Report: EUA Ocean State Corporation et al., Appeals to Appellate Tax Board, Commonwealth of Massachusetts

Docket Nos. C258405-406, C258424-425, C258882-883, C259158-159, C259653, & C262566-568

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TABLE OF CONTENTS

Synapse Energy Economics

Synapse Energy Economics, Inc. provides research, testimony, reports and regulatory support to consumer advocates, environmental organizations, regulatory commissions, state energy offices, and others. The company was founded in May 1996 to specialize in consulting on electric industry restructuring issues.

We assess the many public policy implications of electricity industry planning, regulation and restructuring, with an emphasis on consumer and environmental protection. Our work covers various inter-related issues pertaining to restructuring, such as market power, stranded costs, performance-based ratemaking, reliability, mergers and acquisitions, divestiture plans, energy efficiency, renewable resources, consumer aggregation, power plant economics, environmental disclosure, and regulation of distribution companies. Our research frequently incorporates economic analyses and computer modeling of electricity generation facilities.

We work for a wide range of clients throughout the US, including Attorneys General, Offices of Consumer Advocates, Public Utility Commissions and their staff, a variety of environmental groups, foundations, the Environmental Protection Agency, the Department of Energy, the Department of Justice, the Federal Trade Commission, the National Association of Regulatory Utility Commissioners, and others.

Additional information about Synapse Energy Economics, its qualifications, staff, clients, projects and reports are available on-line at www.synapse-energy.com.

The Synapse staffmembers who participated in this investigation were Paul Peterson, David Schlissel, and Alex Moffet.

Introduction

Synapse Energy Economics, Inc. was retained by the Massachusetts Department of Revenue to analyze two issues. First, what is the physical nature of electricity and is it a tangible product or a service. Second, how were the production, transportation, and delivery of electricity to ultimate consumers accomplished during 1994 through 1998 under the commercial market rules in effect at that time.

In conducting our analysis, Synapse reviewed numerous documents related to the contracts between Ocean State Power (OSP)[1], the entity that generated electricity, and the public service companies (Companies)[2] that had the contractual rights to the generation output from OSP for their retail consumers. Synapse also reviewed documents related to the procedural history of the dockets on appeal before the Appellate Tax Board, as well as associated FERC Form No. 1 filings of OSP. Synapse conducted independent research on the physical nature of electricity, court cases that have discussed the legal analysis describing the nature of electricity, and New England Power Pool documents related to the commercial treatment of electricity transactions in New England.

In writing this Report, Synapse relied on the research described above as well as Synapse staff's significant years of experience in analyzing electric utility issues in numerous proceedings, reports, and other job-related experiences.

Electricity: the commercial product

In its simplest form, electricity is the flow of free electrons along a path. For commercial purposes, the flow of electrons is organized along a wire path for delivery to a specific point. The flow of water through a pipe is frequently used as an analogy for the flow of electricity along a wire. Water flow over time is determined by volume and pressure; the gallons inside the pipe times the pressure provided by a pump. The flow of electricity over time is determined by volume and pressure as well; the amperage represents the "gallons" of electrons and the voltage represents the "pressure" of the pump. For electricity, the amperage times the volts equals a unit of measurement called a watt. Just as the characteristics (length, diameter, impediments, etc.) of the pipe can affect the

[1] OSP is used herein as a general term for the generation entity for all the contracts relevant to generating units Oceans State Power I and Ocean State Power II.

[2] From 1994 through August 1998, the contracting companies (with their contract percentages in parentheses) were Boston Edison Company (BECO 23.5%), Montaup Electric Company (Montaup 28%), and New England Power (NEP 48.5%). For the last four months of 1998, the contracting companies were the same except that TransCanada Power Marketing Ltd. (TPML) assumed NEP's share of 48.5%; TPML is not a state-regulated public service company.

actual pressure of the water, the characteristics of the wire (called its resistance) can affect the pressure or voltage of the electricity.[3]

Electricity is tangible under a dictionary definition of "capable of being perceived, especially by the sense of touch".[4] Anyone who has poked a pin into an electrical outlet can verify that tangible aspect of electricity. Historical accounts of the early scientific experiments with electricity in the 18th and 19th centuries also refer to this tangible property of electricity.[5] Webster's dictionary further defines tangible as "capable of being appraised at an actual or approximate value". As discussed in later sections of this report, the contracts between buyers and sellers and the commercial transportation system administered by NEPOOL demonstrate that this definition is satisfied.

Webster's dictionary provides several definitions of property. The pertinent ones for this discussion include: "something owned or possessed"; " the exclusive right to possess, enjoy, and dispose of a thing"; and "something to which a person has a legal title". There are numerous documents in this proceeding that describe the ownership, possession, and legal rights of the parties in regard to the generation output of an electrical product that is measured in watts delivered per hour.[6] This demonstrates that OSP and its contractual partners were engaging in a sale and purchase of something that met this aspect of a dictionary definition of property. It further demonstrates that it is the physical, tangible properties of electricity that give it its commercial, or market, value.

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[3] This description of the nature of electricity and how it is measured can be found in a variety of physics and other textbooks. For examples, see Physics, Haliday, Resnick, and Krane (1992); and America's Electric Utilities: Past Present and Future, Hyman (1997).

[4] Webster's Seventh New Collegiate Dictionary (1963)

[5] See comments in Ben Franklin's Science, Cohen (1990); History and Present State of Electricity, Priestly (1794); and Elements of Early Modern Physics, Heilbron (1982). Heilbron provides a particularly vivid description of the early experiments in 1746 on page 184:

> "Cunaeus showed Musschenbroek and his assistant, J.N.S. Allamand, how they too could blast themselves with electricity. 'I thought I was done for,' the professor wrote Reaumur, his correspondent at the Paris Academy, adding precise direction for realizing the 'terrible experiment' and advice not to try it. The courageous Nollet, informed by Reaumur, bent himself doubled and knocked out his wind. Others who tried reported nose bleedings, temporary paralysis, concussions, convulsions, and dizziness. The gallant Winkler warned that his wife was unable to walk after he used her to short a Leyden jar."

[6] Usually described in units of kilowatt-hours (KWH) or meagwatt-hours (MWH).

Electricity can be produced through chemical and mechanical processes. Chemical processes include batteries and photovoltaics and are relatively insignificant (today) for commercial purposes. The overwhelming majority of electricity for commercial use is produced through a mechanical process that utilizes a source of energy (fossil fuel, nuclear, wind, water, etc.) to cause a magnet to spin through coils of wire in a generator. The spinning magnet induces the flow of electrons through the coils of wire, thereby creating electricity. The generation output, the watts, flow through meters that measure the amount of product produced over time and report the results in units of watt-hours. These watt-hours can be aggregated into kilowatt-hours, megawatt-hours, or gigawatt-hours and then later broken down into smaller sub-components that are measured by meters at customer sites of consumption. This ability to aggregate and divide electricity provides further support for considering it a tangible, measurable, commercial product.

Electricity: the commercial service

After being produced by a generator, the electric product is then transported over wires for delivery to ultimate consumers. The transportation and delivery of electricity is accomplished through an integrated system of transmission and distribution facilities that includes transformers and other electrical equipment to maintain the proper voltage (pressure) over different sized wires and distances. The transportation system that delivers the kilowatt-hours produced through the generation of electricity is best described as a commercial service, not a market product. The relevant dictionary definition for such a service is "useful labor that does not produce a tangible commodity"; "providing services or producer goods" and "to perform any of the business functions auxiliary to production or distribution". [7] The transmission and distribution system for the delivery of electrical products is analogous to the aqueducts, pipes, and pumps that deliver water to a consumer's tap.

This concept of service is not unique to the electric industry. Many natural gas and water utility companies provide a combination of service and product to their customers. In

[7] Webster's, op. cit.

fact, many of these utilities are named "public service companies". The bills from the distribution service company (the Companies in this report) to their customers usually refer to a monthly "service charge" and a "product" charge. OSP's bills, on the other hand, do not contain a service charge, just the watts and watt-hours that it produces. For the electric industry, and the purposes of the underlying proceedings related to this report, it is useful and appropriate to think of these two elements separately: the product of kilowatt-hours that are produced, delivered, and consumed (the tangible property) and the transmission and distribution system (the service) that provides the conduit for delivery of the tangible property.

OSP sales

In order to understand how the transactions between OSP (the generator of the electricity product) and the Companies (the various utilities purchasing on behalf of their customers) resulted in the delivery of kilowatt-hours of electricity to Massachusetts's consumers, one needs to understand both the physical and commercial operation of the New England bulk power transmission system.

Background of NEPOOL

In the fall of 1965, the Northeast United States experienced a cascading loss of electric power that created an unprecedented total blackout. That experience led to the creation of the New England Power Pool (NEPOOL) in September 1971. From the outset, NEPOOL had two overarching objectives: (1) to maintain the reliability of the bulk power system for the delivery of electricity to consumers and (2) to achieve the maximum economic efficiency of that delivery consistent with prudent utility practices. The members of NEPOOL, the Participants, are all signatories to the New England Power Pool Agreement, the governing document.[8]

[8] The New England Power Pool Agreement has been amended numerous times since September 1971. After the first amendment, the Agreement became the New England Power Pool Agreement as Amended through the First Amendment. At the time of the transactions at issue in this proceeding, the Agreement had been amended 32 times and is generally referred to as the Restated NEPOOL Agreement through the 32nd Amendment.

Section 4.1 of the Agreement describes NEPOOL's objectives:

> The objectives of NEPOOL are, through joint planning, central dispatching, cooperation in environmental matters and coordinated construction, operation and maintenance of electric generation and transmission facilities owned or controlled by the Participants and through the provision of a means for more effective coordination with other power pools and utilities situated in the United States and Canada,
>
> (a) to assure that the bulk power supply of New England and any adjoining areas served by Participants conforms to proper standards of reliability; and
>
> (b) to attain maximum practicable economy, consistent with such proper standards of reliability, in such bulk power supply and to provide for equitable sharing of the resulting benefits and costs.

In practical terms, this means that all the individual utilities that own transmission and generation facilities agree to place those facilities under the operational control of a single, central dispatch that will operate the system as a single utility for purposes of reliability and maximum economy. The benefits of central dispatch to each Participant are significant. First, in an emergency, the resources of other Participants will be immediately available to a Participant in trouble through the sudden loss of a generation unit or a transmission line. Second, through the coordination provided by NEPOOL, each Participant can operate, maintain, repair, and improve its system with fewer resources maintained as reserves. Third, through central cost-based dispatch, each Participant can benefit from any excess power available from less expensive resources than its own.

OSP entered into contracts for the sale of kilowatt-hours to the Companies, all of which are NEPOOL Participants.[9] Those contracts provide for OSP to deliver a percentage of its generation output on behalf of each of the contracting entities to the NEPOOL PTF system.[10] The PTF system, also called the New England bulk power system, consists of

[9] NEPOOL Agreement at 91-92 for NEP, Montaup, and BECO. TPML joined NEPOOL in 1998 and is listed as a NEPOOL Participant in the 3_ Amendment to the NEPOOL Agreement.
[10] The NEPOOL PTF system is the NEPOOL Pool Transmission Facility system, also known as the New England bulk power system.

all the transmission lines, substations, and other equipment that transports and regulates the flow of electricity. OSP's ability to place its generation output on the NEPOOL PTF system is governed by the NEPOOL Agreement. Only Participants, or entities controlled by Participants, are eligible to participate in the NEPOOL PTF system.[11] Participants are required, to the extent practical, to place all generation and transmission facilities under central dispatch.[12] The objective of central dispatch is to maintain a reliable system and to satisfy the Participants' energy requirements (KWHs) at the lowest cost.[13]

NEPOOL system dispatch and accounting

As mentioned above, the purpose of the NEPOOL Agreement is to achieve its goals of a reliable and economically efficient bulk power system through the control of all generation and transmission facilities as if New England was a single utility. The actual flows of electricity over the bulk power system follow the laws of physics mentioned earlier (amperage, voltage, resistance, and distance). Thus, the physical operation of the system will bear little relationship to the contractual arrangements of the NEPOOL Participants. A simple example will suffice:

> A Participant with customers in VT owns a 25% share in a VT generation unit and a 5% share in a ME generation unit. Similarly, a Participant with customers in ME owns a 25% share in a ME generation unit and a 5% share in a VT generation unit.[14] On a contractual basis, each Participant receives 5% of its energy for its customers from a remote location. In reality, each Participant is receiving 30% of its energy for its customers from an in-state resource. The electricity flows from the generation unit to the nearby customers because that is, in most cases, the physical path of least resistance. It also results in much lower line losses than if the electricity, as per the terms of the contract, traveled hundreds of miles to the remote state.

[11] NEPOOL Agreement Sec. 3.1. An exception to this rule is for contracts with non-Participants on behalf of NEPOOL, such as the HQ Firm Energy contract. Id. at Sec. 12.10
[12] Id. at 12.2.
[13] Id. at 12.4.
[14] These types of contractual arrangements are common and very important for the support of a broad range of generation units by multiple owners, rather than having a single owner whose financial health could be imperiled if its solely-owned generation unit developed operational problems

To accommodate both the physical reality of electricity flows and to account for the improved economic efficiency that such flows produce, the NEPOOL Agreement and its associated operational rules created a commercial transaction system that fully accounts for all electricity flows on the bulk power system and their associated savings, and, more importantly, provides a mechanism for sharing the benefits of a coordinated, central dispatch of lowest cost units first. In order to accomplish this, there must be reconciliation between the physical dispatch of the system and the contractual (or Own Load) dispatch of the system.

The NEPOOL system operated in the following manner. The operators of the centralized dispatch knew the operating characteristics and fuel costs of all generation units. The forecast of day-ahead loads was sufficiently precise to allow the operators to select units for their overall operating costs based on the lowest cost units first.[15] For each hour, a marginal cost of energy was determined based on the average cost of all the units run in excess of their contracted amounts. In addition, line loss calculations were made each hour based on the actual losses experienced on the system.

At the same time, the NEPOOL system operators knew all the Participants contracts and purchase agreements that they had made to meet their customers' demand (Own Load). The operators also knew the actual customer loads for each Participant for each hour. The operators simulated each Participant's contractual dispatch on a stand-alone basis by stacking their commitments from lowest cost to highest cost until the customer loads were met.

If the total of a Participant's contracts and purchases actually dispatched (as opposed to the theoretical Own Load dispatch) in a given hour exceeded their customers' loads, then that Participant was determined to have a positive net interchange for the hour. The excess kilowatt-hours would be allocated to a savings pool as a sale to that pool.[16]

[15] In general, this "least cost" dispatch was established on a weekly basis. Adjustments were made on a daily basis and there were always some exceptions due to local reliability concerns (constraints) and the designation of some generation units as "must-run".
[16] NEPOOL Agreement Sec. 12.5, 12.5A, and 14.8

If the total of a Participant's contracts and purchases actually dispatched (again, as opposed to the theoretical Own Load dispatch) in a given hour was less than their customers' loads, then that Participant was determined to have a negative net interchange for the hour. The deficient amount of kilowatt-hours would be allocated to the savings pool as a purchase from that pool.[17]

The value of the kilowatt-hours in the savings pool would be determined by the difference in price between the excess kilowatt-hours (low) and the deficient kilowatt-hours (high) as determined by each Participant's Own Load dispatch.[18] An example of a two-Participant transaction for one MWH would be an excess sale to the pool at $30 per MWH and a deficient purchase at $50 per MWH. The savings pool would have $20 and each Participant would receive $10. Both Participants would benefit because the seller would receive $40 instead of $30, and the purchaser would pay, effectively, $40 instead of $50.[19]

There were certain adjustments made to the relative positions of buyers and sellers in the savings pool based on a variety of specific factors such as scheduled and unscheduled outages of generation units. In addition, there were "bonus" savings shares that applied under certain conditions. Transmission losses were also applied to the purchases from the savings pool to reflect the actual system losses for each hour.[20]

Thus, from a commercial transaction perspective, NEPOOL allocated the generation output (MWH) that OSP placed on the NEPOOL PTF system to the customers (loads) of the Companies that held unit entitlements to OSP's generation. Regardless of the physical flow of electricity on the PTF system, NEPOOL assigned the total amount of OSP generation to the retail customers of the contractual Companies (BECO, Montaup, NEP, and TPML). At the same moment that the MWHs entered the PTF system,

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[17] Id.
[18] Id. at 12.6 and 14.8
[19] The actual dollar differences were usually much smaller; the $30 and $50 example used here is for illustrative purposes, only.
[20] NEPOOL Agreement Sec. 14.

NEPOOL delivered MWHs, for commercial purposes, to the contracting NEPOOL Participants to satisfy their customer loads that were occurring on a simultaneous basis. In other words, at the moment that the MWHs entered the NEPOOL system, they were placed under the possession and control of retail customers through their individual meters. These retail customers were the loads that were demanding the electricity.

The only circumstances by which OSP generation products would be delivered to consumers other than those of the Companies would be if OSP generation products were the "excess generation" allocated to the shared savings pool by NEPOOL. Because OSP is considered a base load unit (as opposed to an intermediate or peaking unit), it is unlikely that its output would ever be the highest cost generation in any of the Companies' Own Load portfolio. Base load plants are often among the lowest cost generation resources that a utility has. Nonetheless, if OSP could show that it was the highest priced Own Load unit during hours when any of the Companies were providing excess resources to the shared savings pool, then an adjustment would need to be made to the conclusion that all OSP generation product was consumed by the Companies' retail customers.

FERC Form No. 1

FERC Form Number 1 is the standard reporting form that every electric utility must file each year with the Federal Energy Regulatory Commission (FERC). The form provides a detailed report on the utility's corporate and financial structure as well as an accounting of the production, sales, transmission, and consumption of electricity. For example, Ocean State Power's 1995 annual FERC Form No. 1 shows that it is a subsidiary of two holding companies, Eastern Utilities Associates (EUA) and New England Electric Systems (NEES).[21] It also states that its entire generation output was sold to three entities: Boston Edison Company (377,457 MWH); New England Power (779,007 MWH); and Montaup Electric Company (449,736 MWH).[22]

[21] FERC Form No. 1 at 102.
[22] Id. at 310-311.

In order to determine the appropriate allocation of the sales of Ocean State Power's sales to Massachusetts's customers, the FERC Form No. 1 filings of BECO, Montaup, NEP, and TPML would need to be reviewed. Those filings would show all the resources (contracts and purchase agreements) that each entity used to meet its various customer loads.

Conclusions

1. Electricity is a tangible product, the vast majority of which is produced through mechanical generation systems that spin a magnet through a coil of wires.

2. Kilowatt-hours (KWH) of electricity are the tangible property that is sold to consumers.

3. The electrical connections (the transmission and distributions system) that allow the delivery of electricity are the service that is sold to consumers.

4. NEPOOL, through the NEPOOL Agreement, controls and accounts for all generation and transmission service in New England.

5. NEPOOL administers a commercial accounting system that reconciles the physical flows of electricity with each NEPOOL Participant's contractual obligations and loads.

6. At the same moment that generation MWH are placed on to the NEPOOL PTF system, an equivalent amount of MWH are delivered to the possession of retail customers through their individual meters.

7. NEPOOL manages a "shared savings pool" to accommodate imbalances in individual Participant's Own Load contracts and the actual dispatch of all generation units in New England.

8. FERC Form No. 1 is the recognized source for determining the quantities of generation, sale, transmission, and delivery of tangible electric property.