From Cost Hurdle to Market Asset: How Program Administrators Can Use Certified Attributes to Help Fund and Measure Equitable Building Decarbonization

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ABSTRACT

Equitable building decarbonization programs, rapidly expanding nationwide, face financing gaps that impede deep retrofits in low- and moderate-income (LMI) housing. Local government and utility program incentives often fail to cover the full costs of safety, energy efficiency, electrification, and renewable energy upgrades, leading to significant need for supplemental funding or revenue to move projects forward. Structural barriers historically have prevented residential building upgrades from generating carbon market revenue. Additionally, evaluation protocols, dominated by deemed savings and annual emissions factors, tend to obscure these interventions' true impact on the grid and carbon emissions.

Recent ACEEE and Rewiring America analysis suggests demand-side energy resources could alleviate capacity constraints from emerging load growth. Their research describes how new financial and M&V models leveraging granular Energy Attribute Certificate (EAC) platforms can provide revenue while supporting grid capacity requirements for new large loads. We extend this research by documenting case studies from organizations using Automated M&V (AM&V), and systems recording hourly granular EACs, to finance efficiency and electrification projects and how transparent tracking methodologies are being developed. We also modeled scenarios to understand project types most likely to support EAC revenue. Our research finds meaningful revenue generation is achievable, and we outline a framework for integrating these platforms into LMI program operations.

Our goal is to create new revenue streams by enabling carbon market buyers to purchase premium credits generated via equitable building decarbonization. This mechanism promises not only new funding sources but also fundamentally shifts a program's equity focus from a cost hurdle to a scalable market asset.

Introduction

Housing affordability and habitability in the U.S. can be improved while simultaneously addressing climate change. Nearly all the 125 million homes in the U.S. will need energy-related upgrades by 2050, and an estimated 45 million homes need additional habitability repairs (Webster 2024, Divringi 2023). Among low-income Americans, the need is particularly acute, with over 25% spending at least 15% of their income on energy bills (Drehobl, Ross, and Ayala 2020). Data center proliferation, regulatory uncertainty, and geopolitical instability threaten to push energy costs higher, placing even greater strain on family budgets and wellbeing.

Programs designed to deliver safety improvements, home repair, energy efficiency upgrades, electrification, and onsite renewable energy to low- and moderate-income (LMI) housing have expanded rapidly in recent years. There is growing attention to “equitable” building retrofits, which refer to energy efficiency upgrades and decarbonization measures that are designed to be accessible, affordable, and beneficial to all, particularly LMI and vulnerable populations. They emphasize the importance of ensuring that the benefits of these upgrades and measures are shared fairly and the process is inclusive and supportive of all stakeholders.

Yet the funding and financing architecture underlying most of these programs has not kept pace with the scale of what is needed. Traditional program models rely primarily on incentive payments or rebates calibrated to offset a portion of project costs, plus grant funding or significant property owner co-pays. When a building has significant deferred maintenance, health and safety issues, or needs substantial electrical infrastructure upgrades before electrification is feasible, the gap between available incentive dollars and total project cost can be substantial. For many households and the organizations serving them, that gap is the difference between a project moving forward and one that never materializes. This challenge is compounded by the recent erosion of federal funding and financing support, which has made supplemental revenue streams more important than ever.

This paper seeks to address one of the major opportunities to address this gap: the development of private sector incentives that allow program administrators to capture and monetize more of the value of the work they do. Deep retrofits in LMI buildings generate benefits that extend well beyond reduced utility bills, including improved indoor air quality, reduced health risks from extreme weather, lower greenhouse gas emissions, and contributions to a more resilient and flexible grid. Yet the current program landscape offers no straightforward pathway to translate those co-benefits into project funding. Carbon reductions and improved grid performance go uncompensated. Health and resilience outcomes remain off the balance sheet. As a result, organizations like Elevate, a non-profit that has administered energy and housing programs in frontline communities for decades, must continually seek public and private subsidies that require complex braiding of available incentives and financing sources to make project finances pencil.

An underlying reason these secondary values are so difficult to capture is that most program evaluation frameworks are not equipped to measure actual outcomes. The predominant approach relies on deemed savings estimates, which assign a fixed value to a given measure based on engineering calculations. Deemed approaches serve important administrative purposes, but are a poor foundation for verifying real-world energy savings, carbon reduction, or grid impacts with the transparency and granularity that emerging markets increasingly demand. When a program installs a heat pump in a particular building on a particular grid, the actual carbon intensity and demand reduction that retrofit delivers varies considerably depending on what regional generators are running at that moment. Deemed estimates cannot capture that variation, and cannot support the auditable, time-stamped documentation that corporate buyers of carbon and energy attribute claims, grid operators, or carbon markets require.

A recent convergence of tools and market conditions suggests a promising path forward. Energy Attribute Certificates, or EACs, are a kind of market-based instrument that has long been used in the electricity sector to track the environmental attributes of renewable generation on an hourly basis. More recently, the same logic has been extended to the demand side. Avoided load and avoided emissions can be tracked with comparable granularity using Automated

Measurement and Verification (AM&V) platforms that analyze interval meter data in real time and compare it against modeled baselines. When an energy efficiency package, decarbonization measure, load-shifting device, or on-site renewable energy installation reduces or shifts consumption during a period of high grid carbon intensity, that reduction can be documented, timestamped, and issued as a certificate that can be sold to buyers in the carbon market or utilities seeking to verify demand-side capacity resources.

This creates the possibility of a revenue stream that did not previously exist, and is of particular relevance for LMI-focused program administrators. Rather than functioning solely as subsidy providers dependent on braided funding, organizations administering equitable building retrofit programs could begin to function as asset originators, generating certificates with market value from the verified impacts of their work. While EACs can be generated from any residential efficiency and electrification retrofits, instrument buyers have increasingly integrated social impact criteria into their offtake approaches. The equity mission would not change, but the financial structure could, in ways that might help reduce the funding gap that has long constrained the scale and depth of this work.

This paper, which draws on work by Elevate, WattCarbon, and WSP, explores that possibility through the specific lens of building retrofit program design aimed at driving investment into LMI communities. We examine why building energy efficiency and decarbonization have historically struggled to be valued in carbon markets, how measurement and verification practice is evolving, and what promising new tools and concepts are emerging. We describe forward-looking program design scenarios that illustrate these approaches in practice and conclude with recommendations for program administrators, buyers, funders, and policy advocates interested in unlocking the full value of equitable building retrofits and clean energy upgrades.

Barriers to Monetizing Building Retrofits Through Carbon Markets

Efforts to monetize energy efficiency and building electrification retrofits through carbon markets date back more than two decades. Although it is well established that these interventions deliver real emissions reductions (Langevin et al. 2023), carbon market mechanisms have struggled to translate energy efficiency and building decarbonization projects into scalable, investable revenue streams. This section reviews prior attempts to monetize building retrofits and synthesizes key structural barriers that have limited their effectiveness.

Carbon Market Overview

Carbon markets turn environmental outcomes like reducing emissions or saving energy into something that can be bought and sold. In these markets, organizations that run projects (such as clean energy installations) generate credits or certificates that represent those benefits. These credits are tracked in registries and can be bought directly, through brokers, or on exchange platforms. Buyers include companies with sustainability or ESG (Environmental, Social, and Governance) goals, as well as regulated organizations—such as utilities or industrial companies—that are required by policy to reduce emissions or procure clean energy. They purchase and retire these credits (or take them out of circulation so they may not be resold) to meet climate targets, report on emissions, or demonstrate broader sustainability commitments. As demand has grown, many buyers are looking for higher-quality credits that show when and where impacts occur and whether they deliver additional benefits, such as community investment. The revenue from these purchases flows back to project developers and program implementers, helping fund and expand new activities.

A Two-Decade History

The first attempts to credit building energy efficiency emerged with the Kyoto Protocol framework, adopted in 1997, under the United Nations Clean Development Mechanism (CDM), which developed multiple methodologies for building retrofits, including HVAC upgrades, envelope improvements, lighting, and fuel switching. Projects such as the Kuyasa low-income housing retrofit program in South Africa demonstrated that aggregated residential interventions could, in principle, be credited through carbon finance frameworks (Kuyasa CDM Project 2009). Subsequent voluntary carbon market (VCM) projects, including Maine Housing's weatherization program under Verra's Verified Carbon Standard (VCS) established in 2005, extended this approach to the US context. While these initiatives established technical feasibility, they failed to generate adequate revenue to meaningfully accelerate the adoption of building energy efficiency measures.

Barriers with Existing Methodologies and VCM Standards

While measurement complexity has limited the applicability of existing methodologies, it has not been the primary factor constraining market uptake. Historically, the more significant barrier has been weak and volatile carbon prices—particularly in U.S. and voluntary markets—which have limited revenue potential for building retrofit projects. In this context, methodological complexity, high transaction costs, and long development timelines further erode project economics, making it difficult for distributed energy efficiency programs to participate at scale.

Through review of existing methodologies and VCM standards, the authors found they are not well suited for measuring savings from building retrofits. Residential retrofits in particular require methodologies and standards that 1) accommodate a variety of measures including weatherization, heat pumps, heat pump water heaters, appliances, and on-site renewables or storage, 2) are flexible with respect to project location, and 3) accommodate a range of available data for the quantification of baseline and project emissions.

We conducted a comparative analysis of established methodologies across multiple VCM standards to assess if any substantially matched typical residential building decarbonization retrofit delivery models, or if a new or modified protocol must be established. Table 1 compares representative CDM, Verra, and Gold Standard methodologies, highlighting differences in baseline development, quantification approaches, and eligibility criteria that constrain their use for deep residential retrofits.

Methodology	**Inception**	**Property Types**	**Fuel Switch Allowed**	**Baseline Develop-ment**	**Project Quantifi-cation**	**Eligibility**
AM0091: Energy Efficiency Tech and fuel switching in new and existing building	2011	Residential (SF, MF), Commerc, Institutional	Yes	Modeling	Modeling	Large Scale (>60 GWh/year)
AMS-II-E. Energy efficiency and fuel switching measures for buildings	2002	Residential (SF, MF), Commerc., Institutional	Yes	Historic Billing Data	Actual Billing Data (Crediting Period)	Small Scale (<60 GWh/year)
AMS-II.R. Energy efficiency space heating measures for residential buildings	2013	Residential (SF, MF)	Yes	Historic Billing Data	Actual Billing Data (Monitor every 2 years)	Small Scale; Space heating only; Resi. only
VM0008v1.1 Weatherization of Single Family and Multifamily Buildings	2012	Residential (SF, MF), Mobile Homes	No	Energy Audit	Energy Audit	Residential only
Thermal Performance Improvements in Low-Income Dwelling Structures	2017	Residential (SF, MF)	Yes, but not explicitly	Modeling	Modeling; Continuous thermal comfort monitoring	Space heating only

Table 1. Established methodologies for quantifying and credit emissions reductions from energy efficiency projects

As shown in Table 1, across standards, existing methodologies share similar features that limit their applicability to deep residential retrofits, including:

- Procedures for modifying established methodologies can be lengthy (12+ months) and subject to long review backlogs. In some cases, the methodology approval process may not include peer review or public disclosure of review comments.
- Methodologies may narrowly restrict project locations (e.g., to non-Annex I countries under the Kyoto Protocol)
- Registry and validation fees are high relative to per-building emissions reductions. Managing these costs incentivizes projects to aggregate verification and issuance events across hundreds of buildings and multiple years of reporting data, lengthening the cycle between project initiation and revenue realization.

Several additional barriers have historically prevented comprehensive residential retrofits from being monetized through existing carbon markets. Market signals for emissions avoidance credits from building retrofits have been persistently weak. Chronic oversupply in the voluntary carbon market through the late 2010s suppressed prices for all carbon credits, limiting revenue relative to project development costs. Most VCM procurement during this period occurred on spot markets, where credits are purchased for immediate delivery at current market prices rather than under long-term contracts, placing market and delivery risk almost entirely on project developers in a way that discourages investment in small, distributed projects (such as energy efficient building retrofits). In more recent years, spot market purchases have declined in favor of forward offtake agreements where buyers commit in advance to purchase future credits at agreed terms (e.g., price, timing, or volume), improving revenue certainty for project investors.

Additionality concerns have compounded demand-side challenges. Building retrofits frequently intersect with ratepayer incentive programs, public subsidies, and local regulatory requirements, complicating claims that carbon revenue is decisive in enabling project implementation. Even when those incentives only partially offset costs, the presence of overlapping support mechanisms can undermine EAC buyer confidence in the incremental impact of carbon finance. As a result, even demonstrably underfunded retrofit programs can fail to meet buyer expectations for additionality, further weakening demand for credits.

Lastly, the growing corporate emphasis on net-zero targets has created a third barrier. Guidance such as the Oxford Principles for Net Zero Aligned Carbon Offsetting and the Science Based Targets Initiative Corporate Net Zero Standard emphasizes the use of carbon dioxide removal to neutralize residual emissions rather than avoidance-based credits (University of Oxford 2020, SBTi 2026). In response, evolving net-zero guidance has begun to shift large corporate buyers' procurement away from emission reductions project types toward carbon dioxide removal options such as afforestation and direct air capture, further constraining demand for retrofit-based credits (Balaji 2025).

From Deemed Savings to Automated M&V

Many of the barriers described above share a common root, the inability to demonstrate that a building retrofit delivered real savings at a real place and time. Addressing the additionality problem, satisfying transparency-focused buyers, and competing with carbon removal projects all require the same foundation of improved measurement.

Today, most energy efficiency programs rely on deemed savings values. These are engineering estimates that assign a fixed energy reduction to a given measure. For example, replacing a gas furnace with a heat pump might be deemed to save a set number of therms per year based on climate zone, building type, and equipment specifications. These population-level averages serve a useful function in program evaluation, where administrators need to estimate aggregate portfolio impacts. But this approach is inadequate for market transactions, where a buyer needs to verify what actually happened at a specific building.

The gap between deemed and metered savings can be substantial. A landmark evaluation of California's Whole House + Retrofit program (the predecessor to PG&E's Advanced Home Upgrade) found that actual electricity savings were a fraction of what the program's simulation tool predicted. PG&E's Advanced Path projects showed a gross realization rate of just 7.7% for electricity; the modeling tool predicted average savings of 2,654 kWh per year, while billing analysis showed actual savings of only 203 kWh per year (DNV GL, 2014). Gas savings fared somewhat better but still showed a realization rate of only 21.4%. At the individual building level, less than 10% achieved electric savings greater than 30%. This is not an isolated finding; a randomized controlled trial of the federal Weatherization Assistance Program covering roughly 30,000 households found that model-projected energy savings were more than double the savings realized vs billing data analysis (Fowlie, Greenstone, and Wolfram, 2018).

From Annual Averages to Hourly Marginal Emissions

Beyond the deemed-versus-metered question, the reliance on annual average emissions factors is a second measurement limitation constraining the value of building retrofits. The carbon impact of a kilowatt-hour saved depends on when that savings occurs, because the local grid's generation mix varies hour to hour. This concept, which appears in attributional emissions accounting under the 24/7 Carbon-Free Energy (CFE) construct and under consequential emissions accounting under the "emissionality" banner, has gained traction in carbon accounting research (Brander 2021)[1]. The EPA's AVERT model, WattTime's marginal emissions data, and academic work on hourly emissions accounting all point in the same direction: annual average emissions factors obscure the true carbon impact of demand-side interventions (Elenes 2022). For building retrofits that switch fuels, shift load profiles, and change heating and cooling patterns, hourly emissions analysis can reveal carbon value that annual approaches miss entirely.

Automated M&V: Principles and Practice

AM&V is an emerging evaluation concept that seeks to address both of these gaps. AM&V uses continuous meter data and statistical modeling to quantify energy savings at the site level, at hourly or sub-hourly intervals, on an ongoing basis. Rather than applying a deemed value once at the time of installation, AM&V systems construct a counterfactual baseline (what the building's consumption would have been absent the intervention) and compare it against actual post-intervention consumption.

Several properties distinguish AM&V from traditional program evaluation. Performance is measured at the individual building level rather than inferred from a population average, and savings are resolved to hourly or sub-hourly intervals, enabling carbon and capacity impacts to be attributed to specific periods rather than averaged across a year. Because monitoring is continuous, the approach also detects performance degradation, seasonal variation, and anomalies over time rather than assuming static post-installation savings. Underlying models, data inputs, and baseline assumptions are documented and accessible, providing the auditable methodology that carbon markets and grid operators require.

From Verified Performance to Certified Assets

The WEATS Registry

Although AM&V principles can improve the accuracy of measured impacts, measurement alone does not create a market asset. Verified savings must be standardized,

[1] Emissionality is an emerging practitioner term describing the degree to which an intervention reduces real-world emissions by displacing higher-emitting sources, i.e., the amount of avoided marginal emissions it creates.

registered, tracked, and made transferable before they can be bought and sold. This is the function of an energy attribute tracking system. An example of this is the WattCarbon Energy Attribute Tracking System (WEATS), a new, independent registry that issues hourly EACs backed by AM&V data. Each EAC carries a unique serial number, a timestamp, and three categories of verified attributes: energy (kWh saved or generated), capacity (kW of peak demand reduced), and carbon (tons of CO_2 avoided, calculated using hourly emissions factors). Meanwhile, WattCarbon's companion Aristotle tool fulfills the measurement side of this process, applying IPMVP methodologies to utility advanced metering infrastructure data to continuously quantify building-level energy savings, peak demand reductions, and carbon impacts at hourly resolution.[2]

This tri-attribute hourly structure differentiates EACs from Renewable Energy Certificates (RECs), which typically carry a single attribute (renewable generation), operate at annual or monthly granularity, and rely on self-reported or periodically audited generation data. Table 2 summarizes the key differences between RECs and EACs.

Attribute	REC	EAC
Energy	Renewable generation only	Generation and verified savings
Capacity	Not tracked	Peak demand reduction (kW)
Carbon	Inferred from average grid factor	Hourly marginal emissions basis
Granularity	Annual or monthly	Hourly
Verification	Self-reported or audited	Continuous meter-based AM&V
Tracking	Generation only	Generation, savings, and demand reduction

Table 2. Comparison of RECs and EACs on key attributes.

WEATS also maintains a complete chain of custody for each certificate, covering issuance, ownership transfers, and retirement. The registry prevents double-counting by ensuring that each unit of verified performance is issued only once and can be retired only once. This audit trail is essential for regulatory compliance and corporate sustainability reporting.

The EAC Pipeline from Building Retrofits

The path from building retrofit to certified asset follows a logical sequence. A building first receives energy efficiency or electrification upgrades. Historical, pre-retrofit utility data from all relevant fuel sources is submitted along with retrofit project features to Aristotle, along with post-retrofit interval usage data when available, which constructs a baseline and continuously measures post-retrofit performance. From that data, the platform quantifies hourly energy savings and calculates the carbon impact using hourly emissions factors for the relevant grid region, supplemented by standard factors where gas savings are present. WEATS then issues

[2] The International Performance Measurement and Verification Protocol (IPMVP) is a globally recognized framework that defines best practices for quantifying and verifying energy and water savings.

EACs representing these verified attributes, each carrying a unique serial number, timestamp, and tri-attribute data (energy, capacity, carbon). The program administrator or asset aggregator offers those certificates to buyers, and an offtaker (such as a corporate buyer) purchases and retires them for their own use, such as for carbon emissions reduction goals or to offset their energy consumption for Scope 2 or Scope 3 reporting. This pipeline transforms a one-time retrofit into an ongoing stream of certified instruments. The building continues generating EACs as long as it continues performing, creating a durable asset from a fixed investment.

Will Buyers Pay a Premium for LMI-Sourced EACs?

Corporate sustainability procurement has evolved beyond simple compliance. Companies with ambitious ESG commitments increasingly seek environmental purchases that deliver verifiable co-benefits like local community impact, equity outcomes, workforce development, and measurable grid contributions. Generic RECs, which often represent undifferentiated renewable generation with no locational or social attributes, are facing growing skepticism from corporate sustainability teams, investors, and standards bodies. In contrast, EACs generated from LMI building decarbonization carry a distinct set of attributes that align with this demand.

The attribute most likely to carry immediate value today is verified local grid impact. Hourly attribution can clearly show when and where demand was reduced, with corresponding carbon and capacity benefits that generic certificates cannot provide. These attributes can be directly monetized as high-integrity environmental claims tied to real, time- and location-specific outcomes. At the same time, when projects are deployed in LMI communities, they deliver additional co-benefits (such as reduced energy burden, improved indoor air quality, air conditioning, and support of local workforce development) that align with many buyers' environmental justice and ESG commitments.

While these community outcomes are not typically priced directly within credit transactions, the ability to trace impacts to specific households or communities can strengthen the overall value proposition, particularly in procurement contexts that emphasize place-based investment or community benefits. For example, an organization like Elevate could provide certificates associated with a specific efficiency measure (such as a heat pump and weatherization installation in a defined community) enabling a level of specificity and transparency that is difficult to achieve with conventional instruments. In this way, the attribute-based framework monetizes verifiable energy and carbon outcomes while enabling differentiated, demonstrable co-benefits for participating communities.

Putting it Together: How Big an Opportunity is this for Practitioners?

Before assessing the revenue potential of LMI-sourced EACs, it is worth being clear about what the market currently does and does not tell us. The EAC market for building energy efficiency, electrification, and other demand-side resources is early stage. Unlike the REC market, which has decades of trading history and published price indices, EAC pricing is still being established through bilateral transactions and forward purchase agreements, and no clearinghouse exists to provide transparency into prevailing prices. There is, at present, no publicly available evidence that EACs are selling at a premium attributable to their equity or community attributes. Overall corporate demand for ESG-linked instruments has softened in some U.S. contexts, driven by increased scrutiny of ESG claims, political polarization, and shifting investor priorities. However, this has coincided with a parallel shift in buyer preferences toward higher-integrity, more transparent environmental assets. The thesis advanced in the previous section (that equity-oriented EACs may garner premium prices) should therefore be understood not as a function of increasing demand volume, but as a function of evolving demand quality, grounded in the direction of corporate ESG procurement trends and the logic of differentiated attributes, such as time and location specific impact and auditable performance. However, this remains a hypothesis that the market has not yet fully validated.

A central question motivating this research is whether EAC revenue can meaningfully contribute to closing the financing gap described in the introduction, and if so, under what conditions. The answer, based on our analysis, is conditional but promising. Not all projects may make financial sense, and understanding why starts with how costs and revenue might relate to each other. Administrative costs, including data collection, reporting, and platform fees, are largely fixed on a per-unit basis regardless of retrofit scope. Revenue, however, is highly variable because the volume (and price) of EACs a project generates is a direct function of its carbon savings and other attributes, which vary considerably depending on retrofit type, baseline fuel use, and local grid carbon intensity. Not every project will generate enough EAC revenue to justify the cost of producing certificates.

To understand which project types are most likely to support viable EAC revenue, Elevate and WSP modeled scenarios across three key variables. The first is annual emissions reductions per unit, ranging from 0.64 to 8.1 tCO2e, which represents an estimated minimum and maximum potential savings drawn from historical Elevate program data on whole-home electrification retrofits in the Midwest. The second is EAC offtake price, ranging from approximately \$14 per tCO2e representing mid-tier spot market REC conditions to \$200 per tCO2e reflecting a theoretical equity premium. The third is crediting period length, spanning five to fifteen years consistent with the useful life of common retrofit measures.

Our findings indicate that meaningful revenue generation is achievable when these three variables align favorably. Depending on the region of implementation, projects involving significant natural gas displacement through electrification may generate high carbon savings, especially where the electric grid is powered by cleaner energy, and therefore may garner the strongest carbon-attributed EAC value. In the same vein, projects that are likely to generate a high volume of grid-impact EACs are those involving load shifting technologies like heat pump water heaters with smart controls or thermal storage systems.

When higher carbon savings or grid impact combines with a premium offtake price and a crediting period reflecting the full useful life of installed equipment, EAC revenue can reach into the thousands of dollars per project, representing a meaningful contribution to the overall funding stack alongside available incentives and public subsidy. This represents a new revenue opportunity for stakeholders like property portfolio owners and program administrators, under the assumption that verified and certified demand-side attributes are a product that today's buyers want to purchase and the market will only develop further as standardization increases and buyer demand grows. Portfolio scale matters here as well. Minting costs are modest relative to revenue in higher-performing scenarios, and aggregation reduces their per-unit impact further.

Putting it Together: How Would Practitioners Integrate EAC Revenue into Program Operations?

One important barrier to making EAC revenue viable in practice is timing. Retrofit capital must be deployed upfront while revenue accrues gradually over years as carbon savings and grid impacts accumulate. Addressing this mismatch is not a new problem, as it resembles existing green lending and Pay-As-You-Save structures already demonstrated in the energy efficiency sector. Two potential revenue models address this challenge in different ways. Under a forward purchase agreement, a buyer would commit to purchasing EACs from a portfolio of projects before deployment, providing upfront capital that helps fund retrofits at the outset (see the Harvest/True Ventures case study). Alternatively, EACs could be issued as savings accrue and sold on an ongoing basis, being recouped in a revolving program fund or supporting debt service on project financing. Beyond these two models, developing EAC-backed financing structures that pull future revenue forward to capitalize present construction costs, potentially in partnership with mission-aligned investors, is a priority area for future work.

For program administrators, EAC revenue should be viewed as a way to supplement existing funding to close gaps rather than replace other sources. For example, consider a project scenario where a standard $3,000 utility incentive can be combined with $5,000 from available federal or state programs. But because no homeowner copay is typically desired for LMI customer projects, an initial $5,000 gap remains. To eliminate this shortfall, administrators can leverage certificate revenue through forward purchases or ongoing sales. Modeled at $50 per megawatt-hour over a ten-year period (a rate comparable to REC prices in high Renewable Portfolio Standard (RPS) markets), this mechanism generates the missing $5,000 to fully fund the project.

Regulatory Considerations

Ratepayer-funded energy efficiency program designers will recognize an immediate question about attribute ownership: If retrofits are funded partly or wholly by ratepayer dollars, who owns the resulting EAC attributes? This is an open policy question that has not yet been definitively resolved in most states. The answer likely depends on framing. EAC revenue could be directed back to the program to reduce the ratepayer cost of achieving the next increment of savings. It could alternatively fund projects that would not proceed at current incentive levels, extending program reach without increasing ratepayer costs. Or the premium above standard EAC rates could be treated as a distinct value stream reflecting co-benefits not captured in the ratepayer-funded energy savings calculation. Program administrators exploring EAC integration should engage their state public utility commissions early to establish clear ownership and revenue allocation frameworks, and also begin thinking through future participant agreements and messaging around transferring the value of energy attributes similar to how solar programs have managed REC ownership for some time.

Case Studies: AM&V and EACs in Action

Harvest Thermal and True Ventures: EAC-Financed Electrification in Truckee, California

In the Truckee-Tahoe region of California, where winter temperatures regularly drop below zero, Harvest completed a decarbonization project in affordable multifamily housing funded through advance purchase of EACs (Harvest Thermal 2025). True Ventures, a technology venture capital firm, purchased the EACs upfront as part of their net-zero pledge, providing the capital that enabled deployment of Harvest's Smart Thermal Battery systems in buildings where gas heating would otherwise have remained the default.

Harvest's Smart Thermal Battery combines a high-efficiency heat pump with a thermal storage system controlled by machine learning algorithms. The system heats water in insulated storage tanks during midday hours, when California's grid runs on more than 54% renewable generation, and releases stored heat during morning and evening peak periods when grid electricity is more expensive and carbon-intensive. This load-shifting capability means the system is not just electrifying heating but also aligning heating demand with the cleanest and cheapest hours on the grid.

After these systems were installed, residents experienced up to 30% reductions in energy bills compared to their previous gas heating systems. The Smart Thermal Battery achieved 90% emissions reductions relative to gas furnaces and 40% lower emissions than conventional heat pumps operating without thermal storage. WattCarbon's Aristotle platform provides continuous measurement and verification of each installation's performance. Hourly device data feeds into baseline models that quantify energy savings, peak demand reduction, and carbon impact using emissions factors specific to the California/Nevada grid region. WEATS issues hourly EACs reflecting these verified attributes. The hourly resolution makes it possible to capture the value of midday-to-evening load shifting that annual or monthly measurement would simply average out.

True Ventures' advance EAC purchase provided project financing before installation began. This is the forward purchase model described earlier. For the affordable housing residents, the alternative was continued reliance on gas furnaces. The EAC revenue helped close the financing gap.

Transsolar and Solar Holler: EAC-Funded Solar in Appalachian Coal Country

In a partnership announced in 2024, Transsolar, a German climate engineering firm, purchased EACs from WattCarbon representing over 200 tonnes of CO_2 reductions from rooftop solar projects in West Virginia built and operated by Solar Holler, a local Appalachian solar developer (Transolar 2024). The capital from EAC purchases flows back to Solar Holler, reducing the cost of solar panels for their customers and accelerating deployment of new projects.

West Virginia's electrical grid is 89% coal-fired. This means that every kilowatt-hour of solar generation in West Virginia displaces coal, the most carbon-intensive fuel source. WattCarbon's hourly M&V and emissions analysis estimated that a single rooftop solar panel in West Virginia has approximately 150 times the carbon reduction impact of the same panel installed in Vermont, which runs on a largely hydro and nuclear electric grid. This outsized carbon impact would not be reflected in a traditional REC market. Across their portfolio, Solar

Holler projects have avoided over 23 million pounds of coal combustion, and residential customers save an average of $1,407 per year on energy bills.

Each EAC is backed by hourly solar generation data verified through Aristotle and registered in WEATS with a unique serial number. Transsolar pays to retire the certificates against its own operations, supporting its corporate climate commitments with verified, high-impact reductions. Transsolar reported that they chose to purchase EACs from Solar Holler's West Virginia projects rather than cheaper, undifferentiated alternatives precisely because of the high-impact attributes these certificates carry. This is early evidence that these kinds of co-benefits can command a price premium, and they are the same attributes that equitable building energy efficiency and decarbonization programs generate.

Case Study Findings

Taken together, these two case studies reveal several patterns relevant to program administrators considering EAC integration. Most fundamentally, forward EAC purchases can function as project financing rather than just post-hoc accounting instruments, as RECs typically do. In both cases, corporate buyers provided capital that directly funded project deployment, representing a genuinely different and potentially transformative use of environmental certificates for programs managing funding gaps. Both cases also illustrate how hourly granularity reveals value and an understanding of impact that annual measurement obscures. The Harvest project's 40% carbon improvement over standard heat pumps and Solar Holler's outsized regional carbon impact may be invisible to traditional accounting. Also, the non-energy co-benefits that LMI programs generate are no longer incidental but central to the entire transaction. In both examples, the corporate buyer chose these EACs because of their community impact.

Emerging Use Cases: VPPs and the Data Center Opportunity

An exciting and possibly larger opportunity than presented by the cases studies is now emerging as policymakers, utilities, and grid operators grapple with unprecedented electricity demand growth. In this case, energy reduction programs could contribute verified capacity that serves as a direct mechanism for managing the grid impacts of data center expansion.

The Data Center Opportunity

Recent research has quantified the scale of the opportunity. The ACEEE report "Faster and Cheaper" finds that energy efficiency achieves savings at approximately $20.70 per MWh, below all supply-side alternatives, and that the United States has between 60 and 200 GW of load flexibility potential within the next decade (Specian and Aquino 2026). Rewiring America's "Homegrown Energy" report demonstrates that residential heat pump upgrades alone could create 30 GW of grid capacity nationally, approximately one-third of projected additional data center capacity needs through 2029, at a cost comparable to new gas generation (Wyent, Verma, & Kanj 2025).

These findings establish that demand-side resources are economically competitive and physically sufficient to address a substantial share of data center-driven load growth. The missing element is verification infrastructure. Data centers and their corporate owners need to demonstrate that their capacity claims are backed by independently verified, continuously monitored performance data, and utility regulators evaluating large-load interconnection applications need confidence that proposed demand-side offsets are real and reliable. This is the function that AM&V and EAC certification provide. A data center seeking to interconnect in a capacity-constrained service territory could procure EACs representing verified peak demand reductions and could maximize societal benefits by working through LMI community-focused program administrators or platforms. This would effectively drive investment into these underfunded program efforts while ensuring the benefits flow to those who need it most.

Connecting Data Center Growth to Community Investment

For policymakers and for building energy efficiency and decarbonization program designers, hourly certified attributes provide an accounting infrastructure that can connect data center load growth needs to community investment in a traceable and enforceable way. The mechanism is straightforward in concept: A utility or regulatory body establishes a requirement, through tariff, order, or voluntary program, that new large-load customers must procure a specified share of their demand from local distributed energy resources. A program administrator then deploys energy efficiency, load shifting, or distributed energy resource (DER) retrofits with a focus on LMI housing. An AM&V platform continuously verifies performance at hourly resolution, and a registry issues EACs representing the verified attributes. The large-load customer purchases and retires those certificates to satisfy its procurement requirement and revenue flows back to the program administrator, funding additional retrofits.

We envision this creating a virtuous cycle in which data center demand for verified capacity generates revenue that funds LMI building retrofit programs. The community benefits, including lower energy bills, improved housing quality, and local jobs, would not be incidental to this arrangement. They could be part of what makes the EACs premium products that buyers would pay for. Several policy mechanisms could enable this framework, including utility tariffs with local DER procurement requirements, state regulatory direction to explore EAC-based funding models (especially for LMI programs), and energy efficiency resource standards that recognize EAC-verified savings. In each case, the granular tracking infrastructure described throughout this paper provides the measurement and accounting backbone such policies require.

Conclusion

The funding gap that limits equitable building energy efficiency and decarbonization retrofits remains substantial, but emerging approaches to creating market value presents a credible route for directing capital and investment into the communities with the greatest need. This paper has traced a path from the structural barriers that have prevented building upgrades from generating carbon market revenue, through the measurement and verification innovations that are beginning to overcome them, to new market infrastructure that can translate program impacts into tradeable assets. The tools, approaches, and concepts described here are mostly already operational, as demonstrated by case studies.

What stands to change is not the nature of the work organizations like Elevate do, but whether markets can recognize value that has always been there and largely gone unmeasured. It’s likely that most deep retrofits in LMI households have reduced carbon emissions, freed grid capacity, improved health outcomes, and supported community resilience. What they have lacked is the measurement infrastructure to prove those impacts with the granularity and auditability that buyers, grid operators, and policymakers require. That infrastructure now exists and case studies show EACs can function as project financing opportunities. We believe the emerging data center capacity challenge creates a moment of unexpected alignment between the needs of large energy consumers, utilities and grid operators, the goals of corporate sustainability programs, and the longstanding funding constraints of equitable housing upgrade programs.

There are several actionable steps stakeholders interested in this idea can take. Program administrators should begin exploring AM&V integration and EAC aggregation as extensions of their existing portfolio management functions. They should also begin exploring program designs and measure packages that produce maximum value in terms of carbon reduction and grid impacts. Policymakers and utility regulators should establish clear frameworks for attribute ownership and create procurement pathways that connect large-load customers to local demand-side resources. Buyers, funders, and financial institutions should develop forward purchase and lending structures that bridge the timing gap between upfront retrofit costs and long-term EAC revenue. Taken together, these steps could shift equitable housing upgrades from a mission that depends on constant subsidy to one that generates premium market value.

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