



# *Overview – EPRI Distribution Planning Research*

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# *Agenda*

- ➔ ◆ Distribution Planning Issues
  - ◆ History 1996 - 2002
  - ◆ Overview of Key Projects
  - ◆ 2003 Program – Distribution Asset Management Target
  - ◆ Website

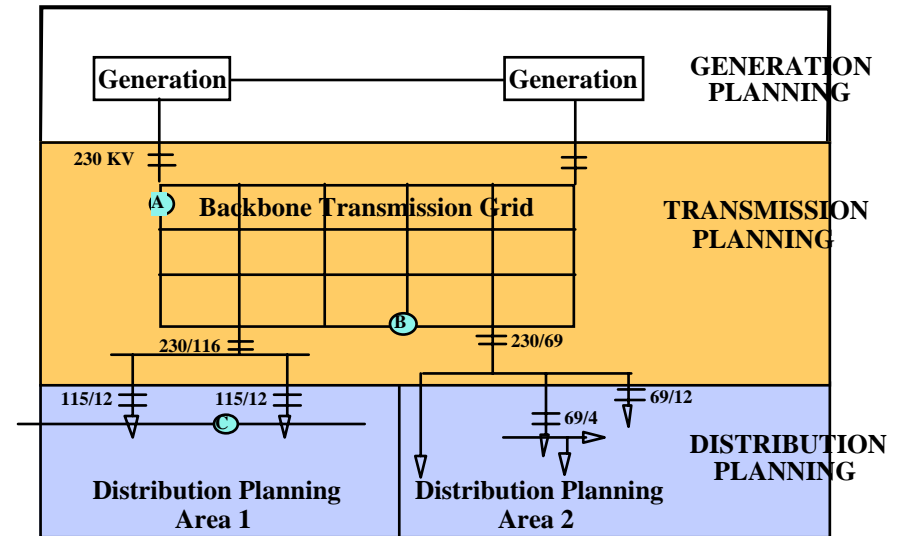


# *Distribution Planning Problem is Complex*

- ◆ What about reliability - how far can we push the system before falling off the edge?
- ◆ How do we get the right-sized capacity when it is needed?
- ◆ Can we save \$ by deferring maintenance?
- ◆ What risks are we taking by practicing “doing-less” decision making (do we really know how close we are to the edge)?

# Distribution Business Planning is Mostly About Solving Investment Problems

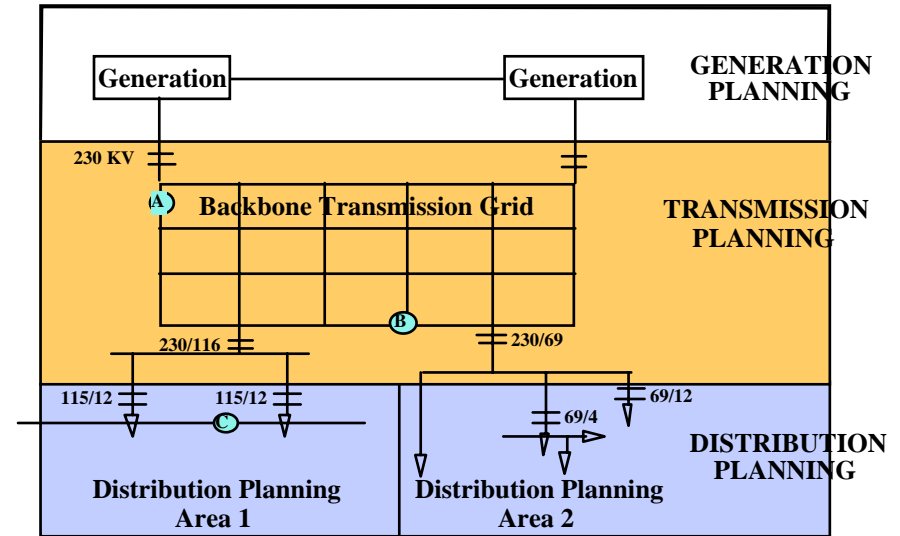
- ◆ 40% to 50% of electric utility net investment
- ◆ Business issues
  - Minimizing investment costs
  - Having “right” infrastructure to meet customer needs
  - Making money
- ◆ Key strategic needs
  - Managing assets
  - Linking investment decisions to customer needs



<u>Net Invest.</u>	
Gen.	= \$8.7B
Tran.	= \$4.5B
Dist.	= <u>\$13.5B</u>
Total	= \$26.7B

# Distribution Business Planning

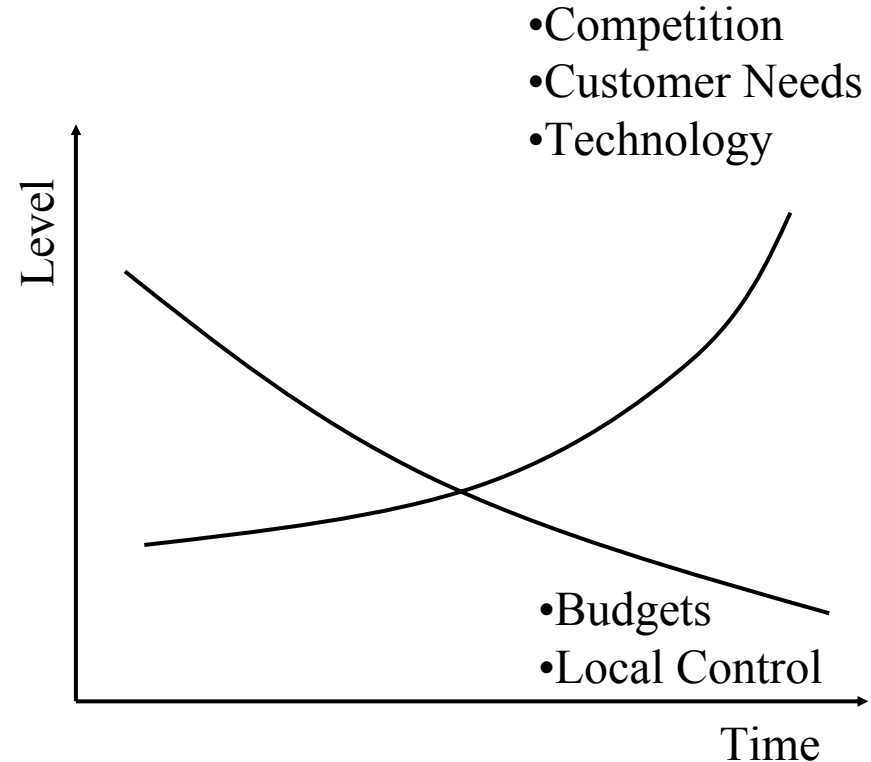
- ◆ Two driving facts
  - Very low revenue to asset ratio
  - Large imbedded asset base
- ◆ Substantial care and feeding is required
  - Repair / Replace
  - Expand / Prepare for future



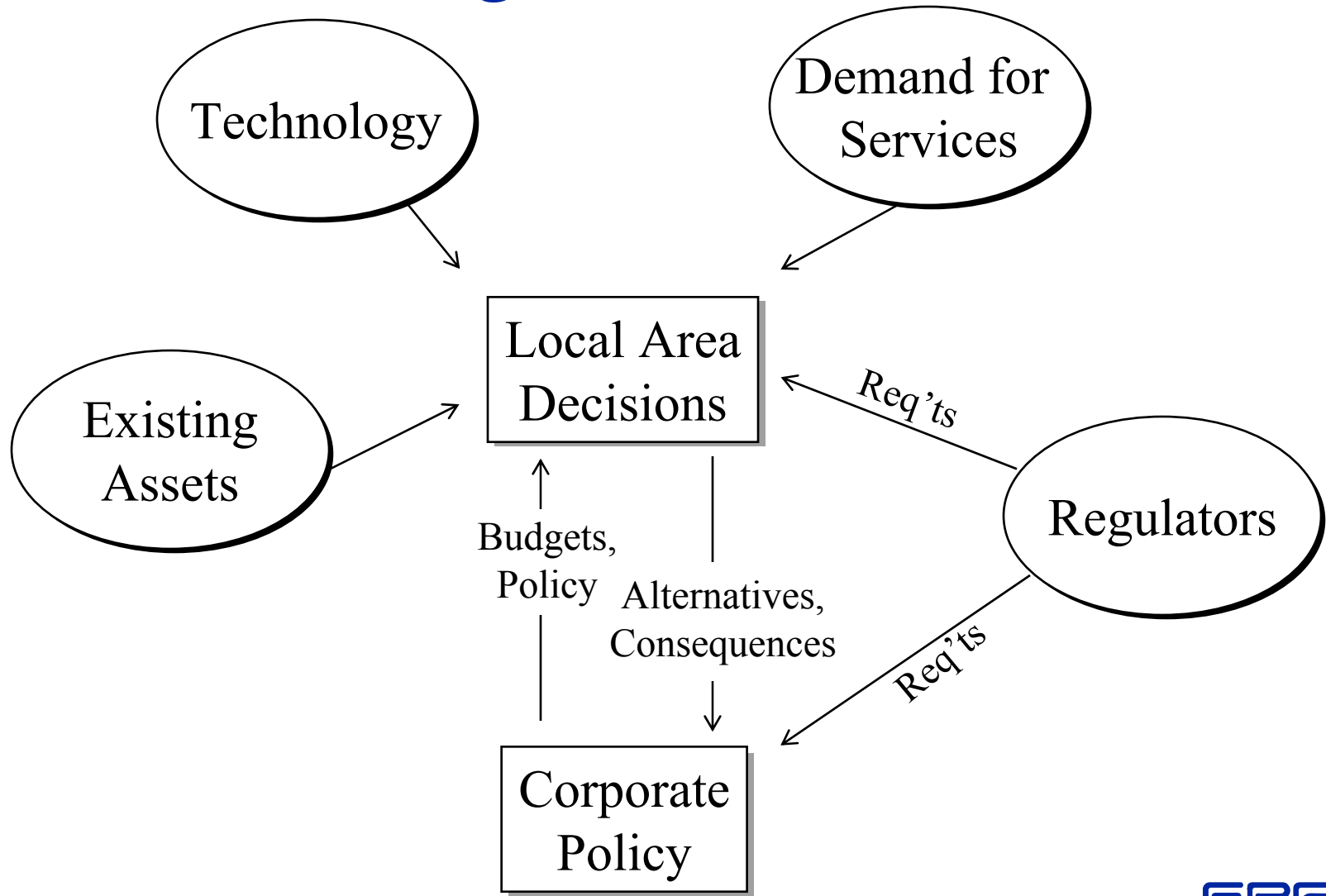
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# Opposing Trends are Changing the Business

- ◆ Increasing levels of key drivers
  - Restructuring & deregulation
  - Regulatory & Corporate scrutiny
  - Customers demand for reliability and service quality
  - Technology change
- ◆ Reduced budgets & increased corporate control
- ◆ Together these are creating a collection of problems



# Nature of Distribution Business Planning Problem





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# *Planning Work 1997 – 2002*

- ◆ December 1996 Chicago Focus Group
- ◆ 1997 - 1998
  - Create the portfolio - projects in Distribution Systems Target
  - Produce V1.0 Area Investment Planning Tools
- ◆ 1999
  - Start work on Customer Needs & Reliability projects
  - V1.5 Strategy Model & V2.0 LoadDynamics
  - Methodology design for Project Prioritization (AEP)



# *Planning Work 1997 – 2002 cont.*

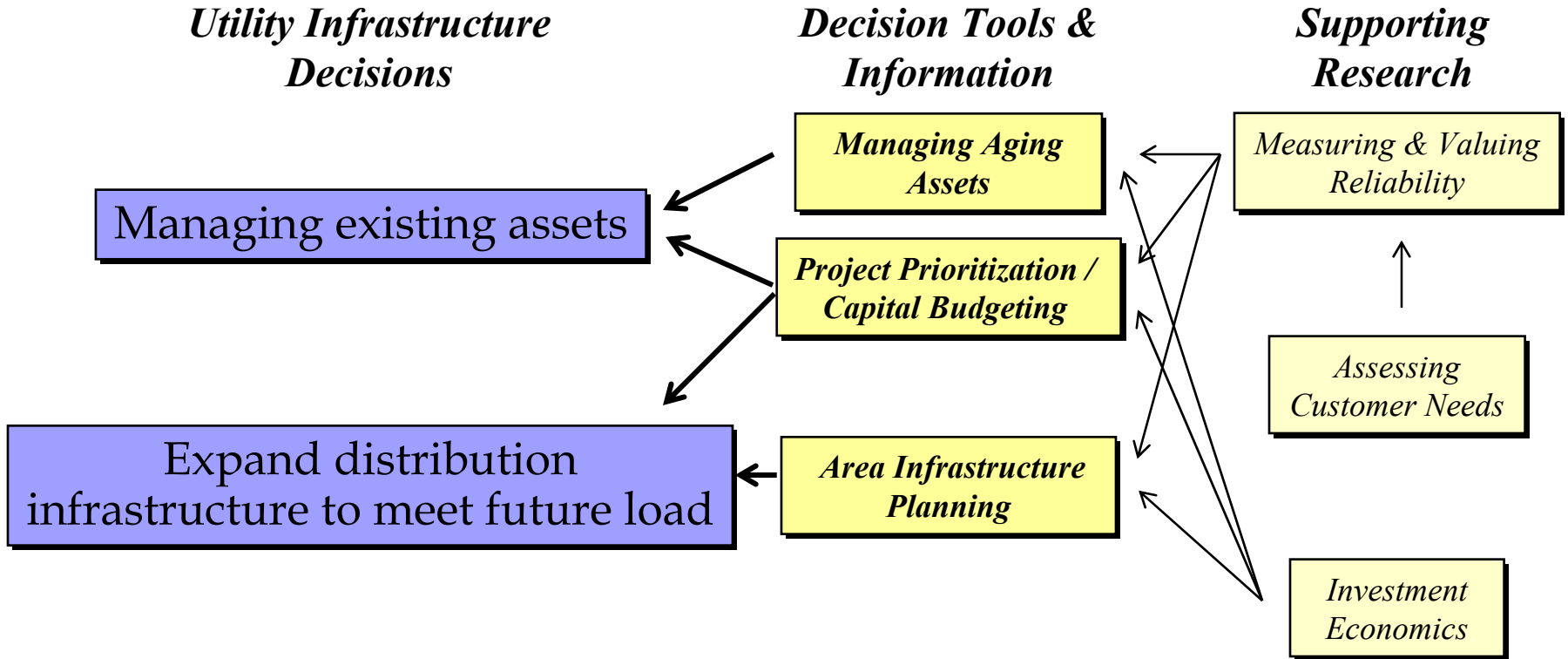
- ◆ 2000
  - Aging Assets - Started
  - Project Prioritization – method & software designed
  - Customer Needs & Reliability – EPRI white papers
  - Area Investment Planning – tech transfer
- ◆ 2001: Focus on Aging Assets and Project Prioritization
- ◆ 2002:
  - Continued focus on Aging Assets and Project Prioritization
  - Some work on Measuring & Valuing Reliability
- ◆ 2003 New EPRI program with two parts
  - Tools to support Asset Planning Decisions – continuation of planning work
  - Asset Management Practices



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# Utility Infrastructure Decisions & EPRI Planning Projects



Underlying Objective: Minimize the lifecycle costs of distribution infrastructure while meeting customer needs for reliability & power quality



# *Managing Aging Assets*

## ◆ Objectives

- Document problem (problematical equipment, financial and reliability risk),
- Develop methodology, data, and software tools to help
  - » Determine repair/replace & capital budgeting strategies
  - » evaluate risks

## ◆ 2001

- Repair / Replace Decision Model – Version 1.0 Software
- Equipment failure research – Research Status Report (1001873)

## ◆ 2002

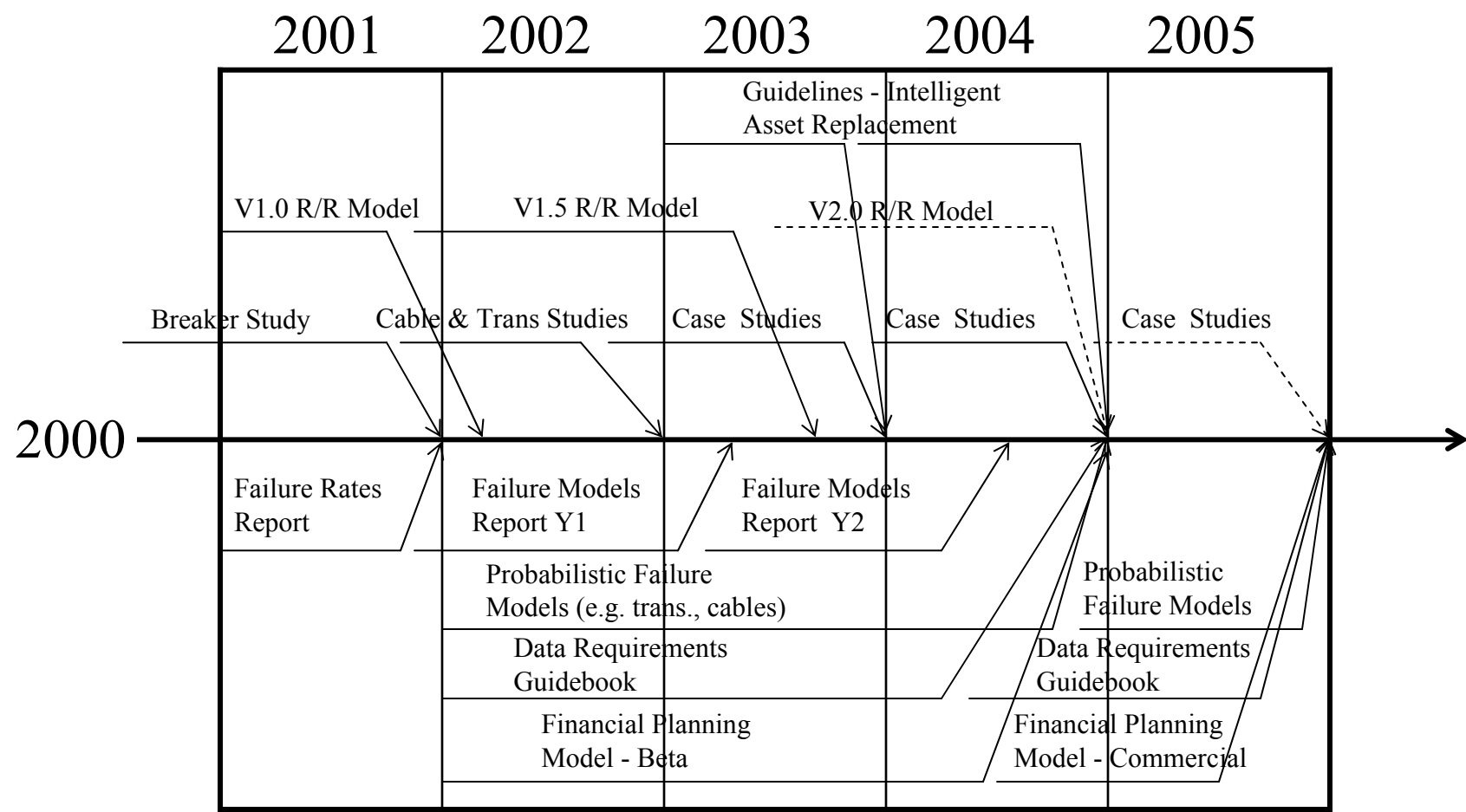
- Improve repair / replace software
- Continue equipment failure research and publish EPRI report
- More case studies and equipment decision models

## ◆ 2003

- Training workshop
- Continue equipment failure research
- Guidelines – Intelligent asset replacement



# Managing Aging Distribution Assets



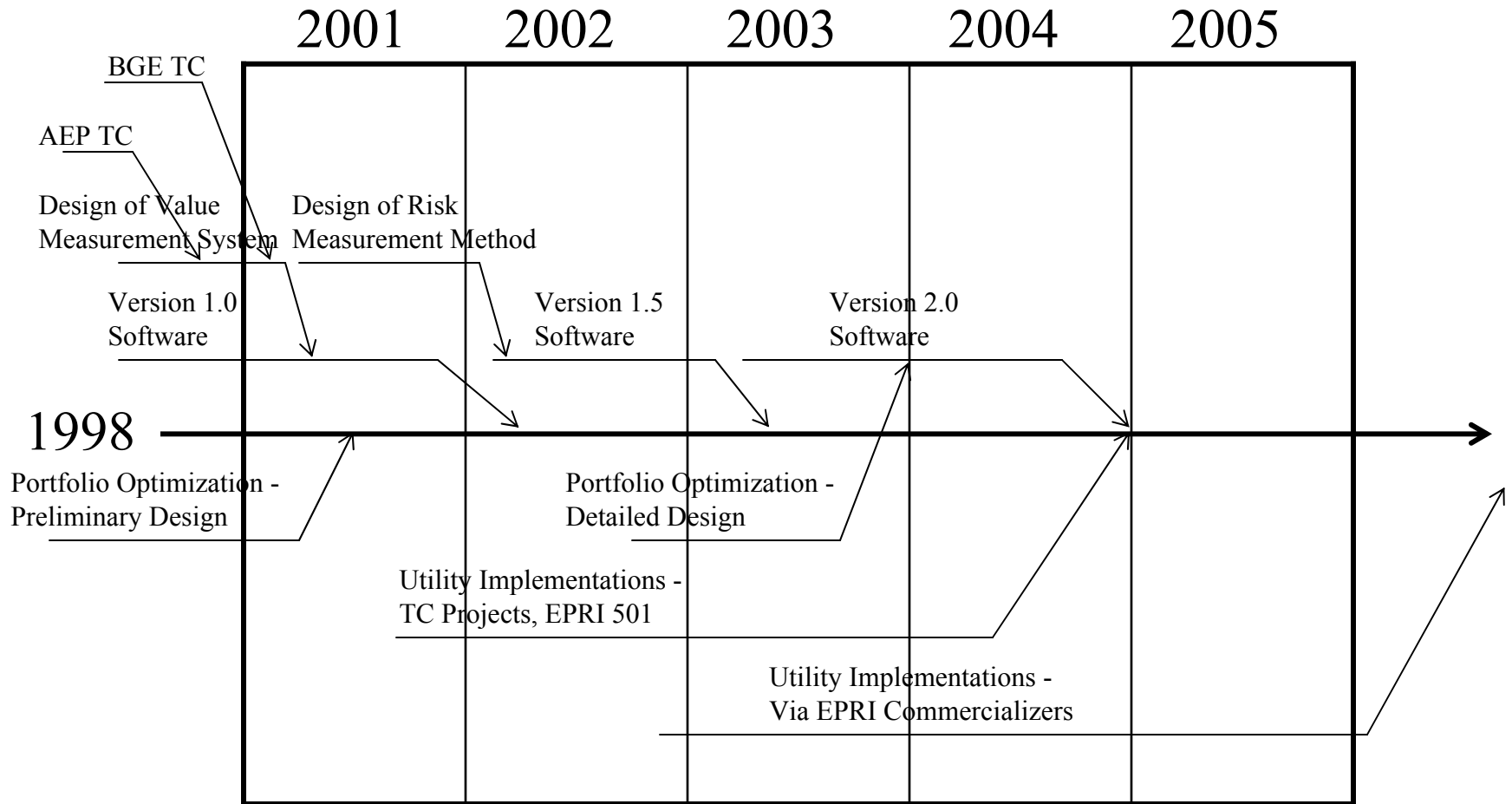


# *Project Prioritization System, P<sup>2</sup>*

- ◆ Objective: Provide distribution planning system
  - Evaluate projects consistently & objectively
  - Select best multi-year portfolio of projects given a budget constraint
  - Understand the implications of changes in budget levels
  
- ◆ 2001
  - Version 1.0 Software
  - Implementation at BGE, TXU started
  - Project Prioritization: Methods Overview – EPRI Report (1001877)
  
- ◆ 2002
  - Improve software – many functionality improvements, adding risk & uniform data reporting
  - More implementations (TXU ComEd, PECO, HECO, NES)
  
- ◆ 2003
  - Training workshop
  - Portfolio Optimization, Integrating reliability / customer satisfaction models
  - Implementations



# Project Prioritization System



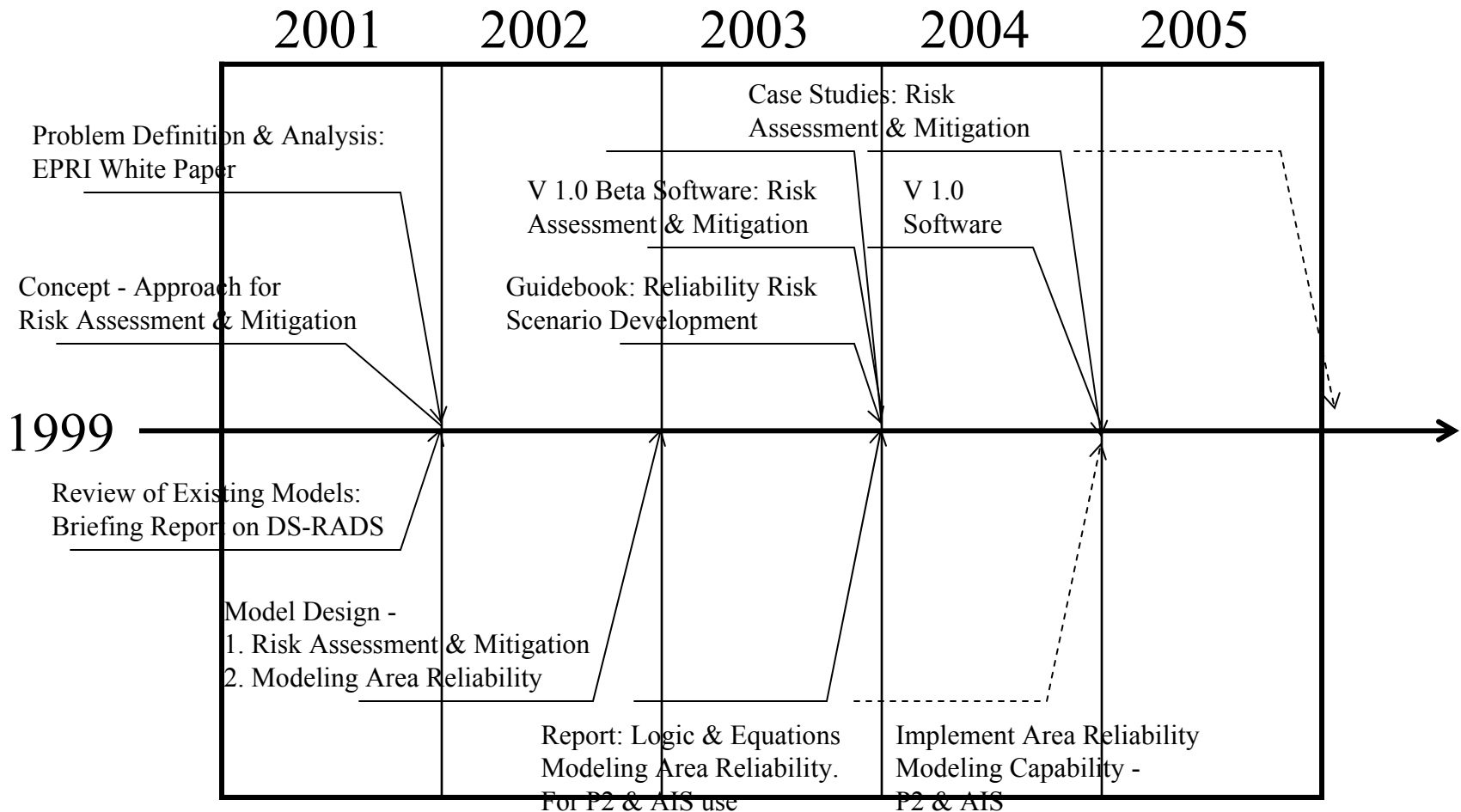


# *Measuring & Valuing Reliability*

- ◆ Objective: Tools for
  - Risk analysis and mitigation
  - Improve alignment of design & spending with area customer needs
- ◆ 2001
  - Algorithms design - Research Status Report (1001882)
  - DS-RADS Review - Research Status Report (1001881)
  - Conceptualization of risk assessment process
- ◆ 2002 - 2003 Integrate algorithms into planning software
  - Standalone risk analysis and risk mitigation tool (model and risk assessment process)
  - Area-specific reliability planning (for Aging Assets P2 and AIS)



# Reliability



# *Area Investment Strategy Tools*

- ◆ Objective: Capability to formulate least-cost infrastructure expansion strategies
  - Given uncertain future load, costs, and siting difficulties,
  - Consideration of distributed generation options; and the service requirements of different customer segments
- ◆ 2001
  - Enhanced models to handle uncertain future load jumps (Strategy Model V1.6, LoadDynamics V2.1)
  - Model support and tech transfer
- ◆ 2002
  - Design of method for improved “area\_specific” reliability modeling
  - Spreadsheet RR methods
  - Model support and tech transfer
- ◆ 2003
  - Not in base EPRI R&D budget
  - Implement improved reliability modeling?
  - Model support and tech transfer



# *Customer Needs*

- ◆ Objective: Provide improved methods and metrics for incorporating area customer into investment & O&M decisions
  
- ◆ 1999 – 2000
  - Extensive Literature review and White Paper
  - Customer Value Model & Spreadsheet
  
- ◆ 2003 – 2004
  - Not in base EPRI R&D budget
  - Improve spreadsheet method & use in Aging Assets & P2?



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  - R&D Goals
  - Focus & Deliverables
- ◆ Website



## *R&D Goals - Provide tools and information to address two key asset management functions*

- ◆ Decision making
  - Managing existing assets
  - Expand distribution infrastructure to meet future load
  
- ◆ Increasing knowledge of asset management practices
  - Identifying management practice with high potential for improvement
    - » Cost reduction
    - » Reliability improvement
  - What works, what does not work, and what works well

Underlying Objective: Minimize the lifecycle costs of distribution infrastructure while meeting customer needs for reliability & power quality



# 2003 Project Focus – Planning Tools

## ◆ Aging Assets

- Continue equipment failure research – build basis for probabilistic prediction of remaining life
- Guidelines, Volume 1: Lessons for research and case studies
- Equipment de-rating research
- Software tools (2 models)
- Training Workshop

## ◆ Project Prioritization

- Version 1.5 P2 Software
- Portfolio Optimization
- Implementation / commercialization
- Training Workshop

## ◆ Reliability

- Risk analysis & mitigation
- Area specific reliability planning

## ◆ Area Investment Strategy

- Model support and tech transfer
- Reliability enhancements?

## ◆ Customer Needs

- Improve spreadsheet method & use in Aging Assets & P2?



# 2003 Official EPRI Deliverables: Planning Tools, cont.

## ◆ Aging Assets

- Version 1.5 Repair / Replace Software 3/31/03
- Training Workshop 3/31/03
- Tech Report: Guide for Intelligent Asset Replacement, Vol. I 12/31/03
- Training Workshop 6/30/04
- Tech Report: Establishing Utility Specific Failure Databases 12/31/04
- Tech Report: Guide for Intelligent Asset Replacement, Vol. II 12/31/03

## ◆ Project Prioritization

- Version 1.5 Software 6/30/03
- Training Workshop 6/30/03
- Version 2.0 Software 6/30/04
- Training Workshop 6/30/04



# *2003 Official EPRI Deliverables: Planning Tools, cont.*

## ◆ Reliability

- Tech Report: Incorporating Reliability into Planning Tools 6/30/03
- Guidebook Reliability-Risk Scenarios Development 12/31/03
- Software: Tool for Design of Risk Mitigation Strategies 12/31/04



# 2003 Official EPRI Deliverables: Asset Management Practices

- ◆ Access to Reliability Knowledge Base
  - Periodic Knowledge Base Updates Through 12/31/04
  - Quarterly publication addressing key issues Through 12/31/04
  - Technical Report 12/31/04
  - Annual seminar Through 12/31/04
  
- ◆ Vegetation Management
  - Tech Report: Practices Assessment and Recommendations 12/31/03
  - TBD 12/31/04
  
- ◆ Wood Pole Management
  - Tech Update 12/31/03
  - Workshop 12/31/04
  - Tech Report 12/31/04



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**VMN Group**

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**Our Mission**

To provide the best in analytical software and methodology that aids electric utilities in making sound business decisions.

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**Company Profile**

The VMN group consists of four individuals with diverse and overlapping backgrounds that are funded primarily by [EPRI](#). Technical expertise includes engineering, economics, mathematics and decision science. The main members and their associations are:

Stephen W. Chapel	EPRI
Charles Feinstein	Santa Clara University and VMNGroupLLC
Peter A. Morris	VMNGroupLLC
Mukund N. Thapa	Stanford Business Software, Inc.

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**Managing Aging Assets**  
Repair / Replace Software  
Equipment Failure Research

**Project Prioritization**  
PMIS System  
Portfolio Analysis Software

**Distribution Reliability**  
Investment and O&M Planning  
Reliability Forecasting

**Customer Needs**  
Customer Value Model  
Reliability Screening Tool

**Investment Strategy**  
Area Investment Strategy Model  
LoadDynamics Model

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