Redefining Value: Incorporating Energy Justice into Regulatory Impact Analyses

Yasmin Yacoby, Rebecca Schloemann, Eric Rubin, Energy Solutions
Jason Price, Industrial Economics, Incorporated

ABSTRACT

Conventional Regulatory Impact Analysis (RIA) typically prioritizes aggregate net benefits in ways that can obscure unequal starting conditions and real-world constraints. This paper argues that conventional RIA approaches are insufficient to evaluate whether regulatory policies advance energy justice in practice and proposes a framework for operationalizing energy justice within regulatory decision-making. This paper presents an integrated approach that combines three complementary analytical lenses: a societal lens assessing overall social welfare; a distributional lens examining how costs and benefits are shared across populations; and an affordability lens evaluating whether policies are financially workable for households and organizations in different circumstances. Across all three lenses, meaningful stakeholder engagement is deemed essential for determining what to analyze and what actions to take based on analytical results.

This paper offers practical recommendations for applying the proposed framework, including the use of differentiated discount rates, energy justice-focused data collection, and recommended affordability metrics. This framework is then applied in the context of a regulatory analysis of appliance standards to demonstrate how this approach can be applied in practice. The authors conclude that energy justice-focused RIA, paired with procedural justice and transparent engagement, can allow regulators to design energy and climate policies that are cost-effective, affordable, and responsive to lived experiences.

Introduction

Energy and climate policies increasingly shape household affordability, public health, economic opportunity, and environmental outcomes across the United States (Krasniqi, Q. et al., 2024). Decisions about building and appliance standards and other energy regulations influence not only energy system costs and related emissions, but also who benefits from the clean energy transition and who bears the costs. Regulatory Impact Analysis (RIA) is central to deciding if policies move forward, how they are designed, and how tradeoffs are evaluated (Dudley, S. et al., 2017). As states and federal agencies pursue more ambitious climate and energy goals, they are recognizing that conventional approaches to RIA, focused primarily on aggregate net benefits, are insufficient to assess whether policies and regulations are effective, affordable, and equitable in terms of "energy justice" in practice (Cecot 2023).

These concerns are not theoretical, and "energy justice" provides a framework for addressing these challenges. For the purposes of this paper, energy justice is defined as the goal of achieving equity in both the social and economic participation in the energy system, while also remediating the social, economic, and health burdens imposed on communities that have been historically harmed by the energy system (Initiative for Energy Justice, 2019). For much of U.S. history, Indigenous and Native communities, Black and brown communities, low-income communities, rural communities, and tribal nations have borne disproportionate costs of the fossil-based energy system, including pollution exposure, disinvestment, and economic exclusion (Bullard, R. D., et al., 2008; Donaghy, T. Q., et al. 2023; Mikati, I, et al. 2018). Approaching the clean energy transition through a justice lens reflects a commitment to ensuring that these same harms are not replicated as energy systems evolve.

Policymakers are increasingly grappling with affordability, “energy burden”, and the uneven impacts of the energy transition on low-income households and Disadvantaged Communities (DACs) (ACEEE 2024; DOE 2021.). The Department of Energy (DOE) defines energy burden as “the percentage of gross household income spent on energy costs.” (DOE 2024b). High energy burdens are associated with increased financial stress and heightened vulnerability to economic, health, and climate-related shocks, making energy burden a critical indicator of whether policies are affordable in practice for the households most at risk (Hernández 2013).[1] For these households, even policies that generate net savings over time may exacerbate short-term hardships if they increase upfront costs or require access to credit (Berkouwer. S., et al. 2021). While many regulations deliver net benefits in aggregate, their impacts are often experienced unevenly, shaped by differences in income, housing conditions, access to capital, and baseline vulnerabilities to adverse economic and climatic impacts (Hernández 2013).

Energy justice rests on three interrelated pillars: **distributive justice**, which concerns how costs and benefits are allocated; **procedural justice**, which concerns who participates in decision-making and whose knowledge informs decision-making; and **recognition justice**, which concerns whether historically marginalized groups are meaningfully acknowledged (Jenkins et al., 2016).

This paper focuses on how the principles of energy justice can be operationalized within RIA with a specific focus on distributive justice. It argues that rigorous technical analysis, paired with meaningful stakeholder engagement, supports more transparent, inclusive, and effective regulatory decision-making in relation to distributive justice. The paper provides an overview of recommendations, emphasizes practical affordability metrics, and combines analytical guidelines and process-oriented considerations. While the examples focus on building sector regulations, the framework presented here is broadly applicable across energy and climate policy contexts.

Framework for Equity-Focused RIA

Throughout this paper, the term RIA is used broadly to reflect the full range of effects that energy and climate policies have in practice. “Impacts” may include monetized costs and benefits, such as program costs, energy savings, and avoided emissions, as well as other effects that are more difficult to quantify, including non-energy impacts, employment effects, health outcomes, and changes in household or organizational risk. This broader framing recognizes that many impacts central to energy justice and lived experience are not fully captured through monetized metrics alone but nonetheless influence how policies are experienced in practice.

Empirical research consistently shows that low-income households and “Disadvantaged Communities” (DACs) are more likely to live in energy inefficient housing, face higher energy costs relative to income, and experience compounding vulnerabilities related to health, climate exposure, and housing quality (Reames 2016; Hernández 2013). These overlapping conditions mean that impacts are rarely experienced uniformly, even when policies are designed to improve or reduce long term costs. In these contexts, policies that appear beneficial *on average* may still impose disproportionate burdens or fail to deliver a fair share of benefits to priority populations. For the purposes of this paper "priority populations" are defined as the subgroups who warrant additional attention to address equity

[1] Other documented impacts of high energy burdens include incurring debt and having utility service disconnected; not being able to heat/cool your home to a comfortable temperature; and poor physical and mental health outcomes (Hernández 2013).

concerns, consistent with the jurisdiction's energy equity policy and with stakeholder input (DOE 2024a).

Conventional RIAs have historically emphasized economic efficiency and aggregate net benefits, often underrepresenting lived experiences, affordability constraints, and structural inequities (Carley & Konisky 2020; Baker et al. 2023). While aggregate analysis remains essential for evaluating overall social welfare, it is not sufficient on its own in context where baseline conditions, risk exposure, and financial constraints differ markedly across populations. In such cases, exclusive reliance on aggregate metrics can mask tradeoffs that are central to whether policies advance energy justice in practice.

Current practice in RIA remains inconsistent in its application of an energy justice lens. Some RIA-related analyses provide robust subgroup or affordability assessments, while others leave important distributional questions unanswered (Krutilla, et al., 2023). In many cases, this inconsistency reflects both limited analytical bandwidth and the absence of clear regulatory requirements or standardized guidance directing agencies to conduct energy justice-focused analyses. For example, DOE appliance standards lifecycle cost analyses often include robust assessments of impacts on subgroups such as renters, seniors, and low to moderate-income households, and examine how cost-effectiveness varies by building type and geography (NASEM 2021). Guidance from the Office of Management and Budget, including Circular A-4, similarly underscores the value of analyzing how regulatory costs and benefits are distributed across subgroups (OMB 2023). In contrast, state-level RIA may provide limited distributional or affordability insight, particularly where agencies lack dedicated resources, access to disaggregated data, or explicit mandates to conduct such analysis, and it can be difficult to find analyses that apply a comprehensive and consistent energy justice-focused framework across multiple dimensions.

This paper seeks to bridge that gap and recommends evaluating the impacts of regulations through three complementary analytical perspectives:

- A **societal lens**, which assesses whether a policy improves overall social welfare;
- A **distributional lens**, which examines how aggregate impacts vary across populations, including how costs and benefits are distributed; and
- An **affordability lens**, which evaluates whether policies are financially workable for households and organizations in varying real-world circumstances.

Taken together, these lenses, alongside meaningful stakeholder engagement, provide a more complete and policy-relevant picture than any single RIA alone. Decisions as to scope of impacts and situations being examined within each lens should be informed by engagement with priority populations and then analyzed through all three perspectives to help policymakers and stakeholders understand whether policies benefit society overall, whether benefits and burdens are equitably shared, and whether policies are affordable in practice. Importantly, not every policy when evaluated through these lenses will achieve all dimensional outcomes. Rather, by better understanding the differing impacts of the policy, policymakers and regulators can make more informed decisions to mitigate unintended consequences.

Across all three lenses, the framework is designed to move beyond representative averages and account for differences in baseline conditions, such as income, energy costs, and access to capital, that shape how regulatory impacts are experienced in practice. This paper argues that such an integrated approach can help regulators work collaboratively with stakeholders to design policies that advance societal goals while improving outcomes for priority populations.

Societal Impacts Analysis

The societal lens for RIA assesses impacts for society as a whole. An important component of a societal RIA is a societal benefit-cost analysis (BCA), which places a monetary value on societal impacts, such as incremental capital costs (e.g., more expensive equipment), operating cost savings, climate benefits (i.e., avoided climate damages), and public health benefits (i.e., avoided morbidity and premature mortality). The goal of a societal BCA is to assess whether the regulation would improve overall "social welfare," the aggregate well-being of people (EPA 2024). The societal lens recognizes that even regulations that affect business or public institutions ultimately affect the well-being of households (OMB 2023). A societal BCA monetizes impacts, converts them to their equivalent value if experienced today ("present value"), and sums costs and benefits to calculate the net present value. If the net present value of a societal BCA is positive, it indicates that the regulation would improve aggregate social welfare (EPA 2024).

Initially, societal RIA and BCA may not appear to be focused on energy justice; however, the societal lens can have important energy justice implications. The societal lens is a powerful tool for incorporating intergenerational equity, an important consideration for energy justice.[2] For regulations that affect climate change, societal RIA should include an analysis of avoided greenhouse gas emissions and avoided climate damages, placing value on the well-being of both current and future generations.

Furthermore, although societal BCA can be seen as objective, choices about which impacts to monetize and which to exclude reflect implicit value judgements. Consistent, meaningful engagement with vulnerable communities throughout the regulatory process can help ensure that societal metrics capture outcomes that matter most to those experiencing the impact. As such, the societal lens allows policymakers and members of priority populations to compare policy alternatives in terms of metrics like avoided pollution, public health benefits, net employment benefits, or land use, thereby supporting more informed decision-making.

Other resources provide more in-depth discussion of societal RIA and BCA (OMB 2023, EPA 2024). For this paper, our aim is to contextualize its relevance for energy justice-focused RIA and highlight selected practical recommendations for energy and climate RIA:

- Equitable stakeholder engagement should inform which societal impact metrics are analyzed. Early engagement can help ensure that analyses capture impacts that communities consider most consequential, such as local air quality, cumulative health effects, or resilience benefits, rather than relying solely on conventionally monetized outcomes.
- When regulations affect climate change or public health, those impacts should be included in the societal RIA and BCA (OMB 2023). Excluding these impacts risks undervaluing policies whose primary benefits accrue through avoided harm rather than direct cost savings.

[2] The intergenerational dimension of social justice is important to consider, as future generations are unable to speak for themselves. This consideration aims to avoid distributive injustice across generations (USDN 2014). As defined by the Max Planck Encyclopedia of Public International Law, "The principle of intergenerational equity states that every generation holds the Earth in common with members of the present generation and with other generations, past and future. The principle articulates a concept of fairness among generations in the use and conservation of the environment and its natural resources" (Intergenerational Equity, n.d.).

- Societal BCA should discount future costs and benefits to the present using societal discount rates (OMB 2023, EPA 2024).[3]
- For societal analysis of regulations affecting distributed energy resources (DERs), analysts should consider monetizing changes in energy use by using avoided energy system costs rather than changes in customer bills, if this is analytically feasible (NASEO 2026).[4]

Distributional Impacts Analysis

Distributional impacts analysis examines how aggregate impacts differ between groups, including how costs and benefits are allocated between populations, and can provide deeper understanding about distributive energy justice. Lawrence Berkeley National Lab's (LBNL) 2024 guide to Distributional Equity Analysis provides a comprehensive overview of methods for assessing distributional impacts in distributed energy resources (DERs). While not designed specifically for RIA, many of its principles are applicable in regulatory contexts. Despite growing recognition of its importance, distributional analysis remains uncommon in RIA and is often limited in scope when conducted (Revesz and Ünel 2023, Cecot 2023).

Distributional impacts analysis is increasingly common for programs that allocate public investment to households, businesses, or institutions, where impacts can be tracked after implementation. In these contexts, once systems are established to identify participants' characteristics (such as locations of DACs), tracking the distribution of benefits can be relatively straightforward. In contrast, for distributional RIA, analysts must model the anticipated impacts rather than recording observed outcomes. Distributional RIA requires analysts to develop granular mathematical models to forecast the impact of the regulation before it is implemented.

For example, to analyze how appliance standards are likely to affect different income groups, the regulatory impact model must be built so that its inputs (e.g. baseline adoption rates, energy use) and outputs (e.g., cost savings) vary by income group. DOE's appliance standards analyses provide examples of this approach, often including robust distributional analysis of financial impacts for subgroups like low-income households and senior-only households, analyzing metrics such as the percentage of consumers who would experience net financial benefits (NASEM 2021, DOE 2024c).

Adding energy justice and equity-focused granularity to an RIA can be challenging in practice. One of the biggest barriers is data availability: acquiring the necessary data often requires dedicated, proactive efforts to collect relevant model input data broken out by groups of interest such as low-income households and DACs which have not proven to be easy to access at state-levels. Added granularity can also make models more complex to develop and run and may make spreadsheet-based modeling more difficult.

Based on cumulative experience and the literature, the following practical recommendations for distributional RIA are offered:

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[3] A societal discount rate reflects the "social rate of time preference"—an overall measure of how much society collectively values consumption of goods and services (EPA 2024). Further discussion of how to estimate a societal discount rate and how to apply the "shadow price of capital" adjustment when additional rigor is needed can be found in U.S. federal RIA guidelines (OMB 2023, EPA 2024).

[4] "Energy system costs" refers to the cost of reliably generating and delivering energy to customers. While it may seem counterintuitive to use energy system costs for an analysis that is focused on social welfare, ultimately the changes in energy system costs flow through to ratepayers (NASEO 2026). In practice, it can be difficult to develop suitable avoided energy system cost factors, especially for long-term RIA in jurisdictions where the energy system will undergo major evolutions in the coming decades, but such tools exist in some jurisdictions (CPUC 2024, Synapse 2026).

- Equitable stakeholder engagement should inform which distributional impact metrics are analyzed. Engagement is essential for prioritizing which analytically feasible distributions reflect real-world vulnerability and policy concerns. Generally, the recommended pathway is to include analysis of aggregate financial costs and benefits and aggregate public health outcomes for regulations that affect public health. Typically, it will not be practical to include an analysis of the share of avoided climate damages for priority populations.[5]
- Equity-focused data collection will usually be required for robust distributional RIA (EPA 2024). Data should be collected to characterize how the most consequential model input parameters vary between subgroups of interest.
- The type of discount rate used should follow the intent of the analysis (EPA 2024, Institute for Policy Integrity 2025). For example, societal discount rates should be used for an analysis of the distribution of social welfare impacts and private discount rates for an analysis of the distribution of aggregate financial impacts.
- For DERs, whether energy use should be monetized to represent customer bills or energy system cost will depend on the intent of the analysis (e.g., customer bills when analyzing direct financial impacts and energy system costs when analyzing indirect ratepayer impacts).
- Distributional RIA results should be compared to some relevant benchmark(s) to provide context (DOE 2024a). For example, the percentage of total benefits going to a priority population could be compared to a relevant jurisdictional goal and/or to population proportionality.

Affordability Impacts Analysis

Affordability impacts analysis examines financial impacts for different households, businesses, and organizations in varying circumstances and situations. What is described in this paper as affordability analysis is a form of "situational" analysis and serves an important complement to societal and distributional analyses.[6] The term "situational" impacts analysis is used to refer to analysis of representative cases of how households, business, or institutions might be impacted. This paper focuses on situational affordability analysis, but situational analysis could be used to assess and make transparent how regulations might affect health, comfort, resilience, or other endpoints for individuals in different circumstances. Affordability impacts analysis highlights how financial impacts vary across situations, including differences in income, housing characteristics, energy costs, and access to capital.

Generally, situational affordability analysis for building codes and standards requires less data than distributional impacts analysis, because analysts do not have to estimate the relative prevalence of different situations, which requires access to robust building stock data and detailed census information. However, when sufficient information is available, it is possible to estimate the distribution of affordability metrics across households.[7] In cases where distributional impacts analysis is not possible, situational affordability analysis can help to bridge the gap. Providing situationally specific information about financial impacts

[5] In most cases, avoided climate damages will predominantly be experienced by people outside the jurisdiction of interest. Most jurisdictions are unlikely to have reliable estimates of the share of future climate damages that would be experienced by the jurisdiction's defined priority populations.

[6] In other contexts, situational affordability analysis has been referred to using terms such as "household journeys," "representative households," or "case studies," (NYSERDA 2025, CPUC 2021, CARB 2024).

[7] For example, with sufficient building stock and demographic data, one could estimate the distribution of incremental upfront costs, annual utility bill savings, and lifecycle net present value for the entire population or for subgroups (Wilson, E. et al. 2024).

for different representative consumers, including low income and DAC households, can help stakeholders understand the regulation's financial impacts in ways that may be more transparent and meaningful than estimates of aggregate impacts for a subgroup or for society as a whole. Such situational affordability analysis can also directly help policymakers more tangibly understand how different groups within any jurisdiction would be affected financially.

For example, when assessing the affordability of an efficiency standard for residential equipment, it is important to understand that the ability to absorb the incremental upfront cost of a more efficient appliance is dependent on household income level, renter vs. owner status, utility bill rates, and access to capital. A household with income-eligible reduced utility bill rates may take longer to recoup its initial upfront investment, making the initial incremental costs more burdensome. Consumers who must finance upfront costs via a high-interest credit card will see lower net lifecycle cost savings due to the increased cost of borrowing.

This paper recommends that affordability impacts analyses for building sector policies should include the following core financial metrics:

- Incremental upfront costs: The difference in upfront capital costs between the baseline and policy scenario. Upfront costs can be a barrier to adopting energy measures, even if the measure is cost effective over the measure lifetime. Lower incremental upfront costs can help a measure be cost effective for consumers across various income levels.
- First-year operating cost savings: The annual operational cost savings consumers would experience in the first year of operation of the appliance and/or building.
- Simple payback period: The length of time for the consumer to recoup the full incremental upfront cost of the measure (without applying temporal discounting).
- Net lifecycle benefit: The cumulative costs and benefits over the lifetime of the measure, with future savings discounted to present value using an appropriate discount rate.
- Internal rate of return (IRR): The discount rate that would result in a net present value of zero when considering capital costs and operational costs. This discount rate is equivalent to a "break even" discount rate. For consumers, a measure fails to be cost-effective when the interest rates on borrowing, saving, or investing[8] exceed the IRR.

Choosing the appropriate discount rate for affordability impacts analysis is critical but nevertheless challenging for RIA. Discount rates are used to convert a stream of future costs and benefits ("cash flows") to present value—the equivalent value if those future cash flows were to occur today. In the context of building efficiency policy, the higher the discount rate, the less cost-effective an efficiency measure will be. However, if opportunity costs are underestimated, policies may not properly account for barriers to adoption, particularly for households facing high upfront costs and/or limited access to capital. Different discount rates can be used for different contexts and perspectives, and the appropriate discount rate depends on whose perspective is being considered, the questions the analysis aims to answer, and the geographic region and timeframe of the analysis (Li, Q., et al. 2021; OMB 2023). While a lower discount rate reflecting policymakers' concern with long-term societal welfare is usually appropriate for societal analysis, higher private discount rates are generally more appropriate for affordability analysis focused on financial impacts at the customer level, as they better reflect the real short-term financial constraints faced by individual households

[8] When considering the opportunity cost of funds in the context of building codes or standards, included is the consideration of potential return or benefit foregone when households or building owners invest in energy efficient equipment or other efficiency upgrades rather than in their next best alternative, which varies depending on the consumer.

(e.g., high borrowing costs, limited savings, credit constraints, and income volatility) (NASEO 2026). Because of this variation across groups and circumstances, private discount rates lend themselves to assessing financial impacts for different income-based customer classes. For example, a household financing the purchase of a new appliance with a high-interest credit card will have a different perception of the financial impact of that investment compared to a household with access to a lower interest home equity line of credit or the liquidity to purchase the same appliance in cash.

In practice, DOE uses private discount rates for the life-cycle cost portion of their standards impacts analyses (NASEM 2021). Private discount rates vary across customer subgroups based on income, borrowing access, and alternative investment opportunities, and commonly range from approximately 2% to 11% (DOE 2024c, LBNL 2024). DOE's Life Cycle Cost (LCC) analysis for the 2024 residential clothes washers final rule includes a detailed analysis of how private discount rates can vary by household income group, based on empirical patterns of the opportunity cost of funds for different income groups (DOE 2024c). Lower income groups in the 0-59.9 percentile, represented by groups 1 through 3 in Figure 1, have higher effective discount rates than groups 4 through 6 (which represent higher income households), meaning efficiency measures will be less cost-effective for lower income households.

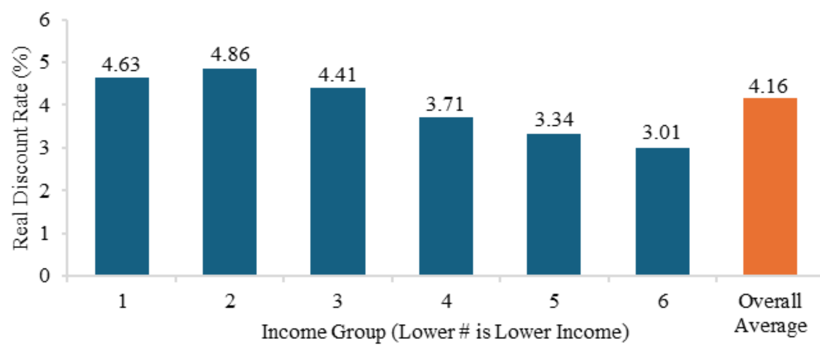

Figure 1: Average Real Effective Discount Rates in the United States. *Source*: DOE 2024c

Of the recommended affordability metrics, IRR is the least commonly used metric and may be less intuitive for some stakeholders, however, this paper found IRR to be a very valuable tool for affordability analysis. More specifically, the use of IRR indicates that consumers will benefit financially from the regulation if their discount rate is less than the IRR. Calculating IRR allows for sidestepping uncertainty about what discount rate to use. For example, for many consumers with limited liquidity, purchase of a more efficient consumer appliance would be financed with a credit card, where interest rates vary, but can exceed 30% for consumers with poor credit history (CPFB 2024). For these consumers, though the exact interest rate they would face may be difficult to discern, an efficiency measure with an IRR that exceeds the credit card interest rate would be cost effective. This approach can be taken when thinking about consumers with even more limited access to credit, for whom financing a purchase may only be possible with support from high interest payday loans or other short-term alternative financing mechanisms, even though the IRR required to make a measure cost-effective may be even higher for such consumers.

In addition to reporting on annual utility bill savings, it can be helpful to expand beyond the core metrics described above and also assess energy burden and energy insecurity. For many lower-income households, a key benefit of efficiency measures may be the resulting reduction in energy burden. A household is considered to have a high energy burden when the total energy/utility costs exceed 6% of the household's income (ACEEE 2019; Forrester, S. P., et al. 2024). Tools like DOE's Low-Income Energy Affordability Data

Tool (LEAD Tool) allow analysts to further understand energy burden by filtering for census tract, building type, building tenure, household income level, and more, supporting a more nuanced affordability assessment. For example, while the average New York low-income energy burden is 8.2%, the average energy burden for a low-income, renter occupied single-family home is 11.76%, and electricity costs tend to make up a higher proportion of energy burden (Ma 2024). When estimating operating cost savings for an efficiency measure, analysts can translate annual reductions in energy bills into reductions in energy burden. This can help contextualize affordability improvements and support qualitative discussions of enhanced energy security.

Energy insecurity is a related but distinct concept from energy burden that captures the lived experience of households struggling to meet basic energy needs, including difficulty maintaining safe indoor temperatures, reliance on unsafe coping strategies, or tradeoffs between paying energy bills and other essential expenses (Hernández, 2016). While energy insecurity is widely recognized in the energy justice literature and increasingly referenced in policy discussions, it is less consistently defined and more difficult to quantify within a conventional RIA. As a result, affordability analysis that focuses exclusively on energy burdens risks overlooking how financial impacts translate into day-to-day hardship, underscoring the need to pair quantitative metrics with qualitative or situational analysis.

While the specific approaches to affordability analysis will vary depending on the questions being asked, broad practical recommendations for constructing robust affordability analyses include:

- Equitable stakeholder engagement should inform which affordability metrics are presented and which situations are analyzed.
- Affordability analysis should, at a minimum, assess and report on: incremental upfront cost, first-year operating cost savings, simple payback period, lifecycle net present value, and IRR.
- Analysts should identify appropriate private discount rates for the different situations, rather than relying on the same, often lower, discount rate used for societal analysis.
- Analysis should explore different ways of contextualizing the benefits of reduced energy consumption, such as quantitative assessments of impact on energy burden and qualitative assessment of what this may mean for households facing energy insecurity.
- For DERs, consider including an analysis of utility bill rate impacts (NASEO 2026).

New York State Appliance Standards: Principles into Practice

Putting this into practice, the authors of this paper conducted a retrospective analysis of a real-world policy and calculated distributional, societal, and affordability impacts. In 2022, the passage of the Advanced Building Codes, Appliance and Equipment Efficiency Standards Act directed New York to adopt statewide efficiency standards for several products and appliances that reduce energy and/or water consumption (New York State 2022). This case study employs the analytical framework proposed in this paper to examine those appliance standards through the three analytical lenses; the intent of this exercise was to understand the impacts and benefits from the **societal impacts analysis** of energy, emissions, and economic impacts, the **distributional impacts analysis** seeking to identify the share of impacts going to DACs in New York and explored **affordability impacts analysis** at the consumer level.[9]

[9] These impacts support statewide goals such as those stated in the 2025 New York State Energy Plan and New York's Climate Leadership and Community Protection Act which, as of 2026, directs New York State agencies

In conducting the **societal impacts analysis**, the authors of this paper developed a stock rollover model, derived input assumptions, and determined target aggregate metrics for assessing societal benefits: energy savings, utility bill savings, monetized climate benefits,[10] global net benefits[11] and net benefits in New York State.[12] An example of a measure analyzed was an air purifier efficiency standard. The analysis estimated that the air purifier standard would provide a cumulative net global benefit of $2.7 billion from 2023-2050. The cumulative net New York State benefit, which does not include monetized climate benefits, is estimated to be just over $2.6 billion from 2023-2050. Gross and net savings are quite close for this standard, as aggregate increased capital costs account to just over $24 million over the analytical period. For this societal impacts analysis, the authors used a discount rate of 2% in alignment with OMB Circular A-4 (Newell, R. G., et al. 2024; OMB 2023).

To facilitate **distributional impacts analysis**, the authors developed allocation factors using New York building stock and census data (Census Bureau 2021). These factors were used to designate the share of equipment installations expected to go to different regions in New York State, different building sectors, and households with different income levels. Utility bill savings were calculated to reflect differences in energy and water prices across New York regions and building sectors. Using the allocation factors, the authors of this paper estimated the portion of benefits accruing to DACs from the suite of appliance standards adopted in 2022. This analysis found that the efficiency standards provided positive net economic benefit proportionally across most metrics, with 50-56% of net economic benefits from individual residential measures benefiting DAC households. Applying this type of distributional analysis can help identify policies with measurable inherent benefits to DACs and can aid in the understanding and determination of policies to ensure policy energy, climate, and equity goals are being achieved.

To understand how cost-effective the standards were for different subgroups, the authors expanded beyond the aforementioned societal and distributional analyses to include detailed **affordability impacts analysis**. Each measure analyzed had an estimated incremental measure cost which remained the same across regions and equity subgroups in the analysis, however the average annual utility bill savings and derivative estimates of lifecycle cost savings, simple payback period, and IRR vary by region and subgroup.

For example, for the residential air purifiers standard, the average annual utility bill savings range from $43 in Upstate New York to $70 in New York City. With an incremental measure cost of $15, all regions in New York had very short simple payback periods as all households recouped their costs in less than four months. Estimating the IRR for air purifiers gives us additional information on the cost-effectiveness of the measure; IRRs for air purifiers range from 286% to 450%. These IRRs are much greater than any typical private discount rate, which tells us that regardless of the interest rate associated with a household's chosen financing mechanism, purchasing the more efficient air purifier will be very cost-effective in the long-run.

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to ensure that DACs receive at least 40% of the benefits of spending on clean energy programs and set a goal of 45% of benefits of clean energy spending going to DACs (New York State 2019, New York State Energy Planning Board & NYSERDA 2026). The New York State Energy Plan further references a target of limiting energy burden for low-income households to less than 6% of household income (New York State Energy Planning Board & NYSERDA 2025).

[10] Monetized climate benefits were calculated using aggregate energy savings and forecasted 2% discount rate social cost of greenhouse gases estimates from the New York State Department of Environmental Conservation (NYS DEC 2023).

[11] Net global benefits are calculated here as the sum of utility bill savings and climate benefits minus increased capital costs, with all future values discounted to present value using the societal discount rate.

[12] Net benefits in New York State are calculated as the utility bill savings minus increased capital costs, with all future values discounted to present value using the societal discount rate.

A major takeaway from the IRR analysis is that, despite variability in IRR across measures and regions, the IRR consistently exceeded 35% for all of the residential measures. Therefore, those measures will be cost effective for consumers unless their discount rate is higher than 35%, which is not plausible regardless of the debt or equity mechanism (DOE 2024c). This finding allowed us to conclude that the standards will have lifecycle financial net benefits, despite uncertainty and variability in consumer discount rates. A deeper distributional analysis, utilizing different discount rates for each equity subgroup could reveal more precise net benefits estimates for each subgroup, but would not change the results of this IRR analysis.

Due to the retrospective nature of this case study, it did not account for the full framework incorporating principles of procedural equity or meaningful stakeholder engagement; however, the use of the analytical components of the framework to calculate different perspectives and impacts from a policy are recommended to be employed alongside procedural equity and transparent engagement to inform policy design into the future.

Meaningful Engagement, Recognition, and Fully Embedding Energy Justice

While the RIA framework can clarify potential impacts and tradeoffs, it cannot determine policy choices alone.[13] Even when societal, distributional, and affordability analyses are conducted rigorously, they require value judgements about which impacts matter most, which populations should be analyzed, and how competing objectives should be weighted. In this context, procedural justice is essential as the mechanism through which analytic priorities are defined and results are interpreted.

The relationship between RIA and stakeholder engagement should be bidirectional. Input from priority populations should inform what metrics, populations, and situations are analyzed, and RIA results should in turn be shared back with communities in an accessible and iterative way, allowing them to informedly influence final decisions and rules. Stakeholder engagement is particularly important for interpreting affordability results, as quantitative metrics such as payback periods or IRRs do not fully capture how households experience financial risk, energy insecurity, or tradeoffs with other essential expenses. Developing equity advisory committees that can be consulted throughout the policy-making process can support this process by providing early guidance, helping interpret technical analyses, and making engagement materials more accessible.

Meaningful engagement goes beyond formal notice-and-comment requirements and involves sustained, two-way interaction with affected communities throughout the regulatory process. This may include co-developing analytical assumptions, validating model outputs against lived experience, and using engagement findings to refine policy design before rules are finalized.

Procedural justice is closely linked to recognition justice. Recognition justice focuses on whether individuals and communities are properly acknowledged as legitimate social actors: whose identities, lived experiences, vulnerabilities, and ways of knowing are treated as valid rather than ignored, mischaracterized, or subordinated to dominant institutional

[13] Impacts vary substantially depending on peoples lived experiences, social positions, and historical exposure to harm, which cannot be fully captured through aggregate metrics. Further, some of the most important benefits and burdens associated with energy and environmental policy, such as dignity, health, autonomy, and community well-being, are difficult or impossible to monetize, even though they are central to people’s evaluation of policy outcomes. Third, different types of impacts, such as upfront costs, affordability, public health, and long-term environmental stability, are fundamentally incommensurable, and reasonable people may place different moral weight on each.

perspectives (van Uffelen, 2022; Jenkins et al., 2016). Engagement processes that formally invite participation but require communities to conform to prevailing technical, economic, or cultural norms to be heard risk reproducing existing power imbalances, even when procedural safeguards are in place. In these cases, stakeholder engagement becomes consultative or symbolic rather than genuinely influential.

Meaningful engagement is crucial because there is no recipe for deciding which policy alternative to adopt based on societal, distributional, and affordability results. Policymakers will want to favor policies that have more societal net benefits, a greater share of benefits for priority populations, and meet affordability expectations across the situations analyzed; however, these indicators often will not align. Policymakers may need to iterate on policy design, develop complementary programs to address affordability gaps, or optimize outcomes across a portfolio of regulations rather than at the level of individual rules.

When transparent analysis is paired with engagement processes that recognize community knowledge as a form of expertise, policymakers are better positioned to anticipate unintended consequences, identify mismatches between modeled outcomes and real-world conditions, and co-develop solutions that are both effective and legitimate.

Conclusion

Energy and climate regulations increasingly shape household affordability, public health, and economic opportunity, not just emissions and system costs. In practice, the impacts of these regulations are filtered through unequal starting conditions, including differences in household finances, energy costs, and access to capital that shape how policies are experienced on the ground. RIA must evolve beyond aggregate net benefits and representative averages to better reflect these real-world constraints.

The framework presented in this paper – combining societal, distributional, and affordability perspectives – provides a practical way to assess whether policies deliver overall benefits, how those impacts are distributed, and whether financial impacts are workable for households and organizations in practice. Rather than treating all households or organizations as starting from the same baseline, this approach makes visible how impacts vary across populations and situations, and where policies that appear cost-effective on average may still create affordability challenges or uneven outcomes. The New York Appliance Standards example illustrates how this approach provide a tangible understanding of the societal, distributional, and affordability impacts for households.

At the same time, energy justice-focused RIAs cannot serve as a decision-making tool in a vacuum. Regulatory impacts are often incommensurable, and reasonable people may weigh affordability, health, and long-term environmental outcomes differently. Analysis should therefore inform, rather than dictate, policy choices. Procedural justice plays a critical role in translating analysis into equitable outcomes: engagement with affected communities should shape what is analyzed and how results are interpreted, while transparent RIA can support iterative policy design and complementary interventions where needed.

By pairing rigorous analysis with meaningful engagement, regulators can design clean energy and climate policies that are not only cost effective, but also affordable, equitable, and responsive to lived experience. This framework and applied example will hopefully inspire policymakers to take practical steps toward this vision, such as collecting foundational data, adding situational affordability analysis to an RIA, or establishing an equity advisory group, to better account for the realities of people, not averages.

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