CHAPTER IX

Recommendations, Priorities, and Cost Estimates

Chapter Structure

A. BACKGROUND

This report has developed a number of recommendations designed to help the utilities improve their response to future storm events. This chapter summarizes those recommendations and also includes a chart that rates each recommendation. The ratings are based on the anticipated effectiveness of a recommendation, compared to the costs required for its implementation.

B. COST BENEFIT OVERVIEW

The December 2008 ice storm resulted in approximately $154 million of recordable property damage in the state of New Hampshire. If other economic factors were known such as loss of income, revenue, and profit due to disruptions of electric power, the total economic impact to the state would be much higher.

The CRREL report determined that a storm of the same magnitude as the December 2008 ice storm should be expected to return on average every ten years. In addition, the CRREL report shows a considerable history of ice storms in New Hampshire for over fifty years. The description in the CRREL report [1] of the January 1998 ice storm provides sufficient information to conclude that the January 1998 ice storm was more severe than the December 2008 ice storm. The 1998 ice storm also did more damage to the NHEC system than did the December 2008 ice storm.[2] However, the 1998 storm affected the less populated areas of northern New Hampshire and, therefore, the impact to the electrical infrastructure was not as severe as the December 2008 ice storm. If the 1998 storm had occurred in the same geographical area as the 2008 storm, a much larger amount of damage would undoubtedly have occurred.

An economic analysis can be performed to determine the costs and benefits which can be expected from the recommendations included in this report. Included in this analysis is the probability of another ice storm and the amount of damage that might result. In this analysis it

[1] See Appendix D.
[2] NHEC. (February 19, 2009). Data Response STAFF 1-49. NHPUC.

was assumed that damage from a fifty year return storm would be double that of the ten year storm that occurred in December 2008. Using this assumption and the determination that the current electrical infrastructure is not designed for a fifty year storm, 50% of the damage would be tree related and 50% would occur to the power system infrastructure. While the December 2008 ice storm has a probability of recurrence of one in ten years (0.1), the probability of the fifty year storm is 0.02.

The annual cost for the damage caused by the ten year and fifty year storms determined by the following calculations are assumed to be independent and additive. The annual cost is based on the annual probability of the incident multiplied by the estimated damage as shown in equation IX – 1.

The total damage to the four electric utilities from the December 2008 ice storm is provided in Chapter II, Table II-5 and is approximately $83.2 million. This amount will be referenced as $Cost_1$, which reflects damage caused mainly by vegetation. $Cost_2$ is then the expected additional cost due to failure of lines, poles, cross arms and other hardware and structures due to ice and wind from a fifty year storm causing forces exceeding the design of the equipment. Equation IX-1 should give the annual cost needed to pay for storm damage due to storms occurring every 10 years that were equal to the December 2008 storm, and storms occurring every 50 years that would cause twice the damage of the December 2008 storm. Equation IX-1 does not include the time value of money.

$$AC = P_1 \cdot Cost_1 + P_2 \cdot Cost_2 \qquad \text{Equation IX-1}$$[3]

$$= 0.1 \cdot \$83.2 \text{ million} + 0.02 \cdot \$83.2 \text{ million}$$

$$= \$9.984 \text{ million}$$

Where,

AC = Annual Cost

P_1 = Probability of a 10 year storm or 0.10

$Cost_1$ = Damage to the system related to trees

P_2 = Probability of a 50 year storm or 0.02

$Cost_2$ = Damage to the system caused by ice and wind

[3] DeGarmo, E.P., Sullivan, W.G., Bontadelli, J.A. (1984). *Engineering Economy* (8th Edition). New York, NY. MacMillan, pgs 474-476.

Collectively, the four electric utilities should expect an annual cost of $9.984 million due to future ice storms and as a result could spend $9.984 million annually to prevent the damage to their systems expected to occur due to 10 year and 50 year ice storms.

The total annual costs were allocated among the four electric utilities based on the percentage of the total number of meters each utility has, as shown in Table IX-1.

Table IX-1 – Annual cost allocation.

Utility	Allocation to Each Utility	Total Annual Cost for 10 year and 50 year Ice Storms	Vegetation Related Cost	System Infrastructure Related Costs
NHEC	6.93%	$692,000	$577,000	$115,000
National Grid	7.81%	$780,000	$650,000	$130,000
PSNH	73.83%	$7,371,000	$6,142,000	$1,289,000
Unitil	11.43%	$1,141,000	$951,000	$190,000
Totals	100.00%	$9,984,000	$8,320,000	$1,664,000

In addition to the 10 year return and 50 year return ice storms, it would be reasonable to assume that other types of storms and natural disasters would increase the estimated annual cost shown in Table IX-1.

Returning to the results from Equation IX – 1, $8.32 million of the $9.984 million in damage (83.33%) is tree related. The other $1.664 million (16.67%) is system infrastructure related damage. It follows that 83.33% of any investment made by a utility to prevent future storm damage should be directed towards reducing tree related outages, and only 16.67% should be directed toward strengthening the infrastructure of the system. Column four in Table IX-1 shows the vegetation related costs associated with the ice storms and column five shows the system infrastructure related costs expected from ice storms. From this analysis it may be seen that most of the money spent by the utilities to prevent ice storm damage should be spent on vegetation management. This conclusion is consistent with many of the other conclusions and recommendations included in this report.

C. RECOMMENDATIONS, PRIORITIES, AND COSTS

The chart below summarizes the recommendations included in this report. It includes three columns titled: benefit, priority, and cost. The benefit column shows the level of benefit for future storm response that the utilities can expect by implementing the recommendation. The priority column lists the relative importance and effectiveness of the recommendation. The cost column provides a cost range for implementing the recommendation. If the cost for implementing the recommendation is an on-going annual cost, the word “annual” is included with that particular cost range. The specific criteria for each of the rankings are discussed below.

Benefits

The following are the definitions of the benefit levels assigned to each recommendation:

High: The recommendation will provide a significant improvement and is cost effective.

Medium: The recommendation will provide a significant improvement, but may be expensive to implement, or the recommendation would provide a reasonable improvement and is cost effective.

Low: The recommendation will provide a reasonable improvement, but would be expensive to implement.

Priorities

The following are the definitions of the priority levels assigned to each recommendation:

High: Implementation would result in significant improvements that will strengthen the power system, improve restoration times, and improve communications. These recommendations should be implemented as soon as possible.

Medium: Implementation would result in meaningful improvements that will strengthen the power system, improve restoration times, and improve communications. Implementation should begin within 12 months.

Low: Implementation would result in improvements that will strengthen the power system, improve restoration times, and improve communications. Benefits are modest or difficult to measure. Implementation should begin within than next 24 months.

Cost Estimates

The following is a list of the cost estimate levels for each recommendation:

High: Implementation cost is estimated to be greater than $2.5 million.

Medium: Implementation cost is estimated to be greater than $100,000 but less than $2.5 million.

Low: Implementation cost is estimated to be less than $100,000 but greater than $10,000.

Minimal: Implementation cost is estimated at $10,000 or less, or the cost of implementation should be included within the normal cost of conducting business according to good utility practices.

Table IX-2 – Summary of recommendations, priorities, and costs.

Recommendation	Benefit	Priority	Cost
II-1 Unitil should adopt a storm restoration strategy that is based on achieving restoration for the largest number of customers in the least amount of time.	High	High	Minimal
II-2 Each electric utility should improve the systems and processes it uses to develop damage assessments and communicate ETRs to customers during storm restoration efforts.	High	High	Low
II-3 Each electric utility should adopt storm restoration procedures that require the process of procuring additional crews to begin at the first indication of an impending storm and include utilities and contractors beyond the local area.	High	High	Minimal
II-4 Each electric utility should improve procedures for communications with state and municipal government officials and emergency response agencies during major storms.	High	High	Minimal
II-5 Each electric utility should modify emergency planning procedures in order to implement a more effective means of estimating resource requirements.	High	Medium	Minimal
III-1 Each electric utility should include post-storm critiques and lessons learned should be included in their Emergency Operations Plan.	High	High	Minimal
III-2 Each electric utility should include a contingency for coincidental emergencies in their Emergency Operations Plan.	High	Medium	Minimal
III-3 Each electric utility should have its representatives make contact in person with the emergency directors of each of the towns in its service territory to gather information on critical customers within those towns. This should be done within 60 days after the publication of this report.	Medium	High	Minimal

Recommendation	Benefit	Priority	Cost
III-4 Each electric utility should expand its emergency response plans to include procedures for communicating with telephone and cable companies so vital telecommunications can be restored as quickly as possible.	High	Medium	Minimal
III-5 Each electric utility should arrange for security services as part of its emergency plan.	High	Low	Minimal
III-6 Each electric utility should develop a method for collecting and archiving data following emergency events and use this data to develop a predictive damage model for use in future storm planning.	Medium	Medium	Low
III-7 Each electric utility should expand emergency readiness drills beyond the individual companies.	Medium	Medium	Low
III-8 Each electric utility should fully implement the Incident Command System (ICS) concept and Unitil should adopt the IMS as its new structure for emergency management.	Medium	High	Low
III-9 PSNH should dedicate an emergency response area solely for the purpose of managing outage events; Unitil should continue with their plans for a dedicated EOC; NHEC should explore options for building a dedicated EOC or obtaining a mobile command center.	Medium	Medium	Medium
III-10 PSNH should purchase an Outage Management System and deploy the system within 12 months of acquiring and implementing a GIS, and Unitil should continue with its present plans for installing an OMS.	Medium	Medium	High
III-11 Each electric utility should identify and train additional damage assessment personnel and have them activated prior to the storm.	Medium	Medium	Medium

Recommendation	Benefit	Priority	Cost
III-12 Each electric utility should develop a mechanism for quickly assessing global damage and providing restoration times in order to allow customers and government to take prompt appropriate action.	Medium	High	Minimal
III-13 Each electric utility should expand its available resource pool to reach across the boundaries between cooperative and investor owned utilities (IOU), and consider using resources from other sources.	Medium	Medium	Minimal
III-14 Each electric utility should work with the community first responders to develop a process for "batching" wires down calls during a major emergency.	High	Medium	Minimal
III-15 Each electric utility needs to expand its communications program to better educate their customers about the restoration process.	Medium	Medium	Medium
III-16 Each electric utility should better define the methods it uses for communications with government officials during emergencies. .	High	Low	Minimal
III-17 Each electric utility should file their Emergency Operating Plans with the State Homeland Security and Emergency Management Office (state EOC) and work with the state to define thresholds which would trigger communications with the EOC.	High	High	Minimal
IV-1 PSNH should inspect the condition of the static wire on Line 367, compare it with the original design, and present a report to the NHPUC.	Medium	High	Minimal
IV-2 NHEC should upgrade their substation SCADA back-up power systems to provide reliable power for a minimum of eight hours.	Medium	High	Medium
IV-3 Each electric utility should perform a review of distribution loads supplied by sub-transmission lines.	High	High	Minimal

Recommendation	Benefit	Priority	Cost
IV-4 Unitil should investigate the failure of the Iron Works Substation transformer and correct any deficiencies on their system that could result in failures in the future.	High	High	Minimal
IV-5 Each electric utility should plan on replacing existing electro-mechanical relays with microprocessor based relays that feature event reporting ability.	Medium	Low	High
V-1 PSNH should abandon their existing OMS system in favor of a modern fully integrated GIS based system, Unitil should continue on the path they have begun and choose an OMS, and National Grid and NHEC should continue on with their plans for their OMS.	Medium	Medium	High
V-2 Each electric utility should include provisions for rapid restoration of communications in their disaster recovery plans.	High	High	Minimal
V-3 Each electric utility should ensure that all its poles, including joint use poles, are being properly inspected.	High	High	Med/High
V-4 Each electric utility should establish a more comprehensive vegetation management plan.	Medium	High	Medium
V-5 State and local governments should extend laws regarding vegetation management for roads and highways to include electric and communication corridors. Utilities should be assisted by local and state government to streamline the property owner permission process.	High	High	Low
V-6 Each electric utility should be required to employ at least one system forester or arborist in their New Hampshire service area.	Medium	Medium	Low (Annual)

Recommendation	Benefit	Priority	Cost
<u>V-7</u> Each electric utility should expand its vegetation management program to include the judicious use of herbicides for stump treatment.	Medium	High	Medium
<u>VI-1</u> Each electric utility should gather and analyze weather and damage information during and immediately following weather events and develop models to predict damage.	High	Medium	Minimal
<u>VI-2</u> PSNH should develop a process for responding to the IMS review and future post action reports and should expand the number of participants in its post storm reviews.	High	Medium	Minimal
<u>VI-3</u> Unitil should include post storm reviews in its Emergency Operations Plans.	High	Medium	Minimal
<u>VI-4</u> NHEC should make post storm critiques a part of its Emergency Operations Plan.	High	Medium	Minimal