SmartGrid Technologies

Technology Category	SmartGrid Application Description	Technology Options	Implementation Benefits	Barriers To Adoption	Commercial Readiness
Advanced Grid Operations	DG Resource Management	Wind power; Fuel cell;	Improved grid control, efficiency & grid stability;	Cost; Siting difficulties; Costs of load following for wind DG; lack of unified grid control architecture; Lack of integrated DG control;	Wind power commercially available; Fuel cell prototype stage;
	Voltage Support	Planned siting for DG;	Improved grid control, efficiency & stability;	Limited control over siting of new resources;	
	Reactive Support	STATCOM; DSTATCOM; SuperVAR; strategic siting for DG; Local/Distributed VAR Control	Voltage Sag & Flicker support; Real-time grid management	Cost; Application specific; Increased grid management complexity; Market for reactive immature;	STATCOM & DSTATCOM are commercially available; SuperVAR is in prototype; Limited RTO control and siting for reactive sources;
	Load-following Support	Other designated DG facilities;	Improved grid reliability;	Cost; Increased use of DG without load following;	
	Power Quality Support	Advanced harmonic filtering;	Improved grid efficiency;	Increased use of harmonic-producing technologies;	
	Power Storage	Batteries; Flywheel	Improved grid efficiency;	Cost; Application specific;	
Monitoring and Load Management	Demand-Side Management	Smart Meters; Open-standards architecture; Grid management infrastructure; Appliance monitoring and control	Improved load management; tariff benefits;	Cost; Lack of unified open-standards control and communications architecture; Customer value	Meters commercially available; some small scale control architectures available (MultiSpeak Initiative); various communication/control architectures not fully integrated;
	Distribution Monitoring and Control	Smart Meters; Islands of Automation; Line Equip Electronic Controls; Line sensors;	Outage Response; Load Characterization and Grid Mgt;Self Healing Networks	Cost; Lack of unified open-standards control and communication architecture; Limited looped systems – ie majority are radial.	Meters commercially available; some small scale control architectures available (MultiSpeak Initiative); various communication/control architectures not fully integrated;

Architecture and Communication Standards	Grid-wide Two-Way Data Acquisition Infrastructure	Smart Meters; Commercial Communication Infrastructures; Proprietary Communication Infrastructures; Consumer IP portal; Open-standards architecture;	Real-time modeling; Self-healing grid; Improved Grid maintenance; Incremental long-term grid reliability improvements;	Cost; Smart Meter adoption will turn on added benefits; Lack of common standards & architecture; Full benefits likely to appear incrementally over time; Limited deployment of some infrastructures.	Smart Meters commercially available; Open-standards communication/control architecture not ready; Common information acquisition model not ready; Limited band width on some infrastructures.
	General			Regarding communication infrastructure, "one size does not fit all". Bandwidth, access and security requirements depends on the application being considered.	Some segments of technology have settled on "defecto" communication standard, still much work needs to be done in the industry to arrive at open standards for communication and application software.
Modeling and Simulation	Grid Management	IT Systems and Application Software	Integration of complex and real-time data to control and maximize grid utilization and reliability	Costs; Proprietary and incompatible software tools, Lack of available monitoring	"Real-time" tools exists and are used at the Transmission and Sub-Transmission levels. Distribution Tools exist; Modeling and simulation based on historical and predicted loads; dynamic islands of automation becoming more available.