Opinion **Dynamics**

IEPEC 2022

ELECTRIFYING TRMS

AT THE CONVERGENCE OF DECARBONIZATION POLICY, PROGRAM DELIVERY, AND EVALUATION

November 3, 2022

PRESENTATION OVERVIEW

- Decarbonization policy and electrification in EE programs
- TRM's role in guiding program design, delivery and evaluation
- Describe a collaborative process and shared lessons from transforming PSEG Long Island's TRM
- Discuss the considerations and implications the electrified TRM had on program design, implementation, and evaluation activities

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Electrification and Decarbonization Nationally

- Decarbonization is an emerging area nationally
  - Inflation Reduction Act (2022) directs $369 billion towards energy security and climate change, including electrification
  - 17 states committed to 100% carbon free electricity generation as early as 2032 (*Clean Energy States Alliance, 2022*)
- Building decarbonization is vital to reaching net-zero carbon by 2050 (NASEM)
  - 20% of fossil fuel furnaces converted to heat pumps
  - 50% reduction in new buildings total energy use by 2030

New Efficiency: New York (NE:NY)

Adopted in 2018, the NE:NY initiative:

- Targets 80% reduction by 2050 in greenhouse gas (GHG) emissions
- **Establishes beneficial electrification (BE) goals for EE programs**

"State's investor-owned utilities will be called on to achieve significantly more in both scale and innovation through their energy efficiency activities…as well as embrace beneficial electrification"

PSEG Long Island TRM Electrification

- PSEG Long Island and TRC began planning for BE in 2018
- Started with the TRM, given its role as a planning tool
- As the manager of the TRM, Opinion Dynamics guided a comprehensive transition to an electrified TRM
- Process involved three phases:
  - Goal setting
  - Transition of key existing measures
  - Creation of new measures

Goal Setting

Define and Establish:

- Key performance metrics
- Overarching baseline assumptions
- Methodological rigor

Consider:

- Increased complexity and volume of assumptions
- Limitations of field collection
- Available resources to define baseline conditions

Goal Setting: What is an Electrified TRM?

"a technical resource that contains energy efficiency measure information used in program planning, implementation, tracking, and reporting and evaluation" (Schiller, Leventis, Eckman, et al. 2017)

Compared to a Traditional TRM

- Similar goals and objectives
- Increased flexibility in replacement scenarios
- Algorithms capture EE and BE
- Increased complexity of assumptions and data needs

Goal Setting: Key Performance Metrics

Term	Definition
kWh_{EE}	Electric energy savings associated with energy efficiency improvements
kWh_{BE}	BE electric energy impacts associated with installed electric equipment replacing fossil fuel equipment.
ΔkWh	Total electric energy impact equal to kWh_{EE} plus kWh_{BE}.
$MMBtu_{EE}$	Fossil fuel energy savings associated with energy efficiency improvements plus kWh_{EE} converted to MMBtu.
$MMBtu_{BE}$	BE fossil fuel energy savings associated with removed fossil fuel equipment replaced by electric equipment.
$MMBtu_{Total}$	Total energy impact.

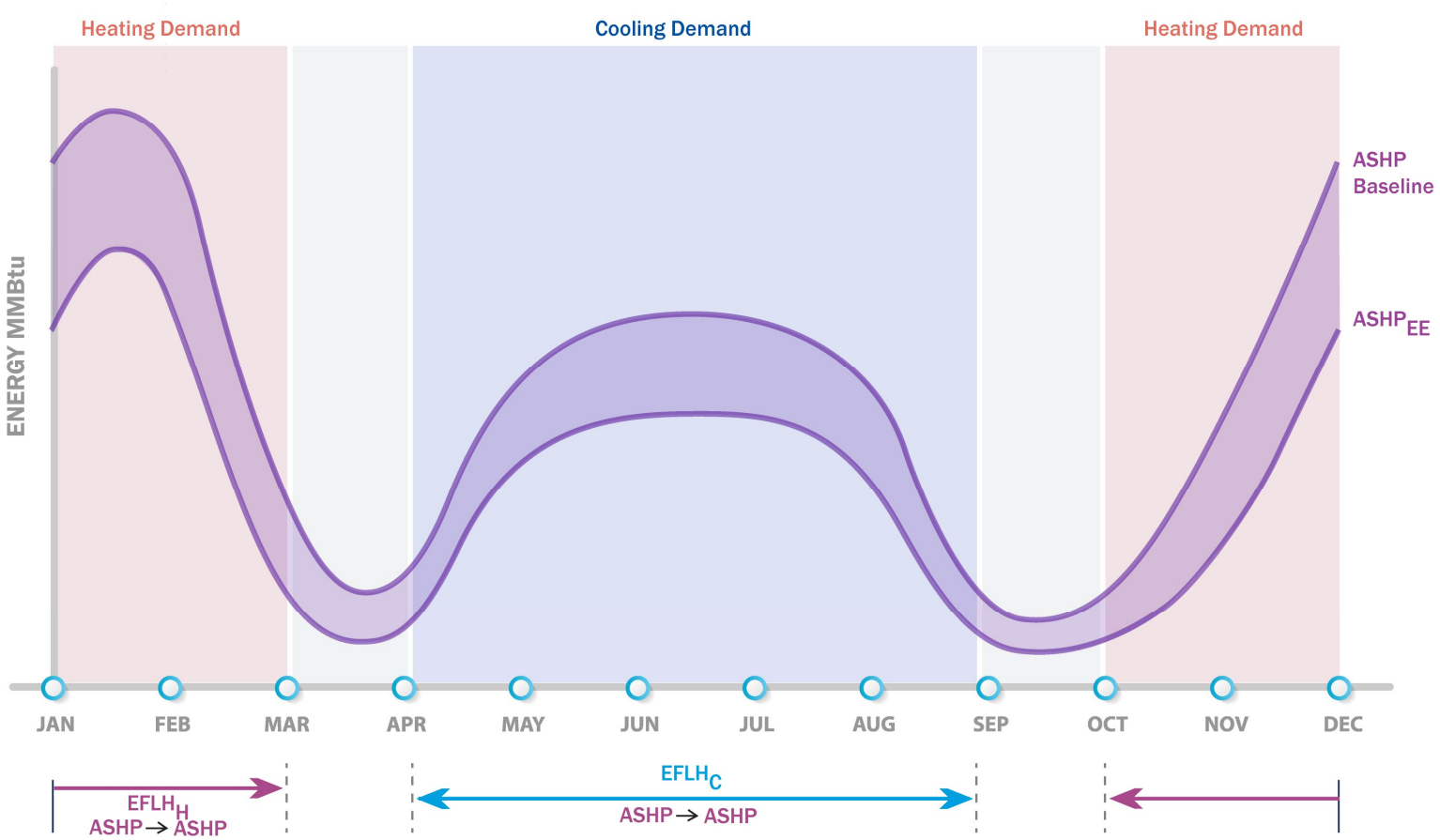
Goal Setting: Key Performance Metrics

Term	ASHP replacing FF Furnace with CAC	Existing Equipment → Efficient Equipment
kWh_{EE}	System Cooling Efficiency Gain	CAC → ASHP
kWh_{BE}	Increased Electricity Usage in Winter	No existing electric baseline → ASHP = –BE
ΔkWh	Total Change in Annual Electricity Usage	Sum of kWh_{EE} and kWh_{BE}
$MMBtu_{EE}$	System FF Heating Efficiency Gain + kWh_{EE} converted	FF Furnace → ASHP (no FF efficiency gain) + kWh_{EE} converted
$MMBtu_{BE}$	Decreased FF Usage in Winter	FF Furnace → ASHP (no FF usage) = +BE
$MMBtu_{Total}$	Total Energy Savings	Sum of $MMBtu_{EE}$, $MMBtu_{BE}$, kWh_{BE} converted

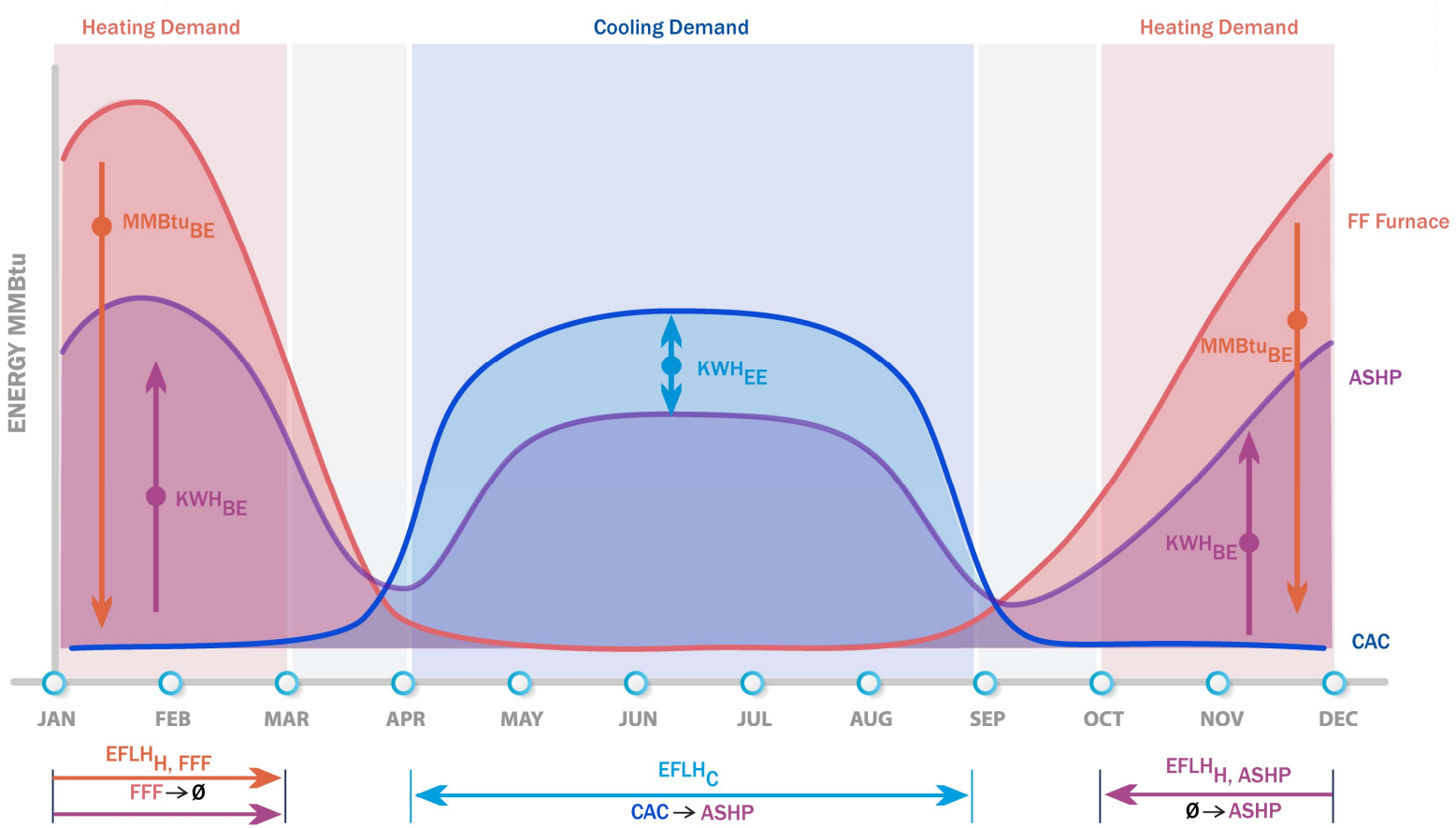
Transition of Existing Measures

- Air Source Heat Pumps
- Cold Climate ASHPs
- Heat Pump Water Heater

ASHP Example: Traditional TRM



ASHP Example: Electrified TRM



Savings Comparison

TRM	Replacement Scenario	kWh_{EE}	kWh_{BE}	ΔkWh	$MMBtu_{EE}$	$MMBtu_{BE}$	$MMBtu_{Total}$
Electrified	ASHP replacing FF heating and CAC	504	-5,324	-4,820	1.7	49.1	50.3
	ASHP replacing FF heating, no prior cooling	351	-5,324	-4,973	1.2	49.1	49.7
	ASHP replacing ER heating and CAC	11,254	0	11,254	38.4	0	38.4
Traditional	ASHP replacing FF heating and CAC	476	0	476	1.6	0	1.6
	ASHP replacing FF heating, no prior cooling	476	0	476	1.6	0	1.6
	ASHP replacing ER heating and CAC	476	0	476	1.6	0	1.6

Creation of New Measures

New Measures

- Battery Operated Lawn Equipment
- Heat Pump Pool Heaters
- Nonroad Vehicle Electrification
- Commercial Cooking Equipment
- VRF multi-split heat pumps

Data Sources

- NY Building Stock Assessments
- PSEG Long Island Potential Study
- EPA Nonroad Emission models and other national standards
- Manufacturer Publications
- Implementer Field Collection
- Historical Program Data
- Subject Matter Expertise

Battery Operated Lawn Equipment

Why lawn equipment?

- 121 million pieces of gasoline lawn and garden equipment (Banks 2015)
- 20.4 million tons of CO2 emissions annually
- Long Island's housing stock with lawns

Considerations when Developing

- No existing measure in TRMs
- EPA Nonroad Technical Reports:
  - average annual operating hours (e.g., time spent mowing lawns)
  - battery runtime to estimate the number of charging cycles
- Commercial versus Residential

Commercial Cooking Equipment

Why commercial kitchens?

- Most energy intensive building activity in the commercial sector (EIA 2015)
- Fossil fuel cooking is one third of food service energy consumption
- Food service is an underserved/hard to reach community
- Lots of potential for additional savings

Equipment	Annual Electric Energy Savings, MMBtu	Annual Fuel Energy Savings, MMBtu	Total MMBtu Saved
Griddle, Electric	7.8	0.0	7.8
Griddle, Gas	0.0	13.1	13.1
Griddle, BE	(30.4)	74.6	44.2
Fryer, Electric	8.1	0.0	8.1
Fryer, Gas	0.0	38.6	38.6
Fryer, BE	(36.0)	84.8	48.8

Conclusions

- Motivated by *NE:NY* policy directing PA's to achieve more energy savings through innovation and decarbonization
- PSEG Long Island, TRC, and Opinion Dynamics developed a first-generation fully electrified TRM

- Reflecting on our shared experiences, the authors have the following recommendations:
  - Develop clear definitions and goals for the TRM through collaborative goal setting
  - Collaborate with the implementer to understand data limitations
  - Identify primary data sources for fossil fuel equipment prevalence

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