

'3H' Report Discussion

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Efficient Appliances for People & the Planet



- Based on a high-resolution (hourly, localized) model of heating demand & operating costs (based on Columbia U.) coupled with Energy Policy Simulator to evaluate monetized health benefits.
- Produced in partnership with Nate 'The House Whisperer' Adams (HVAC 2.0) and Alexander Gard-Murray (Harvard University)
- Extensive review with ACEEE, NRDC, ASAP, RMI, NEEP, NEEA, EI and others

3H = Two Elements of a Comprehensive Strategy

S1. Update the evidence base

- T1.1 Conduct a national heat pump supply chain assessment for components, systems, refrigerants
- ⇒ T1.2 Update DOE engineering analysis to determine incremental costs of efficiency options
- T1.3 Accelerate development of load-based test procedures

S2. Develop strong Federal standards

- ⇒ T2.1 Improve consistency of DOE technical analysis across all heating products
- ⇒ T2.2 Raise MEPS and phase out ENERGY STAR for furnaces and boilers
- T2.3 Require all ACs to be reversible
- T2.4 Enable DR and other smart grid integrations to maximize HP value
- ⇒ T2.5 Transition to fuel-neutral performance standards for heating appliances

S3. Deploy targeted incentives

- T3.1 Manufacturer / Supply House incentives to stock good products in all target markets - capture emergency replacements
- T3.2 Contractor incentives to optimize performance via combined weatherization & heat pump projects
- T3.3 Consumer “cash for clunkers” incentives to proactively replace propane, oil, electric furnaces in off-gas-grid buildings

S4. Build a supportive enabling environment

- T4.1 R&D funding
- T4.2 Leadership on advanced building codes
- T4.3 Investments in workforce development (design, quality installation & service)
- T4.4 Homeowner recovery of efficiency investments
- T4.5 All-electric procurement guidelines for Federal buildings

3H = Incentives + Regulatory Backstop

- Aim to **maximize the speed and scale** of heat pump technology deployment in U.S. homes **at the least cost and with the fewest barriers to market adoption**.
- Target the biggest segment of the residential market (unitary central AC equipment) with a **conservative and pragmatic** approach to:
 - Technology transitions (by installing drop-in replacement equipment at the time of AC failure),
 - Fuel switching (by leaving existing heating equipment in place),
 - Energy efficiency (by aiming for a modest SEER 15 heat pump efficiency level equivalent to the 2023 minimum standard), and
 - Heat pump usage (by setting the heat pump low temperature cutoff to 41°F [5°C]).



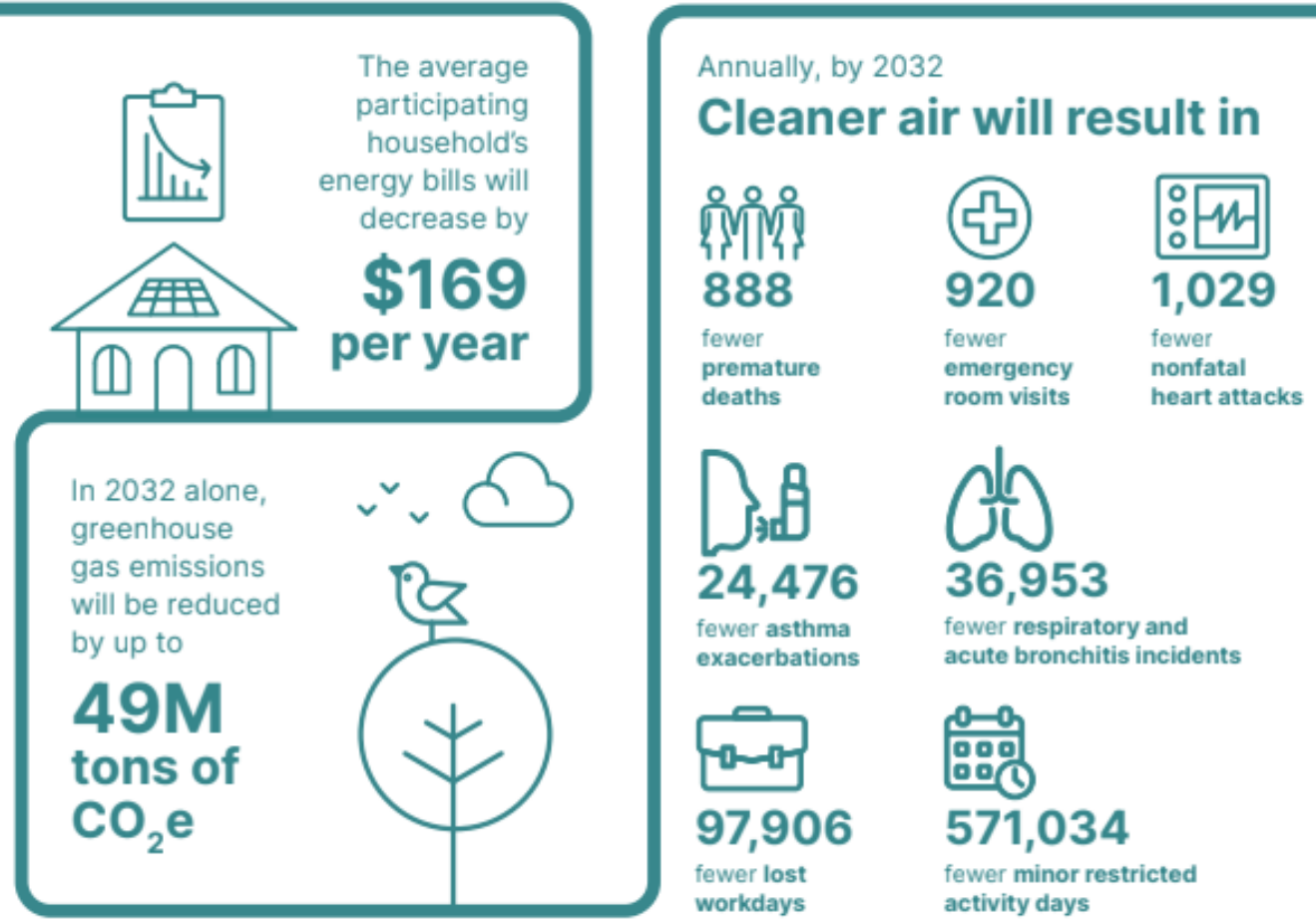
4- to 7-year Federal incentive program beginning in 2022

Payment to manufacturers or distributors, starting at \$400-\$500 per unit and **declining by \$60-\$75 each year**



The program would **deploy 45 million heat pumps** and cost between \$3-\$12 billion

- American consumers would save more than **\$27 billion** on their heating and cooling bills over 10 years.
- Lower air pollution would lead to **\$80 billion** or more in additional societal benefits from reduced air pollution over the same period



- 3H would work well as a foundational element of a broader policy package. Demonstrate what's possible with even the most basic & conservative technical solution.
- Raise the floor and reduce marginal costs of complementary Federal, state, and utility-led programs that aim for greater electrification.
- No discernible change in equipment + increased consumer choice, resilience, and flexibility = low profile electrification infrastructure deployment.
- Avoid or delay the *“keep your filthy hands off my (filthy) furnace”* zeitgeist.
- Buy time for power sector decarbonization by mitigating new winter peaks.
- If targeted at distributors, support local jobs. Trade off increased program costs/complexity in exchange for retaining some buying power and price optimization.

- Focus on base of market
- Use 'hybrid' approaches as a transitional step for heating decarbonization
 - Very cold climates (avoid new winter peaks)
 - New cooling demand
 - Hard-to-get buildings or building owners
- Consider midstream incentives