

Innovation Opportunities & Challenges
for
Advanced Computing in Smart Grid Operation

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GRID |

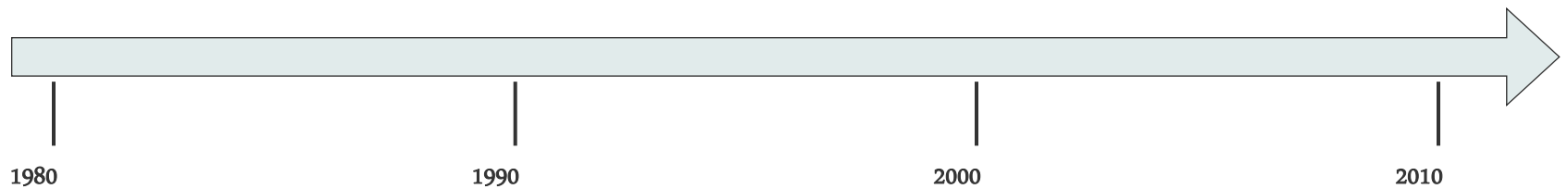
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Electric Utility Evolution

Classic



- Physical infrastructure
- Vertically integrated
- Cost-based operation



Electrification : An Outstanding Engineering Achievement

Greatest Engineering Achievements OF THE 20TH CENTURY

◆ About ◆ Timeline

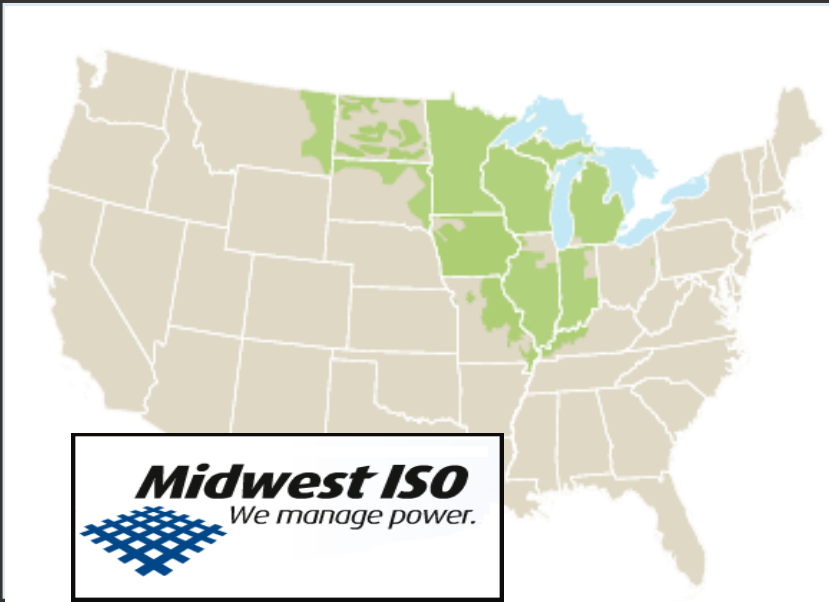
Welcome!

How many of the 20th century's greatest engineering achievements will you use today? A car? Computer? Telephone? Explore our list of the top 20 achievements and learn how engineering shaped a century and changed the world.

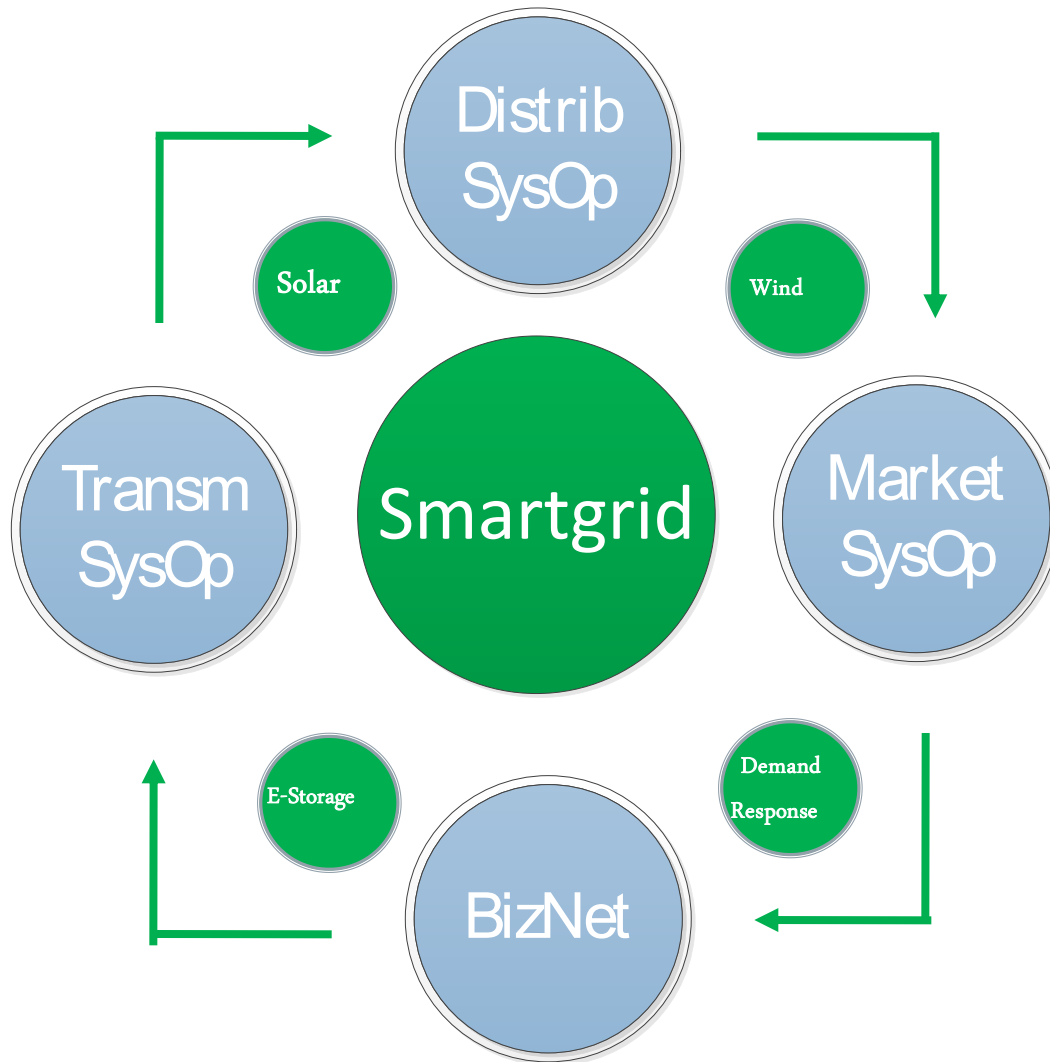
1. **Electrification**
2. Automobile
3. Airplane
4. Water Supply and Distribution
5. Electronics
6. Radio and Television
7. Agricultural Mechanization
8. Computers
9. Telephone
10. Air Conditioning and Refrigeration
11. Highways
12. Spacecraft
13. Internet
14. Imaging
15. Household Appliances
16. Health Technologies
17. Petroleum and Petrochemical Technologies
18. Laser and Fiber Optics
19. Nuclear Technologies
20. High-performance Materials



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Smart Grid Challenges: Distributed Energy Resources (DER)



— Maintain reliability and economic performance

- Security against contingencies
- Economic efficiency & transparency

— Integrate DER operation

- Volatility of renewables & DR
- Limited visibility & controls

— Transform utility business

- Utility distribution practices most heavily affected
- New business protocols across entities in energy eco-system

Solution footprint

- Comprehensive solution includes not only analytical computation but also preparation of input data and assimilation of output results
- Concerns with HPC regarding software interoperability and future technology trend (e.g. distributed cloud computing services),

Problem specification

- Difficult to formulate problems that are visionary, practical, and sufficiently precise

Business context

- Unclear business incentives for regulated electric utilities

R&D organization

- Hub for Grid R&D: attract and leverage expertise across utilities, suppliers, and national labs in collaborative partnership

IT infrastructure

- Life-cycle analysis of advanced computing platforms, from user/developer perspectives, to establish technology and economic targets.

Power/energy applications

- Identify high impact applications that leverage advanced computing technology for Smart Grid transformation of the power industry.

Distribution Operator Training & Simulation

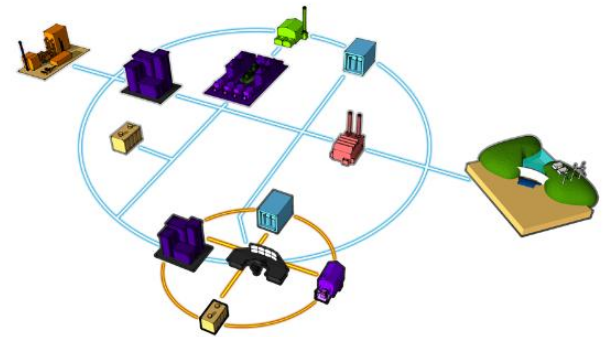
- Workforce training for critical (and ageing) system operators
- Validate new business and operating practices for DER integration
- Structured training from industry generic to utility use-case specific
- Directly benefit from increased computation capacity
 - Simulation details
 - Parallel training sessions

Decision Support Tools for Smart Grid Operation

- Situation awareness of complex grid operation under increased uncertainties and locally intelligent smart devices
- Decision support for real-time preventive, corrective, and self-healing actions
- Comprehensive scenario simulation and analysis with large data volume and high computation burden.

Clean Power Today !

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