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
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 **programmatic approach** and track their progress.
Global Intelligent Utility Network Coalition (GIUNC) develops SGMM

Utilities use SGMM v1.0

Software Engineering Institute serves as model steward

SEI releases SGMM v1.1 product suite

Licensing & certification program for SGMM Navigation begins

SEI releases SGMM v1.2 product suite

Developed by utilities for utilities
Software Engineering Institute

SEI is a federally-funded research and development center at Carnegie Mellon University, a global university recognized worldwide for its energy and environmental research initiatives.

A trusted, objective source of best practices, methods and tools to organizations worldwide, SEI is a global leader in software and systems engineering, process improvement and security best practices – all critical elements of smart grid success.

SEI collaborates in public-private partnership with government and industry on important cyber security, architecture, and interoperability challenges of the smart grid.
SEI’s Role as Steward of the SGMM

Provide **governance** working with multiple stakeholders

Enable **widespread availability**, adoption, and use of the model for the benefit of the community

**Evolve the model** based on stakeholder needs, market developments, user feedback, and interactions with domain experts

Develop **transition** mechanisms—education, training, awareness, research collaboration—to support the model

Grow the SGMM **community** of users worldwide
SMR: Strategy, Management, & Regulatory

OS: Organization & Structure

GO: Grid Operations

WAM: Work & Asset Management

TECH: Technology

CUST: Customer

VCI: Value Chain Integration

SE: Societal & Environmental

8 Domains: Logical groupings of smart grid related characteristics
## Smart Grid Maturity Model – levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0</strong></td>
<td>Default level (status quo)</td>
</tr>
<tr>
<td><strong>1</strong></td>
<td>Initiating</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Enabling</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Integrating</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Optimizing</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Pioneering</td>
</tr>
</tbody>
</table>
# Smart Grid Maturity Model – domains

<table>
<thead>
<tr>
<th>SMR</th>
<th>Strategy, Mgmt &amp; Regulatory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vision, planning, governance, stakeholder collaboration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OS</th>
<th>Organization and Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Culture, structure, training, communications, knowledge mgmt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GO</th>
<th>Grid Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reliability, efficiency, security, safety, observability, control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WAM</th>
<th>Work &amp; Asset Management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Asset monitoring, tracking &amp; maintenance, mobile workforce</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TECH</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IT architecture, standards, infrastructure, integration, tools</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CUST</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pricing, customer participation &amp; experience, advanced services</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VCI</th>
<th>Value Chain Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Demand &amp; supply management, leveraging market opportunities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SE</th>
<th>Societal &amp; Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Responsibility, sustainability, critical infrastructure, efficiency</td>
</tr>
<tr>
<td>Component</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Model</td>
<td>Fully described in the Model Definition document</td>
</tr>
<tr>
<td>Compass Survey</td>
<td>Questionnaire-based assessment yields maturity ratings and comparisons</td>
</tr>
<tr>
<td>Navigation Process</td>
<td>Expert-led workshops to complete Compass and use results to develop consensus aspirations</td>
</tr>
<tr>
<td>Training</td>
<td>Overview Seminar and SGMM Navigator Course</td>
</tr>
<tr>
<td>Partner Program</td>
<td>License organizations and certify individuals to deliver Navigation process</td>
</tr>
</tbody>
</table>

www.sei.cmu.edu/smartgrid
SGMM Compass Survey

Contains

• One question for each expected characteristic in the model and

• Attribute and performance questions

Example questions:

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.

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-step, expert-led process

1. Stakeholders complete SGMM Compass survey
   Discussion and consensus answers lead to internal alignment on current state

2. Stakeholders review survey findings & set aspirational profile
   Consensus on aspirational state and identification of motivations, actions, and obstacles to achieve it
Compass results: maturity profile

In the Compass results, the maturity profile includes a maturity score for each domain. The diagram shows the scores for various domains, with higher scores indicating a higher level of maturity. The SGMM maturity profile highlights the overall level of maturity, with scores ranging from 0 to 5.
Compass results: dashboard

*Example results*

<table>
<thead>
<tr>
<th>Level</th>
<th>Strategy, Management &amp; Regulatory</th>
<th>Organization &amp; Structure</th>
<th>Grid Operations</th>
<th>Work &amp; Asset Management</th>
<th>Technology</th>
<th>Customer</th>
<th>Value Chain Integration</th>
<th>Societal &amp; Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.53</td>
<td></td>
<td>0.25</td>
<td>0.00</td>
<td>0.00</td>
<td>0.20</td>
<td>0.30</td>
<td>0.30</td>
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<tr>
<td>4</td>
<td>0.57</td>
<td>0.17</td>
<td>0.28</td>
<td>0.40</td>
<td>0.36</td>
<td>0.36</td>
<td>0.25</td>
<td>0.40</td>
</tr>
<tr>
<td>3</td>
<td>0.65</td>
<td>0.75</td>
<td>0.57</td>
<td>0.47</td>
<td>0.59</td>
<td>0.58</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>2</td>
<td>1.00</td>
<td>0.82</td>
<td>0.93</td>
<td>1.00</td>
<td>0.92</td>
<td>0.58</td>
<td>0.76</td>
<td>0.76</td>
</tr>
<tr>
<td>1</td>
<td>0.90</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.85</td>
<td>0.78</td>
<td>0.68</td>
<td>0.68</td>
</tr>
<tr>
<td>0</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
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<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Point Range**

<table>
<thead>
<tr>
<th>Range</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 0.70</td>
<td>Green reflects level compliance within the domain</td>
</tr>
<tr>
<td>≥ 0.40 and &lt; 0.70</td>
<td>Yellow reflects significant progress</td>
</tr>
<tr>
<td>&lt; 0.40</td>
<td>Red reflects initial progress</td>
</tr>
<tr>
<td>= 0</td>
<td>Grey reflects has not started</td>
</tr>
</tbody>
</table>
Compass results: peer community comparison

Example results

Orange bars are peer community ranges

Orange diamonds are peer community averages

Green squares are utility ratings (example results)

Community data as of September 2011
Navigation results: consensus aspirations

Example results

This is where we aspire to be in X years

This is where we are today

NOTE: There is no “correct” target profile implied in the model; the optimal profile will vary by utility.
SGMM community: 119 utilities in 21 countries

- USA: 70
- Canada: 10
- India: 9
- Australia: 5
- Brazil: 4
- China: 3
- Mexico: 3
- Netherlands: 2
- Belgium: 1
- Denmark: 1
- France: 1
- Hong Kong: 1
- Ireland: 1
- Israel: 1
- Japan: 1
- Philippines: 1
- Poland: 1
- Spain: 1
- Sweden: 1
- Switzerland: 1
- UK: 1

As of September 2011

- United States: 60%
- EMEA: 11%
- Asia/Pacific: 16%
- Other: 13%

Software Engineering Institute | Carnegie Mellon
SGMM community – meter count

Largest: 34,000,000 Meters

Median: 1,000,000 Meters

Community segmentation breakpoint: 250,000 meters

Smallest: 40 Meters

As of September 2011
SGMM community – utility type

As of September 2011

87.5% Distribution
59.4% Transmission
51.6% Retail
40.6% Generation
21.9% Other

87.5% Distribution
59.4% Transmission
51.6% Retail
40.6% Generation
21.9% Other

PARTIALLY INTEGRATED
2 Functions

1.8% Generation, Transmission
1.8% Generation, Distribution
7.3% Transmission, Distribution
11.8% Distribution, Retail
4.5% Generation, Distribution, Retail
10% Transmission, Distribution, Retail
4.5% Generation, Transmission, Distribution

FULLY INTEGRATED
4 Functions

0.9% Retail Only
25.5% Distribution Only
1.8% Transmission Only
30% Generation, Transmission, Distribution, Retail

SINGLE FUNCTION

PARTIALLY INTEGRATED
3 Functions
SGMM community: all participants
average and range maturity scores as of September 2011
SGMM community: < 250,000 meters
average and range maturity scores as of September 2011
SGMM community: ≥ 250,000 meters
average and range maturity scores as of September 2011
SGMM Partners

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

For the current list of SGMM Partners, visit: www.sei.cmu.edu/partners/sgmm
SGMM Navigator population

SGMM Navigator Certification Statistics

- 41 Navigator trainees (completed course)
- 34 Candidate Navigators (passed exam)
- 7 Certified Navigators (completed all requirements)

As of September 2011
SGMM benefits – a community view

Use of SGMM by utilities

Utilities
- Guidance, common language, & means to track progress

SGMM Partners
- Product to help customers and participation in roadmap development

DOE
- Another mechanism to support grid modernization

SEI
- Maturity & Performance Data

"What works" patterns to inform strategies, services, & programs.

Correlations of performance to maturity patterns and other analyses

Demonstrations of the value of grid modernization.

Improvements to SGMM product suite.
Contact Information

Austin Montgomery
Smart Grid Program Executive
amontgom@sei.cmu.edu
703.908.1110

www.sei.cmu.edu/smartgrid

info@sei.cmu.edu
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