Electric Transmission in Northern NH

What it takes to upgrade, replace or build new transmission needed to support new generation

NHPUC Forum in Groveton
8/7/07

Agenda

- Purpose of meeting –PUC
- The existing process for new generators to connect to the transmission system – ISO-NE
- What it takes to change this process – ISO-NE
- The process for planning, getting approval for & building new transmission – PSNH & National Grid

Agenda (continued)

- New generation proposed for northern NH; what are the transmission needs? – Noble, NCRE
- Possible Alternatives; how are other states & regions addressing this issue - PUC
- Questions -PUC
- Where do we go from here? – PUC
- Additional Information – WWW.PUC.NH.GOV

Why we are here? SB140

- Transmission Infrastructure; Action by Public Utilities Commission. It is in the public interest and to the benefit of New Hampshire to encourage the development of renewable energy. In order to develop substantial electric generation from renewable energy, existing transmission infrastructure, particularly in the northern part of the state, will need to be upgraded or replaced or new transmission facilities will need to be built. Appropriate upgrades to the transmission infrastructure are important to economic development. ***The public utilities commission, in furtherance of its duties under RSA 374-F:8, shall facilitate discussions among parties interested in the upgrade of electricity transmission in the northern part of the state.*** The public utilities commission shall file a report with the general court by December 1, 2007 that describes: the existing electricity transmission system in New Hampshire; the current process for siting, constructing, and financing transmission upgrades and expansion; the approximate costs of potentially appropriate transmission upgrades; approaches pursued by other states to encourage transmission expansion related to renewable generation; and actions the public utilities commission has taken to advance New Hampshire interests with respect to transmission.

Regional System Planning in New England

August 7, 2007

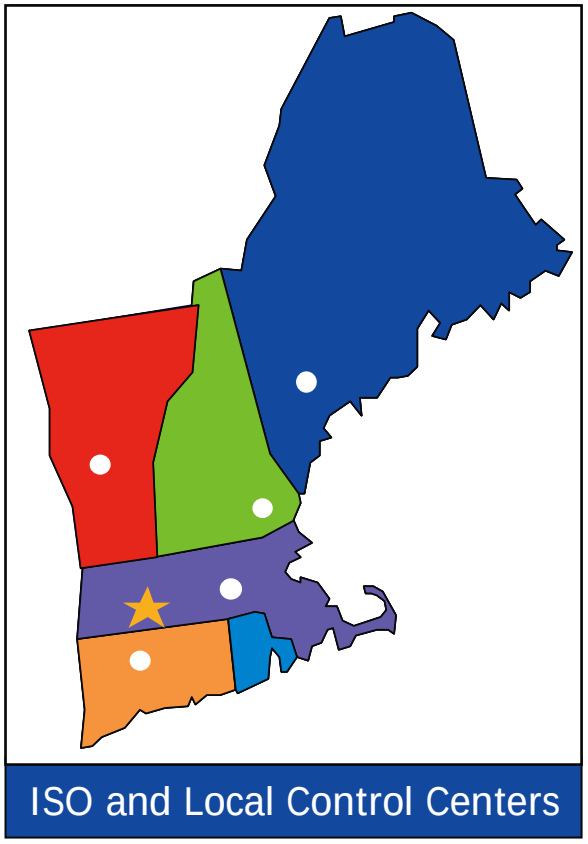
New Hampshire Public Utilities Commission Forum
Groveton, New Hampshire

About ISO New England

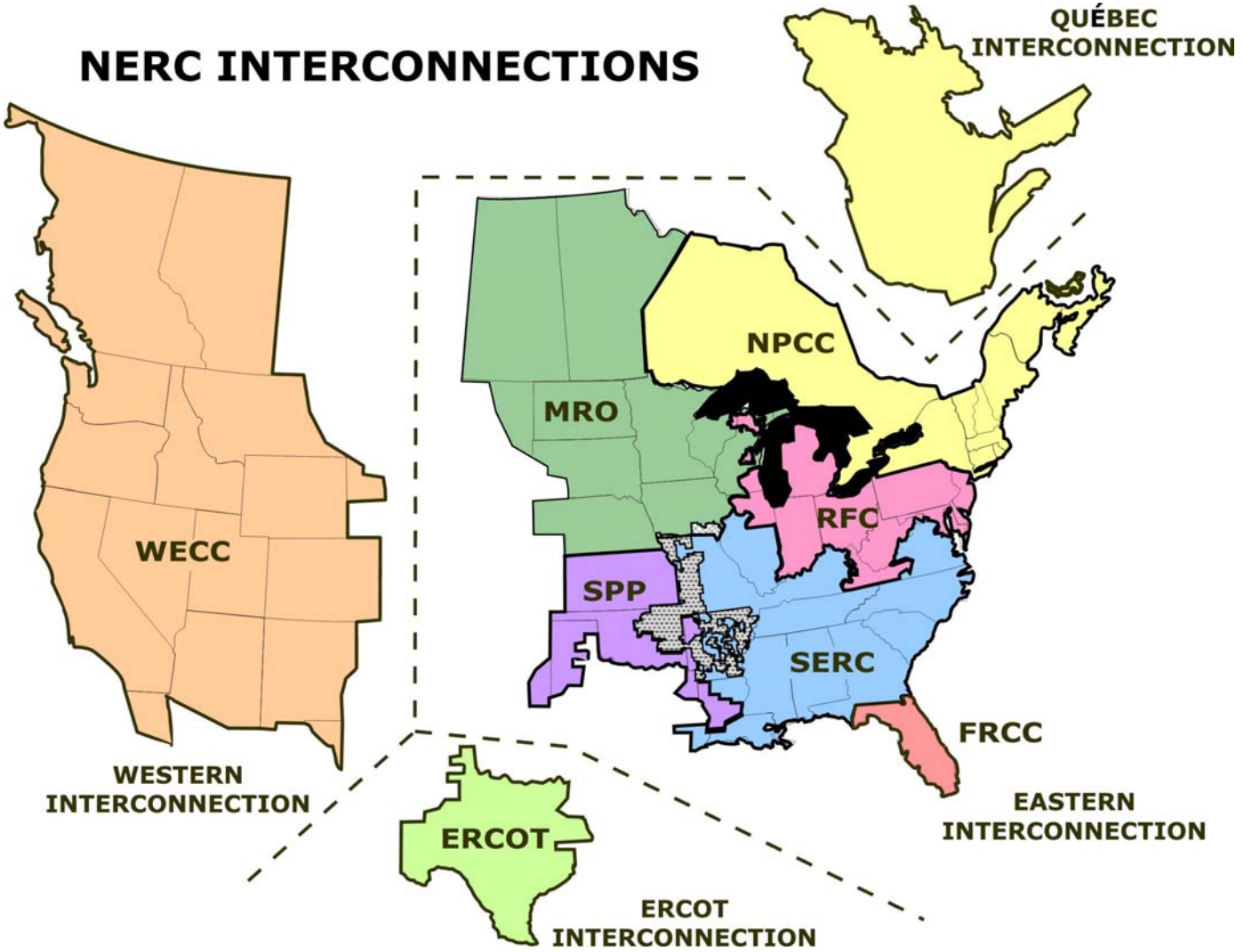
- Regional Transmission Organization for New England
  - Private, not-for-profit corporation created in 1997 to oversee the region's bulk electric power system
  - Independent of companies doing business in the market
  - Regulated by the Federal Energy Regulatory Commission (FERC)
  - Approximately 400 employees headquartered in Holyoke, MA

New England's Electric Power Grid

- 6.5 million customer meters
  - Population: 14 million
- 350+ generators
- 8,000+ miles of high voltage transmission lines
- 12 interconnections to three neighboring systems:
  - New York, New Brunswick, Quebec
- 31,000 megawatts (MW) of installed generating capacity
- 300+ market participants
- Summer peaking system
  - Summer: 28,130 MW (8/06)
  - Winter: 22,818 MW (1/04)



Part of the Eastern Interconnection



ISO-NE: Major Responsibilities

1. **Reliability**
   - Maintain minute-to-minute reliable operation of the region's bulk power generation and transmission system
   - Centralized dispatch of generation, activation of demand response
   - Coordinate operations with neighboring power systems

2. **Markets**
   - Administer and monitor New England's wholesale electricity markets
     - Energy, Capacity and Reserves
   - Internal and external market monitoring

3. **Planning**
   - System needs assessment
   - 10-year transmission plan to ensure a reliable and efficient bulk power system to meet current and future needs

Key Issues in New England

- **Meeting peak demand for electricity**
  - Peak demand is growing faster than overall demand
    - Requires additional power system infrastructure
  - Stronger wholesale/retail linkages could help reduce or shift demand

- **Meeting existing and new environmental requirements**
  - Air regulations (NOx, SO_2)
  - Regional Greenhouse Gas Initiative (CO_2)
  - Renewable Portfolio Standards

- **Developing additional resources**
  - Increasing level and diversity of supply
  - Integrating demand-side resources into the market
  - Balancing reliability with reasonably priced supply

Developing Power System Infrastructure and Resources

- Transmission
  - Needed to maintain reliability in the region as demand grows
  - Improves access to additional or diverse power supplies

- Capacity resources
  - Different types of generation needed to meet different operational needs (e.g., baseload, fast-start, dual-fuel)
  - Demand-side resources (e.g. energy efficiency, demand response, conservation) moving from programs to markets

Overall Transmission Development Process

- Identify needs
- Derive possible solutions
- Define project
- Achieve ISO Reliability and Cost approvals
- Begin state siting
- Stakeholder input throughout

System Planning: Authority

- FERC granted ISO responsibility for regional system planning for the six-state region in 2000
- Part of a federally-approved tariff
  - ISO is reviewing its planning process with New England stakeholders to show it is consistent with the latest FERC Order to promote open access to the transmission system nationwide (Order 890)
- *Mandatory reliability standards reinforce importance of planning for the region*

System Planning: Guided by Reliability Standards

- North American Electric Reliability Corporation
  - Reliability Standards for the Bulk Power Systems of North America
- Northeast Power Coordinating Council
  - Basic Criteria for the Design and Operation of Interconnected Power Systems
- ISO-NE
  - Reliability Standards for the New England Area Bulk Power Supply System

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

ISO new england

Standards are used to ensure that the regional transmission system can reliably deliver power to consumers under a wide range of future system conditions.

System Planning: Process

- Planning process is open and ongoing
  - Regional System Plan (RSP) published annually
    - 2007 Regional System Plan will be the seventh annual regional system plan
    - Ten-year planning horizon
    - Regular updates on status of transmission projects in the plan
  - Stakeholders provide input through the Planning Advisory Committee (PAC), including needs assessment, development of RSP, study results, and transmission alternatives

System Planning: Process, cont.

- RSP identifies system needs
  - Provides opportunities for market solutions (e.g. generation, demand-side measures, and merchant transmission)
    - RSP provides a transmission plan as a backstop for reliability
      - Can be modified based on market solutions that develop
    - RSP does not constitute an integrated resource plan

Types of Transmission Upgrades

- Generation Interconnection
- Elective Transmission
- Merchant Transmission
- Local Benefit Upgrades
- Regional Benefit Upgrades
  - Reliability and Market Efficiency Upgrades
    - May include Localized Costs

ISO-NE Review of Proposed Projects

- ISO-NE Reliability Review
  - Review and approval of all additions to the bulk power system (generation and transmission) pursuant to FERC-approved Tariff (§ I.3.9)
    - Advisory input from NEPOOL Reliability Committee
    - Participation of state representatives
  - Precursor to cost review for transmission projects
- ISO-NE Cost Allocation Review
  - Review costs for transmission proposed to be included in the regional rate pursuant to FERC-approved Tariff (Schedule 12C)
    - Advisory input from NEPOOL Reliability Committee
    - Open stakeholder meetings to review large projects
    - Participation of state representatives

Process for Transmission Cost Sharing

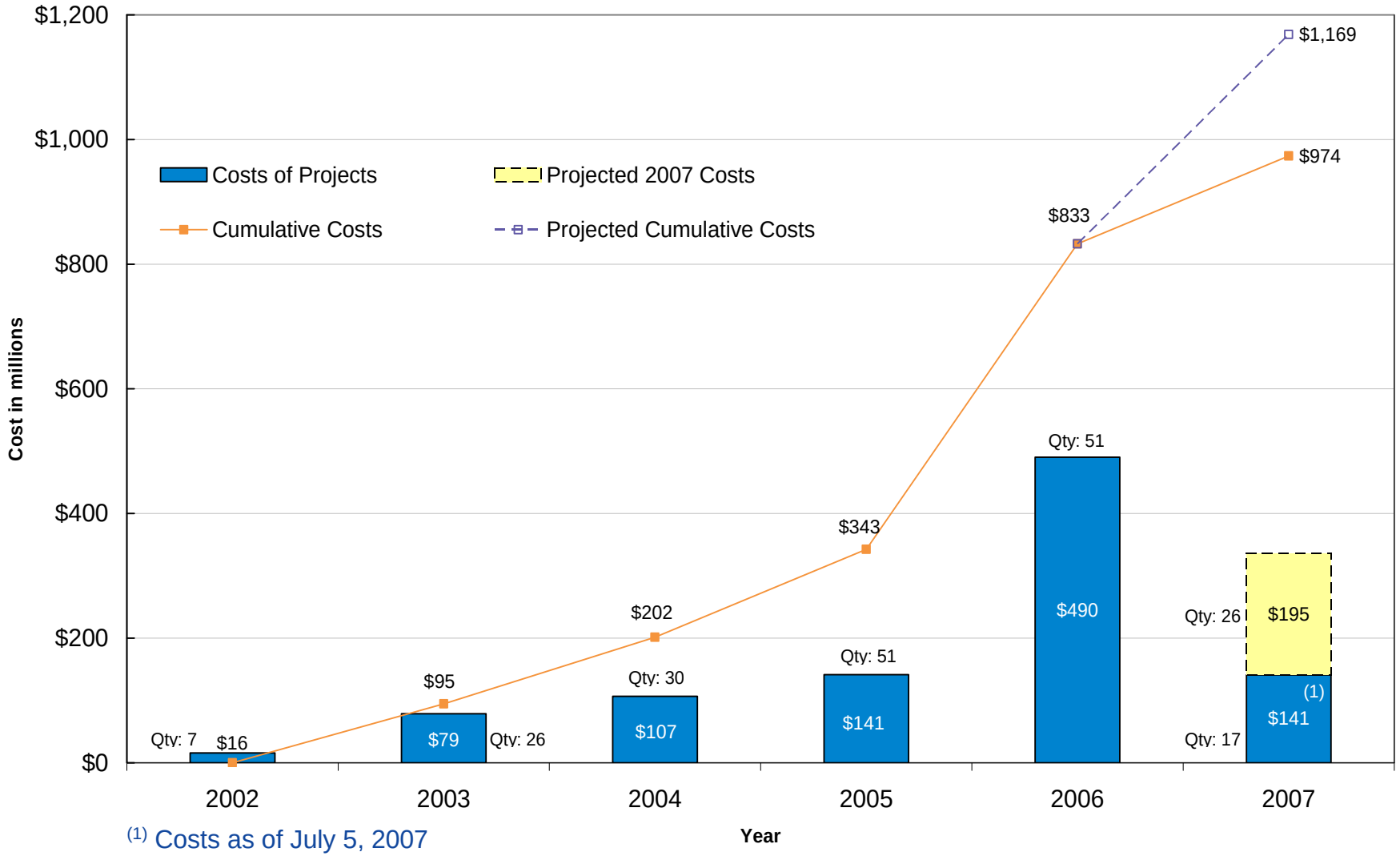
- Applies to projects that benefit the region
  - ISO conducts independent cost review, with stakeholders input
    - Are costs reasonable, in accordance with good utility practice and justified for regional cost support?
    - Projects (or elements of projects) not providing a regional benefit are deemed “localized” and are not supported by the region
  - Consumers pay a share of costs based on their share of regional electricity consumption
    - New Hampshire – Approx. 9% of total usage

- FERC-approved process developed with stakeholders
  - Developed through an extensive stakeholder process in 2002/03
  - Approved by FERC in December 2003

Investment in New England Transmission

- Major investment in transmission
  - More than 200 projects representing an investment of about $1.2 billion will have been placed in-service (2002 through 2007)
  - $3 to $6 billion of active transmission projects
  - Three major new 345-kV projects constructed and put into service in three states
    - An additional three 345-kV projects are under construction in three states
- New studies are underway for all areas of New England

Investment In New England Transmission (cont.)



(1) Costs as of July 5, 2007

Major Transmission Projects and Studies

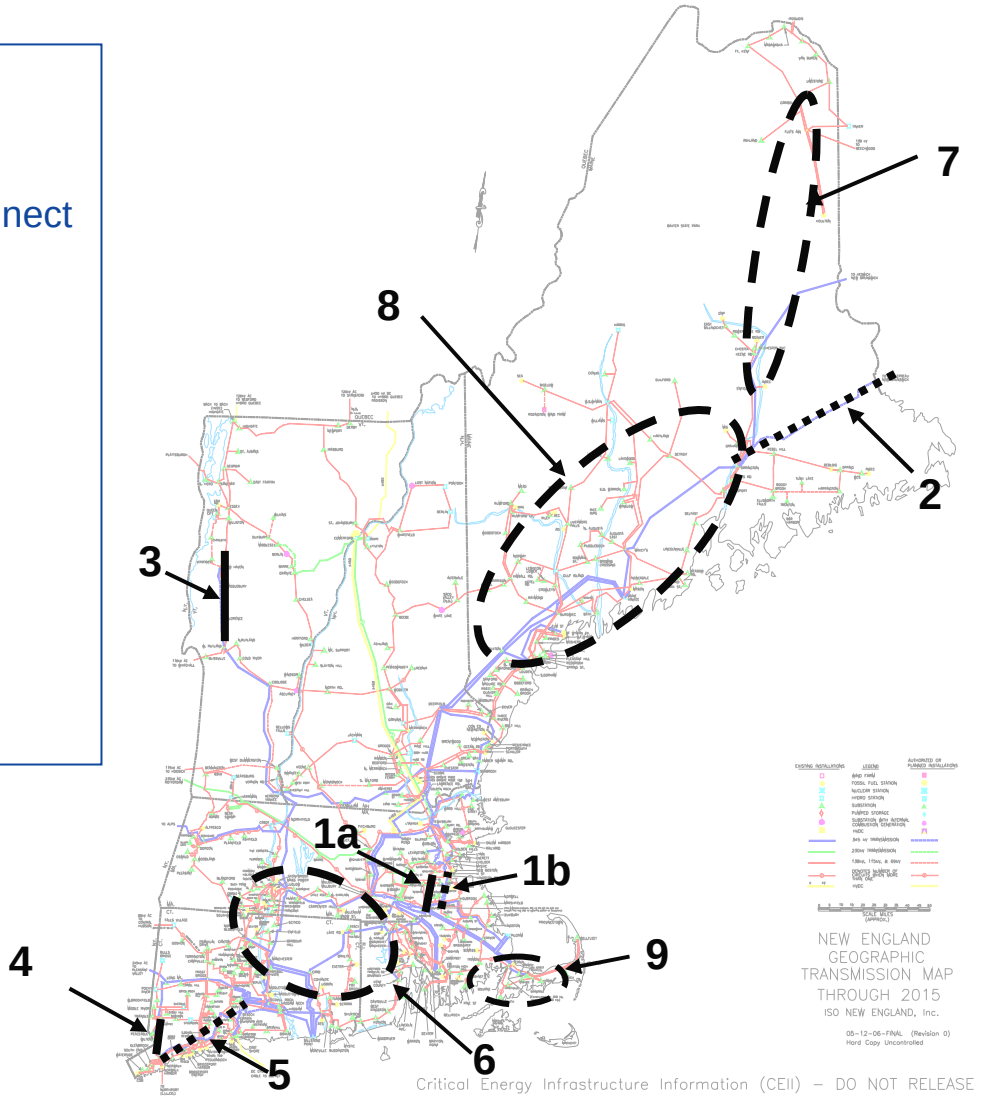
1. NSTAR 345 kV Project
   a. Phase I
   b. Phase II
2. Northeast Reliability Interconnect
3. Northwest Vermont
4. SWCT Phase I
5. SWCT Phase II

6a. NEEWS

6b. Greater Rhode Island

6c. Springfield 115 kV Reinforcements

7. Maine Power Connection
8. Maine Power Reliability Program
9. Southeast Massachusetts



In service

Under construction

Under study

Process for Generation

- **Markets for supply resources**
  - Competitive wholesale electricity markets to achieve adequate power supply resources to ensure a reliable power system
    - Pay-for-performance provisions for all resources
  - Proposals for 12,000 MW of new resources in response to the new capacity market
    - Resources to compete in February 2008 auction to supply system needs beginning in June 2010

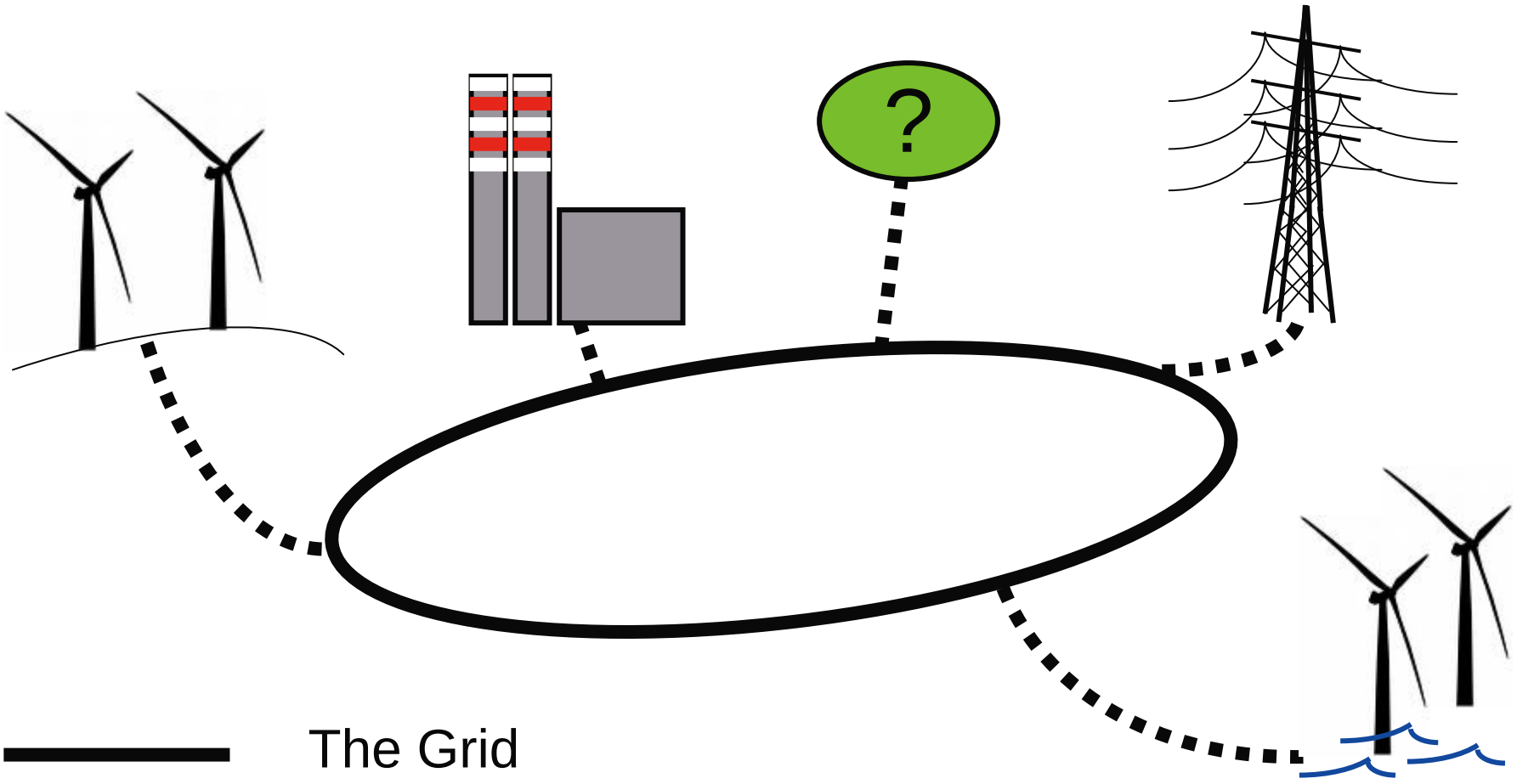
- **Connecting to the Grid**
  - Generation proposals subject to ISO reliability review
    - Projects must not create adverse reliability impacts on the system
  - Proposals studied in the order received
    - Interconnection study “queue” updated regularly on ISO Web site

Two Types of Jurisdiction

- Federal
  - Federal Energy Regulatory Commission interconnection rules
    - Governed by Schedules 22 and 23 of the ISO Tariff
  - Applies to:
    - Projects proposing to connect to the system “administered” by ISO
    - Generation selling into the wholesale electricity market
      - Exception for certain resources connected to the distribution system
- State
  - State interconnection rules
  - Applies to projects proposing to connect to systems that could “affect” the system administered by ISO (e.g. distribution system and neighboring systems)

Connecting to the New England Power Grid

The ISO-NE Interconnection Process



Interconnection Study Queue Process

- ISO conducts/requires studies leading to an Interconnection Agreement
  - Feasibility Study, System Impact Study (SIS), Facility Study
- Transmission Reliability Assessment:
  - Projects larger than 5 MW require a Proposed Plan Application
  - Projects smaller than 5 MW require simple notification to Reliability Committee
- Market Participation:
  - Developer must decide whether to participate in the market as a Settlement-only (price taking) resource, or to offer supply into the market at a price
- Other considerations:
  - Supply (generation) is not always sited close to where the demand is located
    - Energy source (e.g. on or off-shore wind) may be remote
    - Additional transmission may be required

Forward Capacity Market Process

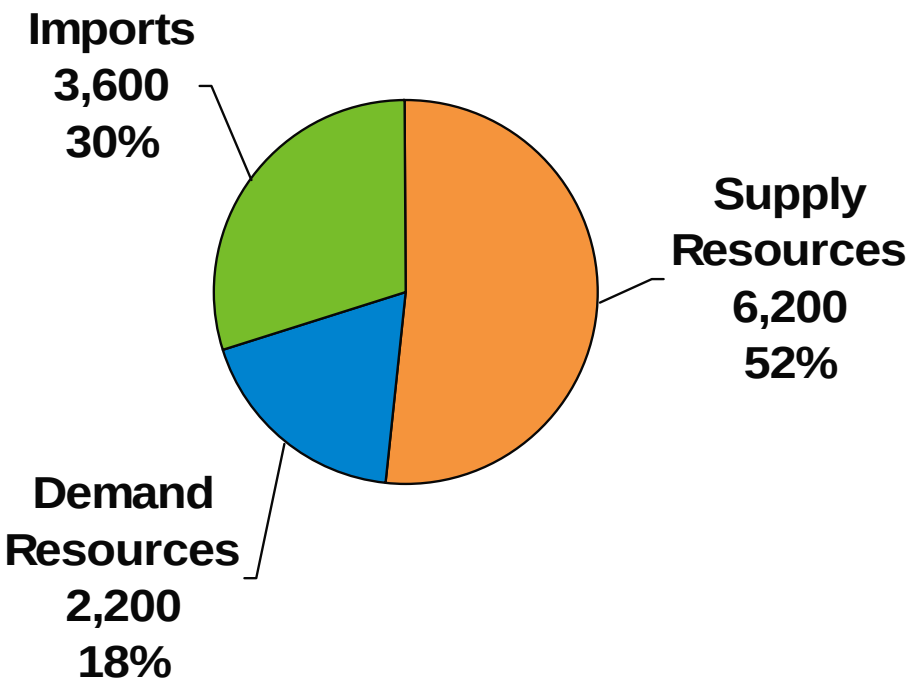
- Procure enough capacity to meet New England's forecasted Installed Capacity Requirements three years in the future

- Select a portfolio of Supply and Demand Resources through a competitive ***Forward Capacity Auction*** process
  - Proposed resources must be pre-qualified to participate in the auction
    - New resources must provide detailed project plans with milestones to complete projects by the commitment period
  - Proposed resources must participate and clear in the auction to be paid for capacity

- Provides a long-term (up to 5 year) commitment to New Supply and Demand Resources to encourage investment

FCM Qualification Package Applications

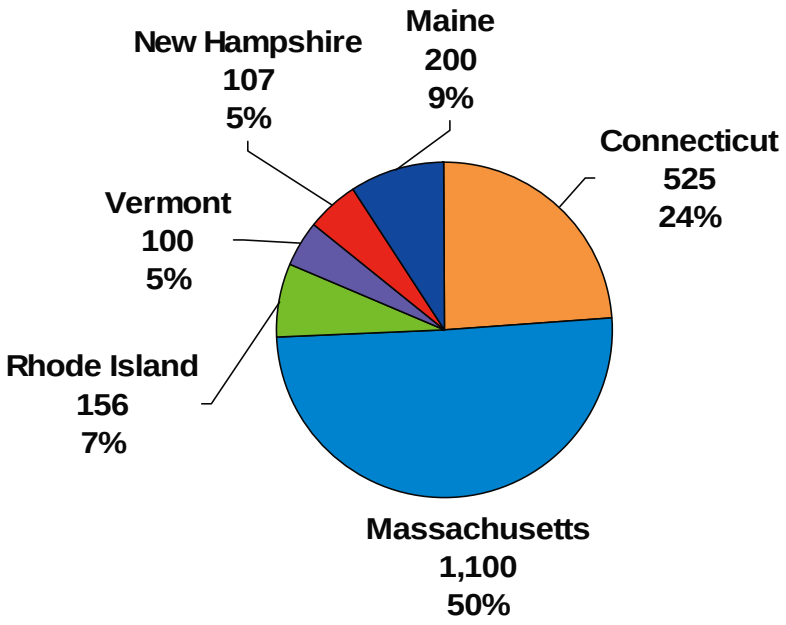
Proposed Resources by Type (MW and %)



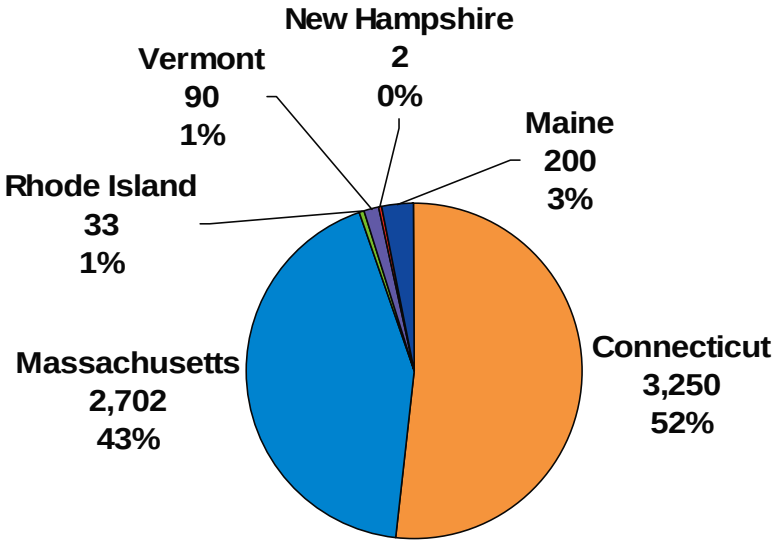
FCM Qualification Package Applications

Proposed Resources by State (MW and %)

Demand Resources



Supply Resources



New Hampshire Projects in the Queue

Project Name	Fuel Type	Summer Capacity (MW)	Winter Capacity (MW)	County	ST
Hydro Project	Water	169	170	Grafton	NH
Combined Cycle	Natural Gas	563	616	Rockingham	NH
Wind Project	Wind	100	100	Coos	NH
Wind Project	Wind	146	146	Coos	NH
Biomass Project	Wood	56	68	Coos	NH
Biomass Project	Wood	45	45	Hillsboro	NH
Biomass Project	Wood	41	41	Coos	NH
Biomass Project	Wood	41	41	Coos	NH
Biomass Project	Wood	17	17	Grafton	NH
Wind Project*	Wind	24	24	Sullivan	NH
Wind Project*	Wind	34	34	Coos	NH
Landfill Gas*	LFG	6	6	Coos	NH

* Project proposes to connect to the distribution system.

Conclusions

- Peak demand growth makes us look at ways to use electricity (and the power system) more efficiently
- Developers and resource owners will face increasing restrictions on environmental emissions
- New capacity market leads to new and diverse types of resources
- Regional System Planning process leads to significant transmission development throughout New England

Public Service of New Hampshire

The Northeast Utilities System

Connecting New Resources to the Northern New Hampshire Transmission System

Current North Country Transmission System

Transmission Lines	**Miles**	**Year Built**
Whitefield- Lost Nation	18	1948
Berlin – Lost Nation	28	1947
Whitefield - Berlin	27	1969
Whitefield - Littleton	17	1958
Whitefield – Franconia Area Tap	15	1969
Littleton – Franconia Area Tap	9	1971

Transmission Planning Criteria

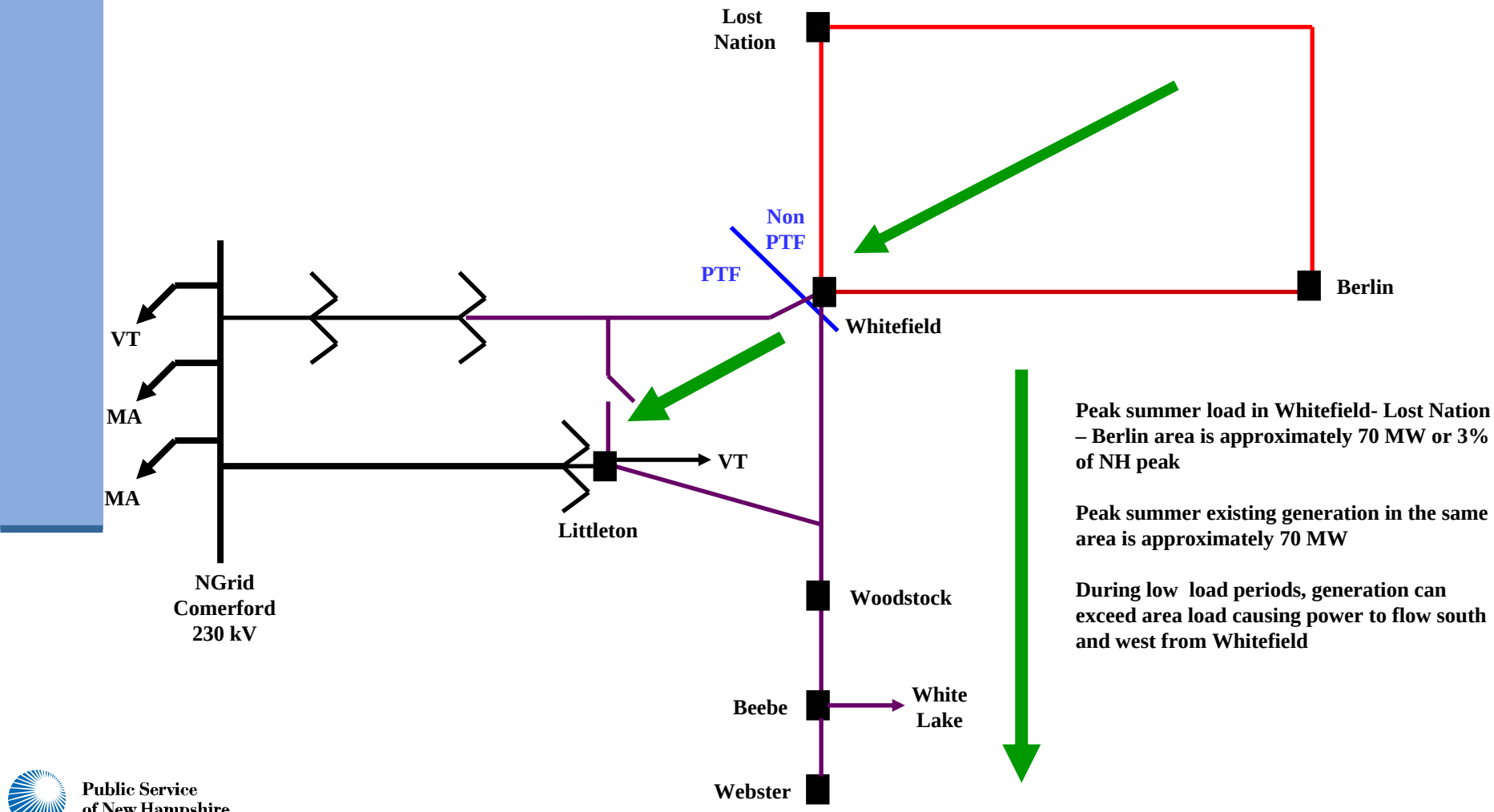
- Planning criteria
  - Facilities must be installed to meet area load assuming a single element is out of service and most generation is not operating. Facility costs are paid by load.
- Generation Interconnection
  - New generation must pay for facilities to connect their unit(s) to the transmission system as well as to pay for system upgrades required to relieve system problems caused by the addition of the new generation.

PSNH's North Country transmission

PSNH's transmission system north of the White Mountains is adequate to support :

- The existing load and existing generation plus load growth for many years to come.
- The addition of approximately 100 MW of new generation without major system upgrades.
- The addition of 400+ MW of new generation <u>if :</u>
  - The transmission lines (over 100 miles) between Littleton - Whitefield – Lost Nation – Berlin and associated substation equipment are upgraded
  - Additional transformation is installed at the Littleton Substation
    - System transmission studies may determine that additional upgrades are required beyond the Northern NH area

Power Flow for New Generation



Peak summer load in Whitefield- Lost Nation – Berlin area is approximately 70 MW or 3% of NH peak

Peak summer existing generation in the same area is approximately 70 MW

During low load periods, generation can exceed area load causing power to flow south and west from Whitefield

Timeframe to install new facilities

- Several steps must be successfully completed before new facilities can be placed in-service to support 400+ MW of new generation
  - Determine exact system needs and receive ISO approval:
    9 - 18 months
  - Site and permit facilities:
    9 - 18 months
  - Construct facilities:
    24 - 36 months
    - Above estimates are typical timeframes, but could be longer depending on time required to resolve various issues, permitting, delivery time of equipment, and system upgrades required outside the northern New Hampshire area.

Conclusions

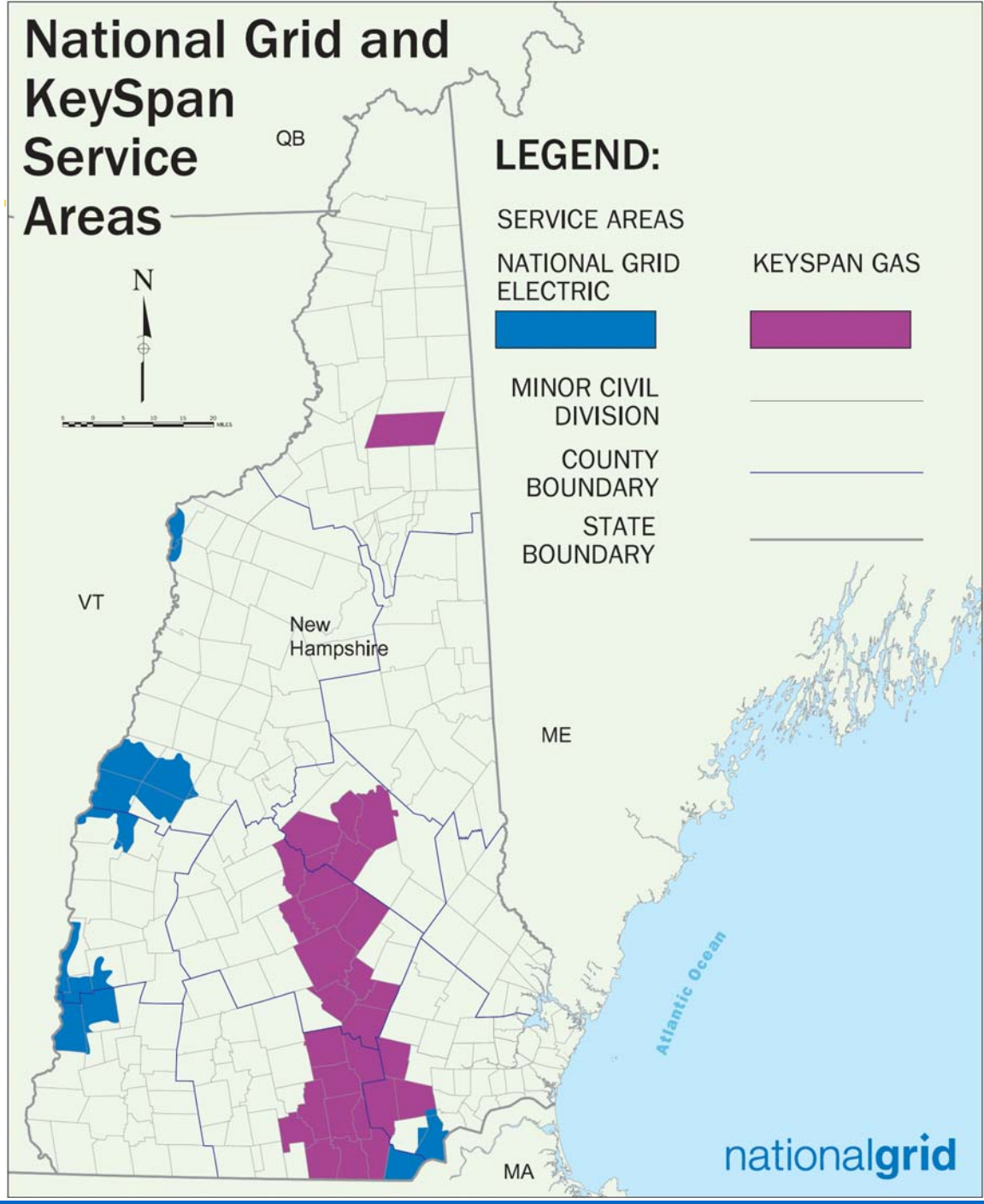
- PSNH system can accommodate 100 MW of new generation without transmission rebuilds.
- Beyond 100 MW of new generation, PSNH is prepared to:
  - Continue to support the economic growth and health of the North Country and the State
  - Work within the well-defined process which the Federal Energy Regulatory Commission has established for use in New England by the ISO-NE and utilities to ensure that the electric system is planned and built in a safe, reliable, fair, and cost-effective manner.
  - Plan, design, construct and modify its transmission system to accommodate new generation
  - Discuss with interested parties creative ways to provide for the recovery of cost incurred for any North Country transmission upgrades
  - Work with interested parties and state and local regulatory officials to resolve issues and obtain necessary approvals to allow transmission upgrades to be completed in the shortest reasonable time frame.

Transmission to Serve Renewables in Northern NH

Dana Walters
National Grid
August 7, 2007

nationalgrid

National Grid Service Areas
(post merger)



Background of National Grid System

- ~ 252 Mi (2 lines at 126 miles each) of 230 kV transmission were developed around 1930 to export power from Comerford and Moore Hydro facilities to the South
- 115 kV was developed to supply local area load
- 230 and 115 kV systems are connected in the area

Areas That May Constrain Movement of New Generation to Customers

- There are several points on the system which could require upgrades associated with the development of new generation in Coos County area.
  - Whitefield 115 kV Loop (NU/ PSNH)
  - 115 kV lines (NU/ PSNH) connecting Whitefield to rest of the system
  - 230 kV lines connecting Comerford to other 230 kV stations (National Grid)
  - 230 kV lines from North Litchfield South to Tewksbury, MA (National Grid)
  - Other individual sections of lines or facilities (Studies may identify some limiting facilities that are difficult to anticipate.) (NU/PSNH, National Grid, VELCO)

How Much Generation Can Be Connected To The System?

- Depends on the location of generation and load
  - If generation directly connected to Comerford 230 kV
    - ~200-400MW (estimate)
  - If generation connected to the 115 kV
    - Less power will flow on the 230 kV
    - 115 kV may be more limiting than the 230 kV
- **Study is required**
  - **to define actual capability**
  - **to understand the impact of the generation interconnections**
  - **to define upgrade requirements to interconnect desired generation**

What Is Required For System Upgrades?

- Transmission required to get more than ~100MW of power out of the Whitefield area
- Connecting generation directly to the Comerford 230 KV may require more transmission and expense than connecting to the 115 kV near Whitefield
- Other Upgrades may be required to reinforce the system beyond the Whitefield area
- **Study is required**
  - **to understand the impact of the generation interconnections**
  - **to define upgrade requirements**
  - **to estimate costs of upgrades**

Next Steps

- **First:** Define the (transmission) need
  - How much generation to design transmission for
  - Requires direction from developers and or state
  - Could involve tariff changes to address stakeholders' needs
- **Second:** Study local options for getting power out of the Whitefield area
- **Third:** Identify other system upgrade requirements for each option of getting power out of Whitefield
- **Fourth:** Evaluate trade-offs between local and system upgrades and select preferred option
- **Fifth:** Reach business agreements
- **Sixth:** License, Permit, Design & Construct

Conclusion

- National Grid willing to work to identify need, challenges of, and options and their costs for transmission system upgrades in northern NH
  - Through existing ISO-NE process
  - In cooperation with New Hampshire PUC
  - With input from developers and community

Noble
ENVIRONMENTAL POWER

Transmission in Coos County: Harnessing the Resource

Prepared for the Public Utilities Commission

August, 7th, 2007

Wind Power…the natural choice

Who Is Noble?

- Develop – Own – Operate business model
- JP Morgan Financial Support
- 4 projects currently under construction across NY and MI
    - •Additional 7 in permitting process, currently pursuing opportunities in 9 states
    - •Studies currently underway for a proposed 100MW windpark located in the Phillips Brook area
        - •Planned interconnection 2009, additional 150MW of wind resources being explored

•Office located in the Old Court House on Main Street in Lancaster.

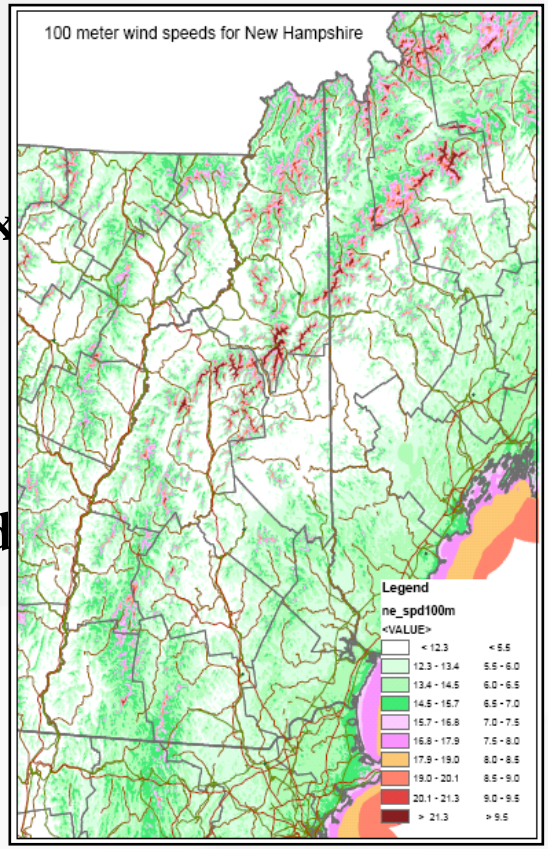
Meeting the State's Energy Policy Goals

Tremendous wind resource in Coos County

Windparks represent a significant capital infusion into local economies (jobs, local goods & services purchased, increased tax revenues, payments to landowners)

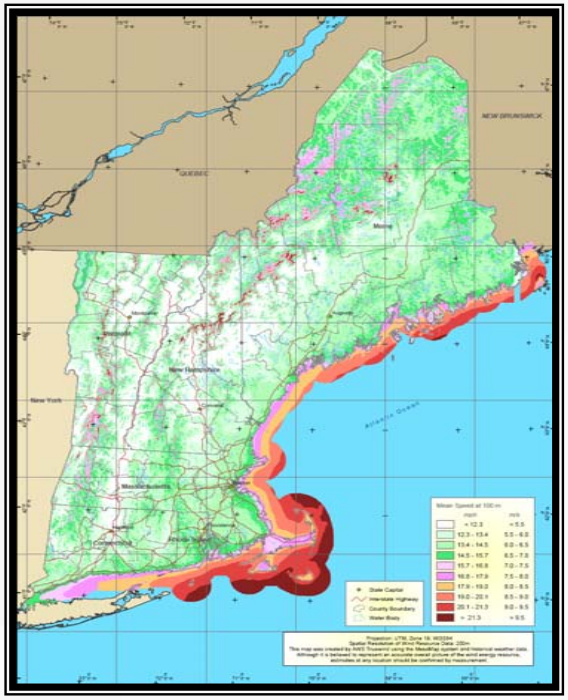
Adding renewable generation will help meet the New Hampshire RPS goals, support air quality controls, diversify fuel resources, encourage pricing pressure and increase reliability to the system.

<u>Coos County has the opportunity to be a leader in the production of clean renewable energy</u>



Transmission Upgrade Concerns: A Developer's Point of View

- Costs
  - The present method of funding transmission is reliant on the Developer's acceptance of all upgrade costs
  - These costs can run into the tens of millions and can force a developer to look to other states
  - Creates balance sheets issues when couple with high costs of turbines - "Heavy Lift"



We as generators are looking to participate in transmission planning that will look beyond

"The Next Megawatt"

North Country
RENEWABLE ENERGY LLC
Nature Powering Life

Groveton Biomass Energy Facility

North Country Transmission Meeting

August 7, 2007

North Country
RENEWABLE ENERGY LLC
Nature Powering Life

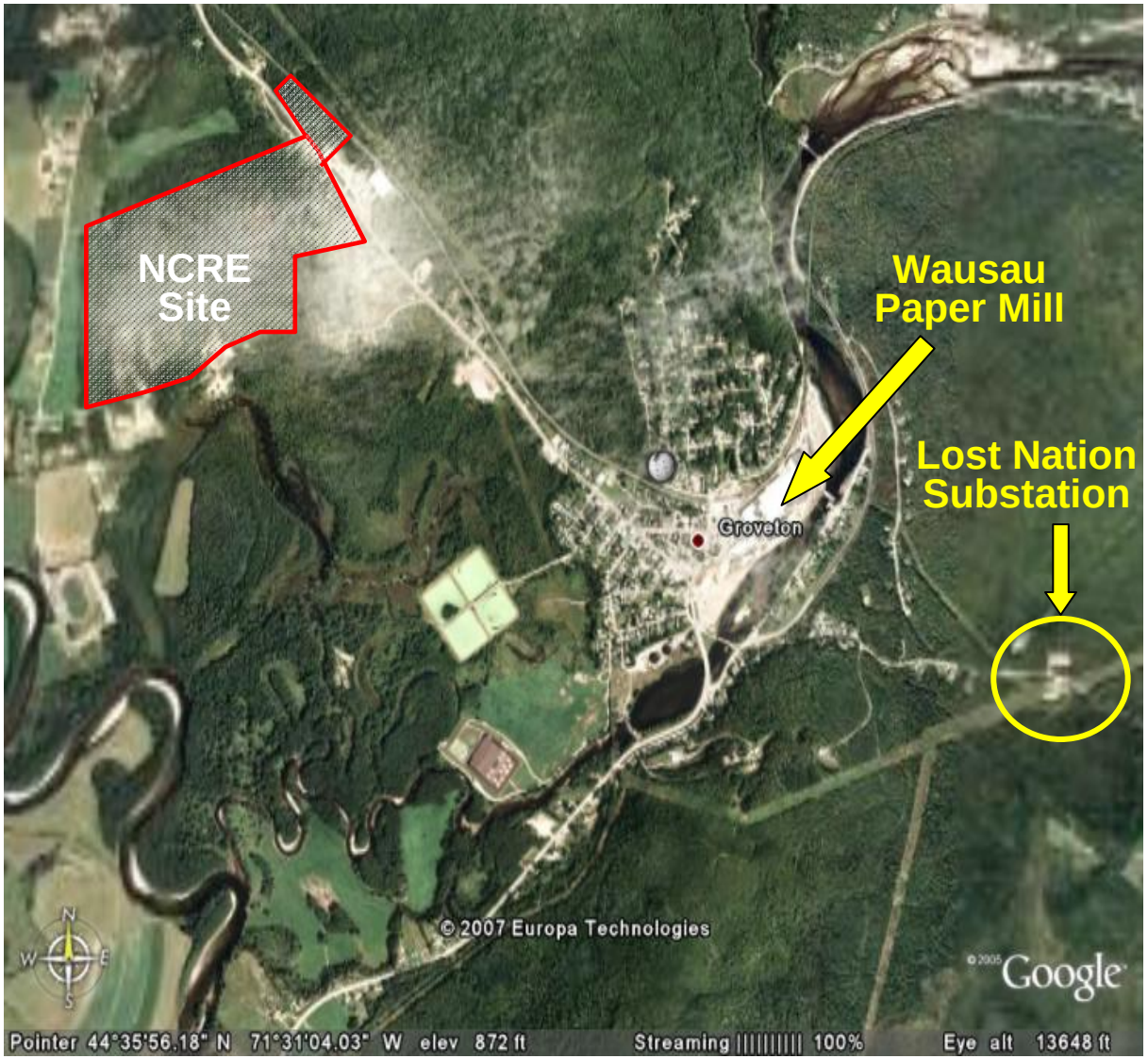
Proposed Project

- Nameplate 75 MW biomass electricity generation facility and collocated wood-based industry
  - Low emission advanced biomass conversion technology
  - Clean sustainable biomass fuel
  - No C&D or MSW
- Located on a 100+ acre site between Brown Road and Route 3, north of downtown Groveton

North Country
RENEWABLE ENERGY LLC
Nature Powering Life

Why Groveton is an Ideal Location for a Biomass Energy Facility

- Community receptiveness
- Access to fuel resources
- Trained and skilled workforce
- Highway access
- Minimal local traffic
- Transmission access
- Proximity to existing industry
- Rail access
- Compatibility with surrounding land use
- Minimal visual and noise impacts



North Country
RENEWABLE ENERGY LLC
Nature Powering Life

Northern NH's Extraordinary Challenges to Developing Renewable Power Plants

- Securing adequate transmission
  - Appears to be insufficient capacity in existing North Country transmission infrastructure
  - Current process for upgrades does not provide for pro-rata or other shared cost allocations
- Securing equipment
  - Boom in renewable energy has led to extremely long lead times on major equipment
- Securing financing
  - Normal process is compounded by uncertainty regarding transmission and equipment in a deregulated energy market

North Country
RENEWABLE ENERGY LLC
Nature Powering Life

Transmission Challenge

- $200 million investment with significant uncertainty on whether there is adequate transmission infrastructure to meet the needs of this project as well as other renewable energy projects
  - Over 400 MW of potential renewable generation already in interconnection queue in North Country
  - Possibly additional 300 MW of potential renewable generation not in queue but could be
  - May only be capacity for an additional 75 – 100 MW without major upgrades/overhaul to grid

Possible Alternatives

- FERC - Order No. 2003 provides that non-network or interconnection facilities are directly assignable costs that should be paid for by the interconnection customer. The Commission, however, ***established its policy prior to recent initiatives to develop renewable energy resources on a much larger scale***. Such resources are often location-constrained.

  We find that the barriers to the development of interconnection infrastructure to location-constrained resources highlight the need for flexibility in applying the Commission's interconnection policy to accommodate these resources.

Possible Alternatives (continued)

- Ca.- FERC approved the California Independent System Operator's (CAISO) proposed mechanism for financing facilities to interconnect location-constrained renewable resources such as wind, geothermal and solar generation to the CAISO's transmission grid.

  The Commission found that the CAISO's proposal strikes a reasonable balance that addresses barriers impeding the development of location-constrained resources while at the same time including appropriate ratepayer protections so as to ensure that rates are just and reasonable and not unduly discriminatory. Electric generation resources become location constrained because of location, relative size and immobility of their fuel source.

Possible Alternatives (continued)

- Co – They are working on a 2 path approach. They are looking into making a filing with FERC similar to that done by Ca. and are looking into using state bonds to finance transmission for location constrained generation
- Other States – Many other states are starting to look into this issue
- Combinations of the above and others???

Glossary of Terms

- PUC – Public Utilities Commission
- ISO-NE - The Independent System Operator for New England's electric grid
- FERC – The Federal Energy Regulatory Commission

Glossary (continued)

PTF Transmission
II.49 Definition of PTF
PTF or Pool Transmission Facilities are the transmission facilities owned by PTOs, over which the ISO shall exercise Operating Authority in accordance with the terms set forth in the TOA, rated 69 kV or above required to allow energy from significant power sources to move freely on the New England Transmission System, and include:
1. All transmission lines and associated facilities owned by PTOs rated 69 kV and above, except for lines and associated facilities that contribute little or no parallel capability to the PTF (as defined in this OATT). The following do not constitute PTF:
(a) Those lines and associated facilities which are required to serve local load only.
(b) **Generator leads, which are defined as radial transmission from a generation bus to the nearest point on the PTF.**
(c) Lines that are normally operated open.