



# ENERGY STAR<sup>®</sup> Commercial Dishwashers

Version 3.0  
April 25, 2019



# Introductions

**Tanja Crk**

EPA

**Adam Spitz & Dan Baldewicz**

ICF





## Agenda

- Background
- Activities to Date
- Purpose of Revision
- Review of Changes Reflected in the Draft 1 Proposal
- Analysis & Results
- Q&A

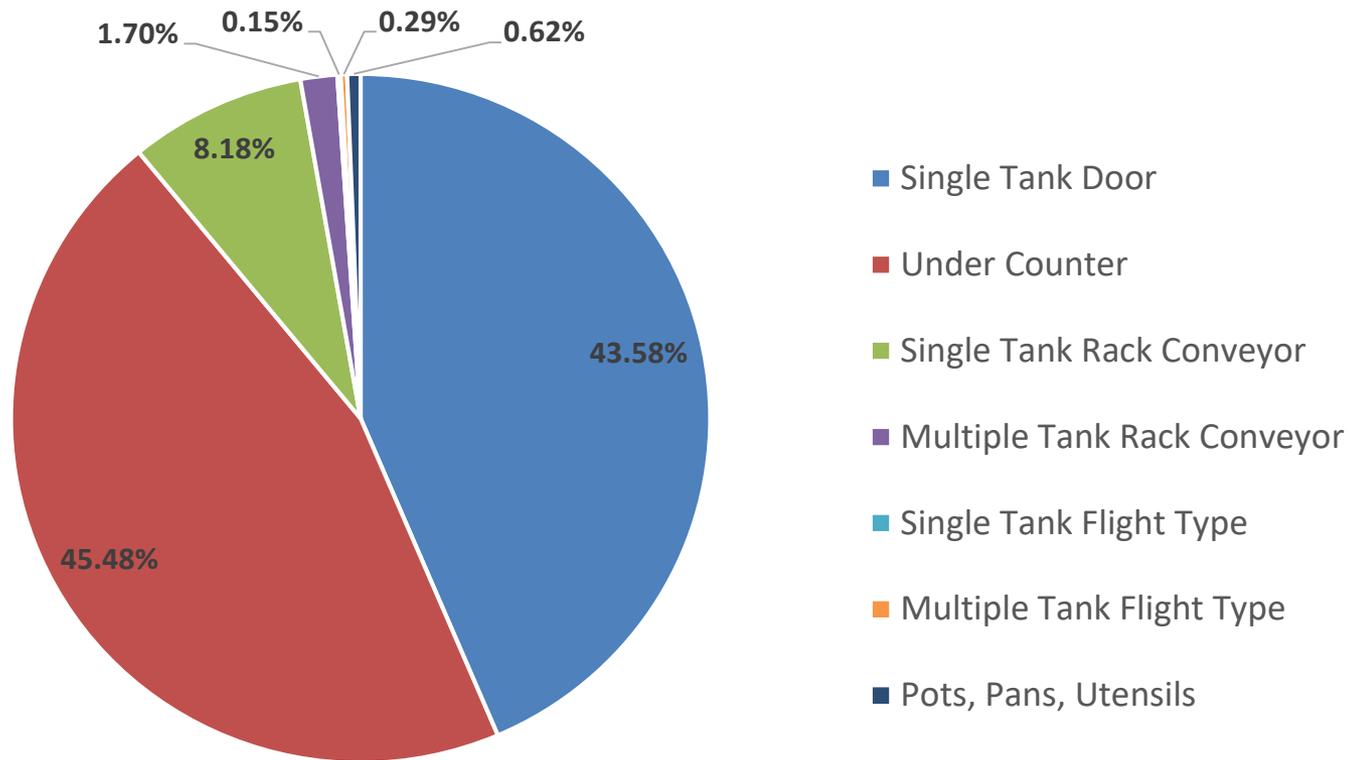


# Background



# Market Characteristics

## U.S. Unit Shipments



Total ENERGY STAR Shipments (2017): 50,751  
Total U.S. Unit Shipments (2017): 75,725

**67%**  
} **market penetration**

# Commercial Dishwasher Equipment



Undercounter  
45% of market



Single tank, door type  
44% of market



Rack conveyor



# Activities to Date



# Commercial Dishwasher Version 3.0 Specification

- Version 1.0 effective date – October 2007
- Version 2.0 effective date – February 2013
- Data Assembly Template & Discussion Guide issued – July 14, 2017
- Data Assembly deadline – October 15, 2017
- Data Assembly extended deadline\* – February 28, 2018
- Draft 1 Version 3.0 Publication – April 3, 2019
- Draft 1 Version 3.0 Webinar – April 25, 2019
- Draft 1 Version 3.0 Comments Due Date – **May 9, 2019**



# History of Commercial Dishwasher Specs

Specification Version	Effective Date	Scope/Details
Version 1.0	October 2007	<ul style="list-style-type: none"> <li>- Product types included: Under counter, Stationary single tank, Single tank conveyor, multiple tank conveyor</li> <li>- Defined idle energy &amp; water consumption performance criteria, for both high temp &amp; low temp products</li> </ul>
Version 2.0	February 2013	<ul style="list-style-type: none"> <li>- Expanded scope to include flight type machines</li> <li>- Revised idle energy and water consumption performance levels</li> </ul>
<i>Version 3.0</i>	<i>2019</i>	<ul style="list-style-type: none"> <li>- (Proposed Updates) Adopting new test methods – add metric for washing energy performance</li> <li>- Revising idle energy and water consumption performance levels</li> </ul>



# Purpose of Revision



## Guiding Principles That Drive Specification Revisions

- **New or revised test methods**
- **Significant increase in ENERGY STAR market penetration**
- Change in Federal minimum efficiency standards
- Technological advancements
- Product performance or quality concerns



# Review of Changes to the Draft 1 Proposal



## Summary of Proposed Revisions

- Terms and definitions
- Scope changes
- Updated test method references
- Update idle energy rate (kW) metrics
- Update water consumption (gal/rack) metrics
- Addition of washing energy (kWh/ rack) metric
- Voltage testing guidance



## Definitions

- *Heat Recovery Machine (term & definition):*  
A sub-type of high temperature, stationary rack or conveyor machine that includes a heat recovery system for the purpose of heating potable water and may not require a dedicated ventilation hood.
- *Washing Energy (term & definition):*  
The rate of energy consumed by the dishwasher while “washing” or “sanitizing” dish loads, as expressed in kWh/rack.
- *Water Consumption (definition)*  
Gallons per rack, per square foot, or per hour depending on the machine type monitored during testing to determine the rate of water usage.



## Scope

- V2.0 Scope (electric; high and low temp):
  - Undercounter
  - Stationary Door Type
  - Pot, Pan, Utensil (PPU)
  - Single Tank Conveyor
  - Multiple Tank Conveyor
  - Single Tank Flight Type
  - Multiple Tank Flight Type
- Proposed V3.0 Draft 1 Scope Reduction
  - PPU (low temp)
  - Flight Type (low temp)



## Test Methods

- Current Version 2.0 Specification
  - *ENERGY STAR Test Method for Commercial Dishwashers (Rev. May-2012)*
- Proposed Version 3.0 Specification
  - *ASTM F1696-18 Standard Test Method for Energy Performance of Stationary-Rack, Door-Type Commercial Dishwashing Machines*
  - *ASTM F1920-15 Standard Test Method for Energy Performance of Rack Conveyor Commercial Dishwashing Machines*



# Requirements Stemming from Updated ASTM Test Method

	Metric	Current ENERGY STAR test method requirement	New ASTM test method requirement ASTM F1696-15 ASTM F1920-15	Notes
<b>Washing Energy Performance Test</b>	Washing Energy Performance (expressed in total kWh/rack)	N/A	Described in ASTM F1696-15 (Section 10.7) and ASTM F1920-15 (Section 10.8)	New certification requirement
<b>Tested Voltage Configuration</b>	Volts	N/A	N/A	New reporting requirement



## Test Guidance

- Washing Energy (Booster Heater)
  - *The total washing energy shall include internal or external booster heater energy in addition to the tank, heat, motor, control, and any additional auxiliary energy, expressed in kWh/rack*
- Idle Energy (Booster Heater)
  - *Booster heater (internal or external) energy consumption should not be part of this measurement unless it cannot be separately monitored per ASTM F1696-18 and ASTM F1920-15 Sections 10.8 and 10.9, respectively*



## Additional V3.0 Comments

- Water Consumption
  - EPA proposed to retain the water consumption metrics, expressed in GPR, GPSF (PPU), and GPH (Flight)
- Dump and Fill Machines
  - All stationary, tank type machines remain in the same category, including dump and fill machines



## Additional V3.0 Comments

- Heat Recovery Machines
  - EPA proposed to maintain same metric levels for each respective sub-type of dishwasher with or without a heat recovery technology
  - Proposed additional recognition on Product Finder for ENERGY STAR certified dishwashers with heat recovery



## Additional V3.0 Comments

- Voltage
  - *For dishwashers with multiple voltage-versatility and those that are available in different voltage configurations, the representative model shall be tested at the most energy consumptive (worst case scenario) rating, according to the manufacturer*



# Analysis & Results



# Approach for Determining V3.0 Proposed Levels

- **Building the Dataset:** EPA assembled idle energy, water consumption, and wash energy test results
  - Performance data sources:
    - ENERGY STAR QPL/Product Finder and stakeholder-submitted data
  - EPA has substantial data for idle energy and water consumption since these are the current metrics used for certification
  - EPA has a select set of wash energy data points and, as such, has taken a conservative approach when setting wash energy levels
  - 308 models total



## Approach for 3D Dataset

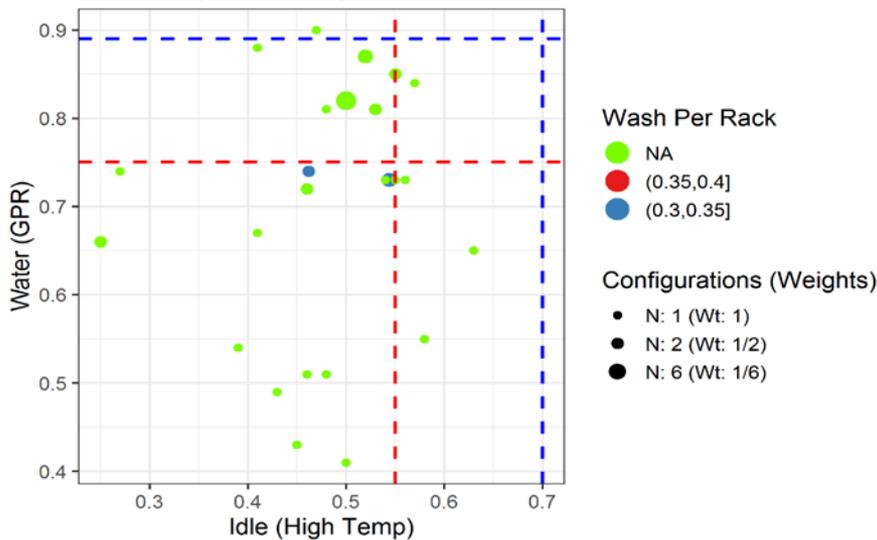
- 3 Criteria: **idle + water** + wash
- Shifted within 25<sup>th</sup> quantile of idle + water data (majority of dataset)
- Overlaid wash data (where available) and made adjustments to the above limits
- Set wash energy threshold based on available data
  - Conservative approach using max levels instead of median
  - Wash energy threshold  $\leq 0.15-0.80$  kWh/rack
- Applied all three criteria in the validation steps and used best professional judgement for determining all three criteria thresholds
  - Tolerance across all three criteria  $\sim 0.05-0.1$  kWh/rack



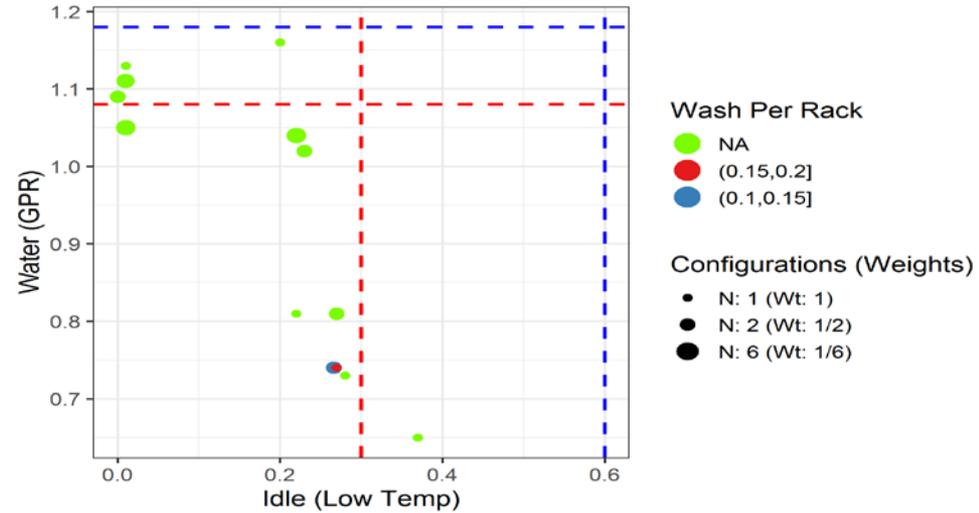
# Stationary Rack, Single Tank-Door Type

- 44% of market
- Models in dataset: 119

Stationary Door (High Temp)



Stationary Door (Low Temp)

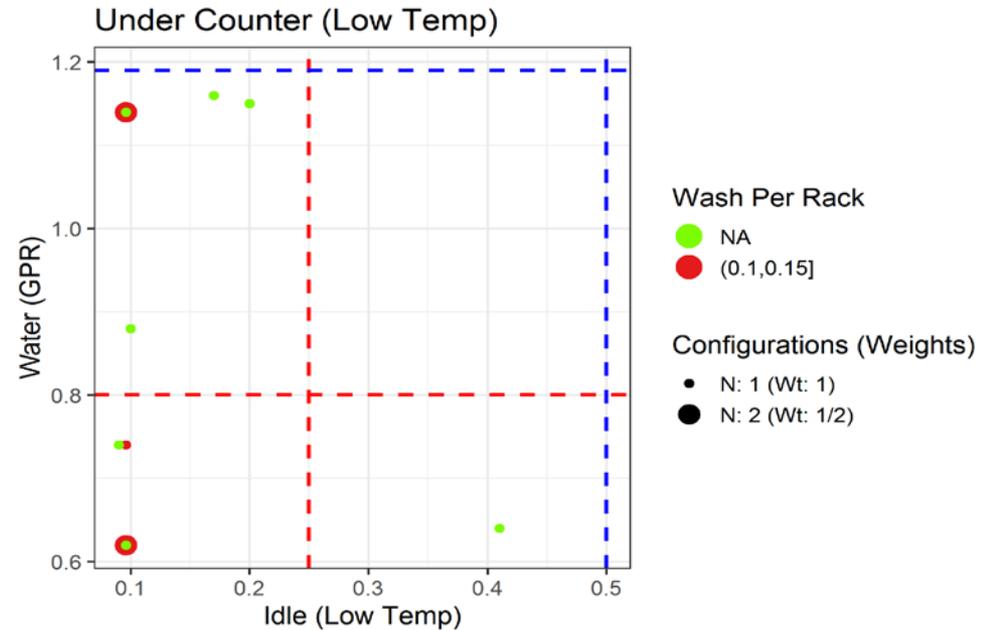
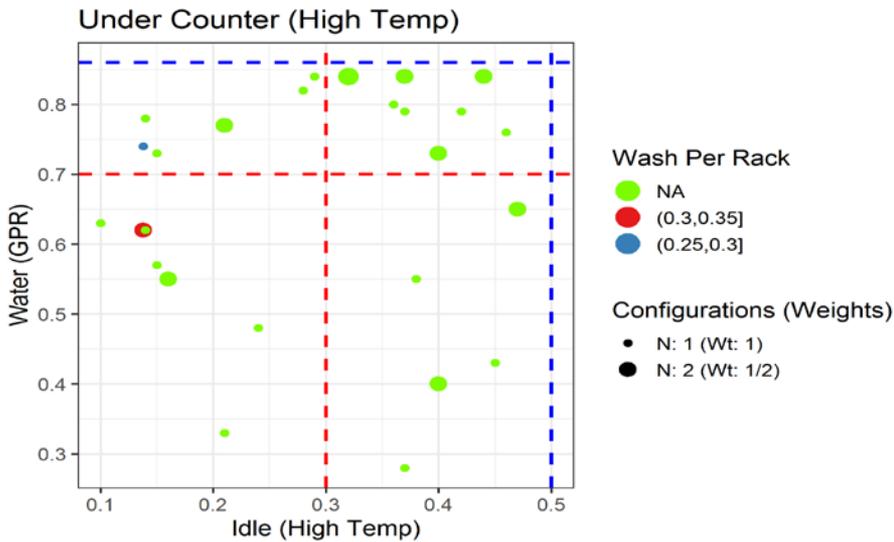


-- Current ENERGY STAR level  
 - - Proposed ENERGY STAR level



# Under Counter

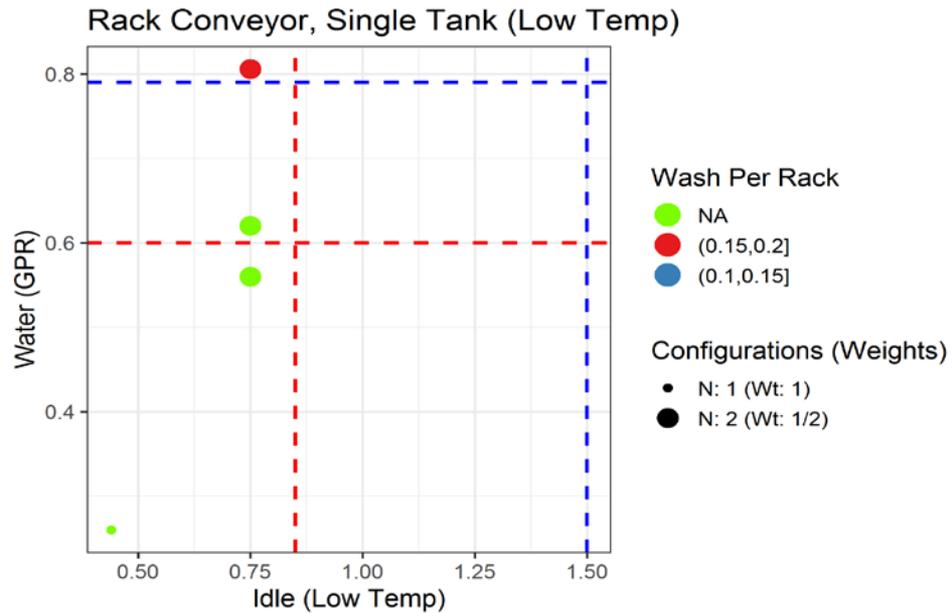
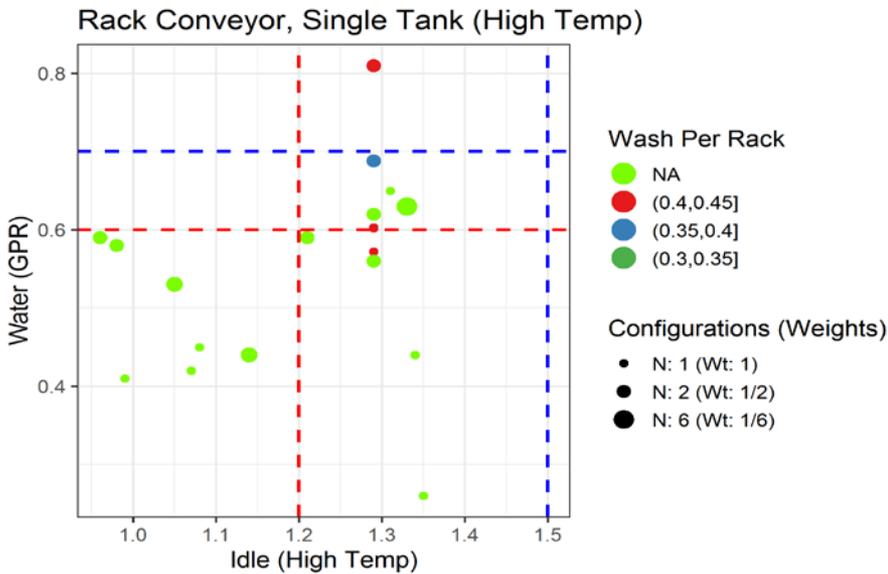
- 45% of market
- Models in dataset: 57



- - Current ENERGY STAR level  
 - - Proposed ENERGY STAR level

# Rack Conveyor, Single Tank

- 8% of market
- Models in dataset: 57



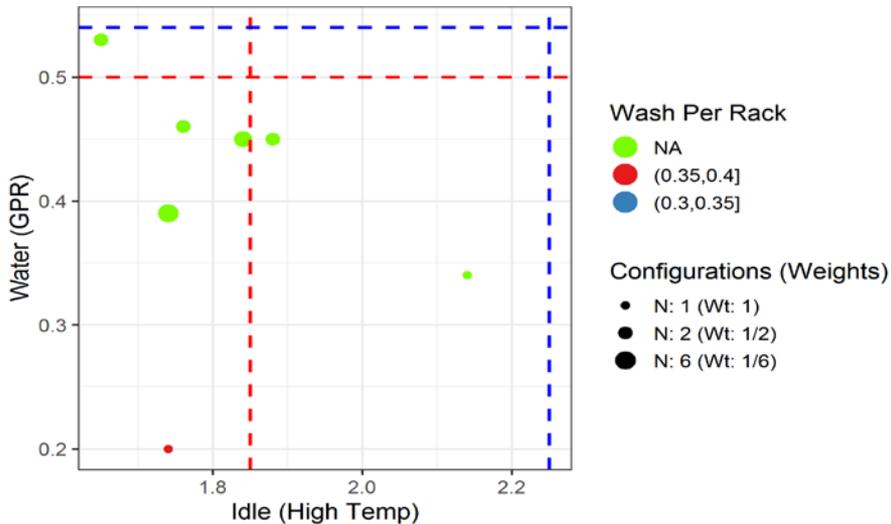
-- Current ENERGY STAR level  
 - - Proposed ENERGY STAR level



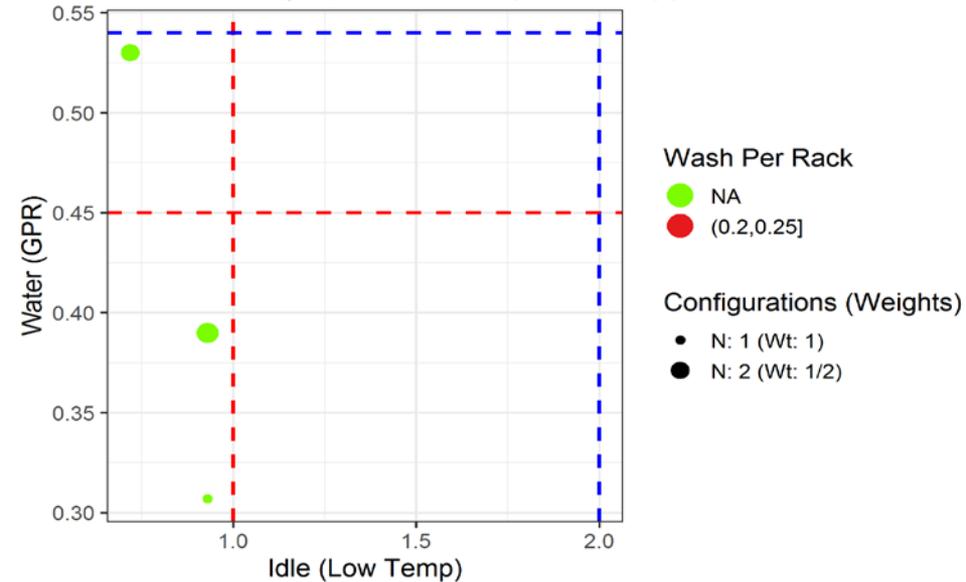
# Rack Conveyor, Multi Tank

- 2% of market
- Models in dataset: 35

Rack Conveyor, Multi Tank (High Temp)



Rack Conveyor, Multi Tank (Low Temp)

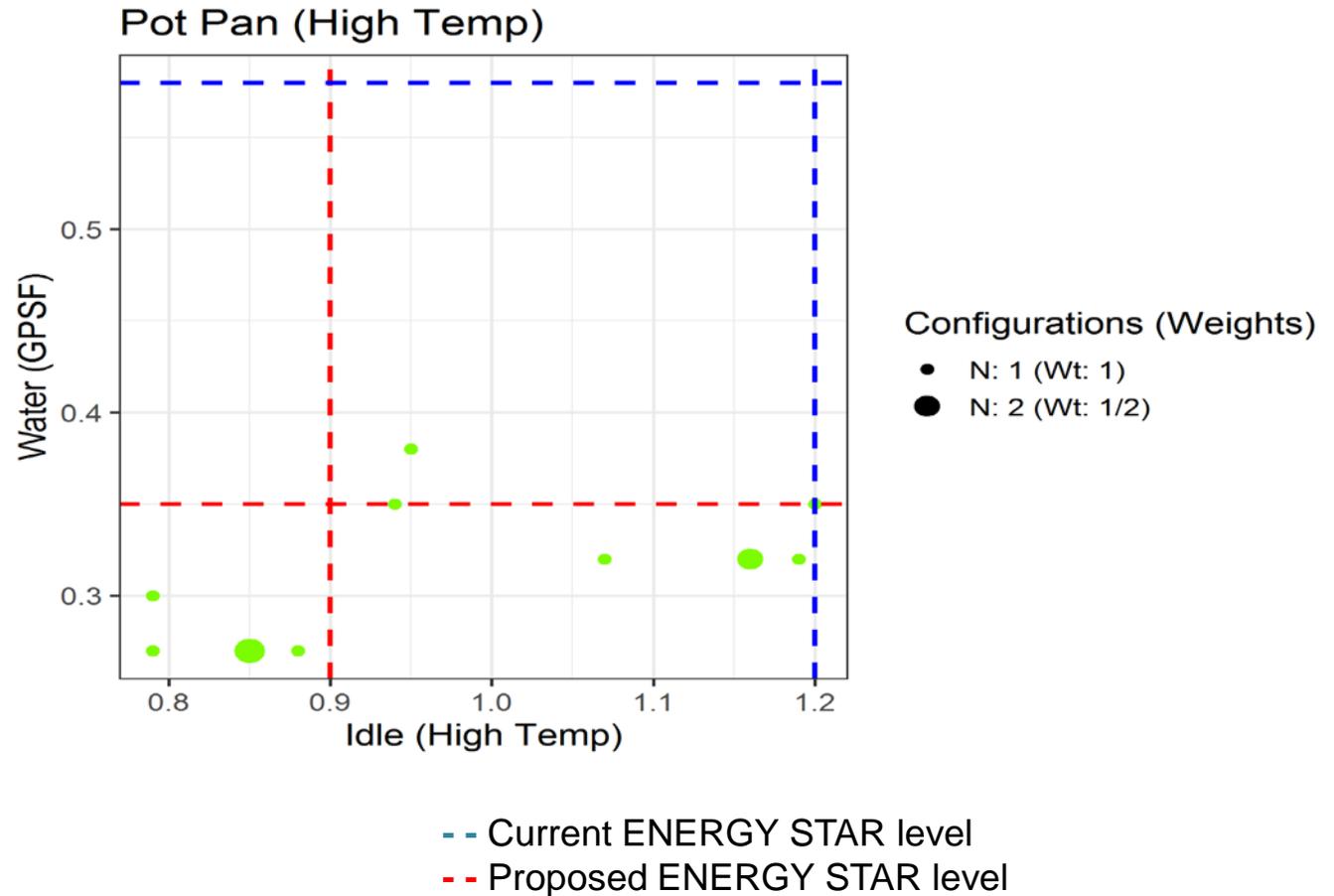


-- Current ENERGY STAR level  
 - - Proposed ENERGY STAR level



# Pot, Pan, Utensil (high temp only)

- <1% of market
- Models in dataset: 16

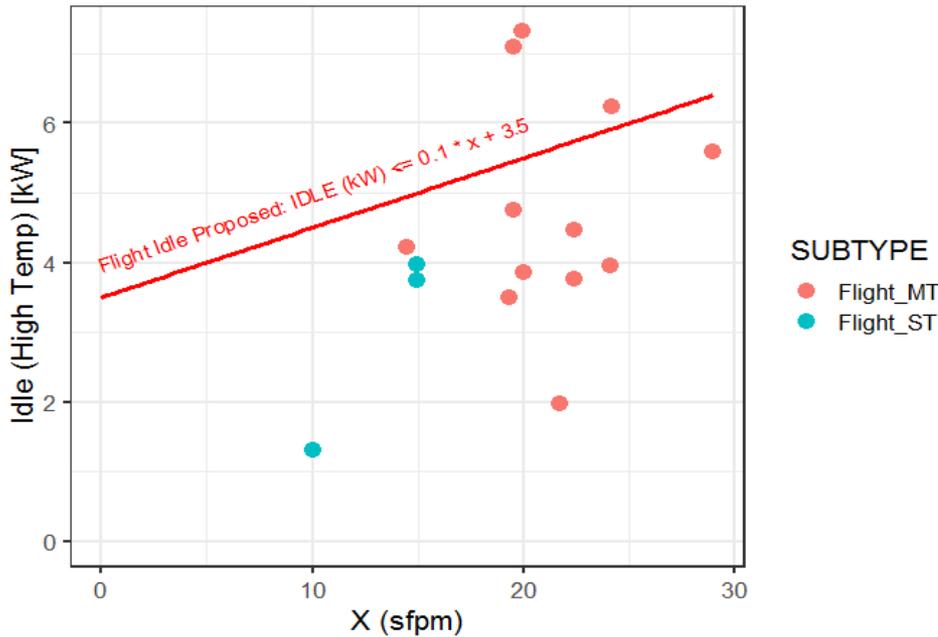




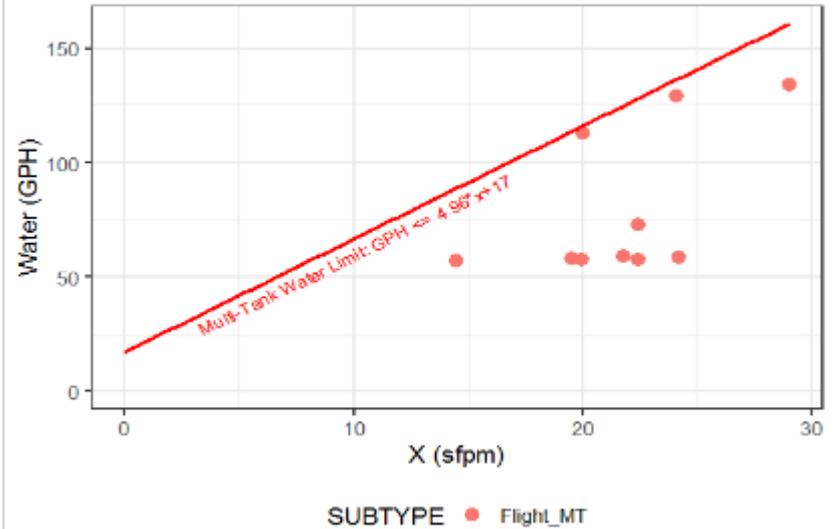
# Flight Types (high temp)

- <1% of market
- Models in dataset: 5 (ST); 19 (MT)

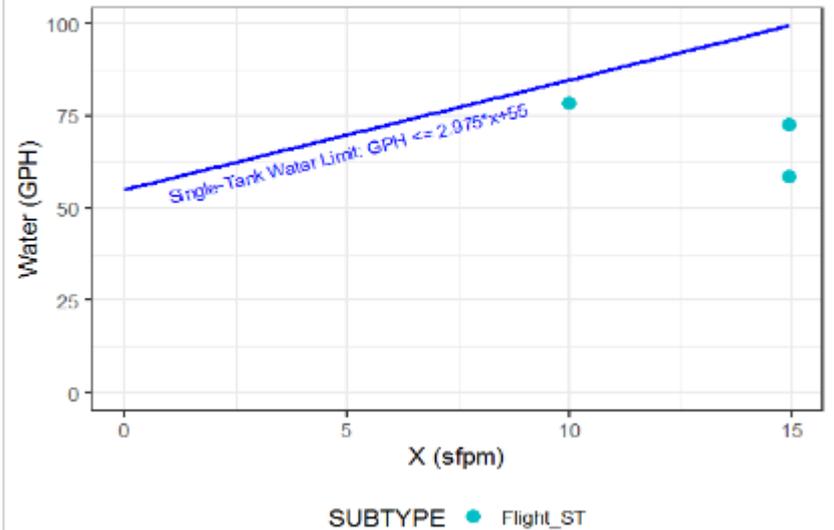
Flight Machines



Flight Machines, Multi Tank



Flight Machines, Single Tank





## Q & A



## Contacts

**Tanja Crk (EPA)**

[Crk.Tanja@epa.gov](mailto:Crk.Tanja@epa.gov)

**Adam Spitz (ICF)**

[Adam.Spitz@icf.com](mailto:Adam.Spitz@icf.com)

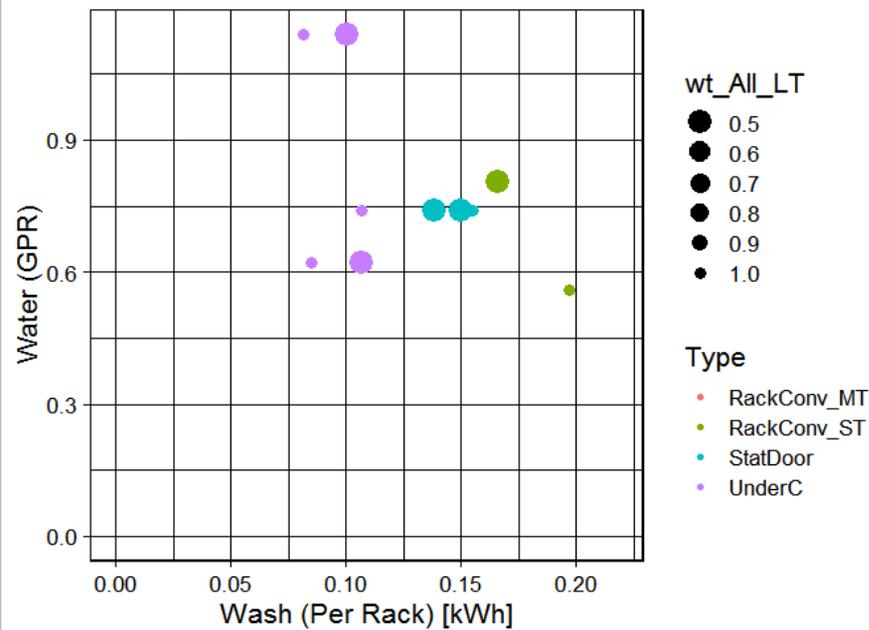
**Dan Baldewicz (ICF)**

[Dan.Baldewicz@icf.com](mailto:Dan.Baldewicz@icf.com)



# Water vs. Wash

Low Temp: Water vs Wash



High Temp: Water vs Wash

