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August 26, 2005

Via Overnight Express

Hon. Jaclyn A. Brilling
Secretary
New York Public Service Commission
3 Empire State Plaza
Albany, NY 12223-1350

Re: Case 03-S-1672 – Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Steam Service.

Dear Secretary Brilling:

Pursuant to the terms of the September 27, 2004, Order Adopting the Terms of a Joint Proposal in the above-captioned proceeding, the Steam Business Development Task Force hereby submits a Steam Business Development Plan, which contains proposed recommendations and an implementation schedule, as provided for in Section H.5. of the Joint Proposal. An original and five copies of the documents are attached.

In accordance with the Order, a Task Force was formed in late 2004, and numerous meetings were held to develop the Plan. A complete list of the Task Force members may be found on page 2 of the Plan. The Plan is a consensus document, and accordingly, individual Task Force members may disagree with particular findings and recommendations contained in it.

Very truly yours,

Tim Daniels
Task Force Chair

Attachments
cc: Task Force Members (via e-mail)

■ 110 William Street, New York, NY 10038 212/619 5000

Steam Business Development Plan

for the

Consolidated Edison Steam System

Prepared by the
Steam Business Development Task Force
with the assistance of
CCN Management Counsel
and
Thornton Energy Associates

August 26, 2005

Steam Business Development Task Force Members

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- **Consolidated Edison, Inc.**
- **Consumer Power Advocates**
- **E Cubed Company, LLC**
- **Empire State Development Corporation**
- **New York City Economic Development Corporation**
- **New York Energy Consumers Council**
- **New York State Department of Public Service Staff**
- **New York State Energy Research & Development Authority**
- **Pace Energy Project**
- **TransGas Energy**
- **Westchester County**

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Acronyms

BIR	Business Incentive Rate
BNYCP	Brooklyn Navy Yard Cogeneration Partners
BOMA	Building Owners & Managers Association
BOY	Beginning of Year
BTU	British Thermal Unit
CC	Combined Cycle
CCF	Hundred Cubic Feet
CEI	Consolidated Edison, Inc.
CHP	Combined Heat & Power
COS	Cost of Service
CPA	Consumer Power Advocates
DADRP	Day Ahead Demand Response Program
DCAS	Department of Citywide Administrative Services
DEP	Department of Environmental Protection
DSM	Demand Side Management
ECSP	Energy Cost Savings Program
EDRP	Emergency Demand Response Program
ENCORE	Energy Cost Reduction
EPA	Environmental Protection Agency
ERRP	East River Repowering Project
ESCO	Energy Service Company (sometimes ESCo)
HRSG	Heat Recovery Steam Generator
HVAC	Heating, Ventilation, & Air Conditioning
ICAP	Installed Capacity
IDEA	International District Energy Association
JP	Joint Proposal
kW	Kilowatt
kWh	Kilowatt Hour
LEED	Leadership in Energy and Environmental Design
MEP	Mechanical, Energy, and Plumbing
mlbs	Thousand pounds
MMlbs	Million pounds
NYCDEP	New York City Department of Environmental Protection
NYCEDC	New York City Economic Development Corporation
NYECC	New York Energy Consumers Council
NYISO	New York Independent System Operator
NYPA	New York Power Authority
NYSERDA	New York State Energy Research & Development Authority
O&M	Operations & Maintenance
OEM	Original Equipment Manufacturers
PBR	Pure Base Revenue
PRLWG	Price Responsive Load Working Group
PSC	Public Service Commission
PV	Present Value
REBNY	Real Estate Board of New York
REIT	Real Estate Investment Trust
SBC	System Benefits Charge
SCR	Special Case Resource Program
SOMIS	Steam Operations Mapping Information System
UCAP	Unforced Capacity
USGBC	United States Green Building Council

1.

Executive Summary

The steam system of Consolidated Edison Company of New York, Inc. (Con Edison or Company herein) makes a valuable contribution to the overall New York City energy portfolio. It serves approximately 1,800 customers with steam for space heating and hot water and provides about 363 of those customers with steam for cooling equipment. The steam system provides advantages to customers that cannot be provided by alternative services. For example, the most competitive alternative to steam heating is gas boilers. Not only do gas boilers consume valuable space within buildings, they require flues that often take away revenue-producing space. More importantly, for some of New York City's landmark buildings, the possibility of installing gas boilers simply does not exist because of space constraints.

In addition to the direct value provided to its customers, the steam system reduces the need for peak summer electricity capacity by about 375 megawatts, benefiting all electric customers in the southeast New York market. The system also avoids the need for additional in-City electricity and natural gas delivery infrastructure and other associated energy costs (e.g., electric energy) and customer expenses that would be incurred were the steam system unavailable.

On September 27, 2004, the New York State Public Service Commission (PSC) issued an order approving a steam rate plan for Con Edison. While overall steam sales have been fairly stable, the steam load has grown relatively slowly, and steam's market share appears to be declining, particularly in the summer. For this reason, one aspect of the rate plan is a requirement that Con Edison take steps to increase steam sales and the number of customers. To promote the steam business, the order requires the Company to work with the Steam Business Development Task Force established by the order to develop the Steam Business Development Plan (Plan) contained herein. In addition, the order requires the Company to study steam system production costs (Steam Production Study) and develop an Energy Infrastructure Master Plan.

The order provides that the Task Force would consist of up to 15 individuals from local and state government, public interest, and consumer and steam supplier groups. It would meet quarterly to address steam air conditioning matters and obtain information from equipment manufacturers, building owners, contractors, and others. The Task Force would track the company's progress in attracting new steam customers at various locations in Manhattan.

This document presents the Plan required by the order. It should be emphasized that the Plan may warrant further consideration and revision when additional insight becomes available from the Master Plan and the Steam Production Study, also being prepared in accordance with the terms of the rate plan.

The Plan describes the steam system's relationship to the development and growth of New York City and acknowledges that today's steam system faces major obstacles, in particular price, to expanding both sales and the customer base. While further efforts will be required to find solutions to address these fundamental economic challenges over the longer term, this Plan is necessarily focused on the recommended short- term measures that can be implemented to maintain steam system viability. These recommended measures, as described in the Chapter 8 implementation plan, cover (1) Con Edison's information systems, (2) Con Edison's resources, (3) Con Edison's product and pricing offerings, and (4) regulatory and institutional initiatives that will help to create a more level playing field between steam and other energy sources.

In addition to the measures set forth herein, the reader should be aware that the competitive position of steam compared to other energy sources such as electricity and natural gas remains a paramount concern.

Objectives of the Steam Business Development Plan

The PSC, when approving the Con Edison steam rate plan that became effective in October 2004, directed the creation of a Steam Business Development Plan to, at a minimum, address five issues:

- Identify market sectors and geographic areas suitable for expansion of steam service, identify market risks and obstacles impeding the growth of steam sales, and recommend the means to overcome them.
- Investigate with applicable equipment vendors possible means of reducing the financing cost and other financial arrangements for purchasing and leasing steam equipment.
- Explore the use of business incentives, including negotiated rates, to promote load growth.
- Set sales growth targets and hold educational workshops and meetings for contractors, building owners and managers, architects, engineers, and equipment manufacturers to increase knowledge of steam benefits.
- Develop mechanisms for monitoring steam business development.

The Task Force's recommendations will be a part of the next steam rate case to be considered by the PSC.

Findings and Recommendations

The fundamental barrier to development of the New York City steam system is steam's cost relative to other heating and cooling options.

- Improvements in building-scale boilers are making it easier for customers to produce steam on-site for less than they can buy it from Con Edison Steam.
- Tax policies harm steam's competitive position. For example, where steam is less expensive than natural gas, differential taxation results in steam having a higher end-use price than natural gas.

- Steam-only cooling is not cost competitive for full requirements applications under current market conditions. Con Edison Steam has won only about 10 percent of new cooling business historically and little or none recently.

Con Edison Steam historically has won about 80-90 percent of new large commercial customer heating loads on or near its existing lines and has a relatively low customer defection rate.

- Customers value the convenience, space savings, and low initial cost of steam, even though operating and lifetime costs are often higher than those for on-site gas boilers.
- Many customers find it very difficult and/or expensive to install boilers and flues in their buildings.
- Customers appreciate not having to employ a full-time operator for steam heating as they would if they had boilers.
- The current effective defection rate is relatively low compared to most businesses.
- Steam's advantages are, however, threatened by customer alternatives, including customer cogeneration and boilers.

Con Edison Steam should concentrate on developing and retaining its existing combined heating and cooling, and large heating customers, while positioning itself to increase penetration in the cooling market.

- Based on data provided by Con Edison Steam, the steam system is close to being capacity constrained during the winter peak period, which limits the available marketable product.
- The steam system risks losing additional steam cooling customers. There have been several recent conversions to electric chillers, although most conversions took place in governmental buildings in which the low electricity rates and favorable financing terms offered by the New York Power Authority (NYPA) played a role.
- An increasing number of steam chillers may be reaching replacement age.
- Discounted summer tariffs provide thin margins, leaving little room for further price discounting to attract or retain cooling load.
- Hybrid steam/electric chiller plants may be attractive to customers as a hedge and an electric peak demand management option but offer only modest returns to Con Edison Steam under the current rates.
- Con Edison Steam should explore the possibility of obtaining certification as a green energy source eligible for Leadership in Energy and Environmental Design (LEED) status to remain an attractive option in the emerging green building market.
- Increased production from central cogeneration has the potential to enhance the perception of steam as a clean energy source and to reduce the net cost of steam.

Con Edison Steam should explore means of increasing price competition in the steam chiller market.

- New steam turbine chillers cost about twice as much as a comparable electric centrifugal chiller, due primarily to the cost of the steam turbine components that are almost all provided by only two companies.
- The three major providers of steam chilling equipment also dominate the electric chiller market, reducing their incentive to lower steam chiller prices.
- Con Edison Steam should explore chilling technologies such as centralized cold water that obviate the need for on-site chillers and may have the convenience benefits of steam heating.

Publicly administered programs, as they affect steam-cooling options, are not fully coordinated, sometimes conflict, and are insufficient to increase steam penetration into the cooling market.

- It would be very useful to develop a unified compilation of public energy policy objectives (such as for electricity peak reduction), develop a commonly held notion of the value of such reduction, and then check for consistency across programs.
- NYPA's Energy Cost Reduction (ENCORE) program reviews total energy use within a building but does not explicitly consider steam chillers' electric peak reduction value – for both the customer and the City as a whole – and may therefore overestimate the value of conversion to electricity.
- The New York State Energy Research and Development Authority (NYSERDA) electric demand reduction programs are not sufficient to overcome completely the steam chiller cost disadvantage for either new or replacement chillers.
- NYSERDA's steam-to-steam chiller replacement incentive levels are not directly tied to the value of electricity peak reduction, and budget totals are relatively modest.
- NYSERDA's New Construction Program has limits of $400,000-500,000 per building, which are not enough to sway design decisions for large projects in New York City.
- The new Demand Side Management (DSM) funding that emerged from the last electric rate case order is an opportunity to develop effective incentives for steam chillers.
  - Given the current steam capacity constraint and historical growth in the steam system's heating load, any effort to stimulate new combined heating and cooling may have to take this constraint into account.
  - There is an opportunity to increase steam chilling penetration without increasing winter peak demand by providing significant incentives for existing heating-only customers to adopt steam chillers to replace all or part of their electric chillers as they come up for replacement.
  - The current steam-to-steam program incentive levels should be increased moderately and the overall budget expanded to recognize the increased number of projects expected.

- Other means of stimulating steam cooling (or confronting new electric chillers with their full costs) should be explored.
- Con Edison Electric's Business Incentive Rate (BIR) offers a discounted electricity price for qualified businesses. Con Edison Steam and the City of New York (City) could consider a similar rate mechanism to encourage steam chilling.
- Con Edison Steam should explore with the City the possibility of creating a steam Energy Cost Savings Program (ECSP).
- The New York Independent System Operator (NYISO) offers various demand reduction programs. Opportunities for steam chilling, consistent with the intent of those programs, should be explored.
- Combining some programs or alerting major customers about programs may help Con Edison Steam to retain steam-cooling customers.

Con Edison Steam should also examine other methods for increasing the annual load factor by encouraging its customers to manage their peak usage and, more broadly, to optimize their energy decisions with respect to the overall system economics.

- Because customers do not currently use steam for cooling unless they also use it for heating, new off-peak steam sales (and, hence, electricity peak load displacement) may be inhibited by winter constraints on the steam system.
- In the short term (next several years), load management techniques such as peak-centered demand charges (already under review), customer side of the meter efficiency services, and preemptive high-efficiency replacements should be explored as ways to free capacity for additional sales. The costs of these programs should be compared to the costs of new capacity.
- Con Edison Steam should evaluate the profitability of its customer accounts and use that information to focus its customer acquisition, development, and retention efforts.
- Con Edison Steam should explore whether benefits can be achieved through alternative rate designs that more precisely track marginal costs and should determine whether rate design changes should be proposed as a result.

Con Edison Steam should take a more active and, where appropriate, broader role in meeting its customers' energy needs.

- Many new facilities feature increasingly complex energy production and management systems to meet economic and environmental objectives.
- To compete for these opportunities, Con Edison Steam needs to be involved early, be seen as a source of ideas as well as energy supply, and be prepared to offer steam solutions that complement the other elements of the facility's systems.
- Con Edison Steam's Business Development Group has a small core of very capable professionals that needs to be augmented by additional internal and external resources, taking account of other Con Edison Steam needs.
- The size, concentration and nature of Con Edison Steam's customer base suggest that accounts be positively managed with annual and longer-term goals and objectives set and monitored.

- The community of important decision influencers including engineering firms, original equipment manufacturers (OEM), vendors and energy developers must also be actively engaged to improve and maintain their appreciation and understanding of steam's value.
- Con Edison Steam should play an active role in providing information to customers and their advisors about steam heating and cooling technologies and the availability and conditions of various external programs to support steam.
- Con Edison Steam should continue and, if possible, accelerate its efforts to develop a comprehensive customer account information system, focusing initially on the combined heating and cooling customers and large heating customers. This system should include detailed equipment information and identify key operating and investment decision makers and influencers and should track contacts and encounters with decision makers.
- Regulatory barriers to Con Edison taking more active positions in customer or developer projects should be addressed if permissible under applicable law.

Expansion into the unserved markets of Hudson Yards and the Greenpoint-Williamsburg area appears challenging under the current line extension business model.

- Line extension is very expensive—$2,000 per foot of 12-inch pipe and up to $4,000 per foot for 20-inch pipe.
- These two large redevelopment projects do not appear to produce sufficient margin to justify the cost of extension based on an initial non-engineering analysis, particularly in the early stages of redevelopment.
- Alternative business models, such as third-party or joint venture ownership arrangements or even stand alone district energy systems, should be considered to the extent they are consistent with applicable law.

For the longer term, Con Edison Steam should consider exploring alternative business models such as combined heat and power (CHP) or campus-style steam chilling and heating systems that might enable the company to grow outside the constraints of the existing steam system and the current line extension policy. Options such as partnering arrangements, while beyond the scope and resources of this plan to consider, should be explored to the extent consistent with applicable law.

2.

Introduction to the Con Edison Steam System

This chapter provides both a historical perspective and a current profile of the Con Edison Steam system.

District steam heating dates from the 14th Century or earlier and is still an attractive energy choice in many markets.[1] Con Edison's steam system, the largest district steam system[2] in the western world, is not nearly that old but has operated continuously since 1882.

Con Edison Steam is a vertically integrated steam producer and distributor that sells steam and steam delivery service to customers below 96th Street in Manhattan. The company also cogenerates electricity at two facilities and purchases steam from the Brooklyn Navy Yard Cogeneration Partners (BNYCP) facility. The steam system provides primarily space and water heating, and powers approximately 625,000 tons of steam absorption and turbine chillers.[3] There are no manufacturing loads on the system but it serves some restaurant and laundry process loads.

Steam Load and Capacity Concerns

In recent years, the steam load has grown relatively slowly, and steam's market share appears to be declining, particularly in the critical summer period.[4] Still, overall steam sales are fairly stable. The 2004-05 winter peak was 9.7 million pounds per hour (MMlbs/hr). The company estimates that the 2005-06 winter peak, at design criteria, will be 10.4 MMlbs/hr.[5] Con Edison Steam recently installed steam-electric production units and added to its steam cogeneration capacity with the East River Repowering Project (ERRP), which went into service in April 2005.

With ERRP operational, peak-period steam generating capacity is approximately 12.3 MMlbs/hr,[6] providing an expected 2005 peak-period margin of about 18 percent. However, after accounting for the 1.5 MMlbs/hr reserve margin maintained, there are only 0.4 MMlbs/hr of additional marketable capacity in the winter.[7]

Due to electricity generation demands, summer peak capacity is somewhat lower (approximately 10.2 MMlbs/hr), and marketable capacity is about 2.0 MMlbs/hr. The

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[1] District Heating Virtual Library, University of Rochester http://www.energy.rochester.edu/dh/: "[T]he oldest district heating system still operating was warming a French village from geothermal hot springs in the early fourteenth century. A steam district heating system has been in use at the U.S. Naval Academy since 1853, and the oldest commercial district heating system still operating began service in Denver on 5 November 1880."

[2] A district steam system such as Con Edison's supplies customers only with steam. District energy systems may provide both steam and electricity and often provide hot water rather than steam. Some district energy systems also provide chilled water. District heating systems typically distribute hot water to a fairly compact group of buildings.

[3] Con Edison Steam.

[4] Customer count has declined slowly but steadily from 1,861 to 1,811 over the 2000-2004 period. See Consolidated Edison, Inc. (CEI) 2004 10-K, Operating Statistics.

[5] Con Edison Steam.

[6] The capacity of the steam system has recently varied between 12.0-12.6 MMlbs/hr as plant ratings change. For the purposes of this report, the capacity is assumed to be 12.3.

[7] Con Edison maintains a 1.5 MMlbs/hr reserve margin sufficient to deal with both low pressure avoidance and loss-of-the-largest-steam-generator criteria.

tight winter reserve margins limit short-term growth significantly and are discussed more fully in Chapter 3.

Steam Delivery System Footprint

The system currently comprises about 87 miles of mains and 18 miles of service lines from 96th Street to downtown Manhattan.[8] To a greater extent than either natural gas or electricity, short-term steam marketing and sales must be focused on locations on or near existing mains. It costs between $2,000 and $4,000 a linear foot to extend lines in the congested New York City subsurface. New integrated or stand-alone systems may be developed, but these efforts take years to plan and implement.

The maps and graphics in this section illustrate the historical and current footprints[9] of the system. Areas for potential expansion in Manhattan and Brooklyn and alternative models for their development are discussed in Chapter 5.

Historical Evolution of the New York City Steam System

The shape of today's system and some of the constraints on its development reflect its evolution over the past century.

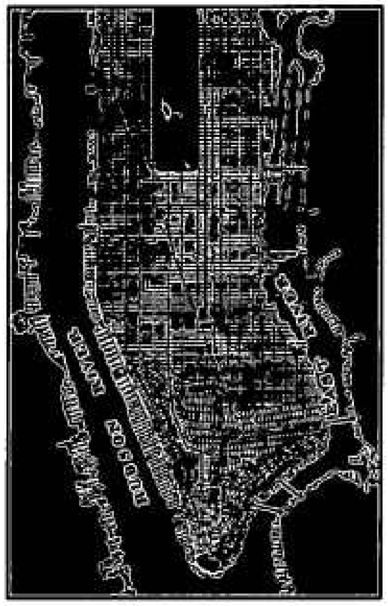
Figure 1. Con Edison Steam circa 1882

The Con Edison system is the result of growth and acquisition during more than 120 years. Today's system is the result of consolidating at least four formerly independent companies and still bears technical and operating remnants of its forbears.

The original New York City system had only 3 miles of main, operated at 80 pounds per square inch (psig), and served only 62 customers in the downtown area. The steam system preceded Edison's Pearl Street Station that opened on September 4, 1882 but did not, as some believe, provide the steam for Edison's dynamos.[10] The electric and steam systems were not fully wedded to become "Consolidated" Edison until the 1930s.

[8] CEI 2004 10-K.
[9] Con Edison Steam.
[10] The Pearl Street Station had its own coal-fired boilers. See http://www.ieee-virtual-museum.org/collection/event.php?id=3456876&lid=1 for background on the early development of electricity system in New York City.

Figure 2. Con Edison Steam circa 1936



The steam system continued to grow both organically and through acquisition. In 1936, Con Edison purchased the New York Steam Company and its 65 miles of main, 6 generating units, and rights to serve 2,500 buildings. This strengthened Con Edison's position in the midtown area, today one of the fastest growing parts of New York City.

Charles Copeland of Goldman Copeland Associates, a prominent New York City engineering firm, points out that the steam system helped build the Manhattan skyline by making it possible to build without boilers and huge chimneys. In turn, the shape of the system – two dense load centers dominated by high rises, one in Midtown and the other Downtown – reflects the underlying geology of Manhattan island. Underlying most of the island is Manhattan schist, a 450 million-year-old metamorphic rock formed under the pressure of the once towering Taconic Mountains. The schist lies only 18 feet below Times Square but plunges to 260 feet below Greenwich Village. Another shallow section lies below the Downtown area. These shallow schist formations constitute the bedrock upon which high rises are built and explain the clustering of the largest buildings.[11]

The system now comprises more than 100 miles of main and service lines and serves more than 1,800 customers. Steam today is transmitted at 400 psig and is distributed at 150 psig – a far cry from the 80 psig of its early days. But, if one looks closely at a map of the system, one can still see the outlines of the predecessor systems.

Steam Production and Cogeneration Capacity

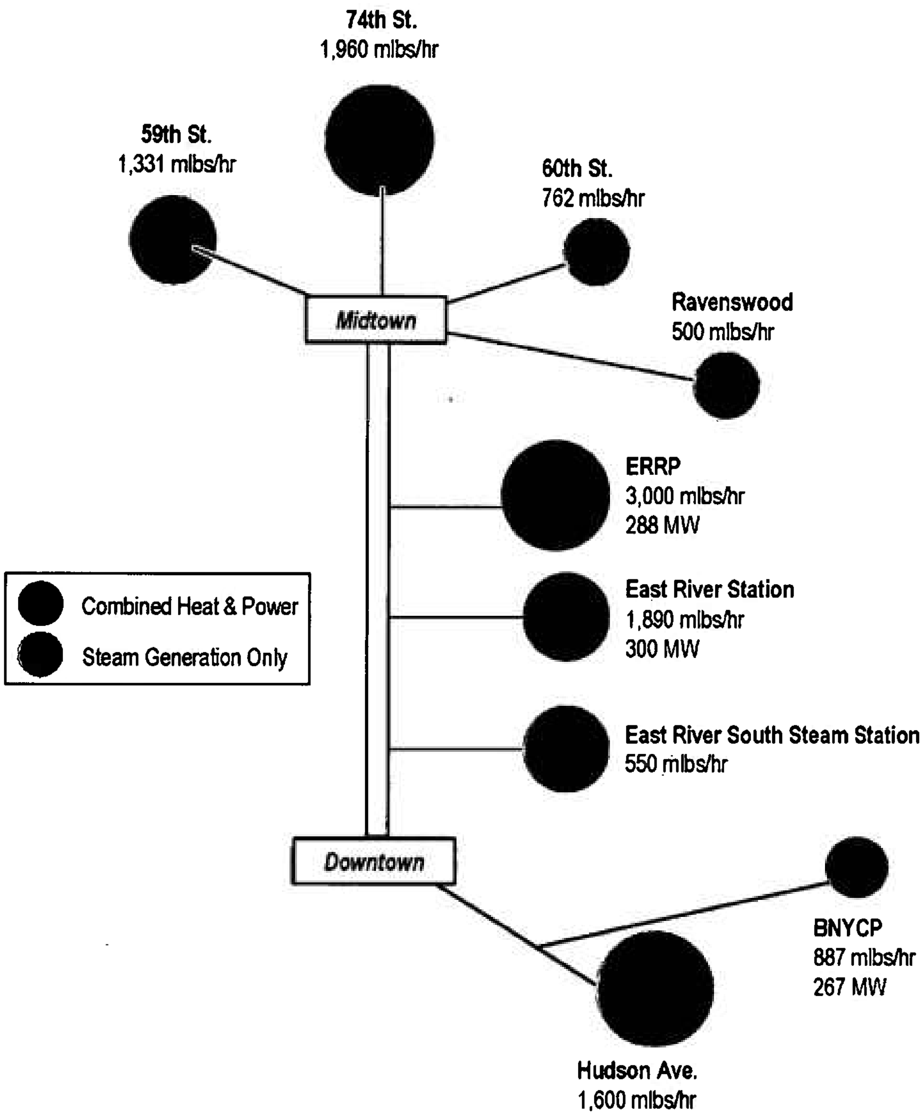
Today, four stations in Manhattan and one each in Brooklyn and Queens generate steam. Two of the plants at these four stations also produce electricity (Figure 3). Forty-nine percent of Con Edison's 2004 steam output were produced in steam-only plants, 36 percent were produced in steam/electric generating plants, and the remaining 15 percent were purchased from the BNYCP cogeneration facility.[12]

The schematic of the steam production fleet below provides a conceptual picture (all of the plants shown are located in Manhattan except for Ravenswood, which is located in Queens, and BNYCP and Hudson Avenue, which are located in Brooklyn). It should be noted that three of the plants[13] have the ability to burn both natural gas and oil. The

[11] Glaciers in New York, an Introduction to Regional Geology
[12] CEI 2004 10-K, Steam Operations.
[13] 59th Street, East River Station, and East River South Steam Station.

ability to burn less expensive fuel oil is one of the steam system's competitive advantages.

Figure 3. Steam System Schematic



Con Edison Steam controls the electric dispatch of ERRP. East River Station produces both steam and electricity but is controlled by Con Edison Electric, which calls on its electricity output during the summer electricity peak period. Therefore, not all of the steam capability of this unit is available for marketing in the summer. Waterside, which also produced electricity, was retired when the ERRP came on line in April 2005.

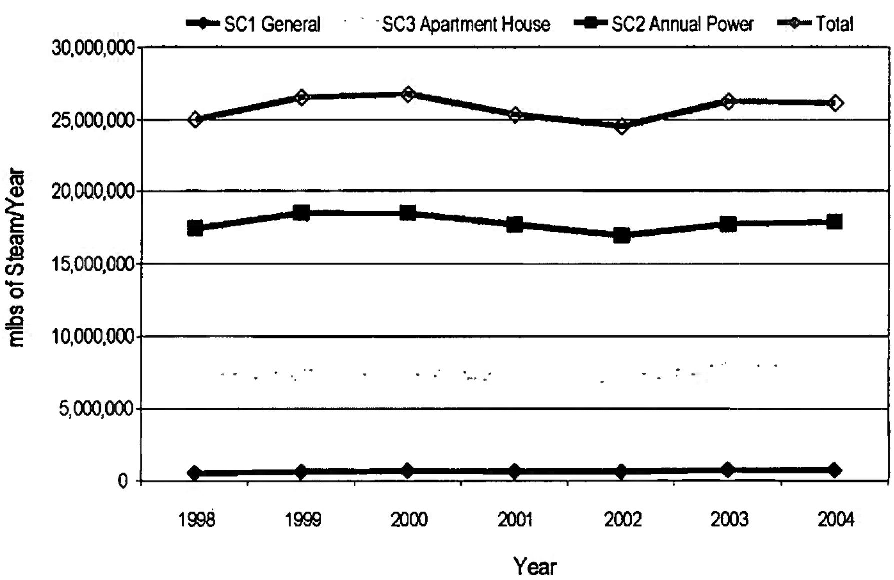
The Con Edison Steam fleet produces two products – steam and electricity – and electricity thus accounts for only a portion of total energy output and an undetermined percentage of revenue. Con Edison Steam's cogeneration production capacity increased by a net 125 megawatts when ERRP went on line in April 2005.

Steam Business Financials

Recent Sales Trends

The recent path of product sales for the SC1 General Service, SC2 Annual Power Service, and SC3 Apartment House Service customer classes is shown in Figure 4. Despite the loss of the World Trade Center in the September 11, 2001 terrorist attacks, and the defection of accounts with sales of more than 540 MMlbs, Con Edison Steam sales have remained relatively stable.

Figure 4. Steam Sales 1998-2004 – By Tariff Class and Total[14]



Recent Financial Performance

Although only a small part of Consolidated Edison, Inc. (CEI), Con Edison Steam is by most standards a substantial business with more than $550 million in annual revenues. As a business unit, the steam operation should be viewed financially on a more or less stand-alone basis; however, CEI's publicly available financial information does not provide an easily accessible picture of the unit on this basis. The financials in Figure 5, in totality, provide some insight into the size and profitability of the steam business and suggest factors to focus on in developing the business.

[14] Con Edison Steam.

Figure 5. Steam Business Financials 1998-2004[15]

Categories	2004	2003	2002	2001	2000	1999	1998
Customers (avg/yr)	1,811	1,825	1,838	1,853	1,861	-	-
Steam Sales (mlbs)	26,128,644	26,248,361	24,519,476	25,327,694	26,733,260	26,532,797	24,995,694
Avg Revenue per mlb	$20.32	$19.47	$15.50	$18.87	$16.38	$12.81	$12.84
Revenues from Steam Sales	$531*	511	380	478	438	340	321
Other Steam Revenues	$21	28	25	28	16	2	2
Total Operating Revenues	$552	539	405	506	454	342	323
Fuel	$262	262	162	229	198	122	109
Purchased Power	$75	55	30	52	43	29	31
Other Production Expenses	$66	65	69	69	62	48	43
Distribution Expenses	$35	20	18	21	20	19	18
Customer Accounts & Administration	$24	21	16	22	23	27	27
EBITDA	$90	116	110	113	108	97	95
Depreciation & Amortization	$19	19	18	18	18	18	17
Taxes Other than Income Tax	$59	58	61	61	61	56	54
Income Tax	$-9	4	-5	6	3	3	5
Total Operating Expenses	$531	504	369	478	428	322	304
Steam Operating Income	$21	35	36	28	26	20	19
Interest	$30	24	-	-	-	-	-
Est Earnings Available for "Common Equity"	$-9	30	-	-	-	-	-
Est Return on "Equity"	-0.029	0.099	-	-	-	-	-
Assets at Original Cost	1,753	1,171	-	-	-	-	-
Utility Plant at Original Cost	823	799	768	759	740	722	605
Accumulated Depreciation	200	-	-	-	-	-	-
Net Utility Plant Value	623	607	-	-	-	-	-
Debt/Equity Ratio Assumed	1 to 1	-	-	-	-	-	-
Construction Expenditures	502	158	84	64	32	28	31

* Dollars stated in millions except average revenue per mlb.

Construction expenditures, largely for ERRP, have been substantial, while Con Edison Steam returns have been low. Estimated earnings before interest, taxes, depreciation, and amortization (EBITDA) have declined during 1998-2004, while the investment base (approximated by utility plant at original cost) has increased more than 35 percent.

Increases in overall revenues have been driven almost entirely by price increases. The number of customers declined modestly, while the average mlb sales per customer remained about the same from 1998 through 2004. Average revenue per mlb, a proxy for the average price seen by customers, increased 58 percent during 1998 to 2004. The largest component of price, fuel plus purchased power, also increased 58 percent during the same period.

[15] 1998-2004 data was obtained primarily from CEI 6-Year Financials and Operating Statistics, for 2003 and 2004. Additional data was derived from the company's 2004 Annual Report and 10-K. These values are actuals and not normalized for weather or other factors.

These figures suggest that the initial focus of business development should be reestablishing profitability by selectively pursuing opportunities that increase utilization of existing assets, while defending profitable relationships.

3.

Market Analysis

This chapter reviews data and information about steam customers and addresses, in part, the PSC's first objective:

Identify market sectors and geographic areas suitable for expansion of steam service, identify market risks and obstacles impeding the growth of steam sales, and recommend the means to overcome them.

The chapter is divided into sections dealing in turn with:

- Customer Load and Marketable Steam Capacity.
- Customer Profile.
- Seasonal Variability and Weather Sensitivity.
- Defection and Returning Loads.
- Energy Decision Influencers.
- Customer Decision Criteria.
- Estimating the Economic Value of Customer Accounts and Delivery Assets.

The views of the customers derived from a recent Internet survey of large New York City energy consumers are shown in the Appendix. Several of the survey findings are noted in the Plan discussed in this chapter and elsewhere.

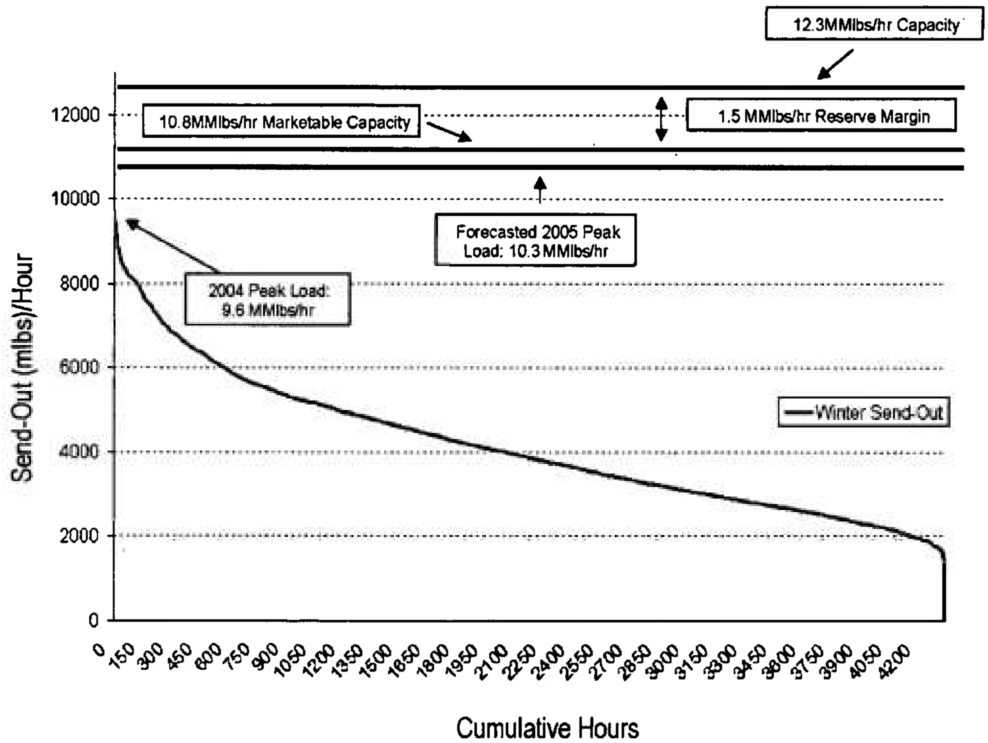
Customer Load and Marketable Steam Capacity

The near-term development challenge facing Con Edison Steam stems largely from the fact that the system is nearing capacity in the peak winter period (November through April) but has a fair amount of marketable product in the summer off-peak period. The company must manage carefully its winter capacity and pursue summer loads that will improve capacity utilization and margins.

Figure 6 illustrates the relationship between the current steam production capacity of 12.3 MMlbs/hr, the reserve margin of 1.5 MMlbs/hr, and the projected 2005-06 peak load of 10.4 MMlbs/hr. The most important point illustrated below is that Con Edison has only about 0.4 MMlbs/hr of marketable steam in the winter period.[16] The graphic also shows how "spiked" the winter peak is – almost 15 percent of the capacity is required to meet the load experienced for only 50 hours of the winter.

[16] The projected 2005-06-peak load reflects system design criteria. The tight capacity situation and the spiked peak suggest a judicious approach to marketing winter loads.

Figure 6. Marketable Product During the Winter Period

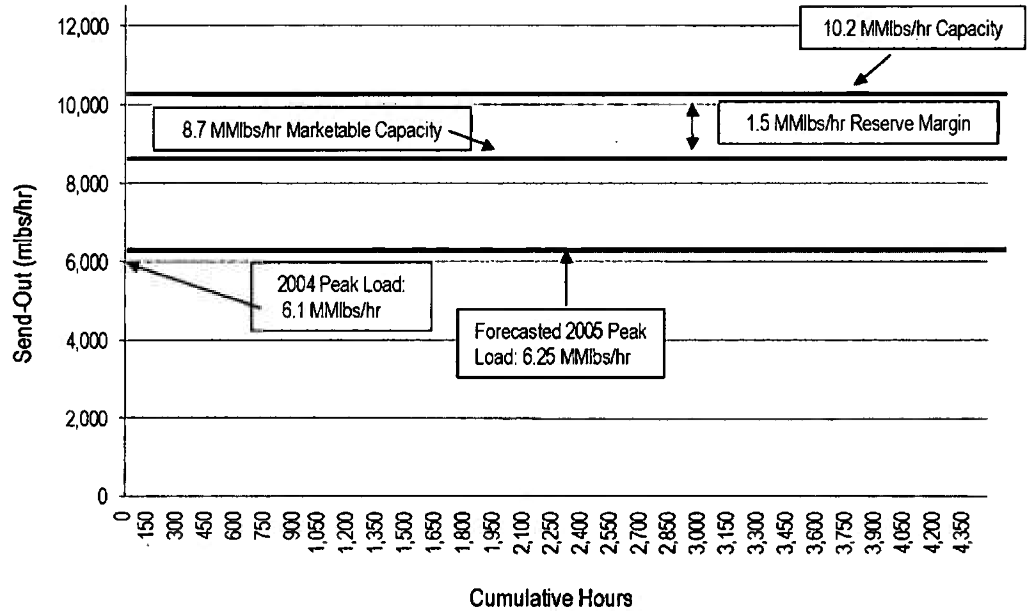


The limited room for growth can be appreciated by comparing the amount of capacity available to that required for particular customers. A combined heating and cooling customer with 600,000 square feet of floor space requires about 14,000 lbs/hr of steam capacity to support its heating load.[17] Given marketable product of about 0.4 MMlbs/hr,[18] there is room only for about 30 new "average" combined heating and cooling customers.

Figure 7 shows the summer period capacity situation. Summer capacity of 10.2 MMlbs/hr reflects the fact that a significant share of the steam fleet is still under the control of Con Edison Electric and is dispatched electrically (as opposed to thermally) during the summer electric peak period. As a result, the amount of marketable summer steam is below the level it would be if the units were dispatched thermally.

[17] 600,000 sq. ft. times 0.02 lbs/hour/sq. ft. times 1.14 for thermal delivery losses = 13,680 lbs/hr/customer, which yields about 30 customers when divided into the available capacity of 0.4 MMlbs.
[18] 12.3 MMlbs capacity less 1.5 MMlbs reserve margin minus projected 2006 peak of 10.4 MMlbs.

Figure 7. Marketable Product During the Summer Period[19]



The "average" heating and cooling customer introduced above uses about 1,700 tons of chilling in the summer, or about 19.4 mlbs/hr of steam capacity.[20] The summer incremental capacity available for sale is approximately 2.0 MMlbs/hr. This available summer capacity will support more than 100 new, average-sized cooling customers. However, the winter capacity constraint limits the number of new combined heating and cooling customers to about 30. Beyond that, it appears that there may be room for 70-80 new cooling-only or cooling added to existing heating-only customers.

Marketing and Sales Implications of Peak Capacity Constraints

The small room for steam peak load growth suggests that marketing of new combined heating and cooling customers as well as large heating load must be pursued carefully. Stimulating cooling load among existing heating-only customers as their electric chillers come up for replacement may be an attractive strategy.

The relationship between customer load and marketable capacity suggests a number of additional development actions, including the following:

- Consider peak period demand charges (with an appropriate transition process) to provide better price signals and to recover some peak capacity.
- Consider the creation of a steam peak load reduction offering.

[19] Con Edison Steam.
[20] 1,700 tons times 10 lbs/ton times 1.14 to account for losses.

- Explore incentives for low-margin heating accounts to shift voluntarily to gas heat to provide them with a lower cost heating solution and recapture some winter capacity, consistent with applicable law.
- Explore additional company or merchant steam production capacity.
- Explore interruptible steam contracts for peak period usage.
- Take back or harvest some existing peak period capacity by working with customers to manage load or to improve efficiency of operation.

Because it is difficult to market for the long term without some notion of the availability and expected cost of future product, Con Edison should explore new demand and supply side options. Such options might include:

- Facilitating customer cogeneration development.
- Exploring re-powering options, such as combined cycles or back pressure turbines at existing plants.
- Considering an auction for new steam capacity.

Customer Profile

Con Edison Steam's ability to increase the value of its customer portfolio depends greatly on its knowledge of its existing customers and its understanding of the reasons for customers' selecting steam or defecting from the system. Load growth on or near its existing steam lines is relatively slow, so Con Edison Steam will likely look first to existing customer development and retention, while pursuing attractive customer acquisition opportunities as they emerge.

Summary Profile of Existing Customer Base

The table below represents the basic data on which the various customer profiles and market sizing estimates for the on-or-near-lines marketing area was constructed.[21]

[21] Data are derived from Con Edison customer information.

Figure 8. Customer Categories and Summary Characteristics

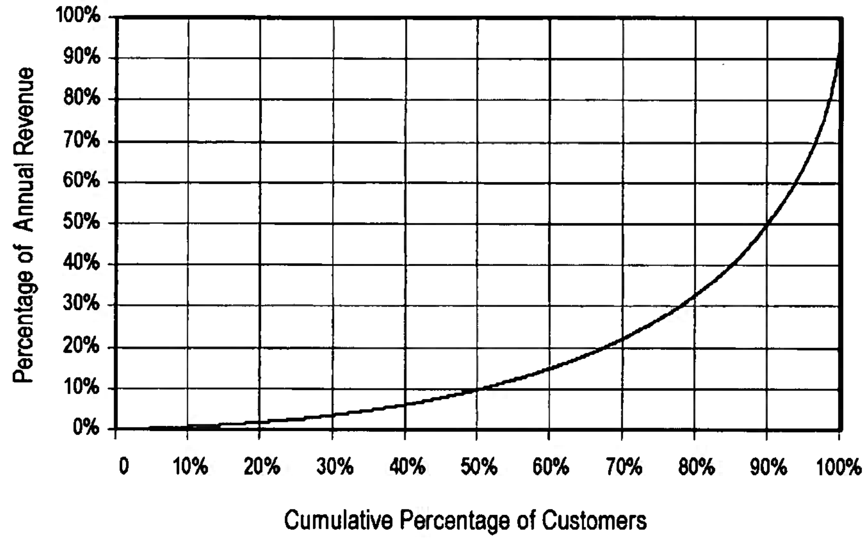
	Total	Steam Cooling (est from Combined)	Combined Heating & Cooling [3]	All Heating-Only	Large Hearing-Only [4]	Small Heating-Only
Customers [1]	1,811	363	363	1,448	250	1,198
2004 Total Revenue [5]	$561,361,007	$116,405,034	$287,082,141	$274,278,866	$172,132,633	$102,146,233
Winter Revenue	$229,082,914	$22,599,693	$97,174,730	$131,908,184	$84,950,401	$46,957,783
Summer Revenue	$81,160,787	$93,805,341	$61,415,122	$19,745,665	$14,209,656	$5,536,008
Customer Charges	$22,549,480	-	$6,458,808	$16,090,672	$3,926,897	$12,163,775
Energy Charges	$184,102,164	-	$98,560,057	$85,542,107	$55,952,699	$29,589,408
Taxes	$44,465,661	-	$23,473,422	$20,992,238	$13,092,980	$7,899,258
2004 Total Sales (mlbs) [2]	26,128,644	6,804,488	14,120,009	12,031,368	7,886,373	4,144,995
Winter Sales (mlbs)	16,723,095	941,654	6,908,994	9,814,101	6,265,176	3,548,925
Summer Sales (mlbs)	9,428,282	5,862,834	7,211,015	2,217,267	1,621,197	596,070
Avg Annual Margin	$14,440	$34,603	$105,930	$29,408	$109,970	$12,596
Avg Winter Margin	$36,937	$10,376	$76,132	$27,111	$100,243	$11,849
Avg Summer Margin	$7,809	$24,227	$29,798	$2,297	$9,727	$746
Total Floorspace (sq.ft.)	578,776,026	218,849,050	218,849,050	359,926,976	229,772,024	130,154,952
Avg Floorspace (sq.ft.)	319,589	602,890	602,890	248,568	743,099	108,644
Avg Floorspace - Turbine-Only (sq.ft.)	1,075,934	1,075,934	1,075,934	n/a	n/a	n/a
Avg Floorspace - Absorption-Only (sq.ft.)	291,800	291,800	291,800	n/a	n/a	n/a
Total Cooling (tons)	625,283	625,283	625,283	n/a	n/a	n/a
Cooling Ratio (sq.ft./ton)	-	350	350	n/a	n/a	n/a
Avg Tons - Turbine-Only	3,136	3,136	3,136	n/a	n/a	n/a
Avg Tons - Absorption-Only	828	828	828	n/a	n/a	n/a
Heating Ratio (mlbs/sq.ft.)	0.02	n/a	0.02	0.03	0.03	0.03
Winter Heating Ratio	-	-	-	0.03	0.03	0.03
Summer Heating Ratio	-	-	-	0.01	0.01	0.00

[1] 2004 10-K, average customer count.
[2] 2004 10-K, Operating Statistics.
[3] Only 2 small cooling customers do not also buy steam for heating (i.e., the cooling and combined are essentially the same).
[4] Defined as the top 250 heating-only customers.
[5] 2004 10-K Notes to Financial Statements, page 157 - rounding in the source.

Customer Size and Revenue Distribution

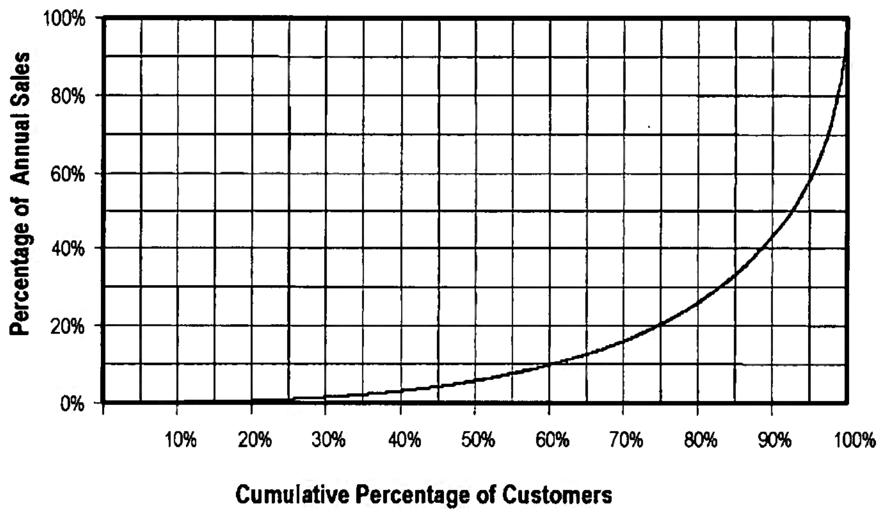
A relatively small number of customers account for most Steam's revenue and sales. The cumulative distribution curve in Figure 9 shows the top 32 percent of customers account for 80 percent of revenues. Moreover, the concentration of commercial and retail building ownership in New York City means that Con Edison Steam must deal with an even smaller group of owners and decision makers. This concentration is helpful from a marketing perspective because it is easier to get to know and deal with a small customer population, but it is also a danger because adverse decisions by a small number of people can result in serious revenue losses.

Figure 9. Cumulative Distribution of Customer Revenue



The revenue concentration shown in Figure 9 reflects the underlying distribution of sales, shown in Figure 10. It is interesting to note that the smallest 75 percent of the customers represent only 20 percent of sales and that 50 percent of the customers account for less than 10 percent of annual sales.

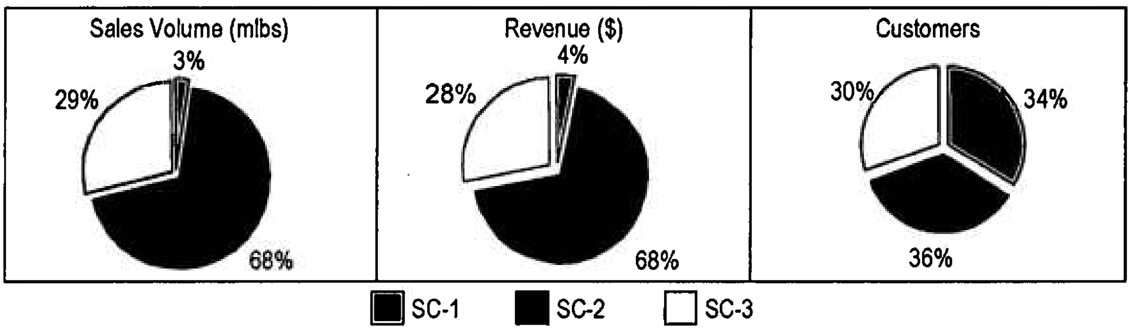
Figure 10. Cumulative Distribution of Customer Sales



Revenue and Sales Distribution by Tariff Class

Another view, illustrated in Figure 11, this time from the tariff class perspective, reinforces the picture of concentrated load and revenues. The 649 SC 2 Annual Power Service customers account for almost 70 percent of both sales volume and revenues, while the 553 customers on SC 3 Apartment Building Service account for nearly all of the remaining sales volume and revenue. The 614 SC 1 General Service customers contribute relatively little to either sales or revenues.

Figure 11. Sales Volume and Revenues by Tariff Class



Implications of Concentrated Sales and Revenue Distributions

All of the tariff classes and most of the building classifications have very concentrated load and revenue patterns similar to those illustrated above for the total system. This means that most steam sales, revenues, and operating contributions derive from a relatively small group of customers.

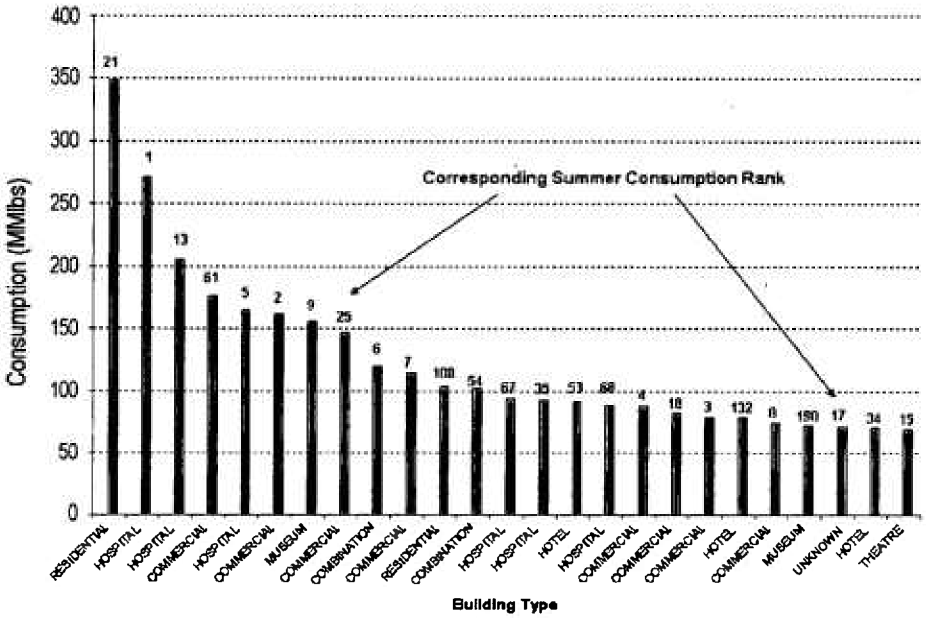
- Concentration confirms the need to focus customer development and retention efforts on an identifiable group of customers and means that the high value group is compact and readily identified.
- Some low margin accounts might better be served by gas if an economical transition program that is consistent with applicable law is developed.
- The relatively small number of highly attractive customers also makes it easier for market rivals such as alternative technologies to target them as potential conversions or cogeneration sites.
- Consideration should be given to managing individual large accounts on a strategic account basis.

Seasonal Consumption Patterns of Largest Customers

One of the most valuable features of the steam system is that its peak is complementary with that of the electricity system. The steam system peaks in the winter and has unused capacity during the electricity system's summer peak period. To the extent that steam can economically increase its penetration into the summer space chilling market, it can contribute to relieving the tight Zone J electricity capacity situation.

Unfortunately, opportunities to develop the summer loads of existing large customers are limited. The largest 20 percent, or about 360 customers,[22] tend already to be both heating and cooling customers. In fact, while there are many heating-only customers, all but two cooling customers are also heating customers. Figure 12 shows the overlap between the ranking of the highest winter customers and summer customers.

Figure 12. Twenty-five Largest Winter Customers and Their Rank Among Summer Steam Users



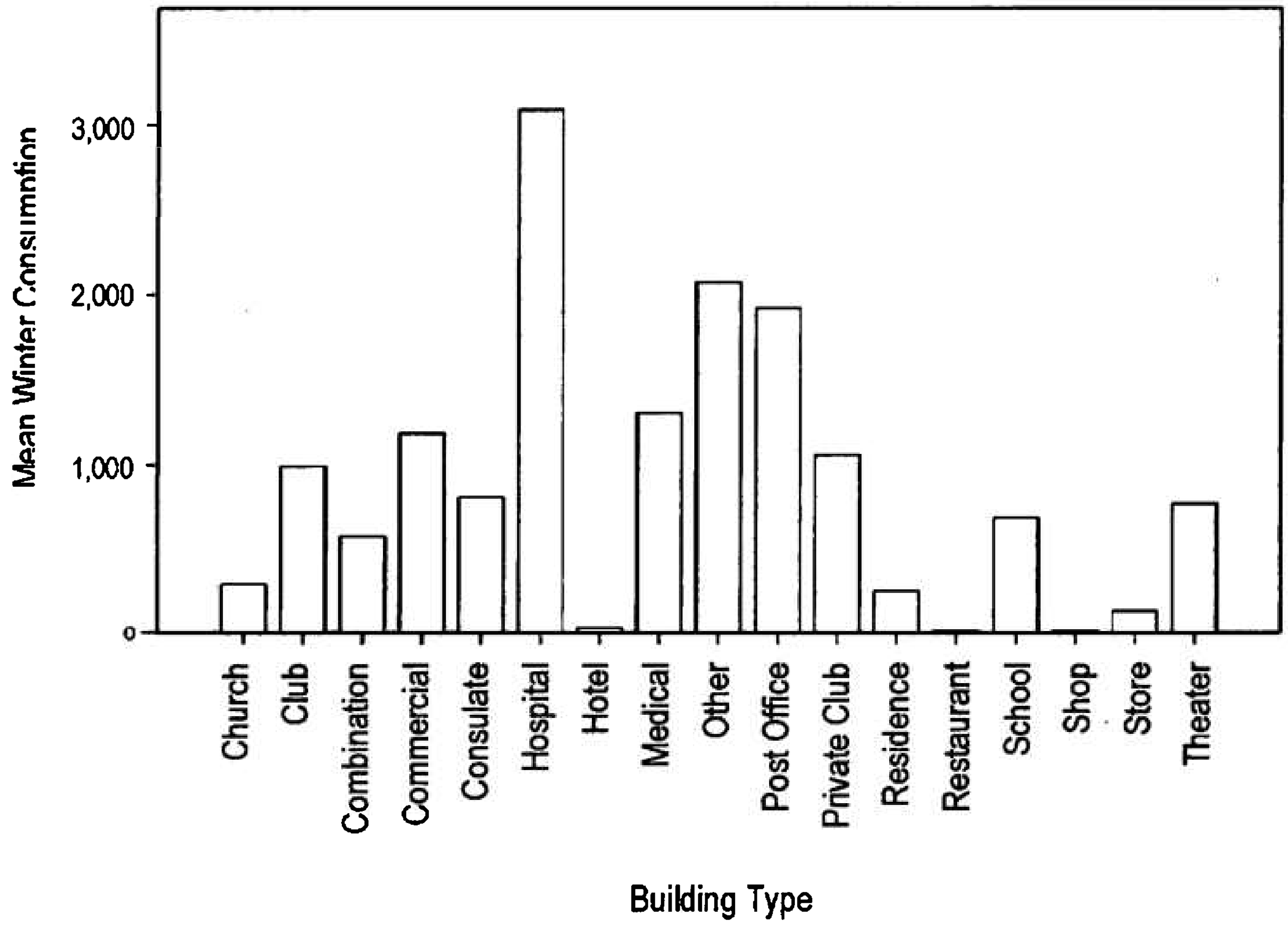
Opportunities to Develop Off-Peak (Summer) Load of the Heating-Only Customers

Steam cooling penetration is already fairly high among the very largest customers. Opportunities to sell off-peak steam to displace on-peak electricity may still be fairly numerous among large- and mid-size steam heating-only customers. As a rough indication of the number of potential add-on cooling prospects, the average winter consumption (a proxy for building size) and the building types of those customers with very low summer steam use were examined.

[22] Average number of 2004 customers = 1,811 x .20 = 362.

As shown below in Figure 13, there are several heating-only customers in the hospital, post office, and theatre categories whose winter sales levels indicate that they may be candidates for steam chilling. This suggests that targeted marketing efforts directed at particular sectors may be valuable. Unfortunately, Con Edison Steam's database does not record the age of the facilities' heating, ventilation, and air conditioning (HVAC) systems and, hence, the potential conversion period.

Figure 13. Average Winter Sales of Heating-Only Customers by Building Type



The top 250 heating-only customers represent approximately 230 million square feet of floor space (Figure 8, page 33). This would call for about 657,000 tons of chilling, which greatly exceeds steam capacity available for off-peak sales. However, given the cost disadvantage of steam cooling and the difficulty of winning these relationships from the electric utility, converting these customers will be a challenge. Conversions from electric to steam are rare and would likely occur only with substantial incentives.

Although Con Edison Steam should selectively pursue opportunities to convert electric chillers entirely to steam cooling, the more promising product may be a hybrid or steam/electric chiller. Hybrid chiller plants offer customers an energy reliability and cost hedge. The plants may be used to manage both peak demand levels and electricity demand charges, although they produce little value for Con Edison under the current rates. The hybrid chiller option is discussed further in Chapter 4, Steam Product Analysis.

Implications of Customers' Seasonal Consumption Patterns

The fact that the very large heating and cooling customers are much the same accounts suggests the following:

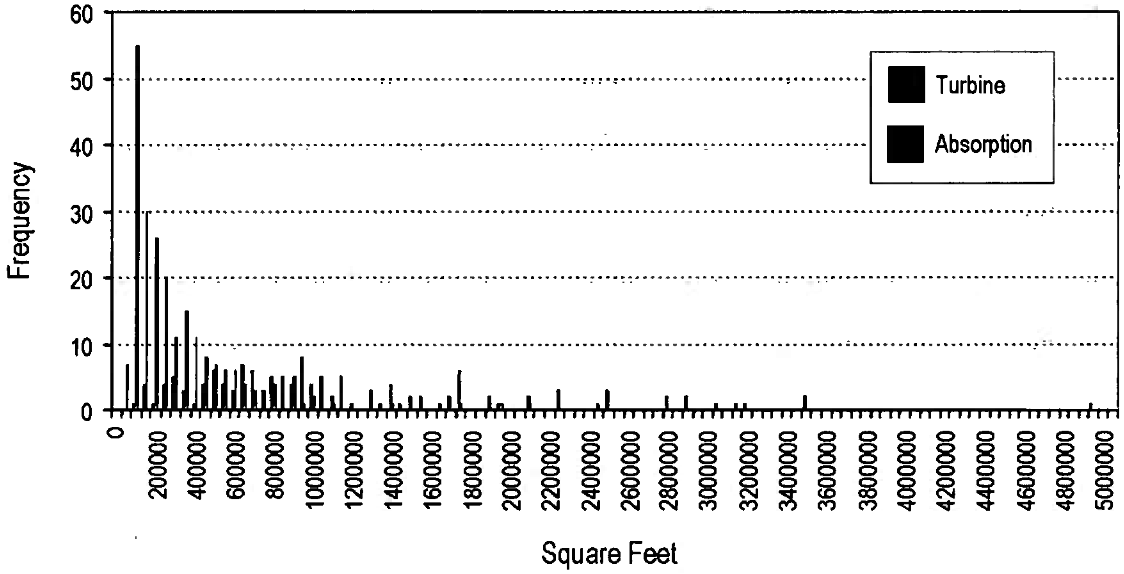
- The potential to market steam cooling service to existing mid to large steam heating-only customers may be limited to the top 250 or so such customers.
- With the possible exception of hybrid steam/electric chillers, it will be extremely difficult to market steam cooling separately from heating without a substantial incentive to offset the equipment cost, operating, and maintenance cost disadvantage.
- The existing combined heating and cooling customers must be defended vigorously from rivals.

Existing Steam Chiller Population

Steam chiller customers are not only among the most valuable accounts, they are responsible for electricity peak load avoidance that benefits all Southeastern New York electric consumers. Of the 366 steam heating and cooling customers, 135 have turbine chillers and 235 have absorption chillers (4 have both chiller types). These customers account for about 625,000 tons of chilling – equivalent to about 375 megawatts of installed capacity.

While absorption chillers are found in buildings of all sizes, they are very concentrated in small- to mid-size buildings under 600,000 square feet, as shown in Figure 14. Turbine chillers are more uniformly distributed and dominate the larger building sizes.

Figure 14. Distribution of Absorption and Turbine Chillers by Building Size



Informal and anecdotal information from customers and Con Edison Steam personnel suggest that many of these chillers are approaching the end of their lives and will become replacement or conversion candidates in the next several years. There may also be a substantial number of dormant steam chillers on the system that were not removed when electric units were installed, and might be a source of hybrid chilling.

Implications of Existing Steam Chiller Distribution

Given the difficulty of selling new steam cooling load, the steam system's value in reducing electricity peak load demand depends greatly on retaining existing cooling customers. These customers are likely the system's prime retention candidates. The current retention program is based largely on the SC5 tariff that allows Con Edison to negotiate a price discount to customers that demonstrate an economic case for defection to electric chillers.

The chiller technology and age distribution suggests consideration of a number of other initiatives:

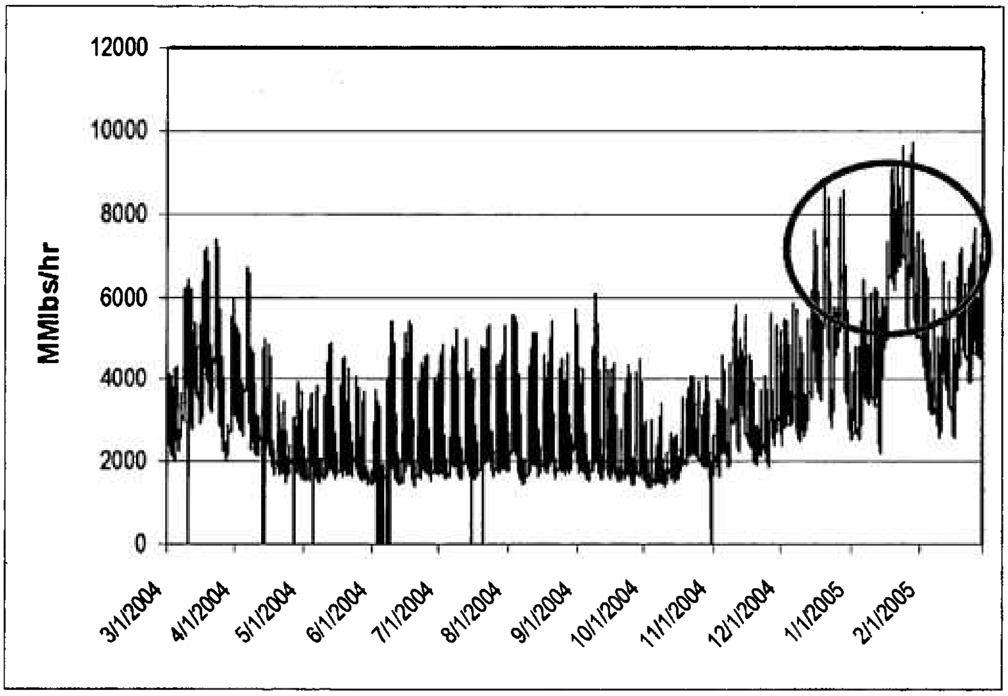
- Conduct rapid development of detailed account information on each of the approximately 360 combined heating and cooling customers, grouping together commonly owned and managed accounts.
- Consider preemptive account retention actions to extend expected account life. This could be accomplished by:
    - Increasing account value by lengthening the expected duration of the relationship.

- Taking steps to increase steam chiller efficiency and reliability by providing on-site technical support, technical audits, and system evaluations that will lengthen the pay-back period from conversion to electric chillers.

Seasonal Variability and Weather Sensitivity

Not surprisingly for a business that sells heating and cooling, Con Edison Steam's total load varies substantially across seasons and is very weather sensitive. Once again, the very prominent spike in the top 50 or so hours (circled in red in Figure 15) requires a disproportionate share of the capacity and reinforces the need to examine load management and peak-centered pricing options.

Figure 15. Annual Send Out – All Loads



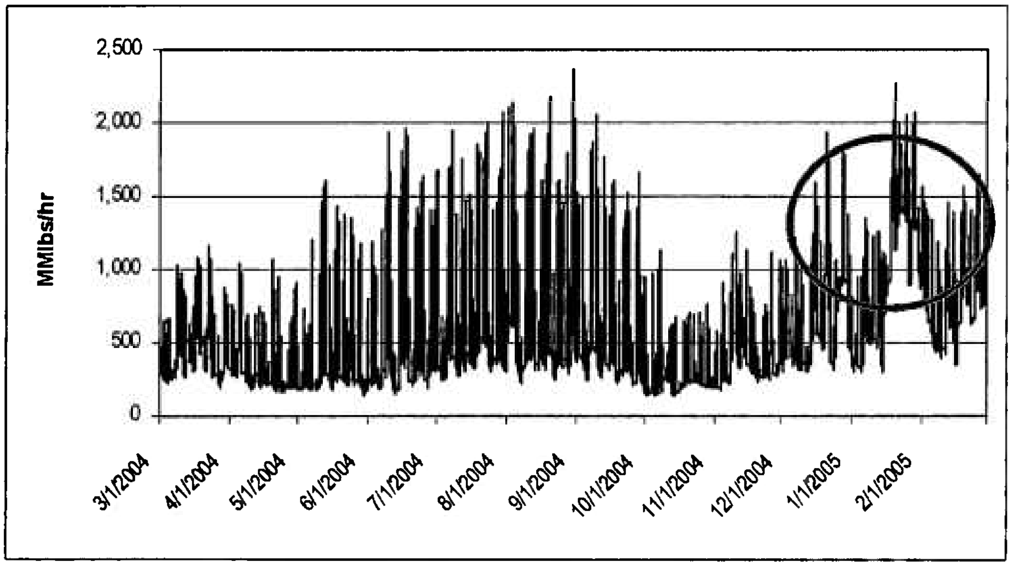
Annual Load Curves for Major Customer Segments

A first-cut indication of the potential for demand charges, load management, shifting, and thermal storage may be gained by examining the load duration curves of different customer groups. The annual load patterns of different building types in the Con Edison load research sample[23] vary somewhat. For example, the commercial customers (Figure

[23] Con Edison Steam hourly load data for 8 hospitals, 15 hotels, 23 apartment buildings, and 30 commercial buildings. The curves shown are the aggregate load for the sample, not a statistical average or a typical customer.

16) in the sample have similar winter and summer peak levels, reflecting the relatively high penetration of steam air conditioning in the commercial segment.

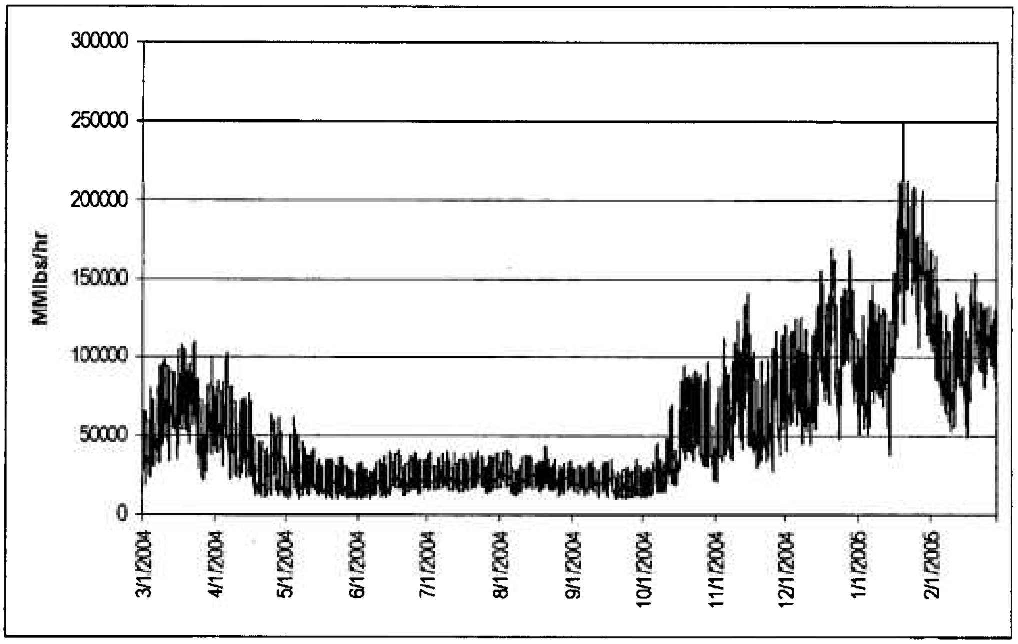
Figure 16. Commercial Building Daily Loads



The apartment building sample in Figure 17 has a pronounced winter peak and a low, nearly constant daily load pattern in the summer. This trend probably reflects the fact that Con Edison has found it very difficult to market steam cooling to apartment buildings since 1990.[24]

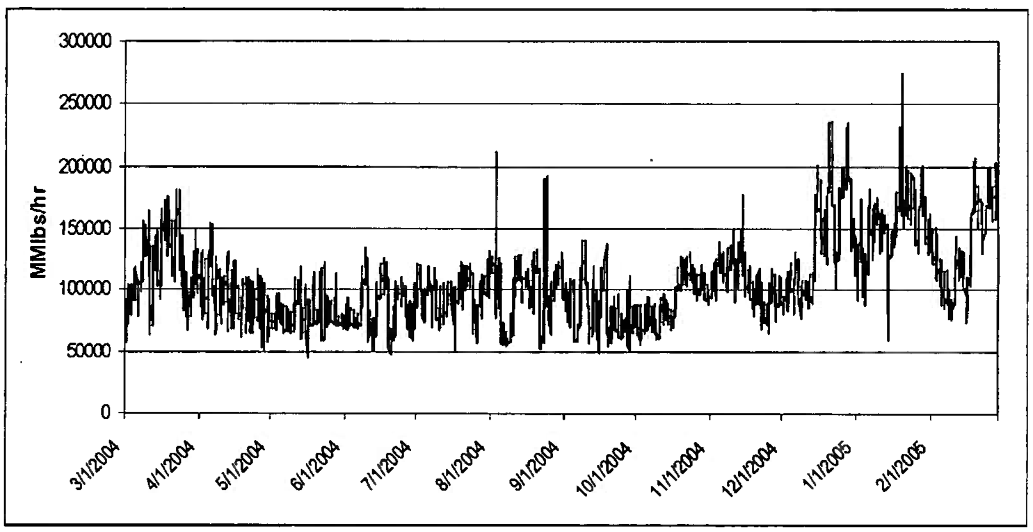
[24] Before 1990, Con Edison Steam captured about 60 percent of the high-rise residential market. After 1990, its share dropped, on average, to about 15 percent. The change appears driven by the displacement of 4-pipe fan coil units (FCU) with central plant by water loop heat pumps with central heat. As a result, the most attractive high-rise residence market remaining is the luxury condominium segment, where the quality of 4-Pipe FCU is still valued and there is less price sensitivity.

Figure 17. Apartment Buildings Annual Pattern of Daily Loads



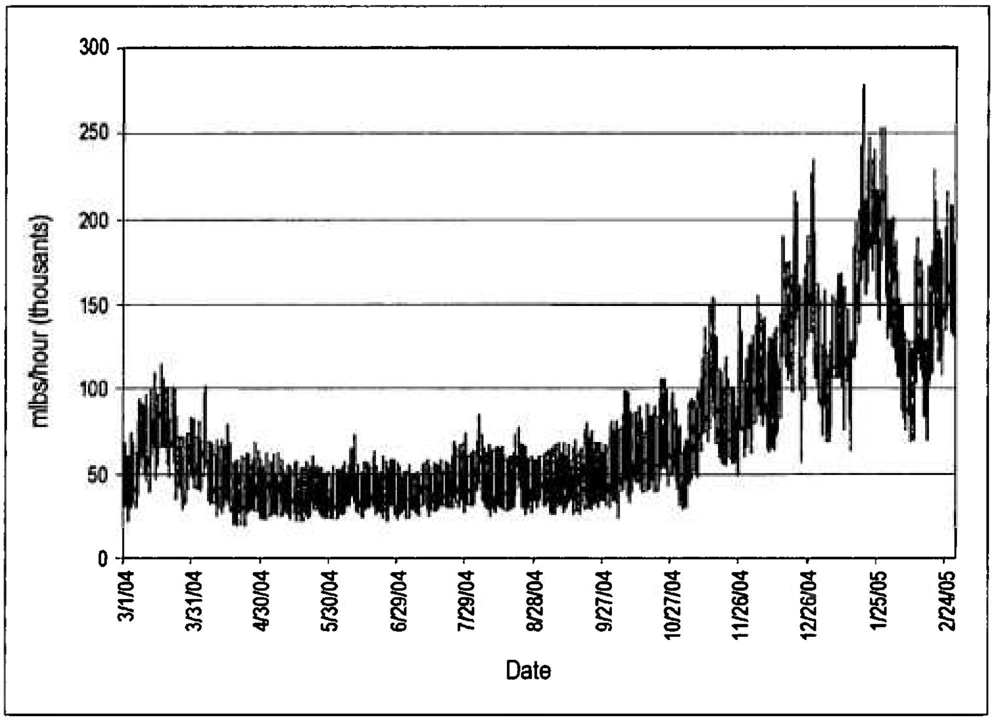
The hospitals in the sample in Figure 18 display a pronounced winter peaking load with a secondary summer peak.

Figure 18. Hospital Annual Daily Loads



Hotel daily loads, like apartment buildings, are relatively low in the summer with some summer period spiking but are very weather sensitive in the winter (Figure 19). Again, this seems to reflect low steam chilling penetration in this segment.

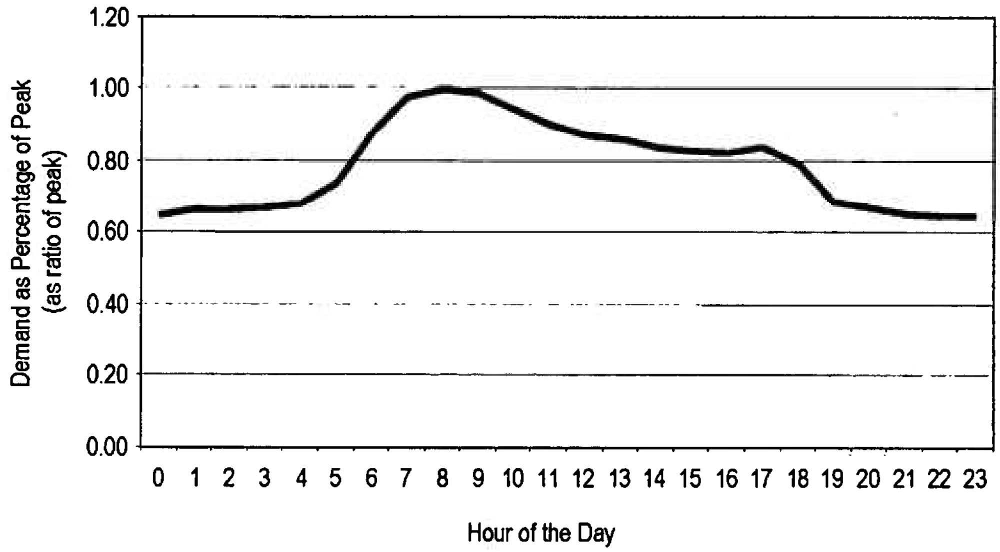
Figure 19. Hotels Annual Daily Loads



Customer Daily Load Curves

Examining the daily load curves provides some insight into the feasibility or effectiveness of the load management and pricing options that could be considered. For example, the average daily load curve for the commercial sample in Figure 20 displays the typical pattern of ramping the temperature up in the early hours in anticipation of tenants arriving for work and then dropping down in the afternoon and evening.

Figure 20. Typical Commercial Customer Load Shape – Winter Day



Implications of Weather Sensitivity and Load Shapes Across Customer Groups

The load shapes of the customer classes suggest a number of potential actions:

- The seasonality and weather sensitivity (especially that coincident with the winter peak) indicate that a carefully designed winter demand charge might help to moderate peak load growth and promote load management actions such as load shifting and thermal storage. Con Edison Steam is currently interviewing selected customers to determine their ability to shift or manage load.
- The severe spike of the peak period and its sensitivity to weather suggest that various real-time management systems based on communication, radio signal, or temperature be explored. Such systems can align more precisely the period of management with the need for load reduction.
- Moderating peak load growth might free up some capacity to serve additional winter loads and, importantly, make room for additional combined cooling and heating customers.
- The underlying resistance to steam cooling of apartments and hotels should be explored further. It appears to be related, at least among apartments, to a preference for water loop heat pumps. Many landlords favor this heating option because it facilitates individually metered and billed service. Tenants who prefer to pay for their own cooling load also resist master metered service.
- Not enough data and analysis were available for this report to draw firm conclusions about the potential for load management. However, the combination of the peak winter capability constraint, the spiked nature of the system and customer loads, weather sensitivity, and the apparent ability to shift or manage loads make a compelling case to accelerate the load research and demand charge analysis.

Customer Defection and Returning Loads

Con Edison Steam is actually quite effective at retaining customers. The defection rate is relatively low by comparison to most businesses. In Con Edison Steam's case, the competition comes not from a rival steam supplier but from electric and natural gas applications. Customers defect from the steam system for several reasons:

- The building may be demolished, often to acquire space for a new building.
- The building may be converted to another use, and that use may have an economic incentive to use another energy source.
- A rival energy supplier or customer cogeneration developer may capture the account.
- Accounts may be put into play because of equipment failure or diminished equipment reliability.

Although the overall defection rate is modest, the loss of summer chilling load is detrimental for the Con Edison electricity system. Almost all of the lost steam chilling load converted to electric chillers, which puts more strain on the electricity system. The 68 customers lost during 1999-2004 averaged 8 MMlbs in annual sales. The City of New York alone accounted for a total of 195 MMlbs lost at four locations.[25]

Calculating defection rates for the steam system is difficult because many "lost" accounts return, sometimes under a different account name, after being inactive for a period of time. During this time, the building may have been renovated or converted or may have changed ownership. Con Edison Steam has recently worked to get a better handle on this cycle and to explore means of identifying and tracking lost and recoverable accounts. The table in Figure 21 indicates the approximate rates of net sales loss over the past several years.

Figure 21. Lost and Returning Business, Adjusted for WTC Loss – 1999-2004[26]

Year	1999	2000	2001	2002	2003	2004	Avg.
mlbs Sales	26,532,797	26,733,260	25,327,694	24,519,476	26,248,361	26,128,644	25,915,039
Lost	176,642	33,996	54,302	130,134	76,983	72,052	90,685
Lost (returning)	56,466	72,044	-	15,687	13,785	20,159	29,690
Returned	0	0	58,010	78,685	0	36,460	28,859
Net Lost Business	223,108	106,040	-3,708	67,136	90,768	55,751	91,516
Defection Rate	0.88%	0.40%	-0.01%	0.27%	0.35%	0.21%	0.35%

[25] Two Hunter College locations accounted for 138 MMLbs in 1999; 100 Centre Street, 12 MMlbs in 2003; and 100 Gold Street, 45 MMlbs in 2004. These conversions were the result of analysis and financial support from the NYPA ENCORE program.
[26] Con Edison Steam. The 2001 results were adjusted to eliminate the effects of the World Trade Center loss on 9/11/2001.

Con Edison Steam has historically replaced and is expected to continue to replace the overall sales and revenues lost to defection and demolition. However, it has not been able to offset the loss of the valuable summer off-peak load that is responsible for the reduction of electricity generation and distribution requirements.

Implications of Defection and Returning Load Analysis

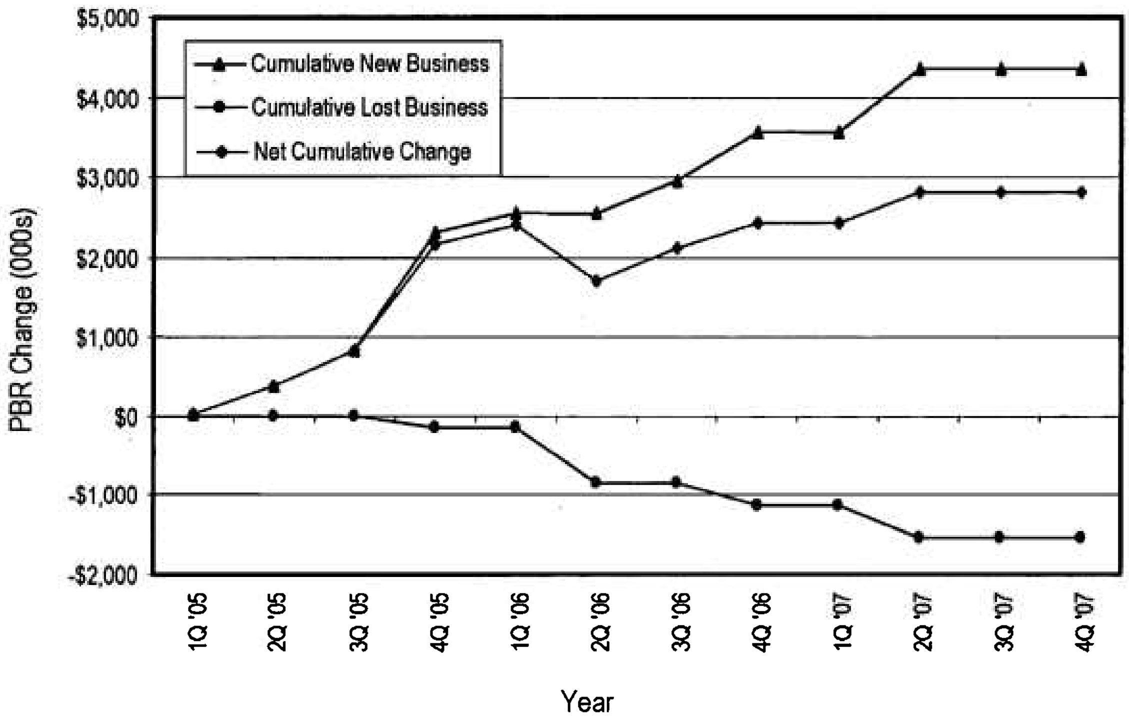
- Although the net defection rate is currently low, the aging of the customer base and especially the installed chiller base may foretell an increase in conversion threats and defections.
- Con Edison Steam should explore means of getting more timely information on cooling load customers who may be considering conversions.
- The NYPA ENCORE program, discussed in Chapter 7, should be examined to determine its effect on steam chiller conversions in light of the peak electricity demand consequences.
- Con Edison should continue to (a) determine the primary causes of defection and customer attrition, (b) explore the feasibility of preventing defections, and (c) ascertain if there are reliable indicators of potential customer defection.

Con Edison Steam recently projected cumulative new pure base revenues of slightly more than $4 million during 2005-2007. This gain is offset to some extent by projected lost business of about $1.5 million, leaving a net increase of under $3 million.

In recent years, Con Edison Steam has added approximately 7 million square feet of heating load per year.[27] The current contestable market on or near Con Edison Steam's lines appears to be a very mature market with net building and floor space additions growing at about 1.0 percent per year. In several areas, conversion of commercial buildings to residential uses has accelerated switching to natural gas heating.

[27] Con Edison Steam. The figure is consistent with a 1 percent per year growth in the estimated 913 million square feet of floor-space near the lines, and a 80 to 90 percent heating load acquisition rate.

Figure 22. Projected Net Growth in Steam Pure Base Revenue (Customer Acquisitions Less Defections) – 2005-2007[28]



Energy Decision Influencers

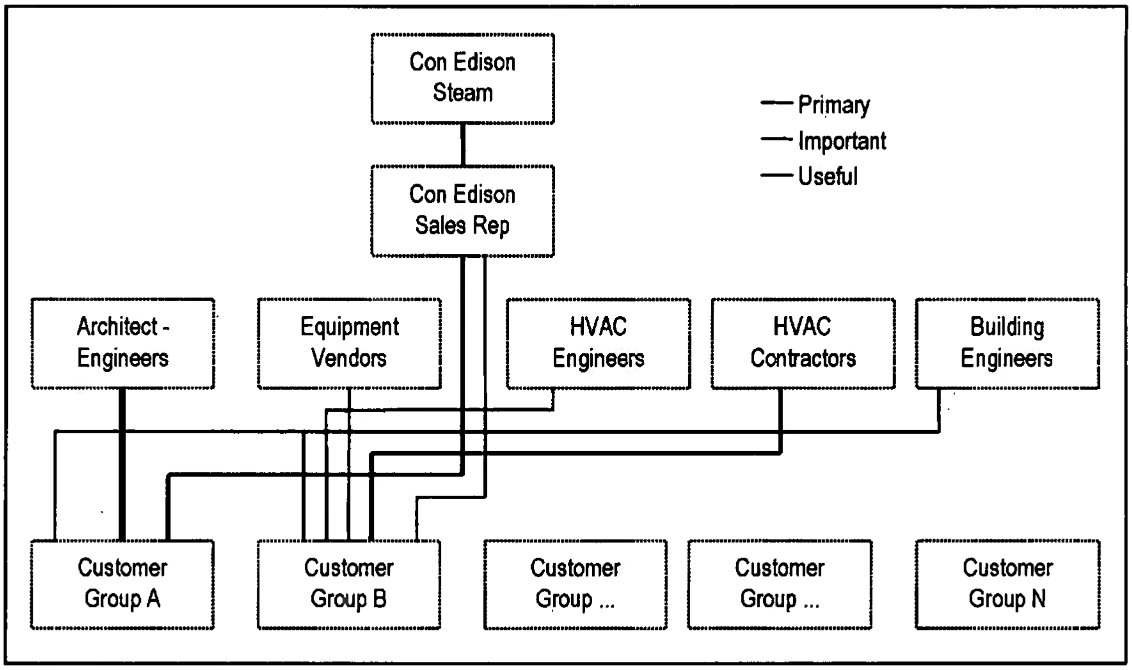
Architects, building engineers, HVAC system designers, contractors, and other energy advisors have a great deal of influence on energy and HVAC decisions. In some cases, the quality of their advice may be affected by lack of familiarity with current steam technology. This ignorance, uncertainty, or misconception may be an obstacle to steam development. As the prominence of steam relative to gas and electricity has declined, the motivation to become familiar with steam has eroded. Con Edison Steam is the only real candidate for the role of steam champion and provider of information.

Figure 23 shows a representative influence diagram indicating the source and importance of various advisors. Understanding the sources and flows of energy and steam-related advice will help Con Edison Steam greatly in positioning itself and in meeting the PSC's fourth objective:

Set sales growth targets and hold educational workshops and meetings for contractors, building owners and managers, architects, engineers, and equipment manufacturers to increase knowledge of steam benefits.

[28] Con Edison Steam.

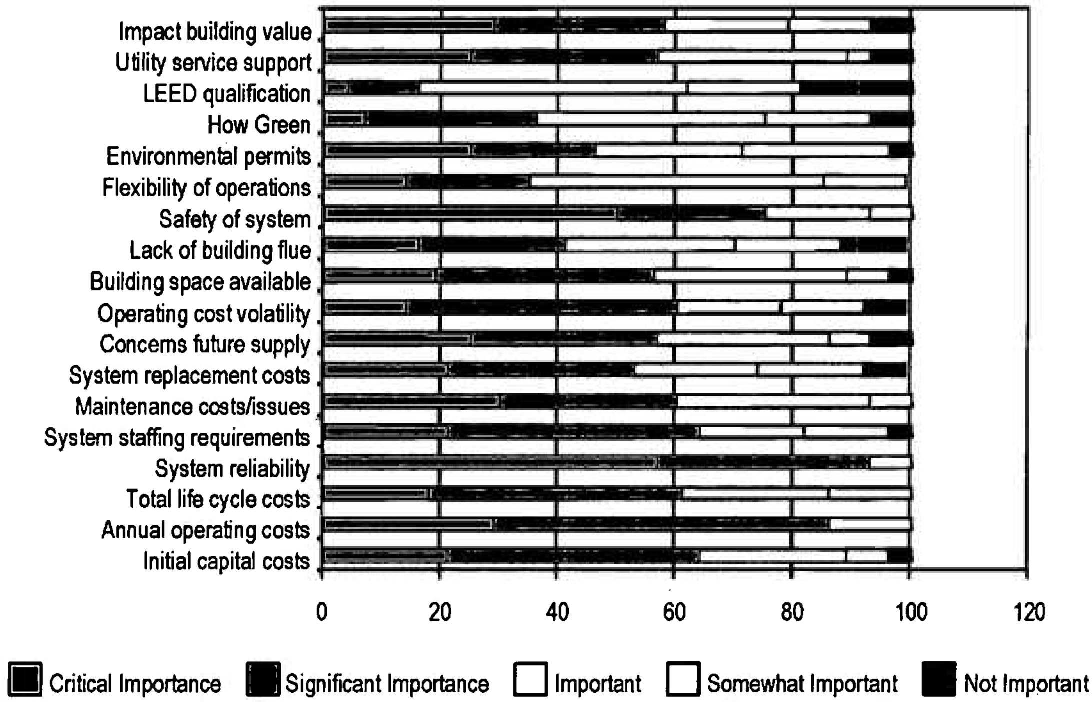
Figure 23. Representative Influence Diagram



Customer Decision Criteria

Customers weigh many factors when making energy supply and operating decisions, but the weights placed on different variables typically reflect the economic incentives of the decision maker. The chart in Figure 24 shows the aggregate responses of the customer survey participants.

Figure 24. System Decision Criteria Ranking[29]



In addition to the expected concern about safety and reliability, the various cost criteria all score highly. The dominance of the annual operating cost factor over total life cycle costs probably reflects the contractual arrangements of the participating building owners and managers. For example, real estate investment trusts (REITs) that pay dividends out of operating income may be more sensitive to operating costs than are owners of commercial buildings who can pass on operating costs more easily than capital costs.

The range of different weights that customers give to particular decision criteria is more evidence of the need to build individual customer account information and to integrate that with insight into the attitudes and perceptions of their advisors.

Estimating the Economic Value of Customer Accounts and Delivery Assets

Understanding the economic value of individual accounts is essential to making decisions about how much to invest in acquiring, developing, and retaining particular accounts. In addition, gathering and assessing the data necessary to estimate account values often stimulate marketing and sales insights.

[29] Customer Survey, 2005.

Only the average values for the broad customer categories introduced in Chapter 3's Figure 8 (page 33) are estimated. Even this limited analysis highlights the important differences in account values of "typical" customers shown in Figure 25. These values represent the net present value of the estimated after tax margin in winter ($4.00/mlb) and summer ($1.50/mlb). Ideally, these figures should be net of incremental account servicing and maintenance costs, but the data do not provide a sound basis for estimating those values.

New and existing combined heating and cooling customers and large heating-only customers have lifetime values of approximately $0.5 million each, reinforcing the need to focus on retaining the large accounts. In contrast, the nearly 1,200 small heating customers have average account values of a little more than $90,000. The significance of this value can be grasped by considering that the typical line extension to a customer is around 30 feet, costing about $60,000, leaving roughly $30,000 to invest in customer acquisition, account set-up, and other initial costs. The estimated average equity value of less than $65,000 per customer produced by adding hybrid chillers to existing large heating-only customers is discouraging and indicates the need to review the revenue model and incentives.

Figure 25. Preliminary Typical Customer Account Values

Customer Type	Avg. Sq.Ft.	mlbs - Summer	mlbs - Winter	After Tax Margin/Year/ Customer	Avg. Customer Equity/Account
Existing combined heating & cooling customers	602,890	19,865	19,033	$63,558	$490,777
New combined heating & cooling customers - new bldgs	602,890	19,865	12,058	$60,563	$467,653
Hybrid chillers added to current heat-only customers	743,099	4,561	-	$4,105	$64,107
Existing large heating-only customers	743,099	6,485	25,061	$65,982	$509,496
New large heating-only customers	602,890	2,412	16,881	$38,344	$296,081
Existing small heating-only customers	108,644	498	2,962	$12,049	$93,035

It is important to note that the positive account values for "typical" accounts do not necessarily mean that either (a) all customers have positive account values, or (b) the system as a whole has a positive value equal to the sum of the customer equity values.

While the total customer equity is positive, the fixed costs of the system to supply them may result in the overall business value being low or negative. Nevertheless, the account value is the appropriate measure to use in assessing the incremental or decremental value of pursuing, developing, and (possibly) transitioning particular accounts. These actions are discussed in Chapter 7, Marketing and Sales Strategy.

Not all steam customers contribute equally to the value of the system. In practice, regulatory convention groups customers into classes and applies average costs to those classes in a way that produces a distribution of account values.

Holding sales volume aside, most low value customer relationships stem from a misalignment of rates and costs. This misalignment is particularly likely when rates are set equal to average costs and (a) actual costs vary substantially above and below the average cost and/or (b) rate classes include a broad range of customers who have very different consumption levels and/or usage patterns. Solutions for low value accounts include refining the pricing structure and tariff class criteria to better reflect costs and consumption patterns. For example, Con Edison Steam currently does not have demand charges and has only three major, very broadly defined (e.g., "General Service") customer groups. As the sample load curves in Figures 15 through 18 indicate, customer groups have very different annual load profiles and, hence, different relative contributions to peak load and capacity responsibility. Based on interval metering data and load research, Con Edison Steam may consider creating new service classifications.

Customer accounts may have low values for a variety of reasons, most significantly:

- The absence of demand charges may understate capacity cost drivers. Con Edison Steam does not presently use demand charges, but it is currently evaluating demand data.
- Customer charges may under-recover general, administrative, and account servicing costs or may include costs that are more properly captured by demand or energy charges.
- Transportation and/or delivery charges may not cover the cost of owning, operating, and maintaining a line because of customer density levels or other factors.

It is important that Con Edison Steam be able to evaluate the economic potential of new, more complex products and relationships. To develop the required understanding of its economic cost structure, Con Edison Steam should conduct a comprehensive marginal cost study to guide and support the new embedded cost of service study.

Demand Rates and Capacity Costs

Con Edison Steam has a very unbalanced annual load duration curve and may face peak load capacity constraints. This suggests that explicit demand charges might send more efficient capacity-related price signals and thereby encourage more effective consumption decisions. Con Edison Steam does not currently levy demand charges on its steam customers but it is installing interval meters.

Some steam customers have resisted demand charges in the past, but the alternative course of either adding new higher cost capacity or rationing peak capacity may be more costly. The review of customer annual load patterns suggests that some customers would benefit fairly easily from the adoption of peak-centered demand charges, and others would likely need to invest in facilitating technologies or change behavior.

Line Profitability and Asset Management

Line profitability analysis is a form of asset management or yield management. As an airline computes the profitability of its various routes or as a supermarket calculates return per shelf foot, a utility can benefit from knowing the absolute and relative values of its embedded (literally in the case of steam) assets. Line profitability, or contribution, is the difference between the delivery revenues generated by the customers on the line and the delivery-related operating, maintenance, and ownership costs of the line. Lines should be built if the net present value of cash flows is positive.

The Company looks closely at the economics of new lines, and it has begun also to examine the profitability of existing lines. This information can identify which lines are most profitable, which are candidates for development, and which should be considered for alternative service options. The adoption of an asset management perspective is worthwhile in its own right as a business development foundation. Regulation tends to instill an average-cost orientation to decision-making, while asset management depends on de-averaging[30] costs, revenues and opportunities, and stimulating more creative thinking about development, planning, and operations.

Development of the steam delivery network calls for an asset-management approach involving several layers of analysis:

- Do line-specific delivery revenues cover line-specific variable costs and contribute to the fixed costs of the system? In other words, are there lines or line segments that do not have sufficient delivery revenues to cover the incremental costs of operating and maintaining them? If there are, efforts should be made to cure the revenue shortfall by adjusting rates or increasing throughput on the line consistent with applicable law.
- Are differential costs of delivery reflected and marketed to optimize the yield on lines and to direct investment to its highest value locations?
  - Would line in-fill efforts be facilitated by promotional delivery charges that reflect underutilization?
  - The current transportation rate, SC6, appears to charge the same per unit of steam transported regardless of length of haul or the location of injection and withdrawal.
- Are line extensions or new networks planned strategically on an expected or potential profitability basis? The line extension policy was relaxed in the last rate case from 100 to 250 feet. The enormous cost of line extension discourages building in advance of demand.

[30] The term de-averaging or deaveraging is common in utility regulatory proceedings examining the unintended consequences of using a common tariff for an entire customer class when the underlying costs of serving individual customers within the class are very disparate. De-averaging refers to the process of conducting and adopting more refined cost-of-service allocations to ensure a better assignment of shared costs to the customers actually driving those costs.

Implications of the Account Economic Value Analysis

Con Edison Steam needs to develop a better understanding of the value of its tangible and intangible assets. The Company has already taken steps to improve the quality of information about its customer accounts and the yield on its assets. Con Edison Steam should:

- Continue to develop a usable account valuation system.
- Continue its efforts to measure the yield on its delivery assets and extend that analysis to its production assets.
- Prepare a new marginal cost-of-service study, and review the potential and opportunities of new pricing structures, such as demand charges, new products, or variations of existing products (transportation rates, hybrid chillers, interruptible steam rates, etc.).

4.

Competitive Product Analysis

Opportunities In Current Markets

This section discusses the cost and performance of steam products versus electricity and natural gas. This material is intended to explore the marketing challenges and opportunities Con Edison Steam faces, both in its existing markets and in creating new sources of revenue. The first part of this chapter examines closely two principal products that account for more than 90 percent of sales and revenues:

- Steam cooling
- Steam space heating

Steam Cooling

Con Edison Steam serves a significant summer cooling load of more than 625,000 tons of chiller capacity distributed across turbine technologies and building sizes as shown below in Figure 26.

Figure 26. Summary of Steam Cooling Customers[31]

Steam Chiller Technology	Customers in Sample	Chiller Tonnage	Average Tonnage	Square Footage	Average Sq.Ft.
Turbine-only	131	413,000	3,152	146 million	1,100,000
Absorption-only	231	192,000	831	70 million	303,000
Both	4	23,000	5,750	8 million	2,000,000
Total	366	628,000	1,716	224 million	

Given Con Edison Steam's pronounced seasonal imbalance of load and capacity and the emerging peak period capacity constraint, it is natural to look to steam cooling as a potentially cost-effective product. Air conditioning drives the electricity peak load but is an off-peak load for steam and natural gas.[32] In-city electricity costs are high:

- Average variable costs of peak energy (NYISO Zone J locational prices) are expected to range from $80- $90 per MWh during 2005-2008.
- Average in-City or Zone J capacity charges (UCAP) are expected to be between $70 and $100 per kilowatt (kW) per year, except in 2006 when several large units are being added.
- New in-City capacity is expensive to build and difficult to site. Recent gas-fired combined cycle units have cost over $1,500 per kW.

[31] The data in this table are derived directly from customer data files and may not correspond exactly to values estimated from the summary table. This is due to rounding and missing data cells on some accounts. These factors are minor.
[32] Given natural gas delivery and volume constraints into the City, it is not clear that there is an "off-peak" period in the usual sense of a relatively low cost period with ample capacity.

Steam cooling's most attractive feature is that it reduces electricity peak demand. In the last rate case, it was estimated that approximately 400 megawatts[33] of electricity generating capacity was displaced by steam chillers. It is currently estimated that steam chilling reduces peak electricity demand in the City by about 375 megawatts.

Electricity distribution demand charges of about $32 per kW/month during the cooling season may offset the relatively high steam costs. Unfortunately, even with a recent change in the on-peak/off-peak price differentials and a special $2/mlb discount for steam chiller loads, Con Edison Steam captured only about 10 percent of the new contestable air conditioning load. Even worse, Con Edison Steam has not captured a significant new air conditioning load in the past two or three years.

Steam heating-only customers may be attractive targets for steam cooling sold as a replacement for electric chillers. However, developing account value or increasing the "share-of-customer" by selling additional products to an existing account generally depends on taking advantage of low incremental capital costs for the add-on sales. Unfortunately, this condition does not apply in the case of stimulating cooling load among heating-only customers because acquiring and installing steam turbine chillers can cost twice as much as comparable electric chillers. Nevertheless, with incentives, some electric-to-steam conversions, especially to steam absorption chillers, may be attractive.

Alternative Chiller Technologies

There are several ways of using steam to remove heat from the air. The technologies vary in terms of heat-removal process, efficient capacity size or scale,[34] capital cost per installed ton, and operating efficiency. The economics of these technologies also depend greatly on the spread between electricity prices and the primary fuel used to produce steam.

The primary fuels used to operate chiller units are electricity, steam, and natural gas. There have been advances in each technology, so it is important that market participants have access to current information.[35] Each technology has different positive and negative externalities that should be considered in addition to the direct economics of owning and operating each chiller type.

[33] Per a March 24, 2005 communication from Con Edison, the 400 megawatt estimate was derived as follows: Con Edison customer data indicates that there are about 625,000 tons of steam chillers installed on the Con Edison steam system. If all that capacity were to be converted to electric chillers and all that capacity were to run at the same time, about 400 megawatts of electric capacity would be required. This would be a conversion value of 0.64kW/ton. Steam chillers use between 10 lbs/ton and 18 lbs/ton, depending upon the technology. Typical efficiency is 20 percent overall.

[34] Capacity is measured in tons. One ton of chilling is 12,000 BTUs. This is the amount of heat absorbed by one ton of ice melting at 0°C over a 24-hour period.

[35] See, for example, Ian Stanswick, "Advances in Steam Cooling," Figure 1, ASHRAE Journal (September 2003) for a discussion of improvements in steam chilling. Mr. Stanswick is Product Manager, Applied Chiller Group, York International Corporation of York, Pennsylvania.

The key, of course, is to match the product closely with the customer's needs. Some district energy systems, such as Trigen-Philadelphia, indicate that they encourage a range of steam cooling systems depending on a customer's tonnage level:[36]

- Turbine-driven centrifugal chillers.
- Single-stage absorption chillers.
- Two-stage absorption chillers.
- Back pressure steam turbine generators that produce electricity and may be used to feed a single-stage steam absorption chiller.

Con Edison indicates that it provides similar services for its customers.

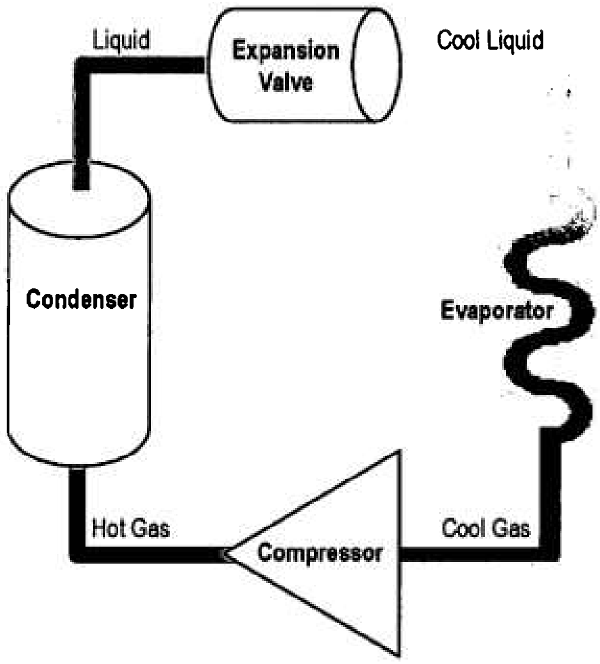
To better understand the differences among types of chillers, their most appropriate applications, and the underlying reasons for their relative efficiencies and costs, the leading chiller technologies are described in the following section.[37]

Centrifugal Chillers

All centrifugal chillers have a cooling circuit made up of a compressor, a condenser, an expansion chamber or valve, and an evaporator. Cooling is accomplished by compressing a cool, low-pressure refrigerant (e.g., R-123a)[38] into a high temperature gas that is routed through a condenser coil to release its heat and condense into a liquid. The liquid refrigerant is then run through an expansion valve that produces a liquid that is circulated through an evaporator coil (heat exchanger), where it absorbs heat from the surrounding space and becomes a vapor that is then returned to be compressed and pumped through the circuit again. The basic circuit is illustrated in Figure 27.

[36] See http://www.trigenphilly.com/ps/ps.html.
[37] See T.A. Heppenheimer, Cold Comfort, Invention & Technology, Vol 20, no. 4, page 26, for an accessible history of air conditioning and the underlying technology.
[38] The chemical name for R-123a is 1,2-dichloro-1,2,2-trifluoroethane. Source: National Institute of Standards and Technology, http://properties.nist.gov/fluidsci/data/r123a.htm.

Figure 27. Centrifugal Chiller Circuit



Centrifugal chillers require an energy source to power the compressors and pumps in the circuit. Centrifugal, or rotary, chillers are most frequently driven by natural gas, electricity, or steam. Natural gas engine-driven chillers use natural gas to fire an engine that runs the compressor. Electric centrifugal chillers use an electric motor (which may be either constant or variable speed) to drive the compressor.

The steam turbine-driven chiller is very similar to the electric driven chiller, except that it uses a steam turbine to provide rotary power rather than an electric motor. High-pressure steam (about 125 psig) is used to spin a condensing turbine producing mechanical energy that drives a vapor compressor that is essentially the same as that used in an electric chiller. The refrigerant condenser, expansion device, and evaporators are nearly identical in steam and electric chillers. A steam turbine-driven chiller requires an additional component – a steam condenser.

The steam turbine chiller is much more efficient than a single-stage absorption steam chiller and slightly more efficient than a two-stage steam absorption chiller. Additionally, the steam turbine chiller takes up less space than a steam absorption unit.

The steam turbine chiller is, however, only about half as efficient as an electric chiller. The steam unit also costs about twice as much as comparable electric units due primarily to the cost of the turbine component. On the Con Edison Steam system, steam condensate must be discharged to the sewer, further increasing operating costs.

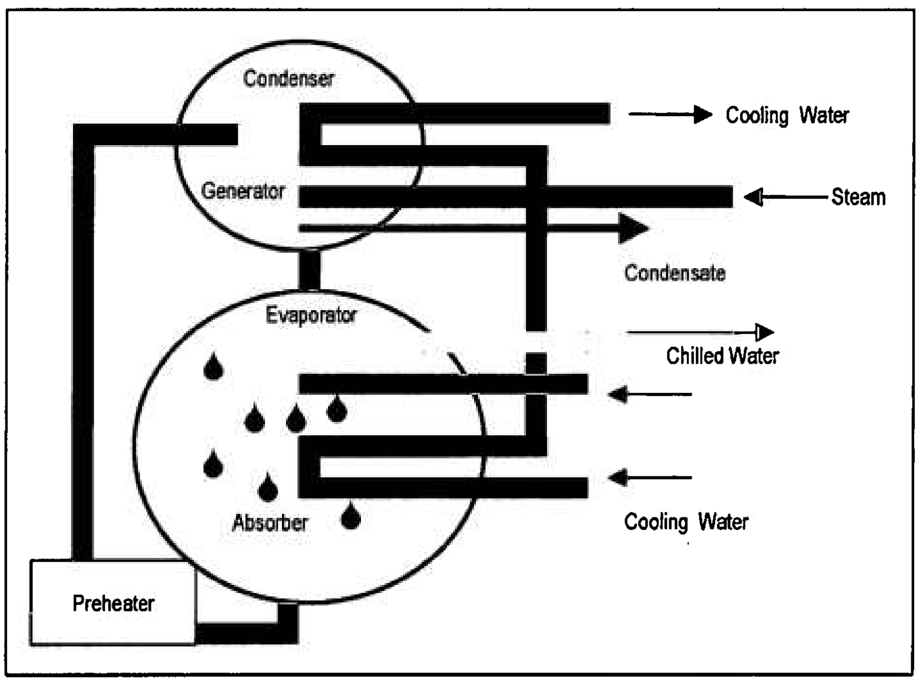
Absorption Chillers[39]

There are currently about 231 absorption chillers providing 192,000 tons (or equivalent to 96 megawatts) of cooling capacity. These chillers, on average, have much lower cooling capacities than centrifugal units, averaging roughly 831 tons per installation. The two primary types of absorption chillers – single-stage and two-stage – are described briefly below.

Single-Stage Absorption Chillers

Absorption chiller technology is very different from that of centrifugal chillers. In the absorption cycle, the external energy source provides heat rather than rotary power. The absorption cycle takes place in a near vacuum and depends on that vacuum rather than adding pressure to the refrigerant. The heat source is generally steam, hot water, or natural gas. Steam absorption chillers use low-pressure (15 psig) steam as a heat source to evaporate water for use in a single-stage thermal compression cycle. Water is used as the refrigerant, and lithium bromide is used as the absorbent. The cycle is only able to work because water and lithium bromide have a tremendous chemical affinity for one another.

Figure 28. Single-Stage Absorption Chiller Circuit



[39] This discussion is based in large part on the technical discussions in Energy Matters Newsletter, Fall 2003, U.S. Department of Energy, Energy Efficiency and Renewable Energy and in the York Millennium Single-Effect Absorption Chillers, Form 155.16-EGI (604), provided by York International Corporation.

The single-stage absorption chiller cycle begins with a dilute solution of lithium bromide from the absorber. The lithium bromide is pumped through a preheater and then on to the generator where heat from steam or hot water causes the solution to boil. This action sends water vapor upward and leaves a concentrated solution of absorbent, which is finally channeled to the preheater where it is cooled by the weak solution making its way to the generator. The refrigerant vapor moves to the condenser, where its heat is extracted by cooling water tubes, causing it to condense and collect in the bottom of the condenser. The refrigerant, now a liquid, is then sprayed over the evaporator tubes. At the near complete vacuum conditions in the unit, the water boils at 39°F, producing vapor and dropping the temperature of the chilled water, which is then used to cool the building. The water vapor produced in the evaporator then travels to the absorber where it is sprayed with a strong lithium bromide solution that absorbs the refrigerant so completely and rapidly out of the chamber that it creates a near vacuum.

Single-stage absorption chillers are the least efficient chiller technology available and require the most physical space to install. A single-stage absorber requires about 18 pounds of 15 psig steam per ton-hour of cooling. Steam condensate has to be cooled before discharging to the sewer, in many cases. However, single-stage absorption chillers can be used in conjunction with low-grade steam from solar, other renewable sources, and even back-pressure turbines. This ability to make use of low-grade steam and technical improvements has led to an increased interest in single-stage absorbers. In addition, since water is the refrigerant, absorption chillers do not require the use of environmentally hazardous chemical refrigerants, and, because they use low-pressure steam, no operator is required.

Two-Stage Absorption Chillers

The two-stage (sometimes called double-effect) absorption chiller cycle is similar to the single-stage but achieves higher heat efficiency in the condenser by dividing the generator into high temperature and low temperature generators. Two-stage absorption units also use higher pressure steam. The efficiency of a two-stage absorption chiller is about 40-50 percent greater than a single-stage unit and comparable to that of a centrifugal chiller. A two-stage absorption unit typically uses 10 lbs per ton-hour of 100-150 psig steam (almost 50 percent less usage than a single-stage absorber).

Both single- and two-stage absorption units are vulnerable to crystallization of the absorbent. Newer technology has greatly diminished this problem. Also, advanced control systems have made operating the units and achieving their potential efficiency much easier.

Comparative Chiller Costs

Steam chillers suffer from both higher first costs and operating costs. The table in Figure 29 summarizes cost data for different chiller technologies.

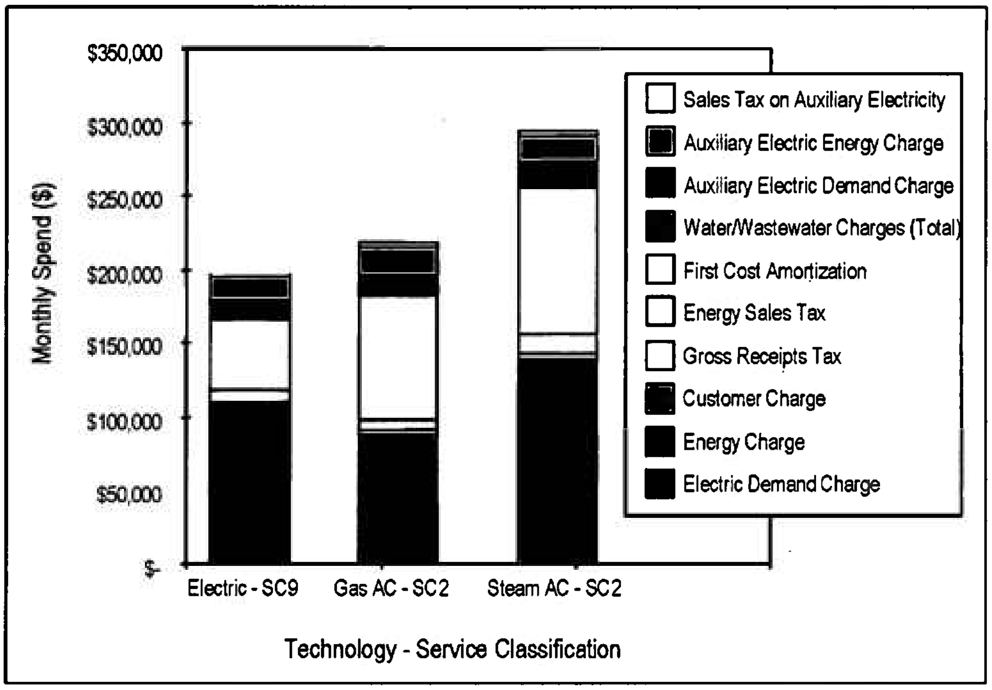
Figure 29. Cost and Operating Parameters for Chiller Options

Technology (COP)[40]	Tonnage Range	First Cost/Ton[41]				Fully-Loaded Operating Cost/Ton-Hr	Major Manufacturers
		Chiller	Turbine or Motor	BOP & Install	Total		
Single-stage steam-fired absorption (0.6-0.9)	100-1,500 500-1,350 100-700	$300	n/a	$700	$1,000	$0.27-$0.30	York Trane Carrier
Two-stage steam-fired absorption (1.0-1.3)	300-675 100-1,660	$625	n/a	$675	$1,300	$0.17-$0.21	York, Carrier Trane
Steam-turbine driven centrifugal (1.6-1.9)	700-5,000	$250	$585	$725	$1,560	$0.17-$0.21	York Carrier (selective)
Gas-engine driven centrifugal (1.9)	350-1,800	$700		$700	$1,400	$0.15	York Trane
Two-stage direct-fired absorption (1.0)	100-1,500 100-1,100		n/a		$1,200	$0.21	Carrier Trane
Variable speed, electric-drive centrifugal (10+)	200-5,000	$350		$550	$900	$0.10-$0.13	York
Electric centrifugal (6-7)	200-3,000 200-8,500	$250		$550	$800	$0.11	Trane York, Carrier
Electric compressor or "crew" (5-7)	80-525	$300		$550	$850	$0.12-$0.16	Carrier

One of the PSC's charges to the Task Force is to explore ways for manufacturers to provide more marketing and financial support. Figure 30 disaggregates chiller cost differences to clarify the source of the economic gaps across steam and competing centrifugal technologies.

[40] COP refers to the Coefficient of Performance, a measure of the ratio of input energy to heat energy removed from the space.
[41] Initial figures were taken from the "Assessment of Non-Electric Cooling Alternatives to Reduce the Electric Demand on New York's Power Grid" prepared by SAIC and NYSERDA, and updated through discussions with vendors and Con Edison engineers.

Figure 30. Comparative Electric, Gas, and Steam Centrifugal Chiller Costs



The scenario illustrated above assumes the best economics for a steam chiller plant. It is immediately apparent that steam-driven air conditioning faces a significant cost disadvantage relative to both electricity and gas in New York City.

In the past, steam cooling was the more efficient choice for large and very large buildings. To test whether steam's disadvantage was a function of building size, chiller operating costs were simulated across a range of building sizes from 200,000 square feet to 2 million square feet, using the following assumptions:

- All-in capital requirements for electric, gas, and steam centrifugal chiller plants of $800/ton, $1,400/ton, and $1,560/ton, respectively.[42]
- Average chiller load requirement is 1 ton of chilled air capacity per 350 square feet of building space.[43]
- Electric chiller efficiency of 0.5 kW/ton, steam chiller efficiency of 8 lbs steam/ton (aggressive), and gas chiller efficiency of 6,500 BTUs/ton (aggressive).
- Plant operating at a full load equivalent value of 250 hours/month – 150 hours peak, 100 hours off-peak.
- Condensate discharge temp of 140°F for a centrifugal chiller with no additional cooling requirement.
- The tax effects of asset depreciation are not figured into the calculation as they are described by a constant function across every technology.

[42] Values taken from the cost study entitled "Assessment of Non-Electric Cooling Alternatives to Reduce the Electric Demand on New York's Power Grid," prepared by SAIC and NYSERDA.
[43] Figure provided by International District Energy Association (IDEA).

As shown in Figure 31, steam chiller monthly operating costs are higher than gas or electric chillers across all building sizes.

Figure 31. Monthly Operating Costs of Competing Chilling Methods

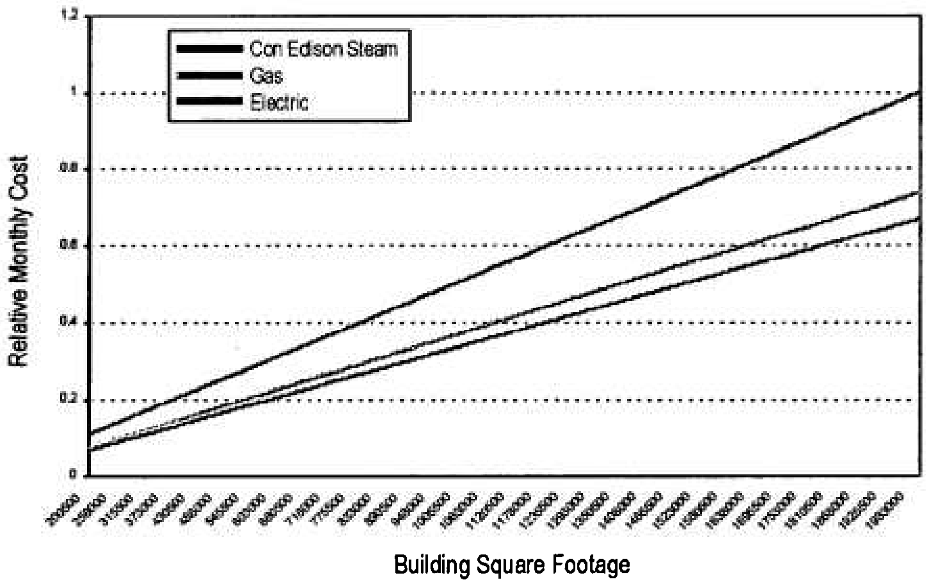
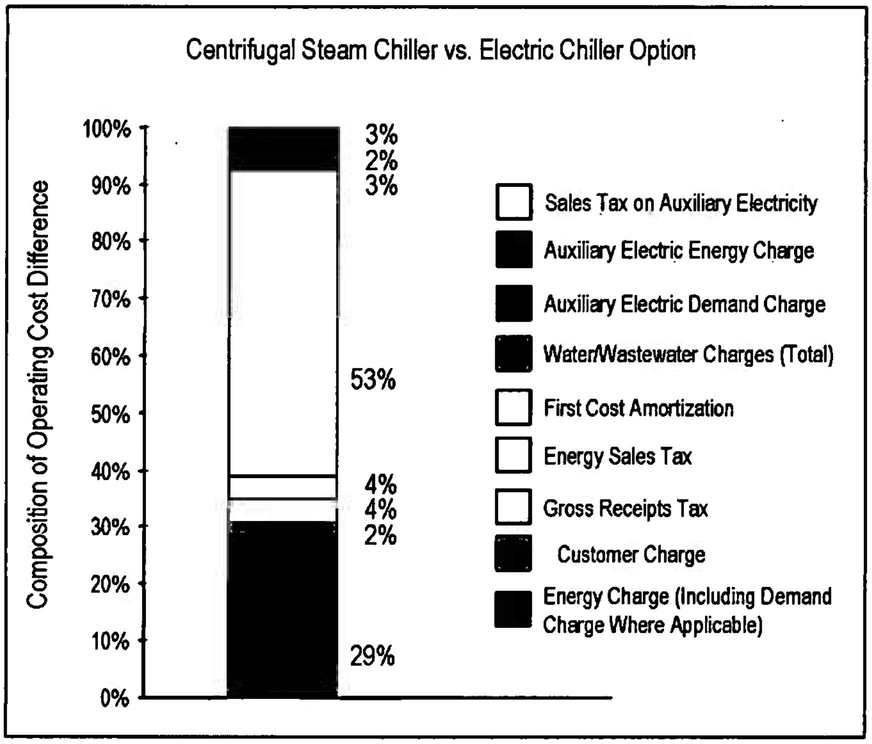


Figure 32 shows the cost gap, by component, between steam and electric centrifugal chillers. As shown, energy costs and equipment costs make up the bulk of the cost differential between steam chilling and electric chilling.

By far the biggest difference (53 percent) lies in the cost of the equipment. This first cost differential can make steam centrifugal chillers as much as 2 times as expensive as comparable electric chillers. The chiller components for steam and electric are essentially the same, so the major cost difference appears to be the steam turbine's cost relative to the electric motors.

Figure 32. Differential Cost Components of Steam Chilling Over Electric Chilling



Indirect Steam Chiller Benefits

To be competitive, a steam chiller must offer other advantages, such as reduced space requirements, lower maintenance costs, or non-energy operating costs, or be credited with externalities, such as electricity peak demand reduction or environmental compatibility. Customers do recognize that reduced electricity peak load may free up building electrical capacity that then may be used to meet new demand. Unfortunately, steam cooling requires more space, and customers perceive that steam equipment is more expensive to maintain (especially the biennial turbine inspection).

The primary competitive advantage of any steam chiller is the avoidance of electricity peak demand charges ($32/kW per month for delivery demand in New York City plus electricity commodity charges). The average Con Edison steam turbine customer operating a 3,152-ton chiller throughout the four-month cooling season avoids about $200,000 per year in electricity delivery demand charges. Facilities that are electrically constrained can free-up electricity capacity for other tenant uses by shifting all or part of their chilling load to steam.

Increasing electricity demand and capacity charges have stimulated interest in hybrid steam and electric chiller systems recently. The hybrid systems are designed to reduce electricity demand charges by running the steam chillers during the highest load periods when demand charges are established.

Steam Cooling Market Development Options

There are five primary and non-exclusive strategies open to Con Edison Steam to promote steam chilling.

Continuing the NYSERDA Incentive Program

This option appears necessary to maintain the current share and is a reasonable public policy if the incentives are cost competitive with alternative ways of avoiding electricity peak generation additions. Incentive guidelines are discussed in later sections.

Securing Concessions from Vendors

This option is not promising. The cost differential between steam and electric centrifugal chillers is primarily due to the turbine over which the chiller vendors have little control. The steam chiller vendors also provide electric chillers and appear to be largely indifferent as to which is sold. While they did not appear interested in concessions, two of the chiller manufacturers indicated that they would engage in more collaborative marketing and selling efforts, particularly if Con Edison Steam could identify high potential candidates.

The steam turbines used by the major chiller vendors are produced predominately by two companies. Although there are other potential manufacturers, it would be difficult to create more turbine competition in the local market. The New York City market is small relative to the total, and the engineering community is reluctant to adopt unfamiliar suppliers. Encouraging greater cost competition in the turbine market therefore is probably best pursued on an industry level through trade associations and collaboratively with other steam systems.

Encouraging More Competition and New Entrants

The third option does not seem practical on a local level. Efforts to promote other chiller manufacturers in the past were unsuccessful and reinforced the engineering firms' reluctance to use unfamiliar equipment. Although there are only three significant chiller manufacturers, competition for new business appears reasonably vigorous. Beyond making customers and influencers more aware of and more receptive to steam chilling, there does not appear to be much Con Edison can do to stimulate competition.

Exploring Non-Chiller–Based Technologies

The centralized chiller option is relatively unfamiliar to New York City customers and engineers and needs further study before a firm recommendation can be made. By eliminating the customer chillers and achieving scale and load diversity efficiencies, Con Edison can reduce the first cost substantially and market the "plug-and-play" character of district cooling. This approach, often called district cooling, has been growing rapidly in Europe and the U.S. and is discussed more fully on page 78.

Exploring Hybrid Steam and Electric Chiller Sets

This option is unlike the others that seek to compete with other chiller energy sources. In the hybrid chiller business models considered, the steam chiller complements the electric units to reduce peak demand charges and, conceivably, earn DSM credits. This strategy probably requires a collaborative approach with vendors or technology influencers, because neither appears likely to vigorously promote the hybrid concept without a collaborative effort.

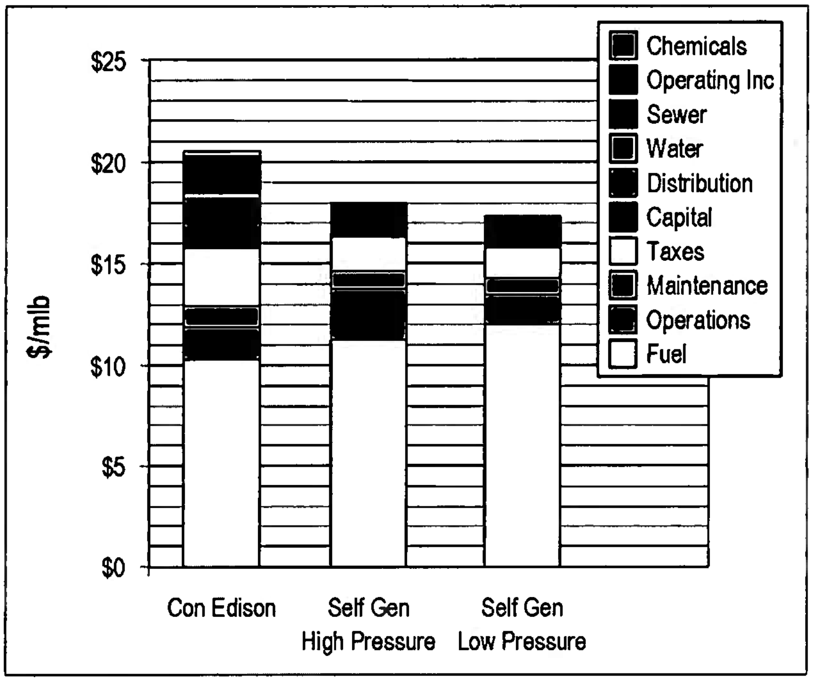
Steam Heating

Steam heating is Con Edison Steam's most important product and its largest revenue source. Steam captures about 80-90 percent of the contestable large commercial heating business on or near its lines. Con Edison Steam currently serves about 1,445 heating-only customers with approximately 360 million square feet of building space.

Steam heating's primary competition comes from on-site gas-fired boilers. New package boiler technology can approach 95 percent efficiency, although 85 percent may be more typical.[44] The chart in Figure 33 uses average costs to show the relative cost of steam from Con Edison and on-site high and low pressure boilers. These comparisons are generic in nature for customers with load factors similar to the steam system. They do not attempt to include site-specific obstacles, such as stack routing, space availability, and fuel pipe routing. They also do not make any allowance for lost building rental space, if applicable, due to boiler construction. Figure 33 shows that, on average, on-site boilers could produce steam at a lower overall cost compared to Con Edison steam. Nevertheless, many customers find that the low space requirements and the benefits of Con Edison steam more than outweigh its direct cost disadvantage. In addition, for some customers, Con Edison steam may be less expensive even if these other factors are not taken into account.

[44] According to Con Edison Steam, 95 percent efficient boilers (LHv) are typically boilers that recover heat from the stack gases to the point that the temperature of the flue gas is lowered to 120°F. These are generally available in smaller sizes and are sometimes called modular boilers. Most conventional boilers are rated at 85 percent efficiency at their rated capacity.

Figure 33. Central vs. On-site Steam Generation Direct Costs[45]



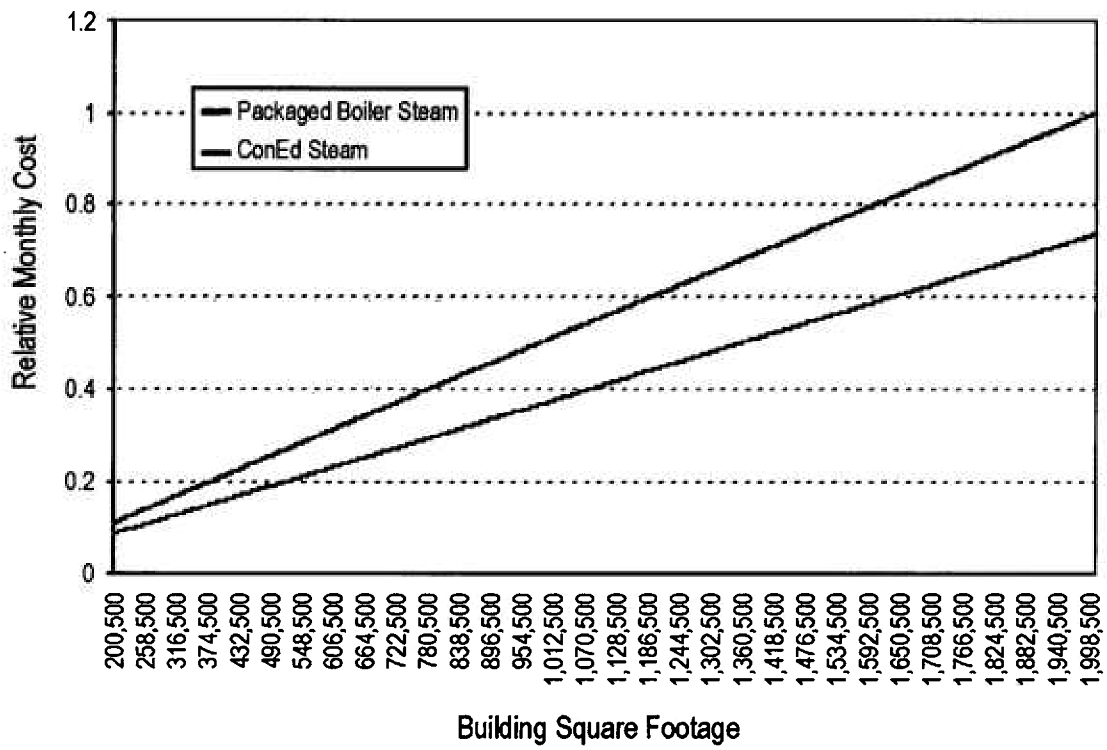
Con Edison steam heating appears to be consistently more expensive than on-site packaged boiler heating solutions. To test whether this was true across all building sizes, monthly space heating costs for buildings ranging from 200,000 to 2,000,000 square feet were simulated using the following assumptions:

- Annual labor requirements for generating steam using on-site packaged boilers range from about $50,000/year for a small building of 10,000 square feet up to $400,000/year for a very large building.
- Capital requirements for installing a packaged boiler solution range from $40 to $60 per lb-hour of steam send-out capacity depending on building size.
- Capital requirements for connecting to the Con Edison Steam grid range from $100,000 for a small building of 10,000 square feet to $500,000 for a very large building.
- The average heating load for a typical New York City building is 0.02 MMBTU/square foot per hour.[46]
- Steam SC2 rate class and Gas SC2 firm service commercial rates were used for all building sizes.[47]
- The tax effects of asset depreciation are not figured into the calculation, because they are described by a constant function across every technology.

[45] Con Edison Steam. Values used in the Con Edison Steam analysis pictured are slightly different than those used elsewhere in this report. This reflects simply the different times the analyses were conducted and does not affect the substantive results.
[46] Con Edison Steam.
[47] Gas Service Classification 12 (interruptible rates), while perhaps a viable alternative for some customers, was not used for this analysis because of lack of information on fuel switching and storage costs and likely frequency of interruption.

Figure 34 shows the relationship between the monthly costs of operation for Con Edison central steam heating versus those of on-site packaged boilers across a range of building sizes. Square footage values are shown on the x-axis. The y-axis shows the monthly cost of both Con Edison steam and packaged boiler steam by building size. As shown, the centralized steam option is always higher than on-site steam production, and the disparity increases with building size.

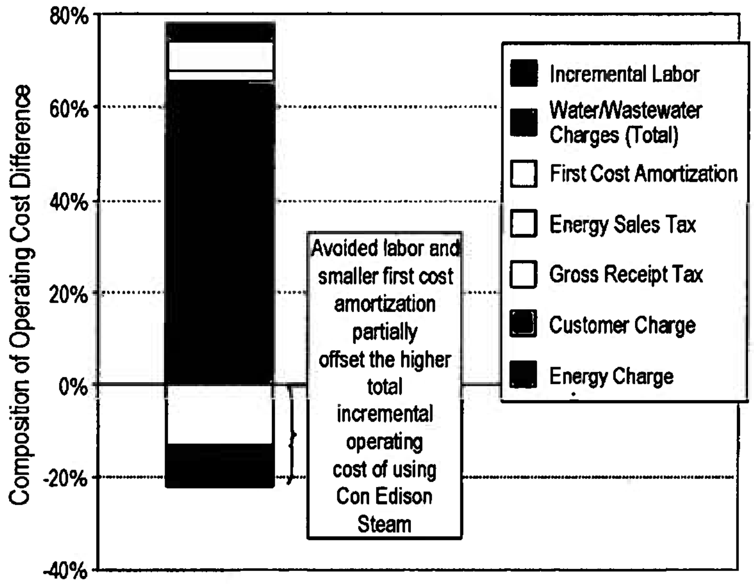
Figure 34. Relative Monthly Operating Costs of Steam and Gas Heating



The average cost differential between steam heating and packaged gas boiler heating increases directly with building size. This relationship was a little surprising because the capital and labor requirements for packaged boilers change more dramatically with building size than do those of Con Edison central steam. The answer is that the average incremental cost per pound of steam is sufficiently greater than that of equivalent BTUs from natural gas to overcome the packaged boilers' higher first costs.

Energy charges for steam, which include commodity and delivery charges, account for most of the monthly heating cost differences between Con Edison steam and on-site packaged boilers. This cost difference is partially offset by the avoided on-site labor costs of central station steam and the lower total capital costs of connecting to the steam grid compared to installing an on-site boiler. Figure 35 shows the relative size of each cost component.

Figure 35. Differential Cost Components – Packaged Boiler vs. Central Steam Heating



Indirect Central Steam Heating Benefits

Despite its higher overall costs, central steam heating has been successful, especially in the commercial building market, because of its indirect benefits. The major indirect benefits of central steam heating include:

- No on-site operator(s) required.
- Freed-up building space to generate revenues.
- No flue stack.
- No first cost for equipment and lower maintenance costs.
- Environmental benefits due to centralized and controlled production units.
- No fuel oil storage costs or delivery problems (fuel oil back-up is necessary to opt for favorable interruptible natural gas rates).

These advantages operate in the new building market and act as barriers to conversion in the replacement market. For example, it would be very expensive and often impractical to install a flue stack in an existing building.

Opportunities and Barriers in New Product Markets

This section addresses some potential new products that may satisfy customer needs and produce new revenues and margins:

- Cogeneration product.
- Supplemental or hybrid chilling.
- Back pressure micro-turbines.
- Steam consumption management services.
- Condensate based products.

Cogeneration Product

Customer on-site cogeneration is emerging as a potentially potent competitor to centrally generated steam. About 45 percent of the respondents to the energy customer survey indicated that they were considering cogeneration (Figure 81, page 159). Although customer responses to questions of this nature typically tend to overstate the potential, the stated percentage is high and warrants concern. Most of the respondents to the survey were large steam heating customers, and approximately 25 to 30 percent of the sample consisted of steam cooling customers.

Customer cogeneration has a number of attractive marketing points:

- It may provide a low cost energy solution by more fully utilizing the energy content of the fuel consumed.
- Facilities are eligible for LEED points that support green positioning and may attract premium rents.
- On-site, dedicated generation facilities may provide a measure of protection from future capacity cost-related increases in utility rates.

In contrast, central cogeneration facilities typically consist of gas turbines coupled with a heat recovery steam generator (HRSG) in a large-scale combined cycle configuration. Byproduct steam is used for heating during winter months and for process hot water year 'round. Steam is also used to drive steam turbine chillers to produce chilled water for cooling. Cogenerating steam and power has the potential to allow the system to price steam or electric favorably by, in effect, offsetting steam production costs with electricity margins or vice versa.

Con Edison's Steam system produces two products—steam and electricity—with the latter being produced by the system's cogeneration plants. Con Edison Steam's cogeneration production capacity recently increased when ERRP went on-line, and there may be opportunities to increase it further.

More cogeneration capacity, whether merchant or owned by Con Edison, has the potential to improve the competitiveness of Con Edison Steam in the following ways:

- Electricity sales into the high-priced NYISO Zone J (New York City) could reduce net steam costs. This will be examined in the Steam Production Study.
- Additional cogeneration production capacity would help to position steam as a clean energy source and perhaps help its customers to qualify for LEED points.

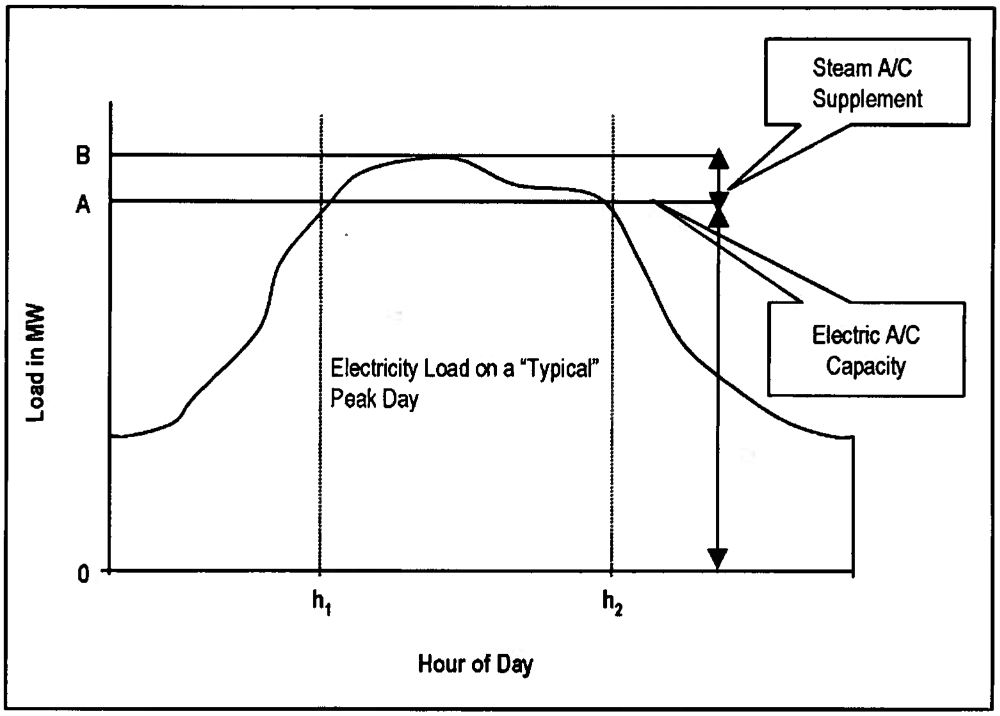
Given the winter steam capacity constraint and the City's tight summer electricity supply, it appears reasonable to explore ways for Con Edison Steam to benefit from central cogeneration development. To do this, Con Edison Steam should consider working with developer cogeneration projects without undue risks to customers. Con Edison Steam should also consider how the SC6 tariff could be made more attractive to users consistent with the principle that it should be a cost-based rate. Con Edison might also participate in new merchant cogeneration projects, by acting as an aggregator to pull together new, potential steam customers or possibly by taking a financial position.

Another possibility is to allow the company to sell a cogenerated electricity/steam product derived from a new or existing Con Edison-owned or merchant cogeneration facility. Depending on the cost of the steam capacity and the availability of any cogeneration benefits that are not streamed to specific customers from a new merchant facility, such a product could reduce overall system costs and increase utilization of the existing Con Edison Steam infrastructure.

Hybrid or Supplemental Steam Air Conditioning

Hybrid steam air conditioning is a promising product that offers the prospect of increasing summer sales while not adding to winter peak load (Figure 36). Typically, steam chillers are combined with electric chillers and operate during the most severe electric peak period. This configuration offers customers an energy hedge and a means to manage electricity demand charges. There are several hybrid steam and electric chiller plants in New York City already and even a one-of-a-kind steam, natural gas, and electric chiller plant in the Time-Life Building.

Figure 36. Hybrid or Supplemental Steam Air Conditioning



As shown in Figure 36, a steam chiller of AB megawatts supplementing a conventional electric air conditioner of 0A megawatts running h_1h_2 hours on a typical peak day would reduce the need for electric air conditioning capacity by AB and avoid AB times the demand charge in bills. Because demand charges are levied throughout the cooling season and shoulder periods, the potential savings may be substantial.[48] The cost of a supplemental steam-driven chiller (especially for an existing customer) may be relatively

[48] It is easier to develop workable estimates of the prospect base if the "typical" peak day curve is converted into a duration curve with each hour in descending rank order. The load duration curve must also reflect that the typical peak period day curve represents a number of days so each typical hourly load has to be multiplied by the number of days in the period. This load duration curve can then be indexed such that the highest hour is set equal to 1.0. The indexing allows the calculations to apply cost ratios independent of scale. The equations can then be solved for approximate values of h_1h_2 and AB for given capacity, operating costs, and demand charges. The h_1h_2 and AB values in turn can be used to estimate the potential contestable market for supplemental steam A/C applications.

A one-period or annualized model can be estimated algebraically where:

- S equals potential savings.
- K_S equals the annualized cost for the supplemental steam unit per MW (or ton equivalent).
- AB the amount of steam capacity in MW or ton equivalent; OS is the operating costs of the steam unit per MWH.
- D is the annualized demand charge per MW as set in the relevant period.
- O_E is the operating cost for electric a/c per MWH.
- c is the load factor for the segment of the curve above the line AB between h1 and h2 included to recognize that the supplemental steam unit doesn't run at same level throughout the period.
- h_1h_2 is the hours of run time for the steam a/c.

Potential savings are then the difference between meeting the load segment AB through the period h_1h_2 with steam or electric a/c capacity:

$S = [(K_s*AB) + (O_S*c*AB)h_1h_2] - [(D*AB) + (O_E*cAB)h_1h_2]$

Breakeven (S=0) occurs when:

$(K_S*AB) + (O_S*c*AB)h_1h_2 = (D*AB) + (O_E*c*AB)h_1h_2$, which reduces to:

$K_S + O_Sc* h_1h_2 = D + O_E c*h_1h_2$ or $(K_S - D)/(O_E - O_S)c = h_1h_2$

The h_1h_2 value can then be projected onto the indexed cooling duration curve to obtain an estimate of AB expressed as a percentage of the peak load level.

low. There seems to be some dormant hybrid chillers in facilities where customers may not have removed the steam chiller when installing a new electric unit. Appropriately structured incentives may be used to target these dormant systems to encourage their reactivation in a hybrid operational mode.

Market Analysis for Hybrid Chiller Plants

The steam chiller and steam hybrid model developed for this analysis solves a linear equation for the optimal mix of chiller types under various assumptions about first costs and operating expense. The model also estimates the break-even hours of operation for the steam component of a hybrid chiller plant at various incentive and demand charge levels. The base case uses the assumptions and data shown in Figure 37.

Figure 37. Steam Hybrid Chiller Model Assumptions

1-time incentive level $/ton (steam only)	$250
1-time incentive level in $/MW equivalent	$500,000
Interest or lease rate	10%/year
Tax depreciation period	20 years
Income tax rate (combined state & federal)	0.4
Lease or amortization period	20 years
Electric demand charge	$32/kW
Electric cooling season length	4 months

The assumptions in Figure 37 yield the costs of ownership for the competing chiller technologies under various levels of incentives, demand charges, and customer charges, as shown in Figure 38. For example, annual ownership costs (including interest, depreciation, and taxes for a 1,818-ton 2-stage absorber chiller plant) are about $237,000 with no incentives or credit for delivery demand charges. The one-time $250/ton incentive drops the ownership cost to $192,000. Credit for the $32/kW demand charge over 4 months drops it even further to $64,000. If the customer is new to steam, the roughly $24,000 per year steam customer charge would bring total annual ownership costs to about $88,000.

Figure 38. Base Case Chiller Costs of Ownership

Chiller Technologies	Net Annual Ownership Cost, Excluding Incentives of Dem & Charge Credits	Net Annual Ownership Cost/MW Equiv, Including 1-Time Incentive	Demand Charge Credit/MW (for Steam Only) $MW multiplied by Cooling Months	Net Annual Cost of Ownership, including Incentive & Demand Credit	Steam Customer Charge/Year (new own, including steam customer only)	Net Annual Cost of Incentive, Demand Charge, and Customer Charge
Steam single-stage absorption (Kss)	$182,683.23	$137,012.42	$128,000	$9,012.42	24,000	$33,012.42
Steam 2-stage absorption (Ks2)	$237,488.20	$191,817.39	$128,000	$63,817.39	24,000	$87,817.39
Steam turbine (Kst)	$284,985.83	$239,315.03	$128,000	$111,315.03	24,000	$135,315.03
Electric turbine (Ket)	$146,146.58	$146,146.58	-	$146,146.58	-	$146,146.58

The next step is to calculate the break-even hours of operation for each technology using representative Con Edison steam and electricity rates. These are shown in Figure 39.

Figure 39. Break-Even Operating Hours for Alternative Chiller Technologies

Chiller Technology	No Incentives or Capacity Credits	With 1-Time $500 Incentive Only	With 1-Time Incentive & Demand Charge Credit	With 1-Time Incentive, Demand Charge, & Customer Charge
Steam single-stage absorption chiller	-108	27	406	335
Steam 2-stage absorption chiller	-679	-339	612	434
Steam turbine chiller	-1,032	-692	259	81

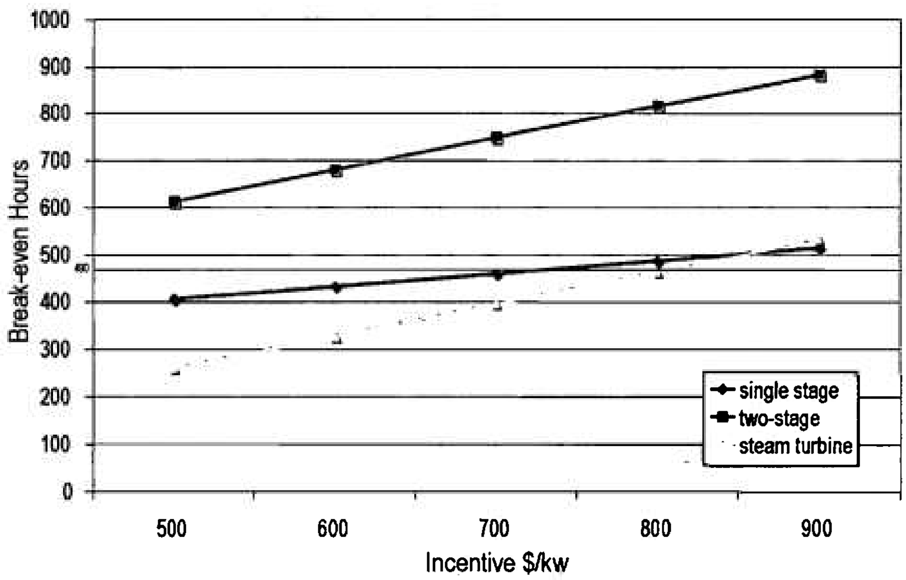
Figure 39 shows that, with a $500/kW ($250/ton) incentive similar to the current NYSERDA program, none of the steam chillers would be economical to pair with electric chillers in a hybrid set. The 27 hours for the single-stage absorber are trivial and would not justify the non-monetary factors involved in hybrid design. However, with a $500/kW incentive and accounting for the $32/kW demand charge, the breakeven hours for the single-stage, two-stage, and steam turbine units (406, 612, and 259, respectively) may be sufficient to warrant consideration of the hybrid system.

The new building case that is modeled by adding the steam customer charge of about $24,000/year produces 335 and 434 hours of break-even running time for the single- and two-stage absorption units, respectively. Under the new building conditions of having to pay the incremental customer charge, the steam turbine chiller drops to an uneconomic 81 hours. This preliminary analysis suggests that hybrid chillers may be attractive in some new building applications.

Some customers may believe that the steam component of the chiller plant may need a break-even run time at least equal to the length of the peak period to be an effective demand charge management option. For example, if the peak period is 480 hours (e.g., 4 months x 4 weeks x 5 days x 6 hours), then the steam component's economic run time should be at least 480 hours. In practice, it is probably necessary to approach the peak period's length and combine other shifting or interruption strategies if more demand reduction is needed. Nevertheless, if the market requires full peak period coverage, only the 2-stage steam chiller would be attractive with a $500/kW 1-time incentive.

The relationship between steam chiller break-even hours and the incentive level is shown in Figure 40. Under the ownership and operating costs modeled, the steam turbine and single-stage steam absorption chillers do not exceed 480 hours until the incentive reaches $800/kW. In contrast, the 2-stage absorption chiller is attractive throughout the range of incentives modeled.

Figure 40. Steam Chiller Break-Even vs. Incentive Levels



Based on this preliminary analysis, we recommend that Con Edison Steam continue its investigation of hybrid chiller sets with particular attention to the revenue implications of their wider usage.

Back Pressure Steam Micro-Turbines

Back pressure turbines can replace the pressure reduction valves commonly used to bring the pressure of the steam down from distribution pressure to the much lower level needed for the customer application. There is a back-pressure steam micro-turbine in the Rolex Building[49] where the owner is evaluating the product.

Back-pressure steam micro-turbines typically come in 100 kW to 275 kW sizes. The units may be economically attractive for customers whose steam load is a steady 8,000-12,000 lbs/hr.

Such steam micro-turbines do not produce a great deal of new revenue and margin for Con Edison, but they may be a useful customer retention and development tool that adds value to the steam product.

Steam Consumption Management Services

Consumption management services are offered by several district energy companies, such as Trigen. These services offer an opportunity to strengthen relationships and forestall conversions. These services could also serve as a prelude to offering more sophisticated services.

Anecdotal evidence suggests that poor maintenance practices (especially at public facilities) reduce equipment lives and lead to premature "end-of-life-experiences." These failures frequently put both the cooling and heating loads in play and, based on the experience of the City of New York government conversions, have a high probability of leading to the installation of electric chillers and gas boilers.

Replacement analysis often overstates the value of increased efficiency. For example, an inefficient steam system may be consuming 100 BTUs/hr to achieve what an efficient system could accomplish with only 80 BTUs/hr. If the old inefficient 100 BTU machine is replaced with new efficient 100 BTU equipment, a part of the potential 20 percent gain in efficiency is lost. Therefore, anticipated efficiency gains must be calculated before determining the ideal size of a replacement system.

Consumption management services provided directly by Con Edison or a third party could provide an early warning of deteriorating equipment, reduce the perceived savings of replacement or conversion, and serve to strengthen customer relationships. Estimating the economic value of such services depends on what customers would pay for such services, the costs of providing them, and the expected benefits.

Condensate-Based Products

Water and sewer charges are significant costs for Con Edison and its customers. Con Edison is a once-through system in which the customer discharges the condensate into the City sewer system. Building a complete return system would be prohibitively expensive, but there seem to be many opportunities to re-use condensate in customer

[49] The Rolex Building is at 665 Fifth Avenue.

buildings as grey water, in fountains, in cooling towers, etc. Some district energy systems, such as Indianapolis, give customers credits to encourage them to reduce the direct discharge of condensate, which displaces other water purchases.

Customers pay water charges as recorded at their water meter. They are also billed for sewer charges at the rate of 159 percent of their water charges. If they use water in cooling towers, they can claim an exemption. Customers are billed sewer charges for steam condensate by the New York City Department of Environmental Protection (DEP). Con Edison reports steam sales by customer to the DEP, which then bills them directly.

The sewer charge paid by customers is found by dividing steam sales in mlbs by 6.2422 to convert steam to hundreds of cubic feet of water (ccf). The resulting ccf value is then multiplied by the water rate of $1.60/ccf and then by the tariff class payment ratio. The tariff class payment ratios are 90 percent for SC-1 customers, 67 percent for SC-2 customers, and 76 percent for SC-3 customers.[50]

Reuse of condensate water can offset water and steam purchases. As indicated above, using condensate as cooling tower make-up can offset water purchases. Using hot condensate to preheat domestic hot water can reduce steam purchased for hot domestic water.

District Energy

Growth of the steam system does not have to be limited to areas that are on or near existing lines. Doing so precludes new steam customers from receiving the potential benefits of steam service in new development areas. Some new development areas may be more cost-effectively served by campus systems that produce some combination of heating, cooling, and electricity close to the end-user and are initially partially or completely isolated from the main steam network.

Developments often take years to reach a scale sufficient to support steam line extension. By the time those developments attain a sufficient scale, other energy sources have already captured the market. In these cases, a strategy based on campus energy systems may offer the best means of serving customers. If and when the load of the campus system grows to a sufficient size, it may be connected to the main steam network or even to additional campus systems.

Campus district energy projects vary depending upon a number of factors, but they typically have all or most of the following characteristics:

- They serve a campus or relatively dense cluster of buildings.
- Their minimum economic size typically ranges from 3.5 to 5.0 million sq.ft., depending on climate and range of products provided.

[50] For example, an SC-2 customer who buys 15,000 mlbs would be billed: 15,000 mlbs/6.2422=2,403 ccf; 2,403 ccf multiplied by 0.67 = 1,610 billed ccf; 1,610 billed ccf multiplied by 159 percent multiplied by $1.60 = $4,095.86 for sewer charges.

- Campus systems typically provide steam or hot water for heating and chilled water for cooling.
- Campus systems usually produce both steam and electricity with the electricity consumed on-campus or sold into the market to offset steam costs.

The network development model (as opposed to the current linear model) outlined above has been employed by a number of regulated and unregulated steam systems. For example, Trigen has entered into offsite projects with the Universities of Pennsylvania and Maryland, among others. In Omaha, the Energy Systems Company took over the Creighton University central plant, integrated into the downtown system and built on the new load center to expand further into the downtown area. Hartford Steam Company built its Capitol District Energy Center to purchase steam from a new cogeneration facility and to produce hot water and chilled water to new customers beyond the original downtown footprint.[51] In the end, all reasonably feasible energy infrastructure configurations should be considered for new areas of development, and the configuration that best serves the needs of rate payers should be the one that is chosen.

District Cooling

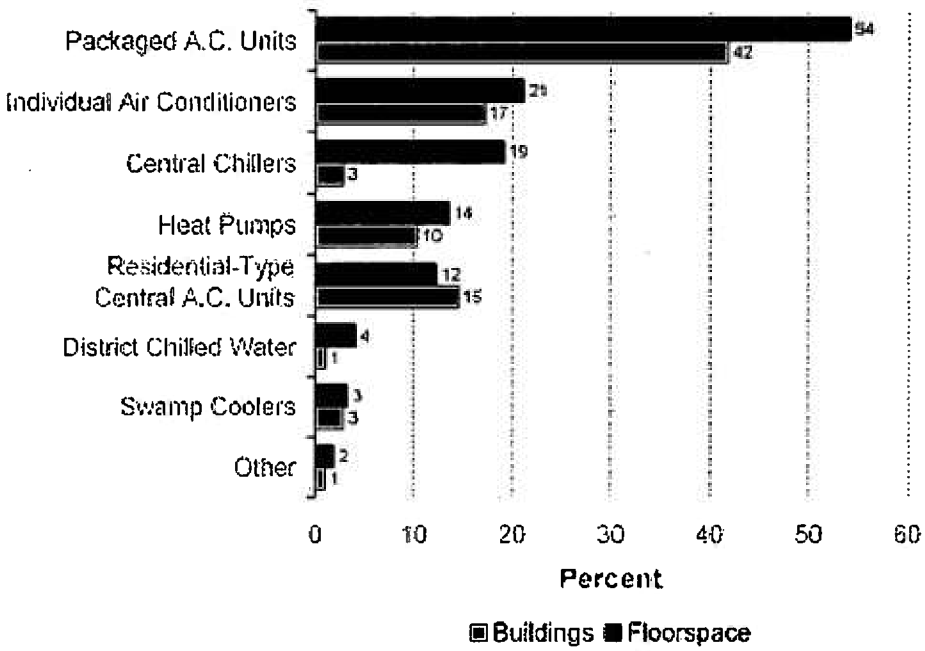
As buildings become tighter and experience greater internal heat generation from computers, lights, and people, cooling capability is now often a 12-month requirement. As a result, the heating market is declining relative to the cooling market in many urban areas, particularly in commercial office buildings. This phenomenon has stimulated many district energy companies to expand into district cooling.

Several district energy systems produce and circulate both hot and chilled water. On the chilling side, this value proposition eliminates on-site equipment ownership and operating costs and has many of the ease-of-use advantages of steam heating. For this reason, some Con Edison Steam customers have expressed interest in a chilled water system.

As shown in Figure 41, district cooling is still a modest factor in the overall energy market. However, it is growing rapidly. The installed cooling capacity in North American cities is 875,000 tons. Campuses, military bases and hospital complexes have 960,000 tons installed now, and there are known plans to add 110,000 tons in the next 3-5 years.[52]

[51] The relative financial success of these campus systems is unclear.
[52] International District Energy Association.

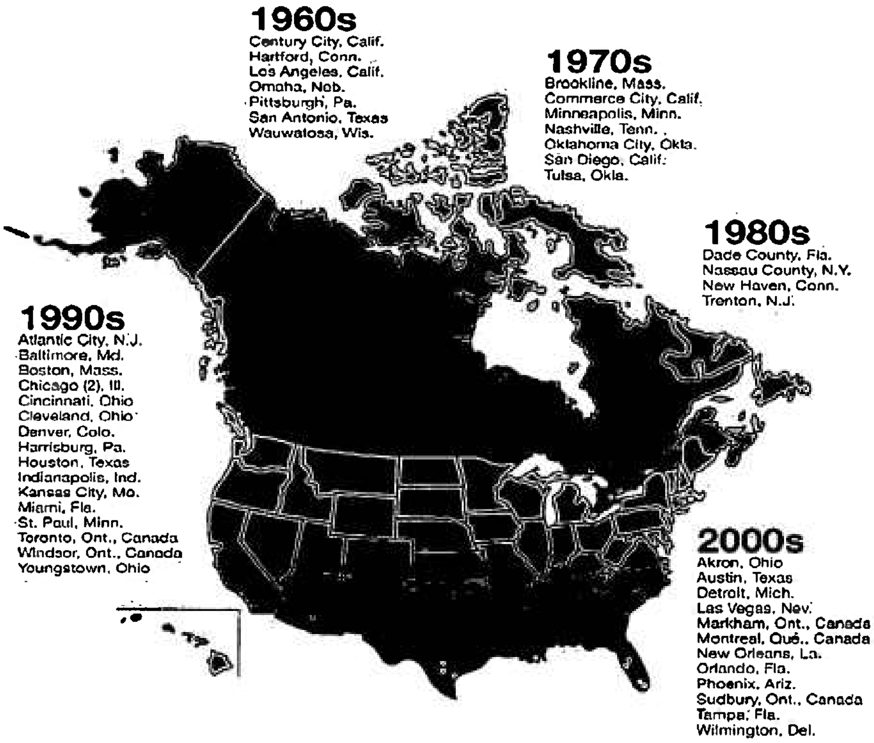
Figure 41. In-District Cooling Captured a Small Share of the Building Cooling Market as of 1999[53]



Many of the larger urban district cooling systems have been launched in just the last 15 years. Figure 42 shows the growth, by decade, in the number of chilled water systems in North America. Some notable systems include Chicago, Toronto, Indianapolis, Denver, Baltimore, and Washington DC. Many of these systems were developed to augment existing steam systems, capture summer revenue and margins, and respond to market demands.

[53] Energy Information Administration, Federal Department of Energy.

Figure 42. North America Chilled Water Systems[54]



Many regulated and unregulated district energy companies have developed district cooling systems to supplement their base heating businesses. The business development and public policy attractions of district cooling include:

- A competitive cooling product that does not require an on-site chiller offered by steam systems to offset the cost disadvantage of steam turbine chillers.
- A low first cost, low maintenance option for cooling customers with the plug-and-play features of steam heat.
- Increased steam capacity utilization and, hence, lower average fixed costs for all customers.
- An alternative to high cost new electricity capacity to meet summer cooling loads.
- A new revenue source to offset the declining need for heat in new buildings with high internal heat generation.

Given the emerging capacity constraint, low capacity factor and need for new profitable loads, a solid customer account development product, and the tight peak electricity capacity situation, Con Edison should explore opportunities to develop local district cooling systems in the Manhattan area. While New York City does face extraordinary underground congestion, high construction costs, and dense urban markets that make any sort of expansion expensive, these conditions are not unknown in other large cities where cooling systems were developed.

[54] International District Energy Association.

5.

Market Potential Estimates

This business development plan focuses on building the value of the Con Edison Steam business by increasing the value of the portfolio of steam customer accounts. In this chapter, the principles of customer account value management are outlined and then illustrated through a market projection model based on those principles.

The market projection model described in this chapter can serve as the basis for the PSC's last two objectives:

Set sales growth targets and hold educational workshops and meetings for contractors, building owners and managers, architects, engineers, and equipment manufacturers to increase knowledge of steam benefits.

Develop mechanisms for monitoring steam business development.

To establish development targets and monitor progress against those targets, Con Edison Steam needs a framework or model that reflects the structure of its market, uses the best available information on important parameters, and is transparent enough that variances from projections can be understood and improvements can be made.

The data and information needed to populate such a model and to project sales targets that could be monitored and serve as a basis for regulatory action are not available. Therefore, this chapter outlines how such a model and target-setting mechanism could be constructed and how such a model could be used for setting targets. Preliminary model results, based on reasonable assumptions and the best available data, are presented to illustrate the approach.

Building Customer Account Portfolio Value

Con Edison Steam's current and prospective customer accounts constitute a portfolio of assets. Con Edison Steam's business development challenge is to grow the value of that portfolio. The company can do this by conducting three marketing and sales activities—acquiring new profitable accounts, developing the value of the existing accounts, and defending or retaining valuable accounts against rivals.

Acquisition efforts should be directed at the highest expected pay-off in terms of additional account value (subject to the emerging capacity constraints). The customer acquisition actions that are explored in this Chapter are:

- Increasing customer penetration along existing lines ("filling-in").
- Capturing a greater percentage of new heating and/or cooling loads in the contestable market (subject to capacity constraints).
- Entering new geographical areas through line extensions or new networks.

Development programs should focus on opportunities to increase account value either by increasing lifetime contribution or extending the expected account life. Typical account development actions are:

- Increasing the profitability of existing accounts by increasing the margin on sales, reducing the costs of products and services sold, or extending the expected duration of the relationship.
- Developing new product and service propositions for existing accounts.
- Capturing a greater share of existing customer heating and cooling load.
- Converting single-load customers to both heating and cooling.

Retention efforts should identify valuable accounts at risk and move to reduce that risk. This may involve:

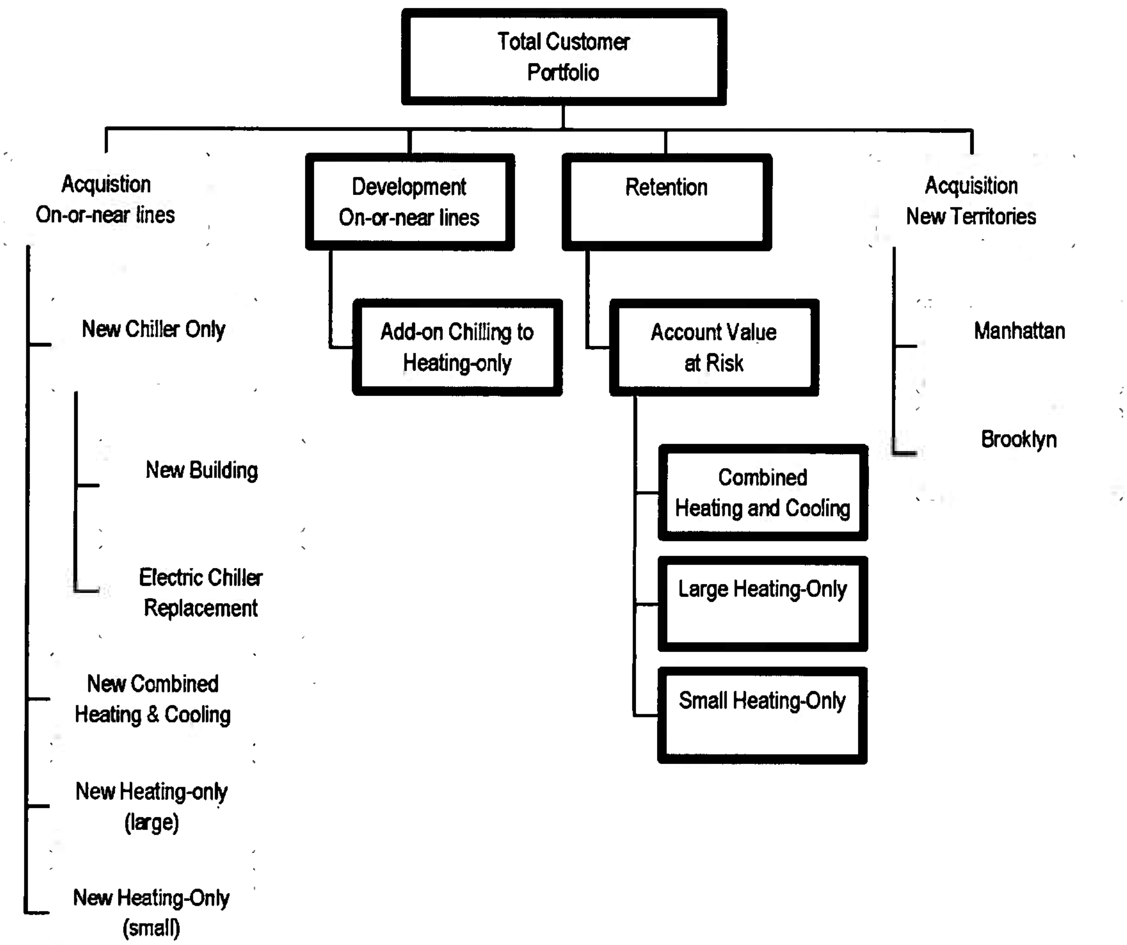
- Anticipating rivals' efforts to convert customers.
- Reducing the real and perceived value of switching from steam.
- Facilitating the voluntary conversion of low-value accounts to a more efficient energy product, within the legal constraints under which Con Edison operates.

The value creation process outlined above defines the actions and strategies that the steam market model must be capable of simulating.

Steam Market Model Structure

The model is structured around the three marketing activities described above and three primary products: heating-only, combined heating and cooling, and cooling-only. The model has two separate modules. The first deals with the existing market territory. The second module is for examining expansion into new territories – in this case, the West Side Hudson Yards and Greenpoint/Williamsburg developments.

Figure 43. Portfolio Development Model

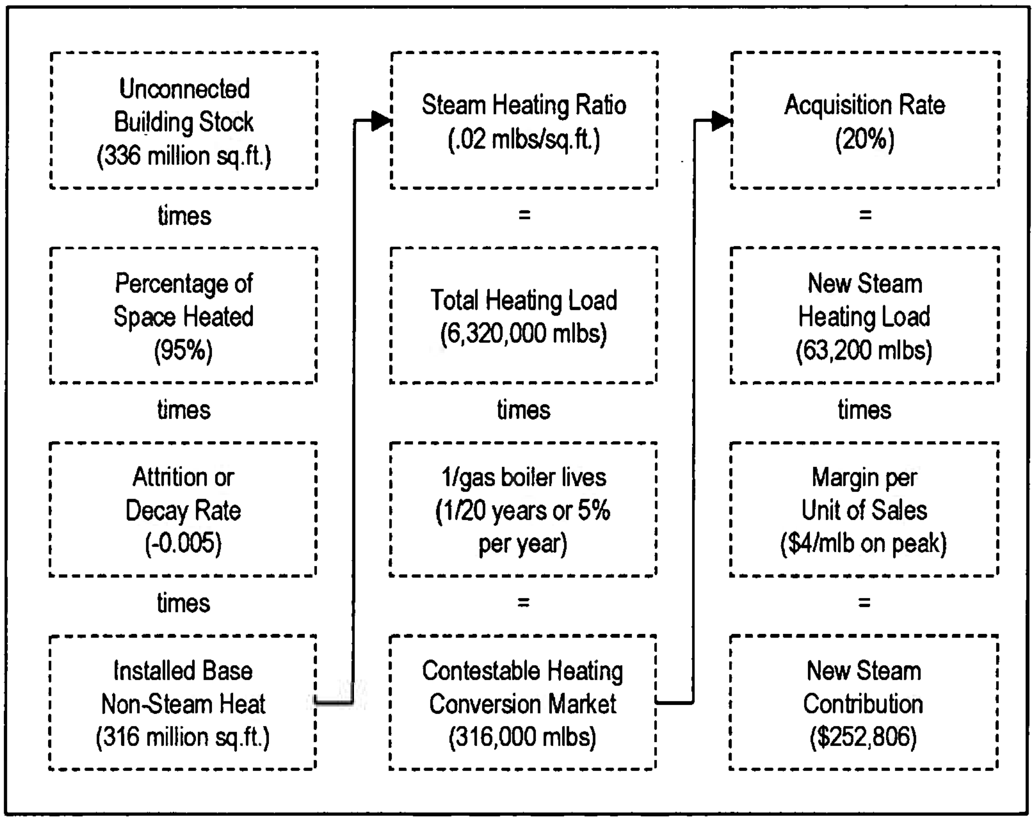


Under each marketing activity, the major product-based sub-modules are used to size markets and to develop projections. For example, the acquisition activities on or near existing lines entail seeking new chiller-only customers from new buildings, conversions of electric chillers, attracting new combined heating and cooling customers, and adding new heating-only customers. Customer segment-specific (e.g., hotels, residential, etc.) projections cannot be made at this time.

Populating the Model with Data

As discussed in Chapter 3, Con Edison Steam currently has relatively little marketing or sales data with which to populate a marketing model. Therefore, the model is designed to initially use the data that are available, and, as more information becomes available, it can be updated and refined. In each module, the model begins with an estimate of the base inventory or population. Sizing variables, such as turnover and growth rate, are then applied to produce an estimate of the contestable market. A "hit rate" or similar value is applied to the contestable market estimate to calculate new sales. The projected new sales value is then the base from which estimated contribution, exclusive of marketing and sales costs, is derived. This contribution can be a basis for allocating resources across different marketing and sales opportunities.

Figure 44. Representative Calculation of New Heating Margin From Sales in the Gas Replacement Market



An important reason for developing the model is to highlight the information and data that needs to be developed though customer research and analysis. Because all of the modules need to begin with a base value for the stock of customers or prospects, from which changes can be calculated, it is necessary to start by estimating the total contestable market.

Opportunities On or Near Lines

Con Edison Steam should focus initially on securing its most valuable customer accounts, developing relationships with existing accounts, and acquiring new customers in the new building market on or near the lines.

The following sections discuss the customer acquisition opportunities in both existing buildings and new buildings, customer development opportunities, and customer retention.

Customer Acquisition Opportunities

Customer Acquisition Opportunities in Unserved Existing Buildings On or Near Lines

The customer acquisition opportunities on or near lines comprise opportunities in the existing but unserved building and in the new building markets.

There are approximately 1,050 buildings on or near[55] the Con Edison steam lines that do not use steam. Some of these buildings may be promising prospects for steam when their existing equipment reaches the end of its life. An example of an "unconnected but on-or-near-lines" prospect is a building located on or close to existing steam lines with gas heating and electric chillers that is evaluating a replacement chilling or heating system.

The size of the contestable "unconnected but on-or-near-lines" market is a function of:

- Square feet of floor space in buildings located on or near the lines but not connected to those lines.
- Growth rate of that type of floor space.
- Percentage of that space that is heated or cooled.
- The lifetime of the existing boiler and/or chiller plant.
- Tons of heating or cooling needed per square foot.[56]

Con Edison Steam estimated that, as of spring 2002, there were approximately 915 million square feet of floor space on or near[57] its steam lines. That study also indicated that approximately 336 million square feet of this space was not connected to the steam system and is, in principle, contestable when the existing heating and cooling equipment reaches the end of its life.

The inventory of existing numbers of buildings on or near lines is diminishing slowly as old structures are demolished to make room for new buildings. The annual "decay" rate is assumed to be 0.005 times the square footage inventory at the beginning of each year. However, it is also assumed that buildings are, on average, getting larger by a net 2 percent and that the overall building stock is growing at 1 percent per year.[58] For planning purposes, it is assumed that 100 percent of the new space is heated and cooled.

[55] "On or near" is defined as within the current 250-foot line extension obligation.
[56] An estimated average thermal load of one ton of capacity per 350 sq.ft. is assumed.
[57] Market Penetration Percentages by Sector (Table 1-1), pp.1-4, Con Edison study.
[58] NYCEDC.

Because prospects that are unconnected but are on or near the lines do not consume any steam currently, they may, in principle, be sold three steam products—heating-only, combined heating and cooling, and cooling-only services.

- Heating-only. These prospects are almost entirely gas heating customers facing a replacement decision.
  - Natural gas/oil boilers have expected lives of 10-20 years on average. To be conservative, 20 years was assumed, and hence 5 percent of the installed gas/oil boiler stock will be in play each year.
  - Approximately 0.02 mlbs/sq.ft. are needed for steam heating.
  - While steam has generally higher operating costs than those of gas, Con Edison reports that it captures approximately 90 percent of the new commercial heating business on or near its lines. Therefore, conversion of some prospects with expiring gas boilers to steam may be attractive, especially in the commercial sector.
  - Switching to steam from natural gas does not require extensive capital costs, and the existing building circulation system can often be used with little or no modification.
  - It appears reasonable to assume that Con Edison Steam might be in a position to capture as much as 20 percent of the heating replacement market in the "unconnected but on-or-near-lines" category.
- Combined Heating and Cooling. Estimating the percentage of combined heating and cooling loads that will be prospects for new equipment each year is difficult.
  - Most of the on or near but unconnected buildings have gas boiler heating systems and electric chillers.
  - Gas and electric equipment lives are not equal. Average lives of 20 years for gas boilers and 30 years for electric chillers are assumed.[59]
  - It appears reasonable to assume that most, if not all, prospects for conversion to combined steam heating and cooling will be drawn from two populations:
    - » Unconnected electric cooling and gas heating customers whose chillers fail and who are open to consideration of a total conversion. Without the foundation of the heating load, it will be extremely difficult to acquire the cooling load of these customers.
    - » Current or new steam heating-only customers who become cooling prospects when their electric chillers fail. This is a form of customer development and is therefore discussed in the section on Customer Account Development.
- Cooling-only (replacement market).
  - Cooling-only sales are likely to be very difficult because the prospects are served already by a different energy source and may incur significant switching or conversion costs.

[59] In the absence of survivor curves, a rough approximation for the probability of failure may be the inverse of the expected life of the equipment. For large populations, this may give reasonable results. For 30-year average life electric chillers, this would be .033 and, for a 20-year life gas boiler, .05. Assuming that the events are independent, the chance of an electric chiller or a gas boiler failure in any one year is the sum of their individual probabilities (.033 + .05 = .083), while the probability of both failing in any one year is the product (.033 * .05 = .0017). Because equipment does not fail at a uniform rate throughout the expected life, this approximation is likely to overestimate failure when the population is young and underestimate it when the population is aging. Failure, or even obsolescence, does not automatically mean replacement, as in many cases the customer will repair rather than replace equipment.

- Con Edison Steam reports that it has only two steam cooling-only customers on the system.
- For the test case shown, the acquisition rate for new steam cooling-only load taken from expiring electric chillers located on or near the steam lines was assumed to be 1 percent.
- The hybrid steam and electric chiller model that has been developed recently may attract increased cooling-only steam customers located on the lines.
  - » This hybrid model system may be eligible for DSM credits as an electric peak demand reduction technology.
  - » The hybrid chiller also reduces users' electric peak demand charges and may free up electrical capacity for other building uses.
  - » Although promising for customers, the relatively low number of run hours means there may be little revenue, or margin, for Con Edison Steam under current rate structures.
  - » It was assumed that the hybrid chiller made up 20 percent of the hybrid tonnage and that steam chiller produced 20 percent of the mlb sales of a full-cooling-requirement steam chiller.

Customer Acquisition Opportunities in the New Building Market On or Near Lines

New buildings within the extension area of the existing steam lines are the second major category of customer account acquisition opportunities. The area around the steam system is relatively mature with very few undeveloped lots, so there is an ongoing process of demolishing and constructing new ones on the same site(s). The model runs assume a relatively modest 1 percent net growth in buildings and a 2 percent increase in the average floor space of new buildings.

In the new building market, there are three marketing and sales opportunities, defined by product:

- Heating sales. These prospects are predominately commercial buildings and other facilities that place a premium on low first cost and may have the ability to pass operating costs through to tenants.
  - Historically, Con Edison Steam has captured 80-90 percent of commercial building heating loads on or near its lines.
  - It has been less successful in the residential segment, achieving something closer to 10 percent.
  - Assuming that commercial buildings represent about 70 percent of the new construction in the Con Edison Steam territory, the heating acquisition rate is about 60 percent.
- Combined heating and cooling sales. These prospects are almost entirely people who find steam attractive for heating and are willing to consider it for cooling.
  - Selling steam for full requirements is increasingly difficult. As noted previously, Con Edison Steam has not sold a new chilling account in several years.

- Given recent experience and the economics of steam for full requirements cooling, this report focuses on the potential for hybrid chillers.
- Assuming attractive steam chiller incentives for new buildings (such as possible new BIR incentives and DSM eligibility) and effective promotion efforts, it may be possible to capture 20 percent of the customers who elect steam heating (20 percent of 60 percent) or 12 percent of the new building sector.
- However, because the steam component of the hybrid chillers is relatively small, the associated revenues from such steam sales are limited, and it may not make economic sense for Con Edison Steam to promote the use of such chillers.

• Cooling-only sales. There are only two steam cooling-only customers, and it is difficult to construct a case for full cooling requirements steam using on-site chillers.
  - The hybrid chiller model discussed previously offers some promise but is still in early in its development cycle.
  - For the longer term, it may be feasible to market central or district cooling.

Customer Development Opportunities with Existing Customers

Account development involves building the expected value of an existing account. In many if not most cases, this means selling the customer more product, increasing the margin on the product sold, or both. Perhaps counter-intuitively, in some cases, increasing account value may require reducing the amount of product or the margin on sales to extend the expected life of the account. Companies may act either preemptively or reactively to keep customers by, for example, offering a price concession in exchange for an extended contract length. For the purposes of this plan, preemptive moves to extend the account lifetime are treated as development actions, and reactive efforts to preserve accounts will be defined as customer retention actions.

• Add-on Sales of Steam Cooling to Current Heating-Only Customers.
  - Con Edison Steam has about 250 large heating-only customers with a total floor space of nearly 230 million sq.ft. (averaging 743,000 sq.ft.) that would call for about 657,000 tons of chiller capacity if all of the space were cooled.
  - These will be difficult sales because (a) the existing relationship with the electricity supplier must be overcome, (b) the technical advisors may be reluctant to suggest converting (especially if they made the original recommendation), and (c) the first costs of a new steam unit may be significantly higher than replacing all or part of an electric chiller.
  - It is assumed that Con Edison Steam will be able to convert 1 out of 20 expiring electric chillers operated by existing steam heating customers to hybrid steam cooling.
  - However, inasmuch it is assumed that steam chillers constitute only 20 percent of the hybrid facility and the sales from those chillers are only 20

percent of that expected from a full-requirements chiller, the resulting mlbs sales are modest.

- No estimates were made of the potential for add-on sales of other products such as cogeneration, back pressure turbines, etc.

Customer Retention

Retention of existing customers is clearly desirable, and Con Edison Steam has been quite effective in accomplishing this, particularly when viewed on a net basis, as shown in Figure 22, page 47).

The model breaks the customer defection and retention problem into two major parts. The first, natural decay because of building demolition or other factors, is based on subjective estimates. The decay rate, estimated to be -0.005 times the beginning-of-year floor space inventory, is small and beyond the control of Con Edison Steam. The second component is the success rate of retention efforts, defined as the percentage of the accounts in play (the potential defectors) each year that are successfully retained. The input assumptions reflect the very low defection rates experienced historically.

Baseline Modeling Assumptions

The assumptions in the table below define the baseline conditions from which estimates of the consequences of changes in policies or marketing and sales success can be made. For example, baseline data are necessary to answer the question, "How does total customer portfolio value change if the acquisition rate for new combined heating and cooling accounts increases or decreases significantly?"

Figure 45. Base Case Modeling Assumptions

Decay rate of buildings (e.g., teardowns)	-0.005
Net growth rate in building size on-or-near lines	0.02
Growth rate in building stock	0.01
Chiller tons per square foot	0.0029
Heating mlbs per square foot	0.02
Revenue per mlb - cooling	$16.00
Revenue per mlb - heating	$24.00
Expected account life: new chiller-only	20
Expected account life: new heating	25
Expected account life: new combined	20
Percentage of space heated new and existing accounts	100
Expected account life: existing combined or chiller-only	10
Expected account life: existing steam heating	15
Expected chiller life: existing electric chiller	10
Expected boiler life: existing natural gas boiler	12.5
mlb sales per chiller ton	10.88
Steam chiller proportion of hybrid chiller	0.2
Hybrid chiller sales percentage of full rqts chiller	0.2
Percentage of space chilled	100
Water heating sales per square foot of heated space (mlbs/year)	0.008
Discount rate before tax (BT)	0.08
Discount rate after tax (AT)	0.05
Expected inflation/escalation per year	0.025
Real BT discount rate	0.055
Real AT discount rate	0.025
Margin per mlb- heating (BT)	$4.00
Margin per mlb - cooling (BT)	$1.50
Combined federal and state income tax rate	0.4
Retention success rate	
Combined Heating and Cooling	0.95
Chilling only	0.9
Large Heating-only	0.975
Small Heating-only (for now assumed replacement = loss)	
Acquisition rate electric-to-steam chiller replacement market	0.1
Acquisition rate (appl to new sq.ft.) steam heat, new buildings	0.6
Acquisition rate steam chiller, given steam heat in new building	0.2
Acquisition rate new steam chiller (no heat) new building	0.01

The parameters in the table above will also tend to indicate where marketing and sales research efforts should be directed.

Preliminary Results for the On-or-Near-Lines Market

The tables and discussion in this section report the results of the model runs using the assumptions above and the approach outlined in the previous sections. Figure 46 shows that the total number of steam customers will increase by 91 (about 5 percent) during the 7-year period of 2004-2010. The model runs did not incorporate any capacity constraints.

Most of the projected gain comes from the approximately 35 new hybrid cooling-only customers and 55 new large heating customers. The former may be overly optimistic, while the very modest projected increase in cooling sales to current heating-only customers may be unduly conservative. Nevertheless, as a test of the suitability of the model serving as a basis for future work, the pattern of results seems reasonable.

Figure 46. Changes in Projected Customer Accounts by Type – Account Acquisition, Development, & Retention Summary – Customer Counts

	2004	2005	2006	2007	2008	2009	2010	Change from 2004-2010
Total Customer Count - Beginning of Year (BOY)	1,811	1,827	1,842	1,857	1,873	1,888	1,902	91
Steam Cooling-Only Customers BOY	0	6	12	18	23	29	35	35
New Cooling-Only in New Buildings Market	1	1	1	1	1	1	1	-
New Cooling-Only in Electric Replacement Market	5	5	5	5	5	5	5	-
Lost Cooling-Only Accounts	0	0	0	0	0	0	0	-
Net Chiller-Only Customer Additions	6	6	6	6	6	6	6	-
Combined Chilling & Heating BOY	363	363	364	364	364	365	365	2
New Combined Heating & Cooling Customers in New Building Market	3	3	3	3	3	3	3	-
New Chilling Customers through Adding on to Heat-Only Account	1	1	1	1	1	1	2	-
Lost Combined Chilling & Heating Customers	-4	-4	-4	-4	-4	-4	-4	-
Net Combined Chilling & Heating Customer Additions	0	0	0	0	0	0	0	-
Large Heating-Only Customers BOY	250	259	268	278	287	296	305	55
New Large Heating-Only Customers in New Building Market	11	11	11	11	11	11	11	-
Lost Large Heating-Only Customers	-2	-2	-2	-2	-2	-2	-2	-
Net Large Heating-Only Customer Additions	9	9	9	9	9	9	9	-
Small Heating-Only Customers BOY	1,198	1,198	1,198	1,198	1,198	1,198	1,198	0
New Small Heating-Only Customers (assumed zero)	0	0	0	0	0	0	0	-
Lost Small Heating-Only Customers (assumed zero)	0	0	0	0	0	0	0	-
Net Small Heating-Only Customer Additions (assumed zero)	0	0	0	0	0	0	0	-

Another perspective is shown in Figure 47, reporting the change in chiller load served and in floor space heated by steam.

Figure 47. Actual and Projected Changes in Chiller Tonnage and Heated Floor Space from Beginning of Year(s) 2004-2010

	2004	2005	2006	2007	2008	2009	2010	Change from 2004-2010
Chiller Tonnage - Beginning of Year (BOY)	625,283	640,449	655,657	670,905	686,198	701,539	716,931	91,648
Steam Chiller-Only Tonnage BOY	0	7,834	15,418	22,752	29,838	36,678	43,272	43,272
New Chiller-Only Tonnage in New Buildings Market	345	348	351	355	358	362	366	-
New Chiller-Only Tonnage in Electric Replacement Market	7645	7546	7448	7351	7256	7162	7069	-
Lost Chiller Only Tonnage	-155	-310	-465	-620	-775	-930	-1,085	-
Net Chiller-Only Customer Tonnage Additions	7,834	7,584	7,334	7,086	6,839	6,594	6,350	-
Steam Chiller Tons in Combined Chilling and Heating BOY	625,283	626,207	627,165	628,132	629,088	630,011	630,876	5,593
New Steam Chiller Tons in Combined Chilling and Heating in New Building Market	4,705	4,763	4,823	4,883	4,944	5,007	5,070	-
New Steam Chiller Tons through Adding on to Heat-Only Accounts	2,472	2,550	2,627	2,704	2,782	2,861	2,940	-
Lost Chiller Tons from Combined Heating and Cooling	-6,253	-6,356	-6,482	-6,631	-6,804	-7,002	-7,226	-
Net Chiller Ton Activity in Combined Heating and Cooling	924	958	968	956	922	865	785	-
Steam Heated Floor Space, sq.ft. BOY	578,776,026	578,234,386	586,570,330	595,009,824	603,554,766	612,207,088	620,968,761	42,192,735
Floor Space in Combined Chilling and Heating Accounts, sq.ft. BOY	218,849,050	220,495,901	222,163,090	223,850,988	225,559,977	227,290,441	229,042,776	10,193,726
New Steam Heated Floor space in Combined Chilling and Heating in New Building Market, sq.ft.	1,646,851	1,667,189	1,687,899	1,708,988	1,730,464	1,752,334	1,774,606	-
Lost Steam Heated Floor Space in Combined Heating and Cooling Segment	-2,188,491	-2,224,553	-2,268,557	-2,320,755	-2,381,397	-2,450,733	-2,529,010	-
Net Heated Floor Space Change in Combined Heating and Cooling Segment	-541,640	-557,364	-580,658	-611,766	-650,933	-698,398	-754,404	-
New Steam Heated Floor Space in Gas Boiler Replacement Market [inactive now]	-	-	-	-	-	-	-	-
Floor Space of Heating-Only Customers, sq.ft., BOY	359,926,976	365,275,881	370,645,816	376,057,325	381,512,207	387,012,284	392,559,402	32,632,426
Floor Space of Large Heating-Only Customers, sq.ft., BOY	229,772,024	235,120,929	240,490,864	245,902,373	251,357,255	256,857,332	262,404,450	32,632,426
New large Heating-Only Floor Space in New Building Market	6,587,404	6,668,755	6,751,595	6,835,953	6,921,858	7,009,338	7,098,424	-
Lost Floor Space in Large Heating-Only Segment	-1238498.3	-1298820.03	-1340086.954	-1381071.32	-1421780.17	-1462220.47	-1502399.14	-
Net Floor Space Change in Large Heating-Only segment	5,348,905	5,369,935	5,411,508	5,454,882	5,500,078	5,547,117	5,596,025	247,119
Floor Space of Small Heating-Only Customers, sq.ft., BOY	130,154,952	130,154,952	130,154,952	130,154,952	130,154,952	130,154,952	130,154,952	0
New Small Heating-Only Floor Space, (assume zero for now)	0	0	0	0	0	0	0	-
Lost Floor Space in Small Heating-Only Segment (assume zero for now)	0	0	0	0	0	0	0	-
Net Floor Space Change in Small Heating-Only Segment	0	0	0	0	0	0	0	-

Over time, as Con Edison Steam refines this model (or a similar tool) and populates it with more detailed data and information, it can become the basis for setting steam marketing and sales targets and for monitoring results.

Opportunities for Off-line Developments

A substantial amount of the City is out of range of the existing steam system. There are many large projects underway or proposed that, but for their distance from the steam system, may be attractive steam prospects. For present purposes, the analysis was confined to the standard products used in the review of opportunities on or near the lines. It is assumed that new developments would be served by line extension from the existing system rather than by, for example, hot water/chilled water district energy, stand-alone CHP, or the installation of the line by a third party. Finally, this report only reviews expansion into two redevelopment areas and does not consider other recognized redevelopment areas such as Lower Manhattan and Downtown Brooklyn.

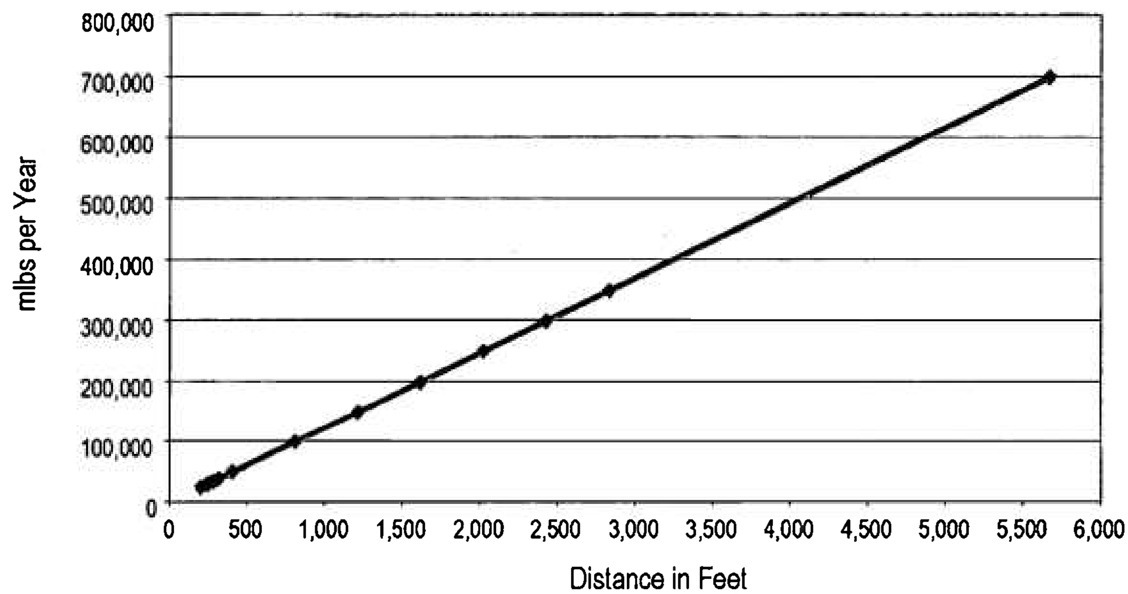
Relationship Between Load Level and Delivery Investment

It is very expensive to extend steam lines. Manhattan distribution and transmission line extensions cost about $2,000 and $4,000 per foot, respectively. Most of this line cost reflects the higher construction costs associated with steam lines, which must be insulated, set into channels and encased in four-foot-by-four-foot concrete jackets to withstand traffic disturbances. In addition, the line extension cost reflects the difficulty of adding new lines to the dense network of pipes and conduit under the streets of New York City, which, as shown in Figure 48, has been a factor in utility construction for many years.

Figure 48. Underground Interference

To justify extending a delivery line, the expected value of the new delivery margins has to equal or exceed the present value of the investment in pipe. The chart in Figure 49 shows the relationship between expected commercial sales and the maximum economic distribution distance.

Figure 49. Commercial Sales and Economic Extension Distance



The average large heating-only customer uses about 31,545 mlbs/yr and warrants a 255-foot line extension, which is about equal to the current line extension obligation. At the other end of the scale, even a very large development equal to 10 percent of the large heating-only class and consuming almost 700 MMlbs per year would warrant only about a mile-long extension.

Brooklyn Development at Greenpoint/Williamsburg[60]

The proposed Greenpoint/Williamsburg development in Brooklyn has been suggested as potential new market geography for Con Edison Steam. It is unclear whether Con Edison has the right to serve steam customers in Brooklyn, but that issue needs to be clarified before proceeding.

The most recent data on Greenpoint/Williamsburg anticipates development of 7,391 dwelling units of 1,100 zoning square feet, or 1,375 gross square feet per unit. Building height limits appear to range from 60 to 110 feet, although there is one area (R8 district)

60 See http://www.nyc.gov/html/dcp/html/greenpointwill/greenoverview.html for details.

where buildings can reach 350 feet. Overall, it appears that 10 million square feet is a reasonable estimate of total floor space. Specific year-by-year development figures do not appear to be available. The total floor space values were therefore prorated over 2006-2013 to simulate a potential building pattern. A conservative estimate of 1.2 million square feet a year of residential apartment buildings and 254,000 square feet of retail, or 32,000 square feet per year until 2013, was used. Development beyond 2013 can, of course, be expected, but it has not been quantified. Some of the important assumptions used in the model are shown in Figure 50.

Figure 50. Development Assumptions for Greenpoint/Williamsburg

Total planned sq.ft. (2006-2013)	10,000,000
Commercial	240,000
Residential	9,760,000
Cost of large diameter line extension $ per ft	$4,000
Distance from Hudson Avenue Station (ft)	15,840
Total cost of transmission line	$63,360,000
Cost of distribution line $ per ft	$2,000
Distribution ft per year	500
Distribution investment $ per yr	$1,000,000
Cooling penetration	
Commercial	0.2
Residential	0.1
Square feet per ton of chiller	350
Mlb sales per chiller ton	22.58
Heating penetration	
Commercial	0.9
Residential	0.2
Mlbs sales per sq.ft. of heating	0.0334
Real AT Discount rate	0.025
Wtd average delivery margin/mlb	
Commercial	1.85
Residential	1.58

The analysis assumes that the development would be served by building a three-mile transmission line[61] from the Hudson Avenue Station in Brooklyn at an investment cost of $4,000 a foot (or $63.4 million). It was also assumed that 500 feet of distribution line per year at $2,000 per foot (or $1 million a year) would be needed to connect buildings to the network. The penetration figures reflect historical success rates in the commercial and high-rise residential markets. Sales are based on Figure 8 (page 33) values for similar customers. Margins for delivery services were estimated using Con Edison estimates for total margins of $4.00/mlb and $1.50/mlb for on-peak and peak, respectively, multiplied by 0.57 to reflect the proportion of delivery assets to total assets,[62] and then weighted by

61 Estimated by inspection using hard copy map and scale; does not reflect an engineering study of potential obstructions or interference problems.

62 New York Public Service Commission Steam Case 03-S-1672, Consolidated Edison Company of New York, Inc. Exhibits, Volume 2, Tab 57, Cost of Service Study – Steam Department Year 2002, Adjusted for Known Changes in Costs and Rates Effective December 8, 2000, Rate Engineering Department, Rate Base, Table 2, page 1, line 13, Total Distribution, column 1 Total Steam System, 437,848,852 divided by line 27, column 1 Total, 767,830,656, which equals 0.57 or 57 percent. When ERRP is put in the rate base, the ratio may change but is likely to reduce the share of rate base attributable to distribution and customer services, so our estimate of margin per delivery mlb is probably conservative.

the representative cooling and heating consumption levels. Figure 51 shows the resulting estimates of the year-by-year costs and delivery margin contributions.

Figure 51. Year-by-Year Estimates of Greenpoint/Williamsburg Delivery Costs and Contributions

	2006	2007	2008	2009	2010	2011	2012	2013
Transmission investment	$63,360,000		-	-	-	-	-	-
Distribution investment	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Square footage per year	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000
Commercial or Retail	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Residential	1,220,000	1,220,000	1,220,000	1,220,000	1,220,000	1,220,000	1,220,000	1,220,000
Cooling sales mlbs	8,258	24,773	49,547	82,578	123,867	173,414	55,482	63,353
Commercial or Retail	387	774	1161	1548	1935	2323	387	387
Residential	7,871	15,741	23,612	31,483	39,354	47,224	55,095	62,966
Heating Sales mlbs	9,051	27,154	54,308	90,514	135,771	190,079	253,439	325,850
Commercial or Retail	902	1,804	2,705	3,607	4,509	5,411	6,313	7,214
Residential	8,150	16,299	24,449	32,598	40,748	48,898	57,047	65,197
Total Sales mlbs	17,309	34,618	51,928	69,237	86,546	103,855	118,842	135,764
Commercial or Retail	1289	2578	3867	5156	6444	7733	6700	7601
Residential	16,020	32,041	48,061	64,081	80,102	96,122	112,142	128,163
Total Delivery Margin per yr (constant)	$27,697	$55,393	$83,090	$110,786	$138,483	$166,179	$189,579	$216,560
Commercial or Retail	$2,384	$4,769	$7,153	$9,538	$11,922	$14,307	$12,394	$14,063
Residential	$25,312	$50,624	$75,936	$101,249	$126,561	$151,873	$177,185	$202,497
Total Delivery Margin per year (real)	$27,021	$52,724	$77,157	$100,367	$122,399	$143,296	$159,487	$177,741
Commercial or Retail	$2,326	$4,539	$6,643	$8,641	$10,537	$12,337	$10,427	$11,542
Residential	$24,695	$48,185	$70,515	$91,726	$111,861	$130,959	$149,060	$166,199

The fairly low delivery service margins reflect the low proportion of commercial customers relative to residential customers. In recent years, Con Edison Steam has been relatively unsuccessful in the apartment market.

The preliminary analysis summarized in Figure 52 indicates that the cost of building the steam transmission line, even from the nearest Con Edison plant in Brooklyn, is not economically feasible. However, this analysis is constrained to the assumptions listed above and the application of the existing line extension business model. A more comprehensive engineering and economic analysis open to additional business development options and with the inclusion of other indirect benefits might produce more thorough analyses.

Figure 52. Summary of Greenpoint/Williamsburg Delivery Investment Costs and Delivery Margins on Sales

Present Values	$ thousand
Transmission Investment	($63,360)
Distribution Investment 2006-2013	($7,170)
Delivery Margin 2006-2013	$860
Delivery Margin 2014-2020	$893
Net value of delivery investment	($68,777)

West Side Manhattan Hudson Yards Development

The Hudson Yards development is comprised of 25 million to 40 million square feet of new floor space anticipated during the next 20 years. A midpoint value was used, and the expected commercial (including retail and hotel) and residential space was prorated during the 20-year period. The same general factors used in the Brooklyn analysis were applied. Line building was assumed to end in 2013, but present values for delivery margins were computed out to 2020.

The assumptions used in the analysis are summarized in Figure 53.

Figure 53. Development Assumptions for Manhattan West Side Hudson Yards

Total planned sq.ft.	32,000,000
Commercial	19,500,000
Residential	12,500,000
Cost of large diameter line extension $ per ft	$4,000
Distance from 59th Street Station (ft)	6,120
Total cost of transmission line	$24,480,000
Cost of distribution line $ per ft	$2,000
Distribution ft per year	3893
Distribution investment $ per yr	$7,786,000
Cooling penetration	
Commercial	0.2
Residential	0.1
Square feet per ton of chiller	350
Mlb sales per chiller ton	22.58
Heating penetration	
Commercial	0.9
Residential	0.2
Mlbs sales per sq ft of heating	0.0334
Real AT Discount rate	0.025
Wtd average delivery margin/mlb	
Commercial	1.85
Residential	1.58

Figure 54 shows the year-by-year delivery investments, construction levels by commercial and residential building type, and the resulting sales revenues and margins for the development period.

Figure 54. Year-by-Year Results for Hudson Yards Development

	2006	2007	2008	2009	2010	2011	2012	2013
Transmission investment	$24,480,000	-	-	-	-	-	-	-
Distribution investment	$7,786,000	$7,786,000	$7,786,000	$7,786,000	$7,786,000	$7,786,000	$7,786,000	$7,786,000
Square footage per year	4,000,000	4,000,000	4,000,000	4,000,000	4,000,000	4,000,000	4,000,000	4,000,000
Commercial or Retail	2,437,500	2,437,500	2,437,500	2,437,500	2,437,500	2,437,500	2,437,500	2,437,500
Residential	1,562,500	1,562,500	1,562,500	1,562,500	1,562,500	1,562,500	1,562,500	1,562,500
Cooling sales mlbs	51,611	103,223	154,834	206,446	258,057	309,669	361,280	412,891
Commercial or Retail	31,451	62,901	94,352	125,803	157,254	188,704	220,155	251,606
Residential	20,161	40,321	60,482	80,643	100,804	120,964	141,125	161,286
Heating sales mlbs	81,084	162,168	243,251	324,335	405,419	486,503	567,586	648,670
Commercial or Retail	73,271	146,543	219,814	293,085	366,356	439,628	512,899	586,170
Residential	7,813	15,625	23,438	31,250	39,063	46,875	54,688	62,500
Total sales mlbs	132,695	265,390	398,086	530,781	663,476	796,171	928,866	1,061,561
Commercial or Retail	104,722	209,444	314,166	418,888	523,610	628,332	733,054	837,776
Residential	27,973	55,946	83,920	111,893	139,866	167,839	195,813	223,786
Total delivery margin per yr (nominal)	$237,933	$475,867	$713,800	$951,733	$1,189,667	$1,427,600	$1,665,533	$1,903,467
Commercial or Retail	$193,736	$387,471	$581,207	$774,943	$968,678	$1,162,414	$1,356,149	$1,549,885
Residential	$44,198	$88,395	$132,593	$176,791	$220,988	$265,186	$309,384	$353,581
Total delivery margin per year (real)	$232,130	$462,157	$662,834	$862,223	$1,051,492	$1,231,015	$1,401,155	$1,562,264
Commercial or Retail	$189,010	$378,021	$539,708	$702,060	$856,170	$1,002,346	$1,140,881	$1,272,063
Residential	$43,120	$84,136	$123,126	$160,164	$195,322	$228,669	$260,274	$290,201

As shown in Figure 55, the heavy investment costs of building the delivery network overwhelm the margins created by delivering the commodity.

Figure 55. Summary Results for Hudson Yards

Present Values	$ thousands
Transmission Investment	($24,480)
Distribution Investment 2006-2013	($55,827)
Delivery Margin 2005-2013	$7,456
Delivery Margin 2014-2020	$9,677
Net Value of Delivery Investment	($63,173)

The summary results in Figures 54 and 55 suggest that, as with the Greenpoint/Williamsburg redevelopment, the West Side redevelopment may not be attractive economically under the current line extension business model. As shown, the net contribution is a negative $63 million, in this case largely because of the extensive distribution investments assumed. The delivery margins are substantially higher than in the Greenpoint/Williamsburg case but still appear insufficient to justify the cost of building new steam transmission and distribution lines. However, as in the Brooklyn case discussed in the section above, a less constrained analysis might produce different results.

6.

Governmental & Policy Factors

This chapter addresses the governmental and regulatory factors that influence the development of the steam system and its competitive position. The chapter is organized into sections dealing in turn with:

- Incentive Policies Overview.
- NYPA Energy Efficiency Programs.
- Business Incentive Rate (BIR) Programs.
- NYSERDA new construction and chiller replacement programs.
- NYISO programs to reduce peak electricity demand.
- Taxation Policies Overview.
- Summary and Findings.

Incentive Policies Overview

The Steam Business Development Plan Working Group is charged with making recommendations on how the new DSM program incentives in the Con Edison service territory should be designed to promote new steam chiller installations and retain existing steam chillers. The DSM program will be funded by a charge to electricity consumers and administered by NYSERDA in a manner similar to the existing New Construction Program and Peak Load Reduction Program. In addition to those two current programs, Con Edison Steam has suggested a new All-Electric to Steam/Electric Program.

The primary objective of the DSM program is to reduce electricity peak demand growth and hence the need for additional electricity generation or transmission into the City. Steam chillers displace electric chillers almost exclusively, and are therefore potentially an effective means of reducing electricity peak demand growth.

Incentive Design Guidelines

Incentives are intended to change the behavior of people from doing what they would have done absent the incentive to something judged as having a higher social value. The incentives discussed in this chapter are largely intended to discourage people from replacing their steam chiller with an electric chiller or to encourage people to consider the purchase of a steam chiller rather than an electric chiller. The following guidelines apply generally to incentive programs that are administered by public agencies or authorities and paid for by utility customers:

- The objective of the program should be clearly defined and measurable.
- The need for the incentive should be well understood.
- The reason for the unwanted behavior that is to be modified by the incentive should be clearly identified, and the corrective effect on that behavior by the incentive should be measurable.

- The benefit flowing from the desired behavior should be greater than the cost of achieving the changed behavior including the incentive and associated costs.
- The cost of providing the benefit should be borne largely by the parties who will benefit from the change in behavior.
- The incentive should not exceed that of an available, lower-cost alternative method of achieving the desired outcome.

The Case for an Incentive to Install or Retain Steam

There would be no need for an incentive if steam chillers were cost competitive with electric chillers. Current data indicate that steam chillers cost nearly twice as much to buy and significantly more to operate on a full requirements basis than comparable electric chillers. See Figure 29 (page 61) for first cost and operating cost comparisons.

Historical evidence suggests that steam chiller incentives can change buying decisions. According to Con Edison, DSM incentives for steam chillers accounted for a quarter of the electric peak reduction achieved in the 1990s. Since then, the cost of steam relative to an equivalent number of BTUs from electricity has increased, making it more difficult to stimulate steam chiller adoption.

The following sections discuss the case for steam chiller incentives in three important market segments:

- Steam chiller incentives in the new building market.
- Steam incentives in the steam-to-steam replacement market.
- Steam incentives in the electricity-to-steam replacement market for heating-only customers.

Steam Chiller Incentives in the New Building Market

No steam cooling customers have been acquired in the past few years, although several have been lost to electric conversions. It has always been difficult to sell steam cooling. At best, the company held only a small share of the cooling market. Today, only 363, or 20 percent, of the Con Edison Steam customers have steam chillers. All but two of these customers are combined heating and cooling customers. Several prominent engineers and building managers declared during interviews that steam cooling was no longer a serious option in new buildings. Not only are first-time costs and operating costs higher than those for electric chillers, but steam chilling often requires more building space.

With steam chilling's substantially higher capital and marketing costs, its requirement for substantially higher capital and operating costs, and its need for expensive building space, it seems reasonable to conclude that, without some sort of incentive, steam chilling will not be able to penetrate the new building cooling market. However, it is rare to sell steam cooling alone, and the ability to sell combined steam heating and cooling is limited by constraints on winter steam capacity. Existing steam production capacity can absorb only about 30 new combined cooling and heating customers. Therefore, stimulating combined steam cooling and heating installations may have the consequence of accelerating the need for more steam capacity.

The amount of new building activity on the Con Edison Steam system was projected using the steam market model described in Chapter 5. The model projects about 23 new building prospects or candidates for new building steam incentives each year on or near existing steam lines. The total contestable cooling load associated with these new buildings is estimated at 39,695 tons in 2005 and increases to 41,898 tons by 2010. This is equivalent to 20 MW or 21 MW of potential peak load increases each year. During the 2004-2010 period, 284,000 new chiller tons (equivalent to 142 MW) are estimated to be added on or near the steam system.

Given the steam capacity constraint, any steam chiller incentive program that captures a significant share of this load may entail adding new steam winter capability if the customer would not have been a steam heating customer except for the steam chiller incentive. Given that most large commercial office buildings near Con Edison lines already opt for steam heating, this would be a small number of buildings at best. In any event, while steam chiller incentives for new construction are recommended, any incentive program may have to take the steam winter capacity constraint into account. A new building steam incentive may have to be integrated with measures to reduce winter steam peaks, such as demand charges, to the extent that it results in incremental winter capacity need.

Steam Incentives for the Steam-to-Steam Replacement Market

There are currently about 363 steam cooling customers, and estimating the steam chiller replacement market for these customers is difficult. Some of the considerations bearing on the estimate include:

- The overall steam defection rate is fairly low, averaging just 0.35 percent of load and less than 1 percent of customers annually over the past 5 years (excluding the loss of the World Trade Center steam load).
- Almost all significant defectors were drawn from the 20 percent of steam customers who are cooling customers.
- The connected chiller load has declined constantly over the past decade.
- Attributing all of the defection to the cooling segment results in a 1.72 percent cooling customer defection rate.
- A common estimate of a 20-year life for steam chillers suggests a much higher defection rate — 5 percent of the steam cooling load (about 18 customers representing 32,000 tons, or the equivalent of 16 MW) may be candidates for replacement.
- A third perspective, that of the customer survey respondents, who represent a significant proportion of the chilling load, tends to confirm that the turnover is closer to 5 percent than 1.72 percent. See the Appendix for details of the customer

survey responses. These customers reported replacement and update activity consistent with a mean age of 10-12 years for the chiller stock. This corresponds to the midpoint of a normal distribution for 20- to 24-year expected lifetimes (Figure 69, page 153).

Three to four percent appears to be a reasonable working estimate of the potential defection rate for steam cooling customers. Applying the 3 and 4 percent per year figures to the current inventory of 625,283 tons results in an estimated potential annual loss of 18,758 to 25,011 tons, equivalent to 9.4 to 12.5 MW. This suggests that approximately 10 to 13 existing steam-cooling customers will be eligible for incentives each year. This is substantially beyond the current level of 5 to 6 projects annually in the existing NYSERDA steam-to-steam program discussed below. This suggests that the program should be expanded if it is intended to be sufficient to cover all expected steam-to-electric conversions.

Incentives for the Electric-to-Steam Replacement Market

Encouraging steam chiller replacements for the electric chillers of existing steam heating-only customers makes sense because it does not add to the steam peak, and the customers are already connected to the steam system. The top 250 heating-only steam customers represent about 230 million sq.ft. of floor space that requires about 660,000 tons of chiller capacity (equivalent to about 330 MW of electric capacity). Assuming that 75 percent of these customers use electric chillers with an average expected life of 20 years, the replacement electric chiller tonnage market starts at about 25,000 tons in 2005 and increases to about 29,400 tons by 2010. Over the 2005 - 2010 period, the model calculates that about 189,000 tons of electric chillers, equivalent to 90MW, will be replaced. The size of this market is very similar to the steam-to-steam market, but it will likely be a more difficult sell and may require a higher per-unit incentive.

No one at Con Edison recalls a recent electric-to-steam chiller conversion. Despite the fact that the heating-only customers are already connected, it will be harder to win cooling sales in this sector than in the new building market. There are several potential barriers to electric-to-steam conversion:

- As noted previously, steam chillers cost more to own and operate.
- Customers and their operating personnel already have a relationship with the electric utility and the chiller vendor, neither of which has much, if any, incentive to encourage a switch to steam.
- The engineering consultant may be reluctant to introduce a new technology into an already functioning and familiar system.
- Steam chillers typically require more building space.

Nevertheless, there may be some opportunity to place hybrid steam/electric chiller sets in some of the larger heating-only accounts. As discussed in Chapter 4, the hybrid chiller set can avoid substantial electricity demand charges and free up electrical capacity in an older building to meet additional applications.

An incentive program for electric-to-steam conversions would likely attract only a fraction of the 13-15 opportunities per year, and the incentive level would likely have to be very high to make the customer economically indifferent between the two technologies.

Benefits of Offering Steam Chiller Incentives

Quantifying the benefits of steam chiller incentives is necessary to set bounds on the incentive level and to judge the effectiveness of the program.

The intended benefits of the incentives are to avoid new peak electricity production and delivery capability including new in-City generation, new transmission, and buying capacity in the Zone J market. The value of the avoided cost benefit is the same in all markets, but the cost of achieving these benefits is likely to vary in each market.

The question is, "What are these benefits worth?" The value of the avoided peak capacity sets an upper bound on the economical steam incentive. There are several ways of estimating the avoided cost of peak electricity capacity, some of which are discussed below, to provide a basis for estimating the benefit of the incentives.

In principle, the opportunity cost of avoided capacity is a function of three variables—the rate of output avoided (kWh per year), the volume or duration of the avoided output (running time per year), and the full time period during which the output will be avoided (installation and retirement dates).[63] Precisely calculating this value requires a fairly complex optimization routine. In practice, people tend to employ proxies they believe are reasonably accurate representations of their opportunity costs.

The cost of a simple cycle turbine generator is often used as a proxy for the avoided cost of peak period growth. A recent NYISO study[64] estimates the installed cost of a simple gas turbine at $1188/kW in 2004 dollars. Using a 20 percent annual carrying charge rate, the annual cost is $238/kW/year before including annual fixed O&M. The NYISO study also estimated $38/kW/year for annual fixed O&M in 2004 dollars. Therefore, the total annual cost is $276/kW/year in 2004 dollars. Assuming 2.5 percent inflation from 2004 to 2005, the annual cost in current dollars is $283/kW/year. This can be regarded as a lower bound cost of avoided new in-City capacity.

Because a chiller frequently runs for 2,000 hours or more, it is less like a simple peaker that is called on only a few hours a year and more like a mid-range production unit. The value of a kW of new base and mid-range central station capacity can be estimated from the recent experience of new plants, such as the 500 MW combined cycle (CC) plant built

[63] See Armen A. Alchian, William R. Allen, University Economics, Elements of Inquiry, Third Edition, 1972, Wadsworth, Belmont CA. pp. 258-262, for an introductory discussion of the output program concept relevant to changes in consumption and production over time.
[64] Levitan and Associates, Independent Study to Establish Parameters of the ICAP Demand Curves for the New York System Operator, August 14, 2004.

by NYPA on the Poletti site that came in at around $1,700/kW (estimate based on discussions with NYPA). With a 20 percent annual carrying charge, this suggests annual costs of $300 to $320/kW before fixed O&M. If fixed O&M were $60/kW, the annual cost of new CC capacity would be $360 to $380/kW/year.

Another possible proxy for the avoided capacity cost is the price to buy UCAP in the NYISO market. For the purposes of this analysis, a range of $70 to $100/kW/year capacity cost was used. Applying a 20 percent discount rate results in a one-time payment equivalent of $350 to $500 per kW. Although a reasonable argument may be made that the NYISO current and forecasted Zone J capacity cost is a valid basis for estimating the benefit of foregoing peak electricity growth, it is difficult to estimate the benefits over the full life of the chiller.

Although there are likely some avoided electricity delivery capital costs, increments of delivery investment are extremely difficult to estimate without very specific and location-specific information and were not considered in this analysis.

The avoided electricity capacity cost is a valid basis for estimating the value or benefit of substituting a steam chiller for an electric chiller, but it is not necessarily the appropriate level for the incentive to cause this behavior. The incentive should be the lowest payment necessary to achieve the desired behavior.

NYSERDA's success in retaining steam chillers with incentives substantially below the avoided peak capacity indicates that the net benefit of the program is positive.

On balance, the benefit from each kW of capacity avoided through the incentive should be approximated using the range between $280 and $380/kW/year, which is equivalent to one-time payments of $1,363 and $1,850/kW, respectively.[65] These figures are substantially higher than the current NYSERDA incentives. Of course, NYSERDA incentives are not intended to equal the foregone capacity value but to offset a portion of the steam chiller acquisition cost.

The following section sets out an analytical framework for estimating the impact of steam chiller incentives of $500 and $1,000 per KW (well below the lower bound for avoided capacity cost developed in this section).

Estimating the Sales Effects of Steam Chiller Incentives

There is no point offering steam chiller incentives if they do not stimulate a noticeable increase in the number of prospects choosing steam over electric chillers. Experience indicates that steam incentives do, in fact, stimulate steam chiller sales, but it is difficult to anticipate precisely by how much without a more rigorous analysis.

[65] The one-time payments include capitalized construction and fixed O&M and are discounted over 20 years at the 20 percent fixed charge rate used by Levitan in its NYISO calculations.

Ideally, the effects of incentives would be based on rigorous price and cross price elasticity studies of buyer choices of steam and electric chillers. Unfortunately, no rigorous econometric studies of chiller price elasticity are publicly available. Therefore, an analytical framework was created that uses the limited information available[66] to develop reasonable estimates of the consequences of various incentive levels. Later, as more data become available, this approach can be refined to make more precise projections.

The model begins by calculating how various one-time incentive payments change the relative long-term costs of chiller technologies. This involves the following:

- Estimating the lifetime cost of owning and operating each type of chiller 2,000 hours a year for 20 years.
- Determining the initial long-term cost ratios.
- Calculating the present value (PV) of the one-time incentive payment necessary to achieve various long-term price ratios and shares.

Figure 56 shows the relationship between the long-term costs and one-time incentives for four chiller types. In each case, the incentive is necessary to achieve the equivalent long-term cost ratio of the electric centrifugal chiller.

Figure 56. Incentive Levels Necessary to Achieve Various Steam/Electric Chiller Lifetime Cost Ratios

Chiller Technology	Base Case [1]	Base Ratios [2]	Base PV [3]	PV incentive for .5 share [4]	PV of incentive/MW to get 1.25 long-term cost ratio	PV of incentive/MW to get 1.50 long-term cost ratio	PV of incentive/MW to get 1.75 long-term cost ratio
Steam single-stage absorption	$1,001,926	2.44	$8,529,958	$5,032,157	$4,157,707	$3,283,257	$2,408,807
Steam 2-stage absorption	$637,366	1.55	$5,426,256	$1,928,455	$1,054,005	$179,554	-
Steam turbine	$733,469	1.79	$6,244,437	$2,746,637	$1,872,186	$997,736	$123,286
Electric turbine	$410,850	-	$3,497801	-	-	-	

[1] Annual cost to own & operate a 1 MW equiv 2,000 hr, excluding customer charge, no incentive, but including electric demand charge savings.
[2] Steam to electricity long-term cost ratio.
[3] Steam to electricity long-term cost ratio.
[4] Amount/MW to get cost to won & operate to parity or 1.0 long-term cost ratio.

This table shows that the incentives for the single-stage absorber, the two- stage absorber, and the steam turbine chiller would have to be $5,032, $1,928, and $2,747 per kW, respectively, to equal the lifetime costs of the electric centrifugal chiller.[67] These incentive payments are rough estimates of the payment necessary to make a buyer indifferent between buying and owning one of the steam chillers instead of the electric chiller. All of these values are substantially higher than the estimated value of an avoided

[66] Research for this report turned up no references, and the finding was confirmed by Ian Spanswick of York International Corporation, the leading supplier of steam chillers in the New York City market.
[67] Table values are in MW. Divide by 1,000 to get kW figures cited in the text.

kW of electric generating capacity and are therefore not economically justified levels for steam chiller incentives.

Lower per kW incentives of $3,283, $179, and $997 for the single-stage absorption chiller, 2-stage absorption chiller, and steam turbine chiller, respectively, would reduce their lifetime cost ratio relative to the electric chiller to 1.5.

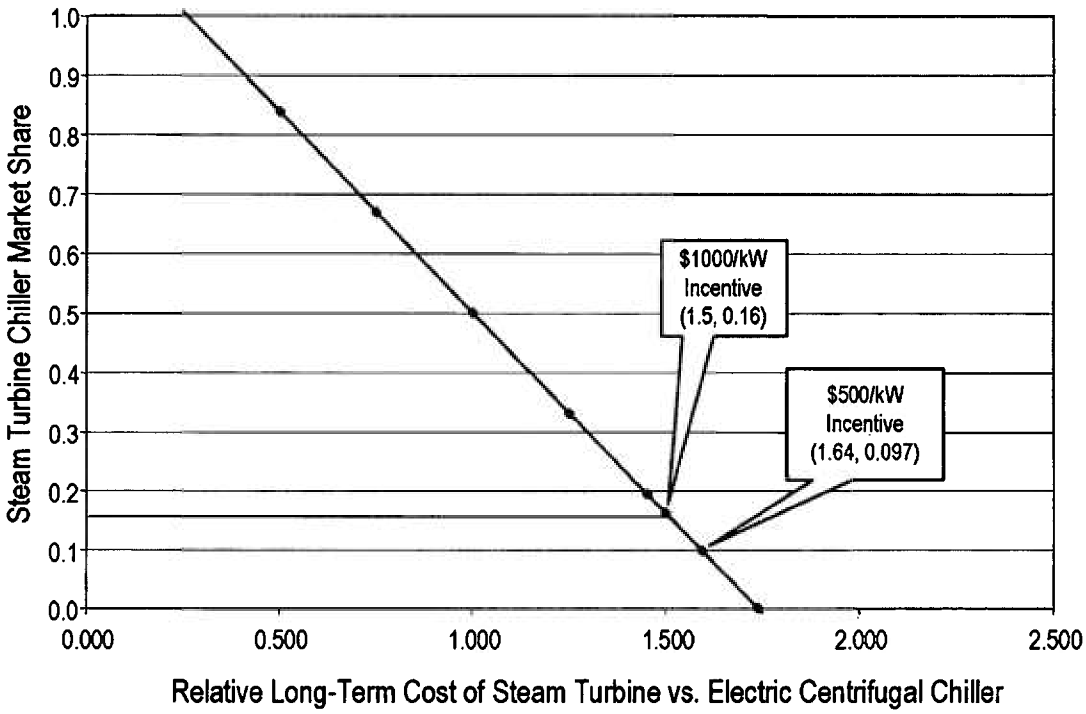
The following sections provide rough estimates of the potential changes in market share or probability of purchase for three types of steam chillers relative to the electric centrifugal chiller. The analysis covers only the effects in the new building market, which is likely the most difficult for steam to penetrate.

Steam Turbine Market Share Under Various Incentive Levels

- The model assumes that customers choose among chiller types primarily on the basis of expected lifetime costs. The relationship is estimated in part by observing that the current ratio of lifetime costs for a steam turbine chiller compared to an electric chiller is 1.78[68] and that steam turbine chillers currently win zero prospects.
- The phenomenon of a zero share for steam turbine chillers is fairly recent and occurred when relative costs where roughly comparable to those of today, so 1.78 is a reasonable estimate of the x-intercept.
- The model also assumes that, if steam chillers achieve lifetime cost parity with electric chillers (a cost ratio of 1.0), each technology will capture approximately half of the market.
- The equation for the line through these two points represents a linear approximation of the trade-off between relative lifetime costs of steam turbine and electric centrifugal chillers (x-axis) and steam share (y-axis).

[68] For this analysis, 2,000 hours of running time is assumed.

Figure 57. Estimated Relationship Between Relative Lifetime Steam Turbine and Electric Chiller Costs and Market Share (New Building Market)



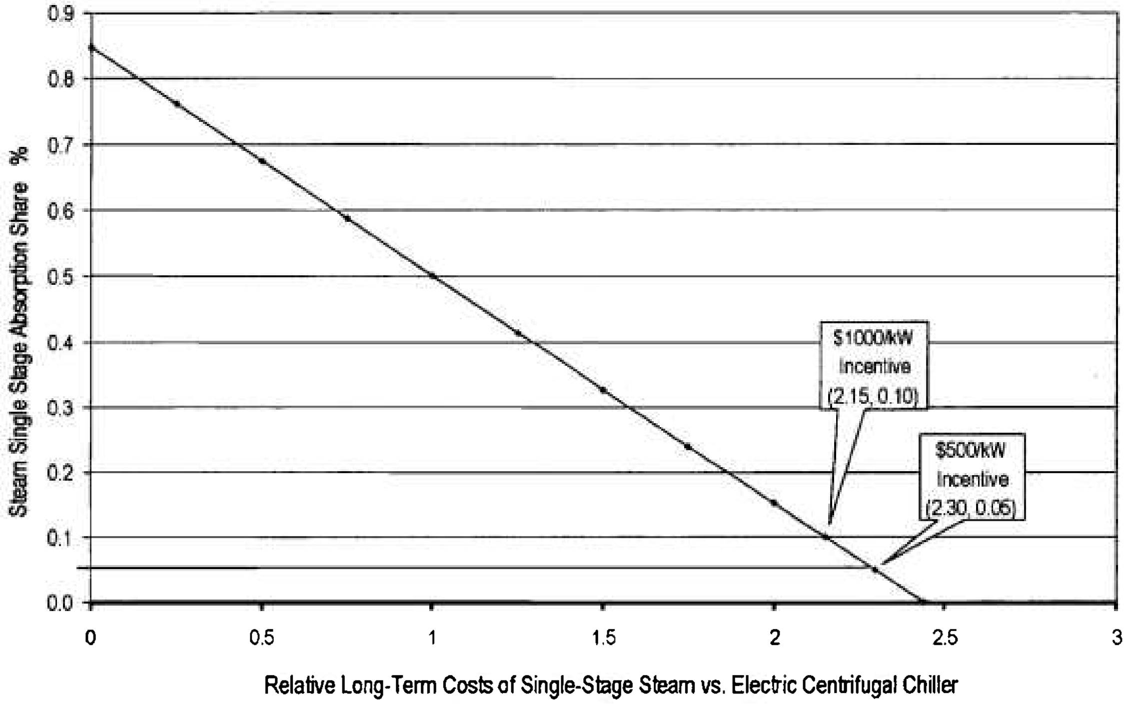
The graph in Figure 57 relates relative lifetime costs of steam and electric centrifugal chillers to corresponding market shares. The ratio of steam turbine to electric chiller lifetime costs is shown on the x-axis, and the corresponding market share value is on the y-axis. For example, when the steam turbine and electric chillers have equal expected lifetime costs, the cost ratio is 1.0 on the x-axis, which corresponds to a 50 percent market share for each technology.

The current lifetime cost ratio of 1.78 results in a zero market share for steam turbine chillers in the new building market, as shown on the x-axis. One-time incentives of $1,000 and $500 per kW result in steam turbine shares of 0.16 and 0.097, respectively. Another way to look at the effect is that the $500/kW incentive moves the probability of purchase from zero to 9 percent; the $1000/kW incentive would raise it another 7 points to 16 percent. Thus, even fairly large incentives are not likely to stimulate significant market shares for steam turbine chillers in the New York City new building market.

<u>Single-Stage Absorption Chiller Estimated Share Relative to Incentives (New Building Market)</u>

Applying the same analytical framework described above for the comparison of steam turbine market shares to the data for the single-stage absorption turbine results in the values shown in Figure 58.

Figure 58. Relative Lifetime Costs and Share for Steam Single-Stage Absorption and Electric Centrifugal Chiller (New Building Market)

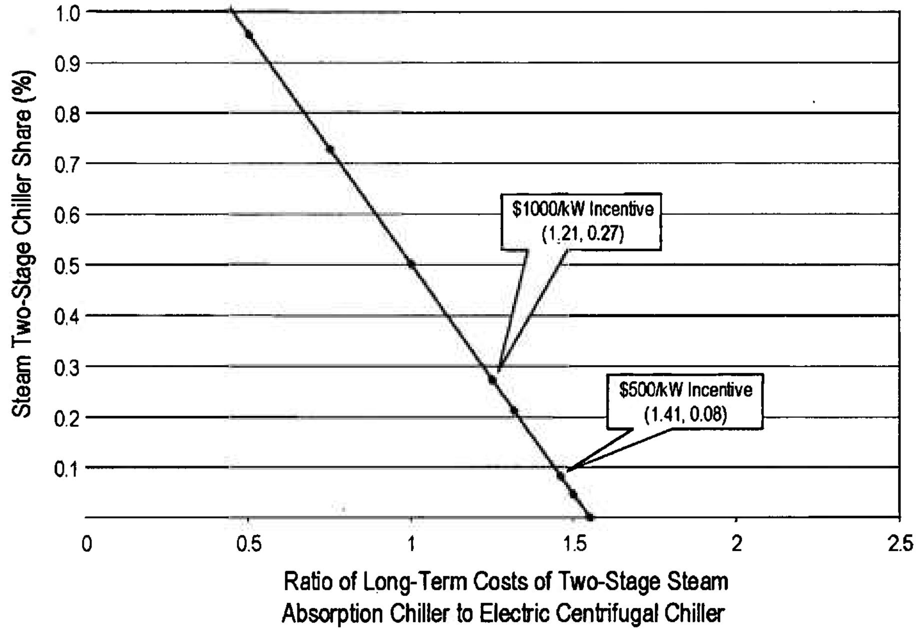


As shown in Figure 58, the steam single-stage absorption chiller has a current lifetime cost ratio relative to the electric centrifugal chiller of about 2.44. Given the space requirements and relatively low technical efficiency of single-stage absorbers, they are ordinarily not attractive options in many new building situations. However, as estimated, $500 and $1,000 per kW upfront incentives might increase share or probability of purchase from the current zero to approximately 5 and 10 percent, respectively.

Two-Stage Absorption Chiller Estimated Share Relative to Incentives (New Building Market)

The two-stage steam absorption chiller is, in many respects, the most competitive alternative to the electric centrifugal chiller, especially in the new building market. A $500/kW incentive achieves a 1.41 lifetime cost ratio with the electric centrifugal chiller and a nearly 8 percent share. Doubling the incentive to $1,000/kW reduces the cost ratio to 1.21 and produces a 27 percent probability of purchase. At this 1.21 cost ratio, other marketing considerations (such as vendor support, energy hedging, clean energy positioning, etc.) may be able to sway decisions toward steam cooling, particularly if combined with steam heating However, the steam production capacity constraint must be kept in mind when marketing combined cooling and heating.

Figure 59. Estimated Relative Lifetime Costs and Share for Steam Two-Stage Absorption and Electric Centrifugal Chillers



Implications of the Incentives on New Building Market Penetration

The rough approximations of price elasticity indicate incentives at the levels discussed could modestly stimulate steam chiller sales in the new building market, particularly the two-stage steam absorption chiller. The analysis was not performed for the two chiller replacement markets. However, the steam incentives may, as discussed in Chapter 4, have a substantial effect on hybrid steam chillers. The incentives increase the number of hours the steam component can run before it is economical to supplant them with electric.

Energy Programs that May Affect Steam Business Development

Business Incentive Rate Program and Energy Cost Savings Program

Con Edison's electric business incentive rate (BIR) currently provides a discount (approximately 30 - 40 percent off the delivery charge) to New York City customers that enter into an economic development agreement with the NYCEDC. If there is such an agreement, Con Edison provides a discount on the distribution portion of the bill, usually for a period of 15 years for large customers—ten years of full discounts followed by a 5-year phase-out period.

One possibility would be to create a comparable BIR benefit for customers who would qualify for BIR if they installed electric chillers but opt, instead, to install steam chillers. If such a program could be developed, it would permit a customer to make the election between steam and electric chillers without consideration of the relative attractiveness of using electric facilities to qualify for BIR, as is now the case.

NYCEDC could also consider a similar proposal to ensure that the City's Energy Cost Savings Program (ECSP) provides a benefit for steam under that program that is equivalent to the benefit that is already provided to gas and electric customers. Under this program, Con Edison provides a discount on the gas and electricity delivery price for customers that the City has determined to satisfy certain economic development criteria, and the City provides Con Edison with a credit on the gross receipts tax that Con Edison would otherwise pay the City. State law governs ECSP, and any change in the program would require the City to make a proposal to have the State Legislature amend the ECSP enabling statute and affirmative action thereon by the Legislature.

New York Power Authority Programs

Con Edison Steam and others have questioned the appropriateness of one public entity, NYPA, promoting the conversion of steam systems owned by another, the City of New York, and potentially imposing additional costs on citizens by stimulating electricity and natural gas demand in the energy-constrained New York City area. NYPA has recently agreed not to encourage the conversion of steam chillers to electric. The following material provides background on the NYPA programs.

NYPA offers the ENCORE program to assist its electricity customers to identify, evaluate, and finance energy efficiency projects. There are two ENCORE programs that affect the steam business:

- Electro-Technologies looks at converting or upgrading applications to electricity.
- Non-electric End-Use looks at efficient conversions or upgrades involving other energy sources.

Both programs affect the City of New York steam installations—the former by identifying steam-to-electric chiller opportunities and the latter by identifying steam-to-gas boiler conversion opportunities.

- NYPA's project or facility evaluation attempts to be a comprehensive look at space conditioning, lighting, and other loads. Therefore, some projects comprising chiller conversion may not result in a net increase in peak electric demand. The increase in peak demand attributable to the new electric chiller may be offset by reductions elsewhere.
- The financing is very favorable—currently about 1.4 percent interest with A 10-year payoff (in some cases, it may go to 20 years).

- This is an area of potential divergence between social and private opportunity costs. Con Edison Steam cannot offer terms comparable to those made possible by a government agency's lower cost of capital. Therefore, a customer weighing two otherwise identical proposals from the government entity and from Con Edison may choose the government bid because of the lower capital costs.

Some effects that the ENCORE program has had on the Con Edison Steam business can be gained by looking at the list of projects, all involving Con Edison Steam customers:

Figure 60. Projects of Con Edison Steam Customers

Major Conversions Under the Electro Technologies Program	In Progress	Major Conversions Under the Non-Electric End-Use Program
• Bellevue Hospital, Steam to Electric Chillers • 100 Centre Street (various municipal offices) steam to electric chillers. • Hunter College, steam to electric chillers.	• Fashion Institute of Technology. - Originally a total change-out of steam to electric. - Draft package calls for a hybrid steam and electric chiller configuration. - Hybrid configuration extends the payback period.	• 100 Centre Street, steam to gas boiler.

Although NYPA has recently agreed to suspend its conversion of steam to electric chillers, NYCEDC should continue the efforts begun during this assignment to work with NYPA, DCAS, and Con Edison to review the NYPA ENCORE methodology, particularly the discount rates used, the benefits ascribed to peak load reduction/increase, and the sensitivity to hybrid chiller options.

New York State Energy Research & Development Authority Programs

NYSERDA offers steam chiller incentives under the New Construction Program and steam-to-steam replacement/upgrade incentives under the Peak Load Reduction Program. The New Construction Program provides about $400,000 to $500,000 per facility to stimulate energy efficiency in new buildings. Incentives under the Peak Load Reduction Program are based on available funds, are performance based, and are tied to avoided load. These incentives have not always been sufficient to alter chiller selection decisions.

The Steam-to-Steam Chiller Replacement Program[69]

The two-year-old steam-to-steam incentive offering under the Peak Load Reduction Program is relatively small. It is funded at approximately $3.1 million annually and covers only about 5 projects a year. It is essentially a steam chiller retention program.

[69] NYSERDA.

Nevertheless, it is highly prized by the City building community and by Con Edison Steam.

The first-year budget was $3.15 million and offered $475/kW. The grants are limited to 70 percent of the project costs and are not to exceed $735,000 per building. Five programs qualified—two will be finished in 2005, and one will roll over to 2006.

The 2005 budget started at $1.5 million and implemented new grant and cap levels of $375/kW up to 65 percent of the project costs, not to exceed $560,000 per building. In response to requests from the City engineering and building community, NYSERDA added another $1.6 million, restoring the budget to the first-year level, but the new grant and cap limits were retained. The lower grant levels reflect NYSERDA's concern that there were free riders in the first-year program that received more than the incremental cost differential between electric and steam chillers. The building community is concerned about the fluctuating funding level of the program and is strongly urging maintenance and even growth of the program.

The NYSERDA steam incentive programs are an important part of the steam chiller retention program. Consideration should be given to expanding the program to handle an expected increase in replacement market candidates. Making inroads into the electric chiller replacement market among existing steam heating customers may require a substantially larger incentive/kW than that presently used in the steam-to-steam market.

New York State Independent System Operator (NYISO)

NYISO offers various demand reduction programs intended to support grid reliability or to enhance market efficiency. These programs are properly not designed to promote or discourage any particular technology. While steam chillers are eligible to participate, the program requirements do not necessarily align well with steam operating characteristics. The NYISO, acting through its Price Responsive Load Working Group (PRLWG), is currently examining the issue of the future form of the demand reduction programs. The results of that process and any program changes that may be authorized by the NYISO may affect the following discussion.

The Emergency Demand Response Program (EDRP) and the Special Case Resource Program (SCR) are designed to enhance electric system reliability by using customer resources to be used to meet system requirements during emergencies called by the NYISO. These resources include both demand response and generation. NYISO subcommittees have also begun consideration of further programs to allow customer or demand side participation in ancillary services (reserves, voltage support) markets.

EDRP pays the higher of the real time energy price or $500 MWh and gives the participant 2 hours to voluntarily respond. The Special Case Resources Program, which provides for a 21-hour advisory notice and a 2-hour activation notice, is a capacity program. The participant accordingly is paid for the capacity that it provides, whether activated or not, and for energy when called at the higher of the real time energy price or $500 MWh, but is subject to financial penalties if it does not respond when called. The capacity credit can be used, assigned, or sold. Hybrid steam/electric chillers could potentially qualify for the SCR program, for which the incentive is currently about $12-$13/kW/month currently for the summer months, or about $6-$7/ton. While SCR payments are a welcome offset to operating costs for existing hybrid facilities, other provisions of the SCR program may be problematic for this technology. For example, because of the typical 4- to 6-hour lead time required to convert from electric chillers to steam power, a participating customer must begin responding within the 21-hour advisory notice, with no assurance that the 2-hour activation notice will be called.

The Day Ahead Demand Response Program (DADRP) is designed to allow customers to manage load or on-site production in response to price signals from the NYISO. There may also be issues with helping customers participate in the DADRP program.

Con Edison is a market participant in the NYISO and, as such, participates actively in the PRLWG and in the various governance committees of the organization. In doing so, it should consider the value of the steam system and work with steam customers to modify NYISO demand response programs to accommodate steam. Any such effort must fairly balance the valid concerns of the Company's electric and steam systems, including the potential electric reliability impacts of those changes.

Taxation Policies

Con Edison Steam customers' 2004 bills included about $79 million in taxes, which is equal to approximately 13.6 percent of Con Edison's steam revenues. This amount includes sales taxes, which are 4 percent for residential customers and more than 8.375 percent for commercial customers. Although the portion of bills attributable to taxes is significant in its own right, the main issue from a business development perspective is how those taxes affect competitive decisions and resource allocations.

In general, tax policies should be neutral between equally legitimate or socially desirable economic decisions. An elected government may reasonably impose different rates of taxation on, say, alcoholic and non-alcoholic beverages but should avoid favoring one class of healthy non-alcoholic beverages over another. This policy criterion is based on equity and efficiency grounds. Society loses when decision makers choose a less efficient or more costly product because of tax-induced distortions.

Con Edison has raised a number of issues regarding the differential taxation of centrally produced steam compared to the same commodity produced on-site.

- **Boiler Fuel Tax**: New York City charges a 4 percent sales tax on gas and oil that is burned in the power plants to generate electricity and steam. Accordingly, when Con Edison buys the fuel to generate energy, it is subject to a 4 percent sales tax. As the price of fuel rises, the sales tax paid to the city on that fuel increases. The sales tax then becomes a cost component of the energy, which, when sold to end use customers, is subject to the City's 2.35 percent Gross Receipts Tax (GRT) and, once again, a 4 percent sales tax for residential customers and a 8.375 percent sales tax for commercial customers (i.e., State 4 percent sales tax, MTA sales tax of 0.375 percent, and a City sales tax of 4 percent). This tax disadvantages Con Edison steam in competing against self-generation, because on-site boilers are not subject to this tax.

- **Sales Taxes**: The State of New York currently exempts the delivery portion of the bill for large commercial customers who purchase from ESCOs from sales taxes. This tax (State and City combined) is 8.375 percent. There is no comparable tax exemption for steam, which is particularly disadvantageous in competing for large commercial customers that have natural gas boilers and purchase their natural gas requirements from ESCOs.
- **Gross Receipts Tax**: The Gross Receipts Tax, which is now levied only by the City and not the State, particularly hurts a business like steam that has modest net income. Its taxes remain the same even though its net income is low. Changing to a net income tax would help the steam business vis-à-vis the gas and electric businesses.

Specific recommendations on tax levels and structures are beyond the scope and resources of this project. However, the issue does have significant business development implications, particularly as customer cogeneration emerges as a potentially tax-favored option for producing steam. Tax issues, therefore, warrant further analysis and consideration by the appropriate administrative and legislative authorities.

Findings

- The BIR offers a discounted electricity price as a business incentive. No comparable steam rate exists. Discussions between Con Edison and NYCEDC about how to extend the benefits of BIR to steam are ongoing and should continue to seek ways of encouraging new businesses locating in New York City to consider using steam.
- Both BIR and ECSP incentives should be comprehensively reviewed to consider their future applicability to steam services.
- NYPA, NYISO, and NYSERDA programs, as they affect steam cooling, are not fully coordinated, sometimes conflict, and are not sufficient to support greater steam penetration into the cooling market.
- The new DSM funding that emerged from the most recent electric rate case is an opportunity to develop more effective incentives for steam chillers.
  - Given the current steam capacity constraint and historical steam heating load growth rates, it does not seem appropriate to stimulate new combined heating and cooling customers.
  - There is an opportunity to increase steam chilling penetration without increasing winter peak demand by providing significant incentives for existing

heating-only customers to adopt steam chillers to replace all or part of their electric chillers as those chillers reach replacement age.
  - The current steam-to-steam program incentive levels should be increased moderately and the overall budget expanded.
- NYPA's ENCORE program reviews total energy use but does not explicitly consider steam chillers' electricity peak reduction value to the customer and the City as a whole and may overstate the benefits of conversion from steam.
- NYSERDA steam-to-steam chiller replacement/upgrade incentives are based on available funds and other program goals and objectives and not directly tied to the value of electricity peak reduction.
  - Budgets for steam chiller replacement/upgrades under the Peak Load Reduction Program have been $3.15 million (33 percent of program budget) in 2004 and $3.1 million (34 percent of program budget) in 2005.
  - The number of projects funded each year is approximately 25 percent of the estimated projects to be replaced/upgraded annually. New Construction Program participants tend to allocate the incentives for measures with more favorable economics.
- NYSERDA's new building program has limits of $400,000 - $500,000 per building. New Construction Program participants tend to allocate incentives for measures with more favorable economics, but those levels appear inadequate in the New York City market.
- NYISO offers various demand reduction programs intended to support grid reliability. These programs are, properly, not designed to promote or discourage any particular technology. While steam chillers are eligible, in principle, to participate, the program requirements do not appear to align well with steam operating characteristics.
- Combining some programs or alerting major customers about programs may help Con Edison Steam to retain steam cooling customers.

7.

Marketing & Sales Strategy

Introduction

This chapter is organized into sections addressing the components of marketing and sales outlined below. In each section, the current situation is briefly described, followed by suggested courses of action, and, in several cases, suggested directions to help achieve the change. This discussion of appropriate approaches to the market is based on:

- The customer survey results set out in the Appendix and numerous interviews conducted with customers and people who influence customer decisions.
- The experience of team members in the steam and similar businesses.
- Discussions with Con Edison Steam staff regarding their insights and experiences.
- A limited assessment of competitors and competitive marketing models.

There is no bright line separating marketing from sales, especially in a business such as steam where account-specific intelligence and relationships are so vital. The next section deals with a range of marketing issues. The succeeding section discusses sales and account management topics, including some internal organizational issues. The final section summarizes the key marketing and sales findings and recommendations in these areas.

Con Edison Steam Marketing Issues

Identifying and Analyzing High Value Marketing Opportunities

This marketing function, sometimes called market research, market intelligence, or environmental scanning, seeks to capture an early "big picture" perspective of factors shaping the business.

The value of this function is defined by how much notice it gives the company of potential new opportunities or hazards to the business. In a long lead time and long purchase cycle business like steam, the earlier the company is aware of an opportunity, the easier it is to introduce its ideas and influence the decision. This calls for long-term insight into:

- Customer needs, desires, and plans.
- Economically or demographically driven opportunities.
- Technology driven opportunities (or threats).
- Competitive profiling.
- Positioning.
- Regulatory or institutional barriers (or incentives).

Each of these areas is discussed briefly below with guidance on the direction of future development efforts.

Customer Needs, Desires, and Plans

It is imperative for Con Edison Steam to get closer to its customers, to better understand them and their needs, and to work with them to develop products and services that meet those needs. This involves fundamental marketing initiatives discussed in this section and account management initiatives covered in the discussion of sales later in this chapter. The marketing task is to understand broader, more general trends that may call for redirecting marketing functions, such as branding, positioning, promotion, etc. The sales function is to identify the customer-specific needs and act on them. There is clearly overlap between the marketing and sales functions in a business like district steam.

By and large, Con Edison Steam does not appear to be actively engaged in major projects early in their development cycle. In many cases, the project is fairly advanced before Con Edison Steam becomes involved. The current lead tracking system, while a thorough effort to gather information and intelligence, is largely a sales-level activity.

To gauge broader market sentiment, Con Edison has attempted some surveying and group-based activities. The customer survey conducted for this business development plan, while limited in scope and participation, provides some general insight into customer perceptions as shown in the Appendix.

At a general level, the survey seems to indicate that customers value the preservation of the steam energy option, recognize that it is not as competitive as other energy sources, realize that the business is not thriving, and are uncertain about Con Edison's level of commitment to the system. These points and others drawn from the survey and other material should establish the agenda for ongoing customer research and direction of the positioning, branding, and communication programs.

Given customers' natural reluctance to participate in unnecessary surveys and their likely suspicion that the survey is a disguised lead generation effort, Con Edison Steam should consider continuing joint surveying efforts with the leading groups in the real estate sector.

Over time, the customer survey should be broadened to include decision influencers and other participants in the New York City energy market, but the appropriate survey channels and processes are not as well defined and need more consideration.

Con Edison Steam's presence in steam industry forums seems small relative to its scale and the challenges it faces. At the industry level, some insight into general steam customer perceptions and trends can be gained by participating in steam industry forums and customer research efforts. Meeting with other people in the steam industry is an important activity that should be encouraged as a means of broadening the perspective of the Con Edison Steam staff and suggesting new approaches to the business. Presenting papers and serving on committees are effective professional development tactics. Legitimate fears of nonproductive industrial junkets can be assuaged if the professional development plan component of the staff resources plan identifies specific needs and matches them with industry programs.

Identifying Economically or Demographically Driven Opportunities

New York City has new developments continuously being planned and older areas constantly changing their character. The basic energy decision-making criteria also appear to be evolving toward embracing greater sensitivity to environmental qualities.

The prospects represented by new developments (two of which, Hudson Yards and Greenpoint/Williamsburg, are discussed elsewhere in this plan) have fairly long lead times and offer opportunities for direct participation and perhaps a chance to influence the design to favor steam. At least preliminarily, serving those areas does not appear to be cost-effective.

It is difficult for Con Edison Steam to participate in projects that are distant from existing lines and whose development takes place in a way that does not justify a line extension in the early days of the development's life. In some cases, these developments ultimately achieve a scale that would support steam investment, but, by the time that critical mass is reached, other energy sources are already in place. Being involved early offers the best chance to propose other district energy and steam-based solutions that offer Con Edison opportunity to grow beyond its existing lines. Earlier involvement may also lead to discussions with government or developers of alternative risk sharing and cooperative investment arrangements to bridge the timing gap in development.

Con Edison Steam should look for means to participate actively and early in New York City development projects and seek to offer steam solutions where appropriate.

Technology Driven Opportunities (or Threats)

A comprehensive business development plan must address the technological factors that are shaping the business's future. This was largely beyond the scope of this effort but should be addressed by Con Edison in its ongoing planning. This report discusses very briefly the existing and future prospects of customer cogeneration, natural gas packaged boilers, renewables, etc., that represent competitive threats to steam as it competes for a portion of the customers' energy budget.

Many people do not seem fully aware of the magnitude of these threats and may be basing decisions or policies on an outmoded view of the marketplace. It is Con Edison Steam's job to make this case. While individual executives and managers are very aware of the issues, the company does not appear to have communicated convincingly the potential threats posed by other technologies and energy suppliers.

One chart from the customer survey (Figure 81, page 159) suggests how vulnerable steam may be to customer cogeneration. Almost 45 percent indicated that they are considering cogeneration. Although these types of survey responses typically overstate intentions, if only a fraction of the customers follow through the results could be damaging to the steam system.

The technological options available to customers and competitors are rapidly changing. Con Edison's business development strategy cannot be limited solely to preserving its existing business model or frustrating the efforts of rivals. Con Edison Steam should also be actively tracking and considering new or emerging technologies that might provide a competitive edge to steam. Again, while individuals are knowledgeable, this knowledge is not often exploited by searching actively for potential prospects for the technologies. In many cases, such efforts may require partnering with vendors and others to develop joint value propositions, if such can be done by Con Edison as a regulated business. There will also be cases where the current regulatory and revenue model may have to be adjusted to provide suitable incentives.

Con Edison Steam's next business development plan should include a section on technological factors, and findings made should be actively communicated to existing and potential customers, influencers, regulators, and government.

Competitive Profiling

Con Edison Steam is in a potentially awkward position when it comes to making the case against its primary competitors and rivals. The key alternatives to steam – electricity and natural gas – are delivered by sister entities that also have marketing and sales functions. The vendors that market and sell steam chillers are the same people selling electric chillers. Nevertheless, Con Edison Steam has to not only give customers a reason to buy its product, it must also be prepared to raise valid issues about the competition. Some new buildings, such as the new Bank of America facility, are willing to invest heavily in green technology and expect to command premium rates. Developers of such buildings might be prepared to pay a premium to diminish the new electricity peak demand they create if the relevant information is properly conveyed to them.

Con Edison Steam has to some extent argued its case against NYPA's efforts to promote electric chilling in government accounts. Con Edison Steam should extend its efforts to understand the competition's marketing points and offer appropriate counter arguments or, where possible, preemptive arguments. But it is difficult to argue compellingly that one offers the cleanest alternative, if one doesn't know the opposition's emission rate. By combining customer-specific knowledge about decision criteria (e.g., customer X is very interested in clean energy) with competitive profiling (e.g., supplier Y has a relatively higher emission rate), proposals can be made more effective.

In its next internal business plan, Con Edison Steam should extend its understanding of the competitive landscape. In the interim, it should argue more aggressively the comparative benefits of steam as a DSM tool, the consequences of electric peak demand growth, heating season constraints on natural gas and the like.

Regulatory or Institutional Barriers (or Incentives)

The competitive position of Con Edison Steam is largely defined by several government and regulatory mandates and restrictions. Some of the current policies are discussed in Chapter 6. For the longer term, Con Edison Steam and the relevant public and market authorities need to rethink the appropriate place of steam in the City's overall energy portfolio, the role Con Edison Steam should play, and the regulatory framework appropriate to that role. Some very fundamental issues, such as the proper role of Con Edison Steam in promoting cogeneration and extending the steam option to new territories, arose during this development planning effort. Current policies were shaped by historical concerns about competition and may warrant reconsideration in light of the existing market condition.

Con Edison Steam is responsible for making the case for steam, and that case should not simply be the default of business as usual but an active program for advancing alternative government and regulatory policies where appropriate and in the public interest.

Targeting Attractive Markets

Measuring Profit Potential

Con Edison Steam has an obligation to serve customers on or near its lines who request steam service. The company also has a fiscal responsibility to allocate its scarce development resources in proportion to expected yield. This requires the capacity to gauge such things as the propensity to purchase steam and expected account value.

The customer account valuation and new market territory models developed in the course of this business development plan can serve as initial templates for the more refined account valuation tools that will be possible when more customer specific information becomes available.

Experience indicates that the process of determining how account value is created and measured stimulates ideas about how to better approach the market and draws attention to the information and data needed to plan and execute marketing and sales campaigns.

Anticipating Competitive Responses

Before launching major customer acquisition programs, the likely response of competitors and incumbent energy service providers has to be weighed carefully. Incumbents may be interested in partnering on a particular project where they bring complementary skills or resources. It is also possible that a chiller manufacturer might be willing to join forces in promoting a particular type of supplemental energy source or a hybrid chiller configuration.

It is sometimes useful to look at one's own company and ask, "How would someone attack this business and convert its customers?" This defensive perspective often surfaces competitive ideas faster than trying to develop marketing and sales plans in the abstract. On the offense, it is useful to view every rival's customers as potential prospects and converts. For example, every cooling account of steam-heating only–customers is a potential prospect, and every aging gas boiler owner is a potential heating prospect. Thinking about how the incumbent provider will react will help to design conversion campaigns.

The discussion of long-term development in Con Edison Steam's next business development plan should address competitive and potential partnering prospects to the extent permissible for a regulated concern.

Developing Marketing Strategies and Plans for Target Markets

Before launching marketing and sales efforts it is important to determine how Con Edison Steam will define itself, position itself versus rivals and create effective value propositions.

Branding

Branding is an effort to convey to customers the company's personality and values in a way that appeals to customers. The brand's association with specific values has to be legitimate, or customers will not find it credible. Because steam is not the least expensive option, its branding strategy must convey another set of values. The leading candidates appear to be related to electricity peak reduction, reliability, and clean energy. There appears to be some momentum in the green building area. One way to validate a branding strategy is to obtain certification from a respected authority in the area. LEED, developed by the United States Green Building Council (USGBC), has quickly become the standard by which buildings are being evaluated for their level of environmental compatibility. Commercial developers are requesting that architects design buildings to achieve LEED designation status and are featuring smart energy design in the marketing to tenants. Unfortunately, LEED does not currently give credit for centrally cogenerated steam.

Implementing a branding strategy for a commodity is very difficult. In the case of a commodity like Con Edison Steam, it probably doesn't make sense to try to brand "steam" but instead to create brands for particular product offerings, such as the hybrid chiller set which might, for example, be branded as the "Demand Reduction Chiller."

Branding is important but not an immediate need and should be addressed when appropriate marketing and sales resources are available to conduct the necessary analysis.

Positioning

Positioning is closely related to branding and refers to how the company defines or positions itself relative to its rivals. The company should take steps to better position its service offerings and business identity in the New York City real estate, energy, engineering, and development communities.

Some customers and influencers have been critical of Con Edison Steam, its relationships with customers, and its approach to the market. More disturbing, several customers and their advisors believe that Con Edison is not committed to its steam business. In some cases, these customers indicate that this lack of confidence is influencing their decisions about new energy applications and conversions. Several major customers believe that Con Edison Steam is, in effect, a "stepchild" to the much larger and more profitable electricity and gas divisions. In fairness, many customers are satisfied with their steam service and even expressed interest in learning more about new steam products and services, but the overall position in the eyes of customers seems to be neutral to negative.

Positioning or, perhaps more specifically, the process of identifying the appropriate positioning versus alternatives and competitors is extremely important. This is because all communication, promotional materials, product development, and other efforts should be aligned with the desired positioning. Con Edison Steam should develop and implement a positioning strategy as soon as practical. This may involve a number of steps:

- Understand customer decision criteria and steam's current "score" against those criteria, singly and in a grouping of competing energy sources.
- Identify those attributes or criteria that are most important and where steam can best distinguish its value proposition(s) from those of rivals.
- Test customer and energy advisor receptivity.
- Convey the desired position in all internal and external communications.

Promotional Efforts

Promotional activities are things such as advertising, trade show appearances, mailings, bill inserts, etc., that a company does to maintain or increase its visibility in the marketplace as contrasted to the more sales-oriented communications or proposals that are in support of transactions. Con Edison Steam's printed marketing material is crisp and professional, but its web site appears uninspired.

Con Edison Steam has recently improved its visibility in the New York City energy and building sector through greater presence at trade events and associations. These are important efforts because, as the steam system's relative position in the City energy portfolio erodes, it is losing what marketers call "mind share" (the amount of awareness of and attention paid to a firm or product) among the owners, architects, and engineers who influence and make energy choice decisions. As a result of the erosion of its visibility, some customers and their advisors may have incorrect or dated perceptions of steam. There are already a few engineering firms that appear to have ruled out considering steam in new facilities.

Promoting Con Edison Steam is almost synonymous with promoting steam itself. Therefore, promotional materials must have a strong theme that may resonate with energy decision makers. Building on the relatively clean energy profile of its new cogeneration facilities is one of the most promising ideas for promoting Con Edison Steam. The environmental benefits of central cogeneration and ERRP in particular do not appear to be broadly appreciated.

Some of the promotional activities that might be considered would fall under the heading of event marketing. For example, Con Edison Steam could invite customer energy managers and their consulting engineers to ERRP. Engineers and other technical people often enjoy plant tours and are often better persuaded by tangible demonstrations than white papers, although the latter have their value in some settings. Other promotional efforts may include linking with and building a network of related energy sites that direct people to useful tools and information on the Con Edison Steam website. In addition, Con Edison should leverage the investment it makes in solving customer problems and take a page out of the software and computer suppliers' playbook by posting technical hints and FAQs (frequently asked questions) on its site.

Another proven promotional tactic is to provide recognition to customers who reduce steam consumption significantly or are operating their building(s) most efficiently in the City. For example, Cleveland Thermal Energy implemented an Annual Customer Energy Efficiency Award program that included a plaque award presented at an event and press release to local media, including the BOMA Chapter and real estate publications. Large customers thus competed for the recognition associated with the most improved and most energy efficient buildings. This type of promotion may seem counter-intuitive, but it can reinforce a positioning strategy based on environmental compatibility. In Con Edison Steam's tight capacity situation, the loss of sales may free up needed capacity and avoid having to add another steam generating unit.

The subject of promotional activities should be addressed more fully in future marketing and sales plans. Although measuring the cost effectiveness of promotional activities is notoriously imprecise, Con Edison Steam should apply some metrics, such as people reached, responses to promotional offers, hits on particular web site pages, etc.

Product Strategy

Several potential steam products and services were discussed in Chapter 4. This section addresses the ongoing process of refreshing the product line and staying in line with customers' needs and desires.

Product innovations in businesses like steam often come from a co-development process involving customers, the company, and other parties. The product co-development process seems especially appropriate as building energy systems become more complex.

Con Edison Steam should identify means of involving customers in guiding the ongoing development of the steam business. Customer involvement in product co-development, service standards, etc., should be encouraged.

Some activities to stimulate product or service ideas may include:

- A Con Edison-sponsored Steam User Group forum for discussing common issues, sharing ideas and approaches, and identifying new product and service options.
- Informal lessons for end users can often give the customers' building operations staff an opportunity to share problems and solutions and can offer Con Edison Steam an insight into day-to-day issues.
- External resources, such as "Steam Best Practices" training offered by the United States Department of Energy (US DOE), may stimulate ideas for new services or products and generate referrals from customers while also strengthening customer retention efforts.
- Keeping abreast of industry technology developments and the of other district energy companies.
- Strengthening ties with research entities such as NYSERDA and encouraging them to support pilot or demonstration projects on promising steam-related technologies.
- Developing relationships with the research and development arms of the major steam equipment vendors.

Once a profitable steam-related product has been successfully launched and validated by any party, Con Edison should leverage its customer data and information to locate and inform prospects about the product and its benefits. In some instances Con Edison should consider sponsoring demonstrations and pilots, or entering risk-sharing agreements to overcome initial resistance to products.

Sales and Customer Relationship Management Issues

Account Relationship Management and Development

Many of the tools and techniques one would expect to find at a $550 million revenue company with a relatively moderate number of high value customer accounts, such as a customer account management system with customer-specific responsibility and accountability, are not in place. Even if the tools and processes were in place, it would be difficult to leverage them with the limited professional resources available.

Con Edison Steam's direct sales and marketing staff does have a process for identifying, tracking, and monitoring significant new projects and steam prospects. This is a spreadsheet-based system that tracks key development data, contact information, timing, and load/revenue projections. This effort, while useful, is largely reactive and should be supplanted by a more active account management process.

There are several major components to an account management system:

- An information system to capture relevant information, track marketing and sales variables, and record interactions.
- An account planning system that sets account goals, allocates resources in accordance with those goals, and monitors results.
- Accountability for results.
- Training and support for the account management staff.
- Frequent customer contact and two-way communication.

Con Edison Steam has proposed a plan to move forward with a more sophisticated database software platform that would improve account information management and reduce costs of updating and maintaining customer information.

Con Edison Professional Support

The objective of the staff and professional support functions should be to increase the effectiveness of front-line account managers and sales executives by:

- Providing the account and sales teams with data, information, and good ideas to discuss with customers.
- Relieving account and sales teams of unnecessary administrative chores.
- Providing scarce technical skills that can be called upon as needed.

Some of these functions, such as engineering, information technology, and planning, appear to be provided from the parent company or other divisions. The resource plan should address the need for in-house technical resources.

Customer Service Interface

A common source of marketing and sales force inefficiency is the pressure to perform what are really customer service functions. Although helping the customer with a particular issue can strengthen relationships and in some cases produce new leads, delegating that help to a specialist is often just as beneficial. In this vein, some district energy companies are strengthening the interface between marketing and sales functions in part by upgrading the customer service function, raising its level in the organization, making it responsible for reducing service issues, and solving them quickly when they arise.

One particularly successful effort in this direction is the creation of a Vice President for Customer Service at District Energy St. Paul, a utility that consistently records 97 percent customer approval ratings. District Energy St. Paul is, of course, significantly smaller than Con Edison Steam,[70] so attention to scale is critical.

The St. Paul position draws on a building operations engineer background, providing troubleshooting for "customer side of the meter" issues on system design and optimization, seasonal start-up, commissioning, and budgeting strategies. An individual with that background could provide the company a new and different perspective into how customers handle energy decisions and budgets, operate buildings, manage staffing, and maintain tenant satisfaction.

Marketing & Sales General Findings & Recommendations

Con Edison Steam should take a more active and, where appropriate, broader role in meeting its customers' energy needs.

- The size, concentration, and nature of Con Edison Steam's customer base suggest that accounts be positively managed with annual and longer-term goals with specified and monitored objectives.
- Many new facilities feature increasingly complex energy production and management systems to meet economic and environmental objectives. To compete for these new, more sophisticated projects, Con Edison Steam needs to be involved early, be seen as a source of ideas as well as steam, and be prepared to offer steam solutions that complement the other elements of the facility's systems.
- Con Edison Steam's Business Development Group has a small core of very capable professionals that needs to be augmented by additional internal and external resources that can upgrade the quality of advice and support offered to steam prospects and customers.
- Many of the most important business development needs are in the marketing and sales functions. Given the long sales cycle, the "one-time" sale character of the

[70] District Energy St. Paul has 115 employees, $50 million annual sales and 165 customer building accounts

product, and other factors, it is recommended that attention should initially be focused on:

- Front-end marketing functions, such as awareness building and positioning, are essential to ensuring that customers consider and evaluate steam based on valid and current facts.
- Branding efforts, perhaps with a clean energy image or LEED strategy, may be called for to counter the poor impression of steam in the minds of some customers.
- Trade ally and channel development efforts are especially important. given the important role of advisors and other indirect customers, i.e., people who participate in or influence the decision but are not a direct party to the transaction.

Con Edison Steam should establish an explicit plan to reach out to and interact with important energy decision influencers, MEP engineering firms, OEM vendors, and energy developers, to improve and maintain the influencers' appreciation and understanding of steam's value.

- Steam's visibility among decision makers and influencers is apparently eroding. This means that fewer people are making the investment in time and attention to stay abreast of steam technology and be able to evaluate it accurately for their clients.
- Con Edison Steam is the logical champion for steam and should play an active role in providing information on steam heating and cooling technology, as well as publicizing the availability and conditions of publicly and privately funded steam incentives or other support programs.

Con Edison Steam should continue and, if possible, accelerate its efforts to develop a comprehensive customer account information system, focusing initially on the combined heating and cooling customers and large heating customers. This system should include:

- Detailed equipment information, such as type, capacity, condition, and age.
- Key operating and investment decision makers and influencers.
- Records of contacts and encounters with decision maker(s).

8.

Implementation Planning

This chapter sets out the Con Edison action items and establishes recommended schedules or target completion dates. In general, the highest priorities and earliest due dates are assigned to the foundation actions that serve as the basis upon which to build the other programs. This does not suggest that other initiatives be curtailed pending implementation of the foundation_actions, but they should be pursued in awareness of the broader program development effort. All actions and programs should be subject to an analysis of their associated costs and benefits.

As discussed in prior chapters, there is a need for a co-development process for many of the recommended actions and programs. This approach involves interested parties in the process and is intended to widen the participation of contributors, to pre-sell or socialize the ideas, and to help overcome Steam's relatively low visibility in the design, development, and engineering community.

Action Items

The action items or tasks are grouped into four areas.

- Information Systems: This area addresses the need to initiate or accelerate efforts to develop or acquire customer- and market-related data and data management tools necessary to guide and support an effective development program.
- Resource and Organizational Development: This area covers the type of internal and external resources necessary to create and pursue the development program, specifically those resources most closely involved with customers and their advisors.
- Product and Pricing Related Development and Analysis: This area identifies products that appear to have market potential, that are consistent with the capability and constraints of the steam system, and that may be profitable to offer. In some cases, additional analysis is needed to develop or refine the proposed product/service initiatives.
- Regulatory and Institutional Initiatives: Items in this area include changes in incentives, regulatory constraints, and similar actions requiring approval by governmental or other agencies and entities.

Information Systems

Account Management System

Con Edison Steam should continue and, if possible, accelerate its efforts to develop and implement a comprehensive customer account information system, focusing initially on the combined heating and cooling customers and the large heating customers. This system should include developing detailed equipment inventories, identifying key operating personnel and investment decision makers, aligning influencers (such as engineers, architects, contractors, and building operators) with decision makers, as well as recording contacts and actions.

The benefits of this account management system include getting a much better picture of the needs and perceptions of the top 450 or so customers that account for the preponderance of the system's revenues and margins. These customers are the most vulnerable to conversion and represent the most attractive development opportunities.

Customer data archiving and steam use reporting should also be considered to assist larger users with steam management and budgeting. Con Edison Steam should use this information system to refine its customer and prospect data and information needs, building on the results of the large customer survey.

Con Edison Steam should perform the following tasks in developing, whether internally or through outside vendors, an Account Management System:

- Identify information sources internal to Con Edison and sources external to Con Edison with relevant customer data, building, and development planning information and other salient facts and statistics.
- Build on the work preparing the customer database used in this project and remain mindful of the models and tools that will use the data.
- Outline the information flows within and across organizations (i.e., both internal and external to Con Edison) on major planning topics such as the new building plans and large-scale projects. External organizations should include, at a minimum, NYCEDC, New York City Department of City Planning, Building Owners & Managers Association (BOMA), Real Estate Board of New York (REBNY), New York Energy Consumers Council (NYECC), Consumer Power Advocates (CPA), Trane, Carrier, York, large-scale developers, and MEP engineering firms.
- Develop specifications for the desired account information system to guide discussions with vendors and other parties. The specifications should include, at a minimum, building owners' and managers' contact data, building demographics (age, floor space, use, etc.), equipment inventory (type, size, age, condition, etc.), major advisors, account history, etc.
- Develop similar specifications for prospects. The prospect management process may be managed within the same system or a separate activity within a sales management system.
- Hold informational discussions at least once when developing or contracting for the development of the Account Management System with no fewer than two vendors of packaged Customer Relationship Management and Sales Force Management systems.
- Explore the systems used by at least three peer companies, perhaps through the offices of IDEA and other trade associations, as well as those used by similarly situated companies.

- Conduct a cost-benefit analysis to determine whether to develop the system internally or go outside for a packaged system.
- Initiate and complete the development or acquisition of the system within 9 months and implement said system no later then 12 months after filing the Business Development Plan with the PSC.

Time Due: 12 months after filing the Business Development Plan with the PSC, except as otherwise noted above.

Priority: High.

Pipeline Asset Management System

Con Edison Steam should continue its efforts to conduct line-by-line profitability or value analysis. The company provides two steam products—the steam commodity and the delivery of that commodity.

The value of Con Edison Steam's delivery assets and hence the price and quality of its steam delivery product depends on the utilization of the system (customers and load per line) and the efficiency and reliability of the delivery system.

Whenever customers use a common facility or resource, there may be a divergence between calculated account values and the yield on the common resource – in this case, a pipeline. Customer relationships may be profitable if viewed solely in terms of average margin per pound of steam, yet the cost of delivering that commodity may erode or totally erase that margin. This may be analogous to a very valuable high mileage frequent flier flying on a very low load factor airline route. Con Edison Steam should do the following:

- Determine those pipelines that have very low load factors and low yield.
- Explore ways of attracting customers to low yield lines.
- Based on the insights from this analysis and other factors, develop an asset or yield management plan for in-ground product delivery assets, consistent with company obligations under the Public Service Law and the Transportation Corporation Law.
- Refine the definition of pipeline profitability or value.
- Identify the out-of-pocket costs associated with particular lines or line groups.

The foremost benefit of an asset management perspective and asset risk and profitability measurement system is to stimulate a change in orientation of the planning and business development function from an average cost, uniform view of assets to a de-averaged perspective. Other benefits include the identification of high leverage opportunities to improve service quality by, for example, focusing upgrades or leakage repairs on high yielding lines. The costs of implementing a delivery asset management plan are relatively minor. Most of the initial costs involve collecting and mapping customer and operating data on a line-specific basis.

Time due: 18-24 months after filing the Business Development Plan with the PSC.

Priority: Medium/Low.

Mapping & Locational Market Analysis

Many utilities have found that mapping enables them to visualize better their customers' and prospects' topography, link effectively to other mapping-enabled databases (such as building demographics), promote better communication with contractors and engineers, and stimulate innovative ways of looking at the system opportunities.

Con Edison Steam should continue to leverage the advances in digital and GIS mapping to gain a crisper, more dynamic picture of its customer and prospect characteristics and distribution. Improved mapping will give the company a better understanding of its customers and prospects, make it easier to link to and integrate with the increasing numbers of marketing- and sales-related geographical databases, and help to align better marketing, operating, and investment decisions.

Con Edison Steam should, at a minimum, review:

- What other large steam and gas companies are doing with mapping technology but not restrict the review to steam companies.
- Mapping activities performed by at least two large steam and gas companies and at least two gas and water companies, given the likelihood that gas/water companies are likely more advanced with implementing and using mapping technology.
- The use of outside expertise to develop a system to meld customer and line data with the locational databases available.
- The feasibility of integrating the Steam Operations Mapping Information System (SOMIS) system data into an interactive customer and distribution mapping platform.
- The appropriate parameters of the system.

The industry and peer practices part of this review should be built around a major upcoming IDEA distribution technology conference planned for later in 2005, at which many practitioners will be available for discussion.

Using the results from this review, the company should define how the information provided by the mapping system will be used in its steam business development efforts. It should then solicit bids from its Information Services department and from external vendors of mapping packages for a comprehensive mapping program.

Time due: Complete the review by end of 2Q 2006 and implement (if the review so indicates) by end of 4Q 2006.

Priority: Medium.

Resource & Organizational Development

Develop a Resource Plan for the Steam Business Development Group

Con Edison Steam should develop a resource plan covering internal people, skills, and systems as well as external resources (such as specialized consultants, and databases) needed to meet the expected steam business development activities outlined in this report, with a focus toward marketing and sales.

The plan should at a minimum:

- Identify the required direct customer-contact staff, marketing professionals, and technical expertise while also evaluating candidates with complementary skill sets, such as real estate operations experience or chief building engineer background.
- Identify the skills, knowledge, and abilities required of each of the resources identified above, and describe how those needs will be met. This should include the objective-setting, measurement, and compensation systems to be employed.
- Consider the use of outside compensation experts to provide realistic estimates of required salaries, bonuses, and compensation structures in the type of professional, consultative relationship management positions necessary.
- Identify the required internal and external resources for indirect marketing activities, such as promotion, surveying, product development, customer account system maintenance, etc. The desired balance between salaried staff and consultants should also be determined, taking into account the expected duration of the requirement, the feasibility of attracting and keeping resources in high demand disciplines as employees, and the likely utilization rates of specialized resources, etc.
- Special attention should be paid to the need for a first-rate communication strategy and resources to implement it. In particular, exploiting the potential of web-based communication, promotion, stakeholder services, and positioning should be explored.

Time due: 6 months after filing the Business Development Plan with the PSC.

Priority: High.

Strengthen Relationships with Advisors and Vendors

Although the building owner may make the final decision on energy systems, it is evident that the facility operators, managers, MEP engineering firms, and vendors play a very large role in the identification of options and the development of the information upon which choices are made.

Con Edison Steam should, in conjunction with the customer account management system described above, develop a coordinated program to build relationships with key energy advisors and vendors. The data, information, and software aspects of the advisor and vendor relationship process are a subset or module of the overall account management system described above. Some representative activities include:

- Identifying and targeting forums in which key advisors and vendors participate and seeking opportunities to present the steam business perspective.
- Developing a presence at the forums in which public and private development initiatives and decisions affecting the Con Edison Steam market are reviewed.
- Assigning explicit liaison responsibilities to major trade and advocacy groups, such as BOMA, REBNY, NYECC, and CPA.
- Exploring Internet-based channels of information dissemination and going beyond the provisions of tariffs and contact data to include technical and commercial steam-related information and pursuing an active program of linkages to the sites of important players and steam-related data sources, and industry resources. The goal should be to become known as the key source for steam-related information.

The benefits of this program include closer relationships with vendors and advisors, earlier notice of potential heating and cooling decisions, and additional opportunities to receive or disseminate steam-related information. Many of the customer account management systems discussed above can handle the information storage and management aspect of this system.

Time due: 12 months after filing the Business Development Plan with the PSC.

Priority: High.

Develop Targeted Marketing Plan

The Steam Business Development Group should develop targeted marketing plans with a focus on retaining and expanding sales. The idea of targeted marketing is to first identify and then target smaller, yet more profitable, customer groups within a total market. The plan should:

- Identify market segments. For examples, the steam unit could break down the market by at least three segments, including industry, building type, and revenue.
- Conduct research within industry and building types to identify the factors most likely to influence energy, among existing customer base, choice for a facility.
- Once the factors are identified, develop specific marketing campaign materials per industry, with specific "facts" that demonstrate the value of steam to the customer.

- Target promotions to the decision makers. Once promotions have been implemented, determine effectiveness of the strategy employed and redesign ineffective promotions.

Time due: 6 months after filing the Business Development Plan with the PSC.

Priority: High.

Product- and Pricing-Related Development

Create Mechanisms for Ongoing Customer Involvement

Identify means of involving customers in guiding the ongoing development of the steam business. Customer involvement in product co-development, service standards, etc., should be encouraged.

Some activities may include a Con Edison Steam-sponsored Steam User Group forum, "lunch box lessons" for end-users, or leveraged DOE Steam Best Practices training to stimulate deeper engagement with leading steam customers and produce positive references and referrals from customers while also strengthening customer retention efforts.

Time due: 12-18 months after filing the Steam Business Development Plan with the PSC.

Priority: Medium/Low.

Conduct a Marginal Cost-of-Service (COS) Study

Con Edison should prepare and submit a new marginal COS study incorporating:

- Incremental costs of new steam capacity to meet peak demand.
- Marginal production costs at different load levels, times of day, day of week, month, and season.
- Incremental line extension costs.
- Incremental costs for connecting and serving additional customers on existing lines.
- Incremental costs to connect new customers off of the existing lines.

Time due: Rate case following that being prepared for autumn 2005.

Priority: Medium.

Propose Steam Demand Charge and Other Initiatives

Given the emerging peak capacity constraint, the "spiked" nature of the total load duration curve, substantial weather sensitivity/volatility, and the diurnal load shapes of many customers, Con Edison should propose the design and implementation of a peak-centered steam demand charge. The charge should be based on consideration of the following and other appropriate elements:

- Determine steam peak and off-peak period costs for capacity and energy (in manner consistent with the peak constraints) and develop a rate structure that reflects the differential.
- Develop a reasonable transition plan to provide customers time to adjust and make necessary investment or changes in operating practices.

Con Edison should propose the creation of a steam peak load reduction or demand response offering to its customers.

Time due: Rate case being prepared for autumn 2005.

Priority: High.

Work to Improve Efficient Steam Usage by Customers

Con Edison Steam should evaluate pricing and other initiatives to stimulate efficient steam usage by customers. Elements of this evaluation should include the following, other concepts developed by the Business Development Group, and discussions with customers, developers, MEP engineering firms, and others.

- Identifying opportunities where steam and HVAC equipment and service providers could be leveraged by Con Edison Steam to provide training, energy audits, and other support to assist Con Edison Steam customers to make better use of their steam equipment and to identify opportunities early in the decision process. These interactions will often generate leads and will enhance the relationship.
- Identify priorities among readily available industry information and technical support options, including government programs such as DOE Steam Best Practices. These "off-the-shelf" programs may be easier to implement in the short term rather than creating an entirely new program at Con Edison.
- Explore the available enabling technologies, including but not limited to wireless interruption or peak load management action signals, thermal storage, pre-heating techniques etc., and educate customers on their potential.
- Explore opportunities to offer operations or efficiency management services to customers, particularly NYPA customers, and facilitate the ability of customers to obtain favorable financing for new chillers, equipment upgrades, and other capital expenditures.

- Develop and initiate a steam customer efficiency outreach program, focusing on the largest customers most vulnerable to switching. It should work with NYSERDA to sponsor or fund some high-visibility demonstration projects of widely applicable steam peak management technologies. Use of case studies, testimonials, and awards could bring mutual benefit.

Time due: 12-18 months after filing the Business Development Plan with the PSC.

Priority: High.

Position Steam as a Clean Energy Source

Con Edison Steam should continue to explore the possibility of being certified as a clean energy source eligible for LEED points to remain an attractive option in the emerging green building market. Increased cogeneration also has the potential to enhance the perception of steam as a green energy source and to reduce the net cost of steam.

Con Edison Steam should explore such actions as:

- Leveraging local resources with broader industry initiatives to capture current progress on national level with the USGBC.
- Developing a case study or white paper on emissions reductions potential resulting from combined heat and power operation at ERRP. Build on the work done in the Article X submission and circulate it widely in the building and engineering community.
- Joining the EPA CHP Partnership Program and submiting ERRP for CHP Partnership Certification and for EPA CHP Energy Star Award once 12 months of operating results are compiled.

Time due: 12-18 months after filing the Steam Business Development Plan with the PSC.

Priority: Medium/Low.

Develop Hybrid Steam Chiller Product Option

Con Edison Steam should work with vendors, MEP engineers, architects, developers, and others to expand interest in and use of hybrid steam/electric chillers.

To support this option, NYSERDA, NYPA, and NYCEDC should be more engaged in the development of the concept as an alternative to 100 percent electric chiller installations in new buildings and in the replacement market. Consideration should be given to crediting Con Edison Steam customers, perhaps through Con Edison's DSM program, a portion of the value of avoided electricity generation attributable to the steam component of the hybrid system. This credit could provide incentives necessary to make the investment in marketing and supporting these electricity peak reduction facilities attractive to Con Edison steam customers.

Other recommendations associated with the development of the hybrid chillers include:

- Continuing the product opportunity analysis, moving from secondary research to co-development, actively involving customers, advisors, vendors, the MEP engineering community, the City, and NYSERDA.
  - Create a working or advisory group comprised of people from the groups above.
  - Refine the market potential estimates, identifying some high-potential customers or prospects.
  - Build on the current internal effort to simulate hybrid chiller configurations, value, and costs.
  - Assemble a working team of potential customers/prospects, MEP engineers, and, possibly, an interested vendor to provide technical insight and operating cost information.
  - Identify and install real time metering and data archiving tools on a "case study" hybrid chiller facility currently in operation in Manhattan to monitor and report on operating results of hybrid plant operation.
- Naming a governmental/regulatory project leader to coordinate with governmental and other agencies.
  - Explore support for early demonstration projects and/or broader support for the hybrid choice as a new or replacement chiller product with NYSERDA.
  - Explore demand management and reduction programs that are compatible with the operating capabilities of hybrid chiller systems with NYISO.
- Exploring with vendors the possibility of a hybrid steam and electric chiller package that anticipates questions and concerns, thereby moving the option closer to being a routinely evaluated alternative, especially in the electric chiller replacement market with heat-only customers.

Time due: Progress report 12 months after filing of the Business Development Plan with the PSC.

Priority: Medium.

Develop a Condensate Re-Use Product

Con Edison Steam should evaluate the development of a condensate re-use product, based on the Goldman Copeland analyses of the potential applications. This program should, if practical, be integrated or coordinated with the LEED or other green building credit program for new and renovated buildings. The tasks involved should include but are not limited to:

- Refining market estimates based on the engineering studies.
- Identifying potential applications of condensate recovery and re-use.
- Establishing a data logging process to measure and quantifying water, chemical, and heat savings.
- Identifying potential candidates for condensate re-use systems and testing their interest in pilot or demonstration programs.
- Seeking partnership opportunities with NYSERDA and the City of New York to support installation of pilot or demonstration systems.
- Exploring with the NYCDEP a discount or credit for water and sewage rates of condensate re-users, recognizing the higher quality (i.e., lower temperature) of the final discharge in some applications.
- Developing a set of product specifications for representative applications so potential customers and their advisors can make preliminary assessments of interest.
- Seeking support from the USGBC and other green certification groups for credit for condensate re-use.

Time due: 24 months after filing the Business Development Plan with the PSC.

Priority: Medium/Low.

Develop an Enhanced Steam Price Risk Management Product

Customers have expressed strong interest in a product that would offer them protection from the volatility of fuel prices (fuel oil and natural gas used to produce steam). Con Edison has a fixed price option and has been reviewing it with its customers. To determine how to enhance this product, Con Edison should:

- Solicit customer and customer advocacy group input into why the previous programs have been unsuccessful.
- Assess industry experience for successful programs at other utilities.

Time due: Provide an update on the fixed rate option in its upcoming rate case filing, and report on April 1, 2006 concerning the status of its efforts.

Priority: Medium/High.

Ameliorating Capacity Constraints

To achieve certain business development goals discussed in the Plan, e.g., increased steam sales, Con Edison should explore obtaining cost-effective and economic (including accounting for stranded investment risk) production capacity from Con Edison-owned or merchant central cogeneration facilities and/or demand side actions, such as peak load reduction and increased efficiency, consistent with the findings in the Production Cost Study and any subsequent PSC action related to that Study.

Options such as long-term contracts, steam capacity auctions, joint venture arrangements in utility or developer cogeneration projects, and demand side measures, should also be explored by Con Edison, subject to the findings of the Production Study and any subsequent PSC action related to that Study.

Time due: Progress Report to be filed 6 months after filing the Production Cost Study with the PSC.

Priority: Medium.

Explore Alternative Business Model Options

Con Edison Steam should examine economic and engineering analyses of the potential for technologies that could be deployed either on or beyond the existing steam network to meet load demands competitively. Such technologies may include but not be limited to centralized chilling or cold water, CHP, or campus style district energy.

Time due: 24 months after filing the Business Development Plan with the PSC.

Priority: Low.

Regulatory and Institutional Initiatives

Strengthen the Current Steam-to-Steam and Electric-to-Steam Chiller Incentives

The DSM program approved by the Commission in Case 04-E-0572 may present an opportunity to offer incentives for steam or hybrid chillers. Con Edison Steam should create a DSM proposal incorporating the following objectives:

- Stimulating new cooling customers.
- Considering the potential to increase steam-chilling penetration without increasing winter peak demand by providing significant incentives for existing heating-only customers to adopt steam chillers.
- Increasing the steam-to-steam program incentive levels and the overall budget to recognize the increased number of projects expected.

Time due: Begin work immediately.

Priority: High.

Work to Develop New Steam-to-Steam Incentives and Electric-to-Steam Chiller Incentives

Con Edison Steam should work with government entities to level the playing field for incentives and alert steam customers when such incentives are available. This could be through the following means:

- Work with NYCEDC on developing a steam chiller incentive comparable to the Con Edison Electric BIR and the ECSP programs.
- Develop a way to inform major customers about steam-related incentive programs.

Time due: Ongoing process, beginning immediately.

Priority: Medium/Low.

Develop a Framework for Long-Term Contractual Relationships

Con Edison Steam has indicated that it is willing to consider different forms of SC5 contracts, such as those with longer terms. In furtherance of this effort, Con Edison Steam should:

- Prepare a list of potential actions it might undertake or cause to be undertaken to increase the attractiveness of steam. Examples of such actions include supporting customers' investments in hybrid chiller sets, turbine maintenance, and consumption management services. For each item listed, the company should identify whether the action would require intermediate or long-term agreements with the customer to make it feasible
- Identify ways in which it could partner with OEM vendors to develop CHP or district cooling facilities designed for service to specific anchor customers or service districts, and assess whether and to what extent the use of long-term customer service contracts would be appropriate to foster customer investments in such facilities

Time due: File a progress report 18 months after filing the Business Development Plan with the PSC.

Priority: Medium.

Appendix

A survey of large New York City energy customers was conducted in 2005 as part of this project. The survey was intended to:

- Offer customers an opportunity to express their opinions.
- Gain a better appreciation of customer perceptions, values, and needs.
- Develop a baseline from which future progress could be measured.

The Internet-based customer survey enabled customers to complete the survey at their convenience, ensured confidentiality, and provided a set of tabulation tools. It also guarded against gaming and multiple submissions from a particular computer.

Steam Business Development Working Group members encouraged participation by many energy customers. The web address was also sent to the Crain's energy list of addresses for New York City. The survey was not limited to steam customers so responses could be compared across segments of the population.

More than 170 visits to the site yielded 30 completed surveys. This level of participation probably reflects the length of the survey, the complexity of some of the questions, and the mechanics of the survey tools. Nevertheless, the respondents represented a substantial number of buildings, and the results are likely indicative of the positions of the large building owners, managers, and their advisors.

Summary Findings

As shown in Figure 82 (page 160), the survey confirmed many hypotheses about the importance of the Con Edison Steam system to customers and their concerns about the level and volatility of costs. The responses to questions intended to test vulnerability to defection underscored the urgency of the system's problems. A bare majority of steam customers remained satisfied with the service level and quality, while nearly half were considering cogeneration at their facilities. Some specific responses follow:

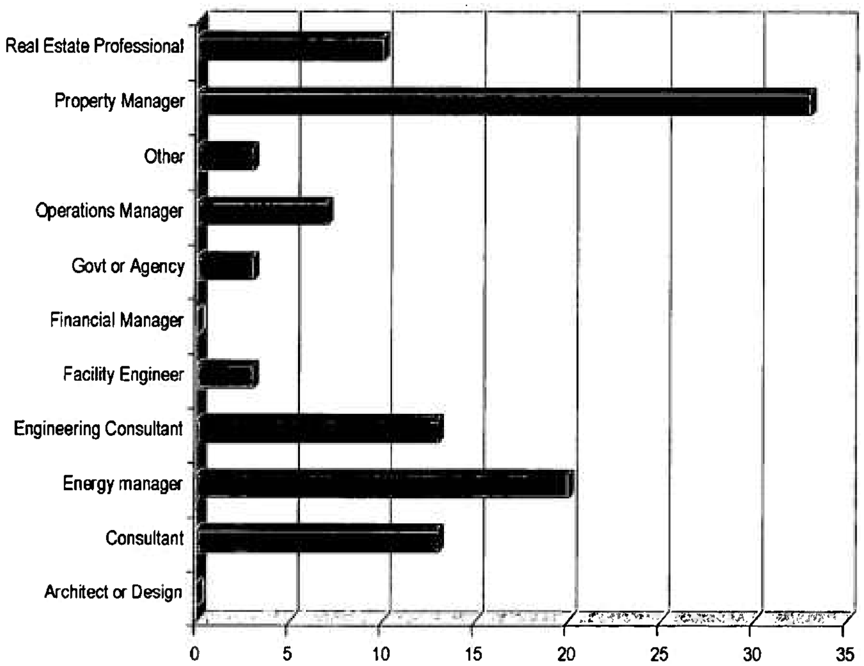
- 96 percent agreed (50 percent strongly agreed) that the steam system is an important option.
- 97 percent agreed (61 percent strongly agreed) that maintenance of a viable New York City steam system is important.
- 74 percent agreed (33 percent strongly agreed) that steam is not competitive with natural gas or electricity for comparable applications.
- 70 percent agreed (33 percent strongly agreed) that they had concerns about Con Edison's long-term commitment to the steam system.
- 51 percent agreed (7 percent strongly agreed) that they were satisfied with the level and quality of steam service.
- 48 percent agreed (15 percent strongly agreed) they would recommend the system to a colleague.
- 45 percent indicated that they were considering on-site cogeneration.

Unmet Needs and Interests

Consistent with their expressed concerns about price levels and volatility, customers expressed interest in price and cost management products. There was also support for service level contracts and guarantees. The application of steam for electric peak shaving also drew substantial interest. Responses below indicate the overall interest with the percentages indicating the values for interested, very interested, and extremely interested, respectively, in parentheses:

- 100 percent (42, 35, 23) were interested in a fuel cost hedging product to manage steam rate volatility.
- 97 percent (31, 31, 35) expressed interest in guaranteed service quality option.
- 92 percent (42, 23, 27) were interested in low-cost steam replacement financing.
- 88 percent (27, 42, 19) indicated interest in using steam for electric peak shaving.

Figure 61. Respondents by Role



As shown in Figure 61, respondents were drawn largely from the property, operations, and energy manager roles with a fair number of energy consultants and other consultants. This suggests that the views expressed are indicative of the operating community. There were, however, no architects or designers in the sample.

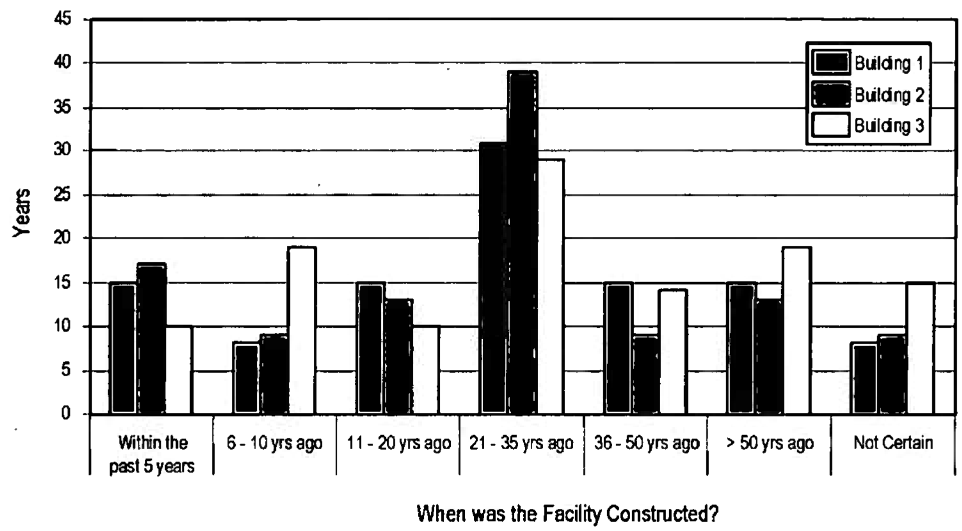
Figure 62. HVAC Responsibility

	Yes	No
Are you responsible for or involved in making decisions about selection and operation of HVAC systems?	87%	13%

	1	2-5	6-10	11-20	>20	n/a
How many buildings are you responsible for?	11%	19%	11%	11%	37%	11%

A very high proportion, 87 percent, of the respondents indicated that they were responsible for or involved in the selection and operation of heating and air conditioning systems. Figure 62 shows the numbers of buildings for which respondents were responsible. Weighting the responses by the mid-points of the values suggests an average of 12-13 buildings per respondent, or somewhere around 330 buildings in the sample. Each respondent was asked to provide information on up to three of the buildings for which he or she was responsible.

Figure 63. Building Age Distribution



As shown in Figure 63, the distribution of building ages appears to be fairly normal with a significant number of middle-aged buildings, those which might be candidates for new or renovated heating and cooling systems. The building age data were considered when estimating building turnover rates.

Figure 64. Principal Use of Facilities

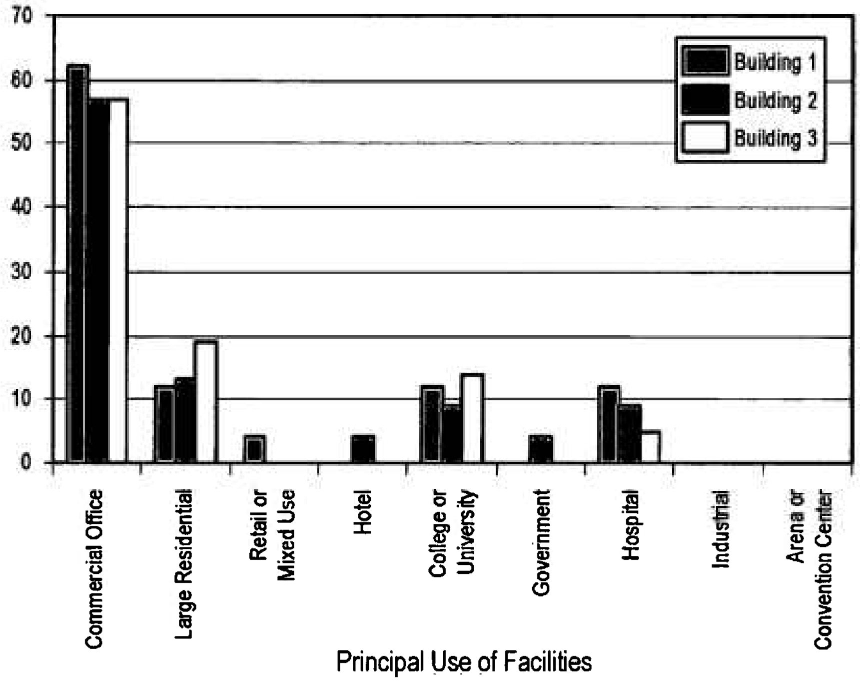
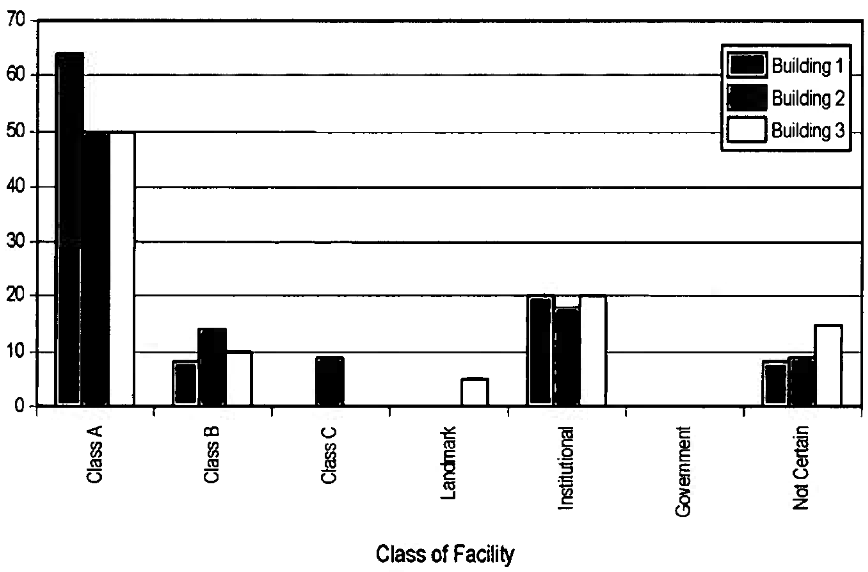


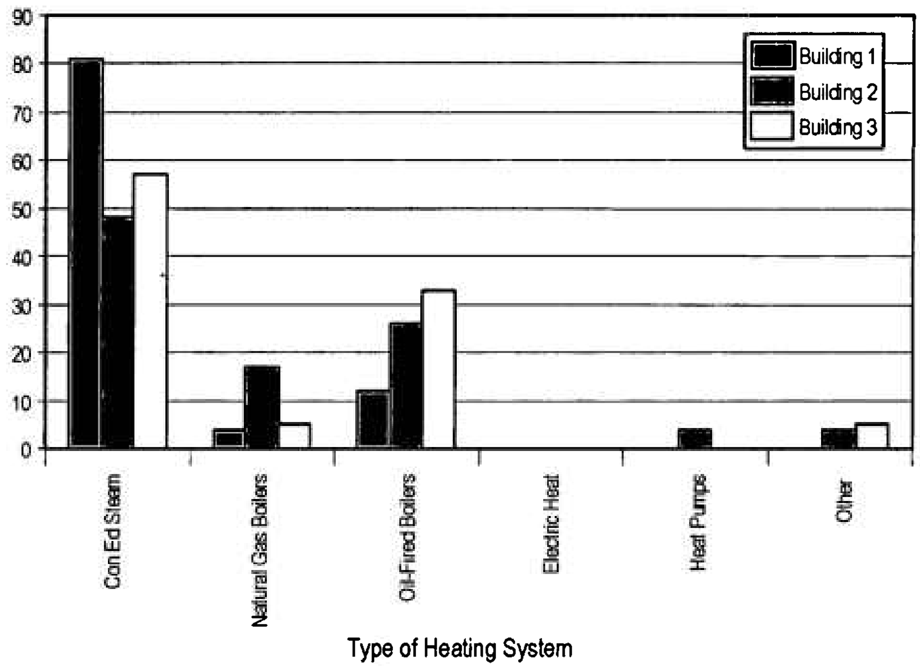
Figure 64 shows that commercial/office use accounted for well over half the buildings with significant numbers of large residential, college/university, and hospital facilities.

Figure 65. Class of Facilities



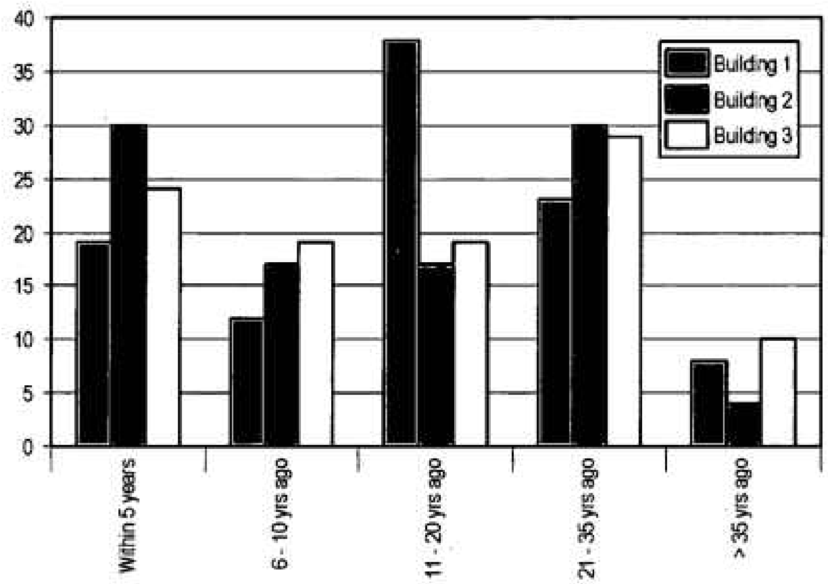
Customers were asked to indicate the class of their facility using the standard real estate terms of "A," "B," "C," and Landmark (e.g., The Empire State Building). Because these terms are used primarily for commercial office buildings, respondents could also indicate that they were institutional or governmental facilities. As shown in Figure 65, most of the buildings were characterized as Class A facilities – typically newer buildings in attractive locations with high-quality amenities.

Figure 66. Distribution of Heating Energy Sources and Types



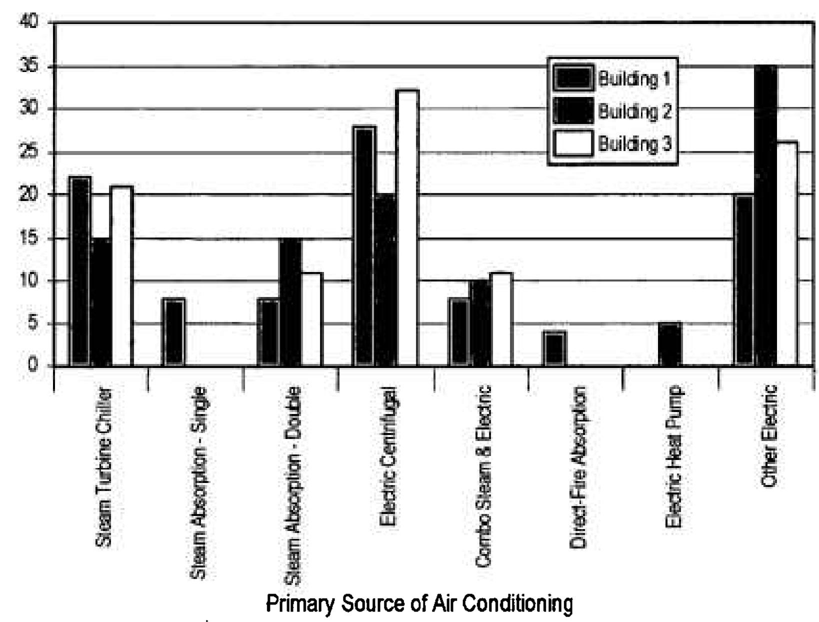
Steam heat accounted for most of the heating systems. The number of oil-fired boilers (around 20 percent) was unexpected by some members of the working team. Electricity is not a major heating source in the sample. Figure 66 shows the heating energy breakdown across buildings.

Figure 67. Heating System - Date of Installation or Replacement/Update



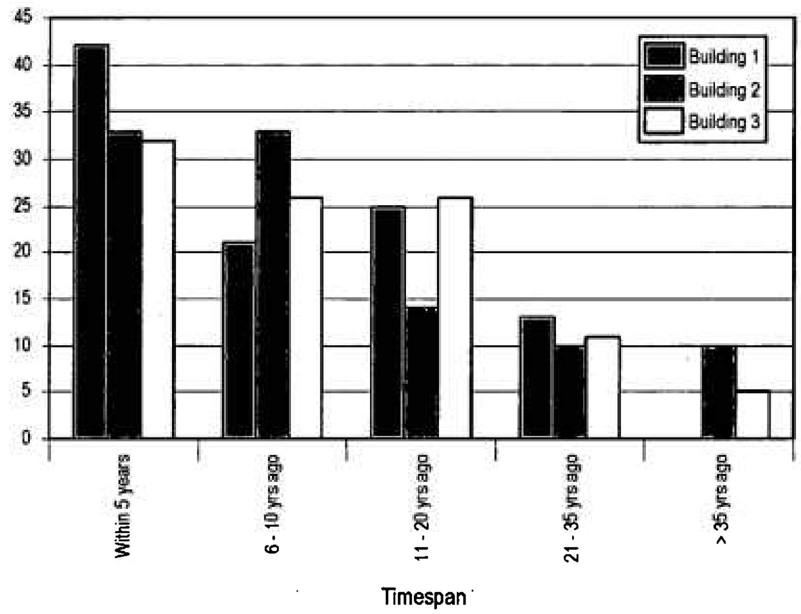
Some idea of the potential heating replacement market can be gained by examining the age of buildings and the age of their heating systems. As shown in Figure 67, more than 20 percent of heating systems have been updated or replaced in the past 5 years. This information was a factor considered in estimating the equipment replacement cycle.

Figure 68. Primary Source of Air Conditioning



As shown in Figure 68, the combined total of all steam chiller types (centrifugal, single- and double-stage absorption) is roughly equal to that of electric centrifugal alone. At a little less than 10 percent, the combination steam and electric chilling systems indicate some opportunity for electric peak shaving products. Other electric, primarily window units, is the largest single category.

Figure 69. Cooling System - Date of Installation or Replacement/Update



The age of the installed cooling system base, an important determinant of the cooling replacement market, is shown in Figure 69. More than 60 percent of the cooling systems have been replaced or updated in the last 10 years – about 6 percent a year.

Figure 70. Availability of Cogeneration, Emergency Power, or Standby Power On-Site

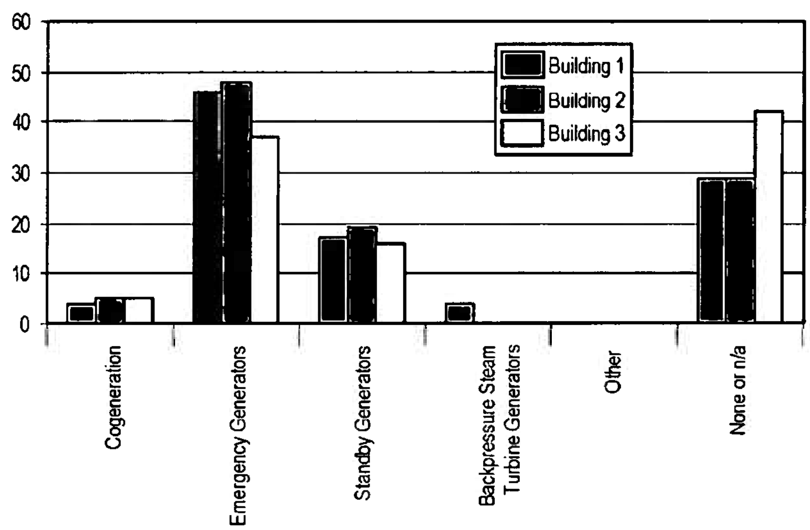
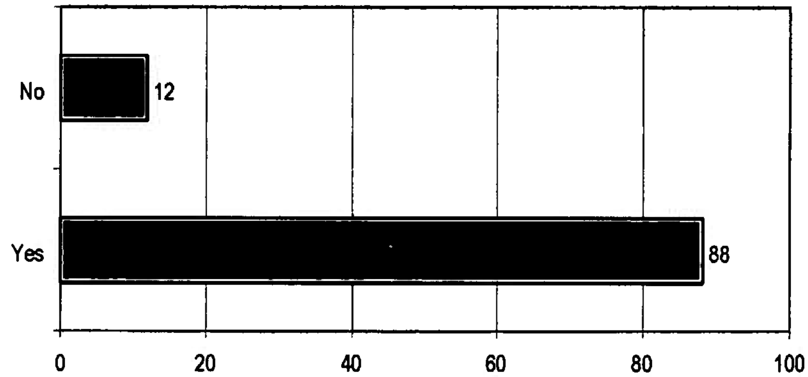


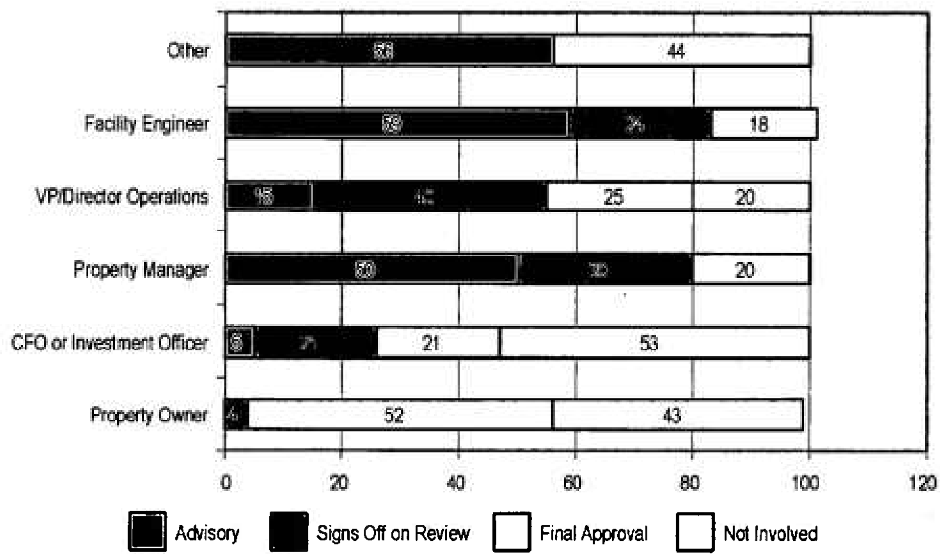
Figure 70 shows that more than half of all buildings have emergency or standby generators. Less than 5 percent of facilities currently have on-site cogeneration.

Figure 71. Use of Outside Consultants and/or Advisors for Significant Energy Decisions



The importance of building and maintaining relationships with energy advisors and engineers is shown in Figure 71. Eighty-eight percent of the respondents confirm that they involve outside experts in significant energy decisions.

Figure 72. Those Involved in Significant Energy Decisions



The variety of roles and active participants shown in Figure 72 underscores the need to understand customer-specific decision processes. One interesting observation is that property owners have final approval in 52 percent of the cases but are not involved in energy decisions at 43 percent of the responding organizations.

Figure 73. Frequency of Outside Advisors

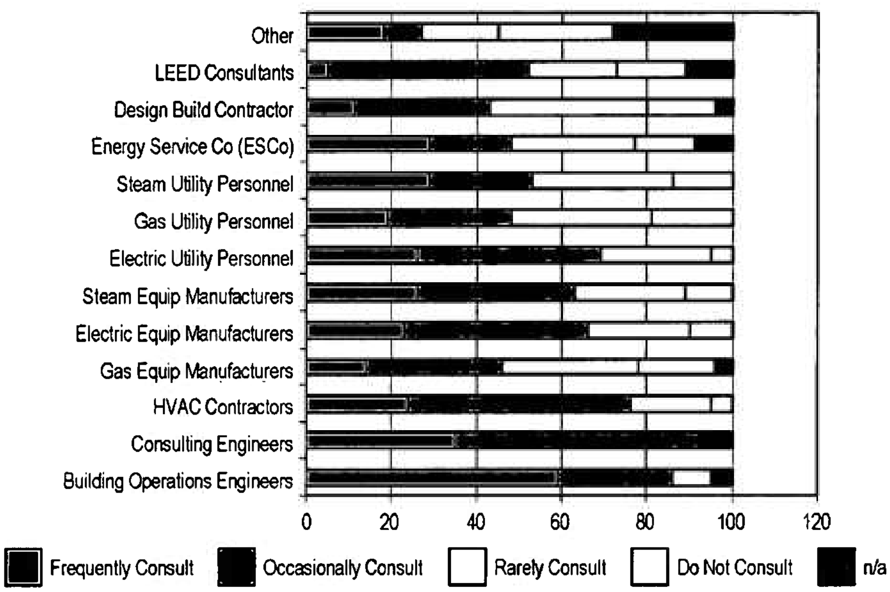
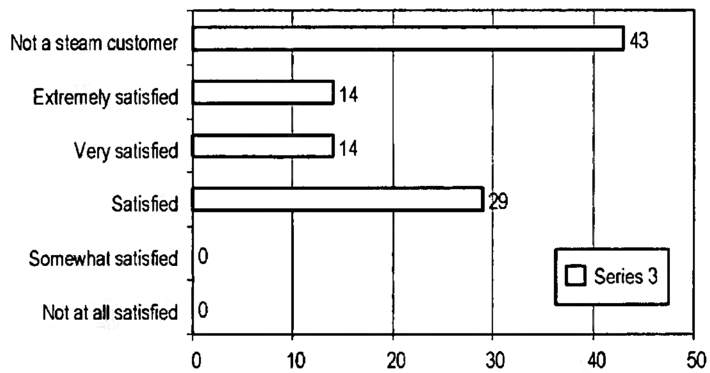


Figure 73 shows that customers and their agents reach out to a large number of different advisors on major energy decisions. The variety of advisors and different levels of outside participation confirms the need to get accurate steam information to many players in the energy industry and to understand the decision-support networks of specific large customers.

Figure 74. Steam Heating Customer Satisfaction



As shown in Figure 74, approximately 51 percent of steam heating customers are satisfied [0.29/(1-0.43)] while almost 25 percent are very satisfied and almost 25 percent are extremely satisfied. This total satisfaction level of 100 percent is much higher than expected and is inconsistent with some of the non-survey data.

Figure 75. Steam Cooling Customer Satisfaction

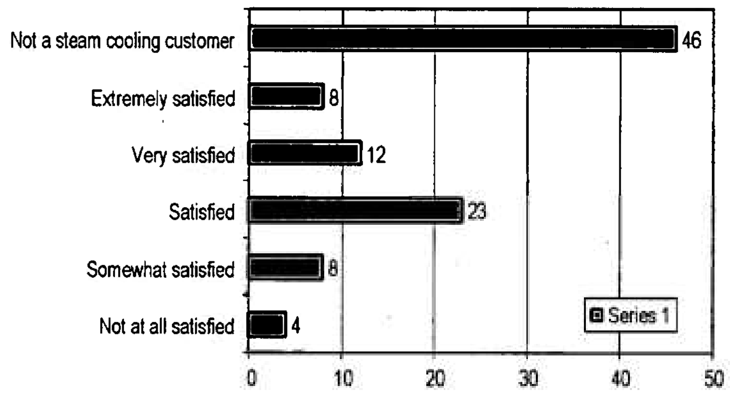


Figure 75 shows that approximately 43 percent, 22 percent, 8 percent of cooling customers are satisfied, very satisfied, or extremely satisfied, respectively.

Figure 76. Important Factors in Energy Decisions

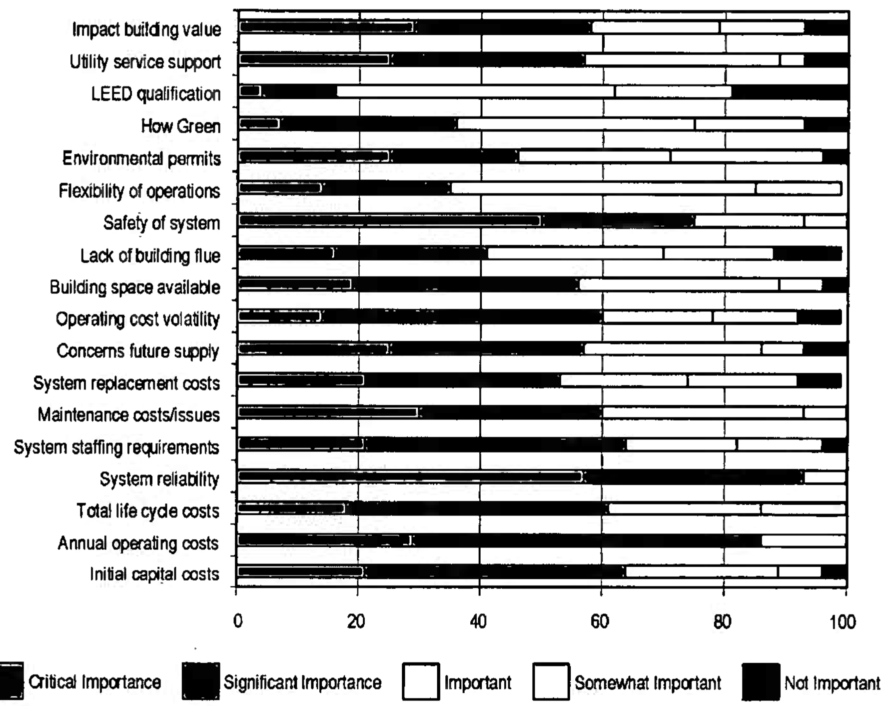


Figure 76 shows the range of factors considered when making decisions and the different weights placed on particular factors. This variety confirms the need to understand customer-specific values and present the case for steam in terms of the multiple decision factors. Other than the expected critical importance of safety and reliability, the highest ranking criteria appear to be variations of cost factors, especially operating costs.

Figure 77. Discount or Cost of Capital Rate Criteria

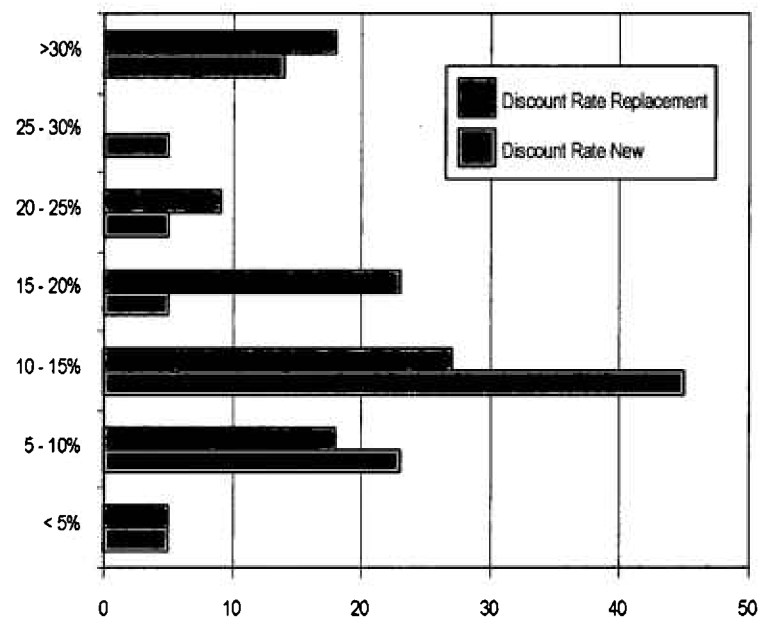


Figure 77 indicates that discount rates used by customers vary substantially. On average, customers apply a lower rate to new projects than to replacement projects.

Figure 78. Steam vs. Gas Heating Comparison

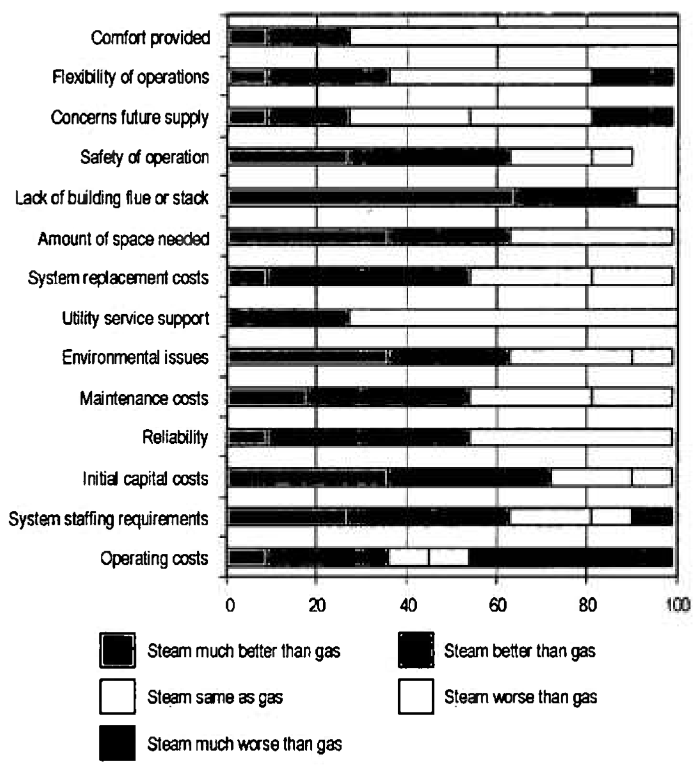


Figure 78 shows the customers' head-to-head evaluations of gas and steam heating. Customers credit steam with significant advantages because of its low space requirements, no flue requirement, and low initial and replacement costs. The lower operating costs of gas heating are its most prominent advantage.

Figure 79. Steam vs. Electric Chiller Comparison

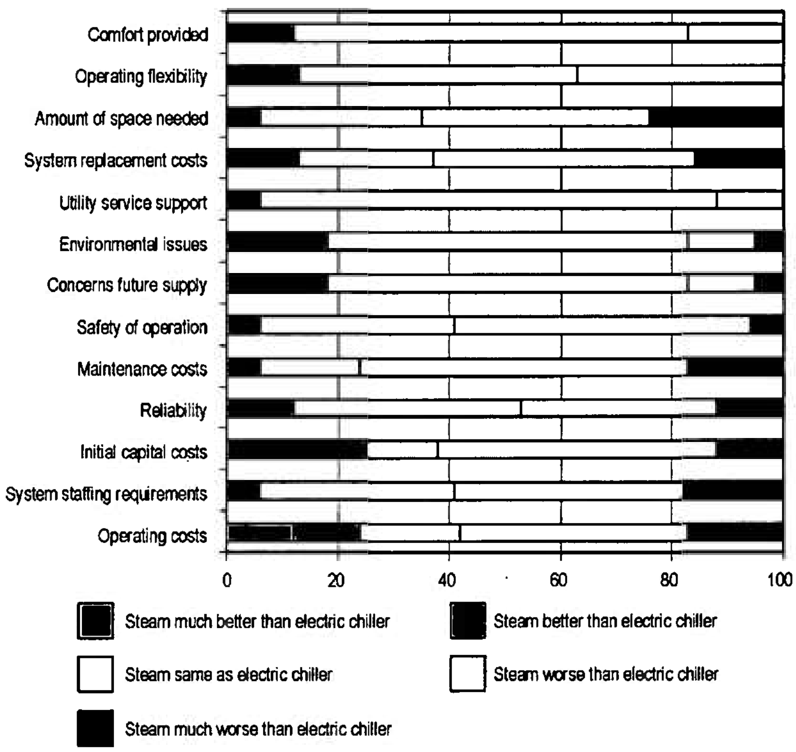


Figure 79 shows respondents' perceptions of steam versus electric chilling. The customers gave a slight advantage or equivalent rating to steam on comfort, reliability, environmental issues, and future assurance of supply. Electricity is generally seen as more attractive on initial, operating, replacement, and maintenance costs.

Figure 80. Unmet Needs and New Products

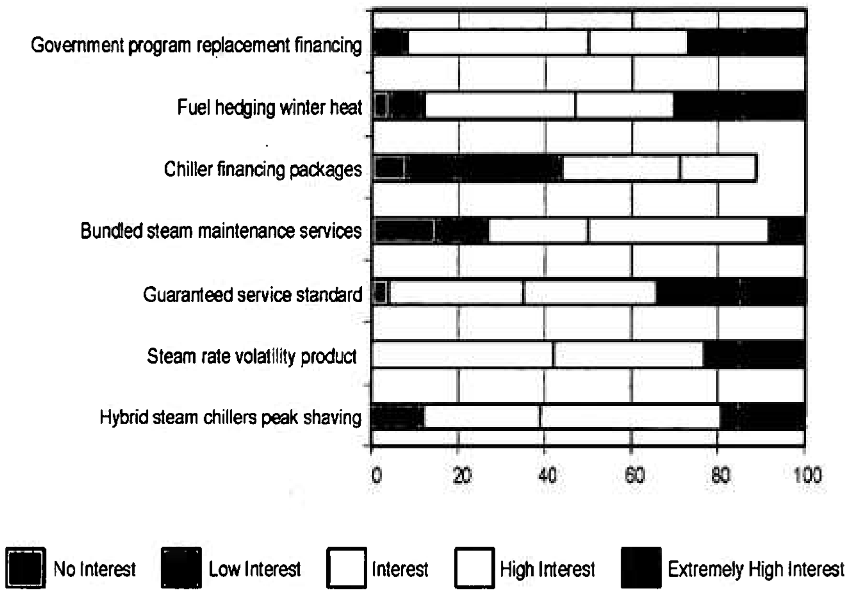


Figure 81. Cogeneration Under Consideration

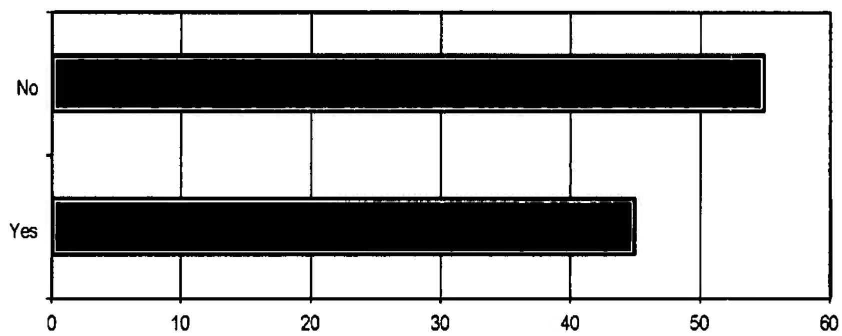


Figure 81 shows that 45 percent off customers or their advisors are considering cogeneration at their facilities. Although responses to these sorts of questions often overstate intentions, the number is very high and must be addressed by the development plan. Figure 82 provides a general statement of customer views.

Figure 82. Opinions and Perceptions

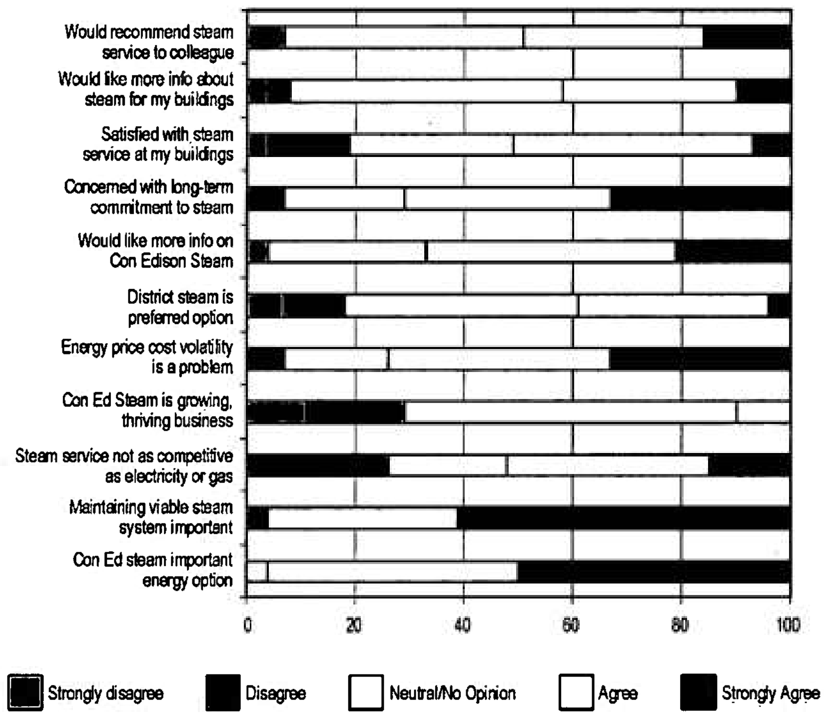


Figure 82 shows that nearly all participants agree (50 percent strongly agree) that steam is an important option and should be maintained. However, only 40 percent indicate steam is a preferred option now and many also question the long-term commitment to the system.