power System Planning Issues**
  - Basic aspects of network integration
  - Capacity value and cost of ancillary services
  - Experiences with wind power integration in the US and Europe
- **Power System Operation Issues**
  - Power system operation and balancing: evaluation and management of the uncertainty of short-term wind power variations
  - Wind forecasting: Available tools and methods for short and medium term forecasting for improved power system operations planning
  - Voltage control, power quality and protection issues
  - Grid codes and recent US and European experiences
  - High penetration issues

# Status & Schedule

- 1st draft of materials completed
- Completion mid-September 2011