Rethinking Municipal Financing: A Hybrid Institutional Capital Model for Local Infrastructure Development

Anton Steshenko
University of Maryland, Robert H. Smith School of Business

Abstract

Municipal governments across the United States face a widening infrastructure investment gap that conventional financing mechanisms—general obligation bonds, federal grants, and direct appropriations—are structurally incapable of closing. The American Society of Civil Engineers estimates a 10-year funding shortfall of $3.7 trillion [1], while approximately $60 trillion in U.S. pension fund assets remains largely inaccessible to local infrastructure markets. This paper argues that the financing gap is fundamentally an institutional design gap rather than a capital scarcity problem. Drawing on evidence from domestic green banks, international blended finance facilities, and the emerging policy framework created by the Infrastructure Investment and Jobs Act (IIJA) of 2021 and the Inflation Reduction Act (IRA) of 2022, this paper proposes a Hybrid Institutional Capital Model (HICM). The HICM combines public credit enhancement in first-loss positions, structured risk allocation across investor tranches, and purpose-built financial intermediaries to mobilize pension fund and insurance capital into local infrastructure. Evidence from the Connecticut Green Bank—which has achieved a 6.7:1 leverage ratio on $463 million in public capital [2]—and the Montgomery County Green Bank, the first county-level green bank in the United States, demonstrates the model's domestic feasibility. Comparative analysis with the UK Green Investment Bank, Germany's KfW, and Australia's Clean Energy Finance Corporation further establishes international precedent. The paper concludes that the challenge is not the absence of capital, but the absence of institutional architecture capable of deploying it at scale.

Keywords: municipal finance, infrastructure investment, blended finance, green banks, institutional capital, public-private partnerships, IIJA, Greenhouse Gas Reduction Fund

1. Introduction

The infrastructure investment gap in the United States is well-documented and persistent. The American Society of Civil Engineers' 2025 Report Card for America's Infrastructure assigned an

overall grade of C-, identifying a 10-year funding shortfall of approximately $3.7 trillion [1]. The Infrastructure Investment and Jobs Act (IIJA) of 2021 committed $1.2 trillion in federal infrastructure spending—the largest such investment in U.S. history—yet even this historic legislation addresses less than half the identified gap [3]. The Inflation Reduction Act (IRA) of 2022 added more than $150 billion in clean energy and environmental investment, but the combined federal commitment still leaves the majority of local infrastructure needs unaddressed.

The conventional policy response—more municipal bond issuance, additional federal appropriations—faces structural limits. The municipal bond market, while large and liquid, primarily serves creditworthy large municipalities. Smaller jurisdictions that account for the majority of infrastructure needs face prohibitive transaction costs, insufficient credit ratings, and limited access to institutional capital markets. Meanwhile, U.S. pension funds manage approximately $60 trillion in assets and insurance companies hold another $10 trillion [4]. Infrastructure, as an asset class, offers long-duration, inflation-linked returns that closely match institutional liabilities. Yet the flow of institutional capital to local U.S. infrastructure remains modest compared to peer economies such as the United Kingdom, Germany, and Australia [3].

The existing literature on infrastructure finance has extensively analyzed individual financing instruments—municipal bonds, public-private partnerships (PPPs), federal credit programs—but has devoted less attention to the institutional architecture required to connect local project pipelines with institutional capital markets at scale. Studies of blended finance [5] and green bank models [6] offer insights into specific mechanisms, but a comprehensive framework integrating these components into a replicable model for U.S. municipalities has not been developed. This paper addresses that gap.

This paper makes three contributions. First, it diagnoses the structural barriers preventing institutional capital from reaching municipal infrastructure investment at scale. Second, it proposes the Hybrid Institutional Capital Model (HICM)—a layered financial architecture that addresses each structural barrier through complementary public and private instruments. Third, it develops a practical implementation framework grounded in domestic and international evidence, with particular focus on the emerging opportunities created by the Greenhouse Gas Reduction Fund (GGRF) established under the IRA.

While prior literature has focused on individual financing mechanisms or the performance of specific green banks, this paper contributes an integrated institutional design framework that links project aggregation, risk allocation, and institutional capital participation into a coherent model applicable across diverse U.S. municipal contexts. The HICM is not a theoretical construct—each of its components has been demonstrated in practice, and this paper's contribution lies in their systematic integration and application to the U.S. municipal finance context.

2. Literature Review

2.1 The Municipal Infrastructure Financing Gap

The infrastructure financing challenge in the United States has been extensively documented. Woetzel et al. [7] estimated a global infrastructure investment gap of at least $350 billion annually, with the United States accounting for a disproportionate share due to decades of underinvestment and deferred maintenance. The Council on Foreign Relations [3] notes that less than half of U.S. public infrastructure and transportation funding came from the federal government in 2020, placing the primary burden on state and local governments that face fiscal constraints. Arezki et al. [8] identified the paradox at the heart of the infrastructure financing problem: a global savings glut coexists with persistent underinvestment in infrastructure, suggesting the problem is one of institutional architecture rather than capital availability.

Research on the barriers to private infrastructure investment has identified several structural factors. Ehlers [9] identified the absence of a sufficient pipeline of investable projects as a primary barrier to institutional capital deployment, arguing that fixed due diligence costs make individual local projects uneconomical for large investors without project aggregation mechanisms." Inderst [10] highlighted the information asymmetries that prevent institutional investors from efficiently pricing risk in infrastructure markets, and the absence of standardized performance data that makes portfolio construction difficult. Weber and Alfen [11] showed that the risk profile of infrastructure projects—particularly construction and demand risk—often does not align with the investment mandates of pension funds and insurance companies without explicit risk layering mechanisms.

2.2 Blended Finance and Credit Enhancement

The concept of blended finance—the strategic use of development finance and philanthropic capital to mobilize private investment in developing markets—has been formalized by the OECD [12] and applied in both emerging and developed economy contexts. Bielenberg et al. [13] demonstrated that guarantees and credit enhancement instruments can mobilize private capital at multiples substantially exceeding direct public lending, while emphasizing that leverage ratios depend critically on intermediary design and governance independence rather than capital volume alone. Bhattacharya et al. [14] argued that a transformation in infrastructure investment requires new intermediaries capable of translating project risks into investable instruments.

In the U.S. context, evidence from the Climate Policy Initiative [15] shows that public finance plays a catalytic role in mobilizing private capital for clean infrastructure investment. In particular, credit enhancement mechanisms—such as first-loss capital—can improve the risk-return profile of projects and reduce the cost of private financing, thereby enabling investments that would otherwise be financially unviable under prevailing market conditions. The effectiveness of public credit enhancement mechanisms depends critically on the design of financial intermediaries. In particular, governance structures that ensure operational independence and maintain credit discipline are widely recognized as essential for attracting and sustaining institutional capital participation [16].

2.3 Green Banks as Infrastructure Intermediaries

Green banks have emerged as a prominent case study in infrastructure finance intermediary design. Evidence from U.S. green banks, including the Connecticut Green Bank, shows that well-structured public financial institutions can mobilize private capital at multiples exceeding direct public lending, while maintaining credit discipline and achieving financially sustainable outcomes [17].

Subsequent research has expanded the green bank literature by linking the model to broader public-private partnership and clean energy finance frameworks. Geddes et al. [18] show that state-level PPP enabling legislation is shaped by institutional, political, and fiscal conditions, underscoring the importance of governance and legal frameworks in public-private infrastructure finance. Complementing this perspective, Frech et al. [19] examine the green bank model as a public-private clean energy finance mechanism, emphasizing its role in mobilizing private capital,

reducing financing barriers, and supporting clean energy investment through specialized financial intermediation.

2.4 Research Gap and Contribution

While the literatures on municipal finance, blended finance, and green banks are each well-developed, they have developed largely in parallel. Municipal finance research has focused on bond market access and credit ratings; blended finance research has emphasized developing country applications; and green bank research has studied individual institutions rather than integrating them into a comprehensive financing architecture. The result is a gap in the literature: there is no integrated framework for connecting local project pipelines to institutional capital markets through a layered architecture of public credit enhancement, specialized intermediaries, and institutional investment vehicles.

This paper fills that gap by proposing the Hybrid Institutional Capital Model (HICM), which integrates the insights of all three literatures into a replicable framework applicable to U.S. municipalities. The HICM's contribution lies not in any single component—each of which has been studied—but in their systematic integration and the development of implementation pathways adapted to the U.S. institutional context.

3. The Structural Problem: Why Capital Does Not Flow to Local Infrastructure

3.1 The Fragmentation of the Municipal Project Pipeline

The United States has approximately 90,000 local government units—counties, municipalities, townships, and special districts—each responsible for some component of local infrastructure [3]. This fragmentation creates a fundamental mismatch with institutional capital requirements. Pension funds and insurance companies typically require minimum transaction sizes of $50–100 million to justify due diligence costs. Yet the median U.S. municipal infrastructure project is orders of magnitude smaller. The result is a structural deal-size gap: economically sound and socially valuable projects remain unfunded not because capital is unavailable, but because individual transactions are too small to attract institutional underwriting.

Fragmentation also creates information asymmetries. Unlike corporate bonds or sovereign debt, municipal infrastructure projects do not generate the standardized, audited performance data that institutional portfolio construction requires [9]. Without comparable data across jurisdictions, institutional investors cannot efficiently price risk or construct diversified infrastructure portfolios from local assets. This is not a minor inconvenience—it is a fundamental market failure that prevents price discovery and sustains the institutional capital gap.

3.2 Risk Architecture Misalignment

Infrastructure projects carry risk profiles that do not match standard institutional investor mandates. Construction risk, demand risk, political and regulatory risk, and revenue risk are present in varying combinations across project types. Pension funds operating under fiduciary duty frameworks are typically constrained from holding first-loss or construction-phase risk, requiring senior secured positions with predictable cash flows [11]. This is not a reflection of risk aversion per se—pension funds do hold equity and alternative assets—but of the regulatory frameworks and fiduciary duties that govern their investment decisions.

Federal credit programs such as TIFIA and WIFIA provide credit enhancement for large transportation and water projects, but their minimum thresholds ($50 million for TIFIA) and administrative requirements exclude the majority of local-level projects. General obligation bonds transfer revenue risk to taxpayers rather than structuring it for capital markets. Revenue bonds require proven revenue streams and sophisticated financial management capacity. The result is a systemic gap: the instruments available to municipalities do not produce investment structures compatible with institutional capital mandates.

3.3 The Intermediary Gap

Perhaps the most underappreciated structural barrier is the absence of specialized financial intermediaries at the local and regional level. In developed infrastructure finance markets—the United Kingdom, Germany, Australia, Canada—a dense ecosystem of intermediaries aggregates project pipelines, structures transactions, provides credit enhancement, and creates investable instruments [3]. These institutions perform the essential function of translating local project realities into capital market language.

In the United States, this intermediary layer is thin and geographically uneven. The largest states have infrastructure financing authorities, but these typically focus on debt issuance rather than creating equity or hybrid instruments that attract institutional capital beyond traditional bond investors. For most municipalities, the intermediary function does not exist—and its absence is self-reinforcing. Without intermediaries to aggregate pipelines and structure transactions, institutional investors cannot develop the market knowledge needed to participate. Without institutional participation, the revenue model for intermediary development is insufficient. Breaking this cycle requires deliberate public investment in intermediary infrastructure [5].

3.4 Regulatory and Fiduciary Constraints

Institutional investors face their own structural constraints. Public pension funds operate under state-level investment statutes that typically require investment-grade credit ratings, limiting exposure to unrated municipal projects. Insurance companies face capital charges under risk-based capital frameworks that penalize infrastructure equity and subordinated debt. The Department of Labor's 2022 rule clarifying that ESG factors may be considered in ERISA plan investment decisions reduced one source of legal uncertainty, but fiduciary frameworks still effectively exclude most local infrastructure opportunities from institutional portfolios without explicit credit enhancement [19].

4. The Hybrid Institutional Capital Model (HICM)

The Hybrid Institutional Capital Model proposed in this paper addresses each of the structural barriers identified above through a layered architecture of public instruments, specialized intermediaries, and institutional capital participation. The model does not require new federal legislation—it is designed to operate within existing federal programs while leveraging the new intermediary capital created by the GGRF.

4.1 Architecture Overview

The HICM operates through four interconnected layers. Each layer addresses a specific structural barrier identified in Section 3.

Layer 1: Project Aggregation and Pipeline Development. A public or quasi-public intermediary—typically a green bank or infrastructure bank—aggregates individual municipal projects into

portfolios of sufficient scale for institutional underwriting. Aggregation addresses the deal-size gap and creates the standardized, comparable performance data that institutional portfolio construction requires. The intermediary performs underwriting across the portfolio, replacing the need for each project to individually attract institutional due diligence.

Layer 2: Public Credit Enhancement and First-Loss Capital. Public capital from federal programs (IIJA, TIFIA, WIFIA, GGRF) or state revolving funds is deployed in first-loss or subordinated positions. This credit enhancement de-risks senior tranches, reducing the risk-adjusted return requirements for institutional investors and making infrastructure portfolios compatible with fiduciary and investment-grade constraints. Empirical examples from green banks and blended-finance structures demonstrate that relatively limited public first-loss support—often in the range of 10–20% of project value—can mobilize substantially larger volumes of private senior capital through leverage mechanisms [7]. The central principle is that public capital deployed as credit enhancement produces materially higher leverage than public capital deployed as direct lending.

Layer 3: Structured Risk Allocation. The intermediary structures project risk into distinct tranches aligned with different investor risk appetites. A typical HICM transaction would include: (a) a first-loss equity tranche (5–15%) absorbed by public or philanthropic capital; (b) a mezzanine tranche (10–20%) accessible to impact investors and CDFIs; and (c) a senior secured tranche (65–80%) structured for pension fund and insurance company participation. Risk structuring requires careful contractual design—payment waterfalls, enforcement mechanisms, and change-in-law provisions—that give senior investors confidence under adverse scenarios.

Layer 4: Institutional Capital Participation. With risk structured and credit-enhanced, institutional investors participate in the senior secured tranche through standardized investment vehicles. Standardized documentation reduces due diligence costs; independent credit ratings on the aggregated portfolio satisfy fiduciary requirements; and secondary market liquidity mechanisms allow position management without project asset liquidation.

4.2 Capital Stack Design and Leverage Mechanics

The HICM capital stack is designed to maximize leverage—the ratio of private capital mobilized per dollar of public capital deployed. International evidence from blended finance facilities and domestic green banks suggests achievable leverage ratios of 5:1 to 10:1 for well-structured

transactions. Table 1 illustrates a representative HICM capital stack for a $100 million municipal clean infrastructure portfolio, alongside comparative structures under alternative financing models.

Table 1. Comparison of Municipal Infrastructure Financing Models

Financing Model	Min. Deal Size	Risk Transfer to Private	Institutional Capital Access	Typical Leverage	Key Limitations
General Obligation Bonds	No minimum	None — risk stays with taxpayers	Limited to bond investors	1:1	Requires credit rating; limited to creditworthy municipalities; no risk layering
Revenue Bonds	$10M+	Partial — revenue risk to bondholders	Moderate	1:1	Requires proven revenue stream; excludes public-benefit projects without user fees
Traditional PPP	$50M+	Significant — construction & demand risk	Moderate	2:1–4:1	High transaction cost; limited to large projects; institutional barriers remain for small municipalities
Federal Grants (IIJA/IRA)	Varies	None — fully public	None	1:1	Supply-constrained; competitive; administrative burden; does not leverage private capital
Hybrid Institutional Capital Model (HICM)	$5M+ (pooled)	Full layering — public first-loss, private senior	High — pension, insurance, impact	5:1–10:1	Requires intermediary capacity; complex governance; longer implementation timeline

Note: Leverage ratios reflect total capital mobilized per dollar of public capital deployed. HICM figures reflect target ratios based on Connecticut Green Bank performance (6.7:1) and international blended finance evidence. Sources: Connecticut Green Bank Annual Report [2], OECD [5] .

In a representative HICM structure for a $100 million portfolio, federal credit enhancement from GGRF or TIFIA provides $10 million (10%) in first-loss protection; a state green bank contributes $15 million (15%) in mezzanine position; impact investors and CDFIs provide $15 million (15%) in subordinated debt; and institutional capital contributes $60 million (60%) in senior secured debt.

Each dollar of public capital enables $2.40 in institutional capital deployment. With recycling of returned principal over a 10-year deployment cycle—a feature central to the green bank model—effective cumulative leverage reaches approximately 6:1 to 8:1, consistent with Connecticut Green Bank's demonstrated performance [2].

4.3 Risk Allocation Framework

The HICM incorporates a systematic approach to risk allocation across three domains, drawing on international PPP practice and the empirical record of domestic green bank transactions.

Construction and Delivery Risk. This encompasses cost overruns, schedule delays, and technical failures during project development. Construction risk is primarily absorbed by project developers through fixed-price engineering, procurement, and construction (EPC) contracts, backstopped by public first-loss capital. Institutional investors in the senior tranche are insulated through drawdown structures that release capital only upon project completion or milestone achievement.

Demand and Revenue Risk. For user-fee-based infrastructure (water utilities, transit systems), demand risk is partially transferred to users through tariff structures. For public-benefit infrastructure without direct user fees—a critical category for many municipal projects—demand risk is assumed by the public sector through availability payment structures, converting revenue uncertainty into a government payment obligation that institutional investors can underwrite as sovereign-adjacent credit risk. Availability payment structures are particularly important for the HICM because they enable institutional capital participation in projects without proven revenue streams.

Political and Regulatory Risk. Long-duration infrastructure investments are exposed to multiple election cycles and regulatory regimes. The HICM addresses political risk through contractual protections (stabilization clauses, change-in-law provisions), political risk insurance, and portfolio diversification across jurisdictions. Institutional investor confidence depends on robust contractual protections that insulate project economics from political interference.

4.4 Comparison with Alternative Financing Models

To position the HICM relative to existing approaches, Table 1 (above) provides a structured comparison across five dimensions: minimum deal size, risk transfer mechanisms, institutional capital access, typical leverage ratios, and key limitations. The comparison reveals that no existing

model combines the deal aggregation capacity, risk layering architecture, and institutional capital access that the HICM integrates.

General obligation bonds offer broad accessibility but no risk transfer and 1:1 leverage. Traditional PPPs achieve significant risk transfer but require minimum deal sizes ($50M+) that exclude most municipal projects and face institutional barriers that limit capital market participation. Federal grants provide critical public resources but generate no leverage and face supply constraints. The HICM's distinctive contribution is its ability to make small-to-medium projects ($5M–$50M) investable for institutional capital through aggregation and risk structuring—a gap that none of the existing models addresses.

4.5 The Role of Green Banks as Institutional Intermediaries

Green banks occupy a central position in the HICM as the intermediary layer that performs project aggregation, credit enhancement, and transaction structuring. Their design—combining financial intermediary functions with a policy mandate for clean infrastructure and a self-sustaining recycling capital model—makes them uniquely suited to bridge the gap between local project pipelines and institutional capital markets.

The green bank model has been validated across diverse institutional contexts. Table 2 compares performance data from four green banks and blended finance institutions, drawing on verified public reporting, alongside the HICM's institutional implications.

Table 2. International Comparison of Green Bank and Blended Finance Models

Institution	Instrument Type	Public Capitalization	Leverage Ratio	Key Enabling Conditions	U.S. Applicability
UK Green Investment Bank (est. 2012)	Equity + debt + guarantees	£3.8B public	~3.5:1	National mandate; sector focus (offshore wind); commercial discipline requirement	Model for GGRF national clean finance institutions; demonstrates self-sustaining model
Germany KfW Municipal Programs	Wholesale lending to commercial banks	Government-backed balance sheet	5:1–8:1	On-lending model; works through commercial banks; below-market rates	Applicable via state revolving funds + commercial bank partnerships;

					avoids direct govt lending
Australia CEFC (est. 2012)	Loans, bonds, equity co-investment	AUD 10B public	~3:1	Dual mandate (policy + commercial return); federal jurisdiction; diverse instrument suite	Supports dual-mandate design for GGRF; federally-backed intermediary in diverse state contexts
Connecticut Green Bank (est. 2011)	Credit enhancement, subordinated debt, C-PACE	~$463M public	6.7:1	State legislation; independent governance; market demand analysis; recycling model	Direct domestic precedent; replicable at state and county level (MCGB model)
Montgomery County Green Bank (est. 2020)	Guarantees, subordinated debt, co-investment	County-funded	~10:1 (target)	County-level governance; creditworthy sponsor; market assessment; GGRF-aligned	First county-level green bank in US; scalable model for 3,000+ U.S. counties

Note: Leverage ratios reflect total investment mobilized divided by public capitalization. UK Green Investment Bank, Australia CEFC, and Montgomery County Green Bank data are drawn from Climate Policy Initiative's The State of Green Banks 2025 *[17] and Coalition for Green Capital reports [16]. Connecticut Green Bank data are based on the official FY2025 Annual Report [2]. KfW municipal financing structures are discussed in Inderst [10] and Weber & Alfen [11]. All figures reflect cumulative performance reported in the most recent publicly available disclosures.*

Several consistent findings emerge from the international comparison. First, leverage ratios improve substantially over time as institutions build track records and develop relationships with private co-investors. The Connecticut Green Bank's leverage ratio increased from approximately 4.5:1 in fiscal year 2016 to 6.7:1 by 2024 [2], suggesting that HICM implementations should be designed for long-term operation rather than short-term demonstration. Second, governance independence is consistently associated with higher leverage ratios. Institutions that maintain credit discipline independent of political cycles attract more private co-investment than those subject to political direction. Third, sectoral focus—particularly on clean energy and climate resilience—enables the development of standardized transaction structures that reduce private investor due diligence costs over time.

5. The Montgomery County Green Bank: A Domestic Precedent

5.1 Institutional Design and Significance

The Montgomery County Green Bank (MCGB), established in 2020, represents a distinctive innovation: the first county-level green bank in the United States [20]. This institutional precedent is significant because it demonstrates that the green bank intermediary model can operate at the sub-state level, enabling potential replication across U.S. counties without requiring state-level legislative action in every case.

MCGB was capitalized with initial public investment from Montgomery County, Maryland—a jurisdiction of approximately one million residents with a strong credit profile anchored by significant federal employment. Its mandate covers clean energy, energy efficiency, and climate resilience projects, with a particular focus on low- and moderate-income communities and commercial real estate that conventional lenders underserve.

The MCGB's financial model is built on credit enhancement rather than direct lending. Rather than deploying public capital as direct loans—which would limit its reach to the volume of public capital available—the bank uses its capital to provide guarantees, subordinated debt, and co-investment that unlocks private lending at more favorable terms. This leverage model is central to the HICM: public capital is most productive when it reduces the cost of private capital, not when it substitutes for it.

5.2 Transaction Structure and Leverage Mechanics

A representative MCGB transaction illustrates the HICM mechanics concretely. Consider a commercial building energy efficiency project requiring $2 million for HVAC replacement, building envelope improvements, and solar installation. The project generates approximately $180,000 in annual energy cost savings sufficient to service the debt, but the owner cannot access conventional bank financing because energy savings cash flows are unfamiliar to conventional underwriters.

MCGB provides a partial loan guarantee—covering 20% of principal—to a participating commercial lender, reducing the lender's net credit exposure to $1.6 million. This reduction brings the effective loan-to-value ratio within the lender's internal credit standards, making the loan approvable. MCGB may also co-invest a subordinated tranche of $200,000 absorbing first losses,

further de-risking the senior lender. The result: $2 million in private capital deployed for $200,000 in MCGB capital, a 10:1 leverage ratio on public capital.

At portfolio scale, the intermediary dimension of the HICM becomes visible. MCGB aggregates multiple such transactions—energy efficiency loans, solar financing, stormwater upgrades—into a diversified portfolio that can be securitized or sold to institutional investors seeking exposure to credit-enhanced clean infrastructure assets. Individual transactions too small for institutional direct investment become investable at portfolio scale through aggregation.

5.3 Conditions for Successful Replication

The MCGB experience, combined with evidence from state-level green banks, suggests four conditions critical for successful replication at the county level.

Creditworthiness of the sponsoring jurisdiction. Montgomery County's strong credit profile lowers the cost of public capital and provides implicit backstop comfort to private co-investors. Counties with weaker credit profiles may need to partner with state-level institutions or access federal capitalization programs directly.

Market demand assessment before capitalization. MCGB was designed based on systematic analysis of local project pipeline depth, financing gaps, and specific market failures—not as a supply-push institution. Replication efforts that begin with institutional design before market analysis risk building capacity without sufficient project demand.

Governance independence from political pressure. MCGB operates with a professional board and investment committee that maintains lending standards independent of electoral cycles—a precondition for attracting private co-investment over time. Institutions that allow political considerations to override credit standards develop reputational problems that deter private partners.

Federal capitalization support. The GGRF, established under the IRA with $27 billion in total appropriations, is the most significant enabling condition for national-scale replication. Deployed as capitalization for a network of county and municipal green banks, it could catalyze the institutional intermediary layer the HICM requires across the country.

6. Implementation Framework for U.S. Municipalities

6.1 Diagnostic Phase: Assessing Institutional Readiness

Before implementing the HICM, municipalities must assess institutional readiness across four dimensions. Project pipeline viability requires identifying a sufficient volume of infrastructure projects with positive net present value and identifiable revenue or savings streams. Financial capacity and credit profile determines the municipality's ability to provide first-loss capital directly or through partnership with higher-credit entities. Administrative capacity encompasses the technical expertise and legal resources required to structure complex financing transactions—the most frequently underestimated barrier. Regulatory environment includes state-level constraints on municipal borrowing, PPP enabling legislation, and restrictions on municipal investment in financial intermediaries.

6.2 Intermediary Design Options

Municipalities face a spectrum of design choices depending on scale, capacity, and political context. An independent municipal green bank—replicating the MCGB model—is appropriate for large, creditworthy municipalities with sufficient pipeline and administrative capacity. A regional green bank pools resources and pipelines across multiple municipalities, achieving scale without requiring each to build full intermediary capacity independently; this is particularly appropriate for metropolitan areas with multiple overlapping jurisdictions. A state green bank partnership leverages an existing state-level intermediary through co-investment agreements—the lowest-cost entry point for municipalities without existing intermediary infrastructure. A CDFI partnership connects municipal project pipelines to Community Development Financial Institutions with established institutional capital market relationships, offering the fastest path to capital for municipalities with limited capacity.

6.3 Federal Program Integration

Effective HICM implementation requires systematic integration with federal financing programs. TIFIA provides federal credit assistance for large surface transportation projects above the $50 million threshold, providing subordinated federal credit that enhances senior private financing. WIFIA provides analogous assistance for water and wastewater infrastructure, with IIJA amendments lowering minimum project size thresholds. The DOE Loan Programs Office,

expanded significantly under IIJA and IRA, provides loan guarantees for clean energy and infrastructure projects with broadened eligible project categories. The EPA Greenhouse Gas Reduction Fund—with $27 billion in available capital—is the most significant new federal intermediary capital source, being deployed through the National Clean Investment Fund and the Clean Communities Investment Accelerator, both of which target precisely the intermediary capital gap the HICM is designed to fill.

6.4 Attracting Institutional Capital: Practical Considerations

Investment-grade credit ratings on aggregated portfolios are non-negotiable for most public pension funds. HICM implementation must include a clear pathway to rated investment vehicles, whether through securitization, pooled bond issuance, or structured note programs. Track record and transparency matter disproportionately for first-time institutional engagement—HICM sponsors should plan for a demonstration transaction phase with full public performance reporting before seeking large-scale institutional commitments. Alignment with pension fund ESG mandates, increasingly formalized through climate action plans at CalPERS, CalSTRS, and comparable institutions, creates specific capital pools that HICM structures with clear climate impact metrics are well-positioned to access.

7. Policy Recommendations

At the federal level, maximizing the deployment effectiveness of the Greenhouse Gas Reduction Fund is the highest-priority near-term action. GGRF capital should be directed toward intermediaries with demonstrated capacity to aggregate local project pipelines, structure credit-enhanced investment vehicles, and engage institutional capital markets—not toward direct project lending. Secondary priorities include expanding TIFIA and WIFIA program thresholds downward to capture smaller municipal projects, and providing regulatory clarity for pension fund infrastructure investment through DOL guidance that explicitly endorses the HICM-type structures as permissible under ERISA fiduciary standards.

At the state level, enabling legislation for county and municipal green bank formation is the highest-leverage policy action. Currently, only a minority of states have enacted explicit green bank enabling legislation; the majority require municipalities to navigate complex combinations

of general corporation law, municipal finance statutes, and procurement regulations to establish intermediary institutions. Standardized enabling legislation—modeled on Connecticut's Green Bank Act—would dramatically reduce the transaction cost of green bank formation at the local level.

At the local level, the most important first step is project pipeline development and systematic engagement with existing federal programs. Municipalities that have not conducted comprehensive infrastructure needs assessments aligned with IIJA funding categories are leaving federal capital on the table. Local governments should establish dedicated infrastructure finance offices—or access shared-services arrangements—with the technical capacity to structure HICM transactions and engage institutional investor communities.

8. Limitations

This paper has several limitations that should be acknowledged. First, the proposed HICM is a conceptual framework supported by comparative evidence rather than an empirically tested model. Quantitative analysis of HICM implementation outcomes across diverse U.S. municipal contexts would strengthen the framework's empirical foundations. Future research employing natural experiments—for example, comparing infrastructure investment outcomes in jurisdictions with and without green bank enabling legislation—could provide more rigorous causal evidence.

Second, the paper draws heavily on the Connecticut Green Bank and Montgomery County Green Bank as domestic precedents. Both operate in jurisdictions with above-average creditworthiness and administrative capacity. The replicability of their leverage ratios and institutional designs in lower-capacity or lower-credit municipalities requires further investigation. Municipalities with weaker fiscal positions may require deeper public first-loss positions or state-level credit backstops to achieve comparable leverage.

Third, the international comparisons—UK Green Investment Bank, KfW, Australia's CEFC—involve institutional contexts that differ from the U.S. in important ways: federal-state relationships, regulatory frameworks, and the depth of capital markets. Direct transference of international leverage ratios or governance models should be approached with caution; adaptation to U.S. institutional conditions is necessary.

Fourth, the paper does not model the interest rate sensitivity of HICM structures. In high-rate environments, the spread between the cost of public credit enhancement and institutional return requirements widens, potentially reducing achievable leverage ratios. Implementation economics should be modeled across rate scenarios before committing to specific capital stack designs.

9. Conclusions

The U.S. infrastructure financing gap will not be closed by federal appropriations alone, nor by incremental expansion of traditional municipal bond issuance. Closing the gap requires a structural transformation of the local infrastructure finance ecosystem—new intermediaries, new instruments, and new connections between local project pipelines and the institutional capital markets that hold the capital infrastructure investment needs.

The Hybrid Institutional Capital Model proposed in this paper offers a practical architecture for this transformation. By combining public credit enhancement in first-loss positions, structured risk allocation across investor tranches, and purpose-built financial intermediaries that aggregate project pipelines and create investable vehicles, the HICM makes local infrastructure projects legible and investable to pension funds, insurance companies, and other institutional investors seeking the long-duration, inflation-protected returns that infrastructure uniquely provides.

The evidence base for this model is substantial. The Connecticut Green Bank has deployed $3.1 billion in total clean energy investment with $463 million in public capital—a 6.7:1 leverage ratio—demonstrating that green bank intermediaries can perform at scale [2]. The UK Green Investment Bank mobilized more than £12 billion in private co-investment before privatization [17]. The Montgomery County Green Bank has proven the model feasible at the county level for the first time in U.S. history [19]. Each component of the HICM has been demonstrated in practice.

What has not existed, until now, is an integrated framework that connects these components into a replicable model for U.S. municipalities—one that can be adapted to diverse local contexts, scaled through federal capitalization, and implemented without requiring new federal legislation. The Greenhouse Gas Reduction Fund provides the capitalization catalyst; the green bank enabling legislation emerging in multiple states provides the legal infrastructure; and the demonstrated performance of domestic and international precedents provides the evidence base.

The infrastructure financing gap is large. But it is not inevitable. The challenge is not the absence of capital, but the absence of institutional architecture capable of deploying it at scale. The Hybrid Institutional Capital Model provides a design for that architecture.

References

[1] American Society of Civil Engineers (ASCE). (2025). 2025 Report Card for America's Infrastructure. ASCE. https://infrastructurereportcard.org

[2] Connecticut Green Bank. (2025). Fiscal Year 2025 Annual Report. Connecticut Green Bank. https://www.ctgreenbank.com/strategy-impact/

[3] Council on Foreign Relations. (2023). The State of U.S. Infrastructure. CFR Backgrounder. https://www.cfr.org/backgrounders/state-us-infrastructure

[4] Thinking Ahead Institute. (2025). Global Pension Assets Study 2025. Willis Towers Watson. Available at: https://www.thinkingaheadinstitute.org/research-papers/global-pension-assets-study-2025/

[5] OECD. (2018). Making Blended Finance Work for the Sustainable Development Goals. OECD Publishing. https://doi.org/10.1787/9789264288768-en

[6] Stephens, J. C., & Sokol, M. (2023). Financial innovation for climate justice: Central banks and transformative "creative disruption". Climate and Development, 15(8), 762–773. https://doi.org/10.1080/17565529.2023.2268589

[7] Woetzel, J., Garemo, N., Mischke, J., Hjerpe, M., & Palter, R. (2016). Bridging Global Infrastructure Gaps. McKinsey Global Institute. https://www.mckinsey.com/capabilities/operations/our-insights/bridging-global-infrastructure-gaps

[8] Arezki, R., Bolton, P., Peters, S., Samama, F., & Stiglitz, J. (2017). From global savings glut to financing infrastructure. Economic Policy, 32(90), 221–261. https://academic.oup.com/economicpolicy/article/32/90/221/3111731

[9] Ehlers, T. (2014). Understanding the Challenges for Infrastructure Finance (BIS Working Paper No. 454). Bank for International Settlements. https://www.bis.org/publ/work454.htm

[10] Inderst, G. (2010). Infrastructure as an Asset Class. EIB Papers, 15(1), 70–105. European Investment Bank. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1860947

[11] Weber, B., & Alfen, H. W. (2016). Infrastructure as an Asset Class: Investment Strategy, Sustainability, Project Finance and PPP (2nd ed.). Wiley Finance.

[12] OECD. (2018). OECD DAC Blended Finance Principles. https://www.oecd.org/en/publications/oecd-dac-blended-finance-principles_dc66bd9c-en.html

[13] Bielenberg, A., Kerlin, M., Oppenheim, J., & Roberts, M. (2016). Financing Change: How to Mobilize Private-Sector Financing for Sustainable Infrastructure. McKinsey Center for Business and Environment. https://www.mckinsey.com/business-functions/sustainability/our-insights/financing-change-how-to-mobilize-private-sector-financing-for-sustainable-infrastructure

[14] Bhattacharya, A., Oppenheim, J., & Stern, N. (2015). Driving Sustainable Development Through Better Infrastructure: Key Elements of a Transformation Program. Brookings Institution. https://www.brookings.edu/research/driving-sustainable-development-through-better-infrastructure

[15] Naran, B., Shankar, V., de Aragão Fernandes, P., Dixon, J., Burnett, J., Abraham, S., Stout, S., Connolly, J., Strinati, C., & Buchner, B. (2025). Global Landscape of Climate Finance 2025. Climate Policy Initiative. https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2025/

[16] Coalition for Green Capital. Semi-annual report July-December 2025. https://cgc.org/news/cgc-submitted-third-semi-annual-report-to-the-epa

[17] Climate Policy Initiative. The State of Green Banks 2025. https://www.climatepolicyinitiative.org/wp-content/uploads/2025/04/The-State-of-Green-Banks-2025.pdf

[18] Geddes, R. R., Wagner, B., & Wagner, B. (2018). Why do U.S. states adopt public-private partnership enabling legislation? Journal of Urban Economics, 78, 30–41. https://doi.org/10.1016/j.jue.2013.07.002

[19] U.S. Department of Labor. (2022). Final Rule on Prudence and Loyalty in Selecting Plan Investments and Exercising Shareholder Rights. Employee Benefits Security Administration. Available at: https://www.dol.gov/agencies/ebsa/about-ebsa/our-activities/resource-center/fact-sheets/final-rule-on-prudence-and-loyalty-in-selecting-plan-investments-and-exercising-shareholder-rights

[20] Montgomery County Green Bank. (2025). 2025 annual report. Montgomery County Green Bank. https://mcgreenbank.org/annual-reports/