

**STATE OF NEW YORK
PUBLIC SERVICE COMMISSION**

- Case 02-E-0781** - Consolidated Edison Company of New York, Inc. – Proceeding on Motion of the Commission as to an Electric Tariff Filing to Establish a New Standby Service in Accordance With Commission Order.
- Case 02-E-0780** - Orange & Rockland Utilities, Inc. – Proceeding on Motion of the Commission as to an Electric Tariff Filing to Establish Standby Service in Accordance With Commission Order.

PREFILED DIRECT TESTIMONY OF

BRUCE A. HEDMAN

MARCH 20, 2003

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1 **INTRODUCTION AND WITNESS QUALIFICATION**

2 Q. PLEASE STATE YOUR NAME, OCCUPATION AND BUSINESS
3 ADDRESS.

4 A. My name is Bruce Hedman. I am a director at Energy and Environmental
5 Analysis (EEA), a management consulting firm located in Virginia. Our
6 address is 1655 North Fort Myer Drive, Arlington, Virginia, 22209.

7 Q. WOULD YOU PLEASE DESCRIBE YOUR QUALIFICATIONS?

8 A . Yes. I received my Bachelor's, Master's and Docterate degrees in mechanical
9 engineering from Drexel University in Philadelphia, Pennsylvania. My focus
10 in graduate school was energy systems analysis.

11 Beside my current position with EEA, I have served as a vice president at
12 Onsite Energy Corporation, an energy services company that specializes in
13 on-site generation and combined heat and power applications. Before joining
14 Onsite in 1998, I was Executive Director of the Industrial Center Inc. in
15 Arlington, Virginia, a natural gas industry technology transfer and market
16 development organization that supports the introduction of new technologies
17 in the industrial market. Prior to this, I was a senior program manager at
18 Battelle Pacific Northwest Laboratory's Washington, DC offices, providing
19 strategic planning and policy support on natural gas issues and end-use

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1 research, development and commercialization. I started my career at the Gas
2 Research Institute in Chicago, holding a variety of research management
3 positions in power generation, alternative fueled vehicles and industrial end-
4 use. When I left GRI in 1994, I was Group Manager, Industrial and Power
5 Generation Products and responsible for the development and
6 commercialization of new natural gas technologies for these priority markets.
7 I began working on CHP (then called cogeneration) issues in the 1980s when I
8 first joined GRI, focusing initially on analyzing market and economic issues.
9 I then became involved in CHP technology development programs and
10 eventually directed GRI's research and commercialization efforts in CHP.
11 My colleagues and I at EEA currently provide consulting services to
12 equipment manufacturers, energy companies and policymakers on CHP
13 markets, technologies and regulatory issues.
14
15 I am a founding board member of the U.S. Combined Heat and Power
16 Association, and currently serve as the organization's Treasurer. I have
17 written or co-authored approximately 75 articles and reports on energy
18 technologies and markets. A copy of my CV is provided in Exhibit ____
19 (BAH-1)

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1 Q. ARE YOU ASSISTING A GROUP OF PARTICIPANTS IN THESE CASES
2 IN PRESENTING THIS TESTIMONY?

3 A. I am assisting the Joint Supporters, a voluntary association which
4 includes a number recent and potential near-term awardees of NYSERDA
5 CHP grants resulting from the program for which we prepared the studies that
6 I discuss below

7 Q. WHAT IS THE PRIMARY PURPOSE OF YOUR TESTIMONY IN THIS
8 CASE?

9 A. I will present testimony concerning the potential for combined heat and power
10 in New York State and the impact of standby rates on the economic
11 development of that potential. My testimony is based on a study we recently
12 completed for the New York State Research and Development Authority
13 (NYSERDA).

14 Q. WOULD YOU PLEASE DESCRIBE HOW YOUR DIRECT TESTIMONY
15 IS ORGANIZED IN THIS CASE?

16 A. My testimony is organized into the following sections:

CASE NOS. 02-E-0781 AND 02-E-0780

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1 (1) Relevancy to this proceeding.

CASE NOS. 02-E-0781 AND 02-E-0780

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- 1 (2) Description of the CHP Market Assessment completed for NYSERDA;

CASE NOS. 02-E-0781 AND 02-E-0780

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- 1 (3) Estimate of the technical potential for CHP in New York State;

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- 1 (4) Analysis of the impact of standby rates on economic penetration of the
- 2 technical potential; and

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1 (5) Conclusions and recommendations.

2

3 Q. WAS THIS TESTIMONY PREPARED BY YOU OR PREPARED UNDER
4 YOUR DIRECTION?

5 A. Yes.

6 **I. RELEVANCY TO THIS PROCEEDING.**

7 Q. PLEASE DESCRIBE THE RELEVANCY OF YOUR TESTIMONY TO
8 THIS PROCEEDING.

9 A. The relevancy of my testimony is based on the fact that the emerging
10 DG/CHP market in New York is quite sensitive to, among other factors, the
11 cost structures such systems face. My testimony will illustrate what the
12 impact of changes in the cost structures faced by DG/CHP projects would
13 have on their likely adoption by end-users.

14 **II. DESCRIPTION OF THE CHP MARKET ASSESSMENT**
15 **COMPLETED FOR NYSERDA**

16 Q. PLEASE DESCRIBE THE CHP MARKET ASSESSMENT YOU
17 COMPLETED FOR NYSERDA

18 A. A team consisting of EEA (the principals involved were then with Energy
19 Nexus Group, a subsidiary of Onsite Energy Corp) and the Pace Energy
20 Project were funded by NYSERDA and Oak Ridge National Laboratory

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1 (ORNL) to profile existing CHP in New York State, analyze the potential for
2 additional CHP development, and identify hurdles to increased deployment of
3 cost-effective, efficient CHP systems within the state. Results of the study
4 and from the analytic process itself were used by NYSERDA to better
5 understand the nature of the opportunity for CHP in New York, to help
6 identify critical technology and market development needs, and as one source
7 of input into the design of their CHP technology development and
8 demonstration program.

9 Q. DID YOU ALLOW FOR STAKEHOLDER INPUT INTO THE DESIGN
10 AND EXECUTION OF YOUR STUDY?

11 A. Yes, a Project Advisory Board comprised of representatives from State
12 regulatory, policymaker and business communities was formed to help review
13 the methodology and evaluate the results. The Board formally met twice;
14 once to review the project methodology and assumptions, and once to review
15 the preliminary results and conclusions.

16 **III. ESTIMATE OF THE TECHNICAL POTENTIAL FOR CHP IN NEW**
17 **YORK**

18 Q. COULD YOU PLEASE DEFINE THE TERM “TECHNICAL
19 POTENTIAL”?

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1 A. The technical market potential is an estimation of market size (in terms of
2 number of potential sites and MW of electric capacity) constrained only by
3 technological limits—the ability of CHP technologies to fit existing customer
4 energy needs. In our analysis, the technical potential was based on existing
5 facilities that have the energy consumption characteristics that could apply
6 CHP. The technical market potential does not consider screening for other
7 factors such as ability to retrofit, owner interest in applying CHP, capital
8 availability, natural gas availability, and variations of energy consumption
9 within customer application/size class. All of these factors affect the
10 feasibility, cost and ultimate acceptance of CHP at a site and are critical in the
11 actual economic implementation of CHP.

12 Q. HOW DID YOU ESTIMATE THE REMAINING TECHNICAL
13 POTENTIAL FOR CHP IN NEW YORK STATE?

14 A. The following approach was used to estimate the market potential for CHP in
15 the commercial/institutional and industrial sectors in New York:

- 16 • *We first identified applications where CHP provides a reasonable fit to*
17 *the electric and thermal needs of the user.* Target applications were
18 identified based on reviewing electric and thermal energy consumption
19 data for various building types and industrial facilities. Data sources
20 include the DOE EIA *1995 Commercial Buildings Energy Consumption*

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1 *Survey (CBECS), the DOE Manufacturing Energy Consumption Survey*
2 *(MECS), 1994* and various market summaries developed by GRI and the
3 American Gas Association. Existing CHP installations in the
4 commercial/institutional and industrial sectors were also reviewed to see
5 what types of applications were currently using CHP. Target
6 commercial/institutional applications included such buildings as hospitals,
7 hotels, nursing homes, universities, schools, commercial laundries, car
8 washes, health clubs, correctional facilities, large office buildings, and
9 large multifamily buildings. Target industrial applications included food
10 processing, chemical plants, paper mills, textile mills, and certain
11 fabrication industries such as fabricated metals products and industrial
12 machinery. These applications all have typical thermal and electric
13 profiles that would support CHP and the industries or commercial sectors
14 have existing experience with CHP either in New York or elsewhere in the
15 country.

16 • *We then quantified the number and size distribution of target applications.*
17 Once applications that could technically support CHP were identified, we
18 used a commercially available database to identify potential CHP sites
19 within the State by target SIC code or application. The database is based
20 on the Dun and Bradstreet financial listings and includes information on

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1 economic activity (8 digit SIC), location (metropolitan area, county,
2 electric utility service area, state) and size (employees) for commercial,
3 institutional and industrial facilities. In addition, for select SICs limited
4 energy consumption information (electric and gas consumption, electric
5 and gas expenditures) is provided based on data from Wharton
6 Econometric Forecasting (WEFA). The database was used to identify the
7 number of facilities in target CHP applications and to group them into size
8 categories based on average electric demand in kW.

9 • *We then estimated CHP potential in terms of MW capacity for each*
10 *application.* Total CHP potential was then derived for each target
11 application based on the number of target facilities in each size category.
12 It was assumed that the CHP system would be sized to meet the average
13 site electric demand for the target applications unless thermal loads limited
14 electric capacity. The analysis only considered traditional hot water-
15 steam/electric power CHP. No estimate was made for mechanical drive
16 applications or for uses of thermal energy other than hot water or steam.
17 We also subtracted out sites with existing CHP from the estimates.

18 Q. WHAT IS YOUR ESTIMATE OF THE TECHNICAL POTENTIAL FOR
19 CHP IN NEW YORK STATE?

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1 A. We estimate the technical potential to be an additional 8,500 MW of CHP
2 capacity at 26,000 sites. About 2,000 MW of this is in industrial facilities
3 (4,800 sites); 6,500 MW is in commercial/institutional facilities (21,300 sites).
4 Sixty-four percent of the industrial potential is in four industry groups:
5 chemicals, food, paper and instruments. Three-fourths of the
6 commercial/institutional potential is in six segments: office buildings,
7 educational facilities, hotels/motels, hospitals, and nursing homes. Almost 80
8 percent of the total technical potential is in three utility service areas:
9 Consolidated Edison – 39 percent, Niagara Mohawk – 28 percent, and the
10 Long Island Power Authority – 12 percent.

11 Q. HOW DOES THE REMAINING TECHNICAL POTENTIAL COMPARE
12 TO EXISTING CHP IN NEW YORK?

13 A. We estimate that in the year 2000 there were approximately 5,000 MW of
14 existing CHP capacity in New York at a little over 210 sites. About 78% of
15 this capacity was in industrial facilities (primarily chemicals, paper and
16 primary metals plants). Much of this capacity was concentrated in a few large
17 “merchant” CHP facilities – facilities that delivered steam to a host site but
18 sold the bulk of the power produced to the grid. Thirty-six sites accounted for
19 89 percent of the existing capacity (4,500 MW).

20

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1 The estimate of technical potential is based on efficiently sizing the system to
2 meet on-site thermal and electricity needs. As a result, the profile of the
3 remaining technical potential is much different. As mentioned earlier, 77
4 percent of the remaining technical potential is in the commercial/institutional
5 sectors. The majority of the remaining CHP potential is in the smaller size
6 range -- 74 percent of the technical potential is below 5 MW in size; 39
7 percent is below 1 MW in size.

8 Q. WHAT ARE THE IMPLICATIONS OF THESE DIFFERENCES?

9 A. Based on our analysis of the technical potential, future CHP development will
10 likely be based on smaller systems efficiently serving the internal needs of an
11 industrial or commercial user. Many of these applications are only now
12 becoming possible as new technologies – advanced natural gas engines,
13 microturbines, improved small gas turbines and fuel cells – enter the market.
14 However, the economics of the smaller systems are still quite marginal as the
15 sales and service infrastructure for these new technologies is still developing.
16 The economic viability of many of these applications can be severely
17 impacted by differences in tariff structures and standby rates.

18 Q. ARE THERE LIMITATIONS TO YOUR ANALYSIS THAT COULD
19 IMPACT THE RESULTS AND CONCLUSIONS?

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1 A. Any analysis is only as good as the base assumptions and input data. The
2 level of effort of this analysis was limited. The energy profiles used for the
3 estimate of technical potential were based on typical application profiles and
4 were not specific to the State or the region. We did not have the resources to
5 verify the existence and characteristics of the 26,000 sites screened from the
6 database. However, within these limitations I believe the analysis was
7 rigorous enough to adequately estimate an accurate order of magnitude
8 estimate of technical potential – anywhere from 6,000 to 11,000 MW with
9 8,500 being the midpoint. I also believe that while the absolute numbers
10 could change within the range above, the breakdowns of relative potential by
11 application, size and utility area are credible.

12 **IV. ANALYSIS OF THE IMPACT OF STANDBY RATES ON**
13 **ESTIMATED ECONOMIC PENETRATION OF THE TECHNICAL**
14 **POTENTIAL**

15 Q. DID YOU ANALYZE ANY LIKELY PENETRATION OF THE
16 TECHNICAL POTENTIAL IN YOUR STUDY?

17 A. Yes, we estimated market penetration through the year 2012 for two scenarios
18 based on the economics of CHP within assumptions for retail electric and
19 natural gas price projections. The analysis was undertaken for the upstate and
20 downstate regions in five size ranges for CHP equipment that reflected the

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1 differences in equipment performance and application needs. Commodity
2 prices for electricity were based on the High Case in the New York State
3 Energy Plan and delivery charges were based on the tariff structures of the
4 two dominant utilities in each region – Niagara Mohawk for upstate and
5 Consolidated Edison for downstate. The scenarios were based on differences
6 in technology costs and performance, and differences in standby rates:

7 • *Base Case* – business as usual based on current CHP technology and
8 current (year 2000) standby rates (standby rates in the upstate region were
9 estimated to be two-thirds of Niagara Mohawk’s Rule 12 level -- to
10 approximate the recently adopted SC-7 Standby Service Rates approved
11 by the New York Public Service Commission).

12 *Accelerated Case* – based on gradual evolution from current to advanced
13 technology, immediate reduction of standby charges to one-half of the
14 base case level (for both upstate and downstate markets), implementation
15 of CHP Initiatives that offer tax incentives equivalent to 10% of initial
16 cost, and increase in customer awareness and adoption rates.

17 Q. WHAT WERE THE DIFFERENCES BETWEEN MARKET
18 PENETRATION BETWEEN THE TWO SCENARIOS?

19 A. In the *Base Case*, 764 MW of CHP is projected to be installed by the year
20 2012. Nearly 70% of this capacity is added in the downstate region. The

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1 greater penetration of CHP in the downstate region is due to a somewhat
2 higher technical potential (54% to 46%), higher power costs, and somewhat
3 lower standby charges. There is minimal penetration in sizes below 5 MW.

4
5 The improvement in market climate assumed for the *Accelerated Case*
6 resulted in an additional 1,400 MW of CHP penetration over the forecast
7 period. Cumulative market penetration reaches nearly 2,200 MW statewide.
8 The downstate region represents about 60 percent of this capacity. The
9 greatest impact is on small systems. The cumulative market penetration of
10 systems below 5 MW increases 370 percent – from 295 MW to 1091 MW. In
11 comparison, the increase in cumulative market penetration of larger systems
12 (greater than 5 MW) is somewhat smaller -- from 470 MW to 1077 MW.

13
14 I would like to be clear that the market penetration analysis we undertook was
15 not meant to predict eventual market development, but was instead meant to
16 help understand how certain market scenarios affect CHP economics and
17 potential market penetration using a simplified market model. The objective
18 was to determine how robust CHP economics might be under various
19 scenarios, what critical factors impact the economics and deployment of CHP,
20 and which of these factors impact target markets and applications of interest to

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1 policymakers and planners. In other words, how sensitive the development of
2 the CHP market is to changes in costs.

3 Q. WHAT PORTION OF THIS DIFFERENCE IS ATTRIBUTABLE TO
4 REDUCTIONS IN STANDBY CHARGES?

5 A. The accelerated case scenario included a number of improvements to the
6 market environment including reductions in CHP system costs due to
7 improved designs and a more developed infrastructure and improvements in
8 CHP system performance due to technology advance, as well as reductions in
9 the assumed standby rates. While it is difficult to determine exactly the
10 impact of the various assumptions because of the interaction among them, we
11 estimate that the reduction in standby charges between the two scenarios is
12 responsible for 35 to 50 percent of the increase in market penetration.
13 Conversely, one could conclude from this analysis that an equal increase in
14 standby charges would have a similar but negative impact on market
15 penetration.

16 **V. CONCLUSIONS AND RECOMMENDATIONS**

17 Q. WHAT ARE YOUR PRINCIPAL CONCLUSIONS AND
18 RECOMMENDATIONS?

19 A. I offer the following conclusions based on our analysis and my experience
20 with CHP:

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- 1 • CHP represents a significant resource for New York State. Even a modest
2 20 percent penetration of the 8,500 MW of technical potential could help
3 close the growing gap between power supply and demand in certain
4 regions in the state as well as deferring the need for costly investments in
5 new transmission infrastructure to meet that rapidly growing demand.
6 Furthermore, CHP is an efficient use of energy resources that can help
7 users reduce energy expenses and better weather price volatility, and offer
8 societal benefits such as overall reductions in emissions to the state.
- 9 • Much of the CHP resource in New York is in size ranges (i.e., below 5
10 MW) and application types (e.g., office buildings, schools and other
11 building types with low to moderate load profiles) where the level and
12 structure of standby rates can have enormous impact on the project
13 economics.

14 Q. DOES THIS CONCLUDE YOUR TESTIMONY?

15 A. Yes.