Power System Planning & Implementation Committee

Meeting IEEE GM 2007

Chaired & Prepared by

ML Chan, Ph.D.

KEMA, Inc., Sunnyvale, CA

mlchan@kema.us

In Attendance

- M.L. Chan, KEMA
- Bob Fletcher, Snohomish PUD
- Wenyuan Li, BCTC
- Rich Christie, U of Washington
- Ibraham Helal, Ain Shams University, Egypt
- Juha Lohjala, Finland
- Jukka Lassila, Finland
- Jarmo Partanen, Finland
- Toshi Funabash, Meidensha Corp
- Mike Henderson, ISO NE
- Fangxing Li, U of Tennessee
- Cheong Siew, BC Hydro
- Zoilo Roldan, SCE
- Kai Strunz, U of Washington
- Jay Giri, Areva
- Karl Schoder, West Virginia University
- Anupam Thatte, Carnegie Mellon University
- Navin Bhatt, AEP
- Siri Varadan, KEMA
- Debra Henderson, OSISoft
- Gerald Cliteur, KEMA
- David Egan, PJM
- Ben Hobbs, John Hopkins/CAISO
- Jian Yang, GE
- Steve Widergren, PNNL

Agenda

1:30 p Introduction

1:40 p Approval of last meeting minutes

1:50 p Smart Grid Overview

2:00 p Embracing Smart Grid in Energy Supply Planning (Jian Yang, Energy Supply WG)

2:15 p More discussion on Energy Supply perspective

2:30 p Embracing Smart Grid in Transmission Planning –Transmission Planning Risk Assessment (Siri Varadan)

2:50 p More discussion on Transmission Planning perspective

3:00 p Embracing Smart Grid in Distribution Planning

3:15 p More discussion on Distribution Planning perspective

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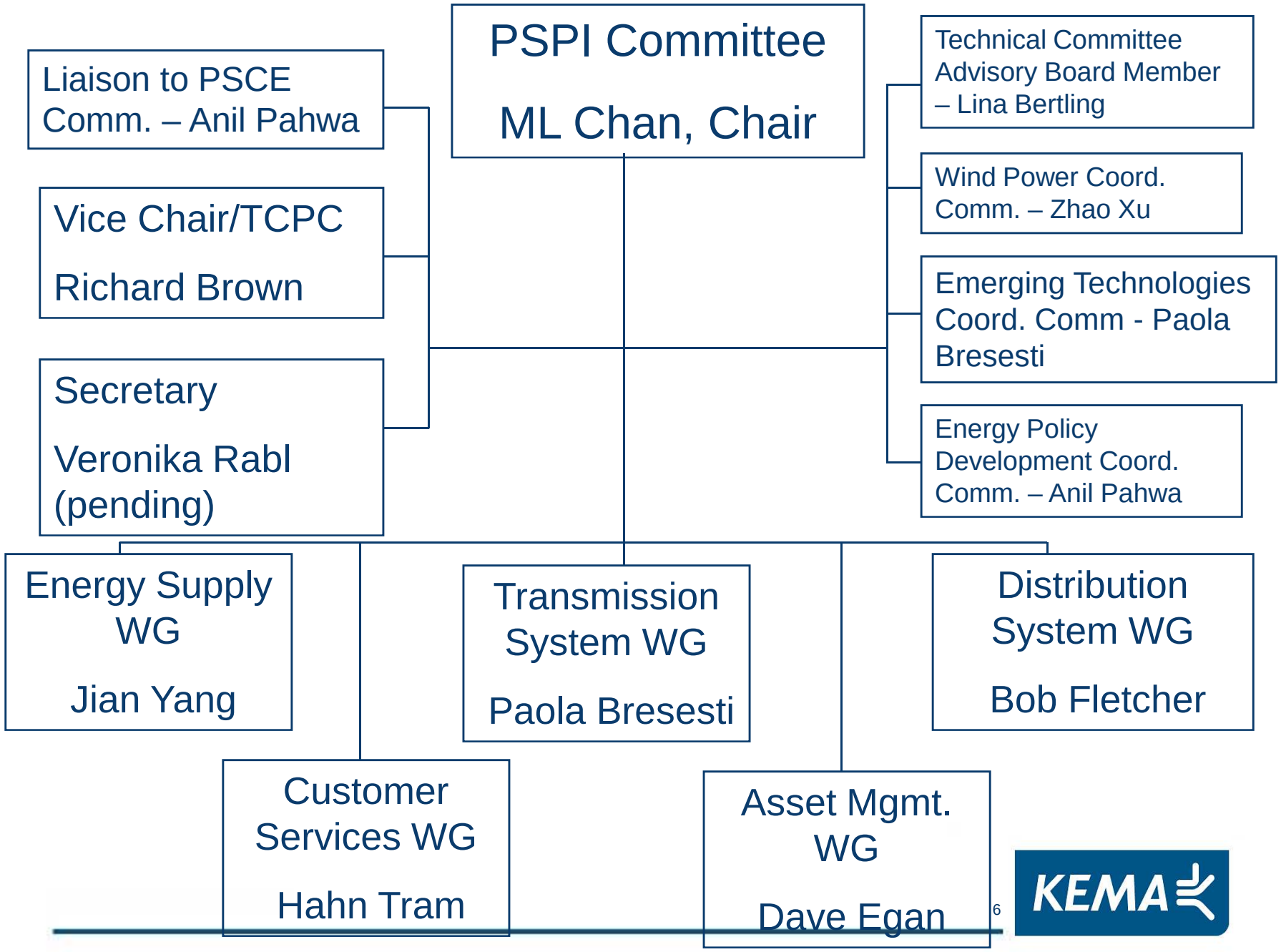
Agenda (cont'd)

3:00 p	Embracing Smart Grid in Asset Management
3:15 p	More discussion on Asset Management perspective
3:00 p	Embracing Smart Grid in Customer Service Planning
3:15 p	More discussion on Customer Service Planning perspective
3:30 p	More discussion on ALL perspectives
4:00 p	Develop IEEE programs on Planning under Smart Grid
4:45 p	Take up responsibilities
5:00 p	Adjourn

Committee Business Items

- Meeting minutes of GM2006 at Montreal approved (Appendix 1)
- Gerald Cliteur passed his baton to David Egan, PJM as Chair of Asset Management WG (Approved). Thank you, Gerard, for getting the WG off the ground!!
- Veronika Rabl requested to resign as Secretary to PSPI Committee due to her inability to attend meetings; being tabled with no decision.
- Anil Pahwa reported that the Energy Policy Development Coordinating Committee is developing a statement that involves system reliability; we need to stay close to that development in our Committee.


PSPI Committee
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Energy Policy Development Coord. Comm. – Anil Pahwa
Energy Supply WG
Jian Yang
Transmission System WG
Paola Bresesti
Distribution System WG
Bob Fletcher
Customer Services WG
Hahn Tram
Asset Mgmt. WG
Dave Egan

PES Technical Council Matters

- PES is strongly encouraging partnering with CIGRE. There is a symposium in 2009 with CIGRE. (WG Chairs – Please find your counterparts in CIGRE and collaborate with them.)
- Work with international bodies if we are developing standards.
- There is an overload of paper and panel sessions; too many “no shows” in sessions, though they register for conference; Solutions - tighten review standard for papers, and set up more poster paper sessions
- Coordinating Committees will stay as a coordinating body that coordinates the activities of different Technical Committees on a particular topic/technology, but not to compete with the Technical Committee activities.

PES Technical Council Matters (cont'd)

- Encourage all to nominate candidates for IEEE Fellows (Congratulations to Richard Brown as the newest IEEE Fellow) because there is a new category of Fellows – "Practitioners" that focus on applications.
- Paper reviews are going well overall – reasonable turnaround time (Thank you, Paper Reviewers!!). Transaction on Power Systems has grown and met the page quota.

Smart Grid Discussion

- ML Chan gave an overview of Smart Grid, from the perspectives of our five WGs (Appendix 2). Then presentation and discussion of issues from each WG's perspective followed.
- Objectives is to develop sessions for
  - GM2008 at Pittsburg, 7/20/08
  - T&D Show at Chicago, 4/21/08
  - PSCE Conference at Seattle, 3/09

Asset Management WG Perspectives

- Three major issues for AM
  - Data needed for AM
  - Methodology for budgeting and planning
  - Disciplines required by AM
- Standard terminologies for AM to be developed
- How does AMI enable AM
  - Communications media afforded by AMI
  - Requires data mining engines
  - What is “asset”? Power delivery asset and information asset?
    - Communications equipment
    - T&D equipment
    - Controllers

Asset Management WG Perspectives (cont'd)

- Aging asset and lifecycle perspective for asset
- Root-cause analyses of asset failures
- Smart Grid and the enterprise IT to make it happen
- Resource requirements to implement AM initiatives

Distribution System Planning WG Perspectives

- Distribution system planning in the context of Smart Grid requires “smart planning” – how to expand “smartly”
- What does the future distribution infrastructure look like? Sensor, controllers and processors proliferation; from data to information to control actions
- What are the new “loads”? DGs, DRs, renewable...
- Need for small area load forecasts that can capture DGs, DRs, etc.

Distribution System Planning WG Perspectives (cont'd)

- Major issues for incorporating Smart Grid
  - Modeling and simulation tools (e.g., wind generators models that capture governor controls)
  - Planning guidelines and standards
  - Push for greater efficiency (e.g., reduce losses)
  - More push for real-time analyses and planning
  - MV and LV to be considered as one system for planning

Transmission Planning WG Perspective

- Siri Varadan presented a methodology for risk assessment in transmission planning in BPA (Appendix 3). It points out a methodology for capturing risks in planning under Smart Grid.
- Paola Bresesti, Chair of Transmission WG, prepared a set of transmission planning issues under Smart Grid (Appendix 4) though she could not make the conference. That provided platform for discussion of issues below.
- Risk and uncertainties come in different forms – "size of the energy resource lumps", how controllable/curtailable/dispatchable are the supply resources; how to quantify risks?

Transmission Planning WG Perspective (cont'd)

- Education of the public is an integral element of transmission planning
- Need for an "Integrated G&T Planning Tool", a TEAM approach; in Canadian market, <10 MW DGs are not on the radar screen, but they should be.
- How to quantify the benefits
  - Competition (e.g., market power impacts)
  - Reliability
  - Sustainability (Is that as simple as CO_2 reduction or should it be a holistic environmental approach? Or should energy efficiency adopt an elemental approach – starting from the transformation of the original chemical elements to kWh?)

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Transmission Planning WG Perspective (cont'd)

- How to model the "load", which is a resource, especially when DGs and renewable are present
- Impacts of Smart technologies (work with T&D Committee's WG1505)
  - PMUs
  - Wide Area Protection Systems
  - FACTS

Energy Supply WG Perspectives

- Resource Adequacy is a major issue
  - Economics vs Reliability vs Environment
  - Site selection (optimization of multiple resource concerns – water, gas, transmission) and Total Energy Planning, not just electric planning
  - Free ridership issue in transmission upgrades
  - Interconnection queue vs inequity
  - Coal/IGCC/GHG vs CO_2
  - Nuclear – permits and cost issues
  - Wind – intermittency a concern to system dispatch
  - Solar – cost
  - Gas (CCGT)
  - Blackstart, AGC, Reactive Power and SR

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Energy Supply WG Perspectives (cont'd)

- Another major issue relates to the Market
  - Market design & impacts (e.g., LMP vs zonal, DA market, capacity market); need to encourage DG and renewable proliferation
  - Emission market
  - Deregulation vs Re-regulation
  - Bidding strategy
  - Merchant vs contracts

Energy Supply WG Perspectives (cont'd)

- Another major set of issues relates to DGs & DRs
  - Emergency generators needed for blackstarts if to be truly "self healing" grid
  - Island and micro-grid operations
  - Size of units
  - Degree of dispatchability for DGs
  - DR as a viable resource; may need to remove rate freeze for DR to be truly viable; policy issue with AMI system investment
  - Fuel cells; could be a mobile load

Sessions Planned

WG (Chair)	T&D Show, Chicago, 4/21-24/08	GM2008, Pittsburg, 7/20/2008	PSCE, Seattle, March 2009
Energy Supply (Jian Yang)		Panel/Combo Session (organized by Mike Henderson) on "Smart Grid and Resource Planning for Economics & Environmental Adequacy"; panelists include different stakeholders such as ISO/FERC, Developers, Envrionmentalists, Utility and Load.	
Transmission (Paola Bresesti)		Panel/Combo Session (organized by Siri Varadan) on "Smart Grid and Integrated G&T Planning Tools"	Panel Session (organized by Mike Henderson) on "WAPS and Inter-area Planning"
Distribution (Robert Fletcher)	Panel Session (organized by Fran Li, with assistance by Ravi Seethapathy) on "Smart Grid and Best Practices in Distribution Planning"	Panel/Combo Session (organized by Bob Fletcher) on "Smart Grid and Distribution Planning"	
Customer Services (Hahn Tram)		Panel/Combo Session (organized by Hahn Tram or designate) on "Large Scale Deployment of AMI Systems - AMR as the Initial Phase"	
Asset Management (Dave Egan)		Panel/Combo Session on "Smart Grid and the Inner Workings of Asset Management - Data for AM, Methodologies for Planning & Budgeting, and Disciplines of AM (organized by Dave Egan)	Paper Session - Standard Terminology for AM (WG paper). Panel session (organized by Zoilo Roldan) on "Aging and Lifecycle of Assets"

Appendix 1 – Approved Meeting Minutes of GM2006 at Montreal

Power System Planning & Implementation Committee

Montreal, Canada

June 21, 2006

Agenda

- Welcome
- Paper presentation as launching pad for us to identify issues and challenges
- Filling of Officer Positions
- Report on matters from Technical Council & other committees
- Discussion on such issues and challenges
- Session development by each WG
  - GMC 2007 in Tampa
  - PSCE 2006
  - T&D Show
- PSCE 2006 at Atlanta,

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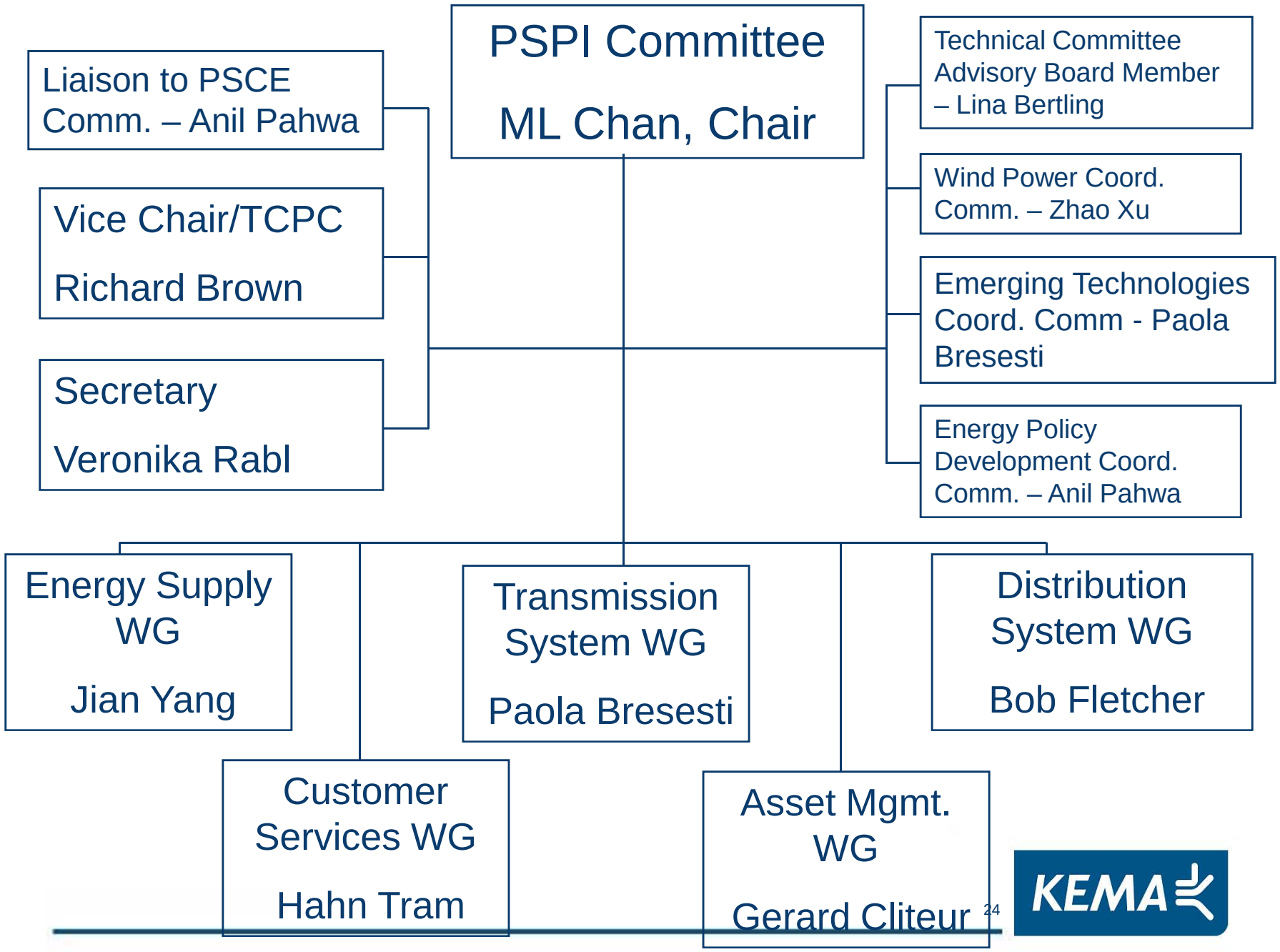
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Energy Supply WG
Jian Yang
Transmission System WG
Paola Bresesti
Distribution System WG
Bob Fletcher
Customer Services WG
Hahn Tram
Asset Mgmt. WG
Gerard Cliteur

Emerging Technologies Coordinating Committee

- Wind Power Coordinating Committee
  - Top 6 issues – capacity value of wind generators; power system operations in relation to UC, load following ; market design, standard wind generator models; collector system design; transmission system in place before wind generators (7-years versus 90 days lead time)
- Modern Grid from DOE/NERL

Technical Council Matters

- Technical Committee Advisory Board needs a member; directly answers to PES Board of Governors
- Annual winter Committee meeting in January 8 period EVERY YEAR; flexible design; low room rate and very low registration fee; conduct committee business
- Energy & Environment Policy Statement close to being balloted by each Committee
- Editorial Board will recognize all reviewers, especially the high performance ones
- Annual committee report (2005 and 2006) by 7/21/06

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Committee Officer Posts to Fill

- Liaison to Emerging Technology Coordinating Committee
- Liaison to Energy Policy Development Coordinating Committee
- Vice Chair of Committee/TCPC
- Liaison to Wind Power Coordinating Committee

See the org chart

Energy Supply WG – Jian Yang

- GM2007: Risks and Management for Energy Suppliers in the Context of Open Markets (reliability, financial, capacity market, development risks etc.)
- PSCE: no plan for 2006 now. For the future: Resource Adequacy - Forward Capacity Market and Generation Development
- For T&D 2008: Green Energy Development and Needed Transmission - The Economics and Policies
- Wind Power as a resource session

Transmission Planning Issues – Paola Bresesti

- Bottom-up and Top-Down Approach
- Market-based investment strategy
- Integrated Planning (integrated G&T)
- Reliability Tools and what is being developed (overlap with PSACE) GM2007
- Market issue and transmission planning, including the first three bullets ; GM2007
- New topics
  - National critical Transmission Corridors in US/TransEuropean Network/ Energy Program (T&D)

Distribution System Planning Issues – Richard Brown

- Reliability planning versus capacity planning
- Value of reliability as defined by PBR incentives and penalties
- Reliability & capacity vs asset management
- Optimization vs bread-and-butter approach; new tools of planning (e.g, optimal switching) GM2007
- Planning for aging infrastructure
- “Equipment Failure Modeling” (to AM WG) GM 2007
- Planning in an Asset Management Organization (GM2007)

Customer Service Planning Issues – Hahn Tran

- AMI as an enabling technology
- Demand response programs being bid into the market
- Demand Response programs being used for regional distribution system planning
- Recent global experience with large AMI deployments; GM 2007

Asset Management Issues – Gerard Cliteur

- Asset-based data availability
- Relationship to capacity and reliability planning
- Portfolio optimization approach
- “Equipment Failure Modeling” (to AM WG) GM 2007
- Tutorial on Asset Management (with PSACE’ Lina) GM2007

2007 IEEE Power Engineering Society General Meeting

Call for Papers

On-line paper submission site opens on or around 16 October 2006.

Though the deadline for paper submission is 5 December 2006, authors are strongly encouraged to submit papers by 1 December so there will be ample time for review, feedback and revision.

The 2007 IEEE Power Engineering Society 2007 General Meeting will be held 24 – 28 June 2007 at the Tampa Convention Center and the Marriott Waterside Hotel in Tampa, Florida, USA. This premier power engineering conference will bring together practicing power engineers and academics from all over the worl The aim of the conference is to provide an international forum for experts to promote, share, and discuss various issues and developments in the field of electrical power engineering.

The theme of the meeting is ***Powering the Future, Today.***

The preferential topics for the meeting are as follows.

Track 1: Understanding and Responding to System–Wide Events, covering such topics as:

- Physical and cyber security concerns
- Line loading, interconnect issues, IPPs
- Operating strategies under reduced generation availability (extreme contingencies)
- Releasing excess capacity through VAR control

Track 2: Securing New Sources of Energy, covering such topics as:

- Inherently safe nuclear reactors, clean coal technologies, gas turbine peaking units
- Solar, wind, tidal, geothermal, biomass, fuel cells
- Dispersed generation
- Environmental and Sustainability Issues

Track 3: Improving Reliability and Power Quality, covering such topics as:

- Power electronic switching (sub-cycle source transfer, plant-wide UPS units)
- Super-conducting energy storage
- Advances in SCADA systems (closed loop systems, advanced communications)
- Aging Infrastructures

Track 4: Using Innovative Measurement and Control Techniques, covering such topics as:

- Advanced protection algorithms, system modeling, economic dispatch
- Fault locating, down conductor detection
- Optical sensing, non-standard instrument transformers

Track 5: Surviving New Markets and New Structures, covering such topics as:

- Software tools (load flow, fault analysis, risk assessment, economic analysis)
- Bundled services and other new post-deregulation economic models
- Improving power engineering education

Submission Requirements: Papers (maximum length 8 pages) must be prepared in accordance with the procedures outlined in the PES Authors Kit, available on the PES web site (home page URL: http://www.ieee.org/power.) Full papers must be submitted to the on-line submission and review site; a link to th site will be available from the PES home page on or about 16 October 2006. All papers must be submitted by 5 December 2006. ***Authors are strongly encouraged to submit papers by 1 December so there will be ample time for review, feedback and revision if necessary.*** Authors will be advised via email of acceptance or rejection of the paper by 12 February 2007. If revisions are required, authors will be notified prior to the date. At least one author of eac paper must register for the meeting and pay the appropriate fee before an accepted paper will be released for publication in the *2007 PES General Meeting Proceedings* or scheduled for presentation during a technical session. *Note: Registration deadline for authors may be earlier than the general registration deadline.*

Additional information about the meeting will be posted as it becomes available on the conference web site at http://www.ieee.org/power.

Tracks for GM2007 at Tampa, Florida, 7/24-28/2007

- **Track 1: Understanding and Responding to System–Wide Events**
- **Track 2: Securing New Sources of Energy**
- **Track 3: Improving Reliability and Power Quality**
- **Track 4: Using Innovative Measurement and Control Techniques**
- **Track 5: Surviving New Markets and New Structures**

GM2007 at Tampa, Florida, 7/24-28/2007

- Theme: “Power the Future, Today”
- Would like to solicit a mega track in addition to the 5 tracks with sub themes
  - Walking closer to the edge
  - Power system hardening
  - Power System 2020 Vision

  We go and invite papers and speakers; work with other Committees
- We need to develop programs for GM2007 following these themes

PSCE, *Atlanta, Georgia 10/27–11/1/06*

Energy Supply WG	System Restoration (Poster) 1178	Generation Operations Scheduling (Poster) 1089, 1157, 1212,	State of Union of Deregulated International Market (Poster) 1099, 1215, 1432, 1446 &1737	
Transmission System WG	Transmission Planning in International Market(Paper) 1082,1107, 1289,1654	*Transmission Planning Paradigm (Panel) 1105, 1373, 1558, 1661, 1683	Transmission Methods (Poster) 1278, 1409, 1422, 1496, 1671	Market Design Issues (Paper) 1269, 1307, 1427, 1537

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PSCE, *Atlanta, Georgia 10/27–11/1/06*

Dist. System WG	**Distribution Planning (Paper) 1070,1349, 1479,1659**
Asset Mgmt. WG	***Asset Management (Panel) 1256, 1648, 1735**
Customer Services WG	**Energy & Load Forecast (Poster) 1261, 1360, 1485, 1678, 1295,**

Program Delivery

	Energy Supply WG	Transmission System WG	Distribution System WG	Asset Mgmt. WG	Customer Services WG
GM 2007	1.Risks and Management for Energy Suppliers in the Context of Open Markets 2.Megatrack session	1.Reliability Tools 2Transmission Planning & Market 3.Megatrack session	1New tools of planning with optimization 2. Dist. Planning in an Asset Management Organization 3.Megatrack session	1.Asset failure rate modeling. 2.Tutorial on Asset Management 3.Megatrack session	1.Recent Experience in AMR Deployment in the world 2.Megatrack session
PSCE 2006	See slides 2 & 3	See slides 2 & 3	See slides 2 & 3	See slides 2 & 3	See slides 2 & 3

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Appendix 2 – Smart Grid Overview

By

M.L. Chan, KEMA, Inc.

Business Drivers for Smart Grid

- Improved Operational Efficiencies
- Improved Supply Reliability
- Improved Service Quality
- Regulatory Compliance
- Sustainability and Global Warming Concerns (Climatic Change)

Grid Requirements

- More visibility to the T&D system
  - IEDs, AMI meters
  - PMUs
  - State estimators
- More local intelligence control of the system
  - Communications infrastructure (e.g., PTP)
  - Ability to communicate/interoperate devices
- PHEVs; interface with Home Area Networks (HAN)
- Condition-based maintenance
- DGs, storage & renewable forming micro-grids

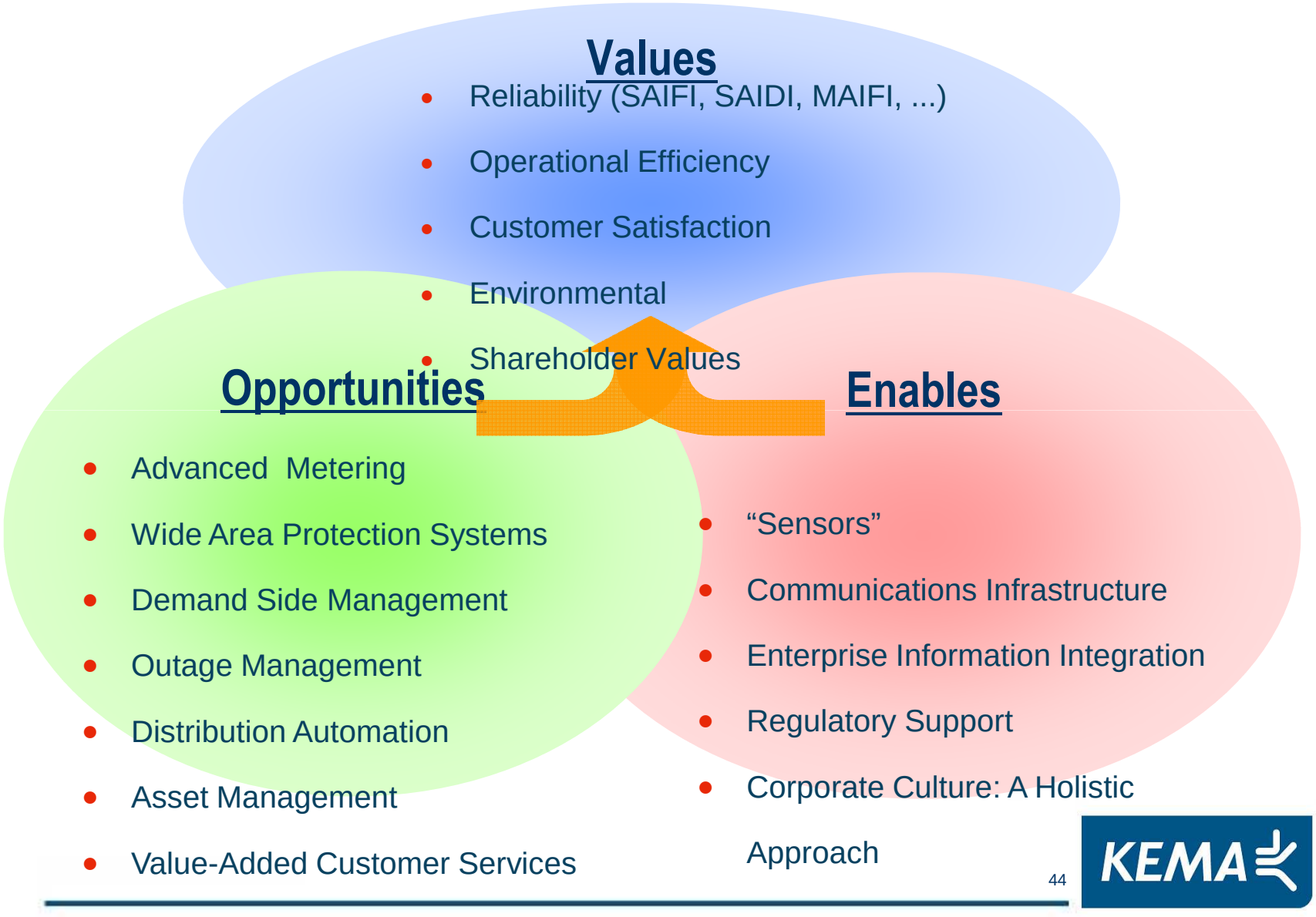
Grid Requirements (cont'd)

- More hardened system against storms/disasters
  - Shorter spans of lines
  - Stronger torque standards for poles and towers
  - UG, composite materials poles
  - Shorter response capabilities (e.g., MDTs)
- System designed, operated and protected for bidirectional power flow
- Differentiated reliability standards for different "grids"
- PQ concerns
- Total energy planning (not just electric)
- Holistic environmental consideration vs carbon only trading or bubble concept

What makes a Smart Grid “Smart”?

- Smart Grid is a vision for the electric delivery system of the future: Utilities, and consumers will accrue returns through the convergence of power delivery and information technologies to achieve improved reliability, reduced O&M costs, avoidance of new capacity, and increased customer satisfaction.
- Such an evolution requires a resistance to the lure of easier short-term solutions made with a “silo” mentality – one without regards to the needs of other parts of the grid and utility operations.

Opportunities and Enablers

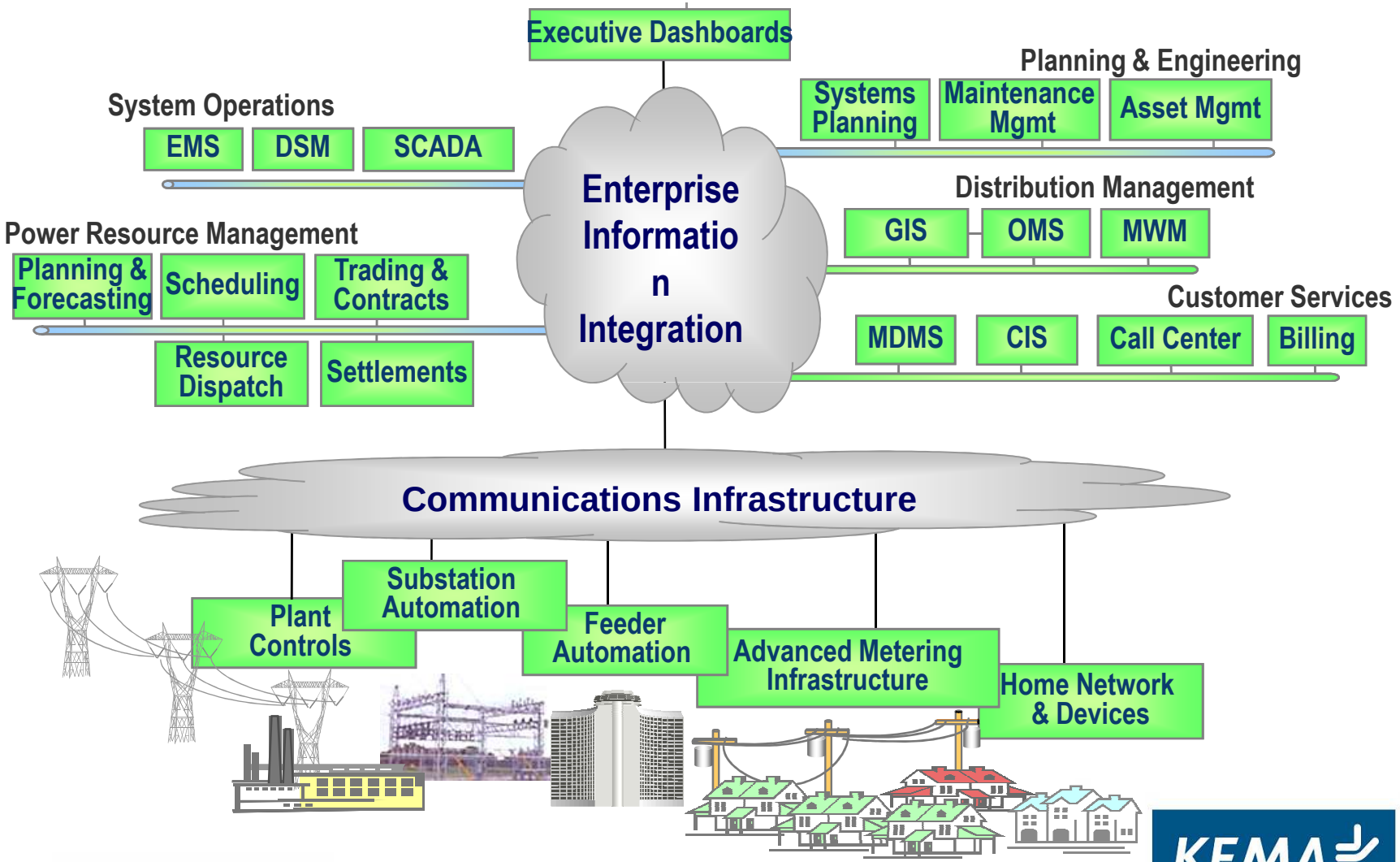


Enabling Technologies

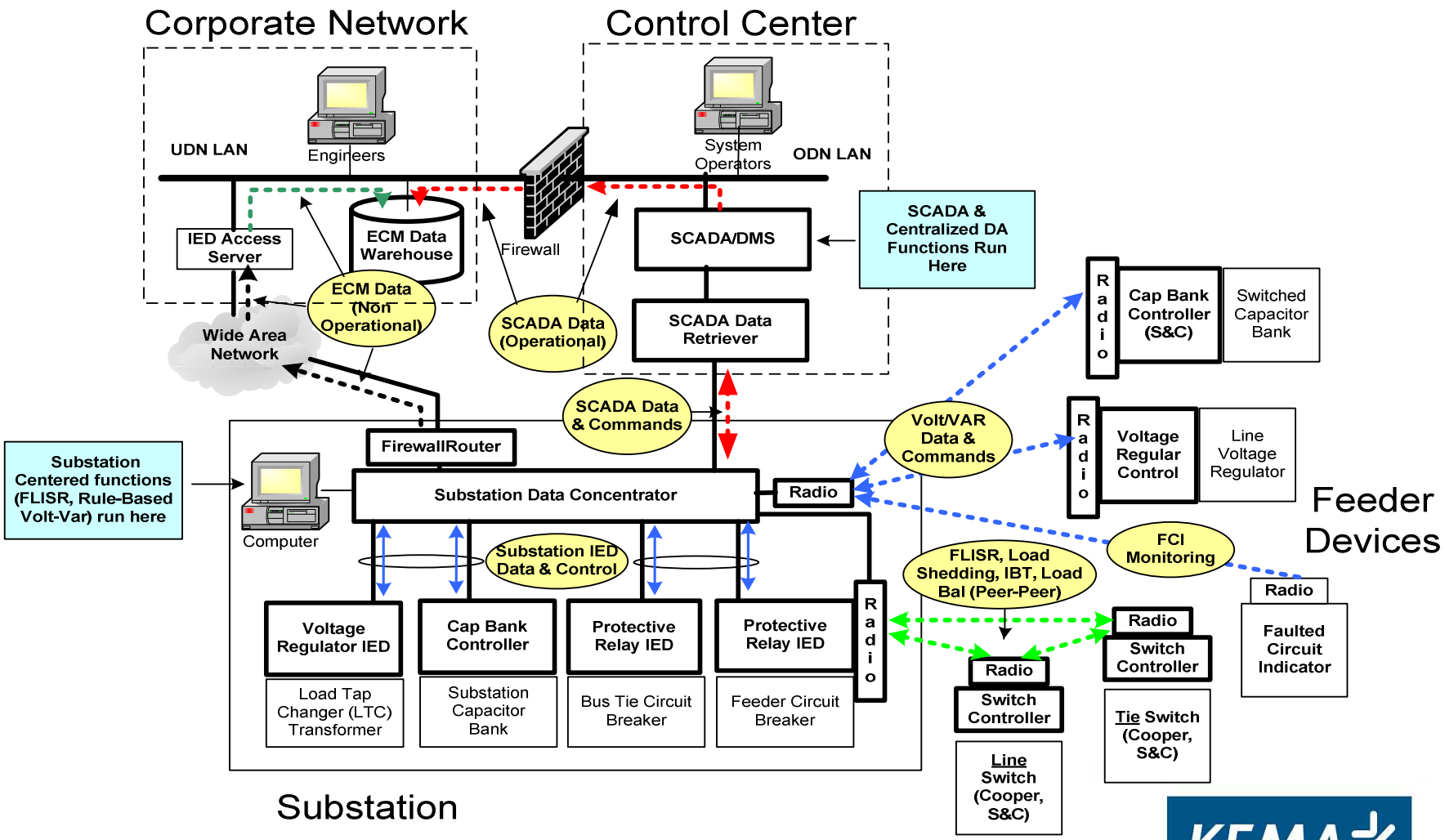
- Advanced sensors
- Communications infrastructure
- Enterprise IT system
- Holistic approach in corporate culture

Enterprise Level Integration

Timely access to information critical for Planning, Engineering, and Operations



System Architecture



Smart Grid & Distribution System

Smart Grid applications at Distribution Systems:

- AMR
- AMI
- Feeder Automation, Integrated volt/var control, Feeder & Sub Peak Load Management, Equipment Condition Monitoring, etc.

Transmission & Smart Grid

- FACTS technologies
- PMUs for Wide Area Protection System
- Remedial Action Schemes
- Var support from DGs
- Equipment Condition Monitoring
- Others

Smart Grid & Energy Supply

- DGs,
- Solar PV systems dispersed in service territory
- Wind farms
- PHEVs
- Nuclear generators
- Integrated Resource Planning (IRP)
- Regional IRP
- Total energy planning
- Holistic environmental evaluation

Smart Grid & Asset Management

- Equipment condition monitoring via communications infrastructure
- Condition-based maintenance incorporating knowledge management techniques
- Data mining from non-operational data

Smart Grid & Customer Services

- Demand Respond program integration
- DGs integration
- PHEV integration
- Micro-grid management
- Integrated Resource Planning
- Targeted DSM programs – Regional Integrated Resource Planning

The Smart Grid of The Future[1]

20th Century Grid	21st Century Smart Grid
Electromechanical	Digital
One-way communications (if any)	Two-way communications
Built for centralized generation	Integrates distributed generation & renewables and supports EVs or hybrids
Radial topology	Network topology; bidirectional power flow
Few sensors	Monitors and sensors throughout; High visibility
Manual restoration	Semi-automated restoration & decision-support systems, and, eventually, self-healing
Prone to failures and blackouts	Adaptive protection and islanding
Scheduled equipment maintenance	Condition-based maintenance
Limited control over power flows	Pervasive control systems; state estimator
Not much sustainability concern	Sustainability and Global Warming concern
Limited price information	Full price information to customers – RTP, CPP, etc.

[1] Modified from the Emerging Smart Grid: **Investment And Entrepreneurial Potential in the Electric Power Grid of the Future, Global Environment Fund, October 2005**

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Appendix 3 – Transmission Risk Planning

Transmission Planning Risk Assessment

Presented at

Technical Combo Session on Smart Grid and Planning

Sponsored by

Power System Planning & Implementation Committee

Authors

S. Varadan, Senior Member, **W.A. Mittelstadt**, Fellow, **R. K. Aggarwal**, Member, **V. VanZandt**, Senior Member, **B. Silverstein**, Senior Member

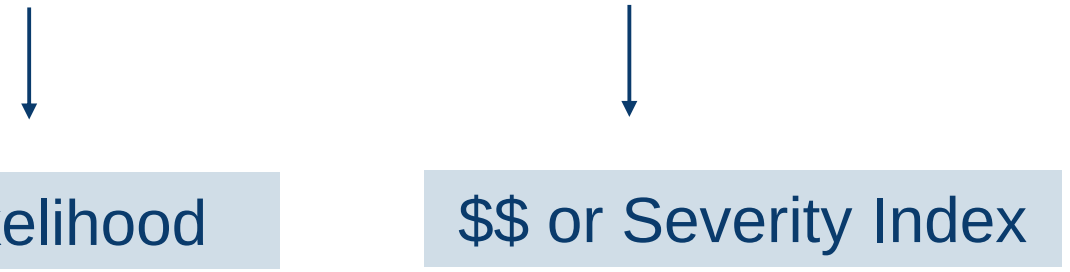
Agenda

- Risk – Background
- Risk in Transmission Planning
- How BPA deals with Risk in Transmission Planning?
  - Motivation
  - AU/NZ Model
  - Tools (Lite and Full Template)
  - Process Integration
- Example Projects and Benefits
- Lessons Learned

Risk - Definition

- Any Event has
  - A certain probability of happening, and
  - A Consequence (or Severity) when it happens

- Risk = (Probability of Event) * (Consequence or Severity)



Purpose of Risk Management

- Understand and Assess Consequences of events
- Manage and balance risk
- Formalized and Structured, Repeatable, Documented
- Embed into “Usual” Process
- Alignment with Corporate Decision Process
- Optimized Portfolio

Risk in Transmission Planning

- Consider Risks at the earliest stages to make the best possible planning decisions.
- To develop a plan of service that gives best value to utility and its customers.

Risk – What does it really mean?

- For Transmission Planning (which typically involves interaction with Design and Construction)
  - Overbuilding
  - Budget overruns
  - Schedule delays
  - Loss of Customers (and potential revenues)
  - Safety
  - Environmental
  - Legal... It all comes down to $$$

Risk – Practical Examples

- In the context of Transmission Planning Risks could involve:
  - Line Routing...going through a Watershed!
  - Wrong Load Forecast...Line in wrong place!
  - Operationally...increased Congestion and Redispatch Costs!
  - Doing Nothing...Safety Hazards!

BPA – Risk Motivation

- Learning from past experiences
- Recognizing future trends
- Realizing the intricacies of Risk on an Enterprise level, spanning several departments
- Realizing the need for an “optimized” portfolio approach to asset management
- Motivation to set the “standard” for risk management in the electric utility business.

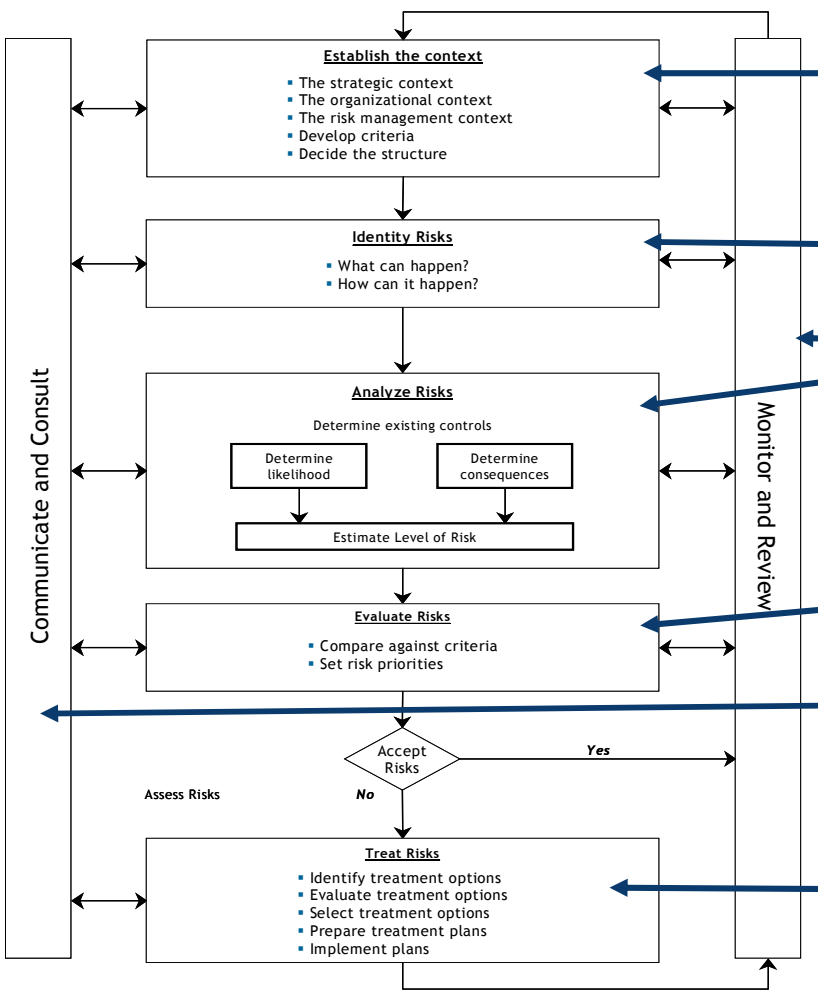
BPA – Risk Strategy

- Choosing a Risk Model (at Corporate Level)
- Applying this Risk Model to Transmission Planning

Implementation based on a three point strategy:

- Develop the Tools
- Develop the Process
- Develop the Personnel

Risk Model



Establish Context

Identify Risks

Australia-New Zealand Model for Risk - AS/NZS 4360:2004. Available for purchase on the Internet at http://www.riskmanagement.com.au/

Monitor and Review

Analyze Risks

Evaluate Risks

Communicate and Consult

Treat Risks

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Risk Tools - Template

- Comprehensive collection of Risk factors arranged into categories of Risk.
- Each factor assigned Risk Likelihood and Severity
- Each factor weighted and Summarized per Category

Risk Tools - Template

- A Structured Way to assess Risk
- Provides Documentation...and Justification
- Is EXCEL based, easy to use, flexible and can be made “Customer” specific
- Created Two Versions
  - Lite (for Projects > 2 MUSD)
  - Full or Detailed

How can this be used?

- A Xmsn project that has a 115 kV 1 Ckt line that is nearing its life term and is getting to be in a state of “unsafe” operation. This line goes through environmentally protected habitat and will not be accessible once a particular window elapses.

Questions to Ask:

- What needs to be done?
- Which is the “Best” alternative?
- Can the reasoning be documented? Is it repeatable?

Risk Tools - Template

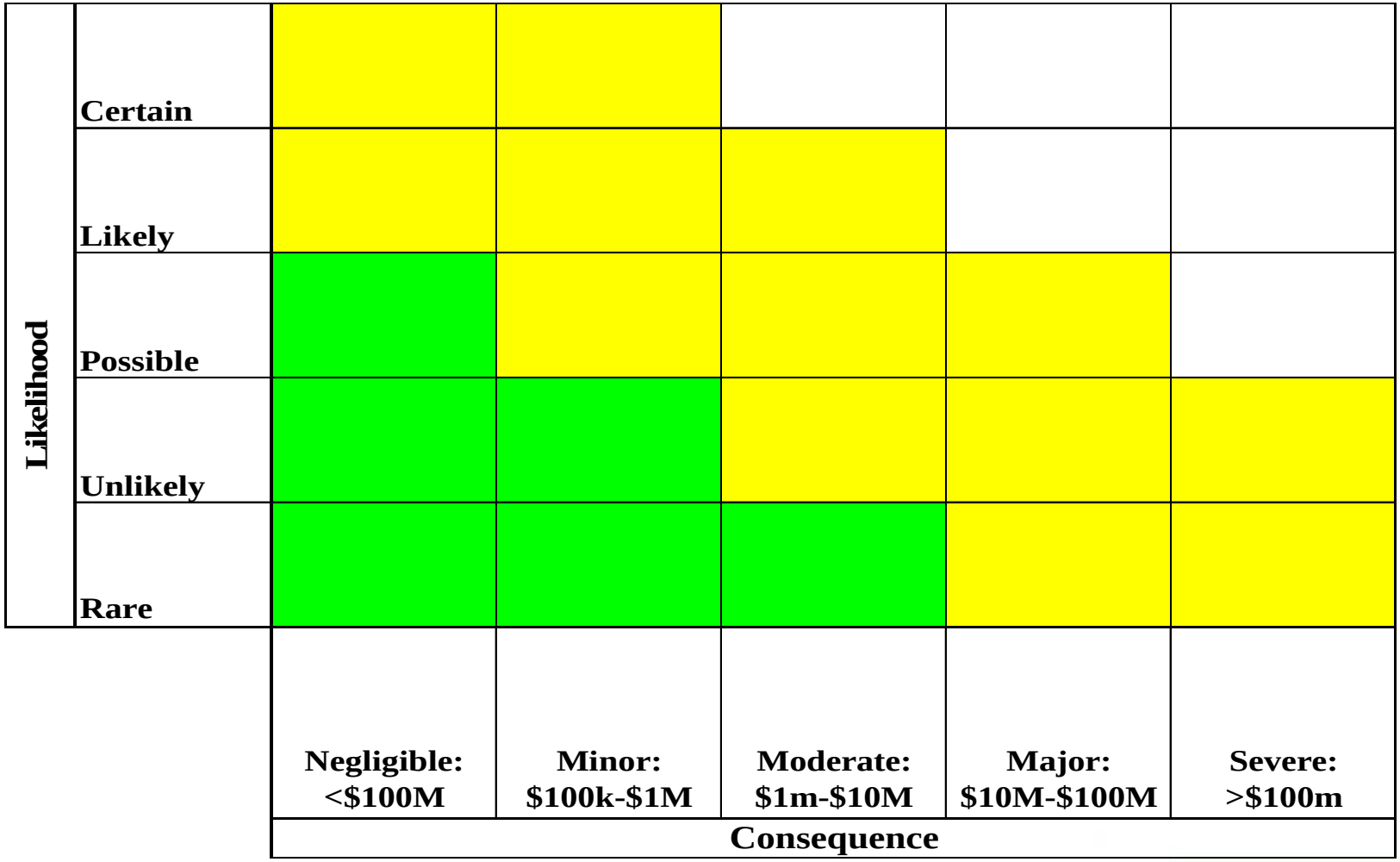
- Describe alternatives
- List “Do-Nothing” alternative first
- Include Non-Wires” alternative, if applicable
- Conduct technical studies to demonstrate that each will meet the solution objective
- Determine estimated alternative cost/benefits

Risk Tools - Consequence Scale

Severity Index		>Low	<High
5	Severe	$100M	$1B
4	Major	$10M	$100M
3	Moderate	$1M	$10M
2	Minor	$100K	$1M
1	Negligible	$10K	$100K
0	None	$0	$0

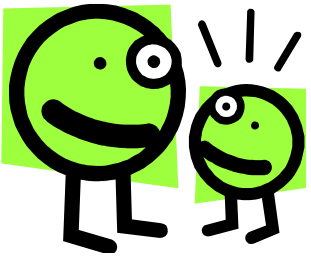
Severity ~ $10^{(Index)}$

Risk Tools - Likelihood Scale



Risk Tools - Likelihood and Consequence for Risk Categories

			Alternative Rank		
Category	**Table**	**Likelihood (0-1)**	**A**	**B**	**C**
Utility Net Cost ($000)	Ref		0	0	0
Societal ($000)	Ref		0	0	0
Design and Construction		1.00			
Construction		1.00			
Schedule slippage		1.00			
Operations		1.00			
Maintenance		1.00			
Health and safety		1.00			
Reliability		1.00			
Environment		1.00			
Technology		1.00			
Supply Chain		1.00			
High Estimated Cost ($000)			**0**	**0**	**0**
Low Estimated Cost ($000)			**0**	**0**	**0**



Communicate and Consult

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Risk Tools – Factors in a Risk Category

		Alternative Severity (0-5)		
Alternative		**A**	**B**	**C**
Feature	**Likelihood (0-1)**	**(0-5)**	**(0-5)**	**(0-5)**
Cultural sites	1.0			
Endangered and/or sensitive species	1.0			
Wetlands, streams, rivers	1.0			
Tribal lands involved and/or coordination	1.0			
Densely populated area	1.0			
Politically sensitive area	1.0			
Landowner rights and coordination	1.0			
Visual impacts	1.0			
Inter-utility coordination	1.0			
New rights of way required	1.0			
Widening of rights of way required	1.0			
Vegetation mgt/noxious weeds	1.0			
Weighted Likelihood		**0.0**	**0.0**	**0.0**
Weighted Risk		**0**	**0**	**0**

Analyze and Evaluate

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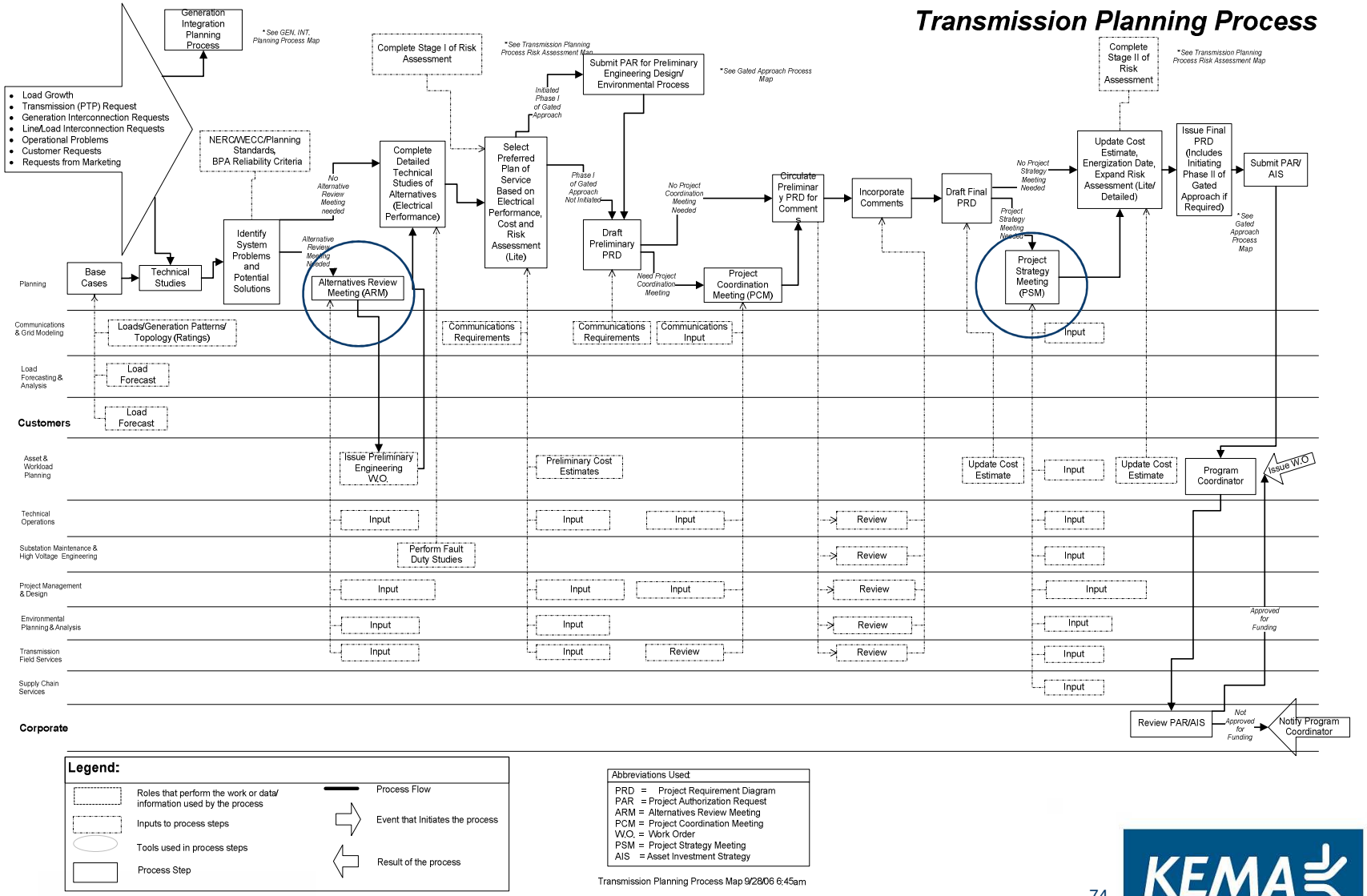
Summarization

			Alternative Rank		
Category	**Table**	**Likelihood (0-1)**	**A**	**B**	**C**
Utility Net Cost ($000)	Ref		0	0	0
Societal ($000)	Ref		0	0	0
Design and Construction		1.00			
Construction		1.00			
Schedule slippage		1.00			
Operations		1.00			
Maintenance		1.00			
Health and safety		1.00			
Reliability		1.00			
Environment		1.00			
Technology		1.00			
Supply Chain		1.00			
High Estimated Cost ($000)			**0**	**0**	**0**
Low Estimated Cost ($000)			**0**	**0**	**0**

Risk – Process Integration



Risk - Personnel

Activities include:

- Training – Workshops, Seminars
- Study Material
- “Hands-on” training
- Training to include planning and non planning personnel to ensure consistency in perception of risk - **Repeatability**

BPA Projects and Benefits

Project Name	Savings (MM USD)
Libby – Troy Line 115 kV Circuit Rebuild	~13
H2F - Nine Canyon Wind Tap (line reconductor)/McNary - Badger Canyon	~1.28
Vantage Substation reconfiguration	In Progress
Rogue SVC	In Progress
Mobile radio replacement	In Progress

BPA Project Benefits

Other benefits include:

- Uniformity and Consistency in application of Risk throughout the Planning Process – Documentation, Training.
- Provided a good “Check & Balance” mechanism
- Earlier involvement of various disciplines to a thorough base for alternatives comparison, ranking and selection
- Comparison and elimination of alternatives at the earliest point in the planning process where choices can result in the greatest opportunity for savings
- A step off point for providing information to the AIS tool and agency risk analysis processes

Lessons Learned

- Savings are significant to warrant Risk Analysis.
- Method is somewhat subjective, but if we get expert input at each stage the subjectivity can be minimized
- Method allows for the use of new data that could potentially alter the decision...real options (flexibility)
- A structured (checklist type), robust approach that is repeatable...
- An excellent way to justify and archive the resulting choice of action.

Conclusion

- Risk in Transmission Planning process
- Application of AU-NZ model
- BPA Three-prong strategy
  - Tools, Process and Personnel

Appendix 4

SMART Transmission Planning

Paola Bresesti, CESI RICERCA

Rationale and Definition

- ✓ **Governments and electric industries in developed countries are facing major challenges to implement a strategy for a reliable, competitive and sustainable electricity supply.**
- ✓ **The development of the transmission infrastructure is a central and recognised issue in this strategy.**
- ✓ ***The main requirement of a SMART Transmission Planning & Development is to effectively assist the achievement of a reliable, competitive and sustainable electricity supply.***

SMART Transmission Planning: main issues

- ✓ **Justification and benefit analysis of transmission expansions (*Panel : S.Francisco 2005, Tampa 2007*)**
- ✓ **Reconciliation of transmission and generation expansion planning (*Panel Montreal 2006*)**
- ✓ **Planning criteria, methods and tools for integration of large scale wind resources.**
- ✓ **Public Consensus on new Transmission Infrastructures**
- ✓ **Incentives and Institutional Support to Transmission**

Justification and benefit analysis of transmission expansions

- ✓ **The benefits of transmission expansions go far beyond the mere reliability improvements; the demonstration and the measure of these benefits, especially those ones related to improved market competition and increased exploitation of renewable resources, are crucial elements to justify new projects and to overcome the present slowdown in transmission investments.**

- ✓ **Focus on :**

  - ✓ **Framework and tools to assess how the development and the technological improvement of the transmission infrastructure contribute to reliability, competitiveness and sustainability of the electricity supply. To assure competition**

  - ✓ **Harmonization of benefit framework to assist the development of multinational interconnection projects.**

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Reconciliation of transmission and generation expansion planning

- ✓ **In restructured power industries generation and transmission are planned by different entities. This gap generates lack of confidence in transmission planning decisions and may result in a certain degree of social losses in case of incorrect planning.** **Warning: reconciliation of transmission and generation expansion planning can be seen as a market distorting action**

- ✓ **Focus on :**

  - ✓ **Methods to predict investments behaviours of generators; integration of these methods into traditional transmission planning tools.**

  - ✓ **Efficient stream line of the transmission planning process that can partially reconcile transmission-generation expansions planning and provide wider confidence to transmission planning decisions**

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Planning criteria for integration of large scale wind resources

- ✓ **Exploitation of wind resources is presently a keystone in the sustainability policy of many countries.**
- ✓ **Focus on:**
  - ✓ **New reliability methods to handle the intermittent nature of wind resources.**
  - ✓ **New planning criteria.**

Public Consensus on new Transmission Infrastructures

- ✓ **In transmission planning the challenges related to public consensus far outweigh the technical challenges; planning models and tools alone cannot overcome the consensus problems.**
- ✓ **Focus on :**
  - ✓ **Communication practices, approach and methods that facilitate the public debate necessary to reach consensus on transmission projects;**

Incentives and Institutional Support to Transmission

- ✓ **Institutions across the world are undertaking specific actions, like NIETC (National Interest Electric Transmission Corridors) in USA and Priority Interconnection Plan in European Union, to promote transmission projects of strategic interest.**
- ✓ **Focus on :**
  - ✓ **Incentives and institutional support that reflect the value of transmission infrastructure for the society;**
  - ✓ **Criteria of eligibility for institutional support.**