



Unlocking Private Capital to Finance Sustainable Infrastructure



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FOREWORD

Strengthening our nation’s infrastructure presents a challenge and opportunity to realize a more resilient, competitive and clean energy future for the next generation. As the nation’s largest green bank, NY Green Bank is a leading investor in clean energy and sustainable infrastructure – directing our \$1 billion towards clean energy projects that are economically viable at commercial financing terms, but that lack the precedent and scale to receive broad support from traditional financing participants. Accelerating private capital investment into sustainable infrastructure projects is a critical role played by NY Green Bank and other similar organizations.

Unlocking the vast amount of private capital required to adequately accelerate the deployment of sustainable infrastructure requires new approaches. Environmental Defense Fund’s report provides insight as to the barriers, challenges and innovative new models currently being employed to enable the deployment of sustainable infrastructure. Investors and public sector professionals seeking both promising returns on their investments and improvements in social and environmental impact can learn from the case studies featured in the report. By leveraging the marketplace, ambitious public sector goals, and strategic interventions and support by philanthropy, it is possible to realize a better model – building sustainable infrastructure and safeguarding investment returns.

NY Green Bank is one example of a model which advances the proliferation of clean energy and sustainable infrastructure in New York State (NYS) through the application of proven financial structures to the State’s emerging clean energy marketplace. As one of the core components of the NYS Clean Energy Fund (CEF), we support the State Energy Plan, Clean Energy Standard, and Governor Cuomo’s broader Reforming the Energy Vision strategy. While we have already proven successful in terms of meeting our annual goals – in many cases well ahead of schedule – in support of the State’s overarching policies, we recognize that we must continue to innovate new ways of working with our private and public sector counterparties in driving more sustainable infrastructure activities.

The experiences of NY Green Bank evidence the possibilities put forth in this report, where evaluation and development of compelling financing structures, effective risk assessment and management, outcome-driven performance verifications, and a commitment to strong stakeholder engagement have allowed us to generate ~\$17.8 million in revenues – a milestone achieved a year ahead of expectations – and to commit \$409.4 million of capital in support of between \$1.2 – \$1.4 billion in total

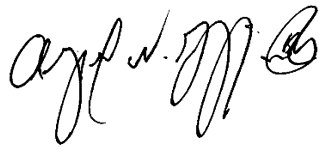


Environmental Defense Fund’s report provides insight as to the barriers, challenges and innovative new models currently being employed to enable the deployment of sustainable infrastructure.

value of clean energy deployment in the State of New York. These investments are expected to reduce greenhouse gas emissions by between 4.3 and 5.8 million metric tons – equivalent to taking between 51,300 – 65,300 cars off the road for 20 years.

Developing a robust market for sustainable infrastructure is imperative to the advancement of society's triple bottom line. NY Green Bank was delighted to contribute our expertise and lessons learned in the development of this report. We hope our experiences, and the experiences of others featured throughout, will enable public, private, non-profit, and academic actors to further mobilize private investment to accelerate the deployment of sustainable infrastructure.

While the road to a sustainable future is long and winding, the development and financing of sustainable infrastructure offers an opportunity to grow our economy, have a more resilient economy, improve our environment and better the livelihoods for every American.

A handwritten signature in black ink, appearing to read 'Alfred Griffin'.

Alfred Griffin

President

NY Green Bank

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ABOUT THIS REPORT

This report introduces a framework to mobilize private finance for sustainable infrastructure projects.¹ The framework's focus includes: identifying suitable funding models, establishing performance measurement, managing diverse risks, and facilitating effective stakeholder engagement. The report's findings are drawn from a comprehensive review of best practices and in-depth interviews with experts and thought leaders involved in the deployment, financing and market development of sustainable infrastructure. Interview participants included representatives from the public, private and non-profit sectors and experts in complementary fields including social impact investing, renewable energy, and community-development finance.

The interviews consistently emphasized the importance of two key factors to further market development:

1. Information sharing and the development of lessons learned from successful sustainable infrastructure projects, and
2. Increased project standardization and replication to attract a diverse array of investors and mainstream the sustainable infrastructure sector.

The report's primary purpose is to provide guidance to public sector stakeholders. Within the U.S., government units often have jurisdiction to initiate new infrastructure projects, conduct repairs and maintenance, and obtain financing. However, governments are limited by the availability of local funds; capital constraints can make it challenging or impossible to meet stated infrastructure development goals. Governments will increasingly need to partner with and seek investment from the private sector. As such, this document provides a framework to support government actors with developing investment-ready projects under traditional and innovative financing mechanisms.

The structure of the report begins with an overview of the U.S. infrastructure crisis and the opportunity for sustainable infrastructure. The introduction is followed by a short primer on infrastructure finance (Section 1) after which the investor framework for investment-ready projects is introduced (Section 2). The remainder of the report follows a modular structure (Sections 3-6). Each module is dedicated to one aspect of the investment-ready framework for sustainable infrastructure projects (Funding Models, Performance Measurement, Risk Management and Stakeholder

This document provides a framework to support government actors with developing investment-ready projects under traditional and innovative financing mechanisms.

¹ See page 16 of this report for a discussion and definition of the terms sustainable infrastructure, which here means infrastructure projects that are compatible with social, economic and environmental goals.

Engagement). The modules each introduce specific challenges from the current market, present a series of pragmatic solutions and provide a relevant case study. Each module also includes resources and tools that states and local governments can turn to as they seek to implement the principles from the framework. After the introductory section, readers can reference any or all subsequent modules. The report concludes with suggestions on how government, private sector, non-profit and community actions can accelerate sustainable infrastructure market growth by promoting replicable and scalable projects.

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EXECUTIVE SUMMARY

There is an estimated \$1.4 trillion gap in funding required to meet infrastructure needs.

Communities throughout the United States are facing unprecedented infrastructure challenges including compromised energy, water, and transportation systems. This is more than just a matter of inconvenience. Unless addressed, decades of neglect and lack of investment will result in loss of business sales, reduced jobs and wages, and negative impacts to the country's GDP.² This crisis cannot be solved by reallocating existing funds - there is an estimated \$1.4 trillion gap in funding³ required to meet infrastructure needs.

How will governments responsible for maintaining infrastructure navigate this monumental challenge and continue to revitalize and promote the sustainable development of America's communities?

This report was developed to help public sector officials navigate infrastructure challenges by providing resources and guidance to resource-constrained local, state and federal government agencies. This report employs a two-pronged approach to discuss the issue by examining demand-side strategies to increase overall demand in sustainable infrastructure projects and supply-side approaches to bolster available capital. For demand-side approaches, the report lays out options for innovative, cost-effective approaches to sustainable infrastructure development that can be used as an alternative to or in combination with traditional gray infrastructure - thereby reducing the overall costs for delivery. On the supply side,

2 American Society of Civil Engineers. 2016. Failure to Act: Closing the Infrastructure Investment Gap for America's Economic Future. Retrieved from: <http://www.infrastructurereportcard.org/wp-content/uploads/2016/10/ASCE-Failure-to-Act-2016-FINAL.pdf>

3 A total of \$3.3 trillion will be needed to upgrade and repair existing infrastructure to meet economic needs by 2025. See: American Society of Civil Engineers. 2016. Failure to Act: Closing the Infrastructure Investment Gap for America's Economic Future. Retrieved from: <http://www.infrastructurereportcard.org/wp-content/uploads/2016/10/ASCE-Failure-to-Act-2016-FINAL.pdf>

the report identifies key barriers that inhibit private capital from playing a larger role in infrastructure development. Taken together, these two strategies may help the public sector deliver on its obligations to serve its constituents.

What is sustainable infrastructure?

It is infrastructure built and managed in a way that helps meet economic, environmental and social goals.⁴ In addition to providing critical infrastructure services, sustainable infrastructure enables government to meet multiple goals with limited resources by integrating environmental and social co-benefits.⁵ These co-benefits have real monetary value. Co-benefits help create more cost-effective infrastructure solutions. Measuring and monetizing co-benefits can be used to develop an economic case for sustainable infrastructure investment that is attractive to a wider pool of investors.

What does the path forward look like for addressing the barriers inhibiting private investment in sustainable infrastructure?

The research and interviews used to develop this report identify four key elements that support the path forward through the creation of projects that are ready for investment, including private capital. Those responsible for planning and financing sustainable infrastructure must:

- **Identify suitable funding models:** Robust funding models will require stable revenue streams. In addition to traditional revenue streams, such as fees and taxes, the economic, social and environmental values produced by sustainable infrastructure should be monetized where possible.
- **Standardize performance measurement:** The measurement of key performance metrics and outcomes produced by sustainable infrastructure are important for determining a project's value. However, consistent and comparable performance metrics across the sector do not yet exist.
- **Manage risks appropriately:** Limited long-term performance data and standardization procedures for sustainable infrastructure may increase risks to both government and private investors. Therefore, identifying, quantifying, mitigating and distributing risk is critical to attracting private investors.

4 Sustainable infrastructure is a term that covers a wide variety of sub-sectors including renewable energy, transportation, waste, water, and stormwater management. Green infrastructure and natural infrastructure, are types of sustainable infrastructure that uses vegetation or other natural elements to provide critical services and meet infrastructure needs while providing a myriad of environmental and social co-benefits. While natural and green infrastructure can be a critical component of the sustainable infrastructure future, they must be used in the right balance with traditional engineered infrastructure in a way that balances cost-effectiveness with providing the right services.

5 Co-benefits are the multiple, additional benefits provided beyond the core service provided. For example, a natural salt marsh that may slow flooding impacts from storm surge or sea level rise can also provide wildlife habitat and space for recreation.

Sustainable infrastructure enables government to meet multiple goals with limited resources by integrating environmental and social co-benefits.

- **Facilitate effective stakeholder engagement:** Convening the right stakeholders and expertise during the planning and developing of a sustainable infrastructure project can significantly increase the likelihood of success. Sustainable infrastructure investment requires changing status quo operating models by employing new technologies and finance methods.

Governments, working in partnership with private investors, can lead the way in addressing barriers to financing sustainable infrastructure projects in ways that work towards increasing the scale of the market. In fact, communities are already taking the steps needed to utilize innovative partnerships and new financing models to build sustainable infrastructure. For example, the U.S. municipal green bond market is growing rapidly and in 2016, DC Water released the first ever Environmental Impact Bond.

The path forward requires active partnership and collaboration between the public and private sectors, as well as support from non-profits and the philanthropic community. A multi-sectoral approach, as the case studies in the report demonstrate, effectively addresses these key barriers, right sizes demand and unlocks the flow of private capital needed to put into place the infrastructure of the future – sustainable infrastructure.

INTRODUCTION

Across the United States, aging infrastructure and delays in implementing new infrastructure place increasing pressure on communities that rely on these critical systems for health, safety, and economic stability. The American Society of Civil Engineers estimates that \$3.3 trillion⁶ is needed to repair and upgrade American infrastructure between now and 2025.⁷ It also estimated that the public sector faces an investment gap of \$1.4 trillion to respond to this need. The investment gap is expected to increase over time. In 2040, \$10.8 trillion in infrastructure investments will be required with an estimated investment gap of \$5.2 trillion.⁸ The gap directly impacts the United States economy through loss of business sales, reduced jobs and wages, and overall losses in the GDP.⁹ These figures do not include the additional costs associated with natural disasters and extreme weather events that are increasingly impacting existing infrastructure.

Due to the economic impact of failing infrastructure, infrastructure investment has traditionally had bipartisan support. However, budget debates and a polarized political landscape have inhibited critical infrastructure investments at the federal level. The Trump Administration has pledged to implement a series of reforms designed to channel approximately \$1 trillion of investment into infrastructure.¹⁰ Though the details of the plan remain unclear, language from the administration's "America First: A Blueprint to Make America Great Again" suggest cuts to existing public infrastructure programs and an

6 In 2015 USD.

7 American Society of Civil Engineers. 2016. Failure to Act: Closing the Infrastructure Investment Gap for America's Economic Future. <http://www.infrastructurereportcard.org/wp-content/uploads/2016/10/ASCE-Failure-to-Act-2016-FINAL.pdf>.

8 Ibid.

9 Ibid.

10 White House Office of Management and Budget. 2017. Fact Sheet 2018 Budget: Infrastructure Initiative. https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/budget/fy2018/fact_sheets/2018%20Budget%20Fact%20Sheet_Infastructure%20Initiative.pdf

increasing dependence on the private sector to compensate for capital needs.¹¹ Local governments who are responsible for planning and financing infrastructure must find ways to attract more private partnership and investment.

While the enormity of the infrastructure gap may seem daunting, it also presents an opportunity to invest in infrastructure that is sustainable and meets the needs of the 21st century. Sustainable infrastructure is built and managed in a manner that is compatible with economic, environmental and social goals—including the responsible use of natural resources, the enhanced support of livelihoods and social well-being, and the long-term resiliency of our communities.¹² Sustainable infrastructure enables governments to have a higher impact with limited resources by integrating environmental and social goals.

ROLE OF THE SECTORS

Private sector investors are a broad group with divergent priorities. Traditionally, investors have been placed in two categories based on their interests: financially-driven and mission-driven or impact investors. While some investors, primarily high net worth individuals, are driven by impact and mission, institutional investors have a fiduciary responsibility to their shareholders. The line between the two sides has increasingly blurred and investors are now often categorized based on a spectrum of their interests (See Appendix A for a further description of this spectrum).

Many types of investors, not just impact investors, now incorporate environmental, social and governance (ESG) criteria in their investment screening processes. Additionally, many types of investors are attracted to the municipal bond market, partially because the bonds are tax exempt. Bonds are one of the main tools of infrastructure finance. This report focuses its analysis on private sector investors with potential interests in sustainable infrastructure investments, including but not limited to impact investors, institutional investors with ESG goals, and/or other parties interested in the municipal bond market.

Partnership with the private sector can have benefits for local governments, which include sharing financial burdens and risks, and leveraging external technical expertise.¹³ However, the private sector's need to balance returns and risks may limit which projects will be attractive for investment and partnership. Certain infrastructure projects with stable revenue streams, such as toll roads and energy infrastructure, may be particularly

11 White House Office of Management and Budget. 2017. America First: A Budget Blueprint to Make Great Again. https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/budget/fy2018/2018_blueprint.pdf.

12 Definition adapted from New Climate Economy. See: The New Climate Economy Global Commission on the Economy and Climate. 2016. The Sustainable Infrastructure Imperative. <http://newclimateeconomy.com/report/2016/>.

13 Sabol, Patrick & Puentes, Robert. 2014. Private Capital, Public Good: Drivers of Successful Infrastructure Public-Private Partnerships. https://www.brookings.edu/wp-content/uploads/2016/07/BMPP_PrivateCapitalPublicGood.pdf.

appealing for private investors. If return on investment is the sole evaluation criteria, the allocation of infrastructure funds may skew away from projects with less tangible or harder to monetize benefits, such as social and environmental outcomes.

It is important that governments maintain their responsibility in developing infrastructure to serve the public good, including advancing economic, environmental and social goals. The role of government includes long-term planning to identify infrastructure needs, and the development of transparent and publicly driven processes for project development. Yet governments' tendency toward risk aversion can also stifle innovation. To that end, partnership and collaboration with the private sector will be critical to closing the investment gap. Policymakers must provide regulations to guide robust partnerships that serve the public good, while creating an enabling environment for innovation with an acceptable level of risk. Enabling measures can include incentives and financial programs that allow markets to grow and thrive. Sustainable infrastructure policies and finance programs must be designed to offer the market some certainty to enable investors make rational financial assessments over the long term.

As the sustainable infrastructure finance landscape shifts, it is important for the public sector to adapt and understand its critical role in developing infrastructure projects that are not only good for the economy, but also equitable, environmentally sustainable, and resilient.

THE SUSTAINABLE INFRASTRUCTURE OPPORTUNITY

The sustainable infrastructure market is growing across the United States and is increasingly being driven by federal, state, or local requirements or sustainability goals. Many states and local governments have committed to significant sustainable infrastructure goals such as adopting climate commitments,¹⁴ generating 100% renewable energy,¹⁵ implementing Complete Street policies and encouraging transportation mode shifts,¹⁶ and using green infrastructure for stormwater management.¹⁷ Additionally, they are developing strategies to make their

Sustainable Infrastructure:

Infrastructure projects that are compatible with the triple bottom-line of social, economic, and environmental goals.

Partnership and collaboration with the private sector will be critical to closing the investment gap.

14 C40 and Arup. How Cities Will get the Job Done. 2016. <http://www.c40.org/researches/deadline-2020-us>.

15 Meister Consultants Group. 2017. Pathways to 100: An Energy Supply Transformation Primer for U.S. Cities. http://www.mc-group.com/wp-content/uploads/2017/08/MCG-Pathways-to-100_Energy-Supply-Transformation-Primer-for-Cities.pdf.

16 Complete Street policies support the development of, "streets that are safe and convenient for everyone—no matter their age, income, race, ethnicity, physical ability, or how they choose to travel." See: Smart Growth America, "The Best Complete Streets Policies of 2016," <https://smartgrowthamerica.org/resources/the-best-complete-streets-policies-of-2016///>.

17 "Stormwater Overview," American Society of Landscape Architects, accessed August 24th, 2017, <https://www.asla.org/stormwateroverview.aspx>.

communities more resilient in the face of extreme weather.¹⁸ While current impacts vary by region, sea level rise, storm surge, flooding, and extreme heat are damaging public infrastructure and private property.¹⁹ These damages can result in loss of life, disruptions to the economy, and are costly for tax-payers to repair.

There are, however, approaches to building and restoring infrastructure that can reduce vulnerability and enhance resilience.²⁰ For example, natural infrastructure²¹ approaches that incorporate elements such as sand dunes, wetlands, and salt marshes can help regulate floods, attenuate waves, and stabilize soils. Green infrastructure such as bio-retention basins, tree trenches and permeable pavement can reduce flooding and the urban heat island effect. Natural and green infrastructure can be used in combination with traditional gray infrastructure, such as seawalls and levees, to address coastal issues.²²

Motivations and policies driving sustainable infrastructure development can be at the local, state, or federal level and may include:²³

- Local policies and plans for economic growth, job growth, and livability
- Cost-savings over the life-time of an asset or lower life-cycle costs as compared to traditional gray infrastructure²⁴
- Local policies and plans to mitigate climate impacts and strengthen climate resilience²⁵
- Local policies and plans for integrating sustainability into social services²⁶
- Clean water regulations and goals
- Clean air regulations and goals

18 International Panel on Climate Change (IPCC). 2014. Climate Change 2014: Impacts, Adaptation, and Vulnerability: Summary for Policymakers. http://www.ipcc.ch/pdf/assessment-report/ar5/wg2/ar5_wgII_spm_en.pdf; and U.S. Global Change Research Program. 2014. National Climate Assessment. <http://nca2014.globalchange.gov/highlights/report-findings/infrastructure>.

19 U.S. Global Change Research Program. 2014. National Climate Assessment. <http://nca2014.globalchange.gov/highlights/report-findings/infrastructure>.

20 National Science and Technology Council. 2015. Ecosystems-Service Assessment: Research Needs for Coastal Green Infrastructure. Retrieved from: https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/cgies_research_agenda_final_082515.pdf

21 A full discussion on definitions of sustainable, green and natural infrastructure is provided on pg. 16

22 This report uses traditional gray infrastructure to describe engineered assets that are built to primarily serve a single need. This contrasts with sustainable infrastructure, which described a wide-range of infrastructure assets that addresses economic, environmental and social needs.

23 Each factor impacts a community differently. Therefore, the list is a collection of impacts and not a prioritized list.

24 An American Society of Landscape Architects study shows that the use of green infrastructure and low-impact development strategies can be less costly than gray infrastructure. However, a review of 479 case studies from across the U.S. show that while 44% found that green infrastructure led to cost reductions, 31% found not cost difference, and 25% found it increased costs. See: "Stormwater Overview," American Society of Landscape Architects, accessed August 24th, 2017, <https://www.asla.org/stormwateroverview.aspx>.

25 Climate resilience is defined as the ability to "prevent, withstand, respond to, and recover from disruption" and can include both physical resilience of built systems, as well as social resilience. See: "Glossary," U.S. Climate Resilience Toolkit, accessed August 24th, 2017, <https://toolkit.climate.gov/content/glossary>.

26 For example, communities may utilize renewable energy for their housing authority buildings to lower the utility costs associated with providing low income housing.

While this report focuses on public infrastructure, private entities deploying or investing in infrastructure also play an important role in growing the market.²⁷ Many businesses have set climate commitments or sustainable infrastructure goals. For example, Google has committed to both energy efficiency measures and renewable energy purchasing, which has resulted in its offices and data centers achieving 100% renewable energy usage in 2017.²⁸

Sustainable infrastructure is a broad and evolving field that captures a wide-variety of subsectors. There are several terms used within the space, occasionally used interchangeably, that have different meanings to different parties. For consistency, this report focuses on the category of sustainable infrastructure as defined in the Spotlight section below, while acknowledging that other terms such as green infrastructure and natural infrastructure describe a subset of categories within the market. For a detailed discussion of these definitions and how they are used throughout this report, please see the Spotlight: Sustainable Infrastructure Definitions below. It is also important to note that while green and natural infrastructure will play a role in meeting the infrastructure needs of the future, there is a continued need for these solutions to be paired with gray infrastructure.

While it is important for the community of practice to develop common language to decrease confusion in the marketplace, it is more important for communities to focus on clearly defining their goals—economic, social, and environmental—and consistently deploy infrastructure projects that incorporate these goals.

While green and natural infrastructure will play a role in meeting the infrastructure needs of the future, there is a continued need for these solutions to be paired with gray infrastructure.

27 Public infrastructure is a physical capital investment, such as roads, airports, water and sewerage plants, provided by local, state, or federal government for the benefit of private households and businesses. See: Fox, William F. and Smith, Tim R. March/April 1990. "Public Infrastructure Policy and Economic Development." <https://www.kansascityfed.org/publicat/ECONREV/EconRevArchive/1990/1q90fox.pdf>.

28 Holzle, Urs. Dec. 6th, 2016. "We're set to reach 100% renewable energy- and it's just the beginning." <https://www.blog.google/topics/environment/100-percent-renewable-energy/>

SPOTLIGHT Sustainable Infrastructure Definitions

Sustainable Infrastructure: infrastructure projects that are compatible with the triple bottom-line of social, economic, and environmental goals.²⁹

- Economic goals may include providing high quality jobs, growing the local economy, avoiding excessive debt or user fees, increasing property values and seeking to build capacity of local suppliers and developers.
- Social goals may include increasing the livability of an area, social equity, and meeting the needs of vulnerable populations.
- Environmental goals may include reducing pollution, mitigating carbon emissions during construction and operation, contributing to the transition to a low-carbon economy, and addressing resiliency in the face of climate change.

Sustainable infrastructure spans multiple sub-sectors, including core infrastructure systems like energy, transportation, drinking water, waste and sanitation, and stormwater management. Sustainable infrastructure includes infrastructure with either engineered or natural elements.

Natural Infrastructure: the strategic use of land, landscapes, or other natural elements to provide services to human populations.³⁰ Existing natural infrastructure includes wetlands, mangroves, vegetated dunes, reefs, and forests. Nature-based infrastructure can be protected, restored or created through processes such as wetland restoration, forest restoration, beach nourishment, and tree planting among others.

The term natural infrastructure is commonly used in the management of stormwater, flood, coastal protection, and urban heat.

Green Infrastructure: utilizes an interconnected network of green spaces that provide a variety of functions, including the restoration of natural hydrology.³¹ While there can be significant overlap with natural infrastructure, green infrastructure projects often include engineered items not found in nature—such as permeable pavements or engineered pipelines.

Green infrastructure is commonly used in stormwater management, and can be applied more broadly to include coastal protection, public parks/open space and street trees.

It is important to note that while these terms “sustainable”, “green” and “natural” infrastructure are not mutually exclusive, they are also not inherently interchangeable. It is the responsibility of those developing and implementing infrastructure assets to ensure that sustainable infrastructure incorporates natural and green elements when appropriate, and encourage natural and green infrastructure projects which incorporate economic, environmental, and social outcomes.

29 Sustainable infrastructure emerged initially as a term used in international development around the UN’s Sustainable Development Goals. However, this term is increasingly being used in the U.S. and other developed nations. The definition used in the report builds on several definitions including those from the New Climate Economy and Brookings. See: New Climate Economy Report, 2016. http://newclimateeconomy.report/2016/wp-content/uploads/sites/4/2014/08/NCE_2016Report.pdf; and Bhattacharya, Amar et. al. 2016. “Delivering on sustainable infrastructure for better development and better climate” <https://www.brookings.edu/research/delivering-on-sustainable-infrastructure-for-better-development-and-better-climate/>

30 Cunniff, Shannon & Aaron Schwartz. 2015. Performance of Natural Infrastructure and Nature-based Measures as Coastal Risk Reduction Features. http://www.edf.org/sites/default/files/summary_ni_literature_compilation_0.pdf.

31 The Environmental Protection Agency (EPA) uses the term green infrastructure to refer to practices that restore a locality’s natural hydrology. This report uses a slightly broader term that recognizes that green infrastructure can include features such parks and open space, street trees, and other vegetated elements that have benefits beyond hydrology, such as reducing urban heat island effect. See: “What is Green Infrastructure?” EPA, accessed August 24th, 2017 <https://www.epa.gov/green-infrastructure/what-green-infrastructure>; and Matthews, Tony et al. 2015. “Reconceptualizing green infrastructure for climate change adaptation: Barriers to adoption and driver for uptake by spatial planners...” *Landscape and Urban Planning* Vol. 138. <http://www.sciencedirect.com/science/article/pii/S0169204615000419>.

INFRASTRUCTURE FINANCE: A PRIMER

This section summarizes the mechanisms most frequently used by the public-sector to finance infrastructure. It provides an analysis of commonly used financing approaches and subsequently discusses innovative and emerging finance models.

FINANCING INFRASTRUCTURE

Sustainable and traditional infrastructure projects face similar challenges in attracting project financing. The public sector typically initiates infrastructure projects to meet constituents' needs and support economic activity.

Governments rely on three primary financing mechanisms: (1) debt financing, (2) cash financing, and (3) grants. Table 1 describes each of these mechanisms and their advantages and challenges.

Of these, debt is the most common financing mechanism for infrastructure development.³² Bonds appeal to investors who have an appetite for a reliable, fixed income stream and have been the favored governmental mechanism for raising capital for infrastructure projects.³³

32 Debt finances approximately 90% of state and local spending. See: Marlow, Justin. 2015. Municipal Bonds and Infrastructure Development- Past, Present, and Future. https://icma.org/sites/default/files/307554_15-08%20Municipal%20Bonds%20and%20Infrastructure%20Development_web%20updated.pdf.

33 Governments with strong credit ratings can typically borrow at very low interest rates because lenders have high confidence that they will be paid.

Table 1. Public Infrastructure Finance

Financing Method	Description	Challenges
Debt Financing	<p>Governments typically issue debt as a general obligation bond or revenue bond. This method allows governments to spread the capital costs of the infrastructure over the lifetime of the asset.</p> <p>The bond market has expanded to include State Revolving Loan Funds, green bonds, and other types of bonds. For more information on bonds see: ICMA’s “Municipal Bonds and Infrastructure Development- Past, Present, and Future.”²⁹</p>	<p>Generable obligation bonds add to municipal debt and existing debt limits. Additionally, low municipal credit ratings may make this approach unusable. Increasing the debt ceiling may be politically contentious.</p> <p>Repayment is often tied to taxes or fees, yet the current tax base may be too low to meet these needs; increasing taxes or fees may present political challenges.</p>
Cash and Savings	<p>This method uses capital improvement planning,³⁰ from existing tax revenue, to finance infrastructure.</p> <p>It is often applied to smaller projects or is used when debt financing is not an option.</p>	<p>Governments have limited capital improvement budgets with competing priorities.</p>
Grants	<p>Federal, state, municipal, or philanthropic grants may be available to pay for all or a portion of the project.</p>	<p>Availability of grants may be limited, and it may be difficult to predict when they will be awarded.</p>

EMERGING APPROACHES TO SUSTAINABLE INFRASTRUCTURE FINANCE

In addition to the traditional financing options discussed above, governments are using three innovative methods to increase the flow of private capital into their sustainable infrastructure projects, including: (1) green bonds, (2) Pay-For-Success (PFS) models in the form of environmental impact bonds, and (3) public-private partnerships (P3).³⁶

34 Marlow, Justin. 2015. Municipal Bonds and Infrastructure Development- Past, Present, and Future. https://icma.org/sites/default/files/307554_15-

35 Capital Improvement Planning refers to the short to medium term plan to build or maintain physical assets, such as built infrastructure or equipment. See: Chen, Can and John R. Bartle. 2017. Infrastructure Financing: A Guide for Local Government Managers. <https://icma.org/documents/infrastructure-financing-guide-local-government-managers>.

36 While P3s have been established for some time and have typically been used for transportation projects, new models like the Community-Based P3 in Prince George’s County, Maryland is being used for green infrastructure development in a way that includes social and environmental outcomes as part of the project.

Green Bonds: Green or Climate Bonds³⁷ are bonds whose proceeds are earmarked specifically for green projects and can be issued as general obligation or revenue bonds. These projects could include energy efficiency, pollution control, habitat restoration, and climate adaptation. While green bonds do not necessarily represent an additional funding option, they can be helpful for attracting additional pools of investors to the bond market. Green bonds have led to an increased availability of funds earmarked for sustainable infrastructure projects.³⁸ The growing popularity of this mechanism for funding both built and natural infrastructure signals an investor appetite for projects with an environmental impact.

Since the Commonwealth of Massachusetts issued the first municipal green bond in 2013, green bonds have raised billions of dollars in capital for green municipal projects and have attracted new types of investors to the general obligation bond space. Trends in the green bond market over the past five years suggest significant room for growth; between 2014 and 2015, the municipal green bond market grew 47% to \$4.7 billion in issuance.³⁹ In 2016 annual issuance grew to \$10.5 billion, which represented 13% of the green bond market.⁴⁰ Green bonds should be verified by an independent party. Two complementary guidance standards, the Green Bond Principles⁴¹ and Climate Bond Standards,⁴² have been developed to support the growth of the green bond market and to ensure transparency, integrity, and standardization. Several credit agencies have also developed their own methods for evaluating green bonds.⁴³

37 “Explaining Green Bonds,” Climate Bonds Initiative, accessed August 24th, 2017, <https://www.climatebonds.net/market/explaining-green-bonds>.

38 Saha, Devashree. 2016. Green bonds take root in the US municipal bond market. <https://www.brookings.edu/blog/the-avenue/2016/10/25/green-bonds-take-root-in-the-u-s-municipal-bond-market/>.

39 Ibid.

40 Climate Bonds Initiative. January 2017. “Green Bonds Highlights 2016.”

41 International Capital Market Association (ICMA Group). 2017. The Green Bond Principles. <https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/GreenBondsBrochure-JUNE2017.pdf>.

42 “Climate Bond Standards,” Climate Bond Initiative, accessed August 24th, 2017, <https://www.climatebonds.net/standards/about>.

43 Moody’s Investor Services. 30 March, 2016. “Announcement: Moody’s publishes methodology on Green Bonds Assessment” https://www.moodys.com/research/Moodys-publishes-methodology-on-Green-Bonds-Assessment--PR_346585.

SPOTLIGHT California IBank and Green Bonds

Since 2014, California has issued a significant amount of municipal green bonds to fund a series of projects, including energy efficiency, water efficiency, and mass transit. In 2017, the California Infrastructure and Economic Development Bank (IBank) issued the largest municipal green bond to date, a \$450 million tax-exempt revenue bond.⁴⁴ This bond will fund critical water projects through the Clean Water State Revolving Fund (CWSRF).⁴⁵ The CWSRF provides low-cost financial assistance to local governments for water projects including wastewater management, stormwater management, non-point source pollution management, and conservation of natural infrastructure such as estuaries.⁴⁶

Pay-for-Success: PFS, also known as pay-for-performance, is a contracting method that makes payments contingent on specific project performance metrics.⁴⁷ Under traditional government contracting, the government pays for short-term services based on measurable outputs, such as the number of beds provided in a homeless shelter. However, the outputs do not necessarily reflect the long-term outcomes and impacts of the services provided, such as reduction in homelessness. PFS allows payment of services to be tied to long-term, multi-year performance outcomes. If a service fails to meet performance outcomes, the government will reduce the payments made to bondholders. This model distributes performance risk amongst government(s), third-party service provider(s), and private investor(s). In PFS projects, private funders provide the upfront capital which is then repaid by the local government as long as project outcomes are successful. While PFS has typically been used for social services, a few communities have successfully applied these principals to environmental services, including those provided by sustainable infrastructure.

Federal, state, and local lawmakers are considering and enacting legislation to streamline and support this mechanism. PFS requires governments to procure and structure contracts based on long-term, performance-based elements, which may not be allowed under local contracting laws. Enabling legislation to support PFS should include streamlined processes to establish performance-based contracts and clarify the legality of the contracting structure. PFS legislation has included allowances for

44 California Infrastructure and Economic Development Bank (IBank). 2017. Staff Report. <http://www.ibank.ca.gov/Portals/1/Board%20Meetings/2017/3.%20SWRCB%202017%20Bonds%20-%20Staff%20Report.pdf?ver=2017-01-13-223637-573>.

45 "Clean Water State Revolving Fund," U.S. Environmental Protection Agency, accessed August 24th, 2017, <https://www.epa.gov/cwsrf>.

46 Ibid.

47 "Basics: What is Pay for Success?" Nonprofit Finance Fund, accessed August 24th, 2017, <http://www.payforsuccess.org/learn/basics/#what-is-pay-for-success>.

conditional payments, payment schedules, and performance evaluation standards.⁴⁸ Eight states,⁴⁹ Washington DC, and several local governments have already enacted enabling legislation, while many more jurisdictions are considering similar policies.⁵⁰ PFS has also gained broad bipartisan support at the federal level, including the introduction of H.R. 576 Social Impact Partnerships to Pay for Results Act (“SIPPRA”). This bipartisan bill encourages partnerships between private and public sectors.⁵¹

However, it is not yet standard for PFS enabling legislation to include environmental services. While states like Massachusetts have passed legislation that allows PFS contracting to be applied to a broad range of activities, others restrict its use to social services such as criminal justice or educational programs.⁵² Communities interested in using a PFS model for sustainable infrastructure should consider how state and local legislation may impact their ability to structure these types of contracts.

SPOTLIGHT DC Water and Sewer Authority’s Environmental Impact Bond

In 2016, the DC Water and Sewer Authority’s (DC Water) environmental impact bond (EIB) became the first environmental services project to use PFS (see Case Study on page 47). Under this EIB, DC Water will develop a connected system of green infrastructure projects, including permeable pavement and bio-retention basins, to reduce the volume of stormwater runoff entering the sewer system. In addition to the repayment of the bond, there is an optional contingent payment based on the project’s performance reducing stormwater volume. If the project underperforms, DC Water will receive a contingent payment from the investors, whereas if the project outperforms anticipated targets, the investors will receive a contingent payment from DC Water. In this example, the investors carry the technology performance risk. Other communities are beginning to look at the EIB and PFS as a model for structuring environmental services, including sustainable infrastructure. The Louisiana Coastal Master planning team is currently working with experts to determine whether a PFS model can be applied to natural infrastructure and the restoration of the Louisiana coast (see Case Study on page 70).

48 Teicher, Parry, John Grossman, and Marcia Chong. 2016. Authorizing Pay for Success Projects: A Legislative Review and Model Pay for Success Legislation. <http://www.thirdsectorcap.org/wp-content/uploads/2016/03/Authorizing-Pay-for-Success-Projects-Legislative-Review.pdf>.

49 Arkansas, California, Colorado, Idaho, Massachusetts, Oklahoma, Texas, Utah, as well as District of Columbia, Denver, Cuyahoga County, and Chicago.

50 Teicher, Parry, John Grossman, and Marcia Chong. 2016. Authorizing Pay for Success Projects: A Legislative Review and Model Pay for Success Legislation. <http://www.thirdsectorcap.org/wp-content/uploads/2016/03/Authorizing-Pay-for-Success-Projects-Legislative-Review.pdf>.

51 Cornell, Leslie and Amy Curran. 2017. Inroads to Innovation: State Adoption of Pay for Success Legislation. Chapman and Cutler LLP. http://www.chapman.com/media/publication/755_Chapman_Inroads_to_Innovation_Pay_for_Success_Legislation_0417.pdf.

52 Ibid.

Public-Private Partnerships: Public-private partnerships (P3s) refer to formal, contractual agreements between a government entity and private company. P3s have been used for a range of infrastructure asset types and deal structures.⁵³ In a P3, the public sector often maintains ownership over the asset, but a private company may be responsible for one or more aspects of the project implementation including design, financing, construction, operation, or maintenance of the asset. In exchange for this responsibility, the private company receives a regularly scheduled concession payment, usually funded by a toll, user fee, rate payment or, tax revenues, subject to availability.⁵⁴ For example, a private entity may design, build, operate and maintain (DBOM) a public transportation asset, such as a new light rail line while the public retains ownership of the asset. The user fees collected by future riders will fund the concession payment to the private company for providing this service to the public. However, in the case that fees are not adequate to recover financing costs, governments can provide an availability payment generated through general tax revenues.⁵⁵ In other P3 models, the private entity may take on fewer stages, such as designing and building of the asset, while the public sector operates and maintains the asset. P3s distribute risk across various stages of project development, operations, and maintenance; the associated risk is assumed by the actor responsible for the relevant stage.⁵⁶

There are many potential benefits to using a P3 to implement infrastructure, including financial, technical and management benefits. While an asset financed and built through a P3 may not provide the same low-cost of capital⁵⁷ as a project developed using a municipal bond, a privately funded asset may allow the government to avoid additional debt. Additionally, private companies may have a lower tolerance for cost-overruns associated with construction, which can help infrastructure project development stay on target. Private companies may also provide operational and management expertise that a government entity may not have in-house.⁵⁸

While P3s have been commonly used in transportation, they are increasingly being used in other sectors of sustainable infrastructure such as stormwater management. In the case study of Prince George's County's Water Partnership, Corvias Solutions entered an agreement with the county to build, operate and maintain green infrastructure that will help the county meet the its clean water requirements (see page 37 for details.)

53 The National Council for Public-Private Partnerships lists 18 different P3 models, ranging from design-build, to design-build-finance-operate-maintain. See: "Types of Partnerships," The National Council for Public-Private Partnerships, accessed August 24th, 2017. <http://www.ncppp.org/ppp-basics/types-of-partnerships/>.

54 Sabol, Patrick and Robert Puentes. 2014. Private Capital, Public Good: Drivers of Successful Infrastructure Public-Private Partnerships. <https://www.brookings.edu/research/private-capital-public-good-drivers-of-successful-infrastructure-public-private-partnerships/>.

55 Dochia, Silviu and Michael Parker. 2009. Introduction to Public-Private Partnerships with Availability Payments. http://www.pwfinance.net/document/research_reports/9%20intro%20availability.pdf

56 Ibid

57 Low cost of capital refers to the tax-exempt, low interest rates that municipal bonds offer.

58 Ibid

P3s have been used in the United States for several decades. Thirty-four states have some form of policy that enables P3s, provides guidance and standards for best practices, and ensures that public interests are protected.⁵⁹ However, these policies vary greatly; many states only allow P3s for certain asset types, such as transportation.⁶⁰ For P3s to be used for a broader array of sustainable infrastructure sub-sectors beyond transportation, state policies must allow additional asset types to be developed through this method. Communities interested in a P3 model for sustainable infrastructure development should consider how their state and local policies may enable or prevent the use of a P3, including what types of assets are allowed.

59 “Public-Private Partnership (P3) Model State Legislation,” Bipartisan Policy Center, accessed August 24th, 2017. <https://bipartisanpolicy.org/library/public-private-partnership-p3-model-legislation/>.

60 Sabol, Patrick and Robert Puentes. 2014. Private Capital, Public Good: Drivers of Successful Infrastructure Public-Private Partnerships. <https://www.brookings.edu/research/private-capital-public-good-drivers-of-successful-infrastructure-public-private-partnerships/>.

2.

INTRODUCTION TO THE INVESTMENT DESIGN FRAMEWORK

Many of the technologies and approaches associated with sustainable infrastructure are emerging practices that lack long-term performance data.⁶¹ Section 2 introduces a structure for evaluating market development and describes the sustainable infrastructure sector's current level of maturity. Attracting private capital to increase deployment of public sustainable infrastructure projects will be crucial to market growth. This section introduces the four components of the Investment Design Framework to assist local governments in creating “investment-ready” projects.

SCALING THE MARKET

Across the United States, many communities are beginning to adopt sustainable infrastructure and utilize innovative financing approaches. The sustainable infrastructure market will likely mature on a similar trajectory to other sectors (see Figure 1 below): (1) early adoption by first movers, (2) market growth, and (3) integration into the mainstream market. Advancing market maturity will require communities and investors to demonstrate successes through a series of projects that overcome the risks associated with sustainable infrastructure investments (see Module D: Risk Management for discussion on risk management). Throughout the research process, experts and research indicated that public-private partnerships could address the infrastructure challenge if the effectiveness of the sustainable infrastructure asset class is consistently demonstrated.

⁶¹ There are a wide variety of sub-sectors within sustainable infrastructure including renewable energy, transportation, water, stormwater, etc. Each sub-sector has its own field of associated technologies which are at various stages of development. For example, using green infrastructure technologies for stormwater has gained popularity in the past decade. However, few communities have implemented this technology at large-scale and lack long-term performance data.

Figure 1. Stages in the Growth of the Sustainable Infrastructure Market



Source: Derived from Multiple Innovation Frameworks.⁶²

62 This analysis pulls from several sources in the field of technology innovation and market development, including Everett Roger’s Diffusion of Innovation in which technology is adopted by five categories of users. It also pulls from research from the Breakthrough Institute on the two “valleys of death” found in clean energy technology adoption. For the purposes of this report, the authors simplified the stages with a focus on commercialization. Many of the technologies associated with sustainable infrastructure have already

Currently, the sub-sectors of sustainable infrastructure are at different stages of market growth and adoption. Several sub-sectors, such as clean energy, are in the market growth stage, while other sub-sectors, such as green infrastructure for stormwater management, are still in an early adoption phase. Although many communities have installed green infrastructure demonstration projects, only a handful have begun construction of larger, citywide or regional scale developments. As such, this report largely addresses the challenges associated with moving from the early adoption to the market growth stage. Several of these challenges are listed below in Table 2.

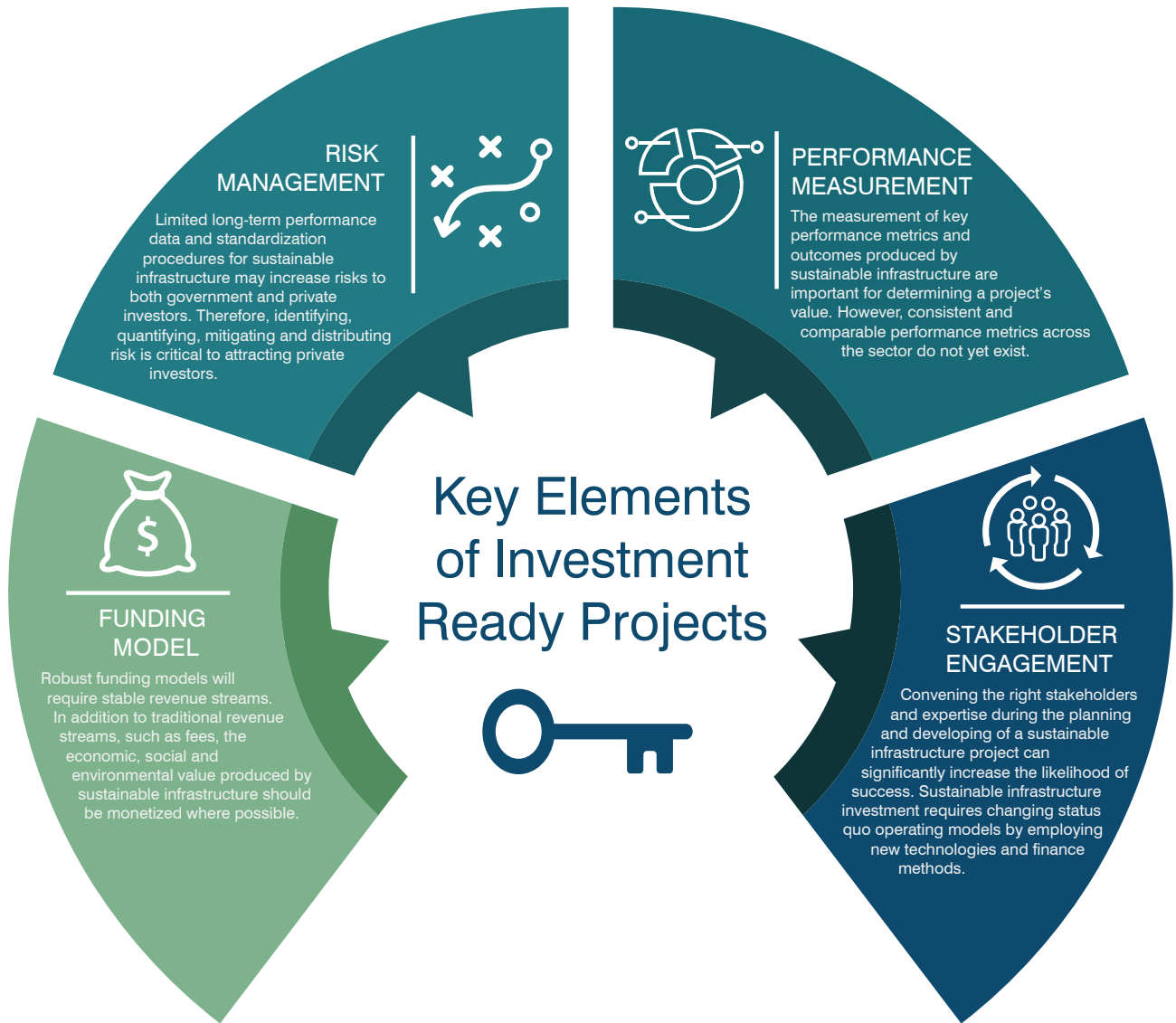
Table 2. Challenges to Financing Sustainable Infrastructure

	Challenge	Impact on Financing
Ambiguous or Multiple Definitions	The use of multiple terms within the sustainable infrastructure space can be confusing to potential investors and government finance offices.	Increased confusion in the market and difficulty attracting potential investors
Information Gap	Investors and governments face information gaps, and may have difficulties communicating across professional boundaries. For example, those who are driving sustainable infrastructure development, such as environmental planners, struggle to communicate project outcomes in ways that highlight both environmental impacts as well as the economic benefits that would resonate with mainstream investors.	Increased risk from unknowns leads to increased cost of capital
Limits to Government Financing	Debt limits, credit ratings, and limitations to expanding tax-bases impact a local government’s ability to finance projects. Issuing additional debt could result in lower credit ratings, increasing the cost of funding. While revenue supported debt addresses some of these challenges, this type of debt is also limited and may not be available. Federal and local regulations may also limit how public money can be spent. For example, a city may be prohibited from spending public dollars on green infrastructure installed on private property.	Competition for limited government capital
Lack of Clear Revenue Streams	Many types of sustainable infrastructure do not produce a clear, readily accessible revenue stream. Constituents may be accustomed to receiving infrastructure services at little or no-cost; thus, taxes or fee increases may be politically challenging, or may require policy changes that take time.	Insufficient revenue
Structure of Financing	Project finance deals may not produce the right return on investment, interest rate, or contract terms to attract a range of private investors. Moreover, single projects may not be easy to replicate or aggregate, which may be required to reach the size of investment needed to attract institutional investors.	Investor financing mismatch
Technology Performance	Sustainable infrastructure is a new market supported by emerging technologies and approaches. As such, standards and performance metrics are still under development. While many pilot projects exist, few large-scale projects with sufficient performance histories have been developed. This circumstance can lead to questions about performance, which can increase risk for the public sector and private investors. Investors must conduct due diligence on new technologies and understand the risks associated with them.	Higher cost of capital Increased costs from repetitive due diligence

been developed and piloted, and are at an early adopter phase of development. See: Rogers, Everett. 2003. Diffusion of Innovation. 5th Edition. New York: Free Press.; and Jenkins, Jesse & Sarah. Mansur. 2011. “Bridging the Clean Energy Valleys of Death: Helping American Entrepreneurs Meet the Nation’s Energy Innovation Imperative.” https://thebreakthrough.org/blog/Valleys_of_Death.pdf.

For the sustainable infrastructure sector to mature, the challenges outlined in Table 2 must be addressed. This report draws from experiences in multiple sub-sectors of the sustainable infrastructure market, including clean energy and transportation, to examine key lessons learned from financing sustainable infrastructure projects and fostering market growth for emerging technologies. The sustainable infrastructure Investment Design Framework, which comprises the latter sections of this report, is a guide for public sector actors to develop “investment-ready” projects. Throughout the interviews and research conducted for this report, four themes emerged as central to addressing the challenges listed in Table 2 and thereby a project’s ability to attract investment. These components are a suitable funding model, transparent performance measurement, robust risk management, and effective stakeholder engagement. However, developing investment-ready sustainable infrastructure projects has been complex and challenging. Thus, this report provides detail on enacting each of these four elements in Modules A-D including funding models, performance measurement, risk management and stakeholder engagement. The elements of the framework (represented in Figure 2) work best when applied together. Developing more investment-ready, replicable projects will usher private capital across sustainable infrastructure sub-sectors to grow the sustainable infrastructure market.

Figure 2. Key Elements of Investment-ready Projects



The following four sections address each of these key challenges in succession, provide additional context and case studies, and provide guidance to addressing these challenges. Report readers may use these sections together or individually.

MODULE A: FUNDING MODELS

Investment-ready infrastructure projects should monetize and capture values associated with its economic, environmental, and social outcomes. There are several pathways to monetize value streams to recoup project costs and achieve required rates of return for investors. This section provides guidance on (1) determining outcomes and services delivered, (2) identifying revenue opportunities, (3) and determining the appropriate financing method.



CHALLENGE

Traditional funding models cannot produce sufficient capital to fill the infrastructure gap or support the growth of the sustainable infrastructure market. Revenue streams that capture the financial value of economic, environmental, and social outcomes can both attract investment and fill the anticipated growth in financing needs. The integration of non-monetary values will require new methodologies for identifying and assessing revenue streams. Typically, revenue streams have been valued based on project outputs (see Outputs vs. Outcomes on page 31). Additional challenges associated with funding models are:

- Local governments have relied on general obligation bonds to finance infrastructure. However, the use of bonds can add to a community's debt burden and can require voter approval.⁶³

Revenue streams that capture the financial value of economic, environmental, and social outcomes can both attract investment and fill the anticipated growth in financing needs.

⁶³ According to the ICMA: "GO bonds are the long-term obligations of local governments backed by the issuer's full faith and credit, which means the issuing governments are obligated to repay bonds from their general tax revenues. GO bonds are traditionally issued to finance projects that do not yield revenues, such as public schools, libraries, public safety equipment, city halls, fire stations, and jails. GO bonds usually have better credit ratings and therefore are less costly to bond issuers than revenue bonds. However, GO bonds are subject to constitutional debt limits. In many states, they require voter approval. Moreover, GO bonds impose a debt obligation on future taxpayers and limit budget flexibility

- The finance industry has traditionally defined environmental and social benefits as “extra-financial” items or “co-benefits” and have not recognized or measured their real costs and values. However, these perceptions are changing; in some cases, co-benefits are being considered within cost-benefit analyses and life-cycle assessments. The finance industry will need to invest additional effort to integrate co-benefits into the broader field of practice.

CONTEXT

Government actors responsible for deploying sustainable infrastructure must identify, quantify and monetize additional revenue streams and avoided costs to attract investment. Historically, states and local governments have funded major infrastructure projects by relying on cash flows from general taxes, earmarked taxes, user fees, or bond proceeds.⁶⁴ These traditional methods rely heavily on outputs—or services provided—to determine appropriate revenue streams. For example, a community can charge users bridge tolls to generate cash flow that pays back investors who financed construction via a revenue bond. This type of revenue stream is easily quantifiable— it is based on the number of users—and is understood by investors. However, these user fees are still challenging to predict and model.

The benefit of sustainable infrastructure—relative to traditional infrastructure—is that it can yield additional economic, environmental and social benefits. These beneficial outcomes, however, are often difficult to measure and may require creative thinking to establish reliable cash flows for investors. For example, building infrastructure that is resilient in the face of flooding and storm surges may have more upfront costs than a conventional infrastructure, but may save money over the lifetime of the asset due to avoided costs associated with increased maintenance and/or reconstruction. However, the savings associated with avoided costs related to flood damage are difficult to quantify and may not translate into cash flows that can be used to secure investment for the project. While this is sometimes addressed through life-cycle cost assessments in the procurement process, it is not standard practice. To scale private sector investment in sustainable infrastructure, it will be essential for the public sector to identify and monetize social and environmental outcomes. It may also require philanthropic investors or others with risk-tolerant capital to fund projects designed to test and demonstrate these kinds of outcomes.

in future years. Revenue bonds, also referred to as nonguaranteed debt, are typically issued to finance public facilities that have definable users with specific revenue streams, such as utilities, toll roads and bridges, educational facilities, and hospitals. Revenue bonds are secured by the pledge of defined revenue sources generated from the bond funded projects (user fees, tolls, facility rent). Revenue bonds generally have more risk due to the uncertainty of generated revenues. Thus, the issuance of revenue bonds costs bond issuers more. However, an advantage is that most revenue bonds are not subject to constitutional debt limits and may not require a public vote.” See: Chen, Can and John R. Bartle. 2017. Infrastructure Financing: A Guide for Local Government Managers. <https://icma.org/documents/infrastructure-financing-guide-local-government-managers>.

64 Chen, Can and John R. Bartle. 2017. Infrastructure Financing: A Guide for Local Government Managers. <https://icma.org/documents/infrastructure-financing-guide-local-government-managers>.

PUBLIC INFRASTRUCTURE FINANCE, REVENUE AND FUNDING

The term financing refers to the act of providing funds for business or economic activities, including infrastructure development.⁶⁵ This report focuses primarily on financing methods that use debt, as well as contractual agreements such as pay-for-success or public-private partnerships (P3) (see page 17 for discussion). Revenue describes the income that is obtained through fees, tolls, taxes, land value capture, cost savings, assessments, or other methods. The funding model refers to how revenue is used to repay the financing.

A reliable revenue stream is required for governments to provide a return to investors. Similarly, when utilizing a P3, revenue is required to make concessional payments to the private entity responsible for maintaining and implementing portions of the infrastructure project (see page 22 for discussion on P3s). While government revenue for infrastructure projects often comes from general taxation, this report provides guidance on identifying additional sources of revenue that can be used to support the project financing.

GUIDANCE

Sustainable infrastructure projects provide additional long-term, beneficial outcomes and value. If these benefits can be quantified and monetized, they can help cities secure additional capital at lower costs.

Sustainable infrastructure investments and financing tools have only recently been deployed, and as such they have not been well defined in the literature. The following table provides a selection of examples of different types of sustainable infrastructure assets, outcomes, outputs, revenue options, and financing methods that could be used to drive investment.

Outputs vs. Outcomes

This document distinguishes between outputs and outcomes, which are terms that are often incorrectly used interchangeably. Both are critical to monetizing the value provided by infrastructure.

Outputs are the products and services delivered by the project. Example: Reduced volume of stormwater entering the sewer system.

Outcomes are the direct, sometimes long-term, impact of the project's outputs. Example: Reduces pollution or cleans water ways.

⁶⁵ US Department of Transportation. 2010. Project Finance Primer. <https://www.fhwa.dot.gov/ipd/pdfs/finance/ProjectFinancePrimerREV4.pdf>

Table 3. Determining appropriate revenue streams and financing methods

Asset	Outcome(s)	Output(s)	Revenue Options	Financing Method
Permeable Pavement, Bioretention Basins	Reduction in pollution; improved water quality; reduced flooding; improved air quality; increased property values	Reduced volume of stormwater runoff	Stormwater fees paid by private property owners; avoided costs from reduced damage public and private property.	Revenue bond Pay for success model Public-private partnerships
Street Trees, Green Roofs, Cool Roofs	Reduced urban heat island; improved air quality; reduced electricity load during peak use times; increased property values	Reduced temperature during peak times	Avoided costs associated with reduced energy usage; avoided healthcare costs associated with asthma and heat induced illness; taxes	Pay-for-success Green bonds
Coastal Wetland	Increased habitat stability; reduced damages to property during storms; increased recreation	Reduced coastal flooding during storms	Avoided costs associated with storm surge and sea level rise; taxes	Pay-for-success Green bonds

The remainder of this section provides guidance for public sector staff and policymakers who are interested in implementing sustainable infrastructure project investments. Government actors should:

1. Determine outcomes and service delivery benefits,⁶⁶ including economic, environmental and social outcomes.
2. Identify potential revenue opportunities, including revenue sources beyond general taxes such as user fees and tolls, land value capture, or cost savings. These cash flow streams can repay debt.
3. Assess the most appropriate financing method(s) and partners.

66 Designing infrastructure sustainably means that asset does not only provide its intended service, but also delivers it can a range of other benefits to a community. See: Albert, Craig and Tam Nguyen. October 2016. "How infrastructure companies can deliver real benefits." <http://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/how-infrastructure-companies-deliver-real-benefits>.

1. DETERMINE OUTCOMES AND SERVICE DELIVERY BENEFITS

To attract private investment, project developers must demonstrate their ability to provide investors a market rate of return on their investment. Communities should think broadly about the economic, social and environmental outcomes of sustainable infrastructure. Sustainable infrastructure development can help strengthen the economy, create new jobs, and increase livability. These factors make a locality more attractive to both business and residents alike, potentially increasing a local government's taxing power. In addition to the direct service provided by sustainable infrastructure, these assets may produce a variety of outcomes, including:

- **Economic outcomes** such as increased economic development, property values, jobs, protection or reduced damages to other built assets.
- **Environmental outcomes** such as reduced contribution to climate change, reduced air and water pollution, improved access to clean water, improved habitat for fisheries, or reduced electricity load.
- **Social outcomes** such as increased resilience, improved public space and recreation, better quality of public health/reduced hospital visits, or lower rates of crime.

Government actors will need to assess how or whether these benefits can be modeled, quantified and monetized, recognizing that some outcomes will be easier to quantify and monetize than others. While many of the outcomes may be monetized, governments may only need one to generate a stable revenue stream for investors. Module B: Performance Measurement, provides a detailed outline on how to appropriately select and measure these types of benefits, including: (1) developing key performance indicators, (2) determining baseline performance, and (3) reporting against performance measurements.

2. IDENTIFY REVENUE OPPORTUNITIES

Once the range of outputs and outcomes are identified, project developers can quantify anticipated revenue and cost savings from the project. In addition to general taxes, revenue may come from a variety of sources, including:

User Fees and Tolls: Many communities collect user fees or tolls for infrastructure assets such as roads, water, the electricity grid, and waste water management. Fees provide a clear source of revenue that can easily be quantified and help service debt.

As it relates to sustainable infrastructure, many communities develop stormwater fees, also known as stormwater utilities,⁶⁷ that charge property owners based on the

Sustainable infrastructure development can help strengthen the economy, create new jobs, and increase livability. These factors make a locality more attractive to both business and residents alike, potentially increasing a local government's tax base and associated revenue.

⁶⁷ Metropolitan Area Planning Council. 2016. Stormwater Financing/Utility Starter kit. http://www.mapc.org/Stormwater_Financing; LaDuca, Ann & John Kosco. 2014. Getting to Green: Paying for Green

amount of impervious surface on their property. The revenue generated from these fees help to pay for stormwater infrastructure, including green infrastructure.

Land Value Capture: Infrastructure can help spur economic development and increase property values within a specific geographic region. This direct economic benefit can be captured through Tax Increment Financing (TIFs)⁶⁸ and District Improvement Financing (DIF) in which the marginal increase in tax revenue is used to repay the infrastructure investment. Special Assessment Districts (SADs) are a similar tool that capture value through a special property tax assessment.⁶⁹

Capturing future value inherently involves some uncertainty, but has been used successfully to finance public transportation and other infrastructure that spurs concentrated development. While land value capture is complicated and difficult to forecast, applying this strategy to the sustainable infrastructure space is feasible and may require additional demonstration for investors less familiar with these practices.

Green infrastructure can increase property values of the surrounding real estate. According to the USDA Forest Service, street trees in Portland, OR increase the value of homes and provide an annual benefit of \$13 million in additional property tax revenue, which more than covers the costs of maintenance (\$4.6 million).⁷⁰ This property tax revenue could be used to fund additional green infrastructure investments.

In California, another land value capture tool called Enhanced Infrastructure Financing District (EIFD), is being used to integrate river revitalization, neighborhood improvement, and community opportunities across an 11 mile stretch of the LA River.⁷¹ The estimated cost of the LA River Revitalization is \$40 million.⁷²

Cost savings: Some types of sustainable infrastructure can provide cost savings over the life of the asset. Cost savings can be realized in two ways: (1) when funding is already allocated or budgeted to develop traditional infrastructure, but the same service can be provided by sustainable infrastructure for a lower cost; and (2) avoided costs, in which infrastructure can help avoid future costs, such as damages from increased flooding. Avoided costs are those that have yet to be incurred or allocated, but can be predicted over the life of an asset.

It can be very challenging to accurately predict and monetize cost savings in either

Infrastructure Financing Options and Resources for Local Decision-Makers. <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100LPA6.txt>

68 Chen, Can and John R. Bartle. 2017. Infrastructure Financing: A Guide for Local Government Managers. <https://icma.org/documents/infrastructure-financing-guide-local-government-managers>.

69 Ibid.

70 USDA Forest Service. 10 March, 2008. "Study shows that street trees increase the value of Portland homes by more than \$1 billion". <https://www.fs.fed.us/pnw/news/2008/03/trees.shtml>.

71 Amador, Cynthia et al. 2016. Enhanced Infrastructure Financing Districts: Resource Guide to EIDFS. <http://cceda.com/wp-content/uploads/EIFD-Resource-Guide-Feb-20161.pdf>.

72 Ibid.

instance. For example, the government entity that is developing the infrastructure may not realize anticipated cost savings. A city may invest in street trees and green roofs, but the benefits will be realized through electricity bill reductions for private properties. These benefits may be expressed through increases in home values and partially captured by tax rates. Additionally, avoided costs are difficult to predict and model; the complexity has been exacerbated by shifting extreme weather and climate change risks.

In practice, green infrastructure can often cost less to implement than traditional gray infrastructure,⁷³ especially if state or federal regulations require cities to install infrastructure that more comprehensively addresses the costs associated with externalities (e.g. the Clean Water Act). For example, the EPA conducted research on the cost-savings associated with green infrastructure investments in the City of Lancaster, PA.⁷⁴ They assessed four impact categories of water, energy, air quality, and climate change and found significant cost-savings across multiple categories; Lancaster's green infrastructure plan would provide approximately \$2.8 million in additional annual environmental benefits and an estimated \$120 million in cost-savings over 25-years compared to gray infrastructure. While this study was not used to identify potential revenue streams, it is an example of monetizing both co-benefits and cost-savings associate with sustainable infrastructure. These benefits and cost-savings could, in theory, be used to identify additional revenue streams.

Lancaster's green infrastructure plan would provide approximately \$2.8 million in additional annual environmental benefits and an estimated \$120 million in cost-savings over 25-years compared to gray infrastructure.

3. DETERMINE THE MOST APPROPRIATE FINANCING METHOD

To succeed, policymakers must also identify appropriate financing methods and partners based on appetites for potential risks and rewards (see Module C: Risk Management for more details). Governments should pursue the simplest financing method available to them, and only turn to innovative solutions when traditional financing is not available. Financing methods may include: general obligation or revenue bonds, including green bonds, pay-for-success models, or public-private partnerships (see Section 2 Infrastructure Finance: A Primer for a more detailed description of each method). User fees and tolls generate revenue streams that provide a wide-range of options for financing, including revenue bonds. Land value

73 Some sustainable infrastructure will have lower upfront costs when compared to their traditional infrastructure counterparts to provide the same type of services. This includes green infrastructure for stormwater management which has gained popularity in part due to cost-savings. Other sectors of sustainable infrastructure may have higher upfront costs, but have lower costs over the life of the asset, while others still will have higher costs throughout. See: Environmental Protection Agency. 14 October 2016. Green Infrastructure Cost-Benefit Resources. <https://www.epa.gov/green-infrastructure/green-infrastructure-cost-benefit-resources>.

74 Mittman, Tamara et al. 2012. The Economic Benefits of Green Infrastructure: A Case Study of Lancaster, PA. https://www.epa.gov/sites/production/files/2015-10/documents/cnt-lancaster-report-508_1.pdf.

capture may also be used to repay revenue bonds or public-private partnerships, but this revenue stream may be less predictable than other user fees. Cost savings are the most challenging to predict and monetize and develop a revenue stream, however they have been used to determine the return on investment in innovative methods such as pay-for-success.

- **Green Bonds** can be structured as either general obligation or revenue bonds. Any of the revenue streams outlined above that provide stable, predictable cash flows can support revenue debt financing. User fees, tolls, and land value capture have been used to successfully structure revenue bonds. If an adequate fee-based revenue stream is not identified, then a general obligation green bond may be more appropriate.
- **Pay-for-Success** is a contingent repayment based on performance of outcomes and may be the most appropriate tool when cost-savings are the primary source of cash-flow. While PFS has been used in the social impact bonds space, there are fewer examples in the environmental space. If the cost-savings are not realized because the infrastructure does not meet its performance outcomes, the contract can be structured so no contingency payment is required.
- **Public-Private Partnerships** often require regular concession payments to a private entity. This can be fulfilled by a revenue source generated from general taxes, user fees and tolls, or land value capture. Depending on the type of P3, up front financing may come from the private entity partner, or from public sector entity.

CONCLUSION

The development of appropriate funding models, including stable revenue streams, is critical to obtaining financing from private investors. However, when utilizing innovative financing methods beyond the traditional bond approach, communities will need to invest time to address and assess extra-financial benefits associated with sustainable infrastructure. These include identifying and measuring performance outcomes, managing risks, and engaging with experts and stakeholders.

CASE STUDY:

Prince George's County - Using Stormwater Fees To Support a CBP3

Snapshot: Prince George's County created the nation's first community-based public-private partnership (CBP3) to develop a sustainable infrastructure project. The county used the project to comply with new regulatory requirements under the Clean Water Act. The partnership is funded by a stormwater fee collected from property owners. The fee provides a stable revenue stream that supported the county's ability to engage a private sector partner, and could also help raise private capital for future infrastructure investments.

SUMMARY INFORMATION

- **Location:** Prince George's County, Maryland
- **Sector:** Stormwater management
- **Goals:** To meet regulatory requirements for improving water quality while generating local economic development benefit
- **Financing tool:** A public-private partnership that relies on a stormwater utility fee⁷⁵
- **Key Actors:** Corvias Solutions, Prince George's County

In 2010, the federal Clean Water Act's new requirements mandated that states address pollution from stormwater runoff.⁷⁶ To comply, many jurisdictions needed to make significant infrastructure investments. In response, Maryland passed legislation which

75 Cannito, Greg. 20 April 2016. "A New Funding Strategy from the Clean Water Partnership P3." <https://thecleanwaterpartnership.com/a-new-funding-strategy-from-the-clean-water-partnership-p3/>.

76 The National Pollutant Discharge Elimination System (NPDES) permit program was created under the Clean Water Act in 1972 to help regulate water pollution. An NPDES permit typically licenses discharge of a pollutant up to a set amount into receiving water. See Environmental Protection Agency (EPA), "National Pollutant Discharge Elimination System (NPDES): NPDES Stormwater Program" <https://www.epa.gov/npdes/about-npdes#overview>.

created the Clean Water Act fee, a mandatory stormwater utility charge. This fee is collected from property owners and funds programs to mitigate stormwater runoff and pollution from impervious surfaces. The fee applies to the City of Baltimore and the state's ten most populous counties. Although the bill took effect in July 2013, its implementation remained controversial. In 2014, gubernatorial candidate Larry Hogan focused portions of his platform on repealing the stormwater fee. After Governor Hogan's election in 2015, lawmakers developed a compromise which made the fee discretionary. However, jurisdictions were still responsible for maintaining sufficient levels of revenue to meet their federal stormwater remediation obligations.⁷⁷

The revised legislation allowed local jurisdictions to determine their own fee schedules. Prince George's County—the second most populous county in Maryland—borders the eastern portion of Washington DC.⁷⁸ To comply with Clean Water Act regulations, the county must make significant investments in stormwater infrastructure by retrofitting up to 15,000 acres of impervious surface area by 2025 at a projected cost of \$1.2 billion.⁷⁹ In response, Prince George's County Council established a Clean Water Act fund and fee schedule to finance necessary infrastructure. Property owners will pay a fixed \$20.58 administrative fee plus \$20.90 per 2,465 square feet of impervious area⁸⁰ through annual property tax bills.⁸¹

Though the stormwater fee provided stable revenue, the county still faced a significant investment gap for its proposed project portfolio. County officials sought ways to streamline costs and improve the efficiency of infrastructure investments. Prince George's County engaged with Corvias Solutions (Corvias),⁸² a private partner with the necessary expertise in development and implementation to help guide program management and share risk.⁸³

In March 2015, Prince George's County and Corvias began a formal collaboration under a community-based public-private partnership (CBP3) model.⁸⁴ Notably, the project is

77 Lexology. "Stormwater alert: Maryland fee program no longer mandatory." 30 Apr 2015. <https://www.lexology.com/library/detail.aspx?g=45bffb1b-ad46-4c51-b90c-4171c1282e74>.

78 U.S. Census. "QuickFacts." Prince George's County, Maryland. 1 Jul 2016. <https://www.census.gov/quickfacts/fact/table/princegeorgescountymaryland/PST045216>.

79 Environmental Protection Agency, "Prince George's County Maryland Clean Water Partnership," 29 August 2016, <https://www.epa.gov/G3/prince-georges-county-maryland-clean-water-partnership>.

80 Department of the Environment. "Prince George's County Clean Water Act Fee Regulation." Authority: Subtitle 10, Division 20, Sec.10-304. 4 Aug. 2016. <http://www.princegeorgescountymd.gov/DocumentCenter/View/16231>.

81 "Clean Water Act," Prince George's County, accessed August 24th, 2017, <http://www.princegeorgescountymd.gov/264/Clean-Water-Act>.

82 Corvias is a privately held company that partners with public sector institutions to address environmental, energy, and other infrastructure challenges.

83 "About the Project," Clean Water Partnership, accessed August 24th, 2017 <https://thecleanwaterpartnership.com/about-the-project/>.

84 According to the Environmental Protection Agency, a CBP3 is a partnership between a local government and a private entity. While there is not a one-size fits all approach to CBP3s, there are variety of potential options that center around providing high quality public services to communities in a cost-effective way. See "Financing Green Infrastructure - Is a Community-Based Public-Private Partnership (CBP3) Right for

the first-ever CBP3 to address stormwater management. Over the first three years of the partnership,⁸⁵ the county provided Corvias with \$100 million⁸⁶ to retrofit two thousand acres of impervious surface with sustainable infrastructure. These infrastructure projects include technologies such as rain-gardens, permeable pavement, and green roofs.⁸⁷ The county provides ongoing oversight for the project, while Corvias serves as the program manager, handling procurement of contracting resources to ensure projects are executed in line with the scope, schedule, and costs.⁸⁸ At a high level, Corvias' role entails implementing stormwater projects in accordance with best management practices and overseeing projects' maintenance over their expected thirty-year lifecycle. This division of project responsibilities effectively distributes the risks associated with construction and maintenance to the private sector.⁸⁹

The partnership's performance goals are outlined under a Master Program Agreement (MPA) and Master Maintenance Agreement jointly created by the county and Corvias. The two main performance areas are environmental (e.g. the reduction of pollutants discharged into local waters) and socioeconomic (e.g. the percent of subcontractors that are local small businesses). Corvias receives payments based on successful and timely achievement of milestones responsive to the project's goals. Concurrent with Corvias's implementation of streamlined processes outlined in the MPA, the capital projects team of the county's Department of the Environment will retrofit another two thousand acres using its traditional procurement practices. The county launched the two projects simultaneously to test the effectiveness of the CBP3 against its status quo processes. The test will identify best practices to decrease costs and improve efficiency.⁹⁰

The CBP3 has a strong focus on community development and socioeconomic improvements. The partnership agreement included a series of community development requirements. One stipulation required Corvias to engage local small, women-owned, or minority-owned businesses for 30% to 40% of the overall project scope. Another called for Corvias to establish a training and internships program for local students interested in stormwater management and sustainable infrastructure. The agreement

You?" Environmental Protection Agency, accessed August 24th, 2017, <https://www.epa.gov/G3/financing-green-infrastructure-community-based-public-private-partnerships-cbp3-right-you>.

85 "Prince George's County Maryland Clean Water Partnership," Environmental Protection Agency, accessed August 24th, 2017, <https://www.epa.gov/G3/prince-georges-county-maryland-clean-water-partnership>.

86 The \$100 million was financed through existing debt. The county's revenue from collecting stormwater fees is used to service debt. See: University of North Carolina, Environmental Finance Center. "Prince George's County Urban Stormwater Retrofit Public Private Partnership." https://efc.sog.unc.edu/sites/www.efc.sog.unc.edu/files/2017/Prince%20Georges_Final_WEB.pdf.

87 Taylor, Charles. "Storm water public-partnership is 'twofer' for Prince George's County, Maryland." 10 Jul 2015. <http://www.naco.org/articles/storm-water-public-partnership-%E2%80%98twofer%E2%80%99-prince-george%E2%80%99s-county-maryland>.

88 Environmental Incentives. 2017. Pay for Performance Contract Mechanisms for Stormwater Management. <http://enviroincentives.com/wp-content/uploads/2017/05/Pay-for-Performance-Contract-Mechanisms-for-Stormwater.pdf>.

89 "Frequently Asked Questions," Clean Water Partnership, accessed August 24th, 2017 <https://www.thecleanwaterpartnership.com/faqs/>.

90 Ibid.

also required Corvias to develop a community outreach plan to educate and engage with community stakeholders such as schools, universities and community leaders. These conditions ensure that the project bolsters local economic development and fosters greater support from the community.⁹¹

The CBP3's contracting model also differed from the County's previous partnerships. Past P3s involved three separate phases of contracting, each of which may have involved different partners: one for design, one for construction and one for maintenance. County officials established one contract for all three phases of the CBP3 with Corvias.⁹² This dramatically reduced contracting time. Furthermore, the public-private partnership facilitates flexibility. State and local law restricts how a government can procure contractors. Partnering with Corvias (which can then subcontract in a less constrained manner) allows greater flexibility.

The County believes that the CBP3 will result in efficiency improvements; the partnership has already begun to yield results in some areas. With Corvias' guidance, the partnership pursued an opportunity to apply for below-market-rate loans through the Maryland Clean Water State Revolving Fund,⁹³ which the state makes available to communities regulated under the Clean Water fee. Even lower rates are available to communities designated as "disadvantaged" according to state affordability criteria.⁹⁴ This fund had not traditionally been used for stormwater. In absence of the partnership, the County may not have had the capacity or expertise to pursue the funding opportunity. The partnership successfully applied for funds at a rate of 1.1%.⁹⁵

REPLICABILITY:

While stormwater fee legislation akin to Maryland's may be difficult to establish, it can yield important benefits. In the case of Prince George's County, the stormwater fee provides a stable source of revenue that allowed the county to engage a private-

91 Corvias. "Corvias Announces \$100m First-of-Its-Kind, 30-Year, Public-Private Partnership with Prince George's County to Tackle Stormwater Management," November 2014, www.corvias.com/news/corvias-announces-100m-first-of-its-kind-30-year-public-private-partnership.

92 Prince George's County Department of the Environment. "Prince George's County's Approach to Meeting Regulatory Stormwater Management Requirements," April 2016, <http://www.thecleanwaterpartnership.com/wp-content/uploads/2016/06/PGC-CBP3-Clean-Water-Partnership.pdf>.

93 Building on a federal investment of \$41 billion, the state Clean Water SRFs have provided more than \$118 billion to communities through 2016 towards a wide variety of water infrastructure projects. See: "Learn about the Clean Water State Revolving Fund (CWSRF)," Environmental Protection Agency, accessed August 24th, 2017, <https://www.epa.gov/cwsrf/learn-about-clean-water-state-revolving-fund-cwsrf>.

94 Chris Heaney. 2005. Comparison of Drinking Water State Revolving Fund (DWSRF) Programs and other Federal Assistance to Disadvantaged Communities in EPA Region 4. <https://efc.sog.unc.edu/reslib/item/comparison-drinking-water-state-revolving-fund-programs-and-other-federal-assistance-0>.

95 Environmental Consulting & Technology, Inc. January 2017. "Assessing Market Size for Large-Scale Green Infrastructure Adoption." www.ectinc.com/wp-content/uploads/2017/01/Assessing-Market-Size-for-Large-Scale-Green-Infrastructure-Adoption.pdf.

sector partner with whom risk could be shared. User-fee models may be an option to support other types of infrastructure projects (see Module A: Funding Models, for additional information on user fees). Finally, the unique focus on local small business engagement helps ensure the project results in community economic development. In summary, a CBP3-style engagement can help distribute risk, recruit external expertise, and generate additional political buy-in.

Table 4. Connections to framework

Module	Connections to Framework
<p>Funding Models</p> 	<p>Maryland’s Clean Water Act stormwater fee generates revenue that can be used to support ongoing retrofits. Stable revenue sources can unlock support from the private sector. In Prince George’s County it enables the public sector to contract with Corvias, and utilize their technical expertise. In other instances, private sector support could come in the form of financing.</p>
<p>Performance Measurement</p> 	<p>Corvias and the county established performance goals in a Master Program Agreement. These goals are used to track progress and replicability. Corvias’ incentive payments are contingent on reaching milestones linked to the agreement’s performance goals. The Master Program agreement used performance measurement to conserve and effectively distribute public funds.</p> <p>The county can also learn and develop metrics from observing the successes and challenges of the CBP3 and the concurrent project by the Department of Environment. The comparison will highlight best practices for future infrastructure projects with the county, Maryland and beyond.</p>
<p>Risk Management</p> 	<p>The community-based public-private partnership distributes risks across two parties. Corvias maintains full responsibility for the maintenance, distribution, development, construction, and technology, shifting operational risk from the county to the private sector.⁹⁶</p>
<p>Stakeholder Engagement</p> 	<p>Prince George’s County has demonstrated that its “first-of-its-kind” CBP3 can successfully utilize the strengths of various stakeholders to support sustainable infrastructure projects. The CBP3 requires Corvias to hire local, minority-owned, or women-owned businesses, which helps ensure community support. Required community outreach will also keep local residents informed during all phases of design and implementation. Corvias will also develop programs to reach a broader set of stakeholders including schools, universities, and community leaders on sustainable infrastructure and stormwater management.</p>

96 “Frequently Asked Questions,” Clean Water Partnership, accessed August 24th, 2017, <https://www.thecleanwaterpartnership.com/faqs/>.

4.

MODULE B: PERFORMANCE MEASUREMENT



Performance measurement can establish methods to track avoided costs and impact-related metrics. However, consistent and comparable performance metrics are still emerging in the sustainable infrastructure sector. Limited access to information about metrics can hamper investment. Sustainable infrastructure projects can attract investment more effectively by developing meaningful measures of financial and environmental improvement and regularly communicating the performance to investors.

CHALLENGE

Some sustainable infrastructure sub-sectors and associated technologies lack clarity and consensus on relevant performance measures.⁹⁷ Additionally, even in sub-sectors where standards are beginning to take shape, investors may be unfamiliar with or hesitant to use the metrics. In summary:

- Investors typically require historical information to identify patterns, probabilities, and risks. However, in many cases, sustainable infrastructure operators and sponsors are unwilling to disseminate information about project performance, or information may not be available on a timescale that matches financing.
- The lack of standardized performance metrics can create uncertainty and hinder investment.⁹⁸

97 Valderrama, Alisa et al. 2012. "Financing Stormwater Retrofits in Philadelphia and Beyond." <https://www.nrdc.org/sites/default/files/StormwaterFinancing-report.pdf>.

98 Mercer; Inter-American Development Bank. 2016. Crossing the Bridge to Sustainable Infrastructure. <http://www.un.org/pga/71/wp-content/uploads/sites/40/2017/06/IADB-and-Mercer-Crossing-the-Bridge-to-Sustainable-Infrastructure-Investing-Exploring-Ways-to-Make-it-Across.pdf>.

CONTEXT

Potential impact of metrics. Measuring performance is necessary for a project to determine financial returns, evaluate asset performance, and identify reporting gaps. These actions help achieve two crucial purposes. First, as described in Module A on Funding Models, performance measurement is the first step in monetizing project outputs and outcomes. Relatedly, many types of investors are increasingly interested in social and environmental impact metrics. As such, investors often look for performance measurement while evaluating projects to better understand both projected cash flows and impact. Second, successful projects can serve as templates that other developers can improve upon, apply to future projects and avoid pitfalls. The Carbon Disclosure Project's (CDP)⁹⁹ Cities Program hosts a global platform for cities to manage and disclose environmental data and C40's Sustainable Infrastructure Network facilitates best practice sharing among cities for financing sustainable infrastructure.¹⁰⁰ Additional information sharing portals, especially regarding metrics, can aid the process of standardization. Greater availability of performance metrics from successful projects can lead to standardizing relevant metrics, which can make it easier and more efficient to compare different investment opportunities. Overall, the disclosure of robust and consistent information improves investors' confidence and familiarity with new investment opportunities, and facilitates the replication of financing approaches. As more deals are replicated and investors grow more familiar with them, the pool of investors increases and the cost of financing may decline as more investors compete for the same opportunities.

Greater availability of performance metrics from successful projects can lead to standardizing relevant metrics, which can make it easier and more efficient to compare different investment opportunities.

GUIDANCE

Developing metrics with investor input and providing transparency through regular reporting can attract financing to specific projects and support market growth.¹⁰¹ The following steps are essential to measuring outcomes:

1. **Devise key performance indicators:** Define project objectives and appropriate metrics to reflect progress.
2. **Determine baseline performance:** Estimate outcomes in the absence of the project to provide a benchmark against which the project's performance can be compared.
3. **Report against performance measurements:** Generate and share reports on performance with investors in a timely and consistent fashion.

99 CDP is a non-profit that manages a global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts. See: "Homepage," CDP, accessed August 24th, 2017 <https://www.cdp.net/en>.

100 C40 is a network that "supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change". See: "About," C40, accessed August 24th, 2017, <http://www.c40.org/about>.

101 As with risk assessment, technical experts can help develop, model, and assess appropriate metrics. See: section 4 – Stakeholder Engagement.

1. DEVISE KEY PERFORMANCE INDICATORS

Performance measurement often includes both long-term objectives and incremental milestones. Organizations will typically develop key performance indicators (KPIs) which are measurable values that reflect a project's effectiveness in achieving its objectives.¹⁰² For the purposes of sustainable infrastructure, metrics will likely fall into three main categories: performance of the asset, co-benefits, and financial returns. Performance generally pertains to the immediate services, or outputs, provided by an infrastructure project. Co-benefits are additional positive social and environmental outcomes. Financial return measures performance in terms of economic value to both the project developer and investor(s). It can be difficult to present performance and financial return measures in a manner consistent with broader market practices. To address this gap, resources to devise metrics are growing. For instance, Global Real Estate Sustainability Benchmark (GRESB) is an investor-driven organization committed to assessing the environmental, social, and governance (ESG) performance of real assets globally.¹⁰³ The organization has over 250 members that use its data to optimize their investment's risk-return profiles. One of its available assessments is an infrastructure assessment. Tools like GRESB's can support the public sector and its partners in creating robust risk assessment metrics and procedures.

Project developers should also prioritize metrics that are directly related to their organization's mission and may already be supported by data tracked for other reporting or regulatory purposes.

As discussed in Module A: Funding Models, there are two aspects of infrastructure projects that could be tied to metrics: outputs - the products or services delivered by the project, and outcomes - the long-term impact of the project's outputs. While outputs may be easier to quantify and measure, many sustainable infrastructure benefits are realized at the outcome level. Additionally, certain outcomes may be easier to measure and monitor, or have readily available proxies. Investors will likely be most interested in outputs and outcomes that are quantifiable and can be monetized. Project developers should also prioritize metrics that are directly related to their organization's mission and may already be supported by data tracked for other reporting or regulatory purposes. Laying out the conditions under which a technology or practice can be expected to perform, exceed, or fall short of targets can support setting useful performance measurements.

Finally, developing metrics in collaboration with project stakeholders can help ensure that all relevant outcomes are captured. When investors are involved early in the process, it is more likely that their issues of interest will be addressed, which will make the investment more attractive. A survey conducted by the Global Impact Investing Network (GIIN) and J.P. Morgan concluded that 98% of impact investors

102 "Introduction to Key Performance Indicators," Klipfolio, accessed August 24th, 2017, <https://www.klipfolio.com/resources/kpi-examples>.

103 "Homepage," GRESB, accessed August 2th, 2017, <https://www.gresb.com/>.

measure the social and environmental performance of their investments.¹⁰⁴ Thus, standardized measures that are relevant, easily calculated, and transparently disclosed can accelerate investment.

2. DETERMINE BASELINE PERFORMANCE

Establishing baseline metrics¹⁰⁵ can support measurement of future performance. This step can be challenging as it may be difficult to obtain verifiable information. If precise baseline data is unavailable, proxy data, or data obtained from similar contexts can be substituted. For example, the DC Water Bond utilized stormwater runoff volume reduction to indicate success in meeting clean water requirements. These indicators were then paired to financial outcomes and facilitated risk sharing (see DC Water Bond Case Study). To find more examples of applicable proxies, The Atlas,¹⁰⁶ a collaborative platform for cities, facilitates data sharing between similar cities. This type of resource can help a city estimate a baseline for indicators based on a similar city's existing data. If the outcome is physically difficult to measure, proxies can play a role in another sense. For instance, the Environmental Protection Agency reports that vehicle miles traveled (VMT) can serve as a useful proxy for greenhouse gases in some instances.¹⁰⁷

3. REPORT AGAINST PERFORMANCE MEASURES

Reporting standardized metrics on a timely and consistent basis is important to investors. They provide project managers with up-to-date project status, facilitating course adjustments as needed and helping to ease investor uncertainty about potential risks. In addition to providing information on project progress, reporting to investors permits comparison across similar types of projects. As investors gain familiarity with such measures, the measures tend to become standardized throughout the sector, rendering risk and return analysis more robust and efficient.

The following table provides example resources to support enacting the above steps for performance measurement.

104 JP Morgan and Global Impact Investing Network. 2015. "Eyes on the Horizon." The Impact Investor Survey. <https://thegiin.org/assets/documents/pub/2015.04%20Eyes%20on%20the%20Horizon.pdf>.

105 Baseline outcomes create a foundation or starting point of comparison for future measurements. See: "Baseline," Investopedia, accessed August 24th, 2017, <http://www.investopedia.com/terms/b/baseline.asp>.

106 "Homepage," The Atlas, accessed August 24th, 2017, <http://www.the-atlas.com/>

107 Environmental Protection Agency. 2011. Guide to Sustainable Transportation Performance Measures. https://www.epa.gov/sites/production/files/2014-01/documents/sustainable_transpo_performance.pdf.

Table 5. Examples of Resources for Performance Measurement

	Featured Example	Specific Resource Description	Broader Context
Collaborative Platforms (and Other Private Sector Innovators)	Atlas Marketplace: Platform	Facilitates knowledge sharing between similar cities facing parallel challenges including measuring performance	Private sector innovators can contribute to scaling sustainable infrastructure. Others may also be relevant to the measurement process
Cities	Milwaukee - Green Infrastructure Baseline Inventory	Provides an example of setting a baseline	Cities may have resources available based on their efforts to develop performance metrics
Non-profits	Center for Neighborhood Technology: Report titled "The Value of Green Infrastructure"	Offers guidance on quantifying benefits that may be helpful in measuring performance	Non-profits could provide research and guidance on performance metrics
State and Federal Agencies	US Environmental Protection Agency: Modeling tools	Provides modeling guidance and tools that are relevant to performance measurement	State and federal agencies often have repositories of information on past projects, best practices, and topic-specific tools (including tools for performance metrics)
Academia	Envision: A collaboration between Harvard Zofnass Program and the Institute for Sustainable Infrastructure	Offers guidelines to optimize sustainable infrastructure, including approaches to quantifying sustainability in infrastructure	Universities may provide high-level guidance on performance metrics; some institutions may also have information specific to their regions

CONCLUSION

Standard financial metrics will always be necessary for financing. However, some sub-sectors of the sustainable infrastructure market have not yet coalesced around consistent performance metrics, which creates uncertainty for investors and can deter their involvement. While crafting measures for a new market can be challenging, several resources across private, public, academic, and non-profit sectors exist to aid in these efforts. Ultimately, setting performance metrics supports standardization, which can help attract investment both to the specific project and the sector.

CASE STUDY:

DC Water: Innovative Outcome Measurement for Environmental Impact Bonds

Snapshot: Combined sewer overflows (CSOs) in DC have polluted nearby waterways and disrupted natural habitats for the last century. DC Water and Sewer Authority (DC Water) worked with the Goldman Sachs Urban Investment Group and the Calvert Foundation to issue the first ever Environmental Impact Bond (EIB) that uses a pay-for-success model to finance the installation of green infrastructure.

SUMMARY INFORMATION

- **Location:** District of Columbia.
- **Key Actors:** DC Water and Sewer Authority, Goldman Sachs Urban Investment Group, Calvert Foundation and additional advisors (listed below).
- **Financing Tool(s):** Environmental Impact Bond (EIB).
- **Goals:** Meet clean water goals and reduce CSOs.

Washington D.C.'s combined sewer system has been polluting Rock Creek and the Anacostia and Potomac Rivers since it was first built in the early 1900s. Heavy rainfall events frequently overwhelm the system and result in harmful combined sewer overflows (CSOs).¹⁰⁸ DC Water and Sewer Authority (DC Water)'s Clean Rivers Project aims to reduce CSOs, improve local water quality, restore ecosystems, and reduce flooding. Initially, the Project included the construction of three large, underground diversion tunnels to act as holding tanks during

108 A Combined sewer system transports both untreated sewage and stormwater runoff through combined pipes to the wastewater treatment plant. These types of sewer systems are designed so that during extreme precipitation the combined waste water, which is too great for the system to handle, is discharged or "overflowed" into local waterways without receiving treatment. Approximately 772 cities in the U.S. have a combined sewer overflow (CSO) system. See: "What are Combined Sewer Systems?" Environmental Protection Agency, accessed August 24th, 2017, <https://www3.epa.gov/region1/eco/uep/cso.html>.

extreme precipitation events.¹⁰⁹ DC Water later revised the Clean Rivers Project plan to include green infrastructure in the Rock Creek Park corridor, which will reduce the volume of stormwater in the system. Green infrastructure, including permeable pavement and bio-retention basins, can capture and filter stormwater where it falls, which in turn reduces the volume of stormwater runoff requiring treatment. The inclusion of green infrastructure in the revised plan allowed DC Water to remove one of the proposed diversion tunnels. The overall cost of the project – including the two engineered diversion tunnels and green infrastructure – is estimated at \$2.6 billion.¹¹⁰

Rock Creek Project A, the first phase of the green infrastructure plan, is slated for construction between 2017-2018.¹¹¹ DC Water is responsible for the development and construction of the infrastructure. Goldman Sachs Urban Investment Group and Calvert Foundation¹¹² are financing the project via the nation’s first Environmental Impact Bond (EIB). The EIB is structured as a \$25 million tax-exempt bond that pays a 3.43% interest rate over a 30-year term with a mandatory tender date in year five.¹¹³ The EIB is modeled after pay-for-success structures that have been utilized in social impact finance, but which are new to the infrastructure sector. The bond is structured with three performance tiers that provide a performance-based contingent payment -or compensate DC Water for underperformance – five-years after project completion based on the volume of stormwater reduction (detailed in the chart below).¹¹⁴

Table 6. Performance Payment Schedule¹¹⁵

Performance Tier	Measurable Outcomes	Contingent Payment
Performance Tier 1	Runoff reduction > 41.3%	DC Water pays investors \$3.3 million
Performance Tier 2	18.6% <= reduction <= 41.3%	No contingent payment
Performance Tier 3	Reduction < 18.6%	Investors will pay DC Water \$3.3 million

109 “DC Utilized Green Infrastructure to Manage Stormwater,” Environmental Protection Agency, accessed August 24th, 2017, <https://www.epa.gov/arc-x/dc-utilizes-green-infrastructure-manage-stormwater>

110 “Green Infrastructure Plan,” DC Water and Sewer, accessed August 24th, 2017, <https://www.dewater.com/green-infrastructure>.

111 “Rock Creek Green Infrastructure Project A,” DC Water and Sewer, accessed August 24th, 2017, <https://www.dewater.com/projects/rock-creek-green-infrastructure-project>.

112 DC Water and Sewer, “DC Water, Goldman Sachs and Calvert Foundation Pioneer Environmental Impact Bond;” 29 Sept. 2016, www.dewater.com/whats-going-on/news/dc-water-goldman-sachs-and-calvert-foundation-pioneer-environmental-impact-bond.

113 Martin, Abby. “A Pioneering Environmental Impact Bond for DC Water.” Conservation Finance Network, Yale Center for Business and The Environment, 10 Jan. 2017, www.conservationfinancenetwork.org/2017/01/02/pioneering-environmental-impact-bond-for-dc-water.

114 Environmental Protection Agency. April 2017. “DC Water’s Environmental Impact Bond: A First of its Kind https://www.epa.gov/sites/production/files/2017-04/documents/dc_waters_environmental_impact_bond_a_first_of_its_kind_final2.pdf.

115 Goldman Sachs. DC Water and Sewer Authority, and Calvert Foundation. 2016. “Fact Sheet: DC Water Environmental Impact Bond” <http://www.goldmansachs.com/media-relations/press-releases/current/dc-water-environmental-impact-bond-fact-sheet.pdf>.

A team of technical, legal, and financial experts developed the performance tiers. Technical experts modeled the expected stormwater volume reduction within a 95% confidence interval based on analysis of key parameters including historic rainfall data, 12 months of rainfall and sewer data monitoring, and expected infiltration rates of various soils in the area.

As illustrated in the table above, performance tiers are tied to a contingent payment provided to either investors or DC Water. In practice, if the stormwater system outperforms the model, DC Water provides a \$3.3 million contingent payment to its investors in addition to the 3.43% interest rate. If the system performs at or near the modeled value, DC Water simply repays the bond at the 3.43% interest rate. If the system significantly underperforms, investors must compensate DC Water for the loss of performance by paying DC Water the \$3.3 million contingent payment.

Accordingly, the pay-for-success model allows the performance risk associated with the technology and project construction costs to be shared across DC Water, Goldman Sachs and the Calvert Foundation, while still providing private investors a reasonable potential return on investment.

REPLICABILITY:

The DC Water EIB offers a replicable model in communities that have stable revenue streams and a rich set of historical data against which to measure key performance indicators. While an environmental impact bond may not be accessible to all communities, governments can take several steps that will lay the ground work to enable this type of project. This includes establishing data tracking systems to support performance metrics, passing a local stormwater fee that generates additional revenue and passing local legislation that supports pay-for-success contracting. Governments with limited capacity should work with technical experts who can develop appropriate models and conduct technology and financial due diligence.

116 An EPA consent decree is the settlement of a legal dispute, whereby DC Water was found in violation of the Clean Water Act and its National Pollutant Discharge Elimination System (NPDES) permit. The 2005 decree was modified in 2015 to allow for the use of green infrastructure to meet its long-term control plan. See: Environmental Protection Agency, "District of Columbia of Water and Sewer Authority, District of Columbia Clean Water Settlement," 20 May, 2015. <https://www.epa.gov/enforcement/district-columbia-water-and-sewer-authority-district-columbia-clean-water-settlement>.

Table 7. Connections to framework

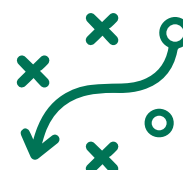
Module	Connections to Framework
<p>Funding Models</p> 	<p>DC Water’s rates and fees include a Clean Rivers Impervious Area Charge and Stormwater Fee.¹¹³ The DC Water Board of Directors established this fee structure prior to the creation of the EIB and it provides a stable revenue stream in addition to the general taxes used to repay the bond. This type of stormwater fee is gaining popularity in the United States as a way for municipalities and water utilities to fund their water pollution control plans and green infrastructure investments.¹¹⁴ Unlike Social Impact Bonds which are a form of contracting, the Environmental Impact Bond was tied to a general obligation bond.</p>
<p>Performance Measurement</p> 	<p>The three performance tiers were developed through extensive modeling (see explanation above). Metrics such as volume of stormwater runoff, as well as pollution levels were already tracked under DC Water’s EPA consent decree,¹¹⁵ which helped create a baseline for performance data. Similarly, since monitoring data used to assess performance of the green infrastructure is in line with DC Water’s overall mission, data collection did not add to their existing workload.</p>
<p>Risk Management</p> 	<p>The pay-for-success model under the EIB allowed the performance risks from the technology and the project’s construction to be shared across DC Water, Goldman Sachs and the Calvert Foundation. The investors were comfortable taking on the technology performance risk because of the clarity and due diligence provided by external experts described above. DC Water has a AA credit rating on subordinate bonds, and a long working relationship with Goldman Sachs, which added to investor confidence.</p>
<p>Stakeholder Engagement</p> 	<p>This project was successfully financed due to strong partnership amongst the three main entities: DC Water, Goldman Sachs and the Calvert Foundation. Notably, DC Water’s strong internal leadership was willing to integrate innovative pay-for-success solutions into their CSO control plan. Goldman Sachs had a previous working relationship with DC Water and was open to innovative thinking.</p> <p>These organizations consulted with external experts throughout the project’s development. Technical, financial, and legal experts provided their knowledge and experience early in the process to help with the EIB’s design and structure.</p>

117 “Impervious Area Charge,” D.C. Water and Sewer, accessed August 24th, 2017, <https://www.dewater.com/impervious-area-charge>.

118 U.S. Environmental Protection Agency. April 2009. “Funding Stormwater Programs.” <https://www3.epa.gov/region1/npdes/stormwater/assets/pdfs/FundingStormwater.pdf>; and Metropolitan Area Planning Council. 15 September 2016. “Stormwater Financing/Utility Starter Kit.” http://www.mapc.org/Stormwater_Financing.

MODULE C: RISK MANAGEMENT

As many sustainable infrastructure technologies are new, they tend to have limited available performance data, lack standardization, and are less understood by traditional developers and financiers. By utilizing risk management tools to mitigate project risks, including credit enhancements, loan guarantees, and partnerships, local governments and investors can collaboratively identify and distribute project risks. These risk management techniques can better align risk and reward, and support greater private sector investment in sustainable infrastructure.



CHALLENGE

Both traditional and sustainable infrastructure projects involve several types of risk. The assessment and distribution of risk affects a project's ability to attract investment. A lack of reliable performance data¹¹⁹ and standardization¹²⁰ in the sector make it difficult for investors and project developers to assess and manage risk in sustainable infrastructure.¹²¹ These challenges affect the ability to forecast revenue streams, estimate the useful life and overall performance of an asset, and secure financing or insurance. In summary:

- Risk assessments may be particularly challenging for certain types of sustainable infrastructure, such as natural infrastructure, where investors have less familiarity

119 The New Climate Economy. The Global Commission on the Economy and Climate. 2017. The Sustainable Infrastructure Imperative. <https://www.newclimateeconomy.report/2016/a-roadmap-for-financing-sustainable-infrastructure/>.

120 Egler, Hans Peter. Frazao Raul. 2016. Sustainable Infrastructure and Finance. United Nations Environment Programme. http://unepinquiry.org/wp-content/uploads/2016/06/Sustainable_Infrastructure_and_Finance.pdf.

121 Marsh & McLennan Companies, Global Infrastructure Practice. 2012. Infrastructure Risk Survey., www.mmc.com/content/dam/mmc-web/Files/infrastructure/12-0749-Infrastructure-survey_v5.pdf.

with technologies and practices and less access to performance data than in other sub-sectors (e.g. renewable energy).

- A limited availability of standardized contract structures, project designs, and environmental requirements create obstacles to assessing project risks.¹²²
- These challenges make it difficult for project developers to assess risk, a requirement to appropriately structure deals and attract investment.

CONTEXT

All infrastructure projects have inherent risks that can impact financial returns and deal development. Common risks are cost overruns due to delays, insufficient revenue generation, technology underperformance, asset failure, and adverse regulatory changes.¹²³ Many of these risks are similar in sustainable infrastructure projects. However, limited access to project performance metrics and unstandardized industry practices create challenges for investors seeking to assess risks and returns. Table 8 describes key risks associated with infrastructure development and discusses how risks may differ in sustainable infrastructure development. These challenges may diminish over time as more sustainable infrastructure projects demonstrate the ability to successfully achieve the needs of public and private stakeholders.

122 Egler, Hans Peter. Frazao Raul. 2016. Sustainable Infrastructure and Finance. United Nations Environment Programme. http://unepinquiry.org/wp-content/uploads/2016/06/Sustainable_Infrastructure_and_Finance.pdf.

123 IRENA. 2016. Unlocking Renewable Energy Investment: The Role of Risk Mitigation and Structured Finance. https://www.irena.org/DocumentDownloads/Publications/IRENA_Risk_Mitigation_and_Structured_Finance_2016.pdf.

Table 8. Example Differences in Risk Between Traditional and Sustainable Infrastructure

Risk Category	Description (Risks associated with) ¹²⁴	How Sustainable Infrastructure Investment is More Risky than Traditional Infrastructure	How Sustainable Infrastructure Investments is Less Risky than Traditional Infrastructure
Development & Construction	Project initiation, approvals, finance, and construction	+ Difficulty securing affordable finance due to lack of financial familiarity with investment and higher due diligence costs	- Some distributed technologies may be constructed faster
Revenue	Challenges accurately forecasting, assessing, and accounting revenue	+ Difficulty determining revenue stream + Potentially longer time to recover costs	- Monetization: benefits could accrue to multiple and varied entities - Environmental co-benefits
Technology	Nascent technology performance and untrained labor force ¹²²	+ Lack of any standard, or lack of consistent standards	- Ultimately leads to more resilient infrastructure, minimizing needed repairs
Operational	Functionality, maintenance, external impacts on equipment, and technical operator capacity	+ May be difficult to insure new technologies + Rapid technological change may impact operational activities or costs	- Some technologies may have less operational needs
Political & Regulatory	Political events or changes in legal or regulatory policies that have an adverse impact on the project (e.g. political support, regulatory transparency and predictability) ¹²³	+ Lack of guidelines, regulations or best practices + Political acceptance of new technology (locally dependent)	- Preference for sustainability (locally dependent) - New regulations that incentivize investment in sustainable infrastructure

In addition to differences between sustainable and traditional infrastructure, there are important differences between the private and public sectors. The public and private sectors traditionally serve different roles in project development, and thus have differing approaches to risk management. Public sector institutions tend to be driven by long-term goals and a mission to serve the public good. Governments have

124 Different organizations define and categorize risk in different ways. For clarity, this table describes how these terms are used in this report.

125 IRENA. 2016. Unlocking Renewable Energy Investment: The Role of Risk Mitigation and Structured Finance. https://www.irena.org/DocumentDownloads/Publications/IRENA_Risk_Mitigation_and_Structured_Finance_2016.pdf.

126 Ibid.

a responsibility to protect the public good, including the health, safety and welfare of their citizens. Therefore, government actors may think about risk in relationship to their long-term goals, including political risks associated with passing policies, raising taxes or fees, or developing a specific project. In contrast, the private sector primarily conceptualizes risks in terms of financial impacts to their investments. Thus, while the private sector can compare dollars to dollars, the public sector often faces the challenge of quantifying benefits and risks that are not immediately financial in nature (see Module A: Funding Models). Assessing both financial and public-service objectives makes it more difficult for governments to assess risk and return related metrics.¹²⁷ Despite serving a different purpose, the government's ability to identify and communicate risk in a manner that resonates with private sector investors is critical to attracting private investment. As such, this section focuses on how to attract private sector capital by assessing, managing, and communicating financial risk effectively. Lastly, in addition to risk management, policies can play an enabling role in setting market conditions to encourage private sector investment in sustainable infrastructure (see Module D: Stakeholder Engagement). Initiatives can include government regulations, incentive programs, as well as education and training programs.¹²⁸ However, this section describes an approach to assessing and managing risk primarily through financial de-risking instruments, as opposed to policy, recognizing each state and jurisdiction has a distinct regulatory context.

GUIDANCE

Assessment and management of risk can ensure that risk is shared between the right parties and aligns with an appropriate return on investment. The following steps are essential to managing risk:¹²⁹

- 1. Identify and Quantify Risks:** Specify the extent of each type of risk present in a project and share the assessment with relevant parties, including investors.
- 2. Mitigate Risks:** Reduce risk where possible.
- 3. Distribute Risks:** Share risk among multiple parties, ensuring that appropriate levels of risk are taken on by the actors best suited to hold the respective risk; this involves compensating actors willing to hold higher risk positions.¹³⁰

127 Ibid.

128 United Nations Environment Programme. 2015. Investing in Solar Heat. http://www.solarthermalworld.org/sites/gstec/files/story/2015-11-12/uneep-mcg_-_swh_financing_and_business_models_11.10.2015.pdf.

129 The four steps listed are not necessarily linear. Mitigation, distribution, and compensation often occur somewhat concurrently. This report separates each step for clarity.

130 OECD. Organization for Economic Co-operation and Development. 2012. Recommendation of the Council on Principles for Public Governance of Public-Private Partnerships. <https://www.oecd.org/governance/budgeting/PPP-Recommendation.pdf>.

1. IDENTIFY AND QUANTIFY RISK

Risks may exist across multiple risk categories, described in Table 5. Where possible, risks should be defined and quantified in both financial and non-financial terms. For example, identification should include both the likelihood of a given risk and its associated financial impact. Given available data, some risks may be easier to identify and quantify than others. When data are available or outside experts can analyze performance, managing risk is more straightforward. In other instances, it may be necessary to use proxies to estimate risk.

Presently, several organizations are working to better assess risk in sustainable infrastructure. One such organization is Global Infrastructure Basel (GIB) Foundation, a Swiss foundation working to promote sustainable and resilient infrastructure through design and financing.¹³¹ Along with an African-based partner, GIB is currently developing SuRe Underwriting – A Sustainable and Resilient Underwriting Standard. In the future, this type of product can help identify a more complete risk-return profile for a sustainable infrastructure project, including the potential risk reductions compared with traditional engineered infrastructure.¹³² After risks have been assessed and communicated with relevant parties, stakeholders can work towards mitigating and distributing risks accordingly.

Investors may be unfamiliar with the risks and baseline performance associated with a sustainable infrastructure approach or technology. To help build market knowledge and support future project development, government agencies and research institutions should consider publicly sharing high-level, technology-specific risk analyses and performance data. Organizations like the Connecticut Green Bank have undertaken such efforts to support market growth.¹³³ Additionally, insurance companies could be a source of important guiding information and expertise in assessing risk. As the Principles for Sustainable Insurance developed by the United Nations Environment Programme's Finance Initiative discuss, the insurance industry possesses a vast amount of data that could enhance risk prevention efforts. If such data were available to the public, it could support efforts to identify and quantify risks associated with sustainable infrastructure. Moreover, leveraging the expertise of these institutions could strengthen risk evaluations.¹³⁴

Finally, identifying and quantifying risks in a nascent sector is difficult. Small

To help build market knowledge and support future project development, government agencies and research institutions could consider publicly sharing high-level, technology-specific risk analyses and performance data.

131 "Homepage," Global Infrastructure Basel, accessed August 24th, 2017, <http://www.gib-foundation.org/>

132 "Sustainability and Resilience Underwriting," Global Infrastructure Basel, accessed August 24th, 2017, <http://www.gib-foundation.org/sustainability-and-resilience-underwriting/>

133 Connecticut Green Bank. 2016. Evaluation Framework: Assessing, Monitoring, and Reporting of Program Impacts and Processes. www.ctgreenbank.com/wp-content/uploads/2017/02/CTGreenBank-Evaluation-Framework-July-2016.pdf.

134 United Nations Environment Programme. 2015 Insurance 2030: Harnessing Insurance for Sustainable Development. <http://www.unepfi.org/psi/wp-content/uploads/2015/06/Insurance2030.pdf>.

differences in modeling can have significant effects on expected outputs and risks.¹³⁵ Technical experts can help assess and conduct due diligence on the proposed technology and asset. Similarly, legal and policy analysts will be helpful to understand policy and regulatory risks.

2. MITIGATE RISK

Several courses of action can mitigate risk. One method is to pair traditional financing with a low-interest Program Related Investment or philanthropic grant. The Omidyar Network, for example, provides flexible capital in other sectors to best meet the needs of projects.¹³⁶ In this model, Omidyar first assesses what problem needs to be solved and then determines the best financial tool to address it.¹³⁷

Loan guarantees¹³⁸ are a related risk mitigation option that could be used in the sustainable infrastructure space. The Section 108 Loan Guarantee program offered by the US Department of Housing and Urban Development (HUD) supplies communities with a flexible source of capital for economic development, housing rehabilitation, and projects to improve physical resilience against natural disasters. Public entities or third-party developers can receive loans to carry out eligible projects.¹³⁹ The Global Impact Investing Network's (GIIN) report, "Scaling the Use of Guarantees in U.S. Community Investing," provides further information on applying loan guarantees and describes how they can address risks relevant to sustainable infrastructure (such as those related to liquidity, sector unfamiliarity, and new product development).¹⁴⁰ Reducing operational, political, development, construction, and revenue risks will entail a combination of strategies, many of which stem from wide stakeholder engagement. For example, if the potential for gentrification following sustainable infrastructure implementation stands as a political risk for the project and community,¹⁴¹ strategies can be employed to minimize this possibility. The Georgetown Law Center offers a toolkit on ways to incorporate equity into sustainable infrastructure.¹⁴²

135 Weissbein, O., Glemarec, Y., Bayraktar, H., & Schmidt, T.S. 2013. Derisking Renewable Energy Investment. A Framework to Support Policymakers in Selecting Public Instruments to Promote Renewable Energy Investment in Developing Countries. New York, NY: United Nations Development Programme. [http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Climate%20Strategies/UNDP%20Derisking%20Renewable%20Energy%20Investment%20-%20Full%20Report%20\(April%202013\).pdf](http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Climate%20Strategies/UNDP%20Derisking%20Renewable%20Energy%20Investment%20-%20Full%20Report%20(April%202013).pdf).

136 "Impact Investing," Omidyar Network. www.omidyar.com/our-work/impact-investing. (accessed on September 5, 2017).

137 Omidyar Network. "Building a Philanthropic Firm." https://www.omidyar.com/sites/default/files/file_archive/Omidyar%20Network%20Approach.pdf (accessed on September 5, 2017).

138 Loan guarantee: "A legally binding agreement under which the guarantor agrees to pay any or all of the amount due on a loan instrument in the event of nonpayment by the borrower." See: "Loan guarantee," OECD, accessed August 24th, 2017. <https://stats.oecd.org/glossary/detail.asp?ID=5966>.

139 "Section 108 Loan Guarantee Program Fact Sheet," Department of Housing and Urban Development, Accessed August 24th, 2017, <https://www.hudexchange.info/programs/section-108/section-108-program-eligibility-requirements/#overview>

140 GIIN. 2017. Scaling the Use of Guarantees in U.S. Community Investing. https://thegiin.org/assets/GIIN_Issue_Brief_Guarantees_final%20for%20web.pdf

141 Hoffner, Jenny. 25 January, 2017. "Challenges in Stormwater Management: How to Avoid Gentrification." American Rivers. <https://www.americanrivers.org/2017/01/challenges-in-stormwater-infrastructure-gentrification/>.

142 "Green Infrastructure Toolkit," Georgetown Climate Center, accessed August 24th, 2017 www.georgetownclimate.org/adaptation/toolkits/green-infrastructure-toolkit/equity-tools.html

SPOTLIGHT: The Role of Green Banks in Risk Management

Green Banks are public or quasi-public institutions dedicated to financing the deployment of sustainable technologies such as clean energy projects in partnership with private lenders. Their purpose is to accelerate clean energy market growth while making energy cheaper and cleaner for consumers, driving job creation, catalyzing private investment in the sector and preserving public dollars. Thus far, while green banks have primarily supported the clean energy market, they could begin to play a more significant role in sustainable infrastructure at large. Green banks offer products to support specific projects, as well as activities that develop the market more broadly.¹⁴³

Green banks offer several products, including but not limited to:

Credit Enhancements are offered to improve the terms of private financing; this product type is useful when private lenders are interested in entering the market but are hesitant due to perceived risks.¹⁴⁴ Credit enhancements reduce the likelihood of default, and can expand the pool of potential investors.

- **First-loss provisions** are a specific type of credit enhancement and refer to any device designed for one entity to absorb capital losses prior to other investors. In this case, the green bank assumes the first loss position. First loss facilities improve the risk/return profile for other investors in the project.

Warehousing and aggregation credit facilities: In some instances, when private financiers are unwilling to lend, green banks can temporarily finance projects, pool them and diversify the underlying risks. Example use cases include (1) if a given clean energy technology is perceived as too risky, (2) if the market segment is viewed as having more credit risk, or (3) if the investments themselves are not cost-effective to underwrite. However, if a group of such projects are aggregated together into a larger portfolio, risks can be diversified and a higher scale can be achieved. Thus, as a group, these investments may be more attractive to investors.¹⁴⁵

Activities in Broader Market Development: Beyond project financing, green banks also undertake activities to grow the market. These include sharing information to facilitate a fuller understanding of technology value, processes, and options to support customer adoption, and standardizing processes to reduce the cost of capital.¹⁴⁶

143 “What is a Green Bank?” Coalition for Green Capital, accessed August 24th, 2017, <http://coalitionforgreencapital.com/whats-a-green-bank-html/>.

144 Credit enhancements are offered by other types of organizations as well (such as community development financial institutions and can take multiple forms, including loan loss reserves). This is an area where philanthropic grants or low-interest Program Related Investments could play a role.

145 “Product Offerings,” NY Green Bank, accessed August 24th, 2017, <https://greenbank.ny.gov/Approach/Product-Offerings>.

146 “Green Bank Activities,” Coalition for Green Capital, accessed August 24th, 2017 <http://coalitionforgreencapital.com/greenbank-activities/>.

3. DISTRIBUTE RISK BETWEEN MULTIPLE PARTIES

Risks that cannot be mitigated should be distributed to meet project participants' goals and appetites for risk. For example, the government may face political risk from utilizing taxpayer dollars to finance a project. Moreover, government organizations tend to be risk averse, which can dampen their appetite for new technology and practices. Investors, on the other hand, may be interested in assuming technology risk if there is the potential for an attractive return on investment. In the case of DC Water's Environmental Impact Bond, the utility shared the technology performance risk with investors to protect its ratepayers if the sustainable infrastructure did not perform as planned, while providing incentives to investors if it performed better than expected (see case study on DC Water). This example highlights an innovative approach for managing the public sector's lower risk appetite by distributing risk among multiple parties. In other examples of P3s, private entities have absorbed construction and operational risks, typically recouping their investment through associated user fees.

In some instances, distributing risk could involve providing "blended finance", or public capital that seeks to attract private capital to an investment. For instance, the Danish Climate Investment Fund (KIF) offers risk capital¹⁴⁷ for climate-related projects (e.g. energy efficiency, clean energy, coastal management, and disaster preparedness). By providing risk capital, KIF has successfully catalyzed capital from multiple private Danish pension funds.¹⁴⁸ This strategy reflects 'tranching', which creates different risk-return profiles for investors.¹⁴⁹ These types of models could prove useful for the domestic sustainable infrastructure market. In another example of tranching, the Transportation Infrastructure Finance and Innovation Act (TIFIA) provides loan guarantees and standby lines of credit that serve to distribute the higher risks of their portfolio among investors.¹⁵⁰

Finally, adequate compensation can help to distribute risk in alignment with investors' risk appetites. Investors have a wide variety in investment objectives, risk appetites and familiarity with infrastructure finance.¹⁵¹ Some organizations may even be well-suited to holding higher risk positions, such as green banks (see Green Bank Spotlight and case study on NY Green Bank). Fees or other forms of compensation are likely necessary to entice these parties into riskier positions.

147 Risk capital: "Capital invested in a business activity that involves a lot of risk, but which may be very profitable." See: "Definition of Risk Capital," Financial Times, Lexicon, accessed August 24th, 2017 <http://lexicon.ft.com/Term?term=risk-capital>

148 Krishnan, Shanti. 2015. Blended Finance: Catalyzing Private Capital for Development Impact. Dalberg Blog. <http://dalberg.com/blog/?p=3565>.

149 OECD. 2015. Infrastructure Financing Instruments and Incentives. <http://www.oecd.org/finance/private-pensions/Infrastructure-Financing-Instruments-and-Incentives.pdf>

150 "TIFIA Credit Program Overview," United States Department of Transportation, accessed August 24th, 2017 <https://www.transportation.gov/tifia/tifia-credit-program-overview>

151 McKinsey & Company, Global Infrastructure Initiative. 2016. Financing Change: How to Mobilize Private Sector Financing for Sustainable Infrastructure. www.globalinfrastructureinitiative.com/article/financing-change-how-mobilize-private-sector-financing-sustainable-infrastructure.

CONCLUSION

Sustainable infrastructure is a relatively new market and some of its sub-sectors lack sufficient levels of reliable performance data for investors to easily assess risk. This challenge can impede investment. Understanding investor appetites and objectives can reveal different and more efficient financial structures to match investor and financing needs. Over time, investors will likely become increasingly familiar with the sector through due diligence and technology testing, and risk assessment could begin to standardize across projects. When this occurs, the risk management challenges to investment in sustainable infrastructure could fall substantially.

CASE STUDY:

The Role of NY Green Bank in De-Risking Clean Energy Investments

Snapshot: The goal of NY Green Bank is to accelerate the clean energy market by increasing the availability of capital for the deployment of clean energy projects. NY Green Bank's technical expertise allows it to uniquely assess risk and identify projects that align with the bank's desired risk and return. It then deploys public funds with the objective of attracting private sector capital to these projects.¹⁵²

- **Location:** State of New York
- **Sub-sector:** Clean energy and energy efficiency
- **Goals:** Creating avenues for greater private sector investment in lesser-known technologies types and business models to help New York State meet its clean energy objectives
- **Financing tools:** Illustrative examples include warehousing and aggregation, longer-term loans and investments, and credit enhancements
- **Target:** Commercially available clean technologies, for which the market offers limited financing

Established in 2014,¹⁵³ NY Green Bank is a \$1 billion division of the New York State Energy Research & Development Authority (NYSERDA). Governor Andrew M. Cuomo established NY Green Bank in response to the renewable energy goals set forth under

152 "Overview," New York Green Bank, accessed September 5th, 2017, <https://greenbank.ny.gov/About/Overview>

153 New York State Energy Research & Development Authority, 22 June 2017. "Governor Cuomo Announces Major Milestone Reached." <https://www.nyserda.ny.gov/About/Newsroom/2017-Announcements/2017-06-22-Governor-Cuomo-Announces-Major-Milestone-Reached-by-NY-Green-Bank>.

the Reforming the Energy Vision (REV)¹⁵⁴ strategy. As the financing component of a comprehensive statewide effort to achieve REV's ambitious goals, NY Green Bank is responsible for accelerating financing markets to accelerate the more wide scale deployment of clean technologies. The New York Public Service Commission allowed the initial capitalization of the bank to utilize repurposed NYSERDA funds¹⁵⁵ and by June of 2017 – just three years later – NY Green Bank announced that it had generated positive net income and was covering its own costs (a goal which was accomplished a year ahead of schedule).

NY Green Bank's goal is to catalyze additional private sector investments in the commercial clean energy market. The organization uses its technical expertise and familiarity with clean energy financing to assess risks of new business models and less well understood technologies that other financial institutions may be unfamiliar with. Due to this, NY Green Bank is often an early participant in these transaction types, underwriting and providing financing for business models with an attractive risk-return profile.¹⁵⁶ Concurrently, NY Green Bank's participation provides a signal to investors that the investment opportunity is strong, resulting in replicable, scalable transactions that will drive investor participation. Thus, investors may be motivated to provide additional capital. Furthermore, NY Green Bank promotes standardization of processes (e.g. contracts, installation practices, servicing practices, credit underwriting methodologies) for financing less well understood technologies. Standardization can reduce costs and further enhance the investment opportunity.

The NY Green Bank's 2017 Annual Business Plan articulates its goals and strategies in detail. It also describes how progress is measured in terms of key performance indicators. At a high level, the specific tools NY Green Bank uses to de-risk, fund and scale clean energy investment are the financing products that it offers. To date, those have included, but are not limited to, (1) warehousing and aggregation credit facilities, (2) term loans and investments, (3) credit enhancements, (4) construction finance, and (5) construction finance paired with long-term loans and investment. Rather than offering a predetermined set of products to the market, NY Green Bank continually develops its products in response to market needs. Moreover, NY Green Bank focuses on funding projects that cannot currently attract sufficient private sector financing, but have the potential to transform the clean energy market.¹⁵⁷

The New York Public Service Commission allowed the initial capitalization of the bank to utilize repurposed NYSERDA funds and by June of 2017 – just three years later – NY Green Bank announced that it had generated positive net income and was covering its own costs (a goal which was accomplished a year ahead of schedule).

154 For additional information see: "Reforming the Energy Vision", New York State Government, accessed September 5th, 2017, <https://rev.ny.gov/>

155 Funds included system-benefit charges, renewable-portfolio-standard funds, and energy-efficiency-portfolio-standard funds. See: "NY Green Bank," U.S. Department of Energy, accessed September 5th, 2017, <https://energy.gov/savings/ny-green-bank>.

156 Investors typically want to make sure risk and reward are aligned: the higher the risk, the higher the return. Investors will review the risk-reward profile of a project (or set of projects) to determine if the investment is aligned as desired.

157 Coalition for Green Capital. 2015. "Growing Clean Energy Markets with Green Bank Financing" <http://coalitionforgreencapital.com/wp-content/uploads/2015/08/CGC-Green-Bank-White-Paper.pdf>.

Below are the four broad categories into which NY Green Bank groups its products:

- **Warehousing and aggregation** makes up a significant portion of NY Green Bank's activity.¹⁵⁸ Because of their relatively small size, many creditworthy projects struggle to attract private sector finance. One method NY Green Bank could utilize to address this challenge is to provide warehouse credit facilities to enable developers to build up larger portfolios of standardized projects.¹⁵⁹ As a specialty clean-energy lender, NY Green Bank can help demonstrate that competitive risk-return profiles are possible for such investments, which can increase investor confidence and attract private sector financing. The short-term financing provides the additional liquidity that may be necessary for a project to progress. In one example, NY Green Bank provided a \$25 million warehouse credit facility to Level Solar, a company that designs and installs residential solar arrays. The warehouse facility provided financing for Level Solar to expand its business development and installations, allowing the company to reach thousands of new customers in a manner that would not be possible without this additional short-term financing. Achieving this new level of scale is expected to help the business attract financing in the commercial market.¹⁶⁰
- To address other issues that project developers, ESCOs,¹⁶¹ or others have identified in the marketplace, NY Green Bank could **provide term loans and investments** in conjunction with other private sector providers. The objective in this category is to provide stable longer-term financing where NY Green Bank's participation could make these investment opportunities more attractive to other investors. For example, in March 2017, NY Green Bank provided a \$1.1 million construction loan to BQ Energy ("BQ"), a renewable energy project developer specializing in landfill and brownfield site redevelopment. The loan facility will enable BQ to complete a 0.87-megawatt ("MW") solar project on a remediated landfill in the Town of Esopus, New York. This was the second completed transaction under what is expected to be an approximately \$30 million portfolio that NY Green Bank is helping to finance in order to build a standardized set of projects that use the same contractors, contracts, and equipment in the underwriting process. NY Green Bank's standardization efforts will increase efficiency and lower future transaction costs.
- **Credit enhancements** include several instruments designed to alleviate default risks and absorb potential project-specific losses. Examples of these higher-risk

158 Warehouse credit facilities refers to the provision of temporary capital allowing project developers to aggregate a portfolio of multiple projects to create a scale that could be more attractive to private sector capital providers.

159 New York Green Bank. "Product Offerings." <https://greenbank.ny.gov/Approach/Product-Offerings> (accessed on September 5, 2017).

160 New York Green Bank. "Transaction Profiles." <https://greenbank.ny.gov/Investments/Transaction-Profiles> (accessed on September 5, 2017).

161 Energy Service Companies (ESCOs) are a delivery mechanism to maximize energy efficiency resources. ESCOs act as project developers – integrating the project's design, financing, installation and operational elements. The main differentiator between ESCOs and other energy efficiency contractors is the guarantee of energy savings which is specified as part of the terms of an energy savings performance contract." See: National Association of Energy Services Companies. 2017. "What is an ESCO?" <http://www.naesco.org/what-is-an-esc>.

positions include providing reserve accounts (funds to be drawn against in the event of default or losses) or holding a junior interest position (a position that receives payment only after other investors).¹⁶² For example, NY Green Bank provided \$5.5 million in credit enhancements to the Energy Improvement Corporation (“EIC”), a nonprofit local development corporation that develops energy efficiency and renewable generation projects for existing properties using the Property Assessed Clean Energy (“PACE”)¹⁶³ loan mechanism. Most of these funds established a reserve fund, which helps local governments pay PACE debt service to EIC if PACE collections fall short due to late payments or defaults.

- **Construction finance** includes a short-term loan to finance the building of a project or to advance efficiency measures. A construction loan is obtained by a developer or project sponsor to cover the costs of a project before obtaining long-term funding.
- **Construction finance + term loans and investments** where NY Green Bank plays multiple roles in the transaction.

REPLICABILITY

NY Green Bank stands out for its focus on transforming clean energy capital markets responsive to market needs. However, it is one of multiple state-level green banks or energy loan facilities in the U.S (e.g. California, Connecticut, Hawaii, and New Jersey). Each institution addresses financing gaps identified within its specific state.

The green bank model could also support other types of sustainable infrastructure and be relevant at jurisdictional levels. Rhode Island uses a similar model to implement broader sustainable infrastructure measures. The state has established an Infrastructure Bank¹⁶⁴ that funds projects ranging from septic systems and drinking water to efficient buildings and roads & bridges. At a smaller scale, Montgomery County, Maryland became the U.S.’s first county-level green bank.¹⁶⁵

The NY Green Bank has designed public financing products and services that effectively attract private sector funding in response to the state’s needs. While NY Green Bank focuses on clean energy at the state level, project developers in the broader sustainable infrastructure market and at other jurisdictional levels face similar needs for short- and long-term financing and credit enhancements. This makes the services and products provided by the NY Green Bank highly replicable for spurring growth in sustainable infrastructure.


162 “New York Green Bank,” U.S. Department of Energy, accessed September 5th, 2017, “<https://energy.gov/savings/ny-green-bank>.”

163 The PACE program allows commercial and nonprofit real estate owners to essentially borrow to finance energy improvements to their properties. Borrowers repay this debt through additional finance charges that are included in the property tax bills collected by the participating municipalities.

164 “Homepage,” Rhode Island Infrastructure Bank, accessed September 5, 2017, <http://www.riib.org/>.

165 “Nation’s First Local Green Bank Designated in Montgomery County, MD” Coalition for Green Capital. 3 August, 2016, <http://coalitionforgreencapital.com/2016/08/03/montgomery-county-green-bank/>; “Montgomery County Green Bank,” Department of Environmental Protection, accessed September 5th, 2017, <https://www.montgomerycountymd.gov/green/energy/green-bank.html>

Table 9. Connections to framework

Module	Connections to Framework
<p>Funding Models</p> 	<p>A New York Public Service Commission petition led to the initial capitalization of NY Green Bank (NYGB). The capitalization initially included repurposed NYSERDA funds - including system-benefit charges,¹⁶⁶ renewable-portfolio-standard funds, and energy-efficiency-portfolio-standard funds along with funds from the Regional Greenhouse Gas Initiative (RGGI). This approach to capitalization highlights the value of identifying existing revenue streams that can be applied to sustainable infrastructure projects. Green banks in other states have been funded in a similar manner using unused federal grants or revenue streams. However, in some instances such as Connecticut, funds were intentionally diverted from grant making into finance to create a stronger market for clean energy technologies.¹⁶⁷ Other states may need to make similar strategic decisions.</p>
<p>Performance Measurement</p> 	<p>NY Green Bank's broad goals are to attract capital to clean energy markets, to be self-sufficient, and to deliver energy and environmental impacts. These goals overarch key performance indicators (KPIs) and specific metrics for NY Green Bank's portfolio at large. (Impact evaluations are also conducted for each transaction.) These actions—setting metrics to track against goals and reporting against them—are the core steps in performance measurement. NY Green Bank's quarterly reports detail progress by providing profiles of transactions, along with providing detailed updates on where it stands against its KPIs.¹⁶⁸</p>
<p>Risk Management</p> 	<p>NY Green Bank's expertise allows it to identify and quantify risk in clean energy projects in ways that other institutions cannot. This enables NY Green Bank to uniquely provide financing to projects that may not be able to obtain financial support from traditional providers. By providing market rate capital for financing of various stages of clean energy projects, NY Green Bank signals to other investors that the investment opportunity is strong. Moreover, its participation allows risk to be distributed differently. While NY Green Bank has focused primarily on clean energy to date, the principles it applies to risk management are relevant for the broader sustainable infrastructure sector.</p> <p>In other instances, because of their relatively small size, even creditworthy projects can face challenges attracting funding.¹⁶⁹ Aggregating smaller projects solves this problem by creating scale and demonstrating strong risk-return profiles in the sector—and thereby increasing investor confidence.</p>
<p>Stakeholder Engagement</p> 	<p>As an expert in clean energy lending, NY Green Bank has technical knowledge that enables it to financially support commercially proven, less well understood technologies. Its participation generates confidence among investors who may then be more inclined to finance the project and can help mobilize transactions at the scale needed to generate investor interest. Expert intermediaries can play a critical role in scaling sustainable infrastructure investment through both subject matter expertise and financial capacity.</p>

166 System benefit charges are on-bill surcharges collected by investor-owned utilities. The charges are used by the state to support a variety of efforts in areas including energy efficiency, education and outreach, research and development, and low-income energy assistance. For additional details, see: "System Benefits Charge", U.S. Department of Energy, accessed September 5th, 2017, <https://energy.gov/savings/system-benefits-charge>.

167 Coalition for Green Capital. 2015. Growing Clean Energy Markets with Green Bank Financing. <http://coalitionforgreencapital.com/wp-content/uploads/2015/08/CGC-Green-Bank-White-Paper.pdf>

168 New York Green Bank, 2017. Business Plan: Annual Review 2016-2017 and Annual Business Plan 2017-2018. <https://greenbank.ny.gov/-/media/greenbanknew/files/nygb-2017-business-plan.pdf>.

169 New York Green Bank. "Product Offerings." <https://greenbank.ny.gov/Approach/Product-Offerings> (accessed on September 5, 2017).

MODULE D: STAKEHOLDER ENGAGEMENT

Convening relevant stakeholders during the planning of a sustainable infrastructure project can significantly impact the likelihood of success. Projects that change the status quo often require a dedicated champion who is prepared to assemble key players and ensure access to internal and external expertise.



CHALLENGE

Altering existing operating models for infrastructure projects may encounter internal inertia. Even when the key elements of investment-ready projects are present, designing sustainable infrastructure projects requires flexibility, creativity and multi-sector dialogue.

In summary:

- Both government and private sector entities rely on established practices and must comply with the laws and regulations that govern their respective responsibilities to the public and to shareholders.
- Rarely does an individual entity have all the necessary knowledge or resources to proceed unilaterally, as sustainable infrastructure financing pulls from a variety of practice areas.
- Each party impacted by an infrastructure investment will have different objectives that must be addressed and aligned during the development process.

CONTEXT

Even when all parties see the value of pursuing a course of action, there may be impediments to implementing a project. Governments are subject to various state and federal laws that can limit flexibility regarding project design, revenue generation, and risk. They are also subject to voter approval and required to provide public goods.

Investors are bound by fiduciary responsibilities that limit the amount of risk they can take on. These restrictions can cause rifts between the sectors. Fortunately, strong and methodical engagement between all relevant parties can reduce these challenges.

CREATING AN ENABLING POLICY ENVIRONMENT

Stakeholder engagement is a critical piece in creating policies and regulations that will enable growth in the sustainable infrastructure market. Predictable and consistent policies are critical for enabling private investment. The process to pass policies and regulations takes time; policymakers should consider which components will be necessary in their locality and begin laying the groundwork early in the process.

Goals and Targets: Many states and local governments have set climate change mitigation and adaptation goals through local planning processes. These are an important starting point for considering sustainable infrastructure outcomes and should be aligned to the extent possible with local infrastructure planning. Aligning public goals with available resources may increase investor confidence in a community's long-term commitment to sustainable infrastructure development. For example, states with Renewable Portfolio Standards (RPS) signal a commitment to renewable energy and can help grow the regional market.¹⁷⁰

Regulations and Legislation: Some funding models require enabling statutes or regulations at the federal, state or local level before they can proceed. For example, the efficacy of pay-for-success (PFS) programs and public-private partnerships (P3s) improves when supported by local enabling legislation exists (see Section 2: Infrastructure Finance: A Primer). Additionally, regulatory and legislative requirements—like the Clean Water Act—may push some communities to seriously consider sustainable infrastructure investments. It is important for individual communities to understand the legal restrictions they may face before they engage potential investors in scoping solutions. See the Introduction to the Framework for more information on enabling environments.

Participatory Process: Public support may be needed to move a project forward, whether in the form of a formal approval through a vote or simply in terms of public opinion. In fact, many communities are required to include opportunities for public meeting and public comment in the development of plans and projects.¹⁷¹ Thus, it is important to consider how stakeholder engagement will fit into a sustainable infrastructure development process and how to clearly articulate the role of private capital in the project.

170 Hurlbut, David. 2008. State Clean Energy Practices: Renewable Portfolio Standards. https://www.nrel.gov/tech_deployment/state_local_governments/pdfs/43512.pdf.

171 Udall Foundation: U.S. Institute for Environmental Conflict Resolution. "Principles for Effective Stakeholder Engagement in Infrastructure Permitting and Review Processes." http://udall.gov/documents/Institute/Udall-InfrastructureStakeholderEngagementPrinciples_Final.pdf.

GUIDANCE

Active engagement of committed stakeholders from both the public and private sectors can support the development and financing of sustainable infrastructure projects. Such engagement entails:

- Identifying leaders who can prioritize the project and advance it to completion;
- Determining the skill sets required for success and identifying the necessary internal and external experts; and
- Ensuring community support.

Leadership: As the driver of public infrastructure deployment, it is up to governments to ensure that new assets are developed sustainably. Changing traditional models—especially for the first time—typically requires a champion in a leadership position who can convene the right legal, financial, political, technical, and subject-matter experts. The champion should commit to overseeing the project from conception through design, financing, and implementation.

Leadership is similarly needed from the private sector. Matching the appropriate funding sources to projects can be a challenge, and the private sector has knowledge that is critical for successful implementation. While implementing sustainable infrastructure projects may require more effort in the short term, private sector leaders are needed to help communities develop the replicable project structures necessary to scale markets. For this to occur, private sector leaders need to articulate both their needs and limitations and collaborate with the public sector to align goals. Committing to work through the challenges can also help investors tap into a growing market for their clients.

Experts: Experts are important for providing both subject matter knowledge and added capacity to resource-strapped governments.

Internally, project leaders should identify the essential team members for a sustainable infrastructure project. As noted earlier, the team should include those staff members who have the legal, financial, political, technical, project management, and subject-matter expertise to navigate the challenges posed by deviating from the status quo.

A community may also need outside expertise to help develop approaches that are both innovative and replicable. A range of private sector, non-profit, and academic intermediaries have stepped in to help align public and private sector entities in communities at the forefront of infrastructure innovations. Intermediaries can fill gaps in expertise, help align divergent priorities into shared goals, and provide additional capacity for project managers, many of whom likely have obligations beyond an individual or set of sustainable infrastructure projects. For example, Harvard's Government Performance Lab and Quantified Ventures assisted DC Water, Calvert, and Goldman Sachs Urban Investment Group in constructing the nation's first EIB (see case study on DC Water). Finally, communities are increasingly sharing best practices through peer-to-

peer networks. Connecting with a similar community that has effectively implemented a similar project can be of tremendous value. For example, the C40 Sustainable Finance Network connects local governments working on sustainable finance to troubleshoot challenges and develop best practices.

Table 10 below includes examples of internal and external experts that could offer valuable input in a sustainable infrastructure process.

Community: As with any infrastructure project, it is important to engage the community that will be impacted and served by the asset. This is especially important when attempting innovations that may deviate from public expectations. Ensuring that community members, organizations, and non-profits are aligned with the proposed solution will be important to its ultimate success—especially if the project requires any sort of public approval, such as a vote to approve the issuance of a bond or approval of new fee structures.

Table 10. Example internal and external experts to engage

Area of Expertise					
	Legal	Financial	Policy	Technical	Project Management
Internal	Bond Counsel; General Counsel	Chief Financial Officer	Sustainability policy lead	Project engineer; scientist	Infrastructure project manager
External		Financial adviser	Policy analyst; academic		Project management consultant; neutral facilitator

ROLE OF THE SECTORS

Attracting private investment in sustainable infrastructure will require collaboration across sectors. Leaders and experts in each sector bring diverse perspectives and content knowledge based on their unique experiences. Each is important to crafting successful projects.

THE ROLE OF THE PUBLIC SECTOR

- **Governments** at the state, regional, county and local level can drive sustainable infrastructure development by issuing debt that finances sustainable infrastructure projects (see Module A: Funding Models). These actors can also implement regulatory drivers to ensure these projects will be completed. For example, the Environmental Protection Agency (EPA) allows sustainable infrastructure technologies to be used to comply with Clean Water permits. Since communities must comply with this regulation, there is an extra assurance that the infrastructure will be completed in a timely manner lowering construction

risks. Government actors can also advance legislative and regulatory changes that create a strong enabling environment for public-private partnerships.

- **Quasi-governmental agencies** such as infrastructure banks, development banks, green banks and community development finance agencies can serve as intermediaries between the public sector and lenders, provide technical assistance, support aggregation of projects, and develop credit enhancements to distribute risk.

THE ROLE OF THE PRIVATE SECTOR

- **Subject-matter experts** in the private sector can provide financial and/or technical assistance and expertise, help structure financing deals, and identify interested investors.
- **Investors** of different kinds can play different roles. As such, it is difficult to generalize investor priorities. Each will have unique insights into what is required to develop a sustainable infrastructure project that will attract their investment. Public pension funds, philanthropies, and family offices may be driven by a desire to engage in social impact investing or driven by a mission that aligns with the goals of sustainable infrastructure.

THE ROLE OF THE NON-PROFIT AND PHILANTHROPY SECTOR

While this report focuses on the public and private sector, it's important to note that non-profit and philanthropic institutions can play several important roles as well.

- **Subject-matter experts** in the non-profit and philanthropy sector for sustainable infrastructure can help ensure projects use the most robust technologies, practices, and performance measurement.
- **Philanthropic donors** can often act more swiftly and with less risk than their public or private sector counterparts. Philanthropic funding, through grants, program-related investments, or mission-related investments, can support innovative pilot projects that serve as test cases for new technology or approaches. Such early-stage support is essential for creating scale with greater public and private investment.
- **Facilitators** can guide stakeholders with different objectives to build consensus where possible and navigate differences appropriately.

CONCLUSION

Successful projects require committed stakeholders. Rethinking traditional ways to design and finance infrastructure to be more sustainable will likely pose challenges, especially when there are restrictions on the course of action or gaps in knowledge. Involving the right parties throughout the project's duration makes for a more informed process and increases the chances of success.

CASE STUDY:

Louisiana's Coastal Master Plan – Engaging Technical Experts and Community Stakeholders

Snapshot: Every 100 minutes, on average, Louisiana loses the equivalent of a football field of land to open water.¹⁷² To help respond to this impact, the state's Coastal Protection and Restoration Authority (CPRA) convenes a broad coalition of stakeholders from the public, private and non-profit sectors to develop a Coastal Master Plan every five years.¹⁷³ The 2017 Coastal Master Plan includes a combination of gray and natural infrastructure projects to create a more sustainable coastal landscape. The projects in the plan are intended to restore and protect the coastal habitats, industries, and infrastructure critical to the region's stability.¹⁷⁴ Currently, only a subset of these projects have dedicated funding. Stakeholder engagement has continued after the plan's adoption to identify additional financing needed to fully implement the plan.

One example of innovative financing is an initiative to design an Environmental Impact Bond (EIB), modeled after DC Water's successful 2016 EIB for green infrastructure, to fund a wetland restoration and resilience project identified in the Coastal Master Plan.

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- **Location:** State of Louisiana – Mississippi River Delta and coastline.
 - **Sub-Sector(s):** Coastal protection.
 - **Financing Tool(s):** State revenue streams and Deepwater Horizon oil spill settlement. Additional financing under development.

172 Couvillion, Brady. "USGS: Louisiana's Rate of Coastal Wetland Loss Continues to Slow" US Geological Society 12 July 2017. <https://www.usgs.gov/news/usgs-louisiana-s-rate-coastal-wetland-loss-continues-slow>

173 The Coastal Protection and Restoration Authority released their first Master Plan in 2007. See: Coastal Protection and Restoration Authority. 2017. "Louisiana's Coastal Comprehensive Master Plan for Sustainable Coast." <http://coastal.la.gov/our-plan/coastal-master-plan/>.

174 "Restoring the Mississippi River Delta," Environmental Defense Fund, accessed on 24 August 2017, www.edf.org/ecosystems/restoring-mississippi-river-delta



- **Goal:** Develop projects that build or maintain land and reduce risk to communities.
- **Key Actors:** Louisiana Coastal Protection and Restoration Authority; EDF and other members of the Restore the Mississippi River Delta coalition; and Quantified Ventures.

In 2005, the Louisiana state legislature created the CPRA to coordinate efforts on coastal restoration and protection following the devastation of Hurricanes Katrina and Rita.¹⁷⁵ The 2010 Deepwater Horizon oil spill and subsequent damage payments added additional urgency to the CPRA's mission to address coastal damages and economic losses. The 2017 Coastal Master Plan builds on plans from previous years by including the most up to date science, such as sea level rise data, and assessing the value of projects. The completed plan includes a mixture of gray and natural infrastructure to protect and restore the Louisiana coastline and Mississippi River Delta. These projects include levees and flood walls (gray infrastructure), as well as barrier islands, marsh and wetland creation, and sediment diversions (natural infrastructure). The 2017 plan identifies 124 projects with a budget of \$50 billion over a 50-year period. The CPRA expects these projects to reduce costs associated with expected damage by as much as \$8.3 billion annually by the plan's 50th year.¹⁷⁶ In June 2017, the Louisiana state legislature passed a resolution approving the Master Plan, along with a FY18 Annual Plan that allocates funding to support elements of 30 of the 124 Coastal Master Plan projects.¹⁷⁷

The CPRA led the plan development process to update the Master Plan which engaged a large group of experts, including the Restore the Mississippi River Delta coalition. Restore the Mississippi River Delta includes five local and national non-profits¹⁷⁸ that work together to provide scientific and economic analysis, public education and advocacy support. Members of the coalition were directly involved in the creation of the Master Plan, including providing technical expertise to the CPRA, educating and informing the public, advocating for policies that support Master Plan funding and implementation, and helping to address questions by facilitating dialogue with the academic community and the private sector.

The CPRA intends to draw on several funding sources for the plan, including allocations under the RESTORE Act, Gulf of Mexico Energy Security Act, Oil Pollution Act (Natural Resources Damages) and the National Fish and Wildlife Foundation Gulf Environmental

175 The Coastal Protection and Restoration Authority released their first Master Plan in 2007. See: "Louisiana's Comprehensive Master Plan for Sustainable Coast," Coastal Protection and Restoration Authority, accessed August 24th, 2017, <http://coastal.la.gov/our-plan/coastal-master-plan/>.

176 Coastal Protection and Restoration Authority. 2017. Louisiana's Comprehensive Master Plan for Sustainable Coast. http://coastal.la.gov/wp-content/uploads/2017/04/2017-Coastal-Master-Plan_Web-Book_CFinal-with-Effective-Date-06092017.pdf

177 The CPRA is required to submit an annual plan to the state legislature. This plan includes funding priorities for the fiscal year, as well as a three-year outlook on revenues and expenditures. See more at: Coastal Protection and Restoration Authority. 2 June 2017. "Approved: 2017 Master Plan and FY 2018 Annual Plan," <http://coastal.la.gov/wp-content/uploads/2017/06/2017.06.02-Governors-Press-Release.pdf>.

178 Coalition to Restore Coastal Louisiana, Lake Ponchartrain Basin Foundation, National Audubon Society, National Wildlife Federation, and Environmental Defense Fund.

Benefit Fund.¹⁷⁹ In addition, Louisiana will receive over \$500 million per year for 15 years from these sources to fund coastal restoration and protection.¹⁸⁰ Each funding source has its own timeline and set of restrictions for use. Despite CPRA's best efforts to match available funding with projects, and given the overall cost of the Coastal Master Plan, additional financing is needed to meet the goals of the Plan.

Environmental Defense Fund and Quantified Ventures are working with the CPRA to develop a Coastal Wetland Restoration and Resilience Environmental Impact Bond (EIB), with support from NatureVest, the conservation investing unit of The Nature Conservancy. This team plans to identify and finance a single wetland restoration project from the 2017 Coastal Master Plan, with the aim of demonstrating the feasibility of utilizing natural infrastructure to lower coastal damage costs.¹⁸¹ In addition to traditional bond investors, this group will also explore funding directly from local businesses that rely on storm protection services of coastal wetland to integrate community beneficiaries of the project. The goal of this process is to accelerate deployment of capital for coastal restoration, incentivize objective, verifiable standards, and advance possibilities around outcome-based financing for other projects. If issued successfully, this would be the second EIB in the nation and the first for coastal restoration.

REPLICABILITY:

The Louisiana Coastal Master Plan demonstrates how engagement of technical experts and stakeholders can balance community priorities of natural preservation and restoration, climate change adaptation and economic development. By utilizing a diverse set of experts, the CPRA created a comprehensive, science-based plan, which also garnered wide community support. The robustness of the metrics and performance outcomes will also likely help attract private investors.

179 "Louisiana Coastal Restoration Funding," Restore the Mississippi River Delta, accessed August 24th, 2017. <http://mississippiriverdelta.org/restoration-solutions/funding/>.

180 "Restoring the Mississippi River Delta," Environmental Defense Fund, accessed August 24th, 2017, www.edf.org/ecosystems/restoring-mississippi-river-delta.

181 Gangi, Dakota. 19 July, 2017. "EDF and TNC partner on new Environmental Impact Bond to fund coastal restoration..." SIB Review. <http://www.sibreview.com/media/2017/7/19/edf-and-tnc-partner-on-new-environmental-impact-bond-to-fund-coastal-restoration-environmental-defense-fund>

Table 11. Connections to the framework

Module	Connections to Framework
<p>Funding Models</p> 	<p>The Master Plan calls for large investments in infrastructure, requiring access to funding from a variety of sources including local, state, and regional allocations, and the financial settlement from BP. While the settlement funds are spread out over time, the state is pursuing ways to accelerate infrastructure deployment in the near-term. In addition to the EIB described above, the state is considering issuing a revenue bond tied to future settlement funding to generate near-term revenue.</p>
<p>Performance Measurement</p> 	<p>The CPRA is required to update the Master Plan every 5 years to be based on the best available science and data. CPRA engaged a variety of technical experts in the planning process, including local non-profits, academic institutions, and consultants. The Master Plan established metrics across 10 areas including: ecosystem, land, social vulnerability, flood protection for critical assets, navigation support, and support for traditional fishing communities.¹⁷⁹ These metrics were used to identify and prioritize the projects to be included in the plan and funded in the FY18 plan. These metrics will also be important in developing performance metrics which will be used to structure the EIB.</p>
<p>Risk Management</p> 	<p>The projects in the Coastal Master Plan are intended to reduce physical risk to Louisiana’s coastal assets. The CPRA is working to match projects with appropriate funding models and financing. Currently, the State and public sector is holding most of the risks associated with the development of the Master Plan. This is one reason that the work on the EIB will be critical to allocating and sharing risk between the State and private investors.</p>
<p>Stakeholder Engagement</p> 	<p>The restoration and protection of the Louisiana coastline is critical to the economic success and well-being of the entire region. The creation of the Master Plan engaged multiple levels of government, public stakeholders, non-profits, and private sectors. This robust engagement led to the plan being unanimously passed by state legislature. Additionally, a concerted process to identify the right financial and economic experts, as well as the construction of an EIB with the support of the private and non-profit sectors.</p>

182 Coastal Protection and Restoration Authority. 2017. Louisiana’s Comprehensive Master Plan for a Sustainable Coast. http://coastal.la.gov/wp-content/uploads/2017/04/2017-Coastal-Master-Plan_Web-Book_CFinal-with-Effective-Date-06092017.pdf.

CONCLUSION: GETTING TO SCALE

Infrastructure is essential to supporting economic prosperity in communities across the United States. The strain from increasing demand and overdue maintenance on the country's existing infrastructure grows daily. Trillions of dollars of investment will be required in the coming decades. While daunting, this need presents an opportunity: to implement sustainable infrastructure projects that support long-term economic, environmental, and social goals. These projects are essential to the achievement of climate commitments and preparing for climate impacts. As political leaders in Washington D.C., state capitals, and city and town halls across the country consider the best ways to address this challenge, it will be essential to consider the role private-sector participation and investment in our nation's infrastructure projects.

Transitioning towards more sustainable infrastructure necessitates the evolution of existing project development protocols to foster the fair and equitable inclusion of capital for the public and investors. Governments and project developers have a responsibility to ensure that infrastructure addresses the diverse needs of their communities. The private sector has a responsibility to align the risk and return of their investments to ensure the proper use of their clients' capital. With a collaborative approach, these aims can be achieved while scaling the sustainable infrastructure market.

Several components are needed to develop investment-ready projects. These include:

- **Identifying project outcomes and rigorously quantifying them in monetary terms.** This is essential to developing funding models that can attract a wider variety of private investment in debt financing and develop more creative approaches;
- **Developing performance metrics** with investor input and reporting on them in a consistent and timely fashion;
- **Assessing and managing risk** to ensure it is shared between the right parties and aligns with an appropriate return on investment; and
- **Convening committed leaders, experts, and stakeholders** to ensure the project

design and implementation is supported by the appropriate technical, legal, and financial expertise to succeed.

There are many communities that are already using this model to create innovative financing mechanisms to develop sustainable infrastructure. These communities can offer references for lessons learned and best practices.

- **Prince George's County** partnered with Corvias Solutions to create the first Community-Based Public-Private Partnership (CBP3) for stormwater management. The partnership's funding model demonstrates how identifying a revenue stream can provide critical financing for a project and help garner support from the private sector.
- **DC Water** worked with Goldman Sachs and the Calvert Foundation to issue the first ever Environmental Impact Bond (EIB), which allows the performance risk associated with green infrastructure technology and project construction costs to be shared across DC Water, Goldman Sachs and the Calvert Foundation, while still giving private investors an attractive potential return on investment.
- **NY Green Bank** is a \$1 billion state sponsored investment fund that de-risks the clean energy market, helping New York to become a top leader in sustainable infrastructure solar development by opening new avenues for private sector investment.
- **The Louisiana Coastal Master Plan** includes a combination of gray infrastructure and natural infrastructure to restore and protect the state's coastline.¹⁸³ A broad coalition from local government, non-profits, and businesses had the expertise required to support this plan moving forward.

These examples indicate a broader trend which is orienting infrastructure towards a more sustainable future. However, for the sustainable infrastructure market to reach the scale in the timeline required by community needs and climate demands, greater effort and investment is required. More projects must successfully reach completion to prove that public and private sector goals can be met sustainably. Each project should be replicable within its own context, and the lessons learned—from successes and failures—should be used to standardize the market to streamline due diligence.

There are a few next steps the public sector can take to assist with moving the market to scale.

For those beginning to engage in early adoption:

- **Establish a culture of civic innovation** in which public servants are encouraged to try new approaches that they believe will deliver better results for constituents—even if there is some risk that it will fail.
- **Identify champions in your departments and in your community** that can think

More projects must successfully reach completion to prove that public and private sector goals can be met sustainably. Each project should be replicable within its own context, and the lessons learned—from successes and failures—should be used to standardize the market to streamline due diligence.

183 "Restoring the Mississippi River Delta," Environmental Defense Fund, accessed August 24th, 2017, www.edf.org/ecosystems/restoring-mississippi-river-delta.

through the complex challenges that will arise throughout the process of integrating sustainable approaches.

- **Develop a sustainability plan** that highlights the outcomes your community prioritizes and strategies to measure success on each infrastructure project.
- **Join a network and reach out to communities like yours** that have already taken the first step towards integrating sustainable and natural infrastructure into their portfolios.

For early adopters:

- **Collaborate across departments** to ensure that all actors involved in deploying infrastructure use a sustainability lens to design, fund, operate, and maintain each asset.
- **Share lessons learned** that can help to shape standards and due diligence processes.
- **Create an enabling environment** that fosters new partnerships and ways to utilize financing models based on lessons learned from previous challenges.

For those that are leading the transition to sustainable infrastructure:

- **Utilize convening power** to help inform the standardization of future projects, standards, and metrics.
- **Work with intermediaries** to capture lessons learned and best practices that can inform state, regional, or national standards.
- **Develop and implement long-term plans to transition all assets** in conjunction with climate action and resiliency planning processes.

For non-governmental actors that want to support market development:

- **Identify your area of expertise** and reach out to a community in need of assistance.
- **Collaborate with thought leaders** to streamline terminology to decrease confusion.
- **Conduct due diligence** to reduce capital costs.
- **Test and publish technology performance** to increase confidence in the market.

There are also next steps private sector actors can take to engage in this market:

- **Identify opportunities to invest** in sustainable infrastructure;
- **Start a sustainable infrastructure division** at your that can begin to conduct due diligence and develop standards for specific types of infrastructure; and
- **Connect** with other investors who are working in this space.

Unlocking private investment and reaching market scale requires active partnership and collaboration between the public and private sectors, as well as support from non-profits and the philanthropic community. Sustainable infrastructure that grows the economy, supports local jobs, supports social equity, reduces pollution, and protects communities from the impacts of climate change is critical to the continued vitality of the United States. With the public and private sector working together and investing in critical sustainable infrastructure, the U.S. can once again become a leader in infrastructure and create a more livable future for all.

APPENDIX A: UNDERSTANDING THE INVESTOR LANDSCAPE

			IMPACT INVESTMENT		
TRADITIONAL	RESPONSIBLE	SUSTAINABLE	MARKET-RATE	CONCESSIONARY	PHILANTHROPY
COMPETITIVE RETURNS					
			ESG RISK MANAGEMENT		
			ESG OPPORTUNITIES		
			HIGH IMPACT SOLUTIONS		
Finance Only	The New Paradigm			Impact Only	
Focus on maximizing financial return with little or no focus on ESG factors	Focus on ESG risks, primarily based on negative screening of harmful products	Focus on ESG opportunities, through investment selection, portfolio management and shareholder advocacy	Focus on opportunities where social or environmental need creates a commercial growth opportunity for market-beating returns	Priority is placed on achieving a social or environmental impact, with investment strategies that may require a financial trade-off	Focus on one or a cluster of issue areas where social or environmental need requires 100% financial trade-off
Focus on one or a cluster of issue areas where social or environmental need requires 100% financial trade-off	PE firm integrating ESG risks into investment analysis; Ethically-screened investment fund	“Best-in-class” SRI fund; Long-only public equity fund using deep integration of ESG to create additional value	Clean energy mutual fund; Emerging markets healthcare fund; Microfinance structured debt fund	Focus on one or a cluster of issue areas where social or environmental need requires 100% financial trade-off	

Source: Bridges Ventures & C-Change¹⁸⁴

184 Bridge Ventures. 2014. Impact Report: Learning from a Multi-Fund Approach. <http://www.bridgesfundmanagement.com/wp-content/uploads/2017/08/Bridges-2014-Impact-Report-print.pdf>; C-Change. 2017. SDG Investing: Advancing a New Normal in Capital Markets. http://www.un.org/esa/ffd/wp-content/uploads/2017/03/SDG-Investing-Report_170306.pdf