Efficiency Maine

Integrated 2-stage thermostat mini-split mini-test preliminary control update

NEEP ASHP Workshop

June 27, 2017

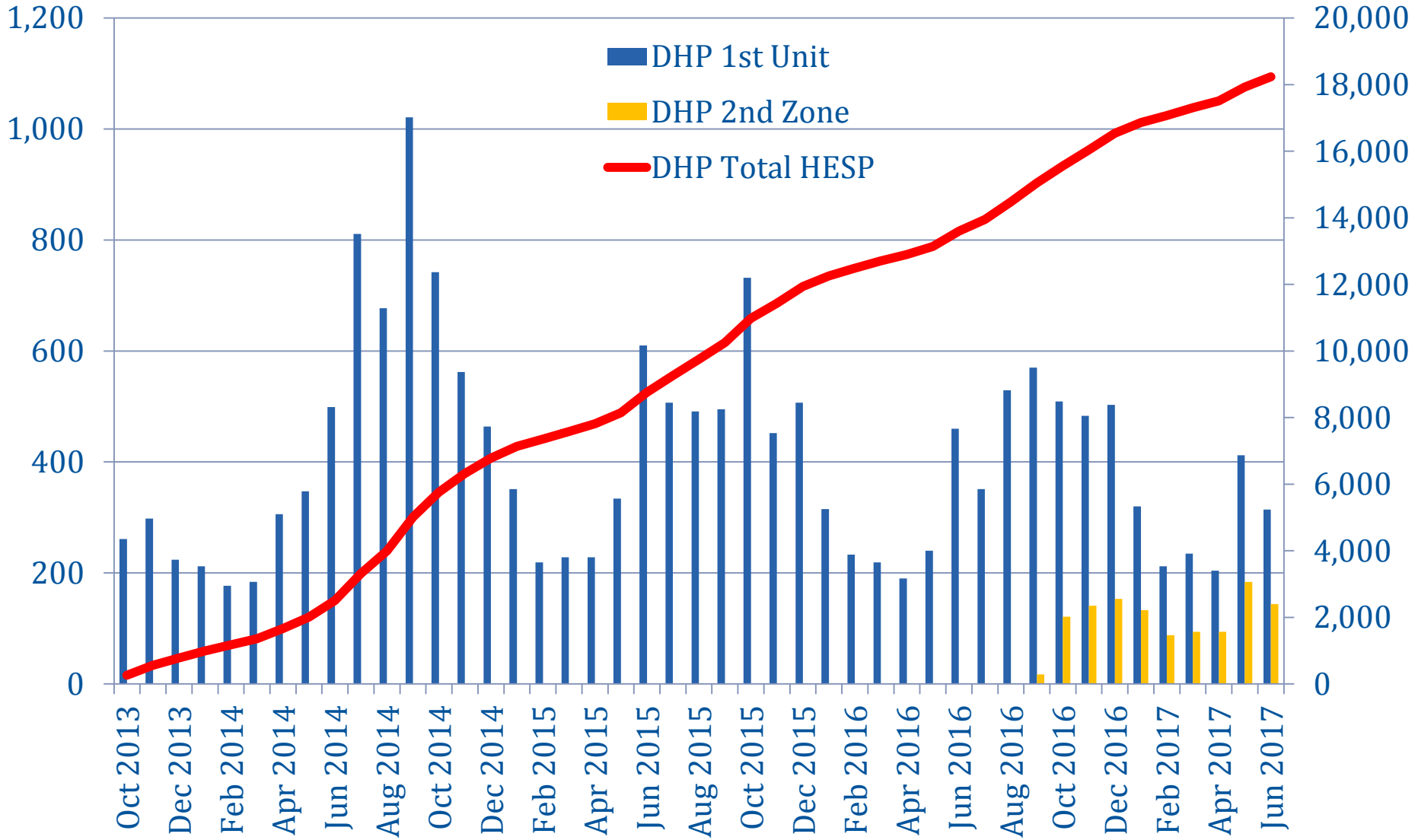
What is Efficiency Maine Trust?

Formed by the Maine Legislature in 2010 as an independent administrator of statewide renewable and energy efficiency programs.

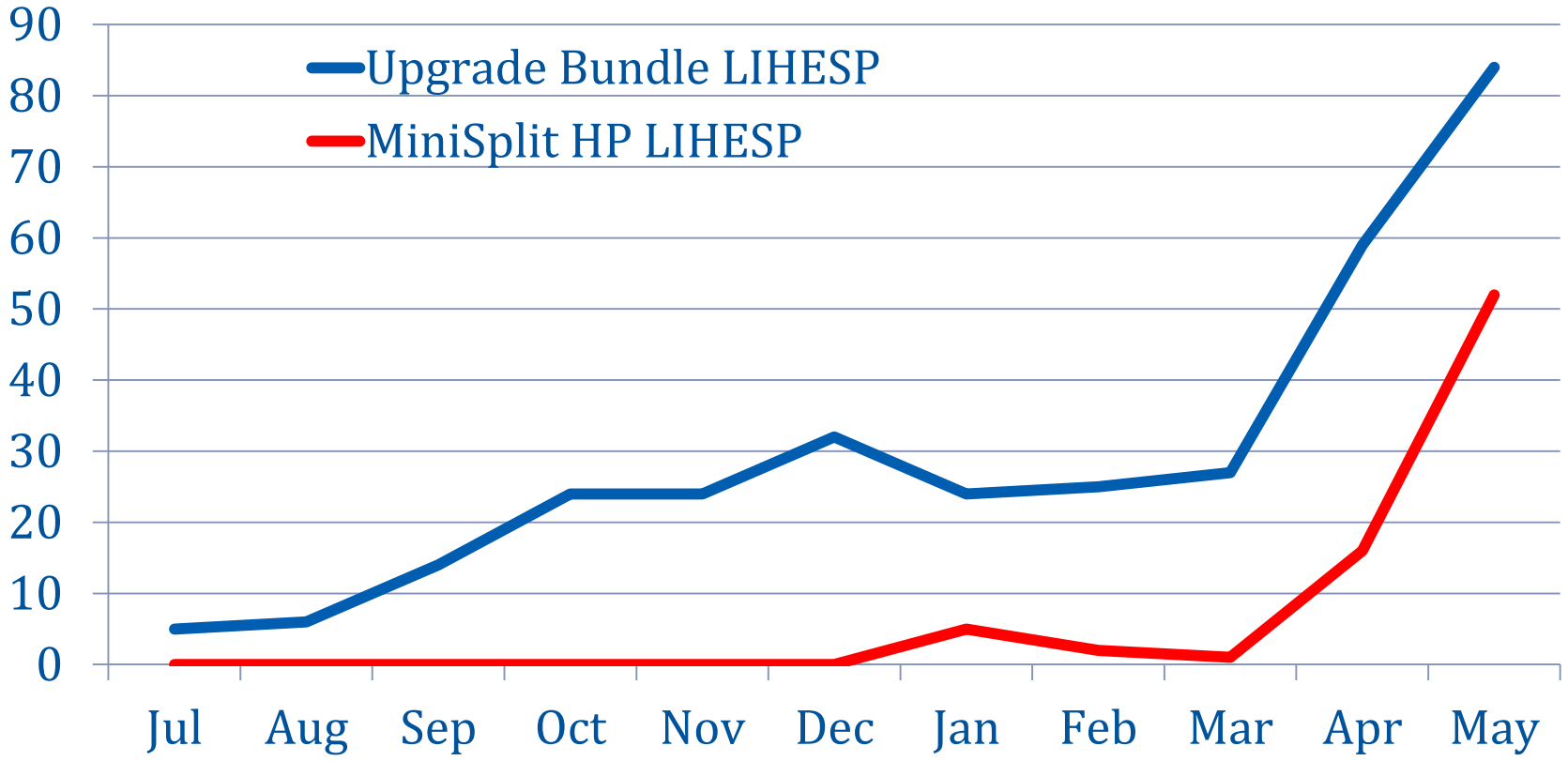
9 member Board of Directors, appointed by the Governor and approved by the Legislature Energy and Utility Committee.

Regulated by the Public Utilities Commission similarly to a utility.

The Trust mission and authority is part of state statute.

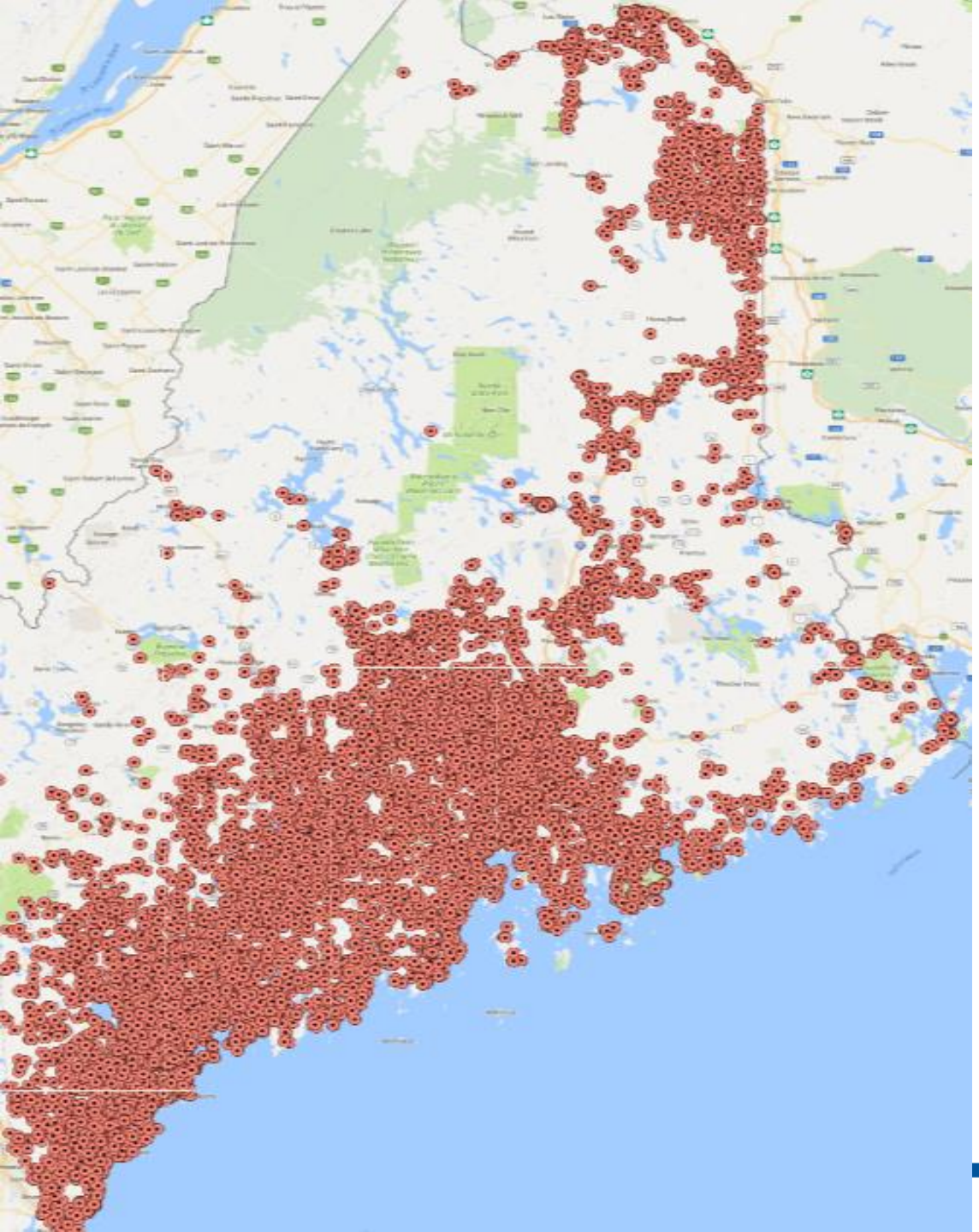


Ductless heat pumps continue to be installed at an average rate of 400 per month statewide in Maine with a clear seasonal pattern.



- "Energy Upgrade Bundle" $1,000 discount on prescriptive but flexible list of weatherization services with $50 co-pay ($1,050 min scope)

- LIHESP MiniSplit - 80% up to $2,000 off DHP for homes that complete Energy Bundle.



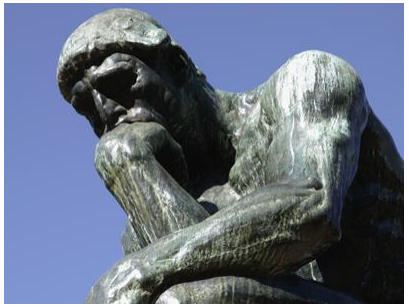
Map showing 18,000 ductless heat pump installations in principle residences over the past 4 years through HESP.

~6,000 have also been installed through commercial and low income programs.

Installation density correlates directly with population.

Very popular in far northern areas where systems are reported to continue to provide heat even at -27F.

Room for improvement:



Homeowners are not reliably optimizing use of heat pumps to maximize savings and displacement of heating load.

Can integrated controls overcome behavior or other complexities to maximize benefit?

Warning:

The following includes preliminary data from a brief data collection period on a sample group insufficiently large to draw any statistically valid conclusions.

Low Income Direct Install heat pump recipients with installations that occurred between 2014 - 2016:

3 small test groups all with hourly electric data logging

Group 1) Heating distribution blocked in room heat pump is located. (5 homes)

Group 2) Employ enhanced heat pump education (7 homes)

Group 3) Install integrated thermostats that control both single head heat pump and central heating system. (7 homes)

Some notes on mini-eval and assumptions:

Intention to demonstrate a workable configuration and identify opportunities for a more rigorous controls pilot.

Electric consumption data and local ambient temperature used to calculate heat production and average performance of heat pumps.

Extrapolation of usage PRE and POST used to gauge the difference across the entire season.

Performance curves created from manufacturer provided information to NEEP heat pump list.

No attempt made in this test to measure reduction in other heat sources.

Integrated Thermostat components:

Mitsubishi FH series 9000
Honeywell VisionPRO 8000
Thermostat Interface
Remote Temp Sensor

#	PRODUCT AND DESCRIPTION
1	MISPACUS444CN1 THERMOSTAT INTERFACE
2	TH8320R1003 VP 8000 W/REDLINK 7DAY PROG 3H/2C HP OR
3	C7089R1013 REDLINK WIRELESS OUTDOOR AIR SENSOR

Other configurations and manufacturers likely work well, but it is critical that configured interaction between thermostat and heat pump allows heat pump algorithms to control compressor and fan speeds.

Group 1 – Block zone distribution PRE and POST

#	Exp. # (PRE/ POST)	Town	Gallons Oil Heat Equiv Full Season
R01A	1 (PRE)	Auburn	226
R01B	1 (POST)	Auburn	261
R02A	1 (PRE)	Dexter	219
R02B	1 (POST)	Dexter	245
R05A	1 (PRE)	Lisbon Falls	8
R05B	1 (POST)	Lisbon Falls	78
R34A	1 (PRE)	Madison	339
R34B	1 (POST)	Madison	319
R39A	1 (PRE)	Dexter	411
R39B	1 (POST)	Dexter	379

Group 2 – Additional training PRE and POST

#	Exp. # (PRE/ POST)	Town	Gallons Oil Heat Equiv Full Season
R03A	2 (PRE)	Jay	62
R03B	2 (POST)	Jay	54
R04A	2 (PRE)	Farmington	60
R04B	2 (POST)	Farmington	57
R08A	2 (PRE)	Lewiston	40
R08B	2 (POST)	Lewiston	71
R13A	2 (PRE)	Waterville	143
R13B	2 (POST)	Waterville	234
R25A	2 (PRE)	Wilton	49
R25B	2 (POST)	Wilton	40
R27A	2 (PRE)	Dover-Foxcroft	23
R27B	2 (POST)	Dover-Foxcroft	192
R36A	2 (PRE)	Dexter	111
R36B	2 (POST)	Dexter	108

Group 3 – Integrated Thermostat PRE and POST

#	Exp. # (PRE/ POST)	Town	Gallons Oil Heat Equiv Full Season
R06A	3 (PRE)	Strong	315
R06B	3 (POST)	Strong	627
R17A	3 (PRE)	Lewiston	413
R17B	3 (POST)	Lewiston	494
R18A	3 (PRE)	Auburn	511
R18B	3 (POST)	Auburn	829
R22A	3 (PRE)	Strong	217
R22B	3 (POST)	Strong	624
R30A	3 (PRE)	Auburn	211
R30B	3 (POST)	Auburn	631
R35A	3 (PRE)	Jay	373
R35B	3 (POST)	Jay	615
R38A	3 (PRE)	Chesterville	175
R38B	3 (POST)	Chesterville	428

Summary

Test	Description	# homes	Average Annual Production (Gallons of Oil Equivalent)* PRE-test	POST-test	Difference
1	Reduce inputs from other sources of heat	5	241	257	16
2	Homeowner training	7	70	108	38
3	Integrated controls for Mitsubishi heat pumps	7	317	607	290

Next steps:

- Continued monitoring of test 3 locations.

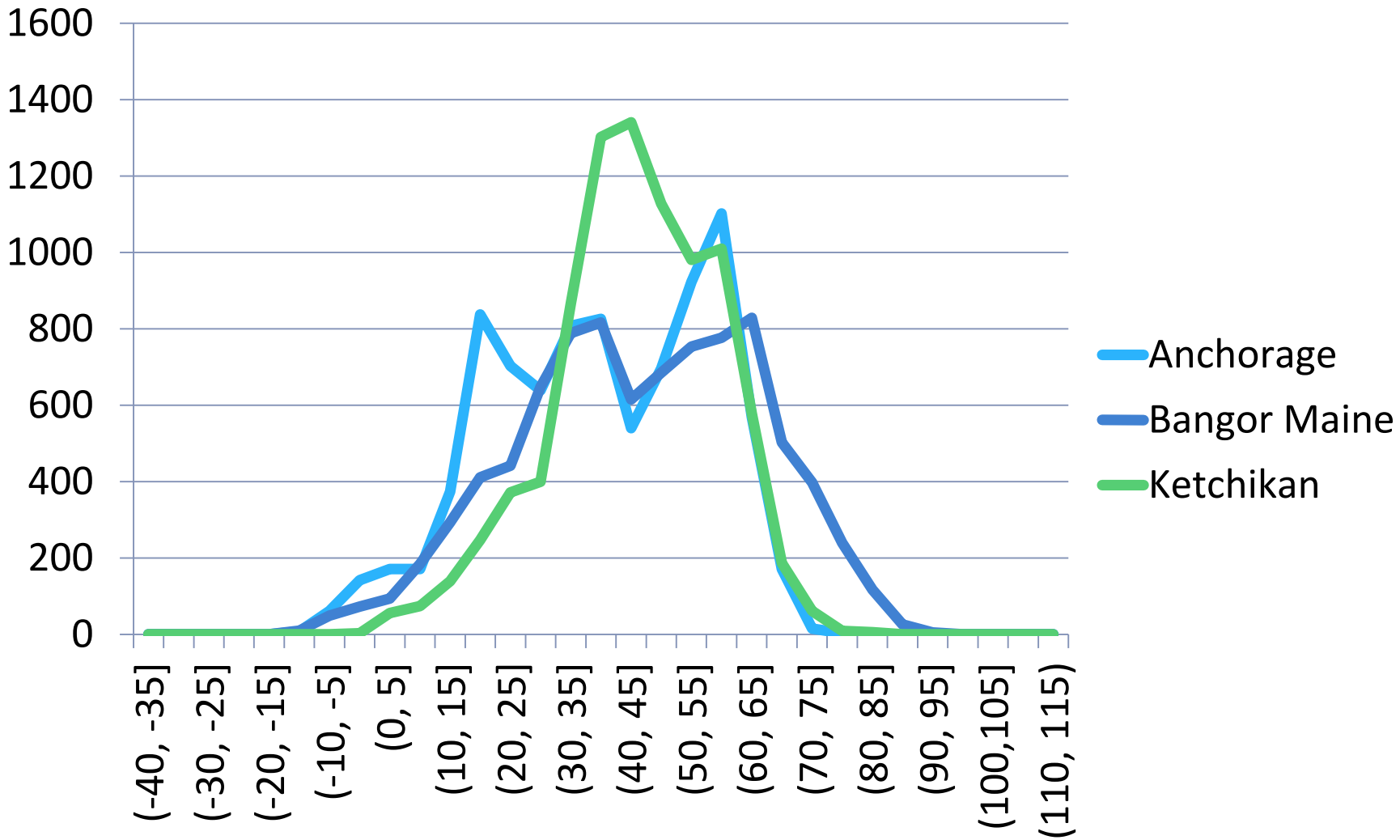
- Logging of LIHESP homes in the year ahead.

- Development of TRM entry for savings calculation and potential rebate design.

- Identification of additional control configurations.

- Full HESP evaluation with heat pump studies in process.

Comparison of hours at bin temperatures



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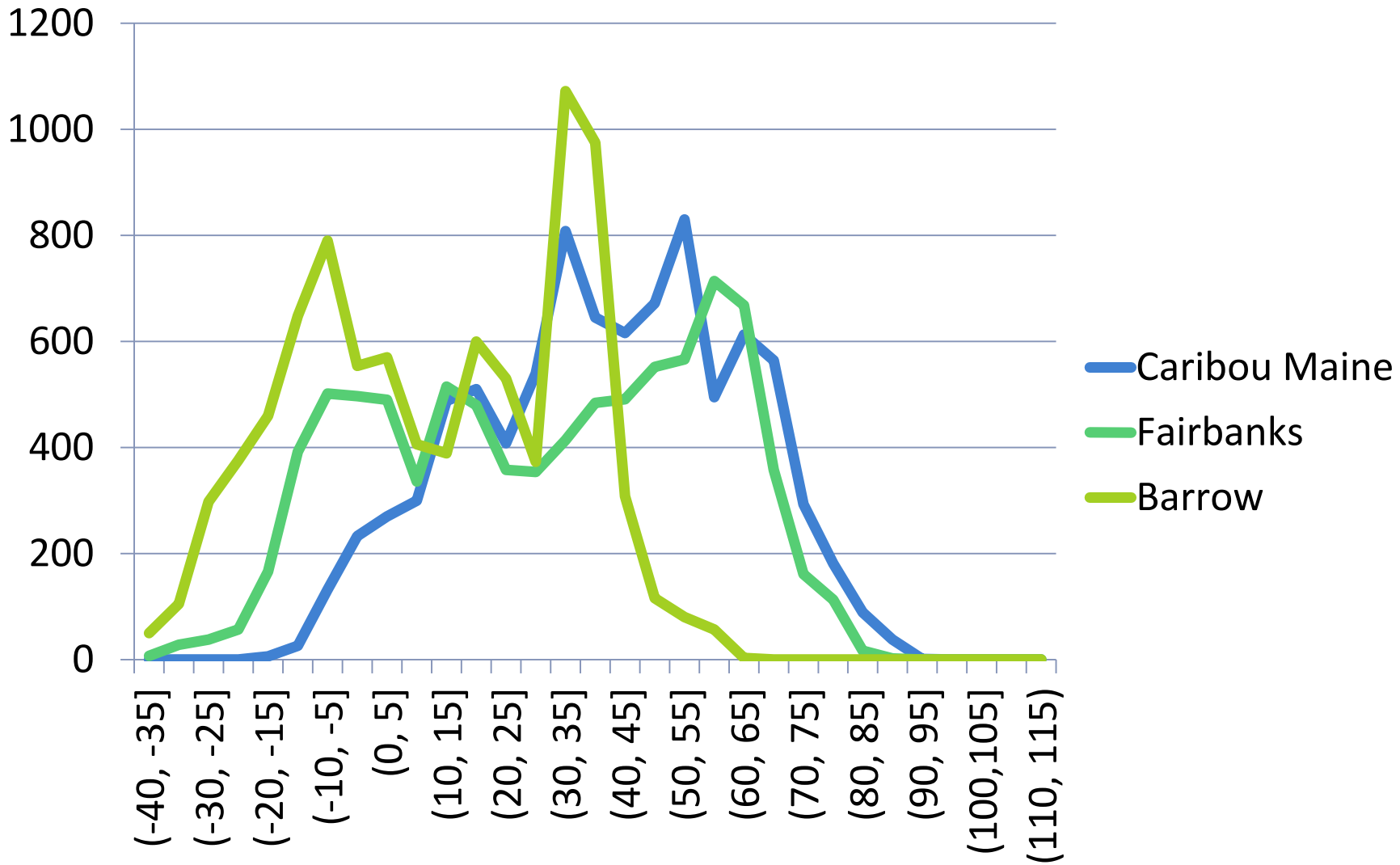

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