# Comments on the Energy Star® Residential Water Heaters: Draft Criteria Analysis

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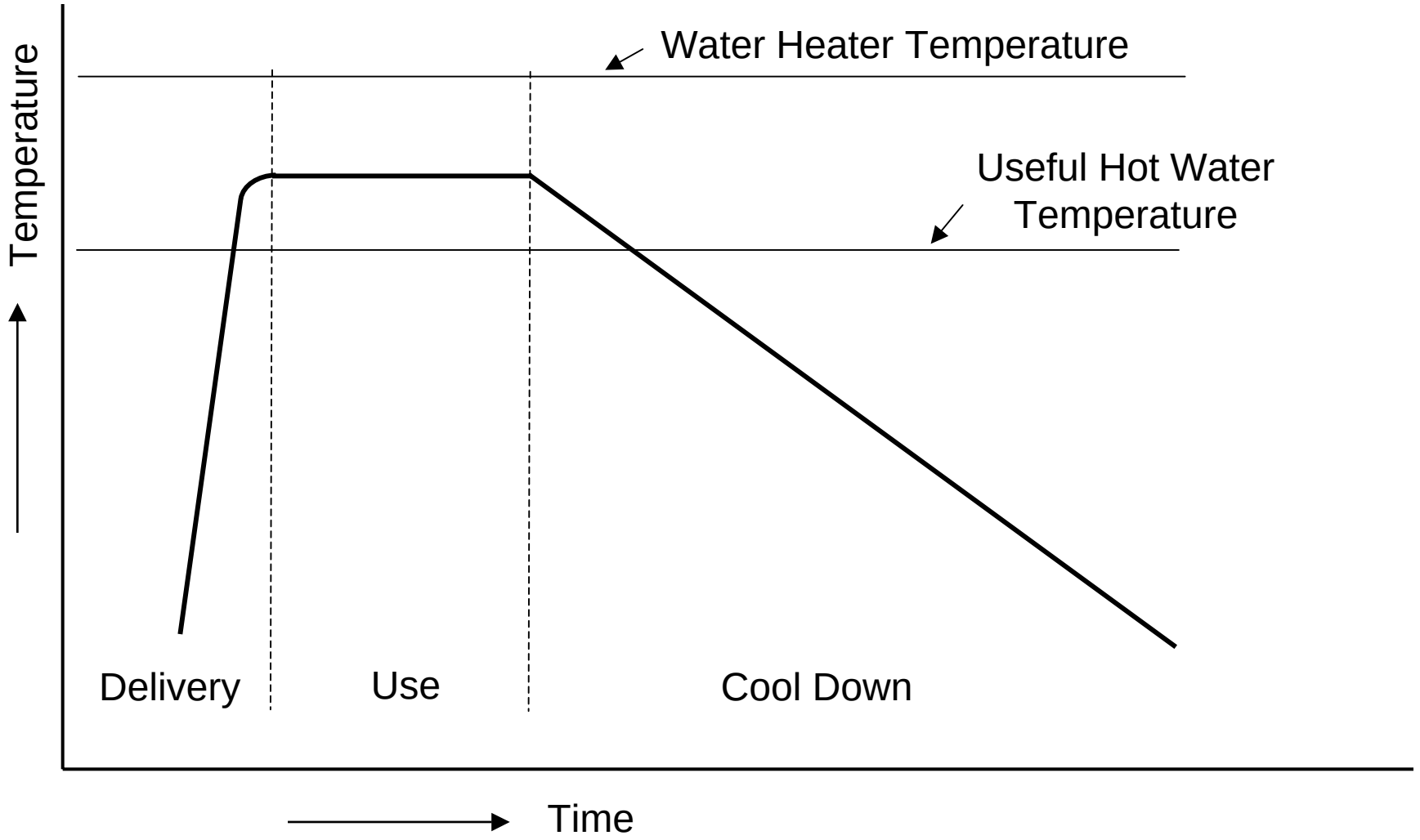
# The Hot Water System

- Treatment and Delivery to the Building
- Use in the Building
  - Water Heater
  - Piping
  - Fixtures
  - Behavior
  - Water Down the Drain
- Waste Water Removal and Treatment

# Typical Hot Water Event



# What Do You Want from your Hot Water System?

- Clean clothes
- Clean hands
- Relaxation
- Clean dishes
- Clean body
- Enjoyment

The service of hot water

# What Do You Expect from your Hot Water System?

## Safety

- Not too hot
- Not too cold
- No harmful bacteria or particulates
- Sanitation

## Reliability

- Little or no maintenance
- Last forever
- Low cost

## Convenience

- Adjustable temperature and flow
- Never run out
- Quiet
- Hot water now

# Incomplete Analysis

**Discussions of each technology are:**

- Not strictly comparative
  - Where are electric costs for gas tankless in Table 2?
  - Where are maintenance costs for each technology?
  - Why aren't implications of tax incentives or rebates treated consistently?
  - Why are product performance and reliability treated consistently?
  - Why are desired warranties so different?
- Legal requirement versus where the products are used.
  - As written, this is about water heaters that meet the legal definitions, sort of.
- Practically silent on pros and cons from the perspective of the potential buyer
- Limited to individual technologies although systems may provide greater service at very high efficiency

# Incomplete Analysis

## Conventional Technologies

- Legal definition is about unequal equipment.
  - Gas has twice the recovery rate of the electric
    - 40,000*0.75=30,000 vs. 4,500*3.412=15,354
- Electric Resistance Storage Water Heaters
  - Minimum EF is 0.82 – 0.88
  - Why excluded from consideration?
    - Savings would be large if all new were 0.95 EF
- Gas Storage Water Heaters
  - Range for EF is 0.53 – 0.65
  - Why excluded from consideration?
    - Savings would be large is all new were 0.65 EF

# Incomplete Analysis

## Advanced Technologies

- Gas Whole Home Tankless
  - Start out with cold water resulting in additional waste of water, energy and time
  - Lower efficiency with small volume draws
  - Cold water sandwich
    - Mfg solution is to install electric resistance storage water heater downstream of gas tankless. Often in conjunction with recirculation system.
    - How much do these changes lower the EF?
  - Flow switch control and size of minimum burner makes them unsuitable as a booster for preheated water
  - What is impact on operating costs of:
    - Maintenance
    - Freeze protection
  - Continuous not instantaneous

# Incomplete Analysis

## Advanced Technologies

- Electric Whole Home Tankless
  - Analysis is limited by “residential” definition. Also unequal equipment.
    - Gas has four times the firing rate
      - 199,999*0.8=160,000 vs. 12*3,412=40,944
  - Homes with 100 amp service will have problems described, but most homes with 200 amp service will not.
    - Why isn’t there a similar discussion on gas tankless?
  - Why has NAHBRC’s 2002 study been overlooked which showed significant savings?
  - Temperature controlled systems are an excellent choice to boost preheated water
    - Solar, geothermal, heat pump

# Incomplete Analysis

## Advanced Technologies

- Solar
  - Analysis is **not** limited by “residential” definition
  - Why minimum 50% solar fraction?
  - Why is a 50 gallon electric storage water heater used as the back up?
    - Only minimum EF
    - Why not electric tankless (only temperature controlled)?

# Incomplete Analysis

## Advanced Technologies

- Heat Pump Water Heaters
- Gas Condensing Water Heaters
- Advanced Non-Condensing Gas Storage
  - Why 50 gallons per hour for 1st hour rating?
- Capacity based EF Criteria
  - Although energy consumption doesn't vary much, criteria seem based on relative EF. Customers get bigger water heaters so they don't run out, so EF of bigger units should be the same as those of smaller units.

# Guiding Principle

Provide people what they want...

**The Service of Hot Water**

with what they expect…

**Safety, Reliability and Convenience**

as efficiently as possible

# What Defines a "Good" Water Heating System?

**Hot Water Flow Rates**

- Peak periods, large demands, or multiple fixtures (high)
- Normal use (medium)
- Small demands (low)

**Incoming water temperature**

- Winter (cold)
- Summer (warm)
- Preheated (almost hot enough)

Provides the desired service under **all** combinations of these conditions**.**

# A "Good" Water Heater

## Residential

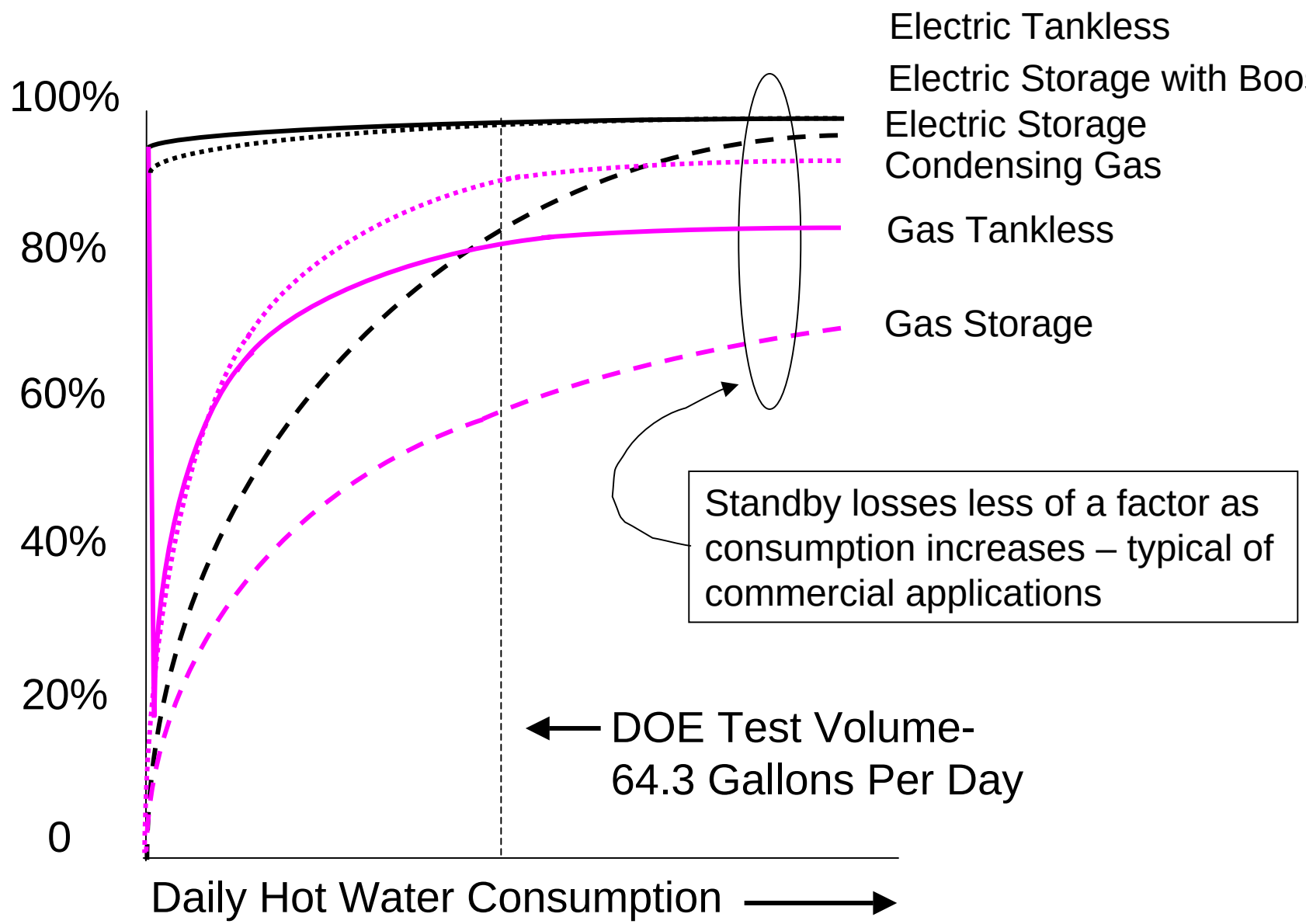
- Meets lifestyle requirements (maybe desires)
  - There are an infinite number of hot water use patterns that must be accommodated.
  - Water heaters stay with the building, so they must be efficient regardless of the use pattern.
- Does not have to be large enough for extreme peak periods, but it must have a large enough burner or element to keep up with the hot water needed for one shower.

# Neither Tank or Tankless is the Answer

**A combination of the two might be better:**

- **Burner or element**
  - Capable of at least 2 gpm of hot water
  - Roughly 80,000 Btu gas or 20 kW electric
- **Modest tank**
  - Some volume for peak conditions
  - Hot water available at the beginning of every draw
- **Possible in both gas and electric**
- **Preheat with Tankless**
  - Combine tankless electric (temperature controlled) with solar, geothermal or heat pump to increase overall system efficiency (COP > 2)

# Relative Efficiency of Water Heaters



# Conclusions

- Energy Star ® must help consumers understand the value of what they are buying
  - Same level of performance, reliability, maintenance, warranty, efficiency (not EF)
  - Focus on systems, not equipment
  - Must be consistent with efforts to reduce carbon footprint, such as Net Zero Homes
    - Solar thermal preheat with electric boost from renewables will be “good”
    - Any electric preheat from renewables will be “okay”
- As the proposal stands, it will make the market worse not better. Until these issues are resolved, this is not ready for prime time.