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Performance of Gas-fired Water Heaters in a 10-home Field Study

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Context: Are high efficiency water heaters justified?

A. Based on field monitoring of existing and replacement gas water heaters, what savings are available from power vent and tankless water heaters (including condensing models)?

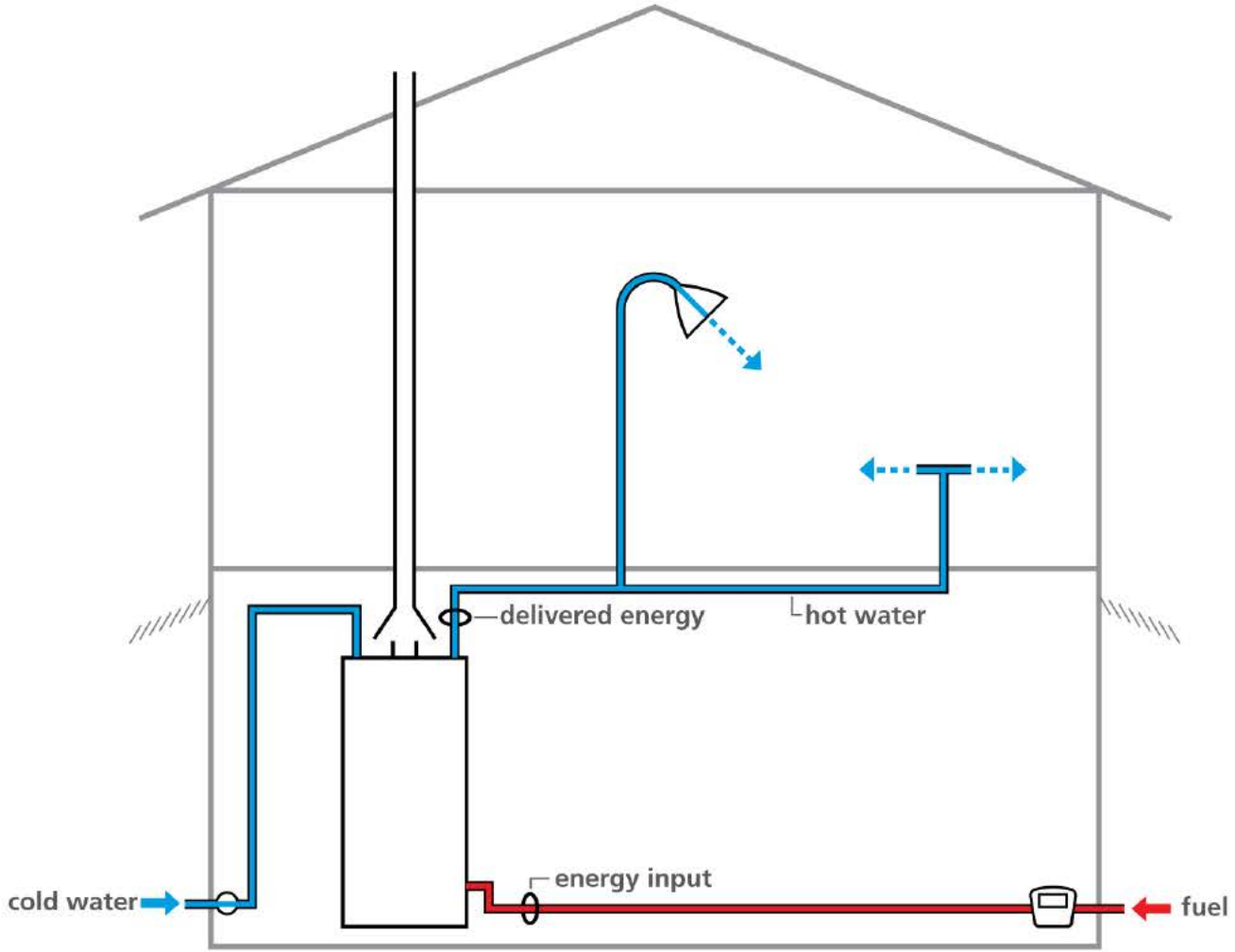
B. How does the measured performance change when the scope of water heater performance is expanded to include the loss of heated air through the vent system?

C. Does combustion products spillage change the picture significantly?

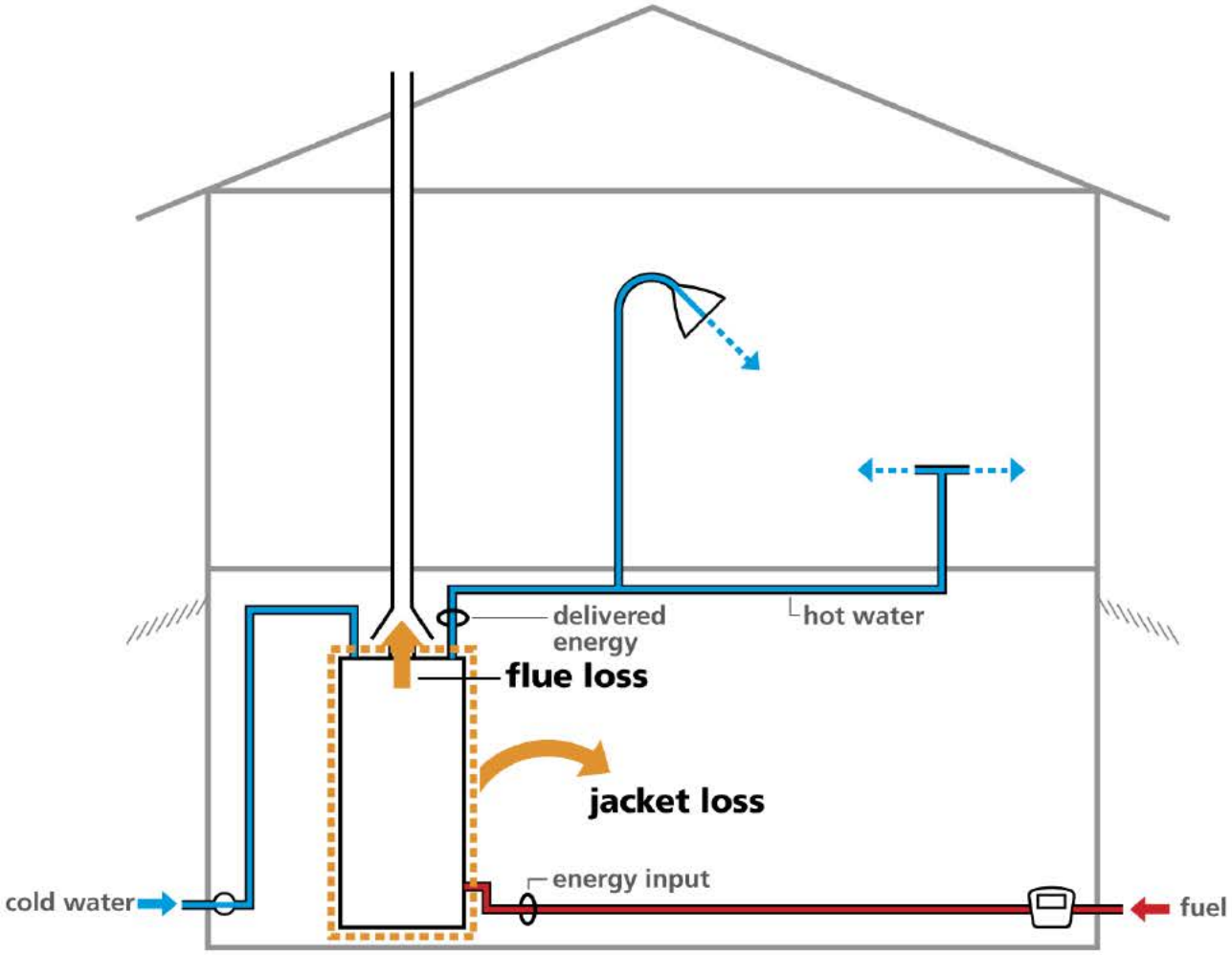
Technical Approach

- Direct replacement experiment
  - Monitored existing atmospheric vent water heaters in 10 homes, then power vent/storage and tankless replacement units
  - Measured efficiency *(including conditioned air loss)*
  - Observed spillage
  - DID NOT survey marketplace purchase and installation pricing

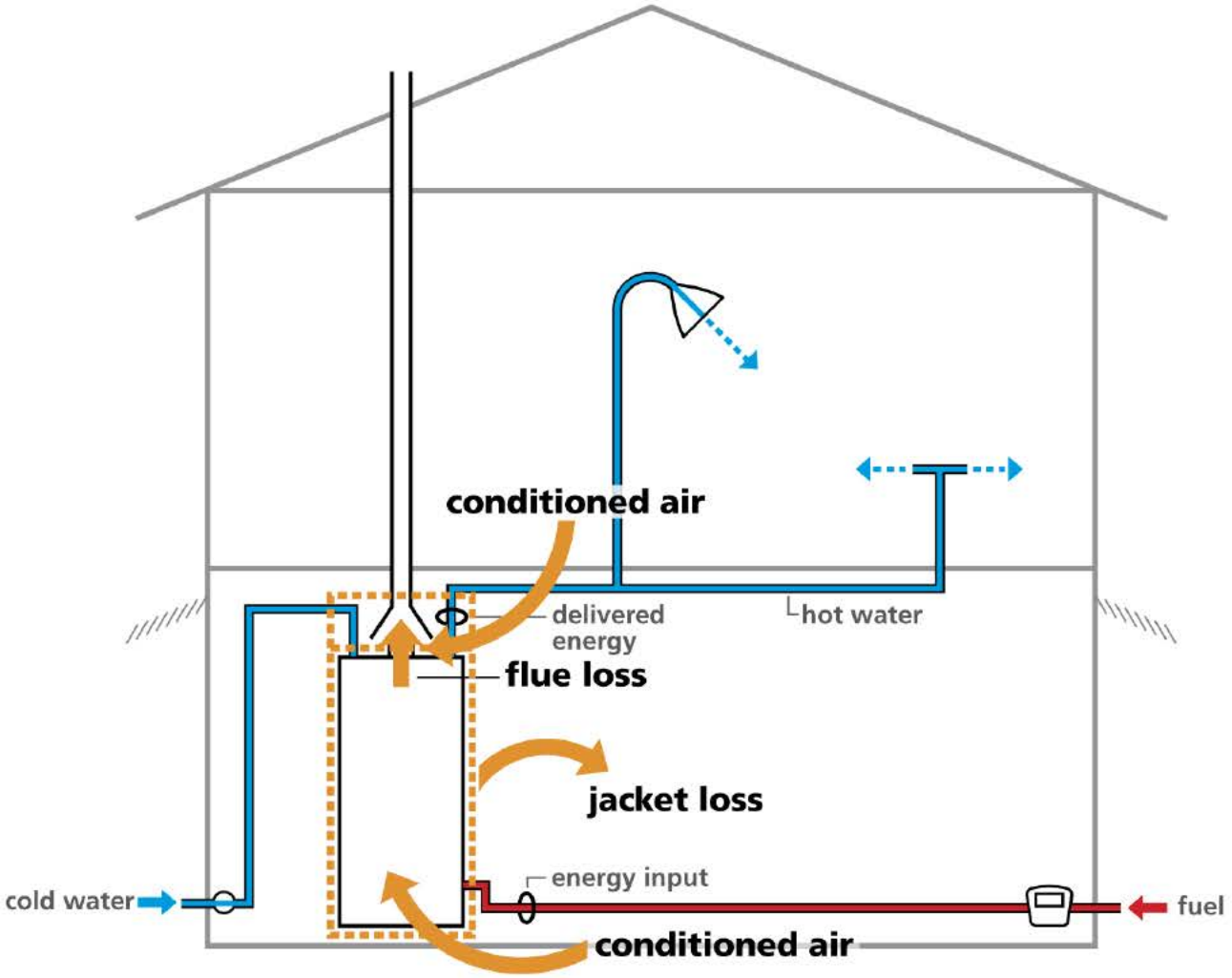
Hot water – basic energy flows



Basic efficiency = output less flue & jacket losses



We looked also measured conditioned air loss.



Recommended Guidance

- Power vent storage (including condensing type) and tankless water heaters (including condensing type) are likely cost-effective in new construction or required replacement *only in high-use homes*
- Replacement of an existing water heater with significant useful life *rarely cost effective*
- *Reduction of installed costs* will reduce payback
- Combustion safety should be a consideration, but will *not usually drive replacement*

Value (replacement on failure, compared to $875 atmospheric vent WH)

Gas $1/therm, Electricity $.12/KWH

Savings ($) and payback (yrs)				
Type (estimated cost)	**25 gal/day**	**50 gal/day**	**75 gal/day**	**100 gal/day**
power-vent ($1300)	$21 (20)	$22 (19)	$23 (18)	$24 (18)
power-vent, condensing ($2000)	$20 (56)	$29 (39)	$39 (29)	$48 (23)
tankless ($2400)	$51 (30)	$54 (28)	$56 (27)	$59 (26)
tankless, condensing ($2600)	$57 (30)	$67 (26)	$78 (22)	$88 (20)

Value – other factors

- Maintenance needs are a barrier to tankless WHs
- Elimination of atmospheric vent often means no need for chimney liner, or no need for chimney in new construction
- Running out of hot water can add value (and load?) to tankless and high-capacity power vent condensing units
- Interaction of heat loss or gain in basements with heating system load still not understood

Market Readiness

- The water heaters investigated represent commercially available technology
- Installed cost is the significant barrier to higher performance water heaters. Costs may drop with time and experience.
- Perhaps a market opportunity for continued improvement to atmospheric water heaters (with higher efficiency and spill-resistant vent design)

Pros and Cons

- Some users may not like response of tankless units (delay in delivering hot water, and inexact temperature control)
- Tankless WHs may require larger gas piping
- Integrated space/WH may be an attractive alternative supporting high efficiency WHs
- Combustion safety and incidence of dangerous spillage is still not well-characterized, but a key factor if present
- Dishwashers, in some cases, won't trigger tankless water heater burner, yielding cold (and poor) wash

References

"Energy Use by Residential Gas-fired Water Heaters"
Scott Pigg, Dan Cautley
Energy Center of Wisconsin
Available via www.ecw.org (Report 254-1)