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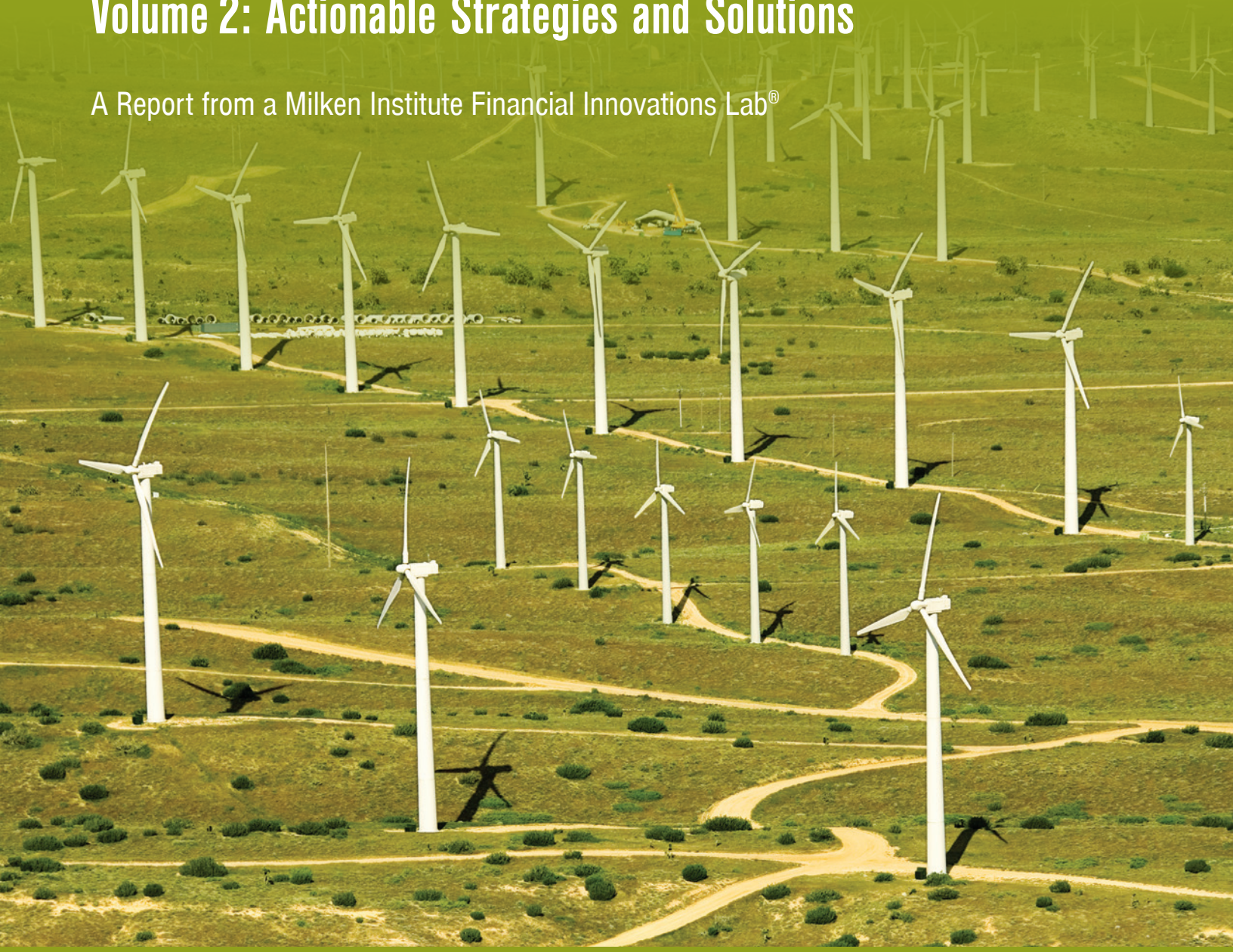
JOHN CHIANG
CALIFORNIA STATE TREASURER

GROWING THE U.S. GREEN BOND MARKET

Volume 2: Actionable Strategies and Solutions

A Report from a Milken Institute Financial Innovations Lab®



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Financial Innovations Labs bring together researchers, policymakers, and business, financial, and professional practitioners to create market-based solutions to business and public-policy challenges. Using real and simulated case studies, participants consider and design alternative capital structures and then apply appropriate financial technologies to them.

ACKNOWLEDGMENTS

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This report was prepared by Maressa Brennan and Caitlin MacLean.

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John Chiang
Treasurer
State of California

August 7, 2018

As 2017 dawned and a new administration bent on rolling back environmental regulations and agreements like the Paris Agreement took office, I issued *Growing the U.S. Green Bond Market – Volume 1: The Barriers and Challenges*. This report was the first in a three-step process I launched to ignite the green bond market in California and the United States.

Growing the U.S. Green Bond Market was the culmination of a five-city "listening tour," in which I met with investors and underwriters to identify the obstacles to expanding the domestic green bond market. At a time when the international market for green bonds was growing significantly faster than the U.S. market, these conversations were a critical first step in making the market for U.S. green bonds as attractive as those issued in Europe, Asia, and the rest of the world.

In partnership with the Milken Institute and Environmental Finance, on February 27 and 28, 2018, we took the second step in this process by convening the first Green Bonds Symposium in California. The first day of the symposium was dedicated to a Financial Innovations Lab—a day-long deep dive into analyzing the obstacles originally identified in my January 2017 report and identifying solutions to overcoming those obstacles. More than 40 subject matter experts met to produce the recommendations contained in this report.

Estimates of what it will take to update America's infrastructure and make it more resilient and greener in the face of the worsening effects of climate change are as high as $4 trillion. In California, just the costs of protecting the state's drinking water supply over the next 20 years will be at least $44.5 billion. These costs continue to grow every year. Green bonds are a financing tool that can help replace our existing infrastructure with greener, carbon-free alternatives.

Growing the U.S. Green Bond Market – Volume 2: Actionable Stategies and Solutions is the culmination of the hard work done on day one of the Green Bonds Symposium. This report contains concrete and actionable recommendations that could make a thriving green bond market in California and the United States a reality. The recommendations include (1) establishing of a Responsible Issuer Program, a state-level program that would provide transaction support and incentives designed to make it easier for municipal issuers to issue green bonds; (2) creating an insurance program that would make it easier for smaller issuers to access the green bond market; (3) creating a municipal issuer pool that would allow smaller issuers to aggregate their bonds to achieve better market results; (4) creating a green bond bank; and (5) evaluating the creation of a taxable green bond program.

With the publication of this report, we will now move on to the third step of this process I launched 18 months ago—the establishment of a Green Bond Market Development Committee that will bring stakeholders together to put this report's recommendations into action and explore other mechanisms that will help make green financing an important and accessible tool for issuers in California and throughout the United States.

I want to thank my partners in this effort, the Milken Institute and Environmental Finance, as well as the experts who lent their time and knowledge to participate in the Financial Innovations Lab, and all of the participants in the two-day symposium.

Together, we can achieve great things and begin the process of turning California and the country's aging infrastructure into the advanced, resilient, and green infrastructure we must have to address the ever-growing impact of climate change on our country. This report is just one step toward a greener, cleaner future.

JOHN CHIANG
California State Treasurer

TABLE OF CONTENTS

Introduction.....1

Issues and Perspectives.....2

Financing Infrastructure in the U.S. 2
State of the Green Bond Market: History, Growth, and Current Stats.....4
Barriers to Expanding the Green Bond Market.....6

Barrier 1: Standardization.....6
Barrier 2: Pricing.....8
Barrier 3: Market Function.....9

Innovative Solutions.....10

Solution: Responsible Issuer Program.....10
Solution: California Green Bond Credit Enhancement.....13
Solution: Regional Municipal Issuer Fund.....13
Solution: Creating a Green Bond Bank.....14
Solution: A Green Taxable Bond Program.....14

Conclusion.....17

List of Participants.....18

Endnotes.....21

Lab participants discuss expanding the U.S. green bond market.

ABSENT INCREASED SPENDING BY GOVERNMENTS AT MANY LEVELS, THESE FUNDING NEEDS WILL **REQUIRE NEW WAYS TO ATTRACT CAPITAL** FOR INFRASTRUCTURE PROJECTS.

INTRODUCTION

Massive hurricanes, raging wildfires, extreme heat events, and other weather catastrophes that were previously considered once-in-a-lifetime events are now occurring at an alarming rate. The devastating effects of climate change on our communities are dramatic: flooding in the streets of Houston from Hurricane Harvey, Hurricane Maria's destruction of Puerto Rico's power grid, fires causing unprecedented damage in California, and ravaged roadways around Santa Barbara due to the Thomas fire and subsequent mudslides, to name just a few. Apart from slowing or reversing the warming of the planet, communities around the world must become more resilient to these types of environmental shocks and stresses.

Unfortunately, the United States' deteriorating infrastructure is woefully underprepared to address the challenge of adapting to climate change. In 2017, the American Society of Civil Engineers (ASCE) gave the U.S. an overall infrastructure grade of D+,[1] with roads, transit, drinking water, and levees receiving even lower marks. The combination of extreme weather and neglected infrastructure is a recipe for disaster. However, taking the necessary steps to forestall calamity comes with a steep price tag. The ASCE estimates it will cost $2 trillion just to bring America's infrastructure into a state of good repair, and an additional $2 trillion to meet the challenge of accelerating climate change. The cost of inaction and delayed action is likely much higher due to sea level rise, extreme weather events, and related infrastructure damage. Absent increased spending by governments at many levels, these funding needs will require new ways to attract capital for infrastructure projects.

In California, the 2017 ASCE report noted that 5.5 percent of California's bridges are rated structurally deficient, while 678 dams are considered to have high hazard potential. It will cost an estimated $44.5 billion to build the infrastructure necessary to protect the Golden State's drinking water over the next 20 years, and $26.2 billion for wastewater infrastructure.[2] In total, California faces a funding gap greater than $400 billion over the next 10 years to address the state's public infrastructure needs.[3]

AS GLOBAL SUSTAINABILITY HAS BECOME AN INCREASINGLY POPULAR AND FREQUENT CONVERSATION, THE MARKET FOR INVESTMENTS THAT ADDRESS CLIMATE CHANGE HAS EXPANDED CONSIDERABLY.

This funding gap has presented an opportunity for global capital markets to create investment vehicles that provide long-term yield, while also helping communities mitigate or adapt to the effects of global warming. One such vehicle that has arisen in the past decade is the green bond: a traditional fixed income security with an additional layer of environmental sustainability. Companies like Toyota have issued green bonds to jumpstart electric vehicle production, while municipalities like Los Angeles have used them to update water treatment facilities. Some market observers argue that many governmental projects are inherently green, yet few public projects are presented as green projects to their investors.

The issuance of green bonds was a tiny fraction of the issuance of the global bonds market in 2017. Expanding the scale of green bonds to dent the $2 trillion infrastructure financing gap will require a variety of policy and product innovations, from standardization and metrics to pricing and public sector incentives.

As it so often does in matters related to the environment, California is leading the way in finding sustainable solutions to its dramatic infrastructure shortcomings. To find new ways to fund these much-needed improvements, California State Treasurer John Chiang began a project in 2016 to outline the challenges in the market and propose innovative solutions. The process began with a series of "listening sessions" throughout the United States. The initial result of those sessions was the publication of Volume 1 of this report, which addresses the state of the U.S. green bond market. Following the release of Volume 1, the Treasurer partnered with the Milken Institute to co-convene a Financial Innovations Lab as part of a two-day Green Bond Symposium, the first event of its kind in the U.S. The Lab, held on the first day of the Symposium at the Milken Institute in Santa Monica, California on February 27, 2018, brought together government leaders, investors, issuers, underwriters, and project developers to discuss and debate potential recommendations that would help to move the market forward. The following report, as a companion to Volume 1, outlines the key issues and solutions.

FINANCING INFRASTRUCTURE IN THE U.S.

The ways in which financial instruments can help mitigate climate change and its effects are myriad. Corporations can invest in more energy-efficient real estate; state and local governments can issue bonds to upgrade their water and waste treatment facilities or to build electric vehicle charging stations. Public-private partnerships can fund the construction of seawalls or brownfield improvements. Even individuals can take out loans to place solar panels on their homes.

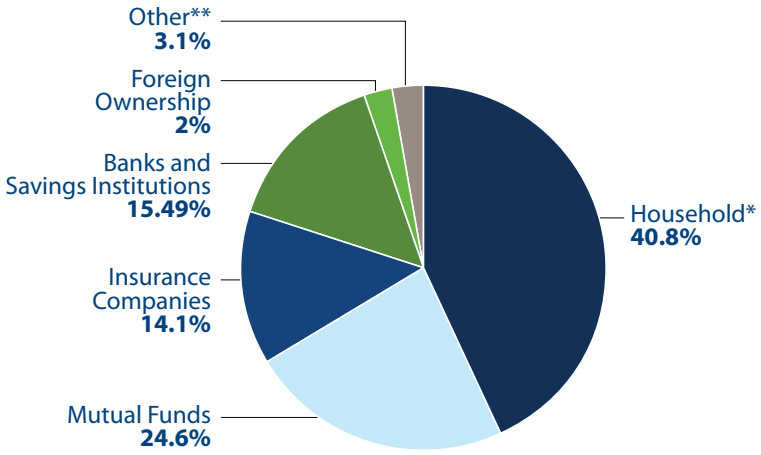
Meeting the multi-trillion shortfall in infrastructure investment estimated by the American Society of Civil Engineers will require the use of all these vehicles and more. The public sector funds the majority of U.S. infrastructure. The federal government provides some support, however the overwhelming majority of infrastructure investment comes from state and local governments. Some 90 percent of non-defense public infrastructure is owned at the state and local levels, with these governments paying 75 percent of maintenance costs.[4] Private investors also participate in infrastructure projects in a variety of ways. They lend money to governmental agencies; the loans are repaid over time from tax revenues or revenues derived from the sale of commodities or services, such as water, natural gas, and electricity. Investors can look at directly owning a project, as well as through an allocation to private equity funds that sponsor infrastructure development and through the purchase of project or corporate bonds. Global infrastructure investment funds have raised more than $260 billion in the past decade, but they struggle to find pipelines of projects to finance.[5]

The most commonly used financial instrument to fund infrastructure projects in the U.S. is the municipal bond, a debt security issued by state and local governments to finance the construction or acquisition of fixed assets intended to benefit the community. The United States has the largest municipal bond market in the world, at nearly $4 trillion outstanding. It is unique for its size, tax treatment, and credit quality. Public issuers like states and local governments depend on issuing municipal bonds as a way to finance projects that benefit their citizens and communities.

Financing infrastructure projects through municipal bonds requires pre-approval by the government's legislative body or the electorate. The approval takes into consideration need, regulation, legal constraints, health concerns, and environmental impact. Once a municipal bond is approved, the governmental agency hires financial advisors, independent bond attorneys, and credit rating agencies before bringing the issuance to an underwriter. The underwriter, usually a bank or a broker-dealer firm, purchases the newly issued securities and re-sells the bonds to the public.[6] This process, and its participants, is important to understand because it demonstrates the complexity of a bond issuance. It is this process that has allowed the U.S. bond market to grow to its current size and operate as a low-risk investment option for millions of Americans. However, the process is only lightly regulated. As a consequence, municipal bond issues tend to be idiosyncratic—often offering features and characteristics that may be similar, but are rarely completely identical to, an issue of bonds by comparable governmental agencies.

Municipal bonds are an effective way for local governments to improve their communities. The majority of municipal bonds are held by individual investors, either directly or through large mutual funds (See Figure 1). A benefit to issuing bonds at a local level is that they are often tax-exempt for the investor. Tax-exempt municipal bonds are free from federal taxation,

FIGURE 1: BREAKDOWN OF BOND OWNERSHIP



Source: Securities Industry and Financial Markets Association, as of Q4 2017. "Household" may include both direct investments by individual investors, as well as other accounts that do not fall into other tracked categories. "Other" includes non-financial corporate and non-corporate business, state and local governments, credit unions, state and local government retirement funds, exchange-traded funds, government-sponsored enterprises, brokers and dealers, and non-U.S. entities.

and usually from state and local income taxes for in-state buyers. It's a system that benefits both the buyer and the bond issuer. Individual investors buy municipal bonds as a shield from paying income taxes, while state and local governments are able to obtain lower borrowing costs than they would on taxable bonds.

There are downsides to this system, including the potential implications of the 2018 tax reform, which created limitations on what and how municipalities could borrow. Bond issuance can take time to structure effectively, and not all projects are eligible as part of the use of proceeds. Additionally, tax-exempt municipal bonds are not attractive investments for institutional investors who themselves enjoy preferential tax treatment. Examples include public pensions, endowments, and foundations. Moreover, typical foreign investors do not need a U.S. tax advantage. Collectively, these investors manage trillions of dollars, but since they already have a preferred tax status or no tax liability at all, they derive little benefit from tax-free bonds, and generally prefer to be paid the higher interest rates garnered from taxable bonds.

A taxable municipal bond market does exist, but it's not nearly as robust as the tax-exempt market, especially for smaller or less frequent issuers. Taxable bonds are often used for projects that are not purely governmental in nature, such as sports facilities. But they can be a great way to access capital for projects disqualified for tax-exempt financing because they attract institutional investors and mutual funds that can't take advantage of tax breaks.

Over the past decade, more municipalities have issued bonds to retrofit existing infrastructure and develop new projects to address the effects of climate change. At the same time, investors are increasingly interested in financial products that can hedge against potential

Mike Milken discusses the effects of climate change on financial markets.

THE RISE OF ESG AND IMPACT INVESTING

Interest in impact investing is rising globally. Since 2005, nearly 2,000 signatories have endorsed the U.N. declaration for Principals of Responsible Investment, a framework that promotes environmental, social, and governance (ESG) fundamentals.[7] In the U.S. alone, sustainable investing assets under management grew 33 percent between 2014 and 2016 to $8.7 trillion.[8] Schroders' Global Investor Study 2017 found that 78 percent of participants were taking sustainability factors into consideration much more seriously than five years ago, and 64 percent have increased their allocation to sustainable funds.[9] Investors see ESG as both a tool to mitigate against potential risks, including from climate change, as well as a way to drive positive social change.

Much of this increase can be attributed to the intergenerational wealth transfer between baby boomers and millennials, which is estimated to be $59 trillion in assets between now and 2060.[10] People aged 25 to 40 think about their investment decisions differently: 75 percent of all investors, but 86 percent of millennials, are interested in sustainable investing.[11] The performance of two different MSCI indexes offers an illustration of how doing well doesn't have to be incompatible with doing good. The company's ESG index (ACWI-ESG) has outperformed its all country world index (ACWI) in eight of the last nine years, proving ESG can produce competitive returns with low volatility.[12]

The data that companies provide about their ESG practices has also improved. Today the market is seeing more systematic, qualitative, objective, and financially relevant approaches to key ESG issues. ESG has been a prominent area of growth in the institutional markets for a number of years, with the retail market now also seeing interest from investors. In 2016, Morningstar introduced a Sustainability Rating for mutual funds to help investors gauge ESG factors.[13] ESG has also driven new regulations. In October 2015, the U.S. Department of Labor acknowledged that ESG considerations "are proper components of the fiduciary's primary analysis of the economic metrics of competing investment choices."[14] Recent updates have called into question how to best operationalize these considerations, but the market remains hopeful.

weather-related credit risks and promote societal impact. Within this perfect environmental and financial storm comes the green bond.

STATE OF THE GREEN BOND MARKET: HISTORY, GROWTH, AND CURRENT STATS

Green bonds are debt issuances used to finance projects that have positive environmental or climate attributes.[15] They give investors the steady and stable returns of a standard bond, while serving as a source of funds for building low-carbon-footprint infrastructure or developing a more resilient capital asset. And their utility has never been greater. As global sustainability has become an increasingly popular and frequent conversation, the market for investments that address climate change has expanded considerably. Green bonds are attractive to a wide range of investors, including many who have a sustainable or socially responsible mandate. This has broadened the market, attracting a more diverse investor base than that of a standard issuance.

The financial markets' increasing appetite for investing in projects with a double bottom line, coupled with America's drastic need for infrastructure improvements, has created the ideal conditions to support a thriving green bond market. Figure 2 summarizes the vast array of infrastructure projects that green bonds could potentially fund. Project types include, but are not limited to, pollution prevention and control, investment in energy-efficient transportation systems, green buildings, and climate change adaptation systems.

FIGURE 2: GREEN BOND SUB-SECTORS AND USE OF PROCEEDS

Renewable energy **Energy storage**	• Renewable energy generation projects, including construction, operation, and maintenance of wind and solar power projects. • Other renewable energy projects include geothermal and tidal. • Rehabilitation of power plants and transmission facilities to reduce GHG emissions; this includes smart grid projects. • Manufacturing of energy efficient and renewable energy products.
Green buildings **Green infrastructure**	• Greening of existing buildings, including projects making significant improvements to the building envelope, energy and water facilities, and energy metering. • Greening of new buildings includes the construction, operation, and maintenance of high star-rated green buildings. • Energy efficiency and conservation projects in buildings.
Industrial efficiency	• Industrial energy and water conservation projects for upgrading technology and process, equipment, and facilities to reduce energy use, water use, and pollutants. This can include cogeneration projects. • Circular economy projects that improve resource reuse, remanufacture, and recycling.
Clean transport	• Rail transport projects, induding construction, equipment purchasing, and technology upgrading. • Urban motor and electric public transport projects, including charging stations for electric vehicles. • Urban rail transit projects, including light rail, metro, monorail, tram networks, etc. Projects to improve energy efficiency of transportation systems can also qualify.
Clean water and utilities **Storm adaptation**	• Clean water, arid drinking water projects, including projects for safe rural drinking water. Small-scale irrigation and water conservation construction projects to build highly efficient water-saving irrigation systems. • Urban water-saving projects to reduce water loss from pipe leakages in the distribution system. River revitalization and preservation, habitat restoration. • Marine ecosystem conservation. • Prevention, control, and adaptation to droughts and flood.
Waste management **Methane reduction**	• Waste management waste-to-energy generation. • Wastewater treatment and methane capture.
Agriculture, bioenergy **Forestry** **Food supply chain**	• Green agriculture development projects includes organic agriculture production that adopts sustainable agriculture techniques and ecological principles. Agriculture supply chain projects can also qualify. • Green forestry development projects includes afforestation projects. • Construction, operations, and maintenance of biomass power generation projects. • Nature protection, ecological restoration, and disaster prevention projects include ecosystem restoration and soil erosion prevention.

Source: CBI "How to Issue a Green Bond."

First introduced by the European Investment Bank[1] (EIB) in 2007 and quickly followed by the World Bank[2] in 2008, green bonds have grown dramatically in popularity. In just over a decade, the green bond market has expanded to more than $160 billion issued worldwide in 2017. That's a more than 75 percent increase from 2016 levels, and nearly four times the dollar volume issued in 2015.[16] Particularly promising is that some of the world's fastest-growing markets (including China, India, and South Africa) are also among the quickest adopters of green bonds. In 2017, 239 individual issuers came to market with green bonds, 146 of them as debut issuers. A high number of new participants is always a good sign for market growth, and the escalating growth in each of the past two years is sure to encourage additional issuers in the future.

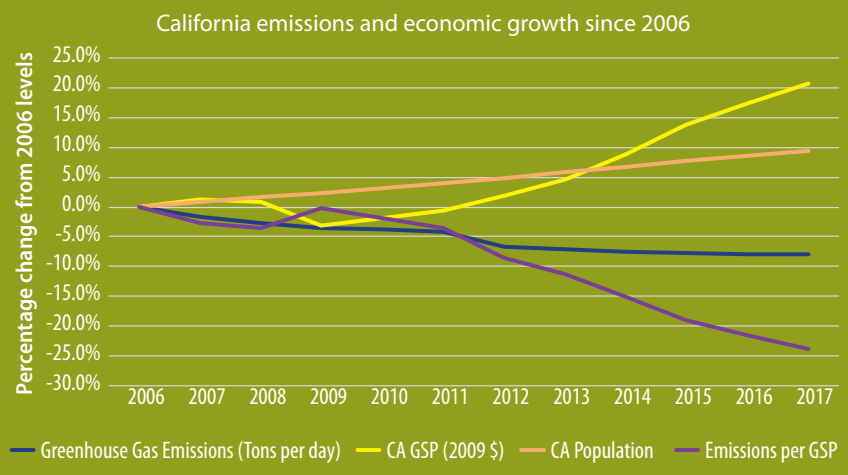
Three nations—the United States, China, and France—accounted for more than half the green bonds issued in 2017.[17] Fannie Mae was the single largest player in this market, issuing $24.9 billion in green mortgage-backed securities. Other prominent issuers included the Republic of France, China Development Bank, and New York City's Metropolitan Transportation Authority. In a comprehensive bid to make its operations 100 percent renewable, in 2016 Apple issued the largest green bond ever by a corporation ($1.5 billion), and issued another $1 billion green bond in 2017, two weeks after President Donald Trump pulled the U.S. out of the Paris climate accord.

The Climate Bonds Initiative organization forecasts as much as $300 billion in issuances for 2018, but warns that more than $1 trillion is still needed to counteract rising CO2 emissions and global temperatures. Even with all this impressive growth, the green bond market still represents only a minor share of the overall United States bond market.[18]

Many participants in the Financial Innovations Lab echoed voices from the Treasurer's Volume 1, attesting to high demand for green bonds, both from individual buyers and socially responsible institutional investors. This can be thought of as the "pull" in a push-pull setting. They believe the limitations on the U.S. green bond market are a supply issue, as most issuances have been oversubscribed. This perception creates an opportunity for California. Potential issuers of green bonds can be thought of as the "push" in the push-pull setting. As a consequence, the efforts of the Financial Innovations Lab focused on both sides of the equation.

In 2017, California became the first U.S. state to reach a cumulative total of $5 billion in green bonds.[19] The Golden State's ambitious goal of shifting to 100 percent renewable energy by 2045 is sure to spur demand for even more such financing. Assembly Bill 32, also known as the California Global Warming Solutions Act of 2006, requires the state to reduce its greenhouse gas emissions to 1990 levels by 2020, and by another 40 percent by 2030. The state has also directed agencies to consider climate change in all planning and investment decisions, including infrastructure planning.[20] The positive news is that these policies in California are having an impact. Despite increases in the state's population and gross state product over the past decade, emissions have declined (See Figure 3). The state has demonstrated that economic growth and environmental sustainability are not mutually exclusive.

FIGURE 3: THE STATE OF CALIFORNIA AND CLIMATE CHANGE



Source: California Air Resources Board, California Department of Finance.

1 The EIB is the European Union's development bank. It is owned by and represents the interests of the European Union's member states. The EIB provides financing and expertise for sustainable investment projects that contribute to the EU's policy objectives.

2 The World Bank is one of the world's largest sources of funding and expertise for developing countries throughout the world. Its primary institutions, the International Bank for Reconstruction and Development and the International Development Association, are commonly called the World Bank.

Prominent green bond issuances have come from across the state, and are being used to finance a diverse range of projects. The Los Angeles Metropolitan Transportation Authority (LA Metro) issued California's largest green bond to date ($471.3 million) in October 2017 to underwrite a variety of much-needed mass transit projects. The City of Los Angeles and the California Infrastructure Economic Development Bank (California IBank) have both issued bonds in excess of $400 million to fund improvements to water and sewer systems. San Francisco's Bay Area Rapid Transit System (BART) issued $384.7 million in green bonds to beef up its public transportation network, while the San Francisco Public Utilities Commission (SFPUC) has issued multiple series of green bonds, with proceeds focused on clean water and renewable energy.[21] SFPUC's experience is particularly interesting because it has issued taxable green bonds as a way to attract a larger investor base.

BARRIERS TO EXPANDING THE GREEN BOND MARKET

Barrier 1: Standardization

Definitions

For all the right reasons, investors like to know what they are getting themselves into before making an investment. Bond investments typically entail long time commitments and limited opportunities for growth of capital. Participants in the Financial Innovations Lab agreed that defining exactly what is meant by a green bond label is critical to the future of this market. The lack of uniform definitions may have helped the rapid and broad expansion of the green bond market so far, but going forward, this heterogeneous collection of offerings will need consistent labels to ensure green bonds are positively contributing to environmental sustainability.[22] Greenwashing—labeling a bond as "green" absent verifiable benefits—is a genuine concern, and the market suffers from critics who bundle legitimate and marginally green issuances together. Several of the biggest deterrents for issuers seeking to label their bonds as green are (a) deciphering the existing definitions and qualifications and understanding how that may affect their legal disclosures; (b) handling the administrative and financial challenges of meeting these requirements; and (c) developing systems to properly manage compliance with these standards and protocols over long periods of time. Standardizing these definitions will improve transparency.

Without uniform definitions, the market looks to verification and certification, and there is currently no one-stop shop for green bond labeling and reporting. Two of the leading agencies in this sphere use somewhat different approaches, but both contain language that say the issuer must be able to prove that the funds and subsequent revenue are tied to green investments.

The Green Bond Principles, launched in 2014, are a set of voluntary guidelines compiled by the International Capital Markets Association. The Principles provide flexibility for the issuer to demonstrate the environmental attributes of the project being financed. To qualify for the Green Bond Principles, issuers must meet defined environmental standards for the following components:

- the use of proceeds,
- the process for project evaluation and selection,
- the management of the disbursement of proceeds,
- and ongoing reporting.

These somewhat loosely defined principles allow for flexibility in innovation and diversification across sectors and among products.

Another widely accepted set of green bond definitions is put forth by the Climate Bonds Initiative (CBI). The Climate Bonds Standard and Certification Scheme requires third-party verification of the environmental benefits of any project, using clear, sector-specific criteria. This pass-fail scheme is currently limited to projects involving certain types of renewable energy, public transit, water management, and green building, but the Climate Bonds Initiative is developing criteria for evaluating other sectors like forestry, information technology, manufacturing, recycling, and waterborne transportation.

Neither method is perfect, but both have moved the market forward by encouraging issuers and investors alike to get involved.

Norway's Center for International Climate Research (CICERO) offers a third way to look at green bonds, utilizing a Shades of Green scale to rank the environmental impact of any project (See Figure 4). Under this system, the projects with the greatest impact on the environment receive a dark green designation, while less sustainable projects receive medium or light green rankings. Projects antithetical to the long-term vision of a low-carbon environment receive a brown designation.

One of the benefits of this sliding scale is the incorporation of the light green designation, which aims to attract new issuers to the green bond market, particularly those in historically non-environmentally focused sectors.

FIGURE 4: CICERO'S SHADES OF GREEN

SHADES OF GREEN	EXAMPLES
Dark green is allocated to projects and solutions that correspond to the long-term vision of a low-carbon and climate-resilient future.	Wind energy projects with a governance structure that integrates environmental concerns
Medium green is allocated to projects and solutions that represent steps toward the long-term vision, but are not quite there yet.	Plug-in hybrid buses
Light green is allocated to projects and solutions that are enviromnentally friendly but do not by themselves represent or contribute to the long-term vision.	Efficiency in fossil fuel infrastructure that decreases cumulative emissions
Brown is for projects that are in opposition to the long-term vision of a low-carbon and climate-resilient future.	New infrastructure for coal

Source: Center for International Climate Research (CICERO).

Data

Another key takeaway from the Financial Innovations Lab was the desire to standardize the metrics used to measure the environmental impact of various projects. Investors have opinions across the board when it comes to requesting data, with some doing their own deep-dive due diligence before making an investment, and others investing on market recommendations. It is important for issuers to improve their data collection to meet growing demands. Projects that maintain existing infrastructure, for example, can collect the requested data through the current partners, including utility companies. As issuers build out newer projects, upgraded tracking meters will streamline the data collection process. The range of green projects is too broad to subscribe to a single metric. Requiring the same data for a project that focuses on clean transportation and one that prevents soil erosion is not logical. But it is possible to set a minimum threshold for the market as a whole and establish key performance indicators within various categories of projects. It is also realistic to streamline data collection practices.

The most common metric used in the environmental space today is the $C0_2$ savings of a project.[23] But this metric isn't as applicable for water-related projects, where it makes more sense to measure water saved, water recycled, and/or total water consumption. Developing standard metrics for each category of project might improve investors' ability to compare the environmental impact of various projects, but comes at the risk of fragmenting the rational application of ubiquitous, easily understandable measurement standards.

Reporting

Standardizing metrics will also put an end to age-old disagreements between investors and issuers over what information to share. Issuers are often confused about what types of information to disclose and where, while investors who like to do their own due diligence often feel they don't have access to data that issuers have readily available. This is not an unfamiliar phenomenon. Traditional financial instruments already have clear reporting guidelines and databases, where information is published in a consistent, timely manner. However, those reporting guidelines are recent enough in their vintage to suggest that smaller, less frequent issuers may still be adapting to them. Moreover, these reporting guidelines are focused primarily on credit factors, namely, what an investor needs to know to form a judgment on probability of timely repayment rather than on factors such as "greenness." Financial Innovations Lab participants suggested that creating similar requirements for reporting green bond metrics would provide access to data that would streamline the process, enable more informed investment decisions, and perhaps remove a layer

of cost. This would not require reinventing the wheel. Similar platforms exist for traditional financial tools like the U.S. Securities and Exchange Commission's Electronic Data Gathering, Analysis and Retrieval (EDGAR) system which automatically collects data submissions from companies required to report quarterly by the SEC; or the Electronic Municipal Market Access (EMMA) platform, which is operated by the Municipal Securities Rulemaking Board, and is the official repository for information on municipal bonds in the United States.

Moreover, prototypes of this kind of metric reporting already exist. Oakland's EcoBlock Project, which aims to convert an entire city block to renewable energy, will feature state-of-the-art tracking meters that will feed real-time metrics into an online platform accessible to issuers, project managers, and investors alike. Sharing this best practice with other less tech-savvy municipalities could reap huge rewards.

Disclosures

The consistent presentation of data goes hand in hand with standardized legal disclosures. Simply put, issuers should explain upfront both the qualitative and quantitative impacts their bonds will have on the environment. Making informed underwriting decisions and helping investors analyze climate-related risks is critical to addressing environmental concerns.[24] Much of the pushback around increasing climate-related disclosures is cultural. There is a perceived risk in divulging more information than necessary. The concern is not about the legality of a project's "greenness;" it is more of a headline risk. Issuers do not want to stake reputations on bonds that could be criticized for being insufficiently ambitious or transformational from an ESG perspective.[25]

Thankfully, this is a job that the Financial Stability Board's Task Force on Climate-Related Financial Disclosures has taken on to promote further investment and lending in the transition to a lower-carbon economy. If climate-related disclosures are deemed material information, they should be required to be included in mainstream annual financial filings and thus become standardly reported information. Although the Task Force didn't emphasize disclosure in bond documents, their emphasis on climate impact transparency could easily apply to bonds.

Barrier 2: Pricing

The newness of the market means that there is little quantitative data to demonstrate any price variation between traditional bonds and those that are issued green. Anecdotal evidence suggests that thus far, because the green aspect of the security does not affect its creditworthiness, the investment yield for a green Apple bond, for example, generally mimics the pricing of a traditional Apple bond, all other structural factors being equal. Lab participants debated whether or not there truly was a "greenium," which is described by the Climate Bond Initiative as the higher price and lower yields of green issuances.[26] Because yields and bond prices move inversely, a reduction in yield offered by an investor will produce a higher price and thus a measurable benefit for the issuer of the green bond. Charging extra for green bonds may be environmentally sustainable, but it isn't yet financially sustainable. Most retail and institutional investors aren't willing to sacrifice a financial return for an environmental benefit until there is a clearer correlation between environmental benefit and lower risk.

The pricing question is fundamental to the bond market; issuers attempt to price at the lowest possible cost of capital and investors wish for the highest risk-adjusted return possible. From an issuer perspective, this means that minimizing the additional costs associated with issuing a green bond could help to improve the overall value of the issuance. Growth of the market will itself help reduce pricing premium; as definitions, metrics, and disclosures become standardized, pricing can and should be streamlined. From an investor perspective, this means better understanding the risk assessment to justify any changes in yield.

With traditional bonds, standardized and widely accepted ratings by a major rating agency offers an opinion on the creditworthiness of a bond, which correlates directly to pricing. Given the early stage and size of the green bond market, many ratings agencies fail to

THERE IS CURRENTLY NO ONE-STOP SHOP FOR GREEN BOND LABELING AND REPORTING.

weigh environmental factors with the same emphasis—or even at all—when rating green bonds. Not surprisingly then, there is little correlation between a bond's greenness and the investment yields available from it, all other things being equal. This failure to price in environmental externalities may be due to lack of data to track correlation between the underlying creditworthiness of an issuer and their ability to address climate change. As several scientists at the Financial Innovations Lab suggested, accurately assessing the environmental impact of efficiently deploying capital may have an immense effect on prices. If non-green bonds are perceived as riskier, then lower yields on green bonds would be justifiable to traditional financial market participants.

Barrier 3: Market Function

The relative newness of the green bond market means that there are still market function kinks that need to be worked out. There are two ways investors can purchase bonds in the U.S.: in the primary market, where the issuer sells indirectly to an investor using the services of an underwriter[3], or the secondary market, where the original investor can re-sell the security, again using the services of an intermediary. The secondary market is crucial to the smooth functioning of the bond market. It is here that most ordinary investors buy bonds, alongside large institutions. An active secondary market enables liquidity—the ability of an investor to convert his or her position to cash before the maturity date of the bond. Liquidity is a highly prized feature of bond investments. There is less of a secondary market for green bonds, however, because there are so few of them. As a result, green bonds may exhibit less liquidity in the secondary market. In a survey done as part of Volume 1 of the Treasurer's Report, investors place liquidity extremely high on a priority list when making investment decisions. The lack of liquidity across the U.S. green bond market is undoubtedly a hindrance to growth.

Exacerbating this problem is the fact that many of the green bonds that do come to market are too small for large investors to purchase because so many institutional investors won't invest in bonds ineligible for inclusion into a market index. A bond market index is a convention used to measure the value of a discrete section of the bond market. It is a common tool used by bond investors to compare available investment yields on one bond to another or overall yields on a group of bonds to the overall market. Index eligibility requires a sufficiently active secondary market to reduce price volatility and establish price and value benchmarks. It is typical that indexes will require minimum levels of outstanding debt by a single issuer for that issuer to become "index eligible." In one example, the minimum amount outstanding for a bond to be included in the U.S. Aggregate Bond Index is $300 million,[27] while the average size of a non-reporting green municipal bond is $106 million.[28] The large majority of green bonds don't qualify for index inclusion, so they are unlikely to be purchased by the market's largest players. Structuring green bonds to make them attractive to large, tax-exempt institutional investors would attract liquidity and break down some of the current barriers the market faces.

STANDARDIZING METRICS WILL ALSO PUT AN END TO AGE-OLD DISAGREEMENTS BETWEEN INVESTORS AND ISSUERS OVER WHAT INFORMATION TO SHARE.

3 An underwriter is typically a bank or broker-dealer firm that buys an aggregation of individual bonds (i.e., an issue from an issuer with the intent of selling individual parts of the issue to investors).

Overcoming the obstacles to additional green bond issuances will require a mix of financial and policy innovations. Lab participants debated and designed potential solutions incorporating a mix of "carrots" (i.e., economic or financial incentives) and "sticks" (i.e., policy or regulations). The discussions focused on the California municipal market as a case study, but the ideas are meant to be transferable to other states across the country.

Solution: Responsible Issuer Program

Addressing market function, pricing, and standardization

Municipal issuers in California have struggled to "go green" because of the perceived costs: the human capital needed to implement an issuance and the additional disclosures and data reporting required for green bonds. At the same time, investors are looking for an easier way to assess the environmental and social impact of any particular deal. Lab participants discussed the creation of a state-level program that would provide transaction support and potential pricing incentives to make it easier for issuers to structure a green bond. Such a program would also aggregate information to help investors measure the environmental impact of any given bond (See Figure 5).

Dubbed a Responsible Issuer (RI) Program, this state initiative would provide municipalities with guidelines on how to issue a green bond, while standardizing definitions, industry performance metrics, and the process through which projects could be validated and reviewed. The RI Program would also educate issuers on how to structure transactions and how to ensure easy and accurate disclosures (See Figure 6). The initiative would utilize existing state resources, including online

FIGURE 5: CREATING A STATEWIDE PROGRAM

Methodology	• Employ baselines for quality and methodological standards • Principles vs. Standards
Metrics	• Adopt a comprehensive set of metrics that will allow for standardization
Reporting	• Streamline data collection
Data Accessibility	• Improve data reporting and accessibility

Source: Milken Institute.

FIGURE 6: ELEMENTS OF THE RESPONSIBLE ISSUER PROGRAM

Responsible Issuer Program

DEFINITIONS

- Utilize Green Bond Principles as an initial guide for what activities will qualify as green
- Create sector-specific key performance indicators (KPIs) to help with assessment of green impact, pre- and post-issuance
- Create a scale of green- light, medium, and dark-based on the selected activities and KPIs

DISCLOSURES

- Create uniform disclosure documents that can be uploaded to existing municipal bond platforms
- Examples:
  - » Continuing disclosure document listed on the Electronic Municipal Market Access (EMMA) website
  - » Green statements in offering document published to Issuer's website
  - » Green statements in the reports submitted to the California Debt and Investment Advisory Commission
- The state should consider creating a dedicated website to consolidate information about green bond issuances

INCENTIVES

- Match California academic experts with municipal issuers to provide expert opinions and guidance on transaction structuring for environmental KPIs and impact measurements
- Create an RI competition for the best-in-class issuances (e.g. adherence to the Climate Bond Standards)
- Create a credit enhancement program that would provide a lower cost of capital for RI munis

Source: Milken Institute.

platforms, to aggregate and publish deal data for issuers and investors alike. It would also help to provide incentives and subsidies for those who qualify as responsible issuers.

The RI Program would create a one-stop-shop for issuers and investors looking to participate in California's green municipal bond market. Each section of the program is meant to address specific barriers that affect the cost of the issuance or investor accessibility.

Definitions

Lab participants generally agreed that state policymakers, issuers, and industry associations should use existing methodologies, such as the Green Bond Principles or the Climate Bonds Standards, to create California-specific definitions for the use of green bond proceeds. They also agreed that these definitions could allow for more flexibility in what might qualify as green. Definitions should be matched to sector-specific performance indicators so that projects funding water treatment, renewable energy, and retrofits of an existing school are each held to different standards. Participants also warmed to the idea of using standard definitions to create a sliding scale similar to CICERO's light, medium, and dark green options.

Disclosures

Because there is an existing system of ongoing financial disclosure to securities investors in the United States and that system is the result of several decades of ad hoc development, continued compliance with legal disclosures and the perceived risk of not meeting those requirements are common concerns for issuers. This is largely the result of the lack of a prescribed protocol for meeting those requirements. The protocol is unlike the ongoing disclosure regime for corporate issuers. Because municipal bonds are exempt from registration under U.S. securities laws, there is a very different type of regulatory guidance to issuers regarding their duty to disclose material events occurring after the issuance of the bond. To ease those fears, the RI Program would streamline the legal paperwork involved in issuing a bond and create a platform through which municipalities and other agencies could more easily publish data on the potential impact of their projects after the issuance of the bond. Legal experts at the Financial Innovations Lab noted that standardizing these transactions could be accomplished by modifying some existing documents and websites, rather than creating them from scratch. For example, municipal issuers already must produce an offering document (the Official Statement) on their website when releasing an issuance; the template for this letter could be updated to include a green statement. Similarly, the Electronic Municipal Market Access (EMMA) database includes a continuing disclosure document, which issuers use to report on financial and operational developments that affect the credit characteristics of their outstanding bonds. It could be restructured to include a section on environmental benefits. The State Treasurer's California Debt and Investment Advisory Commission publishes reports that improve the transparency of how a bond's revenue was spent. It too could be expanded to report on a security's environmental and social impact.

Incentives

Lab participants said the costs of issuing a green bond can often seem problematic to municipalities and agencies. Although the added costs of certification or verification are usually a small portion of overall bond issuance costs, any additional cost can be seen as problematic because there may be little precedent for the expenditure or there may simply be no enabling appropriation from the agency's governing body that would permit it. Further, there can be staffing costs associated with reporting and, depending on the nature of the project and desired level of disclosure, additional human capital costs to conduct environmental assessments would need to be incorporated into the issuer's future budgets. Staffing is usually limited to people with financial expertise, not environmental, and budgets may not support the hiring of additional employees to oversee the green portion of a bond offering. During the Lab, a few participants cited examples of other state agencies and institutions such as the state university system helping to meet staffing needs by providing issuers with pro-bono guidance. Environmental experts at the University of California at San Diego, for example, could help local water agencies perform an environmental assessment

IT IS IMPORTANT FOR ISSUERS TO IMPROVE THEIR DATA COLLECTION TO MEET GROWING DEMANDS.

and help identify the metrics needed to qualify for a green bond.

Another potential incentive for issuers would be an industry recognition for a best-in-class issuance, similar to existing awards in the financial services industry that highlight exceptional bond issuers and underwriters. Thomson Reuters publishes the International Financing Review (IFR) and hosts an annual awards gala that includes categories on the best bond issuer globally, as well as the best U.S. bond issuance.[29] Winners get a trophy and bragging rights across the industry. The Bond Buyer newspaper publishes an annual "Deal of the Year." In a similar vein, the RI Program could include a California state competition for the greenest issuances of the year. Issuers and underwriters at the Financial Innovations Lab agreed that encouraging a competitive spirit among municipalities and agencies could provide another type of reputational incentive.

The RI Program could also include additional state incentives to give issuers a break on the costs of new issuances. Participants debated what types of existing or new policies could be tailored for green bonds, including those solutions listed below.

Next steps: Green bond experts should work to create a detailed blueprint mapping out the existing resources and the new policies that are needed to move the program forward. If legislation is needed, they should collaborate with state legislators to flesh out each element of a Responsible Issuer Program.

Orrick's Steffi Chan discusses legal challenges issuers face.

ADDRESSING ISSUANCE COSTS

During the Lab, participants debated various models that could help reduce the transaction costs associated with green bonds. While there was no consensus from the group as to which model was most viable, most agreed that each of the following pricing innovations merited further research.

- SEB, a Swedish bank, rolls second- and third-party opinions (including assessments from the Climate Bonds Initiative and CICERO) into its underwriting costs. The issuer does not need to pay separately for these services. U.S. banks seeking to gain a competitive advantage in this arena could create some type of green bond package that absorbs more of the transaction costs.
- Some Lab participants debated whether project developers might be willing to assume the costs of environmental assessments for green bonds in exchange for streamlined approval under the California Environmental Quality Act (CEQA), a statewide requirement for disclosing potential environmental effects of a project. However, most participants agreed that this proposal was a longshot, given CEQA's highly political nature.
- In 2017, Singapore's central bank announced a program to offset up to S$100,000 (US$76,000) of certification costs for green bond issuers.[30] The experiment intrigued Lab participants enough to suggest a similar pilot program in California, but cautioned that a model that works for Singapore, a small island city-state, may be difficult to replicate in the U.S.
- The California Pollution Control Financing Authority has a "Small Business Assistance Fund" program to subsidize the cost of bond issuance by up to $210,000. A similar program could be established for qualified green bonds.

Solution: California Green Bond Credit Enhancement

Addressing market function and pricing

Smaller, less creditworthy municipal issuers are often averse to taking on debt because they must pay higher interest rates to compensate investors for the increased risk. To alleviate this situation, California has created insurance programs that cover issuers up to specified amounts if they are unable to pay back the interest or principal. The program is similar to mortgage insurance, which allows less-wealthy borrowers to take on larger loans than they would otherwise qualify for. The insurance allows issuers with below-investment-grade credit to assume the creditworthiness of California (usually AA or AAA, depending on the rating agency) and also the lower interest payments associated with enhanced credit.

The California Office of Statewide Health Planning and Development administers the Cal-Mortgage program, formally known as the California Health Facility Construction Loan Insurance Program. Cal-Mortgage provides credit enhancement for eligible, non-profit, and publicly-owned health care facilities when they borrow money for capital needs. Cal-Mortgage insured loans are guaranteed by the "full faith and credit" of the State of California. The Cal-Mortgage program, which was created in 1968 by an initiative constitutional amendment, is modeled after federal home mortgage programs. The program enables borrowers to obtain lower interest rates when they borrow money for capital facilities, similar to the rates received by the State of California.[31] The program arose from the perceived need to provide safe, quality health care to all Californians, regardless of their geography and economic circumstances. Cal-Mortgage's insurance premiums cover the cost of the program's administration[32] so it operates at no cost to the state's taxpayers or the general fund. Lab participants discussed the possibility of creating a similar Green Bond Insurance Program to encourage smaller municipalities and agencies to take on debt with environmental benefits and a lower cost of capital. One potential downside noted by some Lab participants was the credit impact of California taking on additional contingent liabilities, or calls against the state's balance sheets, as California would be required to pay investors if an issuer defaulted and insufficient reserves to cover such liabilities were not available.

Next steps: To gauge the number of issuers who could qualify for a Green Bond Insurance Program, participants recommended a scoping exercise to understand what type of funding levels would be needed to meet demand. This would then help with modeling for premium pricing and overall administrative costs.

Solution: Regional Municipal Issuer Fund

Addressing market function

As discussed earlier, most green bond issues are often too small to attract institutional investors. To overcome this obstacle, Lab participants debated various models that would aggregate small green bonds into one larger offering. One suggestion was to replicate the work of Connecticut's Metropolitan District (MDC), a group of eight municipal issuers from the Hartford metropolitan area that provide water supply, pollution control, and waste collection services.[33] Individually, none of these municipalities can issue bonds large enough for inclusion in an index, but together, they're able to make larger offerings. The credit rating of the bonds issued by the MDC is an aggregate score based on the financial stability of each of the eight individual member entities. This can pose a problem if one of the members falls into economic trouble. Just such a situation happened in July of 2017, when Moody's Rating Agency downgraded the MDC to an "Aa3" because they had also downgraded the municipality of Hartford, one of the larger issuers in the partnership.[34]

California has various regions that could benefit from a pooled issuance model, especially the largely agricultural Central Valley. Lab participants discussed the potential for a Central Valley Green District that could combine water agencies and/or local municipalities to offer larger bond issuances to address the region's environmental needs.

Next steps: An existing issuing authority could be used for pooled issuance, such as one of the authorities chaired by the Treasurer or a regional authority. Alternatively, like-minded agencies already have authority to enter into "joint powers agreements" that could enable such pooling. Creating such a pooled arrangement requires political will from local legislators. Lab participants agreed that the first step is to identify interested municipalities and agencies and to determine how to aggregate them to make larger issuances feasible and creditworthy.

Michael Kashani, from Goldman Sachs, discusses the potential of taxable green municipal bonds.

Solution: Creating a Green Bond Bank

Addressing market function and standardization

Another option to scale up issuance size and create competitive pricing and encourage standardization is to create a green bond bank. Lab participants discussed various models, including building a new program to fit within the mandate of the existing California Infrastructure and Economic Development Bank (IBank), expansion of the authority of another entity such as the California Pollution Control Financing Authority, or the creation of an entirely new entity.

The California IBank was established in 1994 to provide funding and financial incentives to municipalities and agencies across the state for projects that improve infrastructure and drive economic development. It includes a revolving infrastructure fund to provide loans for projects like bridges and roads, as well as a bond financing program that supports issuance of so-called 501(c)(3) bonds (issued by eligible municipalities on behalf of non-profit organizations) and a clean energy program that directly supports projects that positively impact the environment.[35] Currently the only projects eligible for IBank's clean energy program are those that focus on energy efficiency retrofitting and LED streetlight installations. Lab participants debated whether its mandate could be expanded to include projects that adhere to the Green Bond Principles or the Climate Bonds Standards. Modifying the existing framework could enable the state to formalize a set of criteria for green bond-related projects. These criteria would in turn assure investors that the proceeds are being spent appropriately.

An alternate model would be to create an entirely new entity to support the issuance of green bonds, from providing funding to municipalities, to helping issuers with transaction structuring, to setting standards for the use of proceeds. In 1985, the city of Indianapolis created a regional municipal bond bank, with the purpose of coordinating all local issuance in Marion County. In addition to assisting with investor outreach and transaction preparation, the bond bank's purview includes issuing, buying, and selling securities on behalf of all of the county's municipalities and agencies.[36] The bond bank is funded through fees on its services. Lab participants especially liked the idea of creating a new, self-sustaining government agency, since legislators have limited budgets for existing agencies.

Next steps: State policymakers should consider legislation to promote the development of a state green bond bank. Lab participants also discussed the creation of a city or regional model like a Los Angeles bond bank that would only need local approval.

Solution: A Green Taxable Bond Program

Addressing market function and pricing

Because they are already exempt from taxes, public pension funds and other non-profit organizations derive no benefit from the tax-exempt municipal market. They prefer the additional yield available from the taxable municipal bond market, which is a smaller group of issuances because they have a higher cost of capital for the issuer. In 2009, as a response to the financial crisis, the U.S. Congress created the Build America Bonds (BABs) program. BABs was designed to provide two types of securities: one that offered a 35 percent tax credit for investors, and one that provided a 35 percent subsidy on interest payments to issuers. The objective of the BABs program was to encourage the issuance of debt as a means to stimulate the economy without over-taxing the municipal bond market. The program enabled governmental issuers to offer higher rates to investors but at less direct cost to the governmental agency.[37] In the first year of the program, California issued BABs at a 7.4 percent interest rate, but because of the subsidy from the federal

government, only had to pay 4.8 percent, after allowing for the subsidy payments from the federal government.

The BABs program was authorized by the American Recovery and Reinvestment Act, but Congress failed to reauthorize it the following year.[38] Lab participants generally agreed that the current political environment made it unlikely that Congress would revive BABs or create a new program that would generate similar interest in the taxable municipal market. The additional layer of a green BABs program to specifically address climate change made federal action even more of an uphill battle.

Participants were more optimistic, however, about replicating the program at the state level. California might be able to use funding from the cap and trade program to subsidize the interest costs of taxable bonds for municipal issuers (See Figure 7).

Some Lab participants doubted the feasibility of using cap and trade funding, since most of those dollars have already been allocated to existing initiatives. Other attendees at the Lab noted that while much of the funding has been earmarked, it has not all been spent, and many of the current recipients aren't actually using the money.

Next steps: To create a green taxable municipal bond program at the state level, California should gauge the potential demand from issuers to determine how much funding would be needed to capitalize the subsidy pool. Once legislators assess the scope and size of this potential market, they would need to outline how existing funds could be reallocated or new funds could be raised.

Lab participants draft policy recommendations.

FIGURE 7: GREEN TAXABLE BOND PROGRAM

Source: Milken Institute.

CONCLUSION

Across the U.S., states are seeking additional sources of capital to address the poor condition of their infrastructure. As climate change continues to have an outsized impact on that infrastructure, it is imperative to build and upgrade public projects in a way that increases the sustainability of our communities. Luckily, a financial instrument to achieve these ends already exists, as do the capital and investor interest. Green bonds can play a vital role in financing improvements to aging infrastructure while providing a net benefit for the environment.

The green bond market has grown substantially since its introduction to investors a decade ago. The focus of this Lab is to identify near-term solutions and put into practice next steps that will accelerate that growth exponentially. Those solutions include improving market standardization, defining what is green, streamlining pricing, and improving data reporting and investor accessibility. It will take an innovative collaboration between policymakers and the financial markets; plus buy-in from both lenders and borrowers across the municipal bond issuance process to streamline and grow the green bond market.

By establishing a Responsible Issuer Program, California can use existing state resources to aggregate information to facilitate and simplify market participation. To lower the cost of issuing green bonds, the state can offer credit enhancements or establish a Green Bond Insurance Program. Aggregating smaller issuances into a regional pool or bond bank could make it possible for larger investors to participate in the green bond market. And building a taxable municipal bond program would entice tax-exempt investors to the market.

Because California is widely recognized as a leader in environmental sustainability, pioneering efforts to streamline the green bond market here can serve as a model for other states and countries. Building public infrastructure with future generations in mind is a must, not just in California, but everywhere on the planet.

Treasurer John Chiang discusses the global imperative to address climate change.

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