

Super-Efficient Refrigerators for Apartments: The NYPA/NYCHA Project as a New Market Transformation Model

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Through an innovative market transformation effort, a “super-efficient” refrigerator for apartments is being developed for distribution in 1997. The first effort of its kind, this endeavor represents a different type of market transformation model from that of the original 22-cubic-foot Super-Efficient Refrigerator Program (SERP) because the “golden carrot” for manufacturers here is the huge market represented by public housing authorities (PHAs) instead of utilities. As a consultant to the New York Power Authority (NYPA), EUA Citizens Conservation Services¹ worked with the utility and the New York City Housing Authority (NYCHA) to demonstrate to manufacturers the substantial demand among PHAs for super-efficient refrigerators in the 14-cubic foot size range. NYCHA alone typically purchases over 10,000 refrigerators every year.

In August 1995, NYPA issued a solicitation to manufacturers to develop the smaller super-efficient refrigerator and set aside \$38 million to finance DSM improvements in NYCHA housing, primarily for refrigerator purchases. The winning manufacturer, Maytag, will produce a 14.8-cubic-foot refrigerator with an energy use rating of 437 kWh per year, which is 30 percent better than DOE’s 1993 standard. Other PHAs may piggyback their purchases of the refrigerators—priced at \$308—onto NYCHA’s order.

The project is part of a broader DSM program in which NYPA will finance other electric efficiency measures in NYCHA housing. In return for financing the measures, NYPA secured a contract to serve as NYCHA’s sole electricity provider. The NYPA/NYCHA refrigerator project is the first efficient product initiative aimed directly at low-income customers, typically underserved by DSM programs.

INTRODUCTION

Background

The original Super-Efficient Refrigerator Program (SERP) was the first large-scale voluntary market transformation effort to promote a major increase in appliance efficiency in the United States (Goldstein 1994). In 1993, a consortium of 27 utilities offered a “golden carrot”—\$30 million in rebate money—for the manufacturer who could commercialize the most energy-efficient, CFC-free refrigerator (Feist et al. 1994). SERP required a minimum efficiency improvement of 25 percent beyond the 1993 National Appliance Energy Conservation Act (NAECA)/DOE standard for units in the 20-cubic-foot size range. The winning bidder was Whirlpool, which offered a 22-cubic-foot refrigerator that used 29 percent less energy than the 1993 standards. However, despite the success of the SERP, its application for the multifamily housing market, which accounts for 26 percent of the residential housing market, is extremely limited. Most apartments have refrigerators in the 14-cubic-foot range and are too small for a 22-cubic-foot refrigerator.

The need for a smaller-sized super-efficient refrigerator was evident. The Natural Resources Defense Council (NRDC)

recognized the need for a more efficient small refrigerator. In 1994, NRDC sponsored the work of graduate students who endeavored to define the potential energy savings from improving the efficiency of small refrigerators in public housing. The study determined that a 14-cubic-foot refrigerator in the 400-kWh range was possible.

Meanwhile, Citizens was exploring bulk purchasing options for public housing authorities (PHAs). Citizens initially focused on the General Services Administration’s (GSA) supply schedule, which offers equipment and appliances at wholesale rates to federal agencies. The task was two-fold: (1) to gain access for PHAs to the schedule (they had been denied access to the schedule, because they were not considered federal agencies); and (2) to ensure that the appliances and equipment available through GSA would be the most efficient available. Through advocacy efforts, Citizens helped change the federal legislation to allow local units of government to take advantage of the GSA supply schedule but, in the end, PHAs were still denied access because they did not fit the legislative definition of local unit of government, and the effort failed.

Citizens then began to examine the potential for using bulk PHA purchasing to induce manufacturers to produce more

efficient refrigerators. In the fall of 1994, Citizens presented the New York Power Authority (NYPA) with a proposal to develop a smaller super-efficient refrigerator by pooling demand among public housing authorities, primarily the New York City Housing Authority (NYCHA). The “golden carrot” for the manufacturer would be the potentially huge market represented by 1.3 million units of public housing managed by 3,100 public housing authorities nationally. NYCHA is NYPA’s third largest customer as well as the largest single purchaser of refrigerators in the country. Interested in serving NYCHA with a strong DSM program and interested specifically in the potential of refrigerators, lighting, motors and room air conditioners to cut NYCHA’s electric load, NYPA was already considering the refrigerator concept. NYPA accepted Citizens’ proposal, and the ensuing program became the vehicle for the development of a super-efficient refrigerator in the 14-cubic-foot size range.

Scope

After a competitive bid, NYPA hired Citizens to help develop the super-efficient small refrigerator project as part of a broader DSM program specifically targeted to NYCHA housing. NYPA supplies electricity to the 2,900 buildings in NYCHA’s public housing portfolio. NYPA agreed to invest \$38 million in energy efficiency measures in NYCHA housing over the next decade, and, in return, secured a contract to be NYCHA’s sole electricity provider, a resourceful customer-retention strategy in an industry being transformed by the specter of retail wheeling.

The collaborative program has a special focus on refrigerator replacement. Refrigerators constitute the largest single electric end-use in NYCHA housing, and many of the refrigerators in NYCHA’s 180,000 units are older models that provide a good opportunity for electricity savings. The centerpiece of the refrigerator replacement strategy is the development of a 14.8-cubic-foot unit that is 30 percent more efficient than required by the 1993 NAECA standard. This is the first new appliance efficiency initiative aimed directly at low-income customers, typically underserved by DSM programs.

PROGRAM DEVELOPMENT

As a consultant to NYPA, Citizens began developing the super-efficient small refrigerator program in early 1995. As a first step, Citizens determined the specifications and scheduling of NYCHA’s refrigerator procurement and secured a letter of intent from NYCHA indicating its willingness to purchase a minimum number of refrigerators over the next three years. Citizens also obtained letters of interest from other housing authorities across the country, demonstrating a larger demand for efficient refrigerators. As part of program development, Citizens met with manufacturers and with the

U.S. Department of Housing and Urban Development (HUD) and assisted in the design of a financing program to facilitate NYCHA’s procurement of the refrigerators. In addition, Citizens identified other electric efficiency opportunities in NYCHA housing, including lighting, motors, and air conditioning and drafted an overall DSM program for NYPA in NYCHA housing.

Appliance Recycling Centers of America (ARCA), TAG Associates, and EME Group also contributed to the project as subcontractors to Citizens. ARCA provided input in assessing the refrigerator market. TAG Associates assisted in engaging the interest of other large housing authorities in the project. Finally, EME Group performed technical assessments of savings opportunities from refrigerators as well as other electric end-uses—including lighting, motors and air conditioning—in NYCHA’s portfolio.

Characterizing NYCHA’s refrigerator stock and procurement patterns

As part of its consulting services for NYPA, Citizens characterized the refrigerator stock and procurement practices of NYCHA. The largest public housing authority in the nation, NYCHA manages 2,900 buildings comprising 180,000 apartment units. Most of the refrigerators in NYCHA apartments are in the 14-cubic-foot range, although there are at least three other sizes represented, the most common being 12-cubic-foot units. Many of these refrigerators are old and inefficient. Since HUD, rather than NYCHA or its residents, is responsible for NYCHA’s utility costs, there has been no incentive for the housing authority to purchase more efficient refrigerators. Based on preliminary metering results from an independent contractor, NYPA estimates that the average refrigerator in NYCHA housing consumes 1100 kWh annually.

Before the NYPA program began, NYCHA purchased about 10,000 refrigerators per year, in four categories: 11-, 12-, 13.5-, and 14.3-cubic-foot models. However, 90 percent of the purchases have been in the 14-cubic-foot range. From an analysis of procurement records, EME Group determined that the average annual electricity usage of new 14.3-cubic-foot refrigerators bought between 1991 and 1995 is 617 kWh. Units purchased before 1991 typically use 1100 kWh per year or more.

Under the program, NYPA is financing the purchase of 20,000 refrigerators per year for NYCHA, twice the normal number, in order to accelerate the replacement of inefficient refrigerators and thereby to increase overall savings.

Fostering manufacture interest

Nationwide, 3,100 public housing authorities manage 1.3 million units of public housing. The refrigerators in these apartments are predominantly in the 14-cubic-foot size range. The typical PHA buys these refrigerators in bulk at \$350-\$375 each. Pooling together even a portion of the total PHA demand would influence the national refrigerator market.

To pool demand for super-efficient refrigerators, Citizens solicited several PHAs around the country; these PHAs indicated they would purchase the efficient refrigerators only if the first cost was no higher than what they currently pay. PHAs generally have little incentive to pay extra for more efficient appliances and equipment because HUD reimburses them for their electric bills. Citizens secured letters of support from the following PHAs: Baltimore, Boston, Chicago, Dade County, Kansas City, Seattle, Wilmington, NC, as well as Hempstead and Port Chester in New York State. These letters, along with NYCHA's commitment to the effort, were used to demonstrate to manufacturers the size of the potential demand for the smaller, super-efficient refrigerators.

The Consortium for Energy Efficiency (CEE) organized a meeting, attended by Citizens and NYPA, to discuss with manufacturers the potential for a smaller-sized super-efficient refrigerator and to demonstrate the PHA demand. During a meeting in March 1995, the manufacturers expressed interest in the project and provided feedback on efficiency levels.

Establishing efficiency goals

To set efficiency goals, the project team gathered data on current refrigerator efficiency levels, researched the anticipated 1998 federal standards, and used input from the meeting with manufacturers. From an analysis of current refrigerator markets, Citizens estimated that the typical 14-cubic-foot refrigerator sold today uses about 625 kWh per year, roughly equivalent to the 1993 standard. General Electric and Whirlpool both produce 14-cubic-foot refrigerators that use 500 kWh per year, which is 20 percent more efficient than the 1993 standards. In 1995, this efficiency was considered the "best available" for that size range.

The program team determined that by 1997 it should be possible to produce a 14-cubic-foot model that would meet DOE's anticipated 1998 standards. The 1998 standards (expected to be in effect in 1999) require 30 percent more efficiency than the 1993 standards for 14-cubic-foot refrigerators. This "super-efficient" refrigerator would be available for distribution in the first quarter of 1997, and the team determined that an even more efficient model was possible for distribution in 1998.

Meeting with HUD, establishing protocols

In March 1995, Citizens met John Comerford, Director of HUD's PHA Office of Financial Management, to discuss the possibility of purchasing refrigerators through a performance contract. In the meeting, which was attended by NYPA, NYCHA, and the Consortium for Energy Efficiency, Citizens confirmed that performance contracting was a legitimate vehicle for purchasing "best available" refrigerators, as well as the super-efficient refrigerators, to fulfill NYPA's solicitation. The discussion focused primarily on the methodology for measuring savings and the importance of meeting with the New York City HUD Field Office to gain official approval of NYCHA's plans.

HUD agreed that since NYCHA's refrigerator replacement rate is accelerated under the program, the savings from the replacement refrigerators could be measured using the consumption of the old refrigerators as a baseline. With such a methodology, the savings would be the difference between the consumption of the old refrigerators (whose average usage is 1100 kWh per year) and the new refrigerators, rated at 437 kWh per year. HUD stipulated that metering should be used to establish the baseline.

PROGRAM DESIGN

As part of its overall \$38 million DSM program for NYCHA, NYPA agreed to order and install 20,000 new, efficient refrigerators for NYCHA during each of the next four years. NYPA is acting as an energy services company, financing the new refrigerators and providing engineering and construction management. NYPA will recover materials and labor costs and receive a management fee in monthly payments from NYCHA at six percent over a period not to exceed ten years. In addition, NYPA is financing the removal and recycling of the old refrigerators.

The financing is arranged under an amendment to HUD's Performance Funding System (the mechanism through which HUD reimburses PHAs for utility expenses). This amendment, enacted in 1991 to promote energy performance contracting in public housing, allows PHAs to borrow funds for capital improvements which generate utility savings sufficient to repay, over a period not to exceed twelve years, the debt service costs associated with the improvements. HUD in turn provides an additional line item in its reimbursement ledger equal to the debt service obligations incurred by the PHA. The PHA must demonstrate to HUD that the annual energy savings will be sufficient to cover the debt service payments.

NYCHA is responsible for coordinating with the New York City HUD Field Office the reimbursement of the debt service

payments it makes to NYPA for the duration of the ten-year financing period. NYCHA must document that the annual savings are sufficient to retire the debt service costs.

Refrigerator replacement schedule

NYPA's refrigerator replacement strategy involves several phases. In 1996, 20,000 refrigerators in NYCHA housing will be replaced with best available units that consume about 500 kWh per year. NYPA issued a solicitation for these units in May 1995 and awarded the contract to General Electric. Under the program, the refrigerators distributed by General Electric in 1996 are not available to other PHAs at the negotiated program price, but the super-efficient models distributed in 1997 will be. A minimum purchase of 100 refrigerators will be required. These purchases will be piggy-backed onto NYCHA's order, but these other entities will be responsible for their own financing.

In 1997, the replacement refrigerators will be "super-efficient"—at least 30 percent more efficient than required by 1993 federal standards and meeting or exceeding the 1998 standards. A solicitation for these units was issued in August 1995, guaranteeing a minimum purchase of 20,000 refrigerators. This solicitation is described in more detail below.

The refrigerators distributed in 1998 will be even more efficient than those distributed in 1997. A solicitation for these refrigerators will be issued in early 1997. NYPA has not yet set the efficiency specifications, although the expectation is a refrigerator 35 to 40 percent more efficient than required by the 1993 standards, or 7 to 14 percent more efficient than the 1998 standards.

Solicitation for a super-efficient refrigerator for apartments

The NYPA solicitation specifications, issued in August 1995, required a refrigerator with a minimum volume of 14.3 cubic feet, including 2.8 cubic feet of freezer chest volume, with dimensions of 28 inches wide, 31 inches deep, and 64 inches high. Within these size constraints, NYPA guaranteed the winning manufacturer a minimum purchase of 20,000 refrigerators. In the case that a manufacturer did not meet the width specification of 28 inches but did propose a unit no wider than 29 inches, NYPA would guarantee a minimum purchase of 6,000 units. NYPA indicated in the solicitation that it sought a refrigerator at least 30 percent more efficient than the 1993 standards, but it did not specify any particular efficiency. The efficiency of the refrigerator would be important in that the proposals would be evaluated based on a life-cycle cost analysis.

Maytag, General Electric, and Whirlpool submitted proposals in response to NYPA's solicitation. Maytag proposed the

most efficient unit (the Magic Chef, model CTE1511NAW), with an annual rated usage of 437 kWh (based on DOE's standard test and rating procedure), or about 30 percent more efficient than the 1993 standards. Neither GE's nor Whirlpool's models met NYPA's preference of 30 percent more efficiency than required by the 1993 standards. The relative inefficiency of the runners-up cost them points in the evaluation.

The Magic Chef will have 14.8 cubic feet total interior volume, including 10.65 cubic feet of refrigerator space and 4.15 cubic feet of freezer space. The dimensions will be 28 inches wide, 29 inches deep, and 60 inches high. Maytag will produce the refrigerator in its Moline, Illinois, manufacturing facility, offering it to PHAs at a price of \$308. Eager to break into a market in which it had a low market share, Maytag priced the unit below comparable models typically purchased by PHA procurement officers. PHAs can purchase the refrigerators from September 1 through November 30, 1996, for delivery in March 1997.

Removal and recycling of old refrigerators

Through a competitive solicitation, NYPA hired Planergy to de-manufacture the old refrigerators. Planergy is removing pollutants and recycling usable materials in its Syracuse, NY, facility, which has been approved by NYPA's Environmental Department. Disassembling up to eighty units per day, Planergy removes and recycles the aluminum, copper, insulated wire, iron, and CFCs from the refrigerators. As of mid-April 1996, Planergy had disassembled over 4,500 old units from NYCHA housing, nearly the number of units that had been replaced by that point. The average refrigerator disassembled under the program has yielded approximately 170 pounds of iron, five pounds of aluminum, and one-third pound each of copper, wire, and CFCs. At per-pound market rates of roughly \$0.10 for iron, \$0.30-0.38 for aluminum, \$0.72-\$0.85 for copper, \$0.25 for wire, and \$6.00 for CFCs, the average refrigerator contains about \$20 worth of recyclable materials.

Marketing and program evaluation

Citizens began marketing the super-efficient refrigerator even before an award was made to Maytag. This was accomplished through direct marketing to PHAs and through articles in various publications of the public and assisted housing markets. Recently, the Consortium for Energy Efficiency, which is working in tandem with NYPA, hired a public relations firm to market the refrigerators.

Finally, a plan to evaluate the super-efficient refrigerators is being developed. Synertech Systems Corporation (Synertech) is now monitoring the performance of the "best avail-

able” refrigerators distributed in NYCHA housing in 1996, as well as 200 existing refrigerators in NYCHA developments where refrigerators are scheduled for replacement.

CONCLUSION

The super-efficient refrigerator program may serve as a model for future market transformation efforts using demand pooling as a golden carrot. The PHA/utility relationship is key to this initiative. While certain aspects of the NYPA/NYCHA project are unique, the approach could be replicated by other PHA/utility teams to stimulate the manufacture of more efficient appliances and equipment. NYCHA’s large size is unique, and its procurement system, characterized by detailed and complete record-keeping and a firm knowledge of the market, is uncommonly sophisticated. While NYCHA’s size is unique, its procurement savvy is reproducible.

The formation of procurement alliances among PHAs and/or other large managers of multifamily housing may increasingly become a viable mechanism for increasing the energy efficiency of appliances and equipment in these buildings. The Rebuild Boston initiative, a \$763 million effort funded by DOE to stimulate energy efficiency in multifamily and commercial properties in the City of Boston, is charged with the formation of a procurement alliance to obtain the most efficient appliances and equipment. Eventually, procurement alliances may prove fruitful not only for appliance and equipment purchasing but also for the bulk purchase of transport gas and even electricity.

The NYPA/NYCHA program also offers insight into what utility conservation programs could look like in the future. NYPA’s willingness to design, implement, and finance the

refrigerator program for NYCHA was linked to a simultaneous strategy to commit NYCHA to a 10-year power purchase agreement. Customer retention was a major motivation for NYPA in initiating the program. In an environment of increasing retail competition, utilities may choose to offer programs to their larger customers as part of a customer-retention strategy. These programs may emphasize financing and bulk purchasing. Through such bulk purchasing programs, utilities could play a major role in accelerating the development and use of more efficient appliances and equipment.

REFERENCES

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ENDNOTE

1. The contract was awarded to Citizens Conservation Corporation (CCC) but was transferred to EUA Citizens Conservation Services (EUA CCS) during CCC’s reorganization, after which CCC worked as a subcontractor on the project under EUA CCS. In this paper, we use “Citizens” to refer collectively to both companies.