Targeting Customers for Heat Pump Conversions

Customer Savings Perspective
Grid Costs Perspective
Issues

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Graph of Relative Heating Cost Considering Energy Price and Conversion Efficiency—Average Electric Pricing

($/equivalent million BTU)

$83 Electric Resistance (100% efficient) Today’s Elec Price

Target 16% customers

$68 Propane (old 60%)

$54*****************************Heat Pump (300%) Elec Price Doubles

$51*****Mitsubishi Hyper HP (160% at 5 deg F) Today’s Elec Price

Target old boilers for upgrades

$43 Propane (new 95%)

$42 Oil (old 60%)

$41 *****************************Heat Pump(300%) Elec Price +50%

$30 Oil (new 85%)

$27 *****************************Heat Pump(300%) Today’s Elec Price

$25 Natural Gas (old 60%)

$16 Natural Gas (new 95%)

~Half of customers have no or negative savings at today’s prices

ISO: 2032- adding **15.5%** load for HP/EV= disproportionate costs

- HP is low load factor (13%) spike at worst time of year
- Average LSEEE increases **114.2%**
- Average CO2 increases **67%**
- LSEEE for HP alone is **333 $/MWH**
- CO2 for HP alone is **½ ton/MWH**
  - **Twice the ¼ ton/MWH** of CT's system today

ISO: 2050- Adding **50%** load for HP/EV = disproportionate costs (**4.6X, 2.4X all load**)

- HP/EV **triples** winter peak 20 to 57 GW
- Requires **2.5X** new capacity 40 to 100 GW
- Requires **9X offshore wind** 3.3 to 30.2 GW
  - 4-6 times cost of other resources, maybe more
  - Requires $22B transmission, plus distribution
- Requires **4x** battery storage 7.7 to 33 GW
- Land based wind 4.3 to 7.5 GW
- Large solar 24.7 to 26.3 GW
- Curtailment increases **9X** from 6 to 55 M MWH
  - 2 times CT energy in 2024 (27.5 M MWH)
  - 29% of 2050 energy

Case Study: Boiler-Oil to Gas

- 95% efficiency, fuel cost cut 2/3, 5 year payback
- **Reduced CO2 50% starting 15 years ago**
- Only 12% more CO2 reduction if convert to HP (based on CO2 increasing with HP in 2032)
- Maybe in 25 years (2050) CO2 could be reduced to near zero for $200+B ($3113 per ton CO2, equal to gas tax of $26/gallon)
- Heat Pumps- 70% more expensive than gas at today's electric price and drives higher electric supply costs

Boiler upgrades: CO2 reduction now versus promises of future CO2 reduction in 2050

Targets

- Heat pump conversion of electric resistance-
  - save 2/3 on electric bill, independent of electric rate
  - 16% of 1.2 m households = 192,000 targets
  - $10-16,000 subsidy (like Massachusetts)= $1.9-3 B total
- Replace old boilers with more efficient ones
- Heat pump conversion of electric water heaters (also dehumidifies)
- **Dehumidifiers**-
  - **My largest electric usage**: 450 kWh/month (Max) $100+
  - Today 1.6 L/kWh @ $200, 50 pts; 4.2 L/kWh @ $3900, 105 pts
    - Need to drive cost reduction for high efficiency units
    - Alor Air $599, 2.4 L/kWh, 55 pints/day; 2.3 year payback
  - Health benefit- personal and building
- Induction Ranges- Less energy at peak time and fun to cook with
- Other Conservation items

Final Thoughts

- Need **cost transparency** especially during worst (winter) hours
- We shouldn't be subsidizing heat pump fuel switch as it doubles electric supply prices (4X marginal cost)
- Customers will be upset after spending $20-50k if no savings
- Role for Customer Advocate
  - Customer awareness of costs…. and future costs
  - Protect customers from **cost shifts**
  - Pricing at Long Run Marginal Costs for Heat Pumps
- BTM Solar was often sold and bought for its hedge on future electric prices
  - Why would anyone want to fuel switch heating and pick up more electric price risk?
- CT has one of the cleanest power systems with only 23.5% CO2 of coal—thanks to Nuclear and Gas. We need to build on this success with affordable solutions.

Appendices

Conservation
Economic Rate Principles
Maine Heat Pump Program
Heat Pump Issues

Conservation Perspective

- New generation costs more than existing costs
  - Much more for NetZero heat pump spike
- $168 M annual budget justified on not needing new generation and customer savings
- Should keep that no load growth and customer savings principle. Target:
  - Replace electric resistance heat with HP
  - More efficient boilers
  - Replace electric HW heater with HP
  - More efficient dehumidifiers
  - Other conservation measures: insulation, etc
- Keep up the good work!

Economic Principles

- New HP load has higher marginal cost than present pricing
  - Winter analogue of Summer a/c peak load pricing issue of 1970s/80s
- Economic efficiency: Price should be long run marginal cost, otherwise you're:
  - "Selling more but losing $ on each sale" Alfred Kahn who wrote the book on Regulatory Economics
  - Cost shifting to other customers especially lower income
- Heat Pump: 4.6X is marginal electric cost; 2.4X is average
- Prices may increase further for winter seasonal prices and daily time of use
  - ISO is going to seasonal capacity market,
  - California going to time of use rates, higher fixed charges
  - Connecticut?:
    - Free electricity spring/fall (curtailing 55 M MWH)?
    - 4X winter, 1X summer?
- Proper pricing at Long Run Marginal Costs will make it even more difficult to justify HP fuel switch

Heat Pumps Handicapped by High Electric Prices

- High present prices
- Increase for net zero present load
- Larger increase for adding HP/EV load
- Another increase if long run marginal pricing
- Another increase for seasonal pricing
  - Perhaps some decrease for time of day

Maine Heat Pump Program

- Lower Electric Price (22 cents/kWh) than CT
  - **Promotional rate** for first 5000 customers- 14 cents
    - Free T&D- 8.5 cents reduced to .5 cents
- First Phase **"supplemental"** systems
  - Single unit in great room- less expensive
  - Old system for backup, other rooms
- 2024 program is for "whole house" systems
  - Utility concerned that it favors wealthy
- Concerns: upset customers when rates go up
  - Promo rate not justified by long run marginal costs
  - Promo rate if guaranteed for x years creates long term stranded costs
  - Cost shift-
- Comments by Mainers: expressed concern with future rates and savings and that rates should apply to all. "If they pay less, I'm paying more"

Heat Pump Issues

- Large KW demand spike at low temp may **strain grid** especially if 25 kW electric resistance backup
  - Will exceed any customer storage and not reduce utility costs
- Need for large generator for CT ice storms
  - 10 day outage in 2011, many other multiple day outages in last 40 years
  - 6 kW generator per 30,000 BTU heating
- Propane refrigerant safety cutoff
- **Keep old systems for backup**
- Cost of whole house system
- But HP technology is evolving----don't rush.