

CPUC Fuel Substitution Calculator 2022 Updates

Public Webinar

October 13, 2022



Energy+Environmental Economics

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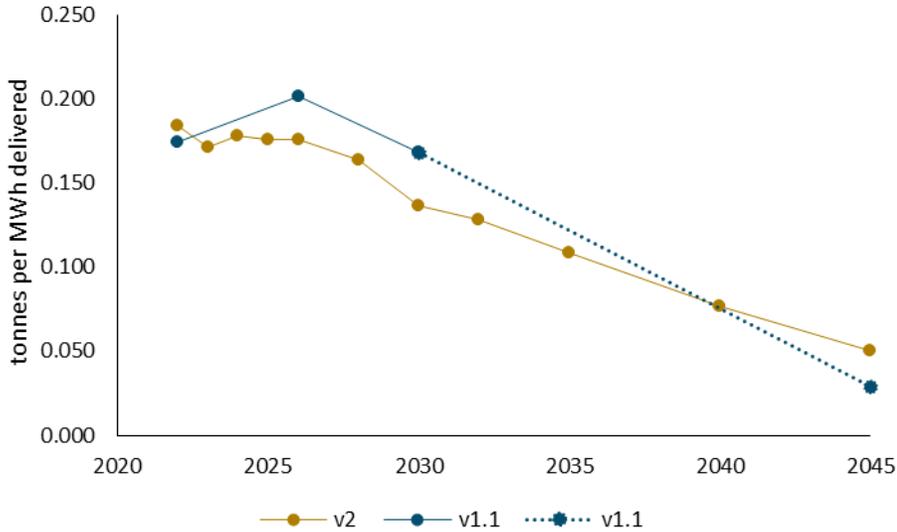
Agenda

- + **Tool background**
- + **Revision plan (changes from v.1.1 to v.2)**
 - Source energy and emissions factors
 - Methane leakage
 - Refrigerant Leakage
- + **Timeline for stakeholder feedback**
- + **Tool Demonstration**
- + **Q&A**

Policy Background

- + D.92-02-075: Established the “three-prong test” which established the original requirements for fuel substitution measures to be eligible for energy efficiency incentives**
- + D.19-08-009 (August 2019): Adopted the “fuel substitution test” such that a measure must save energy and reduce carbon emissions to be eligible**
 - In 2019, the CPUC and E3 developed the Fuel Substitution Calculator to apply the adopted fuel substitution test
 - In 2022, the CPUC and E3 are updating the Fuel Substitution Calculator to reflect recent changes in data and methodology in the Avoided Cost Calculator:
 - Updated grid emissions and source energy factors based on CPUC IRP proceedings
 - Including refrigerant leakage emissions
 - Including methane leakage emissions

Source Energy and Emission Factors Updates

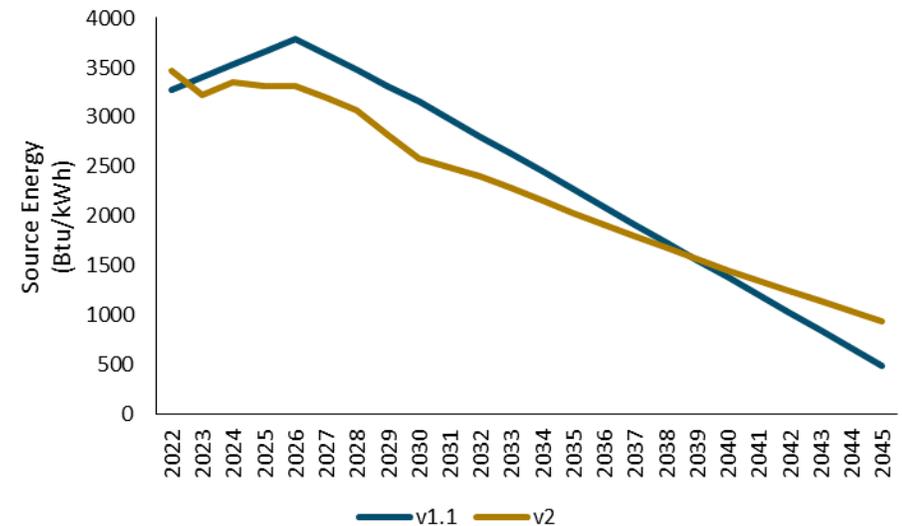


+ v.1.1 used data from the 2017-2018 CPUC Reference System Plan which provided CAISO retail sales and emissions projections through 2030.

- Emissions in 2045 were extrapolated with coarse assumption that SB100 would allow emissions equivalent to natural gas generation serving system losses (7.25%).
- The carbon intensity of a natural gas generation (delivered) is 0.398 tonnes/MWh .

+ In v.2, electricity source energy factors were updated using the latest modeling from the CPUC IRP 2021 Preferred System Plan, which is used in the 2022 Avoided Cost Calculator.

- 2045 emissions intensity based on detailed modeling in IRP



Methane Leakage Emissions Adders

	Data Source	Emissions Adder	Include in Electricity Emissions	Include in Gas Emissions
Upstream in-state methane leakage	2022 ACC/CARB GHG Inventory	5.57%	Yes	Yes
Residential behind-the-meter leakage	2022 ACC/CARB GHG Inventory	3.78%	No	Yes. Only for residential measures.

Assuming 100-year GWP

See 2022 ACC Documentation, Section 12.2: [link](#)

Refrigerant Leakage Emissions

- + CO₂-eq refrigerant leakage emissions calculations consistent with the ACC were added to the tool.
- + The tool provides the user the option to select a refrigerant and its GWP from [CARB's GHG Inventory](#) or provide a custom GWP for the refrigerant used.
- + The tool allows the user to select a representative device from CARB's database or provide custom inputs for leakage rates

Parameters	Description
Global Warming Potential (GWP)	Global warming potential of the refrigerant compared to CO ₂
Refrigerant Charge	Mass of refrigerant contained in the device
Annual refrigerant leakage rate	Typical rate of for the device on an annual basis
End-of-life leakage rate	Leakage rate for the device based on typical disposal practices
Number of years prior to end-of-life with no "top-off" refrigerant added to replace full charge	Shows when the device's refrigerant was last at full charge before end-of-life

Timeline for Stakeholder Feedback

Review with
Travis

- + **October 13th: Draft Revised Tool Released**
- + **December 14th: End of stakeholder review and feedback period**
- + **November 30th: Public webinar on revisions made based on stakeholder feedback. Final Revised Tool Released.**

Demonstration

Demonstration

+ “Webinar Example - Commercial HPWH”: Replace gas heat pump water heater early with a HPWH

+ Install Year = 2025

+ **Measure Device**

- Fuel = Electricity
- EUL = 14 years
- Refrigerant = HFC-134a
- Device = “Heat Pump Water Heater”
- Annual Usage = 2000 kWh

+ **First Baseline**

- Fuel = Natural Gas
- Annual Usage = 240 Therms
- Original device does not use refrigerant

+ **Second Baseline**

- RUL = 3 years
- Annual Usage = 200 Therms
- Original device does not use refrigerant

Demonstration

Measure Description

Fill out this block for all measures (including Normal Replacement and Accelerated Replacement)							
Index	Measure Description	Quantity (# units)	Type	EUL (years)	Install Year	Original fuel	New fuel
1	Commercial packaged Heat Pump 12 EER--EXAMPLE	1.0	Commerical	20	2022	natural gas + electricity	electricity
2	Residential split Heat Pump 15 SEER; 8.7 HSPF--EXAMPLE	1.0	Residential	15	2022	natural gas + electricity	electricity
3	Residential 50 Gallons Heat Pump Domestic Water Heater--EXAMPLE	1.0	Residential	10	2022	natural gas	electricity
4	Webinar Example - Commercial HPWH	1.0	Commerical	14	2025	natural gas	electricity
5							

Measure Characterization

Fill out this block for all measures (including Normal Replacement and Accelerated Replacement)				
Index	Annual usage of measure technology		Measure Refrigerant and Device Description	
	Annual electric usage (kWh)	Annual fuel usage (Therms)	Measure Device	New Refrigerant
1	715.3	0.0	Commercial Unitary AC, < 50-lbs., < 135,000 BTU/h size (includes smaller "residential-type" central AC and heat pumps)	R-410A
2	878.6	0.0	Residential Heat Pumps	R-410A
3	1,497.1	0.0	Heat Pump Water Heaters	R-410A
4	2,000.0	0.0	Heat Pump Water Heaters	HFC-134a
5				

First Baseline Characterization

Fill out this block for all measures (including Normal Replacement and Accelerated Replacement)				
Index	Annual usage of "first" baseline (existing) technology		"First" Baseline (existing) Refrigerant and Device Description	
	Annual electric usage (kWh)	Annual fuel usage (Therms)	Original Device	Original Refrigerant
1	696.2	8.1	Commercial Unitary AC 50-200 lbs., > 135,000 BTU/h size	R-410A
2	514.0	60.0	Residential Unitary AC	R-410A
3	0.0	180.5	Device does not use refrigerant	N/A
4	0.0	240.0	Device does not use refrigerant	N/A
5				

Second Baseline Characterization

Index	Measure Application Type	RUL of existing equipment (years)	Annual usage of "second" baseline technology		"Second" Baseline Refrigerant and Device Description	
			Annual electric usage of the code baseline (kWh)	Annual gas usage of the code baseline (Therms)	Second Refrigerant	Second Baseline Device
1	NR					
2	NR					
3	NR					
4	AR	3.0	0.0	200.0	N/A	Device does not use refrigerant
5	NR					

Demonstration

Index	Section 2.1: Source Energy Savings Calculations		Section 2.2: CO2 Emission Savings		Section 2.3: Results
	Lifecycle Primary Energy Savings (MMBTU at generation source)	Test Pass/Fail	Lifecycle emissions savings	Test Pass/Fail	Conclusion of Fuel Substitution Test
1	15	PASS	81	PASS	Eligible
2	75	PASS	3.1	PASS	Eligible
3	134	PASS	5.7	PASS	Eligible
4	222	PASS	11	PASS	Eligible
5	0	PASS	#VALUE!	#VALUE!	#VALUE!

Section 2.2.1: Supplemental Information		
Electric	Gas	Refrigerant
Lifecycle emissions savings (Metric tCO2)	Lifecycle emissions savings (Metric tCO2)	Lifecycle emissions savings (Metric tCO2)
-0.05	0.91	80.20
-0.85	5.22	-1.24
-2.59	10.47	-2.18
-3.93	16.36	-1.56
0.00	0.00	#VALUE!

Thank You



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Appendix



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Source Energy and Emissions Updates

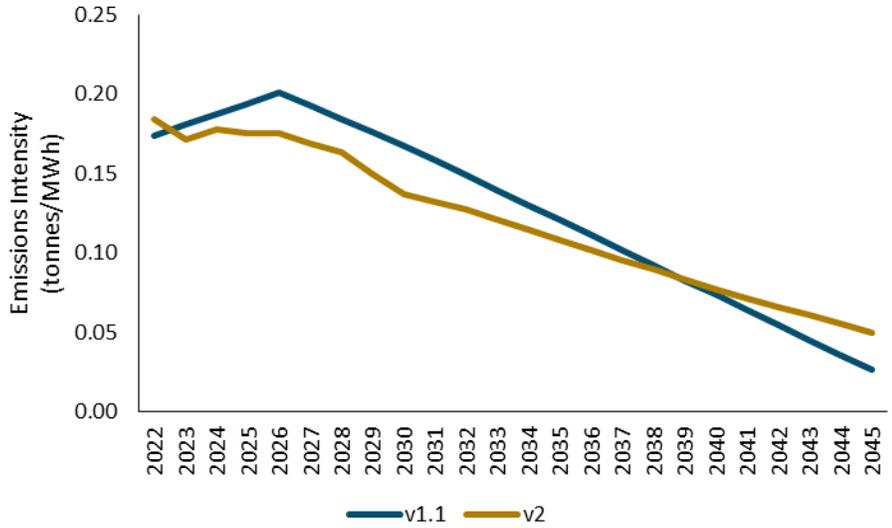
- + Electricity source energy factors were updated using the latest modeling from the CPUC IRP 2021 Preferred System Plan.

2021 Reference System Plan (no new DER case)

		2022	2023	2024	2025	2026	2028	2030	2032	2035	2040	2045
CAISO Emissions	MMTCO ₂	36.7	34.9	36.8	36.7	37.1	35.0	29.7	28.5	24.8	18.5	12.3
Retail Sales	GWh	199,394	204,085	207,184	209,212	211,219	214,282	217,428	222,820	229,568	240,814	245,397

Source Energy and Emissions Factors Updates

Source Emissions Factors



Source Energy Factors

