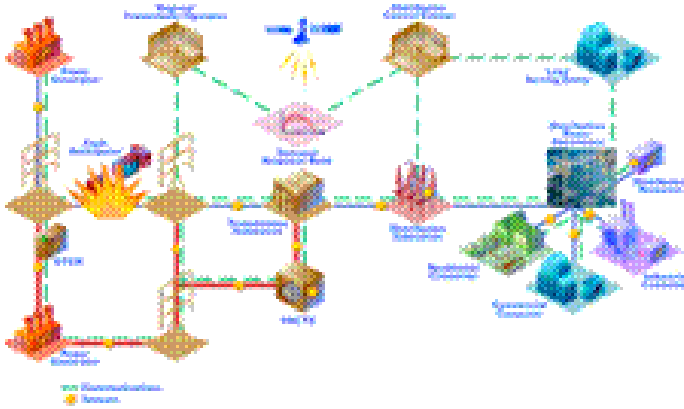


# Intelligrid Architecture

## Architecture for the Intelligent Electricity Grid of the Future



Intelligrid addresses looming industry issues related to the design, deployment, and management of a 21<sup>st</sup> Century power system.

Society has entered a new era of experience driven by digital technologies. Our world is more interconnected than at any time in history, utterly dependent on the integrity of a complex web of networks.

In many ways, the electric power system is the foundation of this interconnection. However, lack of critical infrastructure investment and surging demand for electricity is taxing the electric power system to its limits. Over the last decade, growth in U.S. electricity demand has exceeded new transmission capacity by more than 15 percent. In addition, microprocessor-based technologies have radically altered the nature of the electrical load, resulting in demand that is incompatible with a power system created to meet the needs of an analog economy. This has led to new quality and reliability problems responsible for more than a hundred billion dollars in losses to U.S. industry and society annually.

A focused and coordinated effort to upgrade and modernize the entire electric power system—from generation to transmission, distribution, and end use—is needed in order for the benefits of interconnection to be fully realized.

### DESIGNING THE POWER SYSTEM OF THE FUTURE

The Consortium for an Electric Infrastructure to Support a Digital Society (CEIDS) is a broad-based collaboration of energy, high-tech, and government leaders, working together—with the Electricity Innovation Institute (E2I)—to

Intelligrid is the foundation for the intelligent electric infrastructure of the future and the platform for future technical, process, and service innovation in the energy sector.

address these looming industry issues and set us on a migration path towards the intelligent, self-healing power system of the future.

The foundation of this new system is the Intelligrid Architecture—an open-systems-based comprehensive reference architecture for the energy enterprise of the future. Intelligrid enables the integration of intelligent equipment and data communications networks into a managed enterprise and industry-wide distributed computing system. It is the fundamental basis for enabling enhanced system capabilities, such as the self-healing grid, integrated consumer communications, and real-time energy information and power exchanges.

Intelligrid applies the latest systems engineering methods and computing and communications tools to model the advanced energy enterprise of the future. It cuts across traditional operating boundaries, promoting greater interoperability; enabling unprecedented improvement in performance and asset utilization; and ensuring desirable levels of robustness, responsiveness, and security.

### WHAT IS AN ARCHITECTURE?

The term *architecture* is used to describe the overall technical framework for the development, implementation, operation and maintenance of an information system. It provides a view from a height that enables visioning of the overall system for potential problems and synergies. An *enterprise architecture* represents the system as a dynamic process, offering a complete model of the enterprise operation.

Intelligrid is the *comprehensive reference architecture* for the integrated energy enterprise of the future. It develops a framework of standards and guidelines that cut across traditional operating boundaries, business entities, and other enterprise-level architectures to provide a high-level view of overall systems integration.

Intelligrid directly addresses the need for a coherent approach to managing and integrating large information technology and advanced automation systems throughout the energy enterprise.

CEIDS partners have defined the overall technical framework for the underlying architecture that will support data communications and equipment interoperability. They are contributing to the development of relevant open system standards and creating a shared infrastructure to enable the envisioned power system of the future.

#### INTELLIGRID PROJECT RESULTS

Some of the results and benefits of the Intelligrid project are already in place. For example, opportunities to leverage research and technologies have been defined. With open systems and shared standards, overall costs are lowered, opening the way for additional investment and innovation in the energy sector.

INTELLIGRID has defined the requirements and standards for a variety of advanced applications from wide area measurement and controls of transmission systems to utility distribution operations. Results include:

- Documented systems and architecture requirements to support an industry-wide enterprise architecture for the self-healing grid and integrated consumer communications interface.
- Ongoing coordination with standards development organizations (SDOs) and industry consortia to move the development of key open standards for a robust industry infrastructure forward.
- Use of systems engineering in architecture development to ensure appropriate levels of robustness, security, and leverage opportunities for infrastructure sharing and synergy between power engineering operations and other application domains. A balanced, systems engineering approach was employed throughout, from the initial elicitation of system requirements, to the development of final recommendations.

#### INTELLIGRID PARTNER OPPORTUNITIES

Initial results of the Intelligrid project are already available. These results exposed gaps and vulnerabilities in current standards and practices that have been targeted for future work. Continuing efforts will also examine key areas on a more in-depth level and maintain ongoing coordination with SDOs to ensure the broadest possible level of integration. CEIDS partners will continue to direct research and will have first access to the resulting opportunities for validation and demonstration.

#### A STANDARD PLATFORM PROMOTING INNOVATION

Intelligrid creates a standard platform that will foster technology, process, and service innovation in the energy sector. From improved security, quality, reliability, and availability (SQRA), to greater interactivity and interconnection, Intelligrid creates a baseline for future system design that will ultimately lead to the delivery of lower cost power and the development and deployment of more advanced energy services.

Intelligrid's open-source guidelines are putting CEIDS partners on the path towards the electric power system of the future. With engineering support and training from E2I and EPRI, CEIDS partners are already applying Intelligrid to their systems to enhance performance, increase customer satisfaction, and expand business opportunities. Applications include:

- ✓ Demand response/dynamic pricing implementation
- ✓ Wide area measurement and controls to support real-time grid reliability management
- ✓ Advanced energy master planning (EMP) and remedial action programs
- ✓ Remote and automated system monitoring and management, including increased substation automation

#### THE E2I-EPRI PARTNERSHIP

E2I is a non-profit, public-benefit organization. Through public/private partnerships, E2I stimulates innovation in strategic electricity technologies. It is affiliated with and draws upon EPRI's extensive technical expertise. Established in 1973 as a non-profit center for public interest energy and environmental research, EPRI's collaborative science and technology development program now spans nearly every area of power generation, delivery, and use. More than 1,000 energy organizations and public institutions in 40 countries draw on EPRI's global network of technical and business expertise.

#### BE PART OF THE FUTURE TODAY—CONTACT US

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