Docket UE20723
Before The Prince Edward Island Regulatory and Appeals Commission
IN THE MATTER of
an Application by Maritime Electric Company, Limited for
approval of capital expenditures associated with
the design, construction and commissioning of a 50 MW combustion turbine generator
intended to be located at the Charlottetown Generating station.

Report to
The Island Regulatory and Appeals commission
on
The Review of the MECL Proposal to install a 50 MW Combustion Turbine
at its Charlottetown Generation Station

Prepared by

KnAP Energy Services Inc
September 2015

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1 Introduction

This report was prepared for the Island Regulatory and Appeals Commission in accordance with the terms of reference attached as Appendix I to this report.

1.1 The Objectives

1. to analyze the need for this expenditure taking into consideration the application evidence and related interrogatories.

2. to assess a) transmission capacity and b) generation capacity availability from both Nova Scotia and New Brunswick to the NS Border interchange at Memramcook and the interconnection with the PEI submarine cable system:

3. to provide the Commission with information on the potential availability of firm energy capacity and transmission capacity from the Muskrat Falls and Maritime Link project.

4. to provide the Commission with an assessment of the alternatives proposed, in light of the considerations of the information obtained as part of 2. above, and

5. to draw to the attention of the Commission such other issues and make such other comments and recommendations on related matters as the consultant considers advisable

1.2 The Approach

This report will address the above objectives from the perspective of what may be called traditional electric utility System Planning.

The traditional approach for vertically integrated utilities is to seek out alternatives that might meet corporate and regulatory objectives and satisfy various planning criteria better than the status quo. Utilities pursue the one(s) that have the potential to meet all of the competing requirements to provide reasonable and adequate service at the lowest long term cost.

Appendix II contains a high level summary of the steps in traditional "System Planning".

2 General Commentary on the MECL Filing

2.1 Introduction

This section addresses the approach taken by MECI as compared to the planning approach presented in Appendix II.

2.2 General Commentary

MECL has followed the traditional system planning approach.

MECL has prepared a load forecast and has assessed the ability of its existing system to satisfy its generation and transmission criteria.

MECL has presented qualitative and quantitative assessments of the shortcomings of the existing generation and transmission system to meet its load forecast and reliability criteria.

Based on the Load Forecast, including DSM savings, the capacity of existing generation and purchases, the capacity of the existing cables and the transmission available from the NB system MECL has concluded that reinforcement is required.

The load is growing, the available generation, off-Island transmission and cable capacities are known and it makes sense that some corrective action is required.

2.3 Potential Options Identified by MECL

Based on the evidence and the responses to Information Requests it seems that MECL keeps abreast of the potential for off-Island capacity purchases on an on-going basis.

The MECL Application and responses to various IRs have resulted in a reasonable narrative assessment of possible opportunities for the purchase of off-Island and on-Island capacity.

MECL has concluded that none will be available in a cost effective and timely manner.

2.4 Summary of the Alternatives that were analyzed in the Application.

MECL has provided three basic alternatives:
- Life Extension (LE) of the CTGS
- Installation of a 2nd 50MW CT in Charlottetown
- Installation of a 100MW CT in Charlottetown

Wind Turbine Generation (WTG) in PEI been successful; however, at this time it would seem that new on-Island non-utility generation will not solve the immediate need for reliability reinforcement.

MECL has submitted brief descriptions and cost estimates for the three alternatives presented as being potential solutions for ensuring a continuing acceptable level of reliability.

The following is a summary of the results of the economic and financial analyses from the MECL Application.

Option	CTGS LE	50MW CT	100MW CT	
Present Value M$	126.5	109.4	103.5	from Table 4, page 22
Net New Rev Req't M$	5.6	5.33	10.03	from Table 5, page 27
Rate Increase	2.8%	2.7%	5.0%	from Table 5, page 27

Based on MECLs assumptions and assessments, MECI has recommended the 50MW CT4 as the lowest present value alternative that satisfies its criteria. It also has the lowest rate impact.

3.0 Other Potential Options

3.1 The Maritime Area is in compliance with the NPCC Reliability Criteria

The Maritimes Area filed its latest Comprehensive Area Review of Resource Adequacy with NPCC in 2013. That report was approved by the Reliability Coordinating Committee in December 2013.

That report showed that The Maritimes Area was in compliance with NPCC Reliability Requirements. The report also showed that overall, The Maritimes Area have surplus Planning Reserves.

3.2 Interconnections

The supply to PEI requires additional cable reinforcement and currently relies on on-Island generation to protect against the potential failure of one of the two cables.

It is understood that a new cable is planned for 2016.

In addition to the loss of a single cable there is a new challenge, NBP internal transmission constraints.

NBP has imposed constraints to the supply to southeastern New Brunswick, (the Moncton area).

The firm transmission available to PEI is set at 80MW.

MECL has an entitlement to the 80MW of firm transmission via contracts with NBP.

This 80MW capacity limit means that PEI needs to have sufficient on-Island generating capacity to meet its capacity requirements based on this limit.

The existing sources of off-Island capacity are notionally, New Brunswick, Nova Scotia, Quebec and New England, all of which require access to the NB Power system.

When the Maritime Link goes into service (scheduled for late 2017) an additional alternative will be introduced, although it must be acknowledged that firm transmission through Nova Scotia must also exist and be available.

PEI cannot purchase firm capacity from NBP (or from Quebec or New England) unless there is some form of transmission reinforcement in NB to reduce the limitations of supply to the Moncton area.

The capacity ratings of the interconnections vary continuously depending on system loads, generation, and system configuration. But the one that counts is the 80MW limit.

A firm purchase from NS, by either NBP or MECL would alleviate some of the problems regarding the supply to the Moncton area to the benefit of NB and PEI.

The question is whether a firm capacity purchase is available.

3.3 Off-island Capacity Purchases - New Brunswick

There have been suggestions arising from Information Requests regarding whether MECL has fully addressed certain options that might be available to it.

The MECL Application and some of the IRs imply that there are possible solutions to the issue of the supply to the Moncton area.

The MECL Application does not specifically deal with NBP's options to reinforce NBP's system.

It has been implied in the Application and some IRs that NBP may be contemplating a CT in the Moncton area that may be eventually developed into a Combined Cycle Plant.

From time to time, New Brunswick Power places information in the public domain through its regulatory proceedings.

On November 21, 2014 NBP filed its "2015/16 General Rate Application" with the New Brunswick Energy and Utility Board (NBEUB).

Appendix I of that filing is "NB Power's Integrated Resource Plan 2014".

Appendix 2 is "NB Power's 10-Year Plan – Fiscal Years 2016 to 2025".

3.3.1 NB Power's 10 Year Plan - Fiscal Years 2016 to 2025

NB Power's 10 Year Plan - Fiscal Years 2016 to 2025 does not address the Moncton area transmission constraints nor does it mention a new CT or gas-fired Combined Cycle Plant.

Among the specifically mentioned capital plans is $8.5 million for infrastructure in New Brunswick to support a new submarine cable to PEI. The costs are to be paid for by PEI.

The new cable will definitely offer PEI additional security and permit increased access to more non-firm energy but unfortunately won't relieve the 80MW firm transmission constraint.

3.3.2 NB Power's IRP

NBP filed its 2014 IRP with the NB EUB in July 2104.

Regarding transmission issues the IRP states:
"*The New Brunswick to Nova Scotia and PEI transfer capabilities are a function of the transmission system's transfer capability into the southeastern region of New Brunswick, minus the southeastern region load (mainly Moncton, Dieppe, Riverview and surrounding areas). As the New Brunswick southeastern region load increases, the net electricity transfer capability available to PEI and Nova Scotia is reduced. NB Power's in-province load growth in the Moncton area in the past 10 years has reduced the combined transfer limits to PEI and Nova Scotia." (page 21).*

On page 22, it is sated:
"Although the current transmission system in New Brunswick is sufficient to reliably transfer electricity of the existing generation, potential upgrades may be necessary in the future,

especially in the southeast of the province as load in the Moncton area grows."

On page 23, the plan suggests what may be options to overcome inadequacies when necessary: *"NB Power continues to investigate solutions to future transmission constraints. Obvious solutions include both adding additional transmission as well as* ***strategically locating generation closer to the requirement*** *(emphasis added). Another solution exists that could preserve and extend the existing transmission system. This solution includes targeted demand reduction programs through smart grid technology."*

Perhaps any speculation that there may be a new CT in the Moncton area (that might ultimately become a Combined Cycle Plant, when affordable gas is available) is based on that "*strategically locating generation"* comment noted above.

If one had to speculate on the generation technology that might be a cost effective it would be a CT, not unlike the choice of MECL for CT4.

Under the heading "Major Capital Expenditures" the NBP IRP states: "Moncton loading project is not included in the capital spending forecast but under review." (page 154)

The NBP IRP, for what it designates as the "Supply Plan" does not show new generation until 2020, identified as 75MW Community Energy. The next identified capacity to be added is identified as 100MW Grand Falls and a 90MW CT in 2027. Finally, in 2030, a 350MW interconnection purchase is identified associated with the "Mactaquac Replacement". (page 108)

The IRP also contained a plan identified as "Integrated Plan" that incorporates NBP's Reduce and Shift Demand (RASD) program. In that plan, the first capacity addition was also identified as 75MW Community Energy in 2020. The next capacity identified is the "Mactaquac Replacement" in 2030.(page 130)

Among many generating technologies addressed in the IRP there is mention of the potential suitability of a Compressed Air Energy Storage plant possibly associated with abandoned salt mines between Saint John and Moncton.

There is no mention of a possible Moncton area CT or CC plant.

3.3.3 NB Power's Load Forecast

The NBP load Forecast in the short term is essentially flat and shows significant load reductions in the long term. By 2038 NBP expects its RASD program to achieve approximately 600MW and 2000GWh of savings at a cost of 487M$ but providing a net present value savings of some 440M$.

With a relatively flat near term load forecast due in part the NBP RASD program it is not obvious that a new generator installation (CT) in the Moncton is likely in the near term.

Continued low load growth might delay other reinforcement of supply to the Moncton area.

To the extent that the new Moncton area CT might be less costly than new transmission infrastructure, and if smart grid technology will keep NBP "whole" with respect to its obligations to provide a reliable supply to the Moncton area, one might assume that transmission reinforcement will be deferred to the time that it is the only solution.

In other words, the NBP plan might follow this sequence: first rely on RASD, then a new CT, followed by CC conversion and only then new transmission.

To my knowledge, NBP has not put any potential plan in the public domain.

3.3.4 MECL Minutes of Meeting between NBSO and MECL March, 2013

The following is an excerpt from MECL's response to PEIEC IR-27

As part of the response to IR-27, MECL referred to the subject minutes. The following are excerpts from those minutes.

- **Minute item 14**.
  MECL Question: Does the NBSO have a short term solution to alleviate the current restrictions on the NB/NS/PE Interface?
  NBSO Answer:
  - No.

- **Minute Item 15**.
  MECL Question: Has the NBSO completed any recent transmission studies on the South Eastern portion of the NB transmission system?
  NBSO Answer:
  - There is transmission planning taking place between the NBSO and NB Power, with NB Power being the lead party.
  - Discussions are ongoing between NBSO and NB Power and eventually MECL and NSPI will be invited to those discussions.
  - MECL indicated that it would consider signing a long term transmission reservation in order to help justification for new transmission to southeast NB.

- **Minute Item 16**.
  MECL Question: Does the NBSO have a long term solution to alleviate the current restrictions on the NB/NS/PE Interface?
  NBSO Answer:
  - See response to # 15.
  - There would be a minimum of 2 years before anything would be constructed. This estimate is based upon a best case scenario for design, engineering, procurement and construction of a major transmission project.

3.3.5 Summary Conclusion

It is concluded that for the time-being NBP intends to meet its system design criteria and nothing more. Indeed, why should it?

3.4 Off-Island Purchases - Nova Scotia

There is considerable information in the public domain from filings by Nova Scotia Power with the Nova Scotia Utility and Review Board (NSUARB).

The information that is pertinent to the assessment of a potential capacity purchase from Nova Scotia relate to the load forecast (even the forecasting methodology is evolving), the Interruptible load (IL), the firm peak, the installed capacity and its nature, the large component of WTG and the availability of firm transmission from NS to NB.

The Nova Scotia Power-New Brunswick Power Interconnection Agreement provides among other conditions that NSPI maintain a 20% planning reserve in excess of its firm peak load.

NSPI has a relatively large IL of approximately 125MW or about 6% of the peak load. This enables NSPI to minimize its planning reserve while managing reliability and costs.

Although NSPI theoretically has surplus capacity by virtue of its IL, it is cautious to enter into a firm capacity sale that might lead to a requirement to interrupt in province customers.

There is nothing wrong with that logic. NSPI must act in the interests of its customers.

3.4.1 NSPI Concerns Regarding Future Planning Reserves Requirements

On June 30, 2015 NSPI filed with the NSUARB its “10 Year System Outlook Report”.
A review of that report indicates that there are clearly a number of concerns.

These concerns include:

- the base load forecast.
- the future success of DSM programs that have been approved by the NSUARB.
- accommodating new wind generation on a system not designed for a large percentage of non-dispatchable generation. (600MW of WTG, existing, committed and planned).
- the ability of generation designed to be base loaded thrust into a load following mode and potential impacts on maintenance costs and reliability.
- concern that if the availability of the thermal units suffer, then there might be pressure on NSPI to increase its Planning Reserve (ie greater than 20%).
- concern in regard to a yet-to-experienced variable: the interface with Newfoundland and Labrador via the Maritime Link and perhaps as yet to be determined operational growing pains.

These are legitimate concerns and it is up to NSPI to resolve them with the approval of its regulator.

3.4.2 Summary Conclusion
It appears that no firm supply is available from NSPI at this time due to uncertainties about its required level of Planning Reserves.

3.5 Off-Island Purchases - Newfoundland and Labrador
There have been some questions regarding the firmness of the schedules and in service of the Muskrat Falls hydro development.

For example an article in the NL Telegraph dated July 15, 2015 said: "The president and CEO of Nalcor Energy has stated he can't guarantee Muskrat Falls will generate first power by 2017 as scheduled." There are no official documents that I am aware of that suggest a later in service date.

As part of the various Agreements between Emera and Nalcor, NSPI has applied to the NSUARB to upgrade the interconnection between Onslow and Springhill, NS to provide a firm path of 330MW between Onslow and Memramcook. The cost estimate was $23 Million with proposed in service date of 2016/2017.

The UARB did not approve the project but left the door open for a future new application.

It is likely that that NSPI will submit a new application.

It is understood that whereas Nalcor hopes to export all energy in excess of Newfoundland and Labrador needs it does not intend to sell firm capacity.

3.5.1 Summary Conclusion
It can be concluded at least for the time being that Nalcor is unlikely to sell any of its capacity.

4 Thoughts Regarding the Availability of Gas

There are many uncertainties regarding the supply of natural gas to New England and The Maritimes as addressed by MECL in evidence and response to IRs.

The competitive electricity market in New England has dramatically increased gas demand in New England and has exposed gas distribution customers and electricity customers to volatile prices based upon pipeline capacity constraints from south to north and gas supply constraints from the Maritimes.

In spite of the clear need for new pipeline capacity to supply New England there is opposition arising from NIMBYism, political agendas, and environmental concerns among other issues.

There is a lot of speculation regarding the timing of reinforcement of the pipeline capacity into New England although 2017/2018 is thought by many observers to be likely.

It will be interesting to see if opponents to the new pipeline capacity developments succeed in delaying one or more of the new pipeline proposals.

5 Other Alternatives

This section briefly addresses two items that have attracted several Information Requests. These items are DSM and Battery Storage.

This is not an assessment of the DSM nor the Battery Storage alternatives. It is just a commentary. MECL's filing and responses have addressed these issues.

5.1 DSM

The three major Maritimes utilities have DSM programs in various stages. NBP's program is in progress. NSPI also has had a program for several years. NSPI's new program has been approved and starts in January 2016.

NBP started a new program in 2013 that established annual targets as does the NSPI program.

MECL has presented several programs that are intended to reduce demand and consumption.

The following Table compares the MECL proposed MW reductions (from U20723) with information in the public domain through regulatory filings in NB (2014 IRP) and NS(NSUARB Case number M06733).

Summary of DSM Demand Reduction Targets by MECL, NBP and NSPI After Three Years

	System Demand MW	DSM MW Saved	DSM as % of Peak
MECL	260	6	2.3
NBP	3000	45	1.5
NSPI	1900	63	3.3

MECL estimates of Peak reduction do not appear out of line with the expectations of the DSM programs in NB and NS.

5.2 Storage Systems

Electricity storage can have a role to play, be it pumped hydro, compressed air, production of hydrogen or batteries, among others. The economic effectiveness varies depending on the individual circumstances.

Pumped hydro storage and compressed air options have little potential in PEI but might be possible in NB or NS.

Battery storage is obviously technically viable. Batteries can store direct current electricity from direct current (DC) or alternating current (AC) sources. Batteries can deliver electricity to many devices that can use direct current in a relatively straightforward manner, as long as the voltage ratings are compatible.

The MECL response to "Government Third Party IR-3 (b)" addressed the fact that In order for a battery to deliver AC power (the product that utility systems deliver), conversion devices are required. In addition to the capital costs of the batteries there must be added the costs of

inverter technology and connections to the system. The MECL response indicated that installation costs were not included.

MECL did not add that there also are losses associated with battery charging and discharging that were not included in the MECL response.

MECL offered as an example a 100kWh storage device that could deliver 25kW for 4 hours of peak shaving.

The 50MW CT4 can deliver its rated output for as long as fuel supplies last. If there is a hypothetical transmission outage in NB that lasts longer than the four hours in the hypothetical example the battery will be depleted and can't be recharged until the transmission/generation problem is resolved.

5.3 Summary Conclusion

There are many reasons to support DSM as evidenced by the intentions of the Maritime utilities and world-wide applications.

Battery storage will no doubt play an increasing role as the technology continues to improve.

In some circumstances when the grid cannot accommodate the supply of renewable energy that might be available, rather than curtail, say the output of WTG, the energy is stored for future use. Batteries are also used for re-timing solar energy. Battery storage is commercially available now. It is a matter of affordability in the circumstances.

6 Potential Risks

6.1 Maximum Unit Size

The existing CT3 is a 50MW unit and is the largest single contingency on the island system. The proposed CT4 is also 50MW.

The MECL Interconnection Agreement with NBP permits a unit size up to 30% of the firm peak, which would easily permit the new 50MW unit.

6.2 Cable Failure

Although the reliability of the existing cables has been quite acceptable, the consequences of the loss of one cable could lead to an inability to supply on-Island load for an extended period and is unacceptable.

The MECL criteria attempt to ensure that a loss of one cable will not lead to loss of load.

The installation of the third cable is a valuable addition. In the current circumstances it does little to address the reliability of supply due to the NBP transmission constraint.

6.3 Reliability of Supply to Moncton Area and hence PEI

The dependability of the 80MW capacity supply from New Brunswick is a significant issue.

If, even with RASD programs in place, the load in NB and the Moncton area continues to grow, there will be additional constraints imposed. Until NBP reinforces its supply to Moncton, NBP will reduce the 80MW available to PEI on a proportional basis to any reductions to its own firm load customers.

This issue demonstrates that PEI is exposed to certain risks that are beyond its control. Being overly dependent on external transmission for generation capacity does carry some risk.

An ice storm or a hurricane could result in no supply to PEI from the mainland.

Perhaps there should be a study to address an appropriate minimum availability of on-Island generation. It would seem that none is not an option.

6.4 Delaying a Decision

it is important that decision making is not put off to the point where the reliability of supply to the island will be compromised.

The CT option can begin almost immediately and is not subject to approvals by regulators in other jurisdictions where capital expenditures might be required.

7 General Comments

7.1 More Detailed Information in Filings

The Commission might wish to consider an approach now being used in Nova Scotia. Prior to any major filing, NS Power holds meetings with interested parties to share information and discuss issues before hand.

The intent is to reduce or eliminate some issues by mutual agreement so as to reduce the litigious nature and time required before the UARB. Some of the Information Requests arising from this Application suggest that a somewhat similar process might have reduced some of the concerns raised with respect to this Application.

More early available detail does not necessarily mean or lead to, more bureaucracy. It can mean a better focus on the relevant issues and potentially lead to more timely decisions.

7.3 Interruptible Load

The Commission might request that MECL review its a policy with regard to interruptible load. In Nova Scotia, for example, a customer that elects to take service at an available interruptible rate must remain as an interruptible load until five years from the date of notice that it wishes to return to firm load status or unless approved earlier.

In Nova Scotia, a customer that switches from an interruptible rate back to a firm load rate must remain on a firm rate for two years.

7.4 Routine Reporting and Meetings

To the extent this is not currently being done, the Commission might consider asking MECL for regular updates to its load forecasts, its progress on DSM, assuming there is an approval, its fuel and purchased power costs and forecasts thereof and off-Island issues of potential interest to the Commission such as NBP internal transmission constraints and their effect on PEI.

Other issues might be, for example, the status of market evolution in Nova Scotia, New Brunswick, New England, and soon, Newfoundland and Labrador, ongoing developments in environmental policies and regulations and fuel supply, among others.

8 Conclusions

8.1 The MECL load is growing and the load forecast seems not unreasonable.

8.2 Additional capacity is required by 2017 so as to meet the Planning Criteria.

8.3 MECL has identified the reasonable options that are available in the circumstances. The only on-Island options that will meet reliability requirements are light oil fired combustion turbines.

8.4 New cable capacity and new on-Island generation are not mutually exclusive options.

8.5 The source of any new firm capacity purchase(s) is not apparent. The cost of using the transmission system of NBP and that of other systems are factors to be included in the evaluation of firm generating and transmission capacity above the 80MW contract limit.

8.7 The lack of any evidence of the availability of a source of off-Island firm capacity with a firm transmission path demonstrates that new on-Island generation is the only choice.

8.8 MECL, indeed PEI, can't simply wait for an offer of firm capacity to materialize.

8.9 Although it is not in the Planning Criteria, locating generation where the load is brings additional security of supply. In this case it is also the lowest long term cost option. It would also facilitate the eventual phase out of the CTGS.

8.10 The proposed 50MW CT4 satisfies all of the planning criteria and it is doable in time to satisfy the need.

Appendix I IRAC Docket UE20723 Terms of Reference for Independent Staff Expert

August, 2015 **Page 1**

Part 1 INTRODUCTION

1.1 The Island Regulatory and Appeals Commission (Commission) has authorized commission staff (staff) to retain the services of an independent energy consultant (consultant) for the purpose of providing independent expert advice on matters relating to Maritime Electric's application before the commission for approval of expenditures relating to the design. construction and commissioning of a combustion turbine generator with a nominal rating of 50MW to be located at the Charlottetown Plant Site.

I .2 Staff's intention in seeking such independent advice is to ensure that a full and complete record in this matter is made available to the commission.

1.3 Staff takes no position in this matter.

Part 2 SPECIFICS OF ENGAGEMENT

2.1 The consultant is engaged:

.1 to analyze the need for this expenditure taking into consideration the application evidence and related interrogatories.

.2 to assess a) transmission capacity and b) generation capacity availability from both Nova Scotia and New Brunswick to the NS Border interchange at Memramcook and the interconnection with the PEI submarine cable system:

.3 to provide the Commission with information on the potential availability of firm energy capacity and transmission capacity from the Muskrat Falls and Maritime Link project.

.4 to provide the Commission with an assessment of the alternatives proposed, in light of the considerations of the information obtained as part of .2 above, and

.5 to draw to the attention of the Commission such other issues and make such other comments and recommendations on related matters as the consultant considers advisable

2.2 while the necessity of a public hearing regarding the application has yet to be determined, the consultant shall be prepared to appear at a hearing before the Commission.

2.3 The consultant shall take care to ensure that his analysis is based on the principle that the resulting rates of a public utility are to be as low as possible, consistent with the public utility's duty to provide reasonable and adequate service.

2.4 The consultant may confer with, and issue written questions or interrogatories directly to. Maritime Electric provided both the written questions and written answers are filed with the Commission.

2.5 The consultant shall not confer with any commissioner assigned to hear the application on any matter relating to this engagement.

Part 3 Timing

3.1 The consultant shall deliver ten (10) copies of his written report to

J. Mark Lanigan CPA, CA
Director Corporate & Appellate Services
Island Regulatory and Appeals commission
134 Kent Street. P.O. Box 577
Charlottetown. P.E.I. C1A 7L1

on or before September 16, 2015.

Subsequently the timing has been revised to September 30, 2015.

Appendix II Generic Description of System Planning

1 General

System Planning is concerned with the assessment of practical, environmentally acceptable and potentially cost effective methods of serving the future electrical service needs of customers.

The overall objective is to contribute to the provision of an appropriate combination of generation, transmission and management of electrical demand such that within the guidance of Basic Planning Criteria, customers' requirements for reliable, environmentally sound, high quality electricity service are met at the lowest long term cost

This approach has been historically and universally adopted for vertically integrated utilities.

2 System Planning Activities

System Planning basically requires the following:

- Defining objectives and establishing criteria
- Making reasonable and defendable assumptions
- Estimating future customer demand and energy requirements (Load Forecast)
- Assessing the existing system and its performance against the criteria
- identifying and screening potential resource options (demand and supply)
- Integrating reasonable alternatives into long-term plans
- Assessing the alternative plans in accordance with the criteria
- Obtaining approval for and implementing the most attractive alternative

3 Defining Objectives and Basic Planning Criteria

Utilities Basic Planning Criteria support their corporate mandate. The words in the statement of criteria may vary from system to system but the thrust is usually the same. Utilities have as their objective the provision of an adequate, secure, affordable, environmentally acceptable, quality supply of electricity at the lowest long term cost (also referred to as least present value) while earning their allowed rate of return.

4 Environmental Criteria

Environmental standards and guidelines are for the most part established by the Federal and Provincial Governments and utilities are required to comply with the requirements. For thermal plants, factors that may be considered include greenhouse gasses, SO_2. NOx, particulates, mercury, water use, land use, noise and aesthetics.

5 Reliability Criteria

Reliability is a concept that addresses the degree of performance of the elements of the bulk electricity system that results in electricity being delivered to customers within accepted standards and in the amount desired.

Reliability may be measured by the frequency, duration and magnitude of adverse effects on the electric supply. Electric system reliability can be addressed by considering two basic and functional aspects of the electric system - Adequacy and Security.

Adequacy
The ability of the electric system to supply the aggregate electrical demand and energy requirements of customers at all times, taking into account scheduled and reasonably expected outages of system elements.

Security
The ability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system elements.

Throughout North America, Reliability Standards are set by the North America Electric Reliability Corporation and the eight Regional members. The Northeast Power Coordinating Council (NPCC) oversees the reliability aspects of the interconnected grids of New York, New England, Ontario, Quebec and the Maritimes, each of which is considered an "Area".

Among other objectives, the Adequacy and Security criteria are intended to ensure that events in any Area do not impact other Areas.

Generation
To allow for maintenance, for unexpected outages of generating units and for variations in the load, for example due to weather, the total installed and purchased generating capacity must be greater man the expected peak demand.

In the NPCC Region, Areas attempt to achieve a Loss of Load Probability of not greater than 1 day in 10 years which for predominately thermal based Areas is achieved by maintaining a 15-20% Planning Reserve. (Some predominately hydro systems use a 10% reserve criterion.)

Planning Reserve is the difference between a system's Firm System Peak and Net Generation Capability owned and purchased. Planning Reserve Is usually expressed in percent.

Firm System Peak is the highest electric power requirement occurring in a given period (e.g., an hour, a day, month, season, or year) on the system net of load which is interruptible.

Net Generation Capability is defined as the maximum demonstrated two hour output capability with all units in a station running.

Among other reliability provisions, NPCC also requires that Areas provide for reliable operation of the system by the maintenance of ten minute and thirty minute operating reserves and other requirements.

Transmission
Transmission systems are designed to a single contingency (N-1) criterion which is a norm in all power systems in North America. Basically, the loss of no one system element should precipitate a cascading series of outages which could lead to an entire system shutdown.

Distribution
The norm is a one supply per customer. A second or back-up supply normally requires a capital contribution from the customer. Many utilities adopt specific criteria that include the frequency and duration of customer outages. This is outside the scope of this discussion.

Also, reliability standards for Distribution are outside of NERC and NPCC interest.

Quality of Supply
The magnitude and waveform of voltage supply must be acceptable to customers.

6 Economic Criterion
Plans are adopted that satisfy customers' needs, meet the environmental and reliability criteria and tend over time to minimize the present value of total costs (capital, fuel, operating, maintenance, taxes and losses).

7 Financial Criterion
Plans that satisfy the environmental, reliability and economic criteria must also meet financial requirements. Consideration is given to risks such as the potential failure of a specific undertaking to perform satisfactorily from many perspectives including availability of fuels of sufficient quality and quantity at competitive prices. The impact or project expenditures on the total early year cost of electricity as charged to customers must be judged to be acceptable.

8 Robustness
Sensitivity analyses are undertaken to assess how the preferred plan will perform if subject to various possible but not expected futures.

9 Assumptions
The assessment of how the system will perform requires that reasonable assumptions be made for a variety of things including how existing equipment will perform, the load forecast and its drivers, fuel costs and availability, environment expectations and protection, what neighbouring systems might do, how regulations might evolve, new technologies, interest rates, foreign exchange rates and so on.

10 Load Forecast
The term Load Forecast means the estimate of future quantities of electric power and energy required by customers. It is necessary for operating, budgeting and planning. For long range generation planning, forecasts of the total system energy requirement, system peak demand and load shape are the most important quantities. For transmission and distribution planning the spatial distribution or load is also important.

Load forecasts are usually developed on the basis of three broad direct customer classes (domestic, commercial and industrial) plus wholesale and system sales plus transmission and distribution losses which can include own use.

The forecast of system energy requirement is used in the development of operating budgets and in long range generation planning.

The peak demand forecast is used in determining the need for new capacity or load management or both. It is also the primary factor in transmission and distribution planning

11 Assessing the Existing System
This is an assessment of how well the existing generation and transmission system satisfies all planning criteria. It is the first step in identifying areas where there might be opportunities for improvement.

12 Identifying and Screening Potential Options
Utilities generally keep an "inventory of options" which might have some potential for reducing costs and contribute to the satisfaction of planning and operating criteria and the reduction in cost of service. For each option high level estimates of capital, operating and maintenance, fuelling and other costs are periodically updated and compared against the status quo and other options so as to ensure that planning criteria are reasonably satisfied.

13 Integrating Reasonable Alternatives into Long Term Plans
When screening analysis identifies potentially attractive investments the better options are tested in more detail as an integrated part of a potential future generation mix or transmission configuration.

14 Analysis and Assessment
The analysis includes estimating the costs of developing and operating a new system that continues to meet all planning criteria. Alternative plans that meet reliability and environment criteria are compared on a total present value basis.

Several of the lower present value plans are further tested for changes in the fundamental assumptions so as to test their robustness or ability to satisfy the basic criteria.

The financial impacts of preferred plans are also tested from a rates perspective to determine if early year revenue requirements are reasonably acceptable.

In an ideal world the least present value cost plan will also minimize early year rates but this may not always be the case.

15 Recommending the Best Alternative
As implied in number 14 above, trade-offs are usually necessary and therefore sensitivity or robustness analysis is a must and judgment must be applied in assessing risks.

Appendix III References

NEW BRUNSWICK

New Brunswick Energy and Utility Board http://www.nbeub.ca/

NBP Evidence 14-11-21 NB Power 2015/16 General Rate Application Matter # 0272

- The Application item #NBP1.01
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NOVA SCOTIA

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Nova Scotia Power Rates and Regulation page http://www.nspower.ca/en/home/about-us/electricity-rates-and-regulations/regulatory-initiatives/default.aspx

NSPI IRP 2014
http://www.nspower.ca/site/media/Parent/20141015%202014%20IRP%20Final%20Report.pdf

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- NS UARB - NSPI 2014 IRP Case # M05522
- NS UARB - Efficiency One -NSPI Supply Agreement for Electricity Efficiency and Conservation Activities **(**DSM) Case # M06733
- NS UARB - Decision re NS to NB 138kV transmission capacity increase - Case # M06660
- NSUARB - Decision re Maritime Link - Case # M05419

PEI

IRAC - http://www.irac.pe.ca/

- Utilities - UE21406 - Notice of Application - Maritime Electric Company, Limited - DSM Filing - June 5, 2015
- Utilities - UE20724 - Notice of Application - Maritime Electric Company, Limited - Approval of 2016 Capital Budget - August 7, 2015

OTHER

NPCC - 2013 Maritimes Area Comprehensive Review of Resource Adequacy
https://www.npcc.org/Library/Resource%20Adequacy/Forms/Public%20List.aspx