IECC Cost-Effectiveness Testing

Methodology for calculating lifecycle cost (LCC) for individual residential amendments.

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2050 Partners

Purpose

- Needed a method to cost analyze cost-effectiveness of our proposed amendments, particularly by climate zone, in order to finalize details of the proposals
- Follow accepted practices
- Based on documented and commonly-used data
- Level of effort needed to be aligned with analyzing individual amendments

Proposed Methodology

- Based on PNNL methodology described in 2015 paper
- Some modifications made to update/simplify:
  - Updated energy price and other economic data
  - Added social cost of carbon
  - Removed income tax impact (mortgage deduction)
  - Removed property tax impact
  - Removed residual value for measures with 30+ year lifespan

What it does not do

- This methodology does not provide specifics on how to:
  - Calculate changes in energy consumption
  - Calculate first costs of a measure
- These are the inputs to the LCC model and the methodology for calculating them should be documented and follow accepted practices

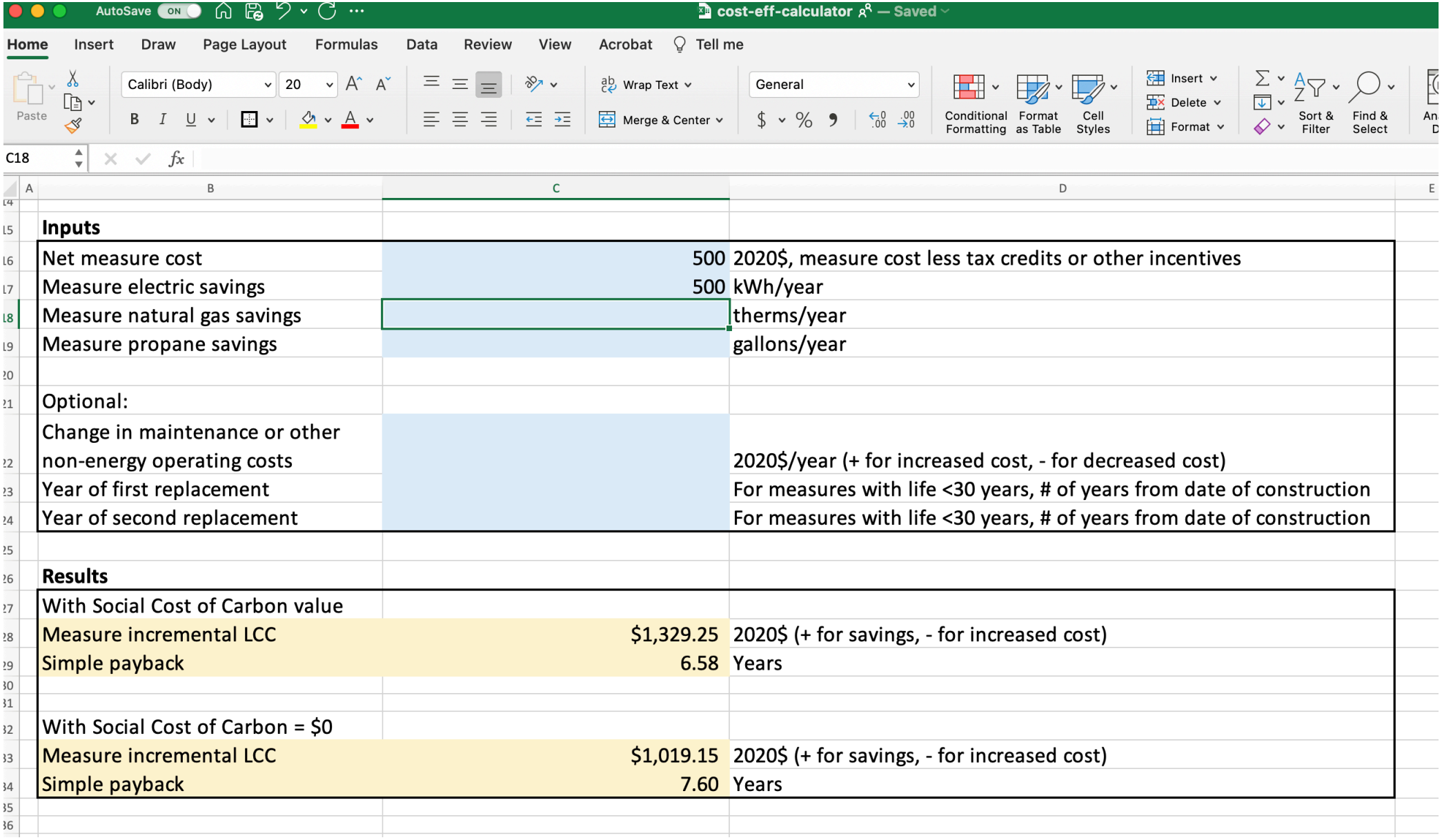
Parameter Values and Sources

Parameter	Value	Source
Mortgage Interest Rate	3.84% nominal	FreddieMac, average of past 5 years for 30 year mortgages
Loan Term	30 years	
Down Payment Rate	20%	
Points and Loan Fees	.55% nominal	FreddieMac, average of past 5 years for 30 year mortgages
Discount Rate	3.84% nominal	Same as mortgage interest rate
Period of Analysis	30 years	
Property Tax Rate	Not used	
Income Tax Rate	Not used	
Home Price Escalation Rate	Not used	
Inflation Rate	2.3%	EIA AEO 2021
Residual value	0 for measures with life >30 years, straight line depreciation for measures replaced within 30 years	

Parameter Values and Sources

Parameter	Value	Source
Baseline fuel prices	Elec: 0.1315 $/kWh Gas: 1.0395 $/therm Propane: 2.35 $/gal	Natural gas: 2020 US residential price from EIA natural gas annual Electricity: 2020 US residential price from EIA electric power annual Propane: Average of latest year of EIA monthly residential heating season prices.
Fuel price escalators	Elec: -0.1% Gas: 0.5% Propane: 1.4%	EIA AEO 2021 reference case, residential by fuel, national
First cost for measures		Sources must be documented. (Potential sources include recent published studies, surveys of retailer prices, RS Means residential cost data, expert judgement.)
Change in energy consumption		Sources must be documented. Building energy modeling or other calculations that use standard accepted practices. Calculated for each climate zone unless it does not substantially impact savings.
Changes in non-energy operating expenses	Assumed to be zero unless warranted for a specific measure	
Social cost of carbon	TBD ~Feb 2022	Interagency Working Group on Social Cost of Greenhouse Gases

Excel-Based Calculator



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	B	C	D
15	**Inputs**		
16	Net measure cost	500	2020$, measure cost less tax credits or other incentives
17	Measure electric savings	500	kWh/year
18	Measure natural gas savings		therms/year
19	Measure propane savings		gallons/year
20			
21	Optional:		
22	Change in maintenance or other non-energy operating costs		2020$/year (+ for increased cost, - for decreased cost)
23	Year of first replacement		For measures with life <30 years, # of years from date of construction
24	Year of second replacement		For measures with life <30 years, # of years from date of construction
25			
26	**Results**		
27	With Social Cost of Carbon value		
28	Measure incremental LCC	$1,329.25	2020$ (+ for savings, - for increased cost)
29	Simple payback	6.58	Years
30			
31			
32	With Social Cost of Carbon = $0		
33	Measure incremental LCC	$1,019.15	2020$ (+ for savings, - for increased cost)
34	Simple payback	7.60	Years
35			
36			

Excel-Based Calculator

	A	B	C	D	E	F	G	H	I	J	K	L
20		Down Pmt	Fees	Mortgage payment	Electric savin	Gas savings	Propane savir	Maintenance	Replacement	Residual valu	SCC	Net cash flow
21	2020	(100.00)	(2.75)									(102.75)
22	2021			($22.68)	65.75	0.00	0.00	0.00	0.00		10.27	53.34
23	2022			($22.68)	67.33	0.00	0.00	0.00	0.00		10.69	55.34
24	2023			($22.68)	68.95	0.00	0.00	0.00	0.00		11.12	57.39
25	2024			($22.68)	70.61	0.00	0.00	0.00	0.00		11.56	59.49
26	2025			($22.68)	72.31	0.00	0.00	0.00	0.00		12.02	61.65
27	2026			($22.68)	74.05	0.00	0.00	0.00	0.00		12.54	63.90
28	2027			($22.68)	75.83	0.00	0.00	0.00	0.00		13.07	66.21
29	2028			($22.68)	77.66	0.00	0.00	0.00	0.00		13.62	68.59
30	2029			($22.68)	79.53	0.00	0.00	0.00	0.00		14.18	71.02
31	2030			($22.68)	81.44	0.00	0.00	0.00	0.00		14.77	73.52
32	2031			($22.68)	83.40	0.00	0.00	0.00	0.00		15.32	76.03
33	2032			($22.68)	85.41	0.00	0.00	0.00	0.00		15.89	78.61
34	2033			($22.68)	87.46	0.00	0.00	0.00	0.00		16.48	81.25
35	2034			($22.68)	89.57	0.00	0.00	0.00	0.00		17.08	83.96
36	2035			($22.68)	91.72	0.00	0.00	0.00	0.00		17.70	86.74
37	2036			($22.68)	93.93	0.00	0.00	0.00	0.00		18.40	89.64
38	2037			($22.68)	96.19	0.00	0.00	0.00	0.00		19.12	92.62
39	2038			($22.68)	98.50	0.00	0.00	0.00	0.00		19.85	95.67
40	2039			($22.68)	100.87	0.00	0.00	0.00	0.00		20.62	98.80
41	2040			($22.68)	103.30	0.00	0.00	0.00	0.00		21.40	102.02
42	2041			($22.68)	105.79	0.00	0.00	0.00	0.00		22.21	105.31
43	2042			($22.68)	108.33	0.00	0.00	0.00	0.00		23.04	108.69
44	2043			($22.68)	110.94	0.00	0.00	0.00	0.00		23.90	112.15
45	2044			($22.68)	113.61	0.00	0.00	0.00	0.00		24.78	115.71
46	2045			($22.68)	116.34	0.00	0.00	0.00	0.00		25.70	119.35
47	2046			($22.68)	119.14	0.00	0.00	0.00	0.00		26.63	123.09
48	2047			($22.68)	122.01	0.00	0.00	0.00	0.00		27.60	126.92

How to Use

- Analyze impact in an individual climate zone
  - When savings varies by climate zone
  - PNNL has published list of representative cities for each climate zone
- Analyze nationwide impact
  - Can weight/aggregate either before or after using calculator

Questions?

Thank You!

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