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IECC 2024 Cost Effectiveness Advisory Group Recommendation Summary

U.S. DEPARTMENT OF ENERGY BATTELLE

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Cost Effectiveness Advisory Group

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The Cost Effectiveness Advisory Group has met on a weekly basis, since October, to develop the cost effectiveness recommendations being presented today.

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Discount Rate

ICC gave guidance to develop cost effectiveness using a 3% and 7% Real Discount Rate per OMB Circular A4.

Discount Rate Basics

1. Real Discount Rate (constant dollar) = Nominal Discount Rate minus Rate of Inflation
2. Discount Rate is used to discount future cash flows back to today's dollars. This makes it easier to compare the installed cost of a measure with the long-term energy savings benefits.
3. Published Guidance on the use of Circular A4 describes the discount rates as follows:

   The 7 percent rate … is a broad measure that reflects the returns to real estate and small business capital as well as corporate capital.

   The 3 percent discount rate is based on a recognition that the effects of regulation do not always fall exclusively or primarily on the allocation of capital. When regulation primarily and directly affects private consumption, a lower discount rate is appropriate.

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Evaluating Cost Effectiveness

The working group recommends adoption of two simplified cost effectiveness methodologies allowing proponents flexibility when providing information.

1. **Scalar Method** –The simple payback of a measure is compared to a pre-determined Scalar Ratio Threshold. This is the method used by ASHRAE 90.1. A measure is deemed cost effective when:

$$\frac{First\ Cost}{Energy\ \&\ Maintenance\ Cost\ Savings} < Scalar\ Ratio\ Threshold$$

2. **Net Present Value (NPV) Method** –First cost and annual electricity, fossil fuel and maintenance cost savings are multiplied by NPV Factors. If the NPV of the cost savings is greater than the NPV of the financed first cost than a measure is deemed cost effective.

$$\begin{aligned} &Fuel\ \$\ Savings * NPV\ Fuel\ Factor \\ &+ Elec.\ \$\ Savings * NPV\ Elec.Factor \\ &+ Maint.\$\ Savings * NPV\ Maint.Factor \end{aligned} > First\ Cost * NPV\ Cost\ Factor$$

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Evaluating Cost Effectiveness

- Scalar Ratio Thresholds and NPV Factors are pre-calculated based on the service life.
- 15-years and 40-years are the recommended default service lifetimes. However, a proponent may also propose a more suitable service life for consideration.
- Each approach eliminates the need to establish complicated LCCA assumptions.
- A weighted scalar ratio threshold can be calculated when energy savings include both heating (fuel) and cooling (electricity) savings.
- Increased annual maintenance costs would be represented as negative cost savings.

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Recommended criteria at 15 years and 40 years

Default Service Life	Scalar Ratio Thresholds			
	3% Discount Rate		7% Discount Rate	
	Fossil Fuel (Heating)	Electricity (Cooling)	Fossil Fuel (Heating)	Electricity (Cooling)
15	12.5	11.5	11.7	10.9
40	26.90	22.90	21.1	18.6

Default Service Life	NPV Factors							
	3% Real Discount Rate				7% Real Discount Rate			
	First Cost	Fossil Fuel	Electricity	Maint.	First Cost	Fossil Fuel	Electricity	Maint.
15	0.92	11.42	10.56	12.00	0.75	8.71	8.11	9.20
40	0.86	23.15	19.74	23.37	0.63	13.21	11.68	13.58

Criteria developed using an Inflated Dollar LCCA (Nominal) using the following assumptions:

- First Cost Down payment: **15%**
- Corporate Tax Rate: **10%**
- Loan Term: **30** years or the service life, whichever is less
- Loan interest Rate: **4.25%**
- Electricity cost: **$0.11 per kWh**
- Fossil Fuel cost: **$12.60 per MMBTU**
- Average annual inflation rate: **2.33%**
- Energy cost escalation: **NIST 2021 fuel price indices** (excluding inflation)
- Discount Rates: **3% real = 5.33% nominal** and **7% real = 9.33% nominal**

Default Service Life	3.8% Discount Rate (ASHRAE 90.1-2022)	
	Fossil Fuel (Heating)	Electricity (Cooling)
15	12.30	11.40
40	25.40	21.90

Using the same economic assumptions, the current ASHRAE 90.1-2022 Scalar Ratio Thresholds are achieved at an equivalent Real Discount Rate of 3.8%.

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Recommended Cost Effective Criteria

Service Life	3% Real Discount Rate						7% Real Discount Rate					
	Scalar Ratio Thresholds		NPV Factors				Scalar Ratio Thresholds		NPV Factors			
	Fossil Fuel (Heating)	Electricity (Cooling)	First Cost	Fossil Fuel	Electricity	Maint.	Fossil Fuel (Heating)	Electricity (Cooling)	First Cost	Maint.	Fossil Fuel	Electricity
10	8.5	8.1	0.94	8.00	7.56	8.56	8.2	7.8	0.81	7.08	6.60	6.26
12	10.1	9.5	0.93	9.41	8.81	9.99	9.6	9.1	0.78	8.01	7.52	7.07
15	**12.5**	**11.5**	**0.92**	**11.42**	**10.56**	**12.00**	**11.7**	**10.9**	**0.75**	**9.20**	**8.71**	**8.11**
17	14	12.8	0.91	12.67	11.62	13.24	13.0	12.0	0.73	9.87	9.39	8.68
20	16.1	14.6	0.90	14.42	13.08	14.97	14.7	13.5	0.70	10.73	10.25	9.40
22	17.5	15.7	0.89	15.50	13.97	16.05	15.8	14.4	0.68	11.21	10.74	9.80
25	19.4	17.3	0.88	17.02	15.21	17.55	17.3	15.7	0.66	11.82	11.36	10.31
27	20.6	18.3	0.87	17.97	15.96	18.48	18.2	16.4	0.65	12.17	11.72	10.59
30	22.4	19.7	0.86	19.32	16.99	19.77	19.4	17.5	0.63	12.61	12.17	10.94
32	23.4	20.5	0.86	20.16	17.62	20.58	19.8	17.8	0.63	12.86	12.43	11.13
35	24.8	21.5	0.86	21.35	18.48	21.70	20.4	18.1	0.63	13.18	12.77	11.38
37	25.7	22.1	0.86	22.10	19.01	22.40	20.7	18.4	0.63	13.35	12.96	11.51
40	**26.90**	**22.90**	**0.86**	**23.15**	**19.74**	**23.37**	**21.1**	**18.6**	**0.63**	**13.58**	**13.21**	**11.68**

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Additional Recommendations approved by AG

Electricity Cost: use $0.11/kWh. Based on the 5-year average value from EIA data rounded to the nearest cent.

Fossil Fuel Cost: use $12.60/MMBTU. The mix of fossil fuels was obtained from CBECS data from last decade (2010-2018), and is based on 67% natural gas, 22% fuel oil, 11% propane. This blended fossil-fuel cost is based on the 5-year weighted average.

First/Construction Costs: RS Means data is preferred for first construction costs, but data from other sources is allowed with proper justification and reference provided to the committee. Straight average of union and open national labor rates from RS Means are preferred for labor rates, but data from other sources is allowed with proper justification and reference provided to the committee.

Service Life: Proponents should use a default service life of 15 years for HVAC/Lighting and 40 years for Envelope measures. Proponents can also justify a different service life for consideration (in addition to the default).

Representative Cities: Where applicable for energy analysis use representative cities from the national IECC cost effectiveness studies. Those cities include: 2A -Tampa, Florida (hot, humid), 3A - Atlanta, Georgia (warm, humid), 3B - El Paso, Texas (hot, dry), 4A - New York, New York (mixed, humid), 5A - Buffalo, New York (cool, humid)

Building Types: Where applicable for energy analysis, use the six prototype buildings that are used for national cost effectiveness studies. These include Small office, Large office, Standalone Retail, Primary School, Small hotel and Mid-rise apartment.

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Proposed Motion:

Adopt the recommended table of Scalar Ratio Thresholds and NPV Factors and the recommendations for electricity cost, fossil fuel cost, first/construction cost estimating, default service life, representative cities and representative building types to be used for calculating cost effectiveness using either the Scalar Ratio (simple payback) approach or a NPV Factor approach.

The Cost Effectiveness Advisory Group unanimously approved these recommendations 9-0-1.

Next Steps:

The Advisory Group will continue to discuss recommendations for the inclusion of externalities, the development of cost effectiveness using time of use electrical rates and how/when to apply cost effectiveness for different types of proposals.

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Example of how to use the recommended criteria

Consider a proposal with a service life of 15 years with a measure first cost of $1000, and electricity savings of $100 and fossil fuel savings of $100.

Using criteria for 7% Real Discount Rate.

Scalar Method

Simple payback = 5 ($1000/$200)

Weighted Scalar Threshold = 11.7 * ($100/$200) + 10.9 * ($100/$200) = **11.3**

Simple payback < Scalar threshold measure demonstrates cost effectiveness

Net Present Value (NPV) Method

NPV Electricity Savings = $100 * 8.11 = $811 and NPV Fuel Savings = $100 * 8.71 = $871.

NPV Savings = $1056 + $1142 = **$1,682** **NPV First Cost** = $1000 * 0.92 = **$920**

NPV Savings > NPV Costs measure demonstrates cost effectiveness

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Example of how to use the recommended criteria

Consider a proposal with a service life of 40 years with a measure first cost of $1000, and electricity savings of $20 and fossil fuel savings of $15.

Using criteria for 3% Real Discount Rate.

Scalar Method

Simple payback = **28.6** ($1000 / $35)

Weighted Scalar Threshold = 26.90 * ($15/$35) + 22.90 * ($20/$35) = **24.6**

Simple payback > Scalar threshold measure does not demonstrate cost effectiveness

Net Present Value (NPV) Method

NPV Electricity Savings = $20 * 19.74 = $394.80 and NPV Fuel Savings = $15 * 23.15 = $347.25.

NPV Savings = $233.6 + $264.2 = **$742** **NPV First Cost** = $1000 * 0.86 = **$860**

NPV Savings < NPV Costs measure does not demonstrate cost effectiveness

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Example of how to use the recommended criteria

Consider a proposal with a service life of 15 years with a measure first cost of $1000, and electricity savings of $43 and fossil fuel savings of $43. Using criteria for both 3% and 7% Disc. Rate

Scalar Method

Simple payback = **11.6** ($1000 / $86)

Weighted Scalar Threshold @ 3% = 12.5 * ($43/$86) + 11.5 * ($43/$86) = **12**

Weighted Scalar Threshold @ 7% = 11.7 * ($43/$86) + 10.9 * ($43/$86) = **11.3**

Net Present Value (NPV) Method

@3% **NPV Savings** = NPV Elec $454 + NPV Fuel $491 = **$945** **NPV Cost** = $1000 * 0.92 = **$920**

@7% **NPV Savings** = NPV Elec $349 + NPV Fuel $375 = **$724** **NPV Cost** = $1000 * 0.75 = **$750**

Passes at 3% but not at 7%

Can calculate the Internal Rate of Return (IRR) which represents the equivalent discount rate at which NPV Savings = NPV Cost as an additional point of reference.

IRR = R1 + ((NPV1 * (R2-R1))/(NPV1-NPV2)) **IRR = 4.94%**

Where R1 = 3%, R2 = 7%, NPV1 = higher NPV (savings - cost) and NPV 2 = lower NPV