FREE Policy Brief Series
Number 8

Foundation for Renewable Energy & Environment

The FREE Policy Brief series offers a topic-by-topic discussion of issues relevant to the overall mission statement of FREE.

This Policy Brief is the result of a presentation to the U.S. Congressional Bipartisan Climate Solutions Caucus (June 7, 2018). This presentation informed the Caucus about the U.S. green finance market as a whole and about several innovative applications in particular.

Green Energy Finance: Status & Trends

Green energy finance is a rapidly growing sector of the economy. This Policy Brief captures the status of the U.S. green finance market and highlights performance of three well-established U.S. mechanisms. Market volume during 2012-2017 is estimated as approximately $54.8 billion, primarily from the issuance of green infrastructure bonds. Findings of our assessment are presented as bullet points.

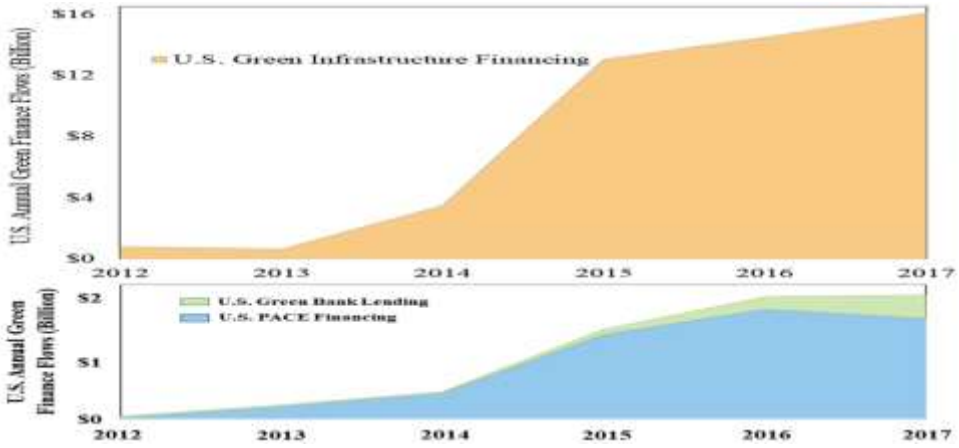

Figure 1(a) and 1(b). Overview of annual green energy investment in the U.S.

Innovative Green Infrastructure Financing

- **Volume:** During 2012-2017, U.S. green infrastructure investments totaled $48.6 billion.
- **Sectors served**: Public and non-profit U.S. cities play an increasingly important role, issuing green bonds of just over $800 million in 2012 and rising to more than $15 billion in 2017.
- **Technology:** Energy efficiency, renewables, CHP (combined heat and power), water and wastewater treatment, microgrids, other.
- **Feature:** Focus is on pooled, self-financing investments often with Guaranteed Savings Agreements (GSAs) for specified conservation measures (CMs) to support payment. Pooled investments are typically above $20 million and can be eligible for tax-exempt bond financing without a pledge of the full faith and credit of government or its taxing powers. Bank lending (using, for example, tax-exempt leases) is also a well-established investment vehicle.

Property Assessed Clean Energy (PACE) Financing

- **Volume:** During 2012-2017, a total of $848.7 million invested in commercial (C-PACE) and $4.6 billion in residential (R-PACE) investments.
- **Sectors served:** Primarily residential; small but growing commercial applications.
- **Technology:** Energy efficiency, renewables.
- **Feature:** 34 states and Washington, D.C. have PACE-enabling legislation.

Green Banks

- **Volume:** During 2012-2017, U.S. green bank investments totaled $743.8 million.

- **Sectors served:** This financing tool can serve all sectors. Currently, green bank lending often serves residential and commercial customers, including small business.
- **Technology:** Energy efficiency, renewables.
- **Feature:** Green banks are active in 6 states. Investments leverage private capital often at a 5:1 ratio.

Scaling up Investment: The Delaware Sustainable Energy Utility (SEU) Bond Program

- **Volume:** The Delaware Sustainable Energy Utility (SEU) issued a $67.4 million AA+ rated bonds (with premiums at sale, $72.5 million).
- **Sectors served:** Pooling of projects involving over 200 conservation measures (CMs) improvements for six state agencies and two higher education institutions.
- **Technology:** Energy efficiency, renewables, CHP, water and wastewater treatment, solar PV.
- **Feature:** Secures low interest rates for self-financing clean energy investments for a pool of state buildings and higher education institutions through the capital markets.
- **Guaranteed Savings:** Leverages project scale and design to realize savings guarantees in excess of total project cost. In Delaware, $148 million in guaranteed savings against all-in costs of $110 million – a net benefit of $38 million (Figure 2 and Table 1). Guarantees by six participating ESCOs (Energy Service Companies), each with $10+ billion in assets and high-quality engineering and construction teams.

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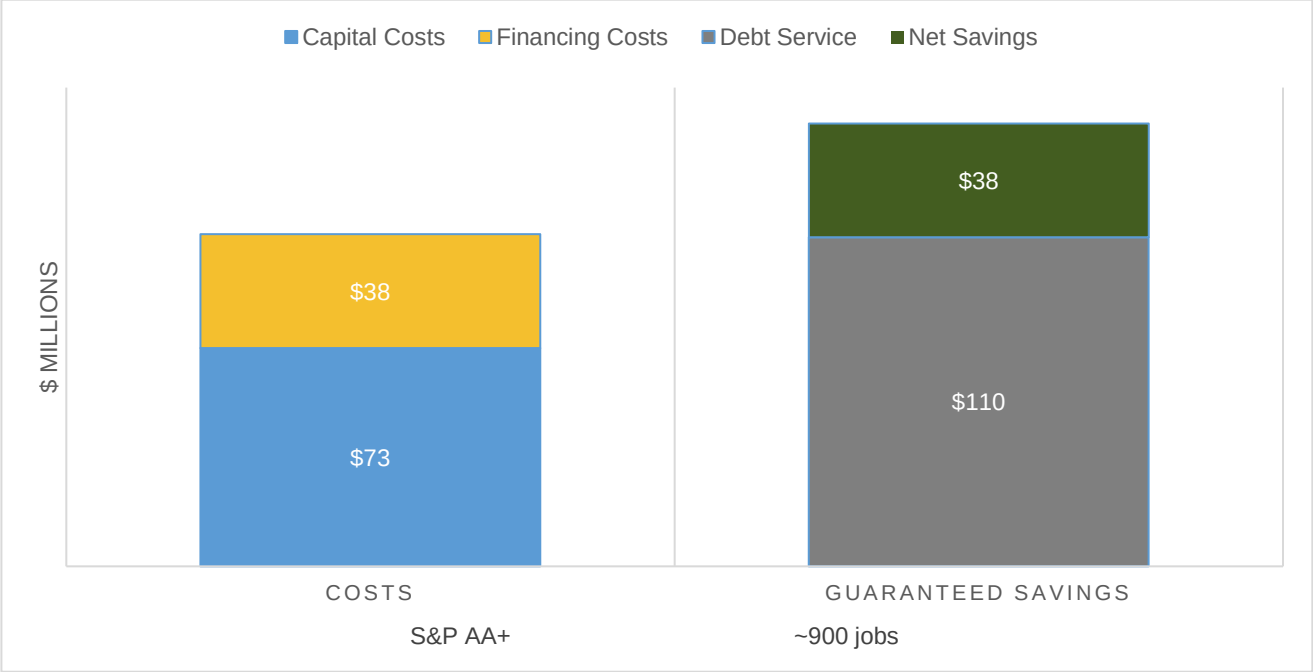

Figure 2. *Delaware SEU Bond Results.*

Table 1. *Delaware SEU Fact Sheet*

Sponsoring Agency	Delaware SEU – a 501(c)(3) corporation created by statute with bond issuing authority
Participants	Six state agencies; two non-profit academic institutions
Country	Delaware, USA
Start Date / End Date	Bond issuance: 1 August, 2011 Final payment: 31 July, 2031
Financing Mechanism	Tax-exempt by-appropriation serial bonds ranging in maturity from 1 year (rate = 0.65%) to 20 years (rate = 4.37%)
Collateral Support	None. No state tax obligation
Total Funding	$67.45 million sale of AA+ rated bonds, arbitrage yield of 3.7%/p.a. (with premiums at sale, $72.55 million)
Other features	Project aggregation (reduces procurement and debt costs) Guaranteed savings Diagnostic M&V (assures measured savings) Standard project documentation (lower costs) A range of bond maturities from 1-20 years (serialization of project debt) 14 year average payback (deep retrofits encouraged)

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Scaling up Investment: The Pennsylvania Sustainable Energy Finance Program (PennSEF)

- **Background:** The Pennsylvania Sustainable Energy Finance (PennSEF) Program was formed as a partnership betwween Pennsylvania Treasury and FREE, with Treasury serving as a prudent investor in PennSEF financings.
- **Investment Strategy:** The PennSEF program represents a platform that enables multiple rounds of investments in a host of public and non-profit sector areas, from street lighting to community college campus improvements, to upgrades for water and wastewater treatment facilities, to resilient energy generation using renewable energy, storage and microgrids.
- **Reduce Costs:** PennSEF organizes projects that reduce energy use by 30-60% and similarly lower the cost of delivery of vital services of non-profits (schools, hospitals, etc.) and governments.

Example – Street Lighting: in 2017, PennSEF completed a $15 million investment, retrofitting 28,000 exterior lights, street lights, and traffic signals with LED technology.

Figure 3. *Before and after: Impact of LED streetlights – 60% energy savings and safer environments.*

- **Municipalities:** Pooled 35 municipalities often too small to affordably procure the technology and too small to arrange advanced engineering, contracting, and financing that could

ensure high savings and low costs. PennSEF prepared common documents, provided expert reviews of the engineering and economics of the project, and organized low-cost financing.

- **Features:** The project secured guaranteed savings of $30.6 million from a national energy service company (ESCO) and obtained low interest rates for this pooled, self-financing clean energy investment. Loans were provided by a regional bank and Pennsylvania Treasury.
- **Result:** Project scale and design were leveraged in order to deliver net savings of $15.6 million with an average 10.6 year payback.

Street Lighting Systems – the "Backbone" for an Internet of Things (IoT) Ecosystem

- **Enabling Platform:** Smart public lighting can be a "backbone" that enables a wide range of other smart city applications such as hosting sensor networks and wireless communication for smart parking, incident detection, emergency response, etc.
- **Digitized Public Lighting:** Connected and smart lighting enables energy management options that lower electricity and maintenance costs, while increasing services that improve safety.
- **Active Management:** Well-defined interfaces enable more reliable and responsive operation of the streetlight portfolio.
- **Resilience:** Software-based monitoring and management can improve community response to weather emergencies, industrial disasters, etc.

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About the Foundation for Renewable Energy & Environment (FREE)

The Foundation for Renewable Energy and Environment (FREE) is a non- profit, international organization established to promote a better future based on energy, water and materials conservation, renewable energy use, environmental resilience, and sustainable livelihoods. Guided by experts and distinguished academics, FREE sponsors research, supports graduate education and consults with organizations on strategies to create new sustainability models, to advise policy makers and other societal leaders, and to provide outreach to communities seeking to transform energy-environment relations. Managing an active agenda of conferences, films, exhibitions, seminars, and publications, FREE works with cities, non-profits, governments, businesses, and academic institutions around the world on environment and renewable energy issues.

The Policy Brief Series is drafted by the FREE research team (http://freefutures.org/about/free-team/free-research-team/). For more information, contact FREE Program Manager Pam Hague (pam@freefutures.org).

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