



MERCURY THERMOSTAT RECYCLING FINAL REPORT ON EFFECT OF FINANCIAL INCENTIVE FOR HVAC CONTRACTORS IN TWO-STATE PILOT November 12, 2007

Introduction

In 2004, the Product Stewardship Institute (PSI) issued a report entitled, *Thermostat Stewardship Initiative – Background Research Summary*, which identified a lack of motivation as one of the central problems for why heating and cooling contractors did not recycle mercury thermostats through the Thermostat Recycling Corporation (TRC) take-back program. The other two issues were a lack of awareness of the problem and a lack of convenient locations to bring their thermostats.

During two PSI-facilitated multi-stakeholder dialogue meetings in 2004, all participants agreed with the need to test the degree to which a financial incentive would increase the rate of thermostat recycling by contractors. In 2006, PSI began to coordinate a pilot project in Indiana and Oregon, testing the effect of a financial incentive provided to heating, ventilation, and air conditioning (HVAC) contractors on the number of mercury thermostats collected and recycled through an industry take-back program. This pilot is one of several mercury thermostat related projects facilitated by PSI over the past four years that are the result of multi-stakeholder collaboration. A description of the other projects is available on the PSI website at: <http://www.productstewardship.us/ThermostatProjects>.

Participants who helped design and implement this incentive pilot included state environmental officials from Oregon and Indiana, thermostat manufacturers, an electric utility, HVAC contractors, and TRC, which administers the industry take-back program. A complete list of the principal stakeholders is provided as Appendix A to this report. A joint PSI/TRC press release announcing the pilot project was issued on January 23, 2006. This document reports on the culmination of the pilot project, and is a follow up to the January 19, 2006, Final Report to the Oregon Department of Environmental Quality, entitled, “Mercury Thermostat Product Stewardship HVAC Contractor Incentive Pilots: Phase I – Project Design.”¹

¹ The press release announcing the pilot project and the Final Report to the OR DEQ are available at: www.productstewardship.us/ThermostatIncentivePilot.

Funding for this project came from a variety of sources. The Oregon Department of Environmental Quality (OR DEQ) contributed \$10,000 for project design. The U.S. Environmental Protection Agency (U.S. EPA) contributed \$50,000 for the implementation and evaluation of the pilot. Portland General Electric provided the financial incentive in Oregon, and two thermostat manufacturers (Honeywell and White-Rodgers) provided the financial incentive in Indiana. Other participants, particularly the OR DEQ, the Indiana Department of Environmental Management (IDEM), TRC, and Honeywell contributed considerable staff time preparing materials used in the pilot, conducting education and outreach related to the pilot, and collecting performance data.

PSI facilitated conference calls with the multi-stakeholder group over a two-year period to design, implement, and evaluate this pilot project. This report is a culmination of that effort. PSI developed a draft Preliminary Final Report on May 20, 2007, and held a multi-stakeholder conference call on June 11 to receive feedback. (Those who participated on the call are listed in Appendix B.) PSI revised the report and issued a second draft Final Report on October 8 and held a second multi-stakeholder conference call on November 1 to receive feedback on the new draft. (Those who participated on that call are also listed in Appendix B.)

On the November 1 call, almost all comments pertained to the Conclusions and Future Potential Research sections. At the end of the call, there was a general consensus on the full text of the report, including the Conclusions and Future Potential Research sections. PSI edited the Conclusions and Future Potential Research sections and distributed the Final Report for final editorial comments. Two days following the deadline for receiving comments, PSI received significant comments from TRC that requested a re-write of multiple sections throughout the report. Incorporating TRC's comments would not have allowed other participants the opportunity to discuss them. Therefore, this report represents a consensus of all stakeholders except TRC and its member companies.

The TRC Thermostat Take-Back Program

The three largest mercury thermostat manufacturers – Honeywell, General Electric, and White Rodgers – established the non-profit entity TRC in 1998. (A fourth manufacturer, Nordyne, joined TRC in 2007.)² Under the program as originally conceived, thermostat wholesalers voluntarily enroll to receive a TRC-supplied container for thermostat collection. HVAC contractors are then encouraged to drop off mercury thermostats at participating wholesaler locations when they purchase new thermostats or other supplies.³ When the

² The TRC program was preceded by a take-back program that Honeywell had established in Minnesota after the State Legislature enacted legislation in 1992 prohibiting the disposal of mercury thermostats, assigning responsibility for compliance to contractors removing thermostats from households, and requiring manufacturers to provide education and incentives to encourage recycling. Honeywell established several take-back programs to serve a variety of customers, including contractors, homeowners, businesses with maintenance staff, and household hazardous waste (HHW) collection centers. The Honeywell wholesaler-based reverse distribution system for contractors was initiated in 1993; a homeowner mail-back program began in 1994; and collections from HHW centers began in 1995. All Honeywell programs ended at the time that the TRC program began.

³ TRC targeted HVAC contractors and wholesalers at program inception since they are involved in approximately 75% of thermostat sales. Homeowners/do-it-yourselfers account for about 25% of thermostat sales.

collection container is full, the wholesaler ships it, at TRC expense, to a Honeywell facility in Minnesota, where the thermostat is dismantled and the mercury switch is sent to a commercial mercury recovery facility. TRC lists participating wholesalers on a website database (<http://www.nema.org/gov/ehs/trc/>) and provides a replacement collection box to the wholesaler after receipt of the shipped container. The out-of-pocket cost for the participating wholesaler is limited to a one-time charge for the initial collection box (\$15 until 2007, now \$25).

The program began in nine states at its inception in 1998, expanded to an additional 13 states in 2000, and became a national program (excluding Alaska and Hawaii) in 2001. The number of thermostats and the amount of mercury collected and recycled annually has increased over time as the program expanded and became better known. From 2001-2006, the number of thermostats collected nationally each year increased from 31,611 to 113,658. From its inception through the end of 2006, TRC collected almost 560,000 thermostats and recycled over 5,000 pounds of mercury. At the end of 2006, approximately 1,400 wholesaler locations were participating in the TRC program across the lower 48 states.⁴

In 2006, in accordance with the multi-stakeholder agreement facilitated by PSI, TRC expanded the original program to include large HVAC contracting companies (with seven or more service technicians) and certain contractors in rural locations. These locations were allowed to obtain their own TRC collection bin in an attempt to improve program convenience for some contractors. As of the end of 2006, 225 HVAC contractors had obtained their own collection bins. In 2007, TRC announced it would further expand the program to include HHW facilities. This expansion was based on a successful pilot project facilitated by PSI and including TRC and government officials in five states. In November 2007, PSI will initiate a pilot project with local retailers to further enhance collection efforts.

TRC Program Performance

While the TRC program results reflect positive momentum, all stakeholders agreed at the outset of this pilot project that there was room for significant improvement. The 1,400 participating wholesalers likely represent about 20 percent of wholesaler locations in the country, based on industry estimates of approximately 7,000 locations nationally. Surveys conducted by several states indicated a low contractor participation rate as well, due to a lack of awareness of the TRC program and environmental impacts from improper disposal of mercury thermostats, an inadequate number of convenient thermostat collection locations, and insufficient motivation.⁵

Stakeholders currently do not agree on the number of mercury thermostats that are discarded each year in the United States. Therefore, it is not possible to state with certainty the percentage of discarded mercury thermostats that TRC collected in a given year. However, using various methodologies, national estimates of mercury thermostats discarded annually range from

⁴ TRC program performance data and other program information can be found at <http://www.nema.org/gov/ehs/trc/>.

⁵ Thermostat Stewardship Initiative – Background Research Summary, PSI, October 2004, pp. 12-14, 15, available at: <http://www.productstewardship.us/displaycommon.cfm?an=1&subarticlenbr=98>.

2 million to over 6 million.⁶ Even at the low end, TRC currently appears to be capturing a small percentage of discarded mercury thermostats.

In addition to providing readily available collection locations and improving education, participants in the PSI-facilitated national dialogue believed that contractors and homeowners would need to be motivated further to significantly increase thermostat collection. They believed that motivating contractors and homeowners was a fundamental challenge for the TRC program. As discussed in PSI's 2004 Background Research Summary, motivation can be grouped into various types of incentives: financial enticements (e.g., cash or credit), non-financial awards (e.g., recognition or publicity), and punishments for failing to comply. An example of a punishment (or disincentive) includes a thermostat recycling requirement for contractors as a condition of their professional license, which includes the potential for license revocation. Incentives and disincentives can be implemented either alone or in combination. Finding the optimal components to provide sufficient motivation to significantly increase thermostat collection is an important objective for any program.

Stakeholders agreed to conduct this pilot project because they believed that a financial incentive was an important motivational tool warranting testing and evaluation. Stakeholders listed in Appendix A jointly designed this pilot so that it would have the greatest chance of providing useful information regarding the effect of a financial incentive on changing HVAC contractor behavior.

King County (Washington) Pilot Project

Prior to initiating this pilot project, King County, Washington, conducted its own financial incentive pilot from October 2004 to April 2005.⁷ PSI's grant proposal to EPA, which ultimately funded this pilot project, commits PSI to include the King County pilot project results in this evaluation report. Under the King County pilot, service technicians were given \$4.00 in cash for each mercury thermostat brought to a participating wholesaler. Wholesalers "fronted" the money, and were subsequently reimbursed by the County, which paid an additional \$1.00 per thermostat for this service. Only 8 of 27 wholesalers already participating in the TRC program agreed to participate in the County incentive pilot. Most wholesalers preferred not to conduct cash transactions with their customers owing to the additional administrative expense. The thermostats collected in the pilot were sent to TRC for recycling.

King County publicized its pilot project through articles in trade publications, posters and brochures at participating wholesalers, and a mailing to 443 HVAC contractors. County staff also visited many HVAC contractors. The best publicity for the pilot, according to County staff, was word-of-mouth among technicians. The County allocated \$10,000 for the pilot (exclusive of staff time), with \$8,000 covering the cost of the financial incentive and \$2,000 covering publicity costs. During the pilot, the average monthly quantity of mercury thermostats recycled in King

⁶ *Ibid.* at 14-15.

⁷ For a description of the pilot project and its results, see: Savina, Gail. Quicksilver Project: Final Report, Seattle, WA: Local Hazardous Waste Management Program in King County, Washington, August 2005. This document is also available on the PSI website, at: www.productstewardship.us/ThermostatIncentivePilot

County (by HVAC contractors only) rose from 83 to 269,⁸ with 115 contractors participating in the incentive.⁹ Over half of the contractors returned more than once during the pilot period. Some technicians changed wholesalers to take advantage of the incentive. The eight wholesalers participating in the rebate collected an average of 210 thermostats per supplier, as compared to 22 thermostats per non-participating supplier. Based on these data, King County concluded that the \$4.00 cash incentive motivated contractors to recycle thermostats.¹⁰

Design Features of the PSI Pilot

The PSI incentive pilot was conducted for one year in Indiana and Oregon, during calendar year 2006. A one-year period was chosen to include both the fall and spring seasons when thermostat replacements are typically highest. Instead of cash, PSI pilot tested an incentive in the form of a rebate off the purchase of a new non-mercury Energy Star qualified thermostat. In Indiana, the new thermostat was required to be manufactured by either Honeywell or White-Rodgers, the providers of the Indiana financial incentive. In Oregon, the rebate could be applied toward the purchase of any Energy Star thermostat, since Portland General Electric financed the incentive. To test different incentive amounts, the rebate was set at \$4.00 in Oregon and at \$3.00 in Indiana.

Pilot participants sought to test the rebate concept for several reasons. First, by encouraging the purchase of Energy Star qualified thermostats through the incentive, mercury release reductions could be obtained from both the recycling of the mercury thermostat and power plant emission reductions achieved by using a more efficient thermostat. Second, participants believed that the link to new sales would reduce the financial burden of providing the financial incentive, and encourage manufacturers and wholesalers to view the incentive as a means to improve sales and to better service their customers. However, all stakeholders recognized that the rebate component would add to the complexity and administrative burden of the incentive.

The incentive program was structured so that a contractor dropping off a mercury thermostat in 2006 at a participating wholesaler would receive a rebate coupon for each thermostat returned. To reduce the potential for fraud, each coupon was given a unique number.¹¹ Upon purchase of an Energy Star qualified thermostat, the contractor mailed the rebate coupon and a proof of purchase to TRC, the third-party administrator for the pilot. Once TRC verified that the thermostat purchased was eligible for the rebate, TRC mailed the contractor a check for the appropriate amount. Multiple coupons could be submitted at the same time, which was often the case. Rebate coupons were accepted by TRC through June 30, 2007. A

⁸ King County estimated that during the pilot period, contractors discarded approximately 400 mercury thermostats per month, signifying that during the incentive pilot period, a majority of HVAC contractor-originated thermostats discarded in King County were recycled. When all mercury thermostats in King County are included, King County collected 298 thermostats per month during the pilot, as compared to 120 per month before the pilot.

⁹ King County estimated that between 100-200 contractors actively engaged in the management of mercury thermostats at the time the pilot was taking place.

¹⁰ King County set a goal of recycling 2,000 thermostats during the six-month pilot period, and met this goal.

¹¹ Although each coupon had a unique number, only rarely did TRC check the number for duplication before issuing the checks.

flow diagram for the incentive redemption process is available on the PSI website at: www.productstewardship.us/ThermostatIncentivePilot.

TRC processed coupons every 3-4 weeks to allow a sufficient number to accumulate. Each processing event required approximately 3-4 hours of staff time. Checks were routinely issued the same day or the following day. TRC sent PGE a monthly invoice for rebates related to the Oregon program. Honeywell and White-Rodgers provided their financial contribution for the Indiana incentive before the pilot began.

To publicize the pilot, participants prepared signs for posting at wholesaler locations and flyers for use by wholesalers and for mailings. Copies of the materials are available on the PSI website at: www.productstewardship.us/ThermostatIncentivePilot. Each state agency mailed materials about the pilot to lists of contractors¹² and wholesalers, and Honeywell encouraged its sales staff to inform wholesalers of the pilot. As explained below, OR DEQ conducted additional outreach activities not replicated in Indiana.

During the pilot period (January to December, 2006), TRC tracked the number of mercury thermostats collected in each of the two states, along with the associated amount of mercury collected. TRC compared these data to the number of mercury thermostats and the amount of mercury collected in each state for the previous two years. In addition, for each state, TRC tracked the number of contractors redeeming coupons, the number of coupons redeemed, and the brands of new thermostats purchased for the rebate. In addition, at the end of the pilot, both state agencies mailed surveys to contractors requesting information on whether they took advantage of the financial incentive, and the reasons for their decision. (Copies of the Indiana and Oregon contractor surveys are available on the PSI website at: www.productstewardship.us/ThermostatIncentivePilot.) Finally, PSI conducted interviews with two non-participating contractors in each state to further understand why the financial incentive was not attractive to them. However, while a substantial amount of data were collected for this project and are presented in this report, the pilot was not designed to generate or test these data for “statistical certainty.”

Pilot Thermostat Collection and Wholesaler Data

Table 1 presents the mercury thermostat collection results for each state, both in number of thermostats and pounds of mercury. In Oregon, the number of thermostats collected increased from 2,052 in 2005 to 4,587 in 2006, an increase of 124 percent. The associated amount of mercury collected in 2006 increased by 139 percent, reflecting the return of some thermostats with multiple switches. During the pilot design phase, participants set a performance goal of 4,000 thermostats for Oregon, representing a four-fold increase from the 1,005 thermostats collected on average from 2002-2004.¹³ The pilot exceeded the performance goal in Oregon. Nationally, only seven states, including Oregon, experienced an increase greater than 100

¹² In the PSI pilot, “contractor” refers to the company performing the HVAC service, not the individual service technician working for the company.

¹³ This 2002-2004 time frame was used to set the performance goal because the pilot was designed during 2005, and collection data from that year were not yet available.

percent in the number of thermostats collected in 2006 as compared to 2005 (see Table 2). Of those states, Oregon was the only state in which more than 2,000 thermostats were collected in 2005. The next closest state, Maine, collected 1,290 thermostats in 2005. However, on a per capita basis, Oregon's 2006 increase appears even more dramatic, rising to over three times the national average (see Table 3).

Table 1 – Mercury Thermostats Collected in Oregon and Indiana (2004-2006)

		Indiana	Oregon
2004	Thermostats	4,340	1,342
	lbs mercury	38.2664	14.9544
2005	Thermostats	5,763	2,052
	lbs mercury	50.5672	22.754
2006	Thermostats	6,080	4,587
	lbs mercury	53.512	54.4298
2004-2005 % Increase	Thermostats	33%	53%
	lbs mercury	32%	52%
2005-2006 % Increase	Thermostats	6%	124%
	lbs mercury	6%	139%
2004-2006 % Increase	Thermostats	40%	242%
	lbs mercury	40%	264%

By contrast, Indiana showed only a 6 percent increase in the number of thermostats collected in 2006 as compared to 2005. This increase was substantially less than many other states, and substantially less than the average for all states combined. During the pilot project design phase, participants set a performance goal of 9,000 thermostats for Indiana, which would have represented nearly a doubling of the 4,626 thermostats collected annually on average from 2002-2004. Indiana did not meet its performance goal.

The pilot project also tracked the number of HVAC wholesalers participating in the TRC program in both states. The number of wholesalers in Indiana increased from 52 in 2005 to 58 in 2006, while in Oregon the number increased from 20 to 44 over the same time period. The larger increase in

Oregon reflects, at least in part, the greater maturity of the Indiana program,¹⁴ since it started in 1998 and the state had conducted substantial outreach about the TRC program since that time.¹⁵

STATE	Table 2 - State Summary of Recent TRC Program Data							
	2004		2005		2006		Percentage Increase	
	STATS	LBS OF MERCURY	STATS	PDS OF MERCURY	STATS	PDS OF MERCURY	2005 vs. 2006	STATS PDS OF Hg
ALABAMA	625	7.15	212	2.14	225	2.5048	6.13%	17.16%
ALASKA								
ARIZONA	375	3.17	357	3.01	892	7.5950	149.86%	152.06%
ARKANSAS	93	1.07	488	5.29	308	2.7962	-36.89%	-47.13%
CALIFORNIA	3025	36.57	3941	46.32	5110	77.3698	29.66%	67.03%
COLORADO	463	3.81	438	3.89	481	3.7262	9.82%	-4.15%
CONNECTICUT	909	6.85	1333	13.54	972	7.9856	-27.08%	-41.03%
DELAWARE	179	2.00	97	1.10	337	3.9928	247.42%	261.80%
FLORIDA	11534	113.84	12955	133.35	14185	154.1568	9.49%	15.60%
GEORGIA	189	2.16			56	0.6262	100.00%	100.00%
HAWAII								
IDAHO	0	0.00						
ILLINOIS	3128	24.36	3597	29.08	4596	37.4170	27.77%	28.68%
INDIANA	4340	38.27	5763	50.57	6080	53.5122	5.50%	5.82%
IOWA	2043	16.50	1811	15.02	2853	24.4466	57.54%	62.80%
KANSAS	530	5.46	289	2.90	140	1.0230	-51.56%	-64.74%
KENTUCKY	443	3.61	281	2.45	1530	16.2130	444.48%	562.03%
LOUISIANA	265	1.98	224	1.93	239	2.0522	6.70%	6.43%
MAINE	1079	9.82	1290	15.11	2924	21.7744	126.67%	44.11%
MARYLAND	2994	33.07	4335	44.85	7342	75.8818	69.37%	69.19%
MASSACHUSETTS	3242	28.47	2978	29.05	3354	27.1622	12.63%	-6.49%
MICHIGAN	2969	23.22	2573	20.30	3528	28.6936	37.12%	41.36%

¹⁴ For the purposes of this report, program “maturity” refers to the duration of the program, the level of outreach conducted while the program has been in operation, and the level of participation by wholesalers and contractors. In 2005, the number of thermostats collected in Indiana was the fourth highest in the TRC program (see Table 2).

¹⁵ From the outset of the TRC program in Indiana, IDEM sent multiple mailings to HVAC wholesalers and contractors, including promotional literature in contractor newsletters. Staff also attended trade meetings and made presentations regarding the TRC program and the related Indiana Pledge Program. Under the Indiana Pledge Program, wholesalers and contractors pledge that they will educate customers on the hazards of mercury, encourage their customers to participate in the TRC program, participate in the TRC program themselves, and encourage their customers to buy mercury-free thermostats. Since the beginning of the TRC program in Indiana, about 250 wholesalers and contractors have joined the Indiana Pledge Program. See Indiana Pledge Program at http://www.in.gov/idem/your_environment/mercury/hvac/index.html.

STATE	Table 2 - State Summary of Recent TRC Program Data							
	2004		2005		2006		Percentage Increase	
	STATS	LBS OF MERCURY	STATS	PDS OF MERCURY	STATS	PDS OF MERCURY	2005 vs. 2006 STATS	PDS OF Hg
MINNESOTA	9832	68.93	8512	64.93	11660	85.9258	36.98%	32.33%
MISSISSIPPI								
MISSOURI	464	4.02	1045	9.91	721	10.4656	-31.00%	5.57%
MONTANA	84	0.56	167	1.36	187	1.4198	11.98%	4.09%
NEBRASKA	528	4.75	591	5.13	1387	11.8606	134.69%	131.04%
NEW HAMPSHIRE	545	4.00	1053	7.87	484	3.8936	-54.04%	-50.55%
NEW JERSEY	1681	14.79	2890	25.62	2418	21.5822	-16.33%	-15.78%
NEW MEXICO					52	0.4340	100.00%	100.00%
NEW YORK	2473	20.97	2211	20.64	3915	34.1186	77.07%	65.30%
NEVADA					263	3.1992	100.00%	100.00%
NORTH CAROLINA	1332	18.59	340	3.88	1852	27.3668	444.71%	606.24%
NORTH DAKOTA	202	1.78	124	1.35			-100.00%	-100.00%
OHIO	4348	36.59	5146	43.65	6841	58.9496	32.94%	35.04%
OKLAHOMA	225	2.05	92	0.90			-100.00%	-100.00%
OREGON	1342	14.95	2052	22.75	4587	54.4298	123.54%	139.21%
PENNSYLVANIA	4609	45.95	5065	46.82	7019	59.3898	38.58%	26.86%
RHODE ISLAND								
SOUTH CAROLINA	531	5.71	409	4.48	261	2.7838	-36.19%	-37.90%
SOUTH DAKOTA	408	3.61	266	2.21	445	5.1336	67.29%	131.93%
TENNESSEE	313	3.06	128	1.54	147	2.1142	14.84%	37.50%
TEXAS	147	1.53	262	3.25	293	2.8582	11.83%	-12.02%
UTAH	0	0.00			441	3.3108	100.00%	100.00%
VERMONT	151	1.20	372	3.01	223	1.9964	-40.05%	-33.74%
VIRGINIA	3578	40.31	4292	44.04	5095	56.4200	18.71%	28.10%
WASHINGTON	1329	18.20	3260	33.86	2359	27.3792	-27.64%	-19.14%
WEST VIRGINIA	174	1.19			148	1.2028	100.00%	100.00%
WISCONSIN	7373	55.31	6660	52.69	7708	57.3810	15.74%	8.91%
WYOMING								
TOTALS	80,094	729.43	87,899	819.81	113,658	1082.5448	29.31%	32.05%

Table 3 – Per Capita TRC Program Collection Data in Pilot States (2004-2006)¹⁶

	<u>2004 TRC Thermostat Collection Per 1,000 People</u>	<u>2005 TRC Thermostat Collection Per 1,000 People</u>	<u>2006 TRC Thermostat Collection Per 1,000 People</u>
<u>U.S.</u>	<u>0.27</u>	<u>0.29</u>	<u>0.38</u>
<u>Oregon</u>	<u>0.36</u>	<u>0.55</u>	<u>1.24</u>
<u>Indiana</u>	<u>0.69</u>	<u>0.91</u>	<u>0.96</u>

Post-Pilot Thermostat Collection Data

PSI obtained thermostat collection data for Oregon and Indiana covering the first six months of 2007 (see Table 4). After the collection phase of the pilot was completed, on December 31, 2006, contractors were no longer able to receive a coupon rebate for thermostats returned. During this post-incentive period, the number of thermostats collected significantly decreased in both Indiana and Oregon. As shown in Table 4, the number of thermostats collected in Oregon during the first half of 2007 was 1,217 as compared to 3,108 thermostats collected during the same period in 2006. The number of thermostats collected in Indiana during the first half of 2007 was 2,115 as compared to 2,571 thermostats collected during the same period. Although these data reflect only six-month results, the data indicate that the number of thermostats collected in both states dropped significantly when the pilot ended. The decrease in Indiana also suggests that the incentive may have prevented a drop-off in program performance in 2006 that would otherwise have occurred in the absence of the incentive. More time will be needed to place Indiana’s 2006 and 2007 data in complete context.

These post-incentive results are consistent with results following the King County, Washington, incentive pilot project, which experienced a 40 percent decrease in the number of thermostats collected in the seven-month period (October 2005 to April 2006), as compared to the number of thermostats collected during those same months a year earlier, when the incentive pilot was in operation. This decline occurred despite an increase in the number of thermostat collection bins within King County from 2005 to 2006.¹⁷

**Table 4 –Summary of Thermostats Collected in Indiana and Oregon
(During and After Pilot Project)**

	First Half of 2006 – During Incentive	All of 2006	First Half of 2007 – Post Incentive
IN	2,571	6,080	2,115
OR	3,108	4,587	1,217

¹⁶ The per capita thermostat collection rates in Table 3 were derived from the 2006 U.S. Census Bureau. Population estimates for Oregon and Indiana were 3,700,758 and 6,313,520 respectively, and the U.S. population was 299,398,484.

¹⁷ See: Savina, Gail. Mercury Thermostat Recycling in King County – Summary Report. Seattle, WA: Local Hazardous Waste Management Program in King County, Washington, 2007, pp. 6-8. This document is also available on the PSI website, at: www.productstewardship.us/ThermostatIncentivePilot.

Pilot Contractor Survey Results

In both states, the number of HVAC contractors that took advantage of the financial incentive was relatively small. In Indiana, only 21 HVAC contractors redeemed coupons in the pilot, as compared to 1,947 contractors in Indiana on the state mailing list. In Oregon, only 38 contractors redeemed incentive coupons, as compared to 451 HVAC contractors on the state mailing list.

In Indiana during the pilot project collection period, only 726 coupons were redeemed for the 6,080 thermostats returned. In Oregon, 1,578 coupons were redeemed for the 4,587 thermostats returned. From these data, we know that many contractors in both states did not take advantage of the incentive.¹⁸

The state agencies in Oregon and Indiana conducted a written survey of contractors following the pilot to gain insight into why contractor participation was so low. In Oregon, of the 451 contractor surveys mailed, responses were received from 81 contractors, for a return rate of 18 percent. In Indiana, 1,947 surveys were mailed and 91 responses were received for a return rate of 5 percent.

The contractor responses to the survey provided insight into why some contractors returned mercury thermostats but chose not to take advantage of the rebate incentive. Of those who returned surveys in both states combined, 58 percent indicated that they participated in the TRC program before the rebate pilot began. Of these contractors, 23 percent took advantage of the financial incentive, and 66 percent disagreed or strongly disagreed with the statement that the rebate program resulted in their company recycling more thermostats. In addition, 98 percent of these respondents agreed or strongly agreed that they would continue to use the TRC program if the rebate were discontinued. Clearly, those already participating in the TRC program did not need an incentive to continue their participation.

By contrast, of those contractors who started to participate in the TRC program as a result of the pilot project, 55 percent took advantage of the financial incentive and redeemed their coupons, and 62 percent agreed or strongly agreed that the rebate program caused their company to recycle more thermostats. In addition, 63 percent of these new participants indicated that they would continue using the TRC program without the rebate (with the remaining 37 percent presumably requiring an incentive to participate in the future).

These survey data indicate that there are likely two classes of contractors that participated in the pilot project. The first class was motivated to participate in the TRC program even before the rebate program began. Nearly all of those contractors said that they would not need an incentive to continue recycling thermostats. For these contractors, the additional motivation provided by the financial incentive appears to be largely unnecessary, so few chose to bother with the rebate.

¹⁸ Stakeholders could not determine the number of coupons actually distributed to contractors because they were unable to retrieve undistributed coupons from wholesalers at the conclusion of the pilot.

The second class of contractors, however, appears to need a financial incentive to motivate them to recycle. More than one-third of contractors who started to participate in the TRC program as a result of the financial incentive stated that they would need that incentive to continue to participate. In addition, two-thirds of these contractors believed that the incentive caused their company to recycle more thermostats. Since the number of contractors who are currently not participating in the TRC program is much greater than those who do participate, the number of contractors falling within this category may be much higher. Moreover, given the collection data from the first half of 2007 provided in Table 4 and similar data from King County, the survey results may significantly overstate the likelihood that newly participating contractors will continue to participate without an incentive. The drop-off in post-pilot collection appears larger than these survey data would indicate.

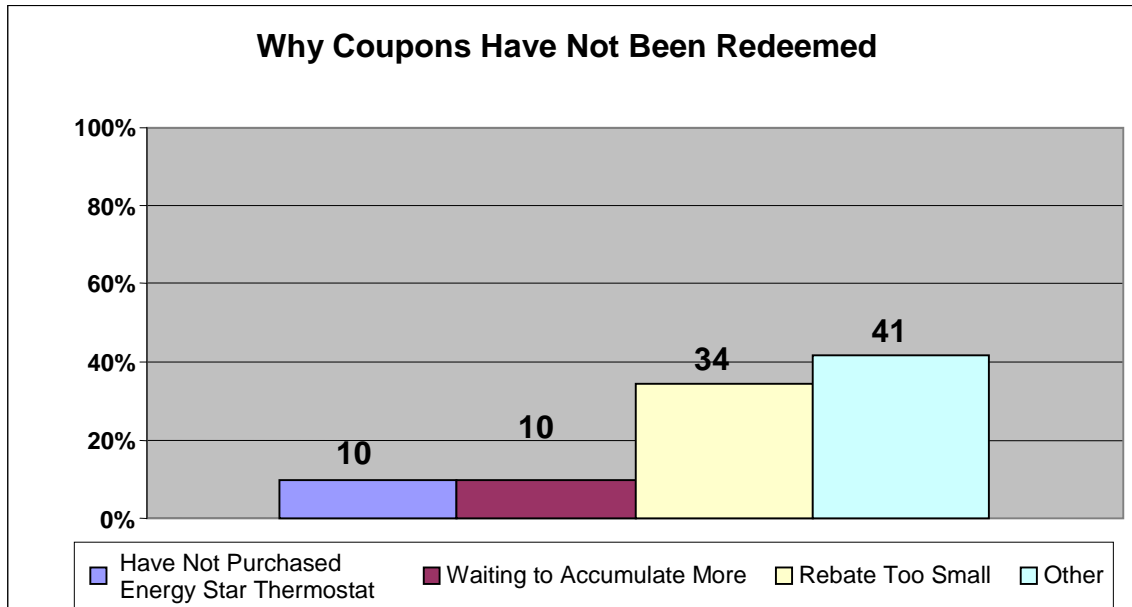
In Indiana, 83 percent of contractors responding to the survey participated in the TRC program before the pilot project began, reflecting the greater maturity of the Indiana program as compared to Oregon. In addition, 70 percent of the Indiana respondents had participated in the TRC program for more than two years, compared to 22 percent of respondents in Oregon. Similarly, 70 percent of Indiana survey respondents did not obtain rebate coupons from wholesalers, as compared to 23 percent in Oregon. These data show that more contractors participated in the TRC program in Indiana before the pilot project began than in Oregon, and these Indiana contractors continued to participate without an incentive.

Contractors did not return coupons for several reasons (see Figure 1). First, over one-third of combined survey respondents believe that the amount of the rebate was too small. In Indiana, 47 percent of survey respondents thought that the amount of the incentive was too small as compared to 27 percent of respondents in Oregon. This finding might suggest that the \$1.00 differential in rebate amounts between Oregon (\$4) and Indiana (\$3) may have contributed to the lower participation rate of Indiana contractors. An additional 10 percent of contractors surveyed had not purchased an Energy Star qualified thermostat to take advantage of the rebate, and another 10 percent of surveyed respondents were “waiting to accumulate more” coupons, even though only one coupon was redeemed after February 2007. A combined 41% of Indiana and Oregon survey respondents indicated “other” reasons for not redeeming coupons, including “too much hassle” and “cost of postage and time,” but most did not elaborate.

When asked what type of financial incentive respondents would prefer if one were provided again, 40 percent of contractors surveyed preferred cash to the contractor, 24 percent preferred a rebate off the purchase of any product, and only 18 percent favored a rebate off an Energy Star qualified thermostat purchase or cash to the service technician (see Figure 2).¹⁹ In Indiana, only 6 percent preferred a rebate off an Energy Star qualified thermostats, perhaps reflecting that only two brands of thermostats were eligible for the rebate in that state while all brands were eligible in Oregon.

¹⁹ It should be noted that service technicians themselves were not surveyed as part of this pilot.

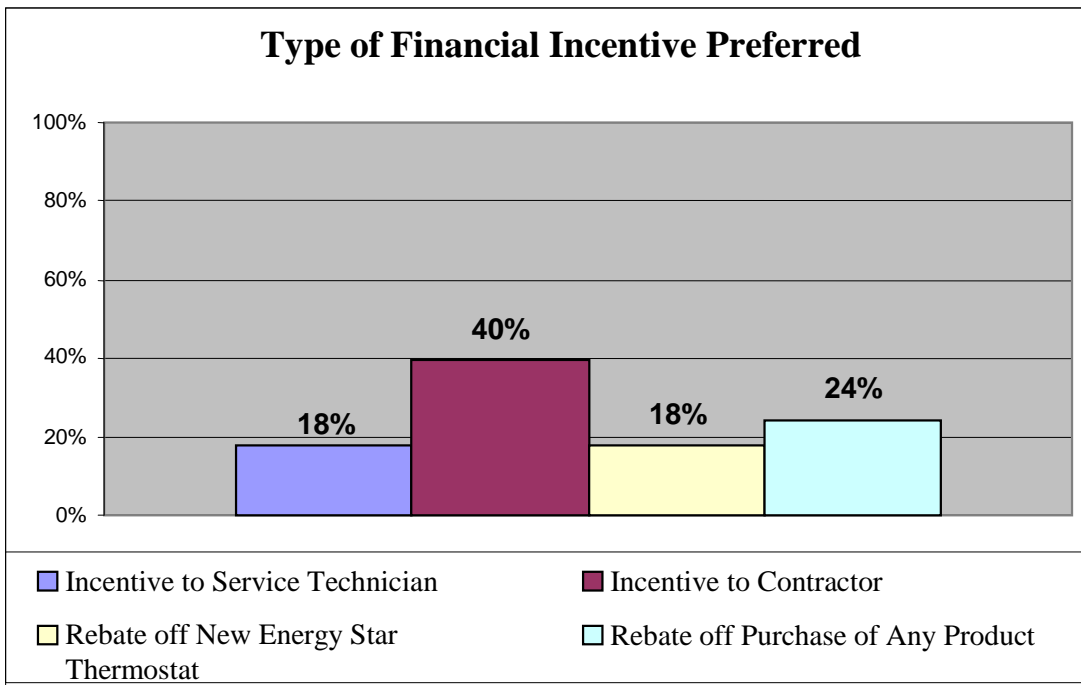
Figure 1 – Combined Oregon and Indiana Contractors Surveyed



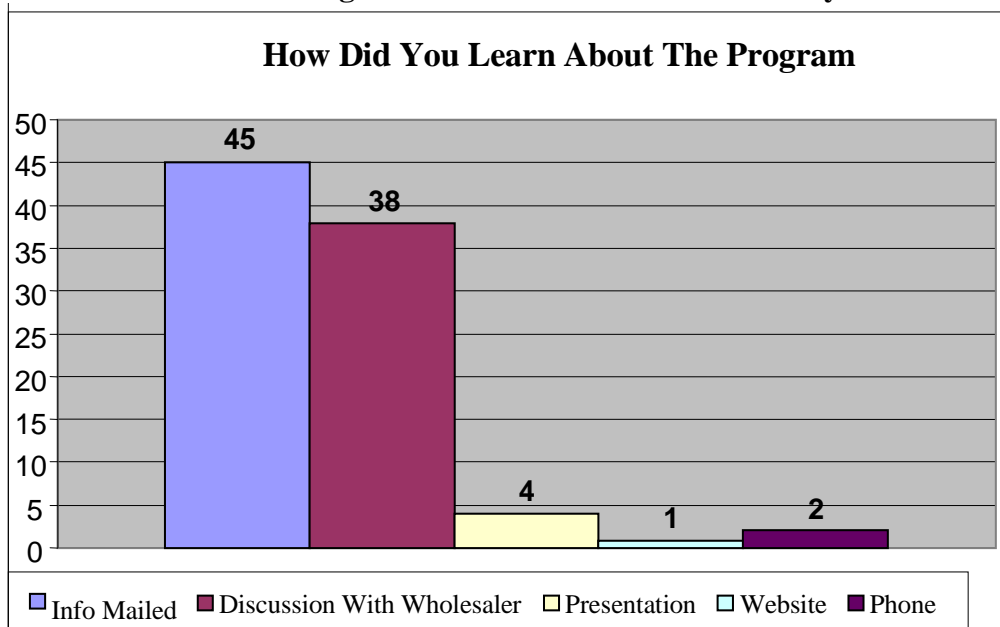
Contractors were also surveyed regarding how they found out about the pilot project. Of those who responded to the survey, 45 percent were alerted to the program through a mailing, while an additional 38 percent found out through their wholesaler (see Figure 3).

As discussed above, the outreach effort in Indiana failed to reach many contractors who were not previously participating in the TRC program, or reached them and could not persuade them to participate. By contrast, the outreach effort in Oregon did entice some new contractors to participate. The Indiana mailing that announced the program was delayed due to staff changes and other factors, and did not occur until February 2006. In addition, Oregon assigned staff to extensively telephone and visit contractors and wholesalers about the rebate program following its initial mailing, and conducted a follow-up mailing in the spring of 2006. This did not occur in Indiana. In Oregon, OR DEQ assigned a temporary intern to conduct project-related outreach activities. In December 2005, this intern telephoned every wholesaler in Oregon and the top 25 contractors, as listed in the Daily Journal of Commerce. By spring 2006, almost 400 contractors in the state were personally contacted by telephone, and a second mailing was sent to 500 contractors. In addition, site visits were made to all wholesalers and large contractors in the Portland metropolitan area, and the cities of Salem, Eugene, Medford, and Bend. During the summer of 2006, all wholesalers were again telephoned to determine if they needed more coupons.

**Figure 2 – Type of Financial Incentive Preferred
Combined Oregon and Indiana Contractors Surveyed**



**Figure 3 – How Did You Learn About The Program
Combined Oregon and Indiana Contractors Surveyed**



To better understand why contractors chose not to participate in the pilot project, PSI conducted four telephone interviews with contractors that did not participate in the pilot project. Two contractors were from Oregon and two contractors were from Indiana. Both Indiana contractors interviewed by PSI did not take advantage of the rebate owing to either a lack of information on the pilot itself or on how to obtain the rebate coupons. Interestingly, all four contractors interviewed by PSI believed that any type of financial incentive would be more likely to entice participation among small contractors as compared to large contractors because smaller contractors are more responsive to money. This may suggest that the two classes of contractors discussed earlier might correspond to large and small contractors. If this is the case, it might suggest that one future option to consider would be an incentive designed to target smaller contractors with a limit on the number of coupons that could be returned.

Cost of Administering Financial Incentive

For this pilot, TRC billed its administrative costs as the value of the incentive plus a \$1.00 administrative fee for each rebate coupon processed. As stated previously, 726 coupons were processed from Indiana contractors, and 1,578 coupons from Oregon contractors. At \$4.00 per coupon in Indiana (including the rebate plus the \$1.00 administrative fee) and \$5.00 per coupon in Oregon, the cost of providing the incentive was \$2,904 in Indiana and \$7,890 in Oregon. PGE budgeted \$20,000 to cover the cost of administering the Oregon financial incentive on 4,000 thermostats (the program goal) at \$5.00 each. However, since many contractors chose not to avail themselves of the incentive, the actual cost to PGE was less than half the budgeted amount even though the program performance goal was exceeded.

TRC estimates that its actual total costs for the pilot were \$29,884. Of this amount, \$8,472 covered the cost of the incentive in both states²⁰, \$212 covered non-staff expenses (mostly bank fees and a post office box rental), and \$21,000 covered its administrative (staff) costs, which was significantly more than the \$1.00 per thermostat it received as an administrative fee.²¹ The majority of staff time was spent verifying the eligibility of the new thermostats purchased for the rebate. However, the number of eligibility problems detected by TRC was relatively small (less than 5) and were typically resolved through phone calls and/or a letter.²² There were only two instances where the contractor did not provide the necessary documentation when requested by TRC. TRC staff time was also devoted to setting up the database and other one-time start-up activities (7-8 hours) and processing the rebate checks.

The high TRC administrative costs were largely due to TRC adhering to staff billing rates in the offices of the National Electrical Manufacturers Association (NEMA) from which TRC operates, even though these rates were higher than necessary for the tasks performed. Since these costs were incurred as a matter of convenience, it is expected that lower staff rates would apply if an incentive were to be offered again. In addition, much of the staff time can be attributed to

²⁰ The \$8,472 does not include the \$1.00 per thermostat administrative charge. TRC covered the cost of the incentive in both states but was reimbursed by Honeywell and White-Rodgers for the Indiana incentive costs and by PGE for the Oregon incentive costs.

²¹ Other costs included a \$200 loan for start-up purposes.

²² These problems involved purchases of non-Energy Star thermostats or the submission of more rebate coupons than proof or purchases.

checking the eligibility of the new thermostats purchased to ensure that they were Energy Star qualified, and limited to Honeywell and White-Rodgers thermostats in Indiana.²³ Since this time did not yield much benefit, the amount of time spent on checking eligibility can be significantly reduced. In fact, based on the experience gathered from this pilot, TRC staff believes that the coupon processing time can be reduced, and the total administrative costs reduced to \$1.00 to \$2.00 per coupon redeemed, particularly if it is no longer necessary to determine the eligibility of new thermostat sales. However, to reduce costs further, the staff billing rate will need to change.

Marginal Cost Per Thermostat Collected

Oregon collected 2,535 more thermostats in 2006 as compared to the amount collected in 2005. With the total cost being \$7,890, the marginal cost per additional thermostat collected was \$3.11. By contrast, in Indiana, 317 more thermostats were collected in 2006 as compared to the amount collected in 2005. With the total cost being \$2,904, the marginal cost per additional thermostat collected was \$9.16. These data indicate that the pilot program was more efficient in Oregon as compared to Indiana owing to the greater increase in the number of thermostats collected in that state.

Brand of Thermostat Purchased

Table 5 lists the brands of qualified thermostats purchased by contractors during the pilot project. As the data indicate, Honeywell thermostats dominated the brands covered by the rebate, even in Oregon where all thermostat brands were eligible for the rebate.

Table 5 – Thermostat Brands Receiving Rebates

Brand	Oregon	Indiana	Total
American Standard	30	0	30
Aprilaire	83	0	83
Bryant	22	0	22
Carrier	39	0	39
Honeywell	1,357	621	1,978
Invensys	1	0	1
Totaline	37	0	37
White Rodgers	9	105	114
Total	1,578	726	2,304

²³ Interview with Jerrod Conaway, TRC, July 17, 2007.

Conclusions

Based on the results of the King County, Washington, pilot project and this PSI Thermostat Incentive Pilot Project, the participants in this pilot project (with the exception of TRC and its member companies) have reached the following conclusions about whether, and to what extent, a financial incentive offered to contractors encourages the increased recycling of mercury thermostats. (For a discussion about the process used to develop this report, including the conclusions, see the Introduction section.)

1. A financial incentive can result in increased collection of thermostats. It can be an effective motivational tool to increase mercury thermostat recycling for those contractors requiring additional motivation. The effectiveness of this tool will depend on the amount and logistics of the incentive provided, how long it is offered, and whether its availability is effectively communicated to contractors. A financial incentive, if provided, will need to be offered on a long-term basis. Any short-term incentive, even up to the one-year duration as tested in this pilot, will not maintain the changed behavior once the incentive is removed. A financial incentive wears off quickly once it is removed.
2. Not all contractors will need an incentive to participate. There appear to be at least two classes of HVAC contractors – those who will participate without an incentive because it is the “right thing to do” (e.g., environmental sensitivity) and those that need other motivation to be convinced to recycle. As described in the PSI Background Summary Report, most contractors currently do not participate in the TRC program.²⁴ Of the contractors surveyed for this pilot who were new participants in the TRC program as a result of the incentive, one-third acknowledged that they would need some type of an incentive to continue to participate. This group of contractors may in fact be much larger than the self-acknowledged one-third, based on the reduction in thermostats collected in both this pilot and the King County pilot once the incentive was removed.
3. The increase in thermostat collection was much higher in Oregon than in Indiana. Factors contributing to this differential in performance include the relative maturity of the Indiana program, fewer thermostat brands eligible for the rebate in Indiana, and the lower amount of the rebate in Indiana. Another contributing factor was the greater level of education and outreach conducted in Oregon as compared to Indiana, including the temporary use of a dedicated intern in Oregon who made personal contact with wholesalers and contractors.
4. The administrative costs of operating this pilot were very high, although these costs can be substantially reduced by simplifying the administration of the incentive, by not verifying Energy Star purchases, and by using staff billed at a rate commensurate with the tasks involved.
5. Other incentive mechanisms are likely to be simpler, more effective, less costly, and more widely accepted than the rebate off an Energy Star purchase. This conclusion is based on data such as the small number of contractors who took advantage of the pilot incentive in both states,

²⁴ Surveys of wholesalers and contractors in Maine and Oregon found participation rates generally between 10-30 percent. *PSI Background Research Summary*, supra. pp. 12-13.

the small number of coupons that were redeemed, and contractor survey results that indicated a preference for at least two other incentives. This conclusion is also based on the inherent complexity of the rebate mechanism that was designed, and the resulting cost of administering the pilot.

6. Education and outreach should be a strong component of all thermostat recycling programs. These programs should be conducted collaboratively among thermostat manufacturers, retailers, government agencies, environmental groups, and other stakeholders. However, one significant barrier demonstrated in other PSI/TRC thermostat pilot projects is the limited ability by most state and local government agencies to undertake aggressive education and outreach activities, due to lack of funding and staff resources.²⁵ In addition, although education and outreach is necessary, it is unlikely that education and outreach alone will be enough to reach high recycling rates.

7. Prior to this pilot, PSI had attributed low contractor participation in the TRC program to three significant factors – lack of awareness of the program, an inadequate number of convenient collection locations, and insufficient motivation. This pilot demonstrates that the most successful results will be achieved by addressing all three factors.

Further Potential Research

Additional data in the following six areas could lead to a better understanding of how to improve mercury thermostat collection, including the appropriate role of a financial incentive in a mercury thermostat collection program. By providing this list, the PSI pilot project participants do not intend to suggest that program enhancements must await the completion of some or all of this research. To the contrary, since mercury thermostat sales have been declining and few new mercury thermostats will be installed in the future due to state legislation and other factors, time is of the essence with respect to achieving program improvements. Each year, the number of mercury thermostats being replaced will decrease. However, a significant number of mercury thermostats are being replaced now, and programs need to be in place to divert them from disposal facilities. Program enhancements can be fine-tuned as more information becomes available.

1. **Evaluate Case Study of Florida Wholesaler Financial Incentive:** Over the past three years, TRC collected more thermostats from Florida annually than from any other state (see Table 2). A substantial portion of Florida's returns are attributable to one wholesaler that reportedly offers a \$1.00 discount off any product in its store for each mercury thermostat returned by its HVAC contractor customers. A case study should be conducted of this wholesaler's methodology and experience to determine the potential for this system to be replicated elsewhere.

²⁵ PSI and TRC jointly participated in two early projects, one that targeted wholesalers with chain stores and the other that expanded collections to contractor locations on a voluntary basis. The wholesaler expansion project enlisted the support of state officials in 30 states in which the headquarters for wholesaler chains were located. The contractor expansion project enlisted the support of all state officials. Both projects were abandoned after it was determined that government officials did not have the resources to participate. For information on these projects, see: www.productstewardship.us/thermostatprojects.

- 2. Evaluate the Effectiveness of Non-Financial Contractor Incentives:** There are many ways to increase thermostat recycling. This pilot project targeted the effects of a financial incentive on thermostat recycling. However, non-financial incentives exist, such as incorporating a provision for thermostat recycling in a contractor's professional license, disposal bans on households and contractors, and a ban on the wholesale and retail sale of thermostats from non-compliant manufacturers. Additional data are needed to better understand the relative effectiveness of financial incentives as compared to enforcement tools, and to better understand whether, and how, a financial incentive may be optimally employed in conjunction with enforcement. Of the non-financial mechanisms, the professional license requirement appears to be the most promising since contractors are in routine contact with licensing officials, who can potentially impact their livelihood. By contrast, environmental agencies tend to have limited resources to enforce against contractors on a sustained basis.

A pilot project should be conducted in one or more states that have an HVAC professional licensing requirement, where mercury thermostat recycling is a condition of the license, and where the professional licensing program has the capability to meaningfully enforce this requirement. Prior to conducting this pilot, however, the number of states with professional licensing requirements should be determined. If a significant number have license requirements, this will be a more important factor. However, states without licensing requirements will be unlikely to develop such a requirement only for this issue. Therefore, at best, this factor will only be a factor in some states. In those states that require a professional license for HVAC contractors, this approach can be tested either separate from, or in combination with, a financial incentive. If additional motivation is needed, and a state does not have professional licensing, the best choice to boost recycling rates is likely to be some type of financial incentive.

- 3. Test Other Financial Incentive Mechanisms:** Other mechanisms should be tested to determine if they will perform as well or better than this pilot project. Data should be kept on administrative costs, total costs, ease of implementation and use, effect on collection rates, and other critical factors. Based on the surveys, contractors prefer the incentive to be cash to the contractor (40 percent), a rebate off the purchase of any product (24 percent), a rebate off an Energy Star qualified thermostat purchase (18 percent), or cash to the service technician (18 percent). This pilot tells us that only 18 percent of contractors surveyed believe that the rebate off the purchase of an Energy Star qualified thermostat is the best mechanism. Interestingly, this is the same percentage of contractors who believed that cash to the technician was preferable. We do not know why there was a preference to provide the incentive to the contractor over the technician, although perhaps we were surveying contractors who preferred to keep the incentive for themselves and not pass it on to their technicians. The implementation of the Maine thermostat law will provide data on a \$5 incentive provided to a technician.
- 4. Test Effect of Education and Outreach:** One significant difference between the efforts in Oregon and Indiana was the degree of education and outreach. Although education and outreach will be needed in all thermostat recycling programs, we still do not know how much recycling can be attributed to these methods alone and in conjunction with financial and non-

financial incentives. This information may be important for the development of thermostat recycling programs, but only if the issue of providing adequate resources to conduct education and outreach is resolved.

5. **Continue Pilot Data Collection:** This report contains post-incentive thermostat collection results in Indiana and Oregon for the first six months following the cessation of the financial incentive. Data should be collected for 12 and 24 month periods following the incentive pilot and then analyzed for further trends and lessons learned, including the effect, if any, of the possible stockpiling of thermostats in anticipation of the incentive.
6. **Promote Energy Star Thermostats:** While the rebate financial incentive pilot was not fully effective, there are other ways of integrating the purchase of Energy Star thermostats into thermostat collection programs. These methods should be explored. There are likely synergies that can improve both program components in a cost-effective manner.

APPENDIX A

KEY PROJECT PARTICIPANTS

- Scott Cassel, Product Stewardship Institute, Inc.
- David Lennett, consultant to the Product Stewardship Institute
- Mark Kohorst, Thermostat Recycling Corporation
- Jerrod Conaway, Thermostat Recycling Corporation
- Dan O'Donnell, Honeywell
- Janis Whitworth, Oregon Department of Environmental Quality
- Abby Boudouris, Oregon Department of Environmental Quality
- Judith Henderson, Oregon Department of Environmental Quality
- Kristin Brier, Indiana Department of Environmental Management
- Doug Findlay, Portland Gas and Electric
- Aaron York, Sr., Aaron York's Quality Air Conditioning & Heating
- Ann Pistell, ME Department of Environmental Protection
- Linda Barr, U.S. EPA

APPENDIX B

PROJECT PARTICIPANTS WHO DEVELOPED THIS REPORT

Participants in June 11 Multi-Stakeholder Conference Call

- Scott Cassel, PSI
- David Lennett, PSI Contractor
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- Jerrod Conway, TRC
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- Mark Elam, Honeywell
- John Sartain, White-Rogers
- Aaron York, HVAC contractor
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- Kristen Brier, IDEM
- Ann Pistell, ME DEP

Participants in November 1 Multi-Stakeholder Conference Call

- Scott Cassel, PSI
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