

Innovative Financing for Voluntary Green Stormwater Infrastructure: Lessons Learned from Energy Efficiency

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ABSTRACT

Cities are increasingly turning to green stormwater infrastructure (GSI) as a distributed solution to relieve growing stormwater management challenges caused by urban development, changing weather patterns and aging infrastructure. Since much of the built environment is privately owned, penetration onto private property is essential; however, given the concentrated costs and diffuse benefits of GSI installations, many hurdles exist for private landowners looking to invest in GSI on their property. Energy efficiency retrofit programs have seen significant success across the built environment despite experiencing similar challenges attracting investment. This research explains the key factors that influence the success of three energy efficiency financing programs in the United States (on-bill repayment, Performance Assessed Clean Energy (PACE) and performance contracting through Energy Services Companies (ESCOs)) and draws cross-sector parallels to GSI in order to inform a decision-making framework for municipalities looking to incentivize private investment in GSI on commercial property. An applied analysis of how these findings impact Seattle, WA illustrates the implications of these findings.

EXECUTIVE SUMMARY

Stormwater management can be a significant challenge in urban areas. As population density grows and impervious surface cover increases, the amount and intensity of stormwater runoff escalates correspondingly, placing added stress on water management systems and natural ecosystems. Green stormwater infrastructure (GSI) is increasingly being seen as a critical tool for addressing these challenges (Garrison and Hobbs 2011). Although a number of cities across the country have turned to GSI as a key component of their stormwater management system, oftentimes the scope is limited to public property. Since GSI is a distributed approach to stormwater management, programs must engage private property owners (Francis 2010). Energy efficiency programs have seen significant success engaging private property owners across the built environment despite experiencing many of the same challenges attracting investment in the face of high up-front costs and limited inherent collateral value (Palmer, Walls and Gerarden 2012).

This project aims to better explain the key factors that influence the success of three types of energy efficiency financing programs in the United States and draw cross-sector parallels to GSI in order to inform a decision-making framework for GSI program design. This is accomplished through 1) a review of the existing literature on energy efficiency program design and the potential equivalencies between energy efficiency and green stormwater infrastructure, 2) an exploration of three financing mechanism case studies, and 3) the definition of decision criteria to provide initial direction for the evaluation of appropriate financing mechanisms in a specific case.

In order to better understand the settings in which specific energy efficiency financing mechanisms would be most appropriate, this research evaluated three financing mechanisms:

- On-Bill Repayment: Third party entities provide up-front capital to customers which is then repaid through a surcharge on the property owner's utility bill.
- PACE Financing: A municipal financing district issues capital to finance energy efficiency retrofits which is then repaid through an assessment on the property tax.
- Performance Contracting with Energy Services Companies (ESCOs): Large commercial firms implement comprehensive energy efficiency retrofits from audit to measurement and verification in fulfillment of Energy Savings Performance Contracts with property owners.

The data informing these case studies was gathered through research of secondary sources, a series of interviews of energy efficiency program administrators and energy and/or GSI industry experts, and a review of example programs. The case analysis informed a consideration of how each financing mechanism could be applied in the stormwater context. The findings reach beyond the existing literature to examine national level themes and provide a local-level decision making framework.

Based on the findings of this report, a number of key factors exist that can direct decision-making around green stormwater infrastructure financing. First, a fundamental consideration is whether a stormwater fee structure exists to create the opportunity for savings. Assuming this requirement is met, the following criteria indicate the suitability of the three financing mechanisms for a specific jurisdiction:

- Building stock of greatest concern
- Authorizing legislation
- Political buy-in
- Incentives
- Regulatory requirements

The importance of each criteria varies for each financing mechanism. PACE programs are most appropriate in states with a history of PACE authorizing legislation, strong regulatory drivers for action and a wider range of target property sizes. Performance contracting is more appropriate in places with a high concentration of large-scale commercial building stock, limited legislative support and multiple available incentives. On-bill repayment programs are most applicable where there are more opportunities to pursue small-scale GSI and strong regulatory drivers for action.

In addition, shared key factors that apply to all three of the case financing mechanisms will impact program viability and are important to consider in program design. These include the stormwater fee size and available margin, the potential to offer credit enhancements, the ability to leverage an economy of scale, the policy requirements affecting loan term stringency, and existing availability of financial partners.

An applied analysis of how these findings impact Seattle, WA further illustrates the implications of these findings. The City has an itemized stormwater fee structure, an existing stormwater consent order and is actively investing in GSI. PACE financing is not possible in the state due to legislative restrictions. However, a stormwater credit already exists in the city and a commercial GSI program would target medium to large-scale commercial customers.

Therefore, it is recommended that the City of Seattle explore performance contracting by supporting the development of a GISC. In order to make this possible, the City could create a public private partnership with local innovators and consider opportunities to provide credit enhancements. Secondly, the City might also consider the potential to offer on-bill repayment for small scale projects. In both cases, the City will need to conduct further inquiry into the financial implications and political feasibility of these endeavors and create a framework for measurement and verification of stormwater savings.

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INTRODUCTION

Stormwater runoff is a significant challenge in urban areas. As population density grows and impervious surface cover increases, the amount and intensity of stormwater runoff escalates correspondingly, placing added stress on water management systems and natural ecosystems. Water running off of impervious surfaces on developed land carries heavy metals, garbage, oil and grease, animal waste and other pollutants into local streams, rivers and lakes. This large volume of water gains velocity in storm drainage systems and flows into natural water bodies, degrading the structural integrity of streams, damaging habitat and depositing sediment. This threatens aquatic life by increasing turbidity, pollutants and nutrient levels and limiting dissolved oxygen (Washington State Department of Water Quality 2009). While the consequences of poor stormwater management are severe, the diversity of sources and pervasive but decentralized nature of the problem make prevention and mitigation of stormwater impacts difficult.

Green infrastructure is increasingly being seen as a critical tool for addressing these challenges (Garrison and Hobbs 2011). As increasing stormwater runoff leads to water quality issues, cities face regulatory consequences. Many cities across the country, such as Philadelphia, Washington D.C., Durham, NC and many others, have turned to installing GSI as a key component of their stormwater management system (Environmental Finance Center Network 2012). These programs are beneficial, but oftentimes the scope of impact is limited to the amount of public property in the jurisdiction (Hughes 2014). Since GSI is a distributed approach to stormwater management, in order to capture runoff and make a comprehensive impact on the overall stormwater system, GSI must also penetrate the private property sector – especially large commercial and industrial facilities with substantial impervious surface (Berahzer and Hughes 2014).

Local stormwater codes, which are often used to enforce federal Clean Water Act requirements, can mandate certain beneficial development practices on private land, such as enforcing strong maximum extent feasible (MEF) requirements for green stormwater infrastructure (GSI) (Seattle Public Utilities 2015). However, while regulatory measures lead to effective management for new construction, full compliance with code is not required for existing buildings unless they undergo a significant retrofit. The requirements do little to encourage new buildings to surpass code and invest in additional GSI.

There is a need for an accelerated, more comprehensive approach, and voluntary stormwater retrofits on commercial and industrial properties have the opportunity to be a practical solution for expanding GSI implementation. However, many hurdles exist for developers and landowners to invest in and construct voluntary green infrastructure. Since GSI retrofits generally require a large up-front investment while offering limited collateral, they encounter difficulty with traditional lending, especially on mortgaged properties such as large commercial or industrial buildings. A program that offers third-party financing

could leverage private dollars to increase access to capital, offset upfront costs and jumpstart the market for commercial GSI installations (Valderrama and Levine 2012).

Energy efficiency programs have seen significant success across the built environment despite experiencing many of the same challenges attracting investment and appropriate financing in the face of high up-front costs and limited inherent collateral value (Palmer, Walls, and Gerarden 2012). A number of reports and programs have identified the opportunity to model stormwater programs and financing after proven energy efficiency models (Valderrama and Levine 2012; Water Environment Federation 2014; Francis 2010). However, while the existing literature identifies potential opportunities, there is a lack of explicit decision-making criteria.

I propose that a major challenge in implementing energy efficiency financing models for GSI is in understanding how to define and understand the financial and programmatic equivalencies between sectors and use them to identify the appropriate strategy for a specific location. A better understanding of what local level conditions inform which incentive mechanism to pursue could help municipalities and cities such as Seattle make decisions to empower voluntary stormwater management and green infrastructure development.

This project aims to better explain the key factors that influence the success of three types of energy efficiency financing programs in the United States and draw cross-sector parallels to GSI in order to inform a decision-making framework. This is accomplished through 1) a review of the existing literature on energy efficiency program design and the potential equivalencies between energy efficiency and green stormwater infrastructure, 2) an exploration of three financing mechanism case studies, and 3) the definition of decision criteria to inform the initial exploration of applicable financing mechanisms in a specific case. An applied analysis of how these findings impact Seattle, WA will further illuminate the implications of these findings.

LITERATURE REVIEW

The built environment accounts for an estimated 74 percent of the total electricity consumption (Hayes et al. 2011) and 42 percent of the overall energy consumption in the United States (Palmer, Walls and Gerarden 2012). The potential for cost savings through more efficient use of this electricity is estimated to be about 65 percent of the energy use in the sector (Nandivada 2014). Since curtailing the consumption of so much energy offsets the need to construct expensive power plants in order to meet demand, utilities consider energy efficiency a resource (Palmer et al. 2012). Existing regulations, design standards and incentives established by government or utilities encourage the implementation of energy efficiency retrofits. Fundamental to the effectiveness of these programs and standards are financing options that

enable building owners to pursue energy efficiency installations despite existing market barriers (Kim et al. 2012).

ENERGY EFFICIENCY MARKET BARRIERS

In order to justify financing an energy efficiency capital investment, both investors and property owners must overcome a number of uncertainties and market barriers to pursue a project. For the customer looking to install retrofits, the high upfront costs, potentially high transaction costs and a lack of information about the best approach disincentivize the pursuit of energy efficiency projects (Kapur et al. 2011). In addition, there is a split incentive between tenants who do not want to invest in the physical structure of a building they do not own, and building owners who do not want to perform retrofits because the energy savings accrue on the tenants' utility bill. This is compounded by a timing mismatch that results from long payback periods that may last longer than the owner plans to keep the property (Nandivada 2014), and limited scalability to smaller projects with small margins (Kim et al. 2012).

Energy efficiency projects' "profit" is based on future savings, which are not certain because they do not exist yet (Kapur et al. 2011). Even if the financial savings of energy efficiency investments are beneficial in an accounting sense, individuals make decisions based on a number of factors that do not align with what might be considered economically rational. Instead they may act on skewed perceptions of risk or asymmetric information (Palmer, Walls and Gerarden 2012). Paired with the fact that energy efficiency investment is not fundamental to many business' core missions and that energy is considered a low-cost commodity in comparison to other business expenses, the barriers to investment are significant (Palmer, Walls, and Gerarden 2012).

The availability of capital is the biggest barrier for energy efficiency retrofits (White 2011). Investors are deterred by the high level of risk in issuing loans whose returns are based on long-term, uncertain savings in a market without a standardized loan product. Because of this, energy efficiency loans provide poor access to secondary markets and investors cannot recapitalize loans to increase the money available like they would in established markets (Hayes et al. 2011). Investors and contractors also incur large transaction costs maintaining program offerings, especially at small scales. This can be complicated by a lack of information about the energy savings payoff from investment, making participation in programs difficult for investors (Palmer, Walls and Gerarden 2012; Kapur et al. 2011).

Despite these barriers, energy efficiency retrofit programs have found national success. About 40 percent of the commercial building stock in the U.S. actively tracks and measures their energy use and ENERGY STAR certifications alone account for 25,000 energy efficient buildings (ENERGY STAR 2016). Through a combination of credit enhancements, innovative partnerships and policy support, energy efficiency programs have found ways to engage building owners and third-party financiers in energy efficiency program financing.

ENERGY EFFICIENCY PROGRAM TYPES

Various program financing structures have been implemented in the United States to promote the implementation of energy efficiency by minimizing the effect of market barriers. This is most commonly accomplished by providing easily-accessible, lower-risk financing up-front to the customer. The majority of financing mechanisms that fuel energy efficiency retrofits are anchored on the promise of future energy savings and can be driven by one or a combination of various players. These include municipalities, state and local governments, utilities, investors and specialized Energy Services Companies (ESCOs), as well as community development financial institutions (CDFIs) which provide financing for a specific beneficial use, such as energy efficiency (Valderrama and Levine 2012).

Notable financing mechanisms include:

- Low Interest Loans: Through the use of credit enhancements supported by available grants or funding allocations, utilities, Community Development Financial Institutions (CDFIs) or other third parties can administer general loan programs to make up-front credit available to customers (Freehling 2011).
- On-Bill Financing: Similar to a loan program, utilities provide up-front capital to fund energy efficiency improvements and facilitate repayment through a surcharge on the property owner's utility bill (Bell, Nadel and Hayes 2011).
- On-Bill Repayment: Similar to on-bill financing, where a loan is repaid through a surcharge on the customer's utility bill, except the capital is provided by a third party entity such as a commercial bank, a CDFI or other investors (Bell, Nadel and Hayes 2011).
- Property Assessed Clean Energy (PACE) Financing: A type of third party financing program that uses bonds issued by a municipal financing district and backed by a lien on the property to finance an energy efficiency upgrade. The funds are repaid through the owner's property tax (Kapur et al. 2011).
- Energy Performance Contracting: Administered by Energy Services Companies, or ESCOs, these contracts allow for the property owner to offset upfront costs by paying for the retrofit with the actual achieved savings from the retrofit. The ESCO manages and monitors the entire retrofit process from audit to installation and verification (Baechler and Webster 2011).
- Benchmarking with required retrofit: Driven by regulatory requirements, these programs mandate that commercial and/or industrial properties benchmark their energy use and subsequently take actions to meet updated building codes on a designated timeline.¹
- Rebate Programs: Typically utility driven, rebate programs offer financial incentives for the installation of energy efficiency equipment (Palmer, Walls and Gerarden 2012).

¹ Personal communication with Pam Emerson. April 2015.

In addition to customizing the overall program design, utilities, municipalities and governments have the ability to pull levers within the greater program framework in order to create attractive financing options, allow for greater flexibility of payback timelines and mitigate overall credit risk.

CREDIT ENHANCEMENTS AND GENERAL PROGRAM SUPPORT

The primary tools that help reduce program risk and address other market barriers that prevent lenders from entering the market or property owners having access to attractive loan offerings include credit enhancements, revolving loan funds and rebates or incentives. These credit enhancements, funds and incentives ultimately serve to support the larger program structure. They are generally not enough on their own to provide project funding and spur investment because they enable the financial market but do not offer management, operations or contractor services (Palmer, Walls and Gerarden 2012). However, they become key factors for the success of other program designs. With different combinations of these offerings, a program can bridge the gap between uneconomical financing efforts and attractive, scalable programs by reducing risk, providing financing or providing incentives (Freehling 2011).

Notable credit enhancements that reduce investment risk include loan-loss reserve funds and loan guarantee programs. Loan loss reserve funds help to encourage investors to make loans that would otherwise be considered high risk by reserving a percentage of existing loan funds in order to cover any losses from default. Loan guarantee programs on the other hand eliminate the lender's risk by fully or partially guaranteeing payment for the loan. These programs are generally administered by government agencies and are most appropriate in markets where default rates are low (Weiss and Vujic 2014). In addition to these tools, program administrators can also pursue interest rate buy-downs by paying investors an upfront sum to cover the present value of interest rate reductions over the life of the loan. This allows investors to offer loans to customers at a reduced interest rate (Weiss and Vujic 2014).

Revolving loan funds allow public entities to offer retrofit financing by leveraging funds from one or more sources (e.g., grant money, public fee or tax, etc.). Loans are issued to projects from this fund and then as the credit is repaid the funds are returned to the revolving loan fund and used to finance other projects (Weiss and Vujic 2014). The challenge with energy efficiency in this case is that with long payback periods the returns might collect too slowly to support a healthy, sustained fund (Hayes et al. 2011).

Utilities can also offer a number of incentives and/or rebates specific to an energy efficient product to help offset the scale of the financial investment and incentivize the selection of energy efficient equipment over standard options. These incentives may be required or promoted by federal, state or local policies such as state renewable portfolio standards (Palmer et al. 2012). Opportunities for solution-specific savings allow for customers to make energy efficient choices in a flexible way depending on their technical needs (Kapur et al. 2011).

In order to be able to provide these financial tools and reduce investment risk, local governments and utilities must have the fiscal capability to offer them. Loan loss reserve funds and revolving loan funds can be established using initial grant dollars, a funding allocation from the state, private contributions, a public fee or tax, or even local funds. However, generally an initial funding stream is needed, even if the fund accrues value through program or ratepayer fees (Freehling 2011).

EQUIVALENCIES BETWEEN EE AND GSI

Analogous to energy efficiency, municipal interest in GSI installations is motivated by a need to mitigate expenses as demand for infrastructure capacity increases. As urbanization and the adverse impacts to waterways and ecosystems intensify, GSI needs to be installed in a distributed way across both public and private property in order to effectively alleviate stress to a stormwater system and offset future infrastructure investments by the utility (Berahzer and Hughes 2014). There is the potential to incentivize GSI installations through a savings-based approach in jurisdictions where the costs of stormwater service have been itemized as a parcel-based, independent fee on the wastewater or drainage bill (Valderrama and Levine 2012). In these systems, utilities can leverage reductions in the amount of impervious area on a given property as “savings” realized in a stormwater fee reduction, much like efficiency savings accrue to an energy bill (Valderrama and Levine 2012).

Because of the distributed nature of stormwater collection systems and the potential for savings-based return on investment, green stormwater infrastructure financing faces many of the same market barriers as energy efficiency retrofits. Most notably, GSI installations have significant up-front costs and transaction costs which deter investment. There is also a timing mismatch, where the benefits of GSI accrue over a longer time period than the property remains with the same owner. Risk and uncertainty abound since loan repayment is based on future savings, and the availability of capital for GSI projects and the scalability of these programs is in question (Francis 2010).

According to Sarah Francis from the Sustainable Business Network, the keys to promoting private investment opportunities in GSI are considered to be the ability to address market barriers, building a community greening “ethic” with shared information and establishing a large, qualified workforce (Francis 2010). These factors are shared with energy efficiency, as is the importance of reducing investor risk by offering credit enhancements in order to establish a successful program track record (Valderrama and Levine 2012). Both sectors also face unclear implications regarding the treatment of financing following the transfer of property ownership and uncertainty around the long-term stability and predictability of the fees, rates and available credits that long-term financing is based on (Valderrama and Levine 2012). This alignment provides the possibility for the solutions that have proven effective in energy efficiency to drive innovative financing for GSI programs.

Existing research has explored the opportunity for cross-sectoral applications of energy efficiency financing mechanisms to GSI. Valderrama and Levine, with the National Resources Defense Council, pursued an in depth analysis of how energy efficiency financing strategies could be applied to GSI programs in Philadelphia (2012). They explored Property Assessed Clean Energy (PACE) programs, performance contracting with Energy Service Companies (ESCOs), on-bill financing, credit enhancement, credit trading and public-private partnerships (P3s). With regard for the type and size of project, Valderrama and Levine point to ESCOs for larger projects and PACE programs or on-bill financing for smaller projects. However, additional credit enhancements and partnerships are seen as useful tools to complement core program structures and contribute to program success (Valderrama and Levine 2012). Similarly, Francis, on behalf of the Sustainable Business Network, also pursued a consideration of possible financing mechanisms for private investment in GSI (2010). The report promotes implementing multiple concurrent solutions, such as establishing GSI versions of ESCOs (GISCs), implementing on-bill financing, and working with insurance companies to provide discounts to customers who install GSI (Francis 2010). However, it is worth noting that both of these authors explored this parallel with the specific case of Philadelphia in mind. There is a need for greater information to inform decision-making for GSI across the nation.

Although recognized parallels exist between energy efficiency and GSI program financing, the additional barriers to market success that GSI faces may prove to complicate implementation of certain programs more than has been true for energy efficiency. GSI incurs additional transaction costs because stormwater runoff is not traditionally metered. Moreover, operations and maintenance costs can be substantial and need to be integrated into capital financing (Hughes 2014). Not to mention that the initial investments and pay-of timescales for GSI can be even greater than for energy efficiency programs, limiting viable installations to massive, aggregated properties that incur large enough sewer costs (Valderrama and Levine 2012).

In addition, stormwater fees, especially parcel-based stormwater fees, are new to the built environment and there is limited data about how these fees will change over time. With even less certainty about how stormwater fee structures and rates will change over time than energy rates, the allocation of funds for projects reliant on stormwater savings will entail additional risk (Valderrama and Levine 2012). Therefore, GSI programs will need to find a way to provide appropriate financial incentives and a wide enough margin for programs to operate. On the other hand, GSI does hold some advantages over energy efficiency. In some cases, GSI may be able to avoid addressing split incentives because the stormwater bill may reach the property owner directly through their property tax rather than being passed on to tenants through a water bill (Environmental Finance Center Network 2012).

Despite these nuances, the threat of stormwater on water bodies across the nation and the regulatory repercussions of failing to meet standards will continue to be a growing threat. They are already serving

to promote investment in this sector as federal water quality mandates increase, infrastructure ages, flooding events increase in frequency and magnitude and the value of housing near green spaces grows (Francis 2010). With the right combination of credit enhancements and financial mechanisms to attract investors, GSI programs may be able to support addressing the location-based needs of stormwater management (Francis 2010; Valderrama and Levine 2012; Valderrama et al. 2013; Hughes 2014).

Table 1. Equivalencies between EE and GSI

Equivalencies	Energy Efficiency	Green Stormwater Infrastructure
Market Barriers	High up-front costs High transaction costs Split incentive Timing mismatch Uncertainty of savings & risk Limited capital availability Scalability	High up-front costs High transaction costs Split incentive Timing mismatch Uncertainty of savings & risk Limited capital availability Scalability More economical land use alternatives
Rate Structure	Base fee + Cost per kWh	Base fee + Cost per % impervious area
Project Scale	Whole-building, technical equipment installation	Landscaping, construction
Key Players	Utilities, property owners, city/county government, contractors	Utilities, property owners, city/county government, contractors
Market Conditions	Established, at scale	Experimental, not scaled
Traditional Drivers of Action	Incentives	Regulations
Measurement	Meters	No Meters – Measurement & Verification needed
Billing Format	Passed on to tenant	Either or both: passed on to tenant (water bill) and/or direct to building owner (property tax)
Economic Drivers	Lower operating cost	Lower stormwater fee, best use of property
Available Information	Medium info, many examples of program success, growing access	Little info, limited proven programs, limited access
Alternatives	Business as usual	Business as usual

METHODS

In order to better understand the settings in which specific energy efficiency financing mechanisms would be most appropriate, this research pursued a case study approach. Three financing mechanisms were selected as cases out of a list of seven potential alternatives – performance contracting with ESCOs, PACE programs and on-bill repayment. Cases were prioritized based on a thorough evaluation of existing

literature and the level of client interest. On-bill repayment (OBR) was selected as a case because of the cross-sector evaluation conducted by Francis (2010) and Valderrama and Levine (2012), and the prevalence of energy efficiency OBR programs across the U.S. Similarly, PACE programs have grown in success and popularity nationally in recent years, and have been evaluated for potential application to GSI in existing literature (Valderrama and Levine 2012). Finally, performance contracting with ESCOs was considered because of client interest, programmatic reliance on third-party implementers and evaluation in existing literature (Francis 2010, Valderrama and Levine 2012).

Cases that were not chosen for further analysis included benchmarking with required retrofit, low interest loans, social marketing and rebate programs. Benchmarking with required retrofit was of interest to the client, but a lack of existing energy efficiency programs implementing this approach limited the potential for analysis.² There were a large number of available low interest loan programs to evaluate, but based on the variable structures of these programs and the similarity to other cases such as on-bill repayment, other cases were pursued in favor of isolating a more specific program design for analysis. As for social marketing, the influence of this mechanism was not significant enough for it to be a standalone program. Similarly, rebate programs for stormwater have not demonstrated success based on the experience of the client because of the limited margins available in stormwater billing rates.

Table 2. Case Selection

Financing Mechanism	Chosen As Case?	Reasoning
On-Bill Repayment	Yes	Client interest, viability in literature ¹
PACE Programs	Yes	Client interest, viability in literature ²
ESCOs	Yes	Client interest, viability in literature ³
Benchmarking with Required Retrofit	No	Lack of existing programs
Low Interest Loans	No	Too general, considerations captured in selected cases
Social Marketing	No	Lack of information, not a standalone program
Rebate Programs	No	Demonstrated lack of potential in GSI context

Sources: ¹ Francis 2010, Valderrama and Levine 2012, ² Valderrama and Levine 2012, ³ Valderrama and Levine 2012, Francis 2010

Each of the three selected case studies focuses on defining the program strategy, evaluating the experience of multiple cities that implemented it, and identifying the key factors that determine the conditions under which selection of each program design is appropriate to inform decision-making. The

² If greater interest in this mechanism exists, lessons may be drawn from the Atlanta Commercial Buildings Energy Efficiency Ordinance. For more information visit: <https://atlantabuildingefficiency.com/>.

case analysis informed a consideration of how each financing mechanism could be applied in the stormwater context, and goes beyond the existing literature to examine national level themes and provide a decision-making framework.

The data informing these case studies was gathered through research of secondary sources, a series of interviews of energy efficiency program administrators and energy and/or GSI industry experts, and a review of example programs. The report primarily relies on publically available data about local policy, energy efficiency program offerings, and local demographics or geographic characteristics. Interview conversations were pursued using a snowball selection method following the recommendations of the client and other interviewees. All interviews targeted program and stormwater-related information and followed the Duke University Institutional Review Board, Human Subject Research Certification best practices. Conversations were conducted over the phone or in-person between December 2015 and March 2016. Evidence collected in the interviews was evaluated by seeking supporting information in the literature and online as cited. Many of the interviewees were current or former program staff and were personally invested in the program's reputation and success. While, the majority of questions were about programmatic facts, opinions are clearly noted in the following evaluation.

A key assumption of this analysis is that GSI incentive programs are possible based on the ability to leverage stormwater fee savings. Since the overarching analysis is conducted using national-level themes, the exploration key factors for consideration does not take into account the program-specific financial characteristics that will naturally impact program feasibility and success. Given the current state of stormwater fee systems across the United States, it is conceivable that the financial leverage does not exist within rate structures to encourage action by private parties. Even so, if and when the negative consequences of relying on grey stormwater infrastructure translate into higher customer rates, the conditions under which cross-sector program design applications are feasible may manifest if they do not exist already.

The advantages of taking a national-scale and sector-wide approach include revealing high level trends to inform initial investigations into appropriate early candidates for program design. Relying on a snowball interview method harnesses disperse industry knowledge on a topic that has not been explored explicitly in depth. On the other hand, the results of this research and the output from the decision tool can therefore only provide general direction and highlight potential tradeoffs between approaches. Specific program design will necessarily need to integrate cite-specific financing information and financial feasibility.

FINANCING MECHANISM CASES

Based on the available literature, there is recognized potential for cross-sector application of financing mechanisms between energy efficiency and green infrastructure because of shared market barriers and similar incentive structures reliant on future savings (Valderrama and Levine 2012, Francis 2010). What is unclear is under what conditions these financing mechanisms might show promise for implementation.

This analysis attempts to identify the appropriate conditions for implementation of on-bill repayment, PACE programs and performance contracting with ESCOs in the GSI realm. By understanding how each financing mechanism leverages market characteristics, addresses investor risk, breaks down knowledge barriers or offers other solutions, this analysis will isolate the key factors that determine program viability.

ON-BILL REPAYMENT

In order to finance energy efficiency retrofits, third party entities or utilities can provide up-front capital that is then repaid through a surcharge on the property owner's utility bill. When this program is led by a third party entity, it is called on-bill repayment (OBR), and when the utility administers the program it is on-bill financing (OBF) (Nandivada 2014). Since this study is most concerned with innovative ways to leverage third party funding, the focus is on on-bill repayment programs. OBR rely on the appeal of low or no up-front costs and low interest rates, with the threat of utility disconnection in the event of default (Kim et al. 2012). They strive to achieve "bill neutrality" by ensuring that energy savings meet or exceed loan payments so the customer does not see an increase in their energy expenses (Kim et al. 2012).

On-bill repayment services can be charged as on-bill loans or on-bill tariffs. Loans are tied to the property owner who must repay any outstanding funds at the point of sale, while tariffs are tied to the utility meter and remain associated with the property throughout the repayment period, making them more appropriate for longer term payback periods (Kats 2012).

On-bill repayment requires enabling legislation from the state legislature. While the framework for administering OBR has been implemented for energy efficiency and 20 states have enabling legislation, existing OBR programs are limited and only a handful had been piloted as of 2014 (Nandivada 2014). However, existing OBR programs have seen low rates of default and positive cash flows, while being able to take advantage of multiple funding sources and target multiple building sectors with one program (Kim et al. 2012).

Findings

Each of the programs included in this analysis had some form of initial funding. Derek Smith, the former CEO of Portland's Clean Energy Works Program, explained that Portland's program was founded without allocated funding, but didn't get off the ground until the City received American Reinvestment and

Recovery Act (ARRA) federal grant funds.³ In New Hampshire, the NH SAVES program was initiated using funding from the Regional Greenhouse Gas Initiative (RGGI), a regional cap and trade agreement to reduce greenhouse gas emissions in the Northeast and Mid-Atlantic.⁴ The initial up-front capital to support OBR programs can come from grants, but also from utilities (ratepayers) and private sources, which maximizes the ability for these programs to take advantage of available markets and overcome market barriers (Bell, Nadel and Hayes 2011).

According to Miriam Joffe-Block from the California Hub for Energy Efficiency Financing (CHEEF) Program, even in OBR and OBF programs that are intended to be self-sustaining, the State typically acts as the lender and provides loans or leases (or originates them through a partnership with a financial institution) and then sells the loan portfolio on the open market or to specific secondary purchasers in order to replenish the capital supply.⁵ For example, Connecticut's new on-bill repayment program pursues this method. In comparison, California's CHEEF OBR pilot is attempting to have private investors assume responsibility for loan origination. As has been done in other states, the pilot offers additional financial security through a loan loss reserve fund that is maintained by an energy efficiency fee collected from ratepayers.⁶

Although on-bill repayment programs where funds come entirely from third-party financiers are less established than financing provided by a utility, California's CHEEF pilots are exploring a commitment to this approach (Box 1).⁷ Interest in these programs by investors is promising, especially since a program can leverage momentum to boost the involved capital once it is up and running. Derek Smith explained that Portland was able to create competition between lenders and generate more attractive offerings because it had 3-4 financial partners offering loans within the same program. However, the challenge in this program became maintaining a sufficient scale of and demand for energy efficiency projects because the lenders needed to have enough customers to justify maintaining the operational expense of offering the program.⁸

Therefore, the scale and target audience of OBR programs is important to recognize. The majority of example programs in the literature, including the program examples included here, are geared toward residential, small business or multi-family properties. Commercial OBR programs exist, but are less prevalent and often exist alongside a residential-scale component to the program (Bell, Nadel and Hayes 2011, Hayes et al. 2011). This indicates that OBR is most effective for small-scale projects that can account for loan repayment in the margin of savings while maintaining a bill-neutral offering.

³ Personal interview with Derek Smith. February 26, 2016.

⁴ Personal interview with Kelly Bryan. December 5, 2015.

⁵ Personal interview with Miriam Joffe-Block. February 23, 2016.

⁶ Ibid.

⁷ Ibid.

⁸ Personal interview with Derek Smith. February 26, 2016.

One study found that lenders feel less risk participating in on-bill programs than in stand-alone energy efficiency financing (Bell, Nadel and Hayes 2011), but the specific requirements of OBR authorizing legislation are important to consider. Some on-bill programs require that the loans be non-transferable so that when the property changes ownership the remainder of the loan must be paid in full (Valderrama and Levine 2012). Jonathan Kevles from Renew Financial, speaking about energy efficiency financing in general, remarked on the significance of these limitations on financing terms, explaining that non-transferability creates additional barriers for property owner and investor engagement.⁹ This would

Box 1. On-Bill Repayment Program Examples



California CHEEF Program

The California Hub for Energy Efficiency Financing is in the process of launching a state-wide on-bill repayment program for residential (and eventually commercial) energy efficiency retrofits. Rather than having the state or utility establish and originate the loans, this program engages private investors on the front end to provide financing directly to the customer. The goal is to enable conditions where loan terms match the unique needs of the lender and customer. Challenges include engaging investors who will have to take on the transaction costs of complying with program requirements. The program is supported by a loan loss reserve fund sustained by ratepayer energy efficiency fees. This credit enhancement allows lenders to offer more attractive terms based on their specific lending requirements. Credit enhancement is offered for up to 15 years and commercial loan repayment is expected to take about 10 years. The state-wide scale of the program is expected to help build a credible market.¹⁰



Portland Clean Energy Works

Portland, OR established the Clean Energy Works Program in 2008 to engage residential homeowners in energy efficiency retrofits. The program was initially funded by ARRA grant dollars and administered by Craft3, a local community development financing institution (CDFI). Targeted retrofits ranged from about \$10-15,000. The program was able to offer loans subsidized by lenders because 3-4 investors were involved at the same time and competed for customers. This loan arrangement was supported by a loan loss reserve fund maintained with federal stimulus funds. Oregon does not have existing energy efficiency legislation, so this program strove to build a private market solution to drive energy efficiency retrofits. The initial pilot ended in 2010 when the grant funding concluded, but went on to inform Clean Energy Works Oregon and other programs in the state. (Bell, Nadel and Hayes 2011)

⁹ Personal interview with Jonathan Kevles. January 25, 2016.

¹⁰ Personal interview with Derek Smith. February 26, 2016.

be especially true for retrofits with longer payback periods that extend beyond the property owner's timeline for building ownership.

Key Factors for Success

Key factors of success for on-bill repayment programs include access to an initial pool of funds to initiate the program and facilitate investment subsidies or offer loans. Credit enhancements to reduce risk and remove market barriers are also essential components of a loan program in order to attract investment. Interest from community development financial institutions (CDFIs), such as in Portland (Box 1), can also be influential in building sustainable private investment.

Local factors of significance include enabling legislation at the state level, which is mandatory for OBR. The cost of energy and the existing incentives will also determine the potential financing terms since the achievable margin from an energy efficiency retrofit will be dependent on the cost per kilowatt hour and scale of potential savings in a given location. As explained by Kendall Bodden from Metrus Energy, properties in a service area with high energy bills and large incentives will benefit more from each kilowatt saved, and therefore have more incentive to pursue energy efficiency retrofits.¹¹

It is also essential for the utility to be willing to sign on and manage the payback of loans through their bill despite the additional transaction fees. Even if the financing is entirely provided by third-party investors, utility involvement is critical for project operations, enrollment, monitoring and verification. Building on that requirement, third-party investors must also benefit enough from the program to warrant taking on the associated transaction costs of administration. A key concern of Miriam Joffe-Block's for the CHEEF pilots is whether financial partners will be willing to comply with the requirements of participating in a program that must align with utility documentation, confidentiality and measurement and verification needs.¹²

Application to GSI

On-bill repayment programs have some potential viability in the world of GSI. As demonstrated in the energy efficiency realm by the California CHEEF pilots (Box 1), an additional charge applied to the stormwater ratepayers' bill could fund a pool of capital to support loans, credit enhancements or program expenses (Valderrama and Levine 2012). Paired with an initial funding source and credit enhancements such as a loan loss reserve fund, a self-sustaining on-bill repayment program for GSI installations may be possible. Regulatory requirements may be influential in motivating investment in these funds (Berahzer and Hughes 2014).

Primary barriers to proper implementation for GSI will include the lack of a shut-off threat, and the sheer cost of GSI installations potentially being too large to allow for traditional bill-neutral repayment. The fact

¹¹ Personal interview with Kendall Bodden. January 29, 2016.

¹² Personal interview with Miriam Joffe-Block. February 23, 2016.

that utilities can leverage the threat of shutting off a customer's electricity helps discourage default; however, shutting off stormwater service is not a possibility because the physical infrastructure providing the service already exists. Therefore, there is less enforcement potential, and greater risk of default. In places where the water and stormwater utility are the same, there may be an opportunity to create this leverage through the water bill, but issues of water rights may halt such an initiative. Legislated requirements may also create barriers on the demand side, including the potential requirement for non-transferability of on-bill repayment loans upon sale of the property. Where possible, these agreements will need to be issued as tariffs so that they transfer ownership with the property, since this is a primary concern for successful GSI financing.

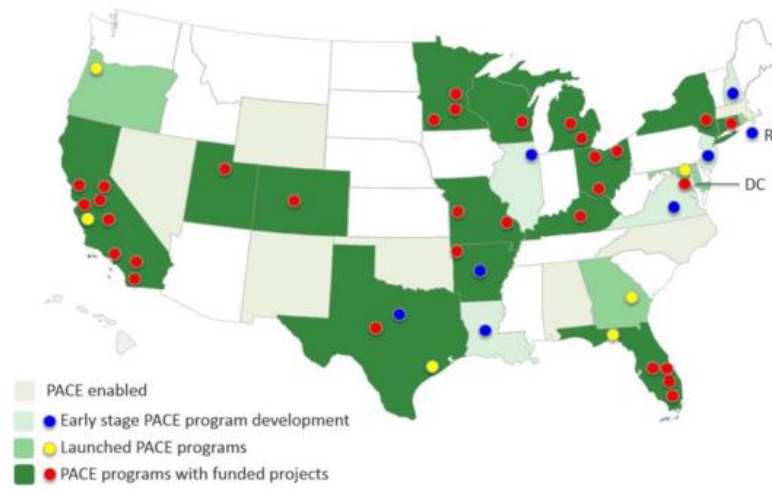
Overall, the implementation of on-bill repayment programs is dependent on the ability to avoid the above barriers in addition to balancing finances. Therefore, small-scale projects with mid-term payback periods may be more eligible for OBR programs, such as small businesses or multifamily properties. Engaging the utility may be difficult because of the operational costs, but utility participation in stormwater retrofits can motivate third-party investment in the sector and may help get a GSI program off the ground (Valderrama and Levine 2012).

PACE PROGRAMS

PACE programs are a type of third party financing program that use property tax liens to back bonds issued by a municipal financing district for energy efficiency retrofits (Kapur et al. 2011). Collection can be orchestrated by the local government or a third party financing institution, but in both cases the loan is repaid, usually over the lifespan of the retrofit, through the owner's property tax (Nandivada 2014).

PACE programs are dependent on enabling state-level legislation that allows for the establishment of municipal taxing districts which can issue a PACE bond. Therefore, creating PACE programs may require substantial changes in government and/or utility policy and practice (Kapur et al. 2011). However, these programs help to overcome a number of market barriers such as the lack of accessible financing to cover up-front costs. Since PACE loans are associated with the property and not the owner, repayment costs remain with the building if it is sold (Kats 2012). PACE programs are growing in popularity and acceptance nationally, although most existing programs were new as of 2013 (Nandivada 2014). Currently, 32 states and the District of Columbia have PACE-enabling legislation and there are 16 commercial PACE programs active across the nation (PACE Nation 2016a).

Figure 1. PACE Legislation and Financing in the U.S.



Source: PACE Nation 2016a

Findings

According to Craig Holland from NatureVest at The Nature Conservancy, PACE programs offer greater security than on-bill financing and other forms of long-term lending because they are associated with the property itself.¹³ The biggest limiting factor to PACE programs is that they require state-level authorizing legislation to exist. However, Jonathan Kevles from Renew Financial which operates CaliforniaFIRST emphasized that the terms of this legislation are also important. Legislation can determine whether or not counties are automatically authorized into the program or if they need to pass individual resolutions as well. It can also determine whether pooled bonding between counties is permitted or if each county must issue bonds individually. Kevles stressed that, in the interest of reaching economies of scale, it is best to limit the barriers to program entry and allow for aggregated financing efforts.¹⁴

While Kevles warned that requiring consent from the mortgage lender to pursue PACE can add time and uncertainty to the financing process,¹⁵ some states require lender consent or notification (especially for more complicated commercial leases) in order to protect the property owner whose lease may be violated by placing a lien on the property that is superior to the existing mortgage (“PACE in Florida” 2016). Other programs require a savings to lending ratio that is greater than one. Although this requirement is intended to ensure the viability of a PACE lien, according to Kevles, it makes creating a project more challenging and doesn’t address the market challenge of making energy services equipment more competitive.¹⁶ As

¹³ Personal interview with Craig Holland. February 17, 2016.

¹⁴ Personal interview with Jonathan Kevles. February 25, 2016.

¹⁵ Ibid.

¹⁶ Ibid.

his opinion shows, these policy and financial security tradeoffs are not black and white. It is necessary to balance providing enough security to guarantee the political, financial and programmatic viability of a program design. However, it is also essential to recognize the consequences of adding or taking away security measures and to find the right combination of measures that will minimize overall risk while maintaining program ease of implementation and attractiveness to both lenders and property owners.

PACE programs can be paired with credit enhancements that support the financial viability of the program. For example, Kevles explained that the CaliforniaFIRST program offers loans which are completely funded by private, third party investors, but Governor Jerry Brown allocated \$10 billion to create a loan loss reserve fund to support losses from the program.¹⁷ These credit enhancements typically require some form of policy driver or government investment, just as they would for OBR programs.

Other players that come together to create and implement PACE programs are third-party program administrators and contractors. It often makes sense for state or local governments to outsource PACE program administration to a firm that has relevant expertise and experience. Some examples include Renewable Funding for CaliforniaFIRST, Sustainable Real Estate Solutions, Inc. for Connecticut CPACE, and the Energy Improvement Corporation for the Energize New York Finance Program (PACE Nation 2016b).

Residential PACE programs have stalled since the recession in 2008 because Fannie Mae and Freddie Mac loans began disallowing additional liens on residential mortgages (City of Berkeley 2010). Since that time, commercial buildings have been the primary recipients of PACE loans. Craig Holland noted that residential programs are further complicated because in implementation, only wealthy homeowners are able to or interested in taking advantage of program offerings which presents an equity issue since most of the energy stress falls disproportionately on low income households.¹⁸ However, commercial participants can take advantage of PACE offerings because they have avoided the restrictions associated with Fannie Mae and Freddie Mac, are oftentimes already located in dense urban areas and the equity problem is less of an issue (Palmer, Walls and Gerarden 2012).

PACE Program development, especially for commercial properties, has been growing in popularity across the country. However, there has been less proven or successful implementation because of its newness to the market (Freehling 2011). Even so, PACE programs have significant potential because they are associated with the property and therefore can maintain much longer payback periods (20 to 25 years) than other financing mechanisms which do not provide enough security for investors to take on long term risk (Valderrama and Levine 2012).

¹⁷ Personal interview with Jonathan Kevles. February 25, 2016.

¹⁸ Personal interview with Craig Holland. February 17, 2016.

Box 2. PACE Financing Program Examples



CaliforniaFIRST Program

California established a state-wide PACE financing program in 2015 to provide financing for commercial and residential energy efficiency retrofits. A third-party program administrator, Renew Financial, runs the program. The primary credit enhancement is a revolving loan fund which was established by a \$10 billion allocation from the state legislature. According to Jonathan Kevles, each county in the state must pass a resolution to participate in the program, but pooled bonding is enabled between counties, allowing for the state-wide implementation. Participating customers are generally reactive to energy or equipment needs.¹⁹



Colorado C-SPACE

The Colorado C-SPACE program is a state-wide program for commercial customers. It is run by a third-party program administrator is Sustainable Real Estate Solutions (SRS). Colorado counties must individually pass a resolution to be authorized into the program. The program is currently only authorized in Boulder County, but 12 other counties are in discussion for program approval. (PACE Nation 2016b; CoPACE Assessment and Financing Agreement 2015).



Texas PACE In-A-Box

PACE is authorized in Texas but there is not a comprehensive state-wide program. Instead, they developed "PACE in a Box" which is a program framework that counties can implement individually. This model has been considered in other states that do not permit pooled bonding, such as Virginia. Currently this program is only available in one county (PACE Nation 2016b).



Connecticut CPACE

Connecticut's state-wide PACE program is seen as the largest and most successful commercial PACE program in operation. CPACE is administered by SRS in partnership with the Connecticut Green Bank. 110 out of the state's 169 municipalities participate in the program. Limited to commercial projects, the PACE program provides low-interest, long-term capital through the lien process so that government financing is not required. The first CPACE project was implemented in 2013. The program initially gained more success than other PACE programs by restoring senior lien status to PACE assessments and requiring mortgage lender permission for project approval (Clean Energy Finance and Investment Authority 2012).

¹⁹ Personal interview with Jonathan Kevles. February 25, 2016.

Key Factors for Success

Key factors for the successful implementation of PACE financing include, first and foremost, existing PACE-enabling legislation or the political will and social interest to pass related legislation. Next, any program needs to offer some combination of government-backed loan guarantees to establish a performance history and help bring additional capital to the market (Kapur et al. 2011). Typically, regulatory requirements, such as a consent order or federal legislation, may spur political support for legislative and financial solutions at the state level (Freehling 2011).

The details of the legislation and other policy requirements are also influential in program success. Pooled bonding between counties, although not mandatory, allows for a state-wide economy of scale even if counties are not automatically authorized into PACE programming. It is also helpful to have limited requirements for loan eligibility and compliance in order to minimize barriers to participation, while still establishing an appropriate level of security.

Application to GSI

PACE programs are well-suited to transfer to GSI financing, primarily because they are integrally associated with the property itself. This means that PACE-financed projects naturally avoid timing mismatch barriers created by lease timelines and split incentives caused by the disparate interests of building owners and renters. This option also suits a variety of project scales and is feasible for expensive retrofits with small margins of savings because it can offer long payback periods of up to 25 years and remain with the property for the length of the repayment.

However, PACE-enabling legislation will likely need to be amended in most states because existing statutes only provide for energy efficiency, renewable energy and water efficiency. There will also need to be a demonstrable financial benefit in savings from installing stormwater benefits. Currently, in order to meet the common requirement for a savings to investment ratio greater than one, existing stormwater credits will need to increase (Valderrama and Levine 2012).

ENERGY PERFORMANCE CONTRACTING WITH ESCOS

Energy Services Companies (ESCOs) are large commercial firms that implement comprehensive energy efficiency retrofits from audit to measurement and verification in fulfillment of Energy Savings Performance Contracts (ESPCs) with property owners (Nandivada 2014). Installation projects are typically designed so the cost-savings meet or exceed the total cost of the retrofit over the life of the contract (Nandivada 2014). By covering the up-front costs and taking responsibility for developing recommendations, engineering solutions, installing the improvements and measuring the cost-savings, ESCOs streamline the process of undergoing an energy efficiency retrofit and reduce the risk of making a large enough investment to produce adequate energy savings returns (Nandivada 2014). They can provide security for the customer's investment by guaranteeing certain annual energy savings thereby

assuming the risk of the investment in exchange for sharing the cost-savings from the retrofit (Kapur et al. 2011).

Customers can allocate internal funds to these project directly, but many ESCOs offer financing through the ESPC. When external financing beyond what the ESCO can provide is needed, Energy Service Agreements (ESAs) can be established between the building owner and a third party investor who then maintains an ESPC with the ESCO. In this case, the third party investment fund owns and pays for all the energy efficiency assets installed as part of the retrofit and acts as an intermediary between the customer and the ESCO who is installing and monitoring the upgrade (Kapur et al. 2011).

Since ESPCs are typically negotiated between an ESCO and the property owner and do not involve a public entity, they do not require enabling legislation (Nandivada 2014). However, policy support is valuable in promoting the success of ESCO-led investments (Osborn et al. 2002). Projects that attract ESCO involvement are generally larger (greater than \$500,000) because of the substantial transaction costs of contract negotiation, baseline calculation and verification of savings. Payback periods for these kinds of projects last 10 or more years, which is not as long as PACE or some forms of OBR financing but is longer than the typical investment payback timeline for internal financing at a business (3-5 years) (Kats 2012).

Findings

ESCOs and ESA financing partners are more likely to be national or international firms that have the capital and expertise to pursue large scale energy efficiency projects. This means that ESCO-centric programs are generally not driven by a utility. Rather, the utility or government role is to make the environment for energy efficient investment attractive to these companies by offering incentives and rebates (Kim et al. 2012).

Kendall Bodden from Metrus Energy explained how ESA project payments are based on actual energy savings performance, where the financing partner installs, owns and operates energy efficiency equipment and sets the cost of the utility bill to equal to or less than the current cost. The financing partner then accrues the savings from the increased performance. Bodden noted that a limitation of this system is that lenders are generally unwilling to offer loans with a payback period of longer than 10 years. This limits the financing partner from being able to support projects whose balance sheets cannot be resolved based on the achievable savings within the time period lending institutions are willing to offer a line of credit.²⁰ This means that for projects to be eligible for ESPCs or ESAs, they must generally reach a large enough scale to produce a sufficient margin of energy savings to justify ESCO and investor involvement. Bodden explained that the cost of energy in a given location and the available incentives

²⁰ Personal interview with Kendall Bodden. January 29, 2016.

Box 3. Energy Services Company (ESCO) Examples



Metrus Energy

Metrus Energy manages and finances large-scale whole-facility energy efficiency retrofits by engaging in ESAs with clients. Metrus provides up front financing for a retrofit and partners with ESCOs that implement energy efficiency projects. Through the contract, Metrus maintains ownership of the installed technology and conducts equipment maintenance and measurement and verification of energy savings. Clients pay Metrus based on realized energy savings under the ESA, and future projects are beginning to incorporate water efficiency measures and savings as well.²¹ Metrus Energy served as a financial ally for the U.S. Department of Energy Better Buildings Challenge and the Alabama SAVES program. Example projects include a \$10 million investment across 5 sites for BAE Systems and a \$5.8 million investment at the Kuakini Medical Center in Hawaii which generates \$1.1 million dollars in annual savings (influenced by Hawaii's high electricity costs) (Metrus Energy 2016).



Amaresco

Amaresco is an ESCO that leverages bill neutral solutions through ESPCs or Power Purchase Agreements to realize energy savings for large-scale commercial, industrial and institutional clients. By offering a variety of energy efficiency and renewable energy solutions, Amaresco is able to help create savings which help pay for energy investments and reach client goals such as ENERGY STAR or LEED certification. Typical clients include large-scale institutional facility owners, such as the San Francisco Housing Authority; the City of West Richland, WA; and the Logan International Airport (Amaresco 2016).



McKinstry

McKinstry is a "full service design, build, operate and maintain" firm that specializes in sustainable solutions for the built environment. They have served as an ESCO to provide energy efficiency retrofit services and have a regional reputation and expertise in the Pacific Northwest. Past retrofit projects include a data center in Washington, the Spokane & Inland Empire Railroad at McKinstry Station, and the 100,000 sqft. Harrison Square office building owned by Oregon Pacific Investment and Development Company. The company prides itself on innovation for the built environment and has an Innovation Center dedicated to crafting new ideas, products and technologies (McKinstry 2016). Their experience with comprehensive building design and improvement make them an excellent candidate for exploring cross-sectoral opportunities for efficiency savings.

²¹ Personal interview with Kendall Bodden. January 29, 2016.

and rebates play a fairly significant role in the margin available to operate projects in, so projects in locations with high energy costs and larger incentives are more eligible for this kind of financing²².

Key Factors for Success

As stressed by Bodden, retrofits must be large enough to justify the investment and cover transaction costs for performance contracting and Energy Services Agreements.²³ Generally, only large facilities or campuses will meet this requirement. The presence of a large number of properties that are either owner-occupied or have low turnover in an area is a benefit, since property owners with a long-term stake in the property will be more willing to pursue a long-term investment (Kapur et al. 2011). As experienced by Metrus Energy, energy costs and the available incentives and rebates for energy efficiency installations are also critical factors for balancing paying for performance with the limited timeline of loan repayment designated by investors.²⁴

Application to GSI

Challenges in applying the ESPC model to GSI include the limited historical record of stormwater fees for modelling how they will change into the future. According to Bodden, projecting future rate changes is a fundamental component of balancing the finances of performance payback based on the difference between the original bill and the new bill over time.²⁵ If the projections have a wide band of error, the financing partner will not be able to maintain profitable projects. In addition, the success of ESPCs is generally reliant on available incentives and rebates from utilities,²⁶ however these credits are not available for stormwater to the same extent that they are for energy efficiency so the existing gains are limited. Future GSI performance contracts would benefit from additional savings opportunities from increases in stormwater fees and/or increases in stormwater rebates. Without this additional incentive, the feasibility of implementation might be limited to properties facing some form of regulatory compliance requirement.

The fact that ESPCs and ESAs are generally limited to 10-year payback periods is limiting given the high costs of installing GSI and the low margin of savings in stormwater fees. Although they offer a solution which spans beyond a business' typical three-year return on investment schedule, these intervals may still not appropriate when ESCOs will look to install large-scale projects since these would require

²² Personal interview with Kendall Bodden. January 29, 2016.

²³ Ibid.

²⁴ Ibid.

²⁵ Ibid.

²⁶ Ibid.

extensive payback periods unless the customer was able to finance a large portion of the installation themselves.

Measurement and verification plays a huge role in the suitability of ESPCs for GSI. As Miriam Joffe-Block discussed with regard to OBR in California, there is a large barrier for investors to participate since they have to comply with both utility and CHEEF verification documentation requirements, which ensure that projects achieve enough savings to justify the investment of ratepayer dollars.²⁷ Since ESCOs (in GSI's case, GISCs) administer the entire retrofit from audit through to measurement and verification, this requirement is incorporated into the process of fulfilling a performance contract. This would reduce the barriers that GSI faces with the need for in-person measurement and verification due to the lack of metering in stormwater by integrating it into the service contract.

Even so, ESCOs offer many advantages. The largest benefit to this approach is that it is wholly driven by private firms and investors. Performance contracting is an engagement between a private company and a property owner and does not require authorizing legislation or political involvement. These contracts are a market solution that must operate within legal frameworks and are promoted by public incentives, but which are not dependent on government action (Osborn et al. 2002). There is more flexibility for this financing mechanism, but it is also more dependent on existing demand from customers.

There are opportunities for variation within this structure as well. Craig Holland proposes a similar approach, where a landscaping firm or other private entity with a lot of extra cash could theoretically serve the same purpose as an ESCO or financing partner. The firm could purchase the capital for the GSI installation and then solve a timing issue with the property owner who buys the installation from them over time much like how the Nature Conservancy conducts land conservation for the government.²⁸ Another innovative approach to this structure proposed by Francis is to create Green Infrastructure Service Companies, or GISCs, which would serve as mini-ESCO firms to support stormwater retrofit implementation with start-up funding from community development financial institutions (CDFIs) (Francis 2010). GISCs would need to develop industry expertise in order to be able to overcome information and knowledge barriers and provide a verifiable product in the GSI market. As Kendall Bodden was able to testify for Metrus Energy, ESCOs are already beginning to integrate water efficiency offerings into their retrofit agreements.²⁹

While performance contracting might not be the most natural fit, creative alterations to the energy efficiency model may pave the way to successful GSI retrofit implementation. There is an essential need

²⁷ Personal interview with Miriam Joffe-Block. February 23, 2016.

²⁸ Personal interview with Craig Holland. February 17, 2016.

²⁹ Personal interview with Kendall Bodden. January 29, 2016.

for an economy of scale to support large firms, but if the market could support GISCs, there would be a great opportunity to target the largest offenders of stormwater pollution and runoff.

DISCUSSION

Amy Pickle from the Nicholas Institute for Environmental Policy Solutions explained that GSI programs that currently exist, whether targeting public or private property, are pretty exclusively driven by regulatory requirements.³⁰ It is not economically rational to pursue GSI in many cases since it is such a distributed solution. However, regulatory drivers, such as a consent order or total maximum daily load (TMDL), that lead to a policy or financial commitment to action on behalf of the local government may create the momentum for investment in a larger program. Currently, the economic drivers for customers (e.g., achieving energy savings) are not as strong for GSI as they are for energy efficiency because savings opportunities and incentives are limited (Hughes 2014). As the cost of maintaining stormwater infrastructure increases and is passed on to the customer, this may become less true.

These opportunities are already occurring across the country. Craig Holland, the Director of Product Development for NatureVest at the Nature Conservancy, shared that when he is looking for somewhere to implement a new GSI program, he looks for three things: 1) a stormwater utility fee, 2) development of standards that mandate retention, and 3) mandated GSI spending on behalf of the local government.³¹ These three components demonstrate a commitment of dollars and local efforts to GSI and lay the groundwork for sufficient momentum for a GSI program.

However, even when these conditions exist, there may be additional barriers. For energy efficiency, there is a recurring theme across all three financing mechanism cases, that availability of capital is oftentimes not the problem – the lack of a “clear and scalable path to a supply of energy efficiency projects” is (Kapur et al. 2011). There is a more serious demand side problem than a supply side problem (Nandivada 2014), because property owners are largely reactive to equipment needs as they arise. Both Derek Smith and Miriam Joffe-Block stressed the needs for a sufficient line-up of projects to justify investor and utility involvement in their programs.³² In addition, Kevles noted the importance of contractors, saying that the contractor a customer contacts to facilitate repairs will oftentimes be the key initiator of a conversation about larger retrofit opportunities,³³ so awareness of contractor interests, contractor buy-in and available contractor expertise are all important. Stormwater will face similar customer and market engagement challenges. According to Holland, the best candidates for GSI retrofits are properties that have a high

³⁰ Personal interview with Amy Pickle. December 8, 2015.

³¹ Personal interview with Craig Holland. February 17, 2016.

³² Personal interviews with Derek Smith, February 26, 2016, and Miriam Joffe-Block, February 23, 2016.

³³ Personal interview with Jonathan Kevles. January 25, 2016.

stormwater bill and a large amount of impervious surface, but limited demand for alternative uses of that space.³⁴ A chosen financing mechanism for GSI needs to attract these property owners first because they are the audience with the most to gain.

In general, the most natural fit, based upon the analysis in this report, for GSI nationwide is PACE financing. PACE programs address the most market barriers by directly associating the loan payment with the property so it accrues to building owner (rather than the tenants) and remains with the property in the event of a sale. PACE also allows for large loan amounts because the property can act as collateral, reducing risk and allowing for longer term payback periods. This is appropriate for GSI because installations are so expensive and the savings margins are currently small. There is also the opportunity to apply PACE programs at a state-wide scale and to multiple development categories (commercial, multifamily, small business, etc.), creating an economy of scale that can magnify program successes. However, the selection of PACE versus another financing mechanism is dependent on authorizing legislation and is therefore either impossible or cumbersome in some states depending on local legal requirements.

While performance contracting is limited to large-scale projects, it avoids policy requirements which limit the viability of programs. GISCs can take advantage of market openness where policy limitations exist. At their full potential, GISCs could harness national economies of scale and be more adaptable to market opportunities. Similarly, while OBR is most suitable for small-scale projects and requires significant administrative costs because of utility involvement, it may be the best choice in some areas where PACE authorizing legislation does not exist and large-scale customers are not interested in performance contracting.

Table 3. Overview of Financial Mechanisms

	Funding Source	Payback Mechanism	Authorizing legislation required?	Typical Payback period	Managing Entity	Project Scale
OBR	State, local and/or private	On-Bill	Yes	3-10 years	Third party admin	Small, Medium
PACE	State and/or private	Property Tax	Yes	20 years	Third party admin, state, county	Small, Medium, Large
ESCOs	Private	Direct to financial institution	No	10 years	ESCO	Large

³⁴ Personal interview with Craig Holland. February 17, 2016.

In all three cases there is the potential for innovation beyond conventional energy efficiency program design to suit GSI sector needs. For example, performance contracting with GISCs could be established through a public-private partnership between a local government entity, CDFIs and a large firm interested in GSI retrofit implementation. This could help spur the innovation needed to create a program in the newly developing GSI space by concentrating resources and capabilities.

Regardless of the final overarching financing mechanism, there will necessarily be the need to provide some form of credit enhancement on top of the general loan and repayment platform. Almost all of the specific programs examined here included some form of credit enhancement (loan loss reserve fund, buy-back guarantee, utility incentives, etc.), if not more than one. The design of a program will need to account for what forms of additional offerings are viable for the local government hosting the program, and what overall structure is appropriate based on the case-specific details.

DECISION MAKING CRITERIA FOR GSI

Although some financing mechanisms might be more appropriate for GSI overall, case-specific details will determine the best fit locally. Based on the findings of this report, a number of key factors exist that can direct decision-making around green stormwater infrastructure financing. The place-based key factors that influence the three financing mechanism cases inform the following decision-making criteria.

The first consideration must necessarily be the opportunity to create savings commensurate with reductions in impact to the stormwater system. An itemized stormwater fee is an important prerequisite for a program because if stormwater sewer services have not been valued, there is no market signal to customers that reducing their impact is desirable. Assuming this requirement is met, the following criteria indicate the suitability of the three financing mechanisms for a specific jurisdiction and most clearly inform decision-making for program design:

- Building stock of greatest concern: small businesses, multifamily, commercial (high rises, office buildings), large-scale commercial (warehouses, large parking lots, multi-building complexes).
- Authorizing legislation: PACE authorizing legislation for energy efficiency, potential for PACE authorizing legislation, OBR authorizing legislation for energy efficiency, potential for OBR authorizing legislation
- Political buy-in: High, medium, low
- Incentives: Significant existing stormwater management incentives, minimal existing incentives, no incentives
- Regulatory requirements: existing requirement (consent order, TMDL, etc.), potential requirements, basic requirements (Clean Water Act)

As demonstrated in Table 4, the criteria that are important for each financing mechanism vary. Fewer key factors impact the viability of performance contracting for GSI so the decision may be more straight-

forward, but pursuit of OBR is more nuanced because there are more considerations which may determine whether or not it is an appropriate option. In general, PACE programs are most appropriate in states with a history of PACE authorizing legislation, strong regulatory drivers for action and a wider range of target property sizes. Performance contracting is more appropriate in places with a high concentration of large-scale commercial building stock, limited legislative support and multiple available incentives. OBR programs are most applicable where there are more opportunities to pursue small-scale GSI and strong regulatory drivers for action.

Table 4. Importance of Criteria for Each Case

Criteria	Importance for OBR	Importance for PACE	Importance for GISCs*
Itemized Stormwater Fee	H	H	H
Building Stock of Greatest Concern	H	L	H
Authorizing Legislation	H	H	L
Political Buy-in	H	H	L
Incentives	M	L	H
Regulatory Requirements	H	H	L

Key: H = High, M = Medium, L = Low

*Green Infrastructure Service Companies

In addition, considerations that apply to all three of the cases are still significant for determining the feasibility of a financing mechanism in a given setting. These shared key factors will impact program viability and are important to consider in program design:

- Stormwater fee margin: A high stormwater fee provides greater incentive for customers to take action to reduce their operating costs and may provide greater flexibility to harness a margin of savings to offer incentives.
- Potential for credit enhancements: Availability of funds to host a loan loss reserve fund, revolving loan fund, loan guarantee, interest rate buy-down, or other credit enhancement can help decrease risk and attract investment
- Ability to create/leverage an economy of scale: State-wide programs with sufficient customer demand will be more able to harness economies of scale
- Policy requirements: Loan or program terms with fewer requirements decrease the risk of investment and are more attractive to investors
- Availability of financial partners: Existing CDFI or commercial lender engagement on sustainable programs is beneficial since established relationships can increase trust and access to resources.

It is encouraged that decision-makers not only consider the current conditions in their jurisdictions with regard to these criteria, but also what has the opportunity to take place. This will inform the various

situations under which each option might be relevant and shed light on program tradeoffs for the location in question.

Box 4. Decision Tool Overview

Stormwater Finance Decision Tool

The requirements and criteria described here have been formulated into a Microsoft Excel-based decision tool to support decision-making and further analysis based on location-specific information (see Appendix A1). The Stormwater Finance Decision Tool translates the criteria identified here into qualitative and quantitative metrics and uses the characteristics of a specific stormwater system to determine which, if any, of the three case financing mechanisms would be appropriate for further consideration in the given jurisdiction. Each criteria is designated as a prerequisite or a market driver based on how it impacts the eligibility of a financing mechanism (qualified/disqualified vs. positive/negative impact). It is then scored (prerequisites 0 or 1 and market drivers -1 to 1) based on the level of impact the chosen characteristic has on the program design's feasibility. The scores are weighted and calculated³⁵ to determine the net benefit of each financing mechanism in the given setting. A net benefit equal to or less than zero indicates the financing mechanism is a poor choice given the selected characteristics and a positive net benefit indicates a potentially attractive financing approach. The tool is intended to provide initial direction for further evaluation of possible program designs by highlighting tradeoffs and bringing the national experience to bear for a specific case.

APPLIED ANALYSIS: SEATTLE, WA

SEATTLE BACKGROUND

Seattle, Washington is among the cities looking for opportunities to expand their city-wide GSI implementation rates. Concerns about stormwater are especially relevant given the pervasive precipitation levels and growing urban population in the region (Seattle OSE and SPU 2015). The City's current stormwater code strongly addresses the need to implement stormwater runoff mitigation measures (Seattle Public Utilities 2015), but the opportunities for property owners to implement voluntary stormwater management on existing property in a cost effective way are currently limited. King County's Rainwise program offers rebates to residential homeowners in combined sewer overflow basins who install eligible GSI projects, and a stormwater facility credit is available for larger users who implement GSI (Seattle Public Utilities 2015). However, according to Pam Emerson at the City of Seattle Office of Sustainability and Environment, the stormwater facility credit is not large enough to incentivize private investment in GSI and there is no existing program to actively engage current property owners and third

³⁵ Formula: $NB = P1 * P2 * (MD1*weight + MD2*weight...)$, where ND = net benefit, P = prerequisite score, MD = market driver score

party investors in GSI implementation.³⁶ The City of Seattle could benefit from more comprehensive action.

The stormwater system in Seattle is managed by Seattle Public Utilities which also manages the city's drinking water, wastewater, garbage, recycling and food waste. The sewer system is composed of combined, partially separated and separated sewers, with the core of the city primarily served by combined or partially separated sewers. These either drain to one of four surrounding water bodies or are treated at the West Point Treatment Plant or a local CSO treatment facility during rain events (Seattle Public Utilities 2015).

Seattle has a history of combined sewer overflows which exceed the frequency permitted by the Clean Water Act. As a consequence of this noncompliance, the U.S. District Court issued a consent decree in 2013 requiring both the City and King County to take action to improve water quality. In response to this and additional challenges such as basement and sewer backups, localized flooding and waterbody habitat degradation, the City of Seattle has taken a number of actions (Seattle OSE and SPU 2015).

A City Council resolution established GSI as a critical element of the city's drainage system and set a city-wide target to manage 700 million gallons of runoff annually with GSI by 2025. In order to establish a roadmap to reach this target, the City released a GSI implementation strategy (Strategy) in 2015. This Strategy relies on the acceleration of GSI retrofits throughout the city in four project types. First, code-required projects are those projects that are mandatory for installment on new properties or properties undergoing a significant retrofit. Second, utility-led and funded retrofit projects on public property will be a large part of the effort to reach the overarching goal. These GSI installations will largely be developed on government property or in the public right of way. Third, utility incentivized projects on residential property aim to impact the stormwater runoff from local neighborhoods, primarily through the county's Rainwise program. Finally, non-utility led projects aim to engage other agencies, private developers and community organizations to install GSI by offering limited local funding (Seattle OSE and SPU 2015). These targeted developments are projected to be sufficient to meet the city-wide goal. However, there is no planned engagement with existing commercial or industrial landowners unless a planned retrofit is significant enough to necessitate that the property comply with current stormwater code requirements. There is also no method of attracting third party investment to finance installations or provide a market-scale solution.

Currently, payment for sewer services by Seattle customers is divided into two parts. The discharge fee is assessed on the property tax and accrues to King County. The sewer fee is charged as a line item on the water bill and accrues to Seattle Public Utilities. Both fees are itemized and assessed based on system use (percent impervious area for the discharge fee and quantity of water consumed on the property for the sewer fee) (Seattle Public Utilities 2016a). While the drainage fee is most directly related to the

³⁶ Personal communication with Pam Emerson. April 2015.

stormwater runoff produced by a property, the sewer fee is also relevant because water efficiency measures could relieve stress on combined or partially combined sewer systems. Since these fees are correlated to a property's level of impact on the sewer system, there is potential to leverage fee savings on one or both charges as an incentive for installing GSI in Seattle. Drainage fee rates in Seattle have doubled since 2009 (CH2M Hill, Inc. 2009), with the most recent increases taking place in 2015 (Seattle Public Utilities 2016a). The large planned investments in stormwater infrastructure as part of the Strategy hint that rate increases will continue into the future.

As for energy efficiency retrofits in Seattle, the city has seen much success. The Seattle 2030 District, a consortium of commercial buildings in Seattle's urban core, has seen a 21.43% reduction in energy usage since 2011 across member buildings (Seattle 2030 District 2013). According to Glenn Amy from Seattle City Light, ESCOs have conducted a large amount of work in the city, namely led by McKinstry, a leading firm in the industry in the Pacific Northwest. Existing energy efficiency programs through Seattle City Light, the local energy utility, already demonstrate partnerships with CDFIs such as Craft3 and the Puget Sound Credit Union.³⁷

Seattle City Light offers a number of energy efficiency incentives and rebates to customers and offers on-bill financing to residential customers through the Community Power Works (CPW) program. The initial federally-funded CPW pilot included commercial and industrial properties (Seattle OSE 2016). However, ongoing local utility-led financing programs have been limited by the state constitution. In particular, PACE-enabling legislation for energy efficiency was proposed in Washington State in 2010 but was not passed into law because of legal concerns that it violates the State's strict constitutional restriction of the use of public funds for private benefit (Valdez 2010a). In order to be able to establish programs that offer public funds as loans or as credit enhancements to produce a more friendly market for energy efficiency investments, the state would either need to pass legislation that worked around the constitutional barrier or amend the state constitution (Valdez 2010b). However, Stan Price from the Northwest Energy Efficiency Council expressed that it is generally accepted by local bond administrators that this would not be possible.³⁸

RECOMMENDATIONS

In order to determine the best financing mechanism for implementation in Seattle, the characteristics of the City's stormwater and policy environment were entered into the Stormwater Finance Decision Tool (Appendix A1). The City has an itemized stormwater fee structure, which is a prerequisite for all three mechanisms. Washington's existing OBR legislation has a positive impact for on-bill repayment, but the lack of potential for PACE legislation disqualifies it as an option. The City's customers of primary concern

³⁷ Personal interview with Glenn Amy. March 30, 2016.

³⁸ Personal interview with Stan Price. March 29, 2016.

are medium to large scale commercial customers, which is most positive for GISCs. The existing stormwater incentives in the city permit a maximum allowable parcel credit of 50 percent (Seattle Public Utilities 2016b), which is beneficial for OBR and GISCs. However, the fact that the average claimed savings is only 9% (Seattle Public Utilities 2016b) has a negative impact because it indicates that the incentives do not influence action. Since there is significant engagement around stormwater issues and GSI in Seattle, political buy-in is assumed to be high, and the existence of a stormwater consent decree in Seattle provides additional impetus for policy-driven solutions. Even so, the most influential factors in this analysis end up being the customers of primary concern and stormwater incentives, resulting in a net benefit of 4.5 for OBR and 7 for GISCs. Therefore, performance contracting with GISCs is the best alternative for the City of Seattle to pursue out of the options analyzed in this report.

Seattle's stormwater fee offers little opportunity for savings without extensive conversion of impervious area. Consequently, there is an opportunity for large properties with significant impervious area to benefit from GSI financing where others cannot. In addition, GISCs will benefit from stormwater fee rate increases which will probably continue into the future to fund the City's Updated Stormwater Management Plan. This will add additional security to investments and reduce risk by increasing the available capital in the stormwater sector.

Challenges for implementing performance contracting with GISCs in Seattle include negotiating contracts that reconcile savings with loan payments within the typical repayment period of 10 years. Due to the newness of the GSI market, there is a greater chance that investors will offer even shorter timelines, further complicating this issue given the small margin for stormwater fee savings. Despite these challenges there is much room for innovation around this general program structure. In order to reduce risk and leverage local interest and resources, the City of Seattle could enter into a public private partnership with a firm willing to act as a GISC and a local CDFI.³⁹ As part of this partnership, the City (or county) could offer risk-reducing incentives, credit enhancements or other support in order to foster the development of a GISC. This could spur innovation in the city, allowing for experimentation around the market-driven solution of performance contracting while reducing market barriers that might prohibit investment.

If the City has additional resources, or determines that investing in a GISC-led model is infeasible or inappropriate, on-bill repayment could also potentially be an option for encouraging GSI retrofits in the City. The benefit of an OBR program is that it would target small to medium commercial customers and could complement a larger simultaneous performance contracting endeavor. In order to be successful, an OBR program would need to be tariff-based and administered by a CDFI in order to avoid allocating public funds for private good and violating the State constitution. Although the scale of retrofit would be limited due to the need to create bill-neutrality, OBR is a proven method in Seattle and could be

³⁹ These could include local innovators such as McKinstry or Beneficial State Bank.

expanded to include residential GSI installations. A thorough evaluation of whether small scale installations can sufficiently impact the stormwater system while achieving savings for customers is necessary before pursuit of on-bill financing. It is recommended that the City also observe the outcome of the CHEEF energy efficiency OBR pilots in California to garner additional lessons learned from OBR financing based on purely private investment.

PACE is not a viable option in Washington because of the policy limitations that exist in the state constitution. PACE financing would be especially attractive for GSI in the City of Seattle because part of the stormwater fee, the drainage fee, is charged as part of the property tax and affects property owners directly. The PACE format necessitates the involvement of the County, but this is a logical relationship since the County is in charge of the property tax portion of the stormwater fees. The potential savings also accrue to the correct party since the property owner could potentially see a reduction in their long term taxes or an increase in the value of their property without facing the split incentive of the benefits accruing primarily to the building tenants. Even so, this option is a non-starter because of the necessity of authorizing legislation and therefore is not eligible for further consideration.

It is recommended that the City of Seattle explore performance contracting by supporting the development of a GISC. In order to make this possible, the City could create a public private partnership with local innovators and consider opportunities to provide credit enhancements. Secondly, the City may also consider the potential to offer OBR for small scale projects. In both cases, the City will need to conduct further inquiry into the financial implications and political feasibility of these endeavors and create a framework for measurement and verification of stormwater savings.

OPPORTUNITIES FOR FURTHER RESEARCH

There are a number of other program design innovations that fell outside of the scope of this paper, but which could also inform potential GSI funding. With regard to energy efficiency, a comprehensive statistical analysis of existing energy efficiency programs in the U.S. could provide deeper insight into the findings explained here. However, other industries may hold similar learnings for GSI. For example, Kendall Bodden discussed how solar companies have done a great job of standardizing their loans.⁴⁰ While the solar industry has been supported by substantial subsidies which do not currently exist for GSI, stormwater programs may be able to learn from the evolution of solar financing.

There is also potential to create leverage for action through insurance markets. Theoretically insurance companies could monetize the reduction in flood and housing risk that they see from stormwater retrofits and offer discounted premiums to property owners who install certain GSI measures. According to

⁴⁰ Personal interview with Kendall Bodden. January 29, 2016.

Francis, this concept has not been successfully implemented, but there could be considerable potential if insurance companies collaborated in these efforts (Francis 2010). Further research into the potential in this sector could provide valuable insight.

As discussed in this report, public private partnerships have the opportunity mobilize initiatives that might not otherwise have the support or resources to get off the ground. Exploring opportunities to engage private partners may open possibilities for innovative program design or financing. In addition, cities across the country are already pursuing innovative financing for GSI that branches out beyond the structures implemented most commonly by energy efficiency programs. Philadelphia Water offers grants which help subsidize the cost of GSI installations on private property (Berahzer and Hughes 2015). Washington DC is newly implementing a stormwater credit-trading program across the District which allows property owners to offset stormwater impacts by purchasing credits from GSI installations elsewhere in the District. This program works because benefits are considered to accrue to the larger Chesapeake Bay watershed rather than the individual small watersheds within D.C. and therefore credits can be traded across the entire area (Holland and Silfen 2015). Although there are limitations to potential parallels, looking into the innovations of other cities may also prove useful.

Overall, there are many vetted approaches after which GSI programs could be modelled. As GSI programs grow in jurisdictions with strong regulatory drivers to push innovation and investment, stormwater programs will need to look to a multitude of sources to find success.

CONCLUSION

The implementation of innovative financing mechanisms for energy efficiency has been a valuable testing ground for other industries looking to create similar levels of engagement with private landowners. Based on the national experience, this research identifies stormwater fee structure, policy landscape, political environment, incentive structure, and target audience as the key factors that illuminate the appropriateness of a given financing solution for GSI. These findings are meant to equip decision makers with useful information to engage in the initial exploration of potential commercial GSI program design. As green stormwater infrastructure becomes a more attractive stormwater management solution for commercial properties due to increased awareness, regulatory drivers or rising rates, these cross-sector parallels will be able to guide a more in-depth look into effective local program design.

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APPENDIX

A1. Stormwater Finance Decision Tool Applied to Seattle

	Prerequisites			Market Drivers						Net Benefit
	Itemized Stormwater Fee	OBR Legislation	PACE Legislation	Customer of Primary Concern	Political Buy-In	Existing Stormwater Incentives	Maximum Allowable Parcel Credit	Average Claimed Savings	SW Consent Decree	
Weight	N/A	N/A	N/A	5	3	2	1	1	4	
Location-Specific Characteristics	Yes	Yes	No	Medium to Large	High	Yes	50-74%	1-10%	Yes	
PACE	1	--	0	0.5	1	0.5	0.5	0	1	0
OBR	1	1	--	-1	1	1	1	-0.5	1	4.5
GISCs	1	--	--	1	0	1	1	-1	0	7

Key for Prerequisites	
Score	Impact
0	Disqualified
0.5	Potential
1	Qualified

Key for Market Drivers	
Score	Impact
-1	Negative
-0.5	Small Negative
0	Neutral
0.5	Small Positive
1	Positive