NEW ENGLAND GOVERNORS' CONFERENCE, INC.

New England Tracking System

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NEW ENGLAND TRACKING SYSTEM (NETS)

A project to develop a methodology to contribute to the development of a region-wide electricity tracking system in New England to support the implementation of a wide-range of restructuring-related policies

The NETS Project

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Advisory Committee Preface to the NETS Project Report

In January 1998, the New England Governors' Conference, Inc. (NEGC) received a grant from the U.S. Environmental Protection Agency to investigate the development of an electricity tracking system for New England. This system -- called the New England Tracking System (NETS) -- would support the implementation of electric industry restructuring-related policies. The NETS project was guided by an Advisory Committee of representatives from US EPA Region 1, NEGC, and state public utility, environmental, and energy offices from New England and New York. Technical support was provided by the consultants, Environmental Futures, Inc., Synapse Energy Economics, and the Tellus Institute. Stakeholder input was received through written comments and a public meeting. The attached report details the findings and recommendations of the NETS project.

Background and Purpose

The NETS project is the latest in a series of public and regulatory initiatives to design and support the implementation of public-purpose programs required by electric industry restructuring legislation and regulations. These programs include:

(1) displaying fuel and emission characteristics of the resource portfolios and products of competitive retail electricity suppliers to support consumer purchase decisions (information disclosure);
(2) requiring supplier portfolios and products to meet output-based emission standards (generation/emission performance standards, or GPS); and
(3) requiring supplier portfolios and products to meet minimum content standards for renewable resources (renewable portfolio standards, or RPS).

In this context, the objective of the NETS project was to determine whether a single, region-wide data calculation and verification procedure to support compliance with, and enforcement of, all of the aforementioned policies, could be developed.

The Advisory Committee proceeded from the shared premise that, given the tightly woven nature of the physical power system and financial markets for electricity in New England, the New England states should, where appropriate, seek a high degree of regional consistency in the implementation of disclosure, GPS, and RPS policies. However, to date no state has completed implementing all regulations required by restructuring legislation, and some states have yet to begin this process. State policies will continue to be developed through individual state proceedings based upon specific legislative language, public input, and local considerations. Although the Advisory Committee believes that regional consistency must continue to be a high priority, we sought to design a tracking system to produce the raw data needed to support the widest possible range of policy options.

Importantly, we wanted to tailor a tracking mechanism to conform with the timing, contractual definitions, and rules and protocols that will be used by the New England Independent System Operator (ISO) for financial settlement of the New England energy market.[1] The Advisory

[1] Although the NETS tracking system was designed in accordance with ISO protocols and definitions, NETS tracking calculations begin with data *output* from the ISO financial settlement system. Thus, if necessary, NETS could be executed by an organization other than the ISO, and no changes would be required in the design of the

Committee considered this an important design criterion in order to minimize the cost, time, and complications that would otherwise result from the development of a wholly independent tracking system.

We believe that the results of the NETS project meet the goals of the project and the above-stated objectives of the Advisory Committee, as described below.

The NETS project builds upon existing generation tracking protocols developed to support information disclosure policies in the New England states. In particular, the NECPUC model disclosure rule and the disclosure regulations of the Massachusetts Department of Telecommunications and Energy (DTE) are based on the ISO's tracking of financial transactions among New England energy market participants as a logical connection between power plant generation and end-use consumption. However, prior to the NETS project, those rules were forced to rely upon an unsatisfactory degree of aggregation for spot market purchases and for system transactions that do not specifically identify the source of generation. In the DTE regulations and the NECPUC model rule, all such transactions are assigned the average regional mix for disclosure purposes, resulting in an overall blending of the generation mix of all companies entering into these types of financial transactions. As discussed below, the NETS tracking system improves upon the NECPUC and Massachusetts tracking protocols by achieving resolution in tracking spot market and system transactions to support implementation of disclosure, GPS, and RPS policies.

To accomplish this, the NETS method applies two conventions agreed upon by the members of the Advisory Committee. First, generation sources are assigned to load-serving entities (LSE)[2] based on the financial transactions between market participants in the New England energy market in each hour. This convention is necessary in order to obtain sufficiently accurate data where needed to support determinations of compliance with, and enforcement of, state policy requirements. However, recognizing some of the concerns expressed by stakeholders (see Issues and Next Steps below), the Advisory Committee's proposal to base a LSE's resource portfolio on hourly energy market data is not intended to restrict states from adopting policies that would allow an LSE to aggregate, average or format load and generation data over a longer period of time.

The second convention agreed upon by the Advisory Committee is that for each transaction that does not specifically identify the source of generation (e.g., power exchange transactions or system power contracts), the transaction shall be assigned the pro-rata mix of the seller's resource portfolio, net of unit contracts. While concerns have been raised about this approach, the Advisory Committee believes that there are options to address these concerns which should be further explored, such as the modified tagging option discussed below.

ISO's financial settlement software. Further, though ISO financial settlement data is necessary for NETS tracking, it is not sufficient. As described in the report, the resulting load-serving entity generation supply portfolios would need to be merged with plant fuel type and emissions data to support the implementation of public policies. Emissions data are not generated by the ISO, and would need to be provided by generators, US EPA, and/or state environmental agencies.

[2] The term LSE has been used in different ways. In this report, LSE is used to indicate a New England region electricity market participant that is a member of NEPOOL, that has electrical load and a resultant energy obligation pursuant to the New England Power Pool Agreement and associated market rules, and thereby has a financial settlement account with the ISO.

The Advisory Committee believes that these conventions will provide states with maximum flexibility in current and future policy development.

Issues and Next Steps

The tracking system in this report successfully achieves the NETS project's original goal -- to demonstrate that development of a tracking system detailed enough to support a broad array of public policies in a deregulated generation market is possible. To develop and implement such policies, much more work needs to be done. The information tracking system proposed in the NETS report was necessarily developed prior to completion of the regulatory and legislative development of disclosure, RPS, and GPS policies in the region. While the results of the project can help inform the process of regulatory development in each state, the methods and recommendations of the report must be revisited as the policy context evolves. The next step, then, is to determine whether and how the data provided by the NETS tracking system can be aggregated and processed to fit the emerging policy decisions in the New England states. Some of the important policy considerations are discussed below, including the tracking of transactions downstream of load-serving entities, thoughtful concerns raised by some commenters about the impact of the NETS tracking conventions on the renewable energy market, and identifying and establishing the tracking system administrator.

Transactions Downstream of Load-Serving Entities

Within the timeframe and budget for the NETS project, the Advisory Committee decided to focus on determination of the resource portfolios of LSEs. However, there will also be different types of transactions occurring downstream of the LSE. For example, an individual LSE may enter into transactions with competitive suppliers that are not NEPOOL participants. The LSE or the non-NEPOOL participants may also further disaggregate their resource portfolios into separate components in order to offer differentiated "products" to retail end-use customers for disclosure purposes. These transactions would be invisible to the ISO financial settlement system, and thus are not addressed by the NETS tracking system. Therefore, the information derived from the NETS tracking system would be necessary, but may not be sufficient, for demonstrating compliance with certain policies. An important next step, then, will be to consider how transactions downstream from the LSE could be incorporated into a tracking system.

Impact on Development of New Renewable Resources

In meetings and in written comments on a draft of the NETS report, energy marketers, retailers, and others raised a number of important concerns for implementing information disclosure policies in the New England states, and how and to what extent the tracking system proposed in the NETS project should be implemented in support of such policies.[3] Specifically, commenters have expressed concern that the proposed NETS tracking method could inadvertently interfere with marketers' ability to obtain the full economic value of the clean generation they bring to the market. This concern centers on the NETS proposal to assign pool and system transactions the pro-rata mix of the seller's resources, and associated

[3] Comments provided are summarized in an attachment to the report.

attributes, on an hourly basis. Given the intermittent nature of most renewable resources and the difficulty small market participants may have in precisely matching load obligations with generation in any given hour, the marketers state that they should have the flexibility to retain the attributes associated with their cleaner resources even when the energy associated with these resources is sold as pool or system transactions pursuant to NEPOOL rules and procedures.

The Advisory Committee agrees that the impact of any policies on the development of renewable resources must be considered very carefully. Although it was not the explicit purpose of this project, the Advisory Committee believes that public policy initiatives to bolster and advance the development and operation of clean, renewable resources are critical in the restructured generation marketplace. Accelerated development of such resources will reduce the costs of complying with federal environmental standards, minimize the impact of electricity generation on depletable fuel resources, stimulate economic development in local industries, and reduce the risk of potential impacts from global climate change. The implementation of any disclosure system should not unnecessarily create barriers to the preservation of the value of renewable resources, and should also allow the value of renewable resource generation from units of less than one megawatt to be accounted for in any tracking system. At the same time, a disclosure system should provide the most accurate and credible account of the power purchased by a consumer.

The Advisory Committee believes that state policy makers will need to do further work to integrate the accurate information provided by the NETS tracking system with the policy goals underlying the disclosure, RPS, and GPS policies. Although the focus of the NETS project was specifically limited to developing a tracking system that provides policymakers with maximum latitude to implement a range of policies, the actual integration of the NETS system with specific disclosure, GPS, and RPS policies should be designed in a manner that supports the public interest objectives underlying these policies. Critical issues that must be considered in this context include: (1) the impact on new market participants (including sources less than one megawatt); (2) the need for public credibility of any disclosure system; (3) relative costs and administrative burdens; and (4) any other tradeoffs in adopting alternative approaches to the treatment of data supplied by the tracking system.

One alternative that has been proposed to resolve these concerns in the context of information disclosure policies is a "tagging" system for spot market transactions, such as that proposed by the Regulatory Assistance Project.[4] Under this modified tagging proposal, attributes (emissions, fuel) associated with spot market transactions would be traded in a secondary market separate from, and settled over a longer time period (monthly, quarterly, or annually) than, the financial transactions recorded in the ISO settlement system. Although generation tracking would be needed to implement such a system, some suppliers believe that tagging for spot market transaction attributes could provide sufficient flexibility for marketing generation products with a higher percentage of cleaner resources than would be otherwise possible. States should carefully consider whether a modified tagging approach could be used in the implementation of disclosure policies without a significant loss of accuracy for consumers.

[4] Regulatory Assistance Project. "Uniform Consumer Disclosure Standards for New England." November 13, 1997.

Clearly, support for clean, renewable resources -- while not an objective of the NETS project per se -- is an important public interest objective shared by members of the Advisory Committee, the New England states, and EPA. State policy makers need to consider over the next few months how to address the concerns raised by renewable marketers.

Tracking System Administrator and Data Confidentiality

The NETS report notes a number of areas where the availability, and the level of confidential treatment, of fuel, emissions, and generation data could frustrate state efforts to verify supplier compliance with state policies. Confidential treatment for some of the input data necessary for the calculations in the NETS tracking system (such as specific hourly generation, contract, and load data) may be necessary to protect the competitive interests of market participants. Only the ISO will have access to this data for all market participants in accordance with the service contract between the ISO and NEPOOL, and the protocols of the NEPOOL Information Policy.[5] In the event that the tracking system is not administered by the ISO, the tracking system administer would have to arrange for access to the necessary confidential information through NEPOOL participants and/or the ISO. The feasibility and costs associated with creating and funding a separate state or private organization to administer the tracking system, with access to the required participant/ISO data and with the necessary authorization from the six New England states, present a significant hurdle.

Importantly, on September 11, 1998, the New England Conference of Public Utilities Commissioners (NECPUC) passed a resolution related to this very topic -- the administration of a tracking system for the New England states:

> *Resolved*, that NECPUC encourages the ISO-NE, in its negotiations with NEPOOL and elsewhere as appropriate, to seek the authority and resources to serve as administrator of a tracking system that will allow verification of compliance with public policies concerning electric generation sold in New England. NECPUC also encourages the ISO-NE to continue to work with the NETS project and others to develop a tracking system that would support competitive and efficient markets at reasonable cost.

Conclusion

This report outlines a tracking system that would provide a greater level of detail for linking power plant generation to LSE resource portfolios than has been identified to date. In particular, the system would accurately track system power and spot market transactions, as well as the generation associated with unit entitlements and contracts. Although this represents a big step forward in the development of information systems to support state policies in a restructured electric industry, much work remains to be done. We recommend that states

[5] We note that the documents governing the role and responsibilities of the ISO, and its administration and settlement of the New England energy market, are evolving. In particular, changes to the contract between the ISO and NEPOOL, and to the NEPOOL Information Policy, are under consideration. In addition, the ISO has recommended to the Federal Energy Regulatory Commission that the energy market be changed to a multi-settlement system as soon as practical. States will need to consider how a tracking system used to support state policies should be adapted in consideration of such changes.

continue to work with the ISO and with stakeholders in the region to further develop the NETS project results to support the implementation of disclosure, GPS, and RPS, and that additional steps be taken as public policies are developed to ensure that the goals of these policies are met while addressing the concerns raised by competitive market participants.

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Disclaimer

Frequently Used Acronyms or Abbreviations

CEMS:	Continuous Emissions Monitoring System
EIA:	U.S. Energy Information Administration
EPA:	U.S. Environmental Protection Agency
EPS:	Emissions Performance Standard
IOU:	Investor Owned Utility
ISO:	Independent System Operator
LSE:	Load Serving Entity
NECPUC:	New England Conference of Public Utilities Commissioners
NEGC:	New England Governors' Conference
NUG:	Non Utility Generator
PUC:	Public Utility Commission
RPS:	Renewable Portfolio Standard
TSA:	Tracking System Administrator

1.0 Introduction

Five of the six New England States have enacted electric industry restructuring laws. Some of these states have already initiated deregulation, while others are scheduled to have full retail competition in their investor-owned utility service territories by July 2000. While each state is developing and implementing distinct restructuring frameworks, New England shares a common power pool and will in essence be a single competitive market. Therefore, the development of uniform and consistent standards for the tracking of electricity information will be valuable to all stakeholders including regulators and market participants.

In the competitive market, customers will have the opportunity to select supply options based on price and other attributes such as renewable energy content and emissions rates. The choice of electricity suppliers based on such attributes will be supported in some states by regulations requiring the disclosure of electricity information. Along these lines, the New England Conference of Public Utilities Commissioners (NECPUC) issued a Model Rule on uniform disclosure of electricity information, and all New England states have already promulgated or are in the process of developing disclosure regulations (using the Model Rule as a starting point).

In addition, New England policy makers have implemented and may continue to implement portfolio standards to encourage the use of renewable energy and regulate the emissions associated with electricity generation. Three states are implementing renewable portfolio standards and two states have provisions for the development of emissions performance standards, all of which will require the tracking of electricity from the source of generation to the load serving entity (LSE).

New England is one market, but with six separate state restructuring initiatives and multiple neighboring systems with which significant electricity transactions take place. With this in mind, this report describes a tracking system which will support each state's various policies and could work based on data produced by the existing ISO-NE settlement system with the intent of maximizing the ease of compliance with such policies for market participants. It is also the intent of this report to provide a model for the development of compatible tracking systems in other electricity systems to both allow for the regional transfer of information and to enable other systems to track electricity information for purposes of supporting disclosure and other policies, such as portfolio standards. This report also discusses the policy context and data resources which factor into the design and operation of our tracking system.

In order for us to gauge the successful development of our tracking system, the following design criteria are considered throughout the report. The New England Tracking System should be:

i) Effective
ii) Accurate
iii) Non-burdensome
iv) Comprehensive
v) Flexible
vi) Simple
vii) Expandable
viii) Inclusive
ix) Credible

The design criteria are further defined and discussed in Chapter 3.

We propose a two step process for our tracking system: i) the tracking of kWhs from the point of generation to the LSE (generation tracking); and ii) the assignment of attributes to the kWh. Our tracking system relies upon the ISO-NE settlement data for generation tracking. A Tracking System Administrator (TSA), either ISO-NE or another entity, will be responsible for assigning attributes to generation tracking. Four types of transactions will be tracked: unit-specific, system, pool (Adjusted Net Interchange), and external (exports and imports). Each will be tracked according to somewhat different rules, which are discussed in Chapter 4.

With regard to the assignment of attributes, if, at a minimum, our tracking system is used to facilitate and verify disclosure policies based on the NECPUC Model Rule, for each reporting period it will require the following data from each generating unit: i) kWh generation; ii) fuel type and consumption; and iii) emissions of SO2, NOx, and CO2. The NECPUC Model Rule also allows for the disaggregation of an LSE's resources by product, and for data to be disclosed quarterly based on monthly data for the most recent one-year period for which data has been collected.

Compliance with other statutes in New England states will also require the tracking of other attributes, such as capacity, vintage (i.e. date the source started delivering power), and additional pollutants. Certain statutes also require that an LSE disaggregate its resources by state, and tracking on a state-wide disaggregated level will generally be useful to satisfy state reporting requirements.

There is currently no single source of data that would fulfill the tracking system's requirements for disclosure and the monitoring of compliance with policies. However, by aggregating data collected by the EPA, Energy Information Administration (EIA), and state air agencies, unit-specific emissions, fuel, and consumption data for most of the generation capacity in New England can be compiled. It is important to note that there is a lag time of anywhere from a few months to over a year before this data becomes available for a given reporting period. Because of variance in lag time, data input processes must be established in order to ensure that the tracking system relies on the most up-to-date data possible, at all times.

The ISO-NE settlement system will collect generation information on an hourly basis and fuel type for most units over 5 MW in New England. ISO-NE will be the most inclusive single data source, and will have the infrastructure on which to merge data from other sources. Our report finds that with minimal recommended changes, the ISO-NE settlement system output can support a TSA's tracking of data for meaningful disclosure and the monitoring of relevant environmental policies. Yet, the report also identifies certain factors that limit one's ability to track all needed information on a timely basis, such as the poor availability and accuracy of data over the short term, and presents recommendations for additional steps to ensure that the tracking system will meet the design criteria described above.

2.0 Policy and Technical Context

This chapter reviews the policy framework and current conditions for tracking and discusses other relevant projects concerning tracking, providing the context for our development of a system that utilizes and complements the ISO-NE's existing settlement system and supports New England state policies. Our review of past and current projects provides us with the perspective to develop a system that will be compatible with developments in neighboring regions and that could serve as a template for the rest of the country. Our review of policies provides us with an understanding of the policy requirements that our system needs to support.

2.1 Policy Context

Five of the six New England states, representing 95% of the retail electricity sales in New England, have enacted electric industry restructuring acts. Vermont is still considering restructuring. Two states, Massachusetts and Rhode Island, have already implemented full retail access in the service territories of all investor-owned utilities.

In general, two types of policies included in restructuring legislation and regulations will require the tracking of electricity information from the point of generation to the point of retail sale. These involve: i)the disclosure of electricity information and ii)portfolio standards, such as renewable portfolio standards (RPS) and emissions performance standards[6] (EPS).

This section discusses the provisions that have been developed for the disclosure and portfolio standards and the requirements they place upon the development of a regional tracking system. A summary of the specific data, resolution, and reporting requirements serves as the basis for the development of our tracking system, which aims to provide a tool to satisfy the policy goals of each state. Please see Appendix A for a framework detailing the related policies in each state.

2.1.1 Policy Context for Disclosure of Electricity Information to Consumers

A January 1997 report entitled "Sustainable Electricity for New England"[7] recommended that the development of "a regional protocol for tracking electricity transactions to allow for the verification of environmental claims" would help support the development of environmentally sustainable energy technologies in the restructured market.

While every state with a restructuring act has provisions for the development or consideration of a disclosure requirement, the Massachusetts Department of Telecommunications and Energy (MA DTE) is the only state public utility regulator in New England to date which has actually promulgated rules specific to the disclosure of electricity information. Its rule requires LSE's to disclose certain electricity information beginning September 1, 1998.

There appears to be, however, general agreement among regional policymakers with regard to adopting uniform disclosure standards. Policymakers believe that the existence of uniform

[6] Emissions Performance Standards, as defined in this paper, are also referred to as generation performance standards and environmental performance standards.
[7] "Sustainable Electricity for New England," by the Tellus Institute (prepared for the New England Governors' Conference): January 1997 (Tellus No. 95-310).

standards will minimize the cost to suppliers associated with compliance with different state disclosure requirements, and, in turn, will provide customers with reliable information. As a result of this general agreement, the New England Conference of Public Utilities Commissioners (NECPUC) issued a Model Rule for disclosure in March 1998 similar to the MA DTE rule. The purpose of NECPUC's Model Rule (Model Rule) is "to provide a common starting point for commissions in the region developing information disclosure policies."[8]

Subsequently, the other New England states, including Vermont, have indicated that they are currently conducting or they soon plan to conduct rulemakings for specific disclosure requirements using the Model Rule as a starting point.[9] Likewise, for purposes of this report, the policy framework for disclosure requirements that will be supported by our tracking system is based in large part upon the Model Rule. Key features of the model rule include recommendations for:

i) treatment of unit contracts, system power and electricity imported into New England;
ii) fuel and emissions characteristics to be included in system disclosure;
iii) appropriate data sources for the determination of relevant characteristics;
iv) appropriate reporting periods; and
v) treatment of company versus product disclosure.

2.1.1.1 Known Resources, System Power and Imports

The NECPUC Model Rule proposes that all generation associated with specific generating units from which an LSE has a unit entitlement or contract will be "Known Resources." [10] For purposes of disclosure, all electricity generated from "Known Resources" will be assigned the fuel and emissions characteristics of the associated unit.

The Model Rule recommends that kWhs not meeting the criteria for "Known Resources" will be "System Power." All kWhs generated from "System Power" will be assigned the attributes of the mix of generating resources in New England net of "Known Resources." These attributes will be known as the "Residual System Mix." The Model Rule does not differentiate between system power transactions and power received from the adjusted net interchange (ANI).

The Model Rule proposes that imports be assigned the fuel characteristic "Import" and the emissions characteristics of the exporting system's mix, however determined. This treatment of imports is recommended until adjacent regions develop a compatible disclosure system. Although the MA DTE rules will assign imports the fuel characteristic "Import" as well, such imports will be assigned the same emissions characteristics as "System Power," until the MA DTE, in consultation with the Massachusetts Department of Environmental Protection (MA DEP), determines representative emissions rates for imports from different regions.

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[8] "Model Rule on Information Disclosure". New England Conference of Public Utilities Commissioners: March 3, 1998 (available at http://www.rapmaine.org/necpucru.html)
[9] Based on state-by-state reports from the NETS Advisory Committee on 4/2/98
[10] For the purposes of this report, we refer to "Known Resources" as unit transactions.

2.1.1.2 Fuel Characteristics

The NECPUC Model Rule proposes that the disclosure label include the following fuel sources: biomass, coal, hydro, municipal solid waste, natural gas, nuclear, oil, solar, wind, and other renewable resources (including fuel cells utilizing renewable fuel sources, landfill gas, and ocean thermal). In addition, the fuel mix associated with an energy storage facility, such as pumped storage hydro, should be the fuel mix of the energy used as input to the storage device, on a rolling average basis. The characteristics disclosed should also include any losses as a result of storage.

Though similar, the MA DTE rule requires the differentiation of generation from small and large hydro units based on capacity (greater than 30 MW is large hydro).

In addition, the recently enacted restructuring legislation in Connecticut requires the disclosure of additional fuel characteristics such as vintage[11] and sustainability of harvest for biomass[12] and licensure status for hydro. Fortunately, any tracking system, such as the one proposed in this report, could accommodate all these types of requirements as long as the system is based on tracking generation from each generating unit.

2.1.1.3 Emissions Characteristics

For purposes of disclosure, the NECPUC Model Rule proposes that at least SO2, NOx, and CO2 be included on the label. In addition, the MA DTE rule states that once the MA DEP determines that sufficiently reliable and accurate information is available, heavy metals (the list is unspecified) must also be disclosed.

The Connecticut Restructuring Act requires the Connecticut Department of Public Utility Control (CT DPUC) to disclose information from LSEs on carbon monoxide (CO), particulate emissions, and other wastes (also unspecified) in addition to SO2, NOx, CO2 and heavy metal (also unspecified) emissions. Quarterly updates for all information disclosed, in a form conducive to customer understanding, are also required. Finally, the Maine Restructuring Act requires the commission to consider requiring suppliers to disclose "expected air emissions" for mercury, fine particulates, and radionuclides in addition to CO2, NOx and SO2 emissions.

2.1.1.4 Determining Fuel and Emission Characteristics and Required Reporting Periods

The NECPUC Model Rule proposes that company resource portfolios be determined using data provided by the ISO-NE and updated on a quarterly basis. The label reporting period should be the most recent one-year period of collected data prior to the reporting quarter. For LSEs that have operated less than a year, either quarterly information (if available) or estimations will be used for disclosure.

The Model Rule recommends that for each "facility,"[13] an annual emissions rate in pounds per kWh be calculated for each pollutant. The emissions rate for each unit should be determined

[11] Vintage, for the purposes of this report, is defined as the date the source started delivering power.
[12] PA 98-28 distinguishes between biomass facilities beginning operation before and after July 1, 1998.
[13] For purposes of the policy framework, "facility" will be defined as "generating unit".

by the state public utility commission and state air quality management agency in consultation with the EPA. Until such time as these rates are developed, the recommended method for calculating these rates for NOx and SO2 is to use, in order of preference: CEM data (for most recent reporting year), emissions factors, or permitted emissions levels. The calculations for CO2 should be based on the carbon content of the fuel.

The MA DTE rule puts forth a similar requirement for determining data to be used, the time resolution of data and the reporting period for disclosure. The Connecticut Restructuring Act also requires emissions and fuel characteristics to be updated at least quarterly. The Maine Restructuring Act directs the Commission to consider requiring suppliers to disclose information based on the previous six-month period.

2.1.1.5 Company Versus Product Disclosure

The NECPUC Model Rule proposes that if an LSE seeks to disaggregate its company's resource portfolio into retail products, it will be required to demonstrate that its disaggregation is based on data that can be verified.

The MA DTE rule further defines the verification process required for competitive suppliers that desire to disaggregate their company's generation mix into products. It states that a competitive supplier will be permitted to disaggregate its resource portfolio into products if this disaggregation is verified prior to March 1, 1999 by an independent auditor, or after March 1, 1999 by ISO-NE.

In addition, a competitive supplier would be required to provide an annual statement from the auditing entity verifying that the electricity generated from resources associated with each product resource mix does not total less than the total obligation associated with the company's entire retail load assigned to such product.

2.1.1.6 Other Disclosure Issues

The NECPUC Model Rule and the MA DTE rule require the state air quality agencies to determine the appropriate treatment of offsets associated with generation units that emit CO2. They also state that cogeneration facilities may make a reasonable allocation of emissions between any electricity produced and other outputs based on measured heat balances.

Unlike the NECPUC Model Rule, pursuant to the Massachusetts Restructuring Act, the MA DTE rule also requires disclosure of labor characteristics for each generation unit. Suppliers with "known resources" will be required to determine whether a majority of employees at each known plant are employed under collective bargaining agreements during the most recent calendar year. For this period, the LSEs will also be required to determine whether these plants experienced a labor dispute and whether any replacement workers were hired. "System Power" shall be based on the New England Region system average for the most recent calendar year. The labor data on the label shall be based on a generation-weighted average for all "System Power" and "Known Resources."

2.1.2 Policy Context for Tracking Information to Monitor Portfolio Standards

In general, an RPS will require LSEs to ensure that a certain percentage of either their retail electric sales or generation comes from renewable energy. Similarly, an EPS may require LSEs to meet set emission levels per kWh based on the sales or generation from its portfolio.

The Massachusetts, Connecticut, and Maine Restructuring Acts provide for either an RPS, an EPS, or both. The Rhode Island and New Hampshire Restructuring Acts do not provide for either type of standard. The Vermont Public Service Board's (VT PSB) December 1996 Report and Order[14], as well as one of the Vermont Legislature's proposed electric industry restructuring bills last year, contained requirements for both an EPS and RPS. While policymakers in the region turn to RPSs and EPSs to advance public policy objectives, there is significant variation in their specific requirements and goals.

For example, while establishing a RPS of 30% renewables based on electric sales, Maine's Restructuring Act defines renewable generation to include qualifying small power production facilities and co-generation under FERC rules,[15] encompassing approximately 50% of existing total generation. The ostensible purpose of this broad definition of renewable generation would seem to be to ensure the continued viability of certain small power production facilities which operate at above market costs, but whose continued generation possesses certain beneficial attributes.

Conversely, the Massachusetts Restructuring Act directs the Massachusetts Department of Energy Resources (MA DOER) to establish a RPS based on retail sales of electricity from new renewable generating sources.[16] It is intended to foster the commercialization of new renewable generating technologies and also, presumably, to encourage the expansion of the regional renewable industry.

While the different portfolio standards in each state result in a diversity of criteria, in each case their monitoring and compliance provisions require detailed and accurate tracking of electricity generation in New England.

2.1.2.1 Renewable Portfolio Standard

The Connecticut, Maine and Massachusetts Restructuring Acts require LSEs to comply with an RPS.

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[14] "The Power To Choose: A Plan to Provide Customer Choice of Electricity Suppliers", State of Vermont Public Service Board: December 30, 1996 (Docket number 5854).

[15] To qualify under the Maine Restructuring laws, a "renewable resource" must qualify "as a qualifying small power production facility under the Federal Energy Regulatory Commission rules, 18 CF12, Part 292, Subpart B, as in effect of January 1, 1997" and "as a qualifying cogeneration facility under the Federal Energy Regulatory Commission rules, 18 CF12, Part 292, Subpart B, as in effect on January 1, 1997 and was constructed prior to January 1, 1997."

[16] Renewable energy generating sources include solar photovoltaic or solar thermal energy; wind energy; ocean thermal, wave, or tidal energy; fuel cells utilizing renewable fuels; landfill gas, and low-emission advanced biomass power conversion technologies, such as gasification using such biomass fuels as wood, agricultural or food wastes, energy crops, biogas, biodiesel, or organic refuse-derived fuel. For purposes of the RPS, "new" renewable generation sources are defined as those starting commercial operation after 12/31/97.

The Massachusetts Restructuring Act directs the MA DOER to establish a renewable portfolio standard (the deadline for the baseline is December 1999). Suppliers are required to "provide a minimum percentage of kilowatt-hours sales to end-use customers in the commonwealth from new renewable energy generating sources". The schedule for the standards requires a one-percent increase from the baseline by December 2003, ramping up one-half percent each year through 2009. An additional one-percent per year is required, thereafter, until a date determined by the MA DOER. Moreover, the MA DOER is required to file a report to the Massachusetts Legislature on whether the Commonwealth should institute a renewable credit-trading program.

The Connecticut Restructuring Act establishes an RPS which classifies eligible renewable generation sources into two tiers (Class I and Class II).[17] These tiers distinguish between new and existing renewable generation sources, fuel type, vintage of generation unit and other attributes such as the licensing status of a hydro unit.

The Connecticut RPS will require that no less than 0.5% of a LSE's total electricity output be generated from Class I sources and that an additional 5.5% comes from either Class I or Class II renewable energy sources. These percentages will ramp up continuously until, by July 1, 2009, the Class I requirement will be 6% and the Class II requirement will be an additional 7%. Exemptions to the requirements will be given to LSEs which provide generation solely from Class II sources. Moreover, an LSE will be able to satisfy its requirements by participating in a credit-trading program. Connecticut's act also states that an LSE may use data from the ISO-NE to demonstrate compliance with its RPS.

The Vermont PSB Report and Order's recommendations for an RPS, which were incorporated into subsequent proposed legislation, would require LSEs to meet minimum standards based on usage for two tiers of renewables, Tier I and Tier II.[18] The credits used to comply with the renewable portfolio requirement would be tradable. A Tier II credit could be exchanged for two Tier I credits.

Under the Maine Restructuring Act, LSEs must ensure that a minimum of 30% of their generation used to support in-state retail sales comes from renewable generation sources. The Maine RPS necessitates tracking of generating source vintage and fuel type. In addition, it will require tracking attributes including capacity (all units must be under 100 MW), as well as tracking the generation units which are included in the definition of "renewable" based on their classification as a small power production or co-generation facility as defined by FERC rules, and not necessarily based on their specific fuel type. At this point it is not clear whether or not a credit trading program will be incorporated into the implementation of Maine's standard.

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[17] Sec. 1: Defines two "Classes" of renewable energy sources, with Class I the "more purely" renewable source, including wind, solar, fuel cell, methane gas from landfills, and sustainable biomass facilities, provided that such a facility begins operating on or after July 1st, 1998. Class II includes waste incineration, landfill gas, and licensed hydro (or facilities that are in compliance with the Clean Water Act and the Canadian Environmental Assessment Agency and are in the licensing process). It also includes biomass facilities which fail to meet the Class I criteria.

[18] Tier I would be any renewable technology that has a capacity less than 80MW and in the case of hydro-electric, is operated with proper FERC licensing, and is in compliance with state water quality standards. Tier II would be any renewable technology that begins regular production of electricity after January 1998 or that was constructed after July 1, 1997.

2.1.2.2 Emissions Performance Standard

The Connecticut Restructuring Act directs the Connecticut Department of Environmental Protection (CT DEP) to establish an EPS for electricity generation facilities supplying electricity to end-users in Connecticut. These uniform portfolio standards will be based on the fuel used for generation and will limit the amount of air pollutants, including but not limited to NOx, SOx, CO2, CO, and mercury emitted per MWh. The standard for each pollutant will go into effect when "three of the states participating in the northeastern states' Ozone Transport Commission as of July 1, 1997, with a total population of not less than 27 million, have adopted such a standard". The Connecticut Restructuring Act also provides for the consideration of an emissions trading program.

The Massachusetts Restructuring Act directs the MA DEP to develop an EPS based on emissions per kWh for any pollutant determined to be of concern to public health. The MA DEP is instructed to establish such a standard by May 1, 2003, unless at least three northeastern states adopt such standards earlier.

The proposed Vermont standard could be even more comprehensive than the Connecticut or Massachusetts standards. It would not limit such a standard to emissions, stating that the "environmental performance standard" would include emissions and other adverse environmental effects per kWh of electricity sold to retail customers in Vermont.

2.1.2.3 Other Statutes

The Massachusetts Restructuring Act contains two additional provisions that would require the tracking of electricity information. The Commonwealth is instructed to conduct studies on: i) the feasibility of requiring all electricity purchases of state agencies to include a minimum renewable portfolio of ten percent, and ii) the feasibility of income tax deductions of 50% of the above-market price for an individual and 25% for any business which buys electricity with a renewable content in excess of minimum RPS requirements.

The Maine Restructuring Act may require tracking for enforcing statutes not directly related to disclosure or compliance with an environmental standard. Under the Maine Restructuring Act, an affiliated competitive LSE would be prohibited from selling or contracting to sell more than 33% of the total electricity sold within the affiliated utility's service territory, and would not be permitted to bid for or provide more than 20% of such territory's load. The verification of compliance with this requirement might need a tracking system.

2.1.3 Policy Context Summary

This review of existing and potential policy mechanisms that have been established or may be established to address the environmental aspects of electric industry restructuring demonstrates the importance of establishing a single comprehensive system for tracking generation from each generating unit to each retail supplier. However, it is clear that the level of detail required to ensure compliance with certain policy mechanisms in one state could differ from the level of detail required for the implementation of different policy mechanisms in other states. For example, specific generation and real-time emissions information will be necessary to verify compliance with a state's EPS, whereas aggregating or averaging generation, fuel and emission

information over a month or a quarter may be sufficient to provide consumers with meaningful information about the fuel and emission characteristics of their electricity purchase decisions. What is critically important, then, is to identify a single region-wide system for tracking generation that provides enough specificity to provide all states with the maximum flexibility in implementing or developing policies to address consumer or environmental implications of electric industry restructuring. The tracking system proposed in Chapter 4 meets this need.

The following summarizes the policy requirements that will need to be satisfied by a tracking system. The regional policies require:

i) data on electricity generated and fuel type for each unit, and emissions per kWh of NOx, SO2, and CO2 for each unit;
ii) electricity to be tracked from each unit to the LSE;
iii) treatment of transactions, including "System Power," "Pool Power," "Known Resources" and "Imports";
iv) allocation of attributes to dual fuel, cogeneration and energy storage units;
v) quarterly disclosure of information based on data for the most recent one-year period (or six-month period as recommended by the Maine Restructuring Act) for which data has been collected;
vi) electricity to be tracked beyond the LSE or company level and disaggregated by state, product, and/or service territory;
vii) data on the capacity (for certain units), vintage (for certain units), licensing status (for hydro), labor characteristics, and emissions per kWh for additional pollutants including CO, mercury, and particulates;
viii) the potential resolution of offsets and emissions credit trading programs.

Based on this report's scope of work, our tracking system satisfies requirements i) through v), and can be expanded to accommodate the other requirements. This tracking system has been designed to be able to satisfy the other requirements, but at the same time does not explicitly incorporate the details at this time. For example, the tracking for product and state disclosure or portfolio requirements may require the tracking of transactions which take place downstream from the ISO-NE settlement process, whereas we only address the tracking of transactions to the LSE (i.e., a member of NEPOOL), and not beyond. In addition, these chapters do not address where to find data on labor characteristics, licensing status (for hydro facilities) and certain emissions characteristics, such as carbon monoxide (CO), mercury, and particulates (at least for now). These issues are, however, addressed in Chapter 7, Implications and Issues, and in the Conclusion's recommendations for issues requiring further work. In addition, with the support of the Advisory Committee, this report identifies improved mechanisms for the treatment of certain transactions which are different than those put forth in both existing and proposed state policies, as well as in the NECPUC Model Rule. For example, Chapter 4 details our system's use of a pro-rata company mix approach for tracking "System Power" as opposed to the use of a system-wide residual average mix, as suggested by the Model Rule.

It is also important to note that the NECPUC Model Rule and the MA DTE rules require that an LSE have data on its portfolio provided by or verified by the ISO-NE. In addition, Connecticut's act states that an LSE may use data from the ISO-NE to demonstrate compliance with renewable portfolio standards. While New England regulators do not have direct jurisdiction over the operations of the ISO-NE, these requirements are a strong incentive

for the ISO-NE's member LSEs to direct a TSA to accommodate the tracking of the information required for disclosure and compliance with other policies and standards. The centralized tracking of all required information will, in turn, reduce the administrative costs to suppliers and regulators. Therefore, our report relies upon the centralized infrastructure of a TSA as the basis for tracking electricity and assigning attributes to LSE portfolios

2.2 Technical Context: Tracking Projects To Date

A significant body of work on the feasibility and design of tracking systems has already been conducted, and additional research is currently under way. This section provides a brief recap of that work, and the organizations and sponsors involved.

2.2.1 National Council on Competition in the Electric Industry

In May 1997, the Regulatory Assistance Project (RAP) and Synapse Energy Economics prepared "Full Environmental Disclosure for Electricity: Tracking and Reporting Key Information" for the National Council on Competition in the Electric Industry.[19] This paper addressed data, tracking and disclosure issues. It was one of the first reports to address the technical issues pertaining to tracking, and it continues to serve as the foundation for additional projects, including the New England Disclosure Project.

2.2.2 New England Disclosure Project

The New England Disclosure Project (NEDP) report was prepared by the Regulatory Assistance Project (RAP) and presented to the region's public utility regulatory commissions.[20] The NEDP report focused on tracking with respect to supporting uniform disclosure.

The NEDP report expanded upon two options for assigning generation to retail suppliers: a settlement-based approach and a tagging-based approach. The settlement-based approach uses information to which ISO-NE is accustomed, such as the hourly generation of every plant in the region, and uses the ISO-NE settlement process to track this information, along with other characteristics, from generation to the LSE's point of retail sale through various contract paths.[21] These contracts include unit entitlements for which an LSE may have ownership or contract rights for the output of a specific unit, system contracts, Adjusted Net Interchange (ANI) or pool transactions, and imports and exports. The LSE's supply portfolio would consist of the characteristics tracked by protocols established for the assignment of attributes to each transaction.

The tagging-based approach allows for tags to be created simultaneously with generation and for the tagged attributes to be bought, sold, and traded independently of electricity. In the NEDP report, RAP proposed using a hybrid tagging and settlement based approach. Under this approach, generation characteristics from unit contracts would be tracked from generation to LSE through the settlement process. During a specified time period, a purchase from ANI

[19] "Full Environmental Disclosure for Electricity: Tracking and Reporting Key Information", the National Council on Competition and the Electric Industry: May 1997 (available at http://www.rapmaine.org/nccei/0002/1.html).
[20] RAP, "Uniform Consumer Disclosure Standards for New England." Revised November 13, 1997.
[21] The term "contract path" used here is not the same as a contract path for transmission.

or pool power, however, would provide the buyer with the right to purchase characteristics (i.e. tags) for an equivalent amount of energy from a seller of ANI or pool power during that same period. An LSE not wishing to pay a premium for electricity attributes would receive a tag reflecting the average characteristics of the unsold tags.

2.2.3 IndeGO Proposal

In March, another paper, "Tracking Generation Attributes for Consumer Disclosure: Technical Criteria for Tracking System" was prepared by Science Applications International Corporation for the National Association of Regulatory Utility Commissioners (NARUC).[22] The report used the IndeGO, the proposed system operator in the Pacific Northwest, as its illustrative model. IndeGO's role was proposed to schedule transmission transactions on the transmission grid it operates. IndeGO was not necessarily supposed to track the source of generation for each transmission transaction, and was not to track transactions to entities taking title to power after it is in the distribution system. In short, unlike ISO-NE, IndeGO was not intended to have a settlement system that follows energy from generation to LSE.

The report proposes two models. One model would require the seller or importer of each energy transaction to fill out an electronic form identifying key characteristics of such energy. The second model would not track attributes for all transactions. It would allow for electricity and attributes to be traded separately, similar to some tagging proposals. Because of the proposed structure of IndeGO, either model would require the implementation of an electronic data exchange that would in effect serve as the tracking system. Plans for the IndeGO system, which provided the basis for this report, have been put on hold.

2.2.4 The New York State Department of Public Service Proposal

The New York State Department of Public Service (NY DPS) staff filed a white paper, entitled "Environmental Disclosure: Empowering New York Consumers to Make Informed Electricity Choices," with the New York Public Service Commission in August 1998. The white paper proposes a combination of using the NY-ISO settlement system to track information from the point of generation to the LSE for certain transactions and allowing spot market participants to buy and sell energy from the spot market and their attributes separately. The NY DPS staff calls its treatment of spot market purchases "conversion transactions". The tracking of electricity information for disclosure purposes would be administered by the NY DPS.

According to the white paper, NY-ISO would be able to identify the units that provided power for unit and system contracts. The attributes of these units would then be assigned to the LSE served by the contract. For spot market transactions, the market participants would be given a set period of time to purchase or sell attributes for blocks of energy previously bought or sold into the spot market. The NY DPS staff is planning on receiving final comments by October 5, 1998.

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[22] "Tracking Generation Attributes for Consumer Disclosure: Technical Criteria for Tracking Systems", Science Applications International Corporation (Prepared for National Association of Regulatory Utility Commissioners): March 1998.

2.2.5 Other Reports and Tracking Work

Also in March 1998, the Center for Clean Air Policy issued a report entitled "Policy Handbook: Disclosure in the Electricity Marketplace." This report was designed as a handbook for state and regional decision makers and includes a discussion of options on disclosure issues such as what type of information to require, how to verify the information, what type of tracking system is needed, and how pollution trading markets might affect disclosure.

At the present time, the nearby PJM-ISO and East Central Area Reliability Council (ECAR) have no formal plans to include a tracking system for electricity information.

2.2.6 Summary

As indicated by the diversity of recent proposals, regulators and other interest groups are making parallel strides in the development of disclosure systems. Ideally, New England and New York should continue to work together to develop compatible tracking systems for the meaningful tracking of attributes for transactions taking place between the two regions, especially since all of New England's imported power from other parts of the United States enters through New York.

It is also important to note that this New England Tracking System Project is the first project to design a tracking system to support both disclosure and monitoring of compliance with portfolio standards. Accordingly, our tracking system should be considered by other regions since its level of detail will support both disclosure requirements, which have already been enacted in at least 10 states (as well as considered at the federal level), and portfolio standards, which are under consideration at both the state and federal level. A regionally compatible tracking system will provide common benefits to each of the participating states.

3.0 Design Criteria

It is important to begin development of a sound tracking system with an articulation of the design criteria for such a system. These derive from its objectives. What are the characteristics that a tracking system should have in order to meet these objectives?

i) Effective
ii) Accurate
iii) Non-burdensome
iv) Comprehensive
v) Flexible
vi) Simple
vii) Expandable
viii) Inclusive
ix) Credible

In this section of the report we will comment briefly on each of these criteria, and then note some of the interrelationships and tradeoffs among them.

Effective. The tracking system should be able to support state and regional policies for electricity disclosure and portfolio standards. Where customer choice or a portfolio standard is intended to make a significant difference to the regional resource mix, the tracking system should enable this to happen. The tracking system should also be designed in a way so that opportunities for participants in the market to avoid or undermine any policy goals should be minimized.

Accurate. The tracking system should provide accurate information about the sources of generation in order to support both mandatory disclosure and portfolio standards.

Non-burdensome. It should be easy to implement. That is, the cost and time requirements for the development of any software should be reasonable. The application of the system should be feasible with a reasonable level of effort by a TSA.

Comprehensive. The system should allow for the identification of a wide range of environmental impacts and fuel-mix information.

Flexible. It should encourage innovation in technology, contracting and marketing. The tracking system must be able to recognize all of the current market arrangements and contend with whatever structures and contracts might evolve in the future. Also, the system should be flexible in adapting to new policy developments.

Simple. It should be straightforward, transparent, and readily understandable.

Expandable. It should work at various scales so that it can start small and grow geographically, ideally being expanded for tracking over a large region.

Inclusive. It should not unreasonably preclude market entities from participation in the green electricity market. This should be true for both existing utilities and new market entrants.

Credible. It must be trustworthy, both initially and over time. To the extent that the system embodies subjective value judgments, they must be made by a clear and public process. For

example, in tracking transactions, the system should make a reasonable effort to connect cause with effect.

These criteria can in some ways conflict with each other. For example, the simplest system will not be the most comprehensive. The most flexible may not be the most credible. The goal of being "non-burdensome" does not mean that suppliers marketing "green electricity" should be allowed to make dubious claims. Different individuals and organizations will no doubt give more or less weight to each of the objectives, possibly leading to very different views of how the tracking system should be designed and how it should work. Where tradeoffs are unavoidable the tracking system should strive to achieve a reasonable balancing of the various criteria.

Perhaps the most fundamental tension has to do with what tracking means. At one extreme, we would like to give consumers information about the sources of the electricity that actually runs their meter. At the other extreme, we might merely assure consumers that an amount of electricity with the attributes reported by their retail supplier was put into the system by someone, somewhere, at some point in time, and not "sold twice." For electricity, the former is impossible. The latter is also virtually meaningless since it would not inform customers about the sources of power for which they are actually paying.

Striking an appropriate balance between these two extremes is a worthy goal. We believe that the proposed tracking system should recognize the impossibility of unambiguously tracking physical flows of electricity through the grid, while at the same time reflecting a cause-and-effect monetary linkage between the consumption and the generation of electricity.

Of course, the system should also make sure that the sum of all attributes reported at the point of retail sale matches the sum of all attributes reported at point of generation, adjusted for losses. Such "conservation of attributes" is a necessary, but not sufficient, requirement for an acceptable tracking system.

As already noted, the NECPUC Model Rule provides partial guidelines for the treatment and classification of generation resources as either "Known Resources" or "System Power." An LSE's resources that are from unit entitlements or contracts that specify generation from a given unit will be treated as "Known Resources," and therefore will be assigned the attributes of the designated unit. Under both the NECPUC Model Rule and ISO-NE's definition of unit transactions, an entitlement or contract for generation from a specific unit that is just for one week, or even one hour, would qualify as a "Known Resource."

A key policy issue is whether or not policy makers may wish to develop stricter criteria for what classifies as a unit contract or "Known Resource." This would potentially allow the tracking and thus the disclosure system to strengthen the long-term cause-and-effect relationship between consumption and generation. For example, in order for a contract to qualify as a "unit transaction" for tracking purposes, a demonstration that the contract was truly responsible for the operation of the unit might be required. The clearest case of this would be a long-term contract that was necessary for the construction financing of a generation facility. A more complex case is one in which an otherwise uneconomic unit would have been retired if not for a new power contract. By requiring some documentation that the power purchase was responsible for the operation of the generator, some linkage between "cause and effect" could

be established. The customer who "purchases" power from a particular source, particularly "green" sources, would, with this approach, have some assurance that the purchase was not merely serving to reallocate existing generation that would have existed and operated anyway.

4.0 Tracking Transactions

Tracking electricity market transactions is essential in order to support policies such as retail supplier portfolio standards and the disclosure of fuel mix and power plant emissions to retail customers. The technical task of tracking involves two steps. First, all transactions between market participants must be tracked, such that all electricity sold at retail is associated with a mix of generators. Second, the attributes of those generators (fuel type, air emissions, etc.) are applied to the resource mix of each supplier. The first step -- tracking the electricity from each generating unit to each LSE -- is the focus of this section.

The key result of tracking can be pictured as a large table with a column for each LSE and a row for each generator. The entries to the table represent the fraction of that LSE's sales that were produced by that generator.[23] The information in this table can be combined with information about the generators, such as the fuel type and emission rates, to produce the summary supplier information to put on the "label" or to determine compliance with applicable portfolio standards.

In the examples presented here, electricity moves from a set of generating units at the top of the diagrams to retail customers at the bottom. In between these two levels is the wholesale power market. Note that the arrows do not conceptually represent wires. Rather, they depict contractual entitlements to electricity as it changes hands through the system as a result of financial transactions.

In our examples, most of the LSEs are integrated companies in the sense that they own utility generation, sell in wholesale markets, and engage in retail sales. In practice, companies may limit their activities. For example, one company may only generate, while another may only buy from the pool to sell at retail. Another may participate in the market entirely as an intermediary, buying and selling electricity at wholesale, with no generation of its own and no retail sales. The system presented here can accommodate tracking for all of these possibilities.

Some important features of the system are, as illustrated, that it tracks energy (kWh), and not capacity (MW) or ancillary services, though it could track any of these. Nor does the system track transactions that are "booked out" (cancelled with other transactions prior to the ISO-NE's implementation of the market), and hence not actually delivered. The tracking system is rooted in physically measured quantities of electricity both at the point of generation and at the point of delivery. In between, contractual relationships determine which generation is assigned to which loads. All of this information—generation and loads for each market participant and bilateral transactions between participants—will be known to ISO-NE.

4.1 Types of Transactions

Tracking transactions through the power pool is, at a conceptual level, a straightforward matter. We propose a system in which unit, system, pool (ANI) and external transactions are each treated differently. In particular, we propose that all system transactions from a company that are not associated with a particular generator are assumed to be from that company's residual

[23] Or, instead of specifying the fractions, the table might be done in terms of energy.

average system mix. These concepts will be presented in general terms, and then in a series of examples. Detailed equations for the tracking system are presented in Appendix B.

Again, there are four types of wholesale market transactions: unit, system, pool, and external. We will discuss each in turn.

Unit transactions, in this system, are treated very simply. The buyer of electricity under a unit contract would have a portion of the generation from the unit allocated directly to its system. The same fraction would be subtracted from the seller/owner's generation mix. The issue of what contracts should qualify for unit status in a tracking system may be quite controversial, as it relates to the underlying objectives of the tracking system. Once it is decided, however, that a particular transaction fits the requirements, then the appropriate treatment is obvious: the attributes of the generator should "flow" with the electricity to the load.

System transactions are those contracts between two companies that do not qualify for "unit" status. These may be firm or non-firm. The duration of contracts will vary. The obvious treatment for system contracts in a tracking system is to assign generation mix attributes to the sales at the average of the selling company's resource portfolio, after unit transactions have been subtracted. This "net resource mix" would appear to be easy to determine, except that in wholesale markets there may be transactions that loop back through one or more companies, so that the original seller is buying a slice of its own previously sold power. This is a surmountable difficulty, which we propose addressing by solving a set of equations simultaneously.

Pool transactions are those that go through the spot market, or power exchange. They often serve a balancing purpose, ensuring that where a company's resources do not match its loads, the company either buys or sells energy to achieve the required balance. In New England, the power exchange transactions will be computed on an hourly basis, with billing each month. The most straightforward treatment of pool transactions is to assume that for companies selling into the pool, the generation has the attributes of the same average mix of the seller that is assigned to that seller's system sales. For buyers from the pool, it is reasonable to assume that each buyer in a particular hour takes a slice of the unit mix that is sold into the pool in that hour. With this approach, the power into the pool bears the attributes of the individual seller but then it is all blended together so that all buyers from the pool take the pool mix. The power exchange is, thus, treated in the same way as any market participant, except that the power exchange does not have its own generation or retail sales.

However, there is another approach to attributing characteristics to the pool mix that could be implemented in the future, particularly when larger amounts of power flow through the pool market. Instead of treating an LSE's internal transactions as either "System Power" or "Known Resources," this approach would treat the ANI component and other components of "System Power" separately. For example, for LSEs that are long on capacity, and therefore who are selling into the pool in a given hour, the mix of generation that they sell to the pool could be differentiated from their system average mix that they provide to their own load (above and beyond the load served by unit contracts). This differentiation can be accomplished by prioritizing their generating resources in the order in which they are dispatched. The lowest cost units can then be assumed to serve the LSEs own load in an amount up to their total system requirements. This generation would comprise their system mix. The higher cost units

which do not serve their own load can then be assumed to be the source of the generation sold into the pool, and would comprise the pool mix for that company.

There are also external transactions, either imports or exports with companies not located in the control area. These pose their own particular problems with regard to data availability. However, if the necessary data is available and the transaction can be categorized as either a unit or system transaction, then the external transactions can be integrated into the approach described above. Ideally, neighboring regions will adopt a consistent approach to tracking, and then the system can be dovetailed to function in an integrated fashion. Otherwise, a set of system default values may be needed.

Our recommended treatment of system transactions differs from that in the NECPUC Model Rule. In NECPUC's model, transactions that are not specific to known resources (Unit Contracts) are all given the regional residual average mix, not the system (as defined above) residual average. The NECPUC rule would lead to a great deal of electricity having the same characteristics, regardless of the generating company that it is purchased from. With our recommended approach, system purchases from two different companies would carry the differences in those companies' resource mixes through to the load.

It is also important to note that transactions will occur below the LSE, for example, when an LSE breaks up its portfolio into products. In a robust competitive market, there may be significant market activity below the LSE level, such as sales to retail suppliers and disaggregation of resources into products. In addition, certain policies such as portfolio standards may require an LSE to disaggregate its resources at the state level. These transactions will not be recorded by the ISO-NE settlement system. The treatment of such transactions is outside the scope of this project. A process for treating sub-LSE transactions was proposed by the MA DOER in response to the MA DTE Notice of Inquiry seeking comments on its proposed rulemaking for electric industry restructuring.[24]

4.2 Tracking Examples

It may be helpful to consider some simplified examples of how tracking would work in order to appreciate some of the implications of the tracking system described above. Let's start with a very simple case with no wholesale transactions, Case 1 in Figure 1 (Please see Appendix C for illustrations of the various cases). Here each company has just enough of its own generation to exactly meet its own load, and the generation mix that one should attribute to retail sales is obvious and unambiguous.[25] There are five generating units (G1…G5). In this example, each generator is a different fuel type (wind, gas, oil, coal and nuclear).

In Cases 2, 3, and 4, we introduce an imbalance between each company's loads and resources so that Company A's load exceeds its resources by 40 MW, and the loads of Companies B and C

[24] The MA DOER comments were submitted on January 30, 1998.
[25] In each of these examples, we assume that there are no losses in transmission and distribution. That assumption will be relaxed in the Appendix.

are each reduced by 20 MW so the overall three-company system remains balanced.[26] There are three options depicted for Company A to make up this deficit. In Case 2 Company A makes a 40 MW unit purchase from Company B's oil unit. The attributes of the oil unit would then be added to Company A's mix for reporting at retail. A pool transaction of 20 MW from Company C to Company B is required in this case in order for the system to balance.

In Case 3, Company A makes up its 40 MW deficit with a system purchase from Company B. This purchase would then have the attributes of Company B's mix, which includes a 20 MW slice of Company C's nuclear generator purchased through the pool. In an example with more companies and a more realistically active wholesale market, the pool mix would be made up of many small slices of generation, representing the mixes of each company selling into the pool.

In Case 4, Company A makes no specific arrangement for its 40 MW deficit, and so the power comes automatically through the pool mechanism.[27] The mix that Company A would report would have a blend of its own generation with that of Companies B and C, since both are sellers into the pool from which Company A buys power.

Tracking for all of the cases discussed thus far is quite obvious, and the tracking of attributes is a matter of simple arithmetic—following the contractual flow of power in one direction from generators to customers. We now proceed to the first ambiguous situation, which requires an allocation convention. This case is Case 5, in which two companies simultaneously buy and sell system power between each other. This can be compared with Case 3, in which the net system transaction between Companies A and B was the same 40 MW. In Case 5, however, Company A is also selling 20 MW to Company B. Therefore, a small slice of Company A's generation ends up reported in Company B's mix.

The resource mix for this case is found by solving the equations for A and B simultaneously. It is a very simple example of the general case presented in Appendix C. With just two companies, the solution can be found algebraically, as presented in Box 1.

[26] The energy units in the example are arbitrary. If the system is implemented on an hourly basis, then each MW would amount to one MWh.

[27] This power from the pool would be priced at the market-clearing price in that hour. What concerns us here is not the price but the generation attributes assigned to it.

Box 1
A Two-Company Example
Solving Case 5 for Company A's Fraction of the Coal Unit

The first step in finding Company A's fraction of coal generation is to write the balance equation for A, with A's sales on the left and A's resources on the right:

$$260\ Ra = 200 \times 0 + 60\ Rb$$

Note that the 200 MW of A's own generation includes none of the coal unit. Note also that A's coal fraction, Ra, depends upon B's coal fraction, Rb.

Next we write the balance equation for Company B, sales on the left and resources to the right:

$$240\ Rb = 100 + 20 \times Ra + 20 \times 0$$

Here, we see that Company B's fraction from the coal unit, Rb, depends upon Company A's coal fraction, Ra. We have two equations with two unknowns, and thus a unique solution should be possible. By substituting the first equation into the second, we get:

$$240\ (260/60)\ Ra = 100 + 20\ Ra$$

Which is the same as:

$$1040\ Ra = 100 + 20\ Ra$$

Or:

$$Ra = 100/1020$$

Or:

$$Ra = 0.0980$$

In order to put this into energy units sold at retail, we multiply the fraction by A's total retail sales:

$$\text{Coal generation sold at retail by company A} = 0.0980 \times 240 = 23.5$$

In Case 6, we introduce a slightly more complex situation in which system transactions between the three companies form a loop: A buys from B who buys from C who buys from A. The electricity that Company A buys from Company B would, in this case, include some of A's own generation, creating a problem of circularity. Fortunately, this is readily solvable by assuming that each company's system sales have the attributes of its average resource mix (net of unit contracts), and solving the three equations simultaneously. As for Case 5, this example is

limited enough to solve using simple algebra, as shown in Box 2. For more complex cases, involving more generating companies and more transactions, one would derive a set of the equations in the same way and solve them using standard software applying the determinant method, or linear programming.

In Case 6, Company A's reported mix would include a small fraction of Company C's nuclear generation. This is the nuclear portion that Company A had purchased through Company B, which accounts for the recursive nature of the transaction.[28]

[28] Note that this is very different from "loop flow" in transmission system operation.

Box 2
A Three-Company Example
Solving Case 6 for Company A's Fraction of the Coal Unit

For the case with a three-company loop, we start with the same equation balancing Company A resources and sales as in the prior example:

$$260\ Ra = 200 \times 0 + 60\ Rb$$

Note again that the 200 MW of A's own generation includes none of the coal unit and that A's coal fraction, Ra, depends upon B's coal fraction, Rb.

The balance equation for Company B, with sales on the left and resources to the right, is:

$$240\ Rb = 100 + 40 \times Rc$$

In this looped case, Company B's fraction of coal generation, Rb, depends upon Company C's coal fraction, Rc. Company C's coal fraction, in turn, depends upon A's coal fraction:

$$220\ Rc = 200 \times 0 + 20\ Ra$$

We now have three equations with three unknowns, and so can again find a unique solution. One approach is to substitute the first and third equations into the second, yielding:

$$240\ (260/60)\ Ra = 100 + 40\ (10/220)\ Ra$$

Which is the same as:

$$1040\ Ra = 100 + 3.7\ Ra$$

Or:

$$Ra = 100/1036.3$$

Or:

$$Ra = 0.0965$$

In order to put this into energy units sold at retail, we multiply the fraction by A's total retail sales:

Coal generation sold at retail by company A = 0.0965 x 240 = 23.2, which is very close to the results in Box 1.

4.3 Explanation of Key Tracking System Design Decisions

The tracking system developed over the course of this project and presented in this report reflects many design decisions. Three of the most important are: i) the use of existing ISO-NE transaction types, ii) the pro-rata allocation for system and pool transactions, and iii) the use of hourly market settlement data for tracking. These merit some explanation.

There are three types of wholesale electricity market transactions within the New England system. *Unit transactions* are incorporated into the market settlement process as percentage shares of particular generating units. For these transactions, we propose that the attributes of the specific generators be assigned along with the entitlement to the electricity. *System transactions* are purchases and sales between two companies in which the amount and timing of the electricity are specified, but with no particular generators specified to produce the power. For system transactions, we propose that the average of the seller's resource portfolio – net of any unit transactions -- be assigned, since there is no objective basis for doing otherwise unless specified by contract. *Pool transactions*, or "adjusted net interchange," are automatic balancing arrangements in which companies with resources exceeding their loads sell at the spot market price to companies with resources less than their loads. Such pool transactions are between a group of sellers and a group of buyers, without identification of specific selling systems with specific buying systems, and without identification of specific generators. For these transactions, we propose that the MWh-weighted attributes of the selling systems in a particular hour be assigned to all of the pool power purchased in that hour. Again, this pro-rata approach is proposed because there is no other objective basis for assigning generation characteristics to power purchased.

The proposal in this report is to build the tracking system directly from these three types of market transactions. They are the three types of transactions recognized in the ISO-NE financial settlement system. Other tracking approaches are possible. However, we are reluctant at this point in time to recommend the creation of new types of transactions beyond those currently built into the ISO-NE rules, procedures, and software. This would place an additional burden upon the ISO at a time when its resources are appropriately focused upon implementing the regional electricity markets in a timely, fair, and efficient manner.

The decision that system transactions and pool transactions be assigned a pro-rata mix of the seller's attributes is, in our view, the most straightforward and fair approach. In the absence of specific provisions in the ISO financial settlement mechanism to the contrary, allocating the characteristics in this manner is an obvious choice. One alternative to this would be to allow the market participants to specify which resources (generators and purchases) are assigned to which sales. While this would offer more flexibility, it would also place a new burden on the market – each transaction would need to indicate the sources, presumably by agreement between the buyer and the seller. There would also be an added task for the tracking system administrator, confirming such transactions and making the distinctions for tracking purposes, and might lead to the need for a tracking system in parallel to the ISO-NE system. Finally, there is the issue of acceptance with consumers. Purchases in which sellers simply state that the desirable attributes went to one buyer while the undesirable attributes went to another will certainly raise questions if this designation process cannot be handled as a unit contract.

Finally, the tracking system proposed herein is based upon *hourly* market settlements. We see this as an important characteristic of a credible tracking system that will hold up over time and support the full range of policies that require the tracking system for their implementation. With the New England energy market functioning on an hourly basis, a tracking system that functions on any other time interval would necessarily involve a loss of detail, by averaging over groups of hours. This approach would be open to legitimate criticism. Relative to hourly tracking, a monthly, quarterly, or annual tracking system would create significant financial winners and losers. The losers would be expected to point out the inaccuracies inherent in not using hourly data and would call for hourly tracking. Also, for air emission policy options, the time of year in which emissions are produced can be important. The potential negative implications of hourly tracking on the value of renewables can be addressed in the implementation details of the various policies. It is not wise to address the desire of some market participants for increased flexibility by sacrificing the accuracy and integrity of the underlying tracking system.

In summary, the tracking system that we present here is intended to be accurate, equitable, and straightforward. It builds upon the existing ISO-NE based market rules and procedures. The burden it places upon the tracking administrator is manageable. While other tracking systems are certainly possible, we believe that this system strikes an appropriate balance among competing concerns, and will serve as a solid foundation upon which to build state and regional policies for disclosure, performance, and portfolio standards.

5.0 Data Requirements and Availability

5.1 Introduction

This chapter is divided into three main parts. We begin with a discussion of the types of data required to complement the generation tracking system devised in Chapter 4, in order to assign attributes (fuel mix and emissions) to each kWh purchased by an LSE in New England.[29] Second, we outline the availability of such data that is collected routinely and made publicly available. Third, we make recommendations regarding the collection of data that would either facilitate or improve the accuracy and timeliness of the tracking system to carry out the policy objectives outlined in Chapter 2.

The principal issues concerning the data needed to overlay on the kWh tracking system to assign attributes to the power sold by LSEs are: i) the types of data that are currently collected; ii) the accuracy of this data; iii) the time resolution of this data; iv) the time lag between the reporting period for the data and when it is released; and v) whether any policy adjustments could be made in the future to better accommodate the undertaking of the policy objectives of tracking.

In Chapter 4, we identified five different major types of transactions – unit transactions, system transactions, imports, exports, and Adjusted Net Interchange (ANI) – in the New England market. Each of these can be handled using our proposed kWh tracking system. Since many transactions will involve individual units, it is necessary to have data at the unit-specific level, where possible. System transactions simply involve power supplied by all the generating units of a generating company not already committed to unit transactions, while imported power could originate either from a particular unit or a set of units outside New England.

For each of these types of transactions, we need the following broad categories of data:

i) total power generated and sold;[30]
ii) fuel breakdown for this power generation, with fuels listed[31] in sufficient detail to address any state policy, such as disclosure, GPS and RPS;
iii) emissions of sulfur dioxide (SO_2), nitrogen oxides (NOx), and carbon dioxide (CO_2) associated with this power (and potentially any additional pollutants included in state GPS or disclosure policies).

In discussing data requirements and availability, it should be remembered that generating units in New England are owned by investor-owned utilities (IOUs), by non-utility generators (NUGs) or by public power authorities. Furthermore, some generation sold in New England may come from cogeneration facilities, which produce steam as well as electricity. We have

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[29] In this report, we deal exclusively with the kWh tracking and assignment of attributes to wholesale transactions that begin with generators and end with LSEs. Such transactions may, of course, occur between a number of LSEs and other NEPOOL participants before arriving at the final LSE.

[30] The amount of power generated will not be equal to the amount of power sold, as a result of line losses. The ISO will track losses in power flows within and into New England.

[31] In the NECPUC Model Rule, for example, these fuels are: biomass, coal, hydro, municipal solid waste, natural gas, nuclear, oil, solar, wind, and other renewable resources.

found that the existence and usefulness of publicly available data depends upon the size of the unit and type of entity (i.e., IOU, NUG, or public) owning the unit, as well as whether the unit is a standard generator or a cogenerator. In addition, the characterization of imported power from Canada is reliant upon Canadian government data and statistics.

This section identifies some data sources that maybe deemed proprietary or confidential (for example, ISO-NE settlement system data on specific units or LSEs). It is, however, important to note that it is not the intention of the tracking system to make such data public, but to aggregate it as required by policies.

5.2 Generation and Sales Data

The ISO-NE's major responsibility in New England will be to ensure that demand for electricity in the region is met as the market clears in each hour. Each LSE operating in New England needs to meet its load obligation in each hour, by either generating its own power, procuring power under bilateral contract from within New England or outside the region, and/or purchasing power from the New England spot market (under ANI). ISO-NE needs to know each LSE's load obligation in each hour in order to determine whether these commitments have been satisfied.

ISO-NE ensures that the demand for electricity is met by dispatching units in New England that are either contracted to run through bilateral contracts or that supply ANI requirements, while allowing for imports and exports. In each hour that the market clears, we believe that a TSA system could be designed or modified to incorporate the kWh tracking system proposed in Chapter 4, in order to produce a matrix showing what fraction of each New England generator's power and what fraction of imported power ends up with each LSE in New England.

Since ISO-NE will be responsible for dispatching New England units, it will have instantaneous and precise information about the kWh output from each unit. In addition, the ISO-NE will know the precise number of kWhs imported into and exported from the New England region in each hour. In the case of imports from other regions of the U.S. or Canada, if a unit is specified, the ISO-NE will also know the name of the unit and the tie-line used to enter the region (thus it will know the region the power entered the system from). In the case of an import of system power, the ISO-NE will only know the tie line, the kWhs imported and the exporting company.

All imports of U.S. power into New England enter the region through the New York Power Pool. However, since the NYPP also imports power from electric systems to its south, west, and north – i.e., PJM, ECAR, and Canada -- it cannot be assumed that all imported power from the U.S. into New England originates in New York. Some of the power entering New England may have been "wheeled" several times from its point of origin (though this is unlikely given the magnitude of current wheeling charges).

As mentioned in Chapter 2, New York has a disclosure proceeding under way, but it is still being developed. The method for providing the data necessary for disclosure has not yet been

finalized. Regardless, NY-ISO will know the source and destination of all power in the system, as well as the point at which all power leaves and enters the state.[32]

While the PJM ISO currently has no plans to perform a power tracking function, the latest proposed method for providing data for disclosure in New Jersey, one of the PJM states, relies upon "settlement-based" tracking. The ECAR region has no plans to develop a system to track electricity information.[33]

The North American Electric Reliability Council (NERC) has proposed a policy (Policy 3[34]) whereby all power generated in one power control area (PCA) and sold to another PCA would be "tagged". If NERC Policy 3 were enacted, all power entering New England through New York or Canada would be "tagged" with the PCA of origin, greatly facilitating the identification and treatment of imported power for the purpose of assigning a proxy fuel and emissions mix.

Under Policy 3, "tagging" would provide the following information about inter-PCA transactions:

i) a unique transaction ID;
ii) transaction dates, and start- and end-times;
iii) energy profile;
iv) identities of the transaction sending, receiving and intermediary control areas.

The schedule for consideration of NERC Policy 3 is as follows:

i) comments on Policy 3 were due by June 15, 1998;
ii) these comments were reviewed at the NERC Interconnected Operations Subcommittee's meeting on June 25-26, 1998;
iii) the above subcommittee will hold a ballot on Policy 3 on November 17-18, 1998;
iv) NERC Board of Trustees will decide upon Policy 3 on January 4-5, 1999.

In the case of imports from Canada, there is additional comprehensive and timely data charting the imports and exports of power between the two countries from Canadian sources. The National Energy Board (NEB) in Canada releases a monthly "Electricity Exports and Imports" report on the Web with details of cross-border power flows, by province, by state, and by major Canadian electric company, with a lag of about three months.

5.3 Fuel Data

Fuel data at the unit-specific level is required to assign a fuel mix to the power that is tracked to each LSE operating in New England.

[32] Personal communication with Harvey Tress, NY PSC, May 1998.
[33] Personal communication with Tom Krynak, June 1998.
[34] The proposed version of NERC Policy 3 can be downloaded from the NERC website (www.nerc.com).

5.3.1 Fuel Data for New England Generating Units

For generating units both located in New England and selling into the grid, the ISO-NE settlement system will know the fuel type associated with most units. In the case of dual fuel units, which are relatively abundant in New England, ISO-NE will know only the types of fuels burned at such units (i.e., oil and gas), but not the primary fuel.[35] This means that other fuel data sources or policy decisions for the treatment of dual fuel units are required in order to establish the fraction of each fuel burned over a given period of time.

5.3.2 Other Fuel Data for U.S. Generating Units

The three main sources of fuel consumption data for U.S. generating units are: i) the Energy Information Administration (EIA) of the U.S. Department of Energy (DOE); ii) the Environmental Protection Agency's Emissions Tracking Systems database; and iii) the Federal Energy Regulatory Commission (FERC) Form 1s and Utility Data Institute (UDI). This data may be required not only to supplement fuel data for New England units, as described above, but more importantly for power imported into New England from New York and other U.S. electric systems.

The usefulness of this data, however, depends upon the ownership of the generator (i.e., investor-owned utility (IOU), public power entity, or non-utility generator (NUG)) and the type of generator (i.e., standard generator or cogenerator), in part because of the confidentiality of NUG information.

The EIA collects fuel consumption data (and various other forms of data) from each IOU unit in the U.S. This data is collected monthly for units with a nameplate capacity greater than 10 MW, and is subsequently published in two different forms[36]:

i) "Inventory of Power Plants in the U.S." report – information at the unit level on an annual basis, released 15 months after the reporting period.
ii) "Steam-Electric Plant Operation and Design Report" – information collected *only* from steam plants through Form EIA-767, with annual data at the unit-specific level. Released in electronic form ("Vector Boiler File") and available 17 months after the reporting period.

The "Inventory of Power Plants" report comprises more types of generators than the "Vector Boiler File," since it is not limited to only steam generators. However, the latter report provides slightly more information about the units that it does cover. In addition, the "Vector Boiler File" also extends its coverage to steam units owned by public power authorities, such as federal power authorities, municipal electric companies and rural electric cooperatives.

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[35] The ISO will flag units with the following transactions: Coal, Coal/Oil, Composite, Diesel Oil, Dispatchable Load, Gas, Hydro: Pondage, Hydro: Pumped Storage, Hydro: Run of River, Nuclear, Oil, Oil/Gas, Wind, Wood/Refuse.

[36] Personal communication with John Colligan, DOE/EIA.

NUGs with a nameplate capacity larger than 5 MW report their fuel consumption (and other data) to EIA using Form EIA-867; however, this data is considered confidential and is not released on a unit-specific basis. Instead, EIA releases this data in aggregated form each year, either by NERC region or by power control area (PCA).[37]

The NUGs that are required to submit Form EIA-867 also include cogeneration facilities (again, those larger than 5 MW) that have made electrical sales to the grid. The data submitted by cogenerators applies to their electrical output *and* steam generation, and does not distinguish between these two outputs.

Another source of fuel data for U.S. generating units are the quarterly filings that affected units must submit to the U.S. Environmental Protection Agency in order to comply with the Acid Rain Program established under Title IV of the 1990 Clean Air Act Amendments (CAAA). The database maintained by this program is called the Emissions Tracking System (ETS). While ETS data serves primarily to monitor unit emissions and ultimately compliance with the Acid Rain Program the required filings also contain information on the primary fuel burned by each unit and the heat input.[38] The coverage and availability of this database are discussed in greater detail in Section 5.4.

The UDI compiles a database each year with several types of information about each IOU unit in the U.S., including the total amount of each fuel burned in the year. This database is drawn from FERC Forms 1 submitted by IOUs each year, and is released with annual data in May of the following year. However, it is probably not appropriate for a NEPOOL tracking system to rely on data from a commercial service.

It is important to note that the EPA is currently compiling a national database called the Generation Emissions Database (GEDB) with generation, fuel consumption by type, and emissions data for every unit (where possible) in the U.S., whether it is investor-owned, a NUG or publicly owned.[39] This database, designed for supporting disclosure will provide regional averages for NUG fuel consumption and emissions, whether at the NERC or the PCA level, and will also separate NUG combustion units from non-combustion units.[40] Averages and estimations will be used for units for which no other data is publicly available. In addition, this database will most likely be updated annually. Although databases compiled on an annual basis may not serve as an ideal source for satisfying all policy requirements of the New England States, the EPA would consider enhancing the GEDB in order to make it more useful for the New England tracking system. In addition, the GEDB may serve as an important resource for determining emissions and fuel mix data from neighboring U.S. regions.[41]

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[37] NUG data is only aggregated at the PCA level if there are more than four NUGs in the area, none of which accounts for more than 90 percent of their combined generation. Otherwise, it is presented at the NERC regional level.

[38] The amount of millions of British thermal units burned at the unit. It is usually estimate through the byproducts of combustion (US EPA Acid Rain Program web site).

[40] Combustion units include coal, oil, gas, nuclear, and biomass.

[41] Personal communication with Rick Morgan, U.S. EPA. A draft of this database is due out in the summer of 1998. He also noted that the EPA would appreciate any comments with regard to how the GEDB could be most useful for tracking systems.

5.3.3 Fuel Data for Canadian Generating Units

There are several sources of fuel data for the Canadian electric power sector. NEB's "Electricity Exports and Imports" report includes data on the fuel breakdown of all Canadian power exported into the U.S., as well as a breakdown of the fuels used by each of the major electric companies in each province exporting power to the U.S. The drawback of this source is that some power exported into the U.S. comes from smaller companies that are not listed in this report, for example smaller companies from Ontario and New Brunswick.

Statistics Canada, a federal agency charged with compiling data for all sectors of the economy, publishes two relevant reports with data on Canadian generation[42]:

i) "Electric Power Statistics" – a monthly report with a breakdown of generation by type of generator (i.e., steam, internal combustion, nuclear, etc.), by province, is available after a three-month lag. The breakdown of generation by fuel type is *not* included in this report.
ii) "Quarterly Report on Energy Supply and Demand" – a quarterly report with a breakdown of electricity generation by fuel type and consumption, by province, is available after a one-month lag.

5.4 Emissions Data

Emissions data at the unit level is needed to assign emissions characteristics to the power purchased by each LSE, as determined by the kWh tracking system. Once again, the quality and existence of emissions data differs widely between units owned by IOUs, NUGs and public authorities, and between the U.S. and Canada. The tracking system could be implemented for the most part using currently available public data. This data, including Acid Rain Program and state permitting data, is also accurate enough to be used for compliance with regulations. Minimum policy adjustments would be needed to centralize access to, and increase the availability and coverage of, emissions data.

5.4.1 Emissions Data for U.S. Generating Units

As stated earlier, the primary purpose of the Acid Rain Program's ETS database is to report emissions of SO_2 and NOx to the EPA for compliance with the Acid Rain Program. The database also collects and reports CO_2, data from each affected unit.

In general, the Acid Rain Program affects all utility (IOU and public power) owned units with a capacity of 25 MW or greater, with the exception of simple combustion turbines. It also affects all new units (brought online after November 15, 1990), including NUGs[43], with a capacity of 25 MW or greater. In addition, all new units with a capacity 25 MW or less using fuels with a sulfur content greater than .05% are affected.[44] The scope of the Acid Rain Program covers 68% of the capacity in New England --- many of the unaffected units are peaking units that do not

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[42] Neither of these reports breaks out exported power from generation serving provincial load.
[43] Rick Morgan of EPA's Acid Rain Division informed us that the EPA estimates that there are 35 NUGs reporting to the ETS, but none of these are from New England thus far.
[44] "Do the Acid Rain SO2 Regulations Apply to You?". EPA, February 1994.

operate very often and therefore the affected capacity most likely represents more than 68% of total generation.[45] It is also important to note that if affected capacity is sold to a NUG it will still be required to comply with the Acid Rain Program.

Coverage of New England Generating Capacity by EPA Acid Rain Program		
	Nameplate (MW)[1]	**% of Emitting**
Emitting generation (fossil fuels, wood, other biomass, solid waste)	**16,410**	**100%**
EPA Acid Rain Program data available	11,199	68%
EPA Acid Rain Program data not available	5,210	32%
NUG's	2,707	16%
Small Utility-owned, 25 MW or less	1,051	6%
Large Utility-owned, >25 MW, fossil fuels[2]	1,331	8%
Large Utility-owned, >25 MW, solid waste, wood	122	1%

[1]1995 data.
[2]Includes units deferred and retired under the Acid Rain Program, qualifying facilities, and simple combustion turbines.
Sources: NERC Electricity supply and demand data, U.S. EPA Acid Rain Program emissions data.
(Table created by Gillian Wright, EPA Region 1, August 1997.)

Units subjected to the Acid Rain Program are required to submit data to the EPA one month after each quarter. The EPA posts this the data one-month later, at the earliest. For example, 1st Quarter data is available May 31 at the earliest. The quarterly data for primary fuel and fuel consumption included in the quarterly filing is also further disaggregated into hours. However, at the time of initial reporting, the data included in this report has not yet been subjected to rigorous quality assurance, and thus may include missing or spurious data. At the end of each calendar year, the four quarters of data are corrected where necessary, and then published as a "scorecard" in annual form (i.e., no quarterly breakdown) by November of the following year.[46]

In the near future, the Acid Rain Program plans to do more quality assurance on quarterly data than is currently performed. This quarterly data will be available six months after the end of the quarter. The EPA eventually hopes to shorten this period down to three months – one month longer than the minimally quality assured quarterly data is currently made available. However, the EPA has not made an explicit decision with regard to whether the new quarterly quality assurance process will be broken down by month, or presented as aggregate quarterly data. Since the New England states are interested in having quality-assured monthly data within an expedited lag time, the EPA has recommended that they continue to share their specific needs

[45] "Disclosure of Emissions Information". Gillian Wright, EPA, August 1997.
[46] Rick Morgan of EPA's Acid Rain Program informed us in a personal communication that EPA intends to make this "scorecard" available by June of the following year. Nick Mangus of EPA's Acid Rain Program also told us that the historical reporting error between the quarterly "Summary Reports" and the corrected "scorecard" has been to *over-report* actual emissions by an average of 13 percent which is significant.

with them in order to allow for the EPA to develop a quality assurance process that may meet those needs.[47]

The EPA also plans to make 'as filed' data (by month) available one month after each quarterly reporting period. For instance, 'as filed' data for January, February and March will be available by the end of April – one month faster than the minimally quality assured quarterly data is currently available.

The Acid Rain Program standards for the collection of data are as follows:

i) All existing coal units greater than 25 MW and all new coal units must use continuous emission monitoring systems (CEMS)for SO_2 and NOx.
ii) Natural gas and oil-fired units must use CEMS for NOx. They have the option of determining SO_2 by 1) measuring heat input (gas only), 2) sampling and a flow meter, or 3) using CEMS.
iii) For CO_2, all units can use a mass balance estimation; CO_2 CEMS; or O_2 CEMS.

This data is collected for purposes of compliance with the Acid Rain Program and, therefore, is generally accurate. Though the data is collected quarterly (disaggregated by hour), the compliance period is the calendar year. Thus, quarterly data reports may not be as accurate as the annual report which goes through extensive quality assurance and is used for determining compliance with the requirements. For additional information on the Acid Rain Program please see Appendix D.

Furthermore, the EPA Ozone Transport Region NOx Budget Program, which is scheduled to begin in the summer of 1999, will affect all fossil fuel burning units with a capacity of 15 MW or greater would cover an additional 22% of New England capacity for NOx.

For units that are not affected by the Acid Rain Program, various other protocols can be used to determine SO_2, NOx and CO_2 emissions rates. For example, the New England states do not require CEM data for Title V compliance, and accept emissions data derived from alternative measures, such as stack testing, manufacturers' data and material balance analysis. In Appendix E, we show the hierarchy for categorizing unit emissions that was devised by the EPA, regional EPA branches, and state air quality offices through the National Pollution Prevention in Permitting Pilot Project (P-4 Project).[48]

Each New England State collects emissions data for criteria pollutants[49] from stationary units, either to monitor compliance with Title V operating permits or to assess fees. In turn, the states are required by Title V to report this data for units that exceed certain thresholds (tons per year) for criteria pollutants to the EPA for publication in the Aerometric Information Retrieval System (AIRS) database. In general, state collection requirements apply to more units.

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[47] Personnel correspondence with Rick Morgan.
[48] EPA in New England is one of 5 regional offices participating in the National Pollution Prevention in Permitting Pilot Project. EPA, the State of Connecticut and Cytec Industries of Wallingford, CT are exploring ways to allow greater flexibility in the operating permit program under the Clean Air Act. The goal of this partnership is to demonstrate that regulatory flexibility and proactive environmental strategies are appealing, profitable, and protective of the environment (www.epa.gov).
[49] The criteria pollutants are SOx, NOx, PM10, VOC, CO and lead.

For example, Vermont requires all facilities emitting more than 5 tons of total pollutants to report their emissions while Connecticut and Maine require reporting for NOx emissions greater than 10 and 25 tons per year, respectively. The EPA requires the states to report data for units emitting more than 100 tons per year of NOx under Title V requirements. In most states, such data collection does not include CO_2 data. The state reports typically are available six months after each calendar year, in a variety of formats. Not all New England states, however, are up to date with their data collection and reporting. The AIRS database, therefore, is also incomplete and not up to date for certain units. Please see Appendix F for a break down of state-by-state and EPA data collection for Title V. These requirements, however, serve as the basis for collecting data on units not affected by the Acid Rain Program.

Breakdown of Emissions Data Available for Generation Capacity				
Source	**SO2**	**NOx**	**CO2**	**Availability**
EPA Emissions Tracking System: Acid Rain Program (www.epa.gov/acidrain/etsdata.html)	68% of all units are tracked	68%	68%	Quarterly data, with minimal quality assurance is available two months after the quarter (disaggregated by hour). Quality assured annual data is available six months later. EPA is currently refining and improving data quality and availability.
EPA Emissions Tracking System: NOx Budget Program	NA	22%	NA	Scheduled to begin Summer 1999 (note that in the meantime, said data could be derived from state permitting data or reporting criteria listed in Appendix E).
CO2 Emissions Multipliers	NA	NA	32%	NA
State Permitting data or data collected from reporting criteria listed in Appendix E.	32%	10%	-	Varies
Total	100%	100%	100%	
(Table adapted from table created by Gillian Wright, EPA Region 1, August 1997.)				

5.4.2 Emissions Data Collection for Canadian Generating Units

Emissions data in Canada is not as comprehensive or timely as in the U.S. Environment Canada, a federal agency, compiles emissions data for the Canadian electric power sector, and releases SO_2 and NOx emissions data, broken down by province, on an annual basis with an 18-month lag. With regard to CO_2, Environment Canada's latest publication was the "Trends in Canada's Greenhouse Gas Emissions, 1990-1995" report, which includes an inventory of emissions for electric generation by province.[50]

[50] Environment Canada also provided us with working spreadsheets that will be used to compile the next CO_2 emissions report for Canada.

In addition, there are some initiatives and provincial reporting requirements for companies to provide emissions data at the plant-specific level.[51] These would be useful for unit transaction imports from Canada.

5.5 Recommendations for Preferred (Ideal) Data Collection

Due to the complexities of data collection and assimilation identified in this section as well as the need for complete, frequently available, and accurate data, a more centralized data collection system would greatly benefit our proposed tracking system's ability to support disclosure and portfolio standards. As we have discussed, though current policies requiring data submittals affect most units, the current data collection system is widely scattered in terms of source, coverage, availability and accuracy. As a potential remedy, we propose the following two parts of an "ideal" or "preferred" data collection scenario.

First, a TSA should ideally gather complete and detailed information on kWh as well as fuel type for all units. Currently the ISO-NE settlement system does not track all units (some units under 5MW do not register on the system) or fuel data with the detail required to satisfy state policies. Consistent with the ISO-NE settlement system, this information would be collected hourly and aggregated periodically as needed. This part of the preferred scenario has the benefit of providing a truly centralized source for the tracking of requisite generation data onto which fuel type and emissions data could be overlaid.

Second, under our preferred scenario, each state in New England should develop a policy requiring all units, regardless of size, to submit emissions data for CO2, NOx and SO2 as well as other pollutants required by any state's disclosure or emissions performance standards (unless the unit is not responsible for the pollutant). Most capacity in New England is already affected by the Acid Rain Program. In addition, states already collect and disclose emissions information from a significant number of units (some of which are not affected by the Acid Rain Program) to comply with Title V requirements.

Additional information may need to be collected from some units, but the collection of data for certain pollutants will not need to be burdensome. Similar to the Acid Rain Program model, units would be required to submit data each quarter (disaggregated by month) in a uniform format within one month of the end of the quarter. The states in turn would submit this data, after quality assurance, one month later in a uniform format to a TSA for overlay onto generation tracking.

If the states were to gather emissions data in this manner, units already required to submit data to the Acid Rain Program would not absorb any additional regulatory burden until pollutants other than CO2, NOx and SO2 require tracking. Generators and other market participants would recognize that the submitted data would be used to enforce compliance with emissions portfolio standards as well as disclosure. In order to ensure that the data collection is non-

[51] In particular, Ontario Hydro is planning a corporate initiative to report emissions of SO_2, NOx, CO_2 and particulate matter at the plant level. Hydro Quebec released emissions data on its plants (mainly hydro). In New Brunswick, New Brunswick Power, the major company, reports annual plant-specific emissions to the Department of Environment, which are available in February of the following year.

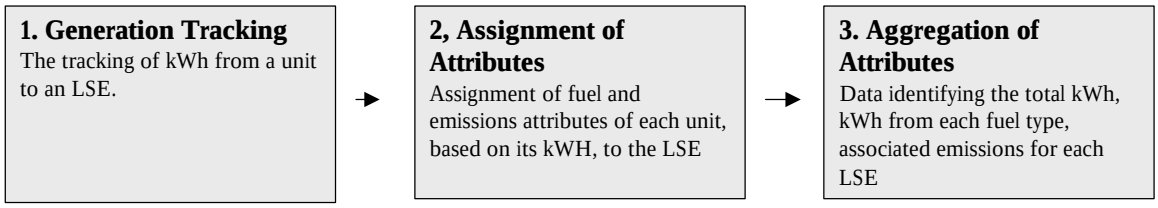
burdensome, units would be allowed flexibility with regard to data collection based on the hierarchy laid out in Appendix E.

This collection of data by the states and a TSA would help level the playing field since disclosure and compliance with emissions standards will affect all market participants. In addition, proprietary interests would still be protected for unit-specific data since it would only be reported in an aggregated format. Recognizing that kWh generated in one state will be sold in another, there would be common benefit in terms of sharing data across state lines and in terms of supporting disclosure and portfolio requirements as required by each state. We recognize that the implementation of the ideal data collection scenario would require an investment in resources by each state and by a TSA, both to demonstrate the value of such policies as well as to administer them once enacted. Accordingly, we propose this scenario as a starting point for continued discussion with regard to furthering the system's ability to satisfy the design criteria.

6.0 Assignment of Attributes

In Chapter 4, we described and explained our proposed kWh tracking system for power acquired by LSEs. In Chapter 5, we discussed the requirements for and availability of fuel and emissions data to overlay on the kWh tracking system in order to assign these attributes to the power sold by each LSE. In this chapter, we bring together the previous two chapters and outline our proposed framework for overlaying the data on the kWh tracking system, in order to accommodate the underlying policy objectives, such as disclosure and portfolio standards.

This process is summarized in the graphic below.



We outline two systems that would overlay fuel and emissions data onto the kWh tracking system. In the first, we describe a system that could be implemented under preferred (ideal) circumstances, in which comprehensive fuel and emissions data is available on a timely basis for all units supplying power under the different types of transactions tracked by the ISO-NE. For this ideal case to materialize, additional data beyond that currently available would have to be collected, as recommended at the end of Chapter 5. In the second case, we describe a system that could be implemented with only existing data sources. While this would be a less desirable system, it could be viewed as an interim system for carrying out disclosure and monitoring portfolio standards, prior to the availability of better data.

In either case, our proposed design for the kWh tracking system will allow the necessary flexibility to accommodate the accuracy and resolution requirements of both current and future policies, including those for quarterly disclosure and for monitoring compliance with a portfolio-based requirement. The system for assigning attributes is fundamentally the same in both cases; the primary differences involve the availability and treatment of data.

For both approaches, implementation includes treatment of i) imported electricity, ii) dual fuel units which burn two different fuels, iii) pumped storage, and iv) cogeneration. In addition, both approaches will require a reconciliation process, for example, to allow for quarterly data submissions to be reviewed on an annual basis for compliance with portfolio or generation performance standards. The approach based on current data resources will also require the use of default values when data is unavailable or insufficiently available.

In this chapter, we also discuss the cost of implementing the two components of our tracking system under the assumption that significant data collection or resolution issues will not be involved.

6.1 Data Resolution and Accuracy

The assignment of fuel and emissions attributes to the kWh tracked from generating units to each LSE will need to accommodate both the shortest period of resolution and the highest levels of accuracy and precision required by state policies. A high level of accuracy will be needed to support policies for disclosure and portfolio standards. For example, some RPS policies require that one-percent of all LSE sales come from eligible renewable resources. This will require that LSE fuel mix accuracy and precision be at least at the 0.1 percent level.

The shortest timeframe for data reporting, either enacted or proposed, is quarterly, based on the most recent one-year period.[52] In order to provide customers with the most meaningful data, this one-year period would be the year ending with the most recent quarter for which data are available. However, it is important to note that data reporting for shorter timeframes (for example monthly) may be required for the implementation and monitoring of portfolio standards. For example, if a dual fuel unit burned oil in April and gas in May, and sold April's generation to one LSE and May's to another, then monthly resolution of data will more accurately reflect the emissions associated with each LSE than quarterly resolution, which would assign the same emissions rates to each LSE. In addition, the ISO-NE settlement system is planning to already produce monthly reports (compiling hourly market activity) for each participant. For purposes of the assignment of attributes, we assume a monthly resolution period.

6.2 Preferred (Ideal) Data Collection Scenario

Under the preferred (ideal) data collection scenario, a TSA collects kWh generation from all units and kWh associated with imports or exports on an hourly basis. Through the kWh tracking protocol, the portion of an LSE's portfolio served by each unit can be determined hourly and aggregated over longer periods, such as monthly or quarterly, as needed.

For the assignment of attributes, two sources of data would be used for ISO-NE units: i) an inventory of each unit flagged with a detailed fuel type description, and ii) emissions data collected from all units on a quarterly basis by each of the states. After discussing fuel and emissions attributes for ISO-NE units, we describe the treatment of imports.

6.2.1 Fuel Attributes for ISO-New England Units

The inventory of fuel characteristics associated with each unit would be maintained by a TSA. This would allow a TSA to record the primary fuel used in each hour for dual fuel units. In addition, the inventory would keep track of other unit-specific information; for example, the capacity, vintage and fuel type of units, as needed. This information would be recorded by a TSA in a database separate from the ISO-NE settlement system or the kWh tracking system.

6.2.1.1 Dual Fuel Units

[52] NECPUC Model Rule.

For units using one fuel type, the data would remain fixed and unambiguous over any aggregation period. In other words, the primary fuel would be the fuel used by the unit in all hours. However, for dual fuel units, which can switch between two or more fuels (e.g., oil and gas), the database would need to keep track of changes in the fuel burned by each dual fuel unit on an hourly basis. As planned, the ISO-NE settlement system will assign a flag indicating both fuels to kWh from dual fuel units. It could, however, assign a single default fuel for every hour that represents the least marketable fuel, for example, coal for coal/oil and oil for oil/gas. Alternatively, the default fuel could be the primary fuel for the unit as long as the average use of the primary fuel in preceding years has exceeded some high percentage of generation, for example 90%. The operator of the dual-fueled unit would be required to notify ISO-NE when reporting data for every hour in which the alternate (non-default) fuel was used.

In addition, the total kWh generated from each fuel in dual fuel units could also be determined for each month through data submitted by all generators serving the grid by New England State requirements. This information would likely show total heat input of each fuel for the unit, rather than the kWh generated from each fuel. In this case, it can reasonably be assumed that the breakdown of kWh generation from each fuel is proportional to the heat input of each fuel.[53] This information could then be overlaid on aggregated monthly data from the kWh tracking system.

It is also important to note that some dual fuel units can also co-fire, or burn different fuels simultaneously. In this case, hourly data informing the ISO-NE which fuel is being burned would not prove useful. The fuel mix for co-firing units could, however, be determined over a month simply from the total heat input of each fuel for the unit, in the same way as for dual fuel units. Thus, accurate and timely fuel mix data could be determined for each unit in New England.

6.2.1.2 Pumped Storage

Tracking the attributes of power acquired from pumped storage units would have to take account of the unique features of this type of generation. Pumped storage units provide power from water that is directed to pass through turbines as it descends from a storage pool from which it is released (discharged) at a higher elevation. As such, these kWh have the fuel attribute of "water" and no emissions attributes. However, since the storage pool was originally filled (charged) and is continually re-filled (re-charged) with water pumped uphill using electricity generated by other units, each kWh provided by the pumped storage unit should bear the attributes of the units used to charge the system, and should reflect the energy losses associated with pumping the water uphill and releasing it through the turbines.[54]

A rough interim solution for pumped storage would be to assign such power certain default characteristics such as those of the regional system mix. However, the ISO-NE settlement system may produce sufficient information on an hour-by-hour basis for a TSA to ascribe accurately the attributes associated with each kWh provided by pumped storage units.[55] This

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[53] This assumes that the heat rate of a dual fuel unit remains unchanged for different fuels.

[54] This does not include the thermodynamic losses at the generating units used for pumping; it includes only the frictional losses in movement of the water uphill, downhill and through the turbines.

[55] Hourly data and the results of calculations based on such data could be aggregated as needed.

would require that the mix of kWh by unit that is embodied in the storage pool be continuously updated each time power is provided during discharge and each time power is used for charging the pool. When the pool is discharged, the kWh generated would bear the unit mix embodied in the pool at that time. The mix would be continually updated as the pool is re-charged, by averaging the kWh by unit embodied in the existing mix prior to re-charge with that embodied in the kWh supplied by units to re-charge the pool. Each kWh provided by the pumped storage unit could thus be translated into kWh by unit for the mix embodied in the pool at the time of discharge. In addition to having the appropriate fuel tags, the emissions characteristics of the cumulative mix of kWh by unit would also be provided. This would reflect accurately the "scale up" (typically about 40%) from the kWh provided to the kWh required for pumping.

6.2.2 Emissions Attributes for ISO-NE Units

Per our recommendation in Chapter 5, hourly emissions data would be collected by each state for all its generation units on a quarterly basis. This is similar to the requirements of the EPA Acid Rain Program on affected units. Within one month following the end of the quarter, each state would have collected and reviewed the data submissions and presented it to a TSA for overlay onto the product of the generation tracking system.

6.2.2.1 Allocation of Emissions to kWh from Cogeneration

Cogeneration facilities simultaneously produce steam for industrial processes and electricity for own-use or sale to the grid. The challenge presented by cogeneration is how to separate meaningfully the fuel and emissions resulting from electrical generation and steam production at the facility. The EPA's Office of Air and Radiation has released a report entitled, "Use of Output-Based Emissions Limits in NOx Regulations: An Investigation in Feasibility," which discusses and proposes solutions for how to separate steam from electricity in cogeneration.

The four different options for treatment of cogeneration outlined in that report are to:

i) ignore the steam generation, implying that all fuel input and emissions are applied to electrical generation;
ii) use FERC guidelines[56] for cogeneration efficiency that credits one-half of the useful steam output – this offsets the fuel input (and emissions) by one-half of the steam output;
iii) subtract entire steam output from fuel input, implying that the fuel input (and emissions) are offset by the total amount of useful steam;
iv) develop estimates for how much electricity generation the steam output would generate if driven through the turbines, and scale back the total fuel use and emissions by the ratio of actual electricity generated to total potential generation.

Options i) and iii) above are simple, but either excessively penalize or reward cogeneration facilities, respectively. Option iv) is arguably the fairest option; however, it requires additional facility-specific data to implement. Thus, we recommend that option ii) be used for cogeneration. This means that the fuel consumption and emissions from the cogeneration facility would be disaggregated between electrical generation and steam production on a *pro rata*

[56] See 18 CFR Part 292, #205.

basis between the energy output of the electrical generation *and* one-half of the energy produced as useful steam.

6.2.3 Emissions and Fuel Attributes for Imports

Until such time that neighboring systems develop compatible tracking systems, current policies assign default values to imports. Default values and other issues surrounding the assignment of attributes to imports are discussed in greater detail in Section 6.3.4.

6.2.4 Aggregation of Attributes

Once the kWh by fuel type has been determined for all units, including pumped storage, cogenerators, NUGs and dual fuel units, as well as imports, they can be combined for any given period and aggregated to give kWh and associated fuel and emissions attributes for the portfolio of each LSE. For the most part, generation and fuel type data will be available on an hourly basis, and aggregated monthly by the ISO-NE settlement system. It is conceivable that emissions data will be available monthly (available as early as one month after each quarter). The following example, derived from the example of kWh tracking of Case 6 in Chapter 4, shows how attributes would be assigned to generation for a one month period.

In the example, we assume the same five generators – Wind, Gas, Oil, Coal, and Nuclear – selling their power to three LSEs – A, B and C. Table 1 shows an illustrative outcome of the ISO-NE settlement system for this example for the month of August. The table shows the capacity and MWh output for each of the five generators, as well as the fraction and absolute amount of each generator's output that ends up with each LSE, based upon the tracking method described in Chapter 4. Table 1 thus shows the amount of generation from each unit purchased by each LSE over the course of August.

Table 1

MWh for the month of August (Generation Tracking)

Unit	WIND	GAS	OIL	COAL	NUCLEAR	Total
Capacity (MW)	100	100	100	100	200	600
Energy (MWh)	22,320	52,080	29,760	59,520	119,040	282,720

Percentage of MWh generation allocated from each unit to LSE

LSE	WIND	GAS	OIL	COAL	NUCLEAR	Total MWh
A	93%	93%	23%	23%	4%	94,600
B	1%	1%	75%	75%	14%	84,355
C	6%	6%	2%	2%	82%	103,766
Total	100%	100%	100%	100%	100%	282,720

MWh allocated from each unit to each LSE (Percentage of generation * total generation)

LSE	WIND	GAS	OIL	COAL	NUCLEAR	Total MWh
A	20,668	48,226	6,900	13,806	5,000	94,600
B	246	573	22,400	44,828	16,308	84,355
C	1,406	3,281	459	887	97,732	103,766
Total	22,320	52,080	29,760	59,520	119,040	282,720

Now, in order for fuel mix and emissions to be assigned to the LSE portfolios for the month of August, data regarding actual fuel use and emissions by generators are required. Table 2 shows the emissions and fuel type data associated with each generator for the month of August. Table 3 assigns the emissions and fuel attributes identified in Table 2 to each of the LSEs, on the basis of the tracking outcome shown in Table 1.

Table 2

Emissions and Fuel Attributes for August

Unit	**WIND**	**GAS**	**OIL**	**COAL**	**NUCLEAR**	**Total**
Capacity (MW)	100	100	100	100	200	600
Energy (MWh)	22,320	52,080	29,760	59,520	119,040	282,720
			Total Emissions (tons)			
SO2	0	23	320	988	0	1,331
NOx	0	281	192	214	0	687
CO2	0	15,858	18,139	58,657	0	92,654
			Emission Rates			
SO2 (lbs/MWh)	0	1	22	33	0	9
NOx (lbs/MWh)	0	11	13	7	0	5
CO2 (lbs/MWh)	0	609	1,219	1,971	0	655
			Fuel Type			
Fuel Type	Wind	Gas	Oil	Coal	Nuclear	

Table 3

Percentage of MWh generation allocated from each unit to LSE

LSE	WIND	GAS	OIL	COAL	NUCLEAR
A	93%	93%	23%	23%	4%
B	1%	1%	75%	75%	14%
C	6%	6%	2%	2%	82%
Total	100%	100%	100%	100%	100%

MWh allocated from each unit to each LSE (Percentage of generation * total generation)

LSE	WIND	GAS	OIL	COAL	NUCLEAR	Total MWh
A	20,668	48,226	6,900	13,806	5,000	94,600
B	246	573	22,400	44,828	16,308	84,355
C	1,406	3,281	459	887	97,732	103,766
Total	22,320	52,080	29,760	59,520	119,040	282,720

SO2 emissions (tons) (Percentage of MWh generation * Total unit emissions (tons))

LSE	WIND	GAS	OIL	COAL	NUCLEAR	Total
A	0	22	74	229	0	325
B	0	0	241	744	0	985
C	0	1	5	15	0	21
Total	0	23	320	988	0	1,331

SO2 emission rate (lbs/Mwh) (SO2 emissions (tons)/Total MWh)

LSE	
A	6.9
B	23.4
C	0.4
Average	9.4

NOx emissions (tons) (Percentage of MWh generation * Total unit emissions (tons))

LSE	WIND	GAS	OIL	COAL	NUCLEAR	Total
A	0	260	45	50	0	355
B	0	3	144	161	0	309
C	0	18	3	3	0	24
Total	0	281	192	214	0	687

NOx emission rate (lbs/Mwh) (NOx emissions (tons)/Total MWh)

LSE	
A	7.5
B	7.3
C	0.5
Average	4.9

CO2 emissions (tons) (Percentage of MWh generation * Total unit emissions (tons))

LSE	WIND	GAS	OIL	COAL	NUCLEAR	Total
A	0	14,685	4,206	13,605	0	32,496
B	0	174	13,653	44,178	0	58,005
C	0	999	280	874	0	2,153
Total	0	15,858	18,139	58,657	0	92,654

CO2 emission rate (lbs/MWh) (CO2 emissions (tons)/Total MWh)

LSE	
A	687
B	1,375
C	41
Average	655

Percentage of each fuel type by LSE (MWh from each unit/Total MWh)

LSE	WIND	GAS	OIL	COAL	NUCLEAR	Total
A	22%	51%	7%	15%	5%	100%
B	0%	1%	27%	53%	19%	100%
C	1%	3%	0%	1%	94%	100%

Table 3 includes the information shown in Table 1 as a point of departure; for example, generator capacity and MWh output, as well as the percentage of output ending up with each LSE. The remainder of Table 3 shows the MWh percentage of each LSE portfolio served by each unit, the contributions of each unit to the overall emissions rate for each LSE, for SO_2, NO_x and CO_2, and the determination of fuel mix for each LSE.

i) The MWh fraction of each LSE portfolio served by each unit in August is calculated by dividing the MWh from each generator ending up at each LSE by the total sales made by the LSE in that month. For example, the MWh percentage of LSE A served by the Wind unit is calculated by dividing 20,668 MWh – the number of MWh tracked to LSE A from the wind unit -- by 94,600 MWh – the total number of MWh tracked to LSE A from all units -- equaling 22%.
ii) The SO2, NOx, and CO2 emissions for each LSE for August are calculated by multiplying the percentage of the MWh from a unit that is allocated to the LSE by the total emissions from that unit.
iii) The fuel mix is calculated in the same way as emissions rates. Fuel mix is simple in that the MWh percentages of each LSE portfolio served by each generator *are* the fuel mix for each LSE.

These results of this hypothetical example for the month of August are also shown in Appendix G. In the ideal scenario, monthly data would be collected quarterly. For example, January, February, and March data would all be available at the end of May. In order, however, for the tracking system to assign attributes to LSEs in the most accurate and feasible manner, and provide the most flexibility for compliance with policies, it will be important for the assignment of attributes to occur each month. Quarterly data (disaggregated by month) could be used for periodic disclosure and to track compliance with portfolio standards. Annual data (disaggregated by month), which may undergo more extensive quality assurance, could be used by a TSA to verify and enforce compliance with portfolio standards.

6.3 Collection Scenario Based on Currently Available Data

In this section, we outline how we believe the tracking system should be implemented, given the *current* availability of data. The principal implementation issues for the tracking system center focus around:

i) the resolution of data (i.e., the time interval for which it is reported)
ii) how often data is collected and reported, and the time lag between the data reporting period and when it becomes available
iii) the treatment of dual fuel units
iv) the treatment of cogeneration facilities
v) the treatment of imports
vi) the use of default values when data is unavailable or insufficiently accurate
vii) how to "true-up" the system for purposes of accuracy and compliance with state policies.

6.3.1 Data Resolution and Lag

The NECPUC Model Rule states on Page 3 that "[t]he label reporting period shall be the most recent one-year period prior to the reporting month for which resource portfolio information has been updated …." This statement implies that the LSE fuel mix and emissions disclosed should reflect the most recently available year's worth of data. This "one-year period" is not necessarily a calendar year and could reflect the latest four quarters or twelve months of data available by the time the information for disclosure is prepared.

Given the data requirements and their availability, NECPUC's prescription implies that fuel mix and emissions data should be disclosed on the basis of the previous four quarters (disaggregated by month) of available data. We recommend that the EPA Acid Rain Program's database be used as the principal data source for the tracking system. This is for two main reasons: i) it contains the basic data on fuel *and* emissions, and thus would eliminate the potential pitfalls of merging data from different sources; and ii) its reporting cycle is quarterly, and thus new data would become available fairly frequently to update previously reported data. The information in EPA's database would be supplemented with fuel consumption data from DOE/EIA and emissions data from New England State air quality agencies, while imports from Canada would be treated using provincial and federal data in order to determine default values. Below, we describe how the system could be implemented, using July 1998 as an example for the reporting and billing month in question.

However, as discussed elsewhere in this report, the purpose of the tracking system will also be to monitor compliance with state policies, such as portfolio standards. Accordingly, the implementation of the tracking system may require: a means for "truing-up" any discrepancies in data due to reporting errors and time lags and the expansion of the tracking system to track transactions downstream of the LSE as well as further track information to the product and state level.

Both of these requirements present numerous challenges; however, we believe our tracking system can be expanded to accommodate them. One of the main issues to be addressed in designing a tracking system for disclosure is the relative merit of using more accurate but less timely and frequent data versus less accurate but more recent and frequent data.

In our recommended approach for implementing the system for disclosure purposes, we have generally opted for the latter option, so that our tracking system reflects relatively recent data, even though it may not have been subjected to as much quality control as desired. We feel it necessary to use data that is recent enough to portray the electric system meaningfully. Furthermore, we do not believe that slight errors in the data used for tracking would significantly affect the fuel mix and emissions disclosed by LSEs, since this information would comprise four quarters' worth of data and would be updated each quarter. In addition, most of the reporting errors to date have overstated emissions.

6.3.2 Fuel Consumption for New England Units

6.3.2.1 IOU and Public Power Units

The determination of fuel consumption by IOU and public power units larger than 25MW for disclosure, for example on the July 1998 bill would require data from the EPA's ETS database, as well as data from the DOE/EIA's "Inventory of Power Plants in the U.S." report. The most

recently available data from EPA's database for reporting in July 1998 would be for the 1st quarter of 1998 (Q1, 1998), since quarterly data is available sixty days after the end of each quarter. The EPA database includes entries for the total fuel consumption by each unit in terms of heat input (i.e., Btus of fuel), as well as the primary fuel of each unit. For units that use only one type of fuel, the fuel type is simply equal to the primary fuel listed in the database.

However, many units in New England and around the country are dual fuel units, which can burn more than one type of fuel (i.e., oil and natural gas). For such units, the primary fuel listed for the unit in the ETS database would not provide sufficient information to determine fuel mix. Thus, we recommend that data on fuel consumption by unit from the DOE/EIA "Inventory of Power Plants in the U.S." be used to divide the total fuel input that is reported in the quarterly EPA database between the various fuels. By July 1998, the *actual* fuel consumption at IOU and public power units would be known for the 1996 calendar year. This ratio of fuel consumption for 1996 could be applied to the total fuel input to each dual fuel unit, in order to determine the fuel mix for the unit. The only exception to this protocol would arise in the case of a unit recently switching fuels, for example from coal to natural gas. In such instances, the unit should be allowed to present evidence to this effect, in which case it would be assigned the new fuel on a forward-looking basis.

Once the fuel consumption has been determined for each IOU unit for each month of Q2, Q3 and Q4 of 1997 and Q1 of 1998, the consumption of fuel at each unit would then be associated with the generation from that unit in the tracking system.

6.3.2.2 Cogenerators and NUG Units

As discussed in Chapter 5, data for NUGs (including cogenerators) are either highly aggregated or simply not available. The fuel type (in the case of dual fuel units, both fuel types) for each NUG unit selling to the grid will be known by ISO-NE. We recommend that NUG fuel consumption be determined by multiplying its kWh of generation by the average regional NUG heat rate for that given fuel, as provided by EIA. In the case of dual fuel units, it could be assumed that such units burn equal quantities of each fuel. This treatment could also extend to cogenerators, both for single fuel and dual fuel facilities; however, some protocol would have to be adopted for disaggregating fuel consumption for (and emissions from) electrical generation, as opposed to steam production.

If NUGs were to claim that the fuel consumption attributed to their units does not accurately reflect *actual* fuel consumption at the unit, then they should be allowed to present evidence to the contrary, in which case, *their* reported fuel mix would be used.

6.3.3 Emissions Data for New England Units

We assume that accurate, timely and frequently reported data on emissions attributes of all units in New England could be provided by the New England states. If this were the case, then emissions data for the tracking system would not present a problem, and could be folded into the tracking system on the same monthly basis as for fuel consumption data. In other words, the emissions reported on the July 1998 bill would reflect the average of emissions for each month of Q2, Q3 and Q4 of 1997, and Q1 of 1998. The actual emissions values disclosed would be calculated by summing the emissions of each pollutant for each month, and dividing

them by the total sales made in each month – information about sales is collected by the ISO-NE settlement system.

In the discussion of emissions below, however, we assume that such data might not be available, at least not in the short term, and thus we suggest how emissions data for the tracking system could be developed using EPA data.

6.3.3.1 IOU Units

It should be remembered that the data released by EPA each quarter (disaggregated by month) has not been rigorously checked for accuracy. Any errors found by EPA in this data are not corrected from quarter to quarter, but rather only corrected in time for the release of the annual emissions report (since it serves primarily to verify annual compliance). The errors appearing in the quarterly data range from missing entries to entries that are incorrect by orders of magnitude.[57] We recommend, to the extent feasible, that all entries in this data be verified with each IOU, and that any seemingly flawed data be corrected.[58] If the data is not questioned by the IOU, then it should be used in the tracking system. In some cases, IOUs fail to provide EPA with data, in which case that quarter's emissions should be calculated on the basis of the previously reported quarter's emissions factors. Thus, if an entry for Q1, 1998, is missing from the database, its emissions would be calculated on the basis of emissions factors from Q4, 1997. It is important to note that annual compliance data, which undergoes extensive quality assurance, is not currently disaggregated by month. As noted in Chapter 5, the EPA is working to improve the future resolution and reporting of the Acid Rain Database.

6.3.3.2 Public Power Units

The treatment of emissions from public power units would be the same as that for IOU units, as discussed above.

6.3.3.3 NUG Units

In the event that NUG emissions cannot be determined at the unit or plant level by state agencies in New England on the basis of permitting and other regulatory requirements, then NUGs could be assigned emissions characteristics based upon: i) the aggregate emissions characteristics for the NERC region or PCA (i.e., in the case of New England, this information would reflect the average of the entire NEPOOL system); ii) verifiable unit-specific information provided specially by the NUG to state agencies; or iii) a default emissions factor applied to all NUGs, depending upon the primary fuel.

We recommend that the tracking system use the average emissions characteristics for New England *unless* NUGs come forward and provide unit-specific information showing lower emissions characteristics. In the event that NUGs do provide such data, then the regional emissions averages applied to the remaining aggregated NUG units would be increased to reflect residual average emissions.

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[57] The EPA's Acid Rain Program has told us that in addition to being more accurate, future quarterly data will also include the methodology used by companies to attribute emissions to units with common or multiple stacks.

[58] This data screening process could be streamlined by designing some algorithm to flag apparently flawed data.

6.3.4 Imported Power

The accurate treatment of imported power will depend on the use of compatible tracking systems by neighboring regions. In the absence of compatible systems, the determination of the treatment of imports is a policy issue.

The NECPUC Model Rule states on Page 4 that "[u]ntil adjacent regions develop compatible disclosure policies, a Load-serving Entity's total imports to New England will be listed as a separate fuel source …." and that "[f]or the purpose of determining emissions characteristics … imports shall be ascribed the characteristics of the exporting system's mix." Thus, for the purposes of disclosure, the NECPUC Model Rule treats imported power as a different fuel type and assumes that it occurs under a system transaction. Below, we discuss how, based on policy direction and available information, imported power could be treated in the tracking system, first for the U.S. and then for Canada.

6.3.4.1 Imported Power from the U.S.

Power imported from the U.S. under a system transaction creates complications, since its precise source may not be known. NERC Policy 3 – the proposal to "tag" power by its PCA of origin – would certainly help this process, if enacted.

If a region has implemented a compatible tracking system and disclosure policies, then the characteristics of power originating in the region could be aggregated to provide fuel mix and emissions information for the transaction. However, if the origin of the imported power is not known with a sufficient degree of confidence, then the fuel mix and emissions characteristics would have to assume some default value, whose determination would then become a matter of policy.

We recommend that imported power be assigned default characteristics representative of the emissions of neighboring regions in order to provide an incentive for the development of compatible tracking systems. The fuel mix of unknown imported power would have to be labeled "unknown" or "imported," while the emissions factors applied to this power recognizes the emissions, in general, of power from neighboring U.S. regions. On July 28, 1998 the MA DEP issued recommended default emissions rates for power imported into the New England Region with regard to information for the disclosure label in Massachusetts. Using data from the 1997 NEPOOL Generation Emissions Analysis (GEA)[59], the MA DEP recommended default values for U.S. imports based on the 1996 total emissions and generation of the following NERC regions: NPCC-New York, MAAC, and ECAR. For CO2, NOx and SO2 respectively, the proposed emissions rates (lbs/MWh) are 1300, 4.1, and 9.8. [60]

[59] The GEA is based on 1996 date reported to the EIA.

[60] Letter to Janet Gail Besser (Commissioner of the MA DTE) from David Struhs (Commissioner of the MA DEP) regarding emissions ratios to support the Massachusetts information disclosure labels, July 28, 1998.

6.3.4.2 Imported Power from Canada

For Canadian imports, the MA DEP proposes to use the New England regional averages until more accurate rates can be identified. However, the fuel mix and emissions characteristics of power imported from Canada could be calculated with relative simplicity, and would fit into this overall system. First, the amount of power entering New England from Canada would be known by ISO-NE, but could also be confirmed by referring to the NEB's "Electricity Exports and Imports" report, which contains a provincial and fuel breakdown of monthly imports and exports between the U.S. and Canada. By July 1998, for example, the imports of power from Canada would be known for all months up to April 1998, and thus total imports could be summed for Q2, Q3 and Q4 of 1997, and for Q1 of 1998. We have been told by Canadian regulators, government agencies and companies that they consider nearly all exports to New England to be system transactions, since the particular units supplying exported power to New England would vary depending upon time of day, season, and unit availability. Nevertheless, the discussion of imports below also covers unit transactions, to the extent possible, in the event that they emerge in the future.

For imports from Canada under system transactions, we recommend that the average fuel mix and emissions characteristics of all electricity generation in the province be applied to exported power reported in NEB's "Electricity Exports and Imports" publication. Thus, the breakdown of fuel mix for electricity generation by province, as published in Statistics Canada's "Quarterly Report on Energy Supply and Demand," would be applied to the kWh imported from each province. This report is published with a one-month lag, and thus Q1, 1998, data would certainly be available by July 1998, the billing month in question.[61]

If a compatible tracking system was in place, the determination of fuel mix and emissions characteristics would depend upon the particular province in question – i.e., whether the power is coming from New Brunswick, Ontario or Quebec. In New Brunswick, unit transactions could be tracked relatively easily. Every power source must file quarterly and annual reports with the provincial Department of the Environment that include details of fuel consumption and emissions of SO2, NOx, and CO2, as well as some other pollutants, at the plant level.[62] These reports are filed within three months of the previous quarter, and thus for July 1998, information would available for Q1 of 1998, as well as for previous quarters.

For Ontario and Quebec, on the other hand, unit transactions would be more difficult to track. The only data for Ontario would come from Ontario Hydro, which is beginning to voluntarily disclose emissions of SO2, NOx, CO2 and particulates, by plant, on an annual basis, as part of a corporate initiative. Fuel specific data would not be known for any units in Ontario, whether owned by Ontario Hydro or another company. In Quebec, all exports into New England come from Hydro Quebec; however, unit-specific information regarding fuel mix and emissions is not

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[61] There are also instances in which power imported from one province to another is subsequently exported into New England. This power is not tracked separately, and thus cannot be traced back to its province of origin. For this reason, we recommend that all power imported from a given province assume the characteristics of that province.

[62] Unit transactions from New Brunswick could, for simplicity, be assumed to have characteristics of the plant.

released. We are told by Hydro-Quebec that virtually all exports into New England are provided by hydro units, since the system is 96 percent hydro, with nuclear power providing some base-load power and a few small oil-fired plants only coming on-line to help reliability or during extreme conditions (such as after the ice storm in early 1998.)[63] In light of this, it would seem prudent to treat unit transaction imports from Ontario and Quebec as system transactions, whereby they would assume the characteristics of the overall region, *unless* adequate proof of the characteristics of the unit could be supplied by the LSE importing the power.

6.4 System Implementation Cost

The tracking system described here can be implemented with a reasonable investment in software, on widely available computing equipment, without disrupting ISO-NE's efforts to get the regional electricity markets up and running. The ISO-NE's software for the implementing the electricity markets is being developed in Java.

The tracking system should be developed as a separate program to be administered by a TSA that uses input from the ISO-NE's market operations and settlements systems. By designing the tracking software as a separate system, it can be developed and implemented without disrupting the development of essential market operations code in any way. The algorithms to solve the system of simultaneous equations are available in many commercially available packages, which could be purchased and integrated into the tracking software.

The size of the tracking problem should be quite manageable. For realistically sized problems, they could be solvable on a Pentium based PC. The data storage requirements could become burdensome over time if the calculations are to be performed on an hourly basis, with all inputs and outputs stored in full detail. However, most of the inputs to the calculation will need to be stored by a TSA in any case, and the outputs of interest are aggregated over reasonably long periods (weeks or months), making the data storage issue manageable. Our ballpark estimate is that it will cost about $300,000 to set up the system over a four-month period and about $300,000 per year to implement it. Please see Appendix H for more detailed information on how we derived our cost estimate.

6.5 Summary

In this chapter, we have outlined how we would implement the tracking system in light of the design criteria discussed in Chapter 3, the system transactions described in Chapter 4, and the data requirements and availability discussed in Chapter 5. In the future, it is possible that either more or less data will become available for use in tracking and disclosure. This will depend upon:

i) the role of the ISO-NE
ii) the ability for New England (and adjoining) states to make emissions data available on a more timely and frequently-reported basis
iii) government reaction to the fact that disclosure cannot occur without supporting data

[63] Personal communication with Environmental Management Unit, Hydro Quebec.

iv) the outcome of the EIA notice of inquiry to make more data confidential with the advent of restructuring

v) other developments, such as the implementation of compatible tracking systems in neighboring regions.

7.0 Implications and Outstanding Issues

In this chapter, we discuss the extent to which our proposal for tracking generation and for assigning attributes to generation fulfills the design criteria discussed above. In Chapter 3, we outlined the following design criteria that we sought to embody in designing our tracking system:

i) Non-burdensome
ii) Inclusive
iii) Accurate
iv) Comprehensive
v) Credible
vi) Flexible
vii) Expandable
viii) Simple
ix) Effective

Our general conclusion is that the tracking system proposed in this report meets all the design criteria. The system will be able to track generation to the LSE level in a manner consistent with the reporting and data requirements proposed in the NECPUC Model Rule, with some further improvements. The examples discussed in Chapter 4 demonstrate that our tracking system can simply and accurately track generation for almost all existing and planned units from the source to the LSE using the available data from the ISO-NE settlement system. As required by certain portfolio standards, however, the system will eventually need to be inclusive of all generation and flexible enough to track beyond the LSE level, for example to the state or product level as a sub-category of LSE sales. In this report, we also identify data sources that are necessary to support the assignment of attributes to generation tracking. However, certain limitations in the availability, scope, and accuracy of this data may inhibit the ability of our system to completely satisfy the design criteria absent additional policy mechanisms.

Our tracking system's ability to use existing infrastructure and data sources is key to permitting it to satisfy disclosure requirements efficiently, support other additional public policies and be compatible with tracking systems in adjacent regions. Our tracking system will rely upon data from the ISO-NE settlement process with the assumption that a TSA (ISO-NE or another third party) will be responsible for administering it. At this time, however, a TSA does not have the mandate to administer a tracking system based on the ISO-NE settlement system; it needs to be given this authority. Even with such a directive in place, certain limitations of the ISO-NE settlement process and data availability could inhibit the tracking proposal's ability to fully meet the design criteria. These limitations include:

i) ISO-NE does not track transactions that may occur "downstream" from LSEs.
ii) ISO-NE does not track generation from units that are less than 1 MW and may not track generation from units less than 5 MW.
iii) ISO-NE does not track the fuel characteristics of units with enough detail to allow for the tracking system to satisfy all policy requirements as precisely as desired.
iv) There is currently no single reliable and timely data source for fuel and emissions data so accurate tracking system reporting will somewhat lag actual market activity.

This chapter discusses the implications of these issues and others with respect to the ability of the proposed tracking system to meet the design criteria. The chapter presents some guidance for the future resolution of these issues.

7.1 Will it be Non-Burdensome?

Yes. Our report finds that at a reasonable cost, a TSA can operate the system. In our opinion, the key to ensuring non-burdensome tracking for market participants and regulators is for NEPOOL members to provide a TSA with the clear mandate to support the tracking of electricity information for state policy requirements. The use of the existing settlement system and the centralization of tracking efforts will minimize administrative responsibilities for LSEs required to comply with state-specific disclosure requirements and portfolio standards. A tracking system is necessary to meet existing state laws.

7.2 Will it be Inclusive?

Yes, with an important caveat. One issue limiting our tracking system's inclusion of all generating units in New England is the ISO-NE's current requirement that only units 5 MW or greater are required to be tele-metered and available for dispatch, and therefore included in the ISO-NE settlement system. Units between 5MW and 1MW can choose to be tele-metered and thus be incorporated into the system. However, units less than 1 MW can not be incorporated into the settlement system. Units not incorporated into the ISO-NE settlement system are currently treated as decrements to load. The NEPOOL members are currently considering the future treatment of such units, for example whether to continue to treat them as negative load or to treat them as a unit from which transactions would register in the settlement process.

An increasing number of smaller units (including cogeneration units) are expected to come on-line in the coming years. Some of these units will also be developed and run to comply with portfolio standards for new generation. To ensure a level playing field, all of these units should be included in the tracking system.

7.3 Will it be Accurate and Comprehensive?

Yes. The generation tracking portion of our system will accurately track information from the source of generation to the LSE based on the level of accuracy now used by the ISO-NE settlement process. Its accuracy with regard to the assignment of attributes, however, will, for the most part, depend on the availability of suitable data on emissions and fuel type.

As noted in Chapter 5, emissions data from the EPA's Acid Rain Program ETS database is available for most generation and is published on a quarterly basis. Additional sources of emissions data for disclosure purposes include state permitting data and other determinants, for example emission factors, which are listed in Appendix E. Much of this data is already used for compliance purposes and is collected with a level of accuracy that will suffice both for disclosure and for monitoring compliance with portfolio standards. No single source, however, provides information on all units, and, therefore, we recommend (in Chapter 5) that policymakers and market participants consider means to streamline data collection for emissions.

Information on fuel type for IOUs that is not derived from the ISO-NE process could be determined from fuel data collected by the EIA. Fuel data on NUGs, however, is considered confidential by the EIA and is only reported in aggregate form. A significant portion of the New England generation capacity currently owned by IOUs will be sold to NUGs in the near future. In addition, NUGs will supply the bulk of new generation in New England. In the absence of fuel data from the ISO-NE, the success of this tracking system and others will depend on access to this data. EIA needs to be made aware of the importance of disclosing all generation information on a unit-specific basis.[64] Foremost, though, we recommend that market participants direct the ISO-NE to collect fuel data for each unit and information on capacity and vintage for certain units at a level of detail that is consistent with all state policy objectives.

The tracking of other attributes, such as labor and other emissions or environmental attributes, faces additional problems with regard to data accuracy and availability. If reliable sources of data are identified, the tracking system would accommodate the assignment of such attributes to LSEs.

7.4 Will it be Credible?

Yes. The tracking system represents the most logical assignment of generation to retail load under current market rules. However, the credibility of the tracking system may ultimately depend on its ability to more closely connect cause and effect. Three issues tied directly to the credibility of the tracking system are i) its ability to identify the attributes of an LSE's "System Power" resources, ii) the definition of a "unit contract" or "Known Resource" for purposes of tracking electricity, and iii) its acceptance by regulators, market participants, and consumers.

To verify product characteristics, a TSA would need transaction data broken down by product in order to ensure that i) the attributes of products sum up to the attributes of an LSE's total resources, ii) resources assigned to each product match the corresponding load obligation, and iii) the attributes of each product reflect the product's assigned generation. With respect to items i) and ii), LSEs in Massachusetts require verification from ISO-NE, as directed by the MA DTE.

To monitor compliance with portfolio standards, a TSA would need transaction data broken down by state in order to verify that i) the attributes of LSE sales to each state sum up to the attributes of an LSE's total resources, ii) resources assigned to each state match the corresponding load obligation, and iii) this accounting system is consistent with product-based retail sales made to each state.

As mentioned earlier, the Maine Restructuring Act contains a provision limiting the sales of an affiliated LSE in its affiliate distribution company's territory. Our proposed tracking system

[64] The EIA proposal has been issued in the Federal Register for a sixty day comment period. Within the thirty days following the comment period, the EIA must submit its policy directive to the Office of Management and Budget (OMB). At this point, comments will go directly to the OMB, and it will be required to approve or disapprove the policy within sixty days. By the end of the year, the EIA should have addressed the issue, potentially affecting the format that 1997 data will be released in.

could be used to support this function if a TSA is provided with information disaggregating total resources by each service territory.

It is important to note that state PUCs do not regulate LSEs that do not serve retail load. It is therefore important for retail suppliers to work with such LSEs in order to ensure that attributes are accurately assigned to portfolios below the LSE level.

With regard to the first issue, absent more detailed tracking, the NECPUC and Massachusetts disclosure policies currently rely on generic regional averages for LSE resources that do not fall into the unit category. During the course of this project, a clear preference was articulated for development of a more detailed tracking system, allocating the generating resources in non-unit contract transactions on a pro-rata basis. The pro-rata treatment of such transactions will more accurately represent each LSE's resources and lend additional credibility to disclosure in the marketplace, as well as provide a more realistic basis for implementation of portfolio standards. We recommend that implementation of disclosure in the NECPUC states account for this greater level of resolution provided in the proposed tracking system. In addition, the merit and complications of the approach we identified for disaggregating the attributes of "System Power" between ANI and system contracts may require further consideration from policy makers.

The second issue will also require the further consideration of policymakers, as they determine the intent of the tracking system with regard to the definition of unit transactions. We recommend that a meaningful balance be struck between a definition of unit contracts that allows LSEs to shift existing renewable resources to meet portfolio standards or localized pockets of retail demand, as is allowed by the current NECPUC model rule definition, and a definition that only recognizes long-term unit contracts, because to do so might better connect the cause and effect relationship between unit contracts and generation construction and dispatch.

With regard to the third issue, broad acceptance of the tracking system by regulators and market participants will result in the implementation of the tracking system. This in turn would allow for the ultimate test of credibility --- whether it is credible to the consumer in the long-term.

7.5 Will it be Flexible?

Yes. However, the tracking system will need to be expanded to allow for tracking and verification of information at the state and product level. Based on the state restructuring laws enacted thus far, portfolio standards will not take effect until 2000 or later. As written, some of these standards will require compliance based on disaggregation beyond the LSE level. This includes the tracking of transactions that may take place "below" the LSE, such as disaggregation at the product level, state level and at the distribution service territory level.

As noted above, the ISO-NE settlement system does not track these downstream transactions. For example, downstream transactions may occur between an LSE that is a member of NEPOOL and a non-member LSE, and therefore may not be tracked by the ISO-NE settlement process[65]. In the absence of a centralized system, it would be an LSE's responsibility to track transactions that it conducts downstream from the ISO-NE settlement process and to

[65] It is unclear how often such transactions will occur because the market is still developing.

ensure that the proper attributes are assigned to these transactions. It is likely that state PUC's have the authority to regulate these aspects of tracking.

Continued work will be needed to determine how to adapt the tracking system to account for transactions and disaggregration beyond the LSE level. Moreover, there are two issues worth noting that this tracking proposal does not address. The first is the treatment of emissions offsets and the facilitation of a tradable credits program. The treatment of offsets and the facilitation of a tradable credits program will most likely occur after generation has been tracked to the LSE or to a further disaggregated level, as required. The second issue is the potential for the development of new transactions and non-conventional products in the marketplace. One example of this issue could be a system contract that excludes power from certain units that would have otherwise been included. The specifics of accounting for these possibilities will require further consideration by policymakers and market participants. We anticipate that our tracking system could evolve as the ISO-NE settlement system is modified to recognize this sort of contract.

7.6 Will it be Expandable?

Yes, but in order to ensure its expandability it will be important to continue to share the findings and approach of the NETS project with other regions and advocate that they adopt compatible systems. In addition, the use of compatible systems in neighboring states will facilitate the exchange of meaningful and accurate electricity information across regions. As New York considers a system for tracking disclosure, we recommend that the NETS project Steering Committee continue to work closely with New York policymakers to further the goal of having a compatible system.

7.7 Will it be Simple?

Yes, the tracking system itself is straightforward. Initial difficulties may develop, of course, in establishing the ISO-NE's settlement system's interface with data from various sources. Additional complexities may include working out the direct application of information from the tracking system to support the range of state requirements within New England. However, these complications are surmountable, and should not be surprising to policymakers.

7.8 Will it be Effective?

Yes, we believe it will be effective. For the tracking proposal to meet the intent underlying each design criteria, it must do so on a long-term basis in a robust competitive retail market. Likewise, its overall effectiveness will be measured by reactions from its administrator, consumers, regulators, market participants, and other stakeholders as well as by its ability to meet public policy goals and be compatible with neighboring tracking systems. However, in order for the tracking proposal to meet design criteria at the point of implementation, the mandate of a TSA must include the tracking of electricity information for disclosure purposes and for portfolio standards, as well as for the verification of compliance with such measures.

Appendix A:
Summary of Disclosure Policies and Portfolio Standards

Summary of Regional Policies and Proposals Requiring or Supported by the Tracking and Disclosure of Electricity Information						
	Connecticut Restructuring Bill, HB 5005	**Massachusetts Restructuring Act**	**Maine Restructuring Act**	**New Hampshire Public Utilities Commission Order 22.875**	**Rhode Island Restructuring Law[66]**	**Vermont Proposed Restructuring Bill(s)**
Status	Enacted April 1998	Enacted November 1997	Enacted May 1997	Issued March 20, 1998	Enacted August 1996	Proposed
Disclosure Requirements Overview	Sec. 17: requires the DPUC to develop a comprehensive public outreach program using information filed under licensing program requirements for end-user LSE's (Sec.22), and uniform disclosure standards.	Generation companies, aggregators, and suppliers will be responsible for providing customers with a disclosure label showing information on the fuel mix and emissions of the generation sources, heavy metals as well as labor characteristics of the company's resource portfolio prior to service and annually. (as determined by the Department of Telecommunications and Energy).	Sec. 3217-3-Sec.4: In order to license competitive electricity suppliers, the PUC will collect information on generation portfolios over the past six months including, but not limited to, a breakdown of oil-fired, nuclear, hydroelectric, coal, biomass and other renewable resources and regional spot market purchases. In addition, the PUC will collect information on projected emissions and aggregate emissions over the last six months for nitrous oxides, sulfur dioxide, mercury, fine particulate, radionuclides and carbon dioxide. After considering the recommendation of a consumer education advisory board, the PUC will adopt specific rules for disclosure by February 1, 1998.	P. 108-109:The order agreed with the findings of the state-working group on disclosure. In summary, the working group found that customers should receive information that is simple, objective and verifiable, the tracking system used should not allow for gaming, uniform disclosure standards should be used on a regional basis, and that the PUC should have a moratorium of 12-18 months on disclosure. In addition, the PUC stated that the NECPUC Model Rules would serve as the basis for initiating a disclosure rule making.	Disclosure not addressed in the restructuring law. Sec. II-F: PUC regulations, however, state that fuel and environmental impacts of the NPP's source or sources of generation must be provided to customers in the format prescribed by the Commission upon its adoption of such a format.[67]	All retail providers would be responsible for providing customers with information on the fuel mix and generation source, determined by the Public Service Board.

[66] And Rhode Island Public Utilities Commission Regulations for Consumer Protection Requirements for Nonregulated Power Producers.

[67] Prior to such adoption, NPP's that make representations about generation, emissions, and other environmental claims must do so in a manner that is factually accurate and not misleading. Any NPP making such a claim must file a copy of the claim and substantiation thereof with the PUC for its information within (10) business days of making it public. The filing must include a description of the contract and/ or entitlements that are being relied on by the NPP to support its claim. PUC intends to consider the NECPUC Model Rules and other submissions to replace the above with regionally uniform regulations.

Summary of Regional Policies and Proposals Requiring or Supported by the Tracking and Disclosure of Electricity Information						
	Connecticut Restructuring Bill HB 5005	**Massachusetts Restructuring Act**	**Maine Restructuring Act**	**New Hampshire Public Utilities Commission Order 22.875**	**Rhode Island Restructuring Law**	**Vermont Proposed Restructuring Bill(s)**
Definition of Renewable	Sec. 1: Defines two "Classes" of renewable energy sources, with Class I the "more purely" renewable source, including wind, solar, fuel cell, methane gas from landfills, and sustainable biomass facilities, provided that such a facility begins operating on or after July 1st, 1998. Class II, including waste incineration, landfill gas, and licensed hydro (or hydro which is applying for a license and is within Clean Water Act or Canadian Environmental Assessment standards). It also includes biomass facilities that fail to meet the Class I criteria.	Renewable energy generating sources, as defined for the renewable benefit fund, include solar photovoltaic or solar thermal energy; wind energy; ocean thermal, wave, or tidal energy; fuel cells utilizing renewable fuels; landfill gas; waste to energy which is a component of conventional municipal solid waste plant technology in commercial use; naturally flowing water and hydroelectric; and low-emission advanced biomass power conversion technologies, such as gasification using such biomass fuels as wood agricultural, or food wastes, energy crops, biogas, biodiesel, or organic refuse derived fuel.[68]	Sec. 3210-2: Renewable resources are defined as generation with capacity less than 100 MW from fuel cells, tidal power, solar array and installations, wind power, geothermal, hydroelectric, biomass, or generators fueled by municipal solid waste in conjunction with recycling. The definition also includes sources of generation that qualify as small power production facilities or co-generation facilities (constructed prior to January, 1997) under FERC rules, 18 Code of Federal Regulations, Part 292, Subpart B, as in effect on January 1, 1997.	Not addressed	Sec. 39-1-2: Renewable energy means power generation technologies that produce electricity from wind energy, small scale (less than 100 megawatts) hydropower plants that do not require the construction of new dams, solar energy, and sustainable managed biomass. Fuel cells may be considered an energy efficiency technology to be included in demand-side management programs.	Renewable technology means a technology that relies on a resource that is being consumed at a harvest rate at or below its natural regeneration rate. This includes solar thermal, hydro less than 80MW, photovoltaics, and fuel cells. Landfill and decay of biomass gases are also included. Solid waste incineration, except for agricultural or silvicultural waste, is not considered renewable. Nuclear energy is excluded as well. A technology may also be considered renewable if it holds promise for enhancing the future use of renewables, is less polluting than existing technologies using fossil fuels, is not being widely used, is cost-effective and is readily convertible to renewable fuels.

[68] Coal, oil, natural gas (except when used in fuel cells) and nuclear power are not considered renewable energy sources. Waste to energy and hydroelectric do not qualify as renewables for the Renewable Portfolio Standard.

Summary of Regional Policies and Proposals Requiring or Supported by the Tracking and Disclosure of Electricity Information						
	Connecticut Restructuring Bill, HB 5005	**Massachusetts Restructuring Act**	**Maine Restructuring Act**	**New Hampshire Public Utilities Commission Order 22.875**	**Rhode Island Restructuring Law**	**Vermont Proposed Restructuring Bill(s)**
Renewable Portfolio Standard	Sec. 25: To be licensed, the Connecticut renewable portfolio standard will require that no less than 0.5% of an LSE's total electricity output be generated from Class I sources and an additional 5.5% come from either Class I or Class II renewable energy sources. These percentages will ramp us continuously until, by July 1, 2009, the Class I requirement will be 6% and the Class II requirement will be an additional 7%. Exemptions to the requirements will be given to LSEs which provide generation solely from Class II sources. Moreover, an LSE will be able to satisfy its requirements by participating in a credit trading program. Connecticut's act also states that an LSE may use data from the ISO to demonstrate compliance with renewable portfolio standards.	Section 50: Directs the MA DOER to establish a renewable portfolio standard (the deadline for the baseline is December 1999). Suppliers are required to "provide a minimum percentage of kilowatthours sales to end-user customers in the commonwealth from new renewable energy generating sources". The schedule for the standards requires a 1% increase from the baseline by December 2003 ramping up .5% each year through 2009. An additional 1% per year is required thereafter until the MA DOER decides to terminate the program.	Sec. 3210-3: Each electricity provider in the state will be required to demonstrate that at least 30% of its generation portfolio based on kWh sales is from renewable resources. The Maine Public Utility Commission (PUC) is directed to develop a system for implementing this requirement by January 1999. As written, the PUC is directed to revisit the RPS within five years of retail competition. Rules adopted are all pursuant to Title 5. 375, subchapter II - A.	Not addressed	Not addressed	There would be two tiers of renewable technologies used in the accounting of the renewable portfolio standard. Tier I would be any renewable technology that has a capacity less than 80MW and in the case of hydro-electric, is operated with proper FERC licensing, and in compliance with state water quality standards. Tier II would be any renewable technology that begins regular production of electricity after January 1998 or that was constructed after July 1, 1997. P. 50: The portfolio requirement for Tier I renewables (existing renewables) would be equal to at least the kWh usage levels in 1995 (roughly 15%).[69]

[69] The portfolio requirement for Tier II renewables (new renewables) would increase every year beginning in 1998 and be at least equal to four percent in 2007. The credits used to comply with the renewable portfolio requirement would be tradable. A Tier II credit would be able to be exchanged for two Tier I credits. The PSB will establish a tradable credit system.

Summary of Regional Policies and Proposals Requiring or Supported by the Tracking and Disclosure of Electricity Information						
	Connecticut Restructuring Bill, HB 5005	**Massachusetts Restructuring Act**	**Maine Restructuring Act**	**New Hampshire Public Utilities Commission Order 22.875**	**Rhode Island Restructuring Law**	**Vermont Proposed Restructuring Bill(s)**
Emissions Performance Standard	Sec 24: Directs the Connecticut Department of Environmental Protection (CT DEP) to establish emissions portfolio standards for electricity generation facilities supplying electricity to end-users in Connecticut. These uniform portfolio standards will be based on the fuel used for generation and will limit the amount of air pollutants, including but not limited to NOx, SOx, CO2, CO, and mercury emitted per MWh.[70]	The Department of Environmental Protection is directed by the legislature to adopt standards based on the emissions per kWh for fossil-fuel generation for any pollutant determined to be of concern to public health by May 1, 2003.	Not addressed	Not addressed	Not addressed	P. 54: Companies selling electricity to retail customers in Vermont would be subject to "environmental portfolio standards." These standards would be set to improve, at a reasonable level, the level of environmental quality in Vermont. The standards would include emissions and other adverse environmental effects per kWh of electricity sold at retail in Vermont.

[70] The standard goes into effect when "three of the states participating in the northeastern states' Ozone Transport Commission as of July 1, 1997, with a total population of not less than 27 million at that have, have adopted such a standard". Connecticut's restructuring act also provides for the consideration of emissions trading program.

Summary of Regional Policies and Proposals Requiring or Supported by the Tracking and Disclosure of Electricity Information						
	Connecticut Restructuring Bill, HB 5005	**Massachusetts Restructuring Act**	**Maine Restructuring Act**	**New Hampshire Public Utilities Commission Order 22.875**	**Rhode Island Restructuring Law**	**Vermont Proposed Restructuring Bill(s)**
Credit Trading	Sec. 24 provides for emissions credit and trading under the GPS developed by DEP.	MA DOER required to prepare feasibility report with Massachusetts Legislature on whether a renewable credit trading program is needed.	MPUC instructed to study a system of tradable credits, but implementation not mandated.	Not addressed	Not addressed	RPS will be tradable and the EPS may also be tradable
Government Procurement	Not addressed	The state will also conduct a feasibility report on the viability of requiring all electricity purchases of state agencies and facilities to include a minimum portfolio of ten percent renewable.	Not addressed	Not addressed	Not addressed	Not addressed
Other	Sec 32: requires the DPUC to monitor the retail market and take action to prevent unfair or deceptive trade practices, ant-competitive or discriminatory conduct, and the unlawful exercise of market power.	Any business purchasing electricity with a portfolio in excess of the minimum renewable portfolio standard will be entitled to a tax deduction equivalent to twenty-five percent of the above-market price (once renewable portfolio standard).	Not addressed	The order also denies all requests for a renewables commercialization program and for the imposition of additional environmental regulations for fossil fuel generation sources. In the order, it reaffirms the position that it took in the issuance of its restructuring plan that the establishment of emission standards should be left up to the DES and EPA.	Not addressed	

Summary of Regional Policies Specific to the Method of Tracking and Disclosure of Electricity Information							
	Connecticut	**Massachusetts**	**Maine**	**New Hampshire**	**Rhode Island**	**Vermont**	**NECPUC Model Rules**
Status	Passed April 28, 1998	Passed March 1998	Plans on utilizing NECPUC standards, plus collection of certain emissions data not required by NECPUC standards (mercury, radionuclides, and fine particulates). Emissions disclosure rulemaking underway. Will be subsumed into consumer information rulemaking starting in late 1998.	Plans on utilizing NECPUC and other submissions for basis of rulemaking to be conducted this year.	Plans on using NECPUC as the basis for its rule-making to be conducted this year.	Plans on using NECPUC as the basis for its rule-making to be conducted this year.	Issued March 3, 1998

Summary of Regional Policies Specific to the Method of Tracking and Disclosure of Electricity Information							
	Connecticut	**Massachusetts**	**Maine**	**New Hampshire**	**Rhode Island**	**Vermont**	**NECPUC Model Rules**
Disclosure Overview	The PUC will provide information about rates and charges provided by an electric supplier, applicable terms and conditions of a contract for services, the percentage of electricity derived from the outlined categories of energy sources, emission characteristics (including heavy metals) as well as estimates for unknown figures. There is a provision for the future establishment of uniform standards for the purposes of comparison by the consumer between air pollutant emission and resource mix.	Sec. 11.06:The table shall contain information on the fuel mix, emissions, and labor characteristics associated with a competitive supplier's company and product resource portfolio and the company resource portfolio used in standard offer or default service. Each competitive supplier must submit an annual report to the DTE including the determination of the company resource portfolio , any products, matching kWh from resources associated with retail load, and statement of verification from an independent auditor or the ISO.	Disclosure required of average prices during previous 6-month period. Must also disclose average duration of supply arrangements, whether or not prices are fixed or variable over a specified time period. Quantity of electricity supplied over the most recent 6-month period by type of generation mix (including but not limited to oil-fired, nuclear, hydro, coal, biomass or other renewable resources. Regional spot market purchases) and expected air emissions and a comparison to regional averages for NOx, SO2, mercury, fine particulate, radionuclides and CO2 over the most recent 6 month period.				Sec. II: Each load serving entity shall prepare an information label for each price offering. Such a label would be a condition for licensure for competitive suppliers.

Summary of Regional Policies Specific to the Method of Tracking and Disclosure of Electricity Information							
	Connecticut	**Massachusetts**	**Maine**	**New Hampshire**	**Rhode Island**	**Vermont**	**NECPUC Model Rules**
Fuel Characteristics	See renewable definition for possible criteria.	Sec. 11.06: The label shall include at least the following fuel sources: biomass, coal, small hydro, large hydro (greater than 30MW), municipal trash, natural gas, nuclear, oil, solar, wind, and other renewable resources (including fuel cells utilizing renewable fuel sources, landfill gas, and ocean thermal. Energy Storage Facilities. The fuel mix associated with an energy storage facility shall be the fuel mix of the energy used as input to the storage device. The characteristics disclosed shall include any losses as a result of storage.	Statements issued will indicate percentages of electricity supply over the most recent 6 month period under categories of generation (including but not limited to oil-fired, nuclear, hydro, coal, biomass or other renewable resources and regional spot market purchases).		See renewable definition for possible criteria.	See renewable definition for possible criteria.	Sec. II D 2: The label shall include at least the following fuel sources: biomass, coal, hydro, municipal solid waste, natural gas, nuclear, oil, solar, wind, and other renewable resources (including fuel cells utilizing renewable fuel sources, landfill gas, and ocean thermal. Energy Storage Facilities. The fuel mix associated with an energy storage facility shall be the fuel mix of the energy used as input to the storage device. The characteristics disclosed shall include any losses as a result of storage.
Fuel Reporting Period		Massachusetts Sec. 11.06:The resource portfolio shall be determined using market settlement data or equivalent data provided by the ISO. It shall be updated on a quarterly basis, and reported for the one-year period prior to the reporting quarter. If a LSE has operated for less than one year but more than three months, it shall report the information that is available. If a LSE has operated for less than three months, it shall report reasonable estimate of its known resources and average system mix.				NECPUC Sec. II D 1:The resource portfolio shall be determined using market settlement data or equivalent data provided by the ISO. It shall be updated on a quarterly basis, and reported for the one-year period prior to the reporting month. If a LSE has operated for less than one year but more than three months, it shall report the information that is available. If a LSE has operated for less than three months, it shall report reasonable estimate of its known resources and average system mix.	

Summary of Regional Policies Specific to the Method of Tracking and Disclosure of Electricity Information			
	Massachusetts		**NECPUC Model Rules**
Known Resources	Massachusetts Sec 11.06: On a monthly basis, the LSE shall determine the total kWh's that are associated with its Known Resources (unit entitlements or contracts that specify dedicated units), and subtract them from its total kWh's of loads served in that month. For the purpose of determining fuel mix, labor and emissions characteristics, kWh's from Known Resources shall be ascribed the characteristics of the associated generating units.		NECPUC Sec. II D 1: On a monthly basis, the LSE shall determine the total kWh's that are associated with its Known Resources (unit entitlements or contracts that specify dedicated units), and subtract them from its total kWh's of loads served in that month. For the purpose of determining fuel mix and emissions characteristics, kWh's from Known Resources shall be ascribed the characteristics of the associated generating units.
System Power	Massachusetts Sec. 11.06: All kWh's that are not associated with Known Resources shall be deemed System Power. For the purpose of determining fuel mix and emission kWh's from System Power, it shall be ascribed the characteristics of the residual system mix. The residual system mix shall be the mix of generating resources in New England net of Known Resources. Until such time as data are available on the residual system mix, system power shall be given the characteristics of the average regional mix.		NECPUC Sec. II D 1:All kWh's that are not associated with Known Resources shall be deemed System Power. For the purpose of determining fuel mix and emission kWh's from System Power, it shall be ascribed the characteristics of the residual system mix. The residual system mix shall be the mix of generating resources in New England net of Known Resources.
Emission Characteristics	Massachusetts Sec. 11.06: For the purposes of emission characteristics disclosure, at the following pollutants shall be separately identified on the label: CO2, NOx, and SOx. When the DEP determine that reliable and accurate information becomes available, heavy metals will be tracked and disclosed. The DTE in consultation with the DEP will determine whether additional pollutants should be disclosed.		NECPUC Sec. II D 3: For the purpose of emission characteristics disclosure, at least the following pollutants shall be separately identified on the label: CO2, NOx, and SOx.

Summary of Regional Policies Specific to the Method of Tracking and Disclosure of Electricity Information			
	Massachusetts		**NECPUC Model Rules**
Emission Calculations	Massachusetts Sec. 11.06: Emissions shall be computed as an annual emissions rate in pounds per kWh. For each emission category, the rate shall be presented as a percentage of the regional average and shall be compared to emissions from a new unit as determined in consultation with the DEP. Emission characteristics of the resource portfolio shall be calculated using annual emission rates for each generating facility as identified by the Commission in consultation with the DEP and the United States Environmental Protection Agency. Until such annual emission rates are identified by the Commission, the annual emissions rates for a generating unit shall be calculated based on one of the following: CEM Data for most recent year divided by generation for same period, emission factors approved by the state or EPA, and if the plant has been in operation for less than one year, the approved level for NOx and SOx, and the carbon content of the fuel for CO2. Energy storage facilities. The emissions associated with an energy storage facility shall be the emissions of the energy used as input to the storage device. The characteristics disclosed shall include any losses as a result of storage. Cogeneration facilities may make a reasonable allocation of emissions between electricity production and other useful output based on measured heat balances. Said allocation shall be reviewed in consultation with the DEP. The use of offsets associated with facilities that emit CO2 shall be as determined by the DEP.		NECPUC Sec. II D 3: Emissions for each emission category shall be computed as an annual emission rate in pounds per kWh. For each emission category, the emission rate of the resource portfolio shall be compared to a reference emission rate. The reference emission rate shall be the New England regional average emission rate. Emission characteristics of the resource portfolio shall be calculated using annual emission rates for each generating facility as identified by the Commission in consultation with the State Air-Quality Agency and the United States Environmental Protection Agency. Until such annual emission rates are identified by the Commission, the annual emissions rates for a generating unit shall be calculated based on one of the following: CEM Data for most recent year divided by generation for same period, emission factors approved by the state or EPA, and if the plant has been in operation for less than one year, the approved level for NOx and SOx, and the carbon content of the fuel for CO2. Energy storage facilities. The emissions associated with an energy storage facility shall be the emissions of the energy used as input to the storage device. The characteristics disclosed shall include any losses as a result of storage. Cogeneration facilities may make a reasonable allocation of emissions between electricity production and other useful output based on measured heat balances. The Commission, in consultation with the State Air-Quality Agency shall review said allocation. The use of offsets associated with facilities that emit CO2 shall be as determined by the Commission, in consultation with the State Air-Quality Agency.
Emissions Reporting Period	See calculations		See calculations

Summary of Regional Policies Specific to the Method of Tracking and Disclosure of Electricity Information							
	Connecticut	**Massachusetts**	**Maine**	**New Hampshire**	**Rhode Island**	**Vermont**	**NECPUC Model Rules**
Imports		Massachusetts Sec. 11.06: All imports shall be called imports for disclosure purposes. For the purpose of disclosing emissions, imports shall be ascribed representative emissions rates as determined in consultation with the DEP. Until such rates are determined, imports shall be ascribed the same characteristics as system power.				NECPUC Sec. II D 1:Until adjacent regions develop compatible disclosure policies, a LSE's total imports to New England will be listed as a separate fuel source. For the purpose of determining emissions characteristics, imports shall be ascribed the characteristics of the exporting system's mix.	
Company and Product Disclosure		Massachusetts Sec. 11.06A competitive supplier may disaggregate its company resource portfolio into products if its products are verified by the ISO, or prior to March 1, 1999 by an independent auditor, and the competitive supplier provided an annual statement form the auditor stating that the kWh form resources associated with each product resource mix are not less than the total obligation associated with retail load assigned to such product.				NECPUC Sec. II D 1: If a LSE seeks to disaggregate its resource portfolio pursuant to this rule and make assignments and provide differentiated labels to particular customer groups, it shall be required to demonstrate that its disaggregation is based on data that can be verified.	
Other		Massachusetts Sec. 11.06: Competitive suppliers with known resources shall be required to determine whether a majority of employees at each known plant are employed under collective bargaining agreements, and if such plants experienced a labor dispute in the most recent calendar year, whether any replacement workers were hired. System power shall be based on the use of replacement labor. The labor data on the label shall be based on a kWh-weighted average for all system power and known resources.					

Appendix B:
Equations for Tracking Electricity Transactions:

Here we describe a set of equations for tracking environmental attributes of electricity from generator to point of retail sale. This tracking system can be used to support a disclosure policy or a portfolio standard. The approach taken here involves two stages. The first stage is determining the resource mix or generating unit mix associated with each company's sales (both retail and wholesale). The second stage then applies the environmental characteristics of the associated generating units to mix.

Each company's transactions involving specific, known generating units[71] should be allocated from the selling company to the buying company *before* the calculations described here are performed. Then, the equations presented here can be used to track responsibility for "system transactions"—those sales from one company to another which are not associated with particular generating units. It is the resource mix *after* accounting for unit transactions that is used for the tracking system proposed here. Note, again, that pool transactions act like a system mixture of unit transactions.

Step One - Uniform Resource Allocations

Energy sales from a company, whether wholesale or retail, represent the same resource characteristics. Such sales are characterized by normalized resource mix vectors whose elements represent the individual resource contributions.

Calculated results - Resource coefficients:

$R_{C,g}$ Fractional contribution from generator g for company c sales (dimensionless)

Normalized $\Sigma_g R_{C,g} = 1$ for all c (company vector $\mathbf{R}_C$ = [g1, g2, g3, …])

Variables for which we have data available:

$S_{g,c}$ Sales from generator g to company c (kWh)

$W_{C,d}$ System sales from company c to company d (kWh)

R_g Generator resource coefficient (1 by definition)

Intermediate variables:

P_g Production from generating facility g (kWh)

S_C Total sales for company c (kWh)

subscripts:

g Generating facility

c,d Wholesale and Distribution companies (including power pools).

---

[71] The issue of what contracts should qualify for "unit" status, thereby carrying the attributes of the individual generator rather than the selling company's mix, is an important one. For purposes of this Appendix, however, we assume that a sorting of contracts into "unit" and "system" categories can be made based upon a set of agreed-upon criteria.

Generation

$$P_g = \Sigma_c \; S_{g,c}$$

Company Total sales (equals all inputs).

$$S_c = \Sigma_g \; S_{g,c} \; + \; \Sigma_d \; W_{d,c}$$

We then apply balance equations for calculating the resource factors. Note that $R_{c,g}$ is based on total company sales.

$$S_c \; R_{c,g} = S_{g,c} \; (R_g=1) + \; \Sigma_d \; W_{d,c} \; R_{d,g} \qquad \text{(for all c and g)}$$

There will be a separate set of equations for each resource g. Each set will contain as many non-zero equations as companies that directly or indirectly use that resource.

Another way of expressing the resource coefficient is as a ratio of total company sales:

$$R_{c,g} = [\; S_{g,c} + \; \Sigma_d \; W_{d,c} \; R_{d,g} \;] \; / \; S_c$$

Step Two - Environmental Impacts

From Step One we have the resource contributions for each company's sales $R_{c,g}$

We now just need to apply the appropriate environmental coefficients from the resources.

Environmental data:

$E_{g,e}$ Emission factor of type e for generating facility g (physical units per kWh)
These coefficients can also be used to represent fuel mix for fuel type e.

Company sales average environmental factors are the weighted mix of the generators.

$$E_{c,e} \; = \; \Sigma_g \; R_{c,g} \; E_{g,e} \qquad \text{(for all c and e).}$$

Including Losses

The previous equations did not account for losses from resource to use.

In the simple case of a uniform loss factor for the entire system under analysis, the environmental coefficients are simply adjusted by multiplying by the inverse of the efficiency. E.g., a 5% loss corresponds to a 95% efficiency, the inverse of which is 1.053.

For more complex situations where different pathways have different loss factors or one of the resources represents pumped storage, then we would need to introduce a second set of resource coefficients. The basic set as used previously represents the net energy flows after losses, and a second set would represent the energy inputs before losses (called $R'_{c,g}$).

The environmental emissions are based on the inputs[72].

$E_{c,e} = \Sigma_g (R'_{c,g} / R_{c,g}) E_{g,e}$ (for all c and e).

Calculating these two sets of resource coefficients values would require two sets of balancing equations. Note that the ratio of the two types coefficients for any resource represents the ratio between the energy produced and the energy delivered.

However, given the fact that it is very difficult to determine actual physical flows on a transmission system, and the inherent ambiguity in determining such flows, it is probably sufficient for disclosure purposes to use average system losses for most purposes.

Revised Equations with Losses

New terms:

$L_{g,c}$ Loss factor associated with generator transfers from g to c (dimensionless)

$L_{c,d}$ Loss factor associated with company transfers from c to d (dimensionless)

$S_{g,c}$ and $W_{c,d}$ represent the energy sales prior to losses

Generation

$$P_g = \Sigma_c S_{g,c}$$

Company Total sales

$$S_c = \Sigma_g (1-L_{g,c}) S_{g,c} + \Sigma_d (1-L_{c,d}) W_{d,c}$$

We then have two sets of coefficients and balance equations based on net and total energy which need to be solved for $R_{c,g}$ and $R'_{c,g}$.

$S_c R_{c,g} = (1-L_{g,c}) S_{g,c} + \Sigma_d (1-L_{c,d}) W_{d,c} R_{d,g}$ (for all c, g)

$S_c R'_{c,g} = S_{g,c} + \Sigma_d W_{d,c} R'_{d,g}$

The resulting environmental calculations are as described before:

$E_{c,e} = \Sigma_g (R'_{c,g} / R_{c,g}) E_{g,e}$ (for all c and e).

[72] Although it is appropriate to weigh physical effects (e.g. lbs/MWh) this way, descriptive coefficients such as fuel mix (e.g. % from coal) might be better represented in their unweighted (or renormalized) form.

The practice for losses in New England is to assign specific loss factors to external transactions. Other losses are determined and then allocated to participants proportional to load.

Extensions

Power Pool

A power pool for tracking purposes is a "company" which only buys and sells to other companies. It typically represents the balance of energy flows within the system. The mix of generation for sales out of the pool would be the average mix of what is sold to the pool.

Pumped Storage

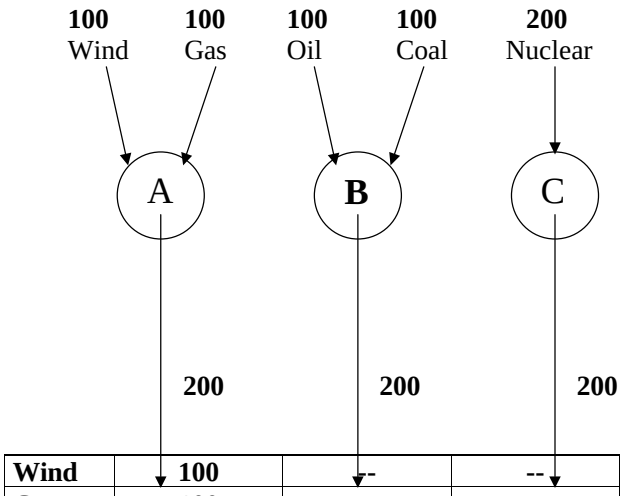
A pumped storage unit can be handled as a "company" which buys in some periods and sells in others. It maintains a history of the resource mix of the purchased power, and its subsequent sales reflect this input. The efficiency of the pumping operation is handled as another loss factor.

External Transactions

These represent imports or exports from companies not in the control area. They could be with individual companies or with the pool as a whole. The resource mix coefficient would follow the same rules as for internal resources. However identifying specific loss factors and environmental coefficients for imports would require additional information from outside the system.

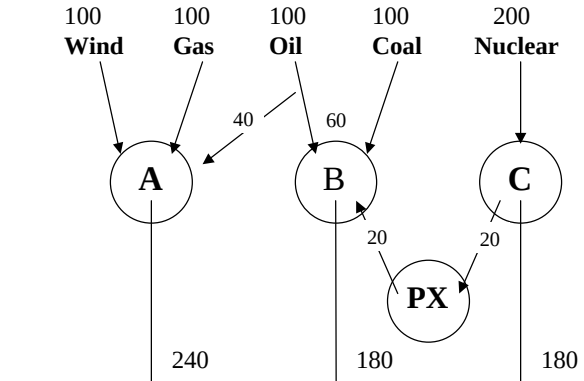
Appendix C:
Tracking Examples

1. No Wholesale Market



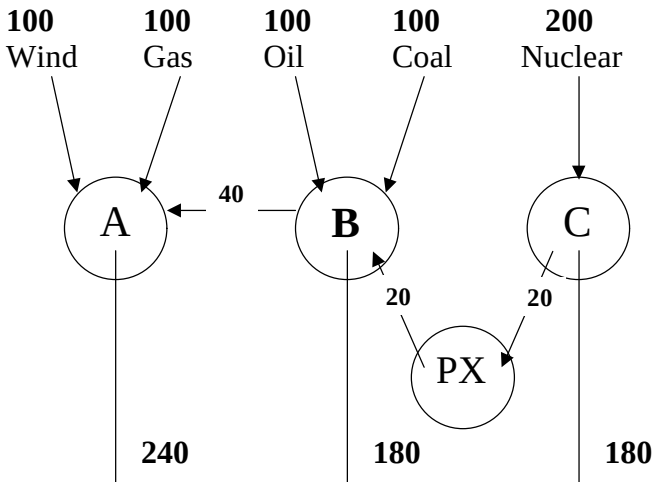
Wind	**100**	**--**	**--**
Gas	**100**	**--**	**--**
Oil	**--**	**100**	**--**
Coal	**--**	**100**	**--**
Nuclear	**--**	**--**	**200**

2. Unit Transaction



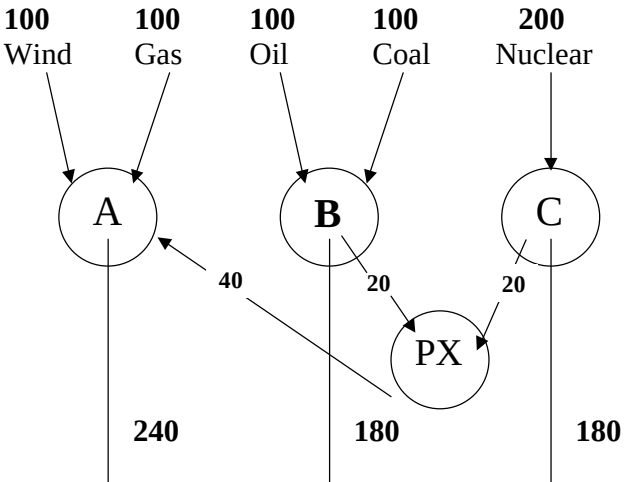
Wind	100	--	--
Gas	100	--	--
Oil	40	60	--
Coal	--	100	--
Nuclear	--	20	180

3. System Transaction



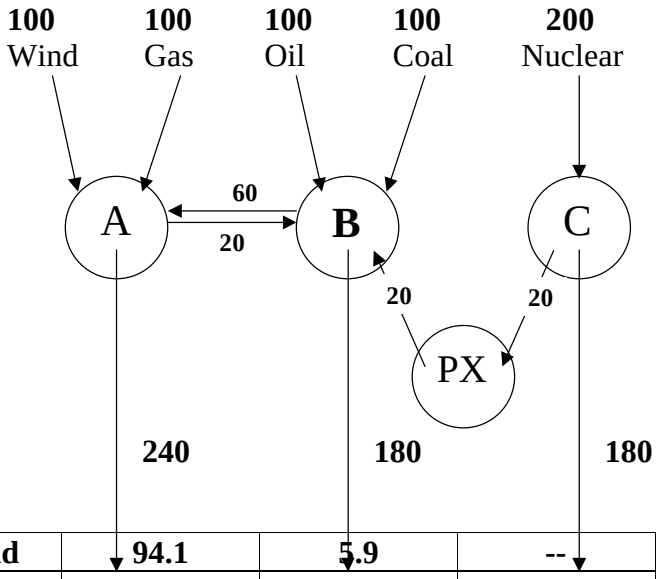
Wind	**100.0**	**--**	**--**
Gas	**100.0**	**--**	**--**
Oil	**18.2**	**81.8**	**--**
Coal	**18.2**	**81.8**	**--**
Nuclear	**3.6**	**16.4**	**180.0**

4. Pool Transaction



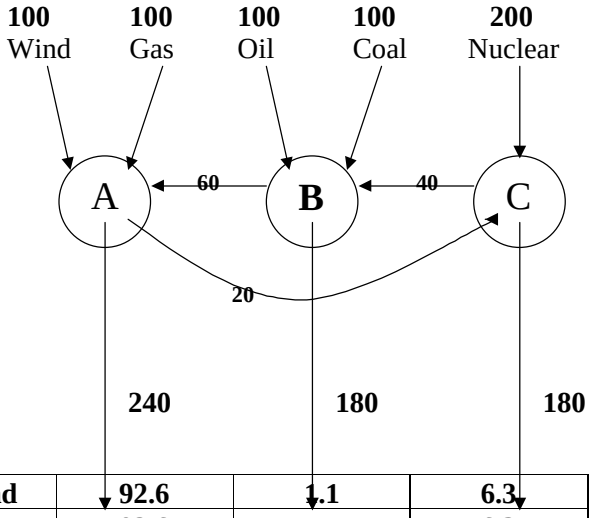
Wind	**100**	**--**	**--**
Gas	**100**	**--**	**--**
Oil	**10**	**90**	**--**
Coal	**10**	**90**	**--**
Nuclear	**20**	**--**	**180**

5. Two-Way System Transaction



Wind	**94.1**	**5.9**	**--**
Gas	**94.1**	**5.9**	**--**
Oil	**23.5**	**76.5**	**--**
Coal	**23.5**	**76.5**	**--**
Nuclear	**4.7**	**15.3**	**180**

6. Loop



Wind	**92.6**	**1.1**	**6.3**
Gas	**92.6**	**1.1**	**6.3**
Oil	**23.2**	**75.3**	**1.6**
Coal	**23.2**	**75.3**	**1.6**
Nuclear	**8.4**	**27.4**	**164.2**

Appendix D:
Overview of EPA CEMS Data Collection (Acid Rain Program)

Memo

To: NEGC/EPA New England Tracking System (NETS)

From: Ernest J. Bouffard, CT DEP

CC: Chris James

Date: 4/1/98

Re: Continuous Emissions Monitoring Data Streams Output from the Acid Rain Program

Executive Summary:

Title I of the Clean Air Act Amendments of 1990 provides the legal basis for regulating non-attainment pollutants. Based on a pervasive, long-term problem, that of attaining the NAAQS for Ozone, Title I created the Ozone Transport Commission (OTC). The OTC consists of states of the northeast corridor. It was charged with attainment planning, in terms of ozone transport, for the region. A Memorandum of Understanding (MOU) was adopted among the majority of states of the Ozone Transport Commission in September of 1994. Also as a result of Title I, In 1991the National Academy of Sciences released a study that concluded that significant reductions of ground-level nitrogen oxides (NOx) and volatile organic compounds (VOCs) {ozone precursors, and surrogates} were necessary in the entire ozone transport region. This initial assessment, by the National Academy, was followed by a detailed modeling process, which simulated ozone production in the transport region. The modeling confirmed that NOx reductions are effective in reducing ozone transport. The states of the OTC implemented a program to require Reasonably Available Control Technology (RACT) for the control of NOx emissions that were submitted in the States'1994 SIP revisions. These measures were insufficient to reach attainment with the ozone standard. The States sought to develop an effective regional program to reduce NOx emissions and other ozone precursors. Survey of available inventory data shows that large [utility or industrial] boilers and large indirect heat exchangers are the source of a substantial portion of the stationary source NOx emissions. The States agreed to propose regulations that will affect these sources in 2003. Furthermore, they agreed to establish a credible emissions budget within the region. The budget will provide NOx emissions allowances on a cap and trade basis, and will take into account efficiency and will have provisions for region wide trading. As a result, States in the region have agreed to reduce emissions by 55 to 75% of 1990 baseline levels.

Such sources are also regulated under the Acid Rain, or Title III of the Clean Air Act Amendments of 1990. Fossil fuel fired Electric generating units of 25 MW and larger are subject to the provisions of the Acid Rain Rule as embodied in the 40CFR75 *et seq*. The requirements are that sources must monitor oxides of sulfur, [SOX], nitrogen oxides [NOX], AND Carbon dioxide [CO2]. The instrumental method or monitoring technique for each respective pollutant is more fully described in the following appendix. The program includes the ability to trade allowances; therefore, the monitoring method chosen must be accurate. As such, there are included within the program provisions for quality assurance, quality control and calibration requirements. The data output from a monitored source is reported quarterly to EPA, the data is reviewed and approximately 60 days later is posted on the EPA Acid Rain Web site address: http://www.epa.gov/acidrain/edata.html. For our purposes, the summary data exists in reports by state, which summarize annual cumulative data for emissions in units of tons of SOX and CO2, cumulative heat Input, and an average emission rate for NOX. The two latter data elements allow calculation of tons of NOX per year.

For the purposes of supporting an explanation of the Acid Rain Program, I thought it would be easiest to use EPA's provided information from their acid Rain Program Web site.

Program Overview

The overall goal of the Acid Rain Program is to achieve significant environmental and public health benefits through reductions in emissions of sulfur dioxide (SO2) and nitrogen oxides (NOX), the primary causes of acid rain. To achieve this goal at the lowest cost to society, the program employs both traditional and innovative, market-based approaches for controlling air pollution. In addition, the program encourages energy efficiency and pollution prevention.

Title IV of the Clean Air Act sets as its primary goal the reduction of annual SO2 emissions by 10 million tons below 1980 levels. To achieve these reductions, the law requires a two-phase tightening of the restrictions placed on fossil fuel-fired power plants.

Phase I began in 1995 and affects 263 units at 110 mostly coal-burning electric utility plants located in 21 eastern and Midwestern states. An additional 182 units joined Phase I of the program as substitution or compensating units, bringing the total of Phase I affected units to 445. Emissions data indicate that 1995 SO2 emissions at these units nationwide were reduced by almost 40% below their required level.

Phase II, which begins in the year 2000, tightens the annual emissions limits imposed on these large, higher emitting plants and also sets restrictions on smaller, cleaner plants fired by coal, oil, and gas, encompassing over 2,000 units in all. The program affects existing utility units serving generators with an output capacity of greater than 25 megawatts and all new utility units.
The Act also calls for a 2 million ton reduction in NOx emissions by the year 2000. A significant portion of this reduction will be achieved by coal-fired utility boilers that will be required to install low NOx burner technologies and to meet new emissions standards.

Continuous Emissions Monitoring Fact Sheet

Continuous emissions monitoring (CEM) is instrumental in ensuring that the mandated reductions of SO2 and NOx are achieved. While traditional emissions limitation programs have required facilities to meet specific emissions rates, the Acid Rain Program requires an accounting of each ton of emissions from each regulated unit. Compliance is then determined through a direct comparison of total annual SO2 emissions reported by CEM and allowances held for the unit.

CEM is the continuous measurement of pollutants emitted into the atmosphere in exhaust gases from combustion or industrial processes. EPA has established requirements for the continuous monitoring of SO2, volumetric flow, NOx, diluent gas, and opacity for units regulated under the Acid Rain Program. In addition, procedures for monitoring or estimating carbon dioxide (CO2) are specified. The CEM rule also contains requirements for equipment performance specifications, certification procedures, and record keeping and reporting.

Frequently Asked Questions About CEM

Why is CEM Necessary?

The Acid Rain Program uses a market-based approach to reduce SO2 emissions in a cost-effective manner. (One allowance is an authorization to emit 1 ton of SO2 during or after a specified calendar year; a utility may buy, sell, or hold allowances as part of its compliance strategy.) Complete and accurate emissions data are key to implementing this market-based approach.

An essential feature of smoothly operating markets is a method for measuring the commodity being traded. The CEM data will supply the gold standard to back up the paper currency of emissions allowances. The CEM requirements, therefore, will instill confidence in the market-based approach by verifying the existence and value of the traded allowance.
What Are the Monitoring Requirements?

The owner or operator of a unit regulated under the Acid Rain Program must install CEM systems on the unit unless otherwise specified in the regulation. CEM systems include:

An SO2 pollutant concentration monitor.
A NOx pollutant concentration monitor.
A volumetric flow monitor.
An opacity monitor.

A diluent gas (O2 or CO2) monitor.
A computer-based data acquisition and handling system (DAHS) for recording and performing calculations with the data.

Table 1 summarizes the CEM requirements. In all cases, a data acquisition and handling system must be used to collect and report the data.

To monitor SO2 emissions in pounds per hour using a CEM system, a facility must use both an SO2 pollutant concentration monitor and a volumetric flow monitor.

For NOx, both a NOx pollutant concentration monitor and a diluent gas monitor are required to calculate an emissions rate in pounds per million British thermal units (lbs./mmBtu).

Opacity monitoring, which measures the percentage of light that can be seen through flue gas, requires only an opacity monitor.

The rule does not require a utility to use a CEM system to measure CO2. If a utility chooses to use a CEM system, however, a CO2 or oxygen monitor plus a flow monitor would be used to compute emissions in tons per hour.

All CEM systems must be in continuous operation and must be able to sample, analyze, and record data at least every 15 minutes. All emissions and flow data will be reduced to 1-hour averages. The rule specifies procedures for converting the hourly emissions data into the appropriate units of measure.

Table 1: CEM Monitor Components

CEM Table 1:
Monitor Components for Acid Rain Regulations

Monitoring Requirement (units required)	Required CEM Monitoring Component					
	SO2	NOx	Flow	Opacity	Diluent Gas	Data Handling
SO2(lbs/hr)	**Yes**		**Yes**			**Yes**
NOx(lbs/mmBtu)*		**Yes**			**Yes**	**Yes**
Opacity(%)				**Yes**		**Yes**
CO2(lbs/hr)**			**Yes**		**Yes**	**Yes**

***Heat input in mm/Btu/hr is also required**
****Alternative methods may be used to monitor CO2**

To Whom Do These Requirements Apply?

All units over 25 megawatts and new units under 25 megawatts that use fuel with a sulfur content greater than .05 percent by weight are required to measure and report emissions under the Acid Rain Program. The new units under 25 megawatts using clean fuels are required to certify their eligibility for an exemption every five years. A unit that formally committed to retirement before December 31, 1994 is exempt from the requirements of the rule. The following is a summary of monitoring method requirements and options:

All existing coal-fired units serving a generator greater than 25 megawatts and all new coal units must use CEMs for SO2, NOx, flow, and opacity.

Units burning natural gas may determine SO2 mass emissions by: (1) measuring heat input with a gas flowmeter and using a default emission rate; or (2) sampling and analyzing gas daily for sulfur and using the volume of gas combusted; or (3) using CEMs.

Units burning oil may monitor SO2 mass emissions by one of the following methods:

1. daily manual oil sampling and analysis plus oil flow meter (to continuously monitor oil usage)
2. sampling and analysis of diesel fuel oil as-delivered plus oil flow meter
3. automatic continuous oil sampling plus oil flow meter
4. SO2 and flow CEMs.

Gas-fired and oil-fired base-loaded units must use NOx CEMs.

Gas-fired peaking units and oil-fired peaking units may either estimate NOx emissions by using site-specific emission correlation and periodic stack testing to verify continued representativeness of the correlation, or use NOx CEMS. The emission correlation method has been significantly streamlined in the revised rule.

All gas-fired units using natural gas for at least 90 percent of their annual heat input and units burning diesel fuel oil are exempt from opacity monitoring.

For CO2 all units can use either (1) a mass balance estimation, or (2) CO2 CEMs, or (3) O2 CEMs in order to estimate CO2 emissions.

If a unit's operation or fuel use changes so that excepted monitoring methods no longer apply, the unit would become subject to CEMS monitoring requirements in the following calendar year.

Appendix

What Are the Certification Requirements?

The Acid Rain Program requires the following performance certification tests for CEM systems:

A 7-day calibration error test for each monitor.

A linearity check for each pollutant concentration monitor.

A relative accuracy test audit (RATA) for each monitor.

A bias test for each SO2 pollutant concentration monitor, flow monitor, and the NOx CEM system.

A cycle time test for each pollutant concentration monitor.

A daily interference test for flow monitors.

An accuracy test is required for fuel flowmeters. Stack tests are required for a NOx emission correlation for gas- and oil-fired peaking units. For all monitoring methods, the DAHS must be tested.

EPA must certify the CEM system (CEMS) before it can be used in the Acid Rain Program. To obtain certification, the owner or operator of a unit must conduct certification tests and submit the results to the EPA and the appropriate State agency.

EPA will issue a notice approving or disapproving the request for certification within 120 days after receiving a complete certification application. If the proposed system is disapproved, the owner or operator must revise the equipment, procedures, or methods as necessary and resubmit a request for certification.

What Are the Deadlines for Compliance?

All required equipment must be installed, certified, and operational by the dates in Table 3.

How Will Emissions Be Calculated for Periods of Missing Data?

The CEM rule contains procedures for filling in data when no valid hour or hours of data have been recorded by a monitor or monitoring system. The rule uses a conservative approach to substitute for missing data. This methodology offers an incentive to keep monitor down-time to a minimum, giving the most accurate and reliable results. The procedures for SO2, NOx, and flow are summarized in Table 2. The recently revised regulation also clarifies missing data procedures for CO2, heat input, and fuel flow.
Table 2: Substitution Criteria for CEM Missing Data Periods

CEM Table 2:
Substitution Criteria for CEM Missing Data Periods

Annual Availability (%) of Monitor or System*	Number of Hours Missing (N)	Value Substituted for Each Missing Hour
Greater than or equal to 95%	**N is less than or equal to 24 hours**	**Average of the hours recorded before and after missing period**
	N is greater than 24 hours	**90th percentile value recorded in the previous 30** days of service or the before/after value, whichever is greater**

Less than 95% but greater than or equal to 90%	**N is less than or equal to 8 hours** **N is greater than 8 hours**	**Average of the hours recorded before and after missing period** **95th percentile value recorded in the previous 30** days of service or the before/after value, whichever is greater**
Less than 90%	**N is greater than 0 hours**	**Maximum value recorded in previous 30** days of service**

***SO2 and flow monitors are individually evaluated for missing data. For NOx monitoring, the monitor system NOx pollutant concentration monitor and diluent gas monitor are considered in combination. NOx and flow monitoring data is correlated to unit electrical output (load) before selecting the percentile values.**

****NOx CEM systems and flow monitors review the previous 90 days of service.**

Table 3: CEM Rule Certification Deadlines

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CEM Table 3:
Rule Certification Deadlines

CEM Rule Certification Deadlines

Type of Unit	Certification Testing Deadline
Phase I	**11/15/93**
Phase II (except for NOx/CO2 at oil and gas-fired units	**1/1/95**
Phase II oil and gas-fired in ozone non-attainment areas	**7/1/95 for NOx and CO2 only**
Other Phase II oil and gas-fired (not in ozone nonattainment area)	**1/1/96 for NOx and CO2 only**
New units	**90 days after commercial operation**
Units with new stack	**90 days after sending emissions through new stack**
Units shutdown on original	**earlier of: 45 unit operating days or**

deadline	**180 days after recommencing commercial operation**
Emergency fuel for gas and oil-fired units	**30 unit operating days after using emergency fuel**
Backup fuel for gas & oil-fired units (App. E only)	**later of: 30 unit operating days after using backup fuel after testing primary fuel or NOx monitoring deadline for gas and oil units**

What Quality Assurance/Quality Control Procedures Are Required?

The operator must perform periodic performance evaluations of the equipment, including daily calibration error tests, daily interference tests for flow monitors, and semi-annual (or annual) RATA and bias tests.

The owner or operator must develop and implement a written quality assurance/quality control plan for each system. The quality control plan must include complete, step-by-step procedures and operations for calibration checks, calibration adjustments, preventive maintenance, audits, and record-keeping and reporting. The quality assurance plan must include procedures for conducting periodic performance tests.

What Are the Record keeping and Reporting Requirements?

The CEM rule includes requirements for notification, record keeping, and reporting for the Acid Rain Program, such as:

Submission of monitoring plans.
Written notifications of monitor certification tests.
Report of certification test results in a "certification application".
Recording and maintaining of hourly emissions data, flow data, and other information.
Quarterly reports of emissions, flow, unit operation, and monitoring performance data.

The owner or operator also must report the data in a standard electronic format available through the Acid Rain Hotline. EPA will use this information to determine compliance with the emissions reductions mandated by the Clean Air Act. Most new record keeping and reporting requirements under the revised rule are optional through December 31, 1995 and are mandatory beginning January 1, 1996.

http://www.epa.gov/acidrain/cems/cemlng.html
Updated March 1997

Appendix E:
National Pollution Prevention in Permitting Pilot Project (P-4 Project)
Emissions Collection Hierarchy

i) If data is available, required, or warranted from continuous monitoring equipment which is installed, operated, and certified in accordance with a permit, order, or regulation issued or administered by the State Air Quality Agency or a designated third party administrator, such data shall be used to determine the rate of emissions;

ii) If such continuous monitoring data is unavailable but stack testing data is available, required, or warranted such testing data shall be used to determine the rate of emissions, provided such testing was conducted in accordance with the procedures contained in 40 CFR 51 Appendices M and P, 40 CFR 60 Appendices A and F, 40 CFR 61 Appendices B and C, or 40 CFR 63 Appendices A and C, or approved by a administrator; or

iii) If such stack testing is unavailable, the rate of emissions shall be calculated using data supplied by the manufacturer of the subject emissions unit, which data was derived from EPA approved emissions testing of such unit or similar unit performed by the manufacturer; or

iv) If such manufacturer's data is unavailable, the emissions rate shall be calculated using data derived from an analysis of pertinent material balances conducted by an individual with appropriate knowledge of the subject process where the emissions unit can be accurately monitored using a material balance; or

v) If data from such a material balance analysis is unavailable, the emissions rate shall be calculated using data from "Compilation of Air Pollutant Emission Factors (AP-42)" published by EPA where there is an emission factor appropriate for the emission source; or

vi) If data from the above methods is unavailable or inappropriate, the emissions rate shall be calculated in accordance with a proposal submitted by the company or a designated third party administrator and approved by the state air quality agency in writing.

Source: Ernest Bouffard, CT DEP

Appendix F:
EPA and State-by-State Emissions Data Collection for Title V

State or Federal Agency	Contact	Pollutants Reported	Reporting Thresholds *	Relevant Statutes	Station Submittal Deadline**	Date Processed by Agency	Format
US-EPA, Region 1	Donald Dahl: 617-565-4298	Criteria Pollutants***	100tpy - PM10, SOx, 50 ypy - VOC, NOx (except in SW CT where the threshold is 25 tpy); 1000tpy - CO; 5tpy - Lead	40 CFR 51.320-323 -requires submittal of emisions from all 50 states to EPA for sources which exceed any of the thresholds		September, but not all states are up to date in their submissions	AIRS database
CT-DEP	Bill Simpson: 860-424-3419	Criteria Pollutants***	25tpy - SO_2, PM10, CO, Lead; 10tpy - VOC/NOx; Or "Major Source" (as defined as being located in serious non-attainment area and having high "potential emissions")	Sec. 182A3b of CAA; Sec. 22A-174-4C1 of Regulation of Con. State Agencies	April 1	Early June	"Access-like" database
MA-DEP ****	Bob Boisselle: 617-292-5609	Criteria Pollutants***	2tpy - PM10, 2.5 tpy - SOx, 10 tpy - VOC, 4.5 tpy - NOx, 50 tpy - CO	M.G.L.C. III, 142A through 142J	March 1	Late July/Early August	excel
ME-DEP	Jeanne Locke: 207-287-7022	Criteria Pollutants***	100tpy - CO; 40tpy - SO_2; 25tpy - NOx, VOCs; 15 tpy - PM10; .1tpy - Lead	Title 38; Chapters 115, 137,140 of ME-DEP rules	September 1	"whenever they can"; currently about a year and a half behind	.dbf files
NH-DES	Sonny Strickland: 603-271-6283	Particulates, PM10, SO_2, NOx, VOC, CO, HCl	Every emission currently has to be reported, but they are considering implement a 5tpy or 10tpy threshold in the future.	Chapter 900 of NH-DES rules	Reports for Nox/VOC must be presented by April 15th; Reports for all other emissions due October 15	October 15 of year following when reports are due	ascii
RI-DEM	Karen Slattery: 401-222-2808 ext.7030	Do not directly report emissions, just report any fuel or VOC	All entities using fuel or emitting "hazardous air pollutants" at a rate greater than 100 lbs/yr	APC #14	Approximately March	Approximately end of December	"Focus" database; can be transferred to most database formats
VT-ANR*****	Dan Riley: 802-241-3840	NOx, VOC, TO, TSP, SO_2, CO, PM, Hydrocarbons	Facilities emitting more than 5 tons per year in total air pollutants	10 V.S.A. 555© and Subchapter VIII/5-801 through 5-808 of the VT Air Pollution Control Regulations	March 1	March 30	ascii

* All states except Rhode Island and New Hampshire will accept data from any collection source but have a hierarchy of CEM, stack-test, manufacturers information and, as a final preference, AP42. Rhode Island uses CEM from large sources, but converts fuel usage into pollutants via AP42 for all other sources. New Hampshire does not accept manufacturer information.

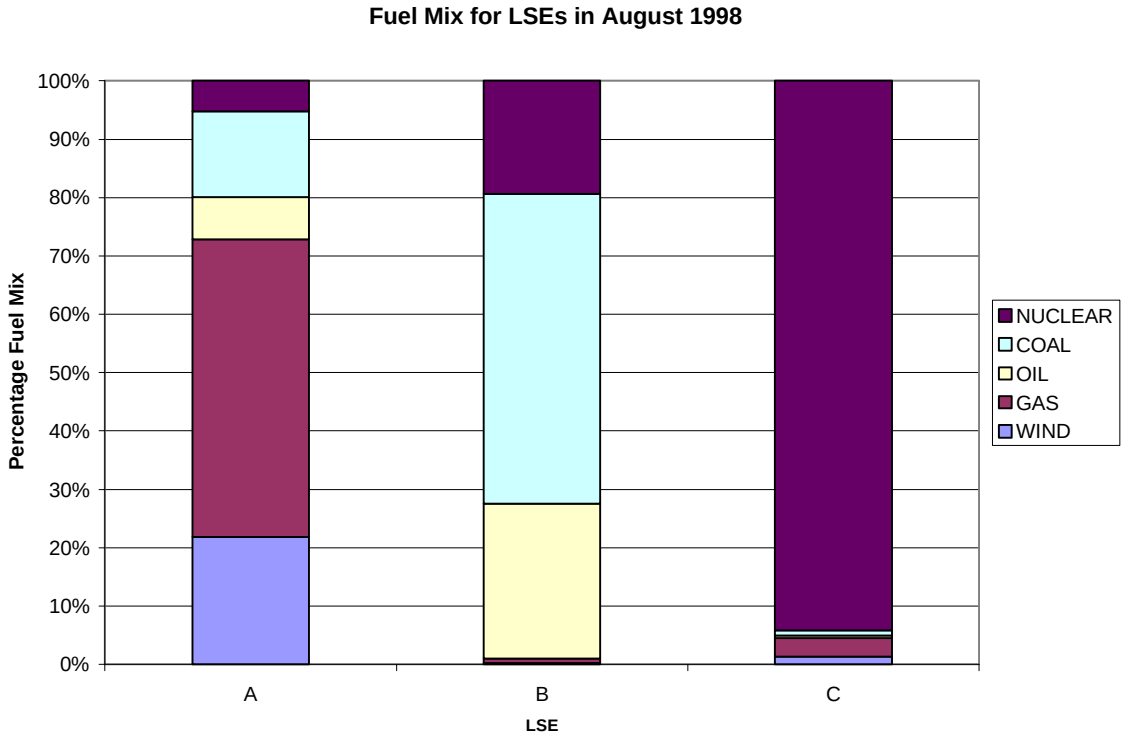
** All data is collected annually, based on the calendar year.

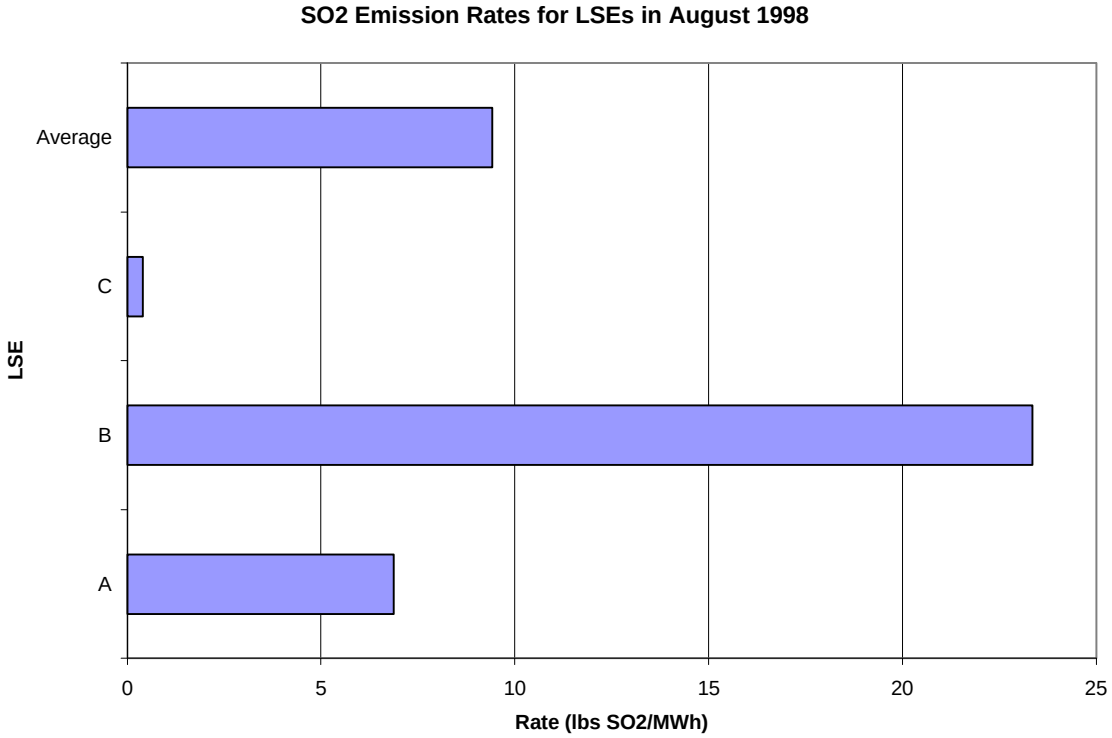
*** Criteria pollutants are: SOx, NOx, PM10, VOC, CO and Lead.

**** In Massachusetts, fee structure is not solely based on emissions. Rather for "major sources" (above EPA criteria threshold) a formula which includes actual emissions and potential controlled and uncontrolled emissions determines the fees. For "minor sources", there are three categories of fees, based on potential emissions as a percentage of threshold levels (contact:Jay Eberly 617-556-1067).

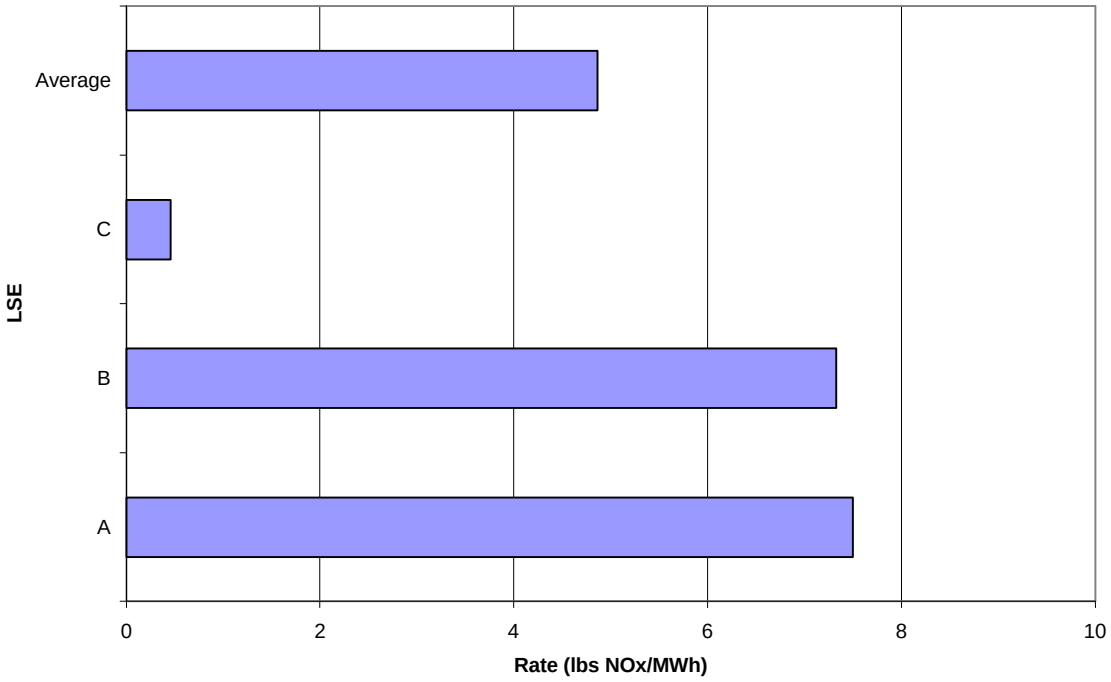
***** In Vermont, fees are not solely based on actual emissions. Facilities emitting 5 to 10 tons of all non-hazardous contaminants (SO_2, PM, CO, NOx and hydrocarbons) are charged based on actual emissions while facilities emitting more than 10 tons of all non-hazardous contaminants are charged a base fee plus a fee for each ton released. For hazardous contaminants, fees are based on actual emissions of pollutants as well as on annual amount of fuel type burned.

Appendix G:
Assignment of Attributes

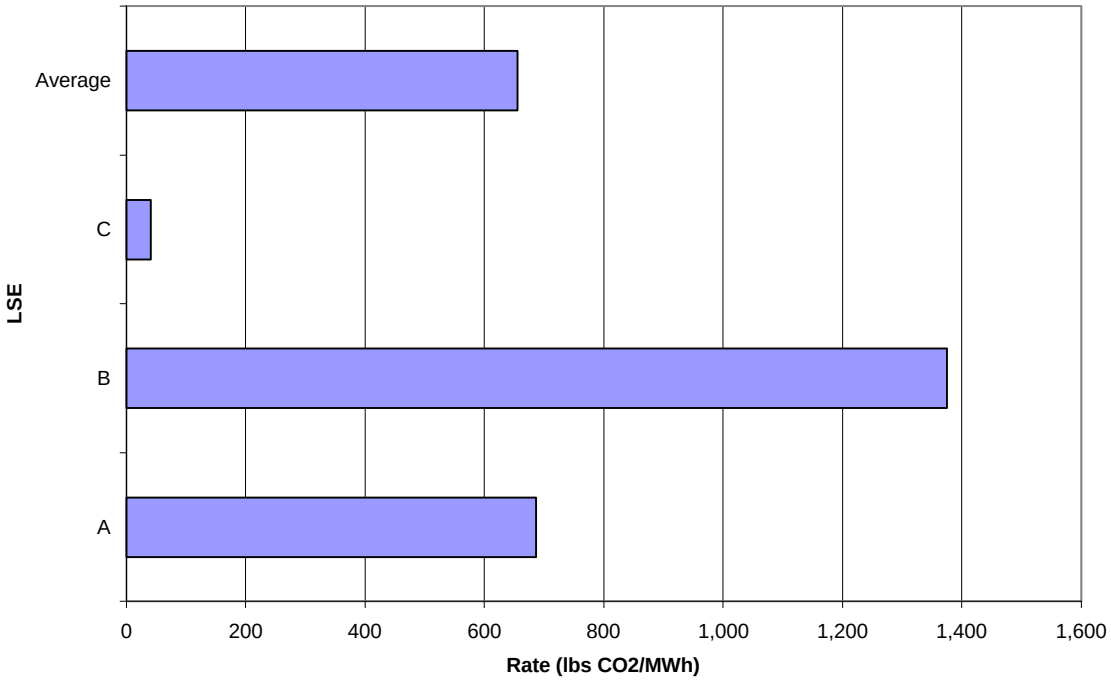




NOx Emission Rates for LSEs in August 1998



CO2 Emission Rates for LSEs in August 1998



Appendix H:
Computational Requirements and Cost Estimate

1. Computational Requirements

The following is a general analysis of the computer resources required to calculate the average sales emission factors.

Assumptions
Calculations performed on an hour by hour basis.
Each hour is independent except for carry over of pumped storage energy.
Number of companies (producer and retail): 100+
Number of generators: 400
Wholesale transactions: 1,000
Environmental categories: 10

Input Data
Generation: 400
Wholesale transactions: 1,000
Loss factors: 1,100
Generation emission factors: 4,000

Output Data
Company resource coefficients: 4,000
Company emission factors: 1,000

Computational Requirements
Calculating the company resource factors $R_{c,g}$ and $R'_{c,g}$ requires solving two sets of simultaneous equations for each resource (800 total). The dimension of each equation set is the number of companies (100+).

$$S_c R_{c,g} = S_{g,c} + \Sigma_d W_{d,c} R_{d,g} \qquad \text{(for all c)}$$

There are a number of simplifying factors:

i) The matrices are fairly sparse. If there are no direct or indirect sales of resource g to company c, then those terms are zero (as then is $R_{c,g}$ itself).

ii) For companies not involved in a sales loop, the coefficients can be calculated by direct substitution.

Each individual equation set is quite simple and easily solvable on a Pentium based PC with the appropriate mathematical software. For example, linear programming problems with thousands of equations and variables are easily solved on PCs using the right software. There is of course the need to get the data from its raw form into an appropriate input format for the computational software and then extracting the solutions. The number of equation sets to solve might create a bottleneck, but some might be so trivial as to not require the full solution algorithm, and each equation set is independent so that the work could be done in parallel with multiple processors.

The data requirements do start to add up however. At about 5,000 numbers for each hour, the total is 3,600,000 numbers per month.

This is of course just an initial feasibility analysis, there are many details to be worked out for the actual implementation.

1. Cost Estimate

The cost of developing and implementing the tracking system described above will depend upon many specific details that are yet to be determined. For example:

i) How are the various data inputs to be collected and verified?
ii) How often should the calculations be performed?
iii) Will the tracking calculations have to be done once with preliminary data and then revised?
iv) How many companies and transactions will there be?
v) How are the results to be communicated?

Here, we estimate the development and implementation cost for the system to track kWh and to assign attributes. This estimate is a preliminary one, based upon a variety of assumptions:

i) The generation and transaction data is readily available in electronic form from the ISO-NE and, similarly, that acceptable data on fuel use and environmental data (or defaults) are available without major difficulty.
ii) Calculations are done each month on an hourly basis using hourly data.
iii) Only one revision will typically be required.
iv) The size and complexity of the calculation is assumed to correspond roughly with that described above.
v) The results can be communicated electronically, sent via email and made available on a web site.

Given these assumptions, our ballpark estimate is that it will cost about $300,000 to set up the system over a four month period and about $300,000 per year to implement it. These figures are developed assuming a staffing plan with four individuals: a manager responsible for planning, oversight, budgeting, and communications; a software system analyst responsible for designing the system and developing the procedures; a database administrator responsible primarily for implementing the system; and a clerical support person. The development of the web site and the installation and set up of computer hardware would be contracted. Other arrangements are possible, and may be preferable depending upon the individuals and organizations involved, and the specifics of the work to be performed.

This operation would be most efficient if it were integrated into the ongoing operations in some organization such as the ISO-NE. In that case the sharing of staff, space and equipment would be possible, perhaps providing important efficiencies. A consulting firm could do this, but acceptable arrangements for data confidentiality would be needed.

Ideally, ISO-NE could take on this task as part of its ongoing functions supporting the electricity market in New England.

The preliminary cost estimate is developed as follows:

System Development and Set Up – 4 months

Manager	full time at $15,000/month	=	$60,000
Software System Analyst	full time at $13,000/month	=	$52,000
Database Administrator	full time at $10,000/month	=	$40,000
Clerical Support	half time at $8,000/month	=	$16,000
Web Site Design and Set Up	contractor	=	$10,000
Computer Hardware and Set Up	fixed price	=	$50,000
Consulting Budget		=	$40,000
Miscellaneous Expenses and Contingency		=	$32,000
Total		=	**$300,000**

Implementation – Annual Budget

Manager	half time at $15,000/month	=	$90,000
Software System Analyst	quarter time at $13,000/month	=	$39,000
Database Administrator	full time at $10,000/month	=	$120,000
Clerical Support	quarter time at $8,000/month	=	$24,000
Web Site Hosting Cost	at $500/month	=	$6,000
Miscellaneous Expenses and Contingency		=	$21,000
Total		=	**$300,000**

Note: Labor costs include salary, benefits, office space, equipment, and supplies.

Appendix I:
Summary of Comments Concerning the Draft NETS Project Report

The following summarizes written comments received from July 14, 1998, the date the first draft of the NETS report was issued, through September 2, 1998 and oral comments delivered at the NETS public meeting on August 13, 1998. The comments concern the tracking methodology proposed in the draft NETS Project Report.

Organizations and individuals that submitted written comments and/or commented at the public meeting included: 1) AllEnergy, 2) the Competitive Power Coalition, 3) Enron, 4) Robert C. Grace, 5) Green Mountain Energy Resources, 6) Independent System Operator New England, 7) the Natural Resources Defense Council, 8) the New York State Department of Environmental Conservation, 9) PG&E Corporation, 10) Renewable Energy Alliance, which represents a number of wholesale and retail renewable energy marketers, 11) Sun Power Electric Company, and 12) the Union of Concerned Scientists.

These comments and questions will require further consideration as the NETS proposal and the development of related polices are assessed with regard to their impacts on the competitive wholesale and retail marketplace as well as the development of renewable energy sources. As indicated in Section 4, we, however, believe, in general, that the use of hourly market data as the basis for data collection and pro-rata treatment of certain transactions will provide a flexible and centralized tool for regulators and market participants to monitor and comply with related policies in a manner that most realistically reflects the financial flow and real-time effects of electricity generation in the competitive marketplace. In addition, in the preface, the Advisory Committee recommends that states, in collaboration with the ISO and with stakeholders in the region, consider the use of the NETS tracking system to support the implementation of disclosure, GPS, and RPS, and that additional steps be taken as public policies are developed to ensure that the goals of these policies are met while addressing the concerns raised by competitive market participants.

It is important to note that the following summary as a whole does not represent the exclusive comments of any one of the above individuals or organizations, but rather the scope of their combined feedback. In addition, numbers representing each organization or individual as listed above are used below to identify comments put forth or supported by each organization or individual.

Comments in support of the draft proposal included:

i) The tracking system should be designed to support both disclosure and portfolio standards. (7)

ii) The use of a centralized system administrator will relieve the burden placed on market participants and each of the six states with regard to disclosure policies and portfolio standards. (7)

iii) The assignment of attributes other than a "system average" to spot market transactions will prevent suppliers from laundering power (with less desirable attributes than the "system average") through the spot market. (7)

iv) The tracking system should be compatible with those of other regions. (7, 8)

Comments critical of the draft proposal included:

i) The process used to develop the draft report did not allow for enough stakeholder involvement. (1, 3, 4, 5, 9, 10)

ii) The competitive market is still developing, therefore, it may be too early to develop and implement a tracking system. (2)

iii) The use of hourly settlement will inhibit the renewable market and hinder the development of retail products, such as a 100% renewable energy product. For example, assume a supplier owns a wind generation facility and serves a load. Based on hourly settlement, the intermittent nature of generation from wind and fluctuations in corresponding load would require the supplier to sell excess generation and its assigned attributes into the spot market in hours when the supplier's generation exceeds its load. Conversely, in hours when the supplier's load exceeds its generation, it would be required to purchase undesirable attributes from the spot market to adjust for the difference. As a result, the tracking system will inhibit a supplier's ability to cost effectively offer desirable retail renewable products and increase the cost of compliance with portfolio standards. (1, 3, 4, 5, 7, 9, 10, 11, 12)

iv) The pro-rata treatment of system and spot market transactions will prevent marketers from designing products that meet the interests of their prospective customers by stripping them of desirable generation characteristics, even if they have enough desirable generation to match their load over a given period of time. This is counter to one of the goals of disclosure, which is to allow for customers to select products that they want. Consider the following instance when supplier A owns 10 MW of wind and 10 MW of oil. In hour X, supplier A's load is 10MW. The pro-rata treatment of supplier A's resources would allocate 5MW of wind and 5 MW of oil to its own load and the same attributes to its 10 MW sale into the spot market. Instead of assigning the attributes of its wind generation to its own load, supplier A would be required to sell half of those attributes into the spot market. The pro-rata treatment would also assign half the attributes associated with supplier A's oil generation to its load. Supplier A would not be able to offer its customers a 100% wind product even though its wind generation matched its load in hour X. (1, 3, 4, 5, 7, 9, 10, 11, 12)

v) The use of hourly settlement and pro rata treatment will reduce the efficiency and liquidity of the proposed market structure by changing the incentive to perform certain transactions, such as pure price hedging. For instance, assume that supplier A has 100 MW of wind generation and a forecasted load of 100MW in hour X. Due to the intermittent nature of wind, on a day-ahead basis, supplier A may purchase a

price hedge (a fixed system contract from supplier B for 100MW) for hour X in order to ensure that it can meet its load obligation. Later, when supplier A believes that there will be significant wind in hour X, it sells its system contract back to supplier B. During hour X, supplier A was able to meet its load obligation with its wind generation. Under the NETS system, instead of supplier A serving its load with the attributes of its wind generation, the pro rata treatment of system power would assign attributes from the system contract with supplier B and the wind generation to supplier A's mix. (1, 3, 4, 5, 7, 9, 10, 11, 12)

vi) The tracking system requires suppliers to procure desirable generation through unit contracts in order to develop desirable products. Unless a supplier controls the dispatch of a source, it cannot rely upon its performance. Managing the portfolio for a retail product under these circumstances would require a certain level of control over resource bidding and large-scale trading operations which only larger market participants may have. These requirements place smaller and new market entrants at a competitive disadvantage. (1, 3, 4, 5, 7, 9, 10, 11, 12)

vii) The exclusion of system power contracts that identify a specific unit (unit-contingent contracts) will limit a supplier's ability to create desirable products if hourly settlement and pro-rata treatment are used in the tracking system. (1, 3, 4, 5, 7, 9, 10, 11, 12)

viii) The proposal does not address how generation from units less than 1 MW would be tracked. (1, 3, 4, 5, 7, 9, 10, 11, 12)

ix) The ISO-NE settlement system is not compatible with the NETS proposal and therefore the ISO-NE might not be capable of serving as the tracking administrator. It should only be used to provide certain information to the tracking administrator. (6)

Questions raised included:

i) What will be the potential confidentiality issues concerning the use of ISO-NE settlement data and other data sources? (6)

ii) Will this proposal be compatible with those of neighboring systems? (7, 8)

iii) Will this tracking system (as opposed to another) provide a barrier to entry for market participants? (1, 3, 4, 5, 7, 9, 10, 11, 12)

iv) Will the bundling of attributes with energy commodity disturb the liquidity of the wholesale marketplace and the offering of desirable products at the retail level? (1, 3, 4, 5, 7, 9, 10, 11, 12)

v) Will this tracking system affect the development and use of renewable energy? (1, 3, 4, 5, 7, 9, 10, 11, 12)

The following highlights a number of proposed modifications which will be considered as states move forward with the development of disclosure policies and portfolio standards (It is important to note that while some proposed solutions complement each other that others may conflict with one another. Therefore, careful consideration must be given to the evaluation of combinations of the proposed modifications.):

i) Involve a greater scope of stakeholders in continued development of the tracking system. (1, 3, 4, 5, 7, 9, 10, 11, 12)

ii) Allow for periodic settlement (monthly, quarterly, or annually). Note that this potential solution does not solve issues associated with pro rata treatment. (1, 3, 4, 5, 7, 9, 10, 11, 12)

iii) Do away with the pro rata treatment of spot market transactions or, alternatively, allow for suppliers to determine and prioritize what attributes get sold into the spot market. (1, 3, 4, 5, 7, 9, 10, 11, 12)

iv) Develop a mechanism to differentiate spot market transactions. For example, use "conversion transactions" (a term from the New York Public Service Disclosure Report) which would allow for spot market transactions of electricity and its corresponding attributes to be traded separately. (1, 3, 4, 5, 7, 9, 10, 11, 12)

v) Allow for unit-contingent system power contracts. (1, 3, 4, 5, 7, 9, 10, 11, 12)

vi) Allow for the netting of wholly or partially offsetting system power transactions. (1, 3, 4, 5, 7, 9, 10, 11, 12)

vii) Conduct additional comparative customer research based on the information derived from the NETS tracking system and other systems. (4)

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