TATA CONSULTANCY SERVICES
Experience certainty.

Process Approach to Smarter T & D Network

Deven B. Patel, Head of OT and ET Initiatives, TCS India Business Unit

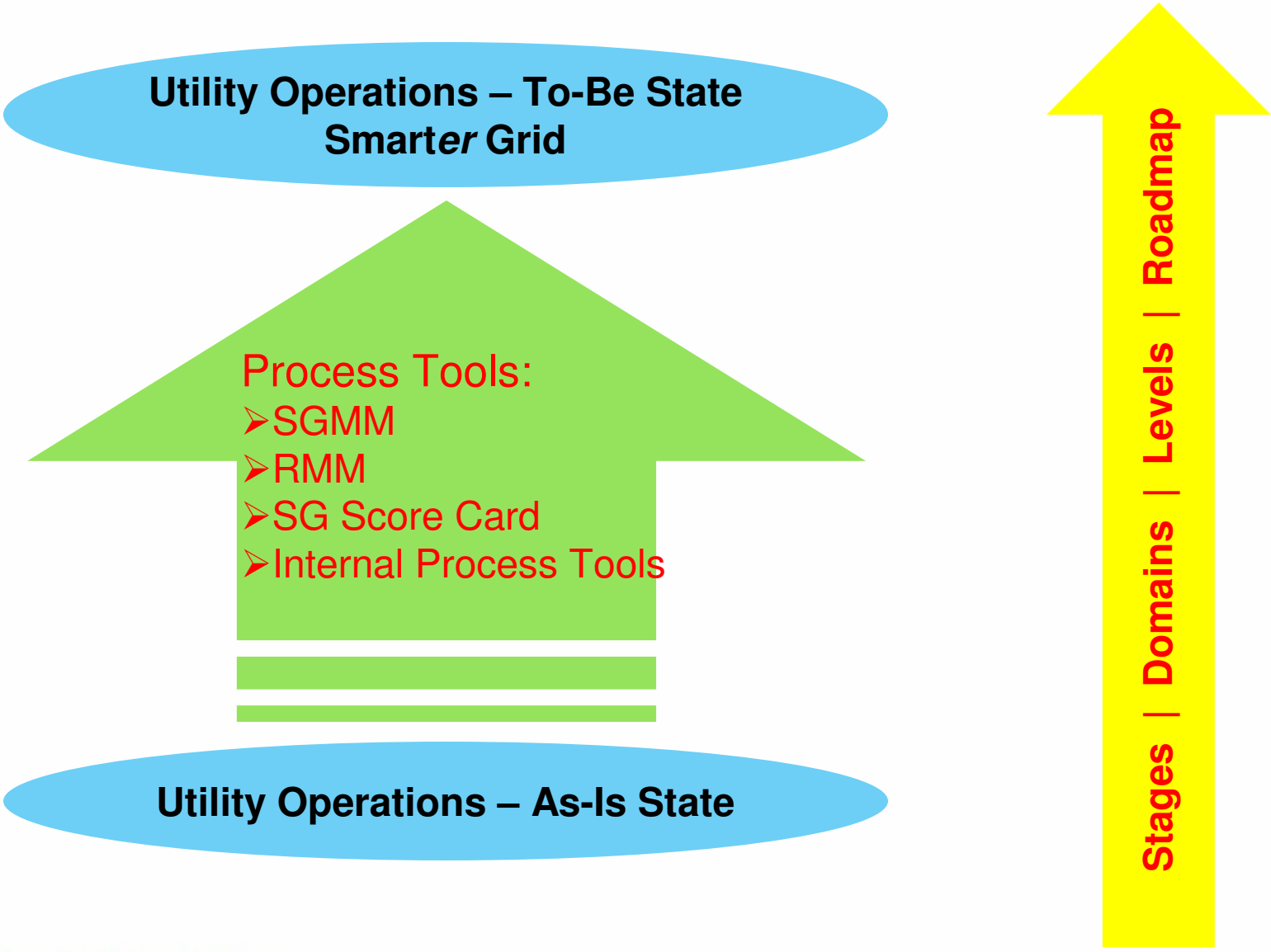
Presentation at CII Conference

02-Nov-2012

Today's Interaction

- Process Tools for Smartening the Grid
- Process Approach to Implementing Smart Grids
- How to enable Advanced Transmission Operations …

Process Tools for Smartening the Grid



Smart Grid Deployment Phases

Planning Analysis	Feasibility Assessment	Technology Selection	System Deployment
• Strategic Business Planning/Visioning • Business Needs Definition • Regulatory Compliance • Technology Trends/Emerging Technologies	• Technology Assessment • Business Case / Economic Justification • Preliminary Cost Scenarios • Project Planning Approval • Team Formation	• Functions & Features Matching • Performance Assessment • Integration Requirements • Vendor Selection • Cost/Benefit Confirmation • Project Approval / Capital Commitment	• Implementation Planning / Phasing • Employee Training • System Testing • Operating Procedure Updates • Value Recognition • ROI Measurement

Process Tools and Approach

Available Process Tools

- Smart Grid Maturity Model by Software Engineering Institute
- Resiliency Maturity Model
- Other Tools

The Smart Grid Maturity Model

It is a management tool

that provides a

common language and framework

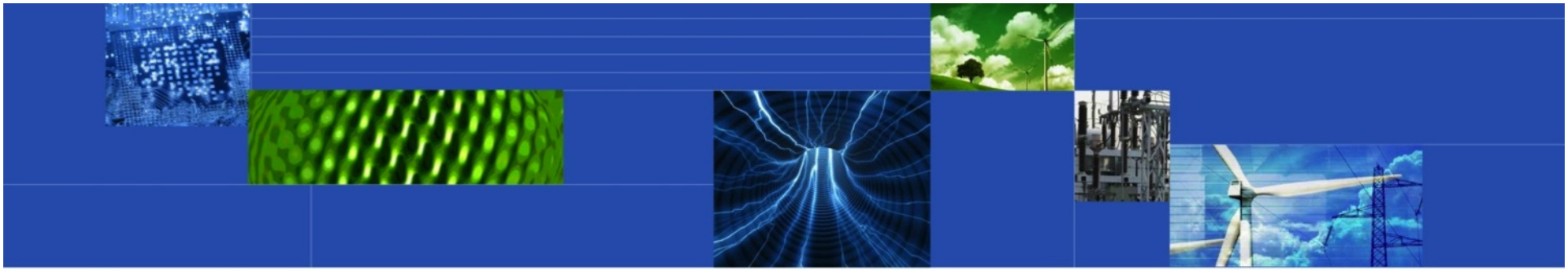
for defining key elements of

smart grid transformation

and helping utilities develop a

programmatic approach

and track their progress



Smart Grid Maturity Model – levels

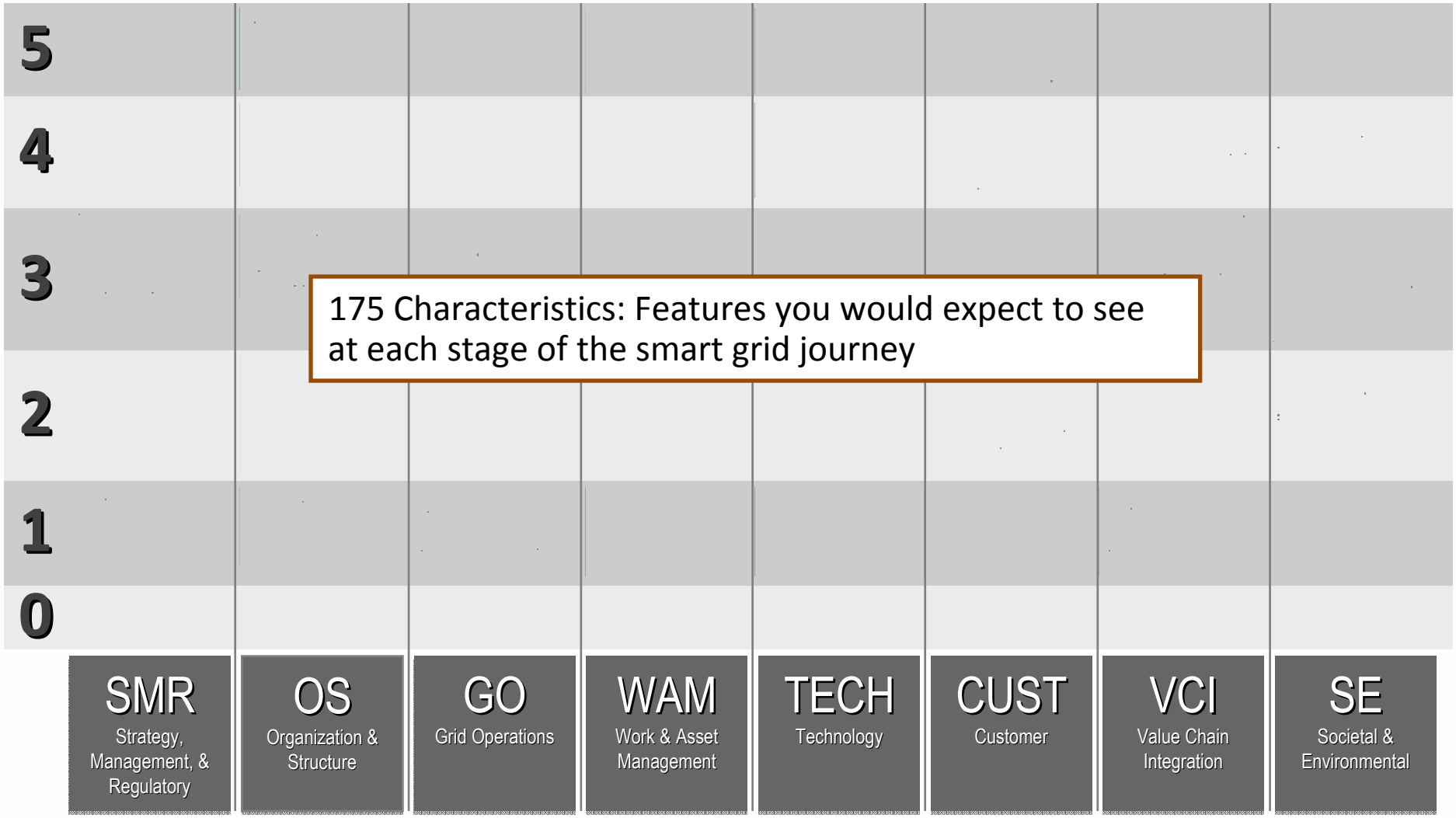
PIONEERING	5	Breaking new ground; industry-leading innovation
OPTIMIZING	4	Optimizing smart grid to benefit entire organization; may reach beyond organization; increased automation
INTEGRATING	3	Integrating smart grid deployments across the organization, realizing measurably improved performance
ENABLING	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)

Smart Grid Maturity Model – 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*

SGMM at a glance

6 Maturity Levels: Defined sets of characteristics and outcomes



8 Domains: Logical groupings of smart grid related characteristics

Resilience: Definition

Resilience

- The power or ability to return to the original form, position, etc., after being bent, compressed, or stretched; elasticity; buoyancy.

Enterprise Resilience

- CERT-RMM defines resilience as "the emergent property of an organization that can continue to carry out its mission after disruption that does not exceed its operational limit

Resilience of the Power System

- **adequacy**—the ability of the bulk power system to supply the aggregate electrical demand and energy requirements of customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements
- **security**—the ability of the bulk power system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system elements from credible contingencies

RMM Process Areas

CERT-RMM provides a metrics-driven method through which the electric utility community can view adequacy and reliability

Example Process Areas

- Risk Management (RISK), to determine how operational risks are being identified, analyzed, and mitigated, and how the risk process is being managed
- Controls Management (CTRL), to determine how operational controls to protect and sustain infrastructure are being identified, implemented, managed, and continuously monitored
- Service Continuity (SC), to determine how service continuity is planned, tested, implemented, and improved as the infrastructure changes and the risk environment changes

Resiliency Maturity Model

Requirements Management
RRD – Resiliency Requirements Development
RRM – Resiliency Requirements Management
Asset Management
ADM – Asset Definition and Management
Establishing Resiliency
SC – Service Continuity
CTRL – Controls Management
RTSE – Resilient Technical Solution Engineering

Governance, Risk, & Compliance
COMP – Compliance
EF – Enterprise Focus
RISK – Risk Management
Supporting Resiliency
COMM – Communications
FRM – Financial Resource Management
HRM – Human Resource Management
OTA – Organizational Training & Awareness

Asset Resiliency Management
EC – Environmental Control
KIM – Knowledge & Information Management
PM – People Management
TM – Technology Management
Sourcing
EXD – External Dependencies
Threat, Incident, & Access Management
AM – Access Management
ID – Identity Management
IMC – Incident Management & Control
VAR – Vulnerability Analysis & Resolution

Data Collection & Logging
MON – Monitoring
Process Management
MA – Measurement and Analysis
OPD – Organizational Process Definition
OPF – Organizational Process Focus

Source: **ww.cert.org/resiliency**

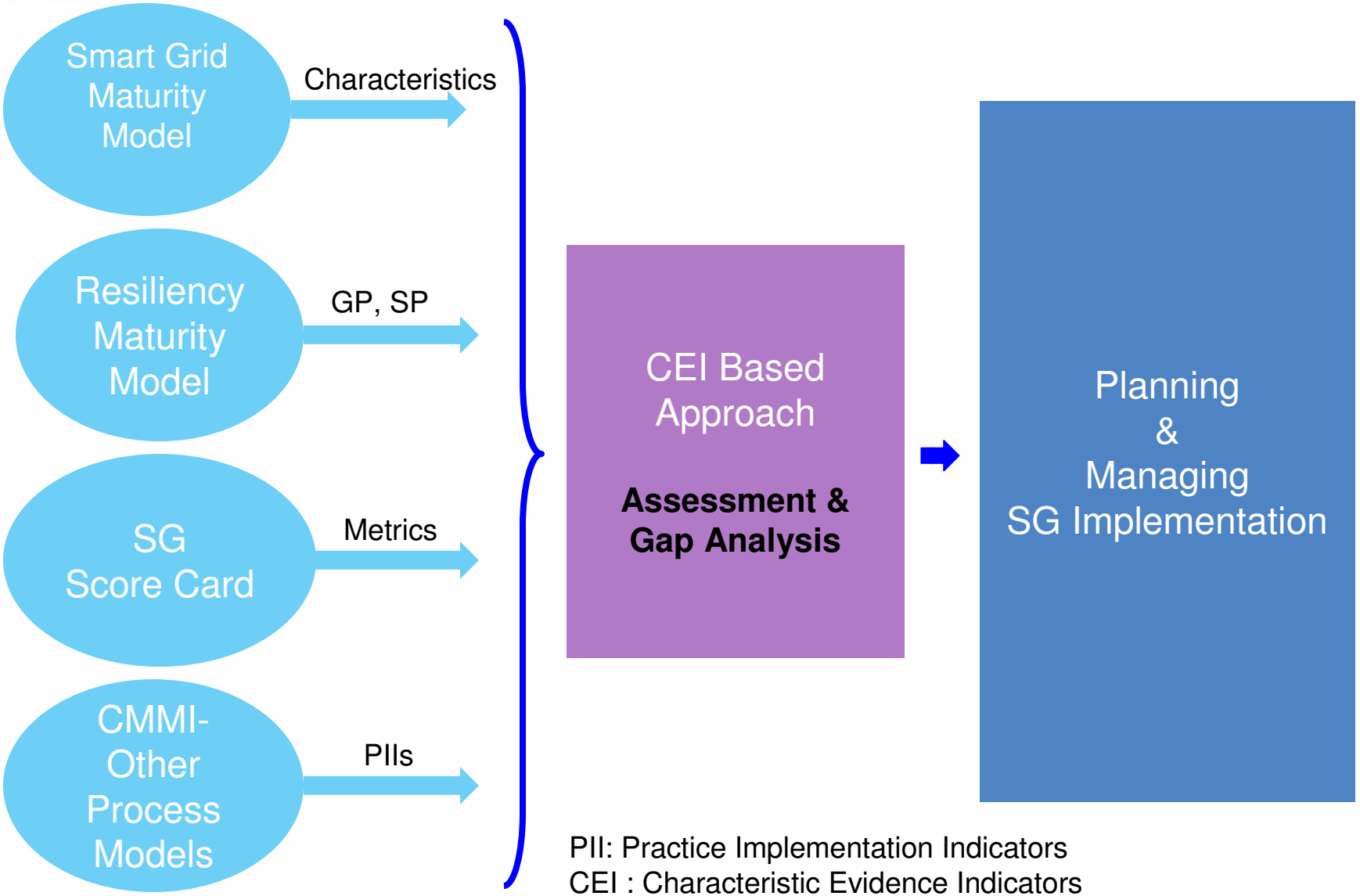
Other Tools

- Smart Grid Score Card
- EDF (Environmental Defense Fund) Evaluation Framework for Smart Grid Deployment Plans
- KEMA Smart Grid Evaluation Metrics
- Metrics published by US Department of Energy

Process Approach to Implementing Smart Grids

TATA CONSULTANCY SERVICES
Experience certainty.

Process Approach to Implementation



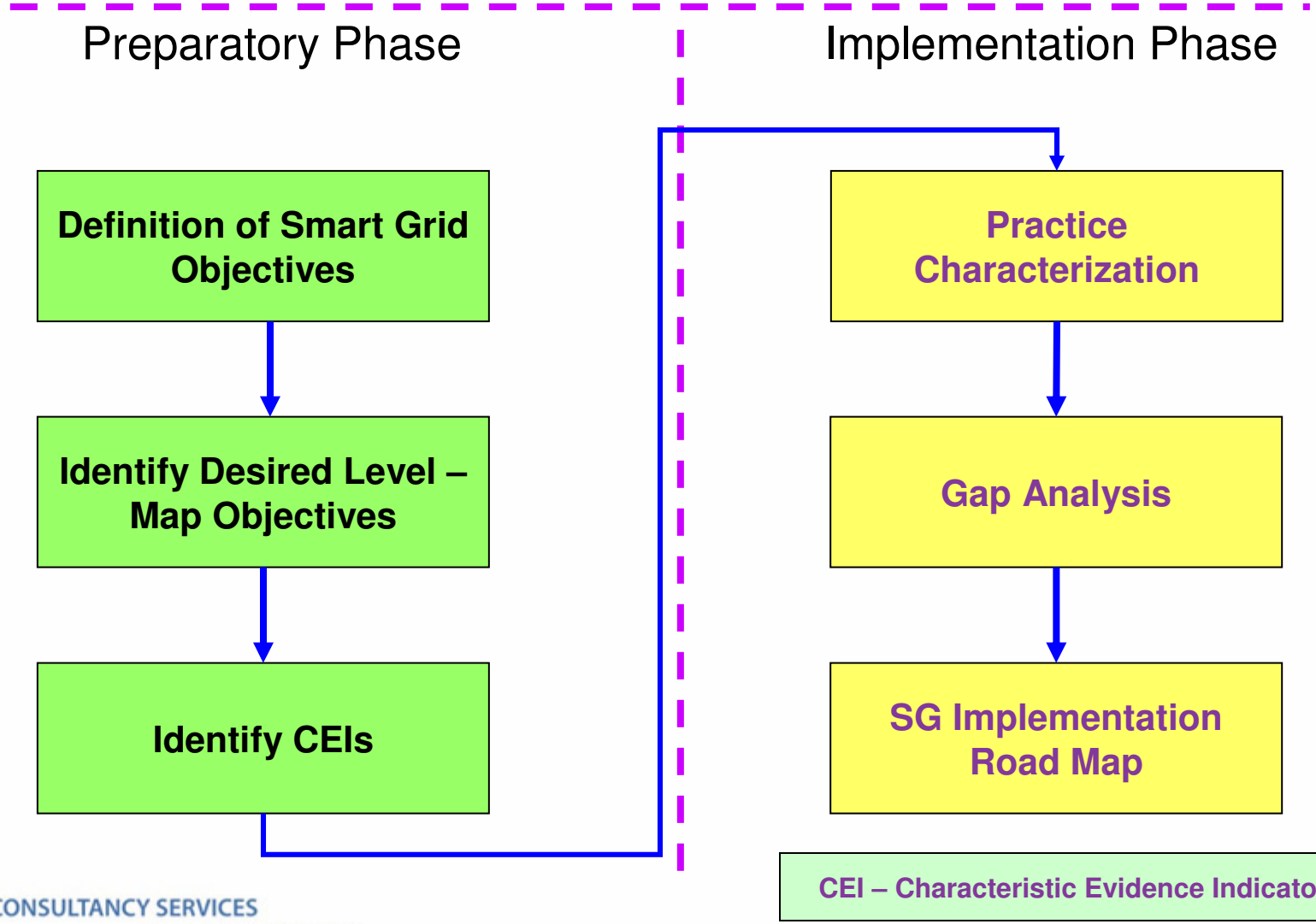
PII: Practice Implementation Indicators
CEI : Characteristic Evidence Indicators
GP, SP: Generic and Specific Practices

Examples of CEI

Characteristic	Objective Evidence	Implementation Evidence
Implementing advanced outage restoration schemes (Grid Operations)	Outage Restoration Functional Description	System generated outage report, Request for planned outage
Pilot remote monitoring on key assets for manual decision making (Grid Operations)	Function Specifications Pilot remote monitoring project	Pilot program results
Education and Training to develop Smart Grid competencies (Organization Structure)	Training plan covering all functional areas	Training records
Information Security Considerations for Smart Grid Initiatives (Technology)	Security practices documented as per standards (ISO 27000, SAS-70)	Implementation check lists for Security practices

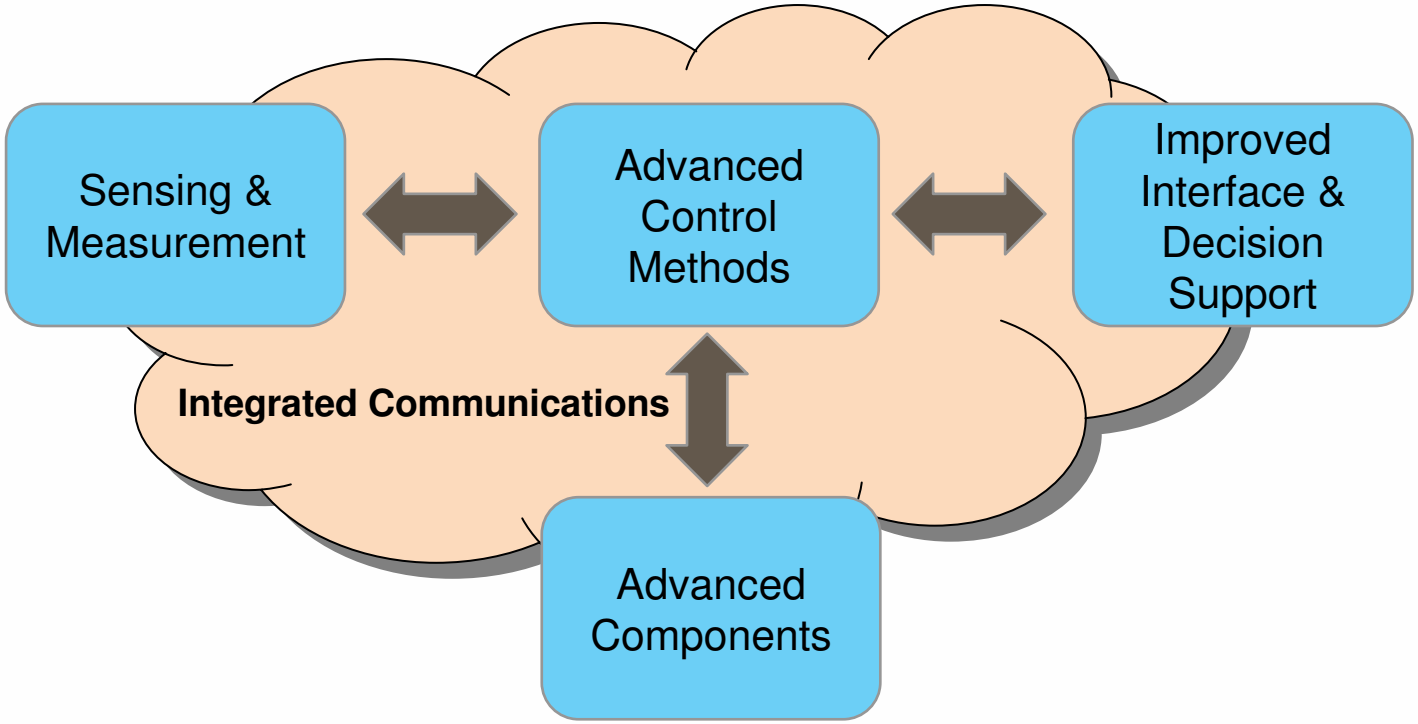
Deployment Steps

Use of model in SG Implementation



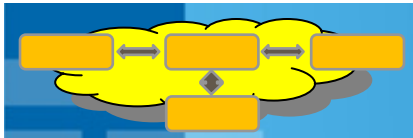
How to enable Advanced Transmission Operations …

Smart Grid Technologies



Integrated communications is the glue that ties everything together

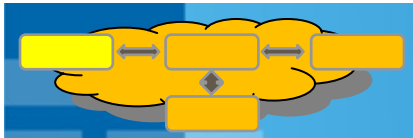
Source: US DoE Modern Grid Initiative



Integrated Communications

- Key to a smarter transmission system, as with the distribution system, is a reliable, high-speed integrated communications (IC) platform
- Ability to rapidly move information between transmission stations, and from these stations to system control centers, provides the basis for virtually all advanced applications
- An integrated communication platform that connects both transmission and distribution creates new opportunities for each to support the other
  - E.g. demand response, distributed generation, distributed storage, and voltage dispatch can all help an regional transmission operator ensure a reliable transmission grid

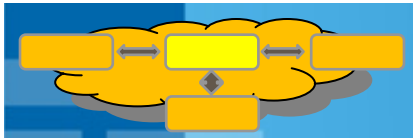
Source: US DoE Modern Grid Initiative



Sensing and Measurements

- Dynamic Line and Equipment Rating
- Synchrophasor Monitoring
- Reliability Assessment
- Advanced Metering Infrastructure

Source: US DoE Modern Grid Initiative

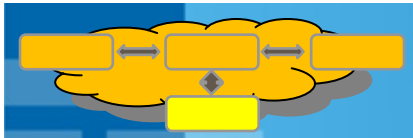


Advanced Control Methods

- Advanced Protection
- Special Protective Systems
- Coordination of Renewable Generation and Storage
- Centralized Flow Control

The complex world of transmission has made the operator's job extremely challenging, but new tools can make it a bit easier

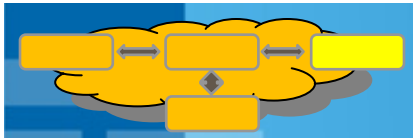
Source: US DoE Modern Grid Initiative



Advanced Components

- Advanced Flow Control Devices
- Fault Current Limiters
- High Temperature Superconducting (HTS) Cables and High Capacity (High Temperature) Conductors
- Advanced Storage

Source: US DoE Modern Grid Initiative



Improved Interface and Decision Support

- Data Mining & Analytics
  - Some data that is available from devices currently deployed across the transmission system is not being collected, or does not have adequate communications to be transmitted, or is not used because it cannot be processed efficiently
  - Instability Prediction from measurements
  - Equipment life calculations based on field measurements

- Fast Simulation & Modeling
  - designed to provide the mathematical underpinning and look-ahead capability for a self-healing grid

- Advanced Visualizations
  - convert masses of power-system data into information that can be understood by human operators at a glance. Animation, color contouring, virtual reality, and other data display techniques will prevent “data overload” and help operators identify, analyze, and act on emerging problems in a timely manner

Source: US DoE Modern Grid Initiative

Technologies and Applications

- Substation Automation
- Geographical Information System for Transmission
- Wide Area Measurement System (WAMS)
- Hi-speed information processing
- Advanced protection and control
- Modeling, simulation and visualization tools
- Advanced grid components for transmission
- Advanced regional operational applications

Deep integration of Advanced Metering, Advanced Distribution Automation and Advanced Asset Management technologies leads us to optimized Transmission Operations that dramatically improve grid operations and efficiency

Source: US DoE Modern Grid Initiative

Q & A

Next Steps …

Deven B. Patel
deven.patel@tcs.com
+91(0) 8866007719

Thank You!!


TATA CONSULTANCY SERVICES
Promise what we deliver.
Deliver what we promise. That's
certainty