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The hidden pitfalls in evaluating the cost-effectiveness of energy efficiency policies: a call for theoretical and quantitative rigor

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What is cost-effectiveness?

Cost-effectiveness is the backbone of credible EE programme evaluation

What it means

- Value for money: Do the discounted benefits of an EE policy/program exceed its discounted costs?
- Reported as Levelized Cost of Saved Energy (€/MWh-saved); optionally BCR > 1 or NPV > 0

Why it’s essential

- *Prioritization*: compare measures/instruments on a common metric.
- *Accountability*: shows taxpayers/regulators where money delivers impact in times of tight budgets.
- *Learning loop*: ex-post results improve ex-ante planning & targets.

Risks of not measuring (or doing it inconsistently)

- *Misallocation of funds*: cheap-looking programs that don’t deliver net savings.
- *Policy lock-in*: underinvest in deep retrofits; overpay for short-lived kWh.
- *Credibility & compliance risks*: harder to defend targets, audits, and budgets.

How cost-effective are energy efficiency programmes?

EE is typically the cheapest kilowatt-hour, but results hinge on various factors

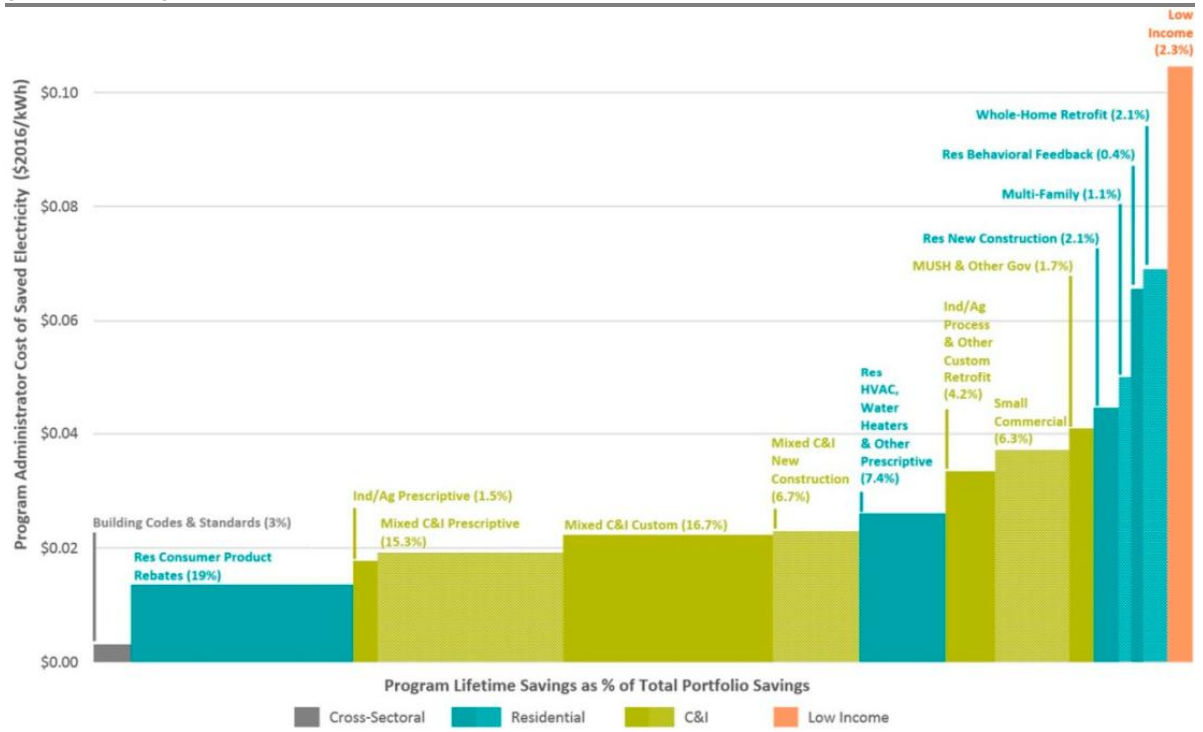
Europe (obligations & building programmes)

- Reviews of EEOS report obligated-party costs ~0.4–1.1 €c/kWh with benefit–cost ratios >1 in most countries examined [1]
- Germany's BEG building programmes: evaluations show positive cost–benefit and high leverage of public funds (≈ €1 subsidy → ~€5-6 private investment) [2]

US (utility-funded programs)

- Large meta-studies find a levelized cost of saved electricity (programme administrator cost) 1-10 ¢/kWh [3]
- Sector split:
  commerce & industry (C&I) 1-4 ¢/kWh;
  residential 3-7¢/kWh; low-income higher

Composite cost curve for electricity efficiency programs funded by utility customers (2009–2015)



Source: [3]

[1]: Rosenow, Jan; Bayer, Edith (2017): Costs and benefits of Energy Efficiency Obligations: A review of European programmes. In Energy Policy 107, pp. 53–62. DOI: 10.1016/j.enpol.2017.04.014.

[2] Heinrich, Stephan; Langreder, Nora; Grodeke, Anna-Maria; Hoch, Markus; Jessing, Dominik; Wachter, Philipp et al. (2025): Förderwirkungen BEG 2023. Kurzfassung der Evaluationsergebnisse. Evaluation des Förderprogramms „Bundesförderung für. Berlin: Bundesministerium für Wirtschaft und Klimaschutz (BMWK).

[3] Goldman, Charles A.; Hoffman, Ian; Murphy, Sean; Mims Frick, Natalie; Leventis, Greg; Schwartz, Lisa (2020): The Cost of Saving Electricity: A Multi-Program Cost Curve for Programs Funded by U.S. Utility Customers. In Energies 13 (9), p. 2369. DOI: 10.3390/en13092369.

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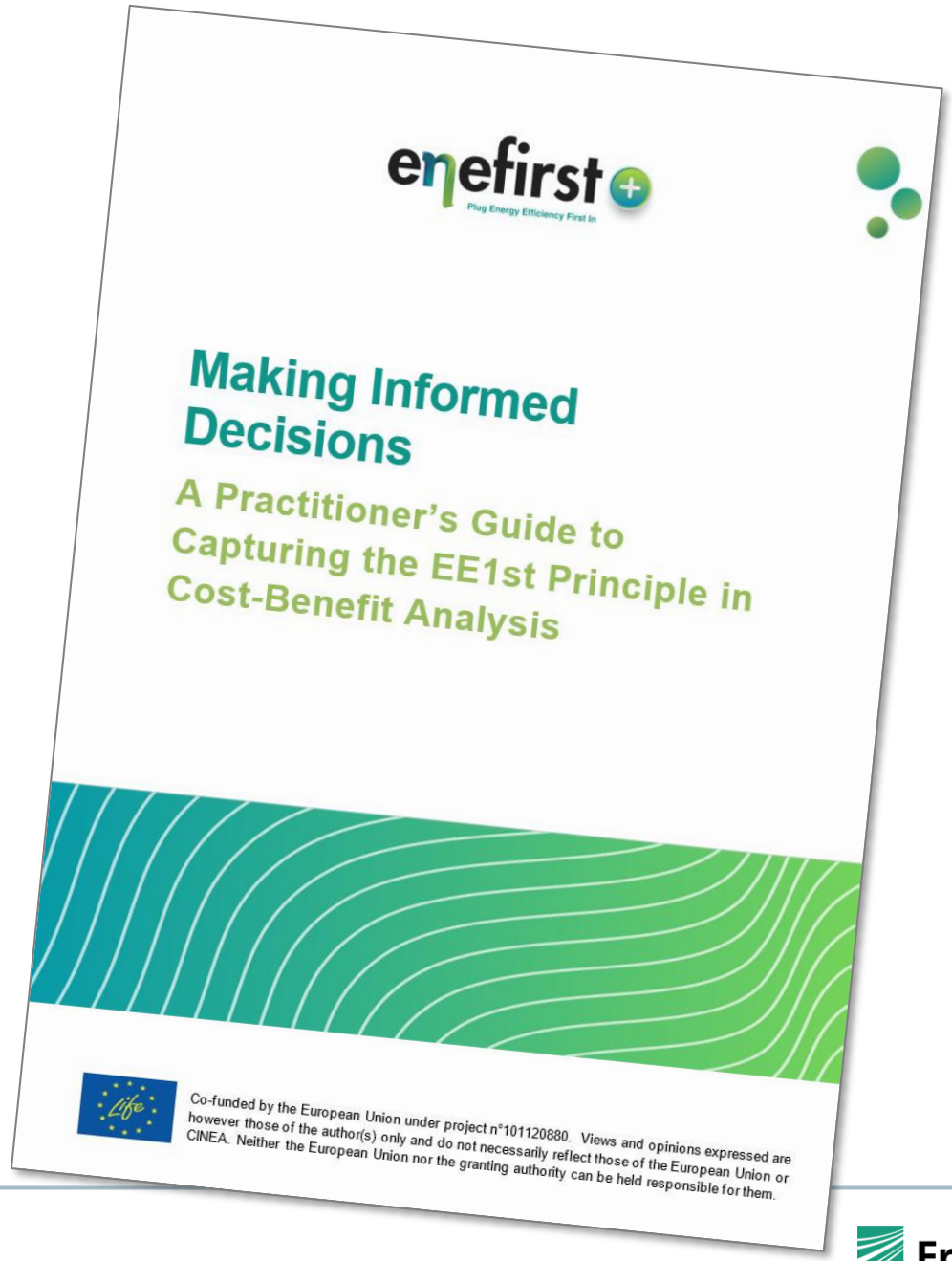
Three issues for today

Perspective: whose costs & benefits?

How to deal with transfer payments?

How to deal with multiple benefits?



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Issue 01: Perspective: whose costs & benefits?

Cost-effectiveness only makes sense relative to a declared perspective ▷ societal, private, or state-budget.

Mixing perspectives blends different costs, benefits, and transfers, which turns results into apples-to-oranges and undermining decisions.

Issue 01: Perspective: whose costs & benefits?

Perspective determines what “cost-effective” means

Perspective	Core question it answers	Purpose in policy evaluation
 **Societal *(economic analysis)***	Is the community, region, or nation better off as a whole – does the programme deliver *net societal benefits*?	• Strategic policy design and comparisons vs. supply • Regulatory impact assessments • NECPs/long-term planning
 **Private *(financial analysis)***	Does the programme make financial sense for the *asset owner* (household, firm, obligated party)?	• Design of programmes: reveals whether subsidies and/or taxation are needed to bridge the gap between private and societal returns. • Distributional impacts across income/tenant/business segments
 **State-budget *(fiscal analysis)***	What is the net effect of the project on *public revenues and expenditures*?	• National and local budget planning and affordability • Public debt and deficit screening under EU or national fiscal-rule frameworks.

EU vs US context (why perspective choice differs)

United States

- Integrated utilities often plan both supply and EE portfolios.
- Comparing Program Administrator Cost (PAC) test results directly to the cost of new supply is meaningful for resource planning.

Europe

- EE delivered via state programmes or EEOS, while supply is procured in competitive markets.
- Use societal (economic) perspective as the anchor; compare to the societal LCOE of alternative supply options.

Issue 01: Perspective: whose costs & benefits?

Recommended cost-item treatment across perspectives

Cost item	Societal	Private	State-budget	Explanation
Capital-related costs [a]	✓	✓	✗	Physical assets (equipment, installation, land, decommissioning) consume real resources, so they are a welfare cost (societal) and a cash outflow for the investor (private). They matter to the budget only if the State pays them directly, which is not the norm, hence exclusion from the pure fiscal column.
Operation-related costs [a]	✓	✓	✗	O&M and fuel are ongoing resource uses: society counts them and so does the owner who pays the bills. They do not usually flow through the Treasury, so they are absent from the fiscal view except where the State is itself the operator.
Energy-related costs [a]	✓	✓	✗	Payments for purchased energy and network services represent real resource use (generation fuel, grid losses) and private expenditure. They are normally excluded from a strict fiscal ledger unless the State is the buyer or seller.
Public charges and transfers	✗	✓	✓	Taxes, subsidies, emission-permit payments and levies shift money between actors but do not change the overall resource pool. They therefore drop out of the societal ledger, yet they alter investor cash flow (private) and the public balance sheet (fiscal).
Transaction costs	✓	!?	✓	Time and effort spent on information search, negotiation and compliance are real resources, so society counts them. Private actors may or may not monetise these “hassle” costs. Governments should include their own administrative outlays – processing subsidy applications, inspections, reporting – because they directly affect public expenditures.
Other private non-market costs	✓	!?	✗	Comfort gains, stress reduction, and similar effects raise or lower welfare and thus enter the societal account. Private actors include them only if they perceive and monetise them; they do not affect public revenues or spending.
External costs [b]	✓	✗	✗	Climate damage, air-quality impacts, noise and land-use effects fall on society at large, so they are central to economic analysis. They are absent from private and fiscal views unless internalised through taxes or regulation.

Legend: ✓ = normally included, !? = may be included, ✗ = normally excluded

[a] Excluding taxes, subsidies and other public transfers; [b] Excluding costs already internalised through public charges and transfers

Issue 02: Transfer payments

Grants, taxes, and levies are transfer payments – money shuffled between households, firms, and the state that doesn't change real resources.

Counting them as societal costs distorts cost-effectiveness by confusing cash flows with real economic costs.

Issue 02: Transfer payments

Transfers relabel who pays/receives; they don't change the quantity of labor, materials, or energy used

What are transfer payments?

Money that moves between actors (households ↔ firms ↔ government) without creating/using goods or services. At the societal level, these flows net to zero.

Common transfer payments: grants/rebates, tax credits, VAT, carbon taxes/allowances, EEOS surcharges passed through to bills.

Illustration 1: Heat pump grant

Heat pump incremental capex: €5,000.
Government pays €2,000

Taxpayers → Treasury → Household

- **Societal view:** €5,000 cost (real resources) grant is a transfer).
- **Private view:** Grant is a €2,000 benefit (reduces own outlay → higher NPV).
- **State-budget view:** €2,000 outlay (+ admin cost).

Illustration 2: VAT on heat pump purchase

Same project with VAT (say 19%).
= €950

Households → Treasury → Public services → Society

- **Societal view:** No change in resource cost; VAT is a transfer.
- **Private view:** €950 cost (cash outlay)
- **State-budget view:** €950 revenue (fiscal inflow).

Issue 02: Transfer payments

Transfer payments in EEOS (Energy Efficiency Obligation Schemes)

What's real resource costs vs. transfer inside an EEOS?

Real costs (≠ transfers)

incremental measure capex & installation, M&V, audits, program admin/IT, marketing, vendor onboarding, verification/compliance.

Rule of thumb

If it buys labor/materials/services for measures or delivery, it's a **resource**.

If it relabels who pays/receives (rebate, credit price, levy, fine), it's a **transfer**.

How to treat EEOS transfers by perspective

Transfer cost item	Societal (economic)	Private (financial)	State-budget (fiscal)
Rebates to customers/installers	✗ (transfer) but include admin to deliver	✓ Benefit to participants; cash in to vendors	!? Usually off-budget; track only if public funds top-up
White certificate credit purchases (buy/sell)	✗ (transfer) but include registry/trading transaction costs	✓ Cost for buyers, revenue for sellers	!? If fees/taxes apply, treat as revenue/outlay
Levies/surcharges on bills to recover EEOS costs	✗ (transfer) but include underlying delivery/admin resources	✓ Cost for consumers (non-participants)	!? Parafiscal inflow/outflow (track if collected by state agency)
Penalties/fines for non-compliance	✗ (transfer) but include enforcement admin	✓ Cost to obligated party	✓ Revenue to state (if paid to Treasury)

Issue 02: Transfer payments

Common mistakes

5 Common mistakes when dealing with transfer payments

1. Counting grants as societal costs
   → Fix: treat as transfers; include only admin/real costs.
2. Including VAT/energy taxes/labour taxes in societal NPV
   → Fix: remove; they're transfers.
3. Double counting carbon (both carbon price paid and shadow price)
   → Fix: pick one consistent valuation approach.
4. Mixing perspectives in one ratio (e.g., consumer benefits with societal costs) → Fix: keep tests separate
5. Ignoring delivery/admin costs
   → Fix: always include real resources to target/verify/pay programmes

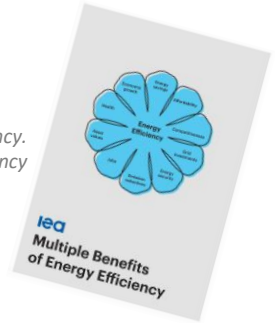
Issue 03: Multiple benefits

Multiple benefits are significant. However, in CBA, they count only when they reflect real resource changes or unpriced externalities. Redistributions and transfers, should be reported separately and not added to the NPV.

Issue 03: Multiple benefits

Recap of the IEA's set of multiple benefits

IEA (2025) Multiple Benefits of Energy Efficiency. https://www.iea.org/reports/multiple-benefits-of-energy-efficiency



Energy savings	Energy efficiency measures reduce the amount of energy required to fuel and grow our economies.
Affordability	Energy efficiency measures can reduce energy bills for households, decrease energy poverty, and make access to energy services more affordable.
Competitiveness	Energy efficiency can improve competitiveness at both the firm level (reducing costs, increasing product value) and at the country level (reducing the amount of energy required to produce economic output).
Grid investments	Energy efficiency can help close the gap between supply and demand, but often at a lower cost, and more quickly, than new generation and grid expansion.
Energy security	Energy efficiency can help mitigate energy security risks by reducing the reliance on fossil fuel imports, improving grid reliability, and acting as a buffer to supply shocks.
Emission reductions	Energy efficiency can reduce emissions of greenhouse gases and air pollutants and make the energy system more sustainable.
Health improvements	Energy efficiency can improve health by creating healthy indoor and outdoor living environments with comfortable temperatures and humidity levels, and improved air quality.
Asset-value uplift	Energy efficiency can increase the value of assets, such as homes, buildings or equipment, and lead to lower vacancy rates and longer equipment lifespans.
Jobs	Investment in energy efficiency creates jobs in a wide range of occupations and geographic locations.
Macro-economic growth (GDP)	Energy efficiency allows countries to generate more economic activity using the same amount of energy. It is also linked to increased labour productivity and other economic benefits.

Issue 03: Multiple benefits

Assigning benefits by perspective using a 2×2 matrix

Valuation

Incidence

	Explicit (priced)	Implicit (not priced)
Investor (internal)	Things the investor actually pays/receives via prices/tariffs/taxes, e.g. bill savings.	Investor experiences value/cost but it's not on a bill; needs WTP or proxy, e.g. comfort/thermal quality.
Resource effects beyond the investor	First-order marginal costs inside the energy system, e.g. avoided grid investments.	True externalities: a cost/benefit not borne by the decision-maker and not mediated by prices, e.g. air pollution health impacts.

Rules of thumb for the three perspectives

Society (economic): count real resource costs/benefits and unpriced externalities.

Private (financial): Include anything explicit on the bill + internal implicit items if you have WTP evidence.

State-budget (fiscal): count public outlays and revenues only.

Issue 03: Multiple benefits

Why some ‘multiple benefits’ don’t belong in CBA

	Why it’s tempting	CBA diagnosis	How to treat instead
Asset values 	Retrofits often raise sale/rental prices.	Higher asset values mainly capitalize benefits that are already counted (lower bills, comfort, lower risk). Adding both **double counts** the same welfare gain.	Count the underlying **benefits** directly (energy savings, comfort via WTP, health), not the resale price effect.
Jobs 	Projects employ installers, engineers, manufacturers.	Payrolls are already included as part of **project costs** (labor is a resource). Adding “jobs” again as a benefit double counts. In near-full employment, extra jobs mostly displace workers from other uses (**opportunity cost**).	Keep labor in costs. *Edge case*: If there’s substantial involuntary unemployment or labor market distortions, use a **shadow wage** (< market wage) to value labor cost. But not a separate “jobs benefit.”
GDP 	General equilibrium studies show positive GDP impacts from EE spending.	GDP changes reflect economy-wide **price and spending reallocation** (multipliers). Adding “GDP gain” to CBA double counts capex, O&M, and savings **already valued** with default financial costs.	Keep CBA at the **partial-equilibrium level**. If policymakers want macro signals, report general equilibrium results separately, as context, not inside the NPV.

Issue 03: Multiple benefits

Check out the MICATool

SEED MICAT

Support Energy Efficiency Deployment with the Multiple Impacts CAlculation Tool

Objective

Support the EU and its Member States at all governance levels in including Multiple Impacts in their operationalisation and implementation of the **Energy Efficiency First principle**, based on a strong and reliable analytical tool – the **MICATool**.

https://app.micatool.eu/

Conclusion

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