# Transmission Expansion:
# Issues and Recommendations

North American Electric Reliability Council

Prepared by the
Transmission Adequacy Issues Task Force
of the
NERC Planning Committee

NERC Board of Trustees
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# TABLE OF CONTENTS

# Introduction

The Transmission Adequacy Issues Task Force's (TAITF) analysis of issues and obstacles that are impacting the planning and expansion of the transmission systems is outlined in this report. The report also presents recommendations to reduce or eliminate these obstacles to the expansion or reinforcement of the transmission systems. Particular emphasis is placed on the recommendations where NERC can play a significant role in achieving these objectives.

The deregulation of wholesale electricity supply in the electric industry has led to a number of changes, including the restructuring of the electric industry, and has created many new challenges for all market participants. In part, as a result of deregulation, a rapid expansion of one portion of the electric system — generation supply — has occurred. However, the expansion of the transmission systems has not been well coordinated with the generation expansion in all regions. The failure to expand transmission on a regional basis has led to congestion in various parts of the North American transmission systems, preventing the electricity market from working as efficiently at it might.

Planning new generation or new transmission requires a coordinated approach to ensure electric system reliability and efficient congestion management. A market approach to planning will require providing all transmission customers access to well-defined transmission rights and efficient price signals that show the consequences of their transmission use decisions. If a market approach is successful, the decisions of where, when, and how to relieve congestion will be driven by economic considerations in addition to reliability requirements.

The issues and recommendations in this report reflect the deliberations of the Task Force as well as feedback from the NERC Planning Committee and the NERC Market Interface Committee. In addition, information from four Regional Council transmission interviews (ERCOT, MAAC, MAIN, and MAPP) provided valuable input to the Task Force.

## Executive Summary

The reliable operation of the interconnected transmission systems in the near term is highly dependent upon coordination and proper actions by transmission system operators. In the longer term, the reliability of the interconnected transmission systems will also be highly dependent upon the location of new generation resources and the addition of new transmission facilities.

With few major transmission facilities and reinforcements identified for construction over the next several years, transmission congestion is expected to increase and electricity transactions will likely continue to be curtailed.

The Transmission Adequacy Issues Task Force has identified a number of key issues that are impacting the planning and construction of new transmission facilities or transmission reinforcements. The Task Force has also made a number of associated recommendations to reduce or eliminate the obstacles to transmission expansion. These recommendations focus largely on actions or activities that NERC can pursue. For areas beyond NERC's responsibility, NERC also encourages the electric industry, the regulatory community, and others to consider a number of actions.

The Task Force's issues and recommendations pertaining to transmission expansion are grouped into the following four areas that are described in the next four sections:

- Planning
- Cost Recovery
- Siting
- Education

While the issues in each section of the report are numbered and thereby represent somewhat of a general prioritization, the numbering is intended primarily to improve communications and to associate the recommended actions with the particular issues.

Coordination is an underlying theme in each of these four areas. The Task Force, therefore, elected to include elements of its coordination findings within the four issue groups. Coordination is required among various stakeholder groups and regulatory bodies. Coordination is also necessary among those entities that deal with the technical elements of planning, siting, and constructing transmission facilities, including regional reliability groups and transmission entities responsible for the reliability of the bulk electric systems.

## Background

On October 20, 2000, Planning Committee Chairman Harlow R. Peterson appointed a Transmission Adequacy Issues Task Force comprised primarily of PC members. The creation of this Task Force was confirmed by the PC with its approval of the Task Force's scope (Appendix A) at the November 14–15, 2000 PC meeting.

The Task Force's charge was to identify key issues or obstacles impacting the planning and expansion of the transmission systems and to recommend actions or activities that NERC, the electric industry, or others can possibly pursue to help reduce or eliminate them.

Over the November 2000–February 2001 period, the Task Force reviewed, summarized, and extracted a number of issues impacting the planning and expansion of the transmission systems from several major electric industry reports (Appendix B). These reports and their reviews, through a number of Task Force conference calls, provided background on the Task Force's assignment. As part of this process, the Task Force identified to the extent possible: industry trends in transmission expansion; issues (industry structure, regulatory framework, siting, investments in facilities, other) impacting transmission expansion; recommendations to reduce or eliminate obstacles to transmission expansion; and other miscellaneous items.

In mid-January 2001, the Task Force invited representatives from each of four Regions — MAPP, MAAC, ERCOT, and MAIN — to an interview-type meeting in February 2001 to discuss each Region's recent transmission planning and expansion activities. The Regional participants are identified in Appendix C.

The industry reports and the transmission interview formed the basis for the Task Force's preliminary findings and recommendations.

Based on comments from the NERC Planning Committee and Market Interface Committee on its preliminary findings and recommendations, a review of transmission-related technologies being explored to more fully utilize existing transmission systems and to find alternate solutions to transmission expansion, and a review of portions of the National Energy Policy Development Group's May 2001 *National Energy Policy* report to the President of the United States, the Task Force completed its draft report for further Planning Committee and Market Interface Committee review in July 2001.

# Transmission Reliability and Need

Among the purposes for which the North American Electric Reliability Council (NERC) was formed are the following:

a) to promote the reliability and adequacy of the bulk electric supply by the electric systems in North America, and

b) to develop, implement, and, consistent with executed agreement(s) with Regional Councils, enforce standards that provide for an adequate level of reliability of the bulk power systems in North America.

## Transmission Reliability

NERC addresses bulk electric system reliability by considering two basic and functional aspects of the electric system — adequacy and security.

- **Adequacy** — The ability of the electric system to supply aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and unscheduled outages of system facilities.

- **Security** — The ability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system facilities.

The ability of the electric transmission systems to transfer electric power among their interconnected elements and deliver power from generation sources to customers or customer demand centers may be limited by the physical and electrical characteristics of the systems including thermal, voltage, and stability limits. A basic reliability tenet in the planning and expansion of the transmission systems is that the transmission systems should be capable of delivering or transferring electric power to meet the customer demands for electricity while surviving certain critical system disturbances or contingencies by operating reliably within specified thermal, voltage, and stability limits.

To ensure the reliability of the interconnected transmission systems in North America, the planning and operation of these systems must be conducted in compliance with NERC Planning and Operating Standards and Policies. The Regional Reliability Councils (Regions)and their member systems, as well as other entities responsible for the interconnected transmission systems, also may have established additional and more detailed reliability criteria appropriate to their Region or system, and these criteria must be followed as well.

## Transmission Need

The historical reasons for transmission system expansion have generally been tied to:

a) integrating electric generation sources to serve defined customer demands in a specified area or region,

b) providing flexibility to handle shifts in facility loadings caused by maintenance and forced outages of generation and transmission equipment,

c) sharing generating capacity through diversity in customer demands and generation availability, and

d) allowing for the economic exchange of electric power among neighboring systems when temporary surpluses in generating capacity are available.

These reasons for transmission development, expansion, and reinforcement must now be reexamined in the context of competitive electricity markets. These markets require transmission expansion not only to interconnect new generation capacity but also to provide flexibility for the delivery of that generation capacity to customers. Both the customer's selection of supplier and the customer's load variations with time must be considered.

Transmission systems are being subjected to power flows in magnitude and directions that were not considered when the systems were planned. In many instances, these new flow patterns result in an increasing number of transmission facilities being identified as limits to electric power delivery or transfers. As indicated in the May 2001 *National Energy Policy* report — "more electricity is being shipped longer distances over a transmission system that was initially designed only to provide limited power and reserve sharing among neighboring utilities."

Open access to the transmission systems has raised concern about the definition or justification of need for new transmission projects. In the future, the need for new transmission will likely be based on or driven by access to competitive power supplies in addition to the traditional reliability need or justification. That is, eliminating market congestion and facilitating more liquid electricity markets will be key economic factors in the justification for new transmission. As a result, reliability and commercial value, in addition to safety and environmental impact, will all be important factors assessed by transmission providers, regulators, and government entities in evaluating transmission projects.

While increased competition and restructuring in the electric industry are changing many of the traditional relationships on which the reliability of the North American bulk electric systems was founded, the potential for economic gains or increased electric system flexibility should not be allowed to degrade or encroach upon the reliability of the bulk electric systems. The goal of increasing flexibility and economic choices in electric power supplies is desirable, but should not be achieved at the expense of reliability.

# Issues and Recommendations
# Planning

The following transmission planning and expansion issues deal with the definition of the need for new projects and the development of the justification to construct them. The related recommendations represent approaches to reducing or eliminating the obstacles to transmission expansion.

## Issues

1. Most current transmission projects are being driven by traditional localized and regional reliability needs or by requirements to connect new generation to the interconnected bulk electric transmission systems. Transmission systems designed primarily for reliability purposes may not fully meet the needs of today's competitive electricity markets. The risks and consequences of insufficient transmission capability will need to be evaluated and communicated to electricity customers.

2. In some areas, significant new transmission expansion is required to connect confirmed new generation, to comply with state mandates to enable retail choice, or to provide for growth in customer demands. These complex and rapidly evolving requirements are overwhelming the transmission planning process such that there is not enough time to develop optimal transmission plans.

3. There is an increasing need to focus project commitment decisions on the economics of the project in addition to reliability benefits. Because the electricity supply/demand market operates primarily in the short term and few longer-term transmission service commitments are made, the revenue stream necessary to justify a major transmission project from a business perspective is often difficult to identify. Further, as a result of cost recovery issues, fewer projects are moving into the certification or licensing process. (See Cost Recovery section.)

4. In many areas, transmission margins are becoming so thin that construction outages required to place new transmission facilities in service are very difficult or impossible to schedule. These situations limit the practical construction options available and increase the cost of the project.

5. The number of new generation connection requests and transmission service requests are overwhelming the available planning manpower resources throughout the industry. Some generation requests involve studies of multiple sites because the developers have little information to judge which locations are feasible from a transmission capability perspective. In some cases, the study requests involve an "unreasonable or inordinate" number of alternatives.

6. Generation interconnection locations are often based upon generation developer needs, rather than transmission system impacts, and can lead to inefficient transmission expansion. Therefore, the uncoordinated siting of generation and the development of transmission projects could also result in some transmission being constructed unnecessarily. The probability of generation negating the need for transmission is a realistic scenario in some cases as the siting and construction of new combustion turbine generators generally has a shorter lead time than the construction of new transmission.

7. Generation interconnection planning is complicated by differences in processes and procedures across electric system boundaries and the differing roles in the planning process of various entities across those boundaries. In the short term, uncertainties with respect to evolving industry structures and participants make it difficult to establish coordination procedures related to planning across regional and neighboring system interfaces. Until the participants, the specific industry structures, and the planning processes that will be used are better defined, it is difficult to initiate coordination activities.

8. Analytical tools and the expertise to apply those tools are not keeping up with current demands. Today, planning continues to be largely deterministic because transmission customers and providers lack robust probabilistic tools to help evaluate the risks of insufficient transmission capability.

### Recommendations

1. NERC should assure that its Planning Standards for reliability are strictly enforced. The need and justification for transmission projects must be clearly articulated and communicated to the decision makers and the public to avoid delays or jeopardizing project approval. (Planning Issues 1, 3, and 6)

2. NERC should expand its system adequacy definition to incorporate economic uses of the transmission systems beyond the requirements imposed by its reliability Planning Standards. However, all transmission system expansions designed to meet the needs of the electricity market, while economically justified, must also meet the NERC reliability standards. (Planning Issue 1)

3. NERC and those responsible for the reliability of the transmission systems should survey the generation developers, the load serving entities, and the electricity marketers as to their information needs regarding future transmission capacity and other market requirements. Such information, if appropriate from a non-competitive perspective, could be provided and updated periodically to help focus generator interconnection and transmission service requests. It is envisioned that this information might include: a) identification of areas with little generation relative to demand, b) areas saturated with generation, c) guidelines relating

plant size and transmission outlet capability that would demonstrate how larger plants need to be connected to higher voltage systems, and d) technical data for generation developers to make their own preliminary assessment of transmission reliability (steady state, stability, and short circuit analyses). (Planning Issues 2 and 5)

4. The transmission owning entities responsible for the reliability of the interconnected transmission systems should periodically review and document their future transmission corridor requirements with appropriate regulatory bodies. (Planning Issue 2)

5. NERC should provide a forum for the investigation, development, and application of new and existing transmission planning tools that can enhance planning decisions and streamline the planning process. It should also support the collection of the necessary data to develop and implement such tools. Some examples of relevant tools include: a) probabilistic risk assessment tools that can assist in making business decisions on new projects, and b) system modeling tools that could provide reasonable scenarios of future power flow patterns to aid in developing longer-range plans and the business case for justifying major transmission projects. (Planning Issues 3 and 8)

6. Major transmission projects, where possible, should be planned with appropriate margin to provide capacity to meet system needs beyond the current or near-term system requirements. Such margins may provide the flexibility required to maintain reliability during maintenance and construction outages, and may also help conserve and make optimal use of difficult to obtain right-of-way corridors. These transmission margins could be achieved, for example, by using larger conductors, providing space for additional circuits on structures (e.g., double circuit structures) or on the right of way, and employing tower designs readily adaptable to higher voltage operation. NERC should support the implementation of such margins where practical. (Planning Issue 4)

7. Formal coordination procedures among neighboring Regions, systems, and other entities should be developed by the regional transmission organizations (RTOs) and regional reliability organizations to avoid case-by-case resolution of the planning and expansion of the transmission systems. The coordination process should integrate the planning of generation facilities with transmission. (Planning Issues 6 and 7)

# Issues and Recommendations
# Cost Recovery

A key factor that has been identified as affecting the expansion of the transmission systems is the recovery of the investments needed to provide for reliable and efficient transmission systems. NERC does not have the authority to order the expansion of generation or transmission facilities, nor does NERC have the authority to guarantee the cost recovery of the investments needed to ensure that an efficient electricity market occurs. NERC, however, can identify issues that should be considered during the development of a cost recovery policy and encourage the development of cost recovery policies to avoid a degradation in the reliability of electric service in North America.

## Issues

1. Some entities responsible for the reliability of the interconnected systems are concerned about the timely recovery of transmission investment at a fair rate of return.

   The May 2001 *National Energy Policy* report directs "the Secretary of Energy to work with FERC to relieve transmission constraints by encouraging the use of incentive rate-making proposals." Some stakeholders have proposed incentive rates as a means to encourage investment in transmission. Other stakeholders oppose incentive rates.

2. In some cases, cost responsibility for transmission additions and upgrades is unresolved. Disagreements exist among stakeholders concerning how much of the cost of transmission system expansion should be borne by specific market participants versus how much expansion cost should be allocated more broadly.

## Recommendations

1. Consistent with FERC Order 2000, NERC should encourage regulators to authorize cost recovery mechanisms that encourage investment in needed transmission facilities. Further, where regional transmission projects are involved, regional cost recovery mechanisms need to be developed. (Cost Recovery Issue 1)

2. NERC should facilitate the development of technical bases for determining the distinction between system upgrades and generation interconnection facilities. Regulators should use this information to review current policies and resolve issues concerning the assignment of cost responsibility for transmission investment. (Cost Recovery Issue 2)

# Issues and Recommendations
# Siting

Siting and routing issues represent significant obstacles to the expansion of the transmission systems. These issues revolve around the difficulties of acquiring regulatory approval and rights-of-way (ROWs) for transmission lines.

## Issues

1. The fact that electricity markets are increasingly regional rather than local makes the siting and routing of transmission more difficult since multiple regulatory jurisdictions are involved. In some cases, the local regulators and the general public, whose properties are impacted by the transmission facilities, may not see any direct benefits from such regional projects.

2. ROW acquisition is often strongly opposed by landowners and public interest groups based upon health, environmental, and other concerns. This opposition can result in lengthy project delays or cancellation.

3. The failure to clearly convey the need and justification of a transmission project to the regulatory and public entities impedes the permitting process for new transmission projects. The permitting process becomes even more imposing and complex when transmission lines cross state (provincial) lines, federal lands, or international boundaries, where several regulatory bodies, each with different requirements or perceptions of the project's need and usefulness, are involved.

4. Some regulatory agencies responsible for managing the siting process have inadequate resources to complete their investigations in a timely manner.

## Recommendations

1. NERC should sponsor a forum, in conjunction with the National Association of Regulatory Utility Commissioners (and other appropriate state entities), the Federal Energy Regulatory Commission, and applicable Canadian regulatory bodies, to develop generalized siting and routing guidelines for transmission projects that cross state (provincial) lines, federal lands, and international borders. Among other issues, these guidelines should address:

    - roles of state (provincial) and federal authorities regarding siting and route selection,
    - definition of the study area,
    - number of alternate routes to be studied in the routing process,

- standardization of procedures among different jurisdictions, and
- processes to better educate the general public, public interest groups, and regulatory bodies on the need and benefits of new transmission, and environmental concerns. (Siting Issues 1, 2, and 3)

2. The transmission system planning process must encourage greater regulatory and stakeholder participation. This participation must occur early in the planning process as opposed to waiting until the certification or licensing phase. (Siting Issue 3)

3. Even though transmission expansion may not be required for several years into the future, the certification or licensing process should allow for the identification and acquisition of critical ROWs or corridors for transmission projects as early as possible. Transmission providers should be permitted to acquire and recover costs for future use corridors. (Siting Issues 1 and 3)

4. Regulatory agencies should be adequately staffed or engage outside consultants, as needed, to implement the siting process in a timely fashion. Siting laws should permit the applicant entities to fund such consultants. (Siting Issue 4)

# Issues and Recommendations
# Education

Understanding and expertise in the engineering aspects of electric power systems on the part of those that authorize, regulate, invest in, and use transmission are necessary to properly develop policy and evaluate transmission project viability. Wide-ranging and continuing education of all participants involved in transmission projects, including transmission planners and executives, regulators, environmentalists, generators, power marketers, and other users, will be a key ingredient in developing and implementing projects successfully.

## Issues

1. In some cases, insufficient understanding and lack of expertise at local, state, and federal regulatory agencies of current trends and issues within the electric industry as a whole, including knowledge of the technical impact of deregulation and FERC orders, are major contributors to project delays and even abandonment.

2. The electric industry's failure in some cases to properly educate the regulators and the public on the need for transmission projects and the consequences of inadequate transmission have led to differing viewpoints, inactivity, and poor decision making, and ultimately higher costs to the customer.

3. Limited availability of engineers with power system training causes concern for the ability to plan, construct, operate, and maintain the electrical system infrastructure of the future.

4. The ability of the educational system to produce new power system engineers has been drastically reduced due, in many cases, to program reduction or elimination.

5. Transmission system terminology and definitions vary across the NERC Interconnections, contributing to confusion and in some instances conflict.

## Recommendations

1. NERC, in collaboration with other industry groups, should develop and update generic course materials and presentations on the planning and operation of the transmission systems for the regulators and the public in light of today's environment of the industry's change to deregulation and vertical disintegration. (Education Issues 1 and 2)

2. Early in the planning process, project sponsors and other associated parties should develop and present project specific presentations targeted to the public on the planning, justification, environmental effects, and operation of proposed transmission projects. (Education Issues 1 and 2)

3. NERC should establish a pool of technical advisors or experts that can be engaged by regulatory and governmental authorities in their policy formulation and decision making activities on transmission related issues. (Education Issues 1, 2, and 4)

4. NERC, through its membership, should encourage and promote power system engineering programs at local colleges and universities, including sponsoring cooperative and work-study programs at member companies. (Education Issues 3 and 4)

5. NERC should encourage the IEEE Power Engineering Society to perform an analysis of the status of power engineering education and the power engineering job market to provide a strategic look at existing and future capabilities and needs. This analysis should include a review of salary implications. A report of this analysis will be disseminated by NERC to its members. (Education Issues 3 and 4)

6. NERC should continue to develop and communicate standard language and measurements appropriate to the transmission systems. (Education Issue 5)

# Transmission-Related Technologies

The open-access use of the transmission systems for purposes for which they were not planned has loaded these systems to their limits in some areas. In considering solutions that will address these limitations for the near- and longer-term delivery of reliable electric power, applications of technologies such as HVDC transmission, flexible AC transmission system (FACTS) devices, and superconductivity are being explored to fully utilize existing transmission systems and to find alternate solutions to transmission expansion.

## HVDC Transmission

HVDC transmission has been an economically competitive alternative to high voltage AC transmission for applications involving long distances. The technical complexity and high cost of tapping a HVDC transmission line has made it less attractive for network applications. However, recent advances in converter technology have made HVDC a viable alternative for serving small remote load centers (up to 200 MW).

Applications of HVDC transmission must overcome similar hurdles (such as environmental concerns, right-of-way acquisition, etc.) as those associated with AC transmission. The beneficiaries of the HVDC technology will be those communities and towns located large distances from the electrical grid (generation). Additionally, HVDC transmission may be an effective alternative to AC transmission for increasing the power transfer capability of existing right-of-way corridors. HVDC (back-to-back or short DC links) technology is also ideally suited to interconnect large AC networks, networks of different frequencies, and for underwater cable applications.

## Flexible AC Transmission Systems

FACTS technology in some cases can increase the utilization of the capacity of an existing transmission line (within its thermal rating) by providing precise adjustments of transmission line voltage, impedance, or phase angle to control real and reactive power flows. FACTS devices can also improve system stability including low frequency power system oscillation damping.

Although FACTS devices have generally been applied to optimize transmission performance and security, case specific analysis is required to assess the impact of the FACTS devices on transmission reliability relative to transmission line additions.

## Superconducting Transmission

Superconductivity was discovered at the beginning of the 20$^{th}$ century. In 1986, the discovery of ceramic-based high temperature superconductors (HTS) opened the possibility of applying this new technology to transmission cables, power transformers, fault current limiters,

and other power devices. The ability to achieve the superconductivity state by using inexpensive liquid nitrogen, rather than liquid helium, as required by the original superconductors, has made this technology more attractive for possible application to the electric industry. Such applications include:

- HTS cables that may be capable of carrying 3 to 5 times more power than conventional cables,

- HTS windings and tap-changers that may transform existing oil-filled power transformers into compact, environmentally friendly (i.e. dry), and highly efficient devices, and

- HTS fault current limiters that may provide a more economical solution to limiting fault current levels than conventional technology.

HTS technology may be a viable "local area" alternative in the next 15 to 20 years, but at best it will only play a small part in the expansion of the bulk power transmission systems. The May 2001 *National Energy Policy* report recommends expanded research and development on transmission superconductivity.

### Summary: Transmission-Related Technologies

Advances in technology could play an important role in addressing and providing solutions for system constraints such as voltage and stability. However, the above technologies need further research for widespread cost effective applications. HVDC transmission is comparable to conventional AC transmission with regard to requirements for land and right-of-way requirements and has been used in a number of significant commercial applications at various high voltage levels worldwide.

Application of FACTS devices allows more optimal utilization of existing transmission systems and improves operating flexibility and system stability. HTS products are promising but are expected to only play a small role in local areas. These new technologies are expected to provide increased utilization of existing transmission facilities, however, they should not be viewed as a viable alternative or wholesale replacement for transmission system expansion.

**Appendix A**

# Scope of the Transmission Adequacy Issues Task Force

## Background

NERC's *Reliability Assessment 2000–2009* report indicates that in the near term (2000–2004), transmission system reliability in the United States, Canada, and the northern portion of Baja California Norte, Mexico, is expected to be satisfactory. However, this reliability is highly dependent upon coordination with surrounding systems and proper transmission system operator actions. Few major transmission system facility additions are planned for this period.

In the long term (2005–2009), the reliability of the interconnected transmission systems will be highly dependent upon the location of new generating resources. Unless proper incentives can be developed to encourage investment in new transmission facilities and siting problems can be resolved, few new transmission facilities and reinforcements are expected to be constructed.

Based on discussions at recent NERC Planning Committee meetings, the PC needs to investigate, identify, and understand the key issues that influence and impact the planning and construction of new transmission facilities or transmission reinforcements today and in the future. The PC also needs to determine if it can initiate actions or activities to help alleviate obstacles to the planning and construction of new (or reinforced) transmission facilities.

## Purpose(s)

Review the status and recent trends in the planning and construction of new transmission facilities or transmission reinforcements.

Investigate and identify the key issues in the near term and longer range that impact or are expected to impact the planning and construction of transmission facilities.

Recommend actions to help alleviate obstacles to the planning and construction of needed new (or reinforced) transmission facilities from either a reliability or electricity market perspective.

## Scope of Activities

1. Review the data collected on transmission in connection with NERC's ten-year and seasonal reliability assessments to determine the status and recent trends in the planning and construction of transmission facilities. Summarize the key issues identified as impacting or influencing the planning and construction of transmission facilities.

2. Search out other sources related to transmission that may be helpful in identifying the key issues that are impacting the planning and construction of new (or reinforced) transmission facilities.

3. Conduct surveys or interviews with the Regions on transmission planning and those entities that are constructing, or recently announced construction of, new (or reinforced) transmission facilities.

4. Investigate current approaches or new tools being used, or available, to plan transmission facilities and their relationship with generation resources.

5. Prepare a final report that summarizes transmission planning and construction trends and factors impacting the planning and construction of transmission facilities, and recommend actions that the electric industry and/or the PC can pursue to help alleviate obstacles to the planning and construction of new (or reinforced) transmission facilities.

### Membership

- Chairman
- 8–10 Planning Committee members or their representatives

### Reporting

Responsible to the NERC Planning Committee.

### Timeframe or Schedule

1. November 2000 PC meeting — Finalize Task Force's scope of activities.

2. March 2001 PC meeting — Provide status report and a preliminary list of key issues impacting the planning and construction of transmission facilities for review and comment by the PC.

3. July 2001 PC meeting — Present final report and recommended actions that the electric industry and/or the PC can pursue for implementation that will help alleviate obstacles to the planning and construction of new (or reinforced) transmission facilities.

Scope Approved by Planning Committee: November 14, 2000

**Appendix B**

## List of Sources on Transmission Issues

The following is a list of sources related to transmission that were reviewed by the TAITF to identify the key issues that are impacting the planning and expansion of transmission facilities.

- Final (integration) report of "Market-Reliability Interface Collaborative Planning Initiatives" supported by NERC, including the six search conference reports:
  - Atlanta (April 12–14, 2000)
  - Philadelphia (April 17–19, 2000)
  - Dallas (April 25–27, 2000)
  - Chicago (May 2–4, 2000)
  - San Francisco (May 9–11, 2000)
  - Toronto (May 31–June 2, 2000)
- Transmission sections in the NERC Reliability Assessment Reports from 1997 forward.
- Presentations from the "Resource Adequacy Planning Seminars" at the July 2000 NERC Adequacy (now Planning) Committee meeting
- "Expanding U.S. Transmission Capacity," Eric Hirst for Edison Electric Institute, Washington, D.C., July 2000.
- "The Competitive Effects of Transmission Capacity in a Deregulated Electricity Industry," Severn Borenstein, James Bushnell, and Steven Stoft, *RAND Journal of Economics*, Vol. 31, No. 2, Summer 2000, pp. 294–325.
- "The Future of Electric Transmission in the United States — A Vision for Transmission as a Vibrant, Stand-Alone, For-Profit Business," PA Consulting Group, Washington, D.C., January 2001.
- **"**FACTS Technology Development: An Update," Abdel-Aty Edris, (Electric Power Research Institute), IEEE *Power Engineering Review*, Vol. 20, No. 3, March 2000, pp. 4–9.
- "Summary of EPRI's FACTS System Studies," Rambabu Adapa, Electric Power Research Institute.
- "Power Precision with UPFC," Taylor Moore, EPRI Journal, November/December 1998, pp 18–23.
- "Highlights of Principal Transmission Technologies in Use or Planned by AEP (including series capacitors, series reactors, static var compensators (SVCs), unified power flow controllers (UPFCs), static compensators (STATCOMs), and high voltage direct current (HDVC) projects)," Bernie Pasternack, American Electric Power, April 27, 2001.
- "America's Energy Infrastructure: A Comprehensive Delivery System," Chapter 7 of the National Energy Policy Development Group's *National Energy Policy* report to the President of the United States, May 17, 2001.

## Appendix C

# TAITF Regional Transmission Interview Participants

**February 27, 2001 — 10 a.m. to 4 p.m.**
**Orlando, Florida**

ERCOT

Kenneth A. Donohoo
Manager of System Planning, Technical Operations
ERCOT
kdonohoo@ercot.com
512-248-3003

MAAC

Steven R. Herling
General Manager, System Coordination Division
PJM Interconnection, L.L.C.
herling@pjm.com
610-666-8834

Kenneth S. Seiler (Observer)
Senior Engineer, System Planning Department
PJM Interconnection, L.L.C.
seilek@pjm.com
610-666-4410

MAIN

Scott Barnhart
American Transmission Company
sbarnhart@atcllc.com
262-506-6814

Kirit Shah
Ameren Services Company
kshah@ameren.com
314-554-3542

Tom Wiedman (Observer)
Exelon Corporation
thomas.wiedman@exeloncorp.com
708-410-5902

MAPP

Ron W. Mazur
Interconnections & Grid Supply Transmission Planning Engineer
Manitoba Hydro
rwmazur@hydro.mb.ca
204-474-3113

# Appendix D

## TRANSMISSION ADEQUACY ISSUES TASK FORCE

***Bernard M. Pasternack (Chairman)***
Director - Transmission Planning
American Electric Power
825 Tech Center Drive
Gahanna, OH 43230-8250
Phone: 614-552-1600
Fax: 614-552-1676
Email: bmpasternack@aep.com

***Richard A. Wodyka (RRO-MAAC)***
Executive Vice President and COO
PJM Interconnection, L.L.C.
955 Jefferson Avenue
Valley Forge Corporate Center
Norristown, PA 19403-2497
Phone: 610-666-8853
Fax: 610-666-2296
Email: wodykara@www1pjm.com

***Donald R. Volzka (RRO-MAIN)***
Manager, Transmission Planning
Wisconsin Electric Power Company
W237 N1500 Busse Road
Waukesha, WI 53188
Phone: 262-574-6050
Fax: 262-544-7556
Email: don.volzka@wepco.com

***Ken Kuyper (RRO-MAPP)***
Senior Vice President Engineering &
System Operations
Corn Belt Power Cooperative
P.O. Box 508
Humboldt, IA 50548
Phone: 515-332-2571
Fax: 515-332-1375
Email: kenk@cbpower.com

***Glenn B. Ross (RRO-SERC)***
Director Delivery Policy
DominionVirginia Power
P.O. Box 26666, MC OJRP-9
Richmond, VA 23261-6666
Phone: 804-640-2942
Fax: 804-771-4204
Email: glenn_ross@dom.com

***Ajay Garg (RRO-Canada East)***
Sr. Advisor
Network Strategy
Ontario Hydro Networks
483 Bay Street, 15-A6, NT
Toronto, Ontario M5G 2P5
Phone: 416-345-5420
Fax: 416-345-5424
E-mail: ajay.garg@HydroOne.com

***Ron W. Mazur (Canada)***
Manager, System Planning Department
Manitoba Hydro
P.O. Box 815, 820 Taylor Avenue
Winnipeg, Manitoba R3C 2P4
Phone: 204-474-3113
Fax: 204-477-4606
E-mail: rwmazur@hydro.mb.ca

***Erik Westman (Federal)***
Transmission Risk Manager
Bonneville Power Administration
Transmission Business Line
5411 N.E. Highway 99
P.O. Box 491
TOP/DITT2
Vancouver, WA 98666-0491
Phone: 360-418-8680
Fax: 360-418-8376
Email: edwestman@bpa.gov

**TRANSMISSION ADEQUACY ISSUES TASK FORCE** (cont)

***Scott M. Helyer (IPP)***
Director, Transmission
Tenaska, Inc.
1701 East Lamar Boulevard, Suite 100
Arlington, TX 76006
Phone: 817-462-1512
Fax: 817-462-1510
Email: shelyer@tnsk.com

***Gene Anderson (State/Municipal)***
Director - Engineering
Oklahoma Municipal Power Authority
7996 East 147 Road
Calvin, OK 74531
Phone: 405-645-2280
Fax: 405-645-2280
Email: geneaengr@aol.com

***Kenneth P. Linder (EEI Observer)***[a]
Group Director, Energy Delivery
Edison Electric Institute
701 Pennsylvania Avenue, N.W.
Washington, DC 20004
Phone: 202-508-5725
Fax: 202-508-5445
E-mail: klinder@eei.org

***William H. White (BOT Observer)***
Wedge Group Inc.
1415 Louisiana Street
Suite 3000
Houston, TX 77002
Phone: 713-739-6555
Fax: 713-520-1041
E-mail: bwhite@wedgegroup.com

***Virginia C. Sulzberger (Staff Coordinator)***
Director-Engineering
North American Electric Reliability Council
116-390 Village Boulevard
Princeton, NJ 08540
Phone: 609-452-8060
Fax: 609-452-9550
E-mail: virginia@nerc.com

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a) Kenneth P. Linder was initially involved with the Task Force, but retired from EEI prior to the completion of the report.