

# High Performance Circulator (HPC) Pumps



**JESSICA MORRISON, STEPHEN PUTNAM**  
**GRUNDFOS PUMPS CORP.**  
**SEPTEMBER 22, 2016**

# Presentation Overview

2

## **Objective: Seeking TF approval of draft workpaper**

- What is the measure?
- What is the application and market?
- What is the energy savings opportunity at stake?
- Issues and Concerns
- Questions or Comments

# Measure Description

3

## Base Case

### Market Standard Pumping System

- None or Valve Controller
- No VFD
- Standard Induction Type Motor
- Wet End Pump



Grundfos UP 15-29 SU/LC

## Measure Case

### High Performance Circulator Pump

- Integrated “Self-Optimizing” Control Scheme
- Integrated VFD
- Electrically Commutated Motor (ECM, BLPM)
- Highly Efficient Wet End Pump



Grundfos Alpha 15-55 SF/LC

# Measure Description

4

- **Units:** kWh Savings/ Pump (based on running watts)
- **Measure Application and Delivery Type**
  - Replace on Burnout - ROB (primary) – Midstream (direct to wholesale distribution)
- **Eligibility**
  - Climate Zones: All (not climate zone dependent)
  - Building Types: Residential/ Multi-Family
    - ✦ Commercial as well but outside the scope of the workpaper
- **Target Market**
  - Residential hot water recirculation systems in CA
    - ✦ Target the retrofit/ replacement market
- **Market Potential**
  - **Estimated kWh savings opportunity: 19,423,131 kWh (@ 100% market transformation)**
    - ✦ Details on this to follow...



Grundfos Alpha 15-55 SF/LC

# Measure Description

5

- **Measure Costs**

- Baseline cost: \$231 Pump Cost + \$300 Installation Cost = \$531 Total Cost
- Measure cost: \$336 Pump Cost + \$300 Installation Cost = \$636 Total Cost
- Incremental cost: \$105

- **EUL**

- 15 Years per DEER EUL for ECM circulator pumps for the commercial sector.  
However, Efficiency Vermont has carried a effective useful life figure of 20 years.

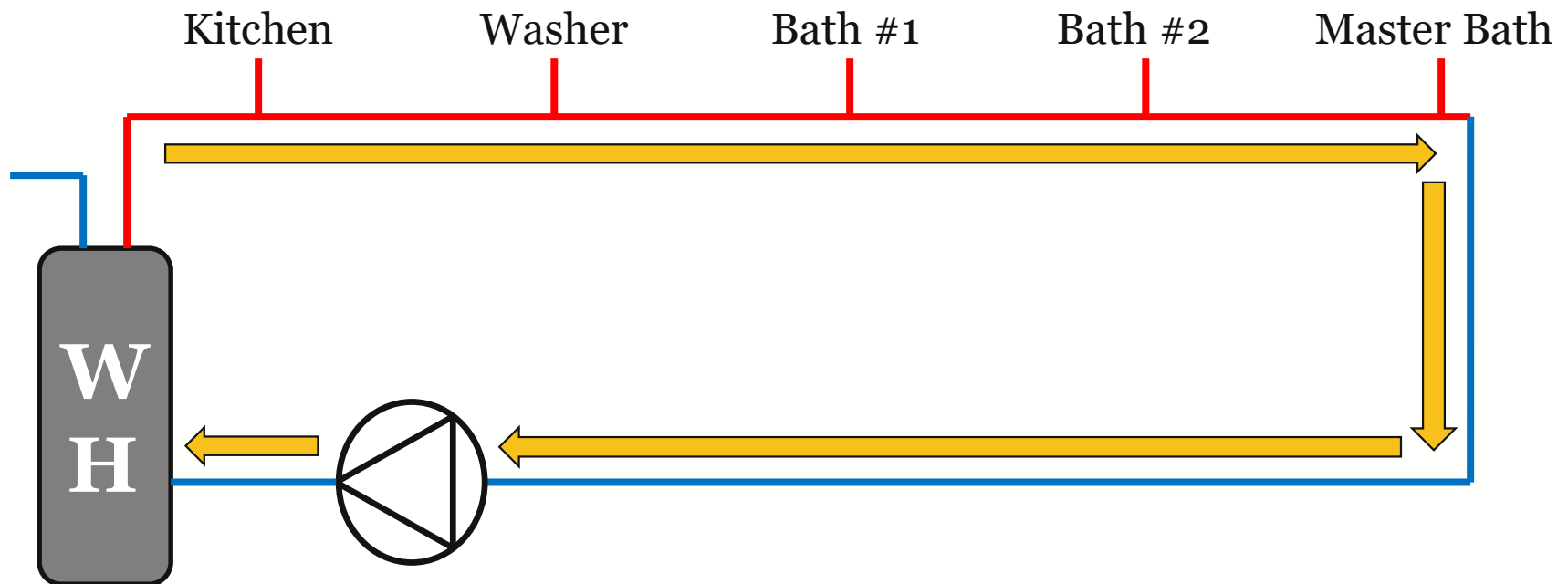
- **NTG**

- All-Default ≤ 2yrs Source: 0.70
  - ✦ However, with intimate CA market knowledge Grundfos would suggest a NTG of 0.93 as there is approximately 7% measure case market penetration. Both Efficiency Vermont and Energize Connecticut have claimed a NTG of 0.95.

# What is the Application?

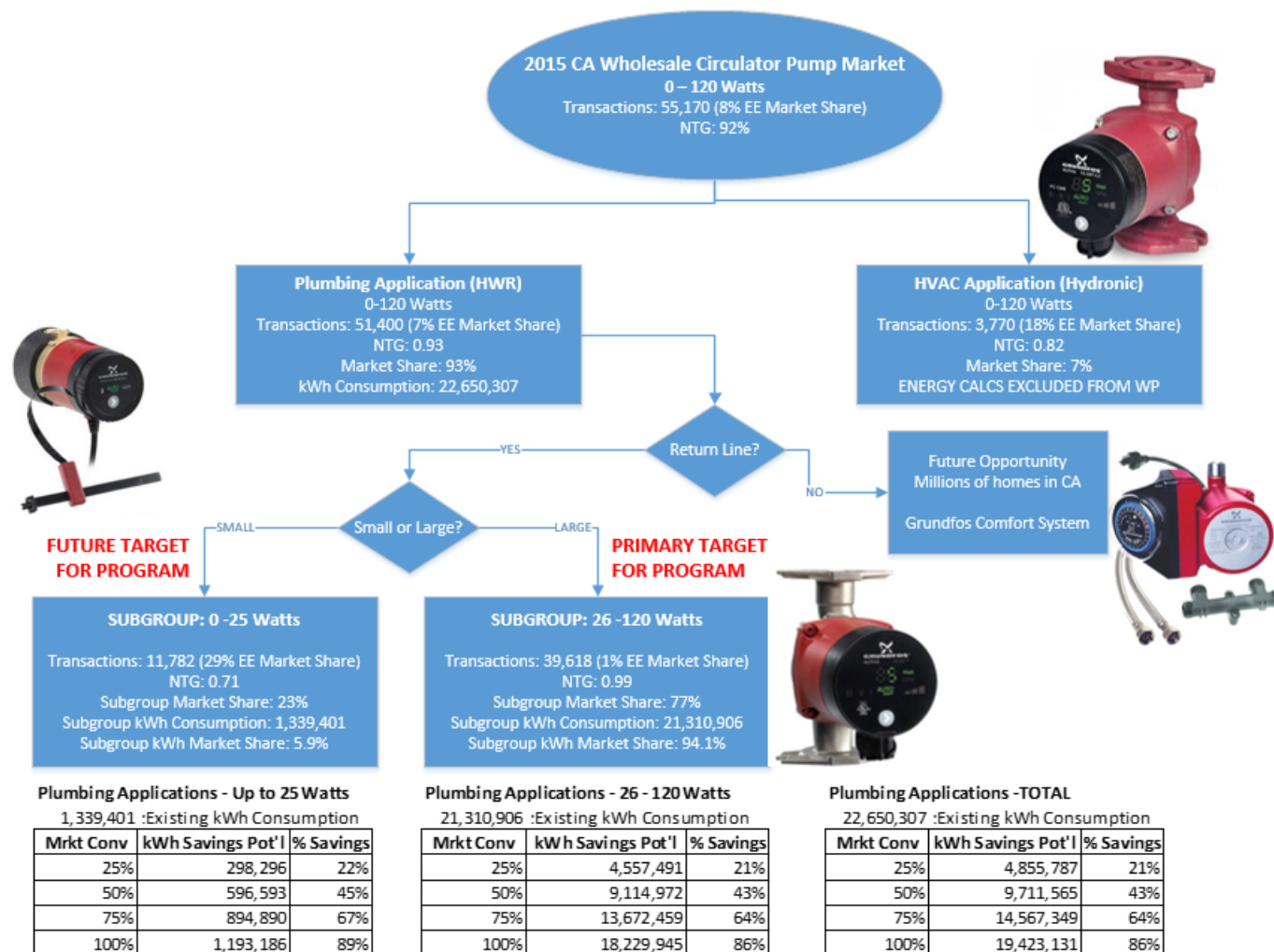
6

## Domestic Hot Water Recirculation



# What is the Existing CA Market?

7



# Existing CA Market Stance?

8

- Contractors are the decision makers for pump selection
  - “Like-for-like” replacement
  - Engineers size in a “safety factor”
  - Upsize pump if like-size not readily available
- Lack of knowledge of how to correctly size a pump
  - Unable to do for retrofit applications
- Cost (NOT EFFICIENCY) is primary deciding factor for pump selection
  - Pump to make it through warranty period without callback

**RESULT...** Cycle of continually oversizing circulator pumps that are inefficient, but are utilized because they cost less!

## **SOLUTION...**

An HPCP with integrated controls and VFD that will “right-size” itself to the specific application into which it is installed, armed with utility incentives in a midstream program, it becomes the most cost effective for contractors to install.

# SOLUTION to CA Market Stance?

9



**Pump Wet End:** Stainless Steel for OPEN (plumbing) applications, Cast Iron for CLOSED (HVAC) applications, 6-1/2" flange-to-flange (standard)

**Integrated VFD:** VFD built directly into the pump, allows for self-optimization ability

**Self-Optimizing:** Algorithm dictates pumps performance and right-sizes for the specific application into which it is installed

**Control Modes:** Single button allows changing to seven different control modes. AUTOAdapt is default setting. Active mode is lit.

**UNITARY SOLUTION:** The Grundfos Alpha is a unitary solution. This means that it is a “plug and pump solution”. Out of the box, the Alpha has the wet end pump, integrated VFD and self –optimizing ability. There is no need for external equipment in order to gain energy savings. Installation takes no additional time, expense or complication as compared to the current market standard.

Out of the box, the Alpha will run in AUTOAdapt, immediately optimizing its performance and coaching contractors to utilize this control feature.

# How much energy will an HPCP save?

10

## Market Standard



### UP 15-29 SU/LC

Max Watts: 87 Watts  
Typical Running Watts\*: 84.2  
kW: 0.084  
kWh/ Yr: 539.87

## HPCP



### Alpha 15-55 SF/LC

Wattage Range: 5-45 Watts  
Typical Running Watts\*: 12.07  
kW: 0.012  
kWh/ Yr: 77.12

kW Savings/ Pump: 0.072  
kWh Savings/ Pump: 463 (85.5%)

Assumed: 6,427 Running Hours/ Year

# Potential in CA Market?

11

CA Wholesale Circulator Market (Up to 120 Watts)			
Plumbing (HWR): 51,400		93.2% <i>Focus of Workpaper - Energy Calcs Based On This Market Application</i>	
Hydronic (HVAC): 3,770		6.8% <i>Market Application is EXCLUDED From Energy Calculations</i>	
TOTAL: 55,170 Qty Pumps Transacted/ Yr			
MARKET SEGMENT - UP TO 25 WATTS - PLUMBING MARKET		MARKET SEGMENT OF 26 - 120 WATTS - PLUMBING MARKET	
% of CA Market: 22.9%		% of CA Market: 77.1%	
Market Qty: 11,782		Market Qty: 39,618	
Market Standard (Up To 25 Watts)	Efficient Option (Up To 25 Watts)	Market Standard (26 - 120 Watts)	Efficient Option (26 - 120 Watts)
Market Segment: 70.6%	Market Segment: 29.4%	Market Segment: 99.3%	Market Segment: 0.7%
UP 15-10 B5/TLC (P/N: 59896215)	Comfort PM Auto	UP 15-29 SU/LC (P/N: 59896776)	Alpha 15-55 SF/LC (P/N: 59896834)
Max Watts: 25	UP 10-16 A PM BU/ LC (P/N: 98420224)	Max Watts: 87	
% Max Watts: 97%	Max Watts: 8.5	% Max Watts: 97%	
Running Watts: 24.25	kW: 0.009	Running Watts: 84.2	Running Watts: 12.1
kW: 0.024	Running Hours/ Day: 4	kW: 0.084	kW: 0.012
Running Hours/ Yr: 6427	Running Hours/ Yr: 1460	Running Hours/ Yr: 6427	Running Hours/ Yr: 6427
kWh/ Yr/ Pump: 156	kWh/ Yr/ Pump: 12.4	kWh/ Yr/ Pump: 541	kWh/ Yr/ Pump: 78
	kWh Savings/ Pump: 143		kWh Savings/ Pump: 463
Existing Market (Qty): 8,318	Existing Market (Qty): 3,464	Existing Market (Qty): 39,341	Existing Market (Qty): 277
Existing Market kWh/ Yr: 1,296,414	Existing Market kWh/ Yr: 42,987	Existing Market kWh/ Yr: 21,289,339	Existing Market kWh/ Yr: 21,567
Existing CA Market kWh: 1,339,401		Existing CA Market kWh: 21,310,906	
Total Existing CA Market kWh: 22,650,307			
Transformed Market Potential		Market Conversion Rate: 100%	
Market Standard (Up To 25 Watts)	Efficient Option (Up To 25 Watts)	Market Standard (26 - 120 Watts)	Efficient Option (26 - 120 Watts)
Qty Pumps Transacted: 0	Qty Pumps Transacted: 11,782	Qty Pumps Transacted: 0	Qty Pumps Transacted: 39,618
kWh: 0	kWh: 146,215	kWh: 0	kWh: 3,080,961
Transformed CA Market kWh: 146,215		Transformed CA Market kWh: 3,080,961	
Total Transformed CA Market kWh: 3,227,176			
kWh Savings: 19,423,132		Savings %: 86%	

## kWh Savings by Market Conversion Rate

25%: 4,855,783 (21% Savings)      75%: 14,567,349 (64% Savings)  
 50%: 9,711,566 (43% Savings)      100%: 19,423,132 (86% Savings)

# Questions or Comments?

12

# How was running wattage calculated?

13

Market Standard: Able to pull power curve internally, wattage reflects best efficiency point (BEP: 10 GPM @ 5' TDH) of 84.2 Watts

HPCP Option: Assumed a 4' per second velocity (best practice) in a 1/2" return line would yield a 2.45 PM. Based on the AUTOAdapt control curve, the resulting head would be approximately 5.5'. Power curves are published for the Grundfos Alpha and at 2.45 GPM @ 5.5' TDH the Alpha consumes 12.1 watts of power.

# Reviewer's Comments / Revisions

14

- Reviewers

- Gary Fernstrom, David Jagger, Chad Worth, Tim Melloch

## At a Glance Summary:

- ✓ Peak Demand Reduction (kW/unit) – originally was based off nameplate. Therefore submittal data was used.
  - BASE CASE: wattage consumption at BEP = **84.2 watts**
  - MEASURE CASE: Assuming  $\frac{1}{2}$  return line on HWR and a 4' per second velocity, the flow = 2.45 GPM. AutoAdapt = TDH at 5.5'. Running watts for 2.45 GPM @ 5.5' TDH is **12.1 watts**
- ✓ Energy Savings (kWh/unit) – originally assumed 8,760 running hours/year
  - Reference DOE rulemaking from circulator pump workgroup which uses a weighted average of pumps that are running with no controller, no timers employed, aquastats employed and on-demand. Now using 6,427.

# Reviewer's Comments / Revisions

15

## At a Glance Summary cont...

### ✓ Labor Cost included in measure cost?

- It was discussed if the measure cost should include installation if ROB and it was determined that it should.

### ✓ Expected Useful Life

- Debated between 15 and 20 years; settled on 15 years based off DEER EUL for ECM circulator pumps

### ✓ Net to Gross

- ✓ Grundfos calculated 92.5; however, based off feedback decided to publish DEER of .70 per CAL TF recommendations. While calling out market data would suggest as well as other NTG values across the US.

# Reviewer's Comments / Revisions

16

## ✓ 1.1 Estimated Residential ROB Market Discussion

- Combined 2 measures to estimate market potential.

## ✓ 1.1 Technical Description

- ✓ AutoAdapt: detection of system pressure changes
  - ✦ Reviewers wanted better understanding of the technology when the faucet is flowing versus when it was not.

## ✓ 1.2.1.3 In-Service Rate / First Year Installation Rate

- Assumed installation rate close to 100%. The Alpha serves the market well due to its ability to right-size, thus providing a single pump solution to vast majority of installation opportunities.

## ✓ 2.1 & 2.2 Baseline by Measure Application Type

- Baseline
  - ✦ First: refers to the first baseline period which in the case of ROB is the only baseline period. If it was ER we would assume a “first” and “second” baseline.

# Reviewer's Comments / Revisions

## ✓ 2.2.3 Peak kW

- There was a discussion on using the DOE running hours (6,427/ Yr) or 8,760/ Yr. Decided to go with 8,760 based on Grundfos market knowledge.

## ✓ 3.1 Base Cases (Costs)

- Data was questions as to weather it included brass and stainless DHW circulators – it includes both installed in HWR applications in CA.

## ✓ Appendix: CA Circulator Wholesale Market Landscape Analysis and Explanation of *AutoAdapt* Functionality

# Issues and Concerns

18

## Abstract Review Comments from the Cal TF

- ✓ Cal TF comment 1
  - Description of how comment was addressed
- ✓ Cal TF comment 2
  - Description of how comment was addressed
- ✗ Cal TF comment 3
  - Explain why comment was not addressed

## Abstract Review Comments from GRUNDFOS

- ✓ Will second workpaper be needed for “smaller” wattage class?
  - Description of how comment was addressed
  
- ✓ Stakeholder comment 2
  - Description of how comment was addressed
  
- ✗ Stakeholder comment 3
  - Explain why comment was not addressed

# Issues and Concerns – Future Updates

20

- Future update topic 1
  - Comment 1
  - Comment 2
  
- Future update topic 2
  - Comment 1
  - Comment 2