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ENERGY

New Hampshire
State Energy Strategy:
Power Generation and Grid Modernization

Presented to:

State Energy Advisory Council



April 21st, 2014

Today we will focus on power generation and grid modernization to identify ways to move NH closer to achieving the ideals expressed in the energy vision.

1. » Strategy Development Process Overview
2. » Power Generation
3. » Grid Modernization
4. » Next Steps

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1. » **Strategy Development Process Overview**
2. » **Power Generation**
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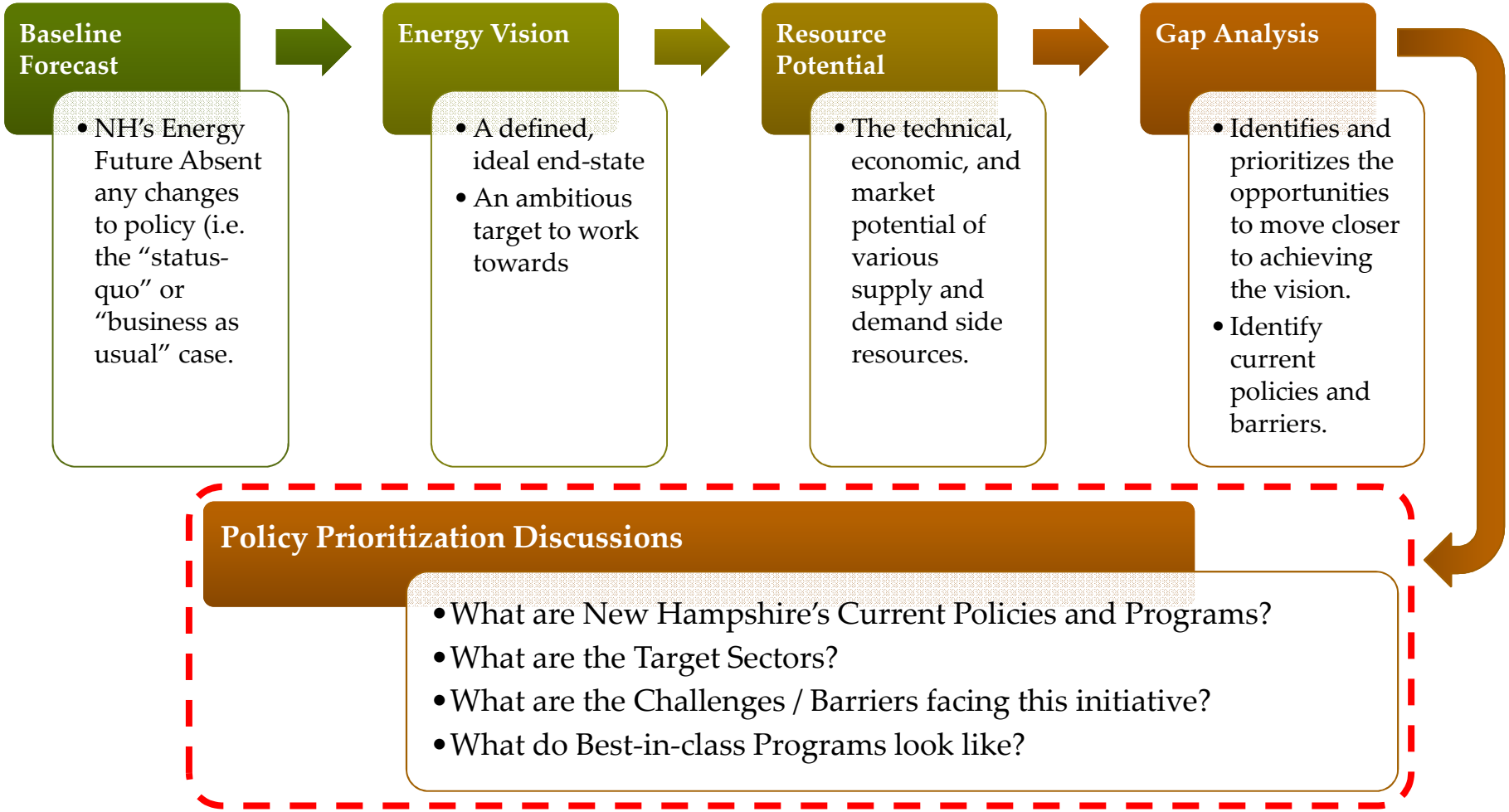
To date, Navigant has prepared the BAU forecast, developed the energy vision, analyzed the resource potential and identified the biggest opportunities to move NH closer to achieving the vision.



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Strategies to incent the expansion of renewable power generation may build on existing policies or borrow from the best-in-class initiatives.

- What are New Hampshire's current policies and programs?
- What are the target installations for this technology?
- What are the challenges / barriers facing this initiative?
- What do best-in-class programs look like?

Residential and Commercial Scale Solar PV	Utility Scale Solar PV	Biomass
Terrestrial Wind	Hydroelectric	Offshore Wind

- Regulatory Policy & Structures
- Finance & Funding
- Innovation & Expertise
- Outreach & Education
- Other

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NH has seen less development of small scale solar PV than other N.E. states despite considerable technical potential.

Current State of Residential and Commercial Solar PV in NH

- 2 MW installed in 2013 to bring the cumulative total to 7 MW (31st nationally)
- RPS requires that 0.3% of all electricity in NH must come from solar PV (baseline forecast suggests this will be met, but not exceeded)
- Net metering and group net metering are in place

Target Installation Characteristics

- Residential, commercial, industrial, and public buildings
- Typical installations are 5kW for residential and 325kW for commercial

Challenges / Barriers

- Cost of equipment including interconnection and metering infrastructure
- Flat REC prices
- Difficult for residential PV to participate in REC market
- No increase in Class II RPS (0.3% is constant through 2025 and thereafter)

Best-in-class Program Elements / Program Examples

- NetZero building requirements incent solar installation
- Increase SREC pricing
- Streamline permitting and interconnection processes
- Restructure RPS targets

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NH has seen little development of utility scale solar PV despite considerable technical potential.

Current State of Utility Scale Solar PV in NH

- 0 MW of utility scale solar in NH (8.8MW in VT and 4.5MW in MA)
- RPS requires that 0.3% of all electricity in NH must come from solar PV built after 2006 starting in 2014. The baseline forecast suggests this will be met, but not exceeded.

Target Installation Characteristics

- 1 MW and larger installations (~18,000 m2)
- Landfills, quarries, private lands

Challenges / Barriers

- Cost of equipment including interconnection and metering infrastructure
- Misconception that there isn't enough sun for solar to work in NH
- Flat REC prices
- No increase in Class II RPS (0.3% is constant through 2025 and thereafter)

Best-in-class Program Elements / Program Examples

- 56 MW utility scale in MA (ranked 4th) with an additional 30 MW under construction and 44 MW in development. VT has 11 MW operating with another 5 MW in development.
- Increase SREC pricing
- Restructure RPS targets

Regulatory Policy & Structures

Finance & Funding

Innovation & Expertise

Outreach & Education

Other

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Power generation using biomass may help keep dollars in state, but will require significant coordination with available resources on private lands.

Current State of Biomass Fired Power Generation in NH

- 267 MW of generation capacity currently installed
- Eligible facilities qualify towards the Class I (New Renewable Energy) and Class III (Existing Biomass Systems < 25MW) resources in the RPS. Class I RPS targets grow from 5% present day to 15% by 2025. Class III RPS targets grow from 7% to 8% to allow for uprating of these assets.

Target Installation Characteristics

- Proximity to managed forest lands / availability of resource

Challenges / Barriers

- Balancing supply and demand between the electric and thermal sectors.
- Estimates of technical and economic potential vary substantially making it difficult to know for certain how close we are to limits.
- Need to match in-state supply with demand or rely on imports
- Need to properly manage forests in order to maximize potential sustainably

Best-in-class Program Elements / Program Examples

- Combined heat and power/thermal uses are most efficient use of wood resource
- Other states are looking beyond wood – e.g. Vermont Cow Power

Regulatory Policy & Structures

Finance & Funding

Innovation & Expertise

Outreach & Education

Other

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Community scale wind provides opportunities to capitalize on NH's wind resources while possibly addressing siting concerns.

Current State of Terrestrial Wind Power in NH

- 171MW of wind in operation in New Hampshire
- Considered a Class I resource in the RPS. Class I is currently 5% of generation in 2014 and will rise to 15% by 2025
- The Federal Production Tax Credit (PTC) expired at the end of 2013

Target Installation Characteristics

- Areas with promising wind resources – largely ridgelines and coastal areas

Challenges / Barriers

- Siting challenges - areas with the best resources may be undesirable for other reasons (views, proximity to residences, etc.)
- With the expiration of the PTC, developers may focus on states with greater wind resources and fewer siting challenges

Best-in-class Program Elements / Program Examples

- States like Wisconsin provide clear siting criteria that give clear guidance to developers and a path for public participation

Regulatory Policy & Structures

Finance & Funding

Innovation & Expertise

Outreach & Education

Other

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While offshore wind shows considerable technical potential for NH, the present day cost of infrastructure may make it cost prohibitive.

Current State of Offshore Wind in NH

- At present, there is no offshore wind in NH nor anywhere in the US

Target Installation Characteristics

- Areas within 50 nautical miles of shore with annual average wind speeds greater than or equal to 6.4 meters per second at 90 meters
- Excludes shipping lanes, marine sanctuaries, and other undevelopable areas

Challenges / Barriers

- Substantial cost of turbines, transmission infrastructure, as well as operations and maintenance
- Environmental considerations for migratory seabirds and other species
- Limited coastline

Best-in-class Program Elements / Program Examples

- Installations in the UK, Netherlands, Denmark and Sweden
- Construction on CapeWind is still on hold pending financing
- The PUC in Maine approved a power purchase contract for a pilot project by Monhegan Island featuring new floating turbines. Pending a successful pilot, the full project would produce 43,000 MWh a year.

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Large scale sources of hydroelectric power have already been built, but additional smaller hydroelectric resources may provide additional power.

Current State of Hydroelectricity in NH

- Currently 455 MW of hydroelectric capacity
- An additional 114 MW were identified as economically viable in the resource potential study, but are largely fragmented resources located away from centers of demand or would require pumped storage.
- RPS targets for Class IV (which includes existing hydroelectric facilities < 5 MW and those facilities <1MW that comply with FERC fish-passage requirements) only grows from 1.4% of generation in 2014 to 1.5% in 2025.

Target Installation Characteristics

- Largely run-of-river small hydroelectric applications
- Pumped hydro to provide on demand power generation

Challenges / Barriers

- Seasonal fluctuation in resource availability
- Scattered remaining resources
- Difficult to access coupled with environmental concerns
- RPS Class IV limited to small, existing, hydro

Best-in-class Program Elements / Program Examples

- The Blenheim-Gilboa Pumped Storage Power Project in the Catskills - NYPA

Regulatory Policy & Structures

Finance & Funding

Innovation & Expertise

Outreach & Education

Other

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Which of the following options offer the best fit with NH's objectives?

Residential and Commercial Scale Solar PV

- Security benefits of distributed generation
- Employment of solar installers
- Makes use of existing infrastructure

Utility Scale Solar PV

- Less costly than rooftop on a $/W basis
- Compounds revenue generating opportunities for underused land resources

Biomass

- Locally grown fuel to keep $ in state
- Employment benefit to loggers
- Provides power on demand (non-intermittent)
- Right mix of thermal and electric/CHP

Terrestrial Wind

- NH has promising wind resources
- Typically cheaper on a $/W basis than solar.
- Wind resources may or may not be near demand centers

Offshore Wind

- Avoids many siting concerns of terrestrial wind
- Significant technical potential

Hydroelectric

- Limited remaining availability
- Environmental impacts and regulations

- *Does this target the biggest opportunities previously identified?*
- *Does this approach fit well in NH?*
- *Does it effectively leverage private financing?*
- *Are there other considerations?*

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Strategies to promote a more modern grid may build on existing policies or borrow from the best-in-class initiatives of other states.

- What are New Hampshire's Current Policies and Programs?
- What are the Target Sectors?
- What are the Challenges / Barriers facing this initiative?
- What do Best-in-class Programs look like?

Smart Grid Infrastructure

Consumer Behavior

Demand Response

Storage

Combined Heat & Power

- Regulatory Policy & Structures
- Finance & Funding
- Innovation & Expertise
- Outreach & Education
- Other

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SmartGrids allow for two-way communication between the utility, its customers, and the sensors along the transmission lines.

Current SmartGrid Development

- NH Electric Cooperative is installing 82,444 Smart Meters, an AMI Communications Network, 500 in home displays, and a consumer web portal
- ISO New England is installing $18 million worth of transmission level sensors

Target Sectors

- Residential, Commercial, Industrial

Challenges / Barriers

- Consumer acceptance due to concerns over privacy
- Quantifying benefits to justify the upfront cost

Best-in-class Program Elements

- CT Light & Power, part of Northeast Utilities "Plan-it-wise" pilot demonstrated peak load reductions of up to 28.5% in the residential and 9.4% in the commercial sector using peak time pricing with controlling technology
- Based on successes of pilots like this, CT Light & Power is deploying AMI across their service territory with expected completion in 2016.

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Consumer behavior programs provide incentives and information to empower consumers to be smarter users of energy.

Current Consumer Behavior Efforts

- Time Of Use (TOU) pilot programs have been tested at Unitil and the New Hampshire Electric Co-op
- PSNH is running a pilot program, in collaboration with OPower , engaging customers in learning about their usage and comparing them to neighbors

Target Sectors

- Residential, Commercial, Industrial

Challenges / Barriers

- Regulatory regimes for efficiency typically do not value consumer behavior programs appropriately
- Lack of consumer awareness about what to do in response to price signals

Best-in-class Program Elements

- CT Light & Power, part of Northeast Utilities "Plan-it-wise" pilot demonstrated peak load reductions of up to 19.6% in the residential and 3.6% in the commercial sector using peak time pricing alone (without automated controls)
- Reliant Energy offers a free Nest Learning Thermostat when customers sign up for their Learn & Conserve 24 plan which provides a dashboard aimed at educating and empowering consumers to save energy and save money.

Regulatory Policy & Structures

Finance & Funding

Innovation & Expertise

Outreach & Education

Other

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Demand response (DR) programs reward consumers who reduce usage during times of high demand to capture benefits of savings to the system.

Current Demand Response Programs in NH

- DR is active at the commercial and industrial level through aggregators like Ameresco and EnerNOC
- ISO NE allows DR to be bid into the capacity market and compete against conventional generation

Target Sectors

- Commercial, Industrial
- Some residential consumers with geothermal heating are eligible to participate in limited DR programs

Challenges / Barriers

- Transaction costs and lack of metering currently limit residential DR
- Consumer concerns over the impact of DR events complicate residential DR programs

Best-in-class Program Elements

- Market adoption of smart appliances may provide in-roads to facilitate wide-spread residential DR programs
- OPower's platform alerts customers (via email, text, or phone) to peak demand events providing advice on how to save energy, and explaining how customers can earn rewards if they trim their time-specific usage.

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Energy storage helps reduce peak load, integrate renewable power generation, increase reliability, and provide backup power.

Current Energy Storage Deployment

- One 1.5 MW compressed air storage project built by SustainX in Seabrook, NH
- Federal and state level incentive programs limited to "one-off" demonstrations and tying storage to renewable generation

Target Sectors

- Residential, Commercial, Industrial

Challenges / Barriers

- Limited federal and state level incentive programs
- A relatively immature and fragmented supply chain
- High system cost and relatively unknown lifetime – market conditions

Best-in-class Program Elements

- California energy storage mandate calls for 1325MW of storage projects by 2020
- FERC order 784 requires frequency regulation payments to be based on speed and precision and has allowed storage to excel in the PJM market

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Several combined heat and power (CHP) systems exist, but additional opportunities exist for greater distributed applications.

Current CHP Deployment

- 18 CHP systems currently active, with a total capacity of 58 MW
- 162 companies in NH with over 200 employees and $10M in annual sales which could potentially benefit from CHP

Target Sectors

- Commercial, Industrial, Municipalities & Schools

Challenges / Barriers

- Residential CHP units are not yet cost competitive with conventional resources
- Upfront cost and operational complexity
- Size limited by base thermal load

Best-in-class Program Elements

- The Portsmouth Naval Shipyard CHP system allows them to be self sufficient and to participate in DR programs with Central Maine Power
- CT offers low interest loans, on bill financing and property tax exemptions
- VT offers corporate tax credits, sales tax exemption and property exemptions

Regulatory Policy & Structures

Finance & Funding

Innovation & Expertise

Outreach & Education

Other

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Which of the following options offer the best fit with NH's objectives?

Smart Grid

- Provides the foundation for two way communications empowering consumers to better manage their energy bills
- Raises privacy concerns for some

Demand Response

- Rewards consumers for curtailing consumption during times of peak demand
- Can be either automated or coordinated
- May be difficult to educate consumer base to reliably respond

Consumer Behavior

- Market signals like TOU pricing programs provide incentives for consumers to load shift
- Programs can lead to confusion
- Consumers need means to shift demand

Storage

- Energy storage provides a variety of benefits including load shifting and frequency regulation
- Assists with renewables integration
- Adds cost to any project

Combined Heat & Power

- CHP provides for high efficiency integration of thermal and electric loads
- Requires adequate scale in thermal demand to be cost effective

- *Does this target the biggest opportunities identified in the gap analysis?*
- *Does this approach fit well in NH?*
- *Does it effectively leverage private financing?*
- *Does it help address economic and energy disparities?*
- *Are there other considerations?*

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Based on today's discussion, Navigant will roadmap the highest priority initiatives, identify key dates, stakeholders, and policy track ownership.

Power Generation and Grid Modernization Policy Discussion

- Based on today's discussion, Navigant will roadmap the highest priority initiatives, identifying key dates, stakeholders, and policy track ownership.

Draft Strategy Discussion

- Draft Strategy Document Complete on May 1st.
- On May 16th we'll return with a presentation of the draft strategy.

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