

# **Drain Water Heat Recovery (DWHR) Energy Efficient Installations**

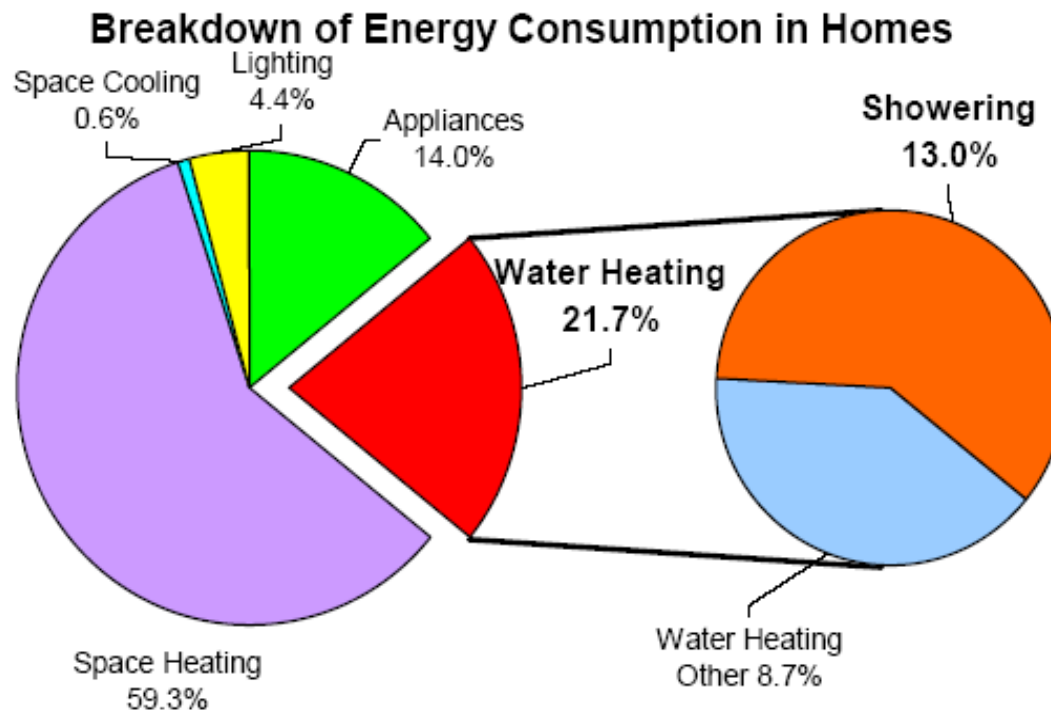
**Proven technology with over 60,000 units installed in  
North America**

**Presented by: Rod Buchalter**

[www.renewability.com](http://www.renewability.com)

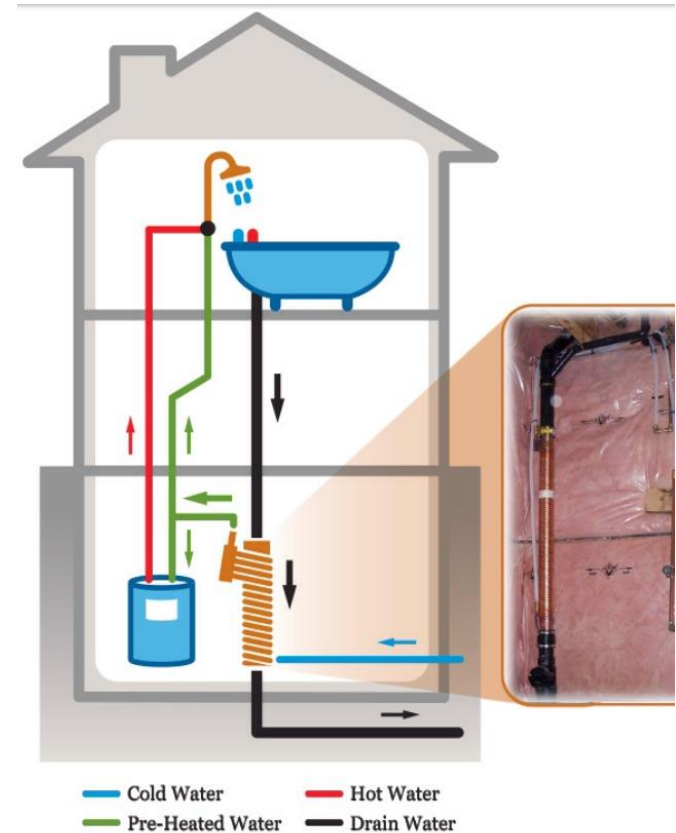
# Residential Water Heating in the USA

Water heating accounts for 20-30% of single home energy consumption, over 60% of this is showering \*



# Drain Water Heat Recovery (DWHR)

DWHR works by using the outgoing warm drain water (typically the shower) to pre-heat the incoming cold fresh water



# Residential Energy Savings Summary

- Showering can be 60% or more of the hot water energy load in the house / building and 90% of that is wasted down the drain.
- DWHR **recovers approximately 50% of the valuable heat energy** that goes down the drain during showering.
- The recovered heat energy can **reduce** water heating cost by up to **35%** plus increase the capacity of the water heating system.

# Temperature Rise on CSA 52.2% eff DWHR @ 2.5 gpm

Fresh Inlet ~ 46°F

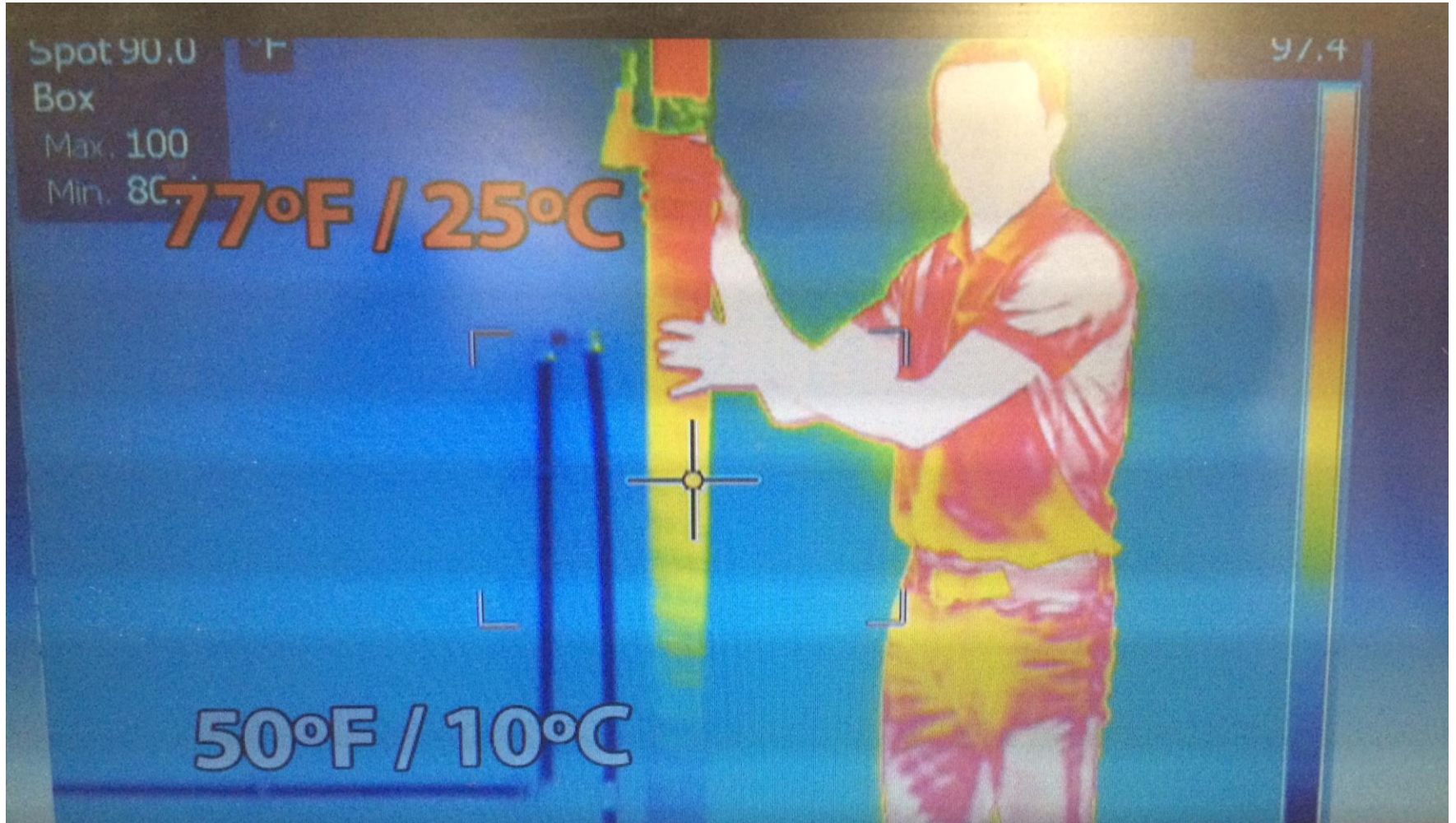
Drain Inlet ~ 101°F

Fresh Outlet ~ 75°F



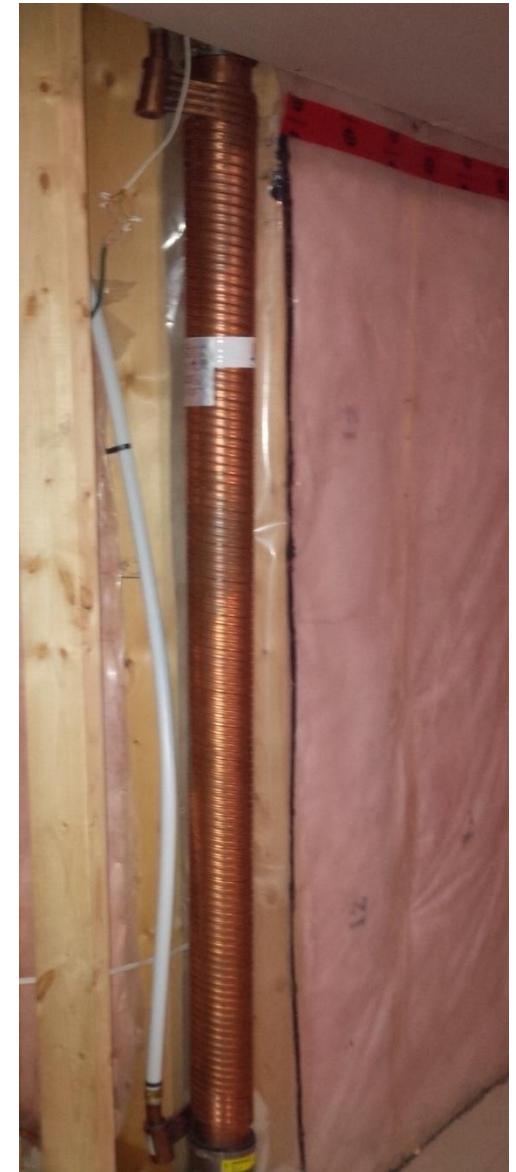


# Infrared Imaging of a DWHR Unit in Operation



# Reasons Builders Include DWHR in New Homes

- Low cost for HERS & LEED points /energy savings
- Increase water heating capacity
- Easy installation, works with any water heating system
- 50+ year life
- No maintenance required



# IECC2015 / HERS DWHR Requirement

**Drain water heat recovery (DWHR) units shall comply with CSA B55.2.**

**Drain water heat recovery units shall be tested in accordance with CSA B55.1. Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi (20.7 kPa) for individual units connected to one or two showers. Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi (13.8 kPa) for individual units connected to three or more showers.**



# DWHR CSA B55.1 Performance Label Recognized by IECC2015 / HERS



- Efficiency and pressure loss tested at 2.5 gpm

# Falling-Film DWHR Heat Exchangers – How They Work

## Center Section:

open pipe

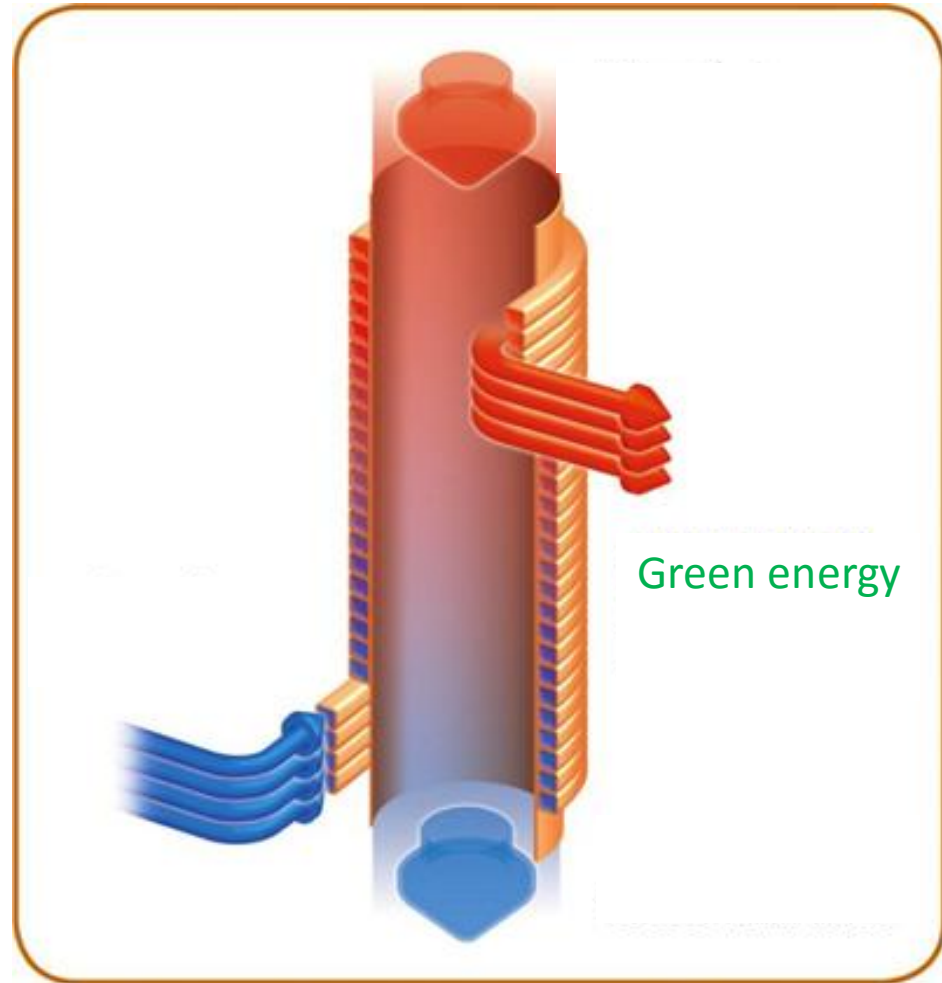
large solids can pass easily

## Surface Tension:

as water falls down a vertical drain pipe, it clings to the inner surface

## Drain Water:

a very thin, turbulent film  
< 1 mm thick



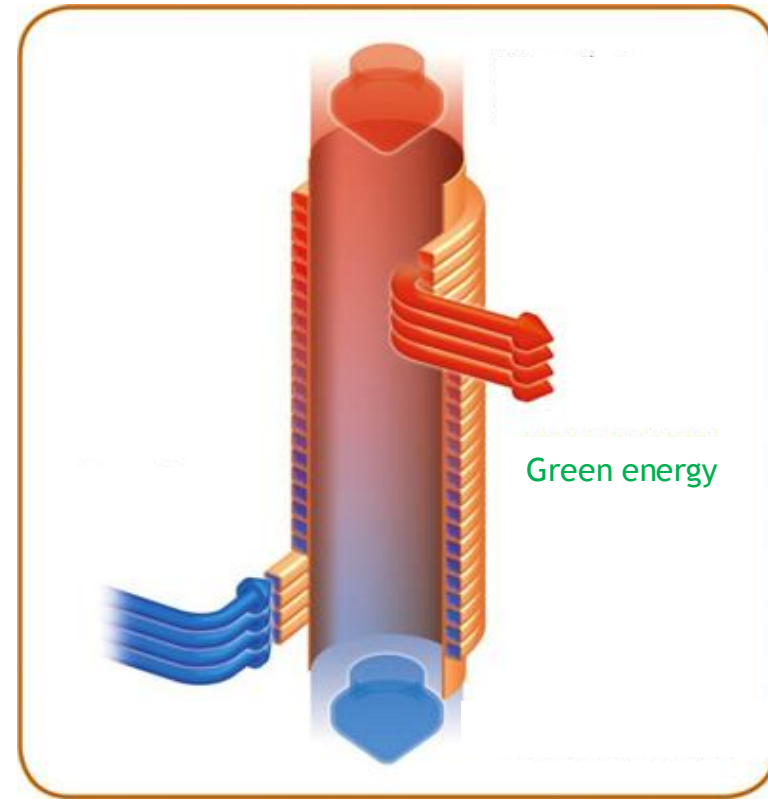
# Falling-Film DWHR Heat Exchangers (cont.)

Drain water

Heat Transfers to

Fresh water

- Heat transfer:
  - $\neq$  contact time is not essential
  - $\equiv$  intimate contact between fluids and walls separating them is key
- All Falling-Film DWHR Units are:
  - Non-fouling
  - Maintenance-free
- Most Falling-Film DWHR Units are:
  - Efficient
  - Practical

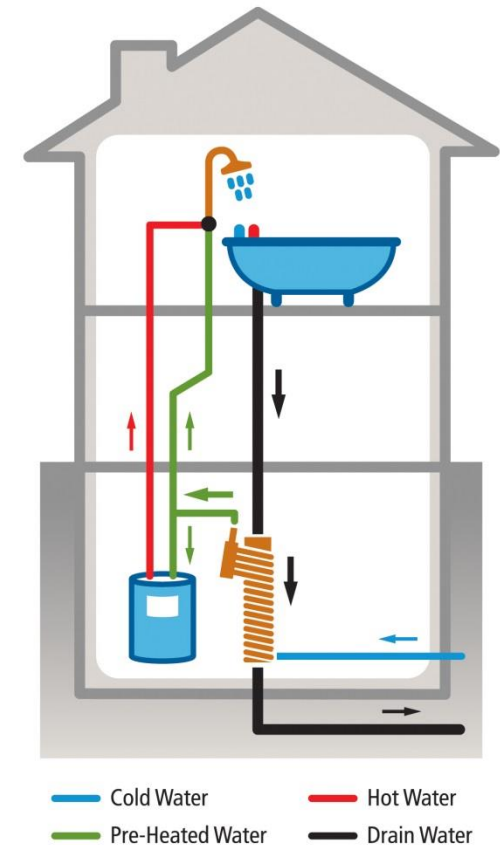


# All Residential DWHR Installations

- Must install DWHR unit vertically
- May be installed in basement or first level wall
- Have at least 1 shower draining through the DWHR unit
- 3 types of installation:

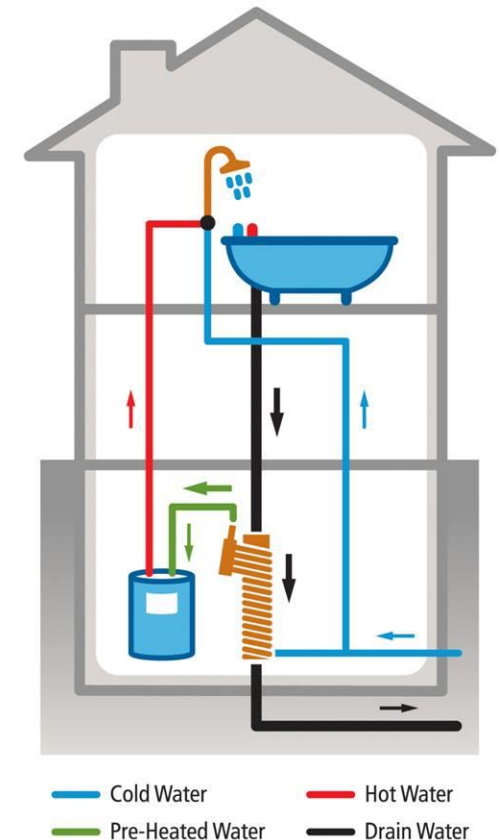
# 1-Equal Flow installation – Most energy efficient

- install drain water heat recovery unit in wall of main floor or basement
- 2 inch or 3 inch DWHR units commonly used
- 2 paths for warm water to reach shower from top of DWHR
- More HERS credit or LEED points



## 2-Unequal Flow installation to the Water Heater

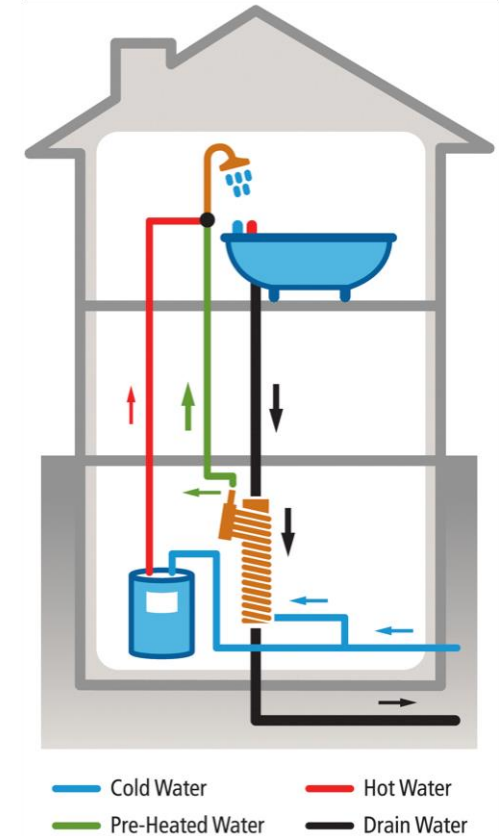
- connect fresh water from DWHR unit to water heater only
- unequal flow installation results in about 23% lower energy savings





# 3-Unequal Flow installation to Cold Side of Shower

- preheated water connected to the cold side of shower only
- unequal flow installation results in about 23% lower energy savings
- effective for tankless water heaters in warm climates



# DWHR Recognized By RESNET

The image is a screenshot of a website page. At the top, there is a navigation bar with the RESNET logo and the text 'CERTIFIED ENERGY AUDITORS/RATERS AND QUALIFIED CONTRACTORS/BUILDERS'. Below the navigation bar is a main content area with a dark header containing the article title: 'RESNET ADOPTS INNOVATIVE DESIGN REQUEST FOR THE DETERMINATION OF DRAIN WATER HEAT RECOVERY (DWHR) SYSTEM HERS INDEX CREDITS'. The article text begins with 'October 2nd, 2014 - Posted by RESNET under Hot Topics, RESNET News' and discusses the installation of DWHR units and the adoption of an Innovative Design Request for HERS Index credits. A sidebar on the right contains a list of menu items and a small section titled 'If you v resid comr subm Post'.

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## RESNET ADOPTS INNOVATIVE DESIGN REQUEST FOR THE DETERMINATION OF DRAIN WATER HEAT RECOVERY (DWHR) SYSTEM HERS INDEX CREDITS

October 2nd, 2014 - Posted by RESNET under [Hot Topics](#), [RESNET News](#)

Over 35,000 Drain Water Heat Recovery (DWHR) units have been installed in homes in North America. Thousands of units are also in operation in commercial buildings such as multi-family residential, hotels, recreation facilities and restaurants. The “IECC 2015 - Commercial” specifically provides for energy credit tradeoffs and IECC 2015 has performance requirements (e.g. maximum pressure loss) for vertically installed DWHR units. The Ontario Building Energy Code also provides for energy credit tradeoffs for DWHR and Natural Resources Canada has had credits for DWHR for more than 7 years.

Fostering innovation that reduces residential energy consumption is a key role that RESNET plays. Water heating is a large energy load in homes and its contribution to total home energy load has increased in recent years as building envelopes and mechanical systems improvements have resulted in significantly reduced energy consumption. However, DWHR systems have yet to be included in HERS.

RESNET has adopted an Innovative Design Request to calculate energy savings for DWHR systems and provide an appropriate HERS Index score credit where these systems are properly installed in homes.

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# Sample RESNET DWHR HERS Input Sheet for Baltimore

| Instructions  | Input Sheet                        | Credit Report  |   |
|---|------------------------------------|--|---|
| <b>DWHR HERS Credit Calculation Tool</b>                        |                                    |  |   |
| <b>Input data is REQUIRED for all yellow-highlighted fields</b> |                                    |  |   |
| <b>Rater Information:</b>                                       |                                    | <b>HERS Software Tool:</b>                               |   |
| Rater Name  | John C. Doe, Jr                    | Name   | XYZ Software Tools                        |
| Rater RESNET ID   | 999-9999-99                        | Version  | v.99.100                                  |
| QA Provider Name  | Built Best Quality Assurance       | <b>Home Characteristics:</b>                             |   |
| QA Provider RESNET ID   | 2014-999                           | Cond. Floor Area (CFA in ft <sup>2</sup> )               | 2400                                      |
| <b>Home Location:</b>   |                                    | Number bedrooms (Nbr)                                    | 3   |
| Street Address  | 99 Example Home Street             | Number of cond. floor levels (Nfl)                       | 2   |
| City Name   | Baltimore                          | Uncond. Basement (Y/N)                                   | No  |
| State Name  | Maryland                           | <b>Rated Home Standard Rating Results (in MBtu):</b>     |   |
| Zip Code  | 21205                              | <b>End Uses:</b>   | <b>Energy Use</b> <b>Fuel</b> <b>MEPI</b> |
| <b>Climate Information:</b>                                     |                                    | Heating  | 49.30 gas 0.78                            |
| TMY Identification  | Baltimore-Washington international | Cooling  | 5.75 elec 13.0                            |
| Ann. Avg. Outdoor Temp. (F)                                     | 55.8                               | Hot Water  | 18.86 gas 0.59                            |
| <b>DWHR Specifications:</b>                                     |                                    | Lgt & Apl  | 23.37                                     |
| DWHR manufacturer   | AquaHot Savers, LLC                | net OPP  | [net on-site power pr                     |
| DWHR Model No.  | AHS 2C-453                         | <b>Reference Home Standard Rating Results (in MBtu):</b> |   |
| <b>DWHR Installation:</b>                                       |                                    | <b>End Uses:</b>   | <b>Energy Use</b> <b>Loads</b>            |
| Showers/Baths connected   | all [pull down menu]               | Heating  | 60.09 34.62                               |
| Equal flow?   | yes [pull down menu]               | Cooling  | 10.74 25.68                               |
| CSA 55.1 DWHR Efficiency  | 46.5%                              | Hot Water  | 19.36 10.60                               |
| Fixture Efficiency  | standard [pull down menu]          | Lgt & Apl  | 26.79                                     |
|   |                                    | <b>HERS Index Results:</b>                               |   |
|   |                                    | Standard HERS Index                                      | 77.6                                      |
|   |                                    | DWHR Credit (ΔHERS)                                      | -1.8                                      |
|   |                                    | Revised HERS Index                                       | 76  |

# Sample RESNET DWHR HERS CREDIT Report for Baltimore

## DWHR HERS Credit Calculation Output Report

### Home Address:

99 Example Home Street  
Baltimore, MD  
99999

### TMY Location:

Baltimore, MD

### Annual Average Outdoor Temperature

55.8 F

### Certified Rater:

Name: Chris Chitester  
ID: 2292590

### RESNET QA Provider:

Name: Comparison  
ID: ##

### DWHR Specifications:

Manufacturer: Generic  
Model No: 50% Model

### HERS Software Tool:

Name: REM/Rate  
Version: v15.1

### DWHR Installation:

Showers/Baths connected all  
Equal Flow? **yes**  
DWHR Efficiency 50.0%  
Fixture Efficiency standard

### Rated Home Characteristics:

Conditioned Floor Area 2025  
Number of Bedrooms 4  
Conditioned Floor Levels 1  
Unconditioned Basement No

### Rated Home Standard Rating Results:

| Home End Use | Energy (MBtu) | Fuel Type | MEPR |
|--------------|---------------|-----------|------|
| Heating      | 50.70         | gas       | 0.78 |
| Cooling      | 4.20          | elec      | 13.0 |
| Hot Water    | 19.10         | gas       | 0.59 |
| Lgt & Apl    | 23.70         | n/a       | n/a  |
| net OPP      | 0.00          |           |      |

### Reference Home Standard Rating Results:

| Home End Use | Energy (MBtu) | Loads (MBtu) |
|--------------|---------------|--------------|
| Heating      | 58.10         | 35.20        |
| Cooling      | 6.60          | 19.00        |
| Hot Water    | 19.40         | 11.30        |
| Lgt & Apl    | 25.60         | 25.60        |

### DWHR Energy Savings:

Hot water energy savings 23.2%  
Whole home energy saving 3.7%

### Certification:

I hereby certify that the information submitted in this report is accurate to the best of my knowledge.

### HERS Credit Calculation Results:

Standard HERS Index score 84.8  
DWHR HERS Index credit **-2.3**  
Revised HERS Index score **83**

Chris Chitester

- Equal flow example
- DWHR credit is **2.3 points** in this example going from a HERS 85 to a **83** (almost an 82)
- 50 % CSA efficient DWHR unit is used in this example

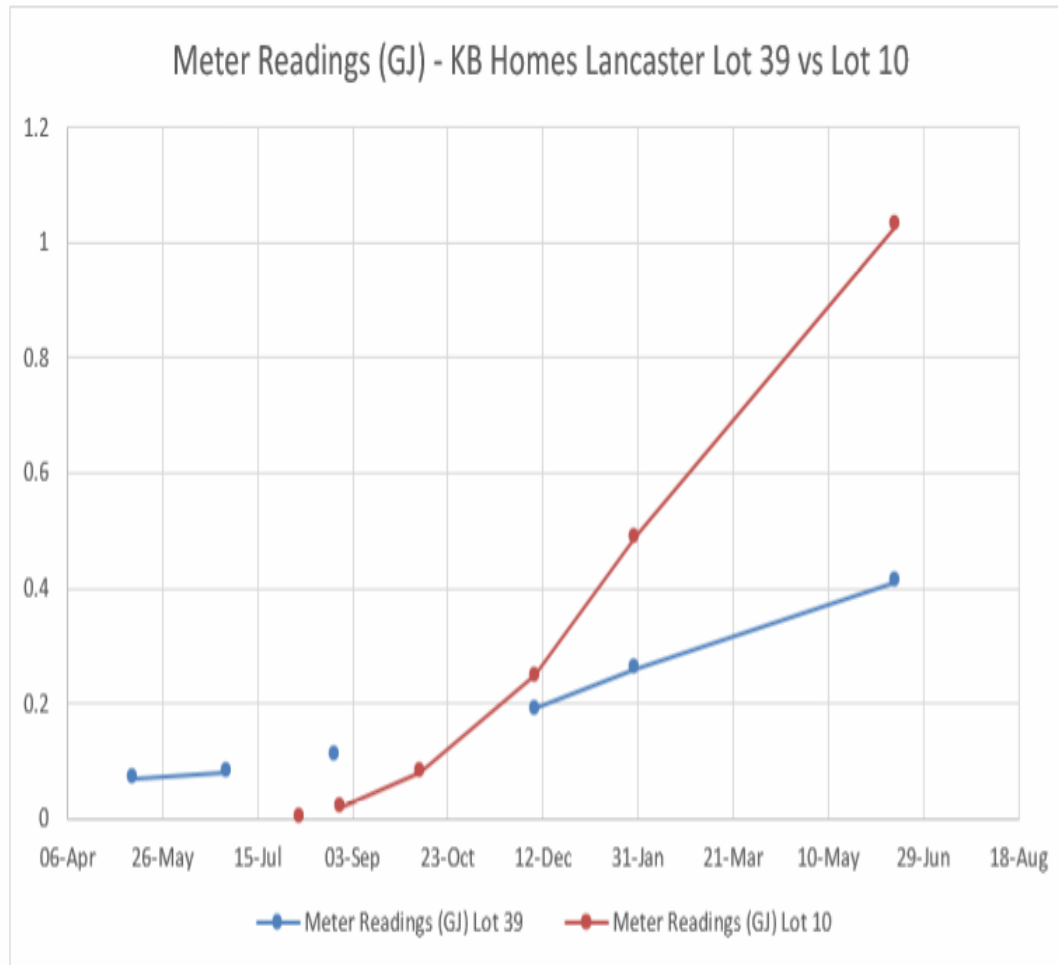
# Sample RESNET DWHR HERS CREDIT Report for Baltimore

| DWHR HERS Credit Calculation Output Report   |               |  |             |                 |               |               |  |
|--|---------------|--|-------------|-----------------|---------------|---------------|--|
| <b>Home Address:</b><br>99 Example Home Street<br>Baltimore, MD<br>99999   |               | <b>TMY Location:</b><br>Baltimore, MD<br><b>Annual Average Outdoor Temperature</b><br>55.8 F   |             |                 |               |               |  |
| <b>Certified Rater:</b><br>Name: Chris Chitester<br>ID: 2292590  |               | <b>RESNET QA Provider:</b><br>Name: Comparison<br>ID: ##   |             |                 |               |               |  |
| <b>DWHR Specifications:</b><br>Manufacturer: Generic<br>Model No: 50% Model  |               | <b>HERS Software Tool:</b><br>Name: REM/Rate<br>Version: v15.1   |             |                 |               |               |  |
| <b>DWHR Installation:</b><br>Showers/Baths connected all<br>Equal Flow? no<br>DWHR Efficiency 50.0%<br>Fixture Efficiency standard |               | <b>Rated Home Characteristics:</b><br>Conditioned Floor Area 2025<br>Number of Bedrooms 4<br>Conditioned Floor Levels 1<br>Unconditioned Basement No |             |                 |               |               |  |
| <b>Rated Home Standard Rating Results:</b>   |               | <b>Reference Home Standard Rating Results:</b>   |             |                 |               |               |  |
| <b>Home</b>  | <b>Energy</b> | <b>Fuel</b>  | <b>MEPR</b> | <b>Home</b>     | <b>Energy</b> | <b>Loads</b>  |  |
| <b>End Use</b>   | <b>(MBtu)</b> | <b>Type</b>  |             | <b>End Use</b>  | <b>(MBtu)</b> | <b>(MBtu)</b> |  |
| Heating  | 50.70         | gas  | 0.78        | Heating         | 58.10         | 35.20         |  |
| Cooling  | 4.20          | elec   | 13.0        | Cooling         | 6.60          | 19.00         |  |
| Hot Water  | 19.10         | gas  | 0.59        | Hot Water       | 19.40         | 11.30         |  |
| Lgt & Apl  | 23.70         | n/a  | n/a         | Lgt & Apl       | 25.60         | 25.60         |  |
| net OPP  | 0.00          |  |             |                 |               |               |  |
| <b>DWHR Energy Savings:</b><br>Hot water energy savings 18.0%<br>Whole home energy saving 2.9%                                     |               | <b>Certification:</b><br>I hereby certify that the information submitted in this report is accurate to the best of my knowledge.                     |             |                 |               |               |  |
| <b>HERS Credit Calculation Results:</b>  |               |  |             |                 |               |               |  |
| Standard HERS Index score  | 84.9          |  |             |                 |               |               |  |
| DWHR HERS Index credit   | -1.8          |  |             |                 |               |               |  |
| <b>Revised HERS Index score</b>  | <b>83</b>     |  |             |                 |               |               |  |
|  |               |  |             | Chris Chitester |               |               |  |

- Unequal flow example
- DWHR credit is **1.8 points or 0.5 points less**
- HERS score is unchanged but could depending on house
- 50 % CSA efficient DWHR unit remains in this example

# Southern California example

Heat Meter Summary Chart (Savings):



- **Lot 10** equal flow
- **Lot 39** unequal flow
- Similar houses  
3 showers / day



Thank you for your time !



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***ENERGY INC.***