Energy Trust of Oregon
Solar Water Heating Program:
Review and Recommendations

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Completed by:

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Table of Contents

Executive Summary

Overview: The Energy Trust of Oregon (ETO) retained Good Company Associates to analyze the ETO's Solar Water Heating Program and make recommendations to improve the success of the program and help create a viable solar water heating industry in the state going forward. This effort seems ideally timed, as the Energy Policy Act of 2005 was just signed and includes a major solar/PV tax incentive. (Note: This federal incentive passed after the majority of the work on this study was completed; therefore, the financial calculations do not reflect this new tax incentive. However, the estimated 30% incentive will drastically increase the cost effectiveness of installing solar water heating systems and should result in a significant increase in demand.)

In order to develop recommendations for ETO's program, we have relied on our experience developing and implementing energy efficiency market transformation programs for numerous technologies. We conducted exploratory interviews with the ETO staff, solar water heating system manufacturers and contractors, state regulators, and other solar water heating program implementers across the country. As a result of these efforts, Good Company Associates has formulated the recommendations detailed in this report, which we believe will help the ETO build on its success and move the Oregon solar water heating industry toward the goal of self-sustainability.

Findings: After a review of the current ETO program, comparisons with other solar water heating programs, and interviews with contractors, manufacturers, and regulators, Good Company has identified the following key findings:

- *Slight ambiguity on program success:* We note that while the ETO's commitment to the program is strong, the definition of program success should be clarified. In deciding how to prioritize implementation of the enclosed recommendations, the ETO should begin with a clear statement of the program's short-term and long-term objectives.
- *Demand outstrips supply:* Relative to other programs, the ETO is providing incentives for installing a respectable number of systems per year. However, based on interviews with contractors and a supply/demand analysis, it appears that the small number of participating installation contractors is limiting the number of solar water heating installations in the state.
- *Limited efforts promoting long-term sustainability of the industry:* The solar water heating industry needs assistance in building a long-term sustainable industry. Contractors and manufacturers do little or nothing to market the industry or build capacity.
- *Limited current installation capacity:* Oregon has strict licensing requirements for solar water heating system installation. While this ensures quality, it has greatly

limited the pool of active contractors. This lack of competition among solar water heating installers is reflected in higher installed system prices and a lack of market momentum.

- *High cost is still a major impediment:* Prior to the passage of the new federal tax incentives, solar water heating systems did not financially justify their cost investment. The new tax bill should improve this, but making solar water heating systems economically attractive will require creative financing and changes in the industry to lower prices.
- *Administration is an impediment:* While reporting is a necessity for this program, the ETO's internal and external project administration may be too onerous and add to the cost of the solar water heating systems and the cost of the administering the program.
- *Building the industry requires more manufacturer involvement:* While solar water heating system manufacturers tend to focus on building markets in states or regions with aggressive incentives, they have not demonstrated significant know-how or capacity to initiate market development.

Recommendations: Based on our key findings, Good Company developed strategies to address the key market barriers identified in our findings. We have formulated very specific recommendations and grouped them according to the categories: Program Format, Program Structure, Program Messaging, or Cross-Cutting Program Initiatives. We believe this categorization will give the ETO staff the ability to assess the demands of each project, the effect of implementing the recommendations, and ultimately choose a package of changes that best suits the ETO's needs and objectives. Our recommendations include:

Program Format

- *Commit to a multi-year program:* One of the biggest hurdles limiting contractors' and manufacturers' investment in building capacity is a concern for the stability of the state or federal incentives. ETO should commit to a long-term, stable incentive infrastructure to help overcome this concern.
- *Review licensing requirements:* Strict contractor licensing requirements are severely limiting the pool of contractors performing solar water heating installations. Currently, there are only 21 contractors with the required SOL license. While plumbers are also eligible to install solar water heating systems, they do not seem interested or educated in this market. ETO must explore how the licensing requirements can be adjusted to ensure an adequate supply of installers in the state.
- *Reduce administrative paperwork:* While some paperwork is a necessary evil, the ETO should consider how to reduce the cost and time required completing this paperwork. We recommend convening a workshop of contractors to work collaboratively to identify ways to meet ETO's reporting needs while reducing this administrative burden on the contractors.

Program Structure

- *Develop financing options:* Even with significant subsidies, solar water heating systems have significant up-front costs and long-term payback periods for consumers. Consequently, the current market consists primarily of affluent consumers looking to do the "right thing" for the environment. Developing new project financing methods will allow more consumers choose to install systems, regardless of their ability to pay.
- *Reduce inspection requirements:* ETO currently inspects every system installation, which creates considerable cost for the program administrators, contractors, and ultimately, consumers. ETO should explore merging the solar water heating inspection requirements into the inspections conducted via ETO's Efficient New Homes Program. Further, ETO may be able to streamline the inspection process through coordination with Trade Ally Coordinators, Advisory Groups, or industry self-policing.

Cross-Cutting Program Initiatives

- *Work cooperatively with the Efficient New Homes Program and other residential programs:* ETO should work to leverage its other programs' efforts to ensure maximum promotion of the solar water heating industry at minimum cost. Installation of solar water heating systems is cheaper on new homes, and builders can become champions of this industry. Working with these existing programs can further increase the outreach of marketing efforts and help integrate the financing of solar water heating systems into more attractive options, such as mortgages.
- *Perform targeted recruitment of new contractors:* In order to see the ETO Solar Water Heating Program ultimately thrive, the number and type of contractors participating in the program must expand. The ETO should undertake a designated focus of educating a cross-section of contractors about the business opportunity solar water heating can provide, and supplying them with the tools and information they need to be successful.
- *Establish an advisory group:* We recommend the creation of an advisory board of participating contractors who fully understand the mission of the ETO and the goals of growing the solar water heating market. Many similar advisory boards for other programs have played valuable roles in addressing issues such as expanding the market, ensuring quality, providing feedback to program administrative staff, alleviating some of the information dissemination burden from program administrative staff, and speaking as one voice to legislative and regulatory bodies.
- *Provide contractor training and education:* Plumbers are by far the largest group of potential installers of solar water heating systems, yet they can also be the least adept at marketing and selling them. We recommend the ETO coordinate an education process through the existing contractors that manage the ETO's Trade Ally program. The Trade Ally program is currently performing outreach and

recruiting to the contracting community, as well as providing support in integrating various energy efficiency initiatives. Therefore, the ETO could use this avenue to reach the plumbing community as well as introduce solar water heating contractors into additional existing home opportunities.

Program Messaging

- *Establish an advertising cooperative:* As indicated in our findings, there is little marketing capacity present in the solar water heating industry. We recommend that the ETO set aside funds in the program budget to promote cooperative advertising among the solar water heating manufacturers, distributors, and contractors to promote the installation of systems.
- *Pilot projects in new construction market:* We recommend that the ETO fund at least two demonstration solar water heating systems with large new home builders in the area to spur consumer interest and builder product acceptance.

At the request of the ETO, Good Company has also included a section addressing the program budget. We have modified budget expenditures to reflect our recommended changes to the program. The new total program budget of roughly $684,000 reflects a reduction in focus on the commercial sector and more emphasis on the residential sector.

Conclusion: In light of the new federal solar and PV incentives, the market for solar water heating should see immediate growth. However, as the duration of these incentives is uncertain, the ETO should use this period to make changes to their program that will foster the long-term sustainability of the industry in Oregon. Hopefully, the federal incentives will drive the economies of scale necessary to bring down the price of solar water heating systems for all consumers. While monitoring the effects of the national market, the ETO should focus on changes to its program which will help the long-term sustainability of the industry in the state. These changes include increasing the capacity of the solar water heating industry, increasing market knowledge acceptance and demand – especially in new home construction, increasing industry marketing capacity, leveraging the ETO's Efficient New Homes Program and the Home Energy Savings Program, and reducing administration related to incentives. We are confident that these steps will help the ETO develop a self-sustaining solar water heating industry in Oregon and achieve its goals for the Solar Water Heating Program.

OVERVIEW

The Energy Trust of Oregon (ETO) retained Good Company Associates to analyze the ETO's Solar Water Heating Program and make recommendations to improve the success of the program and help create a viable solar water heating industry in the state going forward. This effort seems ideally timed, as the Energy Policy Act of 2005 was just signed and includes a major solar/PV tax incentive. (Note: This federal incentive passed after the majority of the work on this study was completed; therefore, the financial calculations do not reflect this new tax incentive. However, the estimated 30% incentive will drastically increase the cost effectiveness of installing solar water heating systems and should result in a significant increase in demand.)

This report involved compiling information from:

- Solar water heating contractors currently participating in the program;
- Contractors in related fields who have not participated in the program;
- Solar water heating programs and program implementers across the U.S.; and
- Our own experiences in managing and implementing successful energy efficiency market transformation programs.

Good Company Associates conducted primary interviews with 15-25 contractors, some of whom are currently in the solar water heating business and some who are knowledgeable of the benefits of solar technologies but have not yet adopted solar water heating installation as a business line. In these interviews, we determined the contractors' primary markets, business sizes, seasonal trends, pricing strategies, understanding of and attitudes toward renewable technologies in general, and thoughts on consumers' adoption rates of solar water heating technologies specifically. We have compiled and analyzed this information in order to develop a contractor-focused strategy for incorporating contractors more fully into the ETO's Solar Water Heating Program.

Further, we also discussed with the contractors their opinions and understanding of:

- The ability of the current solar water heating industry to deliver the market potential;
- Anticipated changes to the industry over time that will affect its ability to deliver;
- What industry changes, if any, are needed to develop a successful market;
- What ETO's program should do to respond to those industry needs;
- Other utility-sponsored energy efficiency programs;
- The ETO, and specifically this program;

- How they believe other contractors in the industry regard ETO, and specifically this program; and
- What they feel is the best way to engage contractors and enlist their help in making this program successful: education, broader outreach, enhanced marketing, more frequent trainings, manufacturer support, distributor support, involvement with associations, or leveraging the homebuilding community.

We performed a review of existing solar water heating programs in various areas of the country to determine what beneficial program elements may be able to be incorporated into the ETO's program. We considered factors such as geography, market size, program budget, program duration, and identified which program elements are most likely to improve ETO's program. When the elements were contractor- or manufacturer-based, we also solicited input from the respective parties. In interviews with the solar water heating system manufacturers, we obtained a better understanding of how they view the residential and commercial market segments in Oregon in terms of opportunities for installations. We then discussed with ETO staff the feasibility of integrating various elements into the ETO program and developed our list of recommendations and estimated budget impacts for ETO's program to effectively incorporate or deliver those elements.

Methodology

The information and observations contained in this report have been gathered and compiled through interviews Good Company Associates conducted with ETO staff, solar water heating contractors in Oregon, solar water heating system manufacturers nationwide, other solar water heating program providers nationally, energy efficiency providers in the northwest, as well as the Oregon Department of Energy (ODOE), and the Oregon Solar Energy Industries Association (OSEIA). This section describes our general methodologies regarding our interview and information compilation processes.

Contractor Interviews

We interviewed eight solar water heating contractors, including several that are among the most active in the ETO's Solar Water Heating Program. Participants providing information for this analysis included:

- Cascade Sun Works
- Bobcat and Sun, Inc.
- Energy Independence
- Energy Service Company
- Gen-Con Solar, Inc.
- Mr. Sun Solar

- Solar Assist
- Gormley Plumbing, Heating and Cooling

The contractor interviews were conducted with primarily open-ended questions, with the goal of assessing the current attitudes of the contractors towards the ETO's Solar Water Heating Program, the capacity of their existing business, their ability/interest in growing their SWH business, their lead generation and sales process, their target customer market, their process for qualifying customers, their financing programs, real or perceived barriers to sales, and which of the manufacturers they represent. We also asked for their thoughts on how to expand the market for solar water heating in Oregon.

Manufacturer Interviews

Each of the approved manufacturers that are listed in the Brightway Specifications were contacted for this study. Those that provided substantive input were:

- Rick Reed, President, Sun Earth, Inc.
- Steve Gorman, President, Thermal Conversion Technology
- William Guiney, General Manager, Solargenix Energy
- Bob Claridge, President, Bobcat & Sun, Inc.

Christel Bieri, President of Heliodyne was also contacted, but no interview was conducted.

As with the contractor interviews, our conversations with the manufacturers involved asking open-ended questions regarding their attitudes toward the Oregon solar water heating market, the ETO program specifically, and the barriers or obstacles that may be hindering system installations.

Program Provider Interviews

We contacted program implementers for ten other solar water heating incentive programs across the country to determine whether successful elements of those programs could be effectively integrated into ETO's program. During these phone interviews, we compiled information regarding:

- Total number of systems installed,
- Number of systems installed annually
- Age of the program,
- Number of eligible customers served,
- Annual budget size,
- Amount of incentives (including whether state tax credits were available),

- Average installed cost of a residential system,
- Number of participating contractors,
- Requirements for contractors in order to be eligible,
- Percentage of installed systems that the program inspects,
- Amount of paperwork required,
- Whether training was provided,
- Involvement of system manufacturers,
- Program marketing/advertising,
- Recommendations and/or warnings.

The list of programs contacted and the responses we received are illustrated in the chart entitled "Comparison of Solar Water Heating Programs Nationally" on page 23 of this report.

FINDINGS

To date, the ETO Solar Water Heating Program has achieved roughly 90 solar water heating system installations by 13 participating contractors since the program began in October 2003. ETO offers an incentive of $0.40 per kWh saved in the first year, which, when partnered with the State of Oregon's tax credit of $0.60 per kWh saved typically decreases residential customers' total installation cost between 40% and 50%. Currently, the ETO does not offer a financing program for solar water heating systems.

Effective July 1, 2004, the State of Oregon began requiring all general contractors who install solar water heating systems to possess the Solar Heating and Cooling Installer (SOL) License. Currently only 21 individuals in the state have obtained this license. Licensure has a relatively high level of requirements, including a two-year apprenticeship. Journeyman plumbers are also eligible to install solar water heating systems in Oregon and are not required to have the SOL license, but the roofing assessment and related structural work are not generally part of their area of expertise. Further, our findings indicate that there is considerable confusion regarding the SOL license in the marketplace. For example, the OSEIA website contains seemingly conflicting information on three of its pages that we believe causes confusion for the average reader. (Please refer to Attachment A.) Further, even in the preparation of this report, we were given the impression by several solar contractors and by OSIEA that the SOL license was a requirement for installing solar water heating systems.

The ETO adopted the Bonneville Power Authority's (BPA) Brightway™ specification for quality control and requires all solar water heating systems to be certified by the Solar Rating and Certification Corporation (SRCC). There are primarily seven solar water heating system manufacturers participating, including SunEarth, Heliodyne, Bobcat and Sun, Radco Products, Thermal Conversion Technology, and Solahart.

Through our interviews with contractors, we found that many of them (roughly 30%) are past retirement age and no longer work full-time, so are not actively seeking to expand their businesses. Several of them, while very positive about the ETO staff for their helpfulness and commitment to the program, felt that the program requires too much paperwork and is unnecessarily burdensome. Further, several solar water heating contractors who also install solar photovoltaic (PV) systems commented that they regard ETO's PV rebate program as more attractive than the Solar Water Heating Program.

Contractors also confirmed what previous marketing and market assessment studies had found: the current profile of buyers of solar water heating systems are well-educated, upscale, mature couples who possess some technical knowledge, disposable income, and an interest in protecting the environment while lowering their risk of high fuel prices for water heating.

Contractor Hurdles

The interesting paradox that was manifested in the contractor interviews was that while the contractors stated that they were extremely interested in expanding the market for solar water heating in Oregon, they all appear to be acting in such a way that limits the market's growth potential. The following is a list of actions (and inactions), which are each discussed in greater detail below.

- "Cherry-picking" only the best opportunities for solar water heating installations in order to maximize profit and incentives,
- Charging above-average prices for installation,
- Not encouraging the manufacturers to offer advertising programs as a vehicle for market expansion and market penetration,
- Limited promotion/education of the SOL license to skilled professionals,
- SOL license holders not hiring apprentices, thus risking an inability to meet the region's future demand,
- Limited efforts to educate consumers on the energy and environmental benefits of solar water heating systems, and
- Not marketing solar water heating to customers outside the current Oregon solar water heating customer profile.

Cherry-Picking

Several of the contractors we interviewed stated that for varying reasons, they selectively qualify potential customers before agreeing to sell or install a solar water heating system. The selective qualification process exists for a number of reasons and is discussed below, but runs counter to the qualifying process that most contractors employ, which is to qualify a customer on the basis of his or her economic criteria, such as income or credit. The reasons that the contractors stated for undertaking this qualification process is to maximize the profit opportunity in each installation. This process is approached with the mindset of attracting the sales that will yield the highest sales price and the lowest risk of any potential installation problems. The factors for qualifying the solar water heating customer include elements such as:

- Preference for Simpler Projects: This equates to the overall project complexity that the contractor must assume. Smaller solar water heating systems and simpler installations often result in comparable or increased income for the contractors.
- Preference for Installations in New Construction: For reasons similar to above, new construction installations are simpler for contractors to install because no new roof penetrations are required. Installations on existing homes also involve the risks of damaging the home's structure and/or owner's furniture.

- Age of the Structure and Roof: Contractors insist this information is important due to the roof penetrations required, the ability of the roof to bear the weight of the solar collectors, and the likelihood of customer complaints. All of these risks could result in being barred from participating in ETO programs, loss of profits for the work performed, and a tainted reputation in a market where few contractors exist.
- Orientation of the Sun: Some contractors mentioned that several firms promote the fact that they can help the homeowner receive the maximum allowable incentive from the ETO, and that this is a method of competing. If the prospect has any interference that would limit the homeowner from achieving the maximum incentive for their home, then the contractors appear to be less willing to assume the risk and may pass up a viable installation.
- Prospect's Location: The contractor may overprice the estimate to avoid taking on an installation that may cost them more, due to the related travel time.

Charging Higher Prices

Based on a survey of other solar water heating programs around the country (please refer to program comparison chart on page 23), the prices on the residential solar water heating systems installed under the ETO's program are slightly higher than the average of the other programs around the country. A number of factors could contribute to this disparity, which include:

- Climate Impact: Most of the units installed in Oregon must include antifreeze protection through drainback systems, which increases the materials component of the project, as well as installation costs.
- Absence of Economies of Scale with Installations: Most solar water heating installations are individual projects; therefore, contractors are unable to leverage the work – and cost savings – of multiple projects. Further, the plumbers and electricians who must appear at the project site to perform specific tasks must bill their portion as a stand-alone task.
- Absence of Economies of Scale with Systems: A manufacturer's pricing to the distributor or to the contractor is priced as a single sale, with no advantages of bulk purchasing or preferred pricing.
- Inspection Process: Participating contractors mentioned the ETO's inspection process as an obstacle they encounter when they sell and install systems for the ETO program. It requires considerable coordination with the inspectors in order to complete an installation. We believe that this perception has a very real effect on the pricing of solar water heating systems, since contractors feel that they must include the additional costs of labor and time to coordinate with the inspectors.
- Competition for Plumbers: The limited number of SOL licensees and the robust residential new construction market have created a shortage of qualified installation contractors. As a result, the market forces of supply and demand are

at work. The existing contractors have as much work as they can perform and they are currently selling their services for what the market will bear. The restrictive aspects of the building codes that require plumber or a SOL licensee to do solar water heating installations appear to be forcing down the number of projects that can be undertaken.

Lack of Advertising Programs

The failure to establish formal advertising programs or cooperative advertising programs is not a failing on the part of the ETO, nor is it unique to the ETO's Solar Water Heating Program. The solar water heating manufacturing community as a whole has not proactively established marketing and advertising messages to promote solar water heating systems among consumers or the contracting community.

Limited Promotion of SOL License

The SOL license for solar water heating installers is well known among the industry contractors, but does not seem to have been promoted outside the solar water heating industry. We spoke with two plumbing contractors who knew that "some license was required" but did not appear to know the details and admitted that it was "not on their radar screen." A number of solar water heating contractors mentioned in the interviews that they have tried to reach out to plumbing contractors to jointly execute some projects, but that the plumbing industry has been fairly unresponsive.

Not Hiring SOL Apprentices

The solar water heating and plumbing firms that have existing SOL licensees have been reluctant to make the investment in hiring apprentices to work toward their own SOL licenses for a variety of reasons. Generally, their reasons had to do with a need for commitment to continued access to the incentives available for solar water heating installations from the ETO. They feel strongly that the incentives are essential to selling solar water heating systems, and that without a long-term commitment to the operation of these programs, they can not commit the investment of hiring, training, and investing in a manpower resource that they do not feel will result in profit.

Need for Promotions to Consumers

Based on interviews with contractors, most of the demand for solar water heating systems is being driven by informed consumers who want to do "the right thing" for their own energy consumption and for the environment. The ETO staff has undertaken several opportunities to present information about the solar water heating program at public forums and to educate the general public and contractors on the benefits of solar water heating. However, due to limited budgets and the current volume of participation in the ETO Solar Water Heating Program, there are considerable constraints on how much the ETO staff can do to educate the market.

Failure to Target New Customer Profiles

In every single interview, the contractors were asked to describe the customer profile that best describes the purchaser of a solar water heating system. In almost every case, the contractors described their current customer profile according to the following descriptions:

- "Wants to do the right thing"
- Highly educated
- High income
- Some technical curiosity
- Disposable income
- Realizes the benefits of distributed generation, such as solar technologies
- Very environmentally conscious

Although it is difficult to determine for certain, it appears that in most cases, the customers that are purchasing solar water heating systems are initiating the requests; as opposed to being presented with this as an option to consider when making decisions to repair or replace their existing water heating systems.

Contractor Licensing Requirements

During the 1970s and 1980s, the quality of installations as well as the quality and reliability of solar water heating equipment was suspect. Too few industry standards existed, and the industry as a whole experienced a dramatic upswing from the introduction of federal tax incentives. Literally overnight, firms with little expertise entered the market, lacking the skills for proper installations and building inferior equipment. When the federal tax incentives were later removed, customers began to demand warranty service on these inferior units, and the firms collapsed, leaving thousands of customers stranded nationwide. Since that time, the industry has consolidated, and dozens of organizations have been established to work closely with the solar water heating industry to ensure that systems are installed properly and that industry training is available for interested contractors. Consequently, the reliability of solar water heating systems has increased dramatically.

An example of this swing in the market is the Sacramento Municipal Utility District (SMUD), which began offering its solar water heating rebate program about ten years ago. Spurred by the creation of a $750 solar water heating rebate by the state of California, SMUD began offering a $750 rebate to its customers in addition. According to SMUD representatives, these incentives caused contractors to "come out of the woodwork" and enter the market in order to serve the new, sizeable demand for solar water heating systems in Sacramento. While the program required contractors to provide warranties to customers, it neglected to require any contractor training or certification. The result was that over 3,000 solar water heating systems were installed

in Sacramento in just a few years' time, but then contractors promptly left the industry and defaulted on their warranties when the state tax credit was removed. Today, SMUD is still offering its customers free solar water heating system maintenance services, free system inspections, and payment of 50% of system maintenance costs (up to $200) as a direct result of contractors exiting the market after the rebates disappeared.

When ETO began its solar water heating program, it wisely required contractors and equipment to be qualified, which served to ensure that installed equipment was reliable and performed as expected. Compared to other states, Oregon possesses some unique challenges due to the climate and orientation of the sun that require a higher understanding of these systems. The potential for freezing temperatures requires that installed solar water heating systems must be designed to prevent water from freezing in the collectors.

According to the state of Oregon Department of Business and Consumer Services, there are currently only 21 individual SOL license holders in Oregon. While there is an apprenticeship program to train new candidates for the SOL license, that apprenticeship program is two years in length and requires 4,000 hours of on-the-job training. We have found that having a low number of solar water heating installers has created an interesting situation: contractors who employ one or more SOL-certified installers are content with the strict requirements for the SOL licenses because they believe it helps to strengthen their position in the marketplace and gives their company a greater opportunity for success. They know that competing contractors cannot emerge quickly, so they are profiting from their oligopoly status on the market. As a result, the established solar water heating contractors are not likely to be lobbying to OSEIA or the State of Oregon for relaxed SOL licensure requirements. On the other hand, the contractors seeking to enter or expand their presence in the solar water heating industry were insistent that the training and licensing requirements should be amended to more reasonable levels.

Through our discussions with ten other solar water heating rebate programs across the country, every single one regards a healthy contractor network as the most important element of a successful program – even above monetary incentives and tax credits. However, despite that importance placed on the contractor, most of those other programs have substantially lower contractor training/licensure requirements than Oregon's SOL license. For example, the solar water heating programs implemented by SMUD, Arizona Public Service, Focus on Energy (Wisconsin), state of Illinois, Hawaii Electric Company, and state of Michigan, do not require special contractor licensing for solar water heating, but only require that installers be licensed contractors. SMUD and Focus on Energy have additional insurance and/or warranty requirements for their participating contractors. It is worth noting that these utilities and states also offer other energy efficiency programs and have processes in place to address inferior work done by contractors to ensure that a high quality of work is maintained.

Contractor Participation

Among the contractors participating in the ETO Solar Water Heating Program, one firm has four license holders and another firm has two license holders. Additionally, at least two of the SOL license holders are 70 or older and not actively installing solar water heating systems, nor are they training apprentices to take over for them.

Almost all of the participating contractors we interviewed stated they are currently operating at or near their capacity regarding solar water heating installations, and two contractors reported turning away some interested buyers and just "cherry-picking" the most profitable customers and/or the best situations for installing solar water heating systems. The reason for this as stated by several of the contractors is that due to competition with other firms, they must guarantee that the customer will receive the full value of the ETO incentive for the system. We also believe that at least a few contractors may be artificially inflating their prices because demand for solar water heating systems is outstripping the supply of licensed installers in Oregon (as discussed previously in the Findings section in more detail). Further, we found that individuals in the plumbing industry in Oregon remain in high demand for traditional plumbing work in the new construction market, so they are not sufficiently motivated to promote or install solar water heating systems.

Economics of Solar Water Heating

The U.S. Department of Energy reports that the average family in the Northwest U.S. region uses approximately 4,450 kWh per year for water heating. Assuming an average residential electricity cost in Oregon of 7.2 cents per kWh, this equates to a cost of about $320.40 per year, or $26.70 per month. According to the Oregon Department of Energy website, solar water heating systems in Oregon are typically sized to supply between 50% and 60% of the household's total water heating needs, or about 2,450 kWh. The table illustrates the economics of five average-sized residential solar water heating systems that have been installed through the ETO Solar Water Heating Program. The last row contains the averages from those systems.

Table 1: Average-Sized Residential Solar Water Heating System Installed in Oregon

Annual Savings (in kWh)	Total Installed Cost	Energy Trust Incentive	State of Oregon Tax Credit	End Cost to Consumer
2,460	$5,250	$960	$1,440	$2,850
2,464	$6,283	$1,120	$1,478	$3,685
2,470	$6,032	$1,040	$1,482	$3,510
2,475	$5,317	$1,040	$1,485	$2,792
2,500	$4,995	$1,000	$1,500	$2,495
2,500	$4,995	$1,000	$1,500	$2,495
2,478	**$5,479**	**$1,027**	**$1,481**	**$2,971**

According to these numbers, the residential customer participating in ETO's program and taking advantage of the Oregon state tax credit will save about $2,508, or 45.8%, on the installed cost of their solar water heating system. Using these average numbers, we calculate a utility bill savings will equal roughly $177.70 per year (2,478 kWh saved at a rate of 7.2 cents per kWh), or about $14.80 per month. Simple payback of a system then requires about 16.7 years.

Financing Options

The lack of a financing option for the mass markets continues to be a barrier for acceptance to a wider audience beyond that of the current profile of an Oregon solar water heating system buyer, since the current payback is approximately 16 years. Experienced program administrators around the country have learned that energy-saving or energy-efficient products that have a simple payback longer than four years require additional justification for the consumer to purchase the product, rather than just energy savings. This additional justification could be the failure of the current appliance and being faced with "repair or replace" choices, realizing improved comfort from the appliance, "doing the right thing" for the environment, concern about America's energy security etc.

The current profile of the typical solar water heating customer in Oregon has remained relatively consistent for the last several years. As noted previously, these customers have disposable income and almost always pay for their solar water heating systems in full up front, so financing options are not typically a consideration for these customers. ODOE, which offers financing to consumers, reported that it does not set up many loans for residential solar water heating systems, acknowledging it is because of the typical customer profile. This means that not only are consumers not asking for loans for the program, but that contractors are not promoting the loan program either. However, moving beyond the current customer profile to the mass-markets will require promotion of financing options in order for these markets to adopt the systems.

As illustrated in Table 2 below, residential customers have several options for financing the $3,000 net cost of a new solar water heating system. The ODOE offers loans for residential customers through the Energy Loan Program. Current interest rates through this program are estimated at 6% for up to 13 years ($27.74 per month) or 5.5% for up to 5 years ($57.30 per month). Bank of America currently offers Oregon residents an 8.1% interest rate for 15 years on a $10,000 to $19,999 home equity loan. If a residential customer made additional improvements to their home and did so with a loan at this rate, the payments for the $3,000 solar water heating system would be $28.85 per month. However, if the $3,000 solar water heating system is installed on a newly constructed home and the $3,000 net cost is rolled into a 30-year mortgage at the going rate of 5.14% interest, the mortgage payment would increase by only $16.36 per month. Energy savings, as previously estimated at $14.80 per month, comes very close to covering the cost of the system with the savings on the utility bill.

Table 2: Residential Customer Financing Options for a $3,000 (net cost) System

Lending Institution	Interest Rate	Term of Loan	Monthly Payment
Oregon DOE	6%	13 years	$27.74
Oregon DOE	5.5%	5 years	$57.50
Bank of America	8.1%	15 years	$28.85
Original Mortgage	5.14%	30 years	$16.36

Strictly considering the above customer financing options, it would seem that the new construction market would serve as the most effective market to achieve additional installations under this program. In addition, the $3,000 net cost would almost certainly be reduced if solar water heating systems are installed during new construction. The price reduction can be expected because the system is included in the design of the home therefore, new roof penetrations become unnecessary. In addition, production builders installing solar water heating systems into their new homes could reduce the cost of installation due to the volume of installations or bulk purchasing. A solar water heating system installed during new construction – with a net cost of $2,000 to $2,500 after rebates – would then be rolled into the overall mortgage, providing a net cost savings to the homeowner from the first month they own the home.

Similarly, during the resale of a home a new buyer typically has a home inspection where the inspector can identify opportunities for solar water heating. The new buyer can purchase and install a system and have it rolled into the overall mortgage cost. If an energy assessment or audit is performed, other energy-saving opportunities can be identified for this and other ETO programs.

Inspection Process

In reviewing the ETO Solar Water Heating Program budget, the current inspection process appears to be very costly, relative to other programs around the country.

Program Name	% Inspected
Arizona Public Svc	0 %
Aspen, CO	0 %
Illinois	10 %
Michigan	20 %
Emerald PUD	100 %
Focus on Energy	100 %
Hawaii	100 %
SMUD	100 %

As illustrated in the preceding chart, other solar water heating programs vary considerably with respect to inspections. These range from no inspection (Arizona Public Service, Aspen Pioneer Solar Program) to leveraging other required inspections (for example, in order to qualify for tax credits in some states, the state requires an inspection protocol), to a detailed inspection of the installed system (such as ETO's process). The ETO currently does an outstanding job of gathering critical information on each installation; however, the process of inspecting 100% of these installations is very costly for the program, at about $325 per inspection.

Complexity of Program Paperwork

One of the comments we consistently heard in speaking with the solar water heating contractors in Oregon that have participated in ETO's program is that the paperwork required by the program is too overbearing and hinders participation. It should be noted that in our experience with programs around the country, this is precisely the first complaint issued by contractors. However, the complexity of the ETO Solar Water Heating Program seems to manifest itself in two primary areas. First, the contractors feel that the paperwork they must complete is burdensome. In comparing the ETO program's paperwork requirements with those of other solar water heating programs nationally, it does appear that the quantity and level of detail for documentation is more cumbersome in the ETO program.

Sales Volume

The ETO currently provides rebates for roughly 50 solar water heating systems per year, with the Eugene Water and Electric Board and other Oregon electric cooperatives rebating approximately another 50 systems annually. However, feedback from solar water heating system manufacturer SunEarth indicated that as many as a few hundred residential solar water heating systems are actually being installed in Oregon.

Below is a table illustrating the number of tax credits that the ODOE stated they have issued over the last four years for the installation of residential solar water heating systems. These numbers indicate that customers are not taking full advantage of either program.

Year	Number of Tax Credits Issued
2004	85
2003	99
2002	68
2001	43

Manufacturers

In many respects, the ETO Solar Water Heating Program is in competition with other state and utility programs for the attention of the solar water heating manufacturers. The heavy emphasis on renewables and the adoption of renewable portfolio standards (RPS) in many states has increased the awareness of PV and solar water heating. These manufacturers have targeted their efforts in states where the incentives or tax credits are high for both the customers and the manufacturers. There are still relatively few domestic manufacturers relative to the market potential. The manufacturers seek to operate in markets where the program requirements for the manufacturer or the equipment remain low; meaning that they seek easy markets with few barriers to the ultimate sale. This is coupled with the fact that contractors have adopted similar behavior patterns (seeking optimum sales situations in order to maximize profit while minimizing potential problems) as the manufacturers.

It is worth noting that we found several of the manufacturers have a deep admiration for the commitment that the ETO and other organizations have shown to solar water heating in Oregon. One company president stated "Those guys are my heroes. If you can make solar water heating work in Oregon, you can make it work anywhere in the country." But we found no manufacturer currently offering any form of cooperative advertising to any of their distributors or contractors in any market in the country. The manufacturers do not feel they need to advertise their product in order to gain greater market share and illustrates the lack of understanding that manufacturers have when it comes to transforming a market.

It can be argued that while the manufacturers that have survived the downsized market, after the previous federal tax incentives were eliminated, they may lack the marketing savvy to successfully grow the market independent of incentives and tax credits. In order to avoid history repeating itself, specific, steps should be taken by the manufacturers so that when the federal tax credits again expire, the industry has broadened its infrastructure and will not be a susceptible to a downturn in the market.

Incentives

The current incentive offered by ETO has a cap of $1,500. This incentive, combined with the tax credit offered by the State of Oregon can often account for almost 50% of a residential customer's total system cost. From researching other solar water heating programs nationally, only Illinois and Michigan – both with 50% rebates – rival the cost savings to solar water heating buyers. (Please refer to the chart entitled "Comparison of Solar Water Heating Programs Nationally" on page 23 for a full comparison of national programs' incentives for solar water heating systems.)

Under the state guidelines for the SOL license, a contractor must be able to forecast two years into the future what the business climate will be for solar water heating in order to eliminate risk, if the firm hopes to use the SOL license holder as a business differentiator in terms of specialized expertise. Some firms with a stable cash flow situation have indicated they are willing to make that risk. Most of the contractors that were interviewed mention that they would be reluctant to hire apprentices for their SOL license-holders until "either the Energy Bill passes in Congress or the ETO commits to providing incentives for the next several years". This re-emphasizes the points made in earlier studies by the ETO around PV and solar water heating, that the size of the incentive is less important than the consistence and duration of the program incentives.

Comparison of Solar Water Heating Programs Nationally

Rebate Program Sponsor	Total Installed	2005	2004	Past Years	Pgrm Age	Customers Served	Annual Budget	Rebate Amt	Avg Installed Cost	# of Contractors	Contractor Req'mts	Inspect
APS (Arizona)	87	43	30	14	3 yrs	1,000,000 customers	$250,000	$700 (doubled this year)	$2,895 to $4,600	6	none; just must be state-certified contractors	0%
Aspen Solar Pioneer Program (Colorado)	several hundred				5 yrs	Pitkin County (Aspen, CO)	$500,000	$1000-$2000		3 (6 or 7 people)	COSEIA or NABCEP certification	0%
Emerald PUD (Oregon)	150				8 yrs	much of central OR		$600, plus up to $1,500 state tax credit		3	contractors certified by EWEB	100%
Energy Trust of Oregon	90	45	35	10	2 yrs	various regions of OR	$600,000	up to $1,500, plus up to $1,500 state tax credit	$5,500	19	state requires SOL license or journeyman plumbers to install	100%
EWEB (Oregon)	950	20-30	20-30	50-60	20 yrs	Eugene, OR		$600, plus up to $1,500 state tax credit	just under $5,000	2	state requires SOL license or journeyman plumbers to install	
Focus on Energy (Wisconsin)	80	25	30	25	3 yrs	many utilities in WI	$400,000	$1,900	$6,500	24	none;"Market Provider" contractors must be insured & give warranty on systems	100%
HECO, MECO, HILCO (Hawaii)	22,000	2,000	2,000	18,000	10 yrs	170,000 customers in single-family homes in HI	$3 MM	$750 (or $1,000), plus 1/3 state tax credit	$4,500	about 20	none; established installer industry makes requirements unnecesary	100%
Illinois	180	20	25	140	8 yrs	majority of IL	$5 MM (includes PV)	50%	$10,000	2 Co's; a few individuals	none; just must be state-certified contractors	10%
Lane Electric (Oregon)		1 or 2	1 or 2	1 or 2		Lane County, OR		$400, plus up to $1,500 state tax credit				
Michigan	0	100 goal	N/A	N/A	1 yr	state of MI		up to 50% or $4K; avg $2,650 per system	$5,000 to $7,000	24 active; 100 trained	must attend a one-day training on how to install; how to participate in program	20%
SMUD (California)	3,000	10	10	2,980	10 yrs	600,000 customers in Sacramento	$292,407	$400 or 100% financing with 10-yr payback period	$4,500 to $5,700	4	none; must be licensed in state; $1MM insurance; no training/ certification req'mts, but must provide 3-yr warranty	100%

Societal Benefits

Economic Case

One of the major values of solar water heating systems is that they reduce the burning of fossil fuels, especially during peak periods. The result is tremendous societal benefits that can be difficult to identify, but whose value should not be overlooked. In reviewing the ETO's incentive calculations, societal benefits are mentioned, but it is unclear what properties or value propositions are being included. Some additional economic sources of value the ETO may want to consider, include:

- Greenhouse gas (GHG) emission reduction: By reducing the use of fossil fuels, solar water heating systems can contribute significantly to the mitigation of GHG emissions. While the value of carbon mitigation is difficult to assign, PacifiCorp has used an $8 per MWh adder for coal plants to calculate the carbon risk associated with them. This example could serve as a guidepost for valuing solar water heatings contribution to carbon reduction.
- Peak demand reduction: Solar water heating systems can play a significant role in reducing peak demand as well. Reduction in peak demand can postpone the need for new transmission, distribution, and generation assets, increase the ability to use cleaner base load plants rather than dirtier peaking plants, and reduce transmission congestion costs.
- Renewable energy credits: While the value of RECs vary widely, and are lower in states without a Renewable Portfolio Standard, some value should be attributed to solar water heating.
- Homeland Security: The U.S. Department of Energy and the Office of Homeland Security acknowledge the benefit that all types of distributed energy generation sources provide toward reducing America's dependence on fuels from foreign countries, as well as providing diversity in generation, and providing a natural defense against terrorism.

Industry Case

Good Company recognizes that the success of ETO's Solar Water Heating Program depends heavily on the program goals as defined by ETO. While the incentive calculations provided by the ETO focus on the economic justification, support of a burgeoning industry is another justification for the program. While solar water heating and PV are currently relatively expensive technologies, the coming years offer the potential for significant price reductions. A reduction in price could drive a spike in demand. Currently, the industry would not have the capacity to meet a large increase in demand; however, the ETO program could play a pivotal role in developing the public's awareness of the solar water heating industry and broadening the pool of SOL license holders and trained solar water heating technicians. Further, by promoting the industry, the ETO may affect new construction practices to incorporate solar water heating systems during the construction phase, rather than as an add-on. Clearly, these benefits are difficult to quantify, but are very real nonetheless.

Commercial Sector

In interviews with other solar water heating programs around the country, we have found limited success stories in promoting solar water heating in the commercial sector. According to a majority of the incentive program managers we spoke with, businesses like to see a 2-3 year payback on capital investments. Unfortunately, solar water heating systems rarely offer this short of a payback. Consequently, many solar water heating incentive programs do not actively promote or market commercial and industrial solar water heating incentive programs. Some programs do not offer commercial incentives at all.

Perhaps the most aggressive commercial program we identified was Wisconsin's Focus on Energy. According to Focus on Energy program manager Bob Ramalow, they do roughly one to two dozen commercial systems per year. They have achieved this success by focusing marketing efforts on pools in public schools and universities, health clubs, and hotels. Rebates are based on projected annual electricity or therms savings and can cover up to 25% of project cost or $35,000. To calculate project savings, Focus on Energy uses RET Screen, a free program provided by the Natural Resources Canada. The program can be downloaded at: http://www.retscreen.net/ang/menu.php . EWEB has also taken a creative cross-marketing approach and tied low interest financing to packages of commercial energy efficiency upgrades that include solar water heating systems.

While Wisconsin seems to have success with their program, most other programs had few success stories. The Sacramento Municipal Utility District cancelled their commercial program due to overall lack of interest. Emerald PUD does not offer commercial rebates. Colorado's Community Office for Resource Efficiency has seen virtually no commercial activity, despite some aggressive rebates. Michigan does not include solar water heating systems for pools and expects very little activity in the commercial sector. Jacksonville Electric has seen little interest in commercial, with less than 5% of projects going to the commercial sector.

In light of the long payback of solar water heating systems and commercial interest's short required payback and focus on economics, we would suggest limiting attention on the commercial sector. Efforts in the sector should be targeted to pools at schools, health clubs, and hotels.

U.S. Congress Energy Bill

President George Bush just signed into law the Energy Policy Act of 2005, which is comprehensive legislation designed to encourage energy efficiency and conservation, promote alternative and renewable energy sources, reduce U.S. dependence on foreign sources of energy, increase domestic production, modernize the electricity grid and encourage the expansion of nuclear energy. These incentives will undoubtedly enhance

the participation in the ETO's PV and solar water heating programs, but we do not yet know the details of accessing those funds.

The bill language includes the following incentives for solar technologies, including PV, solar thermal, and solar hybrid lighting:

- Provides residential customers a tax credit of 30% of the installation cost, up to $2,000 maximum, with an exception for hot tubs or pools, for any property placed in service from December 31, 2005 to December 31, 2007;
- Establishes tax credit for Clean Renewable Energy Bonds;
- Establishes a New Energy Efficient Home Credit, for up to $2,000 on new home construction or $1,000 for new manufactured homes that meet the energy savings requirements;
- Directs the Administrator of General Services to establish a PV energy commercialization program for procurement and installation in new and existing public buildings, appropriating $50M per year through 2010; requiring 150 megawats cumulative acquired during the 5 years of the program;
- Directs the Administrator of General Services to establish a PV energy systems evaluation program to determine what PV systems are available and most beneficial to install in public buildings, appropriating $10M per year through 2010;
- Includes a grant for rural and remote communities of less than 10,000 population to include increase energy efficiency, appropriating $20M per year through 2012;
- Weatherization assistance now includes "providing hot water" in the definition under renewable energy systems, capping expenditure at $3,000 per dwelling unit and, requiring a thermal efficiency rating of at least 15percent;
- Directs the Secretary to establish a rebate program for consumers for the installation of renewable energy systems in a home or small business, with 25% rebate of expenditures up to $3,000. Funding for this program begins at $150M for 2006 and ramping up to $250M for 2001; and
- Provides targets to encourage the Federal Government use renewable energy, in increasing amounts in future years, with double credit for renewable energy produced or used on site at Federal facilities or on Federal lands or Indian land.

While the political process is very uncertain and program and policy implementation decisions should not be based on political forecasts, it is difficult to ignore the magnitude of the impact that this continuing commitment to use solar and other renewable sources will have on the solar water heating industry, and indeed on all solar industries. The tax credits included in the Energy Bill will shorten the payback on solar water heating systems from the current 16 years to less than 10 years. We also believe that the successful implementation of many of our recommendations could further shorten the payback time.

One thing for certain is that we should heed the lessons of the past in regards to the incentives that will be offered under the Energy Bill. Previous solar and wind incentives have led to "booms and busts" in the renewables industry. These incentives will certainly lead to greater focus on solar water heating as an efficiency measure and should result in increased participation in the ETO's Solar Water Heating Program. However, if the market transforming infrastructure is not developed to support a solar water heating industry in the absence of federal tax incentives, then the industry will face certain problems when the federal incentives have expired.

There has not been any input from ODOE to suggest that the tax credits currently offered will be removed when the federal tax credits occur, but this should be watched closely. Tax credits and rebate incentives are beneficial tools in selling solar water heating, especially given the long paybacks that exist today, but they should be an adjunct to program support such as training, marketing, outreach, and consumer education.

RECOMMENDATIONS

We have a number of specific recommendations for the ETO to consider, which we have grouped into four major categories. These categories are:

1) Program Format
2) Program Structure
3) Program Messaging
4) Cross-Cutting Program Outreach Initiatives

Several of the recommendations are simple, easy fixes with very little effort or manpower expenditure. Some of the other recommendations may take many months to implement if the ETO elects to adopt these recommendations. We have proposed activity timeline at the end of this section to demonstrate which tasks are sequential and which tasks can be accomplished in a simultaneous manner. This is of course, is subject to the ETO's own internal prioritization and only serves as a model.

Program Format

The ETO Solar Water Heating Program in its current form attempts to grow the market through providing incentives for consumers and businesses, training opportunities to contractors, leveraging the sales efforts of contractors, and providing quality assurance for purchasers of solar water heating systems. The efforts are broad and provide good general information to interested parties. We recommend that ETO address the functional barriers of the current solar water heating program while simultaneously addressing other program development opportunities.

Commit to Multi-Year Program Incentives

The program incentives have been enough to spark interest, but without long-term incentives, contractors are reluctant to hire apprentices for the SOL license or invest in the business development needed to fully impact this market. The contractors' ability to forecast their return on investment will allow for stable growth of this business opportunity. Currently, these contractors must employ an apprentice for two years before he or she can become SOL-licensed, which is very expensive and risky because the Oregon state tax credit and ETO Solar Water Heating Program may or may not still be in existence in two years. Additionally, this lack of on-going commitment also negatively impacts the apprenticeship opportunity for new contractors trying to enter the solar water heating market.

Review SOL Licensure Requirements

We understand that the SOL license is a state of Oregon requirement and not a requirement by the ETO, but we believe it is a barrier to the growth of ETO's Solar Water Heating Program. Working toward reducing any unnecessary requirements in the licensure process would certainly increase the number of qualified contractors enrolled in the program. This can be accomplished with some collaboration with OSEIA. We recognize that lobbying is a function that the ETO cannot perform; however, the ETO will likely find considerable support from many members of OSEIA, as well as OSEIA board members.

If purpose of the SOL license is to differentiate a superior skill level among solar water heating installers, then this distinction should be promoted to both contractors and consumers.

Paperwork Complexity

We recommend that the ETO consider holding a meeting of participating contractors in Oregon, in which ETO explains the needed metrics. One of the obstacles that many energy efficiency programs face is the contractor's unawareness of the funding documentation required by regulatory and legislative bodies and resistance to see the need for the paperwork. By working with the contractors to develop a more palatable process to provide the information to satisfy program requirements, ETO could reiterate their support for solar water heating programs and encourage additional contractor support.

OSIEA Website

As noted previously and likely an oversight by OSIEA, their website has misleading information regarding the SOL licensure requirements and should be edited to reflect the actual requirements and the intended message.

Program Structure

Financing Options

Opportunities with lending institutions or other financing entities should be investigated to determine whether financing options are available specifically for solar water heating installations. We have had a number of companies such as Fannie Mae, Electric and Gas Industries Association, and Conservation Services Group inform us that they have specific loan programs designed for PV and for solar water heating installations.

In addition, we believe that by informing consumers about ODOE's financing program and enabling your contractors to more fully use the program, you could boost the existing homes market. In this way, the ETO could have all the advantages of a finance program without the expense of operating the program.

Assist Contractors in Securing Financing Options

The job of the contractor is to educate the customer and assist them in making financial decisions. Financing makes solar water heating systems more attractive for the consumers who want to do the right thing environmentally but could not previously afford to pay the entire price of installation. The decision that best suits his or her current financial situation is often tied to how long they plan to own the home or whether additional energy efficiency measures are being completed at one time.

A good analogy is the automotive industry, which offers multiple leasing options, longer terms, no money down, and 0% APR. These financing programs make buying a car easy and affordable. In many cases, even if the consumer does not qualify for the most attractive financing offer, the dealer will find a program that fits the customer's credit and provides the "lowest payment." Keep in mind that U.S. consumers at the broadest level are famous for asking the question "How much per month?" and in some instances ignoring the selling price.

Another barrier for sales is the cost of financing. Primary lenders charge between 1.5% to 7% to contractors that offer promotional programs, and secondary lenders can charge as much as 30%. While 30% is very high, contractors will accept up to 20% for legitimate secondary lenders. In order to stay competitive, contractors must figure financing costs into their pricing structures.

There are a number of financing options that contractors can offer their customers (i.e., 90 days same as cash (SAC), 6 months SAC, 12 months SAC). These "same as cash" programs are very attractive to the customer because he is able to defer making a payment for up to 12 months. Although interest is accruing, the customer has time to save enough money to pay the entire balance before the term expires, using the lender's money at no charge. However, the contractor pays up to 6% of the contract amount for the ability to offer this financing program, so the lender is able to make a small profit and the sale is made.

To make things even more attractive, there are programs labeled "12 months no/no", usually designed for "A" credit customers. In this case, the customer makes no payment, and interest does <u>not</u> begin to accrue until after the 12-month term expires. Once again, the contactor pays up to 10% to offer this program, the lender makes a small profit, and a sale is made. Ultimately, the lender is betting that the customer will not pay off the balance in the first 12 months, so interest will begin accruing, and the customer will begin making regular monthly payments. These programs are usually tied

to a revolving line of credit and are accessed by using the credit card issued at the time of approval.

However, remember that financing is not an issue for the current profile of an ETO solar water heating customer who pays cash for the installation of a system. In order to expand the market beyond this customer profile, creative financing should be considered. The ODOE program is attractive and should be leveraged to the fullest extent, but contractors must have knowledge and the "tools" in hand in order to use this option effectively to close deals.

Less-Than-Perfect Credit Customers

What happens when the contractor offers an "A" credit program and the application is rejected? In the past, this market was not only underserved, but the interest rates were not attractive, the term of the loan was too short (which drives up the payment), and the paperwork was unnecessarily burdensome. As a result, some contractors have become reluctant to offer financing to their customers at all. In fact, some contractors have been so averse to financing that many customers have to ask whether financing is available. The secondary finance markets have now emerged to a point where 85% of the customers that had been previously rejected for financing can now secure it. The market rates are not as attractive for these customers as the very good credit scoring customers, but they do provide access to financing.

Inspection Process

The following are a couple of potential options that would reduce the cost and time needed for inspections in ETO's Solar Water Heating Program:

1) The inspections of solar water heating systems could be rolled into the current inspection process for homes in ETO's Efficient New Homes Program. The contractors performing the work under the Efficient New Homes Program are subject to a complete inspection of the homes before the dry-wall is put up, and then also after construction is complete to provide supplemental testing. The inspector is now charging ETO approximately $400 per inspection, which could potentially be saved.

2) A number of states have already eliminated inspections for solar water heating systems, with the full understanding that the solar water heating industry has made great strides to better train their installers and to "police" their contractors' work more thoroughly. The State of Oregon could work to establish industry standards for installation through Advisory Groups or through Trade Ally Coordinators.

Cross-Cutting Program Initiatives

Cooperative Work with Efficient New Homes Program and Other Residential Programs

Cooperating with Trade Ally Coordinator, who has contacts with all the builders, contractors could learn the skills and develop the tools to further promote the Oregon market. This would allow for recruitment, outreach, and support to be provided to these contractors that are consistent with the support being provided by the other ETO programs.

There is a robust new home market in Oregon, and we have seen from past experience that finding a few builders to commit and become "champions" for a particular technology can have vast impacts on the local homebuilding industry. The ETO's Home Energy Savings Program could leverage relationships with contractors who may be able to provide advertising, education, and outreach efforts to customers who are already making energy efficiency upgrades to their homes. In addition, a number of customers are willing to consider a solar water heating system, since including the cost of a solar water heating system into a new home's 30-year mortgage nets a positive monthly cash flow for the homeowner.

Adding a production builder to the solar water heating program would place downward pressure on the current pricing levels of installed solar water heating systems. The two primary reasons for this are:

- Volume purchasing: Production builders offer a significant volume in purchases and they are able to forecast reasonably well the start and completion dates for construction.
- Consistency in design: Production builders usually offer many similarities in the design and construction approach of their homes. This enables solar water heating installers to understand potential problems before they occur and allows the solar water heating installers to standardize their approach.

We also recommend very close coordination with the Home Energy Savings Program to solidify the solar water heating initiative, secure large-volume installations, increase the awareness of solar water heating, and grow the contractor market. We found that both of the contractors currently supporting the ETO Efficient New Homes Program and Home Energy Savings Program (PECI and CSG) are very interested in incorporating solar water heating into their programs.

While the Home Energy Savings Program doesn't offer the same volume approach, there are many more contractors participating in this program, who are looking for ways to differentiate their services. By including solar water heating into their evaluation process they can increase the dollar amount of upgrades on a per house basis.

Targeted Recruitment of New Contractors

In order to generate volume for this initiative, we believe that targeted recruiting efforts must be undertaken. Part of this recruitment effort would be through various educational efforts, to identify incentives, access information, financing, and other tools to support their business expansion.

To see the ETO Solar Water Heating Program ultimately thrive, the number and type of contractors participating in the program must expand. The ETO should undertake a designated focus of educating a cross-section of contractors on the business opportunity, providing them with the tools and information that they need to be successful.

Establish an Advisory Group

We recommend the creation of an advisory board of participating contractors who fully understand the mission of the ETO and the goal of expanding the solar water heating market. Many similar advisory boards for other programs around the country focus on addressing issues such as expanding the market, ensuring quality, providing feedback to program administrative staff, alleviating some of the information dissemination burden from program administrative staff, and speaking as one voice to legislative and regulatory bodies.

One such advisory group, comprised of Home Energy Rating System raters in the Dallas-Fort Worth, TX area was able to: 1) ensure that new market entrants knew how to secure necessary training, 2) enact voluntary policies and practices for inspections to which all providers adhered, and 3) undertook the goal of expanding the ENERGY STAR Homes Program into the Home Performance with ENERGY STAR Program by adopting the same practices and working with builders to identify the ages of homes in large master-planned communities to identify which were the best prospects.

The ETO currently has a Trade Ally Coordinator that works in its Home Energy Savings Program. The current contractor performing the work, CSG, could help to facilitate the group and work to include new trade allies to the program from building trades outside of the current mix of contractors (such as additional trades from HVAC, insulation, fenestration, etc). CSG has established the Trade Ally Coordinator role for the Home Energy Savings Program and collaboration with the Solar Water Heating Program seems to be a natural fit that could provide additional exposure for the existing installers to the contractors performing work with existing homes.

The ETO should also work closely with OSEIA to keep them aware of the goals and mission of the ETO. Together they could identify ways in which OSEIA can work with legislators and regulatory bodies to see that the policies and rules enacted provide a catalyst to the market for solar water heating and other renewable technologies, rather than a barrier to market expansion.

Contractor Training and Education

Among the various building trades, plumbers have traditionally had the least exposure to crafting and articulating energy savings messages to consumers. Further, they have typically not been exposed to many of the tools used to calculate energy savings or taught how to present them to the customer, unlike other contractors such as electricians, HVAC service and repair technicians, or those in the windows or insulation trades who regularly possess that knowledge and training. And for a lot of reasons, plumbers have not been forced to think about it. The only exposure that many plumbers have had to energy efficiency and savings messages has been to explain to consumers why low-flow toilets were included in the National Energy Policy Act of 1992. An additional consideration is that plumbers are usually unfamiliar with selling their services through multiple buying options such as financing. Water is simply essential to every homeowner and consumers will typically spend as much as it takes to solve water problems.

The plumbing trades must be provided with information about energy efficiency, and ETO could assist them to develop and deliver energy value propositions to the consumers. The ETO can likely accomplish this by coordinating through the existing contractors that manage the ETO's Trade Ally program. For example, Conservation Services Group (CSG) is currently performing outreach and recruiting to the contracting community, as well as providing support in integrating various energy efficiency initiatives. Therefore, the ETO Solar Water Heating Program could use this avenue to reach the plumbing community and could leverage the solar water heating contractors into additional existing home opportunities.

Program Messaging

Promotions with Manufacturers

We recommend establishing brand awareness for the ETO Solar Water Heating Program, through a cooperative advertising and marketing campaign for contractors through distributors/manufacturers. This is an excellent opportunity to engage the solar water heating manufacturers and to teach them how to successfully grow the market, and to show them opportunities to increase their own market share. We believe it is important to encourage this campaign to the manufacturers to combat their view that the Oregon market is too small and less attractive than to other states and regions of the country.

Establish Advertising Cooperative

We recommend that the ETO set aside funds in the Solar Water Heating Program budget to promote cooperative advertising among the solar water heating manufacturers, distributors, and contractors to promote the installation of systems. At

least two of the manufacturers have indicated that they would consider allocating some matching advertising dollars to promote solar water heating in Oregon. SunEarth and Thermal Conversion Technology have indicated that they see a benefit in promoting their systems, with the caveat that they have not engaged in this activity previously, so their experience is limited. They would need to rely on guidance from the ETO.

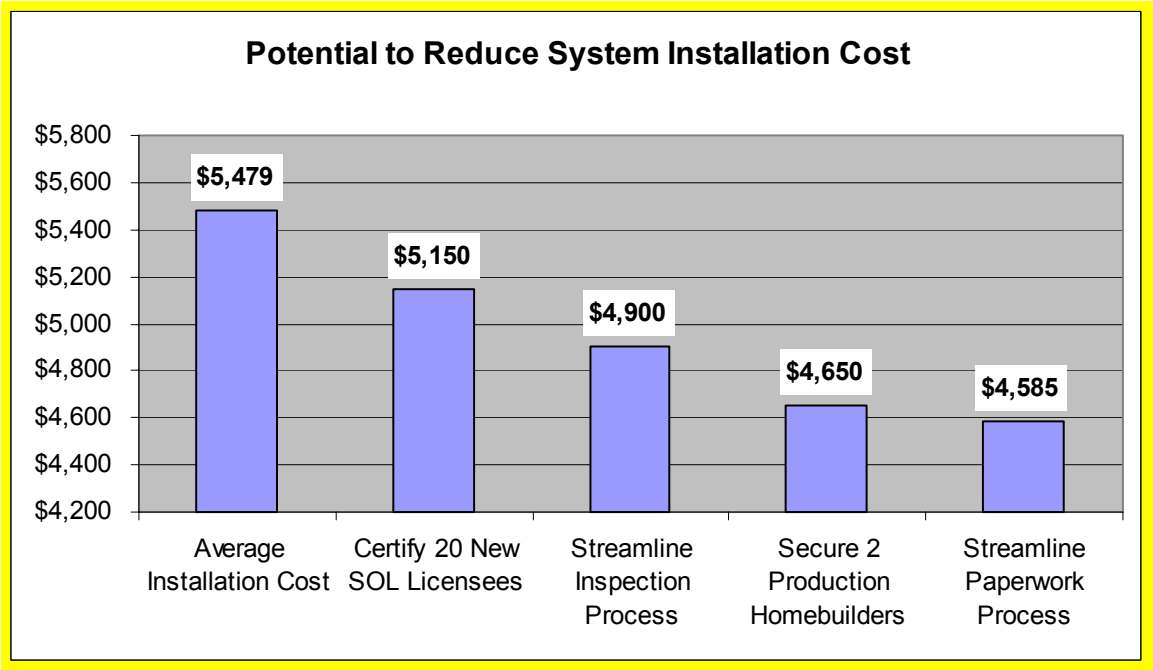
Increasing consumer awareness of solar water heating as an option for serving their heated water needs is a very basic need for the program. Increased awareness through advertising vehicles also serves to raise awareness among contractors that the profitable opportunities exist in PV and solar water heating systems. In addition to getting the manufacturers to focus on increasing consumer and contractor awareness, the marketing and outreach efforts with the manufacturers should include several other key components such as:

- The adoption of tools for selling the value proposition of solar water heating systems (for example, a number of solar water heating are currently available on the web for demonstrating consumer paybacks. See Appendix D for a list.)
- Ensuring that the manufacturers are providing adequate training for inexperienced contractors and installers.
- Encouraging the manufacturers to reach out to organizations such as OSIEA and the plumbing trade associations to increase their awareness and promotion of opportunities in Oregon.
- Collaborating to develop strategies to provide outreach to the other market actors such as lenders, realtors, appraisers, other trade associations, etc.

There are also cross-branding opportunities that exist with the Efficient New Homes Program and the Home Energy Savings Program, where current advertising messages could be "sniped" to include references to the PV and Solar Water Heating Programs of the ETO. These other ETO programs have experience in advertising cooperatives with both contractors and builders, and may serve as a point of leverage for the Solar Water Heating Program to incorporate solar water heating messages into the existing advertising programs. A focus on new construction would surely elicit participation from the manufacturers who desperately want to craft messages and value propositions to address this market.

Advertise Potential Cost Reduced to Consumers

We believe that with the above program changes, the following cost savings projections are within reach. The chart below serves to demonstrate how the installation costs can be reduced, which will encourage more participation by consumers, without increasing incentives.



Customer Marketing, Selection, and Pricing

The Home Energy Savings Program also offers an opportunity to expand into the contracting community and to expand the package of services that these contractors provide to consumers. Based on the financing packages, the new federal tax credits and the value propositions being offered to consumers, solar water heating will make an attractive option to include in "whole-house" upgrades. With increased outreach to consumers and increasing the breadth of types of contractors participating in the program, this would heighten consumer awareness and competition among contractors which should reduce the "cherry-picking" in which the existing contractors engage.

Promoting the Program through a Pilot Project in New Construction

We recommend that the ETO financially assist at least two production builders with the installation of a solar water heating system on a new or model home. This should be accompanied by creative materials in the model home promoting the solar water heating system. Further, this pilot should be conducted with home builders who have expressed interest in including solar water heating systems as an efficiency measure in new construction and are willing to promote the technology.

Activities

2005 through 2006

	Oct. 05	Nov. 05	Dec. 05	Jan. 06	Feb. 06	Mar. 06	Apr. 06	May 06	Jun. 06	Jul. 06	Aug. 06	Sep. 06	Oct. 06	Nov. 06	Dec. 06
Program Format															
Commit to Multi-year	■	■													
Work with OSIEA on SOL licensing	■	■	■	■	■										
Review program paperwork requirements	■	■	■												
OSIEA website corrections	■	■													
Program Structure															
Promote financing options			■	■	■	■	■	■	■	■	■	■	■	■	■
Assist contractors in securing financing options			■	■	■	■	■	■	■	■	■	■	■	■	■
Coordinate inspection process				■	■	■	■	■	■	■	■	■	■	■	■
Cross-Cutting Program Initiatives															
Cooperative Work with the Efficient New Homes and Home Energy Savings Programs				■	■	■	■	■	■	■	■	■	■	■	■
Targeted recruitment of new contractors		■	■	■	■	■	■	■	■	■	■	■	■	■	■
Establish an advisory group															
Contractor training and education			■	■	■					■	■	■	■		
Program Messaging															
Develop advertising initiative		■	■	■											
Promotions with manufacturers					■	■	■	■	■	■					
Pilot projects with new construction builders					■	■	■	■							
Home Energy Savings Program messaging					■	■	■	■	■	■	■	■	■	■	

RECOMMENDED BUDGET CHANGES

We have included a revised budget for the ETO Solar Water Heating Program that proposes a few simple changes, followed by explanations of these recommendations. The primary categories for budget changes are in administration, inspections, market development, and advertising. In order to increase participation among new construction builders and with consumers in the existing home market, we believe more collaboration with those ETO programs will need to occur. The six specific areas of recommended budget reallocation are:

1) Establishing a solar water heating cooperative advertising program with manufacturers and contractors to increase awareness of the ETO program and the benefits of solar water heating systems;
2) Incorporating the logos for both the ETO PV and Solar Water Heating Programs into the advertising messages created for the Efficient New Homes Program and Home Energy Savings Program;
3) Developing resources for meetings with the Trade Ally Coordinator to establish guidelines for cross-program support;
4) Allocating resources to subsidize pilot installations with at least two (2) residential new construction production builders.
5) Leveraging the staff of the implementation firms managing the Efficient New Homes Program and the Home Energy Savings Program for the purposes of more fully integrating solar water heating as an energy efficiency option in both programs.
6) Deemphasizing the focus on commercial installations and increasing the budget for the residential solar water heating sector.

Overall Budget Impact

We are recommending that the commercial solar water heating carve-out in the budget be reduced from $305,120 to $268,117, and that the residential sector carve-out be increased from $369,440 to $415, 984. This equates to an increase in the overall budget of less than $10,000. The information gathered from other programs around the country supports the idea that commercial installations should represent a smaller percentage of the budget. While we agree that there are opportunities in the commercial sector for solar water heating, we do not feel this should represent the current 45% of the total ETO Solar Water Heating Program budget. We also believe that consumer awareness, increased adoption of solar water heating by contractors, and consumer acceptance of the technology is going to be driven more by the residential sector that the commercial sector.

For these reasons, we are making the specific reallocation recommendations in the table below. These proposed budget changes are recommendations only and will require some overall adjustment to meet the ETO's current financial portfolio.

Commercial Solar Water Heating Recommended Budget

Total	Gas	Electric	Gas %	Description	Budget Action
$ 75,000	**$ 34,040**	**$ 40,960**	**45%**	**Financial incentives**	**Decreased overall incentives**
$ 6,250	$ 3,125	$ 3,125	50%	Program Delivery	
$ 2,000	**$ 667**	**$ 1,333**	**33%**	**Business Meetings**	**Increased meetings with contractors**
$ 9,000	**$ 3,000**	**$ 6,000**	**33%**	**Marketing-Media**	**Increased use of logo in existing media**
$ 1,700	$ 567	$ 1,133	33%	Marketing-Events/Sponsorship	
$ 2,000	$ 667	$ 1,333	33%	Planning Services-Specific	
$ 7,500	**$ 2,500**	**$ 5,000**	**33%**	**Marketing-Printing**	**Increased printing costs of new media**
$ 4,940	$ 1,647	$ 3,293	33%	Other Professional Services	
$ 5,000	$ 1,667	$ 3,333	33%	Marketing-Creative Services	
$ 44,130	$ 14,710	$ 29,420	33%	Marketing-Market Development	
$ 9,851	$ 3,284	$ 6,567	33%	Other Program Expenses	
$ 10,000	**$ 5,000**	**$ 5,000**	**50%**	**QA-Subcontracted**	**Reduced total inspections**
$ 20,000	$ 6,667	$ 13,333	33%	Evaluation Services-Specific Education & training	
$ 56,722	$ 25,525	$ 31,197	45%	Staffing	
$ 14,022	$ 4,049	$ 9,973	29%	General admin	
$ 268,115	**$ 107,115**	**$ 161,002**	**39%**	**TOTAL**	

* Shaded rows indicate recommended changes.

Residential Solar Water Heating Recommended Budget

Total	Gas	Electric	Gas %	Description	Budget Action
$ 115,000	**$ 61,715**	**$ 53,285**	**54%**	**Financial Incentives**	**Increased number of installations**
$ 6,250	$ 3,125	$ 3,125	50%	Program Delivery	
$ 6,000	**$ 2,000**	**$ 4,000**	**33%**	**Business Meetings**	**Increased meetings with contractors**
$ 4,940	$ 1,647	$ 3,293	33%	Other Professional Services	
$ 25,500	**$ 8,500**	**$ 17,000**	**33%**	**Marketing-Media**	**Increased brand awareness**
$ 9,600	$ 3,200	$ 6,400	33%	Marketing-Printing	
$ 9,851	$ 3,284	$ 6,567	33%	Other Program Expenses	
$ 13,000	$ 6,500	$ 6,500	50%	QA-Subcontracted	
$ 18,000	**$ 6,000**	**$ 12,000**	**33%**	**Marketing-Events/Sponsorship**	**Sponsorship with contractors**
$ 30,000	**$ 10,000**	**$ 20,000**	**33%**	**Marketing-Market Development**	**Increased pilot installations (new construction)**
$ 15,400	$ 5,133	$ 10,267	33%	Planning Services-Specific	
$ 18,000	**$ 6,000**	**$ 12,000**	**33%**	**Marketing-Creative Services**	**Increased brand awareness and co-op**
$ 21,250	$ 7,083	$ 14,167	33%	Evaluation Services-Specific Education & training	
$ 81,222	$ 43,860	$ 37,362	47%	Staffing	
$ 32,000	$ 20,000	$ 12,000	63%	General admin	
$ 415,986	**$ 198,020**	**$ 227,937**	**61%**	**TOTAL Residential Budget**	

* Shaded rows indicate recommended changes.

$ 684,101 = Total Revised Program Budget

Staffing

The current ETO staffing level of the Solar Water Heating Program includes two full-time staff members. Our evaluation included a look at whether we could recommend a reduction in staff for this program. After a thorough review of the existing workload, the prospects for increased participation, and the summary of recommended actions we have formulated, we believe that the ETO will need both full-time staff people split between the PV and the Solar Water Heating Programs. However, some of the administrative support and overhead allocation should be split with the Efficient New Homes Program and the Home Energy Savings Program if there is considerable collaboration between the two programs.

Marketing Materials

We are recommending that existing materials for the Efficient New Homes Program and the Home Energy Savings Program be "sniped" with the PV or Solar Water Heating Program logos, and that the budget be increased to reflect this change. This should be a relatively minor change and have minimal total budget impact, but will serve to create awareness in the marketplace. Residential new construction builders will certainly want some visibility if they are going to participate in the ETO Solar Water Heating Program, and it will be an asset to the contractors participating in the Home Energy Savings Program as well, since it will reinforce messages that contractors provide to consumers.

Cooperative Advertising

We recommend that an advertising cooperative be established in conjunction with the solar water heating manufacturers and distributors. Several of the larger solar water heating contractors may wish to participate in the cooperative advertising as well, and should be encouraged to do so. In the budget recommendations listed previously, we recommend that the both the commercial and residential marketing-media budgets be increased by almost $24,000 to secure cooperative advertising dollars from the manufacturers. This should allow for targeted placement of advertising in local or specialty publications, but will not be sufficient to secure mass media such as radio, TV, billboards, or newspapers. We recommend that the timing of the announcement of this cooperative should coincide with the meeting of the manufacturers for discussing the impacts of the Energy Bill and the direction for the ETO Solar Water Heating Program.

Inspections

We recommend closer coordination with the ETO's Efficient New Homes Program. In this way, the total budget for inspections can be reduced by using the contractors already in the field performing the residential new construction inspections. These new construction inspectors have two inspections in their process. One inspection is a pre-

drywall inspection, with the second being post-construction to perform blower-door and duct blaster performance testing. We believe the same inspector can inspect all of the items on the ETO's inspection report in those two visits, eliminating the need for further inspections.

Additionally, we feel that there are savings that will naturally occur by deemphasizing the commercial program. The overall number of commercial projects may slightly decrease, which would result in fewer inspections as well.

CONCLUSION

In light of the new federal solar and PV incentives, the market for solar water heating should see immediate growth. However, as the duration of these incentives is uncertain, the ETO should use this period to make changes to their program that will foster the long-term sustainability of the industry in Oregon. Hopefully, the federal incentives will drive the economies of scale necessary to bring down the price of solar water heating systems for all consumers. While monitoring the effects of the national market, the ETO should focus on changes to its program which will help the long-term sustainability of the industry in the state. These changes include increasing the capacity of the solar water heating industry, increasing market knowledge acceptance and demand – especially in new home construction, increasing industry marketing capacity, leveraging the ETO's Efficient New Homes Program and the Home Energy Savings Program, and reducing administration related to incentives. We are confident that these steps will help the ETO develop a self-sustaining solar water heating industry in Oregon and achieve its goals for the Solar Water Heating Program.

OSEIA Sponsored Training

To ensure high quality installations continue in Oregon OSEIA sponsors training programs for renewable energy electricians and solar plumbers. OSEIA members are also entitled to reduced tuition at any OSEIA sponsored courses.

LRT Apprentice Program

The Renewable Energy JATC is currently administering the LRT apprentice program. Updates will be provided on this webpage when available.

OSEIA Members
25 years of excellence
and service

Solar Heating and Cooling Installer (SOL) Training

All individuals who install solar thermal systems in Oregon will be required to obtain this license.

The SOL training program has been approved and is established. We will post updates when available.

OSEIA Sponsored Training Courses

We will be offering a PV code change course in March 2005 by Bill Brooks. More information will be available in the future.

SEE TEXT

Send comments on this site to mailto:info@oregonseia.org. Thank's for visiting!
See our content page for a complete website directory
OSEIA Contact info
Website last updated: June 24, 2005

Required Solar Licenses

Installing solar systems in Oregon can be done by individual homeowners (see below for details) and by licensed installation companies using licensed installers.

If you have any questions regarding legal installations contact the Building Codes Division (BCD) at: http://www.oregonbcd.org/

Oregon License Issues

Solar systems installed in the state of Oregon require proper permits and systems installed by contractors require properly licensed businesses and installers. Consumers should verify the licenses of the people doing work on their homes to protect themselves and their investment. You should always ask for references in addition to proper licenses.

A person is not required to obtain a license to make an electrical installation on residential or farm property that is owned by the person or a member of the person's immediate family if the property is not intended for sale, exchange, lease or rent. You are still required to pull a proper permit. Contact the BCD if you have questions regarding homeowner installations.

You can check licenses very easily at links below.

All Solar Systems

All contractors must have a CCB license. Ask your contractor for their number. If they don't have one they cannot legally work in Oregon. You can check the CCB# at: http://www.ccb.state.or.us/

Solar Electric Systems

1. All businesses installing electric systems must have an electrical contractor license (in addition to the CCB license above). There are 2 legally allowed

Only with 3 clicks do you find that a Journeyman Plumber is an eligible installer

contractor electrical licenses for solar electric installations: General Electrical Contractor (C) and Limited Renewable Energy Contractor (CLR). You can verify these licenses at: http://www.oregonbcd.org/licensesearch.html

2. All electrical contractors installing solar electric systems must use licensed electricians. There are 3 licenses legally allowed to install solar electric systems: General Journeyman (J), a Limited Renewable Energy Technician (LRT), and a Limited Residential Electrician (LR). You can verify these licenses at: http://www.oregonbcd.org/licensesearch.html

Solar Hot Water Systems

1. All businesses installing solar hot water systems must have a Plumbing Business registration (in addition to the CCB license above). You can verify this 'PB' number at: http://www.oregonbcd.org/licensesearch.html

2. All contractors installing solar hot water systems must use licensed plumbers. There are 2 licenses legally allowed to install solar hot water systems: general journeyman plumber and a Solar Heating and Cooling Specialty Plumber (SOL). You can verify these licenses at: http://www.oregonbcd.org/licensesearch.html

LRT License | SOL License

LRT APPRENTICE | SOL (SOLAR THERMAL) TRAINING | OSEIA SPONSORED COURSES

Solar Training Courses Offered in Oregon

Solar Heating and Cooling Installer (SOL)

The Solar Heating and Cooling Installer license is a specialty plumbing license that allows the licensee to install and maintain solar thermal systems.

All solar systems in the state of Oregon must be installed by a licensed individual. Please see license requirements for more information (link).

Send comments on this site to mailto:info@oregonseia.org. Thank's for visiting!
See our content page for a complete website directory
OSEIA Contact info
Website last updated: June 24, 2005

Appendix D

Among the list of firms that can provide financing among various ranges of credit scores are:

Conservation Services Group
40 Washington Street
Westborough, MA 01581
Phone: 508-836-9500
Fax: 508-836-3138

Electric and Gas Industries Association (EGIA)
Sacramento Office
3800 Watt Ave., Suite 105
Sacramento, CA 95821
(916) 609-5300 Main Office
(800) 506-9073 Fax

Fannie Mae
Corporate Headquarters
3900 Wisconsin Avenue, NW
Washington, DC 20016-2892
(202) 752-7000

A number of websites offer SWH Calculators for use by contractors and consumers. We have inserted a partial list of those sites below:

http://www.apricus-solar.com/html/solar_co2_reductions.htm
http://www.infinitepower.org/calc_waterheating.htm
http://www.energyalternatives.ca/content/sub_pages/WaterHeatCalc.html
http://www.enerworks.com/solar_calc.asp
http://www.energywindow.com/calculators/calc-waterheating.shtml
http://chuck-wright.com/calculators/hotwater.html
http://www.siemenssolar.com/solar-calculators/water-heating.html
http://www.dcn.davis.ca.us/go/deant/CompareSolar.html
http://www.solar-energy-facts.org/solar-calculators/water-heating.html
http://www.bio-radiant.com/WaterCal.html
http://www.anycalculator.com/hotwaterheating.htm