



# SGMM

Smart Grid Maturity Model

## A Zero-depth Entry to Using the TSP:

How TSP was used to turn around the SGMM project that was drowning in details

November 4, 2014



# Report Documentation Page

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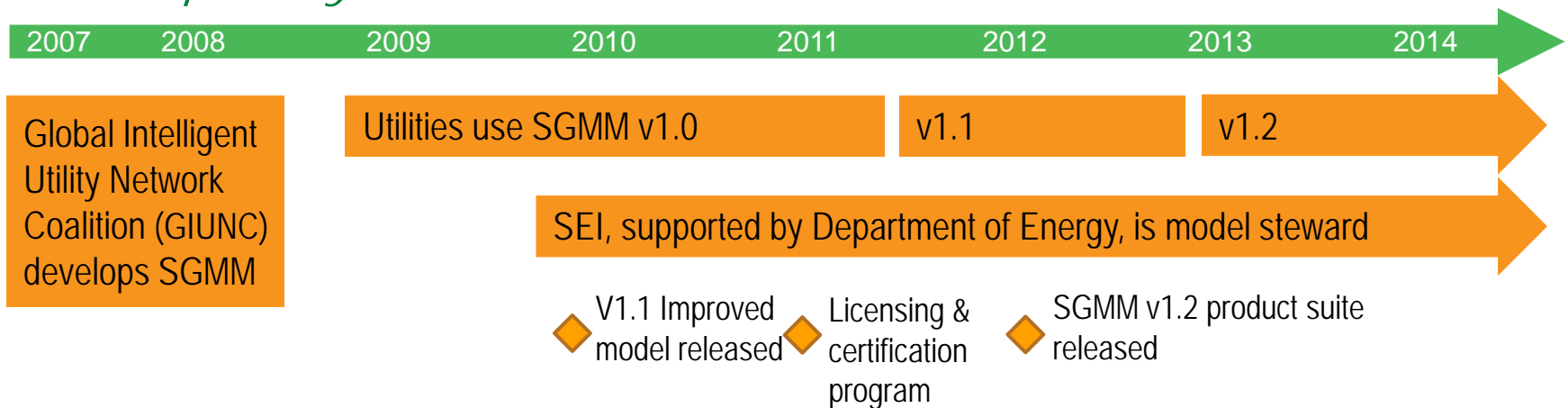
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# The Smart Grid Maturity Model is

*A management tool  
that provides a  
common language and framework  
for defining key elements of  
smart grid transformation  
and helping utilities develop a  
programmatically approach  
and track their progress*

*Developed by Utilities for Utilities*



# SGMM

Smart Grid Maturity Model

V 1.2 Product Suite



## Model

Fully described in the Model Definition document

## Compass Survey

Questionnaire-based assessment yields maturity ratings and comparisons

## Navigation Process

Expert-led workshops to complete Compass and use results to develop consensus aspirations

## Training

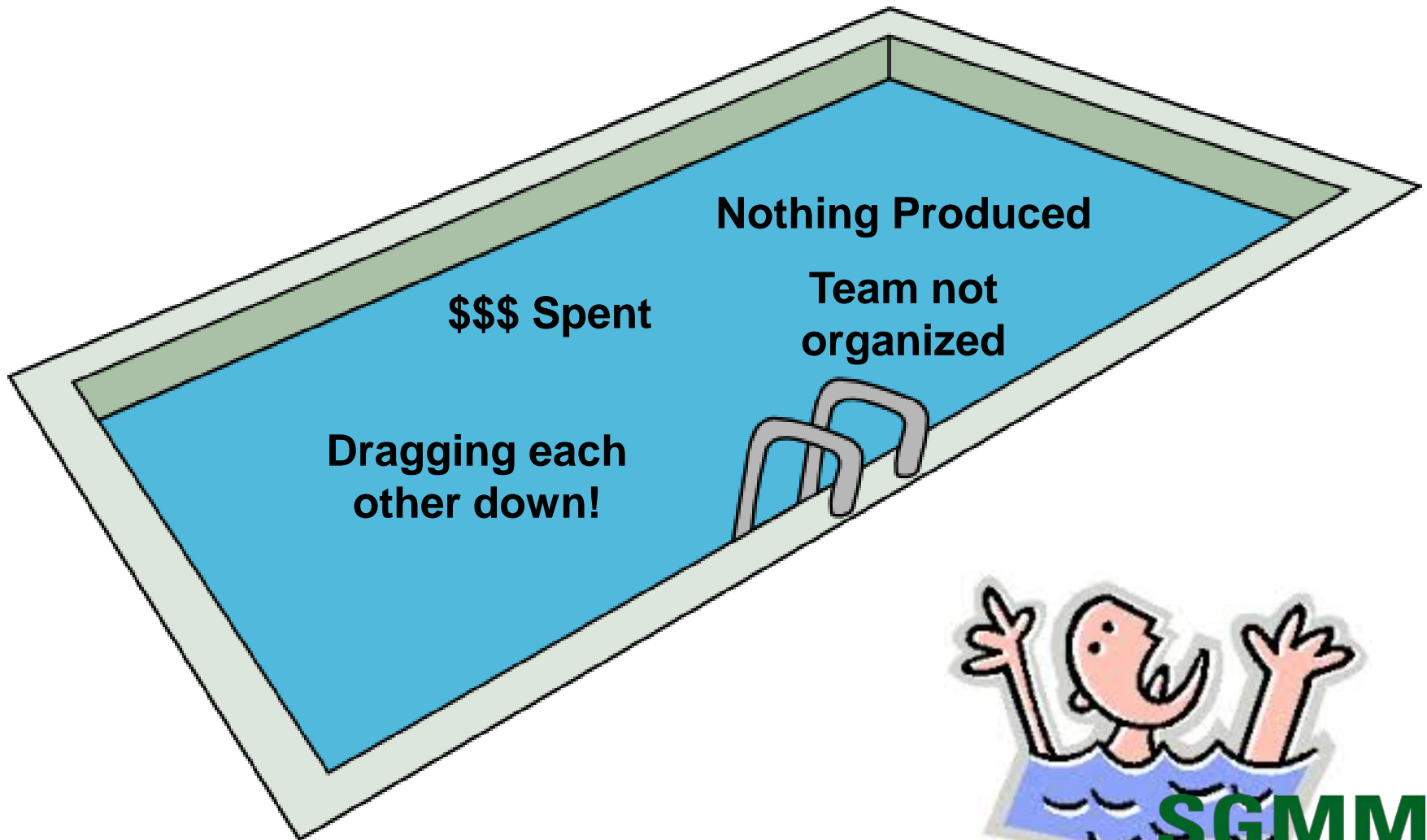
Overview Seminar and SGMM Navigator Course

## Partner Program

License organizations and certify individuals to deliver Navigation process

[www.sei.cmu.edu/smartgrid](http://www.sei.cmu.edu/smartgrid)

# The Problem...



# A Solution...



# TSP is not just for software

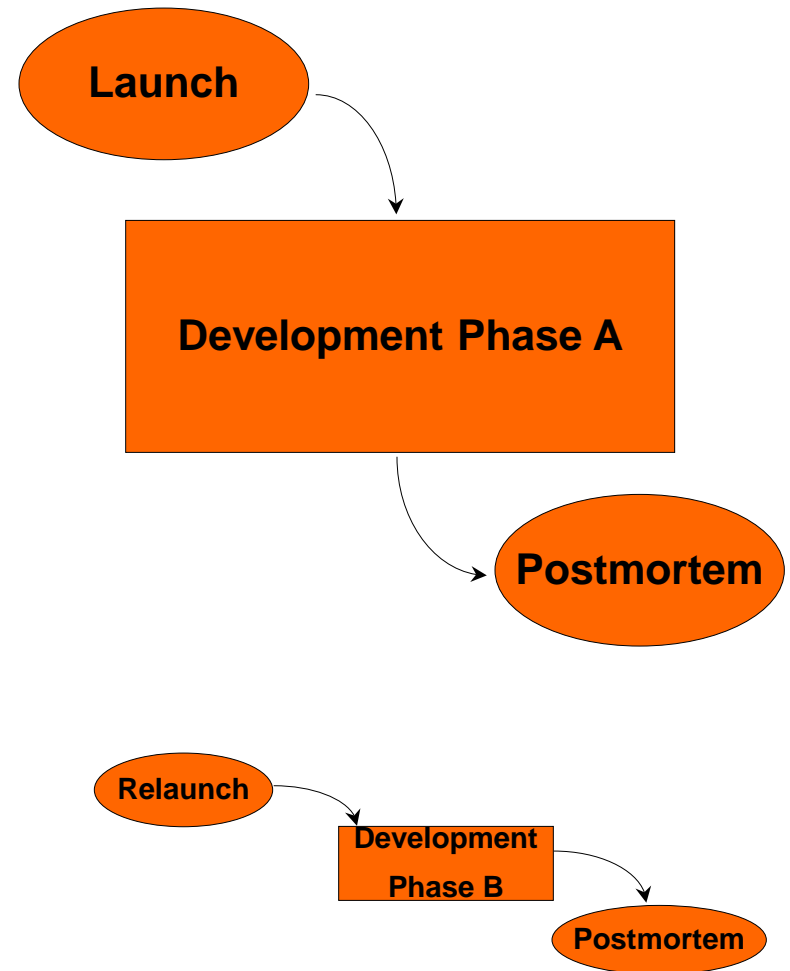
Initially we used TSP as a project management framework.

Later we used TSP to develop/evolve

- core product (model and survey)
- navigation and support processes
- training

Stayed true to the TSP principles.

- team building
- planning and post mortems
- design
- Implementation and testing
- support processes (CM, Inspections, etc.)



# Team building

## Team attributes:

- geographically distributed
- part-time on several projects
- specific skill sets
- never worked together
- a lot of personnel changes – consistent core team

Launches and post-mortems were the primary team building activities.

## Feedback from the launches

- + great team, energizing, missed old team members, great to have new team members, good meeting, great food
- ran out of time, doing math was BAD

## Roles

Project manager

Model owner and architect

Course owner

Process owner

Program development and transition, DOE relationship manager

Licensing POC

Certification POC

Technical writer

Marketing and communications

Navigator

Instructor



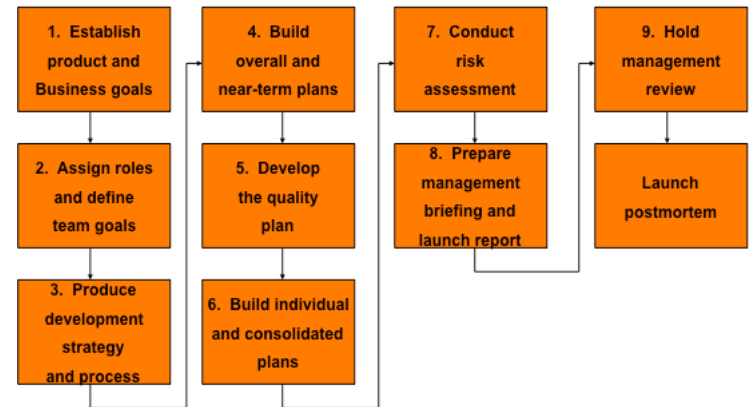
# Team launches

Launches were conducted following a standard launch agenda.

Our first agenda item for each launch was a review of project status (post mortem.)

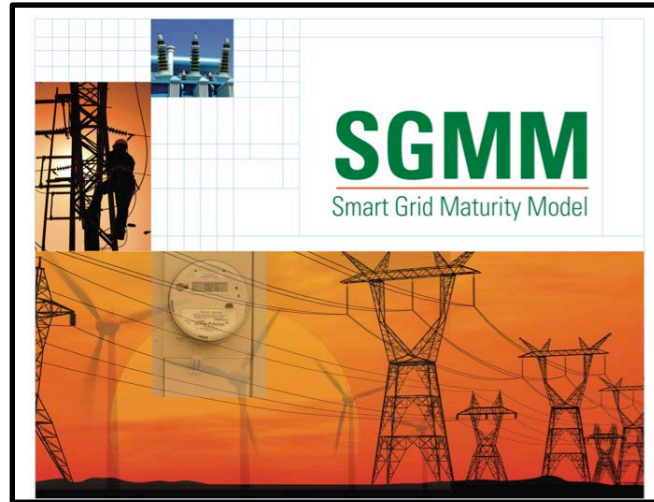
Major differences the launch process were

- team roles were functional
- used MS Project for planning and tracking tasks **and** costs
- used several cost planning tools
- quality planning improved as the product suite advanced

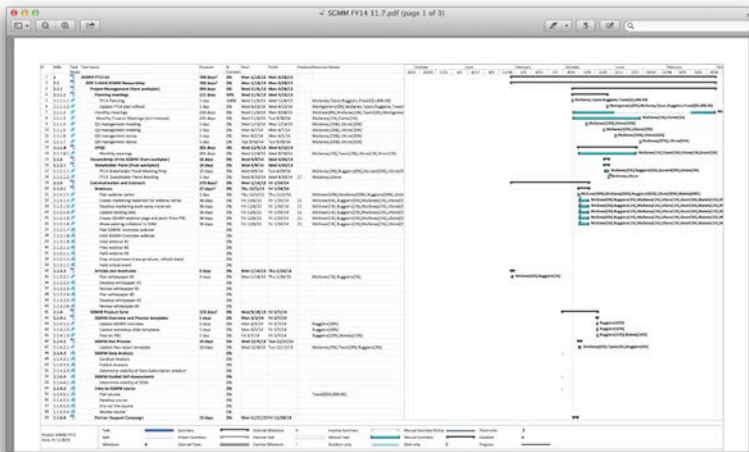


Note: Cost data was handled like defect data. Only aggregate cost data was shown at a team level.

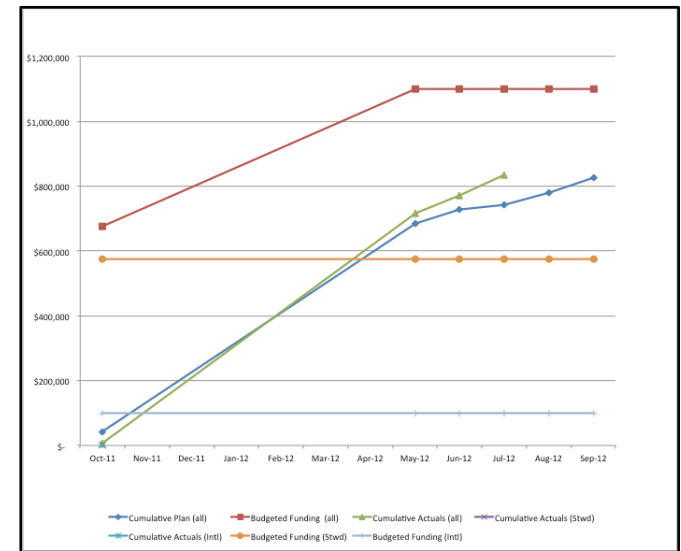
# Launch artifacts



## Meeting 9 Presentation



## WBS with cost data



## Funding Plan

# Load balancing

For each team member, we calculated hours per month and compared that to percentage allocation.

Who Does What When as of Tue 4/27/10 100226 SGMM Mar10-Dec10 v3										
	December	January	February	March	April	May	June	July	August	
Rich Caralli					8.8 hrs	8 hrs	8.8 hrs	8.4 hrs	8.8 hrs	
Rita Briston					8.8 hrs	8 hrs	8.8 hrs	8.4 hrs	8.8 hrs	
David White				7.68 hrs	66 hrs	146 hrs	220.4 hrs	56.88 hrs	47.28 hrs	
James Stevens					77.92 hrs	75.77 hrs	105.03 hrs	27.43 hrs	85.43 hrs	
Barbara Tyson				14.4 hrs	108.88 hrs	107.37 hrs	125.52 hrs	21.28 hrs	47.2 hrs	
Amanda Parente				53.2 hrs	7.52 hrs	168.4 hrs	36.17 hrs	3.37 hrs	9.92 hrs	
Julia Mullaney				32 hrs	93.43 hrs	104.17 hrs	156.4 hrs	35.43 hrs	31.2 hrs	
Austin Montgomery					35.12 hrs	22.23 hrs	85.77 hrs	5.03 hrs	28.17 hrs	
Steve Masters					40.88 hrs	28.17 hrs	37.2 hrs	9.03 hrs	9.92 hrs	
Howard Lipson					3.52 hrs	16.8 hrs	11.52 hrs	3.37 hrs	3.52 hrs	
Ray Jones				8 hrs	104.08 hrs	51.37 hrs	125.28 hrs	25.43 hrs	81.92 hrs	
James Ivers							8 hrs			
Mark Kasunik										
David Biber				18.4 hrs	17.6 hrs	24 hrs				
Chris (APQC)					40 hrs	104 hrs		8 hrs		
Austin (rate)					1.43 hrs	9.6 hrs	10.57 hrs	10.08 hrs	10.57 hrs	
Summer Fowler					1.2 hrs	8 hrs	8.8 hrs	8.4 hrs	8.8 hrs	
3.1 Project mgmt & control					1.2 hrs	8 hrs	8.8 hrs	8.4 hrs	8.8 hrs	

Resource	Budget
Mullaney	33%
White	25%
Montgomery	7%
Tyson	20%
Jones	30%
Ruggiero	15%
McGraw	0%
Zaccardi	10%
Gress	5%
Fowler	5%

# Budget analysis

We analyzed data from three different approaches to finalize the plan.

	Month 1	Month 2	Month 3
Total FTE	0.56	0.56	0.56
Total Labor Cost	\$ 17,025.35	\$ 17,025.35	\$ 17,025.35
Travel (Domestic)	\$ 2,000.00	\$ 2,000.00	\$ 2,000.00
Travel (International)	\$ -	\$ -	\$ -
Printing	\$ -	\$ -	\$ -
Office Supplies	\$ -	\$ -	\$ -
Shipping	\$ -	\$ -	\$ -
Books & Periodicals	\$ -	\$ -	\$ -
Capital Equipment	\$ -	\$ -	\$ -
Non-Capital Equipment	\$ -	\$ -	\$ -
Software (incl Maintenance and Licenses)	\$ -	\$ -	\$ -
Subcontracting/Consulting services	\$ 1,000.00	\$ 1,000.00	\$ 1,000.00
SEI Courses	\$ -	\$ -	\$ -
CMU Courses	\$ -	\$ -	\$ -
CMU Course materials	\$ -	\$ -	\$ -
Ext. Course/conference registration	\$ -	\$ -	\$ -
Total Non-Personnel Expenses (incl overheads)	\$ 3,237.06	\$ 3,237.06	\$ 3,237.06
<b>Total Monthly Cost</b>	<b>\$ 20,262.41</b>	<b>\$ 20,262.41</b>	<b>\$ 20,262.41</b>
<b>TOTAL Project Cost</b>	<b>\$ 243,148.97</b>		

Resource	Budget
Mullaney	33%
White	25%
Montgomery	7%
Tyson	20%
Jones	30%
Ruggiero	15%
McGraw	0%
Zaccardi	10%
Gress	5%
Fowler	5%

WBS	Task Mode	Task Name	Duration	% Complete	Start	Finish	Cost
1		<b>SGMM FY12 All</b>	<b>285 days</b>	<b>89%</b>	<b>Mon 10/3/11</b>	<b>Mon 11/5/12</b>	<b>\$320,565.28</b>
1.1		<b>DOE 5-461B SGMM Stewardship</b>	<b>285 days</b>	<b>90%</b>	<b>Mon 10/3/11</b>	<b>Mon 11/5/12</b>	<b>\$264,488.40</b>
1.1.1		<b>Project Management (from workplan)</b>	<b>221 days</b>	<b>89%</b>	<b>Wed 12/7/11</b>	<b>Wed 10/10/12</b>	<b>\$72,123.94</b>
1.1.1.1		<b>Quarterly Planning Meetings</b>	<b>186.5 days</b>	<b>99%</b>	<b>Wed 12/7/11</b>	<b>Thu 8/23/12</b>	<b>\$34,432.36</b>
1.1.1.1.1		FY12 Planning	0 days	0%			\$0.00
1.1.1.1.2		Q1 Planning	2 days	100%	Wed 12/7/11	Thu 12/8/11	\$0.00
1.1.1.1.3		Q2 Planning	1 day	100%	Thu 1/12/12	Thu 1/12/12	\$8,171.72
1.1.1.1.4		Q3 Planning	0.5 days	100%	Wed 4/25/12	Wed 4/25/12	\$4,085.86
1.1.1.1.5		Q4 Planning	2.5 days	100%	Tue 8/21/12	Thu 8/23/12	\$22,174.78
1.1.1.2		Weekly Team Meetings	194 days	93%	Tue 1/3/12	Fri 9/28/12	\$19,568.08
1.1.1.3		Monthly Finance Meetings (incl invoices)	194 days	88%	Tue 1/3/12	Fri 9/28/12	\$12,818.43
1.1.1.4		<b>Quarterly Reporting to DOE</b>	<b>220 days</b>	<b>75%</b>	<b>Thu 12/8/11</b>	<b>Wed 10/10/12</b>	<b>\$0.00</b>
1.1.1.4.1		Q1 DOE Report	1 day	100%	Thu 12/8/11	Thu 12/8/11	\$0.00
1.1.1.4.2		Q2 DOE Report	1 day	100%	Thu 3/8/12	Thu 3/8/12	\$0.00
1.1.1.4.3		Q3 DOE Report	1 day	100%	Tue 7/10/12	Tue 7/10/12	\$0.00
1.1.1.4.4		Q4 DOE Report	1 day	0%	Wed 10/10/12	Wed 10/10/12	\$0.00

# Launch – lessons learned

- Planning made project AND project team successful
- Team members were overcommitted, but SGMM work got done on time
- Insight into cost “elevated” everyone to a senior management role with ability to make more informed decisions
- Reconciliation of finances was monthly, but the team meetings enable course corrections weekly

# Design – lessons learned

We developed designs for all SGMM artifacts including

- Navigation process
- Training
- Presentations
- Workshops and meetings
- Documents

We developed products plans for each product that defined product objectives, intended audience, and intended usage.

The following are examples of our design documents for various products.

# Process design

## Phase 2: Survey Workshop Workshop

In this step, the organization completes the SGMM assessment survey under the direction of the SGMM Navigator. This step is composed of five steps.



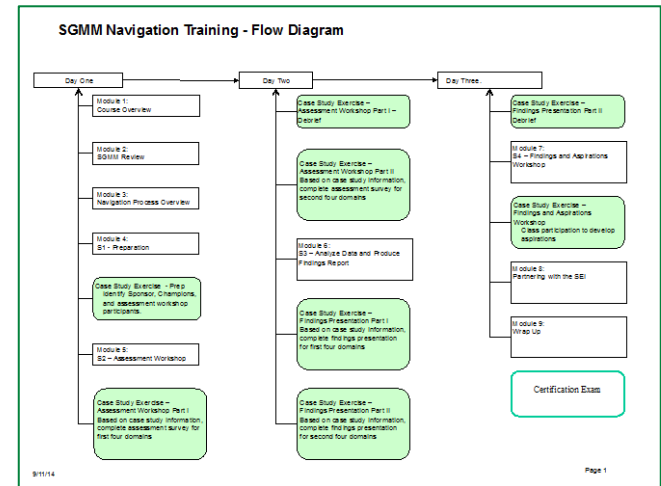
The sponsor kicks off the workshop and motivates the participants by explaining why this effort is important and describes the business objectives of the organization's grid modernization effort. The SGMM Navigator then provides an SGMM overview seminar to establish a common understanding and vocabulary of SGMM. The guidelines for completing the survey are discussed next and the survey is completed. The workshop ends with the SGMM Navigator thanking everyone for their efforts and describing the next steps.

### Process Elements Needed

- assessment workshop script
- assessment workshop agenda template
- assessment presentation template
- assessment survey support tool

Process Element	Purpose	Type	Format	Size
Overall script	To guide the Navigator through the overall process	script	Word	1-2 pgs
Schedule template	Provides the timing of the major steps of the navigation process	template	Word	1 pg
Process Improvement Proposal form	Provide SEI with suggestion for improving the SGMM product suite	form	Word	1 pg
FAQs for Navigators and Users	To provide answers to common questions that navigators as well as users and potential user may have	FAQ	Word	1-2 pgs each
Role and responsibility Specification	To identify the key roles in the SGMM Navigation Process and detail their responsibilities	specification	Word	1-2 pgs
Sponsor kickoff meeting guidelines	To prepare the sponsor to kickoff the overall effort at the facilitated assessment workshop	guideline	Word	1 pg

# Training/Workshops HLD



Component	Educational Objectives	SGMM Reference	Detail	Time Estimate (min)	Comments
<b>Day 1</b>					
Course Overview (Barbara)	<ul style="list-style-type: none"> <li>Get acquainted with the class</li> <li>Students understand the course focus and why it is important to them.</li> <li>Students know what to expect from the course and what is not covered.</li> </ul>		<ul style="list-style-type: none"> <li>Introductions</li> <li>Expectations</li> <li>Course overview (schedule and agenda)</li> </ul>	45	After the standard introduction and logistics, discuss challenges in working with electric utilities that are implementing smart grid. Introductions include background, experience with electric utilities and consulting with the utilities. The lecture ends with an overview of the class including the agenda. NOTE: need to save challenges so we can incorporate them into the course.
Review of the SGMM (Julia)	<p>The students can describe</p> <ul style="list-style-type: none"> <li>how the SGMM can support an electric utility.</li> <li>how each of the components of the product suite is related to each other.</li> <li>the 6 levels of the SGMM.</li> </ul>	<ul style="list-style-type: none"> <li>SGMM MDD</li> <li>Overview Seminar</li> <li>Assessment Survey</li> <li>Pre-test</li> </ul>	<ul style="list-style-type: none"> <li>How the SGMM helps utilities implement smart grid?</li> <li>Discuss components of the product suite</li> <li>SGMM Architecture</li> <li>What are the characteristics of the Levels and Domains?</li> </ul>	45	Discuss with the class what the challenges are for utilities that are participating in modernizing the grid. The outcome of the discussion is common ground on what the smart grid is. The instructor presents how the SGMM supports modernizing the grid. The next topic is on the SGMM product suite (how they fit together) and the SGMM architecture. This leads to a discussion about what the levels are (note: have small group discussions before class discussion). Ask if there are any questions about the pre-test. NOTE: create 5 questions for certification exam.



# Training Module/ Presentation DLD

**Lecture or Module:** Module 7: Findings and Aspirations Workshop

**Course:** SGMM Navigator Training

**Developer:** Barbara Tyson

**Delivery Choice / Instructional Materials:**

Lecture / slides

**Size:**

Number of lecture slides: 17

Number of workbook pages: ??

**Timing:**

Lecture: 45 minutes

Exercises: 90 minutes

**EDUCATIONAL OBJECTIVES:**

Students

- Understand the purpose and outcomes of the Findings and Aspirations workshop
- Describe the navigator's role including design, facilitation, and follow-up

**Transitional Flow**

The instructor continues to walk the students through the steps of the navigation process. This module covers step 4 of the process, the findings and aspiration workshop. This module includes a lecture that describes the fourth step of the process and a class exercise to give the students practice conducting an aspirations identification session.

**Learning Assessments**

Ask the following kinds of questions on the certification exam (15%? questions should come from this section.) Potential questions include:

- TBD later

**STORYBOARD (or at least a high level description)**

**Topics:**

- **Findings and Aspirations Workshop Overview**
- **Presentation of Findings**
- **Identifying Aspirations**
  - o **Review of Organization's Objectives**
  - o **Identifying Gaps Between Objectives and Findings**
  - o **Developing Aspirations Statements**
- **Identifying Next Steps and Workshop Closure**
- **After the Findings and Aspirations Workshop**
- **Aspirations Identification Exercise**

**Findings and Aspirations Workshop Overview**

**Slide 1: Entry Criteria:** The instructor will have the students open their resources notebook to the Findings and Aspirations Workshop tab. The slide will have a flow chart diagram of the five steps of the process. The instructor will provide a very quick overview of the process starting with the entry criteria. The instructor will note that each step will be discussed later in the lecture and that there will be an exercise simulating an identification of aspirations session. The instructor then has the students turn to the script.

**Slide 2. Workshop Kickoff.** The instructor explains the agenda template. The instructor will discuss the overall objectives of the workshop. It is important to discuss both the objectives related to the findings presentation and the identification of aspirations. The instructor leads a discussion on the importance of having the right people at the workshop. This is an opportunity for the sponsor to reinforce commitment to the process and restate the organization's business objectives.

**Presentation of Findings**

**Slide 3. Review of the Findings Presentation Template.** The instructor will quickly review the findings presentation template. The students should be very familiar with the template because they presented their "findings" in the previous exercise. However, if there are any lingering questions, they can be answered here.

**Slide 4. . Presentation of Findings.** The instructor will describe how the presentation of the findings will be conducted. The instructor will lead a discussion on possible interactions during the presentation of the findings. For example, there may be questions regarding how a particular finding was developed; or there may be disagreement with some findings.

**Identifying Aspirations**

# Documents - HLD

## SGMM Leadership Workshop Special Report – High-Level Design

Component	Objectives	Reference (used by writer)	Detail	Size Est. (pgs)	Comments
Acknowledgments	Thank <b>Objectives:</b> participants <b>Objectives:</b> sponsor <b>Objectives:</b> workshop coordinators		One paragraph	1	We'll include TCS as a participant since they sent us input for the workshop.
Executive Summary	Not needed for this report.				The report will be highly organized and easy to navigate so we don't think we need an executive summary.
Abstract	Descriptive summary of the report		Not more than 200 words	.5	Abstracts are descriptive or informative. A descriptive abstract just summarizes the structure of report. A descriptive abstract does not draw conclusions or "sum up" the report or go into the content of the report.
Workshop Overview	Document the purpose of the workshop and how it was conducted.	Workshop <b>Objectives:</b> product plan <b>Objectives:</b> invitation emails <b>Objectives:</b> DLDs <b>Objectives:</b> overview slides	<b>Objectives:</b> Workshop Objectives <b>Objectives:</b> Workshop Participants (by name and company) <b>Objectives:</b> Workshop logistics (date, location, agenda) <b>Objectives:</b> Workshop style (brainstorming and consensus building)	2	
About This SR	Tell the reader <b>Objectives:</b> what is in the report (and what isn't in the report) <b>Objectives:</b> report structure (by topic, not agenda)			1	Write this section last.

# Implementation

The following slides show the team accomplishments with what we produced.

# SGMM at a glance

## 6 Maturity Levels: Defined sets of characteristics and outcomes

<p><b>5</b></p> <ul style="list-style-type: none"> <li>1 Smart grid strategy capitalizes on smart grid as a foundation for the introduction of new services and product offerings.</li> <li>2 Smart grid business activities provide sufficient financial resources to enable continued investment in smart grid sustainment and expansion.</li> <li>3 New business model opportunities emerge as a result of smart grid capabilities and are implemented.</li> </ul>	<ul style="list-style-type: none"> <li>1 The organizational structure enables collaboration with other grid stakeholders to optimize overall grid operation and health.</li> <li>2 The organization is able to readily adapt to support new ventures, products, and services that emerge as a result of smart grid.</li> <li>3 Channels are in place to harvest ideas, develop them, and regard those who help shape future advances in process, workflow complexities, and technology.</li> </ul>	<ul style="list-style-type: none"> <li>1 Self-healing capabilities are present.</li> <li>2 System-wide, analytics-based, and automated grid decision making is in place.</li> </ul>	<ul style="list-style-type: none"> <li>1 The use of assets between and across supply chain participants is optimized with processes defined and executed across the supply chain.</li> <li>2 Assets are leveraged to maximize utilization, including just-in-time asset retirement, based on smart grid data and systems.</li> </ul>	<ul style="list-style-type: none"> <li>1 Autonomic computing and machine learning are implemented.</li> <li>2 The enterprise information infrastructure can automatically identify, mitigate, and recover from cyber incidents.</li> </ul>	<ul style="list-style-type: none"> <li>1 Customers can manage their end-to-end energy supply and usage levels.</li> <li>2 There is automatic outage detection at premise or device level.</li> <li>3 Plug-and-play, customer-based generation is supported.</li> <li>4 Security and privacy for all customer data is assured.</li> <li>5 The organization plays a leadership role in industry-wide information sharing and standards development efforts for smart grid.</li> </ul>	<ul style="list-style-type: none"> <li>1 The optimization of energy assets is automated across the full value chain.</li> <li>2 Resources are adequately dispatchable and controllable so that the organization can take advantage of granular market options.</li> <li>3 The organization's automated control and resource optimization schemes consider and support regional and/or national grid optimization.</li> </ul>	<ul style="list-style-type: none"> <li>1 Triple bottom line goals align with local, regional, and national objectives.</li> <li>2 Customers control their energy-based environmental footprints through automatic optimization of their end-to-end energy supply and usage level (energy source and mix).</li> <li>3 The organization is a leader in developing and promoting industry-wide resilience best practices and/or technologies for protection of the national critical infrastructure.</li> </ul>
<p><b>4</b></p> <ul style="list-style-type: none"> <li>1 Smart grid vision and strategy drive the organization's strategy and direction.</li> <li>2 Smart grid is a core competency throughout the organization.</li> <li>3 Smart grid strategy is shared and revised collaboratively with external stakeholders.</li> </ul>	<ul style="list-style-type: none"> <li>1 Management systems and organizational structure are capable of taking advantage of the increased visibility and control provided through smart grid.</li> <li>2 There is end-to-end grid observability that can be leveraged by internal and external stakeholders.</li> <li>3 Decision making occurs at the closest point of need as a result of an efficient organizational structure and the increased availability of information due to smart grid.</li> </ul>	<ul style="list-style-type: none"> <li>1 Operational data from smart grid deployments is being used to optimize processes across the organization.</li> <li>2 Grid operational management is based on near real-time data.</li> <li>3 Operational forecasts are based on data gathered through smart grid.</li> <li>4 Grid operations information has been made available across functions and LOBs.</li> <li>5 There is automated decision-making within protection schemes that is based on wide-area monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>1 A complete view of assets based on status, connectivity, and proximity is available to the organization.</li> <li>2 Asset models are based on real performance and monitoring data.</li> <li>3 Performance and usage of assets is optimized across the asset fleet and across asset classes.</li> <li>4 A service life for key grid components is managed through condition-based and predictive maintenance, and is based on real and current asset data.</li> </ul>	<ul style="list-style-type: none"> <li>1 Data flows end to end from customer to generation.</li> <li>2 Business processes are optimized by leveraging the enterprise IT architecture.</li> <li>3 Systems have sufficient wide-area situational awareness to enable real-time monitoring and control for complex events.</li> <li>4 Predictive modeling and near real-time simulation are used to optimize request processes.</li> <li>5 Performance is improved through sophisticated systems that are informed by smart grid data.</li> <li>6 Security strategy and tactics continually evolve based on changes in the threat landscape.</li> </ul>	<ul style="list-style-type: none"> <li>1 Support is provided to customers to help analyze and compare usage against all available pricing programs.</li> <li>2 There is outage detection and proactive notification at the circuit level.</li> <li>3 Customers have access to near real-time data on their own usage.</li> <li>4 Residential customers participate in demand response and/or ability-managed remote load control programs.</li> <li>5 Automatic response to pricing signals for devices within the customer's premise is supported.</li> <li>6 In-home net billing programs are enabled.</li> <li>7 A common customer experience has been integrated.</li> </ul>	<ul style="list-style-type: none"> <li>1 Energy resources (including Volt/VAR, DG, and DR) are dispatchable and tradable.</li> <li>2 Portfolio optimization models that encompass available resources and real-time markets are implemented.</li> <li>3 Secure two-way communications with Home Area Networks (HANs) are available.</li> <li>4 Visibility and potential control of customer large-demand appliances to balance demand and supply is available.</li> </ul>	<ul style="list-style-type: none"> <li>1 The organization collaborates with external stakeholders to address environmental and societal issues.</li> <li>2 A public environmental and societal scoreboard is maintained.</li> <li>3 Programs are in place to shave peak demand.</li> <li>4 End-user energy usage and devices are actively managed through the utility's network.</li> <li>5 The organization fulfills its critical infrastructure assurance goals for resiliency, and contributes to those of the region and the nation.</li> </ul>
<p><b>3</b></p> <ul style="list-style-type: none"> <li>1 The smart grid vision, strategy, and business case are incorporated into the vision and strategy.</li> <li>2 A smart grid governance model is established.</li> <li>3 Smart grid leaders with explicit authority across functions and lines of business are designated to ensure effective implementation of the smart grid strategy.</li> <li>4 Required authorizations for smart grid investments have been secured.</li> </ul>	<ul style="list-style-type: none"> <li>1 The smart grid vision and strategy are driving organizational change.</li> <li>2 Smart grid measures are incorporated into the measurement system.</li> <li>3 Performance and compensation are linked to smart grid success.</li> <li>4 Leadership is consistent in communication and actions regarding smart grid.</li> <li>5 A matrix or overlay structure is in place.</li> <li>6 Education and training are underway.</li> </ul>	<ul style="list-style-type: none"> <li>1 Smart grid information is available across systems and organizational functions.</li> <li>2 Control analytics have been implemented and are used to improve cross-LOB decision-making.</li> <li>3 Grid operations planning is now fact-based using grid data made available to all relevant stakeholders.</li> </ul>	<ul style="list-style-type: none"> <li>1 Performance, trend analysis, and event audit data are available for components of the organization's systems.</li> <li>2 CBM programs for key components are in place.</li> <li>3 Remote asset monitoring capabilities are integrated with asset management.</li> </ul>	<ul style="list-style-type: none"> <li>1 Smart grid-impacted business processes are aligned with the enterprise IT architecture across LOBs.</li> <li>2 Systems adhere to an enterprise IT architectural framework for smart grid.</li> <li>3 Smart grid-specific technology has been implemented to improve cross-LOB performance.</li> </ul>	<ul style="list-style-type: none"> <li>1 The organization tailors programs to customer segments.</li> <li>2 Two-way meter communication has been deployed.</li> <li>3 A remote connect/disconnect capability is deployed.</li> <li>4 Demand response and/or remote load control is available to customers.</li> <li>5 There is automatic outage detection at the substation level.</li> </ul>	<ul style="list-style-type: none"> <li>1 An integrated resource plan is in place and includes new targeted resources and technologies.</li> <li>2 Customer premise energy management solutions with market and usage information are enabled.</li> <li>3 Additional resources are available and deployed to provide enhanced service reliability or other value chain benefits.</li> </ul>	<ul style="list-style-type: none"> <li>1 Performance of societal and environmental programs are measured and effectiveness is demonstrated.</li> <li>2 Segmented and tailored information that includes environmental and societal benefits and costs is available to customers.</li> <li>3 Programs to encourage off-peak usage by customers are in place.</li> <li>4 The organization regularly reports on the sustainability and the societal and environmental impacts of its smart grid programs and technologies.</li> </ul>
<p><b>175 Characteristics: Features you would expect to see at each stage of the smart grid journey</b></p>							
<p><b>2</b></p> <ul style="list-style-type: none"> <li>1 An initial smart grid strategy and a business plan are approved by management.</li> <li>2 A common smart grid vision is accepted across the organization.</li> <li>3 Operational investment is explicitly aligned to the smart grid strategy.</li> <li>4 Budgets are established specifically for funding the implementation of the smart grid vision.</li> <li>5 There is collaboration with regulators and other stakeholders regarding implementation of the smart grid vision and strategy.</li> <li>6 There is support and funding for conducting proof-of-concept projects to evaluate feasibility and alignment.</li> </ul>	<ul style="list-style-type: none"> <li>1 A new vision for a smart grid environment is articulated in a smart grid environment vision statement.</li> <li>2 The organization has aligned most operations around end-to-end processes.</li> <li>3 Most smart grid implementation and deployment teams include participants from all functions and LOBs that the deployment will impact.</li> <li>4 Education and training to build smart grid competencies have been identified and are available.</li> <li>5 The linking of performance and compensation plans to achieve smart grid milestones is in progress.</li> </ul>	<ul style="list-style-type: none"> <li>1 Which resource is resource is recognized or organized resource.</li> <li>2 Aside from SCADA, piloting of remote asset monitoring of key grid assets to support manual decision making is underway.</li> <li>4 Investment in and expansion of data communications networks in support of grid operations is underway.</li> </ul>	<ul style="list-style-type: none"> <li>4 An enterprise level or use to asset monitoring based on location, status, and interconnectivity (model) has been developed.</li> <li>3 An organization-wide mobile workforce strategy is in development.</li> </ul>	<ul style="list-style-type: none"> <li>1 Standards are selected to support the smart grid strategy within the enterprise IT architecture.</li> <li>4 A common technology evaluation and selection process is applied for all smart grid activities.</li> <li>5 There is a data communications strategy for the grid.</li> <li>6 Pilots based on connectivity to distributed EEs are underway.</li> <li>7 Security is built into all smart grid initiatives from the outset.</li> </ul>	<ul style="list-style-type: none"> <li>3 The organization is modeling the reliability of grid equipment.</li> <li>4 Remote connect/disconnect is being piloted for residential customer usage.</li> <li>5 The impact on the customer of new services and delivery processes is being assessed.</li> <li>6 Security and privacy requirements for customer protection are specified for smart grid-related pilot projects and RFPs.</li> </ul>	<ul style="list-style-type: none"> <li>1 The vision statement has been incorporated into the smart grid capabilities.</li> <li>3 Pilots to support a diverse resource portfolio have been conducted.</li> <li>4 Secure transactions have been piloted with an expanded portfolio of value chain partners.</li> </ul>	<ul style="list-style-type: none"> <li>1 Smart-grid strategies and work plans address societal and environmental issues.</li> <li>2 Energy efficiency programs for customers have been established.</li> <li>3 The organization considers a "triple bottom line" view when making decisions.</li> <li>4 Environmental proof-of-concept projects are underway that demonstrate smart grid benefits.</li> <li>5 Increasingly granular and more frequent consumption information is available to customers.</li> </ul>
<p><b>1</b></p> <ul style="list-style-type: none"> <li>1 Smart grid vision is developed with a goal of operational improvement.</li> <li>2 Experimental implementations of smart grid concepts are supported.</li> <li>3 Discussions have been held with regulators about the organization's smart grid vision.</li> </ul>	<ul style="list-style-type: none"> <li>1 The organization has articulated its need to build smart grid competencies in its workforce.</li> <li>2 Leadership has demonstrated a commitment to change the organization in support of achieving smart grid.</li> <li>3 Smart grid awareness efforts to inform the workforce of smart grid activities have been initiated.</li> </ul>	<ul style="list-style-type: none"> <li>1 Business cases for new equipment and systems related to smart grid are approved.</li> <li>2 New sensors, switches, and communications technologies are evaluated for grid monitoring and control.</li> <li>3 Proof-of-concept projects and component testing for grid monitoring and control are underway.</li> <li>4 Usage and distribution management systems linked to substation automation are being explored and evaluated.</li> <li>5 Safety and security (physical and cyber) requirements are being defined.</li> </ul>	<ul style="list-style-type: none"> <li>1 Enhancements to work and asset management have been built into approved business cases.</li> <li>2 Potential uses of remote asset monitoring are being evaluated.</li> <li>3 Asset and workforce management equipment and systems are being evaluated for their potential alignment to the smart grid vision.</li> </ul>	<ul style="list-style-type: none"> <li>1 An enterprise IT architecture exists or is under development.</li> <li>2 Existing or proposed IT architecture has been evaluated for quality attributes that support smart grid applications.</li> <li>3 A change control process is used for applications and IT infrastructure.</li> <li>4 Opportunities are identified to use technology to improve departmental performance.</li> <li>5 There is a process to evaluate and select technologies in alignment with smart grid vision and strategies.</li> </ul>	<ul style="list-style-type: none"> <li>1 Research is being conducted on how to use smart grid technologies to enhance the customer's experience, benefits, and participation.</li> <li>2 Security and privacy implications of smart grid are being investigated.</li> <li>3 A vision of the future grid is being communicated to customers.</li> <li>4 The utility consults with public utility commissions and/or other government organizations concerning the impact on customers.</li> </ul>	<ul style="list-style-type: none"> <li>1 Assets and programs necessary to facilitate load management are identified.</li> <li>2 Distributed generation sources and the capabilities needed to support them are identified.</li> <li>3 Energy storage options and the capabilities needed to support them are identified.</li> <li>4 There is a strategy for creating and managing a diverse resource portfolio.</li> <li>5 Security requirements to enable interaction with an expanded portfolio of value chain partners have been identified.</li> </ul>	<ul style="list-style-type: none"> <li>1 The smart grid strategy addresses the organization's role in societal and environmental issues.</li> <li>2 The environmental benefits of the smart grid vision and strategy are publicly promoted.</li> <li>3 Environmental compliance performance records are available for public inspection.</li> <li>4 The smart grid vision or strategy specifies the organization's role in protecting the nation's critical infrastructure.</li> </ul>
<p><b>0</b></p> <p><b>SMR</b> Strategy, Management, &amp; Regulatory</p>	<p><b>OS</b> Organization &amp; Structure</p>	<p><b>GO</b> Grid Operations</p>	<p><b>WAM</b> Work &amp; Asset Management</p>	<p><b>TECH</b> Technology</p>	<p><b>CUST</b> Customer</p>	<p><b>VCI</b> Value Chain Integration</p>	<p><b>SE</b> Societal &amp; Environmental</p>

## 8 Domains: Logical groupings of smart grid related characteristics



# WAM Work and Asset Management

<b>PIONEERING</b> <b>5</b>	<ol style="list-style-type: none"> <li>1 The use of assets between and across supply chain participants is optimized with processes defined and executed across the supply chain.</li> <li>2 Assets are leveraged to maximize utilization, including just-in-time asset retirement, based on smart grid data and systems.</li> </ol>
<b>OPTIMIZING</b> <b>4</b>	<ol style="list-style-type: none"> <li>1 A complete view of assets based on status, connectivity, and proximity is available to the organization.</li> <li>2 Asset models are based on real performance and monitoring data.</li> <li>3 Performance and usage of assets is optimized across the asset fleet and across asset classes.</li> <li>4 Service life for key grid components is managed through condition-based and predictive maintenance, and is based on real and current asset data.</li> </ol>
<b>INTEGRATING</b> <b>3</b>	<ol style="list-style-type: none"> <li>1 Performance, trend analysis, and event audit data are available for components of the organization's systems.</li> <li>2 CBM programs for key components are in place.</li> <li>3 Remote asset monitoring capabilities are integrated with asset management systems.</li> <li>4 Asset models are based on real performance and monitoring data.</li> <li>5 Performance and usage of assets is optimized across the asset fleet and across asset classes.</li> <li>6 Service life for key grid components is managed through condition-based and predictive maintenance, and is based on real and current asset data.</li> <li>7 Modeling of asset investments for key components is underway.</li> </ol>
<b>ENABLING</b> <b>2</b>	<ol style="list-style-type: none"> <li>1 An approach to track, inventory, and maintain event histories of assets is in development.</li> <li>2 An integrated view of GIS for asset monitoring based on smart grid capabilities is in development.</li> <li>3 Remote asset monitoring capabilities are being evaluated.</li> <li>4 Asset models are based on real performance and monitoring data.</li> <li>5 Performance and usage of assets is optimized across the asset fleet and across asset classes.</li> <li>6 Service life for key grid components is managed through condition-based and predictive maintenance, and is based on real and current asset data.</li> <li>7 Modeling of asset investments for key components is underway.</li> </ol>
<b>INITIATING</b> <b>1</b>	<ol style="list-style-type: none"> <li>1 An approach to track, inventory, and maintain event histories of assets is in development.</li> <li>2 An integrated view of GIS for asset monitoring based on smart grid capabilities is in development.</li> <li>3 Remote asset monitoring capabilities are being evaluated.</li> <li>4 Asset models are based on real performance and monitoring data.</li> <li>5 Performance and usage of assets is optimized across the asset fleet and across asset classes.</li> <li>6 Service life for key grid components is managed through condition-based and predictive maintenance, and is based on real and current asset data.</li> <li>7 Modeling of asset investments for key components is underway.</li> </ol>
<b>DEFAULT</b> <b>0</b>	

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

WAM-2.1 An approach to track, inventory, and maintain event histories of assets is in development.

# SGMM Compass Survey

## Contains

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

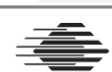
## Example questions:

**WAM-3.2** For what percentage of key components have you implemented condition-based maintenance that uses real-time data from asset monitoring to drive maintenance and replacement decisions?

- 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



# SGMM Navigation: five-phase, expert-led process



## Stakeholders complete SGMM Compass survey

Discussion and consensus  
answers lead to internal  
alignment on current state

## Stakeholders review survey findings & set aspirational profile

Consensus on aspirational state  
and identification of motivations,  
actions, and obstacles to achieve it

# SGMM Partners

SGMM Partners are licensed by the SEI to provide official SGMM services, which are delivered by SEI-certified SGMM Navigators.

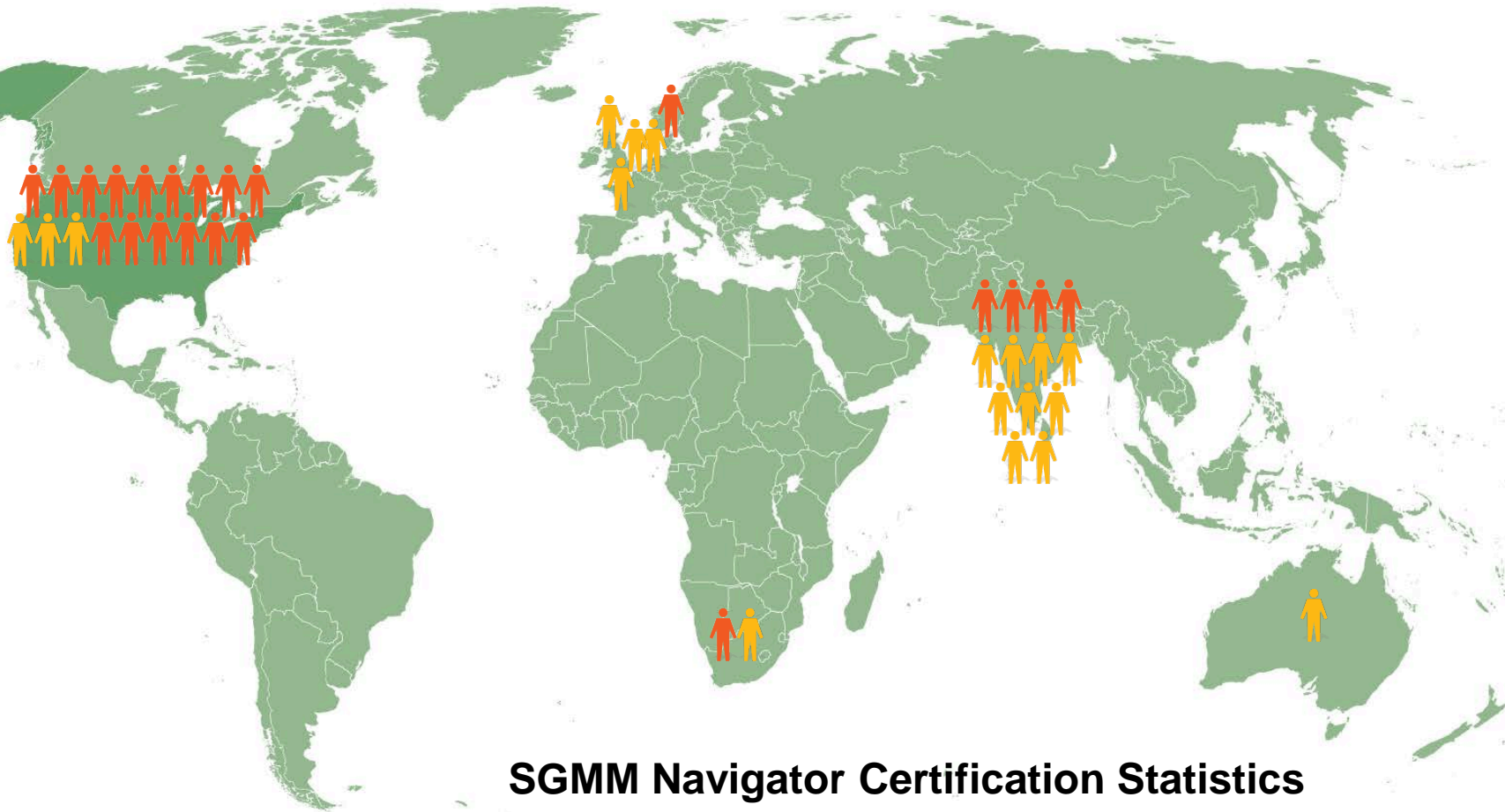


John F. Ryskowski Consulting



<http://partners.clearmodel.com/partners>

# SGMM Navigator population



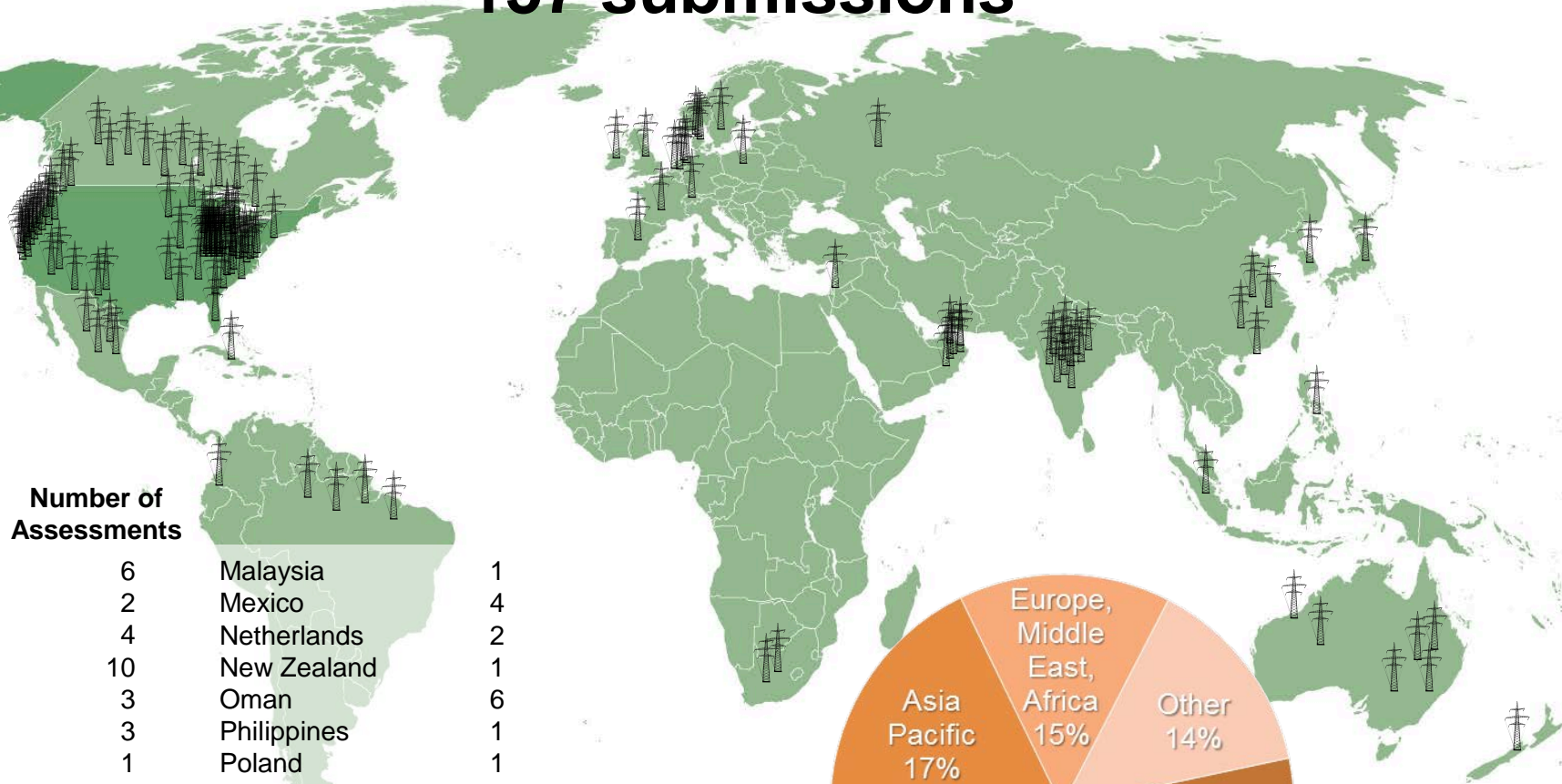
18 Candidate Navigators (*passed exam*)



18 Certified Navigators (*completed all requirements*)

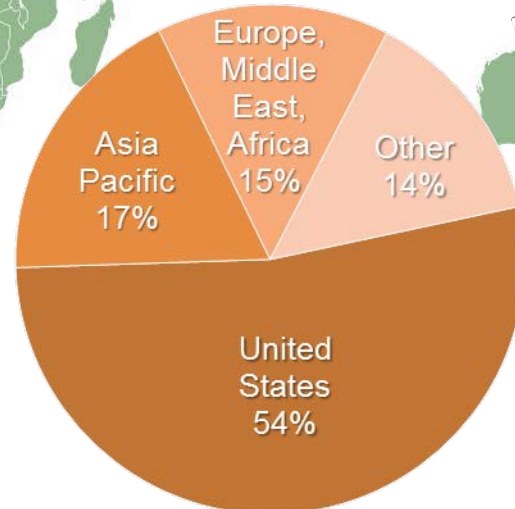


# SGMM History – 142 utilities, 29 countries, 157 submissions



**Number of Assessments**

Country	Number of Assessments
Australia	6
Belgium	2
Brazil	4
Canada	10
China	3
Denmark	3
Ecuador	1
France	1
Hong Kong	1
India	13
Ireland	1
Israel	1
Jamaica	1
Japan	1
Korea, Republic of	1
Malaysia	1
Mexico	4
Netherlands	2
New Zealand	1
Oman	6
Philippines	1
Poland	1
Russian Federation	1
South Africa	2
Spain	1
Sweden	1
Switzerland	1
U.K.	1
United States	85



# SGMM in the press



### LOGGING ON TO SMART GRID

Identify values they see on the Smart Grid landscape.

- Develop a shared Smart Grid vision and roadmap.
- Communicate with internal and external stakeholders using a common language.
- Proactively engage and support decision-making.
- Ensure benefits to the end of the commodity.

Competition on a common basis, which promotes reliable internal development of smart grids and shared information. While working and analyzing the way, the language leads to a shared roadmap to ensure the energy needs and the business to consumers' expectations in an open spirit, providing information, and to discuss related infrastructure, efficiency, and improved services. These steps are essential inputs into the utility's Smart Grid planning and implementation process.

**SELF-ASSESSMENT**

Utilities can also complete the SGMM Compass independently. Just as with a scoring system with varying and scores for each domain in the model, as well as aggregate data from the other utilities that have completed the survey for a comparative analysis. Utilities choosing the self-assessment option will also have access to distributed modeling to help interpret the results.

In a small utility, the SGMM Navigator process yields a mature profile of the utility's current state and a greater than of shared information, as well as a shared completion of milestones, actions, and objectives to realize the intended application.

Table 1 summarizes activities, actions, and objectives determined by 10 utilities that participated in the SGMM Navigator in 2011. Showing three cases between utilities and their associated partners can help facilitate collaboration more effectively.

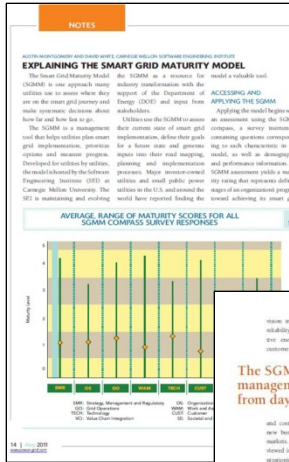
**The Growing SGMM Community**

SGMM now enjoys broad-based attention around utilities to realize smart grids. Many are pursuing SGMM implementation, others are just beginning to think about Smart Grid. The way to build the SGMM model is to work with the community, but all have reported benefits from using the community model.

For utilities that have not yet embarked on a Smart Grid program, SGMM has been a useful tool to help management take a step back from the day-to-day activity, focus cross-departmental discussion and consensus, assess program and other plans for the future. A number of utilities have also used SGMM assessment over time using the model to monitor to assess program and other plans for the future.

SGMM is working hard to realize the benefits of smart grid," said Joe Kowal, Director of smart grid at San Diego Gas & Electric Co. (SDG&E). "Going through the SGMM Navigator process with our cross-cutting smart grid team gave us an opportunity to take a step back to share ideas, perspectives and take stock of our Smart Grid program."

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The SGMM is useful to help management take a step back from day-to-day activity.

### Smart Grid Maturity Model Promotes Manufacturer-Utility Partnerships

Utilities have two options for conducting an SGMM assessment and using the model's results: an SGMM Navigator or completing a self-assessment. Information about the SGMM, including downloadable model artifacts, guidance on using the model and details on the SGMM Navigator process (including becoming a certified SGMM Navigator), is available at <http://www.sei.cmu.edu/sgmm/>. (See Figure 1 for maturity results.)

**USER EXPERIENCES**

SGMM users range from large investment-owned utilities to small municipalities in the U.S. and around the world. Some are pioneers in smart grid implementation, others are just thinking about smart grid. The way in which they use the model differs according to their circumstances, but all have reported benefits from using the community model.

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High Voltage Test Equipment

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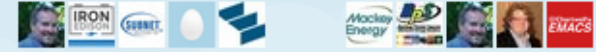
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David White  
SGMM Project Manager

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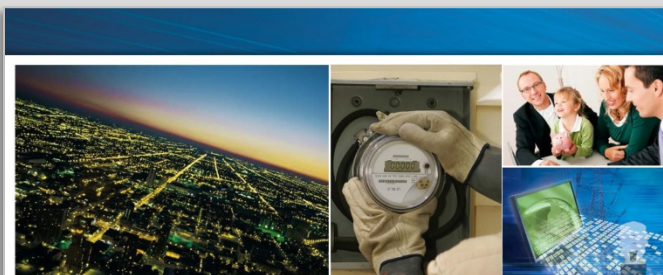
World Energy Council

March 30, 2009

Software Engineering Institute | Carnegie Mellon

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<http://resources.sei.cmu.edu/library/asset-view.cfm?assetid=18614>



**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



<http://resources.sei.cmu.edu/library/asset-view.cfm?assetid=22004>

# Overall lessons learned

Need better methods to conduct requirements analysis

We didn't gather usable historical data

Stickiness – worked great on this project, but team members didn't transfer approach to other projects

Quality was a “journey”

The project produced two complete versions of the product suite with the same budget that was used to produce one document prior to the adoption of TSP

Overall...

# Zero depth entry enabled synchronized team



# Contact Information

**Julia Mullaney**

SGMM Project Manager

[jlg@sei.cmu.edu](mailto:jlg@sei.cmu.edu)

865-558-8819

**Summer Fowler**

Deputy Technical Director CS2

[sfowler@cert.org](mailto:sfowler@cert.org)

412-268-9639

[www.sei.cmu.edu/smartgrid](http://www.sei.cmu.edu/smartgrid)

[info@sei.cmu.edu](mailto:info@sei.cmu.edu)

# Notices

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# A major power grid transformation is underway

## How can utilities

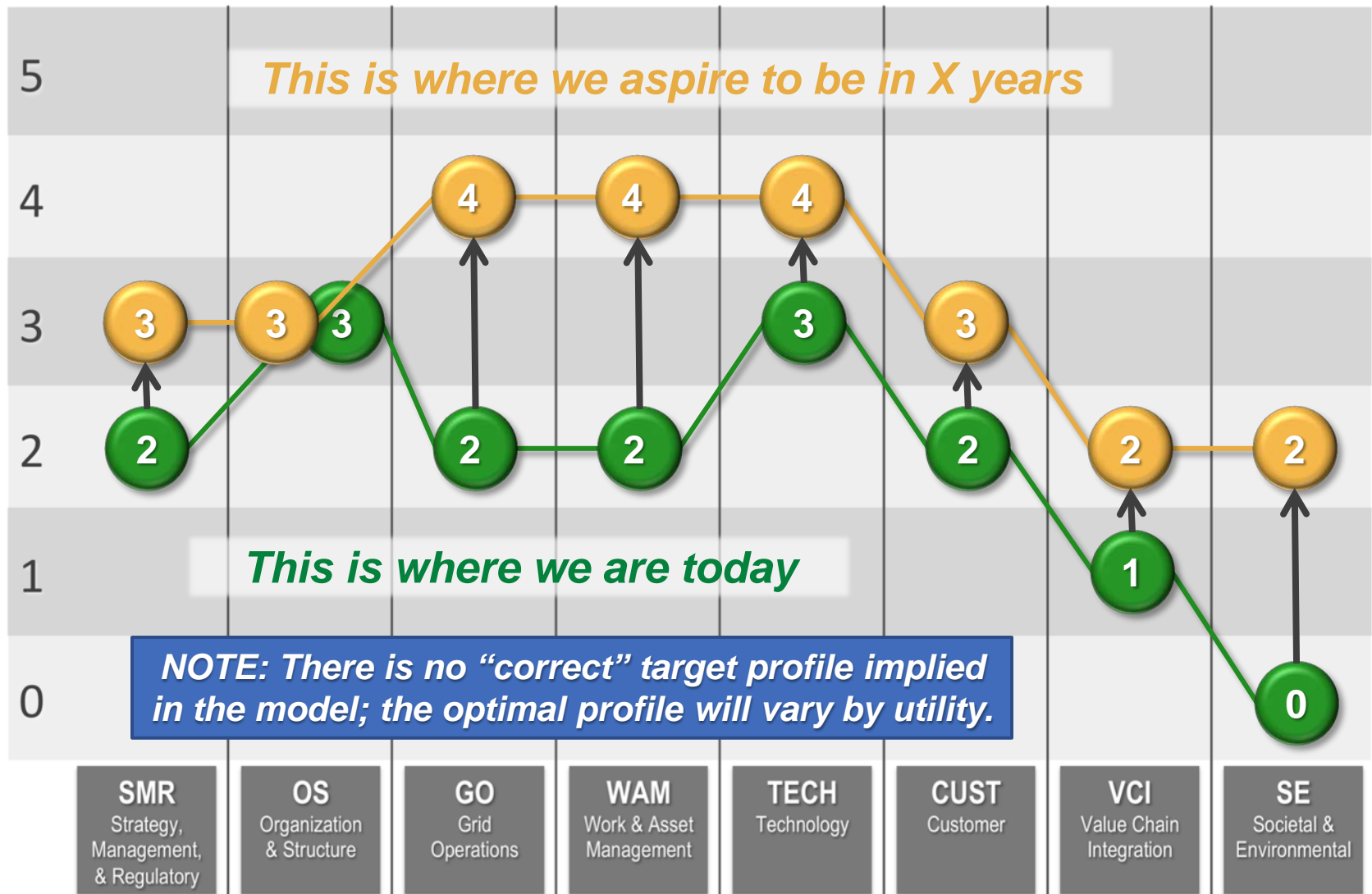
- Develop effective roadmaps?
- Track progress?
- Understand their posture in comparison to peers?

**The Smart Grid Maturity Model was developed by utilities to address these concerns**

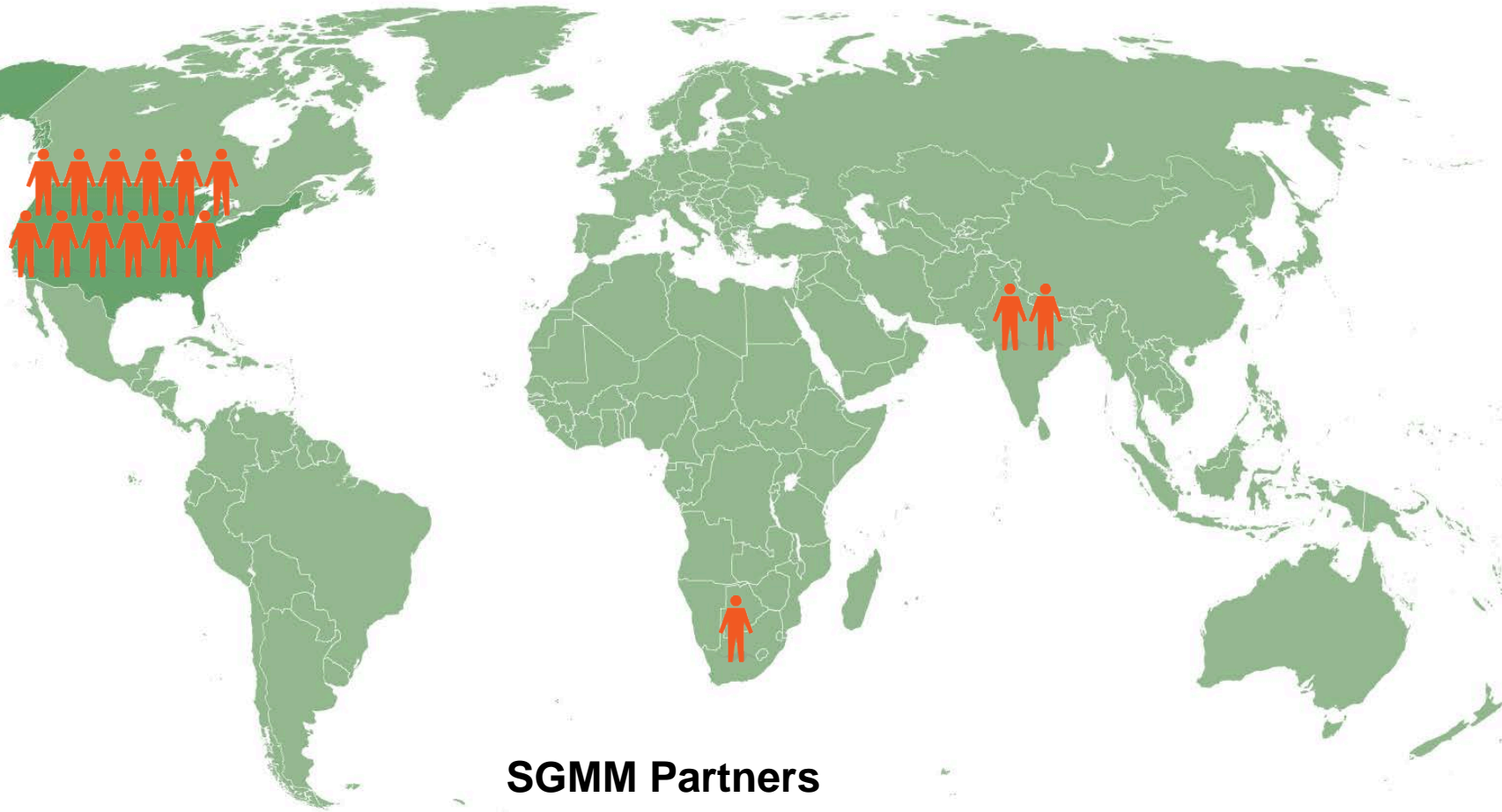


# Navigation results: consensus aspirations

*example results*



# SGMM Partner population



## SGMM Partners

 12 USA, 2 India, 1 South Africa

# SGMM History – 142 utilities, 29 countries, 157 submissions

AES Electropaulo  
 Alameda Municipal Power  
 Allegheny Power  
 Alliander  
 Ameren Illinois  
 Ameren Missouri  
 American Electric Power  
 APCPDCL  
 ATCO Electric  
 ATCO Gas  
 Ausnet  
 Austin Energy  
 AZUSA Light and Water  
 BC Hydro  
 BESCOM  
 Bonneville Power Admin.  
 BSES-Rajdhani  
 BSES Yamuna Power Limited  
 Burbank Water and Power  
 CELPE  
 CenterPoint Energy  
 Centro Sur  
 CESC Limited  
 CESC, Mysore  
 CFE (Mexico) Gulfonorte  
 CFE (Mexico) Jalisco  
 CFE (Mexico) Peninsular  
 Chelan County PUD  
 CitiPower and Powercor Australia Ltd  
 City of Anaheim  
 City of Columbus  
 City of Danville  
 City of Dover  
 City of Hamilton  
 City of Hudson  
 City of Jackson  
 City of Napoleon

City of Painesville  
 City of Palo Alto  
 City of Piqua Power System  
 City of Riverside Public Utilities  
 City of Wapakoneta  
 City of Westerville  
 CLP Power  
 Coldwater Board of Public Utilities  
 Comisión Federal de Electricidad-  
 Corporativo  
 Country Energy  
 CPFL Paulista  
 Dhofar Power Company S.A.O.C.  
 Dominion Virginia Power  
 DONG Energy Sales & Distribution A/S  
 DPSC Limited  
 DTE Energy  
 Duke Energy  
 Eandis  
 East Miss EPA  
 EDF Energy Networks Branch  
 EDP - Energias do Brasil, S.A.  
 EnergyAustralia  
 Enexis  
 Energy  
 EPCOR Distribution & Transmission  
 Ephrata Borough  
 ERDF  
 ESB Networks  
 Eskom Holdings SOC Limited  
 eThekweni Municipality, Electricity Unit  
 Exelon/ComEd  
 Exelon/PECO Energy  
 FirstEnergy  
 Fortum  
 Glendale Water & Power  
 Guangdong Power Co.

Holland Board of Public Works  
 Hydro One  
 Hydro One - Distribution  
 Hydro Ottawa Limited  
 IEC  
 Imperial Irrigation District  
 Integral Energy  
 Intergys  
 Jamaica Public Service Company  
 KEPCO  
 Los Angeles Department of Water and  
 Power  
 Majan Electricity Company S.A.O.C.  
 Manila Electric Company  
 Manitoba Hydro - T&D  
 Marietta Board of Lights and Water  
 Mazoon Electricity Company  
 Memphis Light, Gas and Water Division  
 MSEDCL  
 Muscat Electricity Distribution Company  
 S.A.O.C  
 Muscatine Power & Water  
 Nashville Electric Service  
 NB Power  
 NDPL  
 Noida Power Company Limited  
 Oberlin Municipal Light & Power System  
 Oman Electricity Transmission Co.  
 Pasadena Water and Power  
 Pepco Holdings/PHI  
 PG&E  
 PGN Carolina  
 PGN Florida  
 PNM  
 Portland General Electric  
 PPL Electric Utilities  
 Princeton Electric Plant Board

Progress Energy  
 Puget Sound  
 Redding  
 Reliance Energy  
 Roseville Electric  
 Rural Areas Electricity Company  
 Sacramento Municipal Utility District  
 Salt River Project  
 Santee Cooper  
 SCANA  
 SDG&E  
 SIG Geneva  
 Silicon Valley Power  
 SMEPC - International Cooperation Dept.  
 Snohomish  
 Southern Company  
 Tata Power  
 Tenaga Nasional Berhad  
 Tokyo Electric Power Co.  
 Toronto Hydro Electric System Ltd.  
 Town of Front Royal  
 Tucson Electric Power  
 UGVCL  
 Unión Fenosa Distribución  
 Unison Networks Limited  
 Vattenfall Distribution  
 VELCO  
 Village of Carey, Ohio  
 Village of Clinton  
 Village of Oak Harbor  
 Village of Yellow Springs  
 Wadsworth Electric And Communications  
 Wyandotte Municipal Service  
 Xcel Energy  
 Yantarenergo  
 Zhejiang Jiaying Electric Power Bureau

# Color chart



**Green**

**Utility as-is**

R=4, G=129, B=60



**Gold**

**Utility to-be**

R=231, G=172, B=67



**Blue**

**Full Community**

R=64, G=108, B=187



**Orange**

**Peer Community**

R=222, G=102, B=33