Overview of Utility Systems Integration Activities

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System Integration Goal

- Ensure that wind energy can compete without disadvantage in serving the nation's energy needs
  - Actual interconnection impacts understood
  - Unbiased electric-power market rules
  - Broadly optimized operating strategies
  - Broadly optimized system planning (generation and transmission)

Technology Characterization and Data Collection

- Wind-generator and wind-plant models
  - Provide technical support for wind-industry and utility model-development work
  - Review, exercise, validate, extend models
  - *Essential for electric-system stability studies*
- Wind-farm data monitoring
  - Provide publicly available second-to-second data sets
  - Include several regions with different wind and utility-system characteristics -- 2-to-3-year periods
  - *Essential for eliminating concerns about rapid changes*
- Wind-resource characterization
  - Develop and employ aggregation techniques to generate seasonal, daily, hourly shapes
  - *Essential for reliability evaluations*

Tools and Methods Development

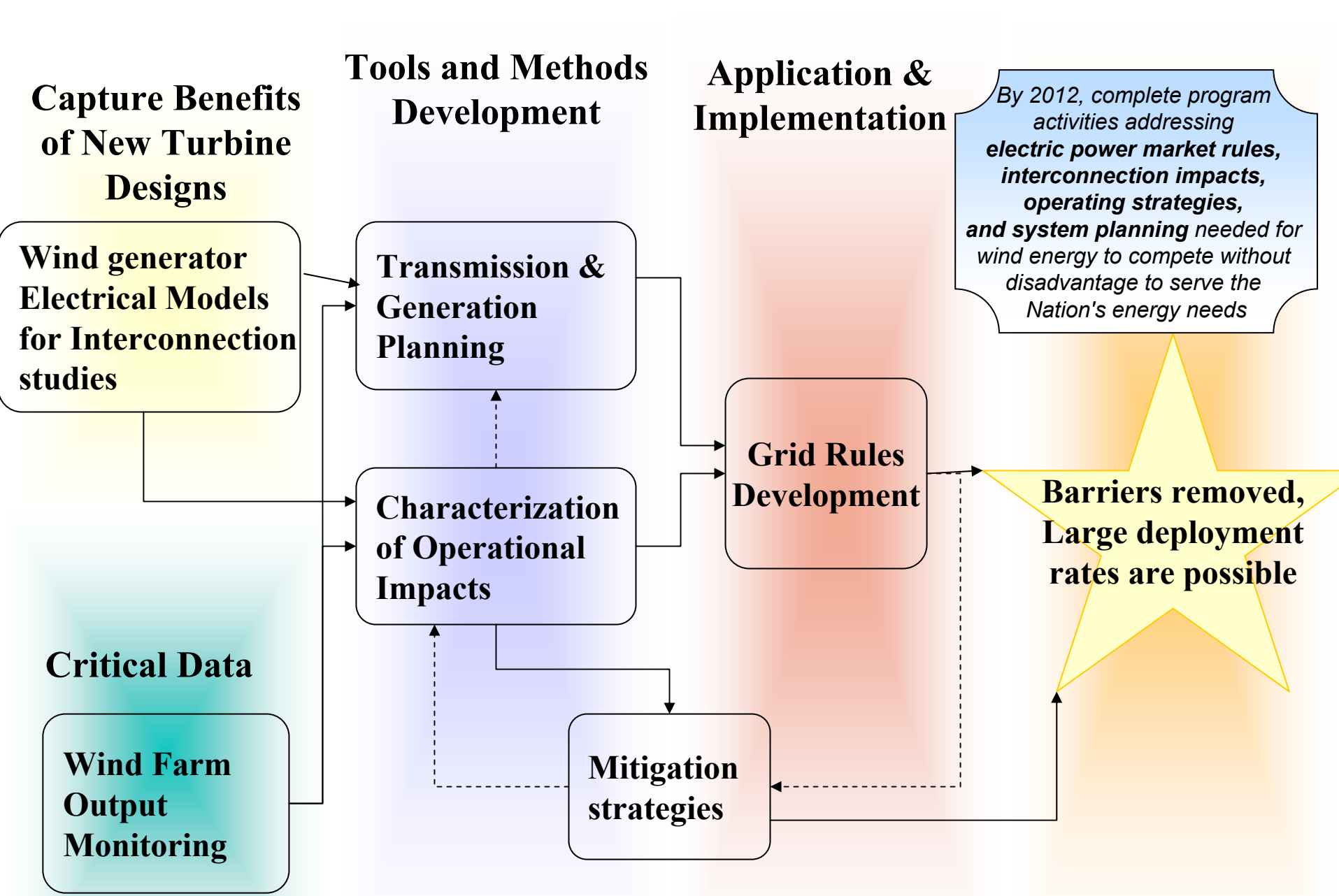
- Electric-system operational impacts
  - Facilitate, support and review impacts analyses conducted by utilities and others
  - Refine analysis tools through complementary studies
  - Seek key insights and assemble comprehensive guidelines
  - *Essential for allaying fears about backup requirements*
- Transmission and generation planning
  - Provide support for proactive, comprehensive regional transmission and wind-generation planning
  - *Essential for overcoming inefficient, incremental and glacial transmission expansion processes*

Application and Implementation

- Grid rules development
  - Provide technical support for those seeking equitable wind access to the electric system
    - Transmission access
    - Real-time markets; imbalance penalty elimination
    - Capacity accreditation
  - *Essential for eliminating arbitrary reductions in wind-energy value*
- Operational impacts mitigation
  - Provide technical support for efforts to reduce impacts of wind variability and increase power-system flexibility
    - Improved use of wind forecasting
    - Power-system control strategies modification
    - Encouragement of utility control-area enlargement
    - Wind-hydro synergy enhancement
  - *Essential for high system penetrations of wind power*

Application and Implementation

- Operational impacts minimization in the long term
  - Provide leadership and technical support for efforts to optimize wind's contribution to energy needs beyond 2015
    - Wind-hydrogen prospects assessment and strategy development
    - Power-system optimization to accommodate and take maximum advantage of characteristics of all generating technologies, including wind
  - *Essential for evolution of wind power into a truly significant contributor toward national energy needs*



System Integration Relationships