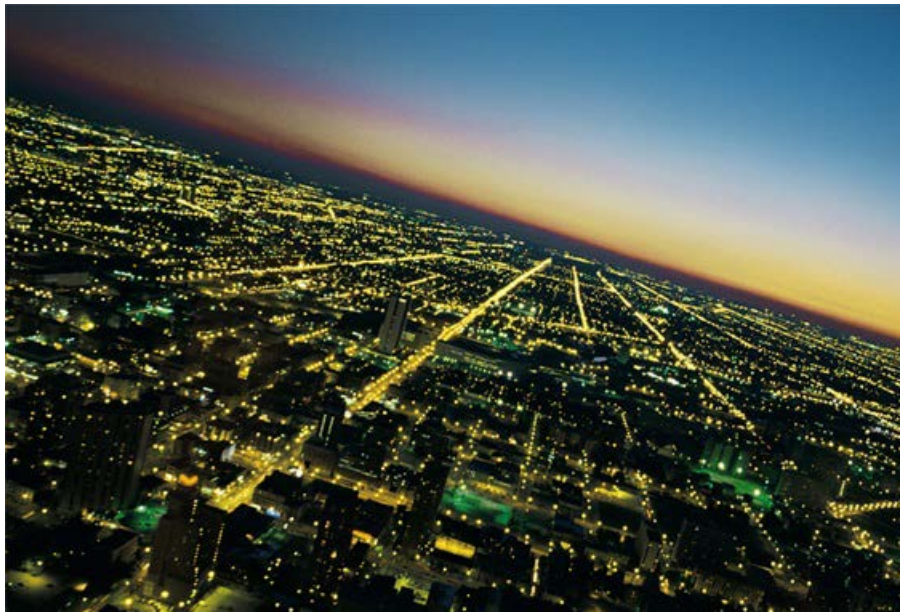


Smart Grid Maturity Model Webinar:

Defining the Pathway to the California Smart Grid of 2020, for Publicly Owned Utilities

Steve Rupp, SAIC

March 21, 2012

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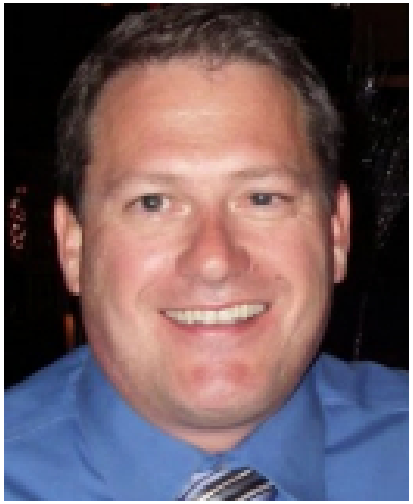
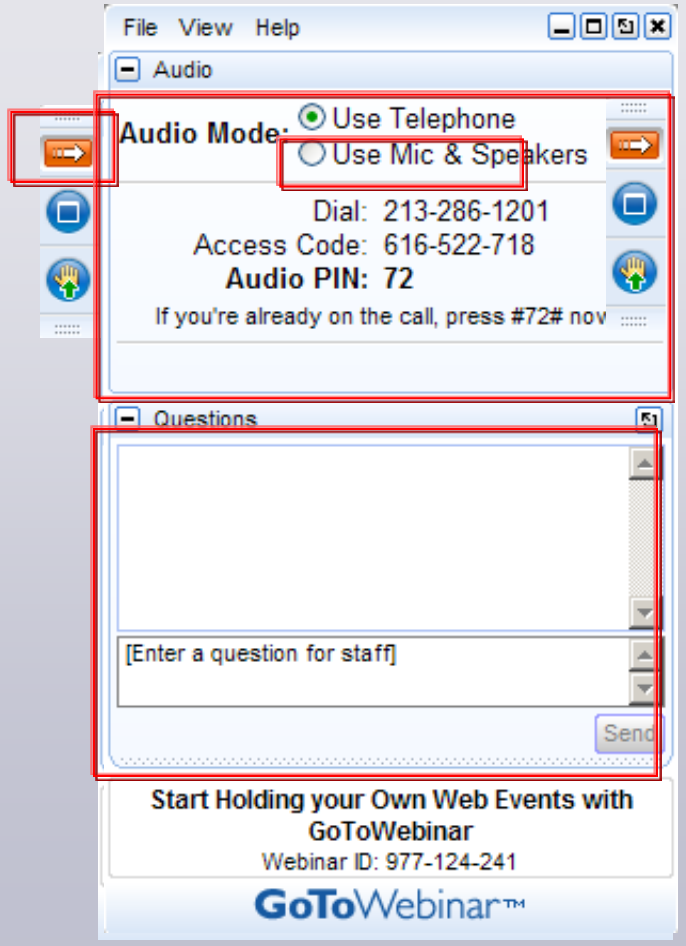
Today's Presenter



Steven S. Rupp, Vice President, SAIC

Mr. Rupp has 28 years of experience in the electric utility industry, including planning, engineering, construction, and operations and maintenance of electric transmission and distribution systems. Mr. Rupp is an SEI Certified Navigator for the Smart Grid Maturity Model. He has facilitated workshops for Sacramento Municipal Utility District, Pasadena Water and Power, Riverside Public Utilities and 11 other public power utilities. He is currently managing a research project for the California Energy Commission to develop a roadmap to the smart grid of 2020 for California's publicly-owned utilities.

How to Participate Today



Open and close your Panel

View, Select, and Test your audio

Submit text questions

Q&A addressed at the end of today's session

Webinar Objectives

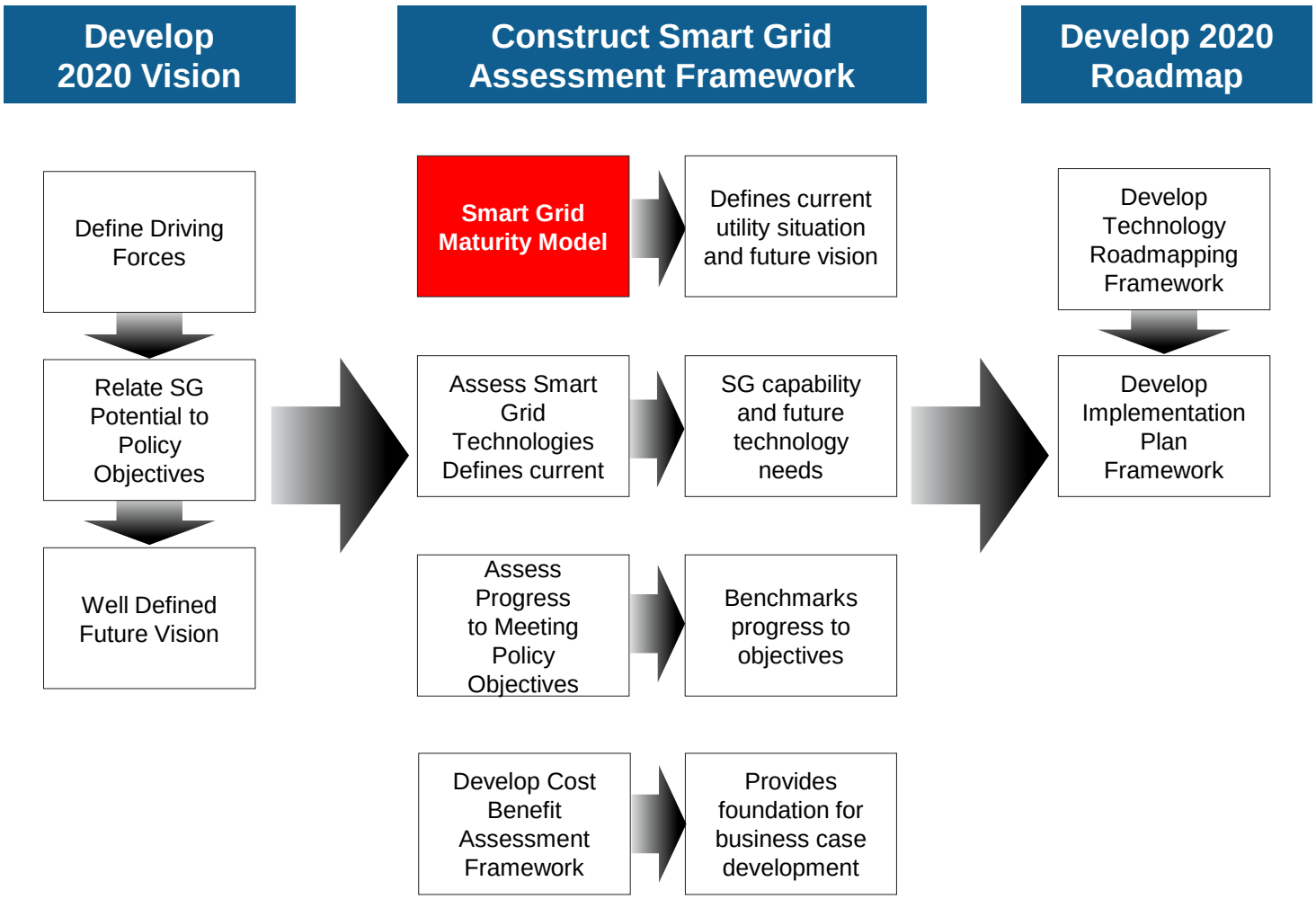
- Provide an overview of the SGMM survey tool and maturity assessment process
- Demonstrate Smart Grid Maturity Model as tool for technology roadmapping and implementation planning
- Demonstrate immediate and expected benefits of the Smart Grid Maturity Model

Polling Question 1

- Is your vision for grid modernization well understood by all elements of your organization?
- Have you identified the challenges that you will encounter in implementing your grid modernization vision and have you developed actionable plans to address those obstacles?

California Energy Commission

Defining the Pathway to the 2020 Smart Grid for Publicly Owned Utilities

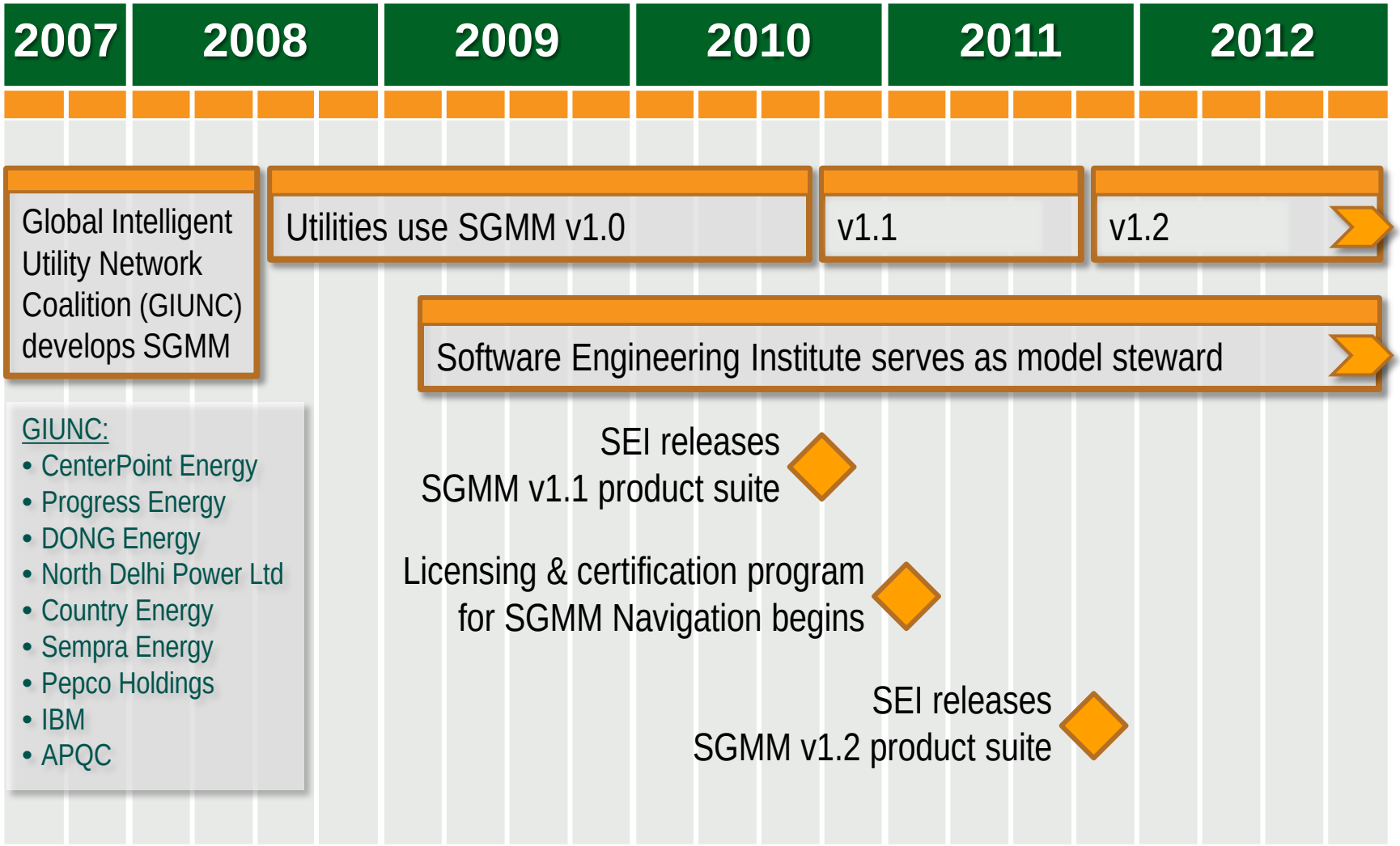


How Is the SGMM Used?

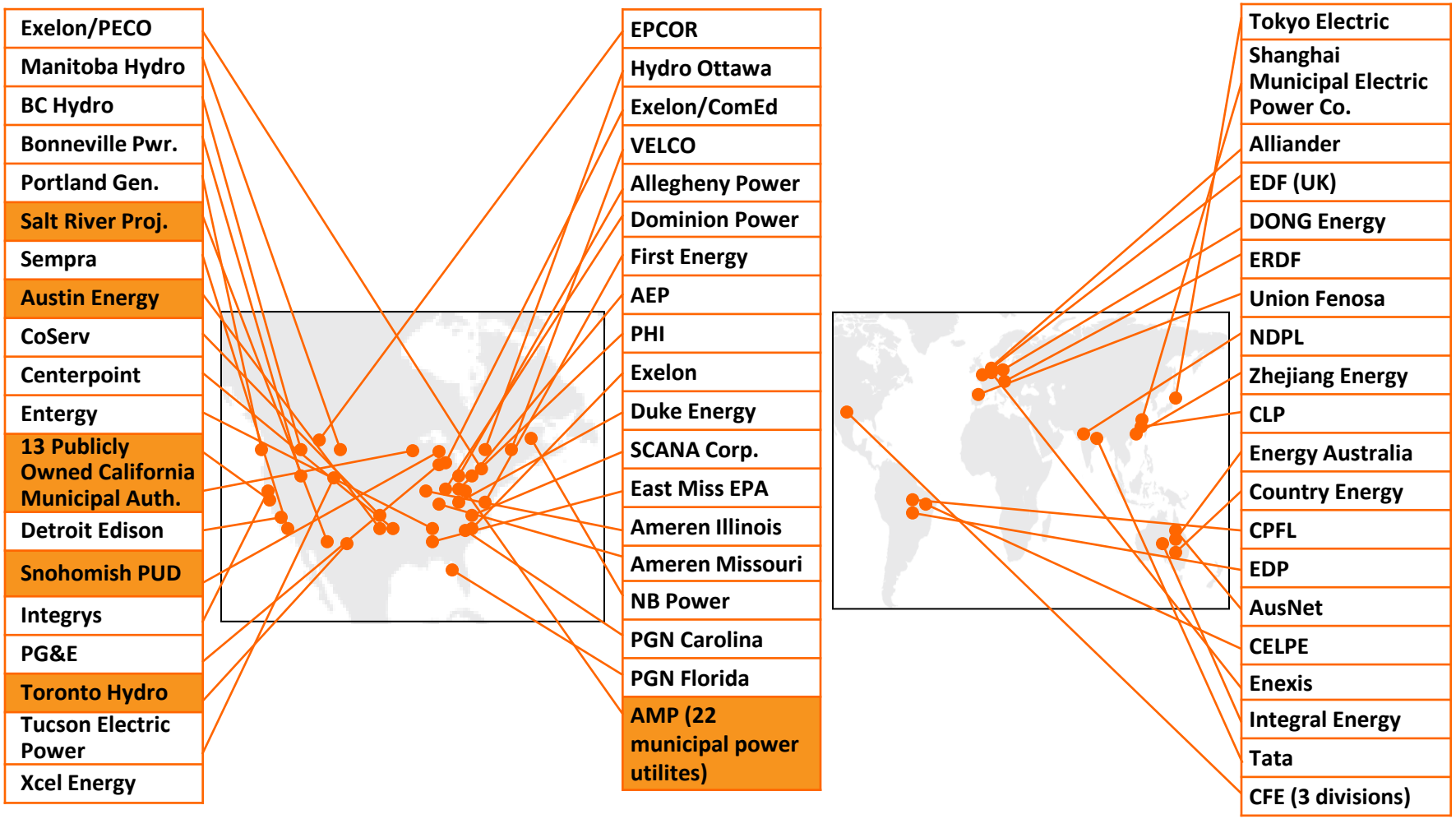
SGMM is used to help organizations

- Identify where they are on the smart grid landscape
- Develop a shared smart grid vision and roadmap
- Communicate using a common language
- Prioritize options and support decision making
- Compare to themselves and the community
- Measure their progress
- Prepare for and facilitate change

Developed by Utilities for Utilities



SGMM User Community Sampling



Eight SGMM Domains

SMR	Strategy, Mgmt & Regulatory *Vision, planning, governance, stakeholder collaboration*	TECH	Technology *IT architecture, standards, infrastructure, integration, tools*
OS	Organization and Structure *Culture, structure, training, communications, knowledge mgmt*	CUST	Customer *Pricing, customer participation & experience, advanced services*
GO	Grid Operations *Reliability, efficiency, security, safety, observability, control*	VCI	Value Chain Integration *Demand & supply management, leveraging market opportunities*
WAM	Work & Asset Management *Asset monitoring, tracking & maintenance, mobile workforce*	SE	Societal & Environmental *Responsibility, sustainability, critical infrastructure, efficiency*

The Smart Grid Maturity Model – Levels

PIONEERING 5	Breaking new ground; industry-leading innovation
OPTIMIZING 4	Optimizing smart grid to benefit entire organization; may reach beyond organization; increased automation
INTEGRATING 3	Integrating smart grid deployments across the organization, realizing measurably improved performance
ENABLING 2	Investing based on clear strategy, implementing first projects to enable smart grid (may be compartmentalized)
INITIATING 1	Taking the first steps, exploring options, conducting experiments, developing smart grid vision
DEFAULT 0	Default level (status quo)

Compass Survey Overview

Section	
1	Company Information – for the Organization Being Assessed
2	Contact Information - Person Responsible for Completing the Compass
3	Demographic Information
4	Performance Information
5	Strategy, Management and Regulatory Domain
6	Organizational Structure Domain
7	Grid Operations Domain
8	Work and Asset Management Domain
9	Technology Domain
10	Customer Domain
11	Value Chain Integration Domain
12	Societal and Environmental Domain

Navigation Process

A five-step process lead by a certified SGMM Navigator

1. Introductory webinar with instructions to complete the first four Compass survey sections are completed prior to the survey workshop
2. Survey Workshop: stakeholders from utility complete the Compass survey as a team, discussions occur to develop consensus on responses
3. Navigator analyzes results and prepares findings
4. Aspirations Workshop: Compass results and findings are presented and discussed; aspirations for planning horizon are agreed through consensus discussions
5. Actions are planned and documentation is completed to conclude the process

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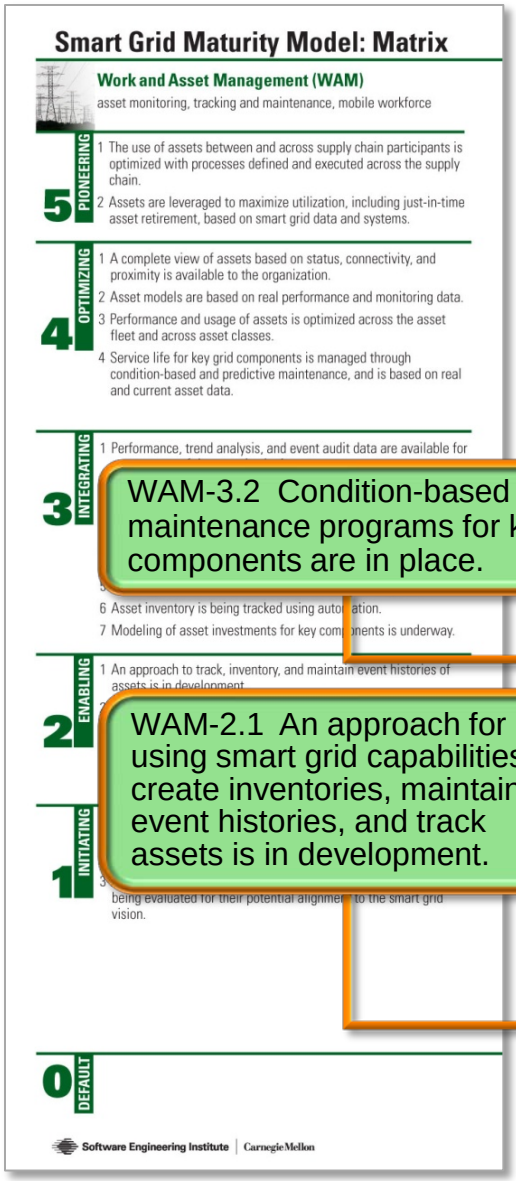
Compass Survey

Contains

- One question for each expected characteristic in the model and
- Demographic and performance questions

Tailored to meet the unique needs of POUs

Example questions



WAM-3.2 Condition-based maintenance programs for key components are in place.

WAM-2.1 An approach for using smart grid capabilities to create inventories, maintain event histories, and track assets is in development.

WAM-3.2 For what percentage of key components have you implemented condition-based maintenance?

- ☐ A. 0%
- ☐ B. 1 - 25%
- ☐ C. 26 - 50%
- ☐ D. 51 - 75%
- ☐ E. 76 - 100%

WAM-2.1 Have you established an approach to track, inventory, and maintain event histories of assets using smart grid capabilities?

- ☐ A. No
- ☐ B. In documented plan including committed schedule and budget
- ☐ C. In development
- ☐ D. Being piloted
- ☐ E. Completed

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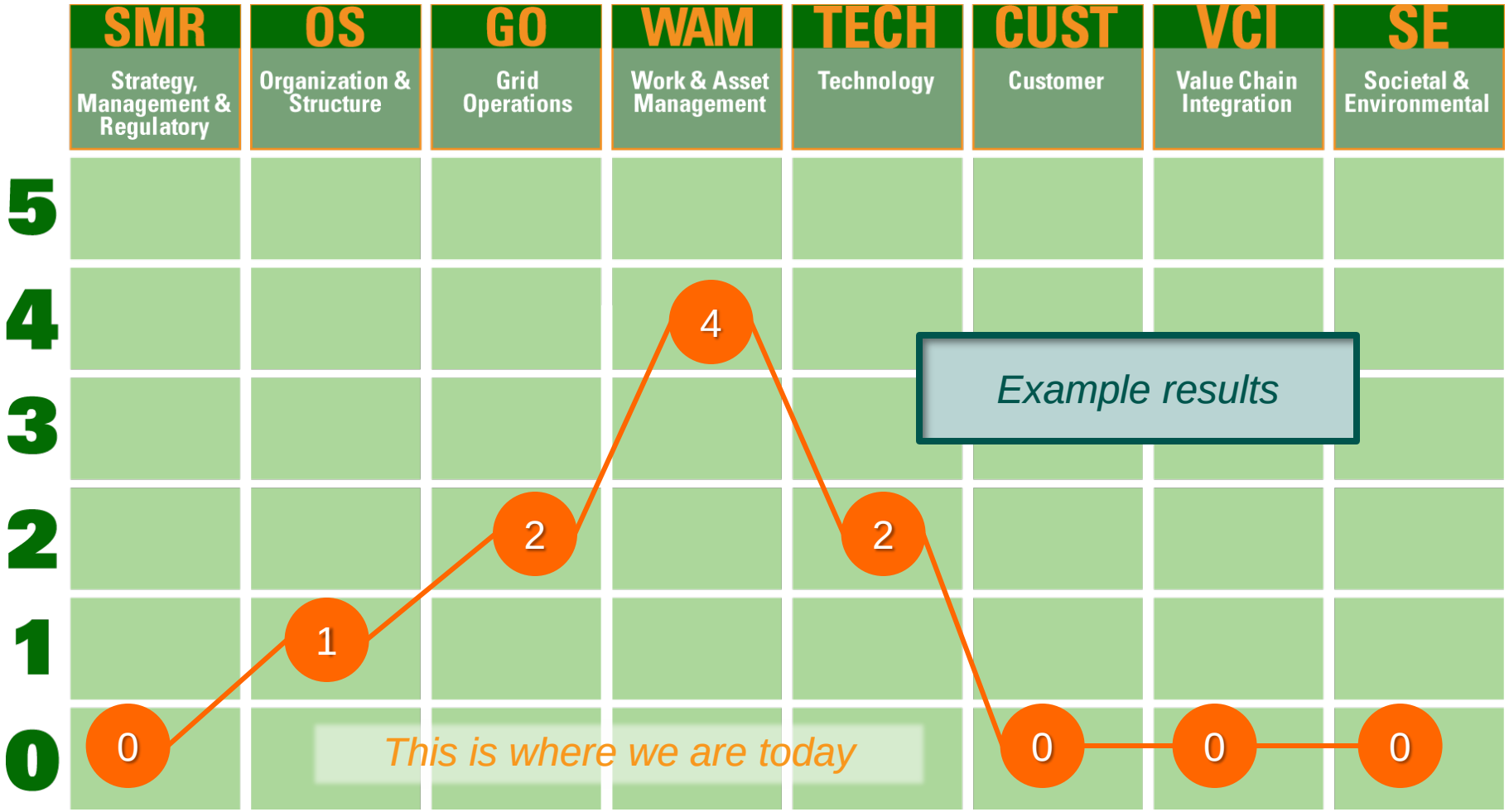
Compass Results

SGMM Survey score provides current rating by domain, for example:



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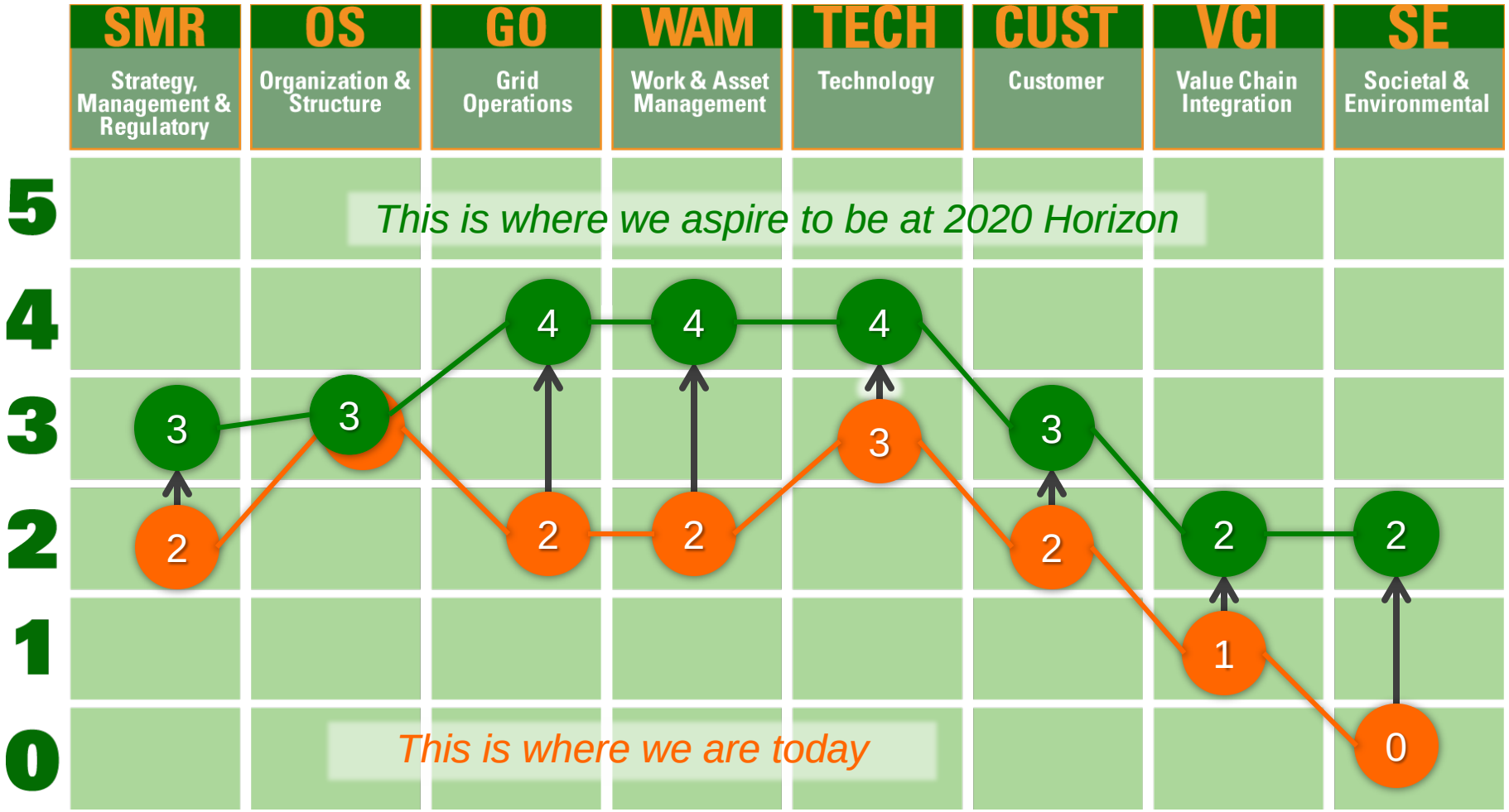
Setting Aspirations

Workshop 2 sets *strategic aspirations* by domain, for example:



Detailed Survey Results

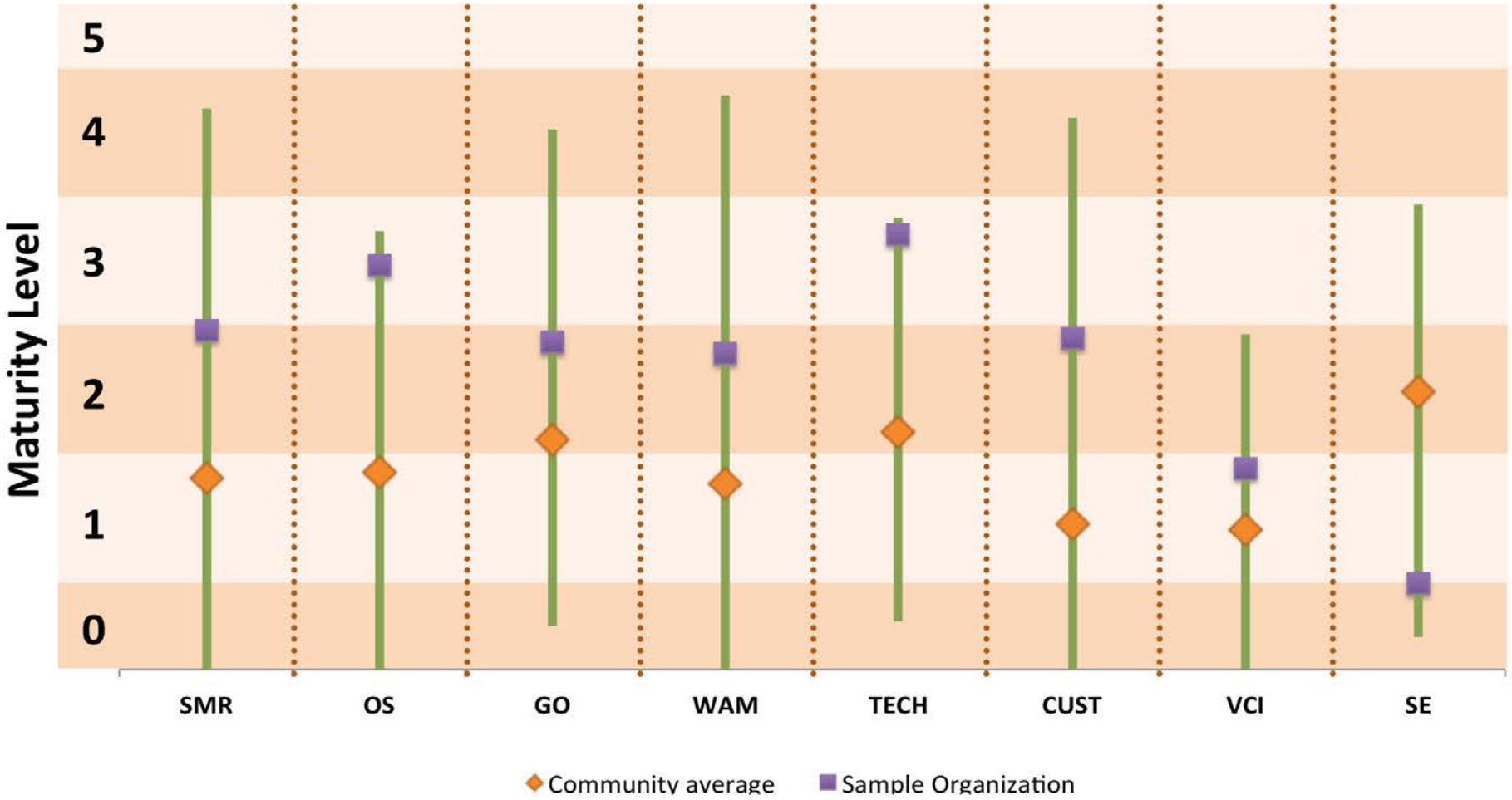
Sample Organization (Fictions Data)								
Level	Strategy, Management & Regulatory	Organization & Structure	Grid Operations	Work & Asset Management	Technology	Customer	Value Chain Integration	Societal & Environmental
5	0.53	0.50	0.25	0.00	0.00	0.20	0.30	0.30
4	0.57	0.17	0.28	0.30	0.40	0.36	0.25	0.40
3	0.65	0.75	0.57	0.47	0.73	0.59	0.58	0.35
2	1.00	0.82	0.93	1.00	1.00	0.92	0.58	0.76
1	0.90	1.00	1.00	1.00	0.84	0.85	0.78	0.68
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

	Point Range	Meaning
	≥ 0.70	Green reflects level compliance within the domain
	≥ 0.40 and < 0.70	Yellow reflects significant progress
	< 0.40	Red reflects initial progress
	= 0	Grey reflects has not started

SGMM Community Comparison

Community Comparison – Average and Range

(We expect 3-4 'communities' based on # of meters, types of service, governance, etc.)



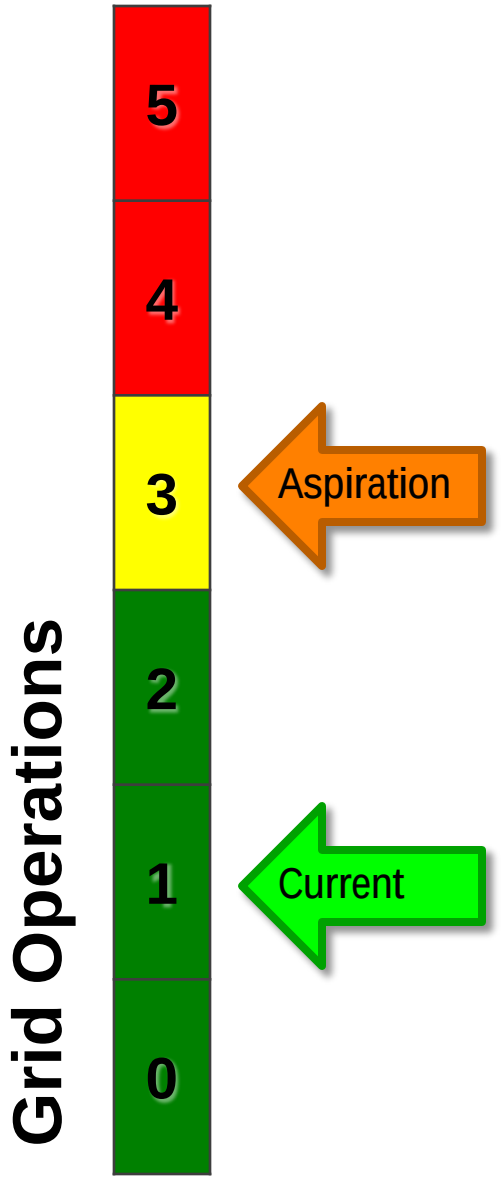
Community Comparison

Legend: Top 10-30% | Bottom 30% | Top 10%

Grid Operations

5		5.2 System-wide, analytics-based, and automated grid decision making is in place.
		5.1 Self-healing capabilities are present.
4		4.5 There is automated decision-making within protection schemes that is based on wide-area monitoring.
		4.4 Grid operations information has been made available across functions and LOBs.
		4.3 Operational forecasts are based on data gathered through smart grid.
		4.2 Grid operational management is based on near real-time data.
		4.1 Operational data from smart grid deployments is being used to optimize processes across the organization.
3		3.6 There is automated decision-making within protection schemes.
		3.5 Grid data is used by an organization's security functions.
		3.4 Smart meters are important grid management sensors.
		3.3 Grid operations planning is now fact-based using grid data made available by smart grid capabilities.
	+	3.2 Control analytics have been implemented and are used to improve cross-LOB decision-making.
		3.1 Smart grid information is available across systems and organizational functions.
2		2.4 Investment in and expansion of data communications networks in support of grid operations is underway.
		2.3 Aside from SCADA, piloting of remote asset monitoring of key grid assets to support manual decision making is underway.
	↓	2.2 Advanced outage restoration schemes are being implemented, which resolve or reduce the magnitude of unplanned outages.
		2.1 Initial distribution to substation automation projects are underway.
1		1.5 Safety and security (physical and cyber) requirements are considered.
		1.4 Outage and distribution management systems linked to substation automation are being explored and evaluated.
	★	1.3 Proof-of-concept projects and component testing for grid monitoring and control are underway.
		1.2 New sensors, switches, and communications technologies are evaluated for grid monitoring and control.
		1.1 Business cases for new equipment and systems related to smart grid are approved.

Aspiration Setting Tool



What motivates this aspiration?

- Working your existing plans and mission
- Regulatory mandates/requirements both direct and indirect
- Expanding knowledge and gaining experience
- Evolution of best practices in industry

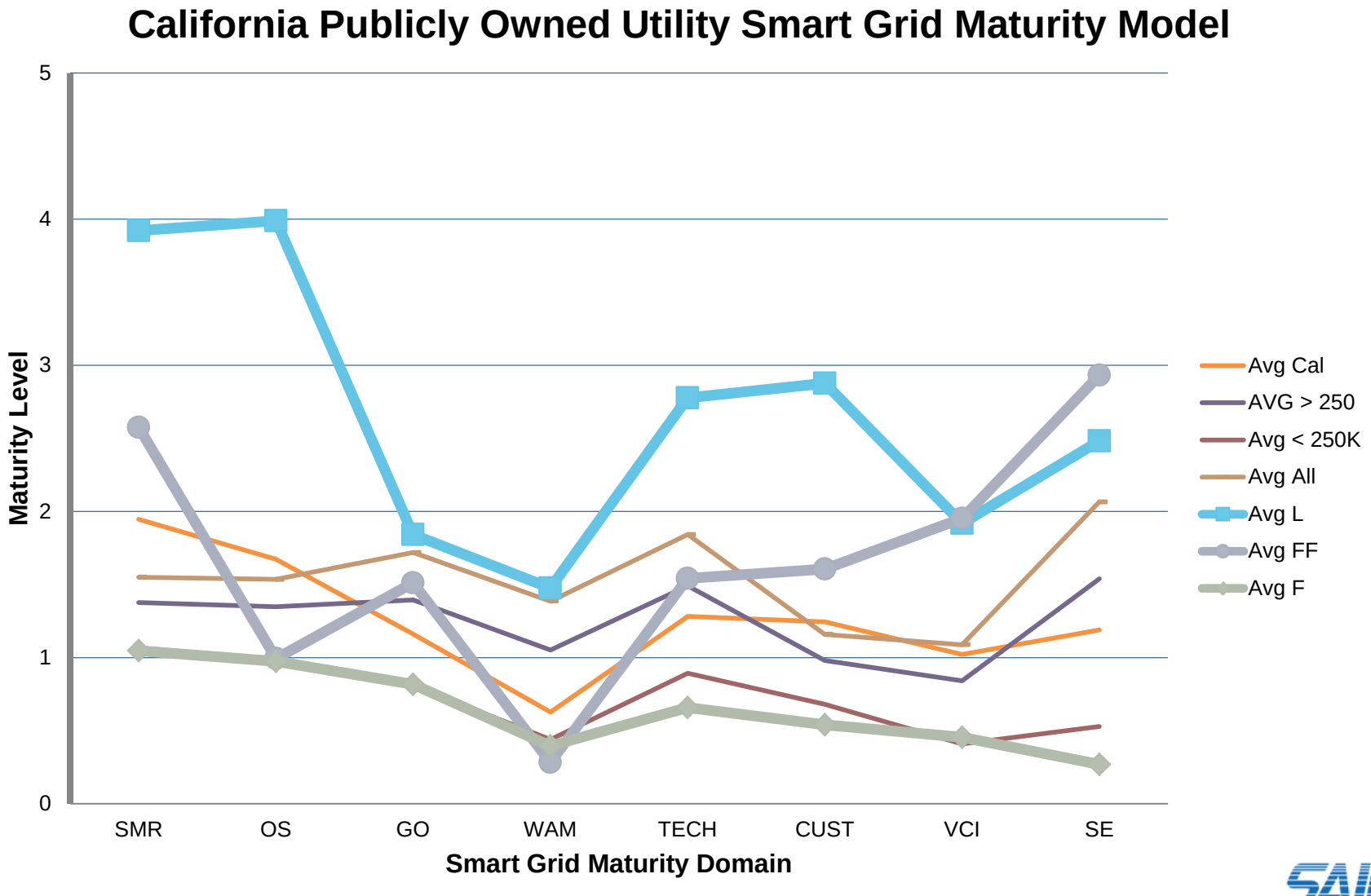
What actions must happen to achieve this aspiration?

- Strategies and plans developed to define vision
- Executive management needs to support vision
- Engage and educate customers
- Engage and educate board and council

What are the obstacles that must be overcome to achieve this aspiration?

- Board needs to vet and support new strategies
- Need sources of funds and other resources competing with other priorities
- Public and customer acceptance of technology value/benefits

Results -- How do California-POU's SGMM results compare?



What is the vision for the smart grid in 2020 from the perspective of publicly-owned utilities?

A successful Smart Grid will enhance the electric, water, and natural gas service offerings POUs provide to their local communities, and improve the efficiency and reliability of the delivery system; lower overall system cost; support clean energy job creation and will be accomplished in a financially responsible manner at a pace and scope of deployment that reflects the financial, environmental and social priorities of the communities that govern and are served by local POUs.

	Followers	Fast Followers	Leaders
Lower overall system cost	Reduce	Maintain	Increase
Enhance service offerings	Maintain	Explore	Enhance
Improve grid efficiency and reliability	Maintain	Improve	Improve
Reflect local financial, environmental and social priorities	React	Explore	Shape
Support clean energy job creation	React	Explore	Create

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Public Power's Unique Perspective on Smart Grid Challenges

Financial

- Very High Entry Costs
- Economies Do Not Scale Downward
- Business Case Uncertainties
- Competing Capital Priorities

Organizational

- Enterprise View Creates Complexity
- Minimizing Cost of Service Remains Common High Priority
- Highly Complex Issue That Is Difficult to Translate to Governance
- Missing from the Strategic Planning Agenda

Operational

- Highly Disruptive Change Element
- Further Blurs Lines Between Technology, Communication and Energy Delivery
- Security and Privacy Issues Complicating Factors
- Huge Gap Between Current and Future Technology States

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Potential Strategies to Overcome Challenges

Financial Strategies

- Prioritize and pace deployment
- Costs will increase initially, then decrease
- Look to unconventional outsourcing and partnering opportunities

Organizational Strategies

- Find a place for smart grid in strategic plans
- Educate governance and boards
- Prepare for disruptive change by getting organized

Operational Strategies

- Evaluate existing systems now
- Upgrade backbone technology first
- Review and update operating practices, policies and procedures

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How will smart grid technologies help utilities achieve state energy policy objectives?

Seven Use Cases Define Utility Application of Smart Grid Technologies	Key Energy Policy Objectives						
	Reduce GHG	Demand Response	Energy Efficiency	Renewable Energy	Grid Resiliency	Distributed Energy	Electric Vehicles
Integrated Protection and Control Improves Service Reliability				✓	✓	✓	
Utility-Customer Interaction Improves Reliability, Eases Customer Bills	✓	✓		✓			
Integrated Distributed Generation & Storage Support Grid	✓		✓		✓	✓	
Voltage Management Improves Power Quality and Delivery Efficiency	✓		✓		✓	✓	✓
Automated Feeder Management Improves Customer Service Reliability	✓		✓		✓		
Grid Monitoring and Control Enables Electric Vehicle Charging	✓						✓
Asset Monitoring Enables Proactive System Planning and Maintenance	✓		✓	✓	✓	✓	✓

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Results -- How are publicly-owned utilities employing smart grid ?

Smart Grid Technologies: DR & DM Programs	Alameda	Anaheim	Azusa	Burbank	Glendale	Imperial	Los Angeles	Palo Alto	Pasadena	Redding	Riverside	Sacramento	Santa Clara
Energy Efficiency Programs	●	●	●	●	●	●	●	●	●	●	●	●	●
Programs to encourage off-peak usage	•	●	•	●	●	●	●	•	●	●	●	●	●
Residential Demand Response	•	◉	•	◉	◉	◉	◉	◉	◉	◉	◉	●	◉
Residential Direct Load Control	•	•	•	•	•	•	•	•	•	•	•	●	•
Residential Dynamic Pricing Programs	•	◉	•	◉	◉	◉	◉	◉	◉	◉	◉	◒	◉
Smart Appliance Programs	•	•	•	•	•	•	•	•	•	•	•	◉	•

● Tracking ◉ Planning ○ Piloting ◒ Deploying ● Deployed

Smart Grid Technologies: DR & DM Technologies	AMP	APU	ALP	BWP	GWP	IID	LADWP	CPAU	PWP	REU	RPU	SMUD	SVP
C&I Direct Load Control Systems	●	●	●	●	●	●	●	●	●	●	●	●	●
C&I Demand Response System	•	●	•	●	●	●	●	•	●	●	●	●	●
Residential Direct Load Control Systems	•	◉	•	◉	◉	◉	◉	◉	◉	◉	◉	●	◉
Residential Demand Response System	•	•	•	•	•	•	•	•	•	•	•	●	•
Residential Energy Management Devices/Systems	•	◉	•	◉	◉	◉	◉	◉	◉	◉	◉	◒	◉
Programmable Controllable Thermostats	•	•	•	•	•	•	•	•	•	•	•	◉	•
Interactive HVAC Thermal Storage	•	◉	•	◉	◉	◉	◉	◉	◉	◉	◉	◒	◉

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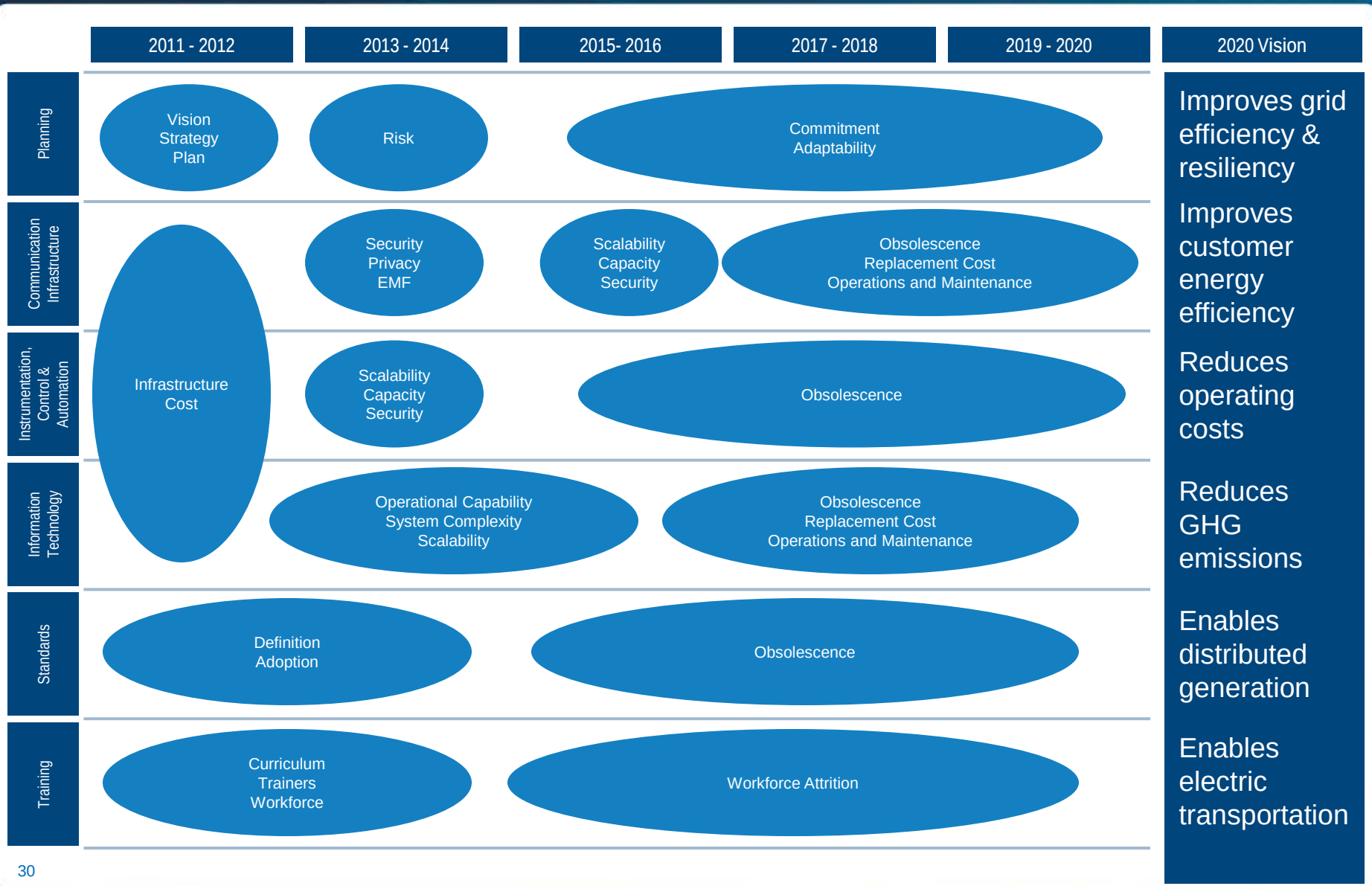
Technology Roadmap Challenges for Voltage Management Use Case



Implementation Roadmap for Voltage Management Use Case -- Leaders

	2011 - 2012	2013 - 2014	2015- 2016	2017 - 2018	2019 - 2020
Planning	Develop objectives , strategy & budgets – experiment, pilot & deploy	Adjust plans based on results of experiments. Identify scope and location of pilots	Adjust plans based on results of pilots. Identify scope and location of feeder scale deployments	Adjust plans based on results of feeder level deployments. Prioritize system wide deployment for desired effect	
	Construct and refine engineering models for experiments and pilots		Integrate engineering model. Define feeder deployments	Refine engineering model as needed for real-time analysis	
Communication Infrastructure	Identify, procure & test comm system elements	Conduct controlled pilots of communications technologies with consideration for terrain coverage, security, reliability, latency and cost.	As needed, expand telecommunications infrastructure (fiber optic, wireless, copper …) to meet latency, bandwidth, frequency, and reliability requirements to support voltage management operations.		
Instrumentation, Control & Automation	Identify, procure, install and test sensors, controllers, advanced inverters & operating schema	VVO Pilot to demonstrate grid benefits CVR Pilot to demonstrate grid & residential EE benefits	Advance pilots to feeder and then substation area level deployments. Prioritize for desired impact. Measure and test results to determine costs/benefits. Pilot and demonstrate advanced inverter technologies in conjunction with distributed generation and electric vehicle charging.		
Information Technology	Evaluate software for voltage management (DMS) Evaluate system integration needs, especially GIS, SCADA, CIS and EA.	Define requirements for VMS (DMS), procure, implement basic functions and integrate with GIS, EA, SCADA & CIS	Procure, deploy and test VMS(DMS) for feeder, substation and system wide deployments. Advance integration effectiveness	Procure, deploy and test VMS(DMS) for feeder, substation and system wide deployments. Advance integration effectivenes	
Standards	Evaluate adapt, and adopt standards for communications, control and security.	Implement cybersecurity standards, refine equipment selections in preparation for feeder scale deployment	Actively participate in advancement and extension of standards for voltage management		
Training	Identify and develop training requirements with emphasis on field and operating personnel	Revise training as needed by evolution of standards and choices of equipment and systems. Reevaluate workforce needs.	Advance extent and depth of training as technological complexity increases with scale of deployment.		

2020 Vision

- Improves grid efficiency & resiliency
- Improves customer energy efficiency
- Reduces operating costs
- Reduces GHG emissions
- Enables distributed generation
- Enables electric transportation

Research Providing Immediate Benefit

- Planning
  - In several instances, this research provided the first opportunity for utilities to have a comprehensive discussion about smart grid among regulators, managers and staff
  - Utilities are aligning smart grid initiatives into their strategic plans using SGMM Lexicon
- Executing
  - Utilities are using this research to evaluate progress and success of current initiatives
- Publicizing
  - Utilities are using research results to broadcast impact of smart grid programs
  - Research garnering national interest and attention by public power

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Expected Near Term Benefits

- Planning
  - Business case framework allows utilities to explore costs and benefits of smart grid initiatives
  - SGMM provides industry framework for developing and measuring progress
- Executing
  - Technology Assessment provides insight into implications of technology and vendor selections
  - Implementation framework provides actionable steps for utilties to advance initiatives

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How Do You Prepare for SGMM?

- Identify your key Smart Grid stakeholders
  - Internal key departments (IT, customer service, operations, engineering, meter reading, accounting, etc.)
  - External stakeholders (Council, public groups, key customers, etc.)
- Understand each stakeholder's:
  - Vision
  - Objectives
  - Status
- Identify your Smart Grid aspirations (e.g., where does your utility want to be in 2020)

Questions?

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How sure are you about your smart grid transformation strategy?

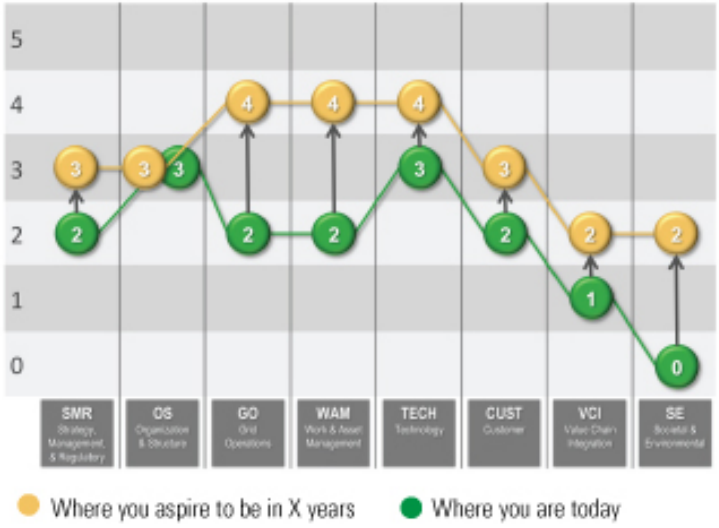
SGMM
Smart Grid Maturity Model
Software Engineering Institute | Carnegie Mellon

Plot your journey to effective smart grid deployment

Our Navigation tools and process help you assess where you are against best practices and gauge where you want to go.

- Chart your transformation
- Prioritize your opportunities for innovation and improvement
- Measure progress

Our Navigation Process Helps You Decide



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