

# In *Hot* Water

## Experiences of Solar Hot Water Arizona

Arizona Solar Center, Inc. and Salt River Project

May 15<sup>th</sup> 2012



# Arizona Solar Center

Your Guide to Solar and Other Renewable Energy Sources in Arizona

### Annual Solar Home Tours



### Educational Modules Downloadable PDFs



### Educational Seminars



The screenshot shows the website's navigation menu, a 'Home Highlights' section with dates, a 'Welcome to the Arizona Solar Center' message, and a 'Monthly Solar Event Calendar' for May 2010. It also includes a 'Reference Menu' and a footer with logos for sponsors like APS and ARPA.

Locate Arizona Installers



Join our Meet-up for Arizona events and find like minded people



Sign up for our email Newsletter

Monthly Solar Event Calendar

#1 Google hit for "Arizona Solar"

Public Professional Lecture Series



Formed in 2001 the AZ Solar Center is a collaboration of Government, Education, State Utilities, Solar Industry, Design Construction, and Non-profits

# WWW.AZSOLARCENTER.ORG

The Mission of the Arizona Solar Center is to enhance the utilization of renewable energy, educate Arizona residents on solar technology development, support commerce and industry in the development of solar and other sustainable technologies and coordinate these efforts throughout the state of Arizona.

# APS



APS and SRP had discussions in early 2010 on field installs through an independent third party



Audit tools and process established



Pilot study of approximately 250 sites



Program immediate implementation  
(failure rate upper 90's%)

Utility requested two special site visits



Results were surprising

# In *Hot* Water Forum



Utility Perspectives, Incentives, Actions  
Joel Dickinson, Senior Engineer SRP



Installation Findings, Lessons Learned, SRCC Guidelines  
Geoff Sutton, Project Coordinator, Az Solar Center



Building on findings  
Daniel Aiello, President, Az Solar Center

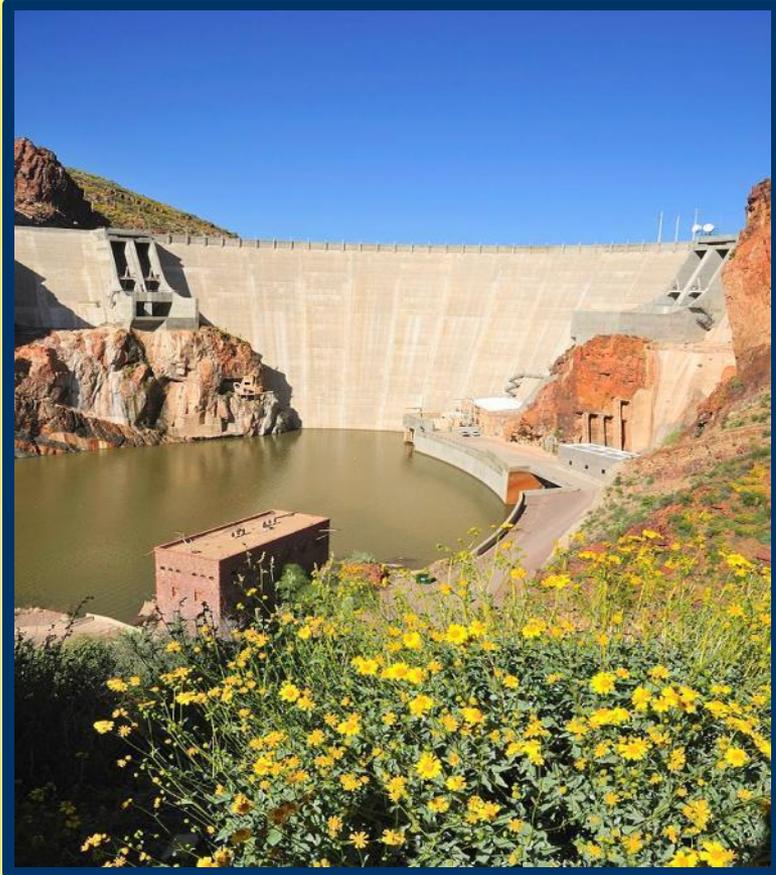
# **In Hot Water: Solar Hot Water Issues in Utility Programs**

*Joel Dickinson, P.E.  
Sr. Engineer  
Salt River Project*

*May 15, 2012*

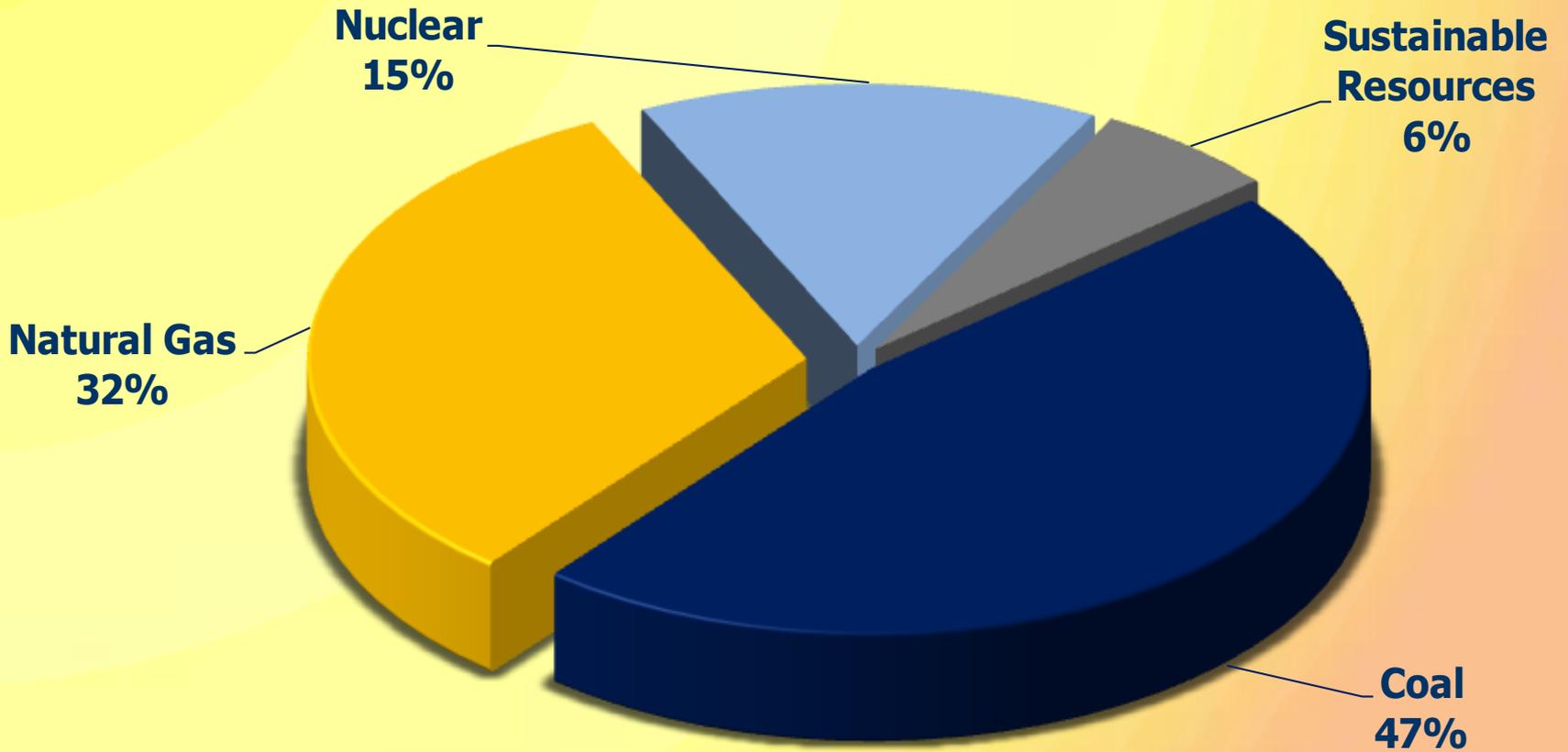


# Who is SRP?



- **Established in 1903 after Theodore Roosevelt signed the National Reclamation Act of 1902**
- **Largest water supplier to the Valley of the Sun**
- **Third largest public power utility in the nation**
- **935,000 electric customers**
- **6,800 MW peak load**

# SRP's Resource Mix



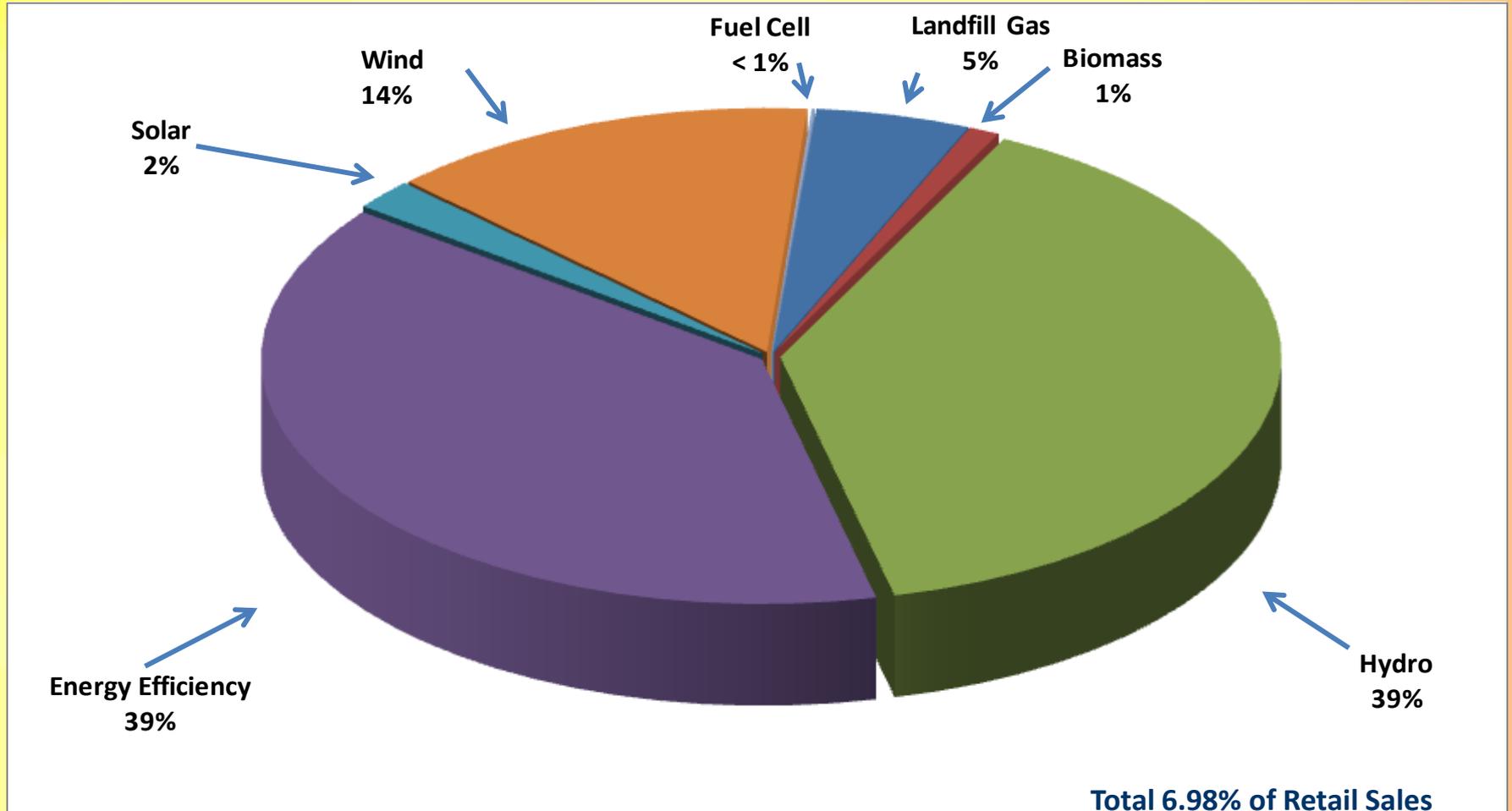
# Sustainable Portfolio Overview



- **Arizona RPS calls for 15% of retail electric sales renewable by 2025**
- **2004 – SRP established sustainable portfolio (includes: renewables and energy efficiency measures) with target of 2% of retail sales by 2010**
- **2006 – SRP adopted target of 15% of retail sales by 2025**
- **2011 – SRP adopted target of 20% of retail sales by 2020**

# Sustainable Portfolio Mix

Fiscal Year 2011



# Renewable Energy Resources



**Hydrogeneration**



**Low Impact Hydro**



**Geothermal**



**Solar**



**Landfill Gas**



**Wind**

# SRP Solar Energy Program



# Program Goals

- **Incentives provided in exchange for the renewable energy credits**
- **Ensure customer experience is rewarding, easy, and pleasant**
  - **Simplify the process wherever possible**
  - **Be a customer advocate by instituting consumer protection measures**
  - **Work with contractors to ensure safe, quality construction**



# SRP Solar Thermal Incentive Structure

- **Incentive is paid to customer in exchange for 20 years of Environmental Attributes associated with the solar water heater**
- **Third party rating agency determines the annual net energy savings in kWh or therms**
  - **OG-300 rating for residential *systems***
  - **OG-100 rating for thermal *panels***
- **Solar Rating and Certification Corporation (SRCC) or International Association of Plumbing and Mechanical Officials (IAPMO) accepted rating agencies**

# Residential Solar Water Heater Incentive

- **Incentive is \$0.40 per kWh of annual energy savings**
- **Solar offset gas or electric**
- **Only OG-300 rated systems eligible**
- **Pro-rate OG-300 rating 80% for panels facing east, west or flat**



# Residential SHW Typical Cost

## SunEarth SOLARAY

OG-300 Rating	Typical Cost	SRP Solar Incentive	AZ Tax Credit	Fed Tax Credit	Net Cost	Annual Savings	Simple Payback
2,880 kWh	\$6,033	\$1,152	\$1,000	\$1,810	\$2071	\$288	7.2 years

## Pacific West Solar Freeze Safe

OG-300 Rating	Typical Cost	SRP Solar Incentive	AZ Tax Credit	Fed Tax Credit	Net Cost	Annual Savings	Simple Payback
2,860 kWh	\$5,185	\$1,144	\$1,000	\$1,556	\$1,485	\$286	5.2 years

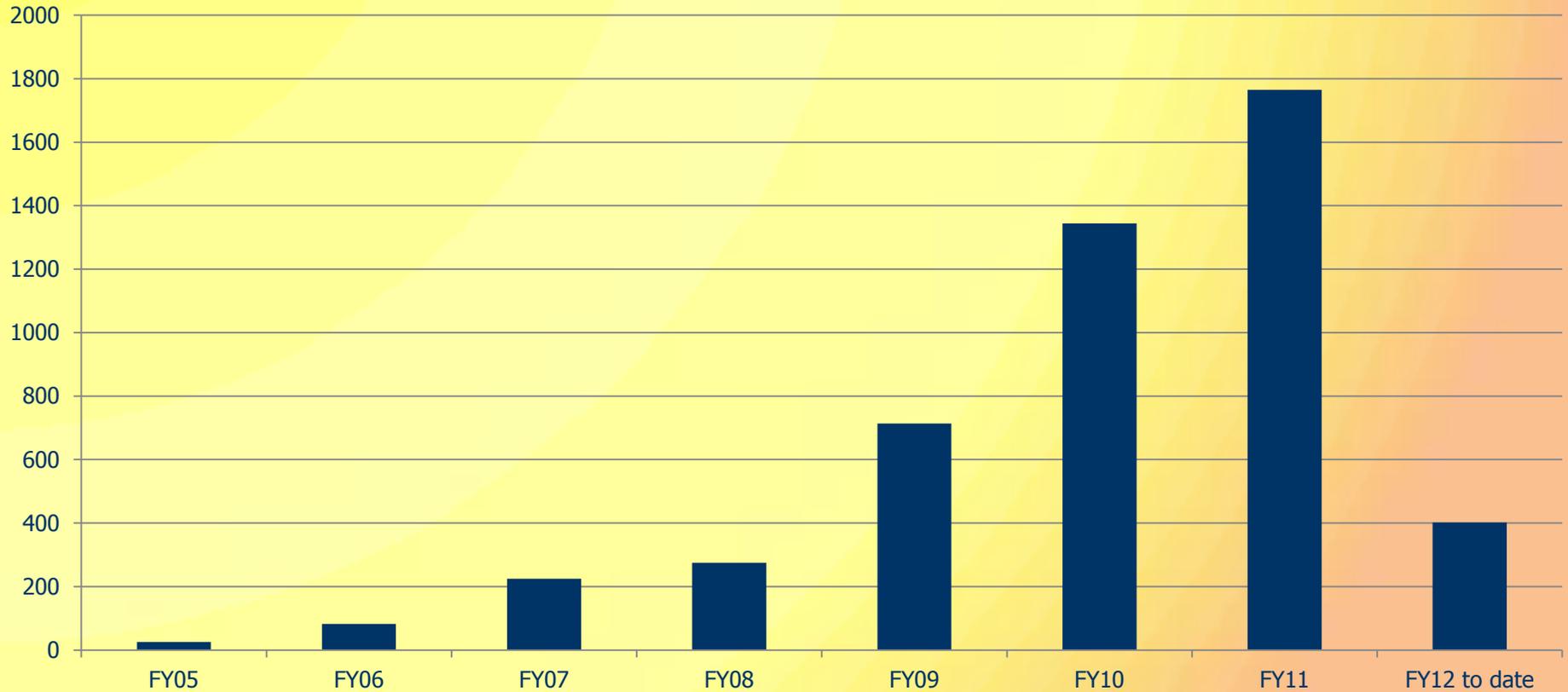
## FAFCO 200 Series

OG-300 Rating	Typical Cost	SRP Solar Incentive	AZ Tax Credit	Fed Tax Credit	Net Cost	Annual Savings	Simple Payback
2,200 kWh	\$9,208	\$880	\$1,000	\$2,762	\$4,566	\$220	20.8 years

**AZ State Tax Credit:** 25%, \$1,000 cap

**Federal Tax Credit:** 30%, no cap

# Application Receipt History



# Solar Incentive Programs

**Solar incentive programs to date launched August 2004**

<b>Program Description</b>	<b>Systems Pending</b>	<b>Systems Paid</b>	<b>Total Systems</b>
<b>Residential Solar Electric</b>	<b>351</b>	<b>2,685</b>	<b>3,036</b>
<b>Residential Solar Water Heating</b>	<b>667</b>	<b>3,967</b>	<b>4,634</b>
<b>Commercial Solar Electric</b>	<b>106</b>	<b>109</b>	<b>215</b>
<b>Commercial Solar Water Heating</b>	<b>22</b>	<b>32</b>	<b>54</b>

***16.3 MW installed and pending (Residential) and  
18.3 MW installed and pending (Commercial)***

***34.6 MW total***

# Program Evolution



- **Require copy of building permit**
- **SRP incentive paid to contractor on customer behalf as a “buy down”**
- **Pro-rate incentive based on panel orientation to allow more participation**
- **Require SRP inspection to verify installed to OG-300**
- **Charge contractor for 3 or more audits on same system**

# **Solar Water Heating Program Audit**

# Residential Water Heating Inspection

- SRP hired Arizona Solar Center (AzSC), an independent third-party, to perform Pilot audits
- Goal of Pilot to verify systems installed to OG-300 Standards
- Random sample of 100 systems installed in 2009
- Due to increase in customer complaints

SRP EarthWise™		RESIDENTIAL SOLAR WATER HEATER PERFORMANCE AUDIT CHECKLIST	
PASS <input type="checkbox"/> FAIL <input type="checkbox"/>		RESERVATION NUMBER: _____	
<b>Project Information</b>		<b>INSPECTOR:</b> _____	
Customer (Present): _____		Date: _____	
Address/ City/ State/ Zip: _____			
Installing Contractor: _____			
Equipment Manufacturer:	SRCC Model:	System Type (drain-back, ICS, ...):	
Solar Tank Manufacturer (Elect, Gas):	Model:	Gallons:	
Secondary Tank (Elect, Gas):	Model:	Gallons:	
Water Temp. at Interior Fixture:	Tilt:	Azimuth:	
<b>Y</b>	<b>N</b>	<b>N/A</b>	<b>SRCC Section</b>
<b>General Requirements</b>			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 System is operating
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2 System installation and components are consistent with incentive application and SRCC approved manual
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3 All components are new (tank, collector, plumbing, pumps, controls)
<input type="checkbox"/>	<input type="checkbox"/>	6.6.1	4 SRCC approved manual is available
<b>Plumbing/Piping</b>			
<input type="checkbox"/>	<input type="checkbox"/>	6.5.14	5 Piping is adequately and appropriately supported
<input type="checkbox"/>	<input type="checkbox"/>	6.1.6.3	6 Pipe insulation with a min. R-2.5 is installed on all hot water pipes and first 5 feet of exposed cold water inlet piping. All exterior piping insulation shall be protected from UV and moisture damage.
<input type="checkbox"/>	<input type="checkbox"/>	6.1.1.3	7 Expansion tank is installed on collector loop piping if applicable
<input type="checkbox"/>	<input type="checkbox"/>	6.5.15	8 Collectors are pitched at least 1/4 inch per foot and piping is continuously pitched between collectors and drain-back reservoir with a minimum 1/4 inch per foot if applicable
<b>Solar Storage Tank</b>			
<input type="checkbox"/>	<input type="checkbox"/>	6.5.6	9 Water tanks installed in or above living space shall be on a drip pan with drain line to a safe location
<input type="checkbox"/>	<input type="checkbox"/>	6.1.3.1	10 Temperature and pressure relief valve is installed on tank to comply with ASME Boiler and Pressure Vessel Code, Division I, Section VIII
<b>Valves</b>			
<input type="checkbox"/>	<input type="checkbox"/>	6.1.5.6	11 Tempering valve(s) are installed and b) On the downstream side of the primary water heater(s), b) Located after anti-convective plumbing, and c) and shall include a set point of 122°F
<input type="checkbox"/>	<input type="checkbox"/>	6.1.1.2	12 All isolation valves shall be labeled with the normal operating position indicated on black with white text
<input type="checkbox"/>	<input type="checkbox"/>	6.3.7	13 Label shall mark all drain and fill valve(s). Label shall identify fluid in that loop. Label shall contain warning: "No other fluid shall be used that would change the original classification of this system. Unauthorized alterations to this system could result in a hazardous health condition." on black with white text
<input type="checkbox"/>	<input type="checkbox"/>	6.3.16	14 Pressure relief valve is installed on the collector loop if applicable
<input type="checkbox"/>	<input type="checkbox"/>	6.3.16	15 Pressure relief valve is installed on drain-back tank if it can be isolated
<b>Controls</b>			
<input type="checkbox"/>	<input type="checkbox"/>	6.5.18	16 Sensor wiring (when outdoor) has a UV-rated exterior jacketing, is continuously attached, and is protected from abrasion, high voltage lines, and high temperature
<input type="checkbox"/>	<input type="checkbox"/>	6.3.5	17 If PIV powered, a high temperature shutoff function is installed and wired through the circulation pump
<b>Collectors(s)</b>			
<input type="checkbox"/>	<input type="checkbox"/>	6.5.13	18 Collectors are substantially un-shaded between 9am and 3pm year-round
<input type="checkbox"/>	<input type="checkbox"/>	6.5.8	19 Collector mounting brackets are secure and properly attached to roof members
<input type="checkbox"/>	<input type="checkbox"/>	6.5.5	20 Roof penetrations are properly sealed in accordance with applicable codes
Reference: OG-300 Operating Guidelines and Minimum Standards for Certifying Solar Water Heating Systems; <a href="http://www.solar-rating.org/standards/standards.htm">http://www.solar-rating.org/standards/standards.htm</a>			
If you have questions about your performance audit, please contact a solar representative at (602) 236-4662 or Solar@SRP@srpnet.com			
12/07/10			

# Examples of Safety / Performance Issues

## Safety Issues

- **Mixing valve missing**
- **Temperature and pressure relief valve installed wrong**
- **No label on system related to heat transfer fluid used**

## Performance Issues

- **Lack of appropriate insulation**
- **Shaded collectors**
- **Systems were not operating**
- **System did not match the plans or application**



# Lessons Learned

- **Don't assume the solar contractor is pulling a building permit for the customer**
- **Don't assume the city or AHJ (Authority Having Jurisdiction) is going to perform inspections**
- **Anticipate heavy marketing to a non-solar savvy customer base**
- **Have a good relationship with rating agency**

# Action Plan

- **All new water heating applications will require an inspection before an incentive will be issued**
- **Improve program documents and contractor guidelines to enhance current incentive program**
- **Better communication with installers and dealers**
- **Sponsor workshops for best practices and lessons learned**

# In Conclusion

- **SRP and the utility industry, face many challenges related to growth, climate change, and balancing costs for our customers as we strive to provide a sustainable energy supply**
- **Solar Water Heating can be a cost effective way to fulfill a solar portfolio**
- **Communication with other incentive managers and industry is important for a successful solar program**

# Connect with SRP



[twitter.com/srpconnect](https://twitter.com/srpconnect)

**facebook.**

[facebook.com/srpconnect](https://facebook.com/srpconnect)

**You Tube**

[youtube.com/srpconnect](https://youtube.com/srpconnect)

# Questions?

**Joel Dickinson, P.E.  
Senior Engineer  
SRP, Solar Initiatives  
(602)236-2071**

**[joel.dickinson@srpnet.com](mailto:joel.dickinson@srpnet.com)**

**For more information on the SRP  
EarthWise Solar Energy Program:**

**[www.srpnet.com/solar](http://www.srpnet.com/solar)**

# SOLAR WATER HEATING SYSTEMS ARIZONA

**Geoff Sutton**

**Project Coordinator**

**Arizona Solar Center**

**Special Site**

**Installation Findings**

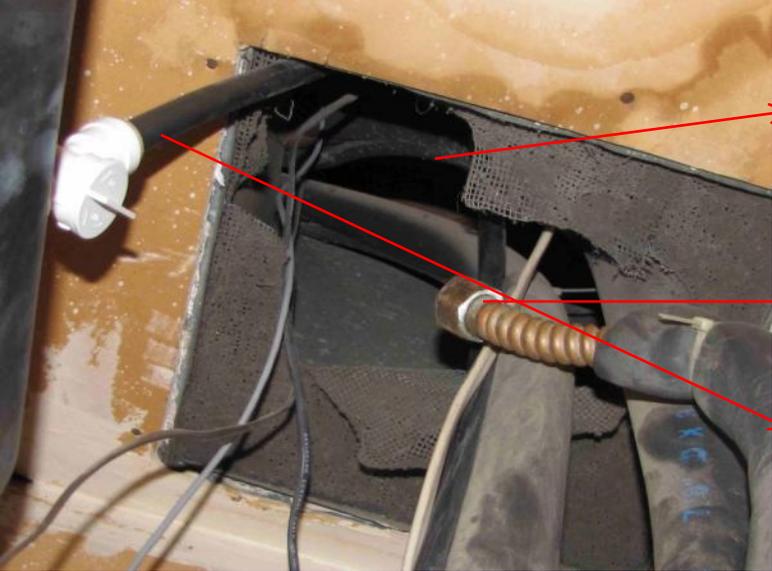
**Lessons Learned**

**SRCC System Guidelines**

Summer of 2010 one of the utilities has two upset customers with their Solar Hot Water System Installs.

This is what was found:

**Special Site**



One foot square hole directly into unconditioned attic

Old lines not removed

Lines not insulated

System drains up



Contractor had incorrect RoC license



Lines not insulated

Circulation module lines are reversed

Drip pan has been cut into



Tie-down tearing out of roof

## Special Site



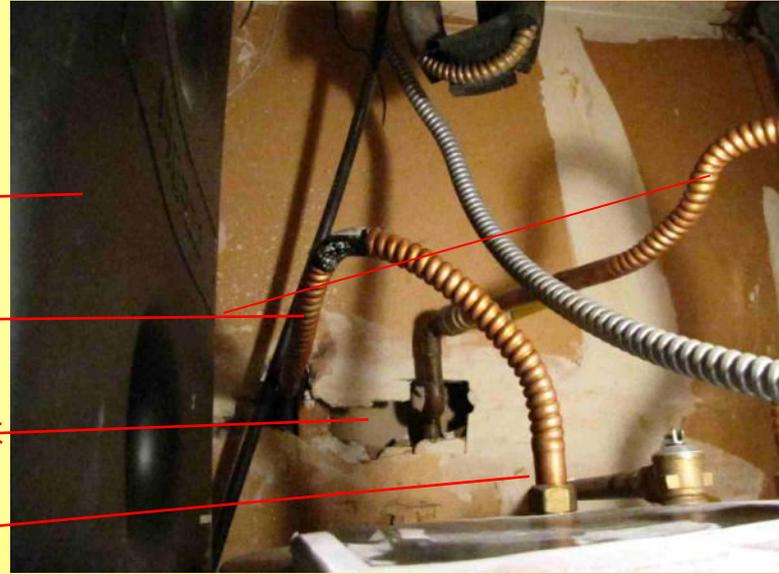
Sensor wire runs  
inside whirly bird

Tank not insulated

No insulation on lines

Hole knocked into wall for  
plumbing

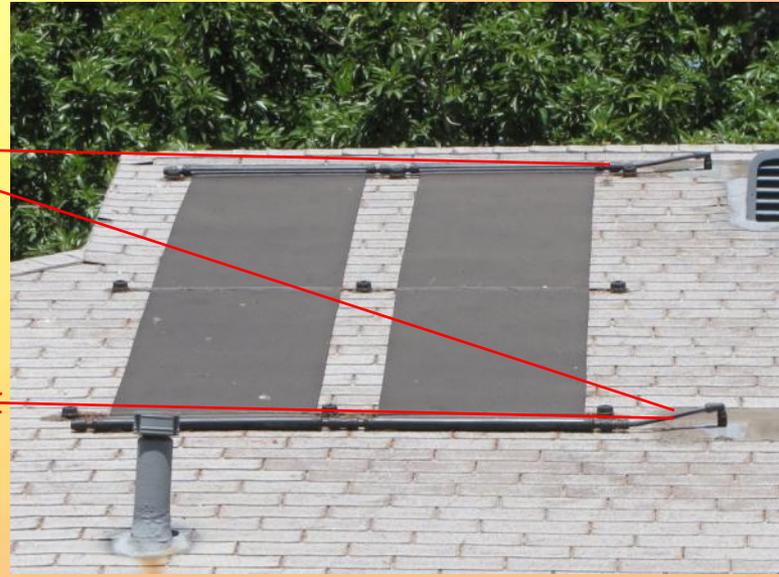
No mixing valve



Inlet and Outlet on  
same side of  
collectors

No Sikaflex

System drains up





Open hole into attic,  
insulation falling into  
house

PEX not insulated

Tank not insulated

## Special Site



No drip pan

Circulation module lines  
reversed

No Labels



Allen Key used for mixing  
valve

Insulation from  
attic falling into  
house



## Special Site



Drains Up

Incorrect Flashing  
install



Sensor not  
installed  
correctly  
floating, note  
roof needs to  
be replaced

Multiple missed holes not correctly  
flashed on roof



# Pilot Program

APS and SRP in the 2<sup>nd</sup> half of 2010 did a random sampling of approximately 250 systems to see how they matched up to the SRCC OG-300 installation guidelines. This is to conform to the Renewable Energy Standard and Tariff (REST) as required by the regulated utilities (APS) under the ACC.

<http://www.azcc.gov/divisions/utilities/electric/environmental.asp>

SRP has a separate program that closely mirrors the ACC requirements. <http://www.srpnet.com/environment/earthwise/solar/default.aspx>

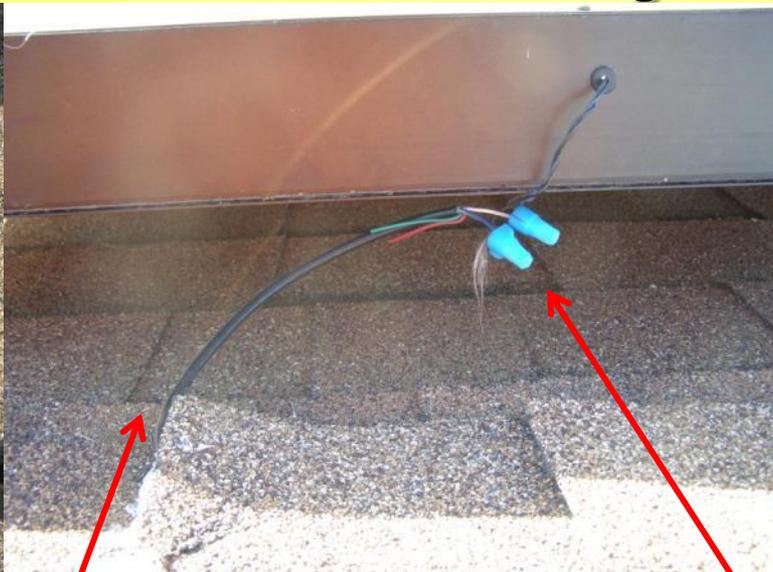
## What was found in the Pilot Program

# Pilot Program

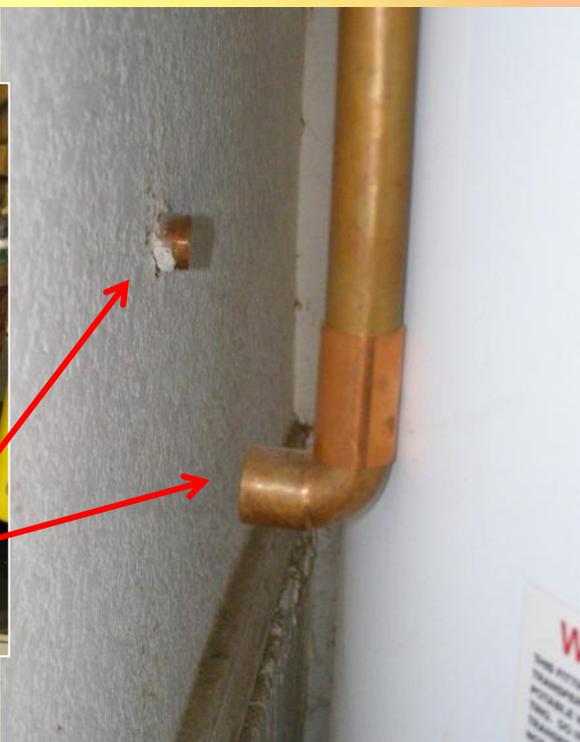
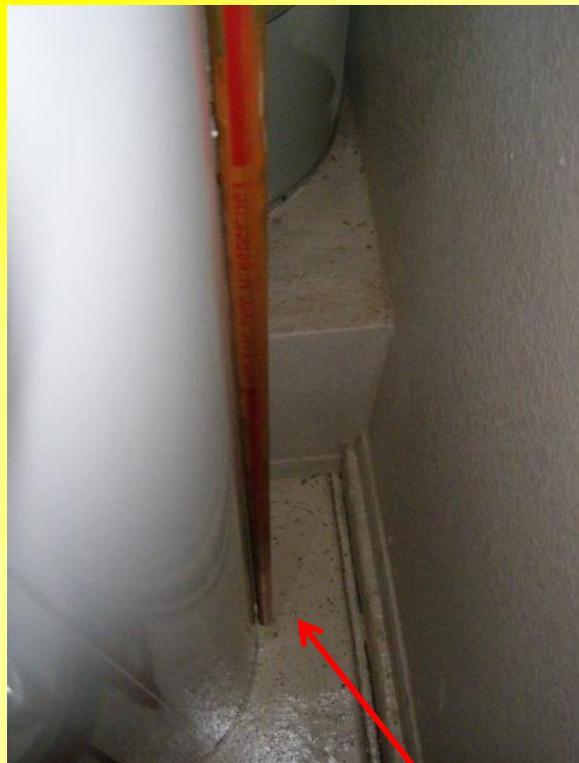
# Installation Findings



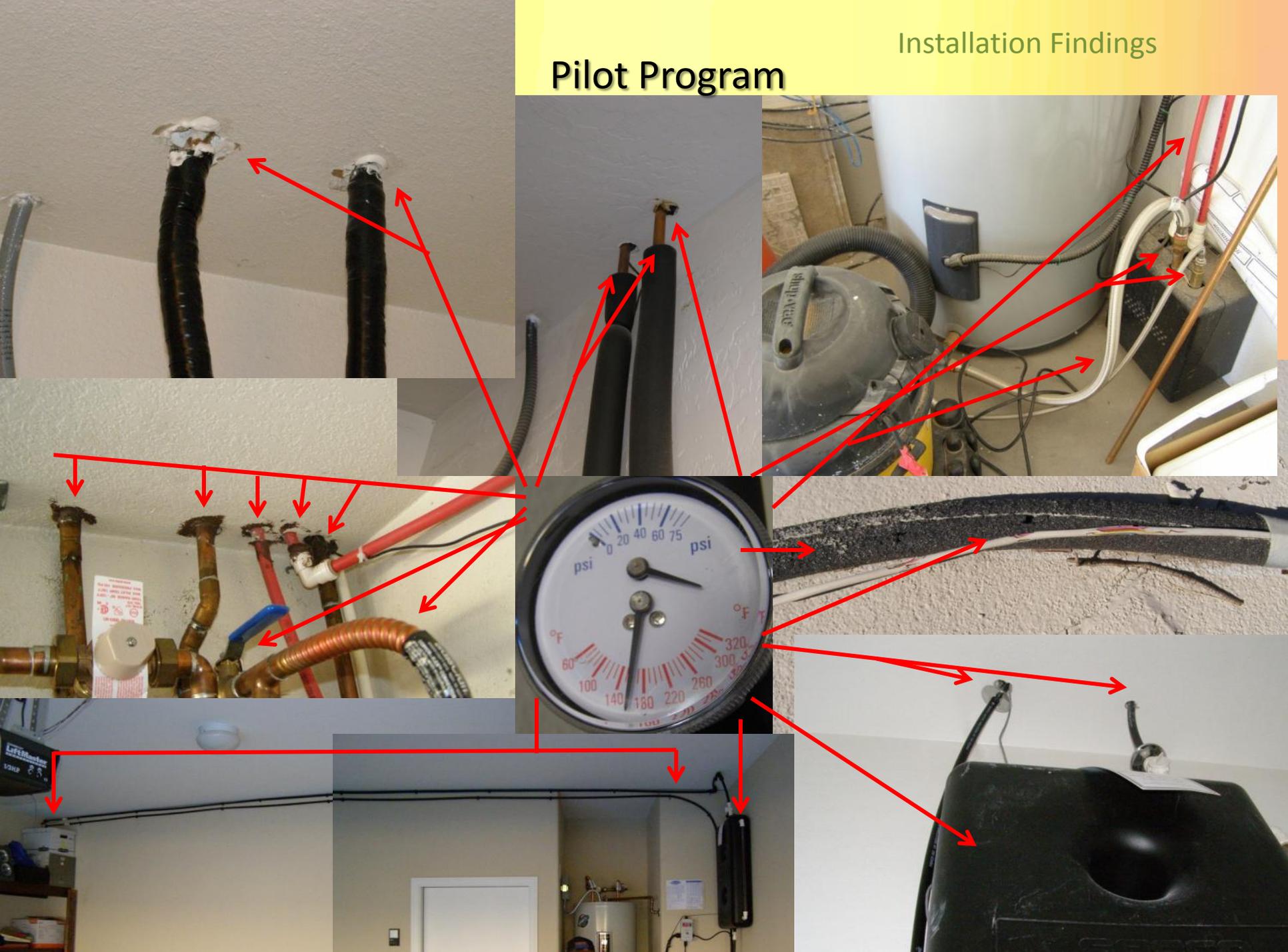
# Pilot Program



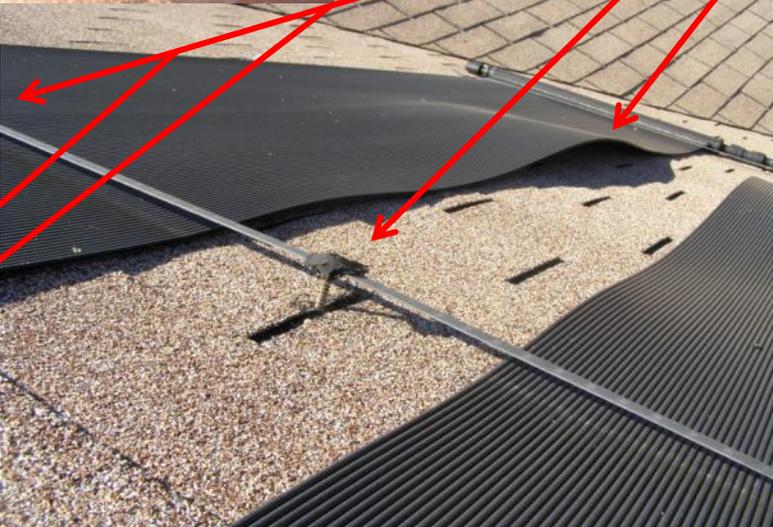
# Pilot Program



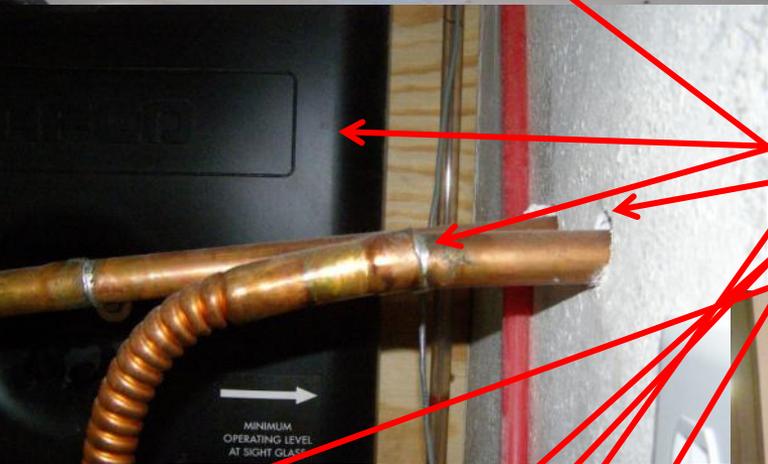
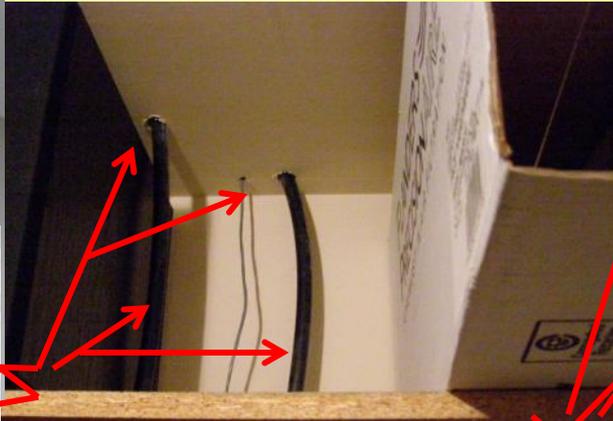
# Pilot Program



# Pilot Program



# Pilot Program



# Installation Findings

TE-40P-80-1



# Installation Findings

VDB-24UX2-50G-50S



## What was Concluded

- Installers were not familiar with the product
- Installers were not correctly trained on the product
- All National, State, Local programs, and the alphabet of codes (IPC, UPC, IBC, NEC, IFC, IECC, IMC) in place are not protecting the consumer
- Many systems were not likely performing to the SRCC OG-300 annual saving numbers that APS and SRP use for their incentive program
- Some homeowners felt disappointed about the product
- Some homeowners had no idea of how the system works
- Lack of system compliance (by AHJ) permitted an easing in the installation standards
- It became the Utilities responsibility

# Solar Rating & Certification Corporation (SRCC) Guidelines

- Arizona Utilities APS, SRP, TEP must comply under A.R.S. to use a standard “as prescribed by a solar rating and certification corporation” for the incentive payments
- All three utilities use the SRCC OG-300 published “Annual Savings” to determine their incentive, all three programs are different

# Solar Rating & Certification Corporation (SRCC) Guidelines

SRCC Document OG-300 June 2011 edition

[http://www.solar-rating.org/certification/ogdocuments/OG300\\_document.pdf](http://www.solar-rating.org/certification/ogdocuments/OG300_document.pdf)

Checklist relies on: **“6.0 Certification of Criteria”** pages 16 to 31

Too much information for home audits, rely on the manufactures booklets and the SRCC accepted drawing for components and correct install locations. i.e. system sizing (modules, tanks), check valves, thermistor, etc...

Audit is very visual orientated, need to assume correct piping is used (should be insulated), correct pumps are installed, lines are sweated correctly.

There is around 20 main points to look at, allowing around 20 to 30 minutes per on site system audit.

# APS and SRP Audit Checklists

### APS

### SRP

### APS SOLAR WATER HEATING SITE VISIT CHECKLIST

Audit # 1 2 3 \_ COMPLIANCE  NON-COMPLIANCE  RESERVATION NUMBER: \_\_\_\_\_

**Project Information**  
 AUDITOR: \_\_\_\_\_

Customer (Present): \_\_\_\_\_ Date: \_\_\_\_\_

Address/ City/ State/ Zip: \_\_\_\_\_ Phone Number: \_\_\_\_\_

Installing Contractor: \_\_\_\_\_

Equipment Manufacturer: \_\_\_\_\_ SRCC Model: \_\_\_\_\_ System Type (drain-back, ICS,...): \_\_\_\_\_

Solar Tank Manufacturer (Elect, Gas): \_\_\_\_\_ Model: \_\_\_\_\_ Gallons: \_\_\_\_\_

Secondary Tank (Elect, Gas): \_\_\_\_\_ Model: \_\_\_\_\_ Gallons: \_\_\_\_\_

Water Temp. at Interior Fixture: \_\_\_\_\_ Refract Rating: \_\_\_\_\_ Tilt: \_\_\_\_\_ Azimuth: \_\_\_\_\_

Y	N	N/A	SRCC Section	General Requirements
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		1 System is operating
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		2 System installation and components are consistent with Incentive application and SRCC approved manual
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		3 All components are new (tank, collector, plumbing, pumps, controls)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.6.1	4 SRCC approved manual is available
<b>Plumbing/Piping</b>				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.5.14	5 Piping is adequately and appropriately supported
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.1.6.3 / 6.2.2	6 Pipe insulation with a min. R-2.6 is installed on all hot water pipes and first 5 feet of exposed cold water inlet piping. All exterior piping insulation shall be protected from UV and moisture damage
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.1.1.3	7 Expansion tank is installed on collector loop piping if applicable
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.5.15	8 Collectors are pitched at least 1/4 inch per foot and piping is continuously pitched between collector(s) and drain-back reservoir with a minimum 1/4 inch per foot if applicable
<b>Solar Storage Tank</b>				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.5.6	9 Water tanks installed in or above living space shall be on a drip pan with drain line to a safe location
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.3.16	10 Temperature and pressure relief valve is installed on tank to comply with ASME Boiler and Pressure Vessel Code, Division 1, Section VIII
<b>Valves</b>				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.1.5.6	11 Tempering valve(s) are installed and a) On the downstream side of the primary water heater(s), b) Located after anti-convective plumbing, and c) shall include a set point of 122 °F
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.1.1.2	12 All isolation valves shall be labeled with the normal operating position indicated on durable and waterproof labels
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.3.7	13 Label shall mark all drain and fill valve(s). Label shall identify fluid in that loop. Label shall contain warning: "No other fluid shall be used that would change the original classification of this system. Unauthorized alterations to this system could result in a hazardous health condition."
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.3.16	14 Pressure relief valve is installed on the collector loop if applicable
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.3.16	15 Pressure relief valve is installed on drain-back tank if it can be isolated
<b>Controls</b>				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.2.4	16 Electrical tape, zip ties, and low temperature insulation are not used
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.5.18	17 Sensor wiring and control sensor (when outdoor) has a UV-rated exterior jacketing, is continuously attached, and is protected from abrasion, high voltage lines, high temperature, and environmental influence
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.3.5	18 If PV powered, a high temperature shutoff function is installed and wired through the circulation pump
<b>Collector(s)</b>				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.5.13	19 Collectors are substantially un-shaded between 9am and 3pm year-round
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		20 Tilt and azimuth of collectors are within program requirements

**NOTES**

Azimuth*	Tilt	Incentive
90-180	>0	0%
30-90	0-33	80%
0-30	0-17	80%
0-30	18-47	100%
0-30	48-75	80%
30-90	0-33	80%
90-180	>0	0%

\* Defined as Variation E or W from South

2/22/2012 Reference: OG-300 Operating Guidelines and Minimum Standards for Certifying Solar Water Heating Systems; <http://www.solar-rating.org/certification/standards.html>

### SRP RESIDENTIAL SOLAR WATER HEATER AUDIT CHECKLIST



Your solar water heating system has received an SRP Audit. Any issues that were found during this audit are identified with a checkmark on the checklist below. The results of this audit are shared with the SRP Account Holder and their Installation Contractor. SRP recommends working with your contractor to resolve the identified issues. All issues must be resolved before your application can be processed for payment.

Application Data  
 AUDITOR: \_\_\_\_\_ AUDIT # 1 2 3 4 \_\_\_\_\_

Customer (Name/Number): \_\_\_\_\_ Date: \_\_\_\_\_

Address (Street/City): \_\_\_\_\_

Dealer: \_\_\_\_\_ Installing Contractor: \_\_\_\_\_

Equipment Manufacturer: \_\_\_\_\_ OG-300 Model: \_\_\_\_\_ Incentive: 100% 80%

**Installation Data**

Solar Tank Manufacturer (Elect, Gas): \_\_\_\_\_ Model: \_\_\_\_\_ Gallons: \_\_\_\_\_

Secondary Tank (Elect, Gas): \_\_\_\_\_ Model: \_\_\_\_\_ Gallons: \_\_\_\_\_

Refract Rating: \_\_\_\_\_ Interior Water Temp: \_\_\_\_\_ Tilt: \_\_\_\_\_ Azimuth: \_\_\_\_\_

**PERFORMANCE ISSUES**  PASS  NOT PASS  PICTURES OF CORRECTIONS MAY BE ACCEPTED\*

<input type="checkbox"/>	1 System not operational	
<input type="checkbox"/>	2 All components are not new	
<input type="checkbox"/>	3 Piping is not supported	
<input type="checkbox"/>	4 Piping or fittings are not adequate	(Collet Clips Missing, Collet Clips Open, UV Caps)
<input type="checkbox"/>	5 Piping or tank is not properly insulated (Located @ Tank, Attic, Roof)	(Missing, Size, UV Protection)
<input type="checkbox"/>	6 Expansion tank not installed correctly	
<input type="checkbox"/>	7 Collector/piping not appropriately pitched	(Collector, Pipe)
<input type="checkbox"/>	8 Valves not properly installed	(Tempering, Pressure Relief, Isolation, Bypass, Drain/Fill)
<input type="checkbox"/>	9 Valves not properly labeled	(Bypass, Isolation, Drain/Fill)
<input type="checkbox"/>	10 Fluids not properly labeled	
<input type="checkbox"/>	11 Sensor/PV wire issues	(Missing, Not Properly Installed, No UV Protection)
<input type="checkbox"/>	12 Sensor and gauges issues	(Missing, Not Properly Installed)
<input type="checkbox"/>	13 High temperature shutoff function is not installed	
<input type="checkbox"/>	14 Collector(s) are shaded	
<input type="checkbox"/>	15 Collector mounting issues	(Panel Orientation, Brackets, Tie Down)
<input type="checkbox"/>	16 Roof penetrations are not sealed	
<input type="checkbox"/>	17 Other _____	
<input type="checkbox"/>	18 Model not OG-300 rated.	(Power Source, #Size of Collectors, Tank Size)
<input type="checkbox"/>	19 Collector azimuth does not meet program requirements	
<input type="checkbox"/>	20 Collector tilt does not meet program requirements	

**APPLICATION ISSUES**  Application Addendum required \_\_\_\_\_  Final Invoice correction required \_\_\_\_\_

<input type="checkbox"/>	A Model not consistent with SRP Application (Type, #Size of Collectors, Tank Size)	
<input type="checkbox"/>	B Collector Orientation does not match application (Azimuth / Tilt)	(Result = Pro-Rate, Full)

Details on the program requirements are available online at [srpnet.com/SWHcontractor](http://srpnet.com/SWHcontractor).  
 For questions regarding your SRP Audit, please contact SRP at [SolarSWH@srpnet.com](mailto:SolarSWH@srpnet.com) or (602) 236-4662.  
 \* SRP reserves the right to re-audit the system if pictures are not conclusive.

3/13/2012

[http://www.aps.com/\\_files/solarRenewable/SWHchecklist.pdf](http://www.aps.com/_files/solarRenewable/SWHchecklist.pdf)

<http://www.srpnet.com/environment/earthwise/solar/pdfx/newforms2013/SWH/RSWHPerfAuditChklist2013.pdf>

# Solar Rating & Certification Corporation (SRCC) Guidelines

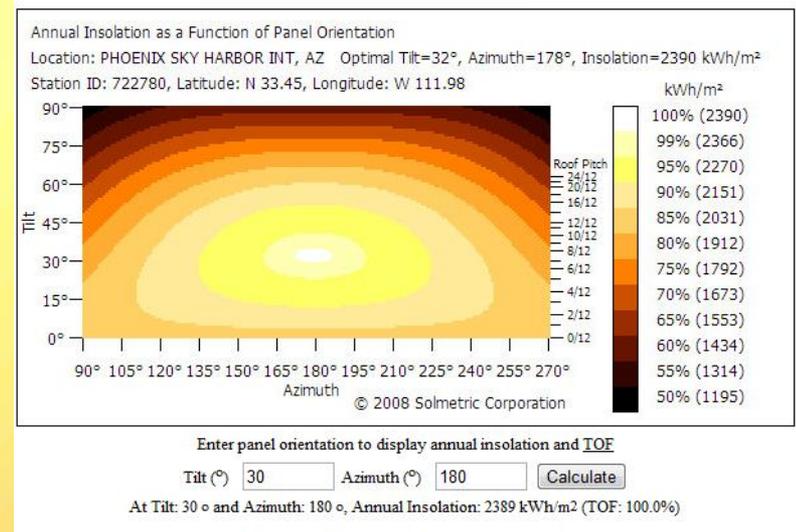
SRCC System Guidelines

Are Components New: The incentive is paid for the utility acquiring the environmental attributes (RECs) of the system. The OG-300 systems are packages for the performance rating and as such need to be new.



# Solar Rating & Certification Corporation (SRCC) Guidelines

Tilt and Azimuth: The incentive payments are based on the OG-300 annual savings for the REC rights.



# Solar Rating & Certification Corporation (SRCC) Guidelines

### 6.1.1.2 Isolation and Bypass

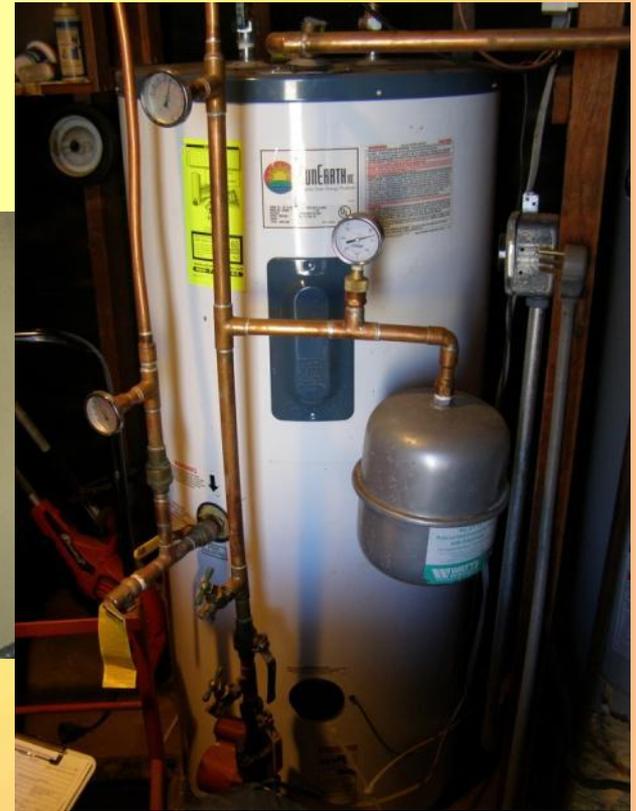
### 6.1.6.11 Piping System

The system is plumbed to the OG-300 drawing with all valves labeled showing normal operating position.



# Solar Rating & Certification Corporation (SRCC) Guidelines

6.1.1.3 Expansion tanks Are expansion tanks installed and properly supported



# Solar Rating & Certification Corporation (SRCC) Guidelines

## SRCC System Guidelines

6.1.1.11 Airborne Pollutants

6.1.2.2 UV Radiation

6.2.2 Solar Degradation

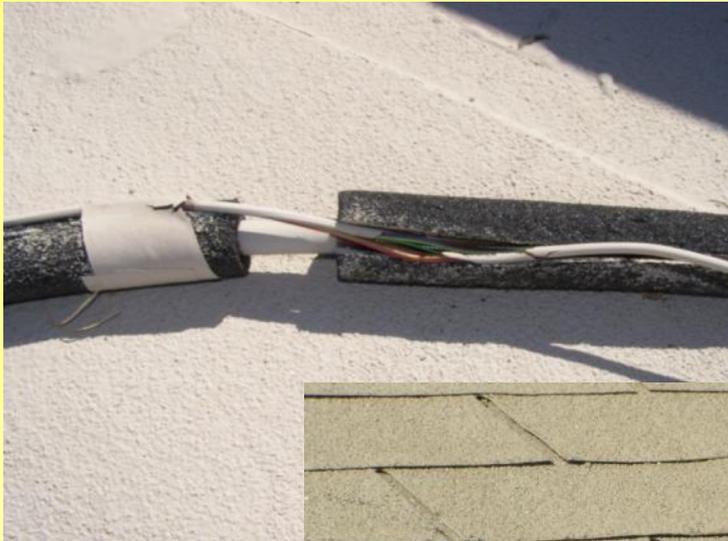
Are components protected from the elements. i.e. Ozone, Moisture, UV



# Solar Rating & Certification Corporation (SRCC) Guidelines

### 6.1.5.5 Control lines and Sensors

Degradation from the environment or system. Incorrect wire sheathing, moisture damage, system operating temperatures



# Solar Rating & Certification Corporation (SRCC) Guidelines

## 6.1.5.6 Temperature Control

Mixing valves need to be installed to the OG-300 drawing. Need to be installed to the manufactures guidelines



# Solar Rating & Certification Corporation (SRCC) Guidelines

SRCC System Guidelines

## 6.1.6.3 Insulation

Needs to be a high temperature EPDM or fiber type based insulation with an R2.6 or better. Needs to conform to 6.1.1.11 Airborne Pollutants, 6.1.2.2 UV Radiation, 6.2.2 Solar Degradation



# Solar Rating & Certification Corporation (SRCC) Guidelines

## 6.2.4 Incompatible Materials

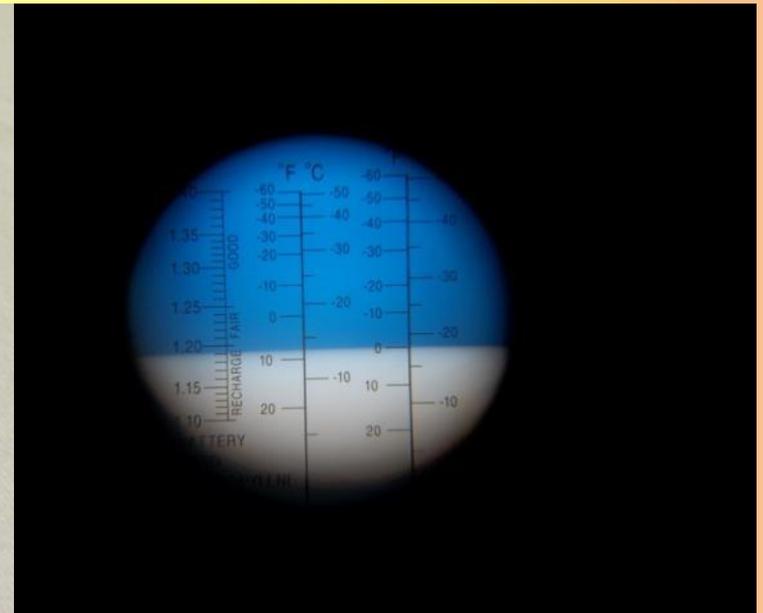
Incorrect Piping like PEX on a drainback at the collector outlet



# Solar Rating & Certification Corporation (SRCC) Guidelines

### 6.2.5 Freeze Protection

Refractometer is used to make sure that glycol is present in the system to the lowest recorded historical low temperature

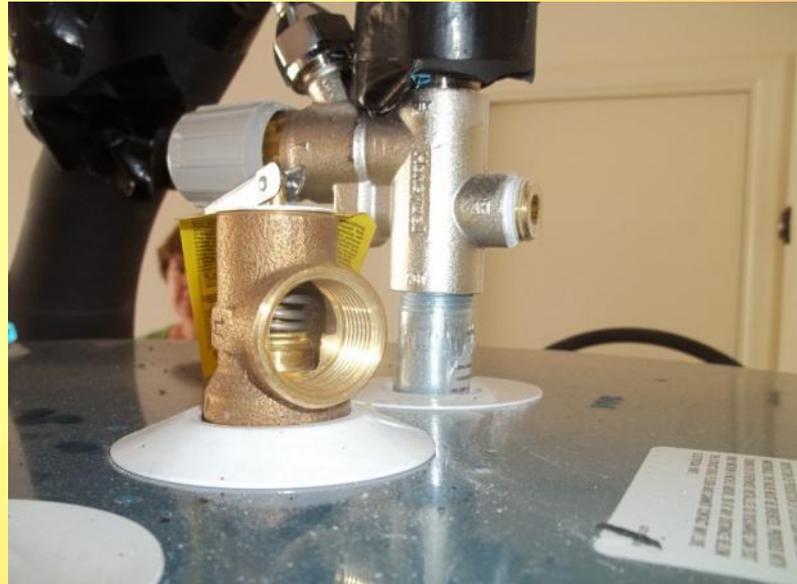


6.3.5 High Temperature Control

6.3.16 Pressure Relief

PV powered systems have a high temperature shut off

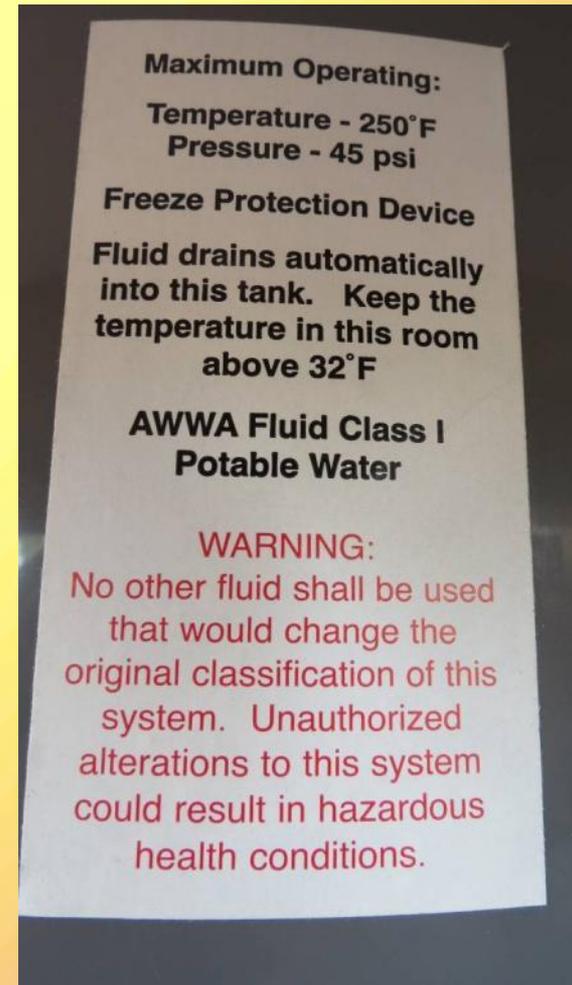
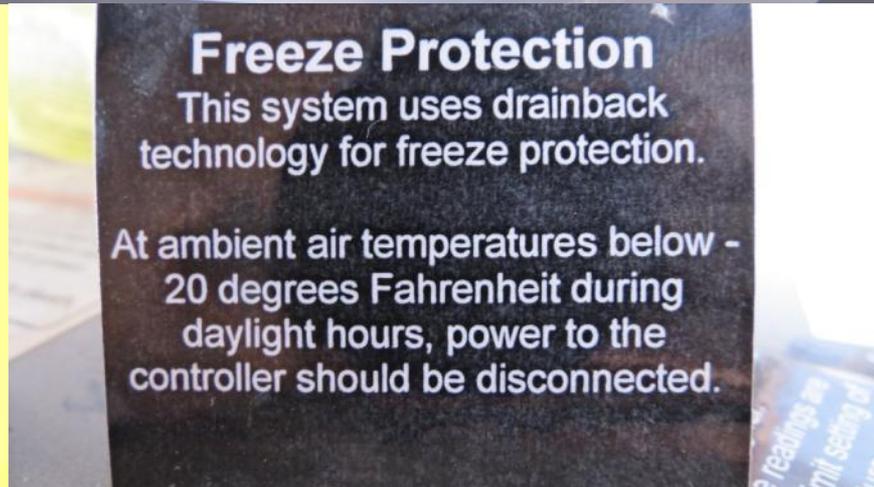
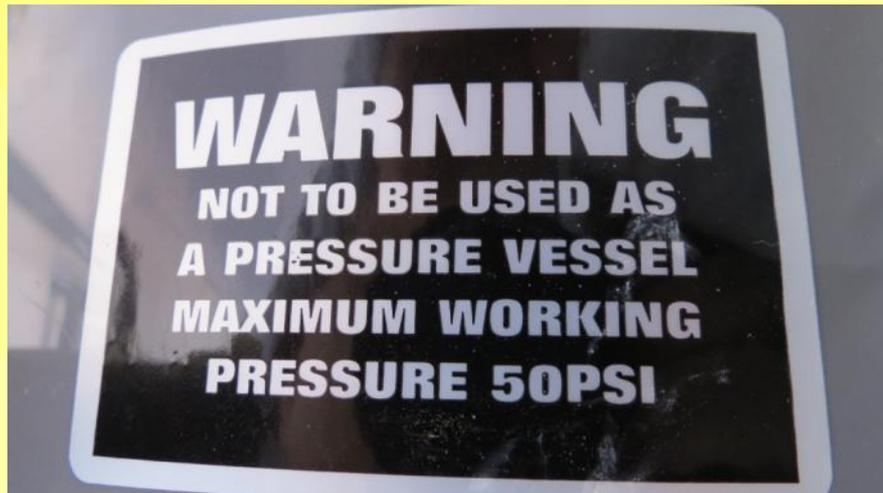
Pressure relief devices are installed to the OG-300 drawing and set below system maximum design pressure



# Solar Rating & Certification Corporation (SRCC) Guidelines

### 6.3.7 Fluid Safety Labeling

Labels to the manufactures and OG-300 guidelines are met

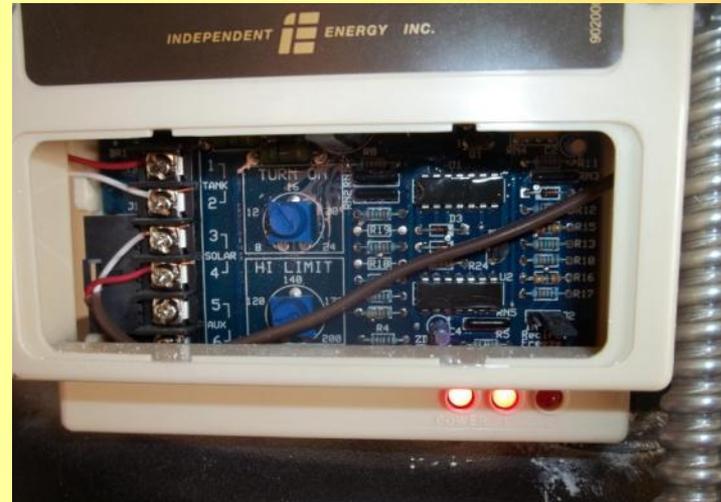


# Solar Rating & Certification Corporation (SRCC) Guidelines

## SRCC System Guidelines

### 6.4.1 Operating Indicators

Working visual indicators to the manufactures and OG-300 drawing are present



# Solar Rating & Certification Corporation (SRCC) Guidelines

SRCC System Guidelines

## 6.5.1 Fire Stopping

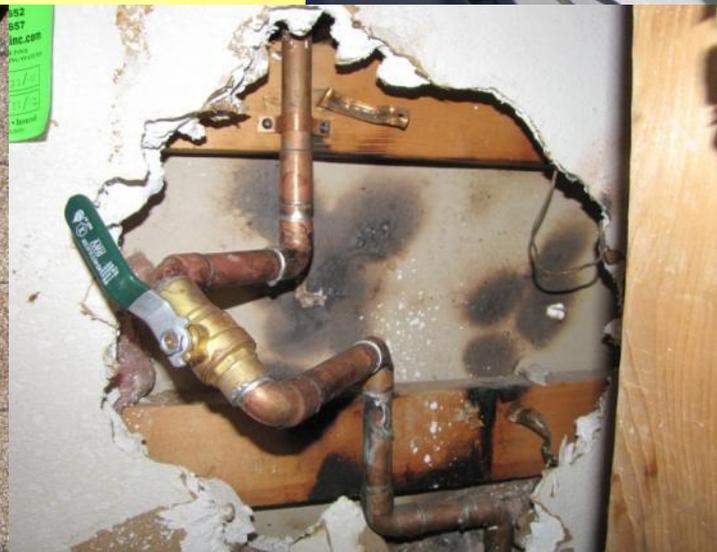
Use it!



# Solar Rating & Certification Corporation (SRCC) Guidelines

## 6.5.5 Building Penetrations

Correctly incorporated flashings and sealants in joists, members, wall systems



# Solar Rating & Certification Corporation (SRCC) Guidelines

### 6.5.6 Water Damage

Water tanks in or above a conditioned space shall have a drip pan with a drain line to a safe location

- Waivers
- Water Alarms



[Redacted]  
[Redacted]  
Phoenix, AZ 85015

TO WHOM IT MAY CONCERN:

I, [Redacted] am aware that my existing solar water heater and all existing equipment attached to it is my responsibility. I am aware that any potential damage caused by the failure of this equipment is also my full responsibility. I do not wish to have a drip pan and/or a drain pipe installed from the solar water heater and will not hold the utility liable for damage caused by a leak.

Homeowners Signature [Redacted] Date April 6, 2012

# Solar Rating & Certification Corporation (SRCC) Guidelines

### 6.5.13 Shading of Collector

Collectors will be substantially un-shaded year round



Upper around 14:00,  
right around 15:30

# Solar Rating & Certification Corporation (SRCC) Guidelines

SRCC System Guidelines

## 6.5.14 Pipe and Component Supports

Piping will conform to the IPC Table 308.5 for hanger spacing. Compression or damage to insulation is to be avoided



# Solar Rating & Certification Corporation (SRCC) Guidelines

SRCC System Guidelines

## 6.5.15 Pitch or Angle of Piping Insulation

Collectors and piping is pitched in a manner to permit evacuation of fluids on drainback systems



# Solar Rating & Certification Corporation (SRCC) Guidelines

## 6.5.18 Control Sensor Installation

Wind, moisture, UV, high voltage wiring, hot piping, electrical tape, zip ties, etc...



6.6.1 Provision for Manuals

Manual is to be the version accepted by  
the SRCC



## STILL IN HOT WATER

On-going audit program (APS, SRP) and establishment of utility educational programs - APS Qualified Solar Installers, etc..

Arizona Solar Center has seen an improvement in compliance rates

Over last 6-months, initial visits APS ~67%

Revisits APS ~97%

**ISSUES REMAIN**

# STILL IN HOT WATER – ISSUES REMAIN

## Az. utilities should NOT be the industry policemen

- SRP and APS are leading the State in addressing the issue, constrained by:
  1. Incentive Programs
  2. Legal boundaries
- Legal entities and trade associations have been minimally involved
- Competency and quality in the solar hot water equipment industry
- Lack of adherence to national, State, local programs, guides, and codes in place to protect consumers
- Limited knowledge of local, county, and State jurisdictions and lack of consistency between jurisdictions
- Lack of consistent and accurate information
- Limitations in professional licensing and certification
- Public disappointment with performance to what was sold
- Public understanding of system is poor

These issues are not unique to Arizona and can be seen in various scenarios, nationally

# BUILDING ON FINDINGS

## Where are the other players?

- Solar installers - Quality/competency issues
- Solar business/contractors - Oversight of subcontractors/field crews
- Jurisdiction inspections – Legal authority
- Utilities - Limited to incentive program context
- Construction/Design industry - Great holes in information base
- Owner - Ultimate beneficiary and least knowledgeable

## Peripheral elements that have an effect:

- Federal, State, PUC programs
- Registrar of Contractors - limited oversight and context
- Industry Trade Association - Lack of participation, & lack of member oversight and education
- Education/Training Institutions - Lack of information and focus on found problem areas

# ARIZONA SOLAR CENTER ACTIVITIES

Looking forward 4000 audits later...

- DEVELOPMENT OF TOOLS APPROPRIATE FOR EACH ELEMENT
- INFORMATION TRANSFER RE: FINDINGS AND EXPERIENCE
- CREATE ACCURATE AND ACCESSIBLE INFORMATION REPOSITORY
- COLLABORATE WITH INDUSTRY AND APPROPRIATE ENTITIES
- CONTINUED WORK IN DEVELOPING AND IMPLEMENTING PROGRAMS WITH UTILITIES
- WORKING WITH STATE AND LOCAL GOVERNMENT FOR IMPLEMENTING INSPECTION COMPETENCY
- WORK WITH THE DESIGN AND CONSTRUCTION INDUSTRY
- DEVELOP INFORMATION, TOOLS, AND ACTION PLANS FOR EXPANDED IMPLEMENTATION; COMMERCIAL SHW AND PV INSTALLATIONS
- WORK WITH INDUSTRY AND STATE AGENCIES; MARKETING PRACTICES

# Arizona Solar Center

The Arizona Solar Center continues to work as a neutral 3<sup>rd</sup> party. The Utility programs have resulted in a significant compliance from single digits in 2010 to the upper 90% range currently

In Hot Water

A Positive thing!!!!

# Contact Information



Daniel Aiello, President  
Arizona Solar Center

[DAiello@azsolarcenter.org](mailto:DAiello@azsolarcenter.org)



Geoff Sutton, Project Coordinator,  
Arizona Solar Center

[GSutton@azsolarcenter.org](mailto:GSutton@azsolarcenter.org)



Joel Dickinson, P.E.  
Senior Engineer  
SRP, Solar Initiatives  
(602)236-2071

[joel.dickinson@srpnet.com](mailto:joel.dickinson@srpnet.com)