Revised Report

Characterization and Energy Efficiency Opportunities in Vending Machines for the Northwestern US Market

Prepared for:

Northwest Power and Conservation Council
Regional Technical Forum

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Executive Summary

This report presents the findings of a market characterization study of the refrigerated beverage vending machine market, completed by Quantec, LLC, and The Cadmus Group for the Regional Technical Forum of the Northwest Power and Conservation Council. The findings of the study are based primarily on approximately 50 in-depth interviews conducted with local and national industry stakeholders, including vending machine manufacturers, bottlers, refurbishers, host sites, and one energy-efficiency technology company. Although the specific questions varied for each stakeholder, interviews were generally aimed at ascertaining the size, characteristics, and trends of the vending machine market in the Pacific Northwest. In addition to the interviews, Quantec, LLC and The Cadmus Group performed a literature review of industry periodicals and conference proceedings, and examined the evaluations of several recent vending machine programs. This report focuses solely on refrigerated beverage vending machines and does not include other types, such as snack or coffee vending machines.

The key findings of the study include:

- Approximately 120,000 vending machines currently reside in the Pacific Northwest.
- The majority of these machines are between 7 and 11 years old and collectively consume over 400 Million kWh annually. About half the machines in service are vintage 1996-1999.
- Every year, 6,000 to 12,000 new vending machines are purchased in the Pacific Northwest. The annual purchase rate of new machines is only 10 to 25 percent of what it was at its peak in 1999. Another 12,000 to 24,000 machines are refurbished annually.
- Overall awareness and use of ENERGY STAR or other energy-efficiency measures is low among bottlers and host sites.
- Programs to date aimed at improving vending machine efficiency through VendingMiser have achieved limited success due to bottler reluctance and poor measure persistence.

In addition to characterizing the current marketplace, the study also identified several opportunities for improving the energy efficiency of the region's vending machine fleet. These opportunities include the following:

- Refurbishment or upgrade programs are a key tool in capturing significant efficiency opportunities of existing machine stock.
- Most bottlers would take advantage of incentives to purchase more efficient components or equipment if such incentives were made available and the incremental cost of the upgrade was low.
- Field installable components, such as fan motors and thermostat controls, could quickly be deployed without having to wait for the industry procurement or refurbishment cycle.
- Bottlers are best positioned to participate in incentive programs and have the ability to accurately track and control the location of any machine.

- Outreach programs to large host sites could generate demand for efficient machines and refurbishments.

1. Introduction

While often overlooked by traditional energy-efficiency programs, refrigerated beverage vending machines ("vending machines") use a surprisingly large amount of energy and represent a significant opportunity for savings. In fact, every year, the 2.6 to 3.2 million vending machines in the United States consume more energy than the entire state of Delaware. In the Pacific Northwest specifically, approximately 120,000 regional vending machines consume approximately 400 million kWh annually and contribute up to 40 MW demand.

Before exploring specific programmatic options intended to increase energy efficiency in a market, it is critical to first understand the targeted market in significant detail. Among other information, it is necessary to understand the roles of, and interaction between, critical market actors; determine the magnitude and current conditions of the market; identify influential factors; and assess current business practices. To conduct such a characterization of the vending machine market in the Pacific Northwest, the Regional Technical Forum (RTF) of the Northwest Power and Conservation Council (NPCC) contracted Quantec, LLC and the Cadmus Group.

Despite significant energy saving opportunities, such as Energy Star Tier 2 and refurbishment specification, penetration of more efficient equipment and practices has been slow in the vending marketplace. This has been due to several key market barriers:

- A split incentive between machine owners and host sites.
- Long equipment life and low turnover rate.
- Large incremental cost of new machine purchases.
- Low awareness of vending machine energy costs and efficient alternatives.
- Lack of information and experience using on-board software controls.

Designing a program able to span multiple host market sectors and target the most effective market actors and segments is a challenge because the vending industry is large and relatively decentralized. The complex interactions between vending operators, bottlers, distributors, and host sites can further confound efforts to implement effective energy-efficiency programs. As a result, having the latest and best possible information available is vital when designing and implementing a program.

This report, drawing upon interviews with a multitude of vending machine market actors (including manufacturers, bottlers, vending operators, refurbishers, and host sites as well as a literature review of vending market materials) provides such information.

Research Questions

Although the specific questions asked of respondents from each market actor group differed depending on their particular role in the market, questions tended to be thematic and center on larger, more general research questions of interest to the RTF. The research questions, which RTF posed initially in the study's request for proposal, were collaboratively refined at the study's kick-off meeting and further shaped during a mid-stream status meeting.

Based on these discussions, the RTF, Quantec, LLC and The Cadmus Group (the Quantec/Cadmus team) generated the following overarching research questions used to guide the study:

- Who are the major market actors?
- What is the size and nature of the vending market?
- What is the average age of a vending machine?
- What are the latest trends in machine design?
- How much energy is consumed by new and vintage vending machines most commonly deployed in the Pacific Northwest?
- What are the current replacement and refurbishment practices?
- What upgrades exist to increase the energy efficiency of the existing machine stocks?

Background Information

In an effort to provide sufficient context for understanding and interpreting the findings of this report, the following section briefly offers basic information about ENERGY STAR vending machine specifications, types of prevalent vending machine models, and their typical energy consumption levels.

ENERGY STAR Specifications[1]

- **Tier I Requirements** (effective April 2004 and August 2006 for new and rebuilt machines, respectively):

$$Y = 0.55\ [8.66 + (0.009 \times C)]$$

- **Tier II Requirements** (effective July 2007 for both new and rebuilt machines):

$$Y = 0.45\ [8.66 + (0.009 \times C)]$$

where:
Y = 24 hr energy consumption (kWh/day) after the machine has stabilized
C = vendible capacity

[1] http://www.energystar.gov/index.cfm?c=vending_machines.pr_crit_vending_machines

The ENERGY STAR website provides examples to illustrate the formulas listed above. According the website under Tier I and Tier II standards, a 650-can capacity machine may consume no more than 7.98 kWh/day and 6.53 kWh/day (rounded), respectively.

In addition, all ENERGY STAR machines must be capable of operating in at least one of the following low power mode states:

- **Lighting Low Power**: Lights off for an extended period of time.
- **Refrigeration Low Power**: The average beverage temperature is allowed to rise above 40°F for an extended period of time.
- **Whole Machine Low Power**: The lights are off and the refrigeration operates in its low power state.

Lastly, the machine must be capable of returning itself to its normal operating conditions at the conclusion of the inactivity period. The low power mode-related controls/software shall be capable of on-site adjustments by the vending operator or machine owner unless the low power controlling device is already pre-programmed when installed in the machine.

Common Vending Machine Models and Energy Consumption

While the national vending machine market is comprised of 2.6 to 3.2 million vending machines, the vast majority of the national fleet is supplied by only three manufacturers. As a result of the limited number of suppliers, there are several specific vending machine models that dominate the current vending machine market. Table 1 provides the model name and typical energy consumption for each predominate manufacturer. Collectively, these models represent over 50% of the existing vending machine stock.

Table 1. Characteristics of Common Vending Machine Models

Manufacturer	Model Name	Energy Consumption kWh/day[2]
Dixie Narco	501EMC	10.51
Dixie Narco	600E	9.37
Royal Vendors	CC804	15.00
Royal Vendors	CC660	14.50
VendoSanden	VMAX 840	9.10
VendoSanden	VMAX 720	8.40

Report Structure

The Quantec/Cadmus team conducted in-depth interviews with machine manufacturers, bottlers, refurbishers, host sites, and USA Technologies–a producer of the widely employed VendingMiser.

[2] Energy consumption values obtained from manufacturer interviews and published data.

Summaries of the Quantec/Cadmus team's discussions with each market actor group are provided in Section 2.

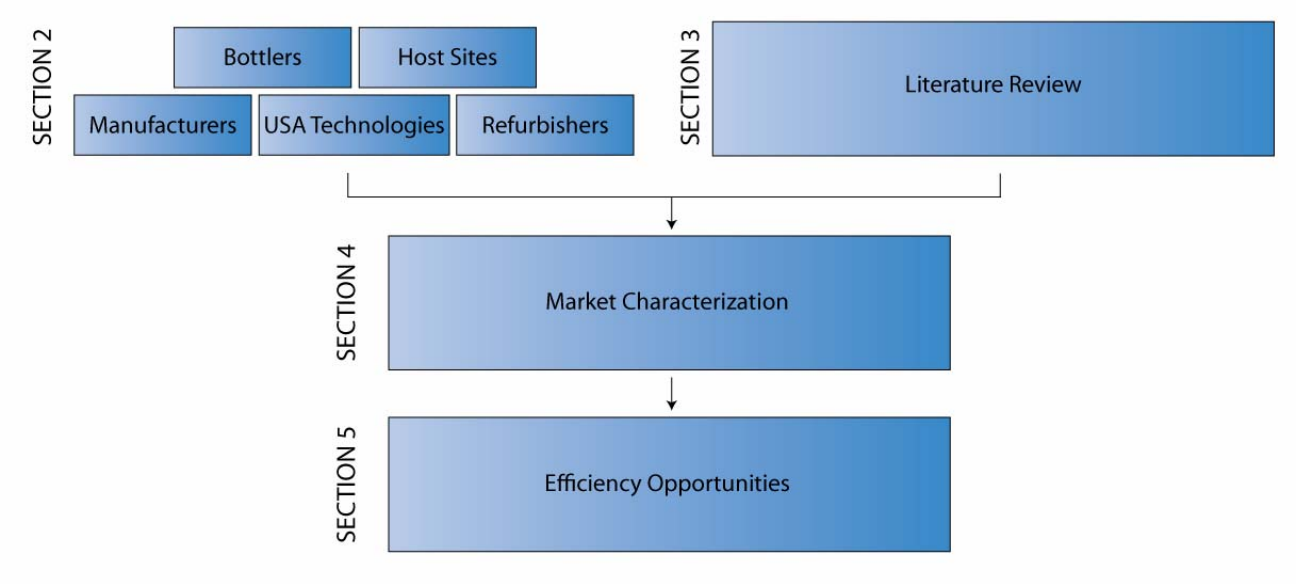
In addition to interviewing national and regional market actors, the Quantec/Cadmus team conducted a literature review of industry periodicals and conference papers. Inquiry findings are provided in Section 3.

Once aggregated and synthesized, the information presented in Sections 2 and 3 was used to characterize the Pacific Northwest vending machine market. Specifically, Section 4 offers a summary of key findings and provides the RTF with critical information regarding, among other things, the market size, the distribution of machine ages and model types, current trends, and the key market actors and their interactions.

After characterizing the market, the Quantec/Cadmus team drew upon information learned to develop a list of energy efficiency opportunities for the vending machine market. Section 5 details these opportunities, providing the potential savings and cost of each opportunity, and makes programmatic suggestions for possible implementation.

The structure of the report – which generally reflects the overall methodology of the study – is represented graphically in Figure 1.

Figure 1. Report Structure



2. Market Actor Interviews

The study's primary means of understanding the vending machine market characteristics, and, subsequently, the existing opportunities for energy efficiency, were simple and straightforward: ask the wide-range of individuals, companies, and associates active in the market.

Methodology

At the outset of the study, the Quantec/Cadmus team created an interview plan intended to ensure efficiency, expediency, and comprehensiveness. Specifically, the interview plan outlined the Team's intention to understand the varying roles and perspectives in the Pacific Northwest vending machine market by conducting in-depth interviews with the following market actor groups:

- Manufacturers
- Bottlers
- Refurbishers
- Host sites

In addition to market actors listed above, the Quantec/Cadmus team interviewed USA Technologies (formerly Bayview Technologies), manufacturer of the VendingMiser (a commonly employed aftermarket motion-activated efficiency device).

Table 2 provides the number of completed interviews per market actor group. The exact number of interviews varies from that proposed in the work plan due to mid-stream adjustments and mid-study determinations of the actual number of actors within each group.

Table 2. Distribution of Market Actor Interviews

Market Actor Group	Completed Interviews	Market Role
Manufacturer	3	Makes vending machines and related equipment
Bottlers	20	Manufactures/sells food/drink products through vending machines and other outlets
Refurbishers	3	Refurbishes or recycles vending machines and associated parts/materials
Host Sites	24	Allows vending machines to be placed on-site, generally in exchange for commissions or other compensation
Technology Companies	1	Manufactures aftermarket devices for vending machines, including energy saving devices

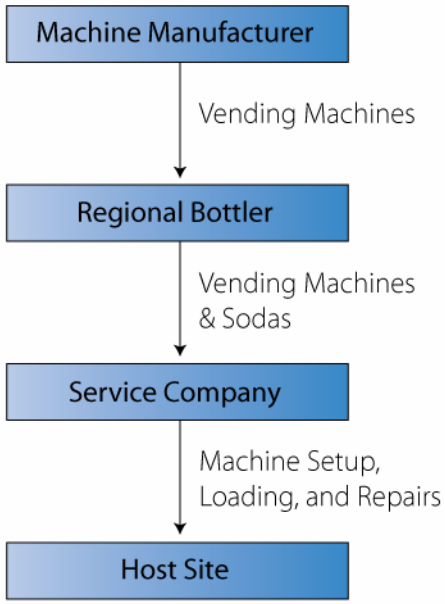
Interview Plan

To maximize the effectiveness of interviews conducted on behalf of the study, Quantec/Cadmus carefully targeted upstream decision makers within each market actor group. Further, interviews

were ordered so interviewed stakeholders within one market actor group had the opportunity to identify critical stakeholders within another group (for example, bottlers were able to identify specific host sites of significance).

Utilizing this top-down approach (illustrated in Figure 2) to guide the interview plan improved the results and validity of the study by ensuring representation of the greatest possible percentage of the vending machine market. As shown in the figure below, manufacturers, distributors, and bottlers are at the top of the vending machine market. For example, utilizing the top-down method, regional bottlers (Coca-Cola Bottling Group, etc.) servicing the Pacific Northwest were interviewed first to gain their unique insights into the region's overall distribution system and key market actors.

Figure 2. Vending Machine Market Flow



Quality Assurance

To ensure that all team members conducting interviews understood the subtleties of the Pacific Northwest's vending machine market as a whole and not only the perceptions of a single market actor group, members of the Quantec/Cadmus team conducted interviews with respondents from all market actors groups. To further enhance the quality of results, the first three interviews within each market actor group were jointly conducted by both Quantec and The Cadmus Group. By conducting the initial interviews in each market actor group collaboratively, Quantec and The Cadmus Group were simultaneously exposed to all unexpected issues or topics that arose and were able to collaboratively revise the interview guide as needed prior to conducting the remainder of interviews within a given market actor group.

Manufacturers

While both the national and regional vending machine markets are of considerable size (3.2 million and 120,000, respectively), only three manufacturers–SandenVendo America Inc., Dixie-Narco Inc., and Royal Venders Inc.–design, construct, and supply virtually all the machines currently operating in the United States. The Quantec/Cadmus team conducted an in-depth interview with a representative of each manufacturer. Throughout the study, when new issues arose or clarification was needed, representatives from each company also responded to ad hoc inquires by the Quantec/Cadmus team via telephone or email.

Interviews conducted with vending machine manufacturers provided key information regarding new vending machine sales, trends in machine types purchased, and many additional factors. As expected, the new machine market is small compared to the total number of machines in operation, but several valuable insights were revealed:

- Approximately 90 percent of vending machines sold are purchased by bottlers; the remaining 10 percent are sold through distributors to third party vending operators.
- Vending machine sales are directly related to population, with approximately 5 percent of new machine sales entering the Pacific Northwest.
- Nationally, sales of new vending machines are approximately 80,000-100,000 units, with about 40 percent of current sales (and growing) being glass front machines.
- Sales of new machines has dropped dramatically in recent years. Manufacturers identified 1999 as the industry peak and noted their current sales were only 10-25 percent of sales at that time.
- According to manufacturers, vending machines will typically stay with a bottler for 10-12 years and undergo an average of two refurbishments. These refurbishments are driven by graphics updates and mechanical repairs/maintenance or vandalism. None of the manufactures noted their units were refurbished regularly as part of a refurbishment plan or cycle.
- Two out of the three manufacturers interviewed plan for all new machines sold by the end of 2008 to meet ENERGY STAR Tier 2 requirements. The third manufacturer is also working towards this goal but feels that it will be an engineering challenge to achieve Tier 2.
- Coke and Pepsi only purchase new Tier 1 ENERGY STAR qualified stack vendor (opaque front) machines and Pepsi purchases only ENERGY STAR qualified glass front machines.
- Presently, nearly all (more than 80 percent) of new machines sold meet ENERGY STAR Tier 1 requirements.

Bottlers and Refurbishers

Bottlers, such as Coca-Cola Bottling Company and Pepsi Bottling Group, are clearly significant actors in the vending machine market. To better understand both the role of bottlers and their perspective on energy efficiency, Quantec and Cadmus interviewed 20 bottlers throughout the

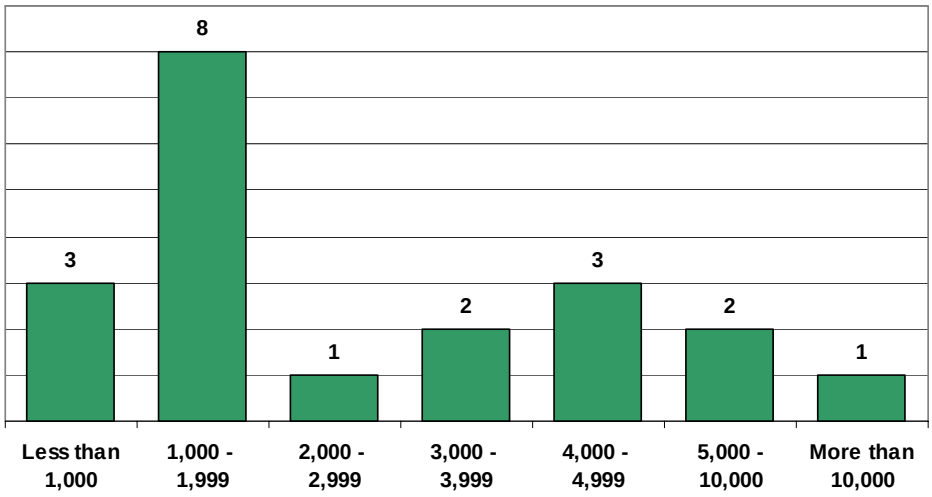
Pacific Northwest. The distribution of interviewed bottlers by state and organization is provided in Table 3.

Table 3. Bottler Interviews by Organization and State

Organization	ID	MT	OR	WA	Overall
Pepsi	3	2	5	1	11
Coke	1	3	2	2	8
7-up/Dr. Pepper	0	0	0	1	1
Overall	4	5	7	4	20

Each of the responding bottlers was questioned regarding the size of the fleet they owned and or managed. Responding bottlers ranged in size from smaller rural bottler with 600 units to a major bottler group with more than 80,000 units across multiple states. Typical responding bottler owning between 1,000 and 2,000 machines. Collectively, the 20 bottlers interviewed owned and or managed approximately 43,000 machines throughout the Pacific Northwest. Given the study's regional estimate of 120,000, the responding bottlers accounted for approximately 36% percent of the total vending machine fleet in the Pacific Northwest. The distribution of bottler by size of owned and/or managed units is provided in Figure 3.

Figure 3. Units Owned/Managed by Responding Bottlers



Although interviews with bottlers were difficult to complete, those responding provided significant insights valuable to the study, including those that follow.

Purchasing or Business Practices

- The majority (90 to 95 percent or more) of bottlers' machines are currently in the field rather than in a warehouse or a refurbishment facility.

- Regional bottlers typically service and fill their own machines, but they may use a third-party operator (often a sister company) to fill a small portion of their fleet.
- Annual machine turnover (new machines purchased) varied by respondent, but tended to be relatively low (typically 10 percent or less).
- While glass-fronts still comprise a small percentage of most bottlers' fleets, most noted an increasing market trend towards the technology. This was a reflection of another trend towards vending more non-carbonated beverages.
- Bottlers stated all their new machines were energy-efficient, but they were generally unfamiliar with ENERGY STAR Tier 1 and Tier 2 labeling and standards.
- Bottlers' preference for newer equipment to be energy-efficient appears to be primarily manufacturer or organizationally-driven. Host site requests for efficiency come primarily from larger accounts (e.g., colleges and school districts).
- Despite exhibiting a preference for a certain manufacturer (new machines typically are purchased from a single manufacturer), bottlers noted they are not under contract with regard to machine procurement.
- Once purchased, machines tend to stay within a bottler's service territory. Machines are typically tracked using vending industry database software and machine serial or asset numbers.
- Bottlers generally disliked VendingMisers and rarely used onboard software controls due to complex programming algorithms and lack of customer requests.
- In addition to bill acceptors, key vending machine features include current (and season-appropriate) graphics and glass-fronts.

Refurbishment or Disposal Practices

- Bottlers reported that machine lifetimes depended primarily on location. Machines placed outdoors last an average of 3 to 10 years, while those inside last 10 to 20 years. Some bottlers reported having almost 30-year-old machines still in operation.
- Frequency and extent of refurbishment practices vary by bottler. However, most bottlers noted that machines are refurbished once or twice during their lifetime and that most work done is strictly maintenance (i.e., not energy efficiency upgrades - although aesthetic improvements are commonly made).
- Very few of the bottlers noted their machines were on a specific refurbishment cycle. Rather, most stated the timing and magnitude of refurbishment was made on a machine-by-machine basis.
- Bottlers noted common catalysts for refurbishment included malfunction, vandalism, and branding changes.
- Decisions regarding refurbishment and replacement are made by local managers. Deciding factors typically included the unit's condition, replacement availability, and a machine's ability to vend the desired products.

- When asked, most bottlers said they would be interested in replacing compressors and other energy-intensive equipment with more efficient models during refurbishment if the cost difference was minimal and the technology was proven.
- While the current capacity of bottlers to conduct in-field refurbishments of specific energy efficient equipment is unknown, bottlers did state they had significant capacity to complete extensive refurbishment efforts in their service warehouses.
- Vending machines have little value at the end of their lives; refrigerant and oil (and sometimes other parts) are taken out, and they are disposed of through scrap metal dealers. Income from scrap, if any, is typically $30 or less.
- Several bottlers noted that, while opportunities exist to sell older machines to independent operators, they are unlikely and reluctant to do so. Continued responsibility for maintenance and brand perception were noted as primary motivators.

Host Sites

To fully understand the vending machine market, it is critical to not only talk to those who manufacture, place, and service vending machines, but also those who use them. However, unlike vending machine manufacturers and bottlers, the potential sample for conducting interviews with machine host sites is vast and relatively unknown. A sampling plan was designed to allocate 40 host site interviews by state and site type by utilizing population and any available machine location data.

Completing host site interviews proved problematic. First, it was not possible to generate a sample of sites known to have vending machines without a population of host sites provided by a bottler. Second, when a site with vending machines was identified and contacted, it was often difficult to reach a respondent familiar with the organization's relationship with the machine's bottler or operator.

Despite these and other challenges, the Quantec/Cadmus Team was able to conduct interviews with 24 host sites. Table 4 provides the distribution of the interviews by site type and state.

Table 4. Host Site Interviews – by State and Site Type

Site Type	ID	MT	OR	WA	Overall
College	1	1	2	1	5
Gas Station	0	0	2	0	2
Government	1	0	0	0	1
Hotel/Motel	1	1	1	3	6
K-12	0	0	3	2	5
Mass Merchandisers	0	1	1	2	4
Medical	0	0	1	0	1
Overall	3	3	10	8	24

Clearly, the 640 machines operating at the 24 responding host sites cannot represent the estimated 120,000 machines located across the Pacific Northwest in a statistically valid manner. Despite this, anecdotal information obtained during the interviews raised a number of interesting issues:

- Often, a number individuals and decision makers are involved with the procurement, maintenance, and finances of vending machines. This fragmentation at host sites may make identifying and working with a primary contact difficult for the purpose of administering an efficiency program.
- While some host sites have limited management positions, making vending-related decisions relatively simple, the process appears to be more time-consuming and bureaucratic for others (e.g., franchisees needing approval by their corporate parents).
- At colleges and universities, decision-making responsibility may vary by the machines' location: decisions made for vending machines located in faculty buildings may be made by faculty, while machines located within dormitories or student housing may be made by student organizations or student life-oriented departments.
- Despite the difficulties in reaching an appropriate contact, those interviewed generally expressed an interest in exploring energy-efficiency options. In fact, several of the host sites contacted are currently or will soon be negotiating new vending machine contracts.
- At K-12 schools (and perhaps other facility types as well), vending machine contracts may be tied to other vendor offerings. For example, the bottler at one school also donated the scoreboard and sponsors sporting events. Termination or augmentation of a contract therefore merits the school's careful consideration of not only energy-related financial implications but also other possible financial implications.
- Some facility types appear more sensitive than others to potential increases in the price of vended products due to the cost of higher-efficiency machines. For example, one hotel representative said paying more for soda would be an acceptable option as their guests represent a captive audience, while contacts from schools expressed hesitation.
- Recent laws in Montana, Oregon and Washington have placed restrictions on the kinds of products vended in schools and some sites (primarily K-12 school districts) have also restricted vending hours of operation[3].

USA Technologies

USA Technologies (formerly Bayview Technologies) is the only company currently manufacturing aftermarket devices designed to control or reduce the energy consumption of vending machines. Their product line includes both the well-known VendingMiser and the newer VM2iQ.

The VendingMiser

The VendingMiser[4] uses an infrared sensor to monitor traffic patterns in the vending machine's vicinity. When the sensor is not activated for a pre-set time (15 minutes), the VendingMiser cuts

[3] http://www.ncsl.org/programs/health/vending.htm

power to the vending machine. Using an external temperature sensor, the VendingMiser re-powers the machine at intervals designed to maintain product temperatures.

The device has been widely used by host sites of varying sizes, from schools to large retail chains. As noted in the Literature Review section, several programs in the Pacific Northwest encouraged the VendingMiser installation. According to USA Technologies, typical VendingMiser installations generate savings from 20 to 40 percent, for a cost of about $90 per unit.

The VendingMiser can cause conflicts with cashless payment systems and computerized vending machine networks, may reduce sales due to forcing machines to appear off from a distance, and may, based on comments from several bottlers, reduce component life on some machines. However, an independent study[5] by Foster-Miller, Inc. in 2002 indicated that the VendingMiser should reduce vending machine operating costs by decreasing the frequency and direct expense of component failures and thus, the number of service calls.

The VM2iQ

The VM2iQ[6] (often referred to as an "internal VendingMiser") operates the evaporator fans and compressor in a low-power mode. When a sale is sensed, the unit checks the internal thermostat of the machine and turns on the refrigeration system if cooling is required. The remainder of the time, the machine cycles the refrigeration system based on a temperature sensor and built-in algorithm.

The unit has not yet been widely adopted, but is part of some ENERGY STAR retrofit kits. Typical savings are 25 to 35 percent according to USA Technologies, and the unit can be purchased in quantity for about $100.

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[4] http://www.usatech.com/energy_management/energy_vm.php

[5] Vending Machine Service Call Reduction Using the Vending Miser, Foster-Miller, Inc., 2/28/2002

[6] http://www.usatech.com/energy_management/energy_vm2iq.php

3. Literature Review

To develop a robust understanding of the vending machine regional and national market as well as to inform other elements of the market characterization study, the Quantec/Cadmus team conducted an extensive review of available vending industry literature.

Methodology

The Quantec/Cadmus team conducted a review of vending industry literature. The literature review provided an opportunity to discover the latest regional and national trends as well as review previous research into market characteristics in the Pacific Northwest and review prevalent existing energy-efficiency opportunities. The Quantec/Cadmus team also drew upon its experience working with the ENERGY STAR program at the national level to formulate the following findings.

Table 4 provides a list of the vending publications and academic or industry papers reviewed for this effort. In addition, the Quantec/Cadmus team drew upon its existing industry contacts to attempt to answer the study's overarching research questions.

Table 5. Selected Vending Industry Publications and Associations For Consultation

Association or Publication	Website URL
National Automated Merchandiser Ass. (NAMA)	www.vending.org
Vending Times	www.vendingtimes.com
Coin Op Today	http://www.coinoptoday.com/
Automated Merchandiser	http://www.amonline.com/
Vending & OCS	N/A
The Vending Yellow Pages	www.vendingconnection.com
BeverageOnline.com	www.beverageonline.com
Online Vending Forum	www.vendingtalk.com

Findings

Currently, relatively little information exists about the specific characteristics of the vending machine market for the Pacific Northwest. Our literature review determined the primary means of reducing energy use in vending machines in the Pacific Northwest (to date) are programs supporting installation of VendingMisers. Several utilities have or currently are offering rebates to support the technology. Another less common and less popular option is delamping machines with older, inefficient lighting.

The overwhelming majority of vending trade publications and other articles focused on new technologies and trends, such as cashless pay systems, remote inventory sensors, and vending healthier beverages rather than explicitly seeking energy efficiency. However, the following energy-related information is worth noting:

- In 2002, BPA launched an initiative with USA Technologies (then Bayview Technologies) to install VendingMisers on all 100,000 vending machines in the four-state region. As of late June 2002, 70 utilities in the four-state region had signed on to the VendingMiser Program, which offers VendingMisers to host sites, often free of charge.
- Idaho's previous governor put out an Executive Order calling for disabling lights in vending machines to conserve energy. Lighted panels on the front of soda machines were concluded to be unnecessary electricity use inside office buildings that are otherwise well lit.
- Avista Utilities in Spokane, Washington, currently offers a $90 rebate for the installation of vending machine controls on cold drink vending machines that dispense non-perishable drinks, provided the machines do not have pre-existing controls.
- The Eugene Water & Electric Board (EWEB) currently offers a $120 rebate on VendingMisers. A number of other utilities are providing similar rebates.[7]
- The Poudre School District in Fort Collins, Colorado, clustered vending machines on school building automation systems to take advantage of Fort Collins Utilities' time-of-use rates. They decided this was a better strategy than an energy control device such as the VendingMiser for two reasons: concerns about vandalism and removal of the devices, and because they did not experience expected savings due to low electricity costs.
- The National Renewable Energy Laboratory (NREL) conducted a study in June 2003 on energy savings for cold drink vending machines; energy savings were analyzed for load managing devices such as the VendingMiser compared to de-lamping machines. Their findings are as follows:
  - Typical illuminated front cold drink vending machines consumption: 7 to 11 kWh/day
  - Over half the energy consumed could be saved by using the load manager and removing the advertising lights.
  - Advertising lighting, especially in older machines, is very inefficient and should be disabled where appropriate or replaced with more efficient lighting.
- Site visits conducted as part of the evaluation of 2003 Energy Trust of Oregon program promoting VendingMisers determine that 32 percent of the program installed units were no longer in place and operational.

[7] http://www.usatech.com/energy_management/energy_rebates.php

4. Market Characterization

Based on the information detailed above, the Quantec/Cadmus team developed a broad overview of the vending machine market in the Pacific Northwest. Generally, the market closely follows national trends and is characterized by an aging, inefficient fleet of vending machines and a relatively modest inflow of new machines to the region.

Summary

Key characteristics of the current vending machine market in the Pacific Northwest can be summarized as follows:

- Approximately 120,000 vending machines currently reside in the Pacific Northwest.
- The majority of these machines are between 7 and 11 years old and, collectively, consume over 500 Million kWh annually.
- Annually, approximately 7,000 to 15,000 new machines are purchased in the Pacific Northwest.
- Coke and Pepsi bottlers own approximately 85 to 90 percent of refrigerated beverage machines.
- Most new machines currently purchased by Coke and Pepsi bottlers are at least ENERGY STAR Tier 1 compliant.
- Bottlers can generally track and locate their inventory very precisely and possess the ability to ensure a specific machine remains within a defined geographic area for its entire effective useful life.
- Glass-front vending machines are a rapidly growing portion of the marketplace. This is primarily driven by their ability to vend a wide-array of products.
- Vending machines are typically in the field between 10 to 15 years but often remain in operation significantly longer.

Market Profile

Number and Age of Machines

The number of vending machines is difficult to pinpoint with certainty in the Pacific Northwest. To increase the certainty of the study, two different approaches were employed. First, a broad "top-down" estimate was generated based on the national vending machine population and information from manufacturer or bottler interviews. Second, this "top-down" estimate was vetted against a "bottom-up" estimate constructed through interviews with host sites and bottlers.

The top-down estimate suggests approximately 120,000 refrigerated beverage machines currently reside in the Pacific Northwest (Washington, Oregon, Idaho, and Montana). The study also

determined the majority of regional machines were manufactured prior to 1999, with 80 percent of the machine stock purchased prior to the ENERGY STAR specification for vending machines. Bounty programs by Coca-Cola were catalysts for the "boom" in vending machine purchases in 1999. The bounty programs offered by Coca-Cola were an effort to quickly capture remaining market share from competitors. Since the current market for locating vending machines is considered relatively saturated by both manufacturers and bottlers, it is unlikely that similar bounty programs will be offered in the future. In fact, industry sales have steadily declined since 1999, with some manufacturers now doing a very small portion of the business (as low as 10 percent) that they were doing at that time.

When assessing the vending machine market it is critical to consider the various vintages of existing machines, as machines of differing ages present different challenges and opportunities for efficiency improvements. Indeed, some efficiency options, particularly those involving software or variable speed components, are only possible on more recent models. In addition, the distribution of machine vintages also provides insight into the timeline for refurbishment and unit retirement. For example, given that respondents claim the average machine remains in operational for approximately 10 – 15 years, units from the pre-1996 vintage will likely be removed from the market independently within the next five years. All of these factors, such as efficiency challenges and unit life, need to be considered collectively when evaluating programmatic options.

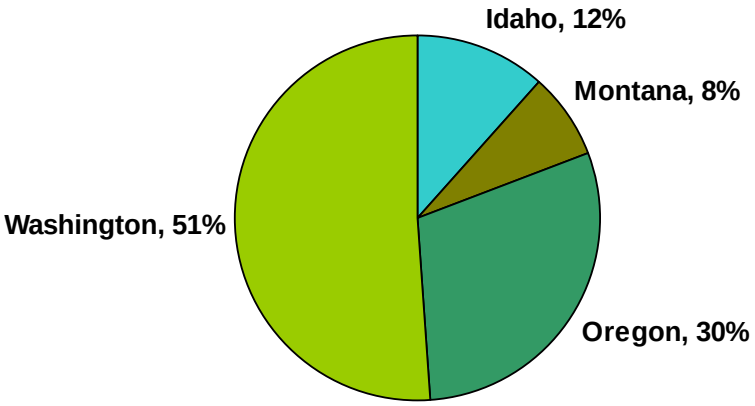
Table 6 provides the estimated distribution of vending machines in the Pacific Northwest by both state and vintage. Similar information regarding distributions by state and vintage are presented graphically in Figure 4 and Figure 5, respectively.

Table 6. Machine Population Estimate – by Age and State

State	Pre-1996	1996-1999	2000-2003	2004-Present	Total
Idaho	1,216	6,655	4,511	1,600	13,982
Montana	796	4,357	2,954	1,047	9,154
Oregon	3,098	16,956	11,494	4,076	35,623
Washington	5,349	29,281	19,849	7,039	61,518
Total	10,459	57,249	38,808	13,762	120,277

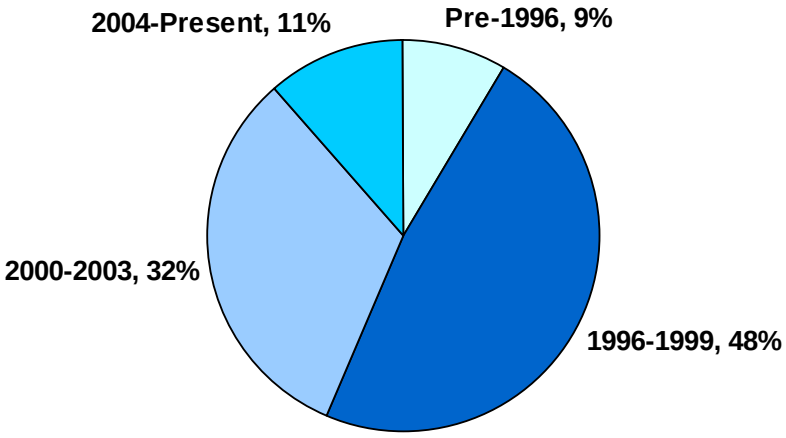
As shown in Figure 4, Oregon and Washington constitute approximately 80 percent of the total machine population, with Montana and Idaho hosting a relatively modest number of machines. As verified by numerous industry contacts, the number of units generally reflects state, region and city population.

Figure 4. Pacific Northwest Vending Machine Population by State



As noted above, only slightly more than 10 percent of the region's machines have been purchased since the inception of the ENEGY STAR standards.

Figure 5. Pacific Northwest Vending Machine Population by Equipment Age



Awareness of ENERGY STAR or Other Efficiency Measures

The overall awareness of ENERGY STAR qualified vending equipment was very low, especially among bottlers and host sites. Many of these bottlers indicated they expected the machine manufacturers to take responsibility for energy efficiency. For larger organizations (e.g., Pepsi Bottling Group and Swire Coca-Cola), awareness of ENERGY STAR was much higher, and obtaining ENERGY STAR qualified equipment was viewed as a desirable goal.

Perhaps due to recent utility programs supporting the technology, awareness of the VendingMiser product was higher than ENERGY STAR, with some bottlers confusing the two. Reactions to the technology were mixed, with many bottlers expressing concerns that the VendingMiser shortened

compressor life and or failed to remain in place and operational when bottlers had participated in previous programs.

Although awareness of onboard software controls for energy efficiency was high, the study revealed these settings are almost never utilized due to their complexity, lack of host site requests, and concerns that, if implemented, the host site would want repeated changes to the programming. The only host site type where the programming features were commonly employed was in school districts, where restrictions on time-of-day vending required use of the features.

5. Opportunities for Energy Efficiency

Given the estimate of 120,000 vending machines currently located throughout the Pacific Northwest collectively using approximately 400 Million kWh per year, even a program generating modest per-machine savings could yield considerable energy conservation benefits. For example, saving even 10 percent of this energy would be roughly equivalent to turning off the lights at 2,400 Pacific Northwest homes.

Building upon findings presented in the previous section, the Quantec/Cadmus team researched the range of possible energy-efficiency options available for each vintage. Once identified, each option's feasibility, potential savings, implementation costs, and possible barriers were determined. This information is summarized from Table 7 through

Table 10. Table 11 summarizes similar information, only organized by efficiency option rather than machine vintage.

In addition to the tables, information about specific emerging technologies (not currently perceived as valid options, but potential alternatives in the future) and high-level programmatic recommendations are provided below.

Finally, while several programs encouraging the adoption of VendingMiser technology have been active in the Pacific Northwest in recent years – most notably the 2002 Bonneville Power Administration program – the Quantec/Cadmus team do not believe the programs have significantly altered the natural state of the vending market. Although some VendingMisers are undoubtedly active and saving energy in the region, comments by both manufacturers and bottlers as well as the results of a regional VendingMiser evaluation lead the team to believe their role in the market to date is minimal and should not significantly impact the strategy or effectiveness of potential vending machine efficiency programs.

Table 7. Efficiency Options for Vintage Pre-1996 (n~10,000 units, 9% of the total market)

Efficiency Option	Option Feasibility	Per-Unit Savings	Unit Lifetime Savings	Per-Unit Implementation Cost	Targeted Market Actor	Major Market Barriers	Other Considerations
T8 Lighting Kit	Low	385	1,155	$100	Bottler/Refurbisher	Reluctance to invest in old equipment Not field installable	Compliment to SSC fan motors, thermostat control
SSC Evaporator Fan Motor	Low	193	579	$65	Bottler/Refurbisher	Reluctance to invest in old equipment Installation requires qualified field staff	Field installable
VendingMiser	Medium	1050	3,150	$150	Host Site/Bottler	Potential bottler resistance Subject to loss/theft/vandalism	Could be moved to a different machine; Field installable
Thermostatic Control	Low	1225	3,675	$150	Bottler/Refurbisher	Reluctance to invest in old equipment Installation requires qualified field staff	Field installable Difficult to field-verify
ENERGY STAR Refurbishment	Not Available-No component kits have been developed for this vintage of machine and the short remaining life of this equipment makes it unlikely that kits will be developed for pre-1996 equipment						
Energy Savings Software	Not Available-Pre 1996 machines are electro-mechanical and do not include the necessary components to activate low power modes						
De-lamping	High	990	2,970	$13	Bottler	Bottler fear of lost sales	Soda purchasers generally captive audience
Early Replacement	Medium	1,700	25,500	$2,000	Bottler	Significant expense of new equipment	High potential for free ridership

Table 8. Efficiency Options for Vintage 1996-1999 (n~57,000 units, 48% of the total market)

Efficiency Option	Option Feasibility	Per-Unit Savings	Unit Lifetime Savings	Per-Unit Implementation Cost	Targeted Market Actor	Major Market Barriers	Other Considerations
T8 Lighting Kit	Medium	385	2,310	$100	Bottler/Refurbisher	Not field installable	Compliment to SSC fan motors, thermostat control
SSC Evaporator Fan Motor	Medium	193	1,158	$65	Bottler/Refurbisher	Trained field staff	Field installable
VendingMiser	Medium	1050	6,300	$150	Host Site/Bottler	Potential bottler resistance Subject to loss/theft/vandalism	Could be moved to a different machine; Field installable
Thermostatic Control	Medium	1225	7,350	$150	Bottler/Refurbisher	Trained field staff	Field installable Difficult to field-verify
ENERGY STAR Refurbishment	Not Available-With Tier 2 Energy Star in effect, the vast majority of older machines cannot be refurbished to meet the more stringent requirements						
Energy Savings Software	Not Available-Pre 1996 machines are electro-mechanical and do not include the necessary components to activate low power modes						
De-lamping	Low	990	5940	$13	Bottler	Bottler fear of lost sales	
Early Replacement	Low	1,700	25,500	$2,000	Bottler	Significant expense of new equipment Bottler unlikely to replace reliable equipment	High potential for free ridership

Table 9. Efficiency Options for Vintage 2000-2003 (n~39,000 units, 32% of the total market)

Efficiency Option	Option Feasibility	Per-Unit Savings	Unit Lifetime Savings	Per-Unit Implementation Cost	Targeted Market Actor	Major Market Barriers	Other Considerations
T8 Lighting Kit	Medium	385	3,850	$100	Bottler/Refurbisher	Not field installable	Compliment to SSC fan motors, thermostat control
SSC Evaporator Fan Motor	High	193	1,930	$65	Bottler/Refurbisher	Trained field staff	Field installable
VendingMiser	Medium	1,050	10,500	$150	Host Site/Bottler	Potential bottler resistance Subject to loss/theft/vandalism	Could be moved to a different machine; Field installable
Thermostatic Control	High	1,225	12,250	$150	Bottler/Refurbisher	Trained field staff	Field installable Difficult to field-verify
ENERGY STAR Refurbishment	Not Available-With Tier 2 Energy Star in effect, the vast majority of older machines cannot be refurbished to meet the more stringent requirements						
Energy Savings Software	Medium	700	7,000	$13	Bottler	Lack of awareness	Difficult to field-verify
De-lamping	Low	990	9,900	$13	Bottler	Bottler fear of lost sales	
Early Replacement	Low	1,700	25,500	$2,000	Bottler	Significant expense of new equipment Bottler unlikely to replace reliable equipment	

Table 10. Efficiency Options for Vintage 2004-present (n~14,000 units, 11% of the total market)

Efficiency Option	Option Feasibility	Per-Unit Savings	Unit Lifetime Savings	Per-Unit Implementation Cost	Targeted Market Actor	Major Market Barriers	Other Considerations
T8 Lighting Kit	Low	385	5,390	$100	Bottler/Refurbisher	Few applicable units	
SSC Evaporator Fan Motor	Low	193	2,702	$65	Bottler/Refurbisher	Few applicable units	
VendingMiser	Medium	1,050	14,700	$150	Host Site/Bottler	Potential bottler resistance Subject to loss/theft/vandalism	Could be moved to a different machine; Field installable
Thermostatic Control	Low	1,225	17,150	$150	Bottler/Refurbisher	Few applicable units	
ENERGY STAR Refurbishment	Low	550	7,700	150	Bottler/Refurbisher	Few applicable units	Only 1 kit available, using USA Technologies' VM2iQ product
Energy Savings Software	High	700	9,800	$13	Bottler	Lack of awareness	
De-lamping	Low	600	8,400	$13	Bottler	Bottler fear of lost sales	Machines placed in visible areas
Early Replacement	Low	500	7,500	$2,000	Bottler	Significant expense of new equipment, Bottler unlikely to replace reliable equipment	

Table 11. Efficiency Options by Measure/Component

Efficiency Option	Vintage Affected	Machines Affected	Estimated Annual Per-Unit Saving	Estimated Per-Unit Implementation Cost	Targeted Market Actor	Major Market Barriers
T8 Lighting Kit	<2002	96,000	385	$50-$100	Bottler/Refurbisher	Not field installable in most cases
SSC Evaporator Fan Motor	<2004	106,000	193	$30-$65	Bottler/Refurbisher	May be difficult to field install in some machines
VendingMiser	All	120,000	1,050	$150	Host Site	Poor persistence and acceptance by bottlers
Thermostatic Control	<2004	106,000	1,225	$50-$150	Bottler/Refurbisher	Expensive and bottlers' skepticism
ENERGY STAR Refurbishment	2000-2003	38,000	1,996	$200-$600	Bottler/Refurbisher	Difficult to get older machines to reach Tier 2. Major component retrofits (e.g., compressor, etc.) may be infeasible
Energy Savings Software	2000 - present	52,000	700	$13	Bottler/Operator	Complicated to set
De-lamping	All	120,000	990	$13	Bottler/Operator	Potential impact on sales
Early Replacement	1996-1999	56,000	1,700	$2,000	Bottler/Operator	Likely to impact older machines, with potential for free ridership

Data and Assumptions:

T8 Lighting Kit - Conversion kit for converting from T12 lamp/ballast to T8. Savings estimated provided by USA Technologies (regarding a DN600E conversion from 135 (T12) to 91 (T8) Watts). Cost based on $40-$60 and $75-$100 estimates provided by Royal Vendors and USA Technologies, respectively.

SSC Fan Motor – Assumes most machines have two evaporator fans, generally using shaded pole motors. Estimated savings per motor: 22W at 100% duty cycle. Cost estimates of $30 and $65 provided by USA Technologies and Royal Vendors, respectively.

VendingMiser - Assumes 30% energy savings for a typical vending machine using 3,500 kWh/yr. Costs provided by USA Technologies.

Thermostatic Control – Assumes 35% energy savings for a typical vending machine using 3,500 kWh/yr. Cost estimates of $50 provided by Dixie-Narco and to $150 (approx. single purchase price of VM2iQ).

ENERGY STAR Refurbishment - Based on combination of T8 kit, 2 SSC fan motors, and thermostat control device – the minimum kit likely to get machines to Tier 2 ENERGY STAR that are not already Tier 1

Energy Saving Software – Assumes 20% savings for using moderate lighting/cold control setbacks on a 3,500 kWh/yr machine and 1/2 hour of implementation time at $25/hour to program machine.

De-lamping – Average savings between T12 (135W) and T8 (91W) lighting systems. Also assumes 1/2 hour of implementation time at $25/hour to remove lighting.

Emerging Technologies

In addition to the efficiency options detailed in the tables above, several new efficiency technologies are emerging. While these technologies are not currently valid options (reasons detailed below), it is important that the RTF monitors their development and considers possible incorporation into any future programs targeting the vending market.

LED Lighting

LED lighting has long been seen as an up and coming alternative to fluorescent lighting in vending machines. As the efficacy of these products continues to improve, and the costs drop, LEDs may gain greater market share for vendor lighting kits. Currently, there are units available but their cost continues to be somewhat higher than equivalent T-8 kits, for only modest additional energy savings.

Onboard Energy Management Systems

Some companies are developing proprietary onboard controllers that connect directly to the control board of the machine, allowing the unit to automatically control the onboard lighting and refrigeration software of the machine. This could effectively remove the need for bottlers to manually program these energy saving features on machines and result in significant energy savings.

Night Light Mode

Night light mode is a programming option for some vending machines that only partially turns off lighting based on lulls in usage, as monitored by onboard software. This feature can be shipped enabled from the manufacturer and functions automatically, without involvement from the bottler/operator.

Programmatic Recommendations

Based on the findings of the study, several program vehicles could be used to address the aforementioned energy-saving opportunities. Each recommendation merits significant further investigation, and also represents the first step towards developing a successful vending machine efficiency program given the existing market in the Pacific Northwest.

Rebates or Incentives on Component Upgrades

The primary market barrier to any of the measures in Table 7-11 is the incremental cost of higher-efficiency components and/or the labor required to program or de-lamp machines. In nearly every interview, bottlers indicated they would take advantage of rebates to purchase more efficient equipment if the incremental cost and administrative barriers could be minimized**.**

Based on the information in Tables 7-11, several measures emerge as particularly promising:

- De-lamping for pre-1996 vintage machines
- Thermostatic controls for 1996-1999 machines
- Fan motors and thermostatic controls for 2000-2003 machines
- Software controls for 2004-present machines

All of these best measures are field installable by bottler staff, allowing access to the greatest possible number of machines. For those undergoing offsite refurbishment, lighting kits may also be added. Table 12 summarizes the cost effectiveness of potential rebates for the various component/measure replacements presented above.

Table 12. Potential Incentive Levels and Cost Effectiveness of Vending Machine Component/Measure Options

Measure	3 Year Energy Savings (kWh)	Potential Incentive ($)	Cost Effectiveness ($/kWh)
T8 Lighting Kit	1,155	$50	$0.04
SSC Evaporator Fan Motor	579	$25	$0.04
VendingMiser	3,150	$75	$0.02
Thermostatic Control	3,675	$75	$0.02
Energy Savings Software	2,100	$25	$0.01
De-lamping	2,970	$25	$0.01

Rebates or Incentives on New Equipment – Early retirement

Based on discussions with manufacturers, the entire stock of new vending machines will meet ENERGY STAR Tier 2 criteria as of the end of 2008. With this in mind, there is little reason to provide financial incentives for new machine purchases unless that incentive is tied to the simultaneous retirement of an older machine. There are nearly 50 ENERGY STAR Tier 2 machine models available today, and more being added to the ENERGY STAR qualified product list each month.

Early retirement programs, if implemented could face difficulty in avoiding free ridership among owners of pre 1996 machines. Conversely, owners of newer machines would be unlikely to dispose of working equipment without a substantial financial incentive, making the cost effectiveness of a early retirement program questionable.

Rebates for Aftermarket Control Devices (VendingMiser)

Based on bottler concerns regarding component life and other issues, combined with mixed results from past regional initiatives, a program to support the Vending Miser should be approached carefully. Working directly with bottlers may minimize some of the attrition seen in past programs.

However, Vending Miser can still be an effective means of reducing vending machine energy consumption and it continues to be supported by numerous programs nationwide.

Remaining Questions and Next Steps

Based on our findings, additional questions remain regarding specific program implementation that were not directly answered as part of this Market Characterization. These, and other, key questions (several specific questions posed by the RTF during the revision process are provided in Appendix D) will help to develop a robust and effective program to improve the efficiency of the vending machine fleet.

- What barriers exist to bottlers/refurbishers obtaining a steady, sufficient supply of high efficiency components?
- Do bottlers have sufficient staff with the required expertise to implement large scale field installations of high efficiency components, such as SSC fan motors or thermostatic controls?
- Would bottlers be willing to accelerate the refurbishment cycle to take advantage of an incentive on a more efficient component?
- What would be the most effective method of raising interest and awareness of program offerings among bottlers?
- What incentive levels are needed, and what program structure would support, an effective early retirement program?

Appendix A: Manufacturer Interview Guide

Regional Technical Forum's Vending Machine Market Characterization Study

Hello, my name is _____, and I am calling on behalf of the Regional Technical Forum. The Regional Technical Forum is an advisory committee established by the Northwest Power Planning Council. We are currently studying the Pacific Northwest's vending machine market to better understand how decisions regarding unit replacement, retrofitting, and energy efficiency in general are made.

We are conducting similar interviews with other regional manufacturers, as well as other market actors such as regional distributors, bottlers, and refurbishers. All of the information gathered for the study is completely confidential and will only be reported in aggregate. We value your opinion on these matters and would greatly appreciate any time you have to speak with us. Do you have a few minutes to talk about these issues?

Interviewee Name: _____

Company: _____

Position: _____

Interviewer Name: _____

Date: _____

Role in Market

1. Would you describe the market for vending machines as localized (Portland, Seattle, etc.) or regional (Pacific Northwest)?

_____

2. How many new vending machines does your company sell annually in the Pacific Northwest?

_____

3. How many types of vending machine models do you sell in the region?

_____

4. Generally, how are the total number of vending machines sold in the Pacific Northwest distributed by model type?

_____

_____

5. Has either the total number of units sold in the region or the distribution of units by model type changed significantly over the past:

- 5 years? _____
- 10 years? _____
- 15 years?_____

6. **[IF YES]** What do you believe was the cause of this change? Was this a part of a nationwide change or a regional shift?

_____

_____

7. What are the price ranges of new vending machines sold (with regard to features/styles) in the Pacific Northwest? What percentage of your total sales is in each price range?

_____

8. How do you track the vending machines you manufacture through the marketplace?

_____

_____

9. Does any of the information you provided above vary significantly within the Pacific Northwest (by state, urban/rural, etc.)?

_____

_____

Energy Efficiency

10. What are the current manufacturing standards for energy efficiency?

_____

_____

11. Have these standards changed significantly in the past:
- 5 years? _____
- 10 years? _____
- 15 years?_____

12. **[IF YES]** What do you believe was the cause of this change? Was this a part of a nation-wide change or a regional shift?

_____

_____

13. Who in the market makes or influences decisions regarding the energy efficiency of machines?

_____

_____

14. What barriers and opportunities exist for the expansion of energy-efficient machines?

._____

_____

15. What portion of vending machines shipped to the Pacific Northwest currently meet:
- ENERGY STAR® Tier 1 criteria? _____
- ENERGY STAR Tier 2 criteria? _____

16. Does this vary significantly from the nation overall or by state within the region?

_____

_____

17. What are some specific differences between an ENERGY STAR (Tier 1 and 2) machine and a non-qualifying model?

18. For a typical new machine, what is the approximate breakdown of energy consumption by major component (e.g. lighting, compressor, evaporator fan, vend motor)?

19. Further, what components have been identified as possessing the greatest potential to cost-effectively reduce energy consumption?

20. Do you foresee any new technologies on the horizon (five years) that will help to reduce the energy use of vending machines? If so, what are they, and are you likely to implement them?

21. Do you foresee any trends in machine design or product storage impacting energy use? (examples - DESIGN: glass front or refrigerant regulations, STORAGE: milk that needs to be kept at constant temperature)?

22. Do you provide your customers with any training about the energy-saving software features of new machines (i.e., storage mode and lighting timers)?

Refurbishment/Replacement

23. How often is a typical vending machine refurbished (assuming no vandalism or other exceptionally harsh conditions) during its life?

24. Given the reality of vandalism and harsh conditions, how often is a typical vending machine refurbished during its life?

25. Who specifically makes the decision to replace or refurbish a machine?

26. How is the decision between replacement and refurbishment made?

27. Do various levels of refurbishment exist (maintenance vs. upgrade)? If so, how is this decision made?

28. **[IF YES]** What proportion of refurbishments are intended to upgrade vs. maintenance? Why do you believe this is?

29. To the best of your knowledge, are specific energy-efficiency options available when refurbishing machines (e.g., lighting and/or compressor upgrade)?

Market Factors

30. What are the most important selling features for most of your customers?

31. What influences the value equation of machine purchasers, and how does this affect purchasing practices for efficient vending machines?

32. What is the design life of a typical new vending machine sold today in the Pacific Northwest? How long is typical machine life as observed in the field?

33. How are machine fleets allocated among host sites, and who makes placement decisions?

Identifying Other Critical Market Actors

34. What bottlers and distributors do you typically work with? What percentage of your overall sales do these bottlers and distributors constitute?

35. As we mentioned at the outset, we are trying to speak with numerous influential regional market actors in the Pacific Northwest to better understand the vending machine market and its current energy efficiency practices. Is there anyone—manufacturer, bottler, distributor, or even host site—that you feel we should attempt to speak with?

Thank you for taking the time to answer these questions for me today. Your opinion is valued and appreciated.

Appendix B: Bottler Interview Guide

Regional Technical Forum's Vending Machine Market Characterization Study

Hello, my name is _____, and I am calling on behalf of the Regional Technical Forum. The Regional Technical Forum is an advisory committee established by the Northwest Power Planning Council. We are currently studying the Pacific Northwest's vending machine market to better understand how decisions regarding unit replacement, retrofitting, and energy efficiency in general are made.

We are conducting similar interviews with other regional bottlers, as well as other market actors such as regional manufacturers, distributors, and refurbishers. All of the information gathered for the study is completely confidential and will only be reported in aggregate. We value your opinion on these matters and would greatly appreciate any time you have to speak with us. Do you have a few minutes to talk about these issues?

Interviewee Name:_____

Company:_____

Position: _____

Interviewer Name: _____

Date: _____

Role in Market

1. Approximately how many vending machines do you own in the Pacific Northwest?

_____

2. How many vending machines, that you own, are placed in the field vs. located in warehouse and refurbishment facilities? (What portion of your fleet is placed at host sites at a given time, on average?

_____

_____

3. What is the geographical extent of your service territory?

_____

_____

4. Do you fill and/or service your own machines or do you rely on third-party vending operators to perform this service?

_____

_____

5. How many types of vending machine models do you own in the region?

_____

6. Generally, how are the total number of vending machines owned in the Pacific Northwest distributed by model type?

_____

_____

7. Has either the total number of units owned in the region or the distribution of units by model type changed significantly over the past:

- 5 years? _____
- 10 years? _____
- 15 years? _____

8. **[IF YES]** What do you believe was the cause of this change? Was this a part of a nation-wide change or a regional shift?

_____

_____

9. How many new vending machines do you purchase every year for sites in the Pacific Northwest?

10. Which manufacturers do you purchase from? What percentage of your total purchases does each manufacturer represent?

11. How do you decide which vending machines will be placed at a particular location? Are there any rules of thumb governing the decision to allocate new vs. used equipment to particular site types?

12. When placing vending machines, how do you determine how many machines will be placed for a particular location? Again, are there rules of thumb that you use to determine the number of vending machines placed at various location types (schools, colleges, factories, jails, offices, etc.)?

13. How do you track the vending machines you own through the marketplace?

14. Do you have the ability to keep a particular vending machine, or vending machine model, within a certain region (e.g., the Pacific Northwest)? If so, how might you accomplish this?

Energy Efficiency

15. Do you have any purchasing preference for ENERGY STAR® or other energy-efficient vending machines? If so, why?

16. What portion of your fleet meets ENERGY STAR (Tier 1 and 2) criteria?

17. What barriers and opportunities exist for the expansion of energy efficient machines?

18. Do you believe there is a competitive advantage from owning/offering energy-efficient equipment?

19. **[IF YES]** Would you be willing to pay an additional cost for a vending machine that is energy efficient? If so, how much?

20. Are you aware of the on-board software features in most new machines that allow you to turn off the lights and refrigeration based on time of day? If so, do you make use of these features? (Why/why not?)

21. If you received a rebate for the purchase of a higher efficiency vending machines, would you take advantage of it – even if it required a little bit of extra paperwork to receive the rebates and order the correct equipment?

22. If you were purchasing and placing energy efficient vending machines, would you be interested in taking part in case studies or other publicity/outreach activities?

Refurbishment/Replacement

23. How often is a typical vending machine refurbished (assuming no vandalism or other exceptionally harsh conditions) during its life?

24. Given the reality of vandalism and harsh conditions, how often is a typical vending machine refurbished during its life?

25. Who specifically makes the decision to replace or refurbish a machine?

26. How is the decision between replacement and refurbishment made?

27. In your best estimation, what percentage of your units are refurbished each year?

28. Do various levels of refurbishment exist (maintenance vs. upgrade)? If so, how is this decision made? What specifically is done during the various refurbishment levels?

29. Where do you send your machines to be refurbished?

30. When you do decide to dispose of a machine, where and how do you dispose of it?

31. Does a vending machine have any value to you at the end of its life? If so, how much and how is that value realized?

32. How do you value your vending machines as assets? How do you depreciate them over time?

Market Factors

33. How long will a typical vending machine last in the Pacific Northwest? What factors affect that lifetime?

34. Do any specific unit features, such as occupancy sensor options, have any impact on sales? If so, what is the impact?

Identifying Other Critical Market Actors

35. Who are the largest vending operators you work with?

36. What are some example host sites you service?

37. As we mentioned at the outset, we are trying to speak with numerous influential regional market actors in the Pacific Northwest to better understand the vending machine market and its current energy-efficiency practices. Is there anyone—manufacturer, bottler, distributor, or even host site—that you feel we should attempt to speak with?

Thank you for taking the time to answer these questions for me today. Your opinion is valued and appreciated.

Appendix C: Host Site Interview Guide

RFT's Vending Machine Market Characterization Study

Hello, my name is _____, and I am calling on behalf of the Regional Technical Forum. The Regional Technical Forum is an advisory committee established by the Northwest Power Planning Council. We are currently studying the Pacific Northwest's vending machine market to better understand how decisions regarding unit replacement, retrofitting, and energy efficiency in general are made.

We are conducting similar interviews with other business operators, vending machine manufacturers, regional bottlers, distributors, and refurbishers. All of the information gathered for the study is completely confidential and will only be reported in aggregate. We value your opinion on these matters and would greatly appreciate any time you have to speak with us. Do you have a few minutes to talk about these issues?

Interviewee Name: _____

Company: _____

Position: _____

Role in Market

1. How many refrigerated beverage (soda) vending machines do you have at your location?

_____

2. Do you know what types of vending machine(s) you have on the premise? [If not, roughly how old are they or are they glass fronts or can machines?]

   BRAND: _____

   MODEL TYPE: _____

   VENDING PRODUCTS: _____

3. Who services and provides your machines and how long have they been doing it?

_____

4. Who is involved in the decision making process for selecting a vending operator?

_____

5. Have your machines ever been replaced or refurbished and, if so, who made the decision to do so?

Energy Efficiency

6. Is energy efficiency something you considered when putting out a request for bids? Have you ever discussed energy costs or efficiency with your current operator?

7. Are you aware of ENERGY STAR® ratings for vending machines and, if so, are your machines ENERGY STAR?

8. Have you ever had VendingMisers on your machines? If so, how did they perform and are they still on the machines?

9. Have you ever discussed the type or age of the machine that would be located at your facility with your current operator?

10. Are you aware of the on-board software features in most new machines that allow you to turn off the lights and put the refrigeration system in a low power mode based on time of day? If so, do you make use of these features? (Why/why not?)

11. Would you be open to paying slightly more for soda in exchange for more energy efficient vending machines?

12. What do you think about a total cost approach to bidding, in which energy costs for vending machines were taken into consideration ($300/year on average), and a lower commission was substituted for more efficient machines that saved you more money than the commission reduction you were taking?

Appendix D: Comments on Draft Report

The following email exchange between members of the RTF Vending Machine Committee took place while reviewing the draft version of this report. While the questions raised in the emails are important and valid, many fall outside the scope of this study (which was market characterization, not program design/implementation). This was confirmed by Charlie Grist, the RTF's primary contact for the study.

As a result, some of the issues raised in the emails are not addressed in the body of the report. However, the Quantec/Cadmus team believes it is important to catalog the remaining questions as they can guide future research on how to effectively apply the lessons of this study.

From Tim Scanlon (Bonneville Power Association) on 6/27/07

> 'Charlie;
>
> I am hoping the final version of the study will provide us with some practical insights on the viability of a refurbishing program, or other program options.
>
> While there is a lot of interesting, anecdotal information contained in the report, I think there needs to be more synthesis and explanation of these findings (including the expansion of the information grid at the end of of the report).
>
> It would be helpful if the final report could identify what are the most promising program options, and provide specific recommendations for how they might be implemented.
>
> In particular, I hope the final report will specifically address the refurbishing option in much greater detail. Without more explanation, I am concerned that some of the initial findings could be taken out of context or lead to the wrong conclusions.
>
> For example:
>
> 1) From the interviews with bottlers, there appears to be no systematic approach to refurbishing and no standard refurbishing (or maintenance) cycle. Looks like decision to refurbish is driven primarily by equipment failure ?
>
> 2) Only a subset of the existing stock of vending machines are capable of being upgraded to the Tier 2 level.?

3) Bottlers apparently don't seem to like Vending Miser, or anything that requires "programming" (as would be the case for the Tier 2 upgrade pkg).

Without more exploration it is not clear whether these findings are merely obstacles or real constraints on the refurbishing option.'

From Spencer Moersfedler (Energy Trust of Oregon) on 6/25/07

It would be really nice to get more background on how we might actually implement a refurb program.

- Who would actually do the refurbs? I talked with Phil and our impression is that the bottlers are willing to use their techs to refurb machines if we help pay for the cost. However, it is not clear if it's the bottlers doing the refurbs or they are using contractor to do it for them. If there is a contractor being used it will be good to know this and they should be interviewed. In addition, it will be good to know if the bottlers will be willing to accelerate the refurb rate in an effort to help us penetrate the market quickly.
- Has anyone looked at the cost-effectiveness of each of the efficiency options in Table 6 including tech time and other expenses (e.g. transportation)? Are these included in the implementation costs in Table 6? If so quotes like $200-$600 are a little loose for moving forward.
- How will the payment structure work? Can the bottlers or refurb contractors bill by the job with a fixed rate for each refurb option in Table 6?
- What can we actually expect to get out of a refurb? Are the refurb techs sophisticated enough to adjust the controls schemes or is it safer to just retrofit parts?
- If we are going to contact the bottlers lets make sure that we make them aware of how to implement efficiency options in their production lines and facilities.
- What about solar options in outdoor vending machines?