

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460



**OFFICE OF
AIR AND RADIATION**

November 26, 2007

Richard Karney
ENERGY STAR Product Program Manager
U.S. Department of Energy
1000 Independence Avenue, SW, EE-2J
Washington, DC 20585-0121

Dear Mr. Karney,

As we indicated last month, I am submitting comments on the Department of Energy's (DOE) Second Draft Criteria Analysis for Residential Water Heaters under the ENERGY STAR Program, on behalf of the Environmental Protection Agency (EPA). EPA shares the goal of accelerating the market adoption of more efficient water heating technologies due to the potential for significant environmental, economic, and energy system benefits. We want to begin our comments by commending DOE for its efforts to advance the discussion on how the federal government can promote water heating technologies that are significantly more efficient than required under the federal minimum standard. However, we believe the DOE proposal requires substantial modification and that substantial additional discussion is necessary to develop a sound suite of policies and programs to effectively capture the energy and environmental potential in the area of water heaters.

A summary of our comments and recommendations is as follows:

- The discussion of how best to accelerate the market adoption of efficient water heaters needs to continue at this time;
- The next step should be to convene a broad stakeholder process to devise a comprehensive strategy for accelerating the adoption of efficient water heaters which would address important cost, performance and market infrastructure issues of advanced water heater technologies and draw upon a full suite of deployment programs and policies, including the possible development of a new program to specifically address the issues with advanced technologies;
- The DOE proposal for using the ENERGY STAR label on advanced water heater technologies that do not meet the principles for success of the ENERGY STAR program should not be pursued at this time;
- The meaning of the ENERGY STAR label on consumer products should not be altered with the attendant potential for consumer confusion by allowing the ENERGY STAR to be used on products which do not meet the principles for the program without

completing a broad stakeholder process that allows thousands of existing stakeholders to comment on such a fundamental change; and

- DOE should propose to use the ENERGY STAR to recognize efficient storage water heaters in a manner that builds upon and is consistent with the success of the ENERGY STAR program.

We are providing these comments and recommendations because our technical review of water heater technologies and review of other stakeholder comments reveals profound consumer issues such as high cost, unclear performance, uneven safety requirements, limited availability of services for quality installation and maintenance, and others are associated with the technologies eligible for the ENERGY STAR based on DOE's proposed criteria. These issues have important implications for fielding successful water heater programs and policies and for the continued success of ENERGY STAR.

ENERGY STAR has proven successful as a consumer guide to highly cost-effective, proven products that deliver reliable energy savings and environmental benefits. A review of the consumer issues accompanying the technologies targeted by DOE's proposal relative to the characteristics of technologies where ENERGY STAR has been successful indicates that

- Use of ENERGY STAR is unlikely to have a significant impact on enhancing the sales of the targeted technologies
- Consumers are not likely to be helped by the ENERGY STAR being on these technologies as there remain a range of complex technical, cost, and other issues for them to wade through and resolve on their own, and
- ENERGY STAR will likely be diminished in value to today's consumers because it would fail to offer them the easy energy-efficient, cost-effective, solution with water heaters as it offers in the more than 50 other product categories for which it is available.
- The current DOE water heater proposal may be appropriate for a new advanced technology program

EPA recommends against adopting the DOE proposal as an ENERGY STAR specification at this time to avoid undermining the large investment that the nation has in the ENERGY STAR program and so that the ENERGY STAR program will be available to promote today's emerging water heater technologies once they have evolved to exhibit the price and performance characteristics necessary for the successful application of ENERGY STAR. In addition, a much broader stakeholder comment process is required on the issue of the change in definition of the ENERGY STAR program that DOE is proposing through this draft water heater specification. Such a change impacts stakeholders well beyond those engaged in the matter of water heaters, potentially thousands of organizations across the country, and they should be proactively engaged in this discussion before the basis of their investment and partnership with the federal government is altered without notice.

To support these recommendations and to assist in the continued discussion, EPA is offering comments in the following areas:

- Review the importance of advancing water heater efficiency
- Review the principles upon which the ENERGY STAR program has built its success

- Propose an approach for using ENERGY STAR on water heaters that is consistent with the ENERGY STAR program principles for success
- Outline the array of technical and market issues that have been raised with regard to advanced water heater technologies that need to be resolved prior to broad promotion to American consumers
- Outline options for pursuing advanced water heater technologies using the suite of policy and program tools available to the federal government and its partners

Importance of Higher Water Heater Efficiency

Water heaters are an important part of home energy use, representing 11% percent of residential energy use (EIA, AEO (2007)), and 17 percent of the typical single family home energy use (EIA, RECs (2001)). Home water heaters cause about 40 million metric tons of (mmtce) of greenhouse gases annually - 50 percent of these emissions result from electric water heaters and 42 percent from gas-fired water heaters. And, the average home spends about \$250 a year to heat water. Addressing this energy use through programs that go beyond the federal minimum standard could be an important contribution to national energy savings and reduced emissions of greenhouse gases. Importantly, given the significance of this energy use in the home energy budget, moderate increases in efficiency beyond the minimum requirements could offer important energy and greenhouse gas savings as additional work is pursued on advanced and emerging technologies.

Further, the numbers provided above characterize the energy use of water heaters within existing homes across the country. Additional energy use is attributable to water heating installed in new construction. However, each of these markets – existing homes and new construction – operate differently with different market actors and market barriers. Each requires a well-defined, dedicated strategy to address the market-specific barriers, the typical decision-making role of the homeowner, and the product distribution system, among other issues. EPA’s comments are focused on the strategies for the existing homes market as this market is where there is large opportunity for efficiency gains by employing the consumer-oriented ENERGY STAR label on efficient products..

Role of ENERGY STAR

Water heaters remain the single largest home energy use for which there is not an ENERGY STAR label to guide consumers as they weigh alternative options, and it is understandable that there is great interest in addressing this gap. However, it is important to add water heaters to the ENERGY STAR program based on a good understanding of the role that ENERGY STAR has played across the more than 50 product categories engaged in the program and the role it can be expected to play with water heaters. This context is important because it is what has been shown to work in enhancing the sales of efficient products, and it is the result of significant investment by the federal government and others that can be damaged if not employed consistently for the benefit of the consumer.

ENERGY STAR has been playing a well defined role in the market place for more than fifteen years helping consumers find products that save them money, while offering good product performance, and helping them protect the environment. It is designed to appeal to the

broadest set of consumers across the country as they are in the market to purchase new products.¹ ENERGY STAR is designed to be an easy choice for a broad set of consumers in a number of ways, and the practical implications of this program design are:

- **Simple way for consumers to find and select energy saving products and practices.** Products either earn it by meeting performance requirements or they do not. There are not tiers for higher efficiency products.
- **Products must be highly cost-effective to the consumer.** A strong financial case is critical for today's consumer – as recently confirmed in the McKinsey survey of the paybacks people will accept when pursuing energy efficiency which reported that about 75 percent of the respondents require a 2 year payback or less. The specifications for ENERGY STAR are typically set where there is a variety of available products that offer consumers with simple paybacks of two to three year, with many providing an immediate payback (no additional first cost), and the maximum being about 5 years.² This includes accounting for any additional installation or maintenance costs relative to the typical alternative as these are real costs to the consumer.
- **Products offer same, if not better, performance.** ENERGY STAR is only used if the products meeting the higher efficiency levels will deliver the same, if not better, performance as the typical alternatives. ENERGY STAR is designed to help show that energy efficiency is not about sacrifice or doing without, but rather that with efficient technologies on the market today, consumers can cut their energy bills substantially, while reducing greenhouse gas emissions. Where additional performance requirements are necessary so that ENERGY STAR qualifying products offer similar or better performance, they are included in the ENERGY STAR specification for that product category.
- **Products provide real energy savings to the consumer.** For ENERGY STAR to be successful consumers must routinely experience real savings from the product purchases and these savings can not be dependent upon the consumer having to solve issues such as complicated design, installation, and maintenance issues. There are additional programs and policies that can be developed when these issues are present.
- **Program offers a level playing field for program partners and technologies.** ENERGY STAR is designed to establish performance levels that differentiate highly efficient products from less efficient products and assist the consumer in purchasing many of the energy using products needed for the home or office. ENERGY STAR provides technology-neutral performance requirements across competing technologies. ENERGY STAR is not used to give one technology an advantage over another if they perform similarly.

When employed to guide consumers to highly cost-effective, proven technologies the ENERGY STAR program can yield significant benefits as can be seen from a review of the product areas yielding the greatest results within the ENERGY STAR program over the last five years. Importantly, there are no examples of ENERGY STAR yielding significant benefits by promoting

¹ This statement describes the role of the ENERGY STAR on products. The ENERGY STAR program is much broader than the product label. It also includes corporate energy management strategies, standardized measurement tools for commercial and industrial facilities, and strategies for improving the efficiency of new and existing homes.

² This statement summarizes the paybacks across the products covered in the ENERGY STAR program from the most recent review of the cost-effectiveness of ENERGY STAR products which will be included in the next Annual Report on Protecting the Integrity of the ENERGY STAR label.

technologies with long pay backs and the other technical and market infrastructure issues that are being raised with the advanced water heater technologies.

Product Category	Cost-effectiveness (payback period)	Estimated Energy Savings 2001 to 2006 (trillion Btu)	Estimated Greenhouse Gas Savings 2001 to 2006 (MMTC)
Computer monitors	No retail premium generally	1300	24
Printers	No retail premium generally	380	6.9
Televisions (including TV/VCR/DVDs)	No retail premium generally	260	4.8
Residential Light Fixtures	< 1 year < 2 years for recessed cans	210	3.9
Furnaces (gas or oil)	< 3 years	210	3.2
Computers	No retail premium generally	150	2.8
Multifunction Devices	No retail premium generally	140	2.6
Copiers	No retail premium generally	110	2.0
Source: LBNL Analysis			

In summary, the ENERGY STAR label is a trustmark for consumers. It has grown tremendously over the last fifteen years to now be used on products in more than fifty product categories, and it is helping the nation save billions of dollars each year on energy bills and avoid significant emissions of greenhouse gases

Indeed, this role for ENERGY STAR was well recognized in the 2003 DOE decision on ENERGY STAR and water heaters. At that time, DOE decided not to pursue it because of market conditions that were inconsistent with the guiding principles of the ENERGY STAR Program. In a January, 2004 letter, the Department summarized the relevant market conditions as follows:

- Labeling conventional technologies would not offer sufficient market differentiation or savings to consumers.
- Labeling “non-conventional” products would not insure product performance could be maintained or enhanced with ENERGY STAR compliant products compared to non-compliant models.
- For most “non-conventional” technologies, purchasers would not recover their incremental investment within a reasonable time period.
- Based on the analysis performed for our report, the non-conventional technologies demonstrated payback timeframes unreasonable for the average consumer, ranging from 3.6 years to 19 years.

- Product availability and infrastructure for “non-conventional” products was not yet broad based.

And little has changed since 2004 with regard to the “non-conventional” technologies.

However, since that time there have been expert reviews and discussions with stakeholders that emphasize the importance of maintaining the consistency in what ENERGY STAR means for the consumer. For example, a recent review of the ENERGY STAR label by a leading brand strategy company, Interbrand, a firm that advises some of the best known brands in the country, emphasized that the future success of the ENERGY STAR program would require the program to continue to conform to its core tenets, including:³

- Technology must be proven, impeccable, and predictable
- Benefits must be reasonably immediate and measurable
- Outcomes must contribute to carbon reduction.
- Opportunities must be easy to access and simple to manage

Further, a key result of a recent EPA workshop on advanced technologies for climate protection was a strong recommendation to protect the ENERGY STAR label and the role of the program as efforts are expanded to address emerging technologies for purposes of greater greenhouse gas reductions. Two of the key recommendations resulting from this group of 75 experts were:⁴

- **Finding 4: Vigorously Protect the ENERGY STAR Brand.** ENERGY STAR is a brand with high consumer recognition and trust that targets the mass market. It distinguishes products that have high energy efficiency, low operating costs, reliable energy savings, and high performance. The ENERGY STAR program is very effective in promoting energy efficiency which lowers customers’ utility bills and reduces greenhouse gas emissions. Seventy-five percent of ENERGY STAR products are no more costly than products that use more energy to operate. In the cases where ENERGY STAR products do have higher purchase and/or installation costs, these costs are quickly recovered in energy savings. Therefore, actions that promote emerging climate protection technology must be carefully crafted to absolutely not endanger the ENERGY STAR program success.
- **Finding 5: Develop Unique Recognition Programs for Emerging Climate Protection Technology.** Much emerging technology offering substantial greenhouse gas reductions are either components in larger integrated systems or will be purchased by home and business owners but installed by contractors. In these market circumstances, EPA [.. and/or DOE] can develop a separate and more comprehensive recognition program that will address the needs of more sophisticated and detail-oriented buyers who will want to know how much energy is being saved, how much GHG emissions are reduced, and how reliable the new product is including ease of repair and expected useful life. ENERGY STAR products often must be quickly purchased to replace failed appliance, while many emerging climate protection products can be more carefully researched and there is more flexibility in choosing the time and place for installation.

³ See Interbrand Report, “Building a Powerful and Enduring Brand: The Past, Present, and Future of the ENERGY STAR Brand,” June 2007.

⁴ See <http://www.epa.gov/cleanenergy/climatetechnology.htm> for additional information.

Unlike ENERGY STAR technologies, emerging technologies are often more expensive to consumers because companies must recover research and product development costs, because production is below economies of scale, and because marketing and warranty costs are higher. EPA [*and/or DOE*] can help these technologies and protect the ENERGY STAR brand reputation by developing unique programs to promote emerging climate protection technology to customers willing to pay more to make the maximum reduction in greenhouse gas emissions. EPA should focus efforts on substantiating economic benefits, widely conceived.

However, there are examples of consumers being advised not to rely upon the ENERGY STAR label by other authoritative sources of consumer advice, when there are technical and performance issues that have not been adequately addressed through the ENERGY STAR program or underlying testing procedures. Recent examples include ENERGY STAR dishwashers prior to soil sensors being incorporated into the testing procedure and ENERGY STAR washing machines that offered an energy intensive, super-heat mode that was not captured in the ENERGY STAR test procedure. These types of occurrences should be avoided to the extent possible to continue to build the value of ENERGY STAR as a helpful guide to consumers and a tool for manufacturers and others whose products meet the program principles. These types of events can be anticipated if advanced technologies earn the ENERGY STAR prior to key issues being addressed

Proposed Approach for Using ENERGY STAR on Water Heaters Given Current Technologies

There is a role for ENERGY STAR to play today to guide consumers to more efficient water heaters that are highly cost-effective and proven. Establishing an ENERGY STAR label for standard gas water heaters with a minimum energy factor of .62 would meet this objective for those consumers seeking to replace their gas water heater. As pointed out by a number of stakeholders, the savings would be substantial at this level and would provide consumers with the kind of choice they have come to expect from ENERGY STAR.

EPA does not agree with establishing a minimum energy factor at the proposed DOE level of .65. By DOE's estimates only about 100,000 units (about 1% of annual sales) are sold each year at this level due to important consumer issues. This includes the cost premium for this product which currently requires 8 years for the consumer to be paid back

In addition, EPA recommends that DOE develop educational messaging for consumers seeking to replace their electric storage water heaters to encourage the purchase of the most efficient water heater available and to provide other energy saving advice. Due to the small degree of differentiation among electric storage water heaters, the pursuit of an ENERGY STAR label for these products appears less useful.

Technical and Market Issues with Advanced Water Heating Technologies

The technologies that can meet the requirements of the current DOE proposal have a variety of technical and market issues associated with them from the consumer perspective that need to be further assessed and addressed. These issues include

- high initial purchase costs with long consumer payback periods,

- higher maintenance costs than typical products (which have not been fully assessed and analyzed),
- higher installation costs than standard products (which have not been fully assessed and analyzed),
- lack of clarity on timeframe for federal or other tax credits to assist consumers with high product costs,
- lack of uniform requirements for flammability safety,
- lack of understanding of energy savings due to inapplicability of current water heater testing procedures,
- lack of product availability, and
- lack of supporting distribution, installation, and maintenance infrastructure

In addition, a PG&E Report (2007) determined that gas tankless water heaters require about 10 to 30 seconds to heat the water to the user selected setpoint which could lead to significant wasted water as the user waits for water to reach a satisfactory temperature for faucet and shower uses. The Consortium for Energy Efficiency (CEE) is planning field research to compare the energy and water use of gas tankless water heaters and storage water heaters. From the standpoint of EPA's Office of Water, it would be prudent to wait until more information is available on the effects of these devices on water use.

This information is summarized in the table below and we have attached more information on these issues in Attachment A. An emphasis is placed on the issues that would confront the consumer attempting to replace a broken water heater as this is a very typical water heater purchasing situation. Based on this information, it is premature to apply the ENERGY STAR label to these emerging technologies, given the issues with cost, availability, and lack of supporting distribution, installation, and maintenance infrastructure. There are many uncertainties and information gaps that need to be addressed and there are more appropriate methods available to advance these emerging technologies. Once addressed and the technologies are demonstrated to meet the requirements for ENERGY STAR, these technologies could be introduced into ENERGY STAR program.

Water Heater Technology	Sales in 2006	Payback Period for Existing Homes	Issues/concerns
Gas Tankless	255,000 (2.6%)	20 years in existing homes without subsidies	<ul style="list-style-type: none"> • Expensive installation; venting and larger gas line • Increased maintenance costs • Lower emissions requirements • Lower safety requirements • Unclear energy savings/inadequate test procedure • Specialized training required for installation • Questions as to overall water use
Heat Pump (electric)	2,000 (< .03%)	3 years	<ul style="list-style-type: none"> • High first cost • Lack of availability • Special installation requirements • Unique maintenance issues • Increased heating load (and cost) due to evaporator coil cooling effect • Specialized training required for installation
Solar with either gas or electric back up	2,430 (< .03%)	10 to 15 years without subsidies Does not include maintenance costs	<ul style="list-style-type: none"> • Not cost effective • Higher maintenance costs • Lack of maintenance infrastructure • Freeze-zone issues • Inadequate test procedure • Specialized training required for proper installation
Gas Condensing	Not in residential market	10 years without subsidies (estimated)	<ul style="list-style-type: none"> • No product available • Product performance and reliability are unknown • Expensive installation: venting, condensate drainage and electric wiring

Suite of Tools Available to Promote Advanced Technologies

There is an array of energy efficiency deployment tools that can be used to address the issues that arise with advanced technologies. These measures have proven successful in helping to overcome market barriers when used at different stages in the market transformation process. For example, the following chart lists a variety of tools for promoting technologies that are at the same market state as the advanced water heating technologies in the DOE proposal:⁵

⁵ This chart was taken from: [ACEEE 98] Nadel, Steven, and Linda Latham. 1998 *The Role of Market Transformation Strategies in Achieving a more Sustainable Energy Future*. American Council for an Energy Efficient Economy. U983 March. Pg. 41.

Goal	Typical Barriers	Typical Tools	Type of Organization
Increase sales of newly-introduced (emerging) technologies	No consumer or purchaser awareness of the new product or its value.	Targeted education/PR to “early adopters,” purchasers who typically buy the newest technologies.	National, regional, local and utilities can help educate consumers.
		Targeted outreach to large purchasers.	National/regional organizations can target large purchasers. Regional/local & utilities can target medium to small purchasers.
	Distribution Channel may not understand, value, stock, or promote the product.	Rebates to consumers to spur demand and interest.	Utilities, manufacturers, or retailers can offer rebates and financing.
		Stocking incentives to distributors. Training/education regarding benefits of new products.	Utilities or manufacturers with help from state or regional organizations.
	Price may be prohibitive.	Rebates or special financing to subsidize the cost.	Utilities can offer rebates and financing. States can offer special financing or tax credits.
		Bulk purchases to increase production and achieve economies of scale.	National or regional organizations can organize these types of deals.
	Purchasers may assign some risk to purchasing a new technology.	Special leases or other ownership options that reduce perceived risk for consumers.	Manufacturers or retailers can offer special incentives, financing, and lease options for new products.
		Visible demonstration projects to show success.	National, regional and utilities may undertake demonstration projects.

By working with other stakeholders, DOE can help facilitate many of these market deployment tools for more efficient water heating technologies and help advance these technologies.

Possible mechanisms include:

- New recognition program for emerging technologies that may be of interest to ‘early adopters’
- Partnerships with utilities and other energy efficiency program administrators to leverage available rate payer funding to advance these technologies through programs that can deliver the necessary services to yield satisfied customers.

Once these technologies have progressed to a point where they are proven, cost-effective, and more widely available with the necessary market infrastructure they could be introduced into the ENERGY STAR program.⁶

In summary, EPA supports DOE's goal of promoting higher efficiency water heaters. However, we are concerned about the important consumer issues raised by EPA and other stakeholders through the public comment process. DOE's second draft analysis does not address many of the concerns and issues associated with water heating technologies raised during meetings and the comment period and mentioned in this letter. These issues could have serious implications in terms of the credibility of the ENERGY STAR program and with the ability of DOE to meet its own goals with regard to water heater technologies. It is necessary to engage in broader discussion of the program and policies that can be used effectively to accelerate the deployment of efficient water heater technologies. EPA would welcome the opportunity to assist DOE in addressing the issues preventing broader acceptance of advanced water heater technologies so that ENERGY STAR could play an effective role at the appropriate time.

Sincerely,

A handwritten signature in black ink, appearing to read 'Kathleen Hogan', written in a cursive style.

Kathleen Hogan
Director
Climate Protection Partnerships Division

cc:

Brian Mclean, EPA
Robert Meyers, EPA

⁶ Ibid. pg. 42.

Attachment A

Some of the key issues from a consumer perspective for the technologies DOE is seeking to highlight with the ENERGY STAR are listed below. Many of these issues have been brought forward through the stakeholder comment process and remain unaddressed.

Tankless gas water heaters

- Lower emissions requirements and hence greater emissions⁷
- The purging of unburned natural gas, a potent greenhouse gas with more climate forcing than carbon dioxide⁸
- Lower requirements for flammability safety⁹
- Increased maintenance costs^{10,11}
- Costs of venting and sizing of gas lines¹²
- Lack of cost-effectiveness with and without tax rebates¹³
- Specialized training is required for proper installation¹⁴

⁷ [PG&E 2007: *Residential Feasibility Assessment of Gas Tankless Water Heaters in PG&E Service Territory (2007 Update of Original 2004 Report)*] pg. 27 “Tankless units currently do not have to meet stringent 1121 requirements [for NOx emissions for water heaters in the CA South Coast Air Quality Management District], although a proposed 2012 requirement would require emissions improvements in tankless units.”

See also, South Coast Air Quality Management District. 2004. Rule 1121: Control of Nitrogen Oxides from Residential Type, natural Gas-Fired Water Heaters. <http://aqmd.gov/rule/reg/reg11/r1121.pdf> (Provides emission regulation for natural gas-fired water heaters.)

One tankless manufacturer claims to be the only manufacturer to have met the requirements gas-fired storage water heaters. Takagi Tankless Water Heaters received Southern California Air Quality Management District (SCAQMD) approval for its low emissions (NOx) with high thermal efficiency. http://takagi.com/web2003/a03_08.htm (SCAQMD regulations on NOx for tankless water heaters are unclear).

⁸ See comments by Capital Sun Group, “DOE should somehow make it known that every time a natural gas tankless water heater is turned off, the system is purged of unburned natural gas, a potent greenhouse gas more forcing than carbon dioxide. The trade-off between saving energy by eliminating tank losses and the increase in greenhouse gas emissions for these units should be compared.”, Judy Kosovich, Capital Sun Group, July 6, 2007.

⁹ Tank type water heaters manufactured after July 1, 2005 have to meet new stringent requirements for flammability safety. However, it appears this requirement was not extended to tankless units. <http://www.buyerschoiceinspections.com/FVIR-Water-Heaters>

¹⁰ T-KD20 Instantaneous Water Heater Installation Manual and Owner’s Guide <http://www.takagi.com/web2003/pdf/tkd20.pdf>

“Particles from [dust, sand, contaminants] objects may clog the air vent or reduce the functions of the rotating fan and cause improper burning of the gas. Regular maintenance is recommended for these types of environment.”

¹¹ [PG&E 2007] pg. 9. Also “The cost per service interval ranges from zero (for do-it-yourselfers) to about \$100. If not flushed, tankless heaters may fail in several years, depending on water quality.” Pg 22.

¹² [PG&E 2007] pg. 28 Cost to increase gas line size in new construction ~ \$950, however retrofitting existing lines costs ~\$1450. Even after the \$300 tax credit the simple payback is still about 20 years.

¹³ [PG&E 2007] pg. 28. Even after the \$300 tax credit the simple payback is still about 20 years for retrofit installations.

- Potential for dangerous installations¹⁵¹⁶
- Current test procedures are not adequate/ questionable energy savings¹⁷
- Not an option for emergency replacement of conventional water heater

Solar water heaters

- Lack of cost-effectiveness¹⁸
- Maintenance costs¹⁹
- Freeze-zone issues – preventive maintenance required for some types of collectors²⁰
- Current test procedure not adequate²¹

¹⁴ [PG&E 2007], pg. 22 “Specialized training is required for proper installation and servicing of tankless heaters. No such training is required for gas storage water heaters.”

¹⁵ [PG&E 2007], pg. 22 “Tankless water heaters can be purchased from “big box” retailers by owner-installers, but vent kits are only offered through wholesalers, preventing owners from installing indoor units without contractor participation. A potential safety concern may exist with homeowners installing these units with sub-standard venting.”

¹⁶ U.S. Department of Energy.-Energy Efficiency and Renewable Energy. A Consumer’s Guide to Energy Efficiency and Renewable Energy: Demand (Tankless or Instantaneous) Water Heaters. http://www.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=12820 “If you're determined to install your water heater yourself, first consult the manufacturer. Manufacturers usually have the necessary installation and instruction manuals. Also, contact your city or town for information about obtaining a permit, if necessary, and about local water heater installation codes.”

¹⁷ The existing DOE test procedure is not suitable for a number of hot water heater technologies and would require significant revisions. Tankless water heaters are highly susceptible to the interval between draws and the volume of each draw. Work done by the Davis Energy Group for CEC Title 24 shows that about 40% of actual, in field, hot water use occurs below the 10.7 gallon draw used by the DOE test procedure. At these lower volumes, the efficiency of a tankless water heater is considerably lower than the rated value, due to the energy needed to reheat the heat exchanger. CEC Title 24 uses an 8.8 point derate of the EF to account for this adjustment. DOE test procedure for determining EF for water heaters may overstate efficiency by as much as 9%, particularly for gas tankless water heaters.

¹⁸ DOE estimates that the simple payback is 7.5 years after taking into account the federal tax credit that can cover 30% of the cost. With no tax credit the payback is 12.5 years. *ENERGY STAR Residential Water Heaters: Second Draft Criteria Analysis and Proposal, October 26, 2007, pg. 7.*

¹⁹ DOE estimates maintenance costs at \$150-200 every three to five years. For comparison, this accounts for up to 40% of the energy savings over three years. These costs were not included in the simple payback calculations. *ENERGY STAR Residential Water Heaters: Second Draft Criteria Analysis and Proposal, October 26, 2007, pg. 9, fn. 9.*

²⁰ See DOE EERE Consumer Guide to Energy Efficiency and Renewable Energy , Solar Water Heating System Freeze Protection, “Don't rely on a collector's and the piping's (collector loop's) insulation to keep them from freezing. The main purpose of the insulation is to reduce heat loss and increase performance. For protecting the collector and piping from damage due to freezing temperatures, you basically have two options: Use an antifreeze solution as the heat-transfer fluid. Drain the collector(s) and piping (collector loop), either manually or automatically, when there's a chance the temperature might drop below the liquid's freezing point.” http://www.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=12960

²¹ The existing DOE test procedure is not suitable for a number of hot water heater technologies and would require significant revisions. The DOE test is not designed for water heaters with preheated “cold” input water. The specified EF calculation uses an assumed 58F cold temperature. In order to standardize this inlet temperature, testing conditions must be tightly controlled regarding the solar portion of the water heater (temperature, incident sunlight, wind speed, and heat transfer fluid). The DOE test procedure provides no guidance regarding the

- Careful attention to proper system design and installation are critical to safe and efficient operation.²²
- Specialized training is required for proper installation²³
- Not an option for emergency replacement of conventional water heater

Heat pump water heater

- Lack of availability
- Needs to be installed in a conditioned space to perform – also, not in unventilated closets or small spaces
- First cost is a significant market barrier²⁴
- Maintenance — Service infrastructure lacking; specialized training and familiarity are required. Consumers would have a much harder time finding repair contractors and would experience longer wait times.²⁵
- The large amount of cooling produced by the evaporator adds significantly to the heating load and can have an adverse economic impact on consumers, particularly in regions dominated by heating load hours. This has not been mentioned or factored into the DOE analysis.
- Specialized training is required for proper installation and maintenance.

Gas Condensing

- No availability
- Product performance and reliability could be an issue
- Expensive installation

preheated solar portion of the test. At best, it could be used to measure the performance of the auxiliary heater in the storage tank for a solar thermal system.

²² E.g. The Florida Solar Energy Center advises “Since the manner of installation can radically affect the reliable operation of the system, check on the installer’s qualifications. By meeting certain requirements and passing an examination, installers can now obtain a solar contractor’s license issued by the Florida Construction Industries Licensing Board. In addition, many solar dealers/installers in the state belong to the Florida Solar Energy Industries Association and abide by its Code of Ethics.” Florida Solar Energy Center, Solar Hot Water Q&A, http://www.fsec.ucf.edu/en/consumer/solar_hot_water/q_and_a/dealers.htm

In fact, in order to ensure safe and effective design and installation, state rebate programs typically send out inspectors to verify proper installation. E.g. “Effective January 1, 2006, solar electric (photovoltaic or PV) systems and solar thermal systems must be verified by a technician tax-credit certified by the Oregon Department of Energy for the homeowner to be eligible for a Residential Energy Tax Credit. Verification indicates that the system was installed according to building codes and met the Oregon Department of Energy performance and quality requirements. Although Certified Technicians have demonstrated basic solar competency, tax-credit certification is NOT a guarantee of proficiency or contractor knowledge.” <http://www.findsolar.com/showfaq.php?id=214&fromsearch=1> (Find Solar is a consumer website for the American Solar Energy Society)

²³ Ibid. Often state incentive programs require that “certified” technicians install solar thermal systems.

²⁴ DOE estimates the installed cost of a HPWH at \$1,500 which is more than double that of a conventional water heater. . ENERGY STAR Residential Water Heaters: Second Draft Criteria Analysis and Proposal, October 26, 2007, pg. 9.

²⁵ ORNL and NYSERDA did a pilot study that showed this was very important to consumers. NYSERDA was able to train a limited number of contractors which helped in this study because almost all participants had performance issues. There is currently very little service infrastructure to rely on.