Risk to Resilience: Rethinking Payment Design for Equity and Contractor Engagement

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ABSTRACT

Utilities increasingly rely on contractors to deliver energy efficiency programs, yet little attention has been paid to how payment structures affect contractor participation and financial risk. This paper presents a secondary analysis of 30 semi-structured contractor interviews originally conducted as part of process evaluations of four Xcel Energy commercial and industrial programs, supplemented by a review of industry literature and peer utility practices.

Findings show that contractors face financial exposure from delayed reimbursement, uncertain incentive amounts, and advancing rebates or discounts before utility payment. These challenges are often most pronounced in custom projects and among small and medium-sized contractors (SMCs), which often have more limited access to working capital (Ketenci and Wolf 2024; Herce et al. 2024).

The paper also reviews several payment-design approaches utilities may consider to reduce contractor exposure, including bridge financing, midstream incentives, milestone-based payments, and on-bill financing (Crowell 2019; National Energy Improvement Fund 2024). The findings suggest that payment design can influence contractor participation, market accessibility, and equitable program delivery (McNamara 2024; Keefe Hardin, and Nagedo 2025). The work presented here provides some indications, or trends, on what solutions could be more effective; but this study was not designed specifically to answer this question, therefore more research is needed to further assess the strengths and challenges of the different solutions.

Introduction

Contractors play a central role in delivering utility-sponsored energy efficiency programs (McNamara 2024; Keefe Hardin, and Nagedo 2025). They identify opportunities, educate customers, install equipment, and frequently serve as the primary point of contact between customers and program administrators. As utilities increasingly rely on contractors to achieve energy savings, electrification goals, and market transformation objectives, contractor participation has become an important component of program success.

While substantial research has examined customer participation barriers and program design, comparatively little attention has been paid to how incentive payment structures affect participating contractors. In many downstream energy efficiency programs, incentive payments are issued only after project completion, review, and approval. As a result, contractors may be required to carry receivables for extended periods or provide upfront discounts to customers

while awaiting reimbursement. These challenges may be particularly significant for small and medium-sized contractors (SMCs), which often operate with more limited access to working capital than larger firms (Ketenci and Wolf 2024; Herce et al. 2024).

Evidence from evaluation work and industry literature suggests that payment timing and reimbursement uncertainty may influence contractor experiences, particularly within custom project pathways. Unlike prescriptive programs, custom projects frequently require engineering review, preapproval, savings calculations, and additional documentation (Puget Sound Energy n.d.; RMI 2025). These requirements can extend project timelines and introduce uncertainty regarding final incentive amounts and payment timing. While these processes serve important program oversight functions, they may also create financial exposure for participating contractors.

This paper draws upon 30 semi-structured contractor interviews conducted as part of process evaluations of four Xcel Energy commercial and industrial programs. During review of interview findings, contractor concerns regarding payment timing, reimbursement uncertainty, and rebate advancement emerged as recurring themes across multiple programs. Several contractors described advancing rebates or discounts to customers to facilitate participation, while others discussed the financial challenges associated with delayed reimbursement, changing incentive amounts, and extended approval timelines.

To better understand the prevalence of these challenges and potential approaches for addressing them, we supplemented the interview analysis with a review of industry literature, publicly available evaluation reports, and examples of payment structures used by utilities and program administrators. These approaches include midstream incentives, bridge-financing mechanisms, milestone-based payments, and on-bill financing (U.S. Environmental Protection Agency, ENERGY STAR n.d.). Rather than evaluating a single preferred model, this paper examines how different approaches may address different forms of contractor financial exposure.

Specifically, this paper addresses three research questions:

- How do downstream payment structures create financial exposure for participating contractors?
- How do these risks differ between prescriptive and custom project pathways?
- What program design approaches may reduce contractor exposure while maintaining program accountability, participation, and program performance?

By focusing on contractor experiences rather than customer financing alone, this paper contributes to a growing discussion regarding how program design affects market participation, contractor diversity, equitable access to energy efficiency programs, and the long-term sustainability of contractor partnerships.

Background

Utilities across the United States continue to invest heavily in energy efficiency programs as a cost-effective resource for managing energy demand, reducing system costs, and supporting policy objectives. In 2024, utility-funded energy efficiency programs represented approximately $7.66 billion in annual investment (McNamara 2024). At the same time, utilities face increasing pressure to expand participation and improve equitable access to energy efficiency opportunities (McNamara 2024; Keefe, Hardin, and Nagdeo 2025).

Contractors play a critical role in achieving these objectives. In many commercial and industrial programs, contractors serve as the primary interface between customers and program administrators, identifying opportunities, recommending equipment, completing installations, and facilitating participation in utility incentive programs (Herce et al. 2024). Contractors may be particularly important in reaching small businesses, underserved customers, and harder-to-reach market segments. As a result, contractor participation and capacity have direct implications for program performance, customer access, and energy savings achievement.

While substantial research has examined customer barriers to participation, comparatively less attention has been paid to how program payment structures affect contractors. In many downstream energy efficiency programs, incentive payments are issued only after project completion, review, and approval. As a result, contractors may be required to carry receivables for extended periods or provide upfront discounts to customers while awaiting reimbursement. These financial obligations may be particularly challenging for small and medium-sized contractors (SMCs), which often operate with more limited access to capital and administrative resources than larger firms (Herce et al. 2024).

Prior research has identified financial and operational constraints as persistent barriers for smaller businesses. Studies examining energy efficiency adoption among SMCs have highlighted limited working capital, staffing constraints, and administrative burden as factors affecting participation in energy-related programs (Ketenci and Wolf 2024; Herce et al. 2024). These challenges may be especially pronounced in custom programs, where engineering review, preapproval, and project-specific calculations can lengthen timelines and increase uncertainty regarding final incentive amounts.

Several publications and utility case studies describe approaches intended to reduce contractor financial exposure, including bridge financing, milestone-based payments, midstream incentives, and on-bill financing (Crowell 2019; National Energy Improvement Fund 2024; U.S. Department of Energy, Better Buildings & Better Plants Initiative n.d.; U.S. Environmental Protection Agency, ENERGY STAR n.d.; Puget Sound Energy n.d.). These approaches vary in their applicability depending on program objectives, measure types, and delivery pathways.

Study Context

During process evaluations conducted across multiple Xcel Energy commercial and industrial programs, contractor concerns regarding payment timing, reimbursement uncertainty,

and rebate advancement emerged as recurring themes. Several respondents described carrying receivables while awaiting reimbursement, while others discussed the challenges associated with guaranteeing incentive values prior to final approval. These observations prompted a broader examination of how downstream payment structures influence contractor financial exposure and what approaches utilities have adopted to address related challenges.

To provide additional context, this study incorporates a review of industry literature, utility case studies, evaluation reports, and federal guidance related to contractor financing, payment structures, and energy efficiency program delivery. These sources describe a range of approaches that utilities and market actors have implemented to address different forms of contractor and customer financial constraints, including midstream incentives, bridge-financing mechanisms, milestone-based payments, and on-bill financing (Crowell 2019; National Energy Improvement Fund 2024; U.S. Department of Energy, Better Buildings & Better Plants Initiative n.d.; U.S. Environmental Protection Agency, ENERGY STAR n.d.; Puget Sound Energy n.d.). Rather than evaluating a single preferred approach, this paper examines how these various models align with the risks identified through contractor interviews.

Methods

This paper draws upon 30 semi-structured contractor interviews conducted as part of process evaluations of four Xcel Energy commercial and industrial programs: Lighting Efficiency (CO), HVAC+R (CO and MN), Custom Efficiency (CO), and Efficiency Controls (MN). The original evaluations were conducted as part of Xcel Energy's EM&V activities and were designed to assess contractor experiences, implementation effectiveness, barriers, and opportunities for program improvement.

Data sources.

The primary data source consisted of 30 contractor interviews. To contextualize interview findings, the analysis was supplemented with a review of utility evaluation reports, publicly available case studies, federal guidance documents, and industry literature discussing contractor financing, payment structures, and program delivery models.

Unit of analysis.

The unit of analysis was the contractor organization. Each trade partner organization was counted once regardless of the number of interview participants representing that organization.

Contractor classification.

Contractors were categorized according to reported geographic service territory. Local contractors operated within a single state (n=5), multi-state contractors operated across multiple states but fewer than five (n=10), and national contractors operated across five or more states (n=10). Five contractors did not provide sufficient information for classification.

These classifications were used as a proxy for organizational scale and financial capacity when examining potential differences in contractor experiences.

Analytic approach.

Interview transcripts and summaries were reviewed using a thematic coding approach. Initial coding focused on references to:

- Payment timing and reimbursement delays
- Rebate advancement practices
- Administrative burden
- Customer affordability concerns
- Custom-project complexity
- Contractor participation barriers
- Potential mitigation approaches

To ensure conservative identification of rebate advancement practices, contractors were coded as advancing rebates only when interview materials contained explicit references to fronting rebate funds, providing invoice credits based on anticipated incentives, or otherwise assuming financial responsibility prior to reimbursement. Contractors who solely assisted customers with rebate applications were not included in this category.

Custom-project complexity was identified through references to engineering review requirements, preapproval processes, custom workbooks, project-specific savings calculations, or other approval steps unique to custom pathways.

Data synthesis and benchmarking.

Interview findings were summarized within a coding matrix linking themes to supporting quotations, contractor characteristics, and program pathways. Findings were compared across contractor classifications and program types to identify recurring patterns.

To assess whether observed contractor experiences reflected broader industry conditions, findings were compared with publicly available literature, utility case studies, and federal guidance. Benchmarking sources were also used to identify examples of payment approaches intended to reduce contractor financial exposure, improve payment predictability, or address customer affordability constraints.

Limitations.

Several limitations should be acknowledged. Interviews were originally conducted for process-evaluation purposes rather than specifically to examine payment design. Findings are based on a relatively small sample of participating contractors and should not be interpreted as statistically representative of all contractors. Finally, confidentiality requirements limit the level

of detail that can be reported regarding specific utilities and contractor organizations included in the benchmarking review.

Findings

Overall, contractors reported high levels of satisfaction with Xcel Energy programs and expressed a strong desire to continue participating in utility-sponsored energy efficiency initiatives. However, interviews also revealed recurring concerns regarding payment timing, reimbursement uncertainty, and the financial burden associated with advancing rebates on behalf of customers. These concerns were most frequently associated with custom project pathways and were particularly pronounced among small and medium-sized contractors (SMCs).

Finding 1: Payment delays create contractor financial risk.

Across the 30 interviews included in this analysis, eight contractors explicitly described payment timing as a source of financial risk. While many respondents characterized prescriptive payment timelines as relatively predictable, several contractors reported substantial variability in actual reimbursement timing. Reported payment cycles ranged from the commonly expected six- to eight-week timeframe to as long as eight to twelve months in isolated cases.

Contractors described delays associated with approval processes, engineering review, post-installation verification, documentation requests, and administrative back-and-forth between program stakeholders. These delays extended contractor receivables and constrained available working capital. In one case, a contractor reported carrying approximately $100,000 in receivables while awaiting reimbursement. Another contractor described delays significant enough to discontinue the practice of advancing rebates altogether.

Table 1 summarizes the most frequently cited payment-related risks identified during interviews.

Table 1. Contractor Financial Risks Identified Through Interview Analysis

Finding category	Specific risk identified	Number of contractors (n)	Primary pathway
Payment delays	Approval and payment delays create cash-flow strain and reimbursement uncertainty	8	Custom
Payment delays	Project timelines extend significantly beyond expected reimbursement windows	2	Prescriptive / Custom
Administrative friction	Authorization gaps, documentation requests, and processing backlogs delay payments	1	Prescriptive / Custom

Finding category	Specific risk identified	Number of contractors (n)	Primary pathway
Custom project complexity	Custom projects perceived as slow, complex, and difficult to incorporate into proposals	7	Custom
Custom project complexity	Engineering review requirements and project-specific calculations increase uncertainty	1	Custom
Preapproval uncertainty	Contractors must estimate or guarantee incentive values before final approval	4	Custom
Rebate advancement	Contractors advance rebates or provide point-of-sale discounts while awaiting reimbursement	7	Prescriptive / Custom
Midstream administration	Payment delays can still occur under midstream structures, though generally less frequently	2	Midstream

Note: Counts represent the number of unique contractor organizations that explicitly discussed the issue during interviews. Contractors could mention multiple risks and therefore may appear in more than one category.

Finding 2: Contractors frequently advance rebates.

Among interviewed contractors, 40% explicitly reported advancing rebates or discounts to customers before receiving reimbursement from the utility. These practices were reported across lighting, HVAC, and refrigeration markets and were observed among local, multi-state, and national contractors.

Contractors indicated that advancing rebates often serves as a competitive necessity, particularly when customers face capital constraints or compare proposals across multiple vendors. Several respondents noted that customers frequently expect contractors to incorporate anticipated rebate values directly into project pricing. As a result, contractors may assume financial responsibility for expected incentives prior to reimbursement.

Advancement practices were more frequently reported among Colorado contractors than Minnesota contractors (59% versus 15%). Interview data suggest that this difference may be related to differing contractor roles across programs. Colorado contractors were generally more involved throughout project development and implementation, while Minnesota contractors more commonly described supporting project scoping and application submission.

Several respondents described the financial strain associated with advancing rebates. One contractor noted that the practice had “almost put us out of business,” while another explained that “trying to guarantee a dollar value… gets a little risky” when project economics remain uncertain. These findings suggest that rebate advancement represents a meaningful source of contractor exposure within downstream program designs.

Finding 3: Custom projects create greater financial exposure.

Contractors consistently characterized custom project pathways as slower, less predictable, and more difficult to incorporate into customer proposals than prescriptive pathways. While prescriptive projects were generally associated with known incentive values and relatively predictable reimbursement timelines, custom projects frequently involved engineering review, project-specific savings calculations, preapproval requirements, and uncertainty regarding final incentive amounts.

Interviewees described custom projects as presenting greater financial exposure because contractors are often required to commit resources before receiving final approval or confirmation of incentive values. Several respondents indicated that uncertainty surrounding custom project timelines made it difficult to guarantee project economics to customers.

Table 2 compares payment-related risks across prescriptive and custom pathways and highlights where contractors reported the greatest financial exposure.

Table 2. Payment-Related Risks by Program Pathway

Payment-related risk	Prescriptive	Custom
Payment timing (n=8)	Often expected within 4–8 weeks, though delays still occur.	Can extend for months in some cases.
Preapproval clarity and predictability (n=3)	Generally clearer and easier to incorporate into proposals.	Greater uncertainty due to engineering review and project-specific approval processes.
Need to advance rebates (n=7)	Common in competitive sales environments.	Less common, but substantially riskier when it occurs due to timeline uncertainty.
Cash flow exposure (n=3)	Can become material if volumes are high or payments are delayed.	Highest level of exposure due to longer reimbursement and approval cycles.
Administrative friction (n=2)	Documentation and communication challenges occasionally reported.	Multi-step review processes frequently cited as sources of delay and uncertainty.
Sales impact (n=1)	Generally easier to quote and market to customers.	More difficult to incorporate into customer proposals due to uncertainty.

Note: Findings reflect contractor interview themes and illustrative comparisons rather than statistically representative differences.

Finding 4: Small and medium-sized contractors face disproportionate risk.

The analysis suggests that payment-related risks may not be distributed equally across contractor types. Among contractors discussing organizational size, 100% of small-business respondents reported advancing rebates or discounts to customers. Comparable rates were substantially lower among medium-sized businesses (40%) and large businesses (30%).

These findings suggest that downstream payment structures may create disproportionate burdens for contractors with limited access to working capital. While larger organizations may possess greater financial flexibility to absorb reimbursement delays, smaller firms may face more significant constraints when required to carry receivables or advance incentives to customers. Consequently, payment design may influence not only contractor experiences but also which firms are able to participate successfully in utility programs.

Cross-cutting observations.

Across interviews, payment-related risks rarely occurred in isolation. Contractors frequently described reimbursement delays, preapproval uncertainty, administrative burden, and rebate advancement as interconnected challenges. These risks were most commonly associated with custom projects, where longer review cycles and uncertainty regarding final incentive amounts increased both financial exposure and project complexity. While contractors generally viewed prescriptive pathways as more predictable, many still reported advancing rebates or discounts to remain competitive. Collectively, these findings suggest that contractor financial exposure is driven not by a single program feature but by the interaction of payment timing, approval processes, and project complexity.

Discussion

The findings of this study suggest that contractor financial exposure within downstream energy efficiency programs is concentrated in four primary areas: rebate advancement, delayed reimbursement, custom-project uncertainty, and administrative friction associated with approval processes. While no single payment structure addresses all of these challenges, utilities and program administrators have adopted a variety of approaches intended to reduce different forms of contractor risk. The effectiveness of these approaches depends on program objectives, measure types, delivery pathways, and regulatory requirements. Consequently, rather than presenting a single preferred solution, this discussion evaluates how different payment approaches align with the risks identified through contractor interviews.

Midstream incentives.

Midstream incentive programs move incentive administration upstream by providing incentives directly to distributors or retailers rather than reimbursing customers or contractors after project completion. Under this structure, customers receive a discounted purchase price at the point of sale and distributors subsequently seek reimbursement from the utility or program administrator (U.S. Environmental Protection Agency, ENERGY STAR n.d.).

From a contractor perspective, this approach substantially reduces the need to advance rebates or carry receivables while awaiting reimbursement. Contractors can incorporate the discounted price directly into project proposals without assuming responsibility for future incentive payments. Several utilities have implemented variations of this model for standardized technologies. For example, Xcel Energy offers midstream incentives for certain lighting measures, while utilities such as DTE, Rocky Mountain Power, and Consumers Energy have developed midstream offerings for lighting, HVAC, and other qualifying equipment categories (DTE Energy n.d.; Rocky Mountain Power n.d.; Consumers Energy n.d.; Energy Solutions n.d.).

The primary advantage of midstream design is that it reduces contractor financial exposure while simplifying the customer experience. However, the model is generally most effective for standardized measures with clearly defined eligibility requirements. Highly customized projects, site-specific engineering solutions, and performance-based measures are often difficult to route through a midstream pathway. Consequently, while midstream incentives may substantially reduce contractor exposure for prescriptive measures, they are less applicable to many of the custom-project risks identified in this study.

Bridge financing and aggregator advances.

Bridge-financing mechanisms and aggregator advance programs seek to address a different challenge: the period between project approval and utility reimbursement. Under these models, a third-party entity advances approved incentive funds shortly after project approval and is reimbursed when utility payments are ultimately issued (Crowell 2019; National Energy Improvement Fund 2024).

One example is the National Energy Improvement Fund's Rebate Bridge program, which advances approved incentive amounts and subsequently recovers funds when utility payments are received. This approach effectively converts a potentially lengthy receivable cycle into near-term liquidity (Crowell 2019; National Energy Improvement Fund 2024).

Among the approaches reviewed, bridge financing most directly addresses the rebate advancement and receivable risks identified during contractor interviews. Several respondents described carrying substantial receivables while awaiting reimbursement, and some indicated that delayed payments constrained their ability to pursue additional projects. By reducing the duration of contractor receivables, bridge financing may improve working capital stability and support continued participation, particularly among small and medium-sized contractors.

The primary trade-off is cost. Fees associated with advance funding reduce the net value of incentives and may not be appropriate for every project. In addition, these approaches generally do not address uncertainty that occurs prior to project approval. Nevertheless, they may provide a useful option in situations where reimbursement timelines cannot be shortened.

On-bill financing.

On-bill financing is frequently discussed as a mechanism for reducing customer capital constraints. Under this approach, a utility or third-party lender provides upfront financing for the project, and the customer repays the balance through utility bills over time. Several utilities, including Southern California Edison, have implemented on-bill financing offerings designed to support energy efficiency investments among commercial customers (U.S. Department of Energy, Better Buildings & Better Plants Initiative n.d.; Southern California Edison 2024).

Unlike bridge-financing mechanisms, on-bill financing primarily addresses customer affordability rather than contractor receivable risk. However, customer affordability and contractor participation are often interconnected. Contractors repeatedly described situations where projects moved forward only because rebate values or discounts reduced upfront costs for customers. By reducing customer capital barriers, on-bill financing may indirectly support contractor participation and project uptake.

At the same time, on-bill financing does not necessarily eliminate reimbursement delays, approval requirements, or administrative processes associated with utility programs. Depending on program design, contractors may still encounter delays associated with inspections, financing approval, or project verification. Consequently, on-bill financing should generally be viewed as a customer-financing mechanism that may indirectly benefit contractors rather than a direct solution to contractor cash-flow challenges.

Milestone-based payments.

Milestone-based payment structures distribute incentive funds across multiple stages of a project rather than issuing a single reimbursement following project completion and verification. Payments may be tied to project assessments, equipment installation, commissioning activities, or verified performance milestones (Puget Sound Energy n.d.; RMI 2025).

This approach appears particularly relevant to the custom-project challenges identified in this study. Contractors consistently described custom pathways as involving longer timelines, greater uncertainty, and larger upfront expenditures than prescriptive projects. By aligning incentive payments more closely with project expenditures, milestone-based payments may reduce both the size and duration of contractor receivables.

Programs such as Puget Sound Energy's pay-for-performance initiatives illustrate how implementation incentives and performance incentives can be distributed throughout the project lifecycle (Puget Sound Energy n.d.). Although milestone-based approaches introduce additional administrative complexity, they may provide a practical mechanism for reducing contractor exposure while maintaining accountability for project outcomes.

Payment predictability and service-level agreements.

Several contractors emphasized that uncertainty regarding payment timing was itself a significant challenge. Even when reimbursement timelines remained lengthy, respondents

indicated that predictable timelines were easier to manage than highly variable approval processes.

One potential approach is the use of payment service-level agreements (SLAs), which establish expectations regarding approval timelines, payment processing, communication protocols, and performance metrics. Unlike financing-based approaches, SLAs do not necessarily reduce the duration of contractor receivables. Instead, they improve predictability and transparency, allowing contractors to better plan staffing, inventory, and project schedules.

For custom projects characterized by engineering review and multi-stage approvals, improved predictability may be as valuable as faster reimbursement. Consequently, SLAs may serve as a complementary strategy alongside financing or payment-design modifications. See Table3.

Table 3: Qualitative Assessment of Payment-Design Approaches by Contractor Risk

Risk identified in interviews	**Midstream**	**Bridge financing**	**Milestone payments**	**On-bill financing**	**Service-level agreements**
Contractors advancing rebates	Moderate	High	Low	Low	Low
Long reimbursement timelines	Moderate	High	High	Low	Moderate
Custom-project uncertainty	Low	Moderate	High	Low	High
Administrative burden	Low	Low	Moderate	Low	High
Customer affordability	Moderate	Low	Low	High	Low
Applicability to custom projects	Low	Moderate	High	Low-Moderate	High
Applicability to prescriptive projects	High	High	Moderate	Moderate	Moderate

Note: Ratings are qualitative and indicate the relative alignment of each approach to the contractor risks identified through interviews.

Matching approaches to risks.

The findings suggest that different approaches address different forms of contractor financial exposure. Bridge-financing mechanisms most directly address rebate advancement and receivable risk. Milestone-based payments and service-level agreements appear particularly relevant for custom projects characterized by long and uncertain approval timelines. Midstream incentives may substantially reduce contractor exposure for standardized prescriptive measures, while on-bill financing primarily addresses customer affordability constraints.

Rather than adopting a single payment model across all program pathways, utilities may benefit from selecting approaches based on the specific risks they seek to address. Contractor financial exposure appears greatest within downstream and custom pathways, suggesting that approaches that improve predictability, reduce receivable duration, and limit the need for contractors to advance incentives may provide the greatest benefit. At the same time, utility objectives, regulatory requirements, program structure, and measure eligibility will continue to shape which approaches are feasible within individual program portfolios.

Conclusions

This paper examined how downstream payment structures influence contractor financial exposure within commercial and industrial energy efficiency programs. Drawing upon 30 contractor interviews conducted across four Xcel Energy programs, the analysis identified four recurring sources of contractor risk: delayed reimbursement, rebate advancement, custom-project uncertainty, and administrative friction associated with approval processes.

The findings indicate that contractor financial exposure is greatest within custom project pathways. Contractors consistently characterized custom projects as slower, less predictable, and more difficult to incorporate into customer proposals than prescriptive pathways. Engineering review requirements, project-specific savings calculations, preapproval processes, and uncertainty regarding final incentive amounts contributed to longer reimbursement timelines and increased financial risk. While contractors generally expressed strong satisfaction with utility programs and a desire to continue participating, many described payment timing and reimbursement uncertainty as meaningful operational challenges.

The analysis also suggests that these risks are not distributed equally across contractor types. Small and medium-sized contractors were more likely to report advancing rebates and were generally less able to absorb extended receivable cycles than larger firms. As a result, payment design may influence not only contractor experiences but also which firms are able to participate successfully in utility programs.

The findings do not suggest that a single payment model can eliminate contractor risk. Rather, the results indicate that different approaches address different forms of financial exposure. Bridge-financing mechanisms align most directly with rebate advancement and receivable risk, while milestone-based payments and service-level agreements appear particularly relevant for custom projects characterized by long and uncertain approval timelines.

Midstream incentives may reduce exposure for standardized prescriptive measures, while on-bill financing primarily addresses customer affordability concerns. The most appropriate approach will depend on program objectives, measure types, regulatory requirements, and the specific risks utilities seek to address.

Ultimately, the findings suggest that payment design should be viewed as more than an administrative consideration. The structure, timing, and predictability of incentive payments influence contractor participation, market accessibility, and the ability of small and medium-sized firms to compete effectively within utility programs. As utilities continue expanding energy efficiency investments and equity objectives, greater attention to contractor-facing payment design may help strengthen program delivery while reducing barriers to participation.

Future research is needed to better understand how payment structures influence contractor participation, contractor diversity, customer access, and long-term program performance. Additional work could evaluate participation outcomes across different payment models, quantify the financial impacts of reimbursement delays, and identify the conditions under which specific approaches are most effective. Given the diversity of utility programs and regulatory environments, future research should focus on understanding which payment approaches work best in different contexts rather than seeking a single universally applicable solution.

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