

Ambient (Clean Energy Coalition) Smart Grid Emerging Technology Roadmap

	Incremental (0 – 3 Years)	Strategic (3 – 10 Years)	Transformational (10+ Years)
TELECOM	<ul style="list-style-type: none"> • Migration of 3G to LTE and rise of small cellular • Ongoing shift of wired to wireless • Tighter integration of comm. and grid / sensor technologies • Telecom evolution will continue to outpace utility adoption • M2M growth • Low bandwidth, high latency 	<ul style="list-style-type: none"> • 3G cellular disappears • Requirements for larger amounts of data • Wired connections migrate to MPLS networks/fiber pushed deeper into networks • Network data load continues to increase • Devices utilize multiple paths/providers rather than a single provider/path. 	<ul style="list-style-type: none"> • Telecom / utilities back-office and customer fulfillment integration • Migration of 4G to 5G cellular • Increased telecom capability evolves from nice to have to required as utility, healthcare, transportation become dependent on data • High band • width, very low latency
GRID DEVICES	<ul style="list-style-type: none"> • Centralized intelligence • Initial development of the tools and control schemes to manage the distribution system • Self-healing and IVVC focus • DER “low” <u>mkt</u> penetration 	<ul style="list-style-type: none"> • Central intelligence combined w/ local/distributed intelligence • Ops driven by analytics & automation • Shift to modularity and interoperability • Adoption of telecom techniques for grid management • DER “medium” penetration 	<ul style="list-style-type: none"> • Centralized <u>intel</u> combined with widespread local/distributed <u>intel</u> • Ops highly automated • All devices have 2-way comm., memory, and processing capabilities • Hierarchical control of field devices • DER “high” penetration
INFORMATION TECHNOLOGY	<ul style="list-style-type: none"> • Competing, proprietary standards • Software is largely centralized and <u>siloed</u> • Architecture is centralized • Message bus limited to data center • “Big data” is big issue 	<ul style="list-style-type: none"> • Standards and interoperability focus • Software less centralized and <u>siloed</u> • Architecture shifting to distributed • Limited field message bus • New tools for mining data for <u>intel</u> 	<ul style="list-style-type: none"> • Applications and architecture fully distributed • Silo functionality largely gone • Data mining and analytics becomes core competency
REGULATORY	<ul style="list-style-type: none"> • Approval contingent on annual review, pilot • Rate base business model • Regulatory confusion about data, disaggregation, privacy 	<ul style="list-style-type: none"> • Benefits proven for “low hanging fruit.” • Some regulation/mandates re: privacy, data, operational functionality. • Business model shifting from rate base to services-focused. 	<ul style="list-style-type: none"> • Regulatory maturity • Business model is full retail competition / disaggregation