
November 1st


hello
MY NAME IS

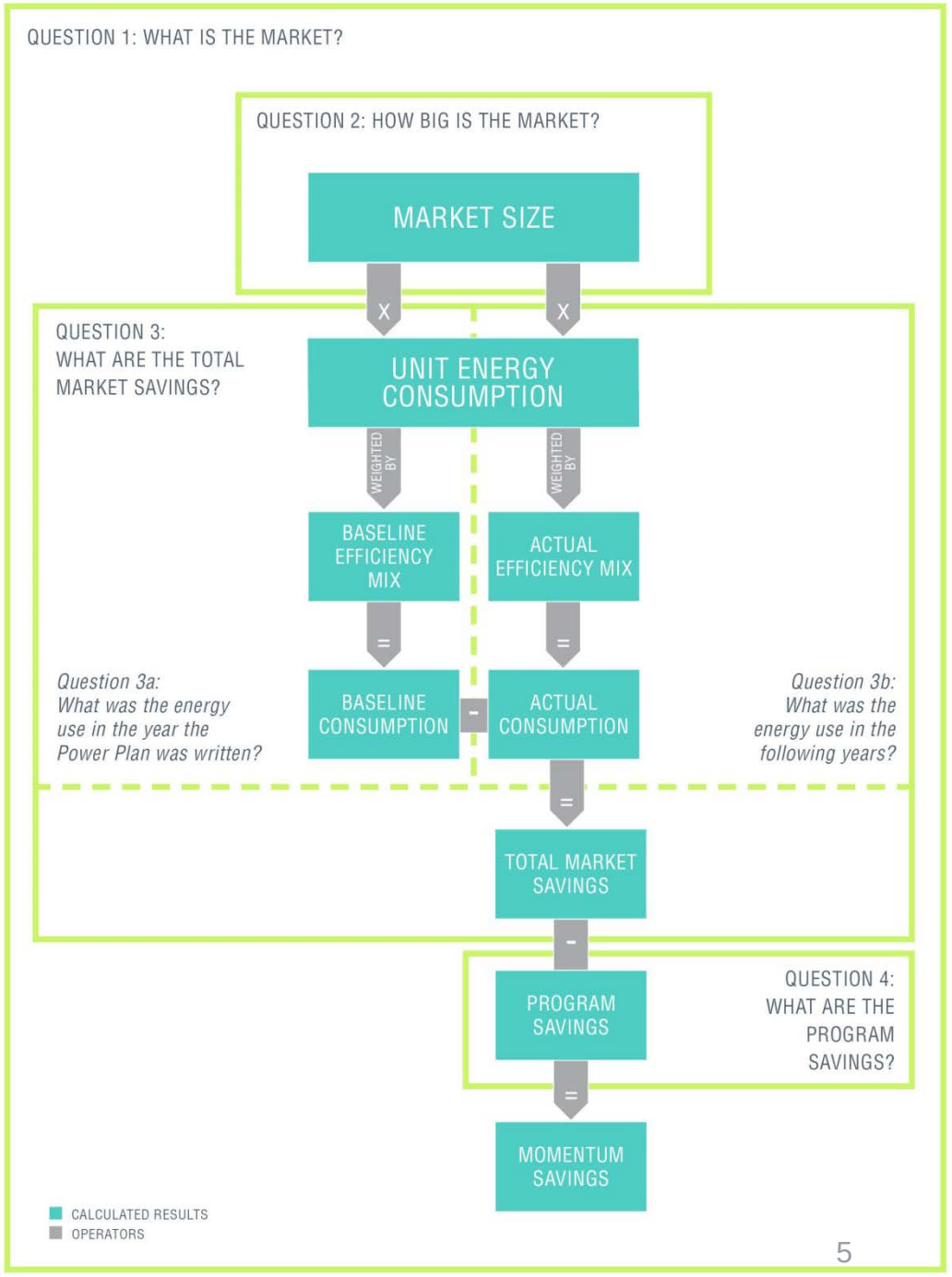

Hot Water

OUR GOAL

Understand how total residential hot water energy consumption is changing over time, and estimate Momentum Savings.

FRAMEWORK

1. What is the market?
2. How big is the market?
3. What are the total market savings?
4. What are the program savings?



WHAT SHOULD BE INCLUDED IN THE MODEL?

Question 1: What is the market?

WHAT IS THE MARKET: BUILDING TYPES

Single family, manufactured homes, and the 90% of multi-family that has in-unit water heating.

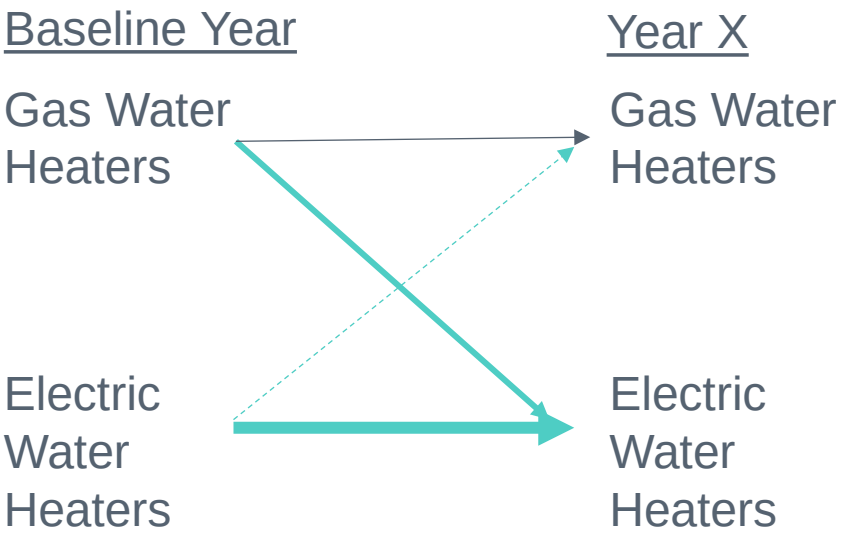
RBSA 2011 says:

- 6% of MF buildings and 18% of MF units are ≥4 stories
- 89% of all MF is “residential use”
- 90% of hot water systems in MF are in-unit (virtually all electric)

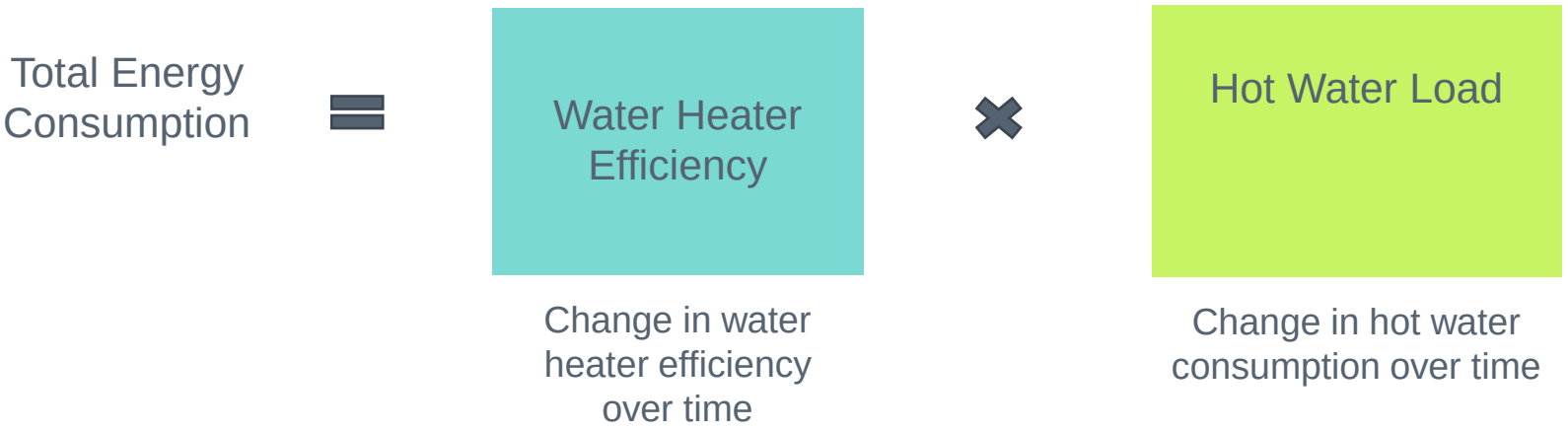
WHAT IS THE MARKET: FUEL TYPE

Electric Only

- Will account for fuel switching with shipments data (primarily)



WHAT IS THE MARKET: TECHNOLOGIES



WHAT IS THE MARKET: TECHNOLOGIES

Impacts water heater efficiency	Impacts water load
Water Heaters Pipe Insulation Solar Water Heaters	Showerheads Aerators Clothes washers Dishwashers TSRV Circulators Wastewater HX

BUT ISN'T NEEA DOING HPWH?

NEEA has collected excellent data on water heater efficiency for their HPWH tracking.

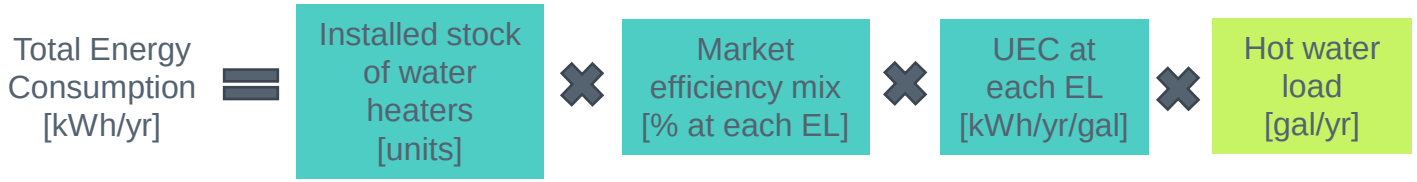
We need to build on this information to estimate savings from changes in *hot water load*.

HOW MUCH ENERGY DOES THE MARKET CONSUME?

Question 2: How big is the market?

HOW BIG IS THE MARKET: ENERGY CONSUMPTION

Calculating consumption for a given year, x



Relevant Technologies
Water heaters
Pipe insulation
Solar water heaters

HOW DO WE CALCULATE HOT WATER LOAD?

We explored three options…

FIRST, A GOOD ANCHOR

Metered hot water provides an anchor to bound uncertainty in estimating hot water load.

2012 RBSA Hot Water Metering Results		
Building Type	Occupancy (occ/household)	Estimated Hot Water Load (gal/day)
Single Family	2.56	40
Manufactured Homes	2.48	39
Multifamily	1.92	33

THREE OPTIONS
CALCULATING HOT WATER LOAD

- **Option A: Hybrid**
- Option B: Bottom Up
- Option C: Top Down

OPTION A

CALCULATING HOT WATER LOAD

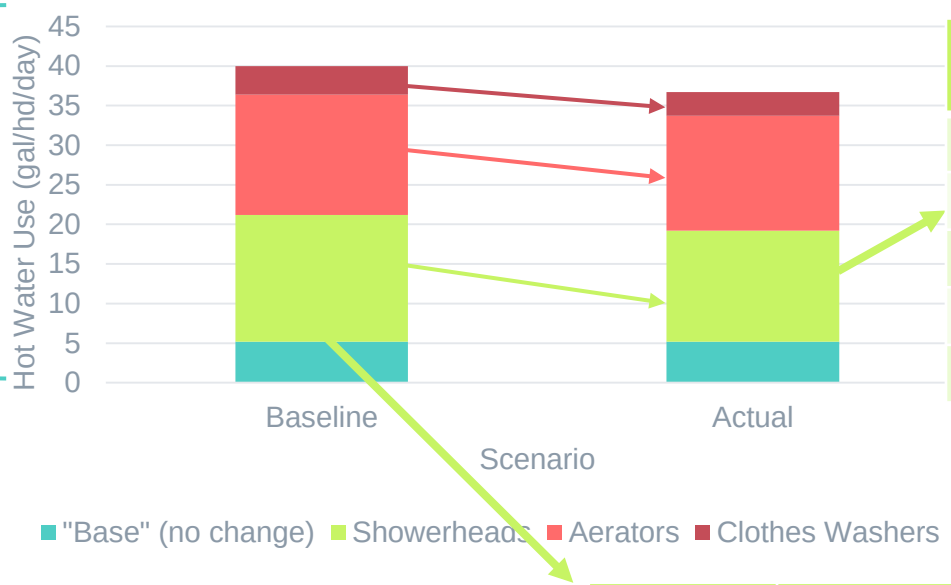
*Start with the baseline hot water load then adjust that load in each subsequent year using installed stock and corresponding change in **unit water consumption (UWC)** for measures with known changes in market efficiency.*

Total hot water load [gal/yr] = "Base" hot water load [gal/yr] + $\sum_{eqpt=1}^{n}$ [Installed stock of eqpt *y* in year x [units in PNW] × Efficiency mix of eqpt *y* in year x [% at each EL] × **UWC** at each EL [gal/yr]]

Eqpt y
Showerheads
Aerators
Clothes washers

EXAMPLE: OPTION A

Hot water load [gal/yr/ water heater]



GPM	Actual Wt %	UWC (gal/day)
<=1.5	25%	YY
1.6-2.0	43%	YY
2.1-2.5	22%	YY
2.6-3.5	8%	YY
3.6+	2%	YY

11*N+12 gallons/ person

Sector	# occ/ WH
SF	2.56
MH	2.48
MF	1.92

From RBSA

1.2 showerheads / WH

GPM	Baseline Wt %	UWC (gal/day)
<=1.5	16.3%	XX
1.6-2.0	32.1%	XX
2.1-2.5	29.5%	XX
2.6-3.5	15.1%	XX
3.6+	7.1%	XX

ILLUSTRATIVE!: DATA STILL IN PROGRESS

OPTION B

CALCULATING HOT WATER LOAD

In each year, calculate total hot water consumption based on all installed equipment that consumes hot water.

Hot water load [gal/yr] = $\sum_{eqpt=1}^{n}$ [Eqpt y gphd ✖ Households]

Eqpt y
Circulators
Showerheads
Aerators
Clothes washers
Dishwashers
Circulators
TSRV
Wastewater HX
Other??

OPTION C

CALCULATING HOT WATER LOAD

In each year, calculate total hot water consumption based on total residential water using the percentage of indoor water usage and hot water usage.

Hot water load [gal/yr] = Total Residential Water Usage × Indoor Water Usage (%) × Hot Water Usage (%)

SUMMARY OF OPTIONS

CALCULATING HOT WATER LOAD

- **Option A: Hybrid**
  - **Grounded in measurement and focuses on technologies that are changing**
- Option B: Bottom Up
  - Uncertainty about all the end uses
- Option C: Top Down
  - Concerns about data acquisition, reliability, and timeliness

WHAT TECHNOLOGIES MATTER MOST?

Question 1: What is the market?

FIRST, HOW DO PEOPLE USE HOT WATER?

Source: Residential End Uses of Water Version 2: Executive Report

SHOWERHEADS ARE BIG

…but is there
opportunity for
momentum savings?

OPPORTUNITY WITH SHOWERHEADS

Sector	Measured Flow Rate Bin (GPM)	Wt %	Wt Avg Flow Rate (GPM)	Source
Single Family	<=1.5	16.30%	2.32*	RBSA 2011, Single Family Study, Table 113
	1.6-2.0	32.10%		
	2.1-2.5	29.50%		
	2.6-3.5	15.10%		
	3.6+	7.10%		
Manufactured Homes	<=1.5	1.80%	2.40*	RBSA 2011, Manufactured Home Study, Table 88
	1.6-2.0	30.60%		
	2.1-2.5	32.50%		
	2.6-3.5	16.60%		
	3.6+	8.40%		
Multifamily	<=1.5	25.10%	2.08*	RBSA 2011, Multifamily Study, Table 80
	1.6-2.0	40.40%		
	2.1-2.5	21.50%		
	2.6-3.5	9.20%		
	3.6+	3.90%		

In 2011, a large % of flow rates were higher than the 2.0 GPM EPA WaterSense standard

WHAT DO WE KNOW ABOUT THE TECHNOLOGIES IN THE MARKET?

Question 1: What is the market?

WATER HEATERS

- Essential to understanding overall consumption
- HPWHs are the largest source of potential in the 7th Plan (323 aMW)
- We have substantial information about
  - efficiency (technology options)
  - market penetration
  - barriers to adoption
  - standards impact
  - energy savings

Data Sources
RBSA 2011 & 2016
RTF measure workbooks
7th Plan
NEEA & BPA program activity
NEEA shipments data

PIPE INSULATION

- There is limited data on pipe insulation in the region, however, including pipe insulation means we more accurately model water heater UECs.
- May present source of market savings.

Data Sources
RBSA 2016
BPA-Qualified measure analysis
Code and evaluations
BPA program activity

SOLAR WATER HEATERS

- Limited market penetration (1%)
- Surveyed as part of RBSA 2011 and RBSA 2016
- Considering excluding unless significant increased penetration observed in RBSA 2016

Data Sources
RBSA 2011 & 2016
7th Plan
RETC
ETO program activity

SHOWERHEADS

- Showerheads present a potentially significant source of hot water savings, second largest potential in 7th Plan (121 aMW)
- The region has substantial data on the penetration of efficient showerheads and associated savings potential
- Planning to estimate change in stock efficiency mix based on RBSA 2016

Data Sources
RBSA 2011 & 2016
7th Plan
RTF measure workbooks
BPA & NEEA program activity
REUWS
Seattle WCS

AERATORS

- There is sufficient information to estimate momentum savings for aerators, although some uncertainty in UES
- High market saturation (65%) with limited program activity
- RTF measure under development

Data Sources
RBSA 2016
7th Plan
RTF measure workbook(s)
Energy Trust program activity
REUWS
Seattle WCS
Energy Trust research
Michigan evaluation

CLOTHES WASHERS

- Medium potential for clothes washers (60 aMW), approximately half of which is due to water heater savings
- Significant regional data exist to estimate market efficiency shift and water heater savings

Data Sources
RBSA 2011 & 2016
7th Plan
RTF measure workbook(s)
BPA & NEEA program activity
NEEA research

DISHWASHERS

- Very small potential (<1 aMW) due to only slight difference in water heater energy between baseline and efficient cases
  - Based on 2010 CEC database, may need to be updated
- Low program activity
- Confirm analysis of CEC database showing only slight difference in water heater energy between baseline and efficient cases still holds

Data Sources
RBSA 2011 & 2016
7th Plan
RTF measure workbook(s)
NEEA program activity
REUWS

CIRCULATORS

- New efficiency opportunity (new RTF measure)
  - Water heater savings for homes with existing DHW recirculation
- Limited primary data on regional past and future market efficiency
  - NEEA pursuing research
- Planning to verify limited market penetration with 2016 RBSA

Data Sources
RBSA 2011 & 2016 (MFAM)
RTF measure workbook(s)
Energy Trust program activity
NEEA research
DOE research

THERMOSTATIC RESTRICTION VALVES

- Likely very little market penetration
- Limited data on installed stock (RBSA 2016 will include)
- Limited data to support savings estimates
- Verify limited penetration when RBSA 2016 released

Data Sources
RBSA 2016 (MFAM)
RTF measure workbook(s)
BPA program activity

WASTEWATER HX

- Likely very little market penetration and therefore limited potential
  - Associated with 7 aMW potential in 7th Plan
- No programs
- Limited data to support actual efficiency mix
- Verify limited penetration when RBSA 2016 released

Data Sources
7th Plan
RETC
RTF measure workbook(s)

NEXT STEPS

- RTF Market Analysis Subcommittee – November 9th
- Continue exploring how to answer Questions 3 and 4
- Methodology memo - January
- Begin building model - January

APPENDIX: GLOSSARY

Term	Definition
Installed Stock	Existing installed units; represents historical choices of the market.
Saturation (baseline & market cases)	The percentage of homes or buildings within a market in which a certain product category is currently installed.
Efficiency Mix (baseline & market cases)	The distribution of efficiency levels within a given market. • Baseline case assumes the efficiency mix in the Council 7th Plan baseline or adjusted baseline. • Market case represents efficiency mix installed in a given year.
Unit Energy Consumption (UEC) / Savings (UES)	The energy consumed (UEC) or saved (UES) by a unit at a given efficiency level.
EL	Efficiency level, e.g., 2.25 GPM or 2.0 COP

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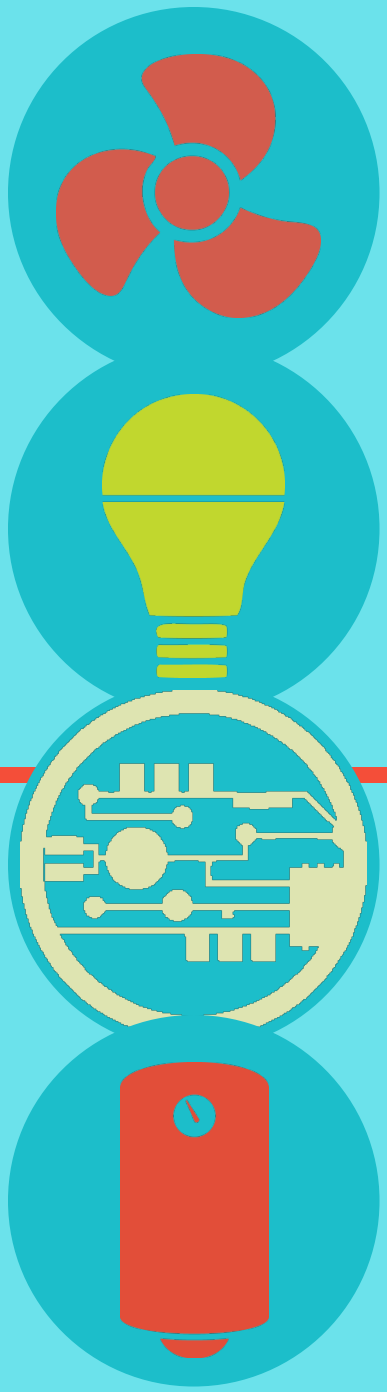

Quick Project Updates

Project	Status
Data Center Draft Methodology	Contracted
OLSA Planning Phase	Contracted
Res Hot Water Draft Methodology	Contracted
Res HVAC Market Intelligence Study	Contracted
Res HVAC Model Development	Contracted
2017 Non-Res Distributor Sales Data	Contracted
Res Hot Water Model Development	Contracted
Res HVAC Baseline Field Study	In Contracting
Data Center Model Development	*Pre-Contracting*
Integrate Capacity into Res Lighting Model	*Pre-Contracting*
HVAC Distributor Sales Data: Round 2	*Pre-Contracting*

THX!

See you December 6th!